DMD1050TS

Satellite Modem Board
Installation and Operation Manual

Part Number MN-DMD1050TS
Revision 2

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.

Comtech EF Data, 2114 West 7th Street, Tempe, Arizona 85281 USA, 480.333.2200, FAX: 480.333.2161

Revision History

Rev	Date	Description
0	Jan 2017	Initial Release.
1	May 2018	Chapter 6: Revised tables 6-1 through 6.15. Added Acronym and Unit of Measurement List in TOC section.
2	Feb 2020	Revised Chapters 7, 8, and 9.

Note: Technical changes are shown with a revision bar in the margin next to the change.
Formatting changes do not have a revision bar.

Table of Contents

List of Figures

List of Tables

Acronym List

Acronym	Description
ACM	Adaptive Coding and Modulation
AES	Advanced Encryption Standard
AGC	Automatic Gain Control
ASIC	Application Specific Integrated Circuit
AUPC	Automatic Upling Power Control
BER	Bit Error Rate
BERT	Bit Error Rate Test
BIST	Built-In Self Test
BUC	Block Up Converter
CBC	Code Block Chaining
CDMA	Code Division Multiple Access
CLI	Command Line Inerface
COMMSPEC	Communication Specification
CRC	Cyclic Redundancy Check
DC	Direct Current
DHCP	Dynamic Host Configuration Protocol
DSP	Digital Signal Processor
DSSS	Direct Sequence Spread Spectrum
EBEM	Enhanced Bandwidth Efficient Modem
EEI	Enhanced Ethernet Interface
EKMS	Electronic Key Management System
EMF	Electromagnetic Field
ESD	Electrostatic Discharge
FDMA	Frequency Division Multiple Access
FEC	Forward Error Correction
FIFO	First In First Out
FIPS	Federal Information Processing Standards

Acronym	Description
FPGA	Field Programmable Gate Array
FTP	File Transfer Protocol
GUI	Graphic User Interface
HDLC	High-level Data Link Control
HSSI	High Speed Serial Interface
IBS	Intelsat Business Service
IDR	Intermediate Data Rate
IESS	Intelsat Earth Station Standards
ITA	Information Throughput Adaption
IV	Initialization Vectors
KDF	Key Derivation Function
LAN	Local Area Network
LDPC	Low Density Parity Check
LED	Light Emitting Diode
M&C	Monitor and Control
MIP	Microprocessor without Interlocked Pipeline Stages
MODCOD	Modulation and Code Rate
NIST	National Institute of Standards and Technology
OID	Object Identifier
PD	Plesiochronous / Doppler
PER	Packet Error Rate
PLL	Phased Locked Loop
QoS	Quality of Service
RLLP	Radyne Link Level Protocol
R-S	Reed Solomon
RT	Receive Timing
RTS	Request to Send
SCC	Satellite Control Channel

Acronym	Description
SCPC	Single Carrier Per Channel
SCR	Serial Clock Receive
SCT	Serial Clock Transmission
SCTE	Serial Clock Transmission External
SKL	Simple Key Loader
SNMP	Simple Network Management Protocol
SSH	Secure Shell
ST	Send Timing
TDK	Traffic Decryption Key
TEK	Traffic Encryption Keys
TRANSEC	Transmission Security
WAN	Wide Area Network

Units of Measurement

Unit / Symbol	Definition
Ω	Ohm
A	Ampere
bps	bits per second
˚C	Celsius (degrees)
Hz	Hertz
kHz	kiloHertz
dB	decibel
dBc	Decibels relative t the carrier
dBm	Decibel-milliwatts
˚F	Fahrenheit (degrees)
Kbps	Kilobit per second
kg	kilogram
ksps	Kilosymbols per second
lbs.	pounds
mA	Milli-amp
Mbps	Megabit per second
MHz	Megahertz
mm	millimeter
ms	millisecond
Msps	Megasymbols per second
mW	milliwatt
in.	inch
Pps	Packets per second
ɥF	100 micro-farads
W	Watt
V	Volt

BLANK PAGE

PREFACE

About this Manual

This manual provides installation and operation information for the Comtech EF Data DMD1050TS Satellite Modem Board.

Unless otherwise specified, these products are referred to collectively throughout this manual as “the modem” or “the unit”.

This is an informational document intended for the persons responsible for the operation and maintenance of the modem.

Conventions and References

Patents and Trademarks

See all of Comtech EF Data's (CEFD) Patents and Patents Pending at: http://patents.comtechefdata.com.

- Comtech EF Data acknowledges that all trademarks are the property of the trademark owners.
- DoubleTalk® is licensed from "Raytheon Applied Signal Technology".
- DoubleTalk® is a registered trademark of "Raytheon Applied Signal Technology".
- Carrier-in-Carrier® is a registered trademark of Comtech EF Data.

Related Documents

The following documents are referenced in this manual:

- Department of Defense (DOD) MIL-STD-188-114A, Electrical Characteristics of Digital Interface Circuits
- Department of Defense (DOD) MIL-STD-188-165A, Interoperability and Performance Standards for SHF Satellite Communications PSK Modems (FDMA Operation) (dated November 2005)
- INTELSAT Earth Station Standards IESS-308, -309, -310, and -315
- EUTELSAT SMS

Military Standards

References to "MIL-STD-188" apply to the 114A series (i.e., MIL-STD-188-114A), which provides electrical and functional characteristics of the unbalanced and balanced voltage digital interface circuits applicable to both long haul and tactical communications. Specifically, these references apply to the MIL-STD-188-114A electrical characteristics for a balanced voltage digital interface circuit, Type 1 generator, for the full range of data rates. For more information, refer to the Department of Defense (DOD) MIL-STD-188-114A, *Electrical Characteristics of Digital Interface Circuits*.

Warnings, Cautions, and Notes

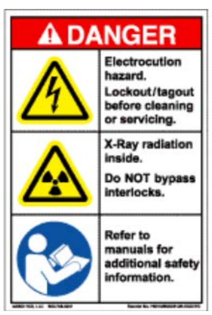
A WARNING GIVES INFORMATION ABOUT A POSSIBLE HAZARD THAT MAY CAUSE DEATH OR SERIOUS INJURY.

A CAUTION gives information about a possible hazard that MAY CAUSE INJURY or PROPERTY DAMAGE.

A NOTE gives important information about a task or the equipment.

A REFERENCE directs you to additional information about a task or the equipment.

Examples of Multi-Hazard Notices



Recommended Standard Designations

The Electronic Industries Association (EIA) designations supersede the Recommended Standard (RS) designations. References to the old designations may be shown when depicting actual text (e.g., RS-232) displayed on Web Server pages, serial remote interfaces, Telnet Command Line Interfaces (CLIs), or unit rear panels. All other references in the manual refer to EIA designations.

CAUTION – YOU SHOULD CAREFULLY REVIEW THE FOLLOWING INFORMATION.

Safety and Compliance

This product is designed for integration into “third party” terminals. The responsibility for electrical safety and compliance lies with the “third party”.

Operating Environment

Refer to Section 2.4.

Product Support

For all product support, please call:

+1.240.243.1880

+1.866.472.3963 (toll free USA)

Comtech EF Data Headquarters

http://www.comtechefdata.com

Comtech EF Data Corp.
2114 West 7th Street
Tempe, Arizona USA 85281

+1.480.333.2200

Warranty Policy

Comtech EF Data products are warranted against defects in material and workmanship for a specific period from the date of shipment, and this period varies by product. In most cases, the warranty period is two years. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective. Repairs are warranted for the remainder of the original warranty or a 90 day extended warranty, whichever is longer. Contact Comtech EF Data for the warranty period specific to the product purchased.

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.

BLANK PAGE

Chapter 1. Introduction

The DMD1050TS Satellite Modem Board, is designed for satellite IP, telecom, video and internet applications.

1.1 Overview

- Full Duplex L-Band satellite modem card
- MIL-STD-188-165A standards
- STANAG 4486 Edition 3 (EBEM)
- FIPs 140-2 Transmision Security
- IDR, IBS and DVB
- Data rates up to 37 Mbps

Figure 1-1. DMD1050TS Satellite Board Modem (Top View)

The DMD1050TS remote accessibility rivals all others in the field. Remote control is via Radyne Link Level Protocol (RLLP), Ethernet 100 Base-T SNMP and Web Browser. It includes control of all the modem's features, plus software maintenance. The DMD1050TS shows monitor and control functions on a PC screen.

Additional options and configuration, such as Monitor and Control (M&C), can be activated in seconds via the Web Browser.

Compatibility is maintained with other modems, such as the DMD2050E, SLM-5650A, DMD1050T, DMD2050, DMD50, DMD20 and the DISA-certified, MIL-188-165 compliant DMD15L, for seamless substitution and addition to existing systems. Compatibility with the Viasat MD1366 EBEM modem is also provided.

The DMD1050TS offers built in standard interfaces that are selectable from MIL-188-114A and a Dual Port Ethernet Bridge.

1.2 DMD1050TS Configurations

You can configure the DMD1050TS in different ways:

- Features and options installed when the unit is ordered
- Feature upgrades
- Hardware options you can install at your location
- Options installed in a unit at a Comtech EF Data Service Center

1.2.1 Features/Options Installed at Time of Order

Features installed when the unit is ordered consist of options pre-installed/initialized in the factory before shipment. You can see these from the web browser.

Factory installed options are chassis and board configurations that occur during manufacture.

1.2.2 Feature Upgrades

Feature upgrades are an easy way of changing the feature set for an installed modem. Feature upgrades are how most options are implemented.

Purchase feature upgrades any time by contacting Comtech EF Data.

1.3 Function Accessibility

With a terminal or personal computer and a serial link, you have access to all functions for remote monitoring and control.

Chapter 2. Installation

2.1 Unpacking and Inspection

Do not use any cutting tool that will extend more than 1/2 inch into the container. This can cause damage to the modem.

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 Satellite Modem Board and its Installation and Operation Manual are packaged and shipped in a pre-formed, reusable cardboard carton containing foam spacing for maximum shipping protection.

Unpack and inspect 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 and user's manual from the carton.
4	Save the packing material for storage or reshipment purposes.
5	Inspect the equipment for any possible damage incurred during shipment. **Note:** If damage is evident, contact the carrier and Comtech EF Data immediately and submit a damage report.
6	Check the contents against the packing list to verify completeness of the shipment.
7	Refer to the sections that follow for further installation instructions.

The Universal Satellite Modem was carefully packaged to avoid damage and should arrive complete with the following items for proper installation:

1. DMD1050TS Satellite Modem Board
2. Installation and Operation Manual

2.2 Installation Requirements

WARNING - DANGER OF EXPLOSION – LITHIUM BATTERY
This unit contains a lithium battery. You must replace the lithium battery with the same or equivalent battery that is recommended by the manufacturer. You must dispose of used batteries as required by local and national regulations. Make sure to prevent static discharge that can cause damage to the Modem Board.

CAUTION - EQUIPMENT DAMAGE
Electrostatic discharge (ESD) causes damage to the equipment.
Before you touch the equipment, obey the ESD precautions.

Installation of the DMD1050TS Modem Board requires adequate planning by the user to ensure no damage will occur to the unit. Package design considerations for the modem board include mounting, temperature limits, adequate ventilation, limited vibration, no exposure to condensation/ moisture and a stable power source.

Mating connectors are supplied with each unit. A full description of the modems pin outs can be found in Section 4. Appendix E gives details of the various connectors and mating connectors supplied.

2.3 Removal from Container and Assembly

The DMD1050TS Modem Unit is assembled fully when shipped.

Carefully unpack the unit.

Make sure that all of the shipped items are in the container.

2.4 Installation Considerations

The operating temperature range for the DMD1050TS is 0 to +60°C (+32 to +140°F). It is designed to be conduction cooled. Heat spreaders conduct from heat generating components to the edges of the assembly.

You can use airflow for cooling, as long as you make sure sufficient airflow is provided so that the rail temperatures do not exceed +60°C (+140°F).

When installed to use conduction cooling, it is best to attach to the metal side rails. See the orange arrows in Figure 2-1. There are four mounting holes on each side for this purpose.

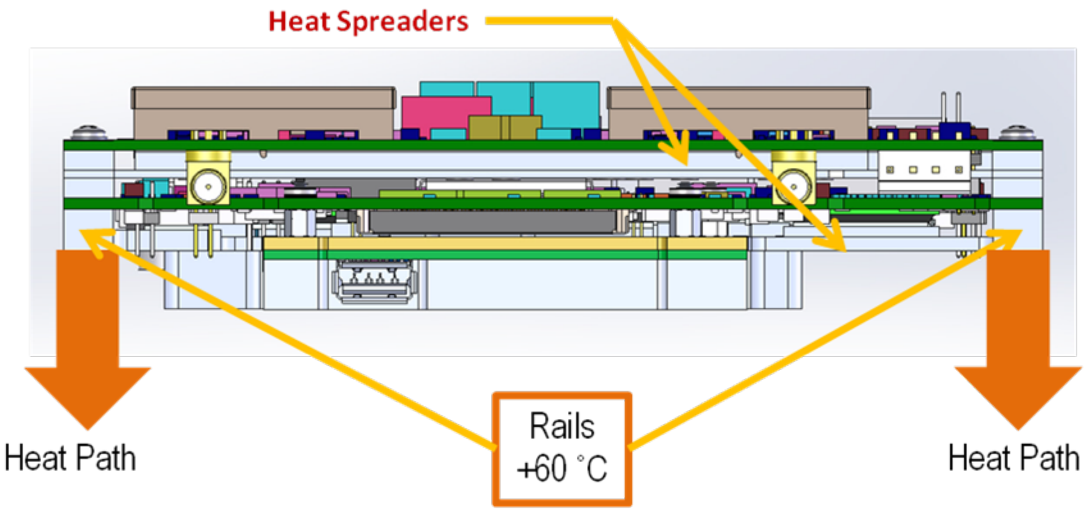


Figure 2-1. Heat Path

Make sure the Modem board has adequate spacing between it and other products, to avoid cross talk or electrical shorts. Do not put Modems immediately above or below a high electromagnetic field (EMF) generator, to prevent output signal corruption and incorrect receive operation.

Do not install the DMD1050TS in an unprotected outdoor location, where there is direct contact with rain, snow, wind or sun.

2.4.1 Tools Required

CAUTION – EQUIPMENT DAMAGE
When you install the modem assembly, make sure it is not put under stress and thus damaged.

The only tools necessary are those used for installing and tightening the eight screws that attach the unit.

2.5 DMD1050TS Initial Configuration Check

CAUTION – EQUIPMENT DAMAGE
Make sure to select the DMD1050TS Interface Type (MIL-188-114A or Ethernet Data Interface) before you install the mating connectors. Failure to do this can cause damage to the Data Interface.

The DMD1050TS is shipped from the factory with preset factory defaults. Upon initial power-up, do a user check to examine the shipped modem configuration.

2.5.1 Standard DMD1050TS Factory Configuration Settings

Use of Strap Code 26 can set the modem configuration. For an explanation and listing of available Strap Codes, see Appendix G. The Frequency and Modulator Output Power are set independently of the strap code.

Modulator	
Data Rate:	2.048 Mbps
Mode:	Closed Network
Satellite Framing:	None
Scrambler:	V.35 (IESS)
Inner FEC:	1/2 Rate Viterbi
Outer FEC:	Disabled
Modulation:	QPSK
Frequency:	950 MHz
Modulator Output Power:	-20 dBm

Demodulator	
Data Rate:	2.048 Mbps
Mode:	Closed Network
Satellite Framing:	None
Scrambler:	V.35 (IESS)
Inner FEC:	1/2 Rate Viterbi
Outer FEC:	Disabled
Modulation:	QPSK
Frequency:	950 MHz

CAUTION – NETWORK MALFUNCTION
Using the modem's loopback capabilities with the Ethernet data interface can cause undesirable network loops. Before you do any data test with an Ethernet interface, make sure to use two modems connected back-to-back. If you use one modem and a loopback, it can cause unwanted results.

To lock up the modem:

- Enter **IF Loopback Enable** in the Test Menu

  - or -

- Connect a Loopback Cable from TX port to RX port

2.6 Modulator Checkout

The Modulator checkout descriptions assume that the DMD1050TS is installed in a suitable location with clean, stable DC power. Make sure that DC spikes do not occur during initial power up.

2.6.1 Initial Power-Up

CAUTION – EQUIPMENT DAMAGE
Make sure that the modem's input DC power is clean, stable and free of spikes. If the input DC power is poor quality, it can cause damage to the unit.

Error! Reference source not found.

New units are shipped with the transmit carrier set to OFF.

You can do the initial field checkout of the modem using the Web Browser or the Terminal Mode. Both have the advantage of giving full screen access to all of the modem's parameters. However, a separate terminal or computer running a Terminal Program is necessary. The modem is configured with the Web Browser enabled.

2.6.2 M&C Web Browser Setup

The Ethernet M&C (J11) Interface requires a standard RJ45 Male connector. The Ethernet Interface is shipped from the factory in an addressable, default condition that gives you access to the unit. This condition is identified as **IP TEST MODE**.

Boot Modes: IPTEST	
IP Address Mask	255.255.255.000
Modem IP Address	192.168.0.238
TRANSEC IP Address	192.168.0.239
Server IP Address	192.168.000.101
Router IP Address	192.168.000.102

See Appendices C and D for set up of the Ethernet M&C Interface.

Connect an Ethernet cable between the unit and a computer that has web browser capability. Open the browser and enter the default web address for the unit.

See Chapter 7 for a description of the Graphic User Interface (GUI) operation and parameters. See Appendix C and Appendix D for setup of the TCP-IP interface and Web browser.

2.6.3 M&C Terminal Setup

You can do the initial field checkout of the modem in Terminal Mode. The Terminal Mode gives you full screen access to the modem's parameters. However, it requires a separate terminal or computer running a terminal program such as Hyper-terminal, and connection to the applicable pins on the Remote Port connector (J3).

You can change these settings via the Web Browser.

Recommended Terminal Settings	
Emulation Type:	VT-100
Baud Rate:	19.2 K
Data Bits:	8
Parity:	No Parity (Fixed)

2.6.3.1 Web Browser and Terminal Interfaces Reset

If you cannot use the Web Browser or Terminal interface, reset the interface defaults.

To reset the interface defaults, use the shorting plug (CNRSHUNT). Do these steps:

1. Make sure the electrical power to the unit is disconnected.
2. Find the JP1 and JP2 connectors.
3. Find pins 1 and 2 on the JP1 and JP2 connectors.
4. Install the CNRSHUNT shorting plug on pins 1 and 2 of JP1, and pins 1 and 2 of JP2.
5. Connect the electrical power to the unit.

This resets the interface defaults. See Chapter 3 for more information.

2.7 Storage

Store the unit in its original packaging. Store the unit in a dry location, where the temperature is stable. Keep it away from direct contact with rain, snow, wind, sun or anything that may cause damage to it.

Chapter 3. Theory of Operation

3.1 DMD1050TS Hardware

The DMD1050TS uses three printed circuit cards in its design. The standard configuration consists of:

- L-Band Assembly
- Digital Baseband Assembly
- FIPs 140-2 TRANSEC Security module

This configuration includes built in data interfaces and several software upgrade options.

A block diagram of the DMD1050TS is shown in Figure 3-1.

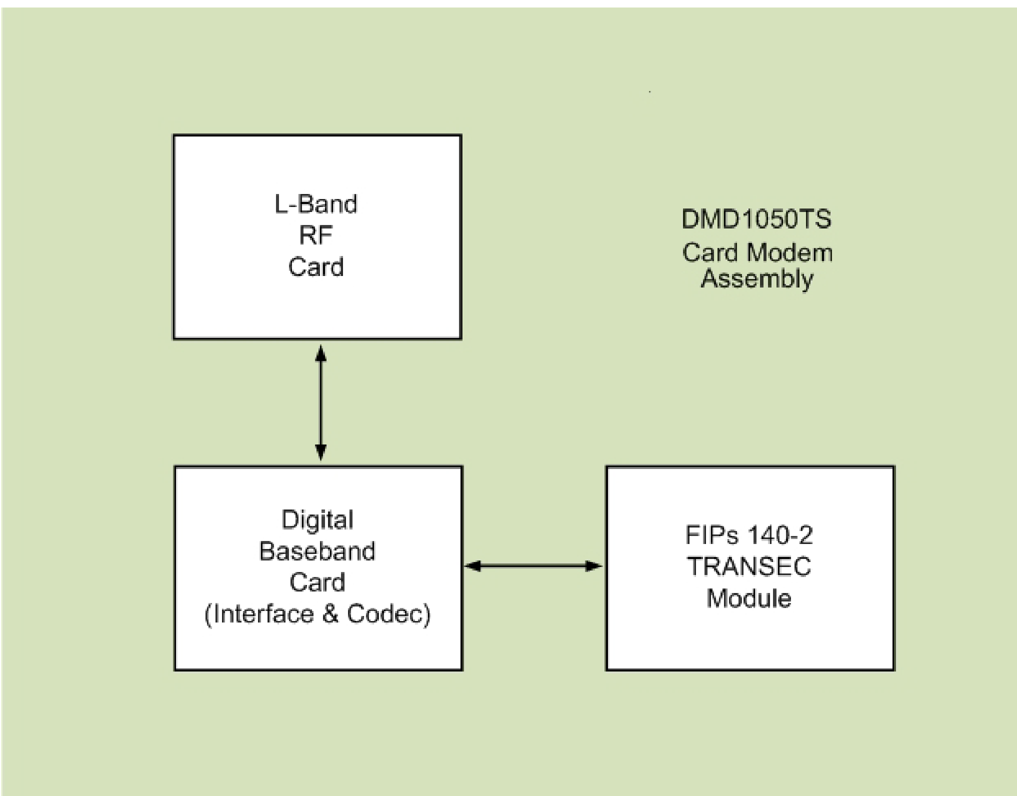


Figure 3-1. DMD1050TS Block Diagram

3.1.1 L-Band Printed Circuit Card

The L-Band/IF Printed Circuit Card consists of:

- Analog modulation function
- Analog complex down conversion
- Two wide-band digital synthesizers

The block diagram of the L-Band Assembly is shown in Figure 3-2.

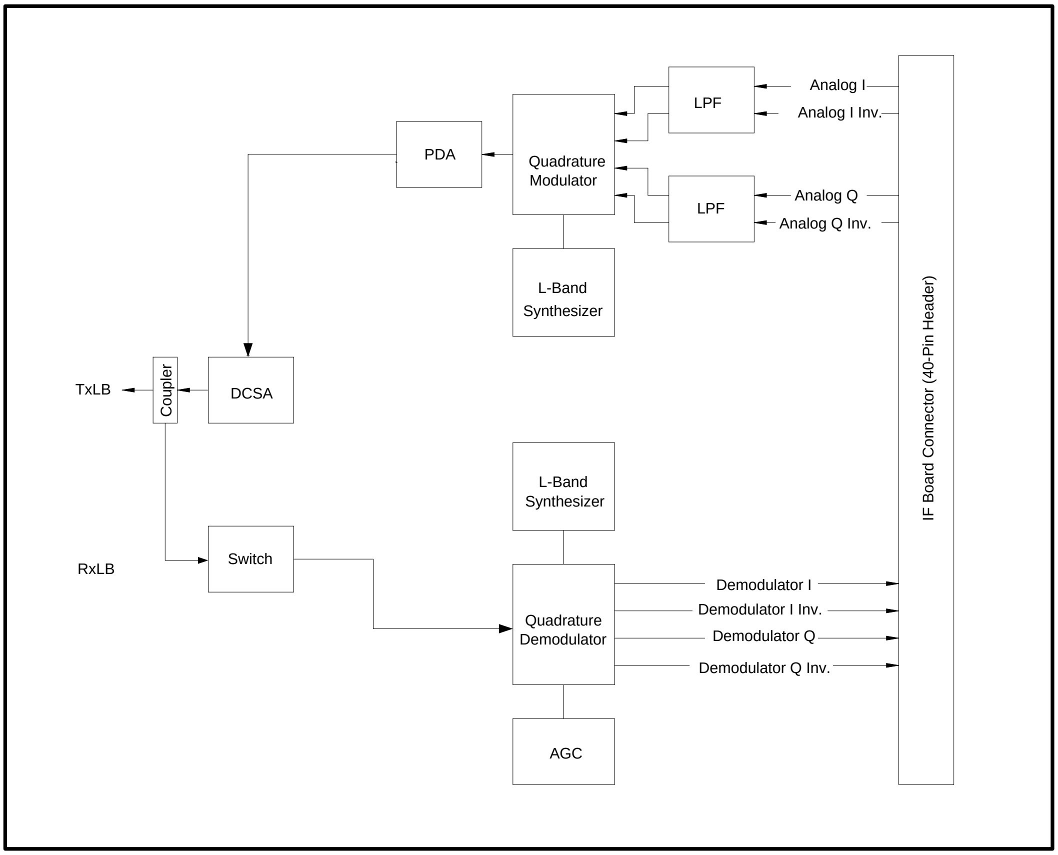


Figure 3-2. L-Band Assembly

In the modulator, analog in-phase (I) and quadrature (Q) signals are generated on the Digital Baseband Printed Circuit Card, routed to the L-Band Printed Circuit Card and modulated at the desired frequency.

The L-Band modulated signal is then passed through a microprocessor-controlled variable attenuator, providing gain control of the output signal.

In the complex down converter, the signal for demodulation is amplified and sent through a variable wideband attenuator for Automatic Gain Control (AGC). The gain-controlled signal is then passed through a complex down converter to a low IF.

3.1.2 Baseband Processing Printed Circuit Card

The advent of million-plus gate count Field-programmable Gate Arrays (FPGAs), advanced logic synthesis tools and Digital Signal Processors (DSPs) providing hundreds of Microprocessor without Interlocked Pipeline Stages (MIPs) supported the design of a software-configurable modem. Large, fast FPGAs now provide designers with what is essentially an on-the-fly programmable Application-specific Integrated Circuit (ASIC).

High speed, complex digital logic functions that previously could only be implemented in dedicated integrated circuits, are now downloaded from a micro-controller through a serial or peripheral interface. When a new digital logic function is needed, a new configuration file is loaded into the FPGA. There is no limit to the number of digital logic configurations available to the FPGA, aside from the amount of Flash memory available to the system microprocessor for storage of configuration files.

The DMD1050TS Baseband Processing Printed Circuit Card provides a flexible architecture that allows many different modes of terrestrial and satellite framing, various Forward Error Correction (FEC) options, digital voice processing and several different modulation/demodulation formats. Also included on the Baseband Printed Circuit Card are a MIL-188-114A/RS-422 synchronous interface and a two-port 10/100 Ethernet Bridge interface.

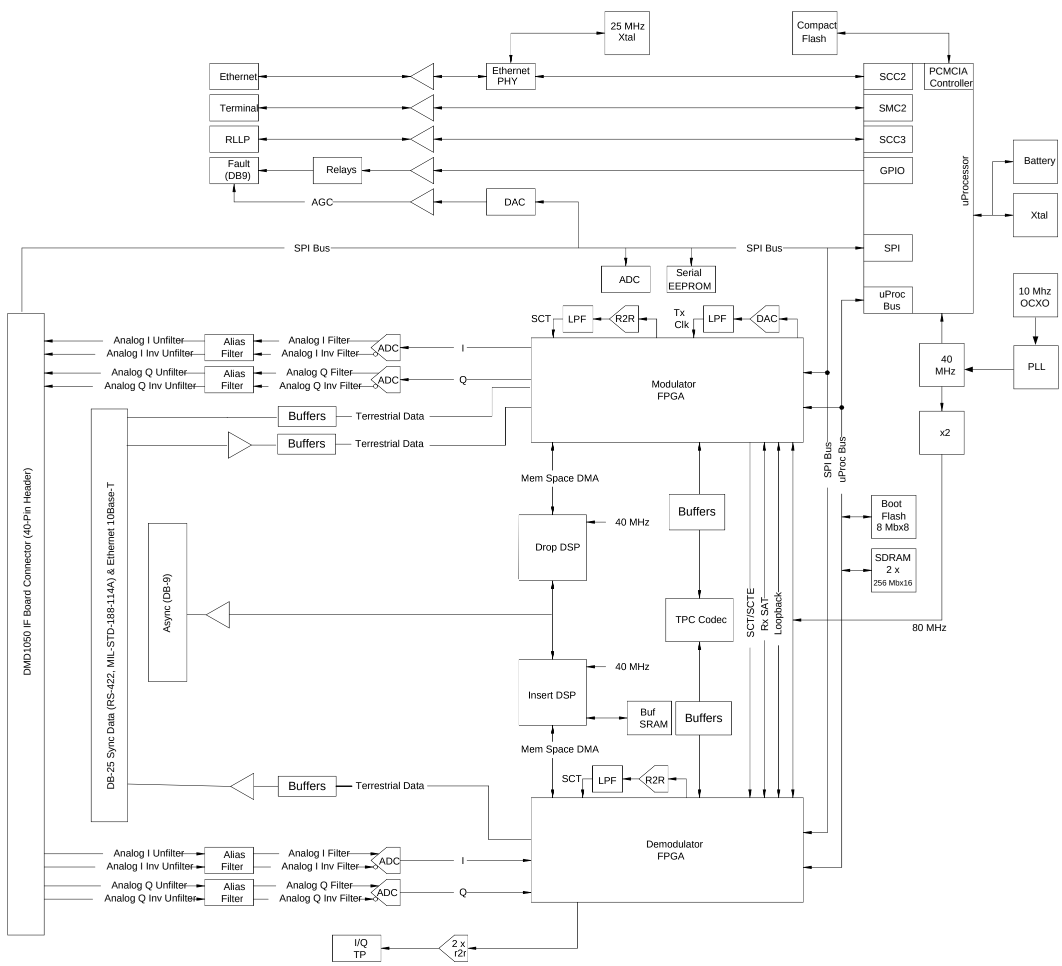


Figure 3-3. DMD1050TS Baseband Processing Card Block Diagram

The Baseband Printed Circuit Card also contains the M&C Circuitry responsible for:

- Programmable part setup and initialization
- Continuous control and adjustment of some functions
- Calibration
- Monitoring fault status
- Calculating and displaying measurements
- Calculations
- User monitor and control interface including any remote interface
- Unit configuration and feature set

The M&C System is based on a powerful microprocessor with a large amount of Flash memory. Several bus architectures are used to interconnect the M&C to all components of the DMD1050TS. Communication to the outside world is done via connections to the remote port, terminal port, Ethernet port and alarm port. The M&C runs on software programmed into its Flash memory. The memory can be reprogrammed via the Ethernet port to allow changes in software.

3.1.3 FIPs 140 Level 2 TRANSEC Security Module

The DMD1050TS Modem Card is optionally equipped with the FIPs 140 Level 2 Transmission Security (TRANSEC) Security Module in standalone operation with the DMD1050TS Modem.

The Federal Information Processing Standards (FIPS) Module is a standalone, independently-certified optional card that is secured to the DMD1050TS baseband processing card. It does bulk encryption and decryption of traffic over the satellite, using the AES-256 algorithm.

The DMD1050TS is fully compatible and interoperable in all specified modes of operation with KIV-19 Provisional and KG-95-1 Provisional TRANSEC equipment used by the Government.

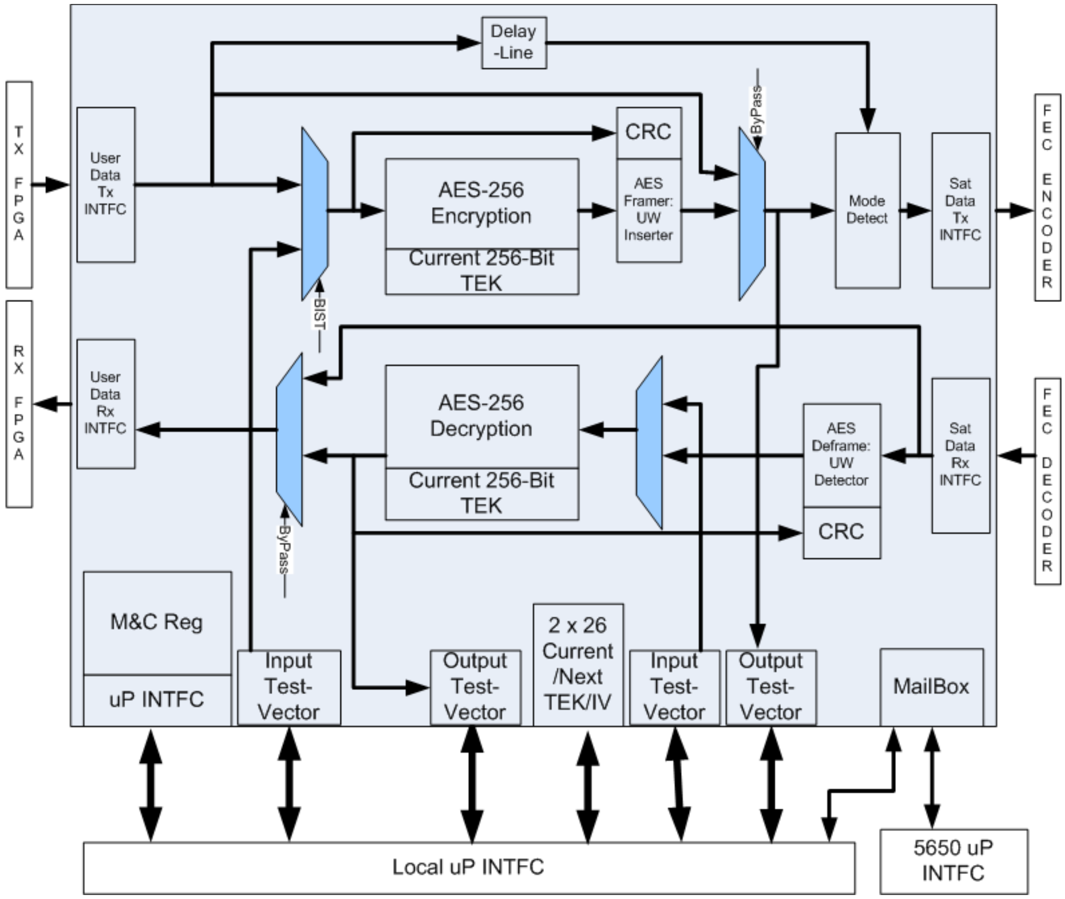


Figure 3-4. DMD1050TS FIPS 140 Level 2 TRANSEC Processing Module Block Diagram

3.2 DMD1050TS Functional Block Diagram

Figure 3-5 shows the DMD1050TS Functional Blocks. The modem is shown in a typical application with customer data, Tx/Rx RF equipment and an antenna.

3.2.1 Baseband Processing

The Baseband Processor does all of the functions required for an Intelsat Buisiness Service (IBS) / Intermediate Data Rate (IDR) Framing Unit, a Reed-Solomon (R-S) Codec. In addition, the Baseband Processing Section provides for transmit clock selection and rate adaptation, as well as a rate adapter and Plesiochronous/Doppler (PD) Buffer in the receive direction. A multiplexer is also provided for the Serial Clock Transmission (SCT) Clock Source for Loop Timing Applications. The transmit and receive paths can be configured independently under processor control.

The DMD1050TS supports IBS & IDR compatible framing modes. Because the modem does not have all supporting interfaces as stipulated by IESS308/309, it is not 100% compliant. IBS and IDR framing modes are supported in a Closed Network Mode.

3.2.2 Tx Baseband Processing

The Tx Data and Clock enters the baseband processor, passes through a rate adapting First In First Out (FIFO) and enters the framer processor. In Closed-Net mode, the data passes through the framer unaltered. In IDR & IBS framing enabled mode, it adds the applicable framing, as defined in IESS-308 and 309. The data is then sent to the R-S encoder.

The R-S encoder encodes the data into R-S blocks. The blocks are then interleaved and synchronized to the frame pattern, as defined by the selected specification (IESS-308, IESS-309, DVB, etc.). After R-S encoding, the composite data and clock are applied to the Baseband Loopback Circuit.

3.2.2.1 Direct Sequence Spread Spectum (DSSS)

Because the DMD1050TS is ideal for systems with very small dishes, or on-the-move systems, there is an increased interest in Spectrum Spreading. To meet this need, optional **DSSS** is available for the DMD1050TS.

DSSS works by modulating the normal carrier with a pseudo-random PN sequence (chips) at a much higher chip rate. The chip rate is determined by the carrier’s symbol rate and a multiplying (spreading) factor.

The DMD1050TS offers spreading in this Low Density Parity Check (LDPC) Modulation and Code Rate (MODCOD):

- HP-LDPC BPSK Rate 1/2

The spreading factors currently supported are 1 (Spreading Off), 2, 4, 8 and 16, up to a maximum chip rate of 10 Mbps. You can select from among four built-in, pseudo-random PN sequences. Thus, multiple spread carriers can occupy the same bandwidth in a Code-Division Multiple Access (CDMA) manner.

Additionally, there is no loss in performance with spreading enabled on the DMD1050TS.

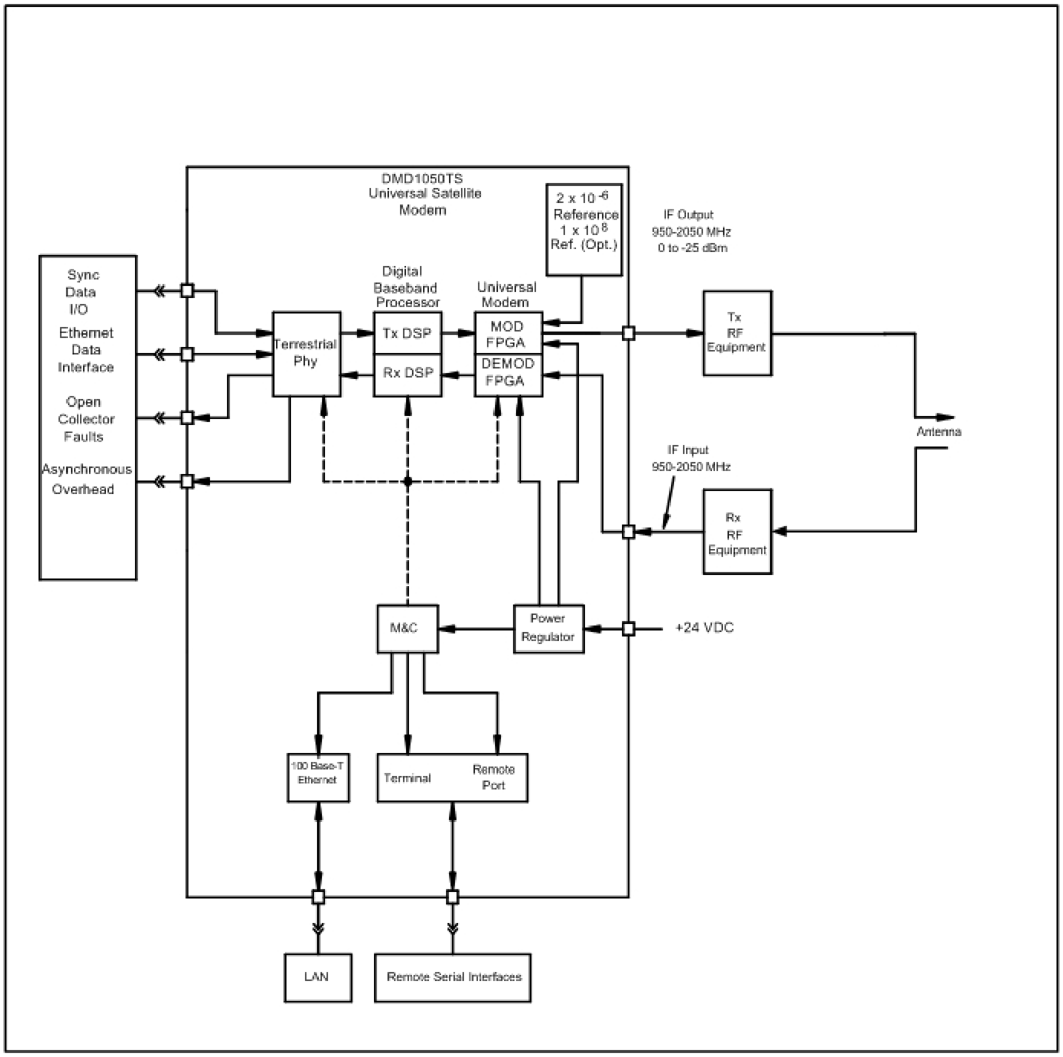


Figure 3-5. DMD1050TS Universal Satellite Modem Functional Block Diagram

3.2.3 Rx Baseband Processing

The Receive Processor performs the inverse function of the Transmit Processor. Data received from the satellite passes through the BB Loopback Circuit to the R-S decoder to the deframer. The deframer acquires the IBS/IDR/DVB frame, synchronizes the R-S decoder, and extracts the received data and overhead from the frame structure. It puts the data into the PD buffer, sending the overhead data to the UIM. The data is extracted from the buffer and is sent to the UIM. Backward Alarm indications are sent to the M&C Subsystem.

3.2.4 FIPs Module Processing

The FIPs Module on the DMD1050TS does bulk encryption and decryption of traffic over the satellite using the AES-256 algorithm. When operating in Non-STANAG 4486 (Enhanced Bandwidth Efficient Modem (EBEM)) modes, the DMD1050TS AES encryption uses Code Block Chaining (CBC) mode to do the encryption and decryption of the user data.

All encryption occurs directly before the FEC encoder, and decryption occurs just after the FEC decoder.

The FIPs module maintains a local copy of the Traffic Encryption Keys (TEK) and the Initialization Vectors (IV). It also provides Built-In Self Test (BIST) functions, per the FIPS 140-2 level requirements. Finally, it provides a simple framing structure with the primary purpose of allowing the decryption engine on the receive side to recover Advanced Encryption Standard (AES) block alignment. However, the framing structure can also provide a means for lossless TEK rollover.

TRANSEC Overhead Rate = (3 + 16 * N) / (16 * N), where N is the Encryption Frame Length

When operating in STANAG 4486 (EBEM) mode bulk encryption and decryption are per the STANAG requirement.

3.2.4.1 Access to the FIPs Module HTTPS Interface

Chapter 8. DYNAMIC POWER CONTROL (DPC) OPERATION
Chapter 9.

See Chapter 8 or Chapter 9 for details on getting access to the functions of the FIPs TRANSEC Module.

3.3 Monitor & Control (M&C)

The modem's M&C system is connected to most of the circuitry on any board in the modem. These connections give status on the operating condition of the circuitry, as well as giving the data required for the various measurements the modem provides. The M&C processes this information, and generates status indications, as well as alarms, when necessary. Detailed status information is available via the modem's user interfaces, including the remote and terminal ports. An external summary fault is available on the RS422 Data interface.

The M&C contains a high-performance microprocessor. It is responsible for overall command and control of modem functions. The M&C is monitoring all subsystems of the modem constantly, by completing a periodic poll routine. It configures the modem by responding to commands input to the system. During each poll cycle, the status of each of the subsystems is collected and reported to each of the external ports. Performance statistics, such as Eb/No, buffer fill %, etc., are compiled. If faults are detected, the M&C acts to minimize the effect of such faults on the system.

The DMD1050TS supports these M&C protocols:

- Terminal Interface (Section 3.3.1)
- Remote Port Interface (Section 3.4)
- Web Browser (Section 3.5)
- M&C Default/Reset Plug Settings (Sections 3.6)
- SNMP (Simple Network Management Protocol) (See the MN-DMDREMOTEOP Remote Protocol Manual)

3.3.1 Terminal Port/ES-ES Communications (J3)

J3 functions as the Modem Remote Port, Terminal Port or ES-ES Communications. For Terminal port application, it supports an asynchronous control protocol. It can be configured to support either RS-232 or RS-485 signal levels. This port is intended for use in computer-based remote M&C. All functions of the modem can be monitored and controlled from this port via a common terminal connected to the Terminal Port. This function is selected from the Web browser.

This port is also dedicated for ES-ES Communications. The port can be configured for a number of communications protocols. Overhead data to/from the UIM is routed to/from the framer/deframer. This port can be configured to support either RS-232 or RS-485 signal levels.

The baud rate and protocol can be selected from the Web Browser.

3.3.2 Terminal Mode Control

The DMD1050TS Terminal Mode Control allows the use of an external terminal or computer to monitor and control the modem from a full screen, interactive presentation operated by the modem itself. No external software is required, other than VT-100 Terminal Emulation Software (e.g., Procomm) for a computer when used as a terminal. The Control Port is typically used as an RS–232 connection to the terminal device. The RS-232 operating parameters can be set using the modem's Web browser, and stored in Non-volatile memory for future use. See the Remote Protocol Manual TM117.

3.3.3 Modem Terminal Mode Control

The modem can be monitored and controlled interactively in the Terminal Mode, with a full screen presentation of current settings and status. Programming is done by selecting the item to be modified and pressing the terminal key of the option number. For example, to change the transmit data rate, enter 33 at the terminal. The modem responds by presenting the options available and requesting input. Two types of input can be requested. If the input is multiple choice, select the desired choice by pressing the Space bar. When the desired option is shown, press the Enter key to select that option. The other possible input type requires a numerical input, such as entering a frequency or data rate.

This type of input is followed by pressing the Enter key. Abort input at any time by pressing the ESC key. Invalid input keys cause an error message to be shown on the terminal.

The Terminal Control Mode supports serial baud rates of 150, 300, 1200, 2400, 4800, 9600, 19200 and 38400. The connection must be set for 8 data bits, 1 stop bit and no parity (8,N,1). Three terminal emulations are supported: VT-100, WYSE 50 and ADDS-VP.

Use the character $ for setting the screen when the terminal is used for the first time. The non-volatile memory is reset.

3.3.4 Modem Setup for Terminal Mode

Terminal Mode communications and protocol are set from the Web browser by setting the Control Mode parameter to Terminal. Then, set the Modem Port, Term Baud and Emulation Parameters as desired. Next, connect a terminal to the J1connector.

All operating software for the Terminal Mode is contained in the DMD1050TS modem internal control software.

These actions initiate full screen terminal mode printing and redrawing of the full screen: a break signal on the communications line, pressing ESC on the terminal, or Power On of the modem.

The Terminal Mode shows the status of all user parameters controlled and read by the processor. It offers a menu that allows changes to any controlled parameter.

The Terminal Mode uses eight screens, each of which have the basic contents of the three modem monitor and control areas, as set in the Web browser matrix columns. Use this screen for setting the parameters of the Modulator, Demodulator, Event, Alarm, Latched Alarm and Interface areas.

The Terminal Control Mode is menu-driven. The permitted values for each item number are shown. To change an item, enter its number and press the Enter key. If the parameter to be changed requires a numeric value, enter the number and press the Enter key. If the parameter is non-numeric, press the Space bar to cycle through the list of available entries.

Items that do not have ID numbers are Status only, and cannot be changed.

3.3.5 Connect the Terminal

1. Connect the computer to the DMD1050TS Remote Connector (J3) using an RS-232 cable.
2. Select Terminal Mode in the Web Browser
3. Make sure the emulation software has these settings:
    - 8 data bits
    - no parity
    - 1 stop bit

3.3.6 Terminal Screens

See MN-DMDREMOTEOP, the Remote Protocol Manual (TM117).

3.4 Modem Remote Communications (Radyne Link Level Protocol)

The Remote Port on J3 allows for control and monitoring of parameters and functions via an RS-232 Serial Interface, or RS-485 for RLLP Protocol.

Enter Equipment Remote Mode setup from the Web Browser interface, System menu. First, set the Remote Port Control to Remote, then set the Multidrop Address as necessary, then set the Remote Interface to RS232 or RS485.

Control and status messages are conveyed between the modem and all subsidiary modems, and the host computer, using packetized message blocks in accordance with a proprietary communications specification. This communication is handled by the RLLP, which serves as a protocol wrapper for the RM&C data.

3.4.1 RLLP Protocol Structure

The Communications Specification (COMMSPEC) defines the interaction of computer resident M&C software used in satellite earth station equipment such as modems, redundancy switches, multiplexers and other ancillary support gear. Communication is bi-directional, and is typically established on one or more full-duplex, 9600-baud, multi-drop control buses that conform to EIA Standard RS-485.

Each piece of earth station equipment on a control bus has a unique physical address, which is assigned during station setup/configuration, or prior to shipment. Valid decimal addresses on one control bus range from 032 through 255, for a total of up to 224 devices per bus. Address 255 of each control bus is usually reserved for the M&C computer.

See MN-DMDREMOTEOP, the Remote Protocol Manual (TM117) for the RLLP Protocol.

3.5 Modem Setup for Ethernet M&C (J11)

This port is dedicated for Ethernet Communications supporting SNMP, FTP and Web Browser to the DMD1050TS base modem, and Secure HTTP (HTTPS) independently to the FIPs module. The port is configured for 100 Base-T communications protocols. The Ethernet M&C interface uses a standard RJ45 Male connector. The Ethernet Interface is shipped from the factory in an addressable BOOT MODE state, that allows you to get access to the unit. This BOOT MODE state is set to IP TEST.

Connect an Ethernet cable between the unit and a computer that has web browser capability. Open the browser, and enter the default web address for the unit.

3.6 M&C Default/Reset Plug Settings (JP1 & JP2)

If you are having difficulty getting access to the Web Browser or the Terminal Interface, reset the M&C interface settings. See Chapter 4 and Appendix D for details.

The default reset procedure resets these M&C items:

- TCP-IP BOOT MODE is set to IP TEST, (modem address 192.168.0.238)
- Remote Control Mode is set to Terminal
- Terminal port is set to RS232
- Web Browser Names and Passwords are reset, (See the Web Browser Setup Guide, Appendix D)

3.7 Ethernet Data Interface – (J10)

With its multi-port interface, automatic Learning and Aging, Auto-Crossover, Auto-Polarity, Auto-Negotiation and embedded Quality of Service, the Enhanced Ethernet Interface offers true Plug-n-Play connectivity.

If the Ethernet Data Interface is selected, then the Tx Clock Source defaults to Serial Clock Transmit External (SCTE), and the Clock Polarity defaults to Normal.

The Ethernet Bridge Interface makes it easy to connect Local Area Networks (LANs) via satellite. Select Ethernet as the terrestrial interface, and connect the LAN into any of the two RJ-45 connectors on the unit.

The DMD1050TS Ethernet Interface maintains backward compatibility with all of these products:

- DMD20/DMD20 LBST/DMD50/DMD2050/DMD2050E and the OM20 with High-level Data Link Control (HDLC) selection RADYNE
- SLM-5650A using a Gigabit Bridge card with HDLC Comtech
- CDM-570/CDM-625 with the HDLC selection Managed 570

It allows for all higher level protocols, like DHCP, UDP, TCP, HTTP and FTP, etc., to pass transparently through the level 2 Bridge interface, and operates with its line speed learning capability. Ethernet packet traffic is forwarded immediately to the applicable ports without unnecessary startup delay.

For users who want more control over traffic, the 10/100 Ethernet interface provides additional QOS controls, and new features, such as port based priorities, strict priority queuing and the ability to operate in a FIFO-like mode.

The full duplex capability of the standard 10/100 interface allows it to pass up to 20 Mbps in each direction over the satellite.

The DMD1050TS supports Radyne HDLC, Comtech HDLC and 570 Managed Swich modes, offering compatibility with all the configurations of Comtech products shown in Table 3-1.

Table 3-1. DMD1050TS HDLC Interoperation

Modem Model	Ethernet Interface	HDLC
DMD20[1]	PLR5171 10/100	Radyne
DMD20 LBST[1]	PLR5171 10/100	Radyne
DMD20[1]	PLR5497 10/100	Radyne
DMD1050 Legacy[1]	N/A	Radyne
DMD1050T[1]	N/A	Radyne
DMD20[1]	PLR5584 10/100/1000	Radyne
DMD20 LBST[1]	PLR5584 10/100/1000	Radyne
DMD50[1]	PLR5584 10/100/1000	Radyne
DMD2050[1]	PLR5584 10/100/1000	Radyne
DMD2050[1]	PLR5584-1 10/100/1000	Radyne
DMD2050E[1] (Standard Configuration)	PLR5584-1 10/100/1000	Radyne
SLM-5650A	Gigabit Bridge Card, Bridge Mode (1.1.2)	Comtech
SLM-5650A	Network Processor Card (GIGE Bridge Mode)	Radyne
CDM-570	Managed switch Mode	Managed 570
CDM-625	Managed switch Mode	Managed 570
[1] Interoperates in any common selectable mode		

3.7.1.1 Configure the Modem to use the Ethernet Data Interface

When the optional Ethernet Data Interface Card is selected, all of the Ethernet related menus can be used to control the interface.

1. Setup the Tx Interface Menu to: (see Chapter 7)
   a. Set the Terrestrial Interface to Ethernet
   b. Set the Ethernet Flow Control as desired
   c. Set the Ethernet Daisy Chain as desired
   d. Set the Ethernet QOS Type as desired
   e. Set the Ethernet QOS Queue as desired
   f. The Tx Clock is set to SCTE automatically
      i. The Tx Clock Polarity is set to Normal automatically

2. Setup the Rx Interface Setup Menu to: (see Chapter 7)
   a. Set the Terrestrial Interface to Ethernet.
   b. Set the Buffer Size to Zero (provides minimum delay).
   c. Buffer Clock is set to Rx Sat.
   d. Set the Buffer Clock Polarity to Normal.

3.7.1.2 Ethernet Flow Control

When Ethernet Flow Control is disabled, if a packet is received for transmission and no packet buffer space is available, the incoming packet is discarded.

When Ethernet Flow Control is enabled, flow control is used to throttle the transmission station to avoid overrunning the transmit buffers. This overrun would cause packets to be dropped. The throttling mechanism used depends on the interface, and whether it is half- or full-duplex.

3.7.1.3 Half-Duplex Flow Control

In half-duplex mode, the unit uses industry standard backpressure to support flow control:

- When available buffer space is almost gone, the modem causes a collision on the input port when it senses an incoming packet. This collision causes the transmitting station to back off, and retry the transmission.
- The interface will stop causing collisions, as soon as free buffer space becomes available.

3.7.1.4 Full-Duplex Flow Control

In full-duplex mode, the interface implements IEEE 8802.3x flow control:

- When available buffer space is almost gone, the unit sends out a pause frame with the maximum pause time, to stop the remote nodes from transmitting.
- The interface sends out another pause frame with the pause time set to zero, as soon as free buffer space becomes available.

3.7.1.5 Ethernet Daisy Chain

When Ethernet Daisy Chain is disabled, Port 2 on the Ethernet Data Interface operates normally. Data received on Port 2 that is not addressed to other equipment on the LAN side, is transmitted over the satellite.

When Port 2 is selected for Daisy Chain, any data received on Port 2 is forwarded to one of the other LAN side ports (Port 1) and is not transmitted over the satellite. This is useful in a point-to-multipoint configuration, as shown in Figure 3-6.

3.7.1.6 Ethernet Quality of Service (QoS) Type

When Normal QoS is selected, the interface sets a packet's priority based on these criteria:

- IEEE 803.3ac Tag when present
- IPv4 Type of Service / Differentiated Services Field
- Ipv6 Traffic Class

When Port Based QoS is selected, the interface sets the priority of a packet based on the port on which it arrived:

- Port 1 (JS2) has the highest priority
- Port 2 (JS3) has the second highest priority

3.7.1.7 Ethernet QoS Queue

When Fair Weighted queuing is selected, the interface transmits packets at a rate of 8, 4, 2 and 1, from the highest priority queue to the lowest, respectively. With Fair Weighted queuing, all queues with data in them are guaranteed to receive some bandwidth.

When Strict Priority is selected, the interface transmits packets from the highest priority queue until it is empty. It then begins transmitting data from the next highest priority queue. If higher priority data arrives, the interface finishes the current packet, and then goes back to transmitting packets from the higher priority queue, until it is empty again. Be careful when selecting Strict Priority, because it is possible for the lower priority queues to be stalled indefinitely.

3.7.1.8 Set Up the DMD1050TS Ethernet Bridge to Operate Like a FIFO

In certain circumstances, it can be desirable to have the Ethernet interface operate in a FIFO-like manner, with no reordering of packets. This can be established by using a single port on the Ethernet interface, and setting the Ethernet QoS Type to Port Based, and the Ethernet QoS Queue to Strict Priority. When set up and used in this manner, the packets are transmitted in the exact order in which they are received.

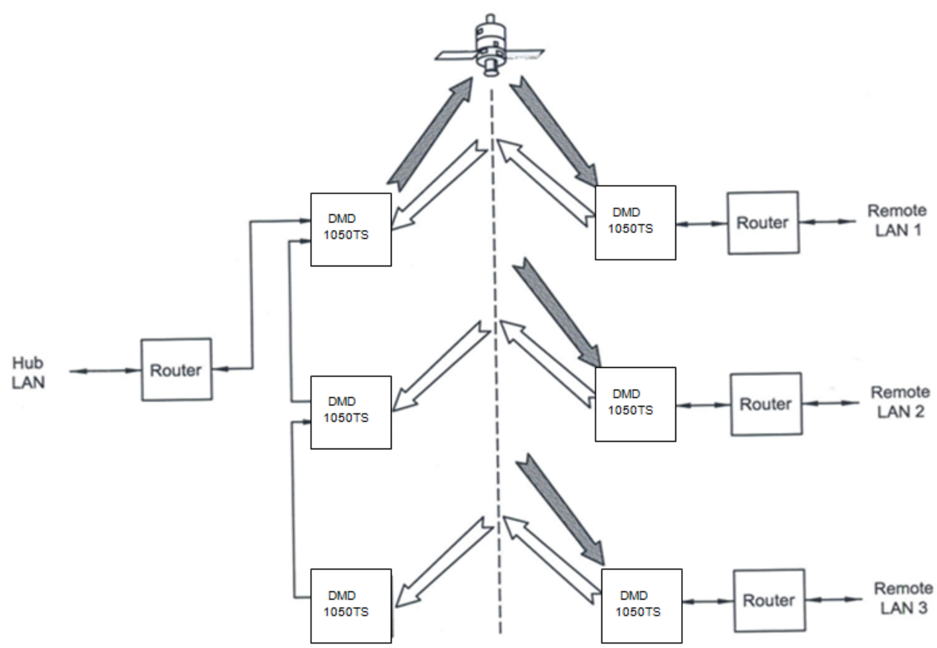


Figure 3-6. Point-to-Multipoint with Daisy Chaining

3.7.1.9 Packet Statistics

These statistics are available from the Monitor Menu, when the Ethernet Data Interface is selected.

- **Total Packets:** shows the total number of Ethernet packets received from the satellite
- **Error Packets:** shows the total number of Ethernet packets received from the satellite that had errors
- **Packet Error Rate:** shows the Ethernet Packet Error Rate (PER) from the satellite
- **Packet Statistics Reset:** allows you to reset the Ethernet Total Packets and Ethernet Error Count by pressing Enter
- **Link Status:** These statuses are available in the Monitor Menu/Link Status Sub-Menu, when the Ethernet Data Interface is selected:
    - **Port 2 Status:** shows the current status of LAN Port 1
    - **Port 3 Status:** shows the current status of LAN Port 2
    - For each of these ports, the status can have one of these values/meanings:
        - **Down:** link is down
        - **Unresolved:** cannot agree on connection speed
        - **10 Mbps Half:** connected at 10 Base-T Half Duplex
        - **10 Mbps Full:** connected at 10 Base-T Full Duplex
        - **100 Mbps Half:** connected at 100 Base-T Half Duplex
        - **100 Mbps Full:** connected at 100 Base-T Full Duplex

If all LAN Ports are down, a Tx Data Activity Minor Alarm is generated.

If the Wide Area Network (WAN) Port is down, a Tx and Rx Ethernet WAN Major Alarm is generated.

3.8 Internal Clock

The time and date are used to time-stamp system events. You can change the time and date via the Web Browser.

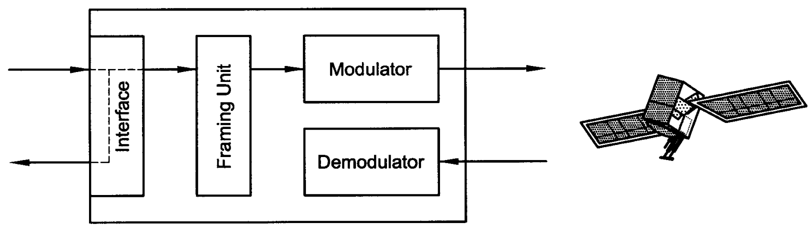
3.9 Loopback Features (Terrestrial & IF)

CAUTION: DATA LOSS POSSIBLE
To run any type of data test with an Ethernet interface, you must use two modems connected back-to-back. Using the modem's loopback with the Ethernet data interface causes unwanted network loops and useless results.

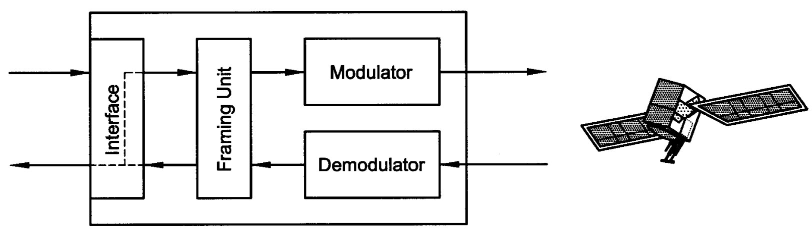
The modem allows for several different loopbacks:

- IF Loopback – Tx IF port is looped back to the Rx IF port
- Tx Terrestrial Loopback - Tx Data port is looped back to the Rx Data port after the interface driver/receiver (prior to the framing unit)
- Tx Baseband Loopback - Tx Data port is looped back to the Rx Data port after the interface driver/receiver (after the framing unit)
- Rx Terrestrial Loopback - Receive Data from the satellite is looped back for retransmission to the satellite, providing a far end loopback (prior to the framing unit)
- Rx Baseband Loopback - Receive Data from the satellite is looped back for retransmission to the satellite, providing a far end loopback (after the framing unit)
- Tx/Rx Terrestrial Loopback - provides both Terrestrial loopbacks simultaneously
- Tx/Rx Baseband Loopback - provides both Baseband loopbacks simultaneously

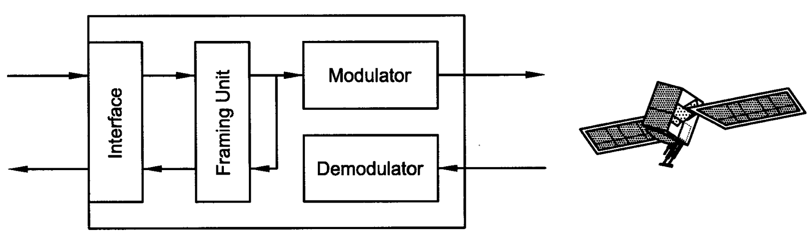
See Figure 3-7 through Figure 3-9 for loopback functional block diagrams.



Tx Terrestrial Loopback



Rx Terrestrial Loopback



Tx Baseband Loopback

Figure 3-7. Loopback Functional Block Diagram

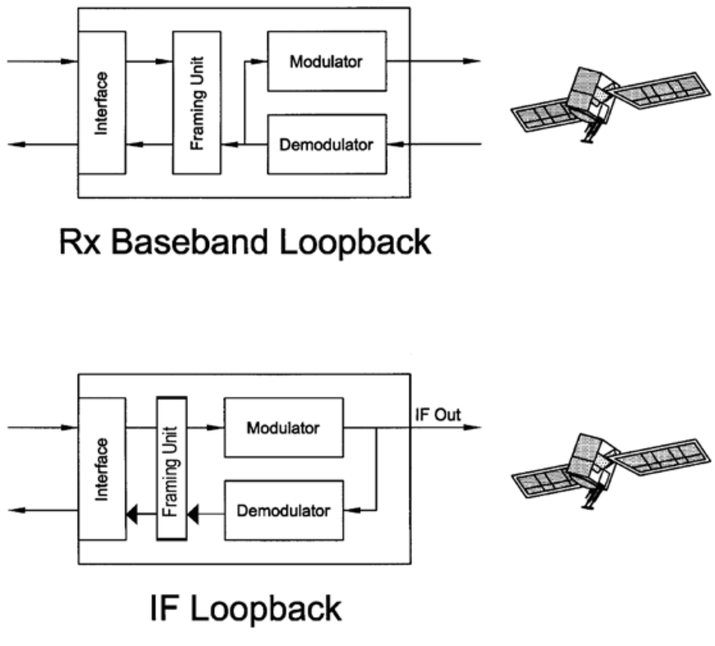


Figure 3-8. Loopback Functional Block Diagram

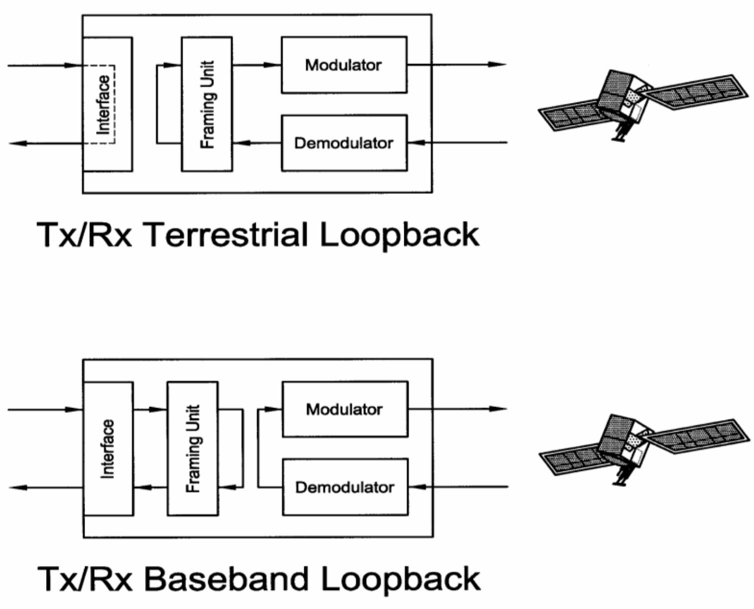


Figure 3-9. Loopback Functional Block Diagram

3.10 DMD1050TS Clocking Options

The DMD1050TS supports several clocking options that can be recovered from the satellite or the terrestrial links. The clocking options allow you to decide which clock best fits the application. Figure 3-10 shows a diagram on how the modem processes the clocks for the Tx Clock source and the Rx Buffer Clock source. Tx and Rx Clocks can be locked independently.

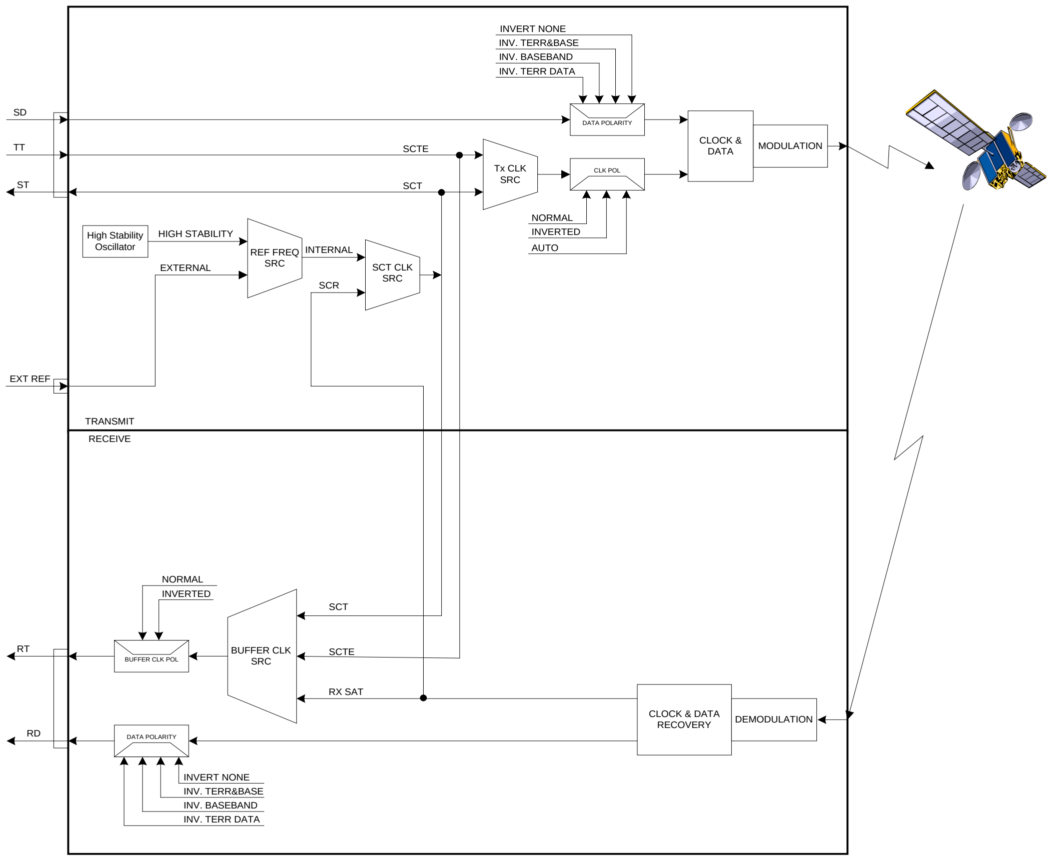


Figure 3-10. Clocking and Polarity Diagram

3.10.1 Tx Clock Options

Tx clock options can be recovered from the terrestrial or satellite interface, or generated internally. You can select the SCTE Clock (Terrestrial), or the SCT internal clock. The modem also allows you to recover the SCT Clock from the satellite (Serial Clock Receive (SCR)), or from the modem internally. The modem allows you to select clock polarity. The Tx clock selections available are:

- SCT (Internal Oscillator)
- SCTE (External Tx Terrestrial Clock)
- Rx Satellite Clock

3.10.1.1 Serial Clock Transmit External (SCTE)

The SCTE clock is the Transmit Terrestrial Clock associated with the data interface. SCTE is an external clock received from the terrestrial equipment. The modem uses the terrestrial clock to lock the internal clock.

Figure 3-10 shows how the Transmit Terrestrial Data enters the modem and is clocked into a deter FIFO. Data is clocked out of the FIFO by the Modulator Clock. The Modulator Clock and Phase-Locked Loop (PLL), along with the Dejitter FIFO, reduce the input jitter. Jitter reduction exceeds the jitter transfer specified in CCITT G.821.

SCTE is sometimes referred to as Tx Terrestrial Timing or Terminal Timing. Terminal Timing is a reference to the RS422 or MIL 188-114A synchronous interfaces.

3.10.1.2 Serial Clock Transmit (SCT)

The SCT clock can be generated internally or recovered from the satellite. The SCT clock source can be used as the Tx clock source, Rx Buffer Clock source, and the Terrestrial Terminal equipment for clocking the transmit data. If the SCT clock is recovered from the satellite, then it is referred to as SCR. SCR is also referred to as Receive Clock, Satellite Clock or Receive Timing (RT).

When SCT clock is configured as Internal, the frequency of the clock is set the same as the Transmit Terrestrial Clock rate. If SCT clock is configured as SCR, the internal clock is set to the same rate as the incoming receive satellite clock. SCT is sometimes referred to as Internal Timing or Send Timing (ST). If the satellite clock is lost, the modem will switch over to the Internal Clock automatically, and revert to SCR when activity is detected.

If SCT is selected, then Terrestrial data that is synchronous to the SCT Clock must be supplied by the modem. The terminal equipment uses the SCT as its clock source. The Autophase Circuit makes sure that the data is clocked correctly into the modem automatically. A return clock is not necessary. The Clock Polarity must be set to Auto.

3.10.2 Rx Buffer Clock Options

The DMD1050TS supports several Rx Buffer clock options that can be recovered from the satellite, from terrestrial links or internally. The clocking options allow you to decide which clock best fits the application. Figure 3-10 shows how the modem processes the clocks for the Tx Clock and the Rx Buffer Clock. Tx and Rx Clocks can be locked independently. These Buffer clock selections are available on the DMD1050TS:

- SCTE (External Tx Terrestrial Clock)
- SCT (Internal Oscillator)
- Rx Satellite Clock

The DMD1050TS handles Rx Buffer clock selections based on source priority levels. See Appendix D.

Priorities are assigned to the clock sources based on source selections. Source 1 has the highest priority, and Source 3 has the lowest priority. If a fallback clock is selected, and activity is lost at the highest priority source, the modem will fall back to the next highest priority clock that has activity. When activity resumes on a higher priority source, the modem resumes using the higher priority source.

Clock Source		Priority
Rx SAT	1	3
SCTE	2	3
SCT	3	3

3.10.2.1 Rx SAT Clock

The Rx SAT clock is recovered from the satellite that is received from the distant end. If selected, the Buffer Clock is locked to the Rx SAT clock.

3.10.2.2 SCTE as Rx Buffer Clock

When SCTE is selected as the Rx Buffer clock, the modem receives the clock from the Transmit Terrestrial interface.

3.10.2.3 SCT as Rx Buffer Clock

If SCT clock is selected as the Rx Buffer clock source, then it must be configured for Internal. SCT is sometimes referred to as Internal Timing or Send Timing (ST).

3.10.2.4 External Reference: J9 SMA Female

This is not actually a clock, but does have some clocking implications. When the external reference is used, the master oscillator in the DMD1050TS is locked to the external reference, and the internal accuracy and stability of the DMD1050TS assumes that of the External Reference. Therefore, not only are the transmit frequencies of the DMD1050TS locked to the external reference, but the modem’s internal SCT Oscillator is locked to the external reference as well.

3.11 Ethernet Data Interface

The modem supports dual port 10/100 Base T Interface. When selected, the Tx Clock Source defaults to SCTE, and the Clock Polarity defaults to Normal. In addition, the Buffer Clock defaults to RxSat, and the Buffer Clock Polarity defaults to Normal. See Appendix C for interface set up and supporting features.

3.12 Reed-Solomon (R-S) Codec

See Figure 3-11, Figure 3-12 and Table 3-2.

Using a R-S Outer Codec concatenated with a Convolutional Inner Codec is an effective way to produce very low error rates, even for poor signal-to-noise ratios, while requiring only a small increase in transmission bandwidth.

Typically, concatenating an R-S Codec requires an increase in transmission bandwidth of only 9 – 12%, while producing a greater than 2 dB improvement in Eb/No. R-S is a block Codec, where K data bytes are fed into the encoder, which adds 2t = (N – K) check bytes to produce an N byte R-S block. The R-S decoder can then correct up to “t” erred bytes in the block.

3.12.1 R-S Operation in the DMD1050TS

When the R-S Codec is enabled, data is fed to the R-S Encoding Section of the DMD1050TS, where it is scrambled, formed into blocks, R-S encoded and interleaved. Unique words are added so that the blocks can be reformed in the Receiving Modem (See Figure 3-11 and Figure 3-12). Data is then sent to the modulator, where it is encoded convolutionally, modulated and transmitted to the satellite.

When the signal is received and demodulated by the Receiving Modem, it is fed to a Viterbi Decoder for the first layer of error correction. After error correction is done by the Viterbi Decoder, the unique words are located and the data is deinterleaved and reformed into blocks. The R-S Decoder then corrects the leftover errors in each block. The data is then descrambled and output from the R-S Section.

3.12.2 R-S Code Rate

The Standard R-S Code Rate is defined by (N, K) where N is the total R-S block size in bytes - data + check bytes -, and K is the number of data bytes input into the R-S Encoder. The transmission rate expansion required by the R-S Codec is then defined by N/K. In Closed Net Mode, the DMD1050TS allows these N and K settings: (126, 112), (219, 201), (194, 178), (225, 205). Table 3-2 shows IBS/IDR compliant modes. Custom R-S rates are available as an option.

3.12.3 Interleaving

The DMD1050TS allows for interleaving depths of 4 or 8 R-S Blocks, so burst errors are spread over 4 or 8 R-S blocks to enhance the error correction of the R-S Codec. In Closed Network Mode, set the interleaver depth to 4 or 8 manually. In DVB Network Mode, the DMD1050TS sets the interleaver depth to 12, automatically.

Figure 3-11. R-S Encoder Functional Block Diagram

Figure 3-12. R-S Decoder Functional Block Diagram

Table 3-2. R-S Codes

Service Type	Data Rate (Kbps)	R-S Code (n, k, t) [1]	Bandwidth Expansion [(n/k) -1]	Interleaving Depth	Maximum [2] R-S Codec Delay (ms)
Small IDR (With 16/15 O/H)	64	(126, 112, 7)	0.125	4	115
	128	(126, 112, 7)	0.125	4	58
	256	(126, 112, 7)	0.125	4	29
	384	(126, 112, 7)	0.125	4	19
	512	(126, 112, 7)	0.125	4	15
	768	(126, 112, 7)	0.125	4	10
	1024	(126, 112, 7)	0.125	4	8
	1536	(126, 112, 7)	0.125	4	5
IDR (With 96 Kbps O/H)	1544	(225, 205,10)	0.0976	4	9
	2048	(219, 201, 9)	0.0896	4	7
	6312	(194, 178, 8)	0.0899	4	2
	8448	(194, 178, 8)	0.0899	4	<2
8PSK	1544	(219, 201, 9)	0.0896	8	18
	2048	(219, 201, 9)	0.0896	8	13
	6312	(219, 201, 9)	0.0896	8	4
	8448	(219, 201, 9)	0.0896	8	3
DVB	All	(204, 188, 8)	0.0851	12	-

[1] n = code length, k = information symbols and t = symbol error correcting capability.
[2] Design objective.

3.13 DMD1050TS Automatic Uplink Power Control (AUPC) Operation

The modem has an optional, built-in provision for AUPC. AUPC is useful when operating power levels are affected by environmental changes in the atmosphere. AUPC attempts to adjust local power output to maintain a constant Eb/No at the receiver location.

The modem supports three versions of AUPC. They include Radyne AUPC, EF AUPC and Near Side AUPC. Radyne AUPC and EF AUPC use satellite overhead to send messages between the local and remote ends of an Single Carrier Per Channel (SCPC) link. The messaging is done with IBS 1/15 and EF AUPC Framing messages.

Strap Code 26 use can set some of the modem configuration. See Appendix G for an explanation and tabular listing of available Strap Codes. The Frequency and Modulator Output Power are set independently of the strap code.

3.13.1 Radyne AUPC

In this setting, the Target Eb/No is the remote value the local unit wants to maintain by adjusting the local power level.

The Radyne AUPC can be set to operate on either or both directions of a link, but always requires a bi-directional channel. Enabling AUPC on one side of the link will activate AUPC on the distant end of the link. It is necessary that both the Modulator and Demodulator be set to the applicable framing for AUPC options to be editable and for the AUPC function to operate correctly.

Examples of the basic Radyne AUPC Operations:

- Assume that the two modems, one at each end of the link, are set to Radyne AUPC operation. Only one direction is discussed, but the same functions can occur in both directions simultaneously.
- The Local Modem is transmitting to the Remote modem under normal conditions, and the Remote modem has a receive Eb/No of 7.5 dB. The Local modem has been set to a Target Eb/No of 7.5 dB with an output power level of -15 dBm.
- It starts to rain at the Remote site, and the Eb/No drops to –7.0 dB, then to –6.8 dB. The Remote Modem is sending update messages of its Eb/No constantly to the Local modem. When the Local modem sees the drop in the remote Eb/No, it starts to raise the output power slowly, and continues to adjust, if the remote Eb/No continues to drop. As the rain increases in intensity, the remote Eb/No decreases, but the Local modem continues to increase its power level to compensate.
- When the rain decreases, the Local modem sees the remote Eb/No start to increase. The Local modem lowers its power level.
- The operation is a feedback control loop, with the added complication of a significant time delay.

3.13.2 EF AUPC

In this setting, the Target Eb/No indicates the local unit wants the remote unit to maintain a power level sufficient to provide the local Eb/No value.

The EF AUPC can be set to operate on either or both directions of a link, but always requires a bi-directional channel. Enabling AUPC on one side of the link activates AUPC on the distant end of the link. It is necessary that both the Modulator and Demodulator be set to the applicable framing for AUPC options to be editable, and for the AUPC function to operate correctly.

Examples of the basic EF AUPC Operations:

- Assume that the two modems, one at each end of the link, are set to AUPC operation. Only one direction is discussed, but the same functions can occur in both directions simultaneously.
- The local modem is transmitting to a modem at a remote locale under normal conditions. The remote modem has a receive Eb/No of 7.5 dB. The local modem has been set with a Target Eb/No of 7.5 dB, and has a current power output of –15 dBm.
- It starts to rain at the local site, and the Eb/No drops to –7.0 dB, then to –6.8 dB. The local modem is sending update messages of its Eb/No to the remote modem constantly. When the remote modem sees the drop in the Eb/No, it begins to raise its output power slowly, and continues to do so until the Target Eb/No is restored at the local site.
- When the rain decreases, the local modem’s Eb/No starts to increase. The remote modem lowers its power level to restore the target value.
- The operation is a feedback control loop, with the added complication of a significant time delay.

3.13.3 Near Side AUPC

The Near Side AUPC is a loop back system that adjusts the broadcast uplink signal when local conditions change. This is done by having the Near Side AUPC attempt to adjust the outbound power to compensate for local weather.

The local receiver must be tuned and locked to the transmitter, and then the internal Eb/No is used for feedback. This creates a Tx-Satellite-Rx control loop.

Near Side AUPC is used primarily for broadcast applications, because the modem cannot expect to receive data from a distant location. Near Side AUPC can be used with any satellite framing mode.

There are safeguards built into the AUPC System. First, the modulator has two parameters, which allow control of the maximum and minimum output power Levels. Second, a nominal, or default, power level is specified, which takes effect if the receive signal or messaging is lost. This nominal power must be set to a level high enough to re-establish communications, regardless of rain fade.

EF AUPC also gives some control over the rate of power change; while Radyne and Near Side AUPC use optimized rates for rain fade compensation.

Table 3-3. Local AUPC Functions

Function	AUPC Available Options	Description
AUPC Mode	Disable, Nearside, Radyne, EFData	Enables/Disables the AUPC to function locally
Nominal Power	0 to -25 dB	Sets default output power to be used
Minimum Power	0 to -25 dB	Sets minimum output power to be used
Maximum Power	0 to -25 dB	Sets maximum output power to be
Target Eb/No	4.0 to 16 dB	Desired Eb/No of remote modem This allows the user to set the desired Eb/No for the local receiver. Radyne AUPC: When configured for Radyne AUPC, this setting is compared against the remote Eb/No and commands to the local modem to increase or decrease the local transmit power. EF AUPC: When configured for EF AUPC, this setting is compared against the local received Eb/No and commands to the remote modem to increase or decrease transmit power. Nearside: When configured for Nearside AUPC, this setting is compared against the received Eb/No of the local modem and commands to the local modem to increase or decrease transmit power.
Tracking Rate	6.0 to 0.5 dB/MIN	Adjustable in .5 dB increments
LOCAL CL ACTION	Hold, Maximum, Nominal	Allows user to determine what power setting the remote modem will use in the event of a carrier loss at the local side.
Remote CL Action	Hold, Maximum, Nominal	This setting allows users to determine what local output power setting to use in the event that the remote end has a carrier loss.
1. The AUPC Menus are located under the Modulator Menu, as shown in Section 4. 2. The EF AUPC Menu shows when EFAUPC Framing is enabled in the Demod and Mod set up menus.		

Table 3-4. Remote AUPC Functions (EF AUPC Only)

Function	AUPC Available Options	Description
AUPC Mode	Disable, EFDATA	Enables/Disables the AUPC to function remotely
Loopback	Enabled/Disabled	Loop back test over satellite link
Tx 2047 Test BER	Enabled/Disabled	Initiates 2047 Test pattern Bit Error Rate Test (BERT)
Rx 2047 BER	Status Menu	Identifies the Bit Error Rate (BER) status on the distant Rx side
AUPC DEF LVL		Sets default output power
The Remote AUPC Menus are supported only by EFAUPC		

3.14 Asynchronous Overhead Operation (J3)

This port is dedicated for ES-ES Communications as well. You can configure the port for several Asyncronous communications protocols. Protocols supported are Standard IBS ES-ES, Enhancd Asyncronous and SCC. Overhead data to/from the UIM is routed to/from the framer/deframer. This port can be configured to support either RS-232 or RS-485 signal levels.

The baud rate and protocol can be selected from the Web Browser.

The Asynchronous Framing/Multiplexer is capable of multiplexing a relatively low speed overhead channel onto the terrestrial data stream, resulting in a slightly higher combined or aggregate data rate through the modem. The overhead channel is recovered at the far end. This added channel is called variously: “An Overhead Channel”, ”Service Channel”, “Async Channel” or, in IESS terminology, an “ES-to-ES Data Channel.” The basic frame structure used by the multiplexer is that specified in the IESS-309 Standard, resulting in a 16/15 Aggregate to through-Data Ratio.

IBS 1/15 framing supports two Asnchrounous protocols.

- For Regular Async:
  - (ES-to-ES), the Baud Rate is approximately 1/2000 of the Data Rate listed in Table 3-3.
- For Enhanced Async:
  - (Radyne Proprietary Async.), the Baud Rate is selectable, but Data Rate is limited. See Table 3-3 for differences between Regular and Enhanced Async.

The maximum Baud Rate is 19,200 bps for IBS Async. Two software-controlled modes are designed into the card to best use the available bits: Standard IBS ES-to-ES and IBS (Enhanced Async).

The Async Channel can be set under software-control to either RS-232 or RS-485 mode. The pin assignments for both modes are shown in Table 3-5. The RS-485 setting controls the output into tri-state, when the modem is not transmitting data, allowing multiple modem outputs to be connected.

Table 3-5. Pin Assignments

Kbps	Baud Rate Example for Standard IBS	Kbps	Baud Rate Example for Enhanced Mode
128	64	9.6	300
256	128	19.2	600
384	192	32	600
512	256	64	1200
640	320	128	2400
768	384	192	4800
896	448	256	4800
1024	512	320	9600
1152	576	384	9600
1280	640	448	9600
1408	704	512	9600
1536	768	576	9600
1664	832	640	19200
1792	896	704	19200
1920	960	768	19200
1920	960	768	19200
2048	1024	832	19200
		896	19200
		960	19200
		1024	19200
		1088	19200
		1152	19200
		1216	19200
		1280	19200
		1344	19200
		1408	19200
		1472	19200
		1536	19200
		1600	19200
		1664	19200
		1728	19200
		1792	19200
		1856	19200
		1920	19200
		1984	19200
		2048	19200

3.15 Standard IBS ES-to-ES Mode

In the first, or Normal, mode, all bit assignments are per the IBS standard. The bits of Overhead Housekeeping byte 32 are used as shown in Table 3-6:

Table 3-6. IBS Standard

Bit Number	Use	IBS Standard
Bit 1	ES-to-ES Data Channel	This bit is routed directly to the ES-to-ES Data Channel. Its data rate is 1/512th of the aggregate rate (or 1/480th of the through terrestrial data rate), and is typically used to super-sample an asynchronous data channel.
Bit 2	Frame Alignment	Part of the Frame Alignment word
Bit 3	Backward Alarm	Transmit and Receive, with main processor to activate Main Alarm/LED
Bit 4	Multiframe Message	As per IBS
Bits 5 and 6	Spare	Not used
Bits 7 and 8	Encryption Utilization	Not used

The ratio of the Through Terrestrial Data Channel Rate to the aggregate rate is 15/16. The standard transmit and receive channels of the ES-to-ES Data Channel in a Standard IBS Mode are raw channels operating at the specific bit rate, as controlled by the data channel rate, without buffering. In addition, no clocks are provided with this channel. Because the data rate provided is rarely exactly that required for a standard rate device, the only method of communicating using this channel is to allow it to super-sample the user data.

3.16 Enhanced Asynchronous Mode (Proprietary)

Because many of the frame bits in the standard IBS mode are not used, an Enhanced Multiplexer Mode can be engaged under software control.

Because this mode changes the use of many of the framed non-data bits, this mode is usable only when the DMD1050TS is at both ends of a link. In this mode, the overhead signaling bytes 16 and 48 can be used to implement a significantly higher speed ES-to-ES Data Channel under software control. When implemented, this rate is 16 times that of the normal ES-to-ES IBS mode, or 1/30th of the terrestrial data rate (1/32nd of the aggregate rate).

The IBS 1/15 framing mode MUST be selected for Asynchronous channel operation to be available.

3.17 Satellite Control Channel (SCC) – J3

The SCC format uses a variable overhead rate to transmit an asynchronous data channel, in addition to the normal data channel. The SCC asynchronous mode implemented on the DMD20 is Pass Thru Mode.

In Pass Thru Mode, there is no formatting or deformatting of the input data in the buffer, and it is transmitted on a first-in first-out basis. In-band data entering the remote port is inserted into the user data stream. The in-band data is received and passed on to the user without any deformatting or depacketizing. The maximum in-band rate supported is 115200 bps.

The Asynchronous Data Interface (J3) is a 10-pin Dual Row header. The data interface can be configured for RS232 or RS485 via the Web Browser or Terminal Screen.

3.17.1 SCC Framing Structure

Each SCC frame consists of:

- A 10-bit synchronization pattern called the Synchronizing Word
- Multiple variable length slots filled with user data
- Multiple 10-bit control words that contain eight bits of in-band data (the extra two bits are for the async start/stop)

The number of user data slots and control words per frame is selected by the SCC Control Ratio Parameter. This can be any value from 1 to 1, through 1 to 7. A higher ratio allows a lower overhead rate, but because there are less Sync Words, there is a higher acquisition time.

Figure 3-13 and Figure 3-14 are examples of control ratios of 1 to 3 and 1 to 1. Figure 3-13 shows three Control Words for every Synchronizing Word, and Figure 3-14 shows one Control Word for every Synchronizing Word.

The Control Ratio of the receiving units must match the Control Ratio of the transmitting unit.

Figure 3-13. 1 to 3 Control Ratio (Example 1)

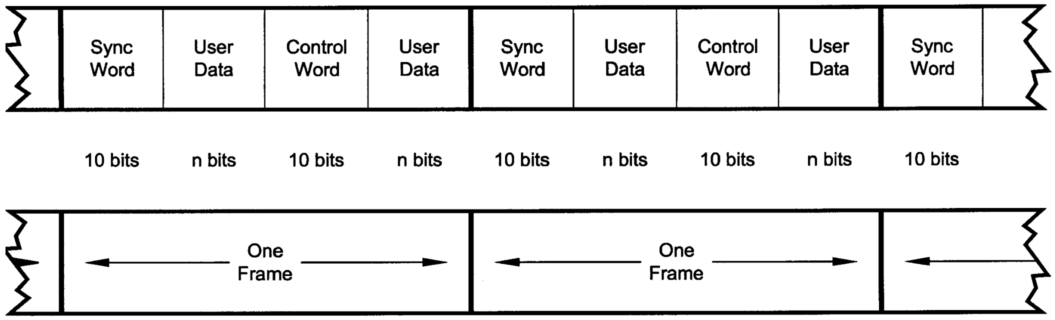


Figure 3-14. 1 to 1 Control Ratio (Example 2)

3.17.2 Aggregate Data Rate

Aggregate Data Rate = User Data Rate + In-Band Rate + Synchronizing Overhead Rate

Because SCC must adjust the overhead so that there are an equal number of user data bits in each slot, the synchronizing overhead cannot be calculated easily. However, dividing the In-Band Rate by the Control Ratio can approximate it. The basic calculation of this rate is shown:

Aggregate Date Rate = User Data Rate + In-Band Rate + (In-Band Rate/Control Ratio)

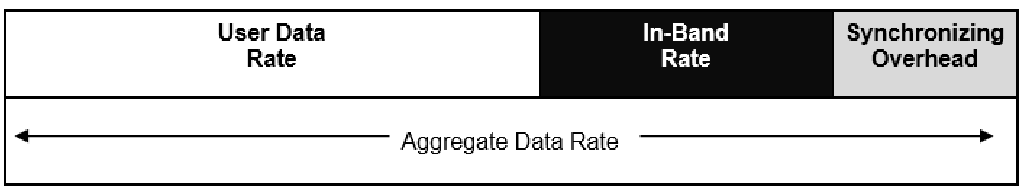


Figure 3-15. Aggregate Data Rate Example

As an example, given these parameters:

User Data Rate:	1,024,000 bps
In-Band Rate:	19,200 bps
Control Ratio:	1 to 7

Aggregate data rate = 1,024,000 + 19,200 + (19,200/7) or approximately 1,045,942 (actually 1045974).

This gives an overhead ratio of 1,045,974/1,024,000 = 1.021

Another constraint changes the actual Aggregate Data Rate. The user data slot size is limited to 2,500 bits. Because of this, the modem increases the in-band rate to reduce the user data slot size. This happens only at higher user data rates.

The Maximum In-Band rate is 115200. The Async interface Rate must be equal or greater in value.

3.17.3 Overhead Rate Comparison

The SCC Overhead Ratio varies, depending on the User Data Rate, the In-Band Rate and the Control Ratio. This gives SCC the advantage of lower overhead rates when compared to IBS, which has a fixed overhead ratio of 16/15 or 1.067. Table 3-7 gives some examples of SCC overhead rates for different user data and control ratios.

Table 3-7. SCC Overhead Rates

User Data Rate	In-Band Rate	Control Ratio	Aggregate Data Rate	Overhead Ratio
512,000	19,200	1/7	533,974	1.043
1,024,000	19,200	1/7	1,045,974	1.021
2,048,000	19,200	1/7	2,069,951	1.011
3,072,000	19,200	1/7	3,093,943	1.007
4,096,000	19,200	1/7	4,117,951	1.005
6,312,000	19,200	1/7	6,337,248	1.004
6,312,000	19,200	1/3	6,337,606	1.004
6,312,000	19,200	1/1	6,350,418	1.006

3.17.4 Actual Overhead Rate Calculation

The modem calculates the minimum in-band rate to limit the size of the user data slots to 2,500 bits. The result is truncated to an integer.

Minimum In-Band = (User Data Rate * Control Ratio)/((Control Ratio + 1) * 250)

Using the larger of Minimum In-Band or the selected In-Band, the modem calculates the number of bits for each user data slot. The result is truncated to an integer.

Slot Bits = (User Data Rate * (Control Ratio * 10))/(In-band Rate * (Control Ratio + 1))

Slot bits of 0 are invalid.

The ratio the modem uses is actually: Actual Ratio = (Slot Bits + 10)/Slot Bits

Example 1:

User Data Rate: 1,024,000 bps
In-Band Rate: 19,200 bps
Control Ratio: 1 to 7
Minimum In-Band = (1,024,000 * 7)/((7 + 1) * 250) = 3,584 (less than In-Band Rate)
Slot Bits = (1,024,000 * (7 * 10))/(19,200 * (7 + 1)) = 466
Actual Ratio = (466 + 10)/466 = 1.021

Example 2:

User Data Rate: 6,312,000 bps
In-Band Rate: 19,200 bps
Control Ratio: 1 to 7

3.17.5 SCC Overhead Channel Setup

1. Set the Framing Mode (located under Mod and Demod Data Menus) to SCC.
   After doing this, two new menus show to the right of the Framing Menu, for both the Mod and Demodulator:
   SCC CTL RATIO
   SCC INBAND RATE

2. Set the desired SCC control ratio:
   SCC CTL RATIO {1/1, 1/2, 1/3, 1/4, 1/5, 1/6, 1/7}
   This allows you to simulate the framing used by the Satellite Control Channel Option (Pass-Thru Mode only). The SCC CTL RATIO is the ratio of overhead in-band data to synchronizing words.

3. Set the desired SCC in-band rate:
   SCC INBAND RATE {300 to 115200}
   This allows you to request the rate of in-band data for the overhead channel. This sets the overhead amount only. The actual amount of data that can be passed through the overhead channel will be set under ES Baud Rate.

4. Go to Interface > General > Tx ASYNC MODE.

5. Set the desired ES Interface type:
   ES INTERFACE {RS-232, RS-485}
   This allows you to select the interface type.

6. Set the desired baud rate for the ASYNC Port (J1).
   This will be the baud rate that will pass through the overhead channel:
   ES BAUD RATE {150 - 115200}
   This allows you to select the baud rate of the ASYNC port (J1) in SCC Mode.

7. Set the desired ES BITS/CHAR:
   ES BITS/CHAR {7,8}
   This allows you to choose between 7 or 8 bits of data.

8. Go to Interface > General > Rx ASYNC MODE and repeat Steps 5 through 7.

The physical connection to the overhead channel is a 10 pin dual row male header (J1). See Appendix E for mating connector details.

Table 3-8. SCC Overhead Chart Examples (Viterbi 3/4 w/V.35 Scrambler)

Modem Data Rate Kbps	SCC Control Channel Rate	In-Band Overhead Rate Setting	Symbol Rate
9.6	1/1	300	6800
9.6	1/2	300	6700
9.6	1/3	300	6667
9.6	1/4	300	6650
9.6	1/5	300	6641
9.6	1/6	300	6634
9.6	1/7	300	6629
9.6	1/1	9600	19200
9.6	1/2	9600	17067
9.6	1/3	9600	15543
9.6	1/4	9600	14400
9.6	1/5	9600	14400
9.6	1/6	9600	14400
9.6	1/7	9600	14400
512	1/1	9600	354165
512	1/2	9600	350948
512	1/3	9600	349867
512	1/4	9600	349346
512	1/5	9600	349201
512	1/6	9600	348802
512	1/7	9600	348658

3.18 EBEM Framing Unit

The DMD1050TS EBEM framing Unit provides the ability to multiplex both Serial (MIL-STD-188-114A or High Speed Serial Interface (HSSI)) with Bridged Ethernet payload, overhead and embedded channel data within the over-the-air transport stream.

3.18.1 EBEM Mode Set Up on the DMD1050TS

When in EBEM Network Spec mode, the Ethernet interface is always active. Therefore, you cannot select it as the interface type when in EBEM mode. EBEM mode always runs two interfaces simultaneously: the Ethernet interface and one of the serial interfaces (HSSI or MIL-188-114A).

First, make sure one of the serial interfaces (HSSI or MIL-188-114A) is set as the interface type. After you enable EBEM as the Network Spec, both the serial interface and the Ethernet interface will be active. However, only the serial interface shows for the interface menus. The Ethernet interface does not show for the interface menus.

When in EBEM mode, the Modulator and Demodulator DATA menus show the **ETH RATE**. This is where you set the Ethernet data rate.

There is also a **DATA RATE,** which is where you set the serial interface data rate.

- Run only Ethernet by setting an **ETH RATE** and then setting **DATA RATE** to 0.
- Run only serial by setting a serial rate for **DATA RATE** and then setting **ETH RATE** to 0.
- Run Ethernet and serial simultaneously by setting both the serial rate for **DATA RATE** and the Ethernet rate for **ETH RATE**.

The combined Ethernet and serial rates must be within the data rate limits for the configuration in use (Modulation type, FEC etc.). Chapter 7, Technical Specifications, shows the data rate limits for the various Mod Cods.

3.18.1.1 Exit EBEM Mode

To change from EBEM mode to another mode, such as closed network mode, you must first have a serial rate set for **DATA RATE**. For example, if you were running in EBEM mode but using only the Ethernet interface (**ETH RATE** is set but the **DATA RATE** set to 0), the modem will not let you exit the EBEM mode until you enter a valid rate for **DATA RATE**.

3.18.2 DMD1050TS Information Throughput Adpatation (ITA)

Refer to Appendix I for additional information.

3.18.3 Embedded Channel

The embedded channel is used for exchanging messages between DMD1050TS units. ITA, AUPC and TRANSEC traffic encryption/decryption key negotiation are typical examples of messages sent through the DMD1050TS embedded channel. The nominal rate of the embedded channel is 4 kbps.

3.19 STANAG Turbo Coding

The DMD1050TS provides STANAG Turbo coding FEC for all specified baseband data rates (64 kbps to 20.0 Mbps) and modulation formats (BPSK, QPSK, 8-PSK, and 16-APSK) with the following code rates: None, 1/2, 2/3, 3/4, 7/8, or 19/20. A decoding function for all Turbo encoded data is also provided.

Turbo codes come extremely close to achieving the absolute maximum channel capacity, in bits per second, for a given transmit power level. For traffic that can tolerate decoding delay and require a low BER (i.e., 1×10–10), Turbo coding can be used. For traffic such as speech, where excessive decoding delays cannot be tolerated and higher BER can be tolerated.

Table 3-9. STANAG Turbo Block Sizes

Block Size (Bits)	Total Composite Data Rate
1024	Data Rate =<1024 kbps
4096	1024 kbps < Data Rate < 4096 kbps
16384	Data Rate ≥ 4096 kbps

3.20 FIPS TRANSEC Module

The DMD1050TS FIPS Security Module provides bulk encryption and decryption of traffic over the satellite that conforms to Security Level 2 as defined in FIPS PUB 140-2 using National Institute of Standards and Technology (NIST) approved 256-bit Advanced Encryption Standard (AES) encryption. Bulk Encryption includes all data coming from the baseband user ports (baseband serial port, overhead channel port and the embedded channel). Bulk Decryption decrypts all of the data coming from the baseband demodulator going to the baseband user ports and the embedded channel. Bulk Encryption and Bulk Decryption are supported by independent AES engines, AES keys and counters.

3.20.1 Traffic Encryption and Decryption Keys and Key Generation

The AES key and the initial counter value of the counter are negotiated using the key negotiation algorithm and messages. The resulting key and initial counter value are then loaded into the AES engine.

3.20.1.1 Key Agreement

The Encryption application has the responsibility for negotiating the TEKs used on the link. To accomplish this, the Encryption application utilizes Initiator and Responder roles. The initiator starts the key agreement protocol with the goal of negotiating a TEK used to encrypt the data transmitted on the link by the initiator. The responding end responds to the messages in the key agreement protocol, using the Traffic Decryption Key (TDK) to decrypt the data received on the link. The Initiator is synonymous with Transmitter (modulator) of a link while Responder is synonymous with Receiver (demodulator) of the same link.

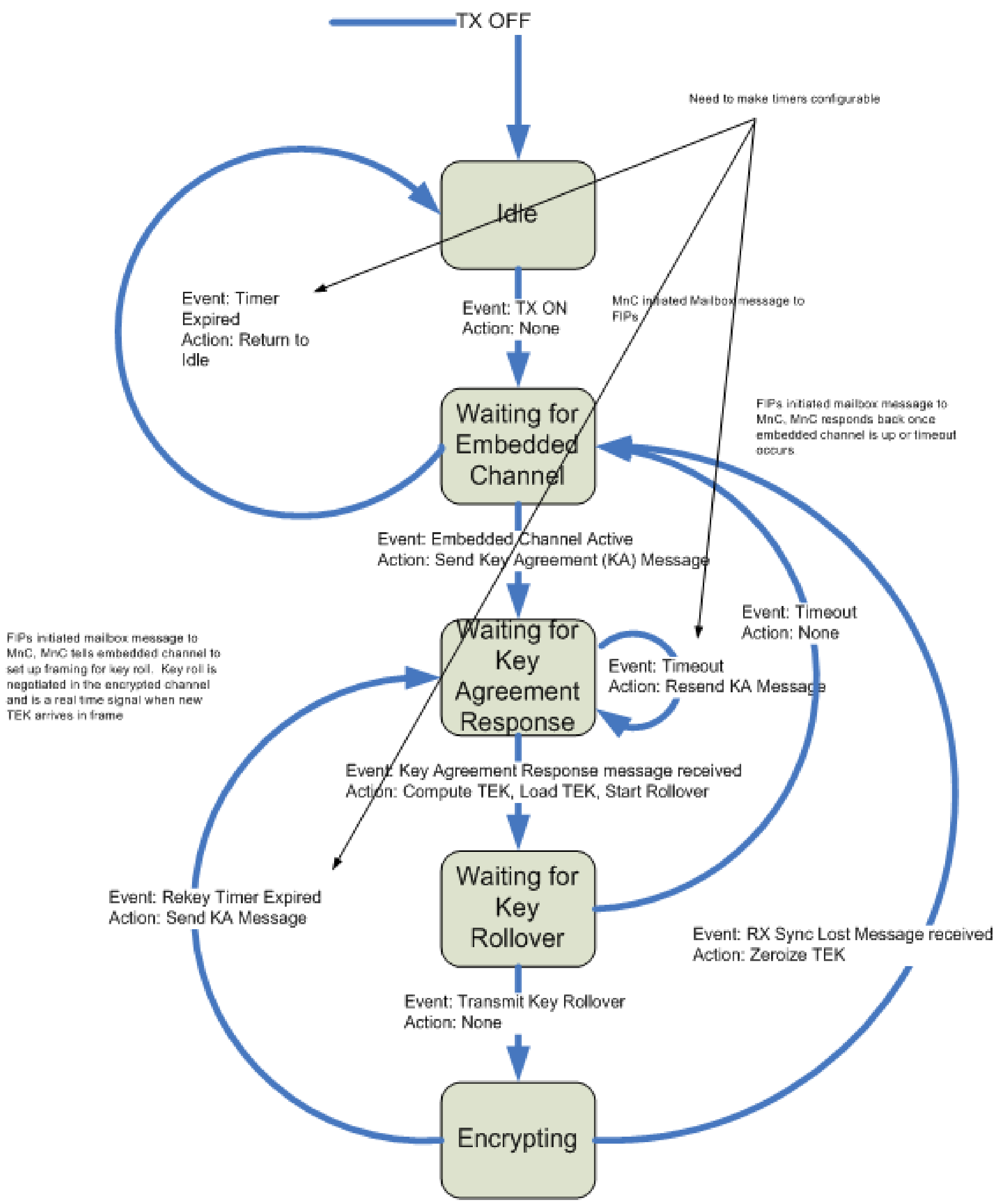


Figure 3-16. Traffic Encryption Key Negotiation

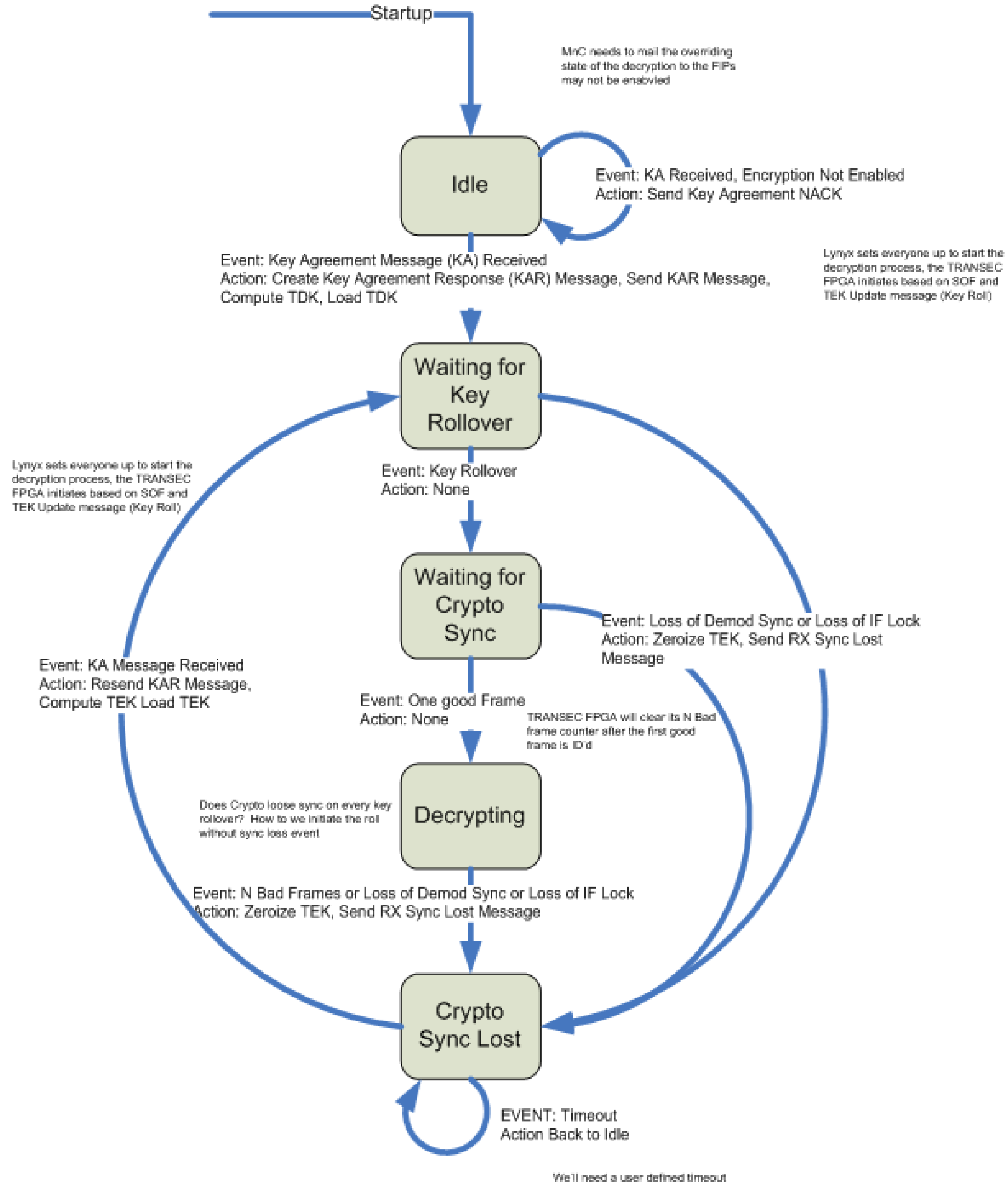


Figure 3-17. Traffic Decryption Key Negotiation

3.20.1.2 Key Agreement Algorithm

The key agreement algorithm used to negotiate a shared secret is the Ephemeral Unified Model, Elliptic Curve Cryptography Cofactor Diffie-Hellman C(2,0,ECC CDH) as specified in the elliptic curve parameters section of NIST SP 800-56A(3).

3.20.1.2.1 Key Derivation

Once the shared secret has been negotiated, the TEK is generated from the shared secret using the Concatenation Key Derivation Function (KDF), as specified in NIST SP 800-56A, Section 5.8.1(3). All hashing algorithms use SHA-512, as defined in FIPS 180-2(4).

3.20.1.3 Accessing Encryption/Decryption Features

The DMD2050E enables the Crypto Officer to administer the FIPs module through authentication. The Crypto Officer Administrator can:

- Load software
- Load key material
- Configure operating parameters
- Monitor performance

The Crypto Officer Administrator must log in from the front panel or the handheld key loader.

Any operator can Enable and Disable encryption.
Any operator with access to the front panel can zeroize the unit.

To configure the modem for legacy mode operation, first use the front panel to disable Encryption.

3.21 DMD1050TS ID Codes (Feature Upgrades)

The modem has unique ID codes that allows feature upgrades to the modem without returning the unit to the factory.

Use these ID codes when additional features are added to a unit. After purchase, CEFD supplies a new ID code that must be entered in the ID code field. Once the new ID code is entered, the modem activates the new features.

3.22 Strap Codes

The Strap Code is a quick set key that sets many of the modem parameters. For quick setup of the DMD1050TS, Strap Codes are very helpful. When a Strap Code is entered, the modem is configured automatically for the code’s corresponding data rate, overhead, code rate, framing, scrambler type and modulation.

Example of how to set a Strap Code:

1. On the Web interface **Modulator Menu**, click the **Transmit** tab.
2. Click **General**.
3. Find **Strap Code**.
4. Click inside the box, and go to the **New Strap Code** submenu.
5. Enter **16**.

The DMD1050TS is configured automatically to the parameters for Strap Code 16.

See Appendix G for the Strap Code options.

BLANK PAGE

Chapter 4. Rear Panel Interface

This section discusses the electrical interfaces on the rear panel. All locations are as seen from the rear of the unit, unless specified otherwise.

4.1 DMD1050TS Connections

All DMD1050TS connections are made to labeled connectors located on the Modem Board.

See Figure 4-1, Figure 4-2, Figure 4-3, and Figure 4-4.

You must use the correct connector to make any connection to the DMD1050TS. See Appendix E for information about the connectors that are used with the DMD1050TS.

The DMD1050TS consists of these assemblies:

- RF Board (PL-0021834)
- Baseband Modem Board (PL-0022534)
- FIPs Security Module (PL-0000192)

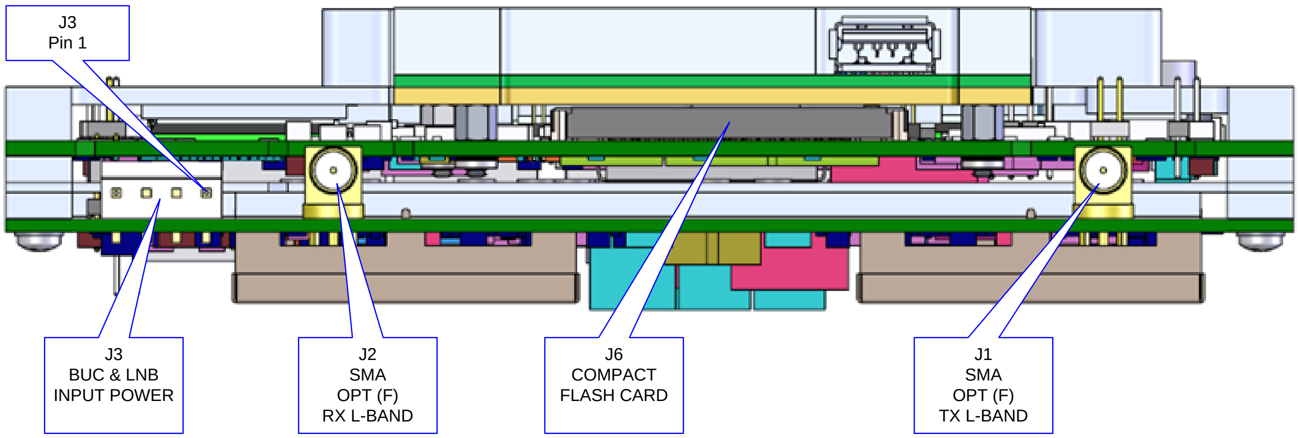


Figure 4-1. DMD1050TS Front View

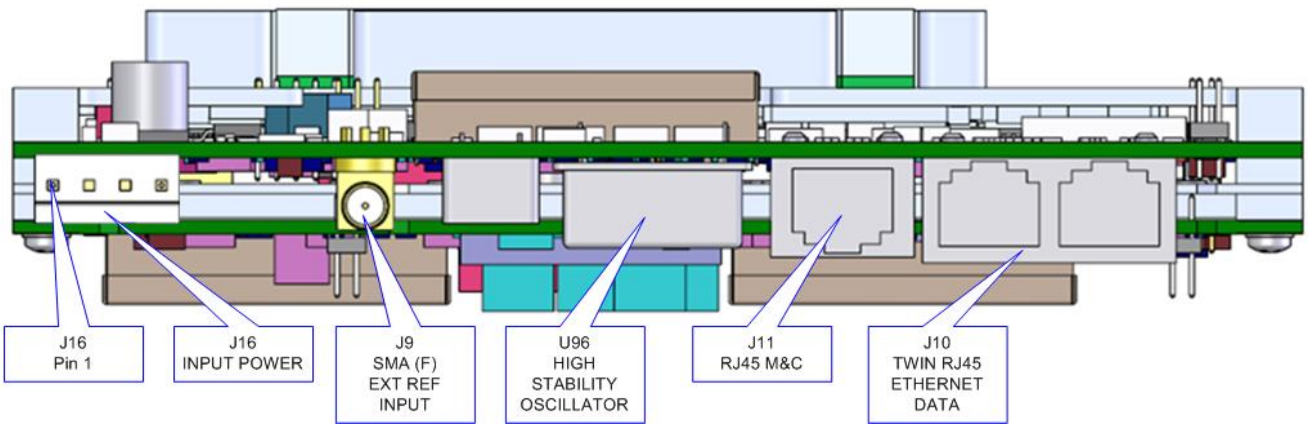


Figure 4-2. DMD1050TS Rear View

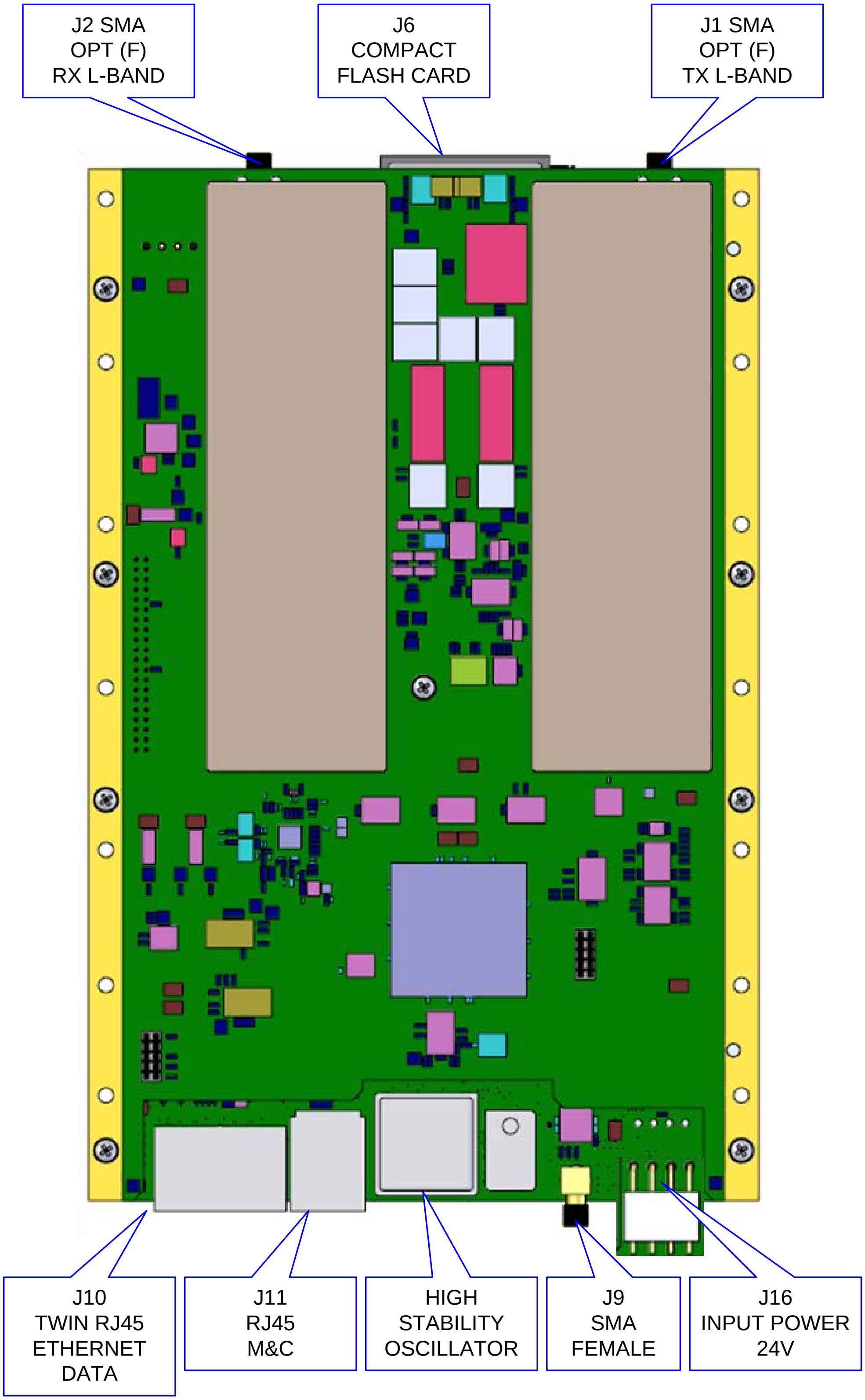


Figure 4-3. RF Board (PL-0021834)

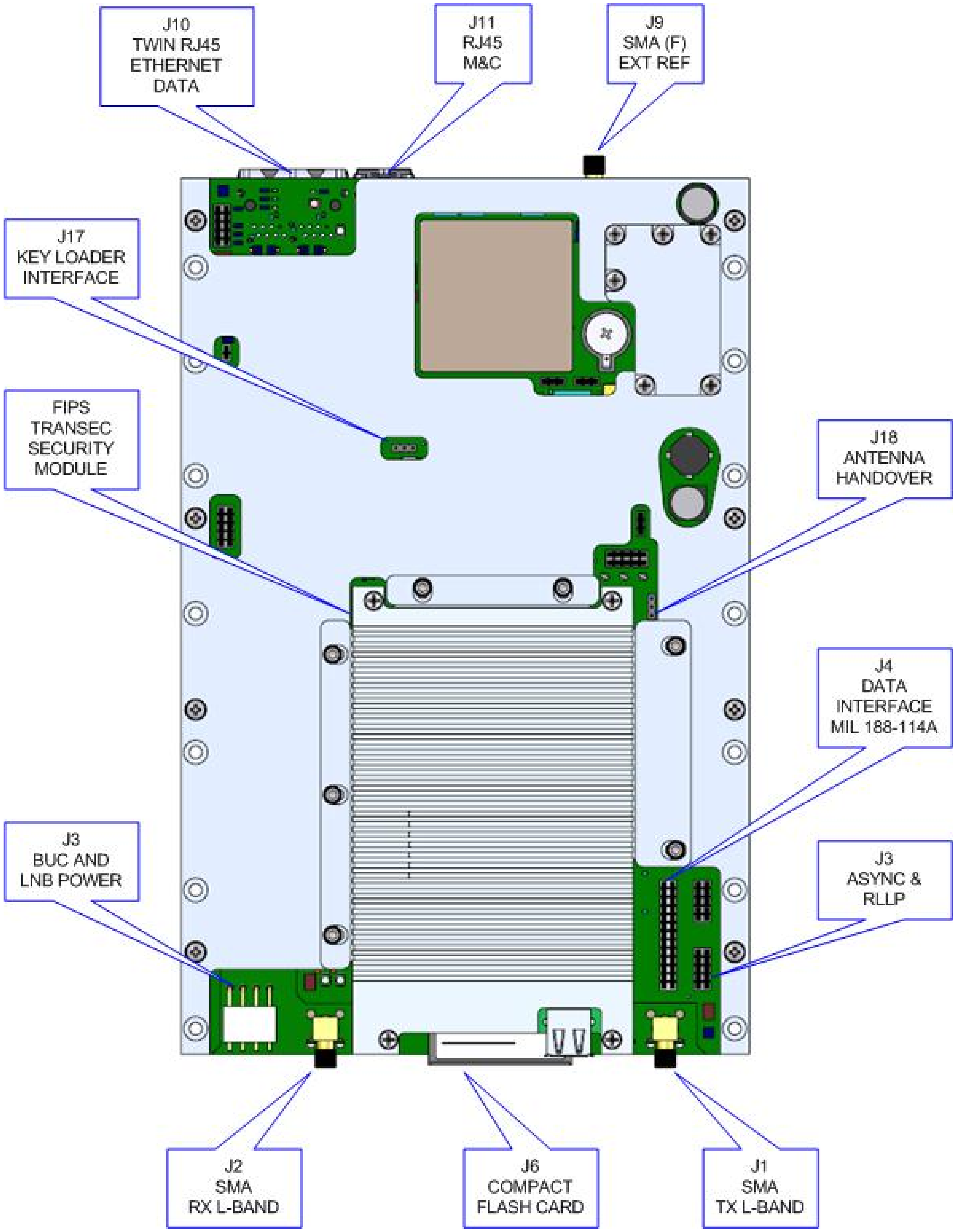


Figure 4-4. Baseband Modem Board (PL-0022534)

4.2 Compact Flash (J6)

A minimum 256 Mbit flash memory card stores all the modem M&C and operational data. It must be installed when the modem is operating.

4.3 Power Input (J16)

The Input DC Power for the modem board requires:

- +21 to +24 Volts DC
- 4 Pin Crimp Terminal Housing
- Mfg (Molex) P/N: 26-60-5040

Table 4-1. DC Input Power Ports (J16)

Pin No.	Signal Name	Signal
1	Ground	GND
2	Ground	GND
3	24 Volts DC	---
4	24 Volts DC	---

4.4 BUC & LNB Power Input (J3)

The Block Up Converter (BUC) and LNB input connector allows you to inject DC voltage externally for the BUC and LNB voltage.

- 4 Pin Crimp Terminal Housing
- Mfg (Molex) P/N: 26-60-5040

Table 4-2. BUC & LNB DC Input Connector (J3)

Pin No.	Signal Name	Signal
1	LNB DC Input	
2	Ground	GND
3	Ground	GND
4	BUC DC Input	

4.5 Modem Connections (Standard)

4.5.1 EXT REF (J9)

The External Reference Port is a 50 Ohm Female SMA Connector. It accepts these frequencies:

MHz					
1.0	1.544	2.0	2.048	5.0	10.0

Input Level: 0.1 Vp-p to 5 Vp-p (Sine or Square wave)

4.5.2 TX L-Band IF (J1)

The Transmit IF Output Port is a 50 Ohm SMA Female Connector that is used for L-Band IF.

The power level is programmable from 0 to -25 dBm, in 0.1 dBm steps.

The IF Frequency is programmable from 950 to 2050 MHz, in 1 Hz Steps.

4.5.3 RX L-Band IF (J2)

The Receive IF Input Port is a 50 Ohm SMA Female Connector that is used for L-Band IF.

The IF Frequency is programmable from 950 to 2050 MHz, in 1 Hz Steps.

4.5.4 ASYNC & Remote Port (J3) – 10-Pin Dual Row Header

This port supports both Asynchronous and Remote interfaces. The remote port supports RS485 or RS232. This port is a 10-pin dual row header.

- 10-Pin Dual Row
- Mfg (Samtec) P/N: TSW-1-05-7-G-D

Table 4-3. ASYNC & Remote Ports (J3)

Pin No.	Signal Name	Signal	Direction
1	RX_ASYNC_B	485/RXD_B	Output
2	RX_ASYNC_A	485/RXD_A	Output
3	TX_ASYNC_B	485/TXD_B	Input
4	TX_ASYNC_A	485/TXD_A	Input
5	RX_RLLP_B	485/CTS	Input
6	RX_RLLP_A	485-A_232	Input
7	TX_RLLP_B	485-B	Output
8	TX_RLLP_A	485-A_232	Output
9	Ground	GND	---
10	No Connect	---	---

4.5.5 Default/Shorting Plug (JP1 JP2) - 3 Pin Male Connector

If you are having difficulty opening the Web Browser or the Terminal Interface, you can reset the M&C interface settings. Use the supplied default plug (CNRSHUNT). See

Figure 4-5.

1. Install the default plug across pins 1 and 2 of JP1 and JP2 connectors.
2. Cycle the power.
3. The interface default settings will reset.

Default jumper/shunts are with the supplied connector kit. The default jumper might be installed between pins 2 and 3.

1. Reposition the jumper across pins 1 & 2.
2. After the default settings have been activated, remove the Jumpers.

Table 4-4. Default/Reset connections: 3-Pin male Connector (JP1 & JP2)

Install Shunt/Jumper Between Pins No.
Pin 1 & 2

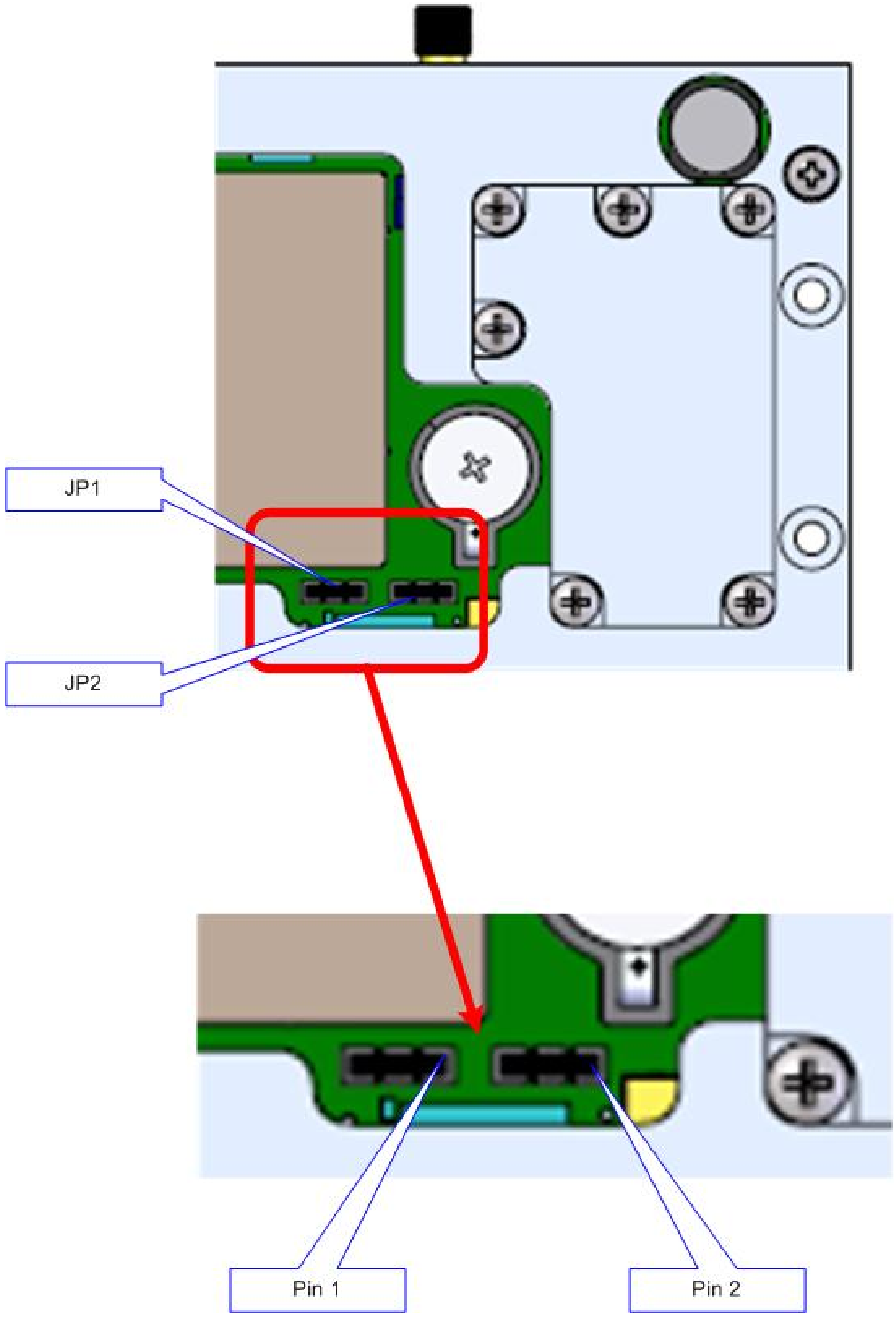


Figure 4-5. Default/Shorting Plug (JP1 and JP2)

4.5.6 MIL-188-114A (J4)

The MIL-188-114A port is an RS422 interface.

- 26-Pin Dual Row Male Header
- Mfg (Samtec) P/N: TSW-1-13-7-G-D

Table 4-5. MIL-188-114A Port (RS-422) 26-Pin Dual Row Header (J2)

Pin No.	Signal Name	Signal	Direction
1	Ground	---	---
2	Send Data B (+)	SD-B	Input
3	Send Data A (-)	SD-A	Input
4	Send Timing A (-)	ST-A	Output
5	Receive Data A (-)	RD-A	Output
6	Receive Data B (+)	RD-B	Output
7	Request To Send A (-)	RS-A	Input
8	Receive Timing A (-)	RT-A	Output
9	Clear To Send A (-)	CS-A	Output
10	Modulator Fault - Open Collector	MF	Output
11	Data Mode A (-)	DM-A	Output
12	Request To Send B (+)	RS-B	Input
13	Ground	GND	---
14	Data Terminal Ready A (-)	TR-A	Input
15	Receiver Ready A (-)	RR-A	Output
16	Demodulator Fault	DF	Output
17	Receive Timing B (+)	RT-B	Output
18	Data Mode B (+)	DM-B	Output
19	Receiver Ready B (+)	RR-B	Output
20	Data Terminal Ready B (+)	TR-B	Input
21	Terminal Timing B (+)	TT-B	Input
22	Terminal Timing A (-)	TT-A	Input
23	Send Timing B (+)	ST-B	Output
24	Antenna AGC	---	Output
25	Clear T Send B (+)	CS-B	Output
26	No Connect	---	---

4.5.7 Ethernet M&C (J11)

The Ethernet M&C Port is a 10 Base-T Interface. J9 is used for the M&C functions of the unit. The physical interface is a standard female RJ-45 connector.

4.5.8 Ethernet Data Interface (J10)

The DMD1050TS Ethernet Data Interface provides two RJ-45, Auto-Crossover and Auto-Sensing, 10/100 Ethernet Data Ports. The physical interfaces are twin female RJ-45 connectors.

4.5.9 DS-101 Simple Key Loader (J17)

The DMD1050TS Simple Key Loader (SKL) Interface J17 can be used to connect an SKL AN/PYQ-10 Electronic Key Management System (EKMS) key management device.

The physical interface is a 3-Pin Male Header Mfg (FCI) P/N: 68771-203HLF.

Table 4-6. DS-101 Simple Key Loader (J17)

Pin No.	Signal Name	Signal	Direction
1	Data I/O (+) (Balanced Differential input or output analog interface)	KEYLOAD_A	Input / Output Input: (Per EIA-485 Specification) Sensitivity: VThH =-1.6V, VThL =+1.6V, Min. Input Resistance 1.73K Output: (Per EIA-485 Specification) VOUT = +(1.5V to 5.0V) with 54 ohm load
2	Ground	---	---
3	Data I/O (-) (Balanced Differential input or output analog interface)	KEYLOAD_B	Same as Pin 1

4.5.10 Antenna Handover (J18)

Future Option

The physical interface is a 3-Pin Male Header Mfg (FCI) P/N: 68771-203HLF.

Table 4-7. Antenna Handover (J18)

Pin No.	Signal Name	Signal	Direction
1	Antenna Handover Control A	ANT_HOC_A	Input Input: Voltage and levels per EIA-422 Specification.
2	Ground	---	---
3	Antenna Handover Control A	ANT_HOC_B	Same as Pin 1

BLANK PAGE

Chapter 5. Maintenance and Troubleshooting

WARNING - DANGER OF EXPLOSION – LITHIUM BATTERY
This unit contains a lithium battery. You must replace the lithium battery with the same or equivalent battery that is recommended by the manufacturer. You must dispose of used batteries as required by local and national regulations. Make sure to prevent static discharge that can cause damage to the Modem Board.

5.1 Periodic Maintenance

The DMD1050TS does not require periodic maintenance.

5.2 Troubleshooting

First, examine all interface signals for correct operation. If a unit is suspected of a defect in field operations after that, replace the unit with another known working DMD1050TS. If a problem still exists, examine the wiring or power.

Table 5-1 is a brief list of problems that can be caused by failures of the modem, or by incorrect setup or configuration for the type of service.

Table 5-1. Symptoms and Possible Causes

SYMPTOM	POSSIBLE CAUSE
The Modem does not acquire the incoming carrier.	Incorrect receive input to the modem
	Receive Carrier Level is too low
	Receive Carrier Frequency is outside of the acquisition range
	Transmit Carrier is incompatible
	Modem is in Test Mode
The Async Port is not configured correctly.	Switches are set incorrectly

5.2.1 Alarm Faults

5.2.1.1 Major Tx Alarms

Alarm	Possible Cause
FPGA CFG	Shows a transmit FPGA hardware failure
DSP CFG	Shows a transmit FPGA failure
SCT Clock PLL	Shows that the Tx SCT Clock PLL is not locked. This alarm flashes during certain parameter changes. A steady display shows a problem in the modem configuration.
SYM Clock PLL	Shows that the Tx Symbol Clock PLL is not locked. This alarm flashes during certain parameter changes. A steady display shows a problem with the incoming clock to the modem (SCTE).
LB Synth PLL	Shows that the Tx L-Band Synthesizer is not locked. This alarm flashes during certain parameter changes. A steady display shows a configuration problem in the modem.
Ethernet WAN	Shows that the WAN Port is down
TRANSEC Ready	Shows that the TRANSEC Security Module has not indicated it is ready for data

5.2.1.2 Major Rx Alarms

Alarm	Possible Cause
FPGA CFG	Shows a receive FPGA hardware failure
DSP CFG	Shows a receive DSP failure
SIGNAL LOCK	Shows that the demod is unable to lock to a signal
FRAME LOCK	Shows that the Framing Unit is unable to find the expected framing pattern
MULTIFRAME LOCK	Shows that the Framing Unit is unable to find the expected framing pattern
LB SYNTH PLL	Shows that the Rx L-Band Synthesizer is not locked. This alarm flashes during certain parameter changes. A steady display shows a problem in the modem configuration.
Ethernet WAN	Shows that the WAN Port is down

5.2.1.3 Minor Tx Alarms

Alarm	Possible Cause
TERR CLK ACT	Shows no Terrestrial Clock activity
TERR DATA ACT	Shows no Tx Data activity
TX TERR AIS	Shows that AIS has been detected in the Tx Data Stream
TX DVB FRAME LOCK	Shows that the Tx Input Data Stream Framing does not match the selected Tx Terr Framing. Incorrect Tx Terr Framing is selected. Incorrectly framed Tx Input Data Stream exists.
Clock Src Fallback	Shows the SCTE clock has fallen back to internal SCT
TPC Conflict Chk	Shows there is a TPC mismatch

5.2.1.4 Minor Rx Alarms

Alarm	Possible Cause
BUFF UNDERFLOW	Shows that a Doppler Buffer underflow has occurred
BUFF NEAR EMPTY	Shows that the Doppler Buffer is about to underflow
BUFF NEAR FULL	Shows that the Doppler Buffer is about to overflow
BUFF OVERFLOW	Shows that a Doppler Buffer overflow has occurred
RX DATA ACTIVITY	Shows that there is no Rx Data activity; for the Ethernet Interface, shows that no Ethernet port is active (no cable is connected)
SAT AIS	Shows that AIS has been detected in the receive satellite data stream
IFEC LOCK	Shows that the Inner Codec is not locked
TPC Conflict Chk	Shows there is a TPC mismatch
OFEC LOCK	Shows that the Reed-Solomon Decoder is not locked
INTERLEAVER	Shows that the Reed-Solomon Interleaver is not synchronized
EBNO (dB)	Shows that the Eb/No is outside of limits
IBS BER	Shows that there are more than one in 1000 bits in error in IBS mode
RX DVB FRAME LOCK	Shows that the Rx Satellite Data Stream Framing is not DVB
Encryption	TRANSEC Module is enabled but not synchronized

5.2.1.5 Common Major Alarms

Alarm	Possible Cause
TERR FPGA CFG	Shows an Interface Card FPGA configuration failure, likely caused by a missing or incorrect file
CODEC FPGA CFG	Shows Turbo Codec Card FPGA configuration failure, likely caused by a missing or incorrect file
CODEC Dev CFG	Shows Turbo Codec ASIC failed to program
+1.5V RX SUPPLY	Shows the measured voltage of the 1.5 Volt Rx power bus inside the modem
+1.5V TX SUPPLY	Shows the measured voltage of the 1.5 Volt Tx power bus inside the modem
+3.3V SUPPLY	Shows the measured voltage of the +3.3 Volt power bus inside the modem
+5V SUPPLY	Shows the measured voltage of the +5 Volt power bus inside the modem
+12V SUPPLY	Shows the measured voltage of the +12 Volt power bus inside the modem
-12V SUPPLY	Shows the measured voltage of the -12 Volt power bus inside the modem
+20V SUPPLY	Shows the measured voltage of the +20 Volt power bus inside the modem
EXT CLOCK ACT	Shows that the External Clock is not active
EXT REF ACT	Shows no activity on the External Reference
EXT REF LOCK	Shows that the External Reference PLL is not locked
Transec Pwr Test	Shows the TRANSEC module has failed POST (Power-On Self Test)

5.2.2 Alarm Masks

CAUTION: DATA LOSS POSSIBLE
Masked alarms can cause undesirable modem performance.

The DMD1050TS does a high degree of self-monitoring and fault isolation. The alarms for these faults are separated into categories:

- Active Alarms
- Common Equipment Faults

Alarms recorded in the event buffer are the same as those in the alarm buffer.

You can mask certain alarms. When an alarm is masked, the Fault Relays are not asserted, but the Alarm is shown. This feature is very helpful during debugging, or to lock out a known failure.

5.2.2.1 Active Alarms

5.2.2.1.1 Major Alarms

Major Alarms mean a modem hardware failure. Major Alarms can flash briefly during modem configuration changes and during power-up, but should not stay lit. Alarms are grouped into Transmit and Receive Alarms. Transmit and Receive alarms are completely independent.

5.2.2.1.2 Minor Alarms

Minor Alarms mean that a problem can persist outside the modem, such as loss of Terrestrial Clock, loss of terrestrial data activity, or a detected transmit or receive AIS condition.

Alarms are grouped into Transmit and Receive Alarms. Transmit and Receive alarms are completely independent.

5.2.2.2 Common Equipment Faults

Common equipment faults mean hardware or configuration problems in the modem that affect both transmit and receive operation. Most common faults mean a hardware failure in the modem, such as a bad power supply. Common faults for the External Reference and External Clock mean a bad modem configuration, not a hardware failure.

5.2.2.3 Latched Alarms

Latched Alarms are used to catch intermittent failures. If a fault occurs, the fault indication is latched, even if the alarm goes away. After the modem is configured and running, it is recommended that you clear the Latched Alarms as a final step.

Chapter 6. Technical Specifications

6.1 Data Rates Limits

6.1.1 Non-EBEM Modes

Non-EBEM Modes			
Modulation	Code Rate	Min Data Rate (Kbps)	Max Data Rate (Mbps)
BPSK	Uncoded	4.8	10.0
BPSK	5/16	2.4	3.125
BPSK	21/44	2.4	4.773
BPSK	1/2	2.4	5.0
BPSK	3/4	3.6	7.5
BPSK	7/8	4.2	8.75
QPSK	Uncoded	9.6	20.0
QPSK	21/44	4.8	9.545
QPSK	1/2	4.8	10.0
QPSK	2/3	6.4	13.333
QPSK	3/4	7.2	15.0
QPSK	7/8	8.4	17.5
OQPSK	21/44	4.8	9.545
OQPSK	1/2	4.8	10.0
OQPSK	2/3	6.4	13.333
OQPSK	3/4	7.2	15.0
OQPSK	7/8	8.4	17.5
8PSK	2/3	9.6	20.0
8PSK	3/4	10.8	20.0
8PSK	7/8	14.4	20.0
8QAM	2/3	9.6	20.0
8QAM	3/4	10.8	20.0
8QAM	7/8	14.4	20.0
16QAM	3/4	14.4	20.0
16QAM	7/8	16.84	20.0

6.1.2 EBEM Modes

EBEM Modes			
Modulation	Code Rate	Min Data Rate (Kbps)	Max Data Rate (Mbps)
BPSK	1/2	64	4.965[1]
BPSK	2/3	64	6.614[1]
BPSK	3/4	64	7.436[1]
BPSK	7/8	64	8.673[1]
BPSK	19/20	64	9.412[1]
QPSK	1/2	64	9.905[1]
QPSK	2/3	64	13.180[1]
QPSK	3/4	64	14.811[1]
QPSK	7/8	64	17.253[1]
QPSK	19/20	64	18.716[1]
8PSK	1/2	256	14.811[1]
8PSK	2/3	256	19.691[1]
8PSK	3/4	256	22.119[1]
8PSK	7/8	256	25.746[1]
8PSK	19/20	256	27.911[1]
16APSK	1/2	256	19.691[1]
16APSK	2/3	256	26.150[1]
16APSK	3/4	256	29.356[1]
16APSK	7/8	256	34.145[1]
16APSK	19/20	256	37.008[1]

6.1.3 Non-DVB Modes

Non-DVB Modes			
Modulation	Code Rate	Min Data Rate	Max Data Rate
BPSK	NONE	4800	10000000
BPSK	VIT 1/2	2400	5000000
BPSK	VIT 3/4	3600	7500000
BPSK	VIT 7/8	4200	8750000
BPSK	SEQ 1/2	2400	2048000
BPSK	SEQ 3/4	3600	2048000
BPSK	SEQ 7/8	4200	2048000
BPSK	TPC 5/16	2400	3125000
BPSK	TPC 21/44	2400	4772727
BPSK	TPC 3/4	3600	7500000
BPSK	TPC 7/8	4200	8750000
BPSK	LDPC 1/2	2400	5000000
BPSK	EBEM TURBO 1/2	64000	4965315
BPSK	EBEM TURBO 2/3	64000	6613713

[1] Max STAMAG rates reflect the maximum user payload with th embedded channel ENABLED.
This is either Ethernet or Mixed Mode with the serial MIL-STD-188-114A and is limited to 20 Mbps.

Non-DVB Modes			
Modulation	Code Rate	Min Data Rate	Max Data Rate
BPSK	EBEM TURBO 3/4	64000	7436434
BPSK	EBEM TURBO 7/8	64000	8673111
BPSK	EBEM TURBO 19/20	64000	9412035
QPSK	NONE	9600	20000000
QPSK	VIT 1/2	4800	10000000
QPSK	VIT 3/4	7200	15000000
QPSK	VIT 7/8	8400	17500000
QPSK	SEQ 1/2	4800	2048000
QPSK	SEQ 3/4	7200	2048000
QPSK	SEQ 7/8	8400	2048000
QPSK	TPC 21/44	4582	9545454
QPSK	TPC 3/4	7200	15000000
QPSK	TPC 7/8	8400	17500000
QPSK	LDPC 1/2	4800	10000000
QPSK	LDPC 2/3	6400	13333333
QPSK	LDPC 3/4	7200	15000000
QPSK	EBEM TURBO 1/2	64000	9905362
QPSK	EBEM TURBO 2/3	64000	13180497
QPSK	EBEM TURBO 3/4	64000	14811320
QPSK	EBEM TURBO 7/8	64000	17252747
QPSK	EBEM TURBO 19/20	64000	18716185
OQPSK	NONE	9600	20000000
OQPSK	VIT 1/2	4800	10000000
OQPSK	VIT 3/4	7200	15000000
OQPSK	VIT 7/8	8400	17500000
OQPSK	SEQ 1/2	4800	2048000
OQPSK	SEQ 3/4	7200	2048000
OQPSK	SEQ 7/8	8400	2048000
OQPSK	TPC 21/44	4582	9545454
OQPSK	TPC 3/4	7200	15000000
OQPSK	TPC 7/8	8400	17500000
OQPSK	LDPC 1/2	4800	10000000
OQPSK	LDPC 2/3	6400	13333333
OQPSK	LDPC 3/4	7200	15000000
8PSK	TRE 2/3	9600	20000000
8PSK	TPC 3/4	10800	20000000
8PSK	TPC 7/8	12600	20000000
8PSK	LDPC 2/3	9600	20000000
8PSK	LDPC 3/4	10800	20000000
8PSK	EBEM TURBO 1/2	256000	14811320
8PSK	EBEM TURBO 2/3	256000	19691268
8PSK	EBEM TURBO 3/4	256000	22118667
8PSK	EBEM TURBO 7/8	256000	25745821
8PSK	EBEM TURBO 19/20	256000	27911111

Non-DVB Modes			
Modulation	Code Rate	Min Data Rate	Max Data Rate
8QAM	TPC 3/4	10800	20000000
8QAM	TPC 7/8	12600	20000000
8QAM	LDPC 2/3	9600	20000000
8QAM	LDPC 3/4	10800	20000000
16QAM	VIT 3/4	14400	20000000
16QAM	VIT 7/8	16800	20000000
16QAM	TPC 3/4	14400	20000000
16QAM	TPC 7/8	16840	20000000
16QAM	LDPC 3/4	14400	20000000
16APSK	EBEM TURBO 1/2	256000	19691268
16APSK	EBEM TURBO 2/3	256000	26149903
16APSK	EBEM TURBO 3/4	256000	29356346
16APSK	EBEM TURBO 7/8	256000	34144709
16APSK	EBEM TURBO 19/20	256000	37008159

6.1.4 DVB Modes

187 Mode			
Modulation	Code Rate	Min Data Rate	Max Data Rate
BPSK	VIT 1/2	2400	4583333
BPSK	VIT 2/3	2934	6111111
BPSK	VIT 3/4	3300	6875000
BPSK	VIT 5/6	3667	7638888
BPSK	VIT 7/8	3850	8020833
QPSK	VIT 1/2	4400	9166666
QPSK	VIT 2/3	5867	12222222
QPSK	VIT 3/4	6600	13750000
QPSK	VIT 5/6	7334	15277777
QPSK	VIT 7/8	7700	16041666
8PSK	TRE 2/3	8800	18333333
8PSK	TRE 5/6	11000	20000000
8PSK	TRE 8/9	11550	20000000
16QAM	TRE 3/4	13200	20000000
16QAM	TRE 7/8	15400	20000000

188 Mode			
Modulation	Code Rate	Min Data Rate	Max Data Rate
BPSK	VIT 1/2	2400	4607843
BPSK	VIT 2/3	2950	6143790
BPSK	VIT 3/4	3318	6911764
BPSK	VIT 5/6	3687	7679738
BPSK	VIT 7/8	3871	8063725
QPSK	VIT 1/2	4424	9215686
QPSK	VIT 2/3	5899	12287581
QPSK	VIT 3/4	6636	13823529
QPSK	VIT 5/6	7373	15359476
QPSK	VIT 7/8	7742	16127450
8PSK	TRE 2/3	8848	18431372
8PSK	TRE 5/6	11059	20000000
8PSK	TRE 8/9	11797	20000000
16QAM	TRE 3/4	13271	20000000
16QAM	TRE 7/8	15483	20000000

204 Mode			
Modulation	Code Rate	Min Data Rate	Max Data Rate
BPSK	VIT 1/2	2400	5000000
BPSK	VIT 2/3	3200	6666666
BPSK	VIT 3/4	3600	7500000
BPSK	VIT 5/6	4000	8333333
BPSK	VIT 7/8	4200	8750000
QPSK	VIT 1/2	4800	10000000
QPSK	VIT 2/3	6400	13333333
QPSK	VIT 3/4	7200	15000000
QPSK	VIT 5/6	8000	16666666
QPSK	VIT 7/8	8400	17500000
8PSK	TRE 2/3	9600	20000000
8PSK	TRE 5/6	12000	20000000
8PSK	TRE 8/9	12800	20000000
16QAM	TRE 3/4	14400	20000000
16QAM	TRE 7/8	16800	20000000

6.2 Modulator

Modulation	BPSK, QPSK, and OQPSK, 8PSK, 8QAM, 16QAM,16APSK	
L-Band Tuning Range	950 to 2050 MHz in 1 Hz Steps	
Impedance	SMA, 50 Ohm or F-Type 75 Ohm (Optional)	
Connector	SMA, or F-Type (Optional)	
Return Loss	SMA 2.0:1	
Output Power	0 to -25 dB	
Output Stability	L-Band, ±1.0 dB Over Frequency and Temperature	
Output Spectrum	Selectable and Meets MIL-188-165A or IESS 308/309/ 310	Power Spectral Mask
Spurious	-55 dBc In-Band	
	-45 dBc Out-of-Band	
On/Off Power Ratio	>60 dB	
Scrambler	OM-73, CCITT V.35 or IBS	
FEC	Viterbi, K = 7 at 1/2, 3/4 and 7/8	
	2/3 Rate Trellis	
	Turbo Product Code (Optional)	
	BPSK 5/16, 21/44	
	QPSK/OQPSK 21/44, 3/4, 7/8	
	8PSK/8QAM/16QAM 3/4, 7/8	
	Low Density Parity Check (Optional)	
	BPSK 1/2	
	QPSK/OQPSK 1/2, 2/3, 3/4	
	8PSK/8QAM 2/3, 3/4	
	16QAM 3/4	
	EBEM (Optional)	
	BPSK 1/2, 2/3, 3/4, 7/8, 19/20	
	QPSK 1/2, 2/3, 3/4, 7/8, 19/20	
	8PSK 1/2, 2/3, 3/4, 7/8, 19/20	
	16APSK 1/2, 2/3, 3/4, 7/8, 19/20	
Outer Encoder Options	Reed-Solomon INTELSAT (DVB Optional)	
	Custom (N, K) Reed-Solomon	
Spread Spectrum	Direct Sequence x2, x4, x8, and x16 (Optional with LDPC)	
Data Clock Source	Internal, External, Rx Recovered	
High Stability	+/- 5 x 10^{-8}	

6.3 Demodulator

Demodulation	BPSK, QPSK, and OQPSK, 8PSK, 8QAM, 16QAM, 16APSK	
IF Tuning Range	L-Band Tuning Range	950 to 2050 MHz in 1 Hz Steps
Impedance	SMA, 50 Ohm, F-Type 75 Ohm (Optional)	
Connector	SMA, F-Type (Optional)	
Return Loss	SMA 2.0:1	
Spectrum	Selectable and Meets MIL-188-165A or INTELSAT IESS	308/309/310 Compliant
Input Level	-55 to +10 dBm and 10 log (Symbol Rate) -120 dBm / Hz, SR < 2500 k	
Total Input Power	+20 dBm or +40 dBc (the Lesser)	
FEC	Viterbi, K = 7 at 1/2, 3/4 and 7/8 Rate,	
	Rate Sequential 1/2, 3/4 and 7/8 (Optional)	
	Trellis 2/3	
	Turbo Product Code (Optional)	
	BPSK 5/16, 21/44	
	QPSK/OQPSK 21/44, 3/4, 7/8	
	8PSK/8QAM/16QAM 3/4, 7/8	
	Low Density Parity Check (Optional)	
	BPSK ½	
	QPSK/OQPSK 1/2, 2/3, 3/4	
	8PSK/8QAM 2/3, ¾	
	16QAM 3/4	
	EBEM (Optional)	
	BPSK 1/2, 2/3, 3/4, 7/8, 19/20	
	QPSK 1/2, 2/3, 3/4, 7/8, 19/20	
	8PSK 1/2, 2/3, 3/4, 7/8, 19/20	
	16APSK 1/2, 2/3, 3/4, 7/8, 19/20	
Decoder Options	Reed-Solomon INTELSAT (DVB Optional)	
	Custom (N, K) Reed-Solomon	
Descrambler	OM-73, CCITT V.35 or IBS	
Acquisition Range	Programmable ±1 kHz to ± 255 kHz	
Reacquisition Range	Programmable ±1 Hz to 25000 Hz	
Sweep Delay Value	0 to 6000 seconds in 100 msec Steps	

6.4 Plesiochronous Buffer

Size	0 msec to 64 msec
Centering	Automatic on Underflow/Overflow
Centering Modes	IBS: Integral Number of Frames
	IDR: Integral Number of Multi-Frames
Clock	External, Rx Recovered or SCT (Internal)

6.5 Monitor and Control

Ethernet 10/100 Base-T/Web Browser/SNMP, Remote RS-485/Terminal RS-232.

6.6 Terrestrial Interfaces

MIL-188-114A	All Rates, Differential, Clock/Data, DCE	
Ethernet 2 Port 10/100 Base-T	Two RJ-45, Auto-Crossover, Auto-Sensing, 10/100 Ethernet	Data Ports. Complies with IEEE 802.3 and IEEE 802.3u.

6.7 Environmental

Prime Power	+21 to +24.5 Volts DC
Operating Temperature	0 to +60°C (+32 to +140°F), 95% Humidity, Non-Condensing
Storage Temperature	-20 to 70°C (-4 to 158°F), 99% humidity, Non-Condensing

6.8 Physical

Size	1.442" x 6.675" x 9.125" 6.675" W x 10.3 D x 1.442" H / (17.78 x 23.12 x 2.54 cm)
Weight	3.71 Pounds (1.68 Kg)

6.9 BER Specifications

6.9.1 BER Performance (Viterbi)

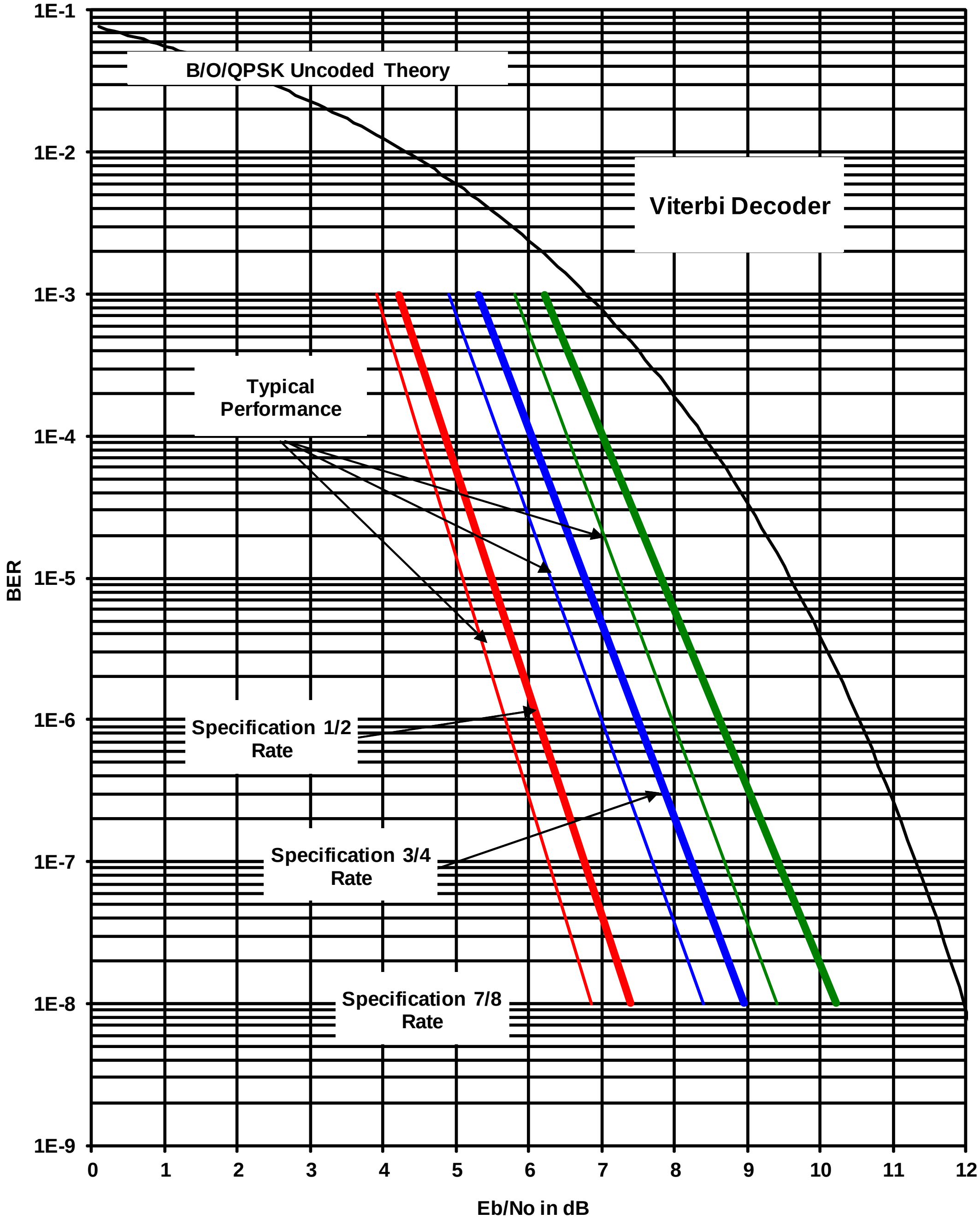


Figure 6-1. B/0/QPSK BER Performance (Viterbi)

Note: Eb/No values include the effect of using differential decoding and v.35 descrambling.

6.9.2 BER Performance (Sequential)

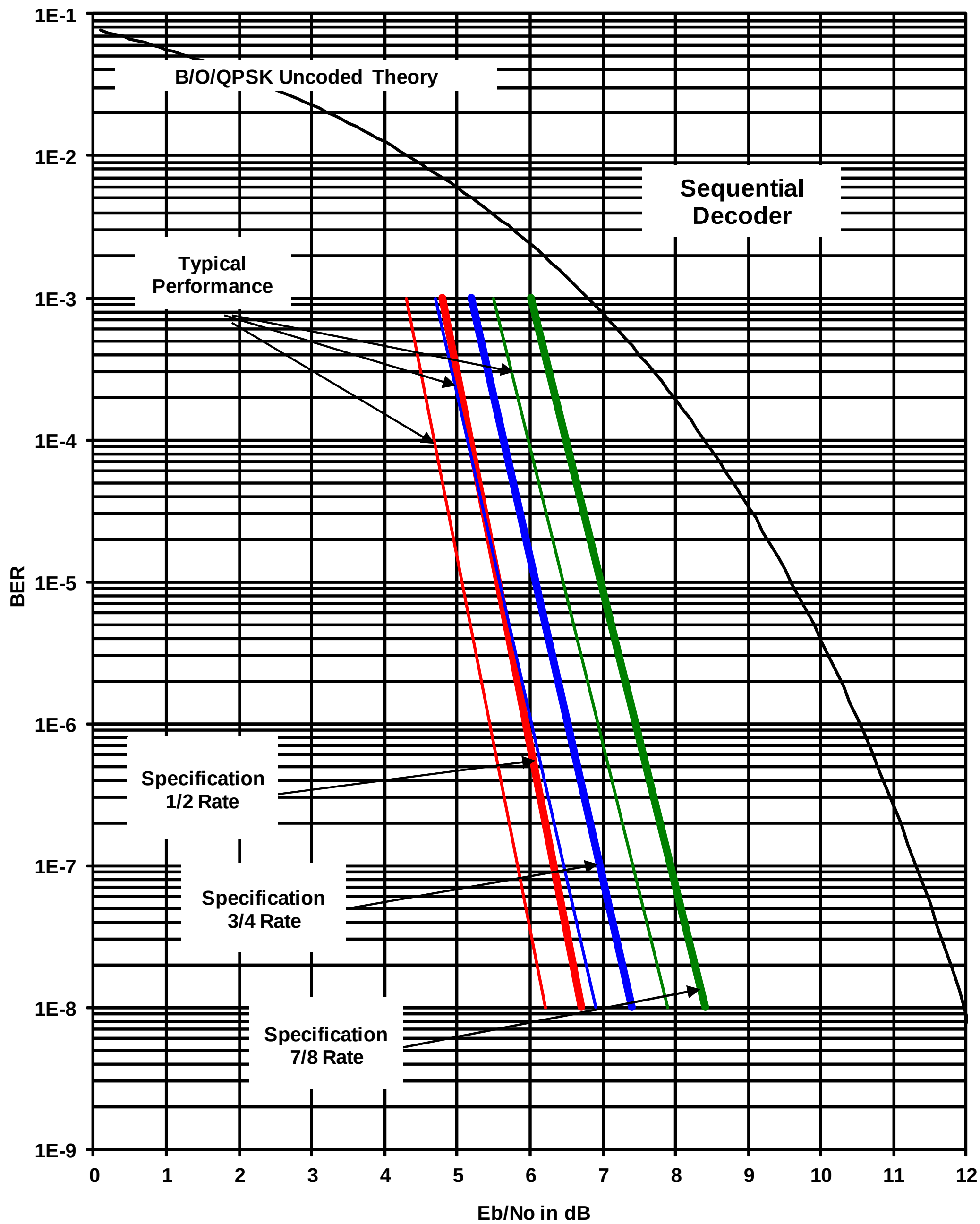


Figure 6-2. B/0/QPSK BER Performance (Sequential)

Note: Eb/No values include the effect of using differential decoding and v.35 descrambling.

6.9.3 BER Performance (Viterbi - w/Reed-Solomon)

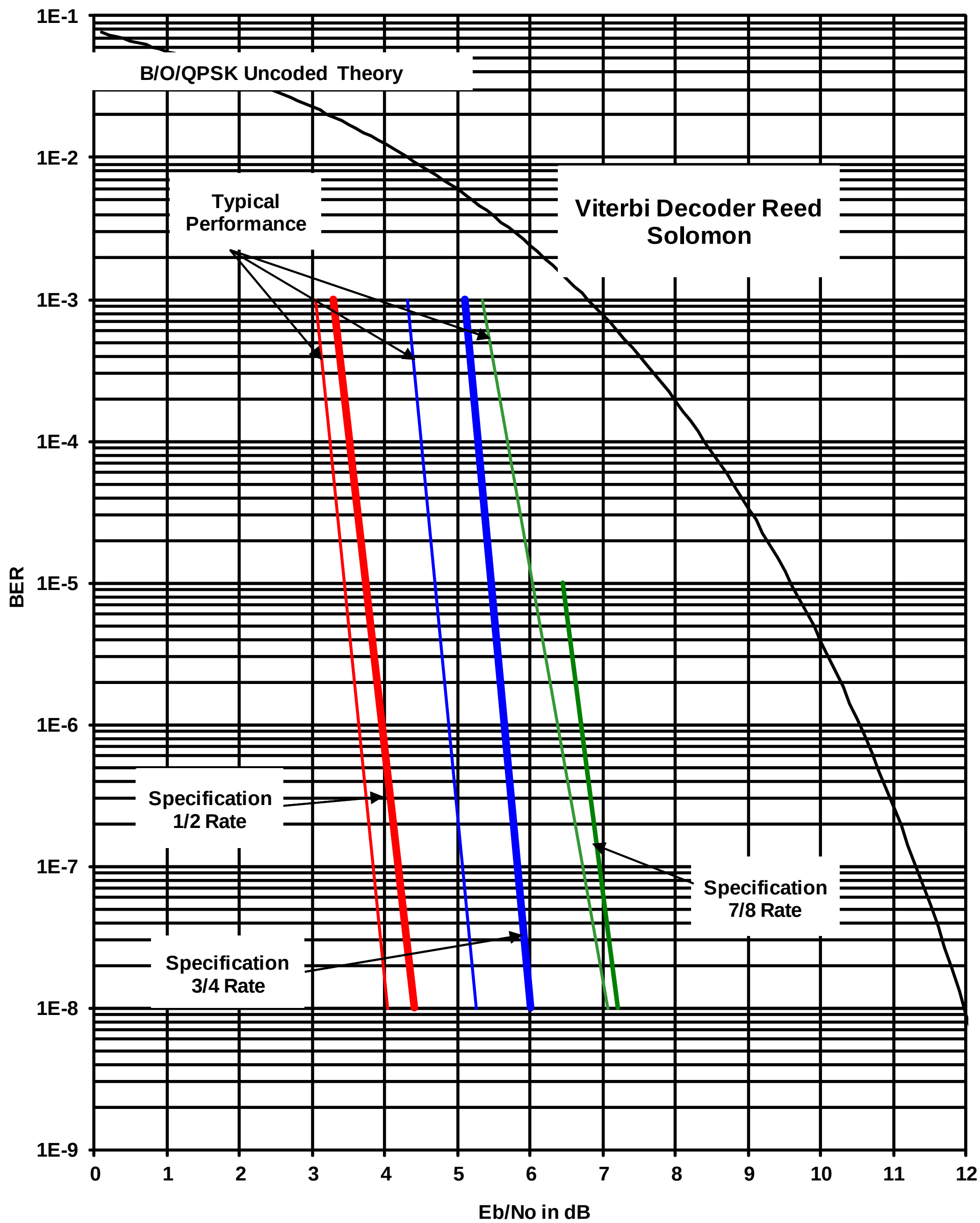


Figure 6-3. B/O/QPSK BER Performance (Viterbi – w/RS)

Note: Eb/No values include the effect of using differential decoding.

6.9.4 BER Performance (8PSK Trellis)

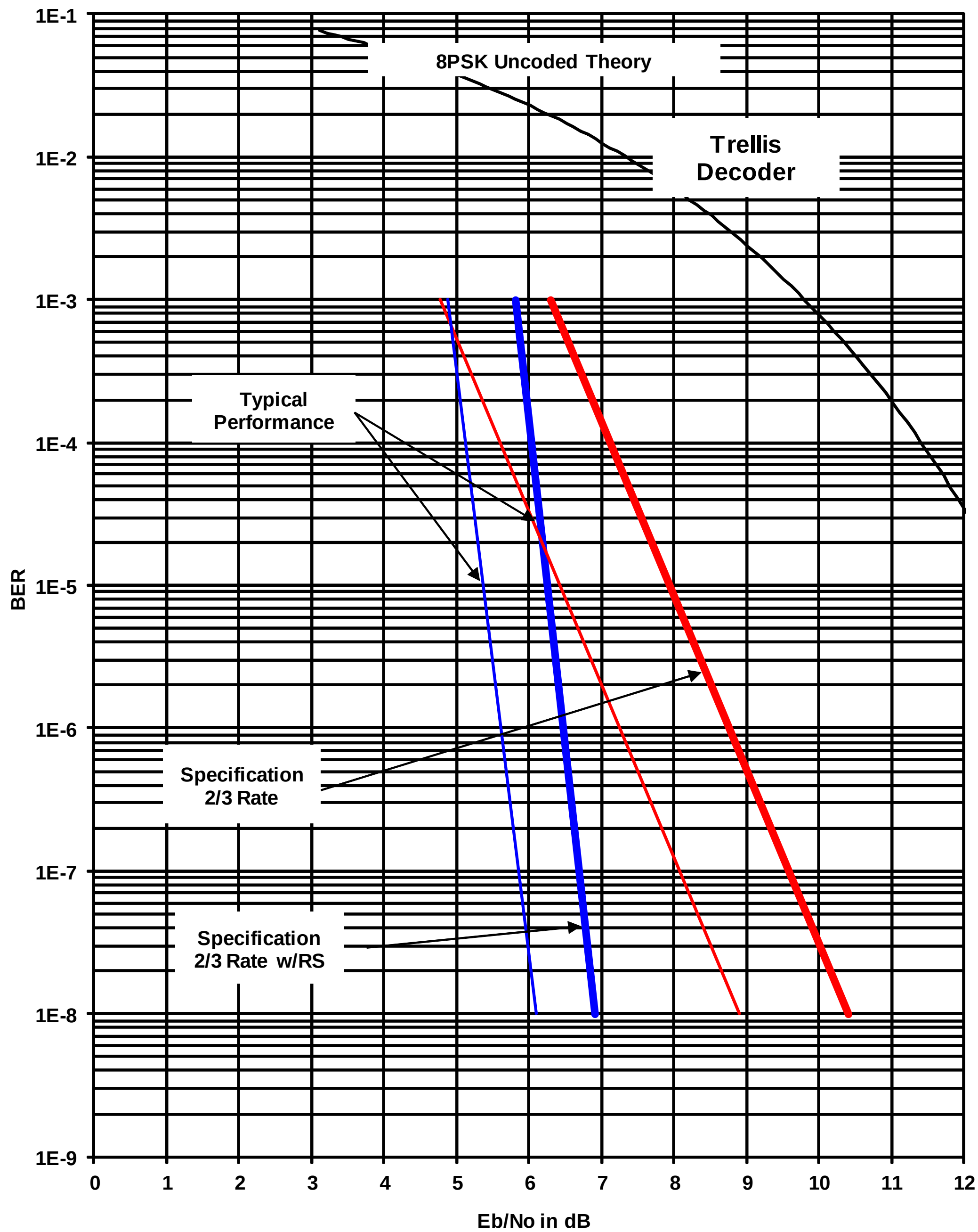


Figure 6-4. 8PSK BER Performance (Trellis)

Note: Eb/No values include the effect of using differential decoding and v.35 descrambling.

6.9.5 BER Performance (16QAM Viterbi)

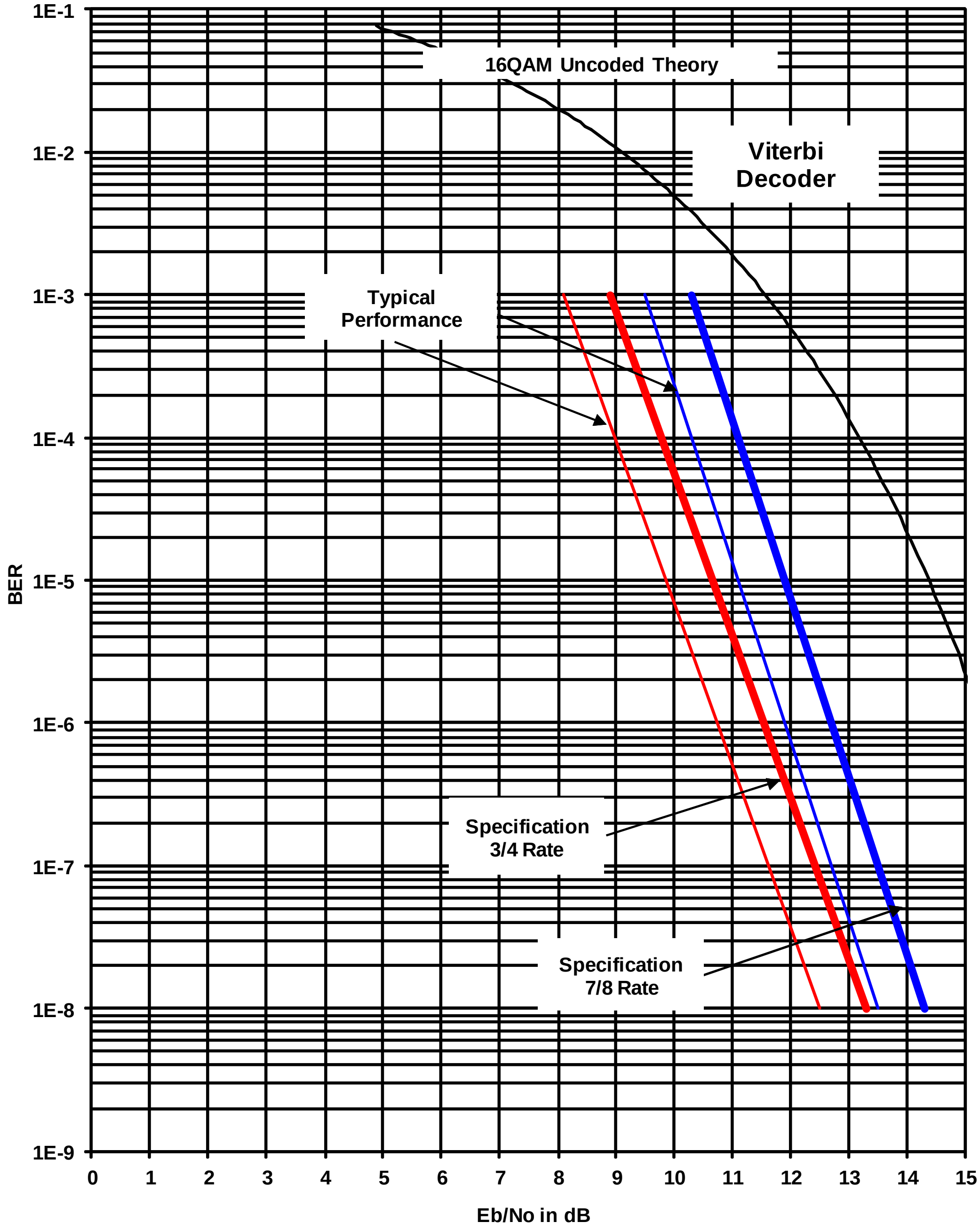


Figure 6-5. 16QAM BER Performance (Viterbi)

Note: Eb/No values include the effect of using differential decoding and v.35 descrambling.

6.9.6 BER Performance (16QAM Viterbi w/Reed-Solomon)

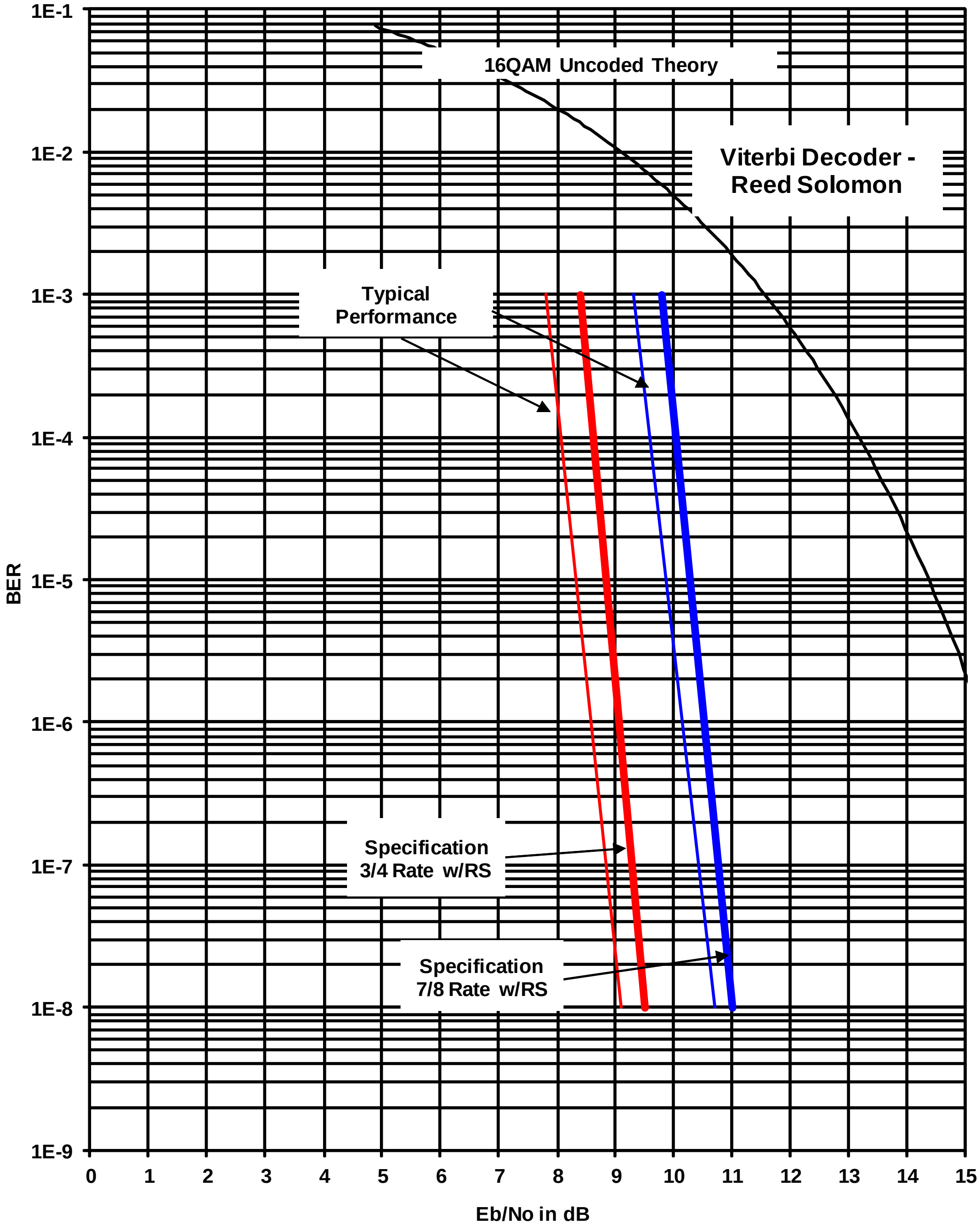


Figure 6-6. 16QAM BER Performance (Viterbi w/RS)

Note: Eb/No values include the effect of using differential decoding.

6.9.7 BER Performance ((O)QPSK Turbo)

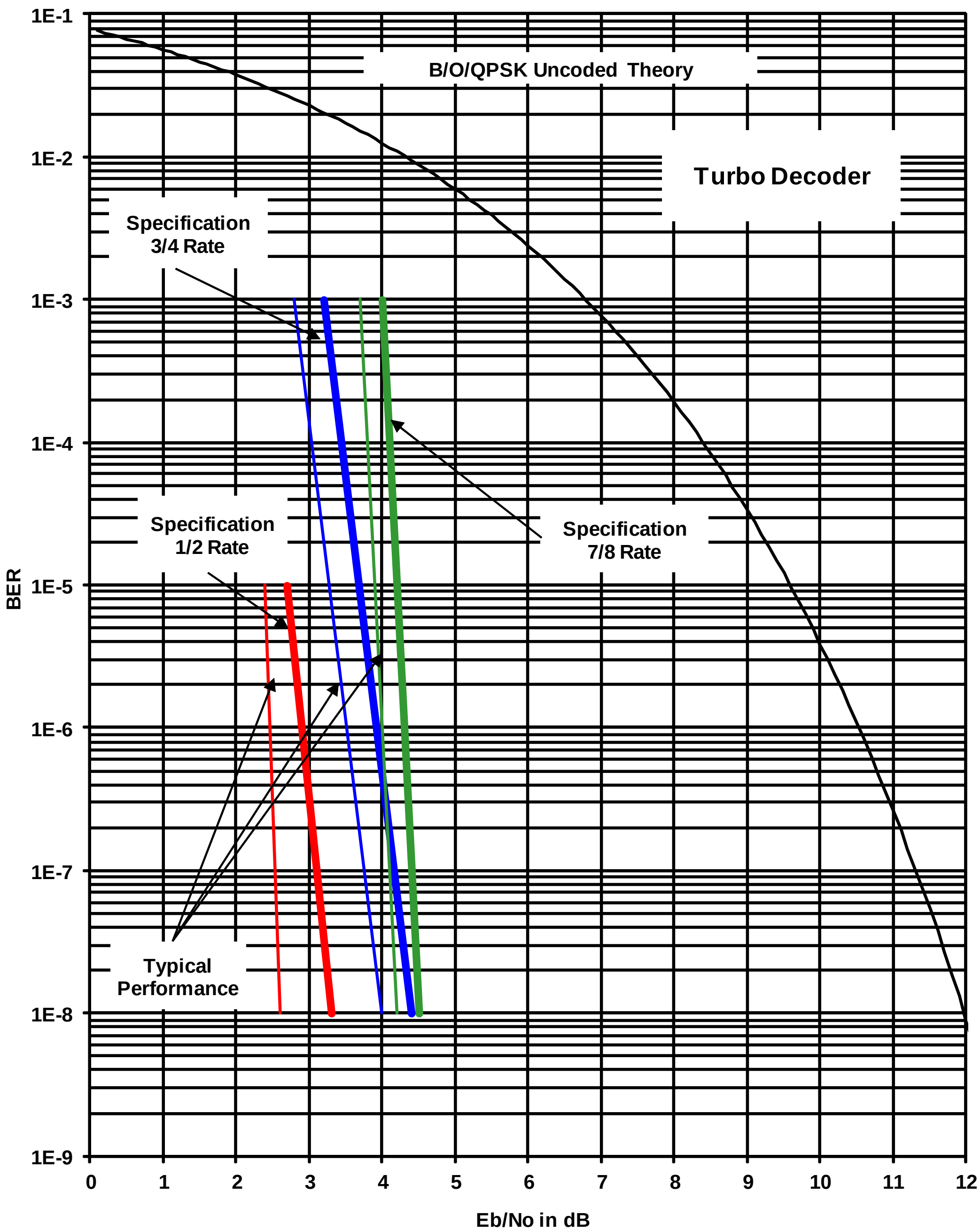


Figure 6-7. (O)QPSK BER Performance (Turbo)

6.9.8 BER Performance (BPSK Turbo)

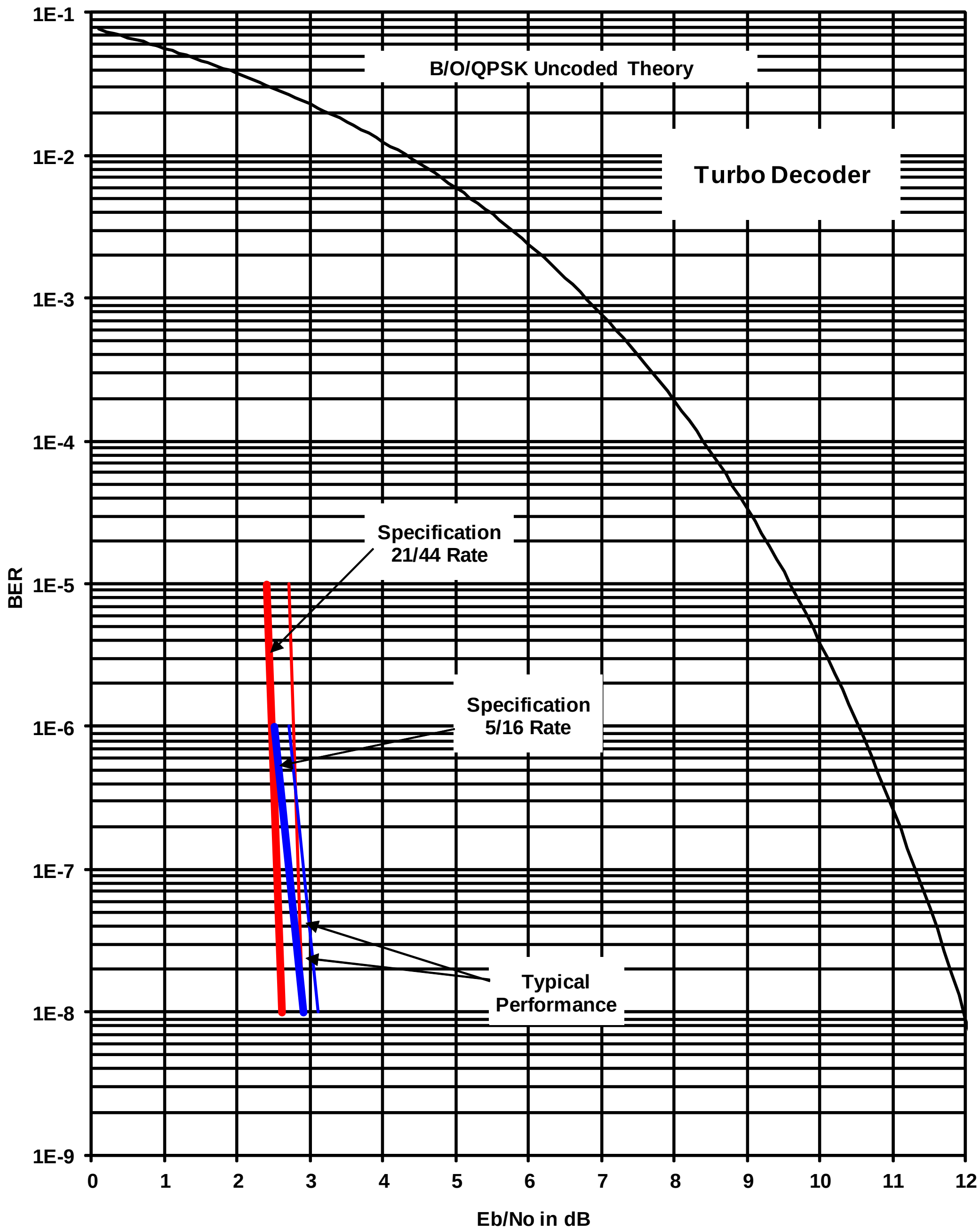


Figure 6-8. BPSK BER Performance (Turbo)

6.9.9 BER Performance (8PSK Turbo)

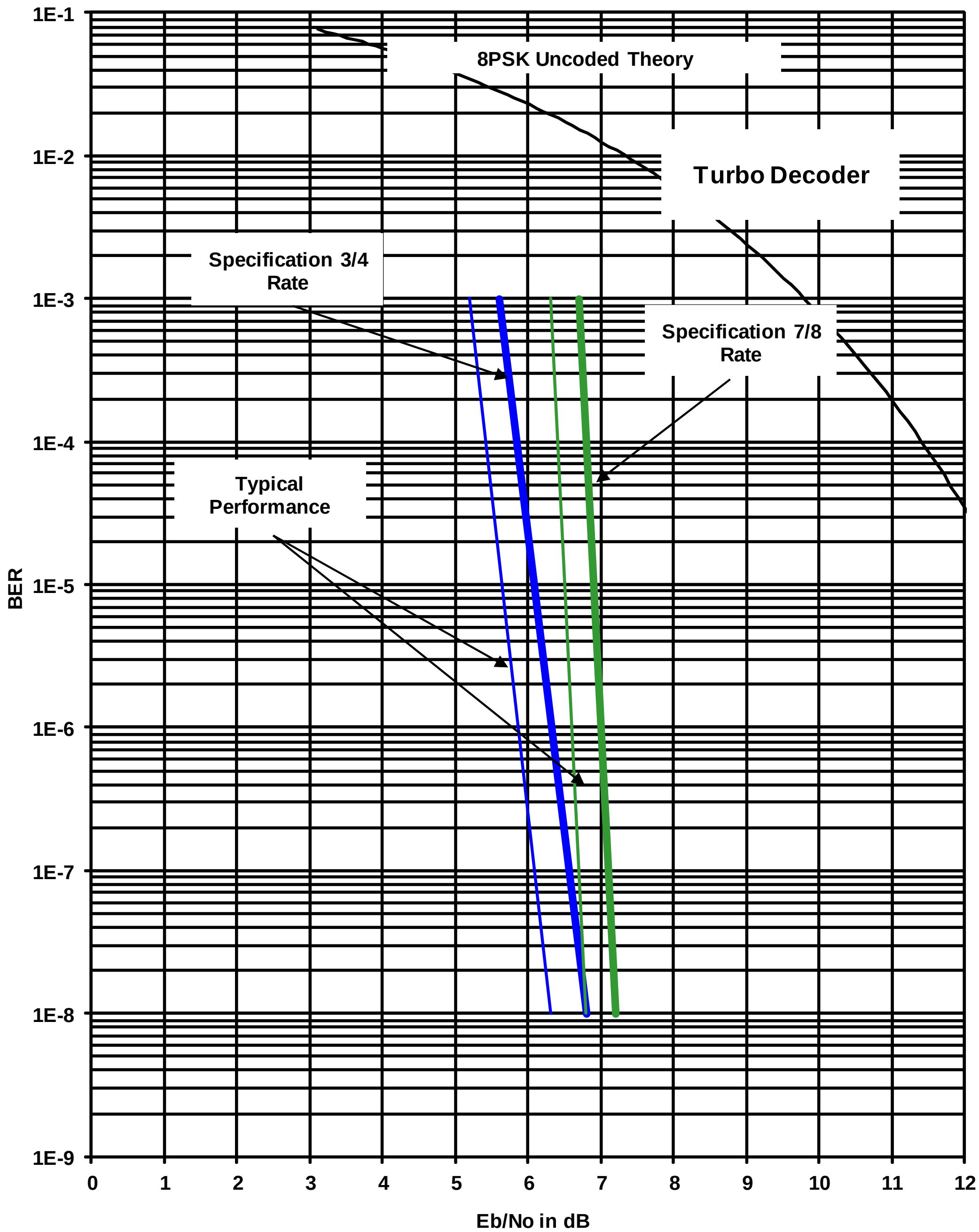


Figure 6-9. 8PSK BER Performance (Turbo)

6.9.10 BER Performance (16QAM Turbo)

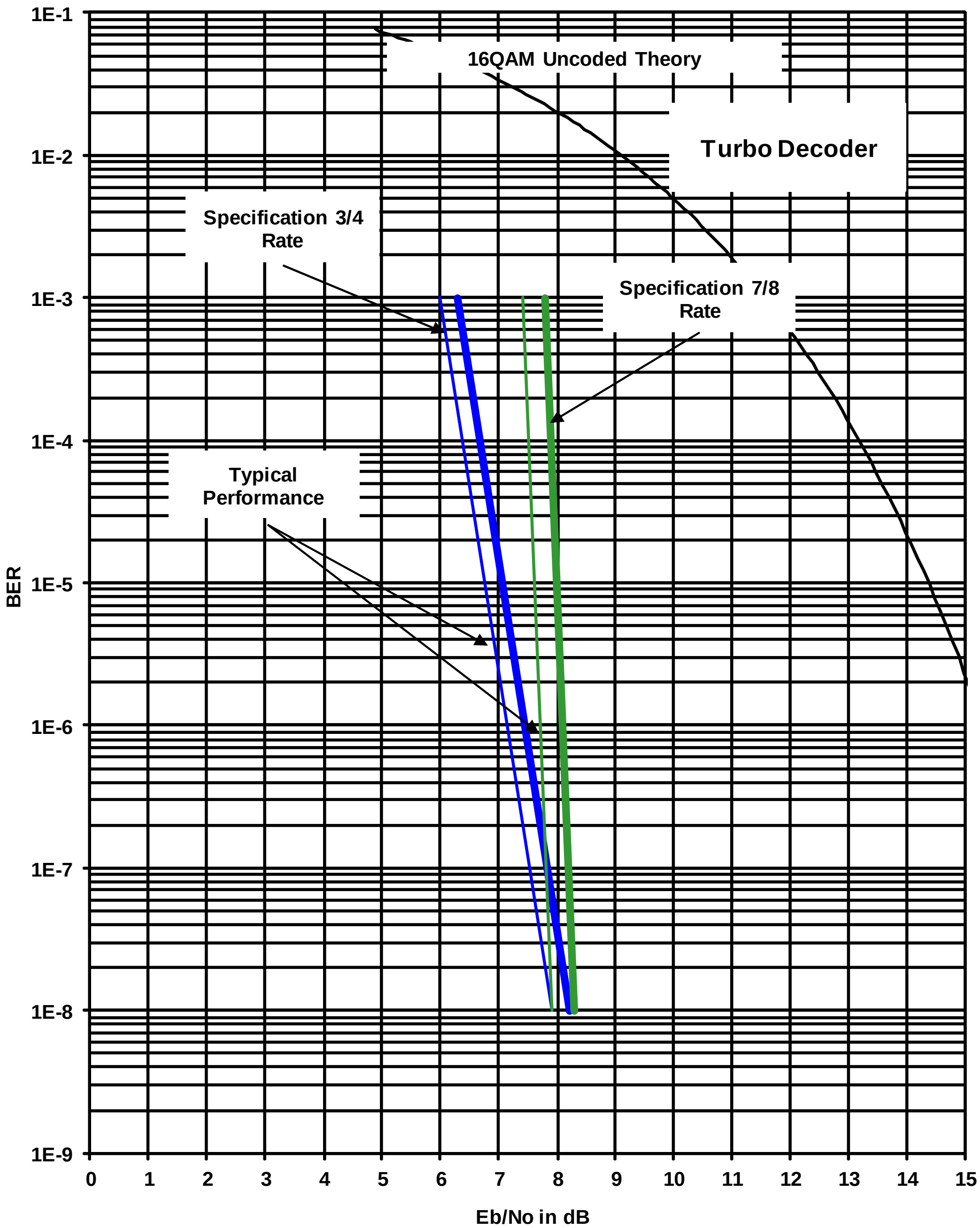


Figure 6-10. 16QAM BER Performance (Turbo)

6.9.11 B/O/QPSK BER Performance (LDPC)

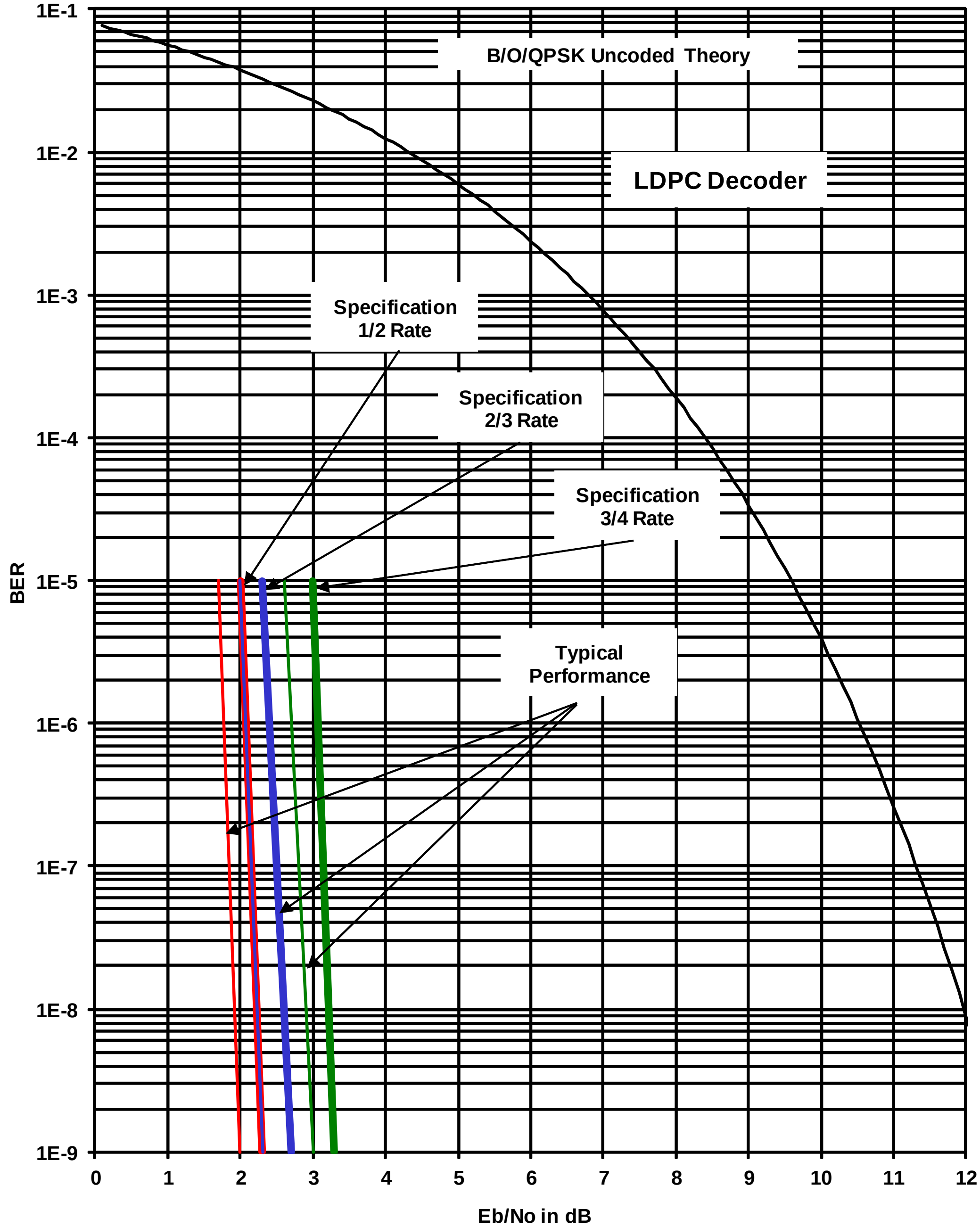


Figure 6-11. B/O/QPSK BER Performance (LDPC)

6.9.12 8PSK/8QAM BER Performance (LDPC)

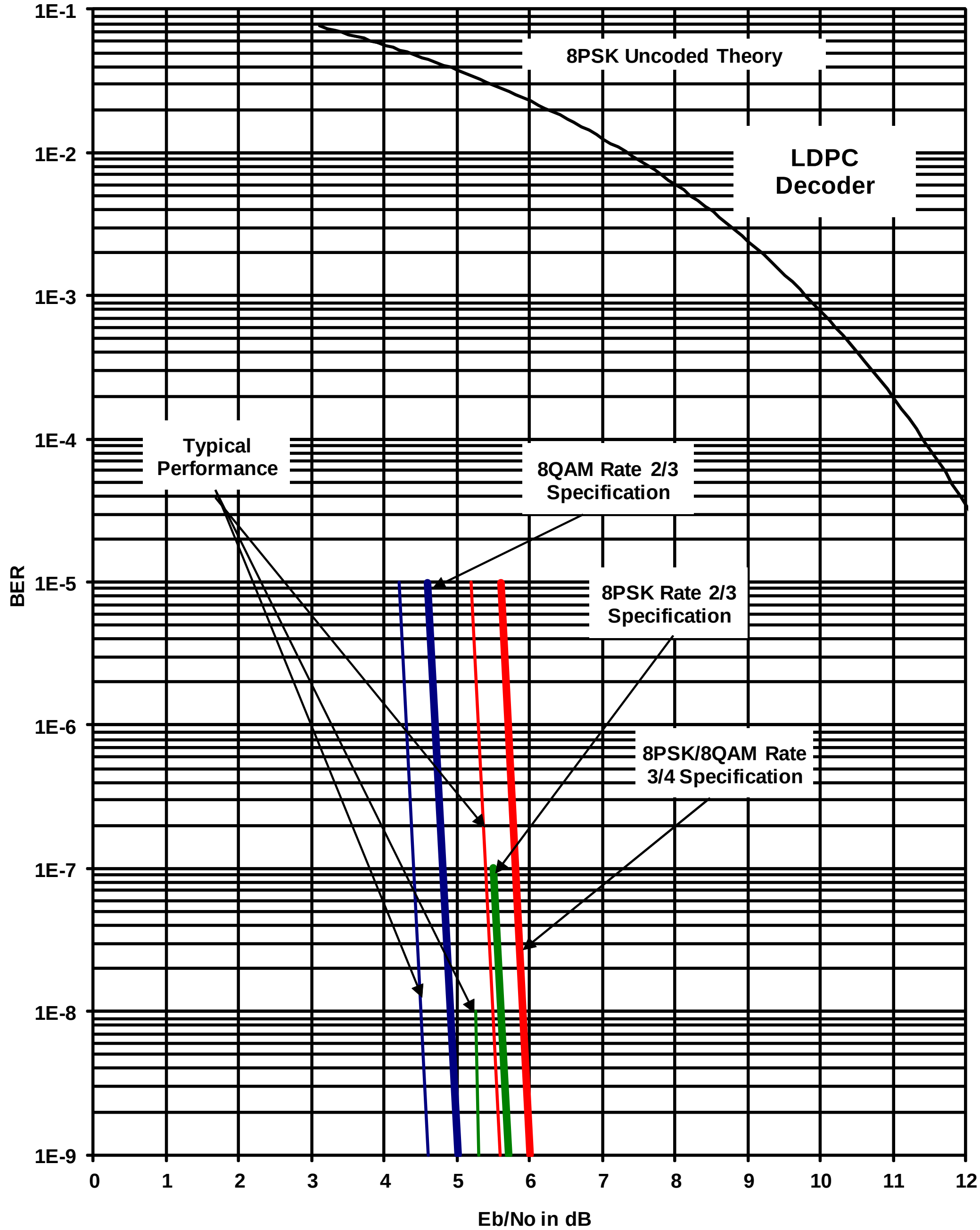


Figure 6-12. 8PSK/8QAM BER Performance (LDPC)

6.9.13 16QAM BER Performance (LDPC)

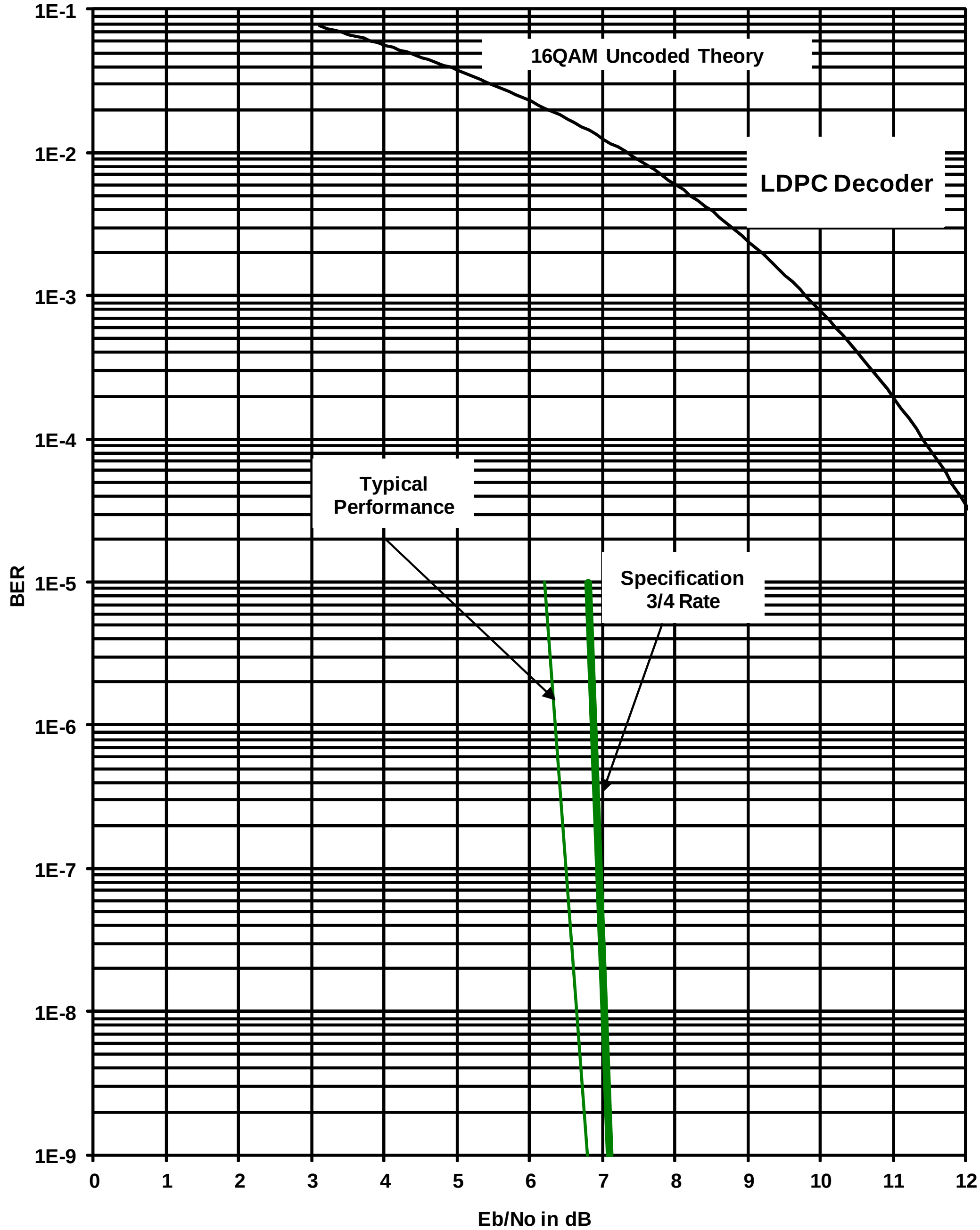


Figure 6-13. 16QAM BER Performance (LDPC)

6.9.14 BER Performance B/O/QPSK (MILSTD 188-165B or STANAG) Turbo

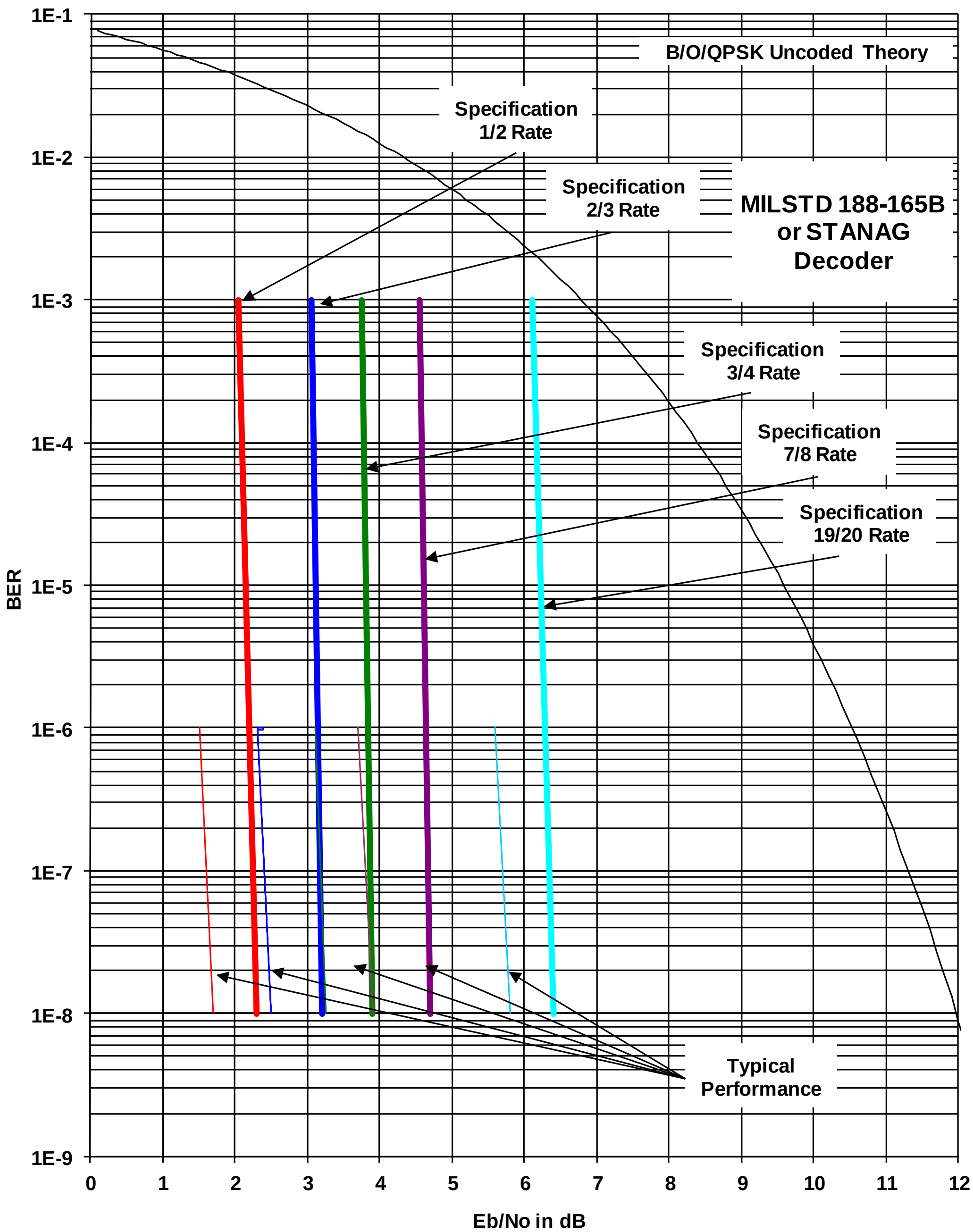


Figure 6-14. BER Performance B/O/QPSK (MILSTD 188-165B or STANAG) Turbo

Note: Eb/No to Bit-Error-Ratio 77 values based on 16k block size.

6.9.15 BER Performance 8-PSK (MILSTD 188-165B or STANAG) Turbo

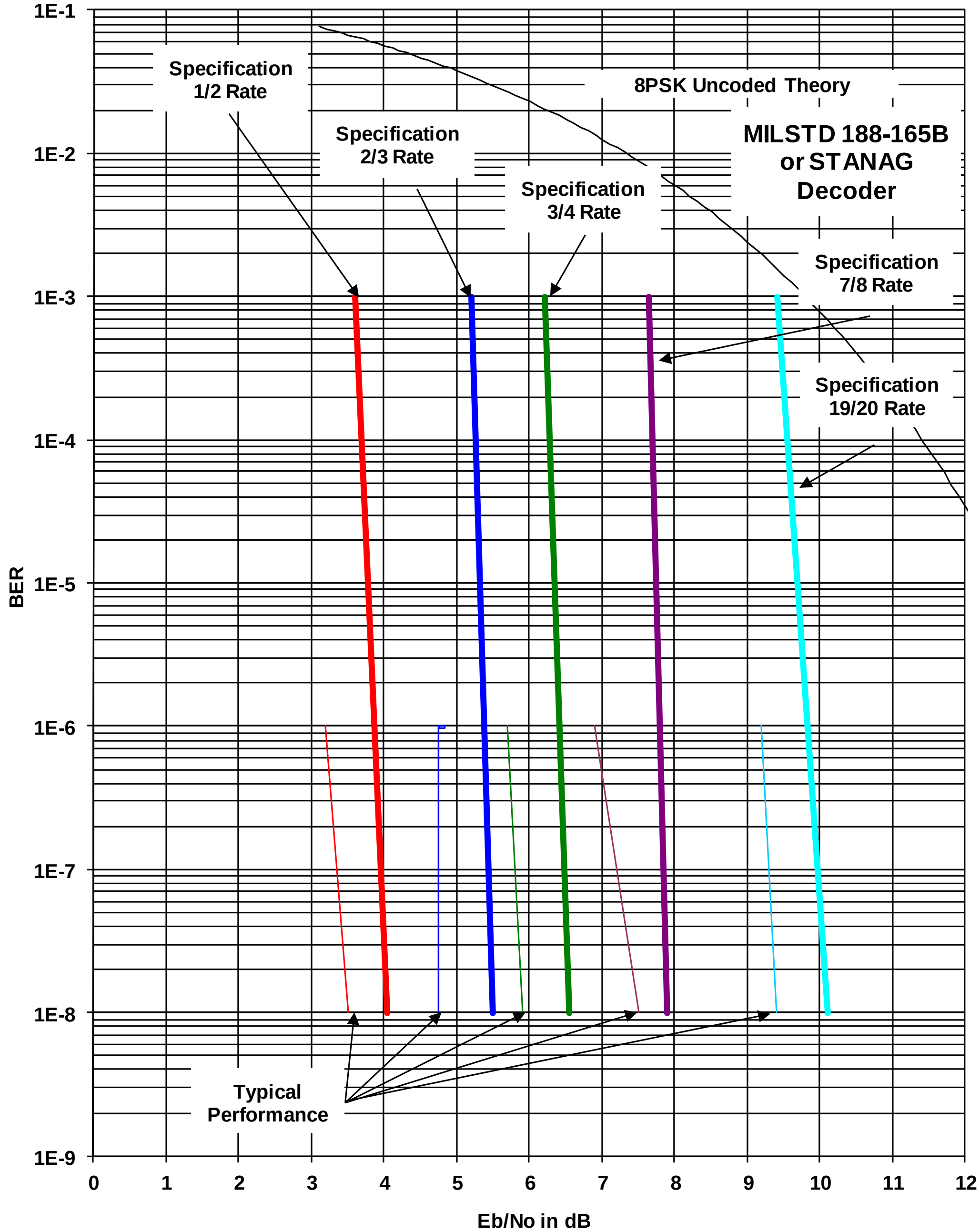


Figure 6-15. BER Performance 8-PSK (MILSTD 188-165B or STANAG) Turbo

Note: Eb/No to Bit-Error-Ratio 77 values based on 16k block size

6.9.16 BER Performance 16APSK (MILSTD 188-165B or STANAG) Turbo

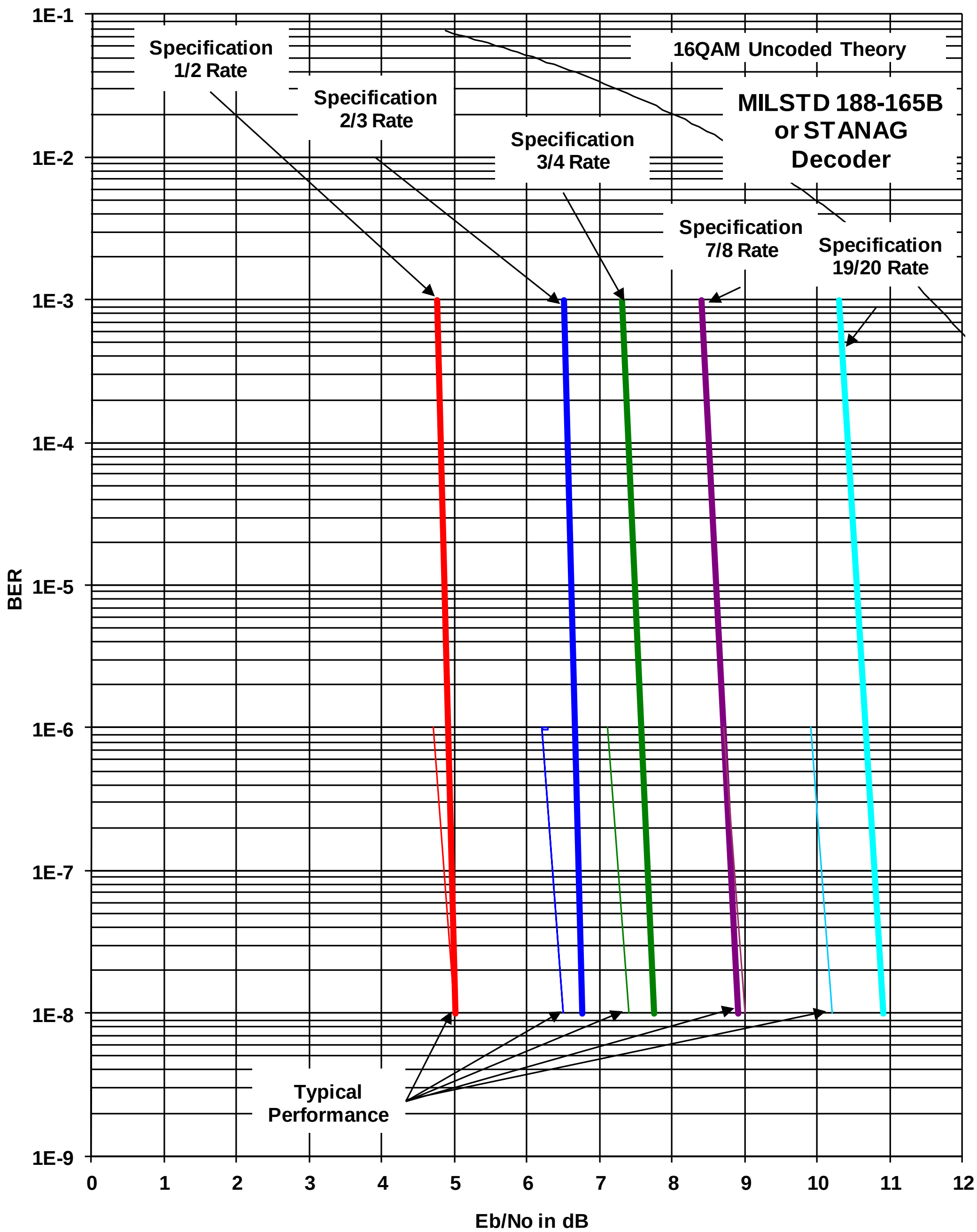


Figure 6-16. BER Performance 16APSK (MILSTD 188-165B or STANAG)

Note: Eb/No to Bit-Error-Ratio 77 values based on 16k block size

Table 6-1. B/O/QPSK BER Performance (Viterbi)

BER	Specification (dB)			Typical (dB)		
	1/2 Rate	3/4 Rate	7/8 Rate	1/2 Rate	3/4 Rate	7/8 Rate
1E-5	5.5	6.8	7.9	5.1	6.3	7.2
1E-6	6.1	7.6	8.6	5.7	7.0	7.9
1E-7	6.7	8.3	9.3	6.2	7.7	8.6
1E-8	7.4	8.9	10.2	6.8	8.4	9.4

Table 6-2. B/O/QPSK BER Performance (Sequential)

BER	Specification (dB)			Typical (dB)		
	1/2 Rate	3/4 Rate	7/8 Rate	1/2 Rate	3/4 Rate	7/8 Rate
1E-5	5.6	6.1	6.9	5.1	5.6	6.4
1E-6	5.9	6.5	7.4	5.4	6.1	6.9
1E-7	6.3	7.0	7.9	5.8	6.5	7.4
1E-8	6.7	7.4	8.4	6.2	6.9	7.9

Table 6-3. B/O/QPSK BER Performance (Viterbi – w/RS)

BER	Specification (dB)			Typical (dB)		
	1/2 Rate	3/4 Rate	7/8 Rate	1/2 Rate	3/4 Rate	7/8 Rate
1E-5	3.8	5.4	6.5	3.4	4.7	6.0
1E-6	4.1	5.6	6.7	3.6	4.9	6.4
1E-7	4.2	5.8	6.9	3.8	5.1	6.7
1E-8	4.4	6.0	7.2	4.0	5.3	7.1

Table 6-4. 8PSK BER Performance (Trellis)

BER	Specification (dB)		Typical (dB)	
	2/3 Rate	2/3 Rate w/RS	2/3 Rate	2/3 Rate w/RS
1E-5	8.2	6.3	6.4	5.4
1E-6	9.0	6.5	7.2	5.6
1E-7	9.8	6.7	8.1	5.8
1E-8	10.4	6.9	8.9	6.1

Table 6-5. 16QAM BER Performance (Viterbi)

BER	Specification (dB)		Typical (dB)	
	3/4 Rate	7/8 Rate	3/4 Rate	7/8 Rate
1E-5	10.7	11.9	9.9	11.1
1E-6	11.5	12.7	10.7	11.9
1E-7	12.4	13.5	11.6	12.7
1E-8	13.3	14.3	12.5	13.5

Table 6-6. 16QAM BER Performance (Viterbi w/RS)

BER	Specification (dB)		Typical (dB)	
	3/4 Rate	7/8 Rate	3/4 Rate	7/8 Rate
1E-5	8.9	8.3	8.3	9.9
1E-6	9.1	8.6	8.6	10.2
1E-7	9.3	8.8	8.8	10.4
1E-8	9.5	9.1	9.1	10.7

Table 6-7. (O)QPSK BER Performancfe (Turbo)

BER	Specification (dB)			Typical (dB)		
	1/2 Rate	3/4 Rate	7/8 Rate	1/2 Rate	3/4 Rate	7/8 Rate
1E-5	2.7	3.6	4.2	2.4	3.2	3.9
1E-6	2.9	3.8	4.3	2.6	3.4	4.0
1E-7	3.1	4.1	4.4	2.8	3.7	4.1
1E-8	3.3	4.4	4.5	3.0	4.0	4.2

Table 6-8. BPSK BER Performance (Turbo)

BER	Specification (dB)		Typical (dB)	
	5/16 Rate	21/44 Rate	5/16 Rate	21/44 Rate
1E-5	-	2.7	-	2.4
1E-6	2.7	2.9	2.5	2.6
1E-7	2.9	3.1	2.7	2.8
1E-8	3.1	3.3	2.9	3.0

Table 6-9. 8PSK BER Performance (Turbo)

BER	Specification (dB)		Typical (dB)	
	3/4 Rate	7/8 Rate	3/4 Rate	7/8 Rate
1E-5	6.0	6.9	5.8	6.5
1E-6	6.2	7.0	6.0	6.6
1E-7	6.4	7.1	6.2	6.7
1E-8	6.8	7.2	6.6	6.8

Table 6-10. 16QAM BER Performance (Turbo)

BER	Specification (dB)		Typical (dB)	
	3/4 Rate	7/8 Rate	3/4 Rate	7/8 Rate
1E-5	7.0	8.0	6.7	7.6
1E-6	7.4	8.1	7.1	7.7
1E-7	7.8	8.2	7.5	7.8
1E-8	8.2	8.3	7.9	7.9

Table 6-11. B/O/QPSK BER Performance (LDPC)

BER	Specification (dB)			Typical (dB)		
	1/2 Rate	2/3 Rate	3/4 Rate	1/2 Rate	2/3 Rate	3/4 Rate
1E-5	2.0	2.3	3.0	1.7	2.0	2.6
1E-6	2.1	2.4	3.1	1.8	2.1	2.7
1E-7	2.2	2.6	3.2	1.9	2.2	2.8
1E-8	2.3	2.7	3.3	2.0	2.3	2.9

Table 6-12. 8PSK / 8-QAM Rate BER Performance (LDPC)

BER	8PSK				8-QAM			
	Specification (dB)		Typical (dB)		Specification (dB)		Typical (dB)	
	2/3 Rate	3/4 Rate	2/3 Rate	3/4 Rate	2/3 Rate	3/4 Rate	2/3 Rate	3/4 Rate
1E-5	5.4	5.6	5.0	5.2	4.6	5.6	4.2	5.2
1E-6	5.5	5.7	5.1	5.3	4.7	5.7	4.3	5.3
1E-7	5.6	5.8	5.2	5.4	4.8	5.8	4.4	5.4
1E-8	5.7	5.9	5.3	5.5	4.9	5.9	4.5	5.5

Table 6-13. 16QAM BER Performance (LDPC)

BER	Specification (dB)	Typical (dB)
	3/4 Rate	3/4 Rate
1E-5	6.8	6.4
1E-6	6.9	6.5
1E-7	7.0	6.6
1E-8	7.1	6.7

Table 6-14. IBS/IDR Compliant Framing Modes

BER	Specification (dB)		Typical (dB)	
	IBS	IDR	IBS	IDR
	1/2 Rate	3/4 Rate	1/2 Rate	3/4 Rate
1E-5	5.3	6.7	5.6	5.9
1E-6	6.0	7.5	6.3	6.6
1E-7	6.6	8.2	6.9	7.3
1E-8	7.1	8.7	7.5	7.8

Table 6-15. B/O/QPSK BER Performance (MIL STD 188-165B or STANAG) Turbo

BER	16 K Block									
	Specification (dB)					Typical (dB)				
	1/2 Rate	2/3 Rate	3/4 Rate	7/8 Rate	19/20 Rate	1/2 Rate	2/3 Rate	3/4 Rate	7/8 Rate	19/20 Rate
1E-5	1.8	2.6	3.1	4.2	5.9	1.4	2.2	2.7	3.8	5.5
1E-6	1.9	2.65	3.15	4.3	6.0	1.5	2.25	2.75	3.9	5.6
1E-7	2.0	2.7	3.2	4.4	6.1	1.6	2.3	2.8	4.0	5.7
1E-8	2.1	2.8	3.3	4.5	6.2	1.7	2.4	2.9	4.1	5.8
	4 K Block									
1E-5	2.1	2.9	3.4	4.5	6.2	1.7	2.5	3.0	4.1	5.8
1E-6	2.2	2.95	3.45	4.6	6.3	1.8	2.55	3.05	4.2	5.9
1E-7	2.3	3.0	3.5	4.7	6.4	1.9	2.6	3.1	4.3	6.0
1E-8	2.4	3.1	3.6	4.8	6.5	2.0	2.7	3.2	4.4	6.1
	1 K Block									
1E-5	3.1	3.9	4.4	5.5	7.2	2.7	3.5	4.0	5.1	6.8
1E-6	3.2	3.95	4.45	5.6	7.3	2.8	3.55	4.05	5.2	6.9
1E-7	3.3	4.0	4.5	5.7	7.4	2.9	3.6	4.1	5.3	7.0
1E-8	3.4	4.1	4.6	5.8	7.5	3.0	3.7	4.2	5.4	7.1

Table 6-16. 8PSK BER Performance (MIL STD 188-165B or STANAG) Turbo

BER	16 K Block									
	Specification (dB)					Typical (dB)				
	1/2 Rate	2/3 Rate	3/4 Rate	7/8 Rate	19/20 Rate	1/2 Rate	2/3 Rate	3/4 Rate	7/8 Rate	19/20 Rate
1E-5	3.5	5.0	6.0	7.2	9.5	3.1	4.6	5.6	6.8	9.1
1E-6	3.6	5.1	6.1	7.3	9.6	3.2	4.7	5.7	6.9	9.2
1E-7	3.7	5.2	6.2	7.5	9.7	3.3	4.8	5.8	7.1	9.3
1E-8	3.9	5.3	6.3	7.9	9.8	3.5	4.9	5.9	7.5	9.4
	4 K Block									
1E-5	3.8	5.3	6.3	7.5	9.8	3.4	4.9	5.9	7.1	9.4
1E-6	3.9	5.4	6.4	7.6	9.9	3.5	5.0	6.0	7.2	9.5
1E-7	4.0	5.5	6.5	7.8	10.0	3.6	5.1	6.1	7.4	9.6
1E-8	4.2	5.6	6.6	8.2	10.1	3.7	5.2	6.2	7.8	9.7
	1 K Block									
1E-5	4.8	6.3	7.3	8.5	10.8	4.4	5.9	6.9	8.1	10.4
1E-6	4.9	6.4	7.4	8.6	10.9	4.5	6.0	7.0	8.2	10.5
1E-7	5.0	6.5	7.5	8.8	11.0	4.6	6.1	7.1	8.4	10.6
1E-8	5.2	6.6	7.6	9.2	11.1	4.7	6.2	7.2	8.8	10.7

Table 6-17. 16APSK BER Performance (MIL STD 188-165B or STANAG) Turbo

BER	16 K Block									
	Specification (dB)					Typical (dB)				
	1/2 Rate	2/3 Rate	3/4 Rate	7/8 Rate	19/20 Rate	1/2 Rate	2/3 Rate	3/4 Rate	7/8 Rate	19/20 Rate
1E-5	4.7	6.5	7.4	8.5	10.5	4.3	6.1	7.0	8.2	10.2
1E-6	4.8	6.6	7.5	8.7	10.7	4.4	6.2	7.1	8.4	10.4
1E-7	4.9	6.7	7.6	8.8	10.8	4.5	6.3	7.2	8.5	10.5
1E-8	5.0	6.8	7.7	8.9	10.9	4.6	6.4	7.3	8.6	10.6
	4 K Block									
1E-5	5.0	6.8	7.7	8.9	10.8	4.6	6.4	7.3	8.5	10.5
1E-6	5.1	6.9	7.8	8.9	11.0	4.7	6.5	7.4	8.7	10.7
1E-7	5.2	7.0	7.9	9.1	11.1	4.8	6.6	7.5	8.8	10.8
1E-8	5.3	7.1	8.0	9.2	11.2	4.9	6.7	7.6	8.9	10.9
	1 K Block									
1E-5	6.0	7.8	8.7	9.8	11.8	5.6	7.4	8.3	9.5	11.5
1E-6	6.1	7.9	8.8	9.9	12.0	5.7	7.5	8.4	9.7	11.7
1E-7	6.2	8.0	8.9	10.1	12.1	5.8	7.6	8.5	9.8	11.8
1E-8	6.3	8.1	9.0	10.2	12.2	5.9	7.7	8.6	9.8	11.9

6.10 ACG Output Voltage

The AGC Output Voltage is a function of the Input Power Level in dBm. The AGC Output Voltage is found on the Alarm connector Pin 24 of J2.

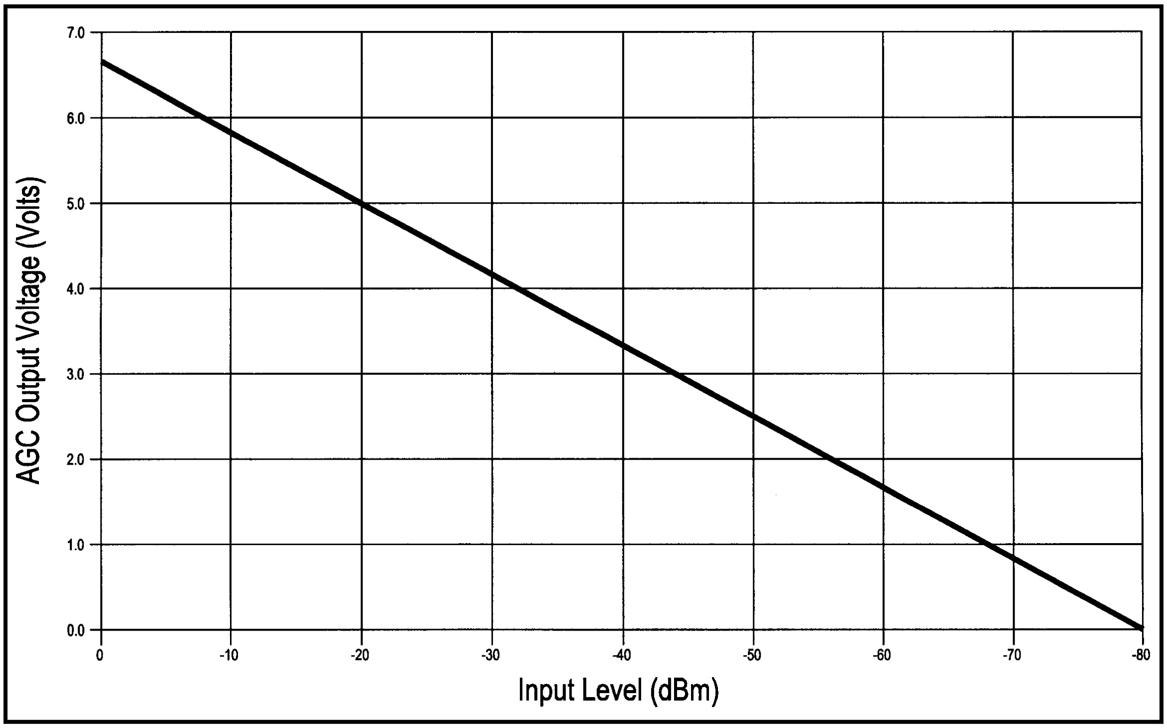


Figure 6-17. AGC Voltage Monitor

6.11 DMD Input Level Specification

Equation 1 – Minimum Input Signal Level above 2500k Symbols per Second

$$-55\ dBm\ to + 10\ dBm,,Symbol\ Rates\ \geq 2500\ kSPS$$

and

Equation 2 - Minimum Input Signal Level Below 2500k Symbols per Second

$$10\log(Symbol\ Rate) - \frac{120dBm}{Hz}\ to + 10\ dBm, Symbol\ Rates\ < 2500\ kSPS$$

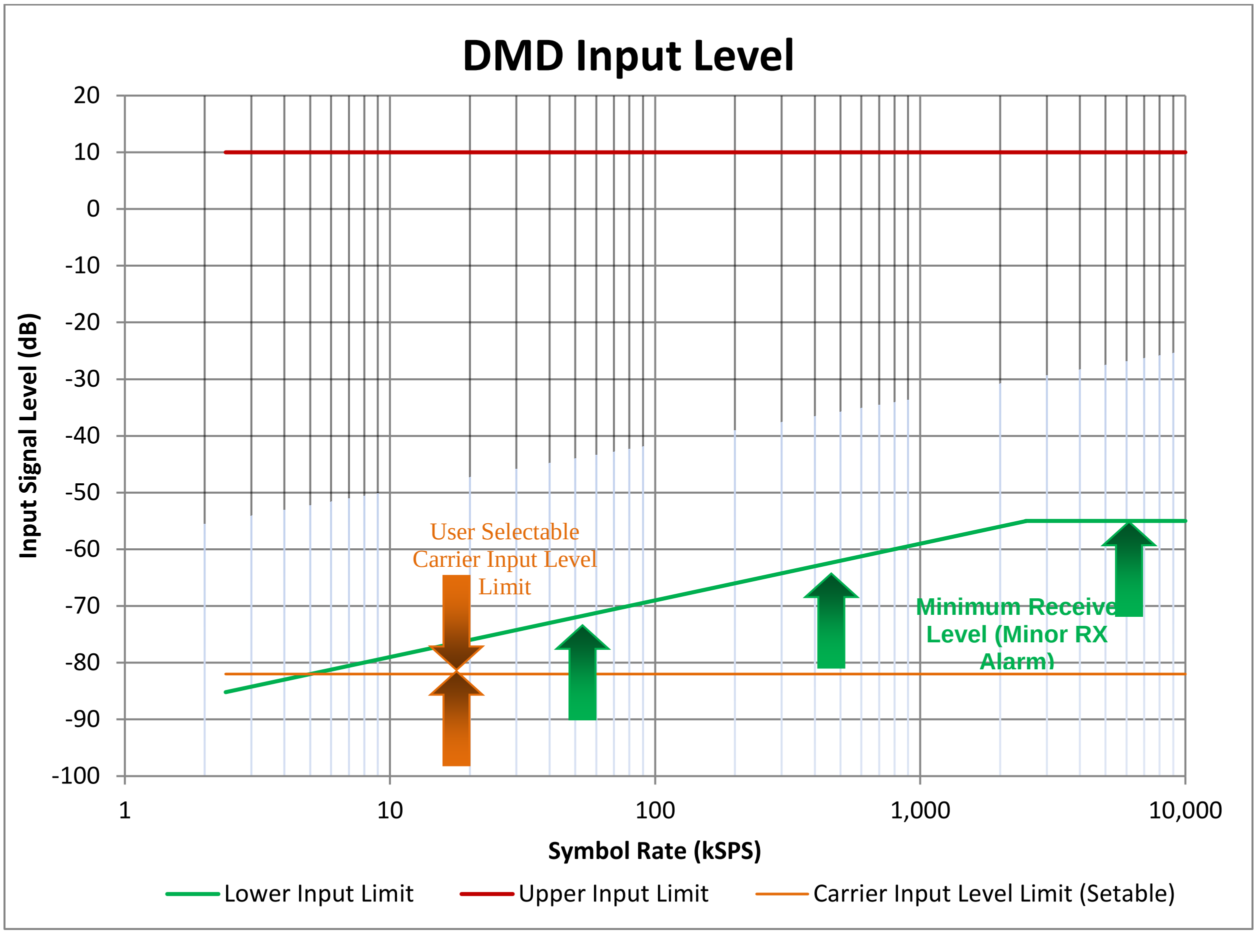


Figure 6-18. DMD1050TS Input Level Specification

BLANK PAGE

Chapter 7. Web Browser

7.1 Web Browser User Interface

This chapter contains instructions for how to configure the interface for both the base modem board and the FIPS TRANSEC module. The Web applications are described as well.

7.2 Configuring Your PC

Get access to the Web Browser interface through the RJ45 (J11), MagJack on the DMD1050TS.

You must use Microsoft Internet Explorer 6 or greater to use the Web Browser menus.

7.3 Graphical User Interface

The Graphical User Interface (GUI) is designed to look like the front panel interface of a DMD product. Figure 7-1 is an example of a GUI layout. For users' familiar with the front panel interface, adjusting to the GUI interface should be easy.

The GUI Interface is divided into functional areas: the DMD-style front panel display simulation, navigation tab area, information/data entry and product information and contact areas.

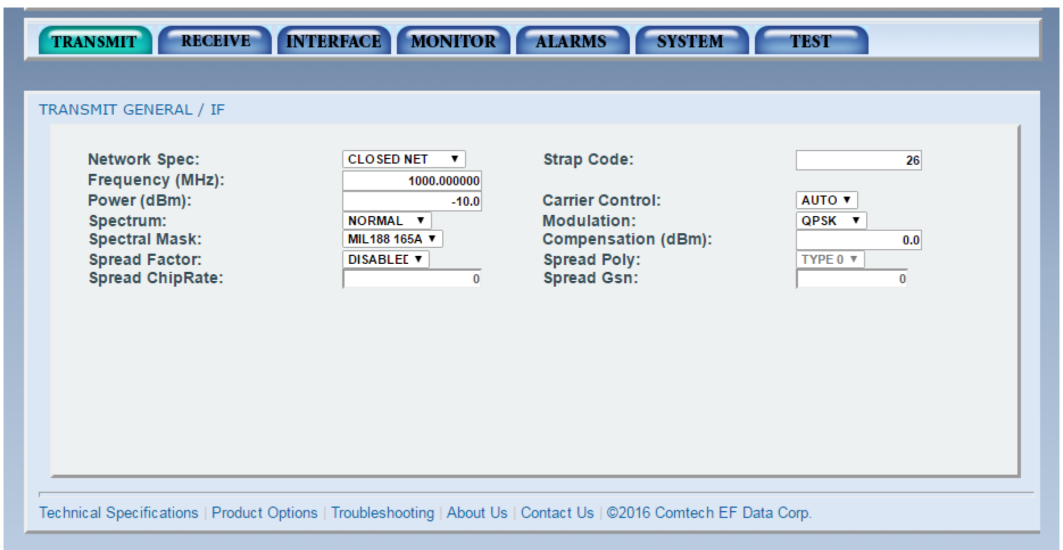


Figure 7-1. Web User Interface Example

7.3.1 Screen Areas

- Product Name - shows which product is connected to the interface
- Product Name/Location - shows the name and location of the unit
- Alarm and Monitor - shows fault and performance status
- Menu Tabs - give access to data and control entry; move the cursor to a tab and a submenu opens
- Data Entry Area - edit parameters in this area
- Product and Contact Information - gives access to technical trouble-shooting, product options and specifications; select **Contact Us** to email Customer Service

7.3.2 Navigation

The navigation scheme consists of tabs and submenus that correspond to the front panel top-level menu selections. When you move the mouse cursor over a tab, the tab opens a submenu. These submenus often correspond to the front panel sub-menus, but some are combined.

Figure 7-2. Navigation Tabs Example

Figure 7-3. Navigation Tabs Submenus Example

A content page shows under the navigation menus. At the top of the page, breadcrumb links remind you how to get to the page.

7.3.3 Light Emitting Diode (LED) Indicators

LEDs show the operational status of the DMD1050TS. The LED colors have these meanings:

- Green means operations are normal
- Yellow means a operations are not normal
- Red means a fault condition exists that is causing lost communications

Figure 7-4. LED Example

Table 7-1. LED Indicators

LED	Color	Function
Modem LED Lights		
Power	Green	The unit is on.
Fault	Red	A hardware fault exists in the unit.
Event	Yellow	A condition or event occurred, and is stored in memory. See the events from the GUI or in the Terminal Mode.
Remote	Green	The unit is in the process of updating firmware with File Transfer Protocol (FTP).
Modulator LED Lights		
Transmit On	Green	The transmitter is on.
Major Alarm	Red	The transmit direction has failed and the transmitter is disabled.
Minor Alarm	Yellow	A transmit warning condition exists.
Test Mode	Yellow	The transmitter is active in Test Mode.
Demodulator LED Lights		
Signal Lock	Green	The receiver is locked to an incoming carrier and data, including FEC Sync.
Major Alarm	Red	The receive direction has failed and traffic is lost.
Minor Alarm	Yellow	A receive warning condition exists.
Test Mode	Yellow	The receiver is active in Test Mode.

7.4 Introduction Page

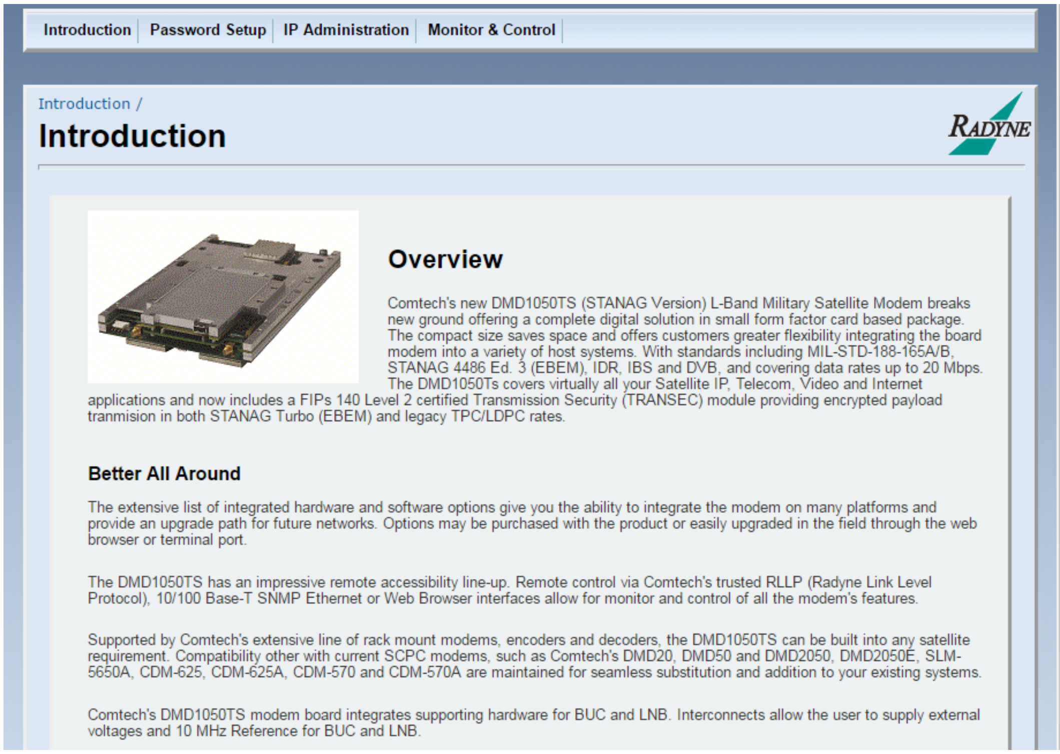


Figure 7-5. Introduction Page Example

This page shows when the web browser starts. The bottom of the page has links for Technical Specifications, Product Options, Troubleshooting, About Us, and Contact us.

The Introduction page gives an overview of the product. It has no configurable items. The main menus and submenus are:

- Introduction
- Password Setup
  - Access
  - Preferences
- IP Administration
  - Modem Addressing
  - Configure Apps
  - Configure PC
- Monitor and Control
  - Transmit
  - Receive
  - Interface
  - Monitor
  - Alarms
  - System
  - Test

7.4.1 Login Screen

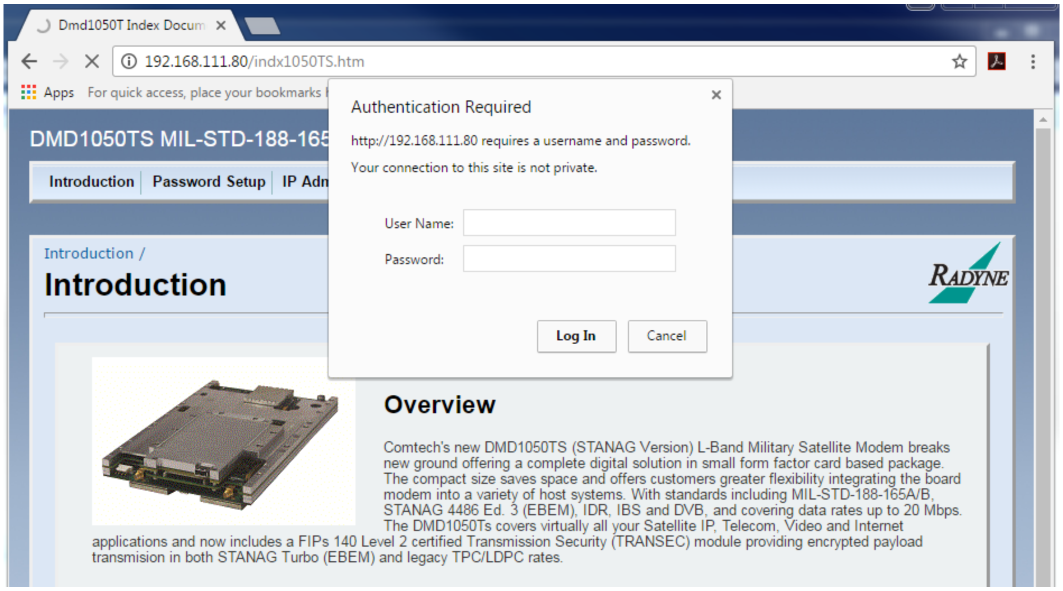


Figure 7-6. Login Screen Example

The Login screen shows when you click any of these tabs: **Password Setup**, **IP Administration** or **Monitor & Control**.

Log in, using the correct **User Name** and **Password**. The DMD1050TS is configured initially with these defaults:

User Name: **admin**

Password: **admin**

See Section 7.6 for more information.

7.5 Password Setup

Click **Password Setup** for the **Access** page to automatically open.

Use the **Access** page to set up access to the system for multiple operators.

7.5.1 Password Setup | Access Page

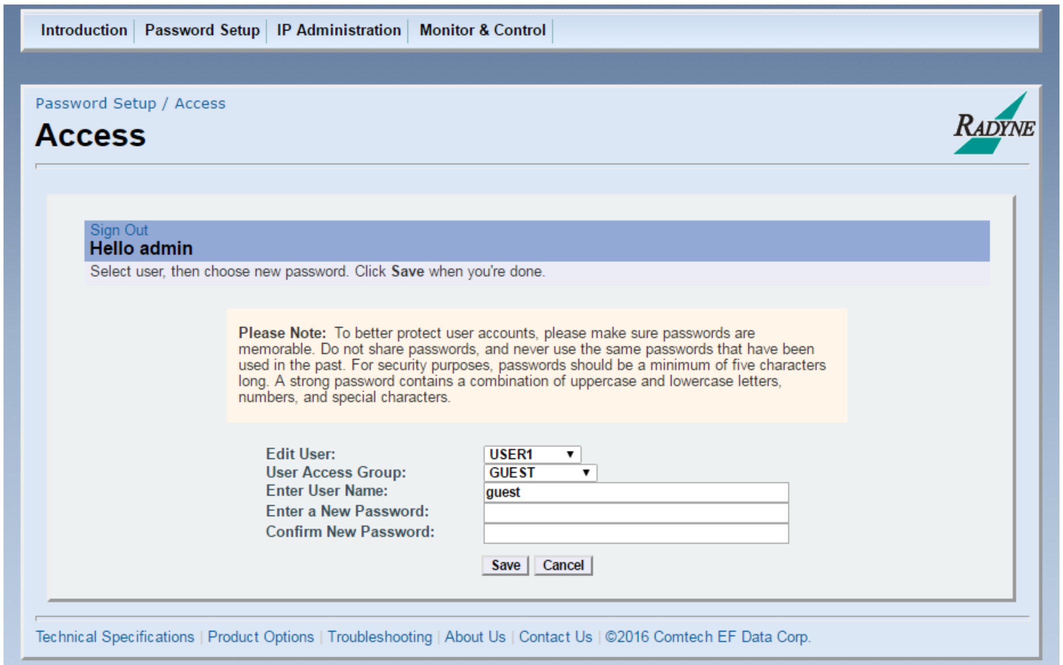


Figure 7-7. Password Setup | Access Page Example

Password Setup | Access Page		
Edit User	• USER 1 • USER 2 • USER 3	Use to select the user number.
User Access Group	• GUEST • OPERATOR • ADMIN	Use to assign the selected user to an access level group.
Enter User Name		Use to assign the user name used for login.
Enter a New Password		Use to assign the password used for login.
Confirm New Password		Enter the password again; it must match the previously entered Password exactly.

Click **Save** (or **Cancel**).

7.5.2 Password Setup | Preferences Page

Figure 7-8. Password Setup | Preferences Page Example

Password Setup | Preferences Page		
User Confirmation	• DISABLED • ENABLED	Enable or disable change confirmation to appear for all changes made in the Web interface. Bandwidth changes are always confirmed, no matter what the selection is for User Confirmation.

7.6 IP Administration

The IP Administration tab offers the following pages to select:

- Modem Addressing
- Configure Apps
- Configure PC

7.6.1 IP Administration | Modem Addressing Page

The Modem Addressing page provides instructions to configure the modem.

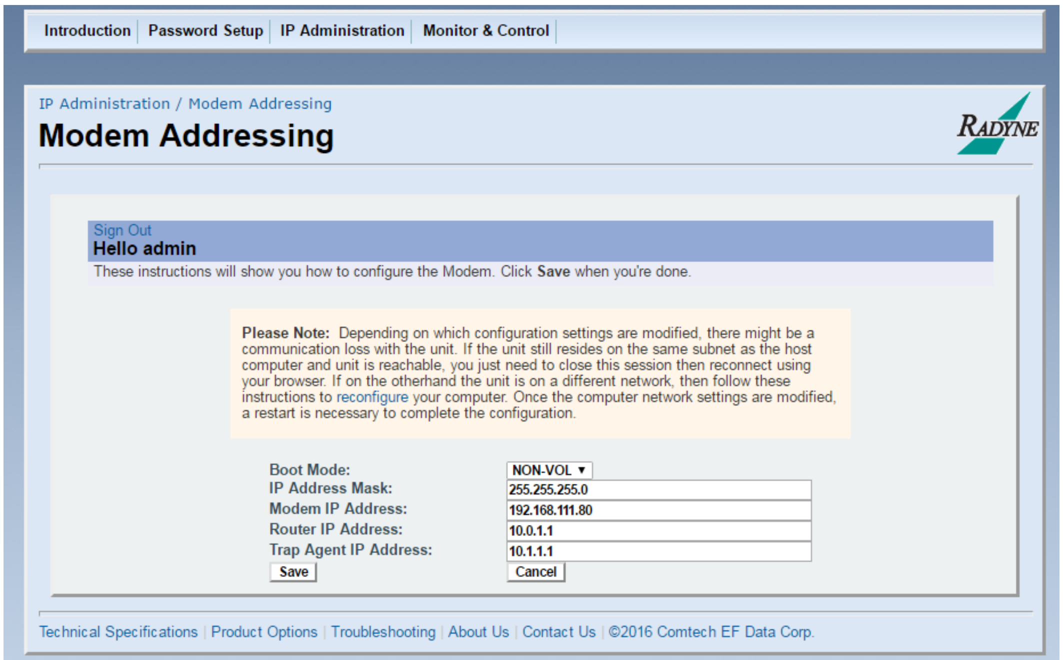


Figure 7-9. IP Administration | Modem Addressing Page Example

<table>
<tr><th colspan="3">IP Administration | Modem Addressing</th></tr>
<tr><td>Boot Mode</td><td>DEFAULT
NON-VOL
BOOTP
IP TEST</td><td>DEFAULT: During initialization (boot up), the modem will restore the web setting to the standard IP Mask and addresses supplied by the modem. The modem will be taken off the network and will not be accessible. The Default settings are:
<table>
<tr><td>IP Address Mask:</td><td>255.000.000.000</td><td>(FF.00.00.00 hex)</td></tr>
<tr><td>Modem IP Address:</td><td>010.000.000.001</td><td>(C0.A8.00.EE hex)</td></tr>
<tr><td>Server IP Address:</td><td>010.001.001.001</td><td>(0A.01.01.01 hex)</td></tr>
<tr><td>Router IP Address:</td><td>010.000.001.001</td><td>(0A.00.01.01 hex)</td></tr>
</table>
NON-VOL: Stores and uses IP Mask and addresses as provided by the user.
BOOTP: During initialization (boot up), the modem will get the names, masks, and IP Addresses of the modem, router, and server.
IP TEST: The IP Test boot mode has a behavior similar to the default boot mode. The Terminal, IP, SNMP, FTP and Web parameters changed by the default setting are reset by the IP Test boot more as well. It stores and uses IP Mask and addresses to fixed settings as listed below.
<table>
<tr><td>Bootp Server Tag:</td><td>206</td><td></td></tr>
<tr><td>IP Address Mask:</td><td>255.255.255.000</td><td>(FF.FF.FF.00 hex)</td></tr>
<tr><td>Modem IP Address:</td><td>192.168.0.238</td><td>(C0.A8.00.EE)</td></tr>
<tr><td>Server IP Address:</td><td>192.168.000.101</td><td>(C0.A8.00.65)</td></tr>
<tr><td>Router IP Address:</td><td>192.168.000.102</td><td>(C0.A8.00.66)</td></tr>
</table></td></tr>
<tr><td>IP Address Mask</td><td>XXX.XXX.XXX.XXX</td><td>The IP Address Mask of the local network is expressed in a hexadecimal format, and must be a valid TCP/IP Mask. This field should be set before changes are made to the Modem or Router Address.</td></tr>
<tr><td>Modem IP Address</td><td>XXX.XXX.XXX.XXX</td><td>The IP Address of the modem must be consistent for the mask defined. This address is expressed in hexadecimal format. Broadcast and loop back addresses are not allowed. These are addresses with all subnet bits set to 0’s or 1’s.</td></tr>
<tr><td>Router IP Address</td><td>XXX.XXX.XXX.XXX</td><td>The IP Address of the Local Network Router. If a router is present on the local network, this address must be consistent with the IP Mask and the subnet of the modem. If no router is present, then the address must be set to a foreign address. This address is expressed in hexadecimal format. Broadcast and loop back addresses are not allowed. These are addresses with all subnet bits set to 0’s or 1’s.</td></tr>
<tr><td>Trap Agent IP Address</td><td>XXX.XXX.XXX.XXX
Hexadecimal Mask
{ddd.ddd.ddd.ddd}
Decimal Mask</td><td>IP address of the device receiving SNMP Traps</td></tr>
</table>

Click **Save** (or **Cancel**).

7.6.2 IP Administration | Configure Apps Page

The Configure Apps page provides instructions to configure applications.

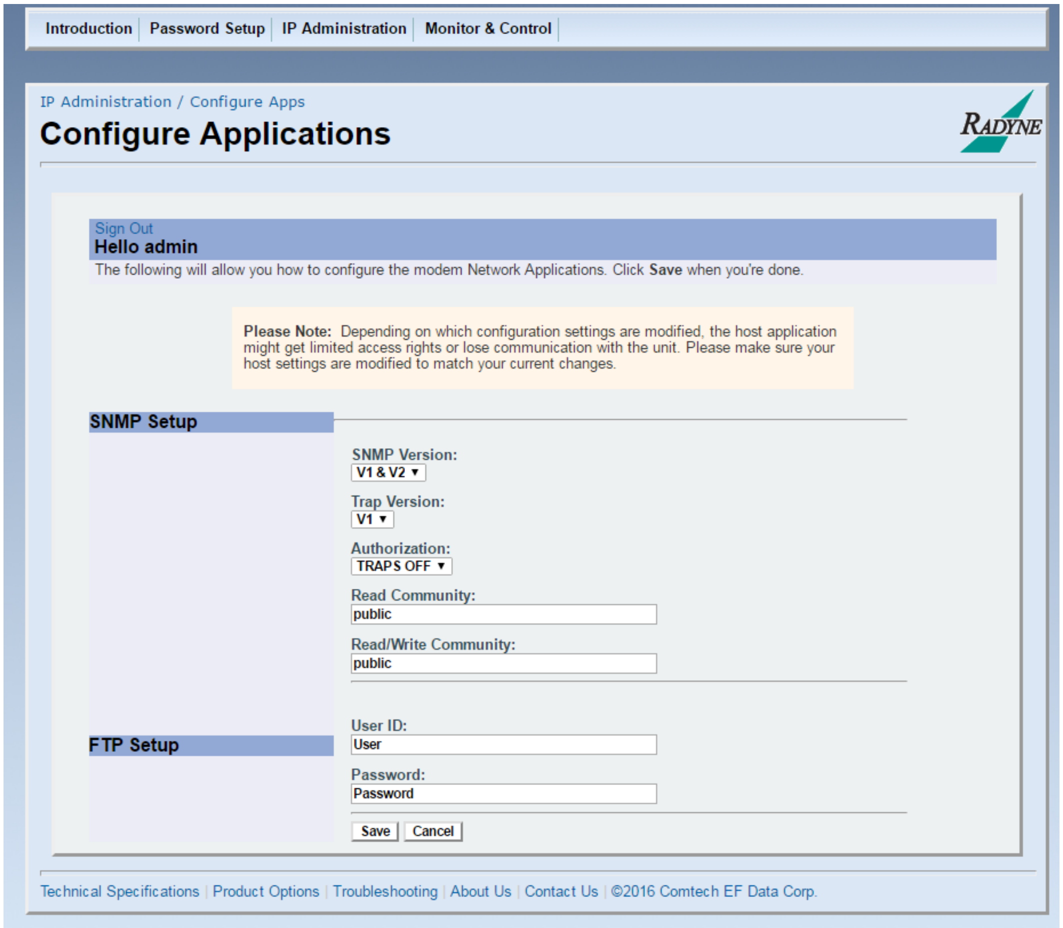


Figure 7-10. IP Administration | Configure Apps Page Example

IP Administration | Configure Applications		
SNMP Setup		
SNMP Version	• V1 & V2 (default) • V3	This selection controls the Simple Network Management Protocol (SNMP) Version that will be used in messaging between the equipment and its host. When V1 & V2 is used, RD COMMUNITY and RDWR COMMUNITY are used to determine the authorization of an incoming message. When V3 is used, three contexts are supported: *public*, *mib2*, and *dev*. Context, Authentication and Privacy are a portion of each SNMPV3 message. The *public* context will only allow the user to see the sysoid of the unit. This is the most restricted access possible and only allows the unit to be identified by a host SNMP Station. The *mib2* context allows a user with appropriate authentication to access the mib2 Object Identifiers (OIDs) and the SNMP OIDs. These are of interest primarily to network operators not controlling the satellite link. The *dev* context allows a user with appropriate authentication to access the device control portion of the MIB. These OIDs are used to control the devices satellite link and operation.
Trap Version	• V1 (default) • V2	This controls the type of message format used when a message trap is generated by the equipment and bound for a SNMP Host. Messages will only be sent if the unit has been authorized to do so.
Authorization	• TRAPS ON (default) • TRAPS OFF	This controls the type of message format used when a message trap is generated by the equipment and bound for a SNMP host. Messages will only be sent if the unit has been authorized to do so.
Read Community	16 characters of name Default = public	This menu is only displayed when SNMP VERSION is set to V1 & V2. This is the community that a host must be acting within when an OID variable is requested by a V1/V2 SNMP message.
Read/Write Community	16 characters of name Default = public	This menu is only displayed when SNMP VERSION is set to V1 & V2. This is the community that a host must be acting within when an OID variable is being changed by a V1/V2 SNMP message.
FTP Setup		
User ID		Enter the user identification for access to an FTP session.
Password		Enter the password for access to an FTP session.

Click **Save** (or **Cancel**).

Table 7-2. SNMP Parameters

SNMP VERSION: V1 & V2			
TRAP VERSION: V1			
AUTHORIZATION: TRAPS OFF			
RD COMMUNITY: PUBLIC			
RDWR COMMUNITY: PUBLIC			
USER 1 Viewer-md5	USER 2 Viewer-sha	USER 3 Oper-md5	USER 4 Oper-sha
ACCESS GROUP VIEWER	ACCESS GROUP VIEWER	ACCESS GROUP OPER	ACCESS GROUP OPER
AUTH PASSWORD Viewer	AUTH PASSWORD Viewer	AUTH PASSWORD Oper	AUTH PASSWORD Oper
PRIV PASSWORD Viewer	PRIV PASSWORD Viewer	PRIV PASSWORD Oper	PRIV PASSWORD Oper
AUTHENTICATION MD5	AUTHENTICATION SHA	AUTHENTICATION MD5	AUTHENTICATION SHA
PRIVACY DES	PRIVACY DES	PRIVACY DES	PRIVACY DES

Table 7-3. Web Parameters

WEB MENU			
Confirmation		• ENABLED • DISABLED	Enable or disable a confirmation response if a change is made to the modem output.
User 1 User 2 User 3	Access Group	• NO GROUP • GUEST • OPER • ADMIN	NO GROUP: Denies all access. GUEST: Guests can access most of the site to see modem parameters. OPER: Operators can monitor and control parameter settings, and change their own authentication passwords. ADMIN: Administrators can monitor and control the parameters, change any user's name and authentication password, and modify IP network settings. ADMIN setting gives access to the entire site.
	Authorization Password	xxxxxxxx	User to select password. The user can modify the Authorization Passwords. The user name can have up to 14 characters supporting alpha and numeric characters. Alpha characters can be entered using the up and down arrow keys. Numeric characters can be selected by using the number keys on the front panel. The user can clear all characters from the front panel screen.
	User Reset		Resets group and password.

Table 7-4. Terminal and Remote Port Parameters

Type	VT100
Baud rate	19200
Interface	RS232
Remote control	Terminal

7.6.3 IP Administration | Configure PC Page

The Configure PC page provides instructions to configure the PC.

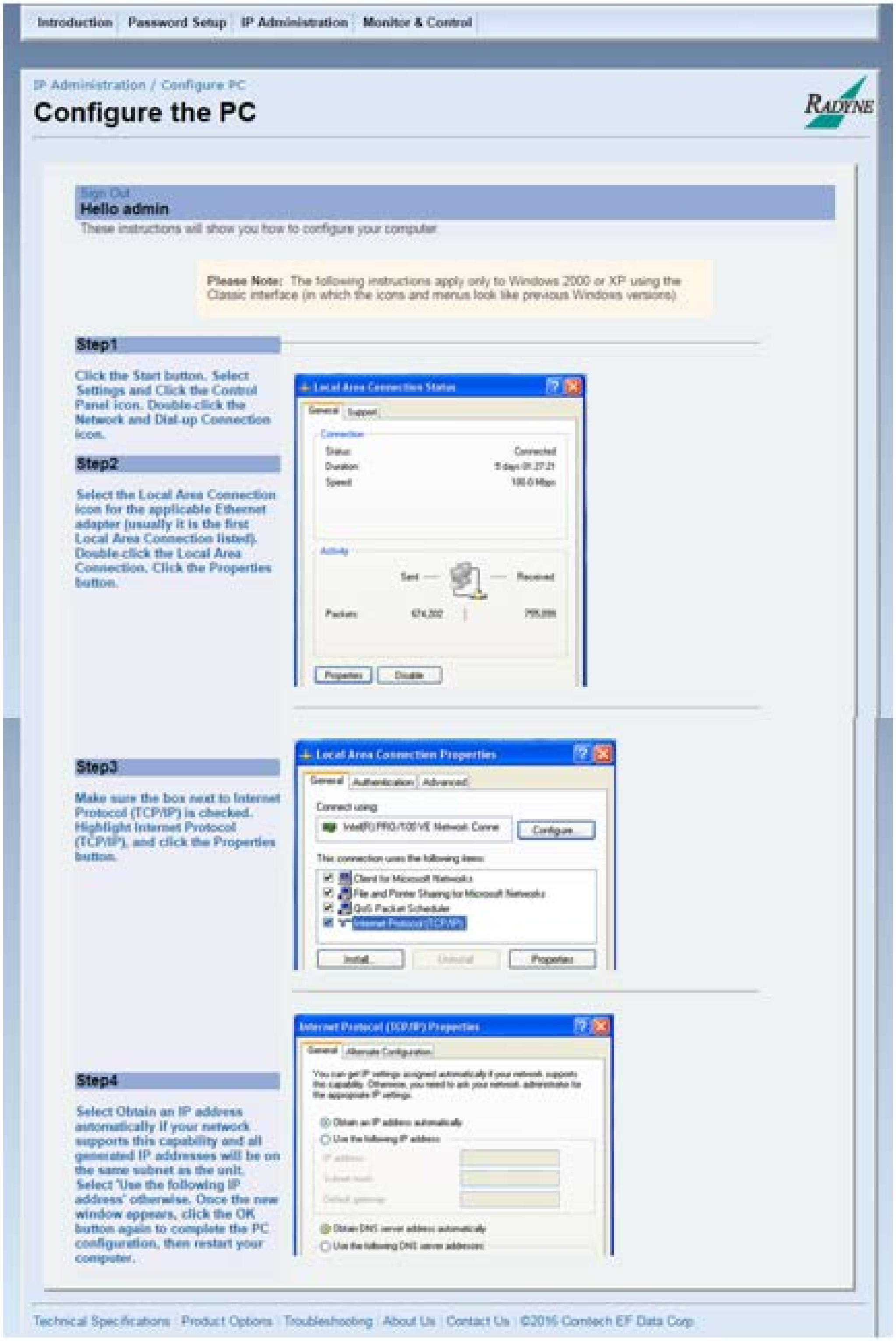


Figure 7-11. IP Administration | Configure PC Page Example

7.7 Monitor and Control Menu

Use this menu to access all modem functions that are monitored and/or controlled.

The **Monitor and Control** menu has the following submenus:

- Transmit
- Receive
- Interface
- Monitor
- Alarms
- System
- Test

7.7.1 Transmit Menu

The Transmit menu has the following submenus:

- General/IF
- Data
- Reed Solomon
- ODU-BUC
- AUPC
- ITA

7.7.1.1 Transmit | General / IF Page

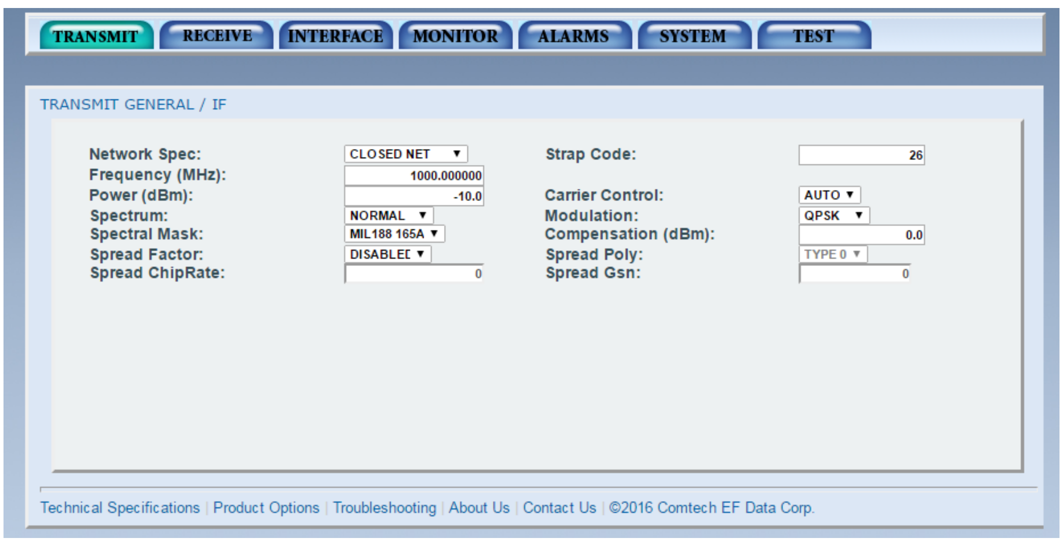


Figure 7-12. Transmit | General | IF Page Example

Transmit / General / IF Page		
Network Specs	• CLOSED NET • IDR (optional) • IBS (optional) • DROP & INSERT (optional) • DVB SAT • MILSTD 188 165A • EBEM (optional)	Supports IDR and IBS Framing Modes in Closed Net. The Network Spec Command sets parameters in the modem to meet a set specification. The purpose is to eliminate keystrokes and compatibility problems. Additionally, data rates not compatible with the selected network specification are allowed. The data rate must be compatible with the selected mode of operation. These parameters are set and cannot be changed while the unit is in the selected mode of operation: See Table 7-5. Network Specifications.
Strap Code	• Data Rate • Inner Code Rate • Satellite Framing • Scrambler • Drop and Insert • Outer Code Rate (Reed-Solomon) • Modulation	The Strap Code is a quick set key that sets many modem parameters. See Appendix G.
Frequency (MHz)	950 – 2050 MHz	Use to enter the Modulator IF Output Frequency of the modem in 1 Hz increments.
Power (dBm)	• 0 to -25 dBm • 0 to -45 dBm (optional)	Use to enter the Transmitter Power Level.
Carrier Control	• OFF • ON • AUTO • VSAT • RTS	Use to select the Carrier type. See Appendix B.
Spectrum	• NORMAL • INVERTED	Use to invert the direction of rotation for PSK Modulation. Normal meets IESS Specification. Spectral inversion can be required if the BUC LO is higher in frequency than the BUC output frequency. This creates a spectral inversion, and the IF spectrum must be inverted again to compensate.
Modulation	• BPSK • QPSK • OQPSK • 8PSK • 8QAM • 16APSK (optional) • 16QAM	Use to select the modulation type.
Spectra Mask	• DVB SAT 0.20 • DVB SAT 0.25 • DVB SAT 0.35 • INTELSAT 0.35 • MIL 188 165A	Use to set the spectral shape of the Tx Data Filter.
Compensation (dBm)	0.0 to 1.0 dB	Use to set the offset on the transmit output power (allows for some specific cable loss up to 1 dB). Use as a correction for user cabinet connectors.

Transmit / General / IF Page		
Spread Factor	• DISABLED • FACTOR x2 • FACTOR, x4 • FACTOR x8 • FACTOR x16	Use to select the Tx spreading factor. This is only selectable if the modem is set to output BPSK+LDPC.
Spread Poly	• TYPE 0 • TYPE 1	Use one of the two built-in Pseudo PN patterns, 0 or 1.
Spread Chip Rate		Use to see the spreader chip rate.
Spread Gsn	0000 - 9999	Use to set the spreader's gold sequence number.

Table 7-5. Network Specifications

Network Specs	Data Rates	Framing	Scrambler	Spectrum
MIL 188 165A	9.6 K – 20.0 Mbps	None	OM73	MIL 188 165A
IDR (IESS-308) (optional)	1.544, 2.048, 6.312, 8.448 Mbps	96 Kbps (IDR)	V.35	Intelsat
IBS (IESS-309) (optional)	< 1.544 ≤ 2048	1/15 (IBS)	IESS-309	Intelsat
Drop & Insert (optional)	n x 64 n = 1, 2, 3, 4, 5, 6, 8, 10,12, 15, 16, 20, 24, 30	1/15 (IBS)	IESS-309	Intelsat
EBEM (EBEM) (optional)	64 K – 37.026 Mbps	EBEM	EBEM	MIL 188 165A
DVB SAT (EN301-201 and EN300-421)	All Rates	DVB	DVB	DVB 0.25, 0.35
Closed Net	All possible combinations allowed. NOTE: The DVB settings require the DVB NETWORK SPEC and the EBEM settings require the EBEM NETWORK SPEC.			

7.7.1.2 Transmit | Data Page

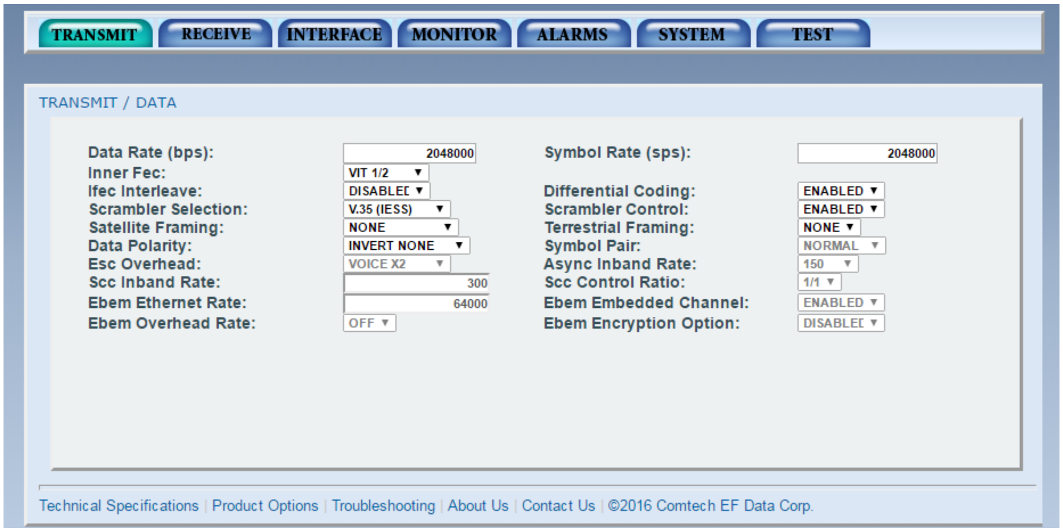


Figure 7-13. Transmit | Data Page Example

<table>
<tr><th colspan="4">Transmit | Data Page</th></tr>
<tr><td>Data Rate (bps)</td><td colspan="2"></td><td>Set the Data Rate in bps steps. See the technical specifications for data rates.</td></tr>
<tr><td>Symbol Rate (sps)</td><td colspan="2"></td><td>Use to view the Symbol Rate.</td></tr>
<tr><td rowspan="11">Inner FEC</td><td>Viterbi</td><td>• None
• 1/2
• 3/4
• 7/8</td><td></td></tr>
<tr><td>Sequential</td><td>• 1/2
• 3/4
• 7/8</td><td></td></tr>
<tr><td>CSEQ</td><td>• 3/4</td><td></td></tr>
<tr><td>CSC</td><td>• 3/4</td><td></td></tr>
<tr><td>Trellis</td><td>• 2/3</td><td>(8PSK)</td></tr>
<tr><td>TPC</td><td>• 5/16
• 21/44</td><td>(BPSK) ≤ 20Mbps</td></tr>
<tr><td>TPC</td><td>• 1/2
• 3/4
• 7/8</td><td>(OQPSK / QPSK)
≤ 20Mbps</td></tr>
<tr><td>TPC</td><td>• 3/4
• 7/8</td><td>(8PSK/ 8QAM)</td></tr>
<tr><td>TPC</td><td>• 3/4
• 7/8</td><td>(16QAM)</td></tr>
<tr><td>DVB VIT</td><td>• 2/3
• 5/6</td><td></td></tr>
<tr><td>DVB Trellis</td><td>• 3/4
• 5/6
• 7/8
• 8/9</td><td></td></tr>
</table>

Transmit | Data Page			
	LDPC	• 1/2 • 2/3 • 3/4	(B/O/QPSK)
	LDPC	• 2/3 • 3/4	(8PSK / 8QAM)
	LDPC	• 3/4	(16QAM)
	Turbo	• 1/2 • 2/3 • 3/4 • 7/8 • 19/20 • None	(B/Q/8/16APSK)
IFEC Interleaver	• DISABLE • ENABLE		Enable or disable the IFEC Interleaver. This is valid only for Radyne turbo codes TPC.495 and TPC.793. It is available only for Radyne Legacy Turbo. Contact Comtech EF Data for availability.
Differential Coding	• DISABLE • ENABLE		Enable or disable the Differential Encoder. An enabled encoder ensures correct phase lock. This may not be adjustable in some modes.
Scrambler Selection	• NONE • V.35 (IESS) • V.35 (CCITT) • V.35 (EF) • V.35 (FC) • OM73 • V.35 (CSTRM) (optional) • R11 (0-2-11) (optional) • IBS w/Optional Framing and Optional Reed-Solomon • Reed-Solomon Scrambler w/Optional Framing • CCIT • V.35EF_RS • TPC Scrambler (Turbo Codec) • DVB • EDMAC • EBEM (optional)		Select the scrambler type.
Scrambler Control	• DISABLED • ENABLED		Enable or disable scrambler operation.

Transmit | Data Page		
Satellite Framing	• NONE • IDR 96K • IBS 1/15 • ASYNC 1/15 • EF AUPC • EDMAC • SCC • EFFICIENT D&I (optional) • DVB • EBEM	Use to select the framing type. This is used only with IDR, IBS or Asynchronous Interface.
Terrestrial Framing	• NONE • 188 • 204	DVB Only
Data Polarity	• INVERT NONE • INV. TERR DATA • INV. BASEBAND • INV. TERR&BASE	Use to invert the Tx Data polarity.
Symbol Pair	• NONE • NORMAL • SWAPPED	Use to swap the I & Q Channels. BPSK Mode Only.
ESC Overhead	• VOICE X2 • DATA 64KBPS	IDR ESC Channel used for Voice or 64 K data channel.
Async Inband Rate	• 75 • 150 • 300 • 600 • 1200 • 2400 • 4800 • 9600 • 19200 • 38400 • 57600 • 115200	Use to select the Async Inband Rate.
SCC Inband Rate	• 300 to 200000 • 3000 to 115200 (when using SCC Framing)	Use to request the rate of in-band data for the overhead channel. This is available only when Tx Satellite Framing is set to SCC.
SCC Control Ratio	• 1:1 • 1:2 • 1:3 • 1:4 • 1:5 • 1:6 • 1:7	Use to simulate the framing used by the Satellite Control Channel Option (Pass Thru Mode only). The SCC Control Ratio is the ratio of overhead in-band data to synchronizing words. This is available only when Tx Satellite Framing is set to SCC.
EBEM Ethernet Rate	XXXXXXXXX	Future option.

Transmit | Data Page		
EBEM Embedded Channel	• DISABLE • ENABLE	Future option. Enable or disable the embedded overhead channel.
EBEM Overhead Rate	• OFF • 8K • 16K • 24K • 32K • 40K • 48K • 56K • 64K	Future option. Use to select the overhead channel bandwidth.
EBEM Encryption Option	• DISABLE • ENABLE	Future option. Enable or disable the program to encrypt the transmit data. This is available when a FIPs Module is installed on the DMD1050TS and the transit FEC is either TPC or LDPC.

7.7.1.3 Transmit | Reed-Solomon Page

These selections are active only when the Reed-Solomon option is installed.

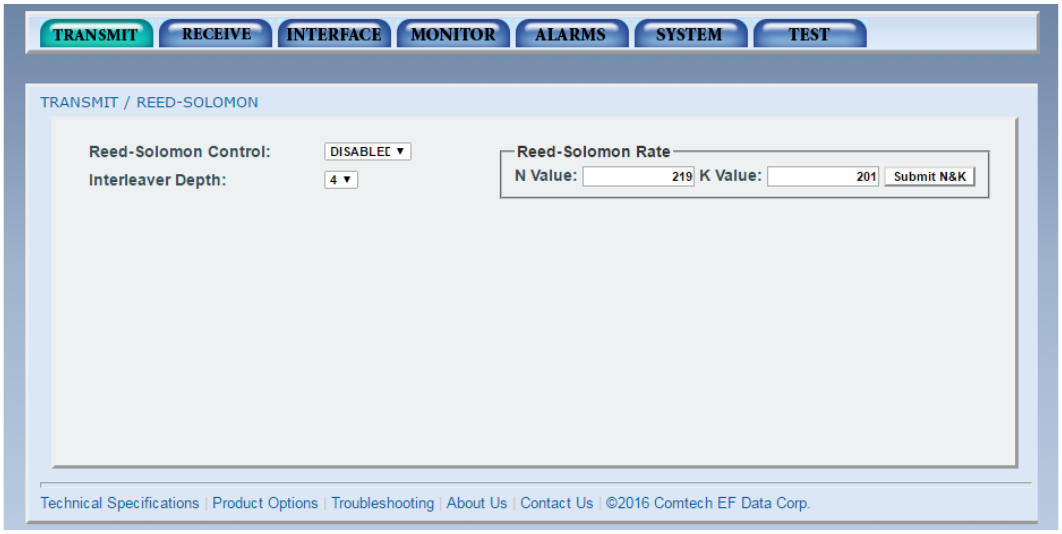


Figure 7-14. Transmit | Reed-Solomon Page Example

Transmit | Reed-Solomon Page		
Reed-Solomon Control	• DISABLED • ENABLED	Enable or disable the R-S Encoder.
Interleaver Depth	• 4 • 8 • 12	Use to select the R-S interleaver depth. In Closed Net Mode, select a depth of 4 or 8.
Reed-Solomon Rate	• N Value • K Value	Use to select custom R-S Codes in Closed Net Mode. This shows the currently used n, k, R-S Codes.

7.7.1.4 Transmit | ODU-BUC Page

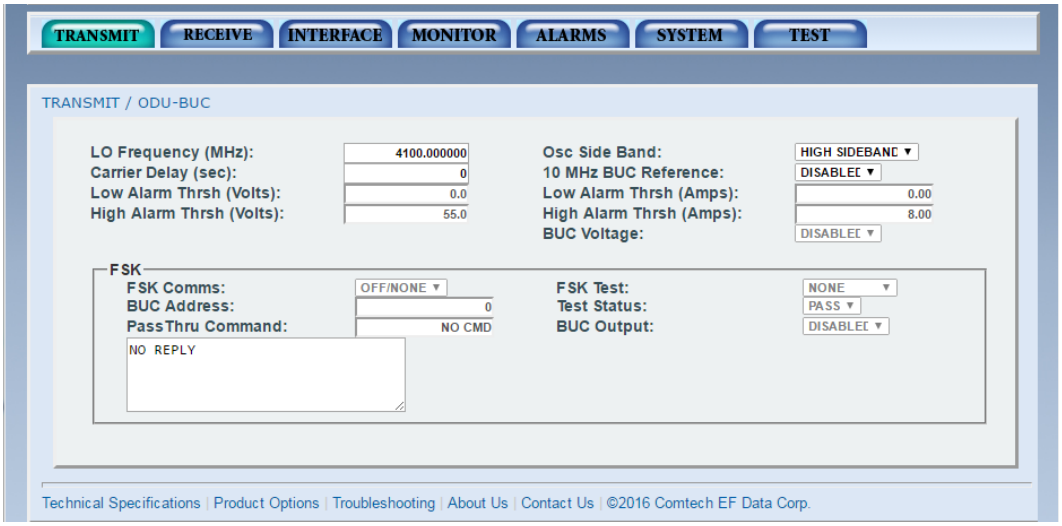


Figure 7-15. Transmit | ODU-BUC Page Example

Transmit | ODU-BUC Page		
LO Frequency (MHz)	4100 to 9749.999999 MHz	Allows the user to enter the Local Oscillator frequency of the BUC LO so the uplink frequency can be displayed correctly (refer to the BUC manufacturer's specification).
Osc Side Band	• LOW SIDEBAND • HIGH SIDEBAND	Use to select the location of the BUC LO. Enter the location of the BUC LO for the UPLINK FREQUENCY to show correctly. The BUC LO can be higher or lower in frequency than the BUC output frequency. If the BUC LO is higher in frequency, then enter HIGH SIDEBAND.
Carrier Delay (sec)	0 to 255	Use to select the time delay to occur after power-up, before the Tx Carrier can be enabled. This allows time for the BUC to stabilize.
10 MHz BUC Reference	• DISABLED • ENABLED	Enable or disable the 10 MHz BUC reference clock.
Low Alarm Thrsh (Volts)	N/A	Not Applicable in the DMD1050TS.
Low Alarm Thrsh (Amps)	N/A	Not Applicable in the DMD1050TS.
High Alarm Thrsh (Volts)	N/A	Not Applicable in the DMD1050TS.
High Alarm Thrsh (Amps)	N/A	Not Applicable in the DMD1050TS.
BUC Voltage	DISABLED (Always Passively ON)	Not Applicable in the DMD1050TS (see Chapter 4, Section 4.4, BUC & LNB Power Input for wiring passthrough power).
FSK		
FSK Comms		Not Available on the DMD1050TS.
FSK Test		Not Available on the DMD1050TS.

Transmit | ODU-BUC Page		
BUC Address		Not Available on the DMD1050TS.
Test Status		Not Available on the DMD1050TS.
Pass Thru Command		Not Available on the DMD1050TS.
BUC Output	DISABLED (Always Passively ON)	Not Available on the DMD1050TS.

7.7.1.5 Transmit | AUPC Page

When modems are configured for Radyne AUPC, the remote Eb/No is displayed in the Monitor Menus.

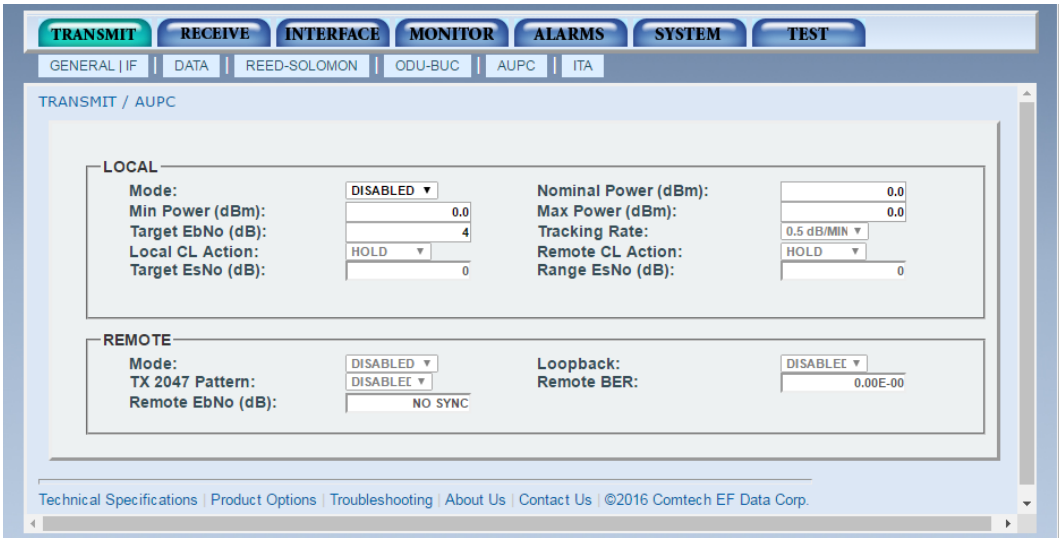


Figure 7-16. Transmit | AUPC Page Example

Transmit | AUPC Page		
LOCAL	The LOCAL page section contains the local configuration parameters for the AUPC function.	
Mode	• DISABLED • EBEM • EFDATA • RADYNE • NEAR SIDE	DISABLED: Enable or disable the Local AUPC Function of the local modem. EBEM: Enables EBEM Local AUPC Function. In the event the remote demodulator losses lock, the local output power level will adjust itself to the nominal level. This nominal power should be set to a level high enough to re-establish communications regardless of rain fade. EFDATA: Enables EFDATA Local AUPC Function. In the event that the remote or local demodulator losses lock, the output power level will adjust itself to the level settings indicated in the 'REMOTE CL ACTION' Menu or the 'LOCAL CL ACTION'. RADYNE: Enables Radyne Local AUPC Function. In the event the remote demodulator losses lock, the local output power level will adjust itself to the nominal level. This nominal power should be set to a level high enough to re-establish communications regardless of rain fade. NEAR SIDE: Enables NEARSIDE Local AUPC function. In the event the local demodulator losses lock due to signal loss, the output power level will adjust itself to the nominal level. This nominal power should be set to a level high enough to re-establish communications regardless of rain fade.

Transmit | AUPC Page		
Nominal Power (dBm)	• 0 to -25 dB • 0 to -45 dB	Use to set the nominal Transmit Power. The nominal transmit power is the default output power level.
Min Power (dBm)	• 0 to -25 dB • 0 to -45 dB	Use to set the minimum Transmit Power. EBEM: When configured for EBEM AUPC, the minimum Transmit Power is the lowest power setting that will be used when the remote modem commands a decrease of the Transmit Power from the Local modem. EFDATA AUPC: When configured for EFDATA AUPC the minimum Transmit Power is the lowest power setting that will be used when the local modem commands a decrease of the Transmit Power from the Remote modem. RADYNE: When configured for Radyne AUPC, the minimum Transmit Power is the lowest power setting that will be used when the remote modem commands a decrease of the Transmit Power from the Local modem. NEARSIDE: When configured for NEARSIDE AUPC the minimum Transmit Power is the lowest power setting that will be used by the local modem when the Eb/No increases above the Eb/No target.
Max Power (dBm)	• 0 to -25 dB • 0 to -45 dB	Use to set the maximum Transmit Power. EBEM: When configured for EBEM AUPC, the maximum Transmit Power is the highest power setting that will be used when the remote modem commands an increase of the Transmit Power from the Local modem. EF AUPC: When configured for EF AUPC, the maximum Transmit Power is the highest power setting that the local modem will use when the local modem commands an increase in Transmit power from the Remote modem. RADYNE: When configured for Radyne AUPC, the maximum Transmit Power is the highest power setting that will be used when the remote modem commands an increase of the Transmit Power from the Local modem. NEARSIDE: When configured for NEARSIDE AUPC the maximum Transmit Power is the highest power setting that will be used by the local modem when the Eb/No decreases below the Eb/No target.
Target Eb/No (dB)	4.0 to 16 dB	Use to set the desired Eb/No for the local receiver. RADYNE AUPC: When configured for Radyne AUPC, this setting is compared against the remote Eb/No and commands to the local modem to increase or decrease the local transmit power. EF AUPC: When configured for EF AUPC, this setting is compared against the local received Eb/No and commands to the remote modem to increase or decrease transmit power. NEARSIDE: When configured for NEARSIDE AUPC, this setting is compared against the received Eb/No of the local modem and commands to the local modem to increase or decrease transmit power.

Transmit | AUPC Page		
Tracking Rate	0.5 to 6.0	Read only. Set the rate at which the commands to increase or decrease Transmit Power are sent. Each command will result in a 0.5 dB increase or decrease in Transmit Power from the remote transmitter. The tracking rate is adjustable from 0.5 dB per minute to 6.0 dB per minute in 0.5 dB steps. (Only available when EFAUPC is selected as the framing)
Local CL Action	• HOLD • NOMINAL • MAXIMUM	Read only. Set the remote transmit power setting used when the local modem receiver loses lock. The setting can be HOLD (no action taken), NOMINAL (the nominal transmit power setting is used), or MAXIMUM (the maximum transmit power setting is used). (Only available when EFAUPC is selected as the framing)
Remote CL Action	• HOLD • NOMINAL • MAXIMUM	Read only. Set the local transmit power setting used when the remote modem receiver loses lock. The setting can be HOLD (no action taken), NOMINAL (the nominal transmit power setting is used), and MAXIMUM (the maximum transmit power setting is used).
Target EsNo (dB)	1.0 to 25 dB	Read only. Set the desired Eb/No for the local receiver. EBEM AUPC: When configured for EBEM AUPC, this setting is compared against the remote Eb/No and commands to the local modem to increase or decrease the local transmit power.
Range EsNo (dB)	0 to 2.0 dB	Defines the range the remote can drift above and below the target Es/No before the local modem makes a power adjustment. Only available in EBEM AUPC Mode.
REMOTE	The REMOTE page section contains the remote configuration parameters for the AUPC function. Remote AUPC menus are available only when the modem is configured for EFDATA mode.	
Mode	• DISABLE • NEAR SIDE • EFDATA • ENABLE (option)	Enable or disable the AUPC Function of the remote modem. The remote AUPC Function is the response of the local modem to commands for an increase or decrease of the Transmit Power in 0.5 dB steps and the command to change to the setting indicated in the 'REMOTE CL ACTION' Menu of the remote modem upon receiver loss of lock.
Loopback	• DISABLED • ENABLED	Enable or disable the Baseband Loopback Test mode of the remote modem.
TX 2047 Pattern	• DISABLED • ENABLED	Enable or disable the Transmit 2047 Pattern Test mode of the remote modem.

Transmit | AUPC Page		
Remote BER		Reports the BER measurement of the receiver 2047 Pattern Test Mode of the remote modem. BER is reported from the $1x10^{-5}$ to $1x10^{-7}$ in tenth decade steps. If the pattern does not synchronize or is out of range, 'NO DATA' is displayed. When modems are configured for RADYNE AUPC, the remote Eb/No shows in the MONITOR menus.
Remote EbNo (dB)	Read Only	Displays the remote modems EB/NO. Only Available in Radyne AUPC Mode.

7.7.1.6 Transmit | ITA Page

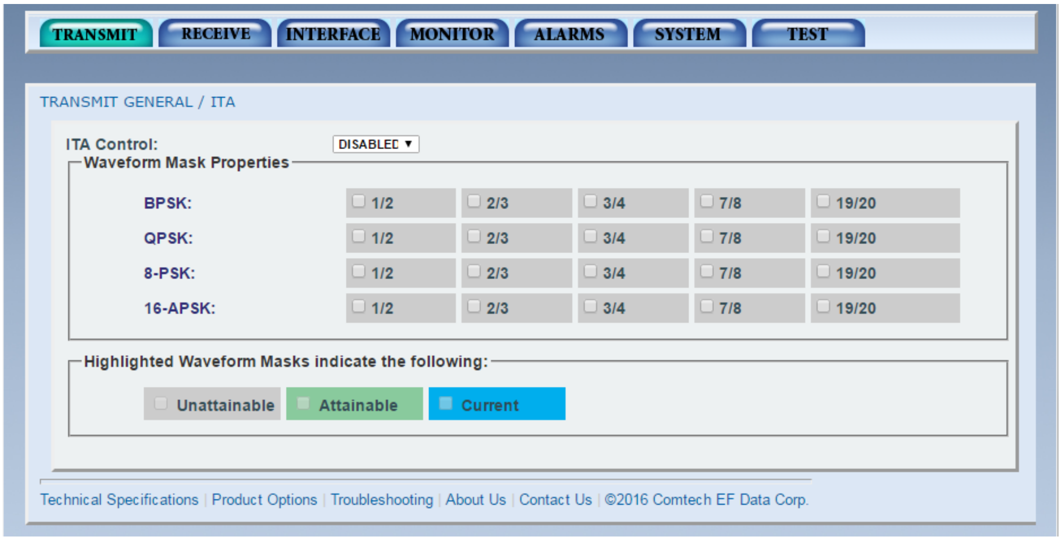


Figure 7-17. Transmit | ITA Page Example

Transmit | ITA Page		
ITA Control	• DISABLED • ENABLED	Enable or disable the ITA function.
Waveform Mask Properties	• BPSK o 1/2 o 2/3 o 3/4 o 7/8 o 19/20 • QPSK o 1/2 o 2/3 o 3/4 o 7/8 o 19/20 • 8-PSK o 1/2 o 2/3 o 3/4 o 7/8 o 19/20 • 16-APSK o 1/2 o 2/3 o 3/4 o 7/8 o 19/20	Use to select the mod/code rate.
Highlighted Waveform Mask Indicate the Following	• Unattainable • Attainable • Current	Displays the status of each waveform when ITA is engaged. Only available in EBEM mode.

7.7.2 Receive Menu

The Receive menu has the following submenus:

- General/IF
- Data
- Reed Solomon
- CNC
- ODU-LNB
- ITA

7.7.2.1 Receive | General / IF Page

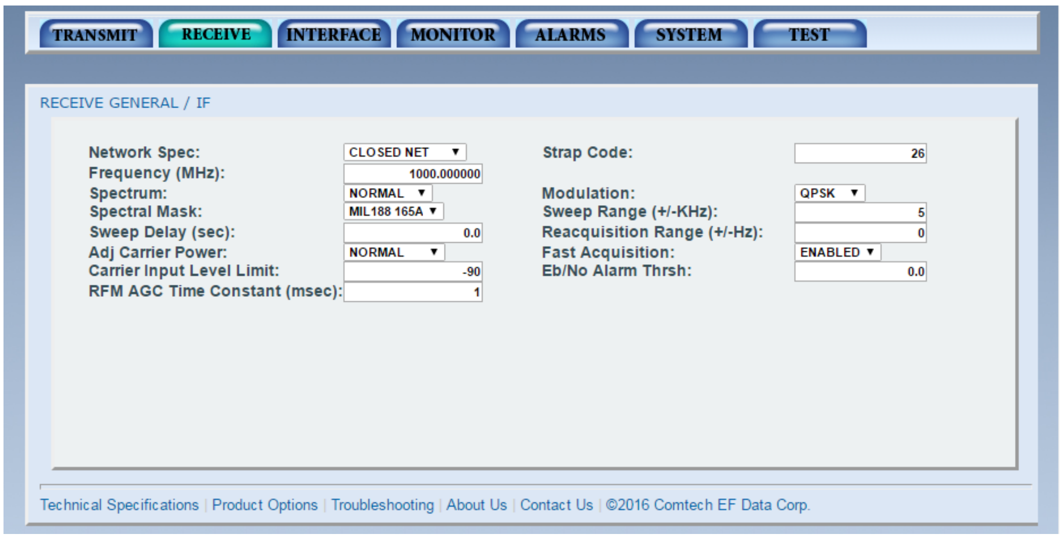


Figure 7-18. Receive | General | IF Page Example

Receive | General | IF Page		
Network Specs	• CLOSED NET • IDR (optional) • IBS (optional) • DROP & INSERT (optional) • DVB SAT • MIL 188 165A • EBEM (optional)	Supports IDR and IBS Framing Modes in Closed Net. To meet a set specification, the Network Spec command sets several parameters in the modem. The purpose is to eliminate keystrokes and compatibility problems. Additionally, data rates not covered by the selected specification are not allowed. The selected Network Spec must be compatible with the selected data rate. The parameters cannot be changed while the unit is in the selected Network Spec. See Table 7-6. Network Specifications.
Strap Code	• Data Rate • Inner Code Rate • Satellite Framing • Scrambler • Drop and Insert • Outer Code Rate (Reed-Solomon) • Modulation	The Strap Code is a quick set key that sets many modem parameters. Consult the strap code guide for available strap codes. See Appendix G.

Receive | General | IF Page		
Frequency (MHz)	• 950 – 2050 MHz	Use to enter the Modulator Frequency in 1 Hz increments.
Spectrum	• NORMAL • INVERTED	Use to invert the direction of rotation for PSK modulation. Normal meets the IESS Specification.
Modulation	• BPSK • QPSK • OQPSK • 8PSK • 16QAM • 8QAM • 16APSK	Use to select the demodulation type.
Spectral Mask	• DVBSAT .20 (optional) • DVBSAT .25 (optional) • DVBSAT .35 (optional) • DVB 0.35 • DVB 0.25 • INTELSAT .35 • MIL 188 165A	Use to set the spectral shape of Tx Data Filter.
Sweep Range (+/- KHz)	±0 to 255 kHz	Use to set the acquisition range for the demodulator.
Sweep Delay (sec)	• 0.0 – 900.0 sec • 0.00 – 6500.0 sec	Use to set the reacquisition delay time in 1/10th second increments.
Reacquisition Range (+/- Hz)	• 0 – 32000 Hz • 0 – 65500 Hz	Use to set the reacquisition sweep in 1 Hz increments.
Adj Carrier Power	• NORMAL • SUPRESSED	Use to set the adjacent carrier as Normal or Suppressed (High Power). The unit will increase or decrease post dissemination gain as necessary.
Fast Acquisition	• DISABLED • ENABLED	Disable or enable the Rx Fast Acquisition capability for low symbol rates.
Carrier Input Level Limit	• -30 to -90 dBm	Use to set the minimum carrier receive level when a carrier drops below this level. The modem will sweep and try to acquire a new signal. This prevents extremely small carriers from falsely locking the modem. Adjust the low-level threshold limit for input power. You can specify a minimum operational signal level at which the system can operate. This allows you to have some control in tuning a real signal, as opposed to an adjacent bleed through, or some other rogue signal. An Input power level below the threshold limit causes a major Input Level alarm on the demodulator. However, this could be problematic to a software algorithm for auto-assist antenna acquisition. The problem could occur if the algorithm uses signal lock as a parameter for antenna signal acquisition that is not specifically qualified with the Input Level indicator. This is most applicable to the DMD1050 and DMD1050TS card based modems.
Eb/No Alarm Thrsh	0.0 to 9.9 dB	Use to select an Eb/No level that will trigger an alarm when the received Eb/No is worse.

Receive | General | IF Page		
RFM AGC Time Constant (msec)	N/A	Not Applicable.

Table 7-6. Network Specifications

Network Specs	Data Rates	Framing	Scrambler	Spectrum
MIL 188 165A	9.6 K – 20.0 Mbps	None	OM73	MIL 188 165A
IDR (IESS-308) (optional)	1.544, 2.048, 6.312, 8.448 Mbps	96 Kbps (IDR)	V.35	Intelsat
IBS (IESS-309) (optional)	< 1.544 ≤ 2048	1/15 (IBS)	IESS-309	Intelsat
Drop & Insert (optional)	n x 64 n = 1, 2, 3, 4, 5, 6, 8, 10,12, 15, 16, 20, 24, 30	1/15 (IBS)	IESS-309	Intelsat
EBEM (EBEM) (optional)	64 K – 37.026 Mbps	EBEM	EBEM	MIL 188 165A
DVB SAT (EN301-201 and EN300-421)	All Rates	DVB	DVB	DVB 0.25, 0.35
Closed Net	All possible combinations allowed. NOTE: The DVB settings require the DVB NETWORK SPEC and the EBEM settings require the EBEM NETWORK SPEC.			

7.7.2.2 Receive | Data Page

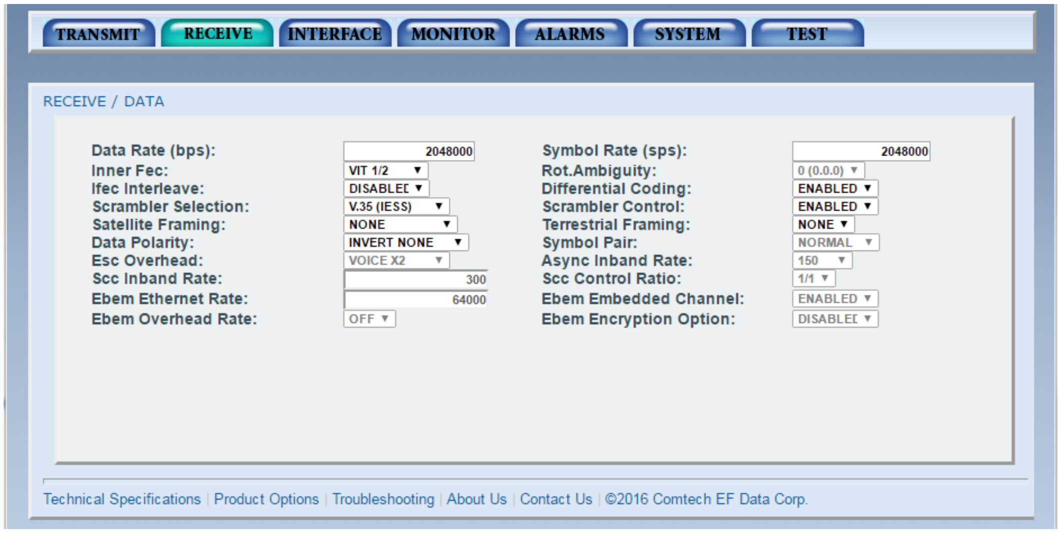


Figure 7-19. Receive | Data Page Example

<table>
<tr><th colspan="4">Receive | Data Page</th></tr>
<tr><td>Data Rate (bps)</td><td colspan="2">Refer to Technical Specifications.</td><td>Use the keypad to set the Data Rate in bps steps. See the technical specifications for data rates.</td></tr>
<tr><td>Symbol Rate (sps)</td><td colspan="2"></td><td>Use to view the Symbol Rate.</td></tr>
<tr><td rowspan="11">Inner FEC</td><td>Viterbi</td><td>• None
• 1/2
• 3/4
• 7/8</td><td></td></tr>
<tr><td>Sequential</td><td>• 1/2
• 3/4
• 7/8</td><td></td></tr>
<tr><td>CSEQ</td><td>• 3/4</td><td></td></tr>
<tr><td>CSC</td><td>• 3/4</td><td></td></tr>
<tr><td>Trellis</td><td>• 2/3</td><td>(8PSK)</td></tr>
<tr><td>TPC</td><td>• 5/16
• 21/44</td><td>(BPSK) ≤ 20Mbps</td></tr>
<tr><td>TPC</td><td>• 1/2
• 3/4
• 7/8</td><td>(OQPSK / QPSK)
≤ 20Mbps</td></tr>
<tr><td>TPC</td><td>• 3/4
• 7/8</td><td>(8PSK/ 8QAM)</td></tr>
<tr><td>TPC</td><td>• 3/4
• 7/8</td><td>(16QAM)</td></tr>
<tr><td>DVB VIT</td><td>• 2/3
• 5/6</td><td></td></tr>
<tr><td>DVB Trellis</td><td>• 3/4
• 5/6
• 7/8
• 8/9</td><td></td></tr>
</table>

Receive | Data Page			
	LDPC	• 1/2 • 2/3 • 3/4	(B/O/QPSK)
	LDPC	• 2/3 • 3/4	(8PSK / 8QAM)
	LDPC	• 3/4	(16QAM)
	Turbo	• 1/2 • 2/3 • 3/4 • 7/8 • 19/20 • None	(B/Q/8/16APSK)
Rot. Ambiguity	• 0 (0,0,0) • 1 (0,0,1) • 2 (0,1,0) • 3 (0,1,1) • 4 (1,0,0) • 5 (1,0,1) • 6 (1,1,0) • 7 (1,1,1)		Allows the user to manually resolve the rotational ambiguity of uncoded 8PSK. This is primarily considered a test function.
IFEC Interleave	• DISABLED • ENABLED		Disable or enable the IFEC Interleave. This is valid only for Radyne turbo codes TPC.495 and TPC.793. This is available only for Radyne legacy Turbo. Contact the factory for availability.
Differential Coding	• DISABLED • ENABLED		Enable or disable the Differential Decoder. Enable the decoder for correct phase lock. This is not adjustable in some modes.
Scrambler Selection	• NONE • V.35 (IESS) • V.35 (CCITT) (optional) • V.35 (EF) • V.35 (FC) • OM73 • V.35 (CSTRM) (optional) • R11 (0-2-11) (optional) • IBS w/Optional Framing and Optional Reed-Solomon • Reed-Solomon Scrambler w/Optional Framing • CCIT • V.35EF_RS • TPC Scrambler (Turbo Codec) • DVB • EDMAC • EBEM		Select the descrambler type.

Receive | Data Page		
Scrambler Control	• DISABLED • ENABLED	Enable or disable the descrambler operation.
Satellite Framing	• NONE • IDR 96K • IBS 1/15 • ASYNC 1/15 • EF AUPC • EDMAC • SCC • EFFICIENT D&I (optional) • DVB • EBEM	Use to select the Framing Type. This is used only with IDR, IBS, or Asynchronous Interface.
Terrestrial Framing	• NONE • 188 • 204	DVB Only.
Data Polarity	• INVERT NONE • INV. TERR DATA • INV. BASEBAND • INV. TERR&BASE	Use to invert the Rx Data polarity.
Symbol Pair	• NONE • SWAPPED • NORMAL (optional)	Use to swap the I & Q Channels. (BPSK Mode Only)
ESC Overhead	• VOICE X2 • DATA 64KBPS	IDR ESC Channel is used for Voice or 64 K data channel.
Async Inband Rate	• 75 • 150 • 300 • 600 • 1200 • 2400 • 4800 • 9600 • 19200 • 38400 • 57600 • 115200	Use to select the Async Inband Rate.
SCC Inband Rate	300 to 200000	This is available only when SCC is selected for the Rx Satellite Framing. Use to request the rate of in-band data for the overhead channel.

Receive | Data Page		
SCC Control Ratio	• 1:1 • 1:2 • 1:3 • 1:4 • 1:5 • 1:6 • 1:7	This is available only when SCC is selected for the Rx Satellite Framing. Use to simulate the framing used by the Satellite Control Channel option (Pass Thru Mode only). The SCC CTL RATIO is the ratio of overhead in-band data to synchronizing words.
EBEM Ethernet Rate	XXXXXXXXX	Future option.
EBEM Embedded Channel	• DISABLE • ENABLE	Future option. Enable or disable the embedded overhead channel.
EBEM Overhead Rate	• OFF • 8K • 16K • 24K • 32K • 40K • 48K • 56K • 64K	Future option. Use to select the overhead channel bandwidth.
EBEM Encryption	• DISABLE • ENABLE	Future option. Use to encrypt the transmit data. This is available when a FIPs Module is installed on the DMD1050TS and the transit FEC is either TPC or LDPC.

7.7.2.3 Receive | Reed-Solomon Page

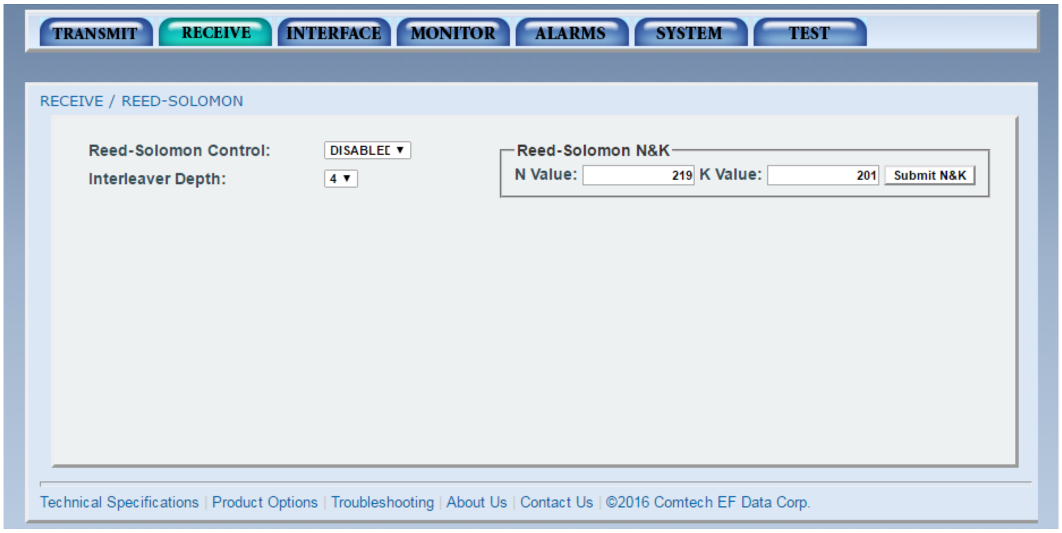


Figure 7-20. Receive | Reed-Solomon Page Example

Receive | Reed-Solomon Page		
Reed-Solomon Control	• DISABLED • ENABLED	Enable or Disable the Reed-Solomon Encoder.
Reed-Solomon N Value	Refer to AN177 for custom Reed Solomon N/K combinations	Shows the N value in use of the Reed-Solomon codes.
Reed-Solomon K Value	Refer to AN177 for custom Reed Solomon N/K combinations	Shows the K value in use of the Reed-Solomon codes.
Interleaver Depth	• 4 • 8 • 12	Use to select the Reed-Solomon interleaver depth. In Closed Net Mode, select a depth of 4 or 8.

7.7.2.4 Receive | CNC Page

The DMD1050TS does not support CNC.

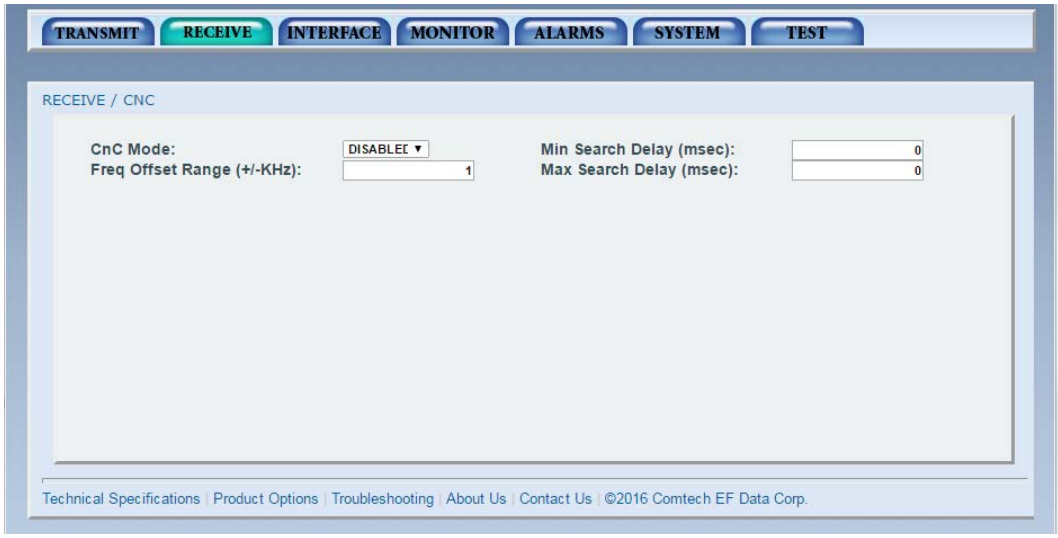


Figure 7-21. Receive | CNC Page Example

Receive | CNC Page		
CnC Mode	DISABLED	This will always show DISABLED.
Min Search Delay (msec)	N/A	N/A
Freq Offset Range (+/-KHz)	N/A	N/A
Max Search Delay (msec)	N/A	N/A

7.7.2.5 Receive |ODU-LNB Page

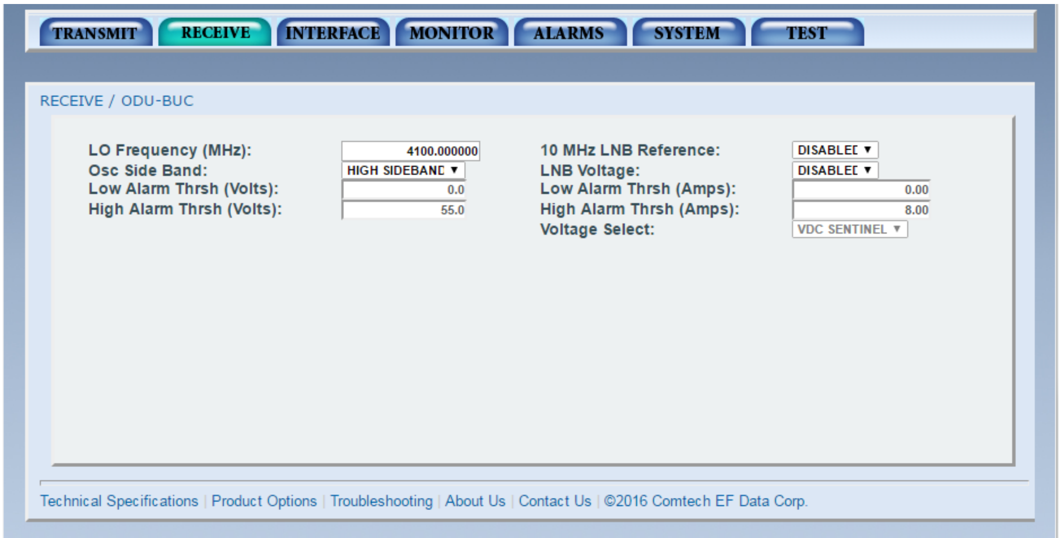


Figure 7-22. Receive | ODU-LNB Page Example

Receive | ODU-LNB Page		
LO Frequency (MHz)	4100 to 9749.999999 MHz	Allows the user to enter the Local Oscillator frequency of the BUC LO so the uplink frequency can be displayed correctly (refer to the manufacturer's specification).
10 MHz LNB Reference	• DISABLED • ENABLED	Enable or disable the 10 MHz BUC reference clock.
Osc Side Band	• LOW SIDEBAND • HIGH SIDEBAND	Use to select the location of the LNB LO. Enter the location of the LNB LO to cause the UPLINK FREQUENCY to show correctly. The LNB LO can be higher or lower in frequency than the LNB output frequency. If the LNB LO is higher in frequency, then you must enter HIGH SIDEBAND.
LNB Voltage	• DISABLED • ENABLED	Enable or disable the LNB supply voltage.
Low Alarm Thrsh (Volts)	N/A	Not Applicable in the DMD1050TS.
Low Alarm Thrsh (Amps)	N/A	Not Applicable in the DMD1050TS.
High Alarm Thrsh (Volts)	N/A	Not Applicable in the DMD1050TS.
High Alarm Thrsh (Amps)	N/A	Not Applicable in the DMD1050TS.
Voltage Select	VDC SENTINEL (Always passively ON)	Not Applicable in the DMD1050TS (See Chapter 4, Section 4.4 BUC & LNB Power Input for wiring passthrough power).

7.7.2.6 Receive | ITA Page

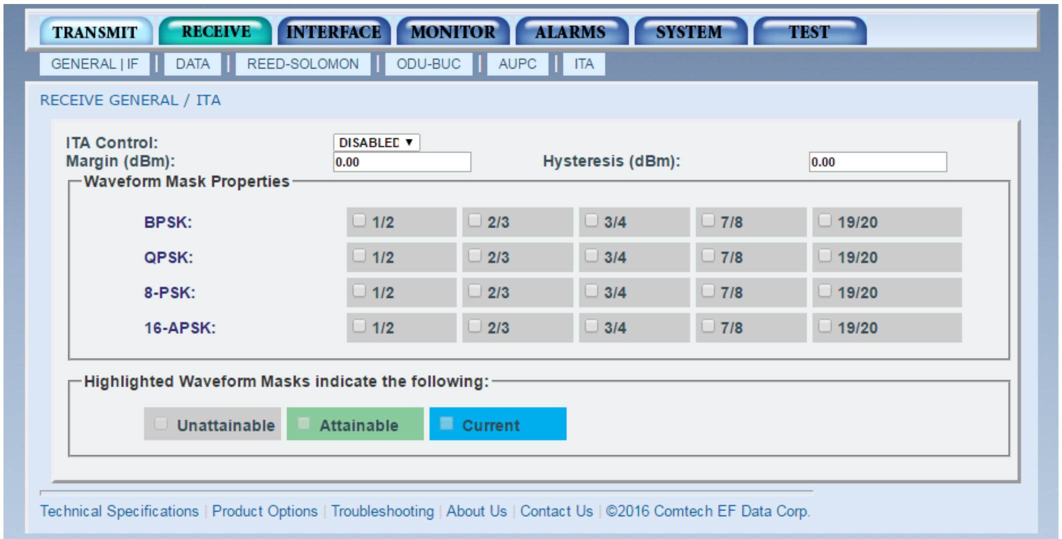


Figure 7-23. Receive | ITA Page Example

Receive | ITA Page		
ITA Control	• DISABLED • ENABLED	Enable or disable the ITA Control.
Margin (dBm)	0 to 2.00 dB	Sets link margin when operating in ITA mode.
Hysteresis (dBm)	0 to 2.00 dB	Sets the variation in Es/No needed to trigger a waveform transition.
Waveform Mask Properties	• BPSK o 1/2 o 2/3 o 3/4 o 7/8 o 19/20 • QPSK o 1/2 o 2/3 o 3/4 o 7/8 o 19/20 • 8-PSK o 1/2 o 2/3 o 3/4 o 7/8 o 19/20 • 16-APSK o 1/2 o 2/3 o 3/4 o 7/8 o 19/20	Us to select the mod/code rate.

Receive | ITA Page		
Highlighted Waveform Mask Indicate the Following	• Unattainable • Attainable • Current	Displays the status of each waveform when ITA is engaged. Only available in EBEM mode.

7.7.3 Interface Menu

The Interface Menu has the following submenus:

- TX Setup
- RX Setup
- General

7.7.3.1 Interface | TX Setup Page

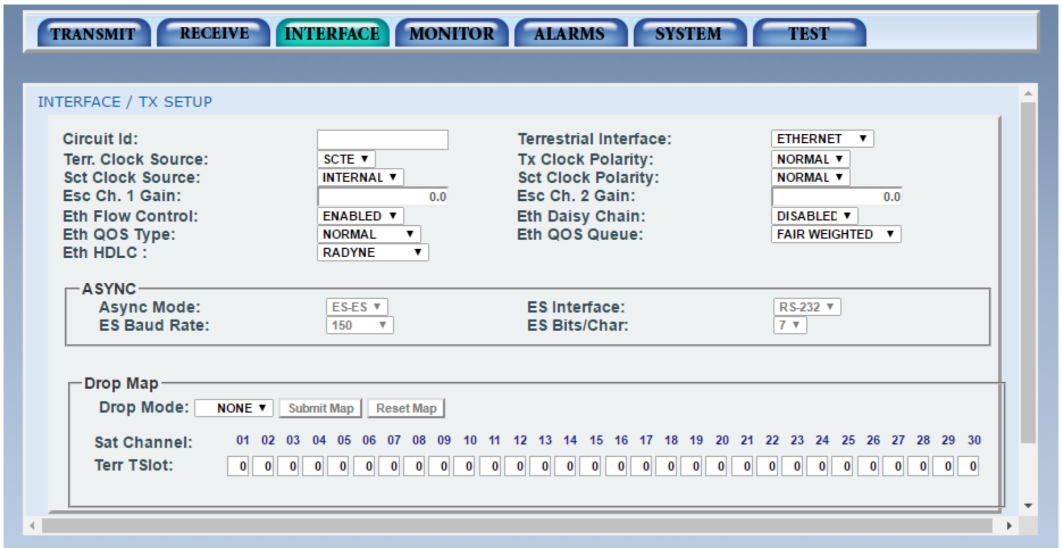


Figure 7-24. Interface | TX Setup Page Example

Interface | TX Setup Page		
Circuit ID		Use to enter a Tx Circuit Identifier. Circuits can have an identifier of up to 11 alphanumeric characters, such as LINK1.
Terrestrial Interface	• ETHERNET • MIL 188 114A	Use to select the Transmit type.
Terr. Clock Source	• SCTE • SCT	Use to select the Transmit Clock source.
Tx Clock Polarity	• AUTO • NORMAL • INVERTED	Use to select the Clock Polarity for the Tx Terrestrial Clock relative to the Tx Data. Select **Auto** to cause the unit to detect wrong polarity and correct it automatically.
SCT Clock Source	• INTERNAL (SCT) • SCR (Rx SAT CLK)	Use to select the SCT Source to be the SCT Oscillator or the RX Satellite Clock. Rx SAT CLK is for loop timing.
SCT Clock Polarity	• AUTO • NORMAL • INVERTED	Use to select the Clock Polarity for the Tx Terrestrial Clock relative to the Tx Data. Select **Auto** to cause the unit to detect wrong polarity and correct it automatically.
Esc Ch. 1 Gain	-20 to +10 dB	Use to select ESC Voice Channel Gain. Only displayed when IDR NETWORK and VOICE Channel are selected.
Esc Ch. 2 Gain	-20 to +10 dB	Use to select ESC Voice Channel Gain. Only displayed when IDR NETWORK and VOICE Channel are selected.

Interface | TX Setup Page		
Eth Flow Control	• DISABLED • ENABLED	Enable or disable flow control. This is only visible when Ethernet is selected as the interface type.
Eth Daisy Chain	• DISABLED • ENABLED	Enable or disable the Ethernet Port Daisy Chaining or enable it on Port 2. This is only visible when Ethernet is selected as the interface type.
Eth QOS Type	• NORMAL • PORT BASED	Use to select the priority hierarchy for processing an IEEE 803.0ac Tag, Ipv4 Type of Service Field/Differentiated Services Field, or Ipv6 Traffic Class Field. The Port Based priority overrides any standard priority. When operating in this mode, Port 1 has the highest priority and Port 2 has the lowest.
Eth QOS Queue	• FAIR WEIGHTED • STRICT PRIORITY	Use to select the queue weighting of 8, 4, 2 or 1, so that even the lowest priority traffic gets some bandwidth. Strict Priority makes sure that the higher priority traffic transmits before the lower priority traffic.
CAUTION Strict Priority can severely limit lower priority traffic.		
ETH HDLC	• RADYNE • COMTECH • MANAGED 570	RADYNE HDLC is supported by all legacy Radyne products that do not allow configuration of the HDLC, or Comtech modems that use the Network Processor card in Gigabit Bridge mode. COMTECH HDLC is supported by the SLM5650A Modem with Ethernet Bridge Card. MANAGED 570 HDLC is for other Comtech HDLCs, such as the CDM-570 and CDM-625 in standard bridge mode. See Table 3-1.
Async Section		
Async Mode	• ES-ES • ESC ENHANCED	Read only; ES-ES is the normal IBS Async Channel. ESC ENHANCED is applicable for Closed Net. It uses the Overhead Signaling bytes in the IBS Overhead to pass asynchronous data.
ES Interface	• RS-232 • RS-485	Read only; shows the ES interface type.
ES Baud Rate	150 - 19200	Read only; shows the ES baud rate in Enhanced Async Mode.
ES Bits/Char	• 7 • 8	Read only; shows the 7- or 8-bit data.
Drop Map Section – Not available on the DMD1050TS		
Drop Mode	N/A	N/A
Sat Channel	N/A	N/A
Terr TSlot	N/A	N/A

7.7.3.2 Interface | RX Setup Page

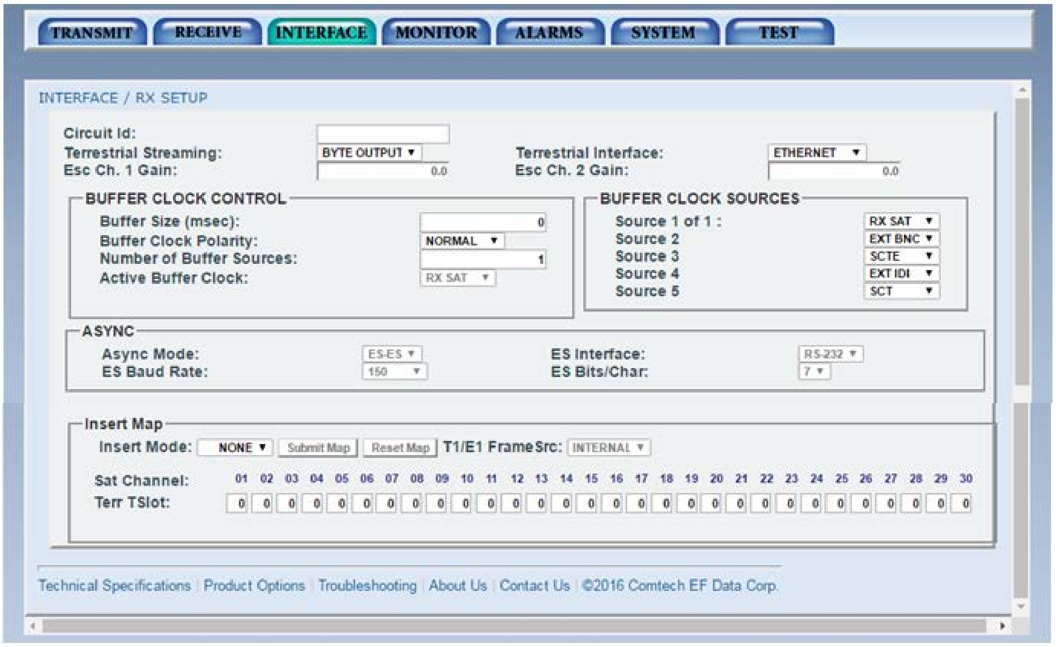


Figure 7-25. Interface | RX Setup Page Example

Interface | RX Setup Page		
Circuit ID		Use to enter a Rx Circuit Identifier. Circuits can have an identifier of up to 11 alphanumeric characters, such as DLINK1.
Terrestrial Streaming	• BYTE OUTPUT • PACKET OUTPUT	ASI only. BYTE OUTPUT: Continuous PACKET OUTPUT: Burst.
Terrestrial Interface	• ETHERNET • MIL 188 114A	Use to select the Receive type.
Esc Ch. 1 Gain	-20 to +10 dB	Use to select ESC Voice Channel Gain. Only displayed when IDR NETWORK and VOICE Channel are selected.
Esc Ch. 2 Gain	-20 to +10 dB	Use to select ESC Voice Channel Gain. Only displayed when IDR NETWORK and VOICE Channel are selected.
BUFFER CLOCK CONTROL Section		
Buffer Size (msec)	0 – 64 msecs	Use to set the Doppler Buffer Size in msec.
Buffer Clock Polarity	• NORMAL • INVERTED	Use to select the Buffer Clock Polarity for the Tx Terrestrial Clock, relative to the Tx Data. If the G.703 Interface is active, the **Buffer Clock Polarity** cannot be changed.
Number of Buffer Sources	1 – 5	Use to select up to 5 clock sources.
Active Buffer Clock	• RXSAT • EXTBNC • SCTE • SCT • EXT IDI	Read only; shows the active buffer clock source.

Interface | RX Setup Page		
BUFFER CLOCK SOURCES Section		
Source 1 of 1	• SCTE (External) • SCT (Internal) • RX SAT • EXT BNC • EXT IDI	Use to assign priorities to the clock sources. The highest priority is 1, and 5 is the last resort.
Source 2	• SCTE (External) • SCT (Internal) • RX SAT • EXT BNC • EXT IDI	Use to assign priorities to the clock sources. The highest priority is 1, and 5 is the last resort.
Source 3	• SCTE (External) • SCT (Internal) • RX SAT • EXT BNC • EXT IDI	Use to assign priorities to the clock sources. The highest priority is 1, and 5 is the last resort.
Source 4	• SCTE (External) • SCT (Internal) • RX SAT • EXT BNC • EXT IDI	Use to assign priorities to the clock sources. The highest priority is 1, and 5 is the last resort.
Source 5	• SCTE (External) • SCT (Internal) • RX SAT • EXT BNC • EXT IDI	Use to assign priorities to the clock sources. The highest priority is 1, and 5 is the last resort.
ASYNC Section		
Async Mode	• ES-ES • ESC ENHANCED	Read only; ES-ES is the normal IBS Async Channel. ESC ENHANCED is applicable for Closed Net. It uses the Overhead Signaling bytes in the IBS Overhead to pass asynchronous data.
ES Interface	• RS-232 • RS-485	Read only; shows the interface type.
ES Baud Rate	150 - 19200	Read only; shows the baud rate in Enhanced Async Mode.
ES Bits/Char	• 7 • 8	Read only: shows 7- or 8-bit data.
INSERT MAP Section – Not available on the DMD1050TS		
Insert Mode	N/A	N/A
T1 / E1 Frame Scr	N/A	N/A
Sat Channel	N/A	N/A
Terr TSlot	N/A	N/A

7.7.3.3 Interface | General Page

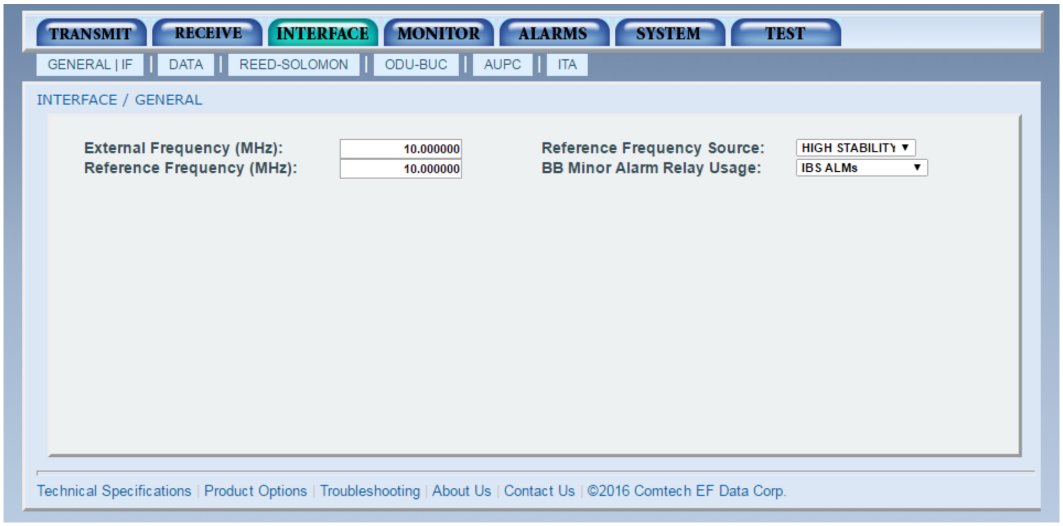


Figure 7-26. Interface | General Page Example

Interface | General Page		
External Frequency (MHz)	Variable through Data Rate	Use to enter the external clock frequency in MHz.
Reference Frequency Source	• INTERNAL • EXTERNAL • HIGH STABILITY	Use to select the Frequency Reference Source.
Reference Frequency (MHz)		Use to enter the Frequency Reference Source in MHz.
BB Minor Alarm Relay Usage	• IBS ALMs • IBS/MNR ALMs • IBS/MNR/MJR ALM • RTS PROMPT • AHO 1:1 SWITCH	IBS ALMs: Only supports IBS prompt and service alarms. Note: The following menus are only supported in closed network: IBS/MNR ALMs: Only supports IBS prompt and service alarms and minor alarms IBS/MNR/MJR ALM: Only supports IBS prompt and service alarms, minor and major alarms. RTS PROMPT: Allows contact closures to be activated when the carrier is configured for RTS signaling. Refer to Radyne AN230 for addition information on utilizing this feature as Keyline Operation AHO 1:1 SWITCH: Is used to signal an antenna handover event

7.7.4 Monitor Menu

The Monitor Menu has the following submenus:

- VOLTAGES
- ETH LINK STATUS
- EVENT
- CNC

7.7.4.1 Monitor | Voltages Page

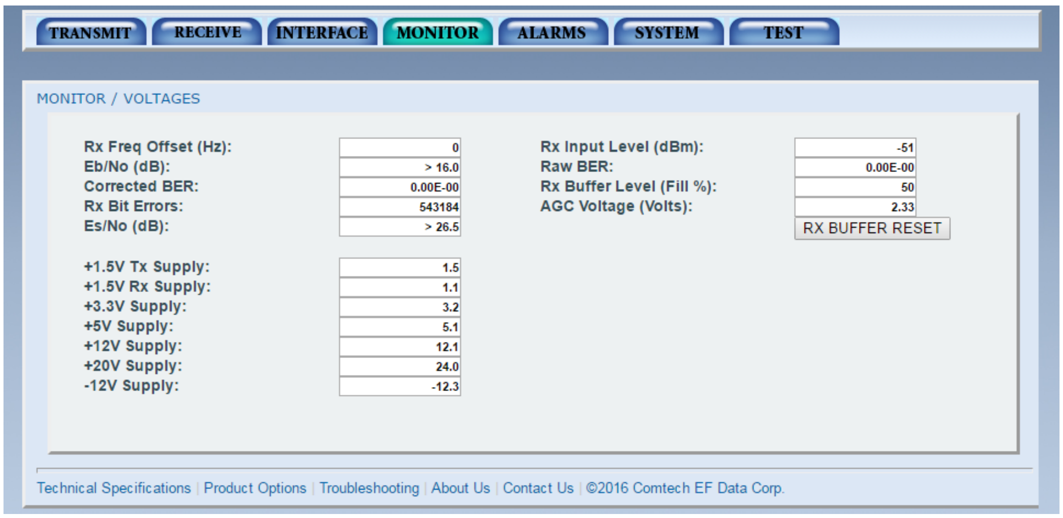


Figure 7-27. Monitor | Voltages Page Example

<table>
<tr><th colspan="3">Monitor | Voltages Page</th></tr>
<tr><td>Rx Offset Frequency (Hz)</td><td></td><td>Read only, this shows the received carrier frequency offset as measured by the modem.</td></tr>
<tr><td>Rx Input Level (dBm)</td><td></td><td>Read only, this shows the estimated receive signal level as seen by the Demodulator.</td></tr>
<tr><td>Eb/No (dB)</td><td></td><td>Read only, this shows the estimated Eb/No as seen by the demodulator.</td></tr>
<tr><td>Raw BER</td><td></td><td>Read only, this shows the estimated channel error rate (before decoding) measured by the modem.</td></tr>
<tr><td>Corrected BER</td><td></td><td>Read only, this shows an estimated corrected bit error rate of the modem. Depending on the symbol rate the modem is running, the high-end performance scale will vary ($10 E^{-9}$, 10^{-10} or 10^{-11}). At some symbol rates, a better-than-scale reading shows as 0.0×10^{-00}. At other symbol rates, it shows as E**. In both cases, they mean performance is better than the scale upper limit.</td></tr>
<tr><td>Rx Buffer Level (Fill %)</td><td>0 – 100%</td><td>Read only, this shows the status of the Doppler Buffer.</td></tr>
<tr><td>Rx Bit Errors</td><td></td><td>Read only, this shows the error count from the Viterbi Decoder.</td></tr>
<tr><td>AGC Voltage (Volts)</td><td></td><td>Monitored AGC Value for use in external equipment, such as radios.</td></tr>
</table>

Monitor | Voltages Page		
Es/No (dB)		Read only, this shows the estimated Es/No as seen by the demodulator.
RX Buffer Reset button		Use the button to re-center the Doppler Buffer each time the ENTER key is pressed while a Web browser page is open.
+1.5V Tx Supply		Read only, this shows the measured voltage of the 1.5 Volt Tx power bus inside the modem.
+1.5V Rx Supply		Read only, this shows the measured voltage of the 1.5 Volt Rx power bus inside the modem.
+3.3V Supply		Read only, this shows the measured voltage of the +3.3 Volt power bus inside the modem.
+5V Supply		Read only, this shows the measured voltage of the +5 Volt power bus inside the modem.
+12V Supply		Read only, this shows the measured voltage of the +12 Volt power bus inside the modem.
+20V Supply		Read only, this shows the measured voltage of the +20 Volt power bus inside the modem.

7.7.4.2 Monitor | ETH Link Status Page

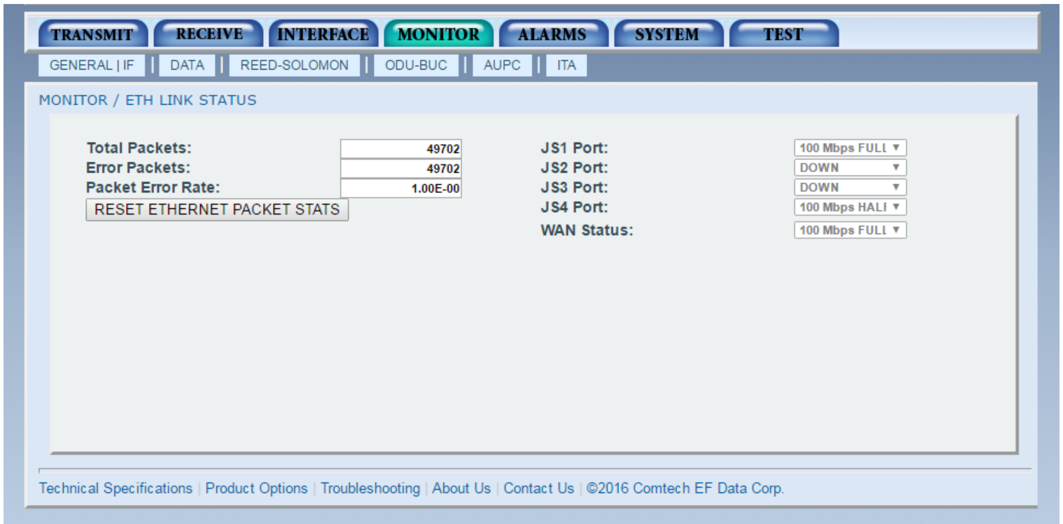


Figure 7-28. Monitor | ETH Link Status Page Example

Monitor | ETH Link Status Page		
Total Packets		Read only; this shows the total number of Ethernet packets received from the satellite. It is visible only when the interface type is Ethernet.
Error Packets		Read only; this shows the number of erred Ethernet packets received from the satellite. It is visible only when the interface type is Ethernet.
Packet Error Rate		Read only; this shows the satellite Packet Error Rate. It is visible only when the interface type is Ethernet.
Reset Ethernet Packet Stats		Use to reset the Ethernet packet statistics. It is visible only when the interface type is Ethernet.
JS1 Port	• Down • Unresolved • 10 Mbps Half • 10 Mbps Full • 100 Mbps Half • 100 Mbps Full • Unused	Read only; this shows the status of the M&C Port. • Down - the link is down. • Unresolved – cannot agree on connection speed. • 10 Mbps Half – connected at 10 Base-T Half Duplex. • 10 Mbps Full – connected at 10 Base-T Full Duplex. • 100 Mbps Half – connected at 100 Base-T Half Duplex. • 100 Mbps Full – connected at 100 Base-T Full Duplex. • Unused – the port is not available.

Monitor | ETH Link Status Page		
JS2 Port	• Down • Unresolved • 10 Mbps Half • 10 Mbps Full • 100 Mbps Half • 100 Mbps Full • Unused	Read only; this shows the status of the LAN Port 1. • Down - the link is down. • Unresolved – cannot agree on connection speed. • 10 Mbps Half – connected at 10 Base-T Half Duplex. • 10 Mbps Full – connected at 10 Base-T Full Duplex. • 100 Mbps Half – connected at 100 Base-T Half Duplex. • 100 Mbps Full – connected at 100 Base-T Full Duplex. • Unused – the port is not available.
JS3 Port	• Down • Unresolved • 10 Mbps Half • 10 Mbps Full • 100 Mbps Half • 100 Mbps Full • Unused	Read only; this shows the status of the LAN Port 2. • Down - the link is down. • Unresolved – cannot agree on connection speed. • 10 Mbps Half – connected at 10 Base-T Half Duplex. • 10 Mbps Full – connected at 10 Base-T Full Duplex. • 100 Mbps Half – connected at 100 Base-T Half Duplex. • 100 Mbps Full – connected at 100 Base-T Full Duplex. • Unused – the port is not available.
JS4 Port	• Down • Unresolved • 10 Mbps Half • 10 Mbps Full • 100 Mbps Half • 100 Mbps Full • Unused	Read only; this shows the status of the FIPS Module Port. • Down - the link is down. • Unresolved – cannot agree on connection speed. • 10 Mbps Half – connected at 10 Base-T Half Duplex. • 10 Mbps Full – connected at 10 Base-T Full Duplex. • 100 Mbps Half – connected at 100 Base-T Half Duplex. • 100 Mbps Full – connected at 100 Base-T Full Duplex. • Unused – the port is not available.
WAN Status		Read only; this shows the status of the WAN Port.

7.7.4.3 Monitor | Event Page

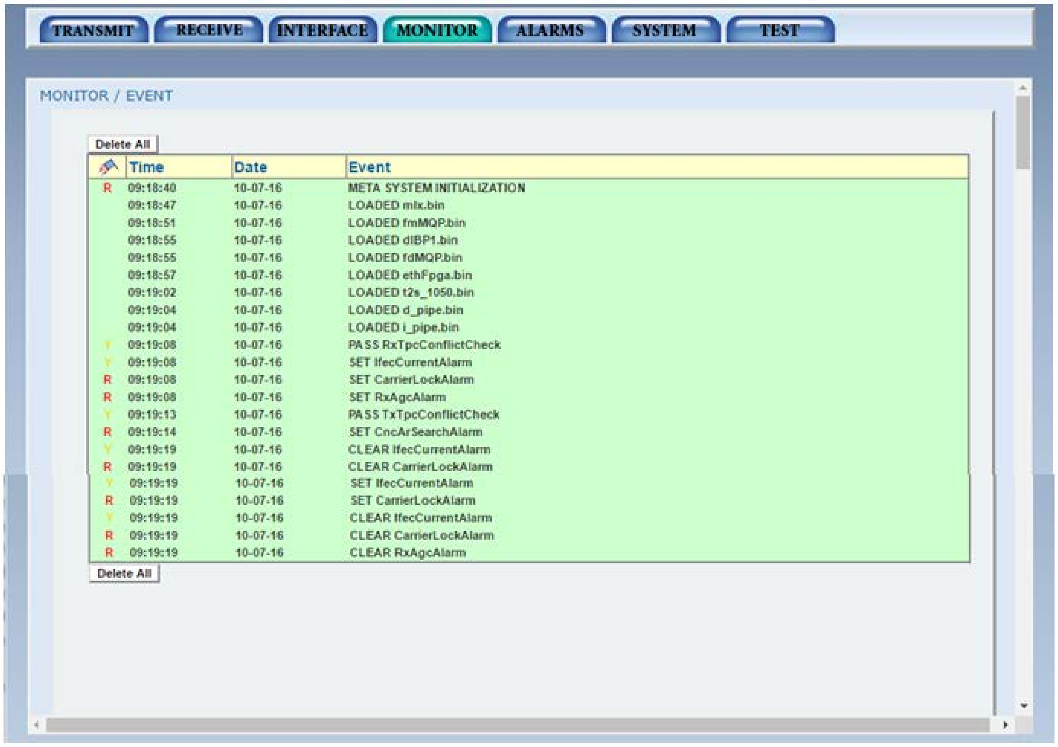


Figure 7-29. Monitor | Event Page Example

Monitor | Event Page		
Delete All		Use to delete all events in the buffer.
Event Type	• I - Informational • Y - Yellow alarm means a transmit or receive warning condition • R - Red alarm means a transmit or receive failure, losing traffic	Use to sort the Event Buffer by warning level, time, date, or event description. Use the log to help examine event occurrences.

7.7.4.4 Monitor | CNC Page

Figure 7-30. Monitor | CNC Page Example

Monitor | CNC Page – Not available on the DMD1050TS		
CnC Delay (usec)	N/A	N/A
CnC Freq Offset (KHz)	N/A	N/A
CnC Ration (dB)	N/A	N/A

7.7.4.5 Alarms Menu

The Alarms menu has the following submenus:

- TRANSMIT
- RECEIVE
- COMMON
- BACKWARD

7.7.4.6 Alarms | Transmit Page

Figure 7-31. Alarms | Transmit Page Example

Alarms | Transmit Page		
MAJOR ALARMS		
FPGA Config	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if a transmit FPGA configuration failure exists.
DSP Config	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if a transmit DSP configuration failure exists.
Sct Clock PLL	• Current • Latched • Masked (checkmark) • Unmasked (no check))	This shows if the Tx SCT Clock PLL is not locked. This alarm flashes during certain modem parameter changes. A steady glow means a configuration failure exists in the modem.
Sym Clock PLL	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Tx Symbol Clock PLL is not locked. This alarm flashes during certain modem parameter changes. A steady glow means a problem exists with the incoming clock to the modem (SCTE).

Alarms | Transmit Page		
LB Synth PLL	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Tx L-Band Synthesizer is not locked. This alarm flashes during certain modem parameter changes. A steady glow means a configuration problem exists in the modem.
Ethernet WAN	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This glows when the interface card has a fault and is not passing data. It works only when the Ethernet Card is installed, and the Ethernet Interface is selected.
TRANSEC Ready	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This glows when the TRANSEC module is ready to pass data.
MINOR ALARMS		
Terr Clock Act	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This glows when no Terrestrial Clock activity exists.
Terr Data Act	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This glows when no Tx Data activity exists.
Terr AIS	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This glows when AIS has been detected in the Tx Data Stream.
Dnl Frame Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	In Drop Mode, the framing unit cannot find the exported terrestrial framing pattern.
Dnl MFrame Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	In Drop Mode, the framing unit cannot find the exported terrestrial framing pattern.
DVB Frame Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This glows when Tx input data stream framing does not match the user-selected TX TERR FRAMING.
Clock Src Failback	• Current • Latched • Masked (checkmark) • Unmasked (no check)	Indicates that the clock resource has fallen.

Alarms | Transmit Page		
TPC Conflict Chk	• Current • Latched • Masked (checkmark) • Unmasked (no check)	Indicates that the TPC parameters are not configured correctly.
FORCE ALARM TEST		Use to force alarms.
RESET LATCHED ALARMS		Use to reset (clear) all Latched Alarms.

7.7.4.7 Alarms | Receive Page

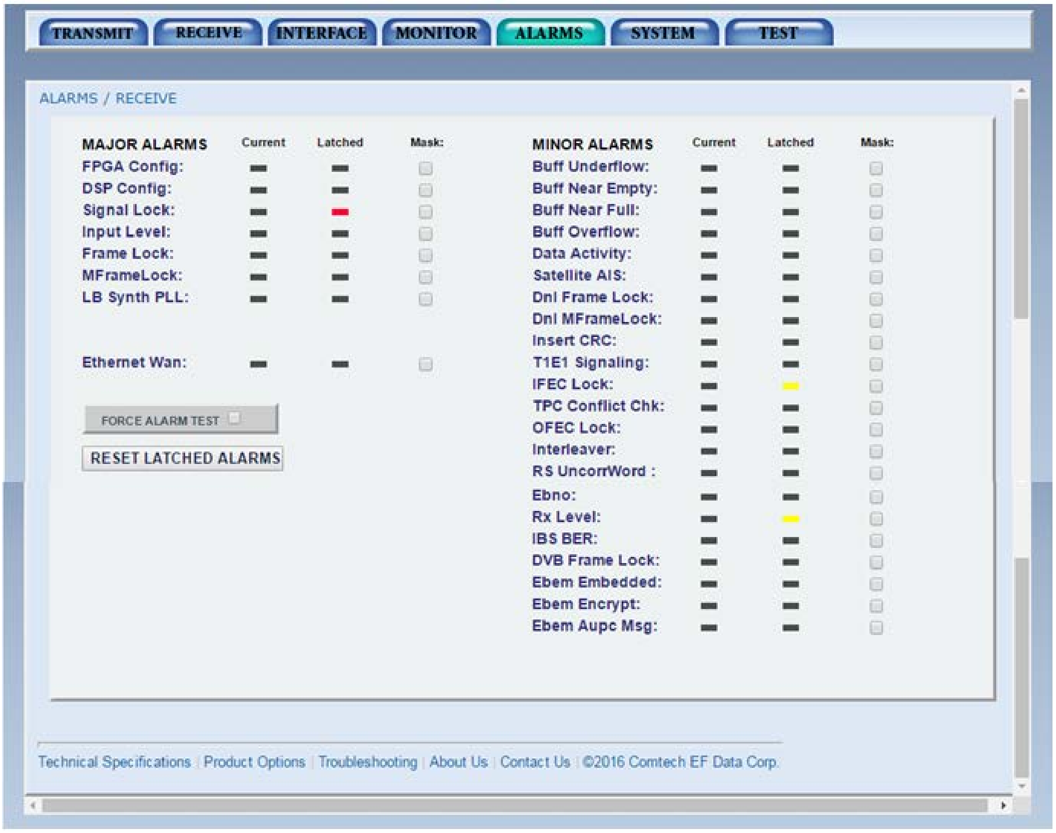


Figure 7-32. Alarms | Receive Page Example

Alarms | Receive Page		
MAJOR ALARMS		
FPGA Config	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if a receive FPGA hardware failure exists.
DSP Config	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if a receive DSP failure exists.
Signal Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the demod cannot lock to a signal.
Input Level	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Rx signal level has fallen below input threshold.

Alarms | Receive Page		
Frame Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Framing Unit cannot find the expected framing pattern.
MFramelock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This alarm flashes during certain modem parameter changes. A steady glow means a problem exists with the incoming clock to the modem (SCTE).
LB Synth PLL	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Rx L-Band Synthesizer is not locked. This alarm flashes during certain modem parameter changes. A steady glow means a configuration problem exists in the modem.
Ethernet WAN	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the interface card is faulted and is not passing data. It glows only when the Ethernet Card is installed and the Ethernet Interface is selected.
MINOR ALARMS		
Buffer Underflow	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if a Doppler Buffer underflow has occurred.
Buff Near Empty	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Doppler Buffer is about to underflow.
Buff Near Full	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Doppler Buffer is about to overflow.
Buffer Overflow	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if a Doppler Buffer overflow has occurred.
Data Activity	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if there is no Rx Data activity.
Satellite AIS	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if AIS has been detected in the receive satellite data stream.

Alarms | Receive Page		
DnI Frame Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	Drop/insert data is frame locked.
DnI MFrame Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	Drop/insert data has multiframe lock.
T1E1 Signaling	• Current • Latched • Masked (checkmark) • Unmasked (no check)	The T1/E1 Signal is not locked.
IFEC Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Framing Unit cannot find the expected framing pattern.
TPC Conflict Chk	• Current • Latched • Masked (checkmark) • Unmasked (no check)	Indicates that the TPC parameters are not configured correctly.
OFEC Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Reed-Solomon Decoder is not locked.
Interleaver	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Reed Solomon Interleaver is not synchronized.
RS Uncorr. Word	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows the status of the Reed Solomon uncoded word fault.
Ebno	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Eb/No is outside of limits.
Rx Level	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Rx level is below allowable limits.
IBS BER	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if there is more than one in 1000 bits in error in IBS Mode.

Alarms | Receive Page		
DVB Frame Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the Rx Satellite Data Stream Framing is not DVB.
Ebem Embedded	• Current • Latched • Masked (checkmark) • Unmasked (no check)	Indicated that the embedded channel is enabled but not in synchronization.
Ebem Encrypt	• Current • Latched • Masked (checkmark) • Unmasked (no check)	Indicated that the encryption is enabled but not in synchronization.
Ebem Aupc Msg	• Current • Latched • Masked (checkmark) • Unmasked (no check)	Indicated that the AUPC is enabled but not receiving incoming messages from remote.
FORCE ALARM TEST		Use to force alarms.
RESET LATCHED ALARMS		Use to reset (Clear) all Latched Alarms.

7.7.4.8 Alarms | Common Page

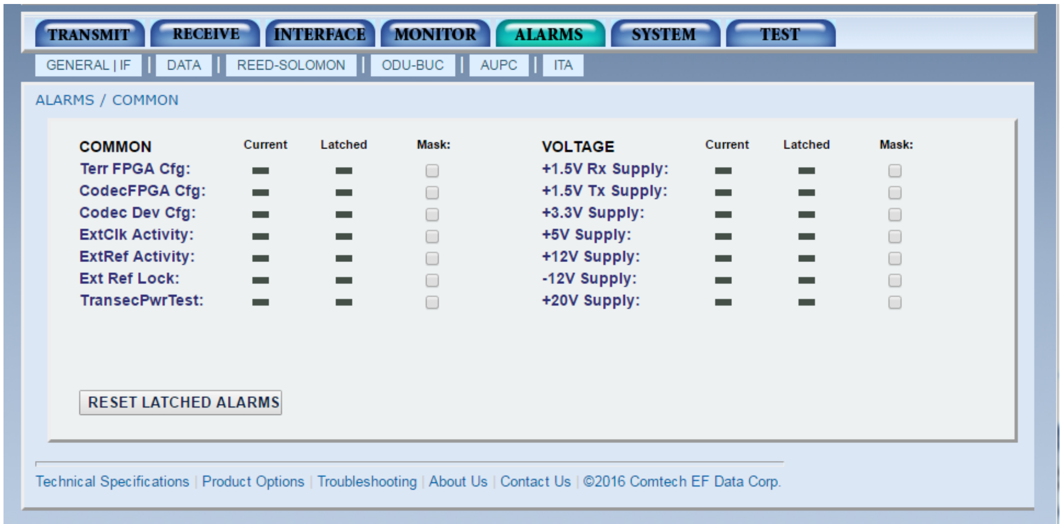


Figure 7-33. Alarms | Common Page Example

Alarms | Common Page		
COMMON		
Terr FPGA Cfg	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if there is an Interface Card FPGA configuration failure.
Codec FPGA Cfg	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if there is a Turbo Codec Card FPGA configuration failure.
Codec Dev Cfg	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if there is a Turbo Codec Card ASIC configuration failure.
ExtClk Activity	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows the External Clock is not active.
ExtRef Activity	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if there is an External Reference Activity failure.
Ext Ref Lock	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows the External Reference PLL is not locked.

Alarms | Common Page		
TransecPwrTest	• Current • Latched • Masked (checkmark) • Unmasked (no check)	Displays the results of the Power On Self Test (POST) done by the TRANSEC module when installed.
VOLTAGE		
+1.5V RX Supply	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the measured voltage of the 1.5 Volt Rx power bus that is inside the modem is xxx.
-1.5V TX Supply	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the measured voltage of the 1.5 Volt Tx power bus that is inside the modem is xxx.
+3.3V Supply	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the measured voltage of the +3.3 Volt power bus that is inside the modem is xxx.
+5V Supply	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the measured voltage of the +5 Volt power bus that is inside the modem is xxx.
+12V Supply	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the measured voltage of the +12 Volt power bus that is inside the modem is xxx.
-12V Supply	• Current • Latched • Masked (checkmark) • Unmasked (no check)	Displays the measured voltage of the -12 Volt power bus located inside the modem.
+20V Supply	• Current • Latched • Masked (checkmark) • Unmasked (no check)	This shows if the measured voltage of the +20 Volt power bus that is inside the modem is xxx.
RESET LATCHED ALARMS		Use to reset (Clear) all Latched Alarms.

7.7.4.9 Alarms | Backward Page

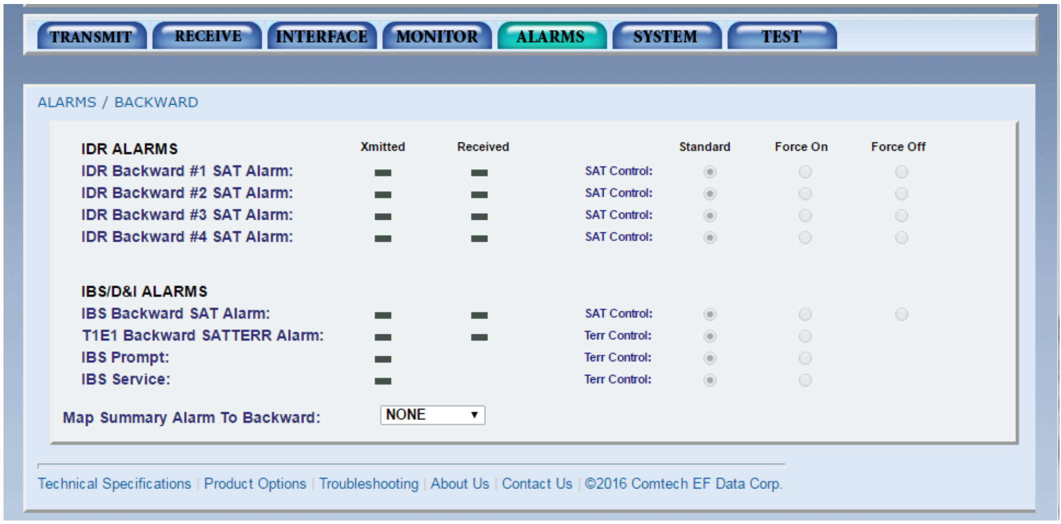


Figure 7-34. Alarms | Backward Page Example

IBS and IDR Backward Alarms are only available through a user interface, such as Web Browser, SNMP, Terminal Screens and RLLP. Physical contacts are not available for the backward alarms.

Alarms | Common Page		
IDR ALARMS		
IDR Backwards #1 SAT Alarm	• Xmitted • Received	
SAT Control	• Standard • Force On • Force Off	
IDR Backwards #2 SAT Alarm	• Xmitted • Received	
SAT Control	• Standard • Force On • Force Off	
IDR Backwards #3 SAT Alarm	• Xmitted • Received	
SAT Control	• Standard • Force On • Force Off	
IDR Backwards #4 SAT Alarm	• Xmitted • Received	
SAT Control	• Standard • Force On • Force Off	

Alarms | Common Page		
IBS/D&I ALARMS		
IBS Backward SAT Alarm	• Xmitted • Received	
SAT Control	• Standard • Force On • Force Off	
T1E1 Backward SATTERR Alarm	• Xmitted • Received	
Terr Control	• Standard • Force On	
IBS Prompt	Xmitted	
Terr Control	• Standard • Force On	
IBS Service	Xmitted	
Terr Control	• Standard • Force On	
Map Summary Alarm to Backward	• NONE • BK 1 • BK 2 • BK 1&2 • BK 3 • BK 1&3 • BK 2&3 • BK 4 • BK 1&4 • BK 2&4 • BK 1&2&4 • BK 3&4 • BK 1&3&4 • BK 2&3&4 • BK 1&2&3&4	Select from the dropdown list.

7.7.5 System Menu

The System Menu has the following submenus:

- TERMINAL / REMOTE
- HW/FW CONFIG
- FEATURES

7.7.5.1 System | Terminal / Remote Page

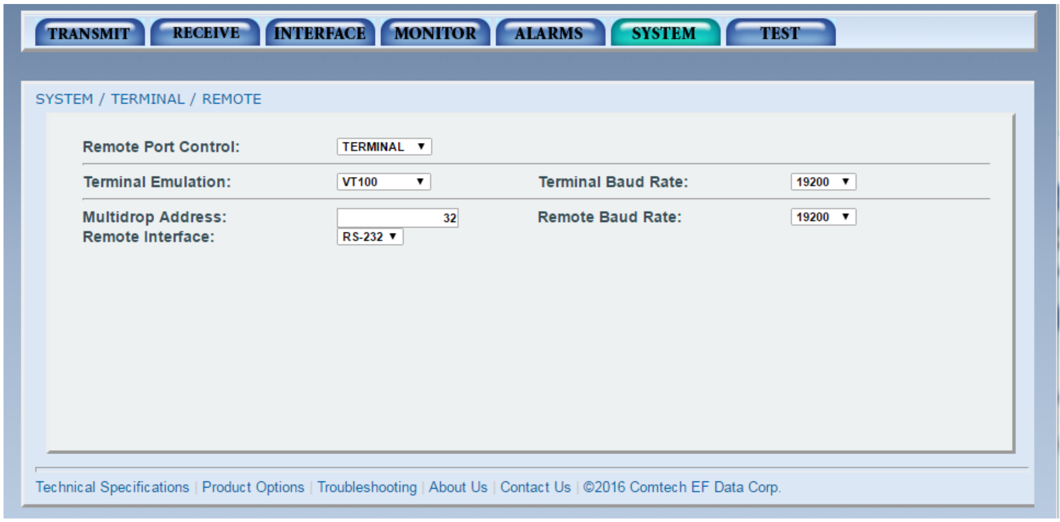


Figure 7-35. System | Terminal / Remote Page Example

System | Terminal / Remote Page		
Remote Port Control	• COMPUTER • TERMINAL	Use to select either terminal RS-232 control, or remote port M&C RS-232/-485 control.
Terminal Emulation	• VIEWPOINT • VT100 • WYSE50	Use to select the emulation type.
Terminal Baud Rate	• 150 • 300 • 600 • 1200 • 2400 • 4800 • 9600 • 19200 • 38400 • 57600 • 115200	Use to enter the terminal baud rate.
Multidrop Address	32 to 255	Use to enter the Remote Port Multidrop Address.

System | Terminal / Remote Page		
Remote Baud Rate	• 150 • 300 • 600 • 1200 • 2400 • 4800 • 9600 • 19200 • 38400 • 57600 • 115200	Use to enter the Remote Port Baud Rate.
Remote Interface	• RS-232 • RS-485	Use to enter the Remote Port interface type.

7.7.5.2 System | HW-FW Config Page

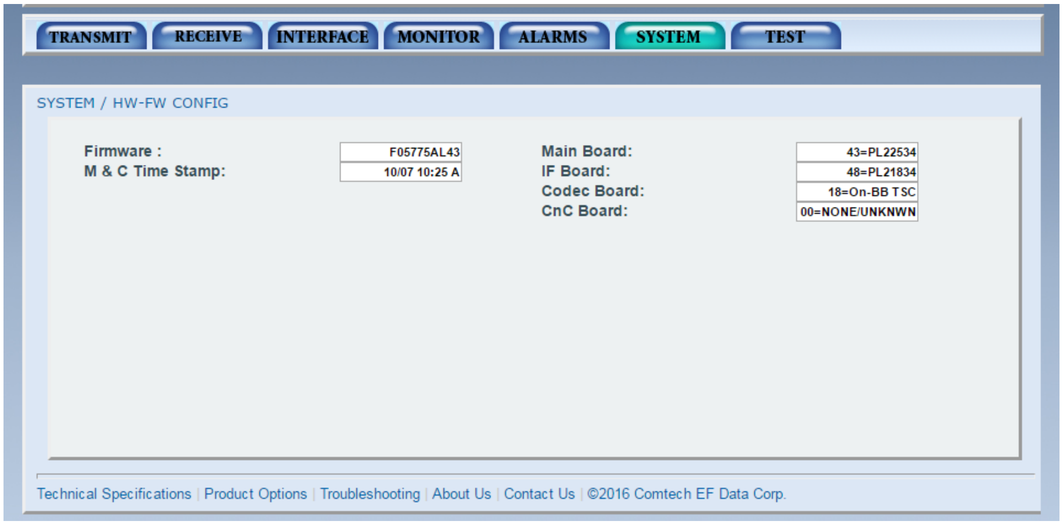


Figure 7-36. System | HW-FW Config Page Example

System | HW-FW Config Page		
Firmware		This shows the installed firmware revision.
M&C Revision		This shows the installed Monitor and Control revision.
M & C Time Stamp		This shows the Date and Time the Modem firmware was built.
IF Board		This shows the Radyne part number for the IF Board Assembly.
Codec Board		This shows the Radyne part number for the Codec Board.
CnC Board		Not applicable in the DMD1050TS.

7.7.5.3 System | Features Page

Figure 7-37. System | Features Page Example

The Web Browser menu lets you see actively enabled features. Adjacent to each feature is a series of symbols that show feature status.

	Installed
	No hardware available; requires hardware for upgrade
	Feature is in Demo Mode and will expire
	Key Code Required
	Call customer service. Feature is enabled, but the required hardware is not detected or has failed.

You can upgrade features using the Web Browser interface.

7.7.6 Test Menu

The Test Menu has the following submenus:

- PATTERN/CARRIER
- I/Q PLOT
- SPECTRUM PLOT

7.7.6.1 Test | Pattern / Carrier Page

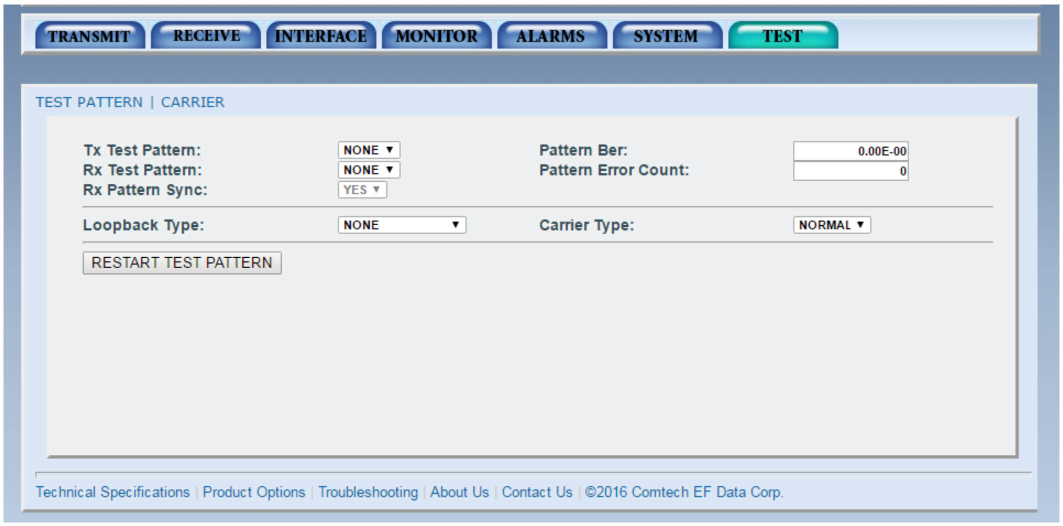


Figure 7-38. Test | Pattern / Carrier Page Example

CAUTION
You can cause undesirable network loops by using the modem's loopback capabilities with the Ethernet data interface.

To run any type of data test with an Ethernet interface, you must use two modems connected back-to-back. Do not use one modem and a loopback.

<table>
<tr><th colspan="3">Test | Pattern / Carrier Page</th></tr>
<tr><td>Tx Test Pattern</td><td>• NONE
• 2047
• 2^15-1
• 2^23-1</td><td>Use to enable the available transmit test patterns.</td></tr>
<tr><td>Rx Test Pattern</td><td>• NONE
• 2047
• 2^15-1
• 2^23-1</td><td>Use to enable the available receive test pattern.</td></tr>
<tr><td>Rx Pattern Sync</td><td>• YES
• NO</td><td>Read only; yes means that the received test pattern is in sync.</td></tr>
</table>

Test | Pattern / Carrier Page		
Loopback Type	• NONE • TERR RX • BASEBAND RX • TERR TX • BASEBAND TX • IFEC TX • IF • TERR TX/RX • BASEBAND TX/RX	
Pattern Ber	• NO SYNC • nnnn x 10^{-n}	This shows the measured Bit Error Rate for the received test pattern.
Pattern Error Count	• NO SYNC • nnnn x 10^{n}	This shows the number of errors detected by the test pattern checker.
Carrier Type	• NORMAL • CW • DUAL • OFFSET • POS FIR • NEG FIR	
RESTART TEST PATTERN		Use to reset the test pattern counter and generator.

7.7.6.2 Test | I/Q Plot Page

The I/Q Plot page shows the RX I/Q sampled data as seen by the receiver.

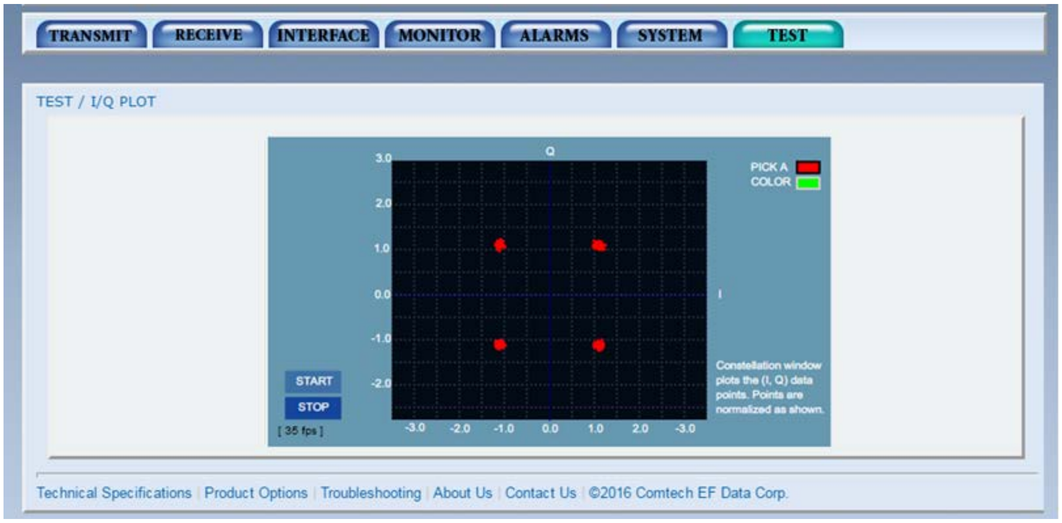


Figure 7-39. Test | I/Q Plot Page Example

Test | I/Q Plot Page		
PICK A COLOR	• RED • GREEN	
START		Click START to run the I/Q Plot.
STOP		Click STOP to end the I/Q Plot.

7.7.6.3 Test | Spectrum Plot Page

The Spectrum Plot page shows the RX Input spectrum sampled data as seen by the receiver, with a center frequency of the receiver's tuned frequency.

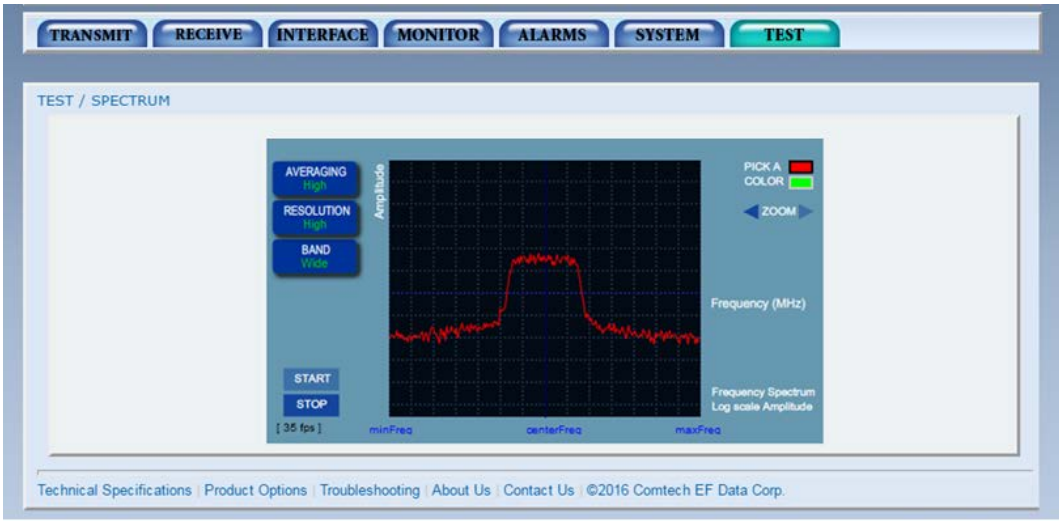


Figure 7-40. Test | Spectrum Plot Page Example

Test | Spectrum Plot Page		
AVERAGING	• Off • Low • Medium • High	Hover over the AVERAGING button to display the selections. Click on one of the selections, and then it will appear in green on the AVERAGING button.
RESOLUTION	• Low • Medium • High	Hover over the RESOLUTION button to display the selections. Click on one of the selections, and then it will appear in green on the RESOLUTION button.
BAND	• Narrow • Wide	Hover over the BAND button to display the selections. Click on one of the selections, and then it will appear in green on the BAND button.
PICK A COLOR	• RED • GREEN	Use to select color preference.
ZOOM		After starting the test, use the arrows on either side of ZOOM to zoom in / out of the graph.
START		Use to run the Spectrum Plot.
STOP		Use to end the Spectrum Plot.

7.8 TRANSEC Module HTTP Interface

Refer to Chapter 8 for detailed information on the TRANSEC Module HTTP Interface.

BLANK PAGE

Chapter 8. TRANSEC Module HTTPS Interface

8.1 TRANSEC Module Overview

The DMD Satellite Modem's may be equipped with the optional FIPs 140 Level 2 certified TRANSEC Module Interface. The TRANSEC Module operates in standalone mode with the DMD Base Modem.

The DMD modems equipped with the TRANSEC can operate in both standard BLOCK mode (TPC and LDPC) for interoperation with legacy block mode encrypters (this is fully compatible and interoperable in all specified modes of operation, with KIV-19 Provisional and KG-95-1 Provisional Transmission Security (TRANSEC) equipment used by the Government) and in COUNTER mode for interoperation with STANAG "EBEM" modes. The HTTPS pages and menus are specific to the mode in which the TRANSEC module is configured for.

EIA-422 data rates higher than 20 Mbps (for complete interoperability with the KG-95-1) are provisional.

For either configuration, the TRANSEC Module Interface provides a proxy function of HTTPS connections to the Base Modem. Thus, a secure HTTPS connection to the TRANSEC Module allows secure user access to all Base Modem parameters through this indirect proxy connection. The secure management interfaces supported by the TRANSEC Module Interface are listed as follows:

Base Modem	TRANSEC Module
HTTP	HTTPS SSH

8.2 TRANSEC Module HTTPS Interface (Common)

The user can fully control and monitor operation of the DMD TRANSEC Module from its HTTPS (Secure HTTP) Interface.

The pages in the DMD TRANSEC Module HTTPS Interface have been designed for optimal performance when using Microsoft's Internet Explorer Version 7.0 or higher, or Mozilla Firefox Version 2.0 or higher.

8.3 Open the TRANSEC Module HTTPS Interface

From the PC, type the IP address of the DMD TRANSEC Module into the **Address** area of the Web browser. In the example, www.xxx.yyy.zzz represents the IP address of TRANSEC Module.

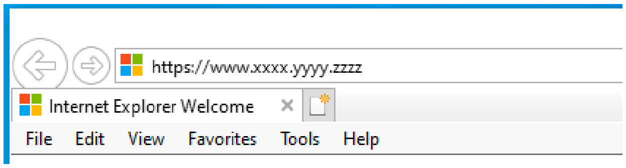


Figure 8-1. Internet Explorer, Version 11 Example

If a Security Alert shows, click **Continue to this website** to proceed.

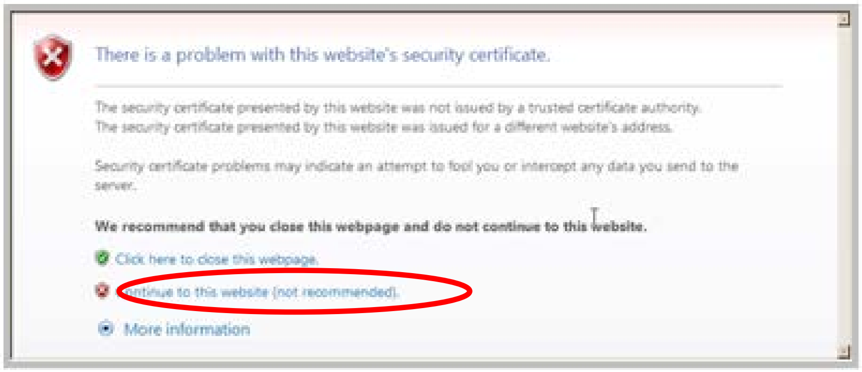


Figure 8-2. Security Alert Page

8.3.1 BLOCK Mode Logon Page

From the login page in the TRANSEC Module HTTPS interface, use the **Interface Navigator** to select one of three modes of operation.

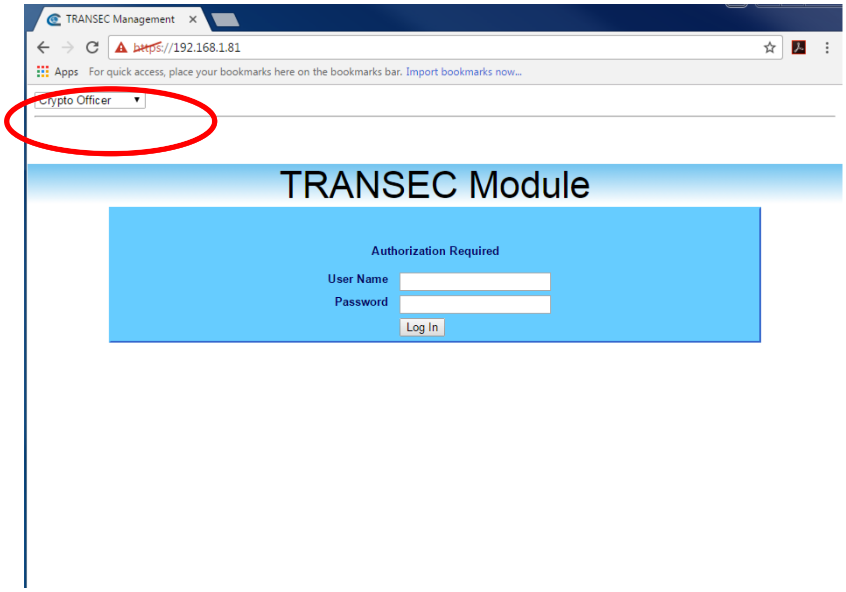


Figure 8-3. BLOCK Mode Logon Page

Crypto Officer: Connects to the secure TRANSEC Module HTTPS Interface (**User Name** and **Password** required).

Modem Operator: Not available on DMD modems.

Network Operator: Not available on DMD modems.

Once the login page opens, **Crypto Officer** appears as the default.

On the **Login** page, type in a valid Crypto Officer **User Name** and Crypto Officer **Password**. The default for both is **comtech.** Click **Log In**.

The TRANSEC Module User Name and Password are each restricted to a minimum of 7 and a maximum of 25 characters, excluding: (ASCII Code 58), < (ASCII Code 60), > (ASCII Code 62), " (ASCII Code 34), and ~ (ASCII Code 126).

Once the **User Name** and **Password** are accepted, the TRANSEC Module **Configure** page opens.

8.3.2 COUNTER Mode Logon Page

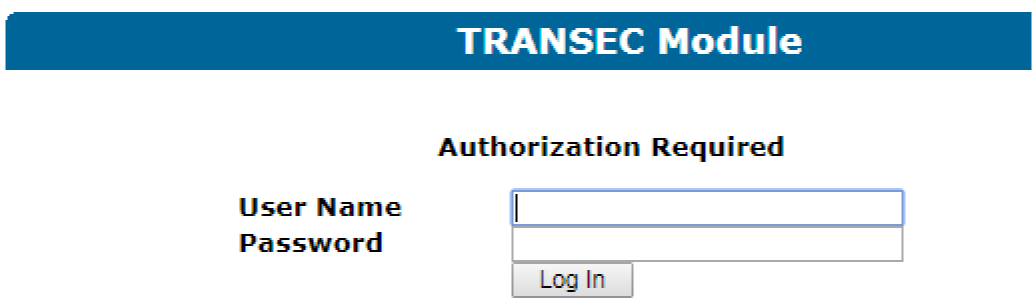


Figure 8-4. COUNTER Mode Logon Page

On the **Login** page, type in a valid Crypto Officer **User Name** and Crypto Officer **Password**. The default for both is **comtech.** Click **Log In**.

The TRANSEC Module User Name and Password are each restricted to a minimum of 7 and a maximum of 25 characters, excluding: (ASCII Code 58), < (ASCII Code 60), > (ASCII Code 62), " (ASCII Code 34), and ~ (ASCII Code 126).

Once the **User Name** and **Password** are accepted, the TRANSEC Module **Configure** page opens.

8.3.3 Interface Instructions for Older Browsers (Common)

While legacy IE browser versions (e.g., Internet Explorer 6.0), can be used, Comtech EF Data Technical Support does not support services for these older browsers. If you have problems connecting to the secure web interface using an older browser, try this troubleshooting tip:

1. From the browser tool bar, go to the **Tools | Internet Options | Advanced** tab. See Figure 8-4.
2. Under the **Security** heading, use the check boxes to:
   a. Disable the Secure Sockets Layers (SSL 2.0 and SSL 3.0).
   b. Enable the Transport Layer Security (TLS 1.0).
3. Make sure to enable SSL again, once troubleshooting is finished.

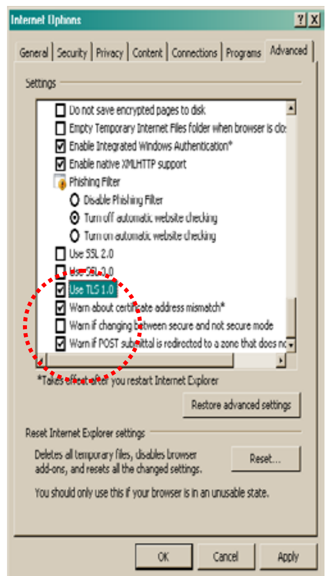


Figure 8-5. Tools | Internet Options | Advanced | Security Settings

8.3.3.1 HTTPS Interface Menu Tree (Common)

This menu tree diagram shows the options available via the TRANSEC Module HTTPS Interface:

Interface Navigator Drop-down Menu	Page Navigation Tabs				
	Configure	Monitor	Log*	Firmware	Upload
Crypto Officer					

The **Interface Navigator Drop-down Menu** and its selections (shown in green) allow secure access to one of the DMD Web interfaces (Crypto Officer ONLY on DMD modems).

Once **Crypto Officer** (i.e., the TRANSEC Module HTTPS Interface) is selected, the available navigation tabs (above, shown in blue) are available.

* Log is only available in BLOCK mode.

Click any tab or hyperlink to continue.

8.4 TRANSEC Module HTTPS Interface Page Descriptions (BLOCK Mode)

8.4.1 Configure

The **Configure** page provides configuration and management functions.

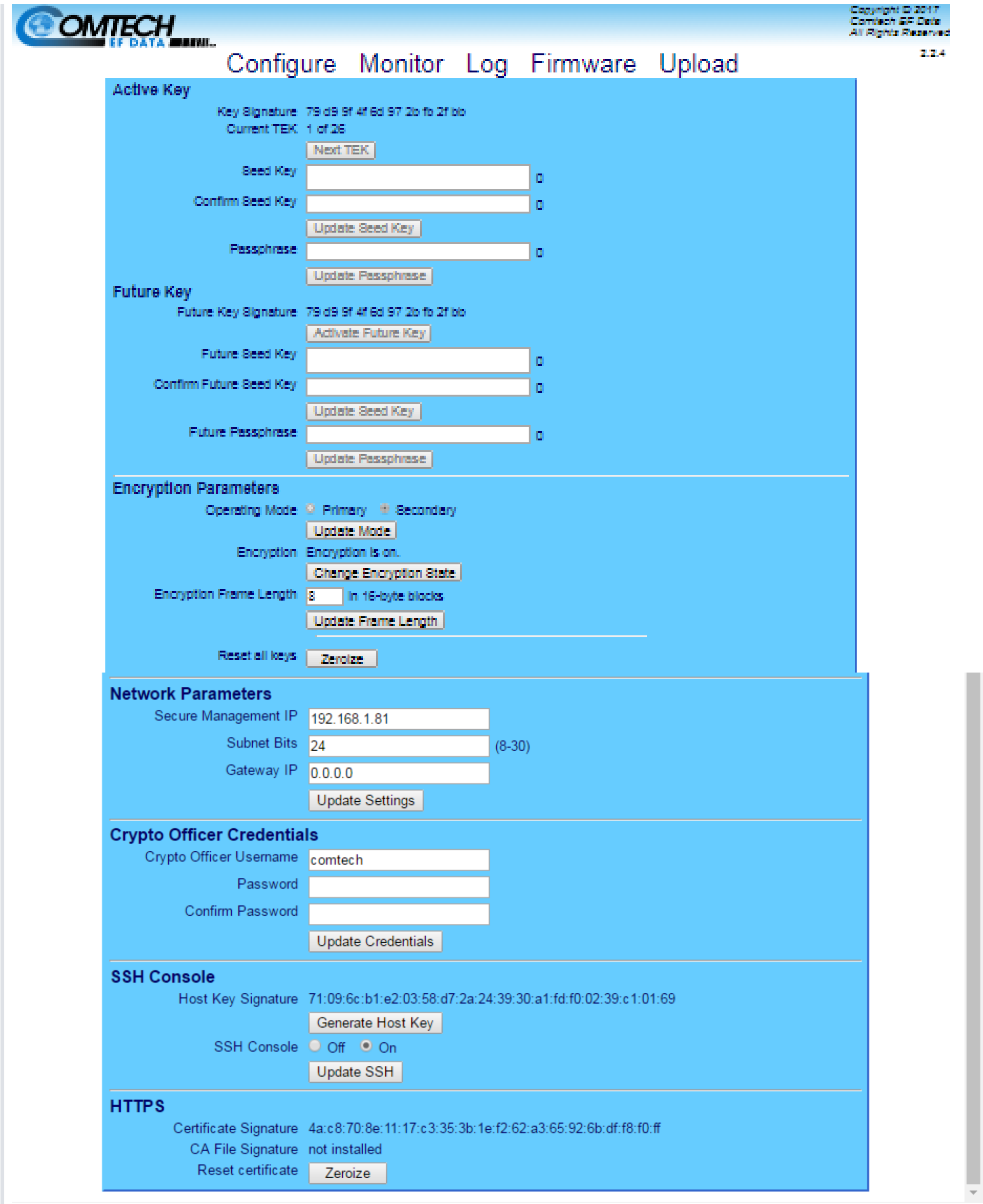


Figure 8-6. Configure Page (BLOCK Mode)

8.4.1.1 Active Key

Item	Description
Key Signature *(read-only)*	This is a signature, or fingerprint, of the Transmission Encryption Keys (TEKs) generated by the **Seed Key** and **Passphrase**. The user can compare signatures on different modems to ensure that each has the same **Seed Key** and **Passphrase**. NOTE: The TEKs are updated *only* when a **Passphrase** is submitted.
Current TEK *(read-only)*	The user may generate 26 TEKs from the **Seed Key** and **Passphrase** (described below). The active TEK (1 through 26) is displayed here. When it is desired to change the encryption key being used to encrypt traffic, click **Next TEK** to select the next key in the set of 26 TEKs. Note the following: • The **Next TEK** button is disabled when the module is in secondary mode, and the current TEK mirrors the TEK the connected primary modem uses. • The TEK only increments and never decrements; the user cannot re-use a previous key. *The only way to reset the TEK to 1 is by clicking* **Activate Future Key** (described below).
Seed Key *(write-only)*	Enter a 32-character **Seed Key** in this text box to generate TEKs when the TRANSEC Module is given a **Passphrase** (described below).
Confirm Seed Key *(write-only)*	Re-enter the newly created **Seed Key** in this text box to ensure its accuracy. Once the **Seed Key** is *entered* and *confirmed*, click **Update Seed Key** to finalize this change.
Enter Passphrase *(write-only)*	Accepts a 10- to 32-character Passphrase that is combined with the previously entered **Seed Key** to generate TEKs. Once the **Passphrase** is *entered*, click **Update Passphrase** to finalize this change.

8.4.1.2 Future Key

Item	Description
Future Key Signature	The user can program a second seed key and passphrase to generate a second set of TEKs. These keys will lie dormant until the user activates them by clicking **Activate Future Key.** At that time, the following happens: 1. The active TEKs are replaced by the ones generated with the **Future Seed Key** and **Future Passphrase**. 2. The **Current TEK** gets reset to 1. 3. Secondary modems connected to this one will also activate their **Future Keys.** NOTE: The **[Activate Future Key]** button is active *only* when the following conditions are met: 1. The modem is in **Primary** mode (see **Encryption Mode**, explained below). 2. The Current TEK is greater than 1.
Future Seed Key *(write-only)*	Enter a 32-character **Future Seed Key** in this text box to generate a TEK when the TRANSEC Module is given a **Future Passphrase** (described below).
Confirm Future Seed Key *(write-only)*	Re-enter the newly created Future **Seed Key** in this text box to ensure its accuracy. Once the **Future Seed Key** is *entered* and *confirmed*, click **Update Seed Key** to finalize this change.
Future Passphrase *(write-only)*	Accepts a 10- to 32-character Passphrase that is combined with the previously entered **Seed Key** to generate TEKs. Once the **Passphrase** is *entered*, click **Update Passphrase** to finalize this change.

8.4.1.3 Encryption Parameters

Item	Description
Operating Mode	Set encryption in the TRANSEC Module as **Primary** or **Secondary**. Note the following: • If **Primary** is selected, the TRANSEC Module will allow the user to advance the TEK and activate the future key independently of any other modems. • If **Secondary** is selected, the TRANSEC Module's TEK automatically mirrors the TEK of the primary modem and the module will activate the future key when the primary modem activates its future key. Click **Update Mode** when done.
Encryption	Click **Change Encryption State** to display the **On** and **Off** radio buttons. The "layered" appearance of this control is intended to prevent the user from accidentally toggling the Encryption State. By selecting the Encryption State as '**On**', this causes the data traffic to be encrypted by the TRANSEC Module using the current TEK. This encrypted data is then delivered to the base modem for transmission, regardless of the state of the receiving modem. Three user-defined parameters must match in order for encrypted communication to commence between two TRANSEC Module-equipped modems: 1. Seed Key. 2. Passphrase. 3. Encryption Frame Length. Select the desired operational state, then click **Update Encryption** to save the selected state and then return this selection to its "protected" mode; the **On/Off** radio buttons will be hidden once again and the operational state message will update accordingly (i.e., "**Encryption is On**" or "**Encryption is Off**").
Encryption Frame Length	Use this text box to specify the length of the Advanced Encryption Standard (AES) 256 encryption frame. Acceptable range is from 1 (fast acquisition, high overhead) to 255 (slower acquisition, low overhead). Once the desired **Encryption Frame Length** has been entered, click **Update Frame Length** to implement this change.
Reset all keys	Click **Zeroize** to reset all encryption keys in the module's memory and flash to default values.

8.4.1.4 Network Parameters

Item	Description
Secure Management IP	Allows users to change the IP address of the TRANSEC Module to suit their own operational environment. NOTE: If this text box changes, it will be necessary to repeat the process in Section 8.3 using the newly-designated IP address, to regain access to the TRANSEC Web Interface.
Subnet Bits	Allows users to modify the IP subnet mask of the TRANSEC Module to suit their own operational environment.
Gateway IP	Allows users to modify the default gateway of the TRANSEC Module to suit their own operational environment. NOTE: The IP address entered in the text box must match the subnet of the Secure Management IP. If it does not then the Gateway IP text box will default to 0.0.0.0.

Click **Update Settings** to apply changes made to any of these parameters.

8.4.1.5 Crypto Officer Credentials

This section is used to create a TRANSEC Module **Crypto Officer Username** and **Crypto Officer Password.** Note that are each restricted to a minimum of **7** and a maximum of **25** characters, excluding**:** (ASCII Code 58), **<** (ASCII Code 60), **>** (ASCII Code 62), **"** (ASCII Code 34), and **~** (ASCII Code 126).

The default for both the **Crypto Officer Username** and **Password** is **transec**.

Item	Description
Crypto Officer Username	Use this text box to create the desired username.
Password	Use this text box to create the desired password for the username being created.
Confirm Password	Use this text box to re-enter the previously entered password.

Once the Username is entered and the Password is *confirmed*, click **Update Credentials** to finalize this update.

8.4.1.6 SSH (Secure Shell) Console

Item	Description
Host Key Signature	This key signature, or fingerprint, helps to identify the TRANSEC Module when connecting through SSH. SSH clients typically show the host key signature when they connect to a system for the first time. The user can then compare the host key the SSH client shows with the host key the TRANSEC Module displays to verify that they are the same. Click **Generate New Host Key** to generate a new host key that uniquely identifies the TRANSEC Module. After doing this, SSH clients that have connected to the TRANSEC Module before will usually note or warn that the host key has changed when they connect again.
SSH Console	Click **On** or **Off** to set administrative access to the console, then click **Update SS** to implement this setting.

8.4.1.7 HTTPS

Item	Description
Certificate Signature	Displays the digital fingerprint of the installed SSL certificate, which helps identify the certificate.
CA File Signature	Displays the digital fingerprint of the installed CA File, which helps identify the file.
Reset certificate	Resets the SSL certificate to the factory default.

8.4.2 Monitor

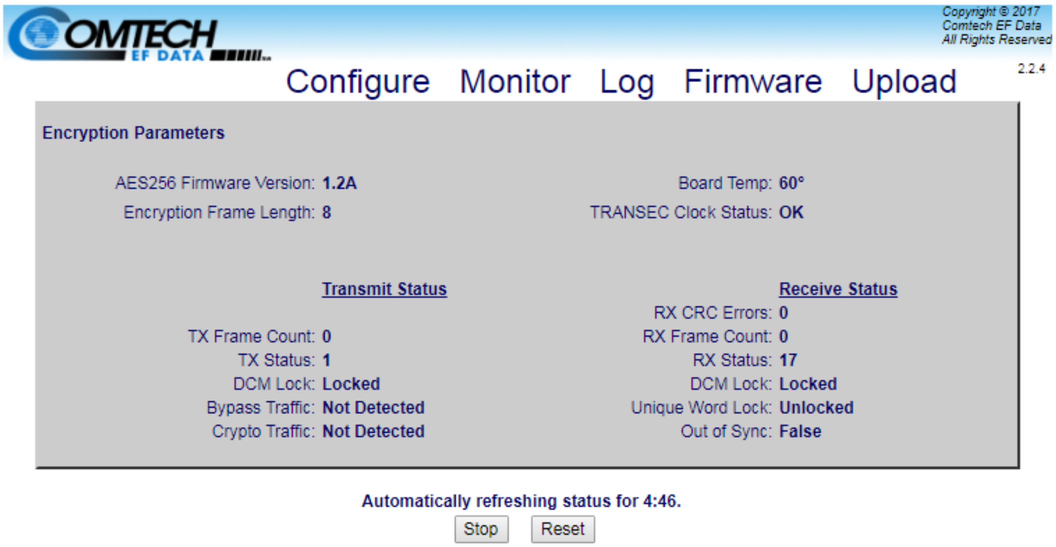


Figure 8-7. Monitor Page (BLOCK Mode)

8.4.2.1 Encryption Parameters

Item	Description
AES256 Firmware Version	Identifies the version of the AES 256 core.
Encryption Frame Length	Displays the currently configured AES 256 frame length.
Board Temp	Displays the temperature of the TRANSEC Module
TRANSEC Clock Status	Displays the DCM locked status for the AES 256 core.

8.4.2.2 Transmit Status

Item	Description
TX Frame Count	Displays the number of transmitted AES 256 frames.
TX Status	Describes the value of the Tx Status register.
DCM Lock	Displays the state of the Tx DCM lock.
Bypass Traffic	Displays the encryption status (**Bypass on** means *Encryption off*).
Crypto Traffic	When **Detected**, the module has sampled outgoing traffic and verifies it has been encrypted. When **Not Detected**, encryption is off, or the module cannot verify encrypted traffic.

8.4.2.3 Receive Status

Item	Description
RX CRC Errors	Displays the count of received CRC errors.
RX Frame Count	Displays the number of received AES 256 frames.
RX Status	Displays the value of the Rx Status register.
DCM Lock	Displays the state of the Rx DCM lock.
Unique Word Lock	Indicates that the decryption engine has successfully found the unique word and has been able to lock to it.
Out of Sync	Indicates that an out-of-sync condition has been detected by the encryption engine.

8.4.2.4 Automatic Refresh Status Timer

The page updates itself automatically for the duration of the countdown timer. When the timer reaches **0:00**, the page will stop updating to help conserve system resources.

To manually override the timer, click **Stop** to interrupt or **Reset** to restart the timer.

8.4.3 Log

Use this page to see the events log specific to the TRANSEC Module, and to monitor and troubleshoot the health of the TRANSEC Module.

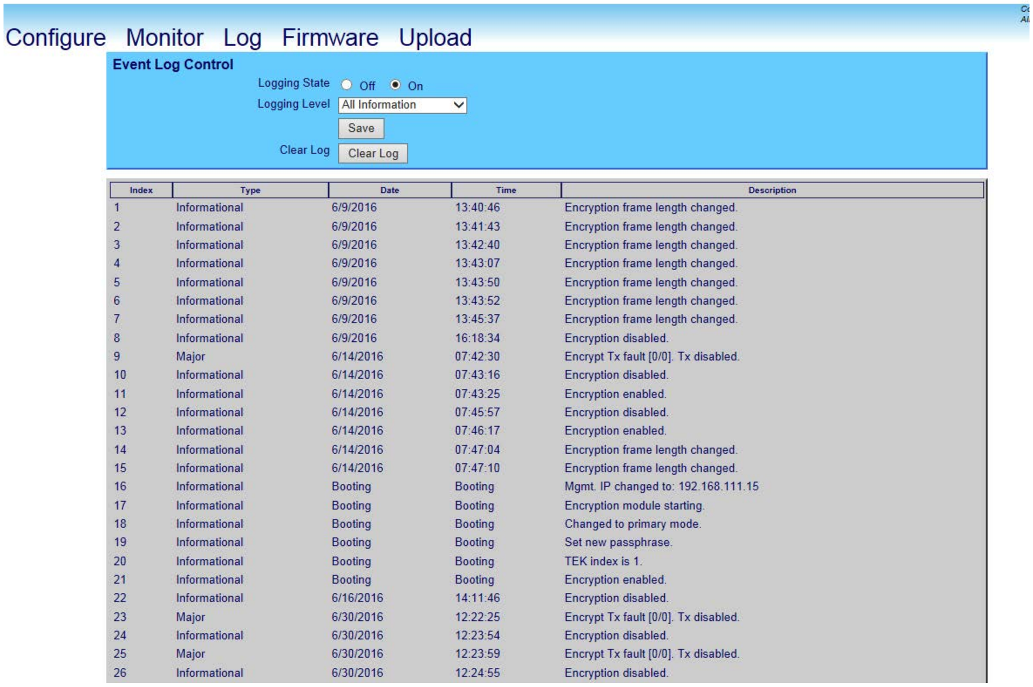


Figure 8-8. Log Page (BLOCK Mode)

8.4.3.1 Event Log Control

Item	Description
Logging State On/Off	Enables/disables logging of event messages.
Logging Level	This drop-down menu controls the maximum filtering level of displayed messages. Choices are **Errors Only**, **Errors and Warnings**, and **All Information**. Click **Save** to save the settings.

8.4.3.2 Event Log

Column	Description
Index	The event messages are numbered in the order they are received.
Type	Describes the severity of the event.
Date	Displays the date that the event was logged in using MONTH/DAY/YEAR format.
Time	Displays the time of day that the event was logged in 24-hour format.
Description	Displays a brief description of the logged event.

Table 8-1. Event Log Message Types

Event Type (By order of severity – from least to worst case)		
Event Type	Event Description	Level of Severity / User Action
Informational	Normal operational status change; e.g., successful password or configuration setting change.	Minimum. Event logged is for user reference only.
Warning	Status change that the system might not accept or expect; e.g., setting the future passphrase without first setting the future seed key, entering an invalid remote command, etc.	*Moderate.* User should consult the pertinent sections of this manual to troubleshoot, and then repeat command or procedure as needed.
Minor	Error condition that the system should be able to recover from without affecting the operation of the system; e.g., encountering software 'bug', etc. Such events are not recorded into the Events Log.	*Moderate.* User should report issues when convenient to Comtech EF Data Customer Support.
Major	A more severe error that may indicate a degradation of the stability of the system; e.g., out-of-range temperature readings for the TRANSEC Module, etc.	Maximum. User should contact Comtech EF Data Customer Support as soon as possible to address issue.
Critical	The most severe error level indicating that system failure has occurred or is imminent; e.g., memory allocation failure, OS failure, etc.	Maximum. User should contact Comtech EF Data Customer Support immediately to arrange for RMA / in-factory service.

Click **Clear Log** to clear the event log of all messages. The event log is reset to zero entries.

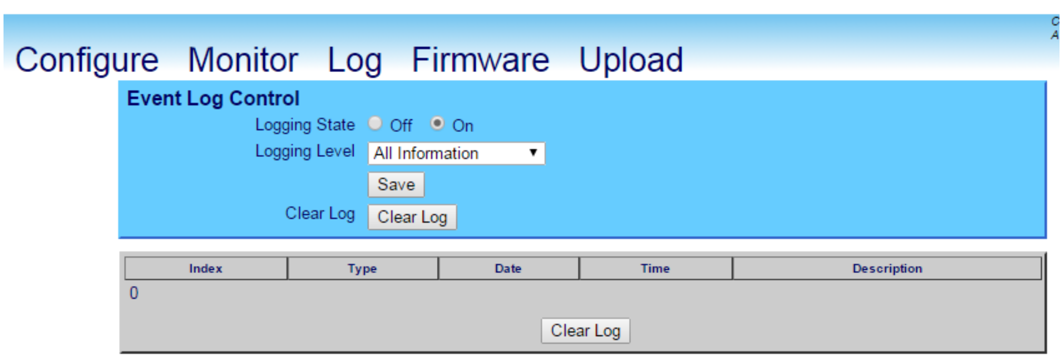


Figure 8-9. Event Log Page Cleared (BLOCK Mode)

8.4.4 Firmware

The firmware page provides firmware status and management capabilities for the TRANSEC module.

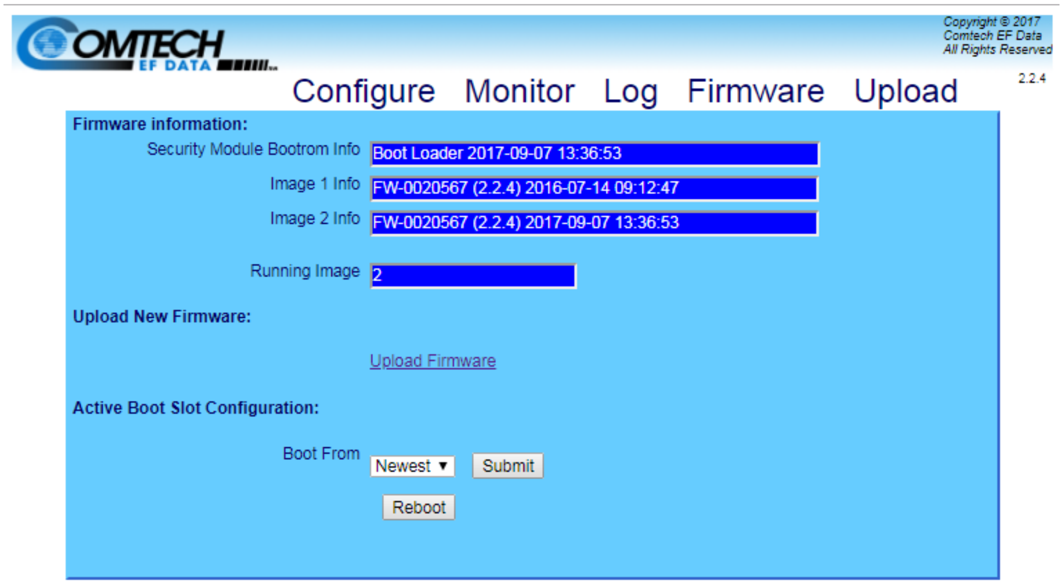


Figure 8-10 Firmware Unit Info Page (BLOCK Mode)

8.4.4.1 Firmware Information

Item	Description
Security Module Bootrom Info	Boot Loader version information.
Image 1 Info	Slot 1 firmware image version information.
Image 2 Info	Slot 2 firmware image version information.
Running Image	Indicates the active firmware image.

8.4.4.2 Upload New Firmware

Item	Description
Upload New Firmware	Click to navigate to the Upload page

8.4.4.3 Active Boot Slot Configuration

Item	Description
Boot From	Select the firmware image to load on the next boot. Click [Submit] to save the selection.
[Reboot]	Reboot the modem.

8.4.5 Upload

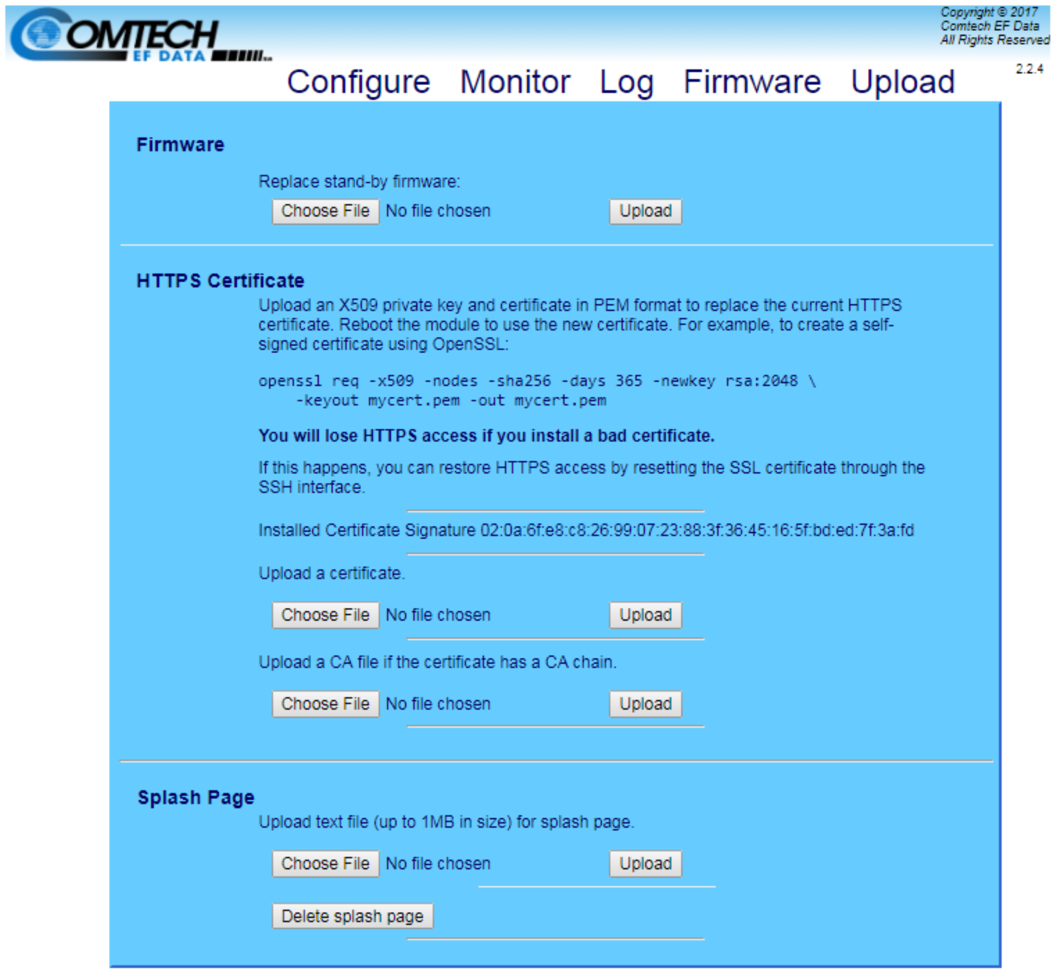


Figure 8-11. Upload Page (BLOCK Mode)

8.4.5.1 Firmware

Use this area to select a file, and then upload updated firmware.

See Section 8.5 for detailed information on the procedures associated with the TRANSEC Module firmware update process.

8.4.5.2 HTTPS Certificate

Use this area to upload an X509 private key and certificate in PEM format to replace the current HTTPS certificate.

HTTPS access will be lost if a bad certificate is installed. If this happens, restore the HTTPS access by resetting the SSL certificate through the SSH interface.

8.4.5.3 Splash Page

Use this area to upload a text file (up to 1MB in size) to replace the current splash page.

8.5 TRANSEC Module HTTPS Interface Page Descriptions (COUNTER Mode)

8.5.1 Configure Page

The **Configure** page provides configuration and management functions.

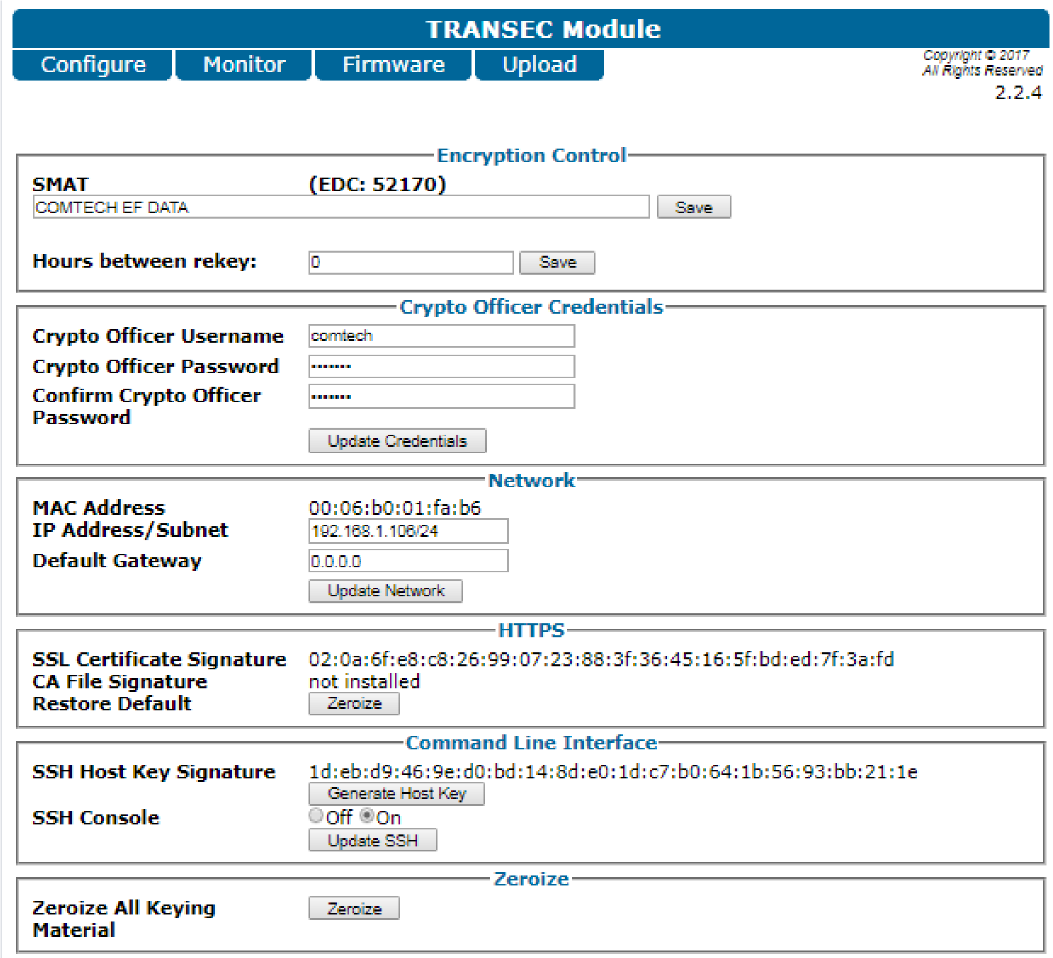


Figure 8-12. Configure Page (COUNTER Mode)

8.5.1.1 Encryption Control

Item	Description
SMAT *(write-only)*	Enter a 40-character Shared Message Authentication Token to exchange secure messages with peer.
Rekey Timer *(write -only)*	Hours until the module rekey's with peer

8.5.1.2 Crypto Officer Credentials

This section is used to create a TRANSEC Module **Crypto Officer Username** and **Crypto Officer Password.** Note that are each restricted to a minimum of **7** and a maximum of **25** characters, excluding**:** (ASCII Code 58), **<** (ASCII Code 60), **>** (ASCII Code 62), **“** (ASCII Code 34), and **~** (ASCII Code 126).

The default for both the **Crypto Officer Username** and **Password** is **transec**.

Item	Description
Crypto Officer Username	Use this text box to create the desired username.
Password	Use this text box to create the desired password for the username being created.
Confirm Password	Use this text box to re-enter the previously entered password.

Once the Username is entered and the Password is *confirmed*, click **Update Credentials** to finalize this update.

8.5.1.3 Network

Item	Description
MAC Address	Displays the modules Physical MAC (Read Only)
Secure Management IP	Allows users to change the IP address of the TRANSEC Module to suit their own operational environment. NOTE: If this text box changes, it will be necessary to repeat the process in Section 8.3 using the newly-designated IP address, to regain access to the TRANSEC Web Interface.
Subnet Bits	Allows users to modify the IP subnet mask of the TRANSEC Module to suit their own operational environment.
Gateway IP	Allows users to modify the default gateway of the TRANSEC Module to suit their own operational environment. NOTE: The IP address entered in the text box must match the subnet of the Secure Management IP. If it does not, then the Gateway IP text box will default to 0.0.0.0.

Click **Update Network** to apply changes made to any of these parameters.

8.5.1.4 HTTPS

Item	Description
SSL Certificate Signature	Displays the digital fingerprint of the installed SSL certificate, which helps identify the certificate.
CA File Signature	Displays the digital fingerprint of the installed CA File, which helps identify the file.
Restore Default	(ZEROIZE) Resets the SSL certificate to the factory default.

8.5.1.5 Command Line Interface

Item	Description
SSH Host Key Signature	This key signature, or fingerprint, helps to identify the TRANSEC Module when connecting through SSH. SSH clients typically show the host key signature when they connect to a system for the first time. The user can then compare the host key the SSH client shows with the host key the TRANSEC Module displays to verify that they are the same. Click **Generate New Host Key** to generate a new host key that uniquely identifies the TRANSEC Module. After doing this, SSH clients that have connected to the TRANSEC Module before will usually note or warn that the host key has changed when they connect again.
SSH Console	Click **On** or **Off** to set administrative access to the console, then click **Update SS** to implement this setting.

8.5.2 Monitor Page

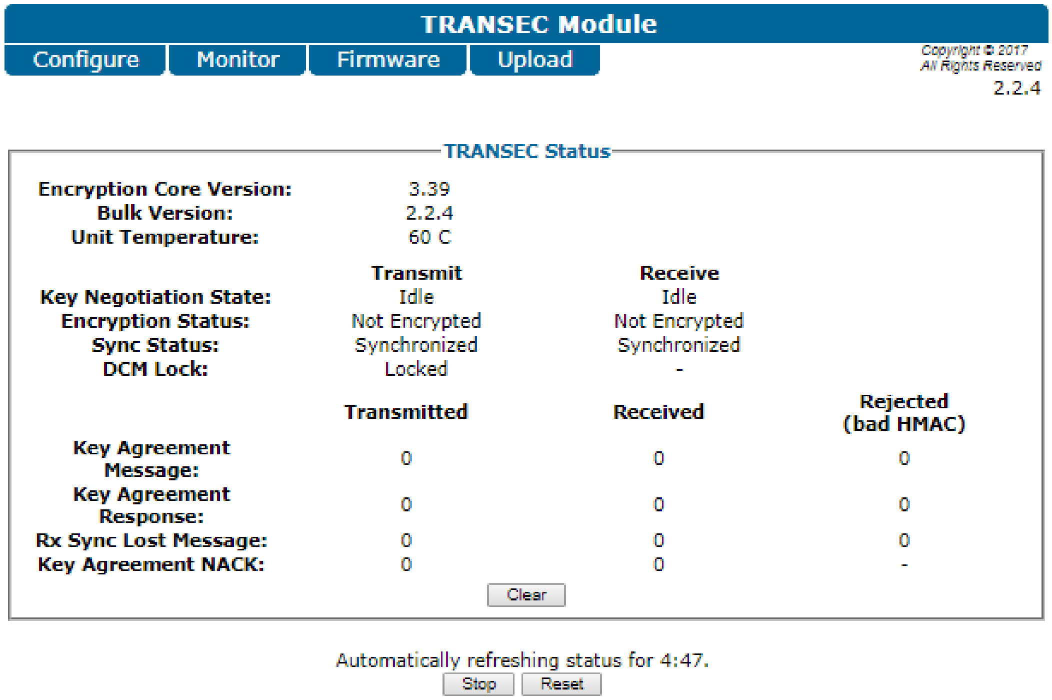


Figure 8-13. Monitor Page (COUNTER Mode)

8.5.2.1 TRANSEC Status

Item	Description
Encryption Core Version	Identifies the version of the core.
Bulk Version	Identifies the Unified Bulk software version.
Unit Temp	Displays the temperature of the TRANSEC Module
Key Negotiation State	Displays the current state of the negotiation state machine Transmit: • Idle • Waiting for Embedded Channel • Waiting for Key Agreement Respose • Waiting for Key Rollover • Encrypting Receive: • Idle • Waiting for Key Rollover • Waiting for Crypto Sync • Decrypting • Crypto Sync Loss
Sync Status	Displays the modules synchronization status
DCM Lock	Displays the DCM lock state (Transmit Only)

Item	Description	
Key Agreement Message	Transmitted:	Displays the number of Key Agrement Messages Transmitted over the embedded channel
	Received:	Displays the number of Key Agrement Messages Received over the embedded channel
	Rejected (Bad HMAC)	Displays the number of Key Agreement Messages that were received, but rejected due to Bad HMAC. This typically means that there is a mismatch in the peer modems SMAT.
Key Agreement Response	Transmitted:	Displays the number of Key Agrement Responses Transmitted over the embedded channel
	Received:	Displays the number of Key Agrement Responses Received over the embedded channel
	Rejected (Bad HMAC)	Displays the number of Key Agreement Responses that were received, but rejected due to Bad HMAC. This typically means that there is a mismatch in the peer modems SMAT.
Rx Sync Lost Mesage	Transmitted:	Displays the number of Rx Sync Lost mesages Transmitted over the embedded channel
	Received:	Displays the number of Rx Sync Lost mesages Received over the embedded channel
	Rejected (Bad HMAC)	Displays the number of Rx Sync Lost mesages that were received, but rejected due to Bad HMAC. This typically means that there is a mismatch in the peer modems SMAT.
Key Agreement NACK	Transmitted:	Displays the number of Key Agreement NAC's Transmitted over the embedded channel
	Received:	Displays the number of Key Agreement NAC's Received over the embedded channel
Clear	Clears all counters	

8.5.2.2 Automatic Refresh Status Timer

The page updates itself automatically for the duration of the countdown timer. When the timer reaches **0:00**, the page will stop updating to help conserve system resources.

To manually override the timer, click **Stop** to interrupt or **Reset** to restart the timer.

8.5.3 Firmware

The firmware page provides firmware status and management capabilities for the TRANSEC module.

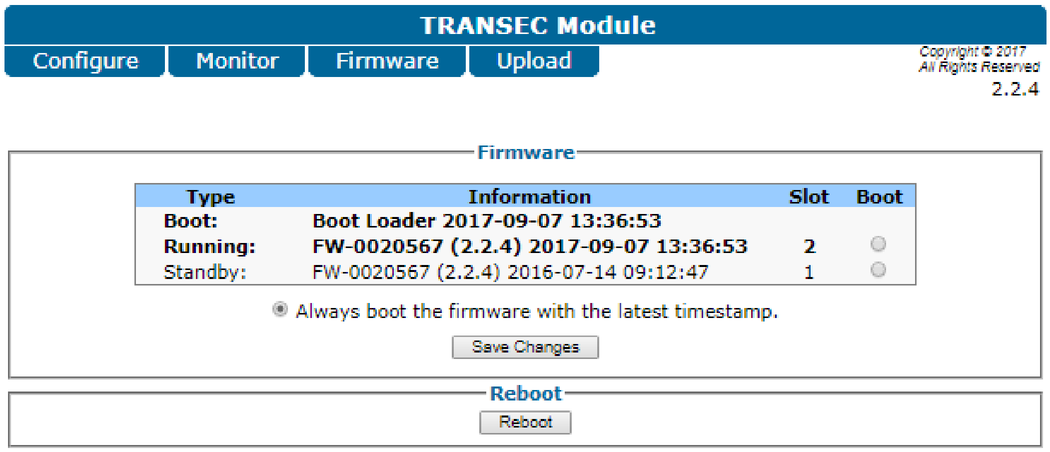


Figure 8-14. Firmware Unit Info Page (COUNTER Mode)

8.5.3.1 Firmware Information

Item	Description
Boot:	Boot Loader version information.
Running	Displays the running firmware image version information.
Standby:	Displays the standby firmware image version information.
Boot	Allows the Crypto Officer to select the running image at next module bootup.

8.5.3.2 Reboot

Item	Description
Reboot	Reboots the module.

8.5.4 Upload

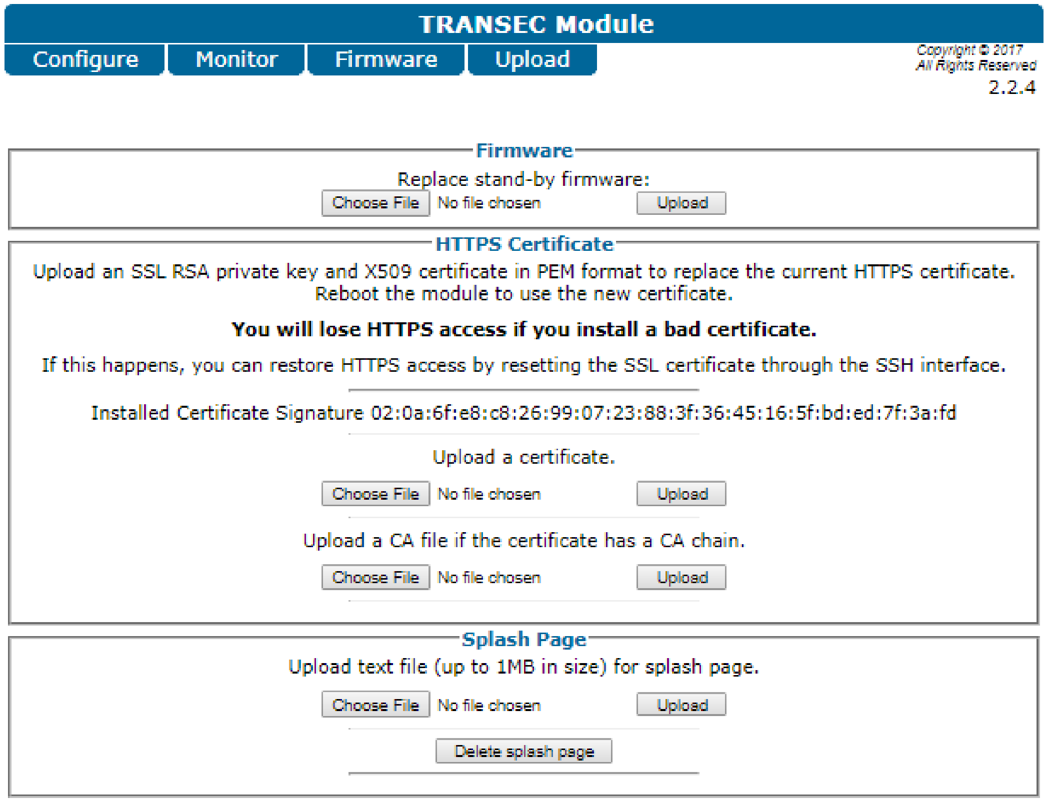


Figure 8-15. Upload Page (COUNTER Mode)

8.5.4.1 Firmware

Use this area to select a file, and then upload updated firmware.

See Section 8.5 for detailed information on the procedures associated with the TRANSEC Module firmware update process.

8.5.4.2 HTTPS Certificate

Use this area to upload an X509 private key and certificate in PEM format to replace the current HTTPS certificate.

HTTPS access will be lost if a bad certificate is installed. If this happens, restore the HTTPS access by resetting the SSL certificate through the SSH interface.

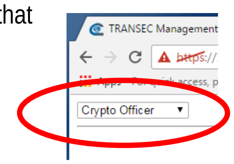
8.5.4.3 Splash Page

Use this area to upload a text file (up to 1MB in size) to replace the current splash page.

8.6 TRANSEC Module Update Procedure (Common)

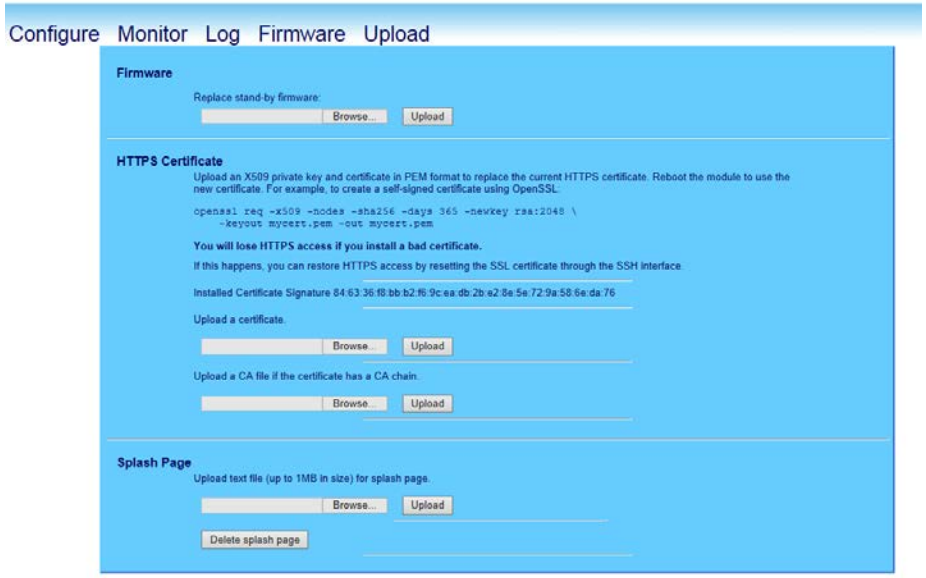
Firmware updates for the TRANSEC Module (also referred to in front panel menu screens as the "Option Card") are not available from the Comtech EF Data Web site, but they may be obtained from Comtech EF Data on an as-needed basis. To obtain these updates, contact Comtech EF Data Customer Support to request access to the modem firmware update files online FTP site. The CEFD Customer Support representative will arrange for full firmware access information and download privileges at that time.

Step	Task
1	**Contact Comtech EF Data Customer Support** during normal business hours to request delivery of the DMD's TRANSEC Module firmware update files. The Customer Support representative will arrange for full firmware access information and download privileges at that time. **Note:** To aid identification, use the **TRANSEC Module HTTPS Interface > Firmware Info** to see the Bootrom, Bulk1, and Bulk2 firmware loads information.
2	**Create a temporary folder** (directory) on an external PC (note that the drive letter **c:** is used in this example; any valid writable drive letter can be used): • *For Windows Explorer:* Select **File > New > Folder** to create a new folder, and then rename it from "**New Folder**" to "**temp**" or another convenient, unused name. Assuming "**temp**" works, a "*c:\temp*" folder should now be created. • *For Windows Command-line:* Click **Start** on the Windows taskbar, and then click the "**Run...**" icon (or, depending on Windows OS versions *prior* to Windows 95, click the "**MS-DOS Prompt**" icon from the Main Menu). Then, to open a Command-line window… o *For Windows 95 or Windows 98* – Type "**command**". o *For any Windows OS versions <u>later</u> than Windows 98* – Type "**cmd**" *or* "**command**". *Alternately,* from **Start**, select *All Programs > Accessories > Command Prompt.* At the Command-line prompt (**c:\>**), type "**mkdir temp**" or "**md temp**" (without quotes – **mkdir** and **md** stand for *make directory*). This is the same as creating a new folder from Windows Explorer. There should now be a "*c:\temp*" subdirectory created.
3	**Download the correct firmware file** that was obtained from Comtech EF Data Customer Support to this temporary folder. The DMD TRANSEC Module firmware is **FW-0020567x**, where "x" denotes the firmware revision letter.
4	**Extract the file** in the temporary folder on the PC: **Fw-0020567x.bin**, where "x" denotes the revision letter of the module bulk image file.
5	**Confirm that the files have been extracted** to the specified temporary folder on the PC. Using Command-line, type "**cd c:\temp**" to change to the temporary directory created in *Step 2*, then use the "**dir**" command to list the files extracted from the downloaded archive file.
6	**Connect the PC** to the modem's Ethernet via a hub or a switch, or directly to the PC with a crossover cable.

Step	Task
7	**Send a "ping" command** to the TRANSEC Module to verify the connection and communication. *First, determine the IP address of the TRANSEC Module from the front panel:* SELECT: **Configure → Transec → Module IP Address** *menus.* *Then,* using Command-line to "ping" the modem – at the prompt, type "**ping** *xxx.xxx.xxx.xxx*" (where '*xxx.xxx.xxx.xxx*' is the TRANSEC Module's IP address). The results should confirm whether or not the module is connected and communicating.
8	**Initiate a secure Web session** with the DMD TRANSEC Module via its HTTPS Interface. The example uses Internet Explorer Version 7.0. From the PC, type ***https://xxx.xxx.xxx.xxx*** (where "*xxx.xxx.xxx.xxx*" represents the IP address of the TRANSEC Module) into the **Address** area of the Web browser:  To log in to the secure interface, select **Crypto Officer** from the navigation list that is provided in the upper left-hand corner of each page, then click **[Go!]**. When prompted, enter the User Name and Password at the **Login** page:  • Factory Default User Name is **comtech** • Factory Default Password is **comtech**

<table>
<tr><th>Step</th><th>Task</th></tr>
<tr><td>9</td><td>Update the TRANSEC Module bulk firmware:

a) Open the Upload page:



b) In the Firmware section of the page, locate the update file downloaded to the PC during Steps 2 through 4 :

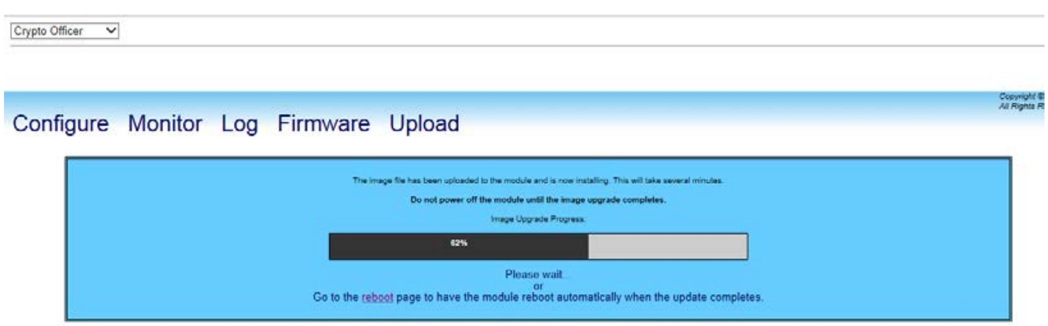
• Click Browse. The Choose File dialog box will open.

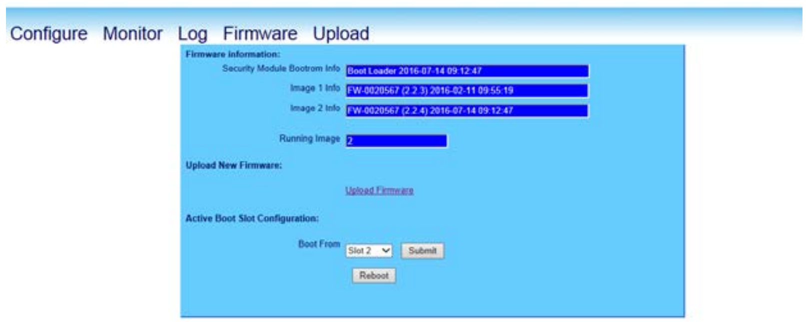
• Locate the folder created for the file download; double-click on the folder name to open the folder.

c) Select the update file, and then click Open. The filename should appear in the Replace stand-by firmware text box.

d) Click Upload to begin the Firmware Application Process.</td></tr>
<tr><td>10</td><td>Wait while the file transfers. After Upload is clicked, the Image Upgrade Process page appears while the TRANSEC Module transfers, and then uploads the update file from the PC.

Allow sufficient time for the file to be uploaded – approximately five minutes is required for the process to be completed. During the upload process, the page displays a transfer progress bar that provides the scrolling percentage of completion. During transfer, the message Please Wait will display.


</td></tr>
</table>

Step	Task
10 (cont)	***Any power failure during this process will result in failure of the TRANSEC Module.*** In the event that an error occurs during the Image Upgrade Process, then a message stating that an error occurred will appear. For troubleshooting purposes, three common reasons for disruption of the Firmware Application Process are: • Power Failure; • Loss of Ethernet signal (e.g., disconnection of Ethernet cable); Attempting to load firmware other than the TRANSEC Module bulk firmware (i.e., FW-0020567x.bin). Upon successful completion of transfer, the progress bar shows **100%**.
11	On the **Firmware** page, **verify** that the newly-uploaded firmware is reported in the proper **Security Module Bulk Info** slot. If not, update the **Active Boot Slot Configuration** by using the drop-down menu to select **Newest** to force the TRANSEC Module to boot using the firmware with the most recent build date. Click **Submit** when done. 
12	Click **Reboot** to boot the TRANSEC Module with the new firmware. The modem will reboot with the new firmware. It will be necessary to restart the DMD TRANSEC Module HTTPS Interface session once the modem has returned online.
13	To load the second image, repeat *Steps 9* through *11*.

BLANK PAGE

Chapter 9. TRANSEC Module SSH CLI Operation

9.1 Overview

This chapter describes the Command Line Interface (CLI) user menu system provided with the DMD Satellite Modem's optional TRANSEC Module via a SSH (Secure Shell) interface.

The SSH interface allows you to change operating parameters similar to those found on the TRANSEC Module HTTPS Interface. You can use the monitoring, configuration and control operations available via the module's HTTPS Interface.

See **Chapter 8 TRANSEC Module HTTPS Intergface**, for detailed information about the command functionality.

The DMD modems equipped with TRANSEC can operate in both standard BLOCK mode (TPC and LDPC) for interoperation with legacy block mode encrypters and in COUNTER mode for interoperation with STANAG "EBEM" modes. The SSH menus are specific to the mode in which the TRANSEC module is configured for.

9.1.1 SSH User Access (Common)

When connecting via SSH, you must have network connectivity to the TRANSEC Module. This connectivity can be via a local LAN, a remote LAN, or via a satellite link from another modem.

As in Chapter 8, PuTTY is used. It is a free and open source terminal emulator application used as a serial console client for SSH, Telnet, rlogin and raw TCP computing protocols.

While the TRANSEC Module CLI main and nested screens are identical across terminal emulator applications, setup can differ slightly. This chapter assumes you are familiar with the preferred SSH interface.

Once connected to the TRANSEC Module via the SSH interface, you must enter a login name and password (the defaults for both are **comtech**). Once a valid login and password are entered, the CLI Main Menu opens. See Figure 9-1.

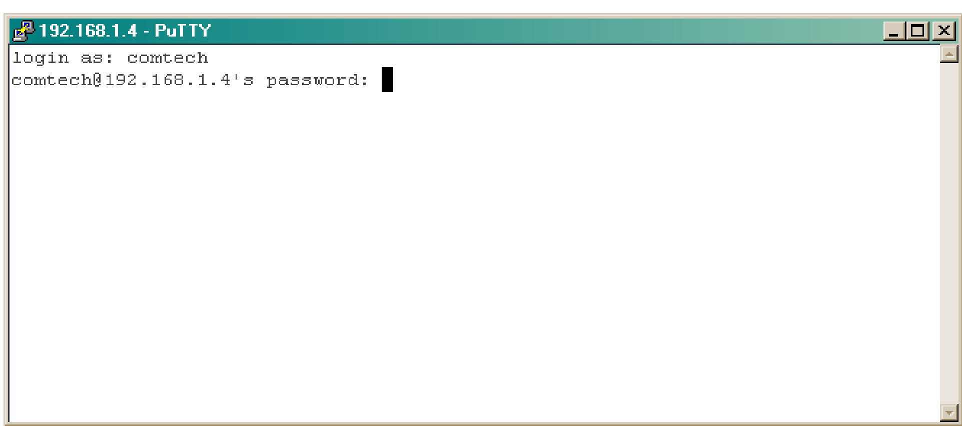


Figure 9-1. Logon Screen Example

9.2 Command Line Interface (Common)

9.2.1 CLI Menu System – Parallel Functionality

The CLI allows you to change operating parameters in a manner similar to that of monitor, configure and control functions using the Web browser menus. See Chapter 8.

9.2.2 CLI Menu – Common Information, Navigation, Operation Features

With some exceptions, the screen examples in this chapter use these standards:

Menu Options/Fields	Entry	Description
[Text field example]	[RO]	Typically found in the body of the screen. This means the field is a read-only status/informational message. No user action is required for this item.
Logout of Administration Session	L	Found at the bottom of the screen. Allows you to log out of the SSH session.
Exit Menu	X	Found at the bottom of the screen. Allows you to exit the current menu and return to the parent menu. Alternately, press the **Esc** key to do the same action.

Typically, once any mnemonic is entered, you are prompted to type in a functional selection, an alphanumeric configuration string, or an operational value. This prompt shows at the bottom of the active screen. It is a selection choice and/or a blank prompt (a solid bar), as shown in this example:

```
 Log out of Administration Ses
 Exit Menu...................
SSH:
 0 - Off
 1 - On
enter new value
█
```

If a parameter is rejected for any reason, an error shows at the top of the screen, along with an explanation:

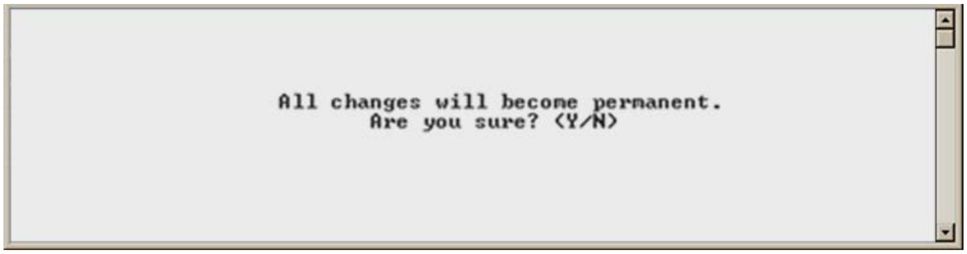
```
                    SSH Console Menu
           <error occurred: invalid selection>
```

```
                 Active Encryption Key Menu
      <error occurred: Input must be at least 32 characters.>
```

9.2.2.1 Save

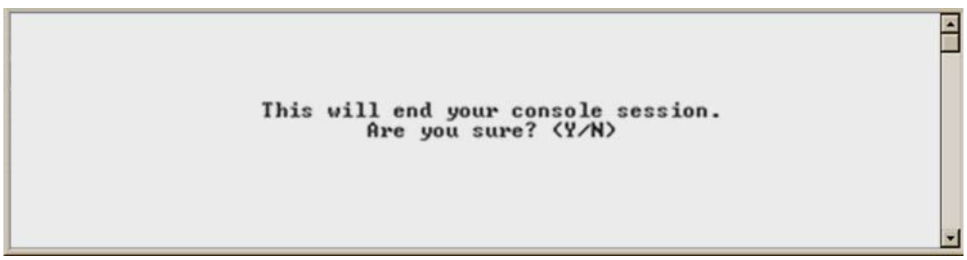
Before you end the CLI session, make sure to save changes to permanent storage. Unsaved changes remain active as long as the modem remains in operation; however, unsaved changes are lost if, for example, the unit loses power.

Use the **S** command on any menu to save changed parameters. A prompt asks you to confirm that all changes will be permanent:



9.2.2.2 Log out

Use the **L** command to log out of a CLI session. A prompt asks you to confirm that the session should be ended:



9.2.3 BLOCK Mode Menu

The **Main Menu** is the CLI's primary navigation screen. All selections open submenus, as shown in Table 9-1.

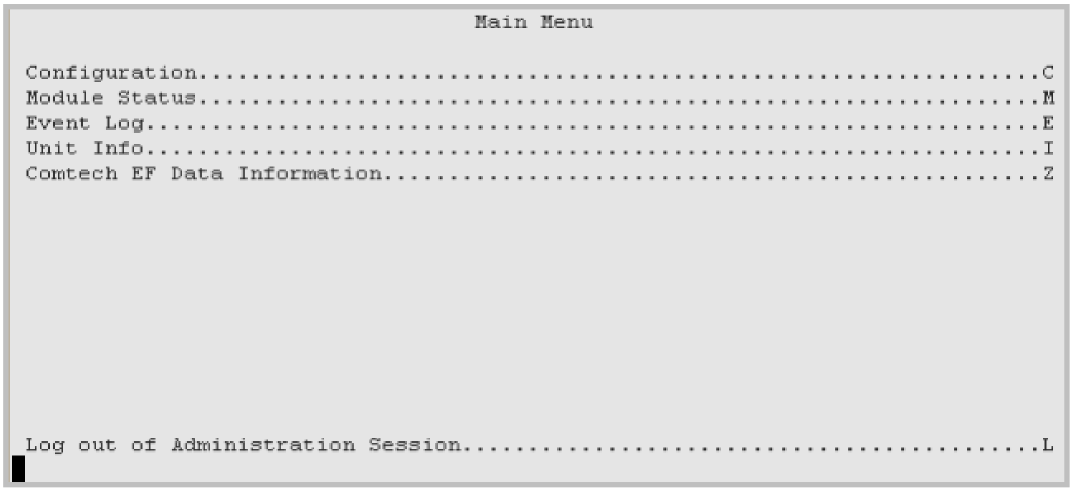
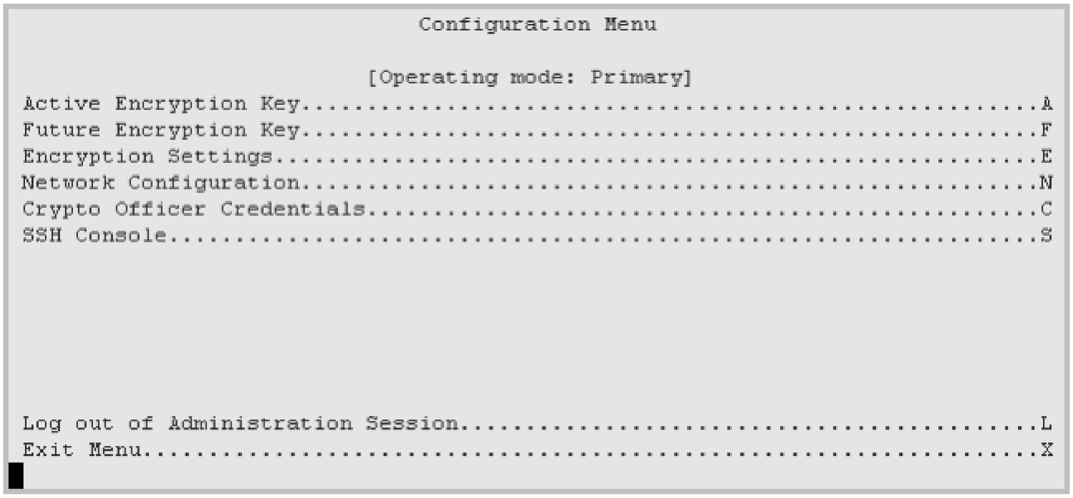


Figure 9-2. Main Menu Example (Block Mode)

Table 9-1. CLI Submenus (Block Mode)

Submenu	Entry	Function/Description
Configuration	C	The Configuration Menu screen lets you configure the TRANSEC Module encryption features.
Module Status	M	The Module Status screen has no other menus. This read-only screen shows the TRANSEC Module's existing operating parameters.
Event Log	E	Opens the Event Log screen. Use it to monitor and control operational faults and alarms.
Unit Info	I	Opens the Unit Info screen. Use it to to change the firmware bootup settings and system reboot controls.
Comtech EF Data Information	Z	Opens the Comtech EF Data Information screen. It has no other menus. This read-only screen gives customer support contact information.

9.2.3.1 Configuration Menu [C] (Block Mode)


```
                         Configuration Menu

                       [Operating mode: Primary]
Active Encryption Key.....................................................A
Future Encryption Key.....................................................F
Encryption Settings.......................................................E
Network Configuration.....................................................N
Crypto Officer Credentials................................................C
SSH Console...............................................................S






Log out of Administration Session.........................................L
Exit Menu.................................................................X
```

Figure 9-3. Configuration Menu Example (Block Mode)

Table 9-2. Configuration Menu Options (Block Mode)

Menu Options/Fields	Entry	Description
[Operating mode:]	[RO]	Identifies the modem's active Encryption Mode as Primary or Secondary
Active Encryption Key	A	Opens the Active Encryption Key Menu
Future Encryption Key	F	Opens the Future Encryption Key Menu
Encryption Settings	E	Opens the Encryption Menu
Network Configuration	N	Opens the Network Menu
Crypto Officer Credentials	C	Opens the Credentials Menu
SSH Console	S	Opens the SSH Console Menu

9.2.3.1.1 Configuration | Active Encryption Key Menu [A] (Block Mode)

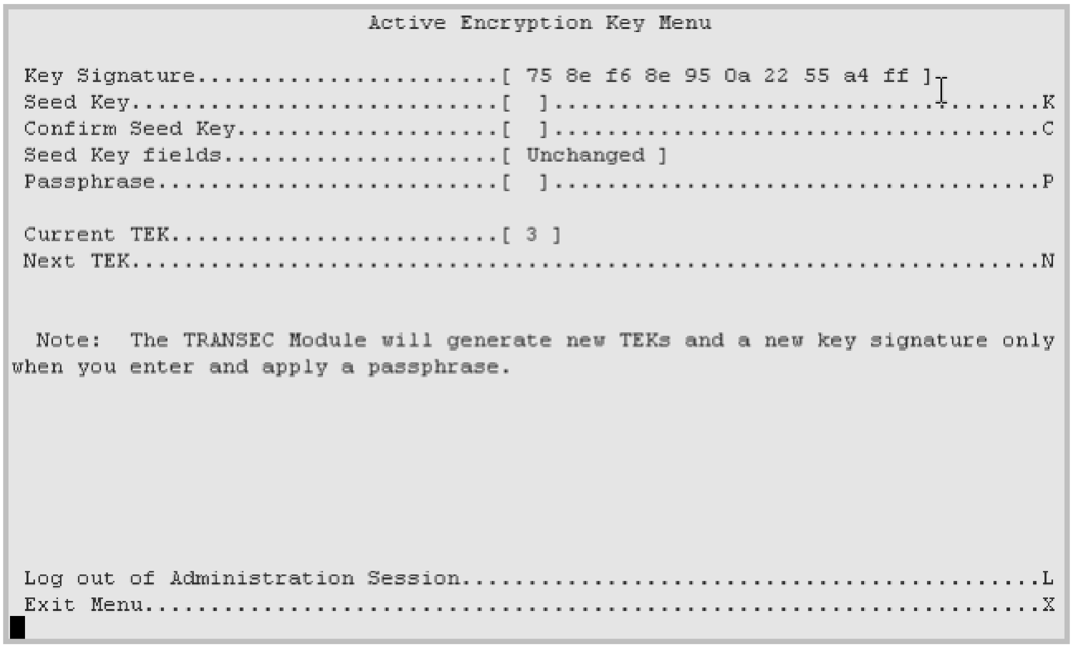
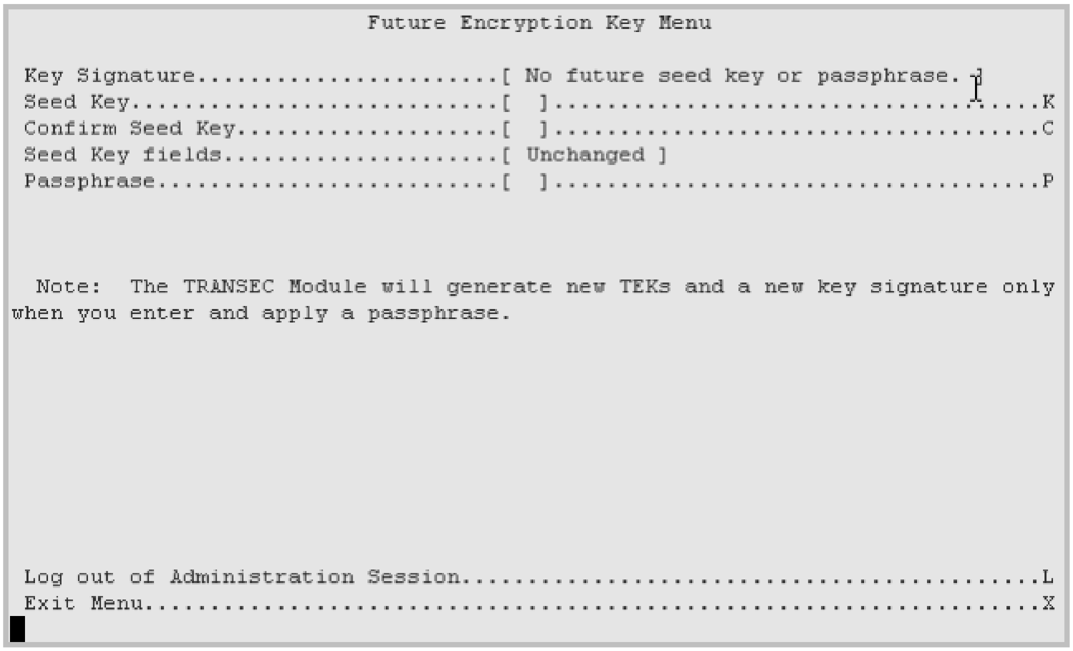


Figure 9-4. Active Encryption Key Menu Example (Block Mode)

Table 9-3. Active Encryption Key Menu Options (Block Mode)

Menu Options/Fields	Entry	Description/User Prompt
[Key Signature]	[RO]	The active **Key Signature** is shown here.
Seed Key	K	Enter a 32-character active **Seed Key** to generate a **TEK** when the TRANSEC Module is given a **Passphrase**.
Confirm Seed Key	C	Confirm the active **Seed Key** .
[Seed Key fields]	[RO]	Shows the status of the active **Seed Key** in real time.
Passphrase	P	Enter a 10- to 32-character **Passphrase** that is combined with the active **Seed Key** to generate **TEKs**.
[Current TEK]	[RO]	Identifies the **Current TEK** (1 through 26).
Next TEK	N	Generates the next available **TEK**; the **Current TEK** field updates accordingly. **Note:** This command is disabled when the module is in secondary mode, and the **Current TEK** mirrors the **TEK** used by the connected primary modem.

9.2.3.1.2 Configuration | Future Encryption Key Menu [F] (Block Mode)



```
                         Future Encryption Key Menu

 Key Signature.......................[ No future seed key or passphrase. ]
 Seed Key............................[  ].................................K
 Confirm Seed Key....................[  ].................................C
 Seed Key fields.....................[ Unchanged ]
 Passphrase..........................[  ].................................P



  Note:  The TRANSEC Module will generate new TEKs and a new key signature only
when you enter and apply a passphrase.









 Log out of Administration Session.......................................L
 Exit Menu...............................................................X
```

Figure 9-5. Future Encryption Key Menu Example (Block Mode)

The **Future Encryption Key Menu** has options or fields that are identical to those on the **Active Encryption Key Menu**. However, all commands are applicable to **Future Encryption Keys** only.

Table 9-4. Future Encryption Key Menu Options (Block Mode)

Menu Options/Fields	Entry	Description/User Prompt
[Key Signature]	[RO]	The future **Key Signature** is shown here.
Seed Key	K	Enter a 32-character future **Seed Key** to generate a **TEK** when the TRANSEC Module is given a **Passphrase.**
Confirm Seed Key	C	Confirm the future **Seed Key** .
[Seed Key fields]	[RO]	Shows the status of the future **Seed Key** in real time.
Passphrase	P	User is prompted to enter a 10- to 32-character **Passphrase** that is combined with the previously entered future **Seed Key** to generate TEKs.
Activate Future Key	I (Not shown)	Activates the future **Seed Key** and resets the **TEK** index to 1. **Note:** This option shows only when all of these are true: a) the module is in primary mode b) you have entered a future **Seed Key** and **Passphrase** c) you have advanced the current **TEK** so that it is in the range of 2 to 26

9.2.3.1.3 Configuration | Encryption Menu [E] (Block Mode)

```
                               Encryption Menu

Encryption.........................[ Disabled ]............................E
Operating Mode.....................[ Primary ]............................O
Frame Length.......................[ 16 ]...................................F

Zeroize All Keys............................................................Z
Run Self Tests..............................................................R









Log out of Administration Session.........................................L
Exit Menu...................................................................X
```

Figure 9-6. Encryption Menu Example (Block Mode)

Table 9-5. Encryption Menu Options (Block Mode)

Menu Options/Fields	Entry	Description
Encryption	E	Prompts you to set the Encryption Mode operation: 0: Disabled 1: Enabled
Operating Mode	O	Prompts you to set the Operating Mode operation: 0: Primary 1: Secondary
Frame Length	F	Specify the length of the AES 256 encryption frame, from 1 to 255.
Zeroize All Keys	Z	Resets all encryption keys in the module's memory and flash to default values.
Run Self Tests	R	Runs the module's cryptographic self tests. If the tests succeed, the module resumes operation. If the tests fail, the module reports an error to the event log. If encryption is enabled and the tests fail, the module stops transmitting data, for protection.

9.2.3.1.4 Configuration | Network Menu [N] (Block Mode)

```
                                  Network Menu

Secure Management IP................[ 192.168.1.4 ].........................M
Subnet Bits.........................[ 24 ]..................................B
Gateway IP..........................[ 0.0.0.0 ]...........................G









Log out of Administration Session..........................................L
Exit Menu..................................................................X
```

Figure 9-7. Network Menu Example (Block Mode)

Table 9-6. Network Menu Options (Block Mode)

Menu Options/Fields	Entry	Description
Secure Management IP	M	Change the TRANSEC Module IP address as necessary. **Note:** If this address is changed, you must repeat the login process for the SSH interface, using the new IP address, to regain access to the TRANSEC Module SSH CLI.
Subnet Bits	B	Change the IP subnet mask of the TRANSEC Module as necessary.
Gateway IP	G	Change the TRANSEC Module IP gateway address as necessary. **Note:** If this address is changed, it must match the subnet of the **Secure Management IP**. If it does not match, then the Gateway IP text box will default to 0.0.0.0.

9.2.3.1.5 Configuration | Credentials Menu [C] (Block Mode)

```
                              Credentials Menu

Crypto Officer User Name............[ comtech ]............................U
Crypto Officer Password.............[  ]...................................P
Confirm Password....................[  ]...................................C
Password fields.....................[ Unchanged ]






















Log out of Administration Session.........................................L
Exit Menu.................................................................X
```

Figure 9-8. Credentials Menu Example (Block Mode)

Table 9-7. Credentials Menu Options (Block Mode)

Menu Options/Fields	Entry	Description
Crypto Officer User Name	U	Enter the desired User Name.
Crypto Officer Password	P	Enter the desired Password.
Confirm Password	C	Confirm the Password just entered.
[Password Fields]	[RO]	Shows the status of the password field in real time.

The Crypto Officer User Name and Password are each restricted to a minimum of 7 and a maximum of 25 characters. Excluded are:

: ASCII Code 58

< ASCII Code 60

> ASCII Code 62

“ ASCII Code 34

~ ASCII Code 126

9.2.3.1.6 Configuration | SSH Console Menu [S] (Block Mode)

```
                                SSH Console Menu

Host Key Signature........[ 94:fb:ef:0f:f3:90:51:d9:67:de:4b:a6:b0:db:f1:37 ]
Generate new host key.....................................................G
SSH................................[ On ]..................................S











Log out of Administration Session.........................................L
Exit Menu.................................................................X
```

Figure 9-9. SSH Console Menu Example (Block Mode)

Table 9-8. SSH Console Menu Options (Block Mode)

Menu Options/Fields	Entry	Description
[Host Key Signature]	[RO]	Shows the key signature, or fingerprint, which helps to identify the TRANSEC Module when connecting through SSH.
Generate new host Key	G	Generate a new host key that uniquely identifies the TRANSEC Module.
SSH	S	Change the Secure Shell Console operation: 0: Off 1: On

9.2.3.2 Module Status Screen [M] (Block Mode)

```
                           Encryption Parameters

AES256 Version          1.39              Operating Mode          Primary
Encryption Frame Length 16                Board Temperature       54 C
                                          TRANSEC Clock Status    OK

        Transmit Status                            Receive Status
Tx Frame Count   0                        Rx Frame Count    0
Tx Status        1                        Rx Status         17
DCM Lock         Locked                   DCM Lock          Locked
Bypass Traffic   Not Detected             Rx CRC Errors     0
Crypto Traffic   Not Detected             Unique Word Lock Unlocked
BIST Done        No                       BIST Done         No





                        Press Any Character to Continue
```

Figure 9-10. Module Status Screen Example (Block Mode)

The read-only **Module Status** screen, shows the operating parameters for the TRANSEC Module Interface:

- AES 256 Version
- Encryption Frame Length
- Operating Mode
- Board Temperature
- TRANSEC Clock Status
- Transmit Status
- Receive Status

Press any key to return to the **Main Menu**.

9.2.3.3 Event Log Menu [E] (Block Mode)

```
                                 Event Log Menu

Logging............................[ On ]..................................M
Logging Level......................[ All Information ].....................E

View Event Log............................................................V
Clear Event Log...........................................................C











Log out of Administration Session.........................................L
Exit Menu.................................................................X
```

Figure 9-11. Event Log Menu Example (Block Mode)

Table 9-9. Event Log Menu Options (Block Mode)

Menu Options/Fields	Entry	Description
Logging	M	Sets recording of events and alarms: 0: Off 1: On
Logging Level	E	Sets the level of information collected for the Events Log: 0: Errors Only 1: Errors and Warning 2: All Information
View Event Log	V	Shows the tally of events logged since the last time the Log was cleared.
Clear Event Log	C	Clears the event log of all messages. Once selected, you see this prompt: This action will clear the event log. Are you sure? (Y/N) Enter Y or N. If Y is entered, the event log is reset to zero entries, and you see this prompt: Event log cleared. Press Any Character to Continue. Press any key to return to the **Event Log Menu**.

9.2.3.4 Unit Info Menu [I] (Block Mode)

See Appendix H for information about the TRANSEC Module firmware update process.

The **Unit Information Menu** provides information to verify the correct firmware is loaded.

```
                              Unit Info Menu

Bootrom Info..............[ FW-0000059 - 17:17:13 06/03/10 ]
Bulk 1 Info...............[ FW-0000058( 1.1.7k ) - 17:23:58 05/01/09 ]
Bulk 2 Info...............[ FW-0000058( 1.1.8f ) - 17:17:13 06/03/10 ]
Boot From.........................[ Slot 2 ]..............................B

Reboot....................................................................R



Log out of Administration Session.........................................L
Exit Menu.................................................................X
```

Figure 9-12. Unit Info Menu Example (Block Mode)

Table 9-10. Unit Information Options (Block Mode)

Menu Options/Fields	Entry	Description
[Bootrom Info]	[RO]	Shows the bootrom firmware.
[Bulk 1 Info]	[RO]	Shows the firmware version loaded into Slot 1.
[Bulk 2 Info]	[RO]	Shows the firmware version loaded into Slot 2.
Boot From	B	Select the firmware boot source for modem operations: 0: Newest. This selects the most current firmware residing in either Slot 1 or Slot 2, automatically. 1: Slot 1. This selects the firmware in the Slot 1 location. 2: Slot 2. This selects the firmware in the Slot 2 location. **Note:** If the **Boot From** selection is changed, you must reboot the modem so that the firmware selection is loaded for operation.
Reboot	R	Reboots the modem. When selected, you see this prompt: This action will reboot the TRANSEC module. Are you sure? (Y/N) Enter **Y** or **N**. If **Y** is entered, the reboot process begins by closing the SSH CLI. THIS MODEM WILL REBOOT IN FIVE SECONDS! BOOTING MODEM… …PLEASE WAIT INITIALIZING MODEM… Once the modem reboots, you must start a new SSH CLI session to resume use of this interface.

9.2.3.5 Comtech EF Data Information screen [Z] (Block Mode)

The **read-only Comtech EF Data Information** screen shows basic contact information for Comtech EF Data Sales and Customer Support.

```
                           Comtech EF Data Information

Sales:
  sales@comtechefdata.com
  Phone: 480-333-2177
  Fax:   480-333-2540

Service:
  cdmipsupport@comtechefdata.com
  Primary:    480-333-2433
  Alternate:  480-282-2850

For product information online, please visit http://www.comtechefdata.com/.

To request a product CD-ROM, call 480-333-2200 or e-mail sales@comtechefdata.com



                        Press Any Character to Continue
```

Figure 9-13. Comtech EF Data Information Screen Example (Block Mode)

Press any key to return to the **Main Menu**.

9.2.4 COUNTER Mode Menu

The Main Menu is the CLI’s primary navigatin screen. All selections open submenus, as shown in Table 9-11.

```
                              TRANSEC 2.2.4

Configure......................................................................C
Monitor........................................................................M
Unit Info......................................................................I
Comtech EF Data Information....................................................Z

Log out of Administration Session..............................................L
```

Figure 9-14. Main Menu Example (Counter Mode)

Table 9-11. CLI Submenus (Counter Mode)

Submenu	Entry	Function/Description
Configuration	C	The Configuration Menu screen lets you configure the TRANSEC Module encryption features.
Module Status	M	The Module Status screen has no other menus. This read-only screen shows the TRANSEC Module’s existing operating parameters.
Unit Info	I	Opens the Unit Info screen. Use it to to change the firmware bootup settings and system reboot controls.
Comtech EF Data Information	Z	Opens the Comtech EF Data Information screen. It has no other menus. This read-only screen gives customer support contact information.

9.2.4.1 Configuration Menu [C] (Counter Mode)

```
                              Configuration Menu

Encryption Control.........................................................E
Network Configuration......................................................N
Crypto Officer Credentials.................................................C
HTTPS Configuration........................................................H
SSH Console................................................................S










Log out of Administration Session..........................................L
Exit Menu..................................................................X
```

Table 9-12. Configuration Menu Example (Counter Mode)

Table 9-13. Configuration Menu Options (Counter Mode)

Menu Options/Fields	Entry	Description
Encryption Settings	E	Opens the Encryption Menu
Network Configuration	N	Opens the Network Menu
Crypto Officer Credentials	C	Opens the Credentials Menu
HTTPS Configuration	H	Opens the HTTPS Console Menu
SSH Console	S	Opens the SSH Console Menu

9.2.4.1.1 Configuration | Encryption Menu [E] (Counter Mode)

```
                             Encryption Menu

Hours until rekey..[ 8 ]....................................................M
SMAT...............[ COMTECH EF DATA                          ].............S
EDC................[ 52170 ]

Saved RNG Seed EDC.[ 0 ]
New RNG Seed EDC...[ - ]
New RNG Seed.......[  ].....................................................R

Clear RNG Seed..............................................................C

Zeroize Entire Module.......................................................Z

Log out of Administration Session...........................................L
Exit Menu...................................................................X
```

Figure 9-15. Encryption Menu Example (Counter Mode)

Table 9-14. Encryption Menu Options (Counter Mode)

Menu Options/Fields	Entry	Description/User Prompt
Rekey Timer	M	Hours until the module rekey's with peer
SMAT	S	Enter a 40-character **Shared Message Authentication Token** to exchange secure messages with peer.
RNG Seed	R	Enter a 78 Numeric **Seed Key** used as initial state to generate random numbers via ANSI X9.31 DRNG .
Clear RNG Seed	C	Clears the **Seed Key**.
Zeroize All Keys	Z	Resets all encryption keys in the module's memory and flash to default values.

9.2.4.1.2 Configuration | Network Menu [N]

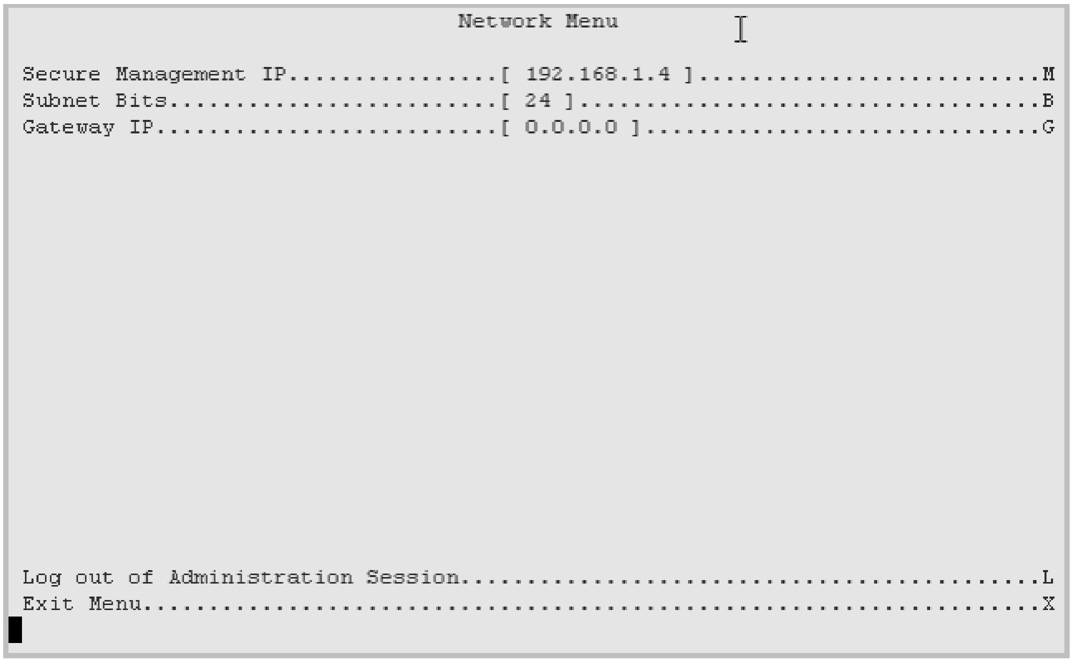


Figure 9-16. Network Menu Example (Counter Mode)

Table 9-15. Network Menu Options (Counter Mode)

Menu Options/Fields	Entry	Description
Secure Management IP	M	Change the TRANSEC Module IP address as necessary. **Note:** If this address is changed, you must repeat the login process for the SSH interface, using the new IP address, to regain access to the TRANSEC Module SSH CLI.
Subnet Bits	B	Change the IP subnet mask of the TRANSEC Module as necessary.
Gateway IP	G	Change the TRANSEC Module IP gateway address as necessary. **Note:** If this address is changed, it must match the subnet of the **Secure Management IP**. If it does not match, then the Gateway IP text box will default to 0.0.0.0.

9.2.4.1.3 Configuration | Credentials Menu [C] (Counter Mode)

```
                                Credentials Menu

Crypto Officer User Name............[ comtech ]............................U
Crypto Officer Password.............[  ]...................................P
Confirm Password....................[  ]...................................C
Password fields.....................[ Unchanged ]


Log out of Administration Session..........................................L
Exit Menu..................................................................X
```

Figure 9-17. Credentials Menu Example (Counter Mode)

Table 9-16. Credentials Menu Example (Counter Mode)

Menu Options/Fields	Entry	Description
Crypto Officer User Name	U	Enter the desired User Name.
Crypto Officer Password	P	Enter the desired Password.
Confirm Password	C	Confirm the Password just entered.
[Password Fields]	[RO]	Shows the status of the password field in real time.

The Crypto Officer User Name and Password are each restricted to a minimum of 7 and a maximum of 25 characters. Excluded are:

- : ASCII Code 58
- < ASCII Code 60
- > ASCII Code 62
- “ ASCII Code 34
- ~ ASCII Code 126

9.2.4.1.4 Configuration | HTTPS Configuration Menu [H] (Counter Mode)

```
                                   HTTPS Menu


SSL Certificate Fingerprint
[ 02:0a:6f:e8:c8:26:99:07:23:88:3f:36:45:16:5f:bd:ed:7f:3a:fd ]
CA File Fingerprint
[ not installed ]
Zeroize Certificate..........................................................Z













Log out of Administration Session............................................L
Exit Menu....................................................................X
```

Figure 9-18. HTTPS Configuration Menu Example (Counter Mode)

Table 9-17. HTTPS Configuration Menu Options (Counter Mode)

Menu Options/Fields	Entry	Description
SSL Certificate Signature	[R0]	Displays the digital fingerprint of the installed SSL certificate, which helps identify the certificate.
CA File Signature	[RO]	Displays the digital fingerprint of the installed CA File, which helps identify the file.
Restore Default	Z	(ZEROIZE) Resets the SSL certificate to the factory default.

9.2.4.1.5 Configuration | SSH Console Menu [S] (Counter Mode)

```
                              SSH Console Menu

Host Key Signature........[ 94:fb:ef:0f:f3:90:51:d9:67:de:4b:a6:b0:db:f1:37 ]
Generate new host key.....................................................G
SSH.................................[ On ].................................S















Log out of Administration Session.........................................L
Exit Menu.................................................................X
```

Figure 9-19. SSH Console Mode Example (Counter Mode)

Table 9-18. SSh Console Menu Options (Counter Mode)

Menu Options/Fields	Entry	Description
[Host Key Signature]	[RO]	Shows the key signature, or fingerprint, which helps to identify the TRANSEC Module when connecting through SSH.
Generate new host Key	G	Generate a new host key that uniquely identifies the TRANSEC Module.
SSH	S	Change the Secure Shell Console operation: 0 – Off 1 – On

9.2.4.2 Module Status Screen [M] (Counter Mode)

```
                              Encryption Parameters

AES256 Version          1.39              Operating Mode         Primary
Encryption Frame Length 16                Board Temperature      54 C
                                          TRANSEC Clock Status   OK

        Transmit Status                           Receive Status
Tx Frame Count   0                        Rx Frame Count    0
Tx Status        1                        Rx Status         17
DCM Lock         Locked                   DCM Lock          Locked
Bypass Traffic   Not Detected             Rx CRC Errors     0
Crypto Traffic   Not Detected             Unique Word Lock Unlocked
BIST Done        No                       BIST Done         No






                        Press Any Character to Continue
```

Figure 9-20. Module Status Screen Example (Counter Mode)

The read-only **Module Status** screen, shows the operating parameters for the TRANSEC Module Interface:

- AES 256 Version
- Encryption Frame Length
- Operating Mode
- Board Temperature
- TRANSEC Clock Status
- Transmit Status
- Receive Status

Press any key to return to the **Main Menu**.

9.2.4.3 Unit Info Menu [I] (Counter Mode)

The **Unit Information Menu** provides information to verify the correct firmware is loaded.

```
                          Unit Info Menu

Bootrom Info...............[ FW-0000059 - 17:17:13 06/03/10 ]
Bulk 1 Info................[ FW-0000058( 1.1.7k ) - 17:23:58 05/01/09 ]
Bulk 2 Info................[ FW-0000058( 1.1.8f ) - 17:17:13 06/03/10 ]
Boot From..........................[ Slot 2 ]..............................B

Reboot.....................................................................R



Log out of Administration Session..........................................L
Exit Menu..................................................................X
```

Figure 9-21. Unit Info Menu Example (Counter Mode)

Table 9-19. Unit Info Menu Example (Counter Mode)

Menu Options/Fields	Entry	Description
[Bootrom Info]	[RO]	Shows the bootrom firmware.
[Bulk 1 Info]	[RO]	Shows the firmware version loaded into Slot 1.
[Bulk 2 Info]	[RO]	Shows the firmware version loaded into Slot 2.
Boot From	B	Select the firmware boot source for modem operations: 0 – Newest selects the most current firmware residing in either Slot 1 or Slot 2, automatically 1 – Slot 1 selects the firmware in the Slot 1 location 2 – Slot 2 selects the firmware in the Slot 2 location Note: If the Boot From selection is changed, you must reboot the modem so that the firmware selection is loaded for operation.
Reboot	R	Reboots the modem. When selected, you see this prompt: This action will reboot the TRANSEC module. Are you sure? (Y/N) Enter Y or N. If Y is entered, the reboot process begins by closing the SSH CLI. THIS MODEM WILL REBOOT IN FIVE SECONDS! BOOTING MODEM… …PLEASE WAIT INITIALIZING MODEM… Once the modem reboots, you must start a new SSH CLI session to resume use of this interface.

9.2.4.4 Comtech EF Data Informatin Screen [Z] (Counter Mode)

The **read-only Comtech EF Data Information** screen shows basic contact information for Comtech EF Data Sales and Customer Support.

```
                          Comtech EF Data Information

Sales:
  sales@comtechefdata.com
  Phone: 480-333-2177
  Fax:   480-333-2540

Service:
  cdmipsupport@comtechefdata.com
  Primary:    480-333-2433
  Alternate:  480-282-2850

For product information online, please visit http://www.comtechefdata.com/.

To request a product CD-ROM, call 480-333-2200 or e-mail sales@comtechefdata.com




                        Press Any Character to Continue
```

Figure 9-22. Comtech EF Data Information Screen Example (Counter Mode)

Press any key to return to the **Main Menu**.

Appendix A. Product Options

A.1 Hardware Options

These optional hardware assemblies are available:

- PL-0000192 FIPs 140-2 TRANSEC Module

A.2 Customized Options

The DMD1050TS can be customized for specific requirements. Most modifications or customizations occur through firmware and or software changes.

These are examples of the customization types available:

- Customized Data Rates
- Customized Scrambler/Descramblers
- Customized Overhead Framing Structures
- Customized Modulation Formats

Contact the CEFD Customer Service or Sales Department for all customization requests.

BLANK PAGE

Appendix B. Carrier Control

B.1 States

The DMD1050TS transmitter turns off the carrier output automatically when the modem finds there is a major alarm. This prevents the carrier from outputting an unknown spectrum and disturbing adjacent carriers. To override this automatic drop of the carrier, mask the alarm that is causing the fault. Masking causes the modulator output spectrum to transmit, even when the fault occurs.

These Carrier Control states are available:

- Carrier **OFF**
- Carrier **ON**
- Carrier **AUTO**
- Carrier **VSAT**
- Carrier **RTS**

B.2 Carrier Off

Modulator output is disabled.

B.3 Carrier On

In the user interface, turn modulator output off before reprogramming modulator functions that can change the output spectrum. After this change, you must enter **Yes** to re-enable output.

When using the terminal, turn the modulator off while reprogramming modulator functions that can change the output spectrum. After the reprogramming, you must turn the output on manually.

B.4 Carrier Auto

In the user interface, turn modulator output off before reprogramming modulator functions that can change the output spectrum. After the change, the output turns on automatically.

When using the terminal, turn the modulator off while reprogramming modulator functions that can change the output spectrum. After the change, the output turns on automatically.

B.5 Carrier VSat

Use the interface to turn Modulator output off before reprogramming modulator functions that can change the output spectrum. After the change, you must enter **Yes** to re-enable output.

When using the terminal, turn the modulator off while reprogramming modulator functions that can change the output spectrum. After reprogramming, you must turn the output on manually.

Additionally, VSat mode disables the modulator’s output if the modem’s demodulator does not have signal lock. When signal lock returns to the demodulator, the modem’s modulator turns the carrier on again.

B.6 Carrier Request to Send (RTS)

Use the interface to turn Modulator output off before reprogramming modulator functions that can change the output spectrum. After the change, you must enter **Yes** to re-enable output.

When using the terminal, turn the modulator off while reprogramming modulator functions that can change the output spectrum. After reprogramming, you must turn the output on manually.

Additionally, Request to Send (RTS) mode enables the modulator’s output based on the RTS lead of the data interface. When RTS is enabled on the data interface, the modulator turns the carrier on. When the RTS is disabled, the modulator turns the carrier off.

Appendix C. TCP/IP Ethernet Setup

C.1 Introduction

The modem supports SNMP, FTP protocols and the Web Browser. Use of the protocols depends on the correct setup of the TCP-IP menus. Use this document only as a guideline for setting up the TCP-IP menus.

Contact the IT manager for guidance to make sure setup is successful. For additional information on the WEB or SNMP configurations and descriptions, see the Remote Protocol Manual (TM117).

C.2 TCP/IP Network Configuration

Each unit requires configuration with the correct network settings. Contact the IT manager for valid IP address mask, modem, server and router IP addresses.

1. Use the dumb terminal System menu.
2. Select the TCP / IP sub menu.
3. Enter the TCP / IP menu.

These sub menus will show, but their order can vary.

C.2.1 Boot Mode Submenu

Use the **BootMode** submenu to select the operating boot mode for the TCP/IP. Several selections are available.

When configuring the modem for the Web Browser, you must set **Boot Mode** to **NON-VOL**.

The DMD1050TS is set with the Boot Mode configured as **Default** when shipped from the factory. Verify that the Boot Mode is **Default**.

To access the unit via the Ethernet port, set the Boot Mode to **IP TEST**. This sets the IP parameter to an accessible address. To use an alternate address, set the Boot Mode to NON-VOL.

As an example, we will use a new modem IP address of 172.018.100.205 for the remaining of the TCP-IP setup procedure. Contact the IT manager for guidance to make sure setup is successful.

C.2.1.1 Default Selection

If the Ethernet interface is not used, select the **Default** mode. IP Address or mask changes are not permitted while in this mode of operation.

The IP addresses are not accessible. These parameters are set, and cannot change, until the **Boot Mode** is changed.

- IP MASK 255.000.000.000
- MODEM IP ADDR 010.000.000.001
- SERVER IP ADDR 010.001.001.001
- ROUTER IP ADDR 010.000.001.001

C.2.1.2 BOOTp Selection

At boot time, if **BOOTp** is enabled, the modem uses the **BOOTp** protocol to get names, masks and IP Addresses of the modem, router and server from the Network Manager automatically. This must be consistent with the tag expected by the user's **BOOTp** server. If **BOOTp** is disabled, the modem ignores the **BOOT SERVER TAG** setting.

C.2.1.3 Non-Vol Selection

NON-VOL allows for setting up all required IP Addresses. It stores the information to the non-volatile memory. The modem restores the saved settings into the correct fields when the power cycles.

C.2.1.4 IP Test Selection

The **IP TEST** selection is similar to the **Default** selection. When **IP TEST** is enabled, these preset parameters are programmed. They do not change until the selection is changed.

- IP Mask 255.255.255.000
- Modem IP Address 192.168.000.238
- Server IP Address 192.168.000.101
- Router IP Address 192.168.000.102
- TRANSEC IP Address 192.168.000.239

To edit these parameters, change the boot mode to **NON-VOL**.

C.2.2 Boot Server Tag Submenu

This allows you to select the operating boot tag when operating in the **BOOTp** mode. The default setting of 206 is selected automatically when the boot mode is set to **DEFAULT** (factory preset mode).

C.2.3 Modem Host Submenu

This shows the operating unit Host name, such as DMD20. It is read only.

C.2.4 IP Address Mask Submenu

This allows you to enter the IP Address Mask. Enter the IP Address Mask based on the Network settings. Contact the IP Administrator if you do not know this address.

Example IP Address Mask: 255.255.000.000

C.2.5 Modem IP Address Submenu

This allows you to enter the Modem's individual network IP Address. Each device on the network must have a unique address. Contact the IP Administrator for the correct address setting.

Example Modem IP Address: 172.018.100.215

C.2.6 Server IP Address Submenu

This allows you to set up the Network Server IP Address. This address is for the Host that optionally boots the DMD20 on power-up, and is the SNMP Trap Server. This IP Address must be consistent with the Modem IP Address. Broadcast and loop back addresses are not allowed.

Example Server IP Address: 172.018.004.250

C.2.7 Router IP Address Submenu

This allows you to set up the Network Router IP Address. If a router exists on the local network, and it is to be used, this address must be consistent with the IP Address Mask and the subnet of the modem. If no router is present, then the address must be set to a foreign address. Broadcast and loop back addresses are not allowed.

Example for router not used: Router IP Address: 010.000.001.001

C.2.8 Modem Ethernet Address Submenu

This shows the Modem (Unit) Ethernet Address. The Modem Ethernet Address is configured at the factory. It is a unique, Radyne equipment identifier address.

Example: 0010650903EB

C.2.9 Ethernet Rate Submenu

This shows the operating Ethernet port data rate. If multiple rates are available, then you can specify the Ethernet port data rate (10BaseT).

Example Ethernet port Data Rate: 10 MBPS/HD

C.3 Network Configuration Summary

If the example information was entered for all the submenus, then here is the TCP/IP configuration summary for a no router specified setup:

1. Boot Mode = NON-VOL
2. Bootp Server Tag = 206
3. Modem Host= DMD1050TS
4. IP Address Mask = 255.255.0.0
5. Modem IP Address = 172.18.100.215
6. Server IP Address = 172.18.4.250
7. Router IP Address = 010.000.001.001
8. Modem Ethernet Address= 001065nnnnnn
9. Ethernet Rate = 10 MBPS/HD

C.4 Ethernet Test

C.4.1 Connect the Modem Ethernet Cable to a Network Link

Connect the Network Switch (Hub) to the Modem Ethernet port (J11) using standard RJ-45 to RJ-45 10BaseT (CAT-5) Cables as shown:

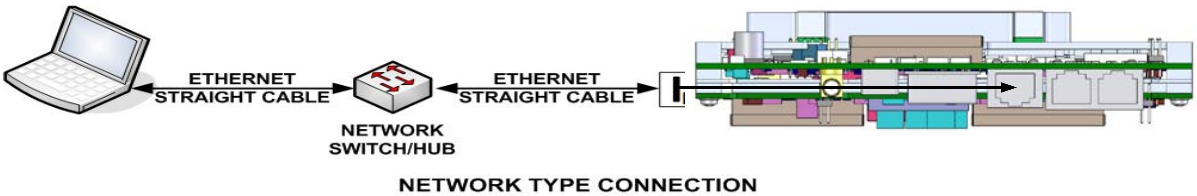
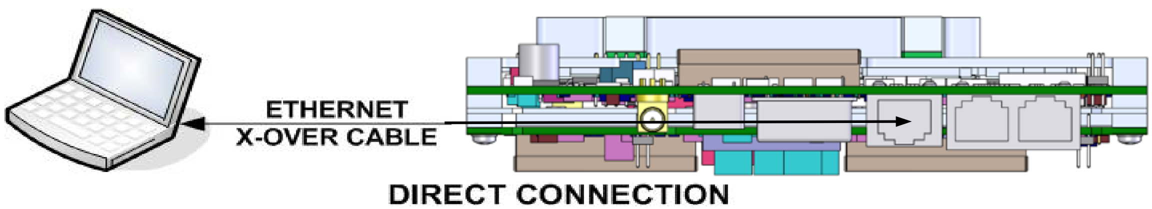


Figure C-1. DMD1050TS Ethernet Network Connection

C.4.2 Connect the Modem Ethernet Cable Directly to a Computer (without a Network)



Make sure the Computer TCP/IP is configured correctly. You can use this setup procedure as a guide.

<u>**For Windows 2000 or XP Classic Only:**</u>

1. Click the **Start** button
2. Select **Settings**
3. Click the **Control Panel** icon
4. Double click the **Network Connections** icon
5. Select the **Local Area Connection** icon for the applicable Ethernet adapter. Usually, it is the first Local Area Connection listed.
6. Double click the **Local Area Connection**
7. Click the **Properties** icon

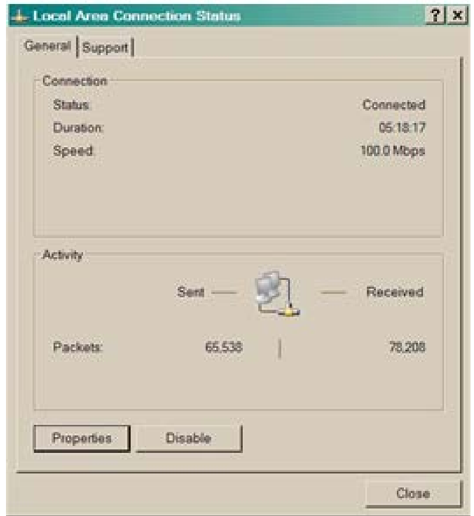


Figure C-2. Local Area Connection Status Box

8. Make sure that the box adjacent to **Internet Protocol (TCP/IP)** is checked
9. Select **Interconnect Protocol (TCP/IP)**
10. Click the **Properties** button

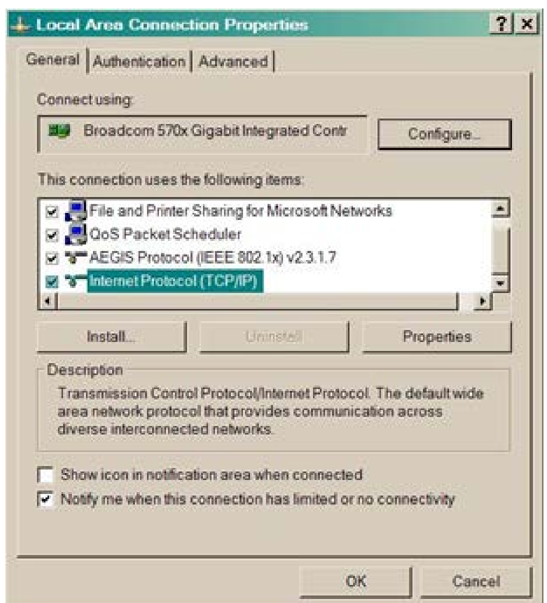


Figure C-3. Local Area Connection Properties Box

11. Select **Use the following IP Address**
12. Enter an **IP Address** that is offset by five or so numbers from the equipment address. The computer and the equipment to which it is connecting cannot have identical addresses.
13. Enter a **Subnet Mask**. This must be identical to the subnet mask programmed into the equipment.
14. Click the **OK** button to complete the PC Configuration.

Some computers require the computer to be restarted for the changes to take effect.

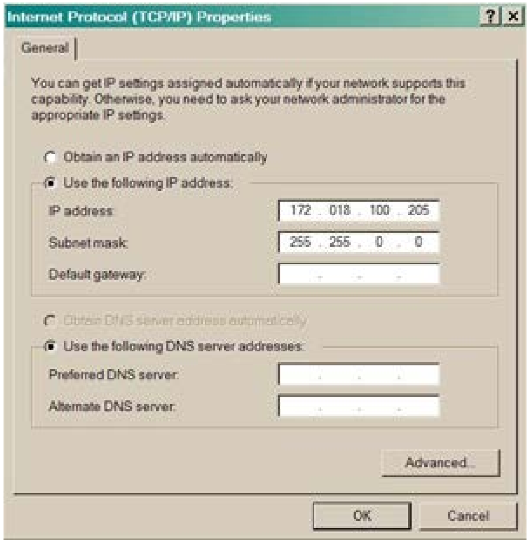


Figure C-4. Internet Protocol (TCP/IP) Properties Box

15. To reconnect the computer to a network, select **Obtain an IP address automatically.**

C.5 Test the Ethernet Connection using the Ping Command (Optional)

To make sure that connectivity and settings are correct, use the **ping** command. The results of the **ping** command will show if the Host (Equipment) is responding correctly.

1. Open an MSDOS command prompt.

```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
```

2. At the command prompt, enter **ping xxx.xx.xxx.xxx**
where xxx.xx.xxx.xxx is the IP Address of the equipment to be tested.

```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\> ping 172.18.100.215
```

3. If the **ping** succeeds, the screen shows:

```
C:\>ping 172.18.100.215

Pinging 172.18.100.215 with 32 bytes of data:

Reply from 172.18.100.215: bytes=32 time=109ms TTL=64
Reply from 172.18.100.215: bytes=32 time<1ms TTL=64
Reply from 172.18.100.215: bytes=32 time=2ms TTL=64
Reply from 172.18.100.215: bytes=32 time=123ms TTL=64

Ping statistics for 172.18.100.215:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 123ms, Average = 58ms
```

4. If the **ping** is unsuccessful, the screen shows:

```
C:\>ping 172.18.100.215

Pinging 172.18.100.215 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 172.18.100.215:
Packets: Sent = 4, Received = 0, Lost = 4 (100%
loss),
```

5. For an unsuccessful response, check these items:
   a. The correct cables are connected to the Ethernet port, and they are secured.
   b. The Link Light is illuminated.
   c. The IP Address matches the Modem’s IP Address.
   d. The Server and Modem are on the same subnet.

BLANK PAGE

Appendix D. Web Browser Setup Guide

D.1 Introduction

This section gives setup instructions to access the Web Browser through the RJ45 Ethernet interface. The Web user interface allows for complete monitoring and control of all modem parameters and functions, via a 10BaseT Ethernet connection.

D.2 Required Items

- Modem
- RJ45 to RJ45 CAT5 Ethernet cable
- Computer
- Default Plug/Jumper if necessary for JP1 and JP2

D.3 Web Interface Setup Guidelines

D.3.1 Prepare the DMD1050TS for Web Setup

The unit leaves the factory with the IP addresses pre-configured to an accessible IP address, known as IP TEST MODE.

If you have difficulty getting access to the Web Browser interface, install the Default Jumper/Plug that will change the IP addresses to an accessible address.

To reset IP addresses, install the Default Plug between pins 1 and 2 on JP1 and JP2. Jumpers are supplied in the connector kit. This changes the IP network setting so you can get access to it.

1. Turn power off to the DMD1050TS.
2. Install the Reset jumper between pins 1 and 2 of JP1 and JP2 connector. See Figure 4-5 for the jumper location.
3. Turn power on for the DMD1050TS.
4. Let it run for two minutes.
5. Turn power off for the DMD1050TS.
6. Remove the Reset jumper from JP1 and JP2.

The IP addresses are configured as listed here:

Boot Modes	IPTEST
Bootp Server Tag:	206
IP Address Mask:	255.255.255.000
Modem IP Address:	192.168.0.238
Server IP Address:	192.168.000.101
Router IP Address:	192.168.000.102
TRANSEC IP Address:	192.168.0.239

To allow the computer to recognize the modem, the Subnet Masks of the computer and modem must match. The IP Address Mask is 255.255.255.000. Contact the network administrator to confirm IP addresses and masks.

1. Turn power on to the unit.
2. Connect the RJ45 cable from the DMD1050TS to the computer/router/bridge, as shown in Figure D-1.

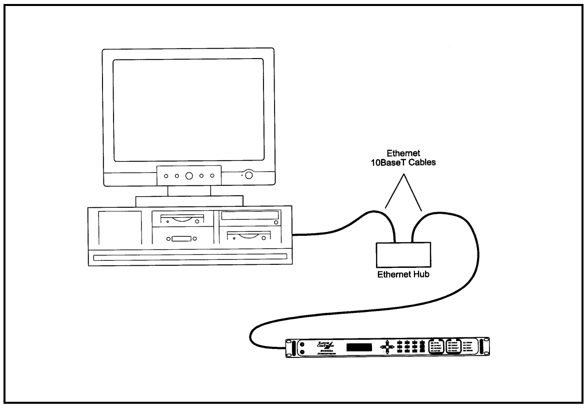


Figure D-1. Ethernet Connection

3. Do a PING test to make sure there is communication between the modem and the computer. Example: ping 192.168.0.238

If everything is functioning correctly, replies from the modem show on the computer screen, along with the time it took to respond.

If unsuccessful, make sure of these items:

a. The cables are secure.

b. The Link Light is lit.

c. The IP Address matches the modem's IP Address.

d. The server and modem are on the same subnet.

4. Open the Web browser on the computer.
5. Enter the IP Address 192.168.0.238 in the address field.
6. Press the Enter key.

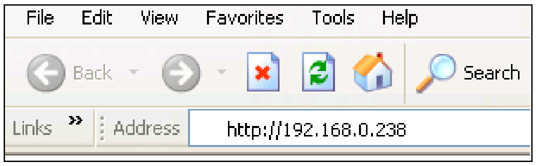


Figure D-2. Internet Browser Address

See Figure D-3. The Introduction page shows general information about the modem, features, capabilities and available options. Technical specifications and product options are available in a PDF format.

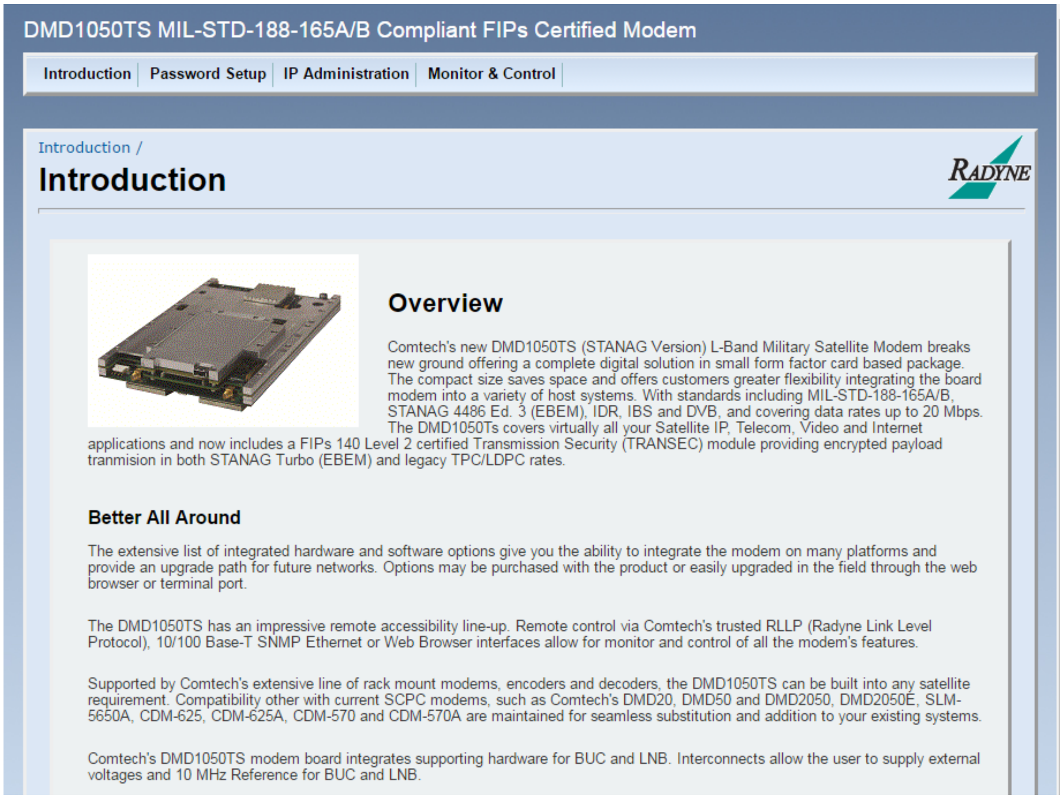


Figure D-3. Web Browser - Modem Introduction Page

Select any tab, and the modem requests authentication via a User Name and Password. The DMD1050TS is configured initially with these defaults:

User Name: **admin**
Password: **admin**

The modem allows for specific administrative privileges for different users. See Section D.5.

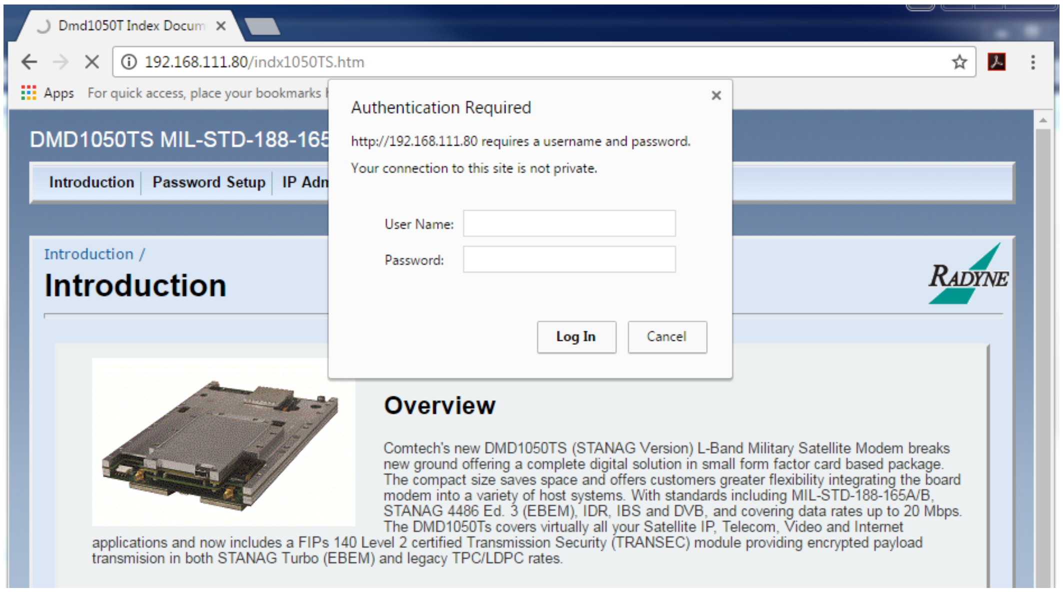


Figure D-4. Password Setup Screen

D.4 IP Network Change from the Initial Web Setup

D.4.1 Configure the modem

The modem must be configured with the correct network settings. Contact your network administrator for an IP address mask, and modem, server and router IP addresses that are valid for your network.

To recognize a subnet, each system in the subnet must have the same subnet mask. Set this field before changing the Modem or Router Address. See Figure D-5.

1. Configure the modem with the new subnet addresses.
    a. From the modem introduction page, click the **IP ADMINISTRATION**.
    b. Enter your **User Name** and **Password** on the logon popup.
    c. Press **Enter**.
    d. Change the **Boot Mode** to **NON-VOL**.
    NON-VOL - stores and uses IP Mask and addresses.
    e. Change IP addresses and subnet mask to the recommended settings.
    f. Click **Save** to accept the changes.
2. Otherwise, click **Cancel** any time to abort changes and reload the existing IP network settings.

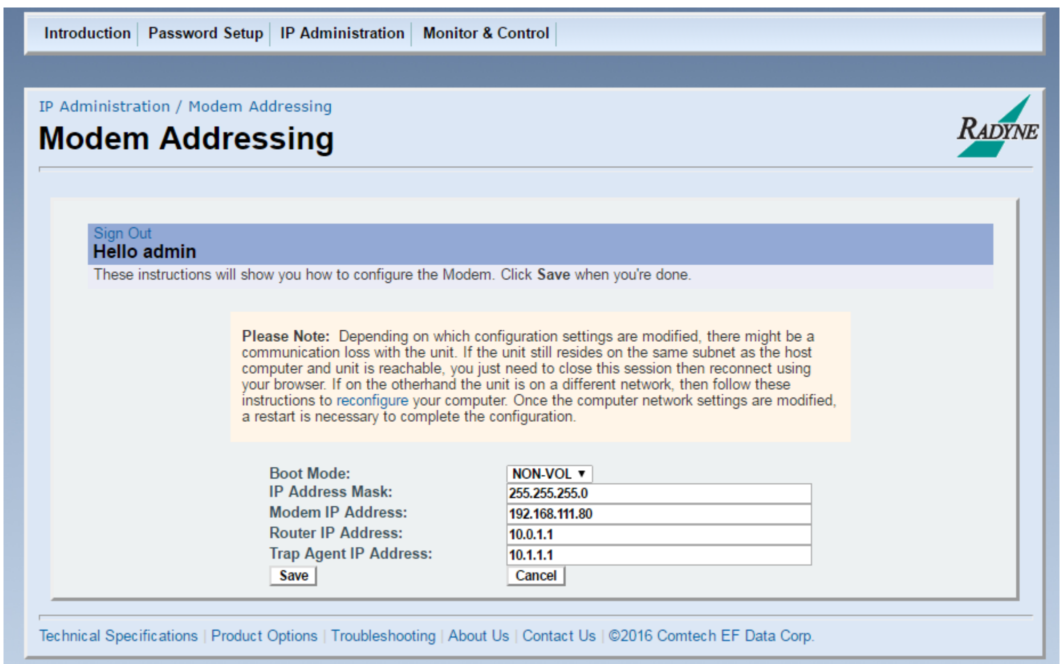


Figure D-5. Modem Addressing Screen

D.4.2 Configure the Computer

The computer must be configured with the correct network settings that were used for the Modem. Contact your network administrator for an IP address mask and modem, server and router IP addresses valid for your network.

To recognize a subnet, each system in the subnet must have the same subnet mask. Set this field after the changes are made to the Modem. See Figure D-6.

1. Configure the computer with the new subnet addresses.
   a. Do a ping test to make sure there is communication between the modem and the computer.
   Example: ping 192.168.0.238
   b. If communication is functioning correctly, replies from the modem show on the computer screen, along with the time it took to respond. Skip to Step 2.
   c. If unsuccessful, make sure of these items:
      i. The cables are secure.
      ii. The Link Light is lit.
      iii. The IP Address matches the Modem's IP Address.
      iv. The Server and Modem are on the same subnet.
2. Open the Web browser on the computer. See Figure D-2.
3. Enter the new IP Address assigned by the network administrator.
4. Press **Enter**.

D.5 Web Users Setup and Configuration Control Options

Authentication and authorization, together with a User database and a security realm, are used to create a secure site.

Users are people that need to have access to the system, and Groups contain users. Often, Groups represent category of users. Access rights and authentication make it possible to restrict/control access to a specific set of web users.

The web user database has three users. The initial default user names are **guest**, **oper** and **admin**. You can change any of the three user names.

The user name can have up to 14 alpha and numeric characters. Enter Alpha characters using the up and down arrow keys. Enter Numeric characters using the number keys.

Web User	Authentication Password	Access Group
guest	guest	GUEST
oper	oper	OPER
admin	admin	ADMIN

Access levels include:

GUEST - Guests can navigate most of the site, and see modem parameter settings.

OPER - Operators can monitor and control modem parameter settings, and change their own passwords.

ADMIN - At this highest access level, the Administrator can monitor and control the modem's parameters, change any user's name and password, and change IP network settings. The **Admin** setting gives access to the entire site.

The **Password** must be memorable, never shared or reused. For better security, passwords must be a minimum length of five printable characters.

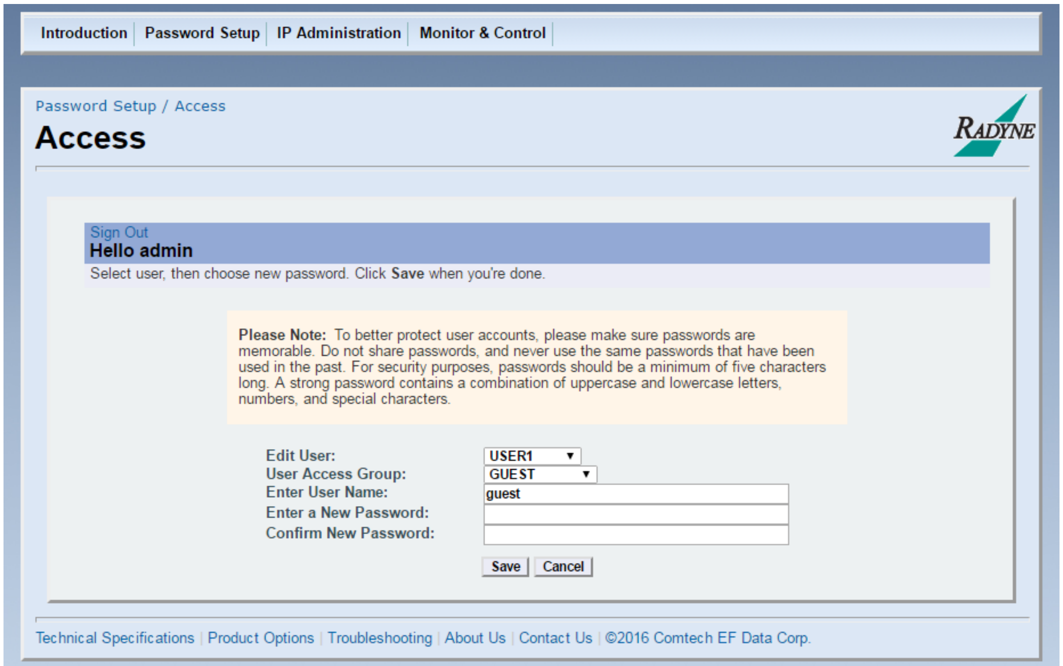


Figure D-6. User Settings/Access Screen

1. On the modem introduction page, click the **ADMINISTRATION** tab.
2. If necessary, enter your **User Name** and **Password** on the logon popup.
3. Press **Enter**.
4. Select **USER1**, **USER2** or **USER3** from the drop-down **Edit User** menu.
   The applicable **User Name** and access rights are updated on the screen.
5. Select a new **User Name** if desired, and **Password**.
6. Confirm the new **Password**.
7. Click **Save**.
8. Otherwise, click **Cancel** at any time to abort the changes and reload the existing user settings.

D.5.1 Change the Password

Users can change their own Passwords. See Section D.5.

D.5.2 Boot Mode Options (Reference only)

Boot Mode selections are based on the network's requirements for setting up the Web browser. Boot Mode options include:

DEFAULT

During initialization (boot up), the modem restores the web settings to the standard IP Mask and addresses supplied by the modem. The modem is taken off the network and is not accessible. The Default settings are listed as follows:

IP Address Mask:	255.000.000.000	(FF.00.00.00 hex)
Modem IP Address:	010.000.000.001	(C0.A8.00.EE hex)
Server IP Address:	010.001.001.001	(0A.01.01.01 hex)
Router IP Address:	010.000.001.001	(0A.00.01.01 hex)

BOOTp

During initialization (boot up), the modem gets the names, masks and IP Addresses of the modem, router and server.

NON-VOL - Stores and uses IP Mask and addresses provided by the user.

IP TEST - Stores and uses IP Mask and addresses to fixed settings as listed as follows:

BOOTp Server Tag:	206	
IP Address Mask:	255.255.255.000	(FF.FF.FF.00 hex)
Modem IP Address:	192.168.0.238	(C0.A8.00.EE)
Server IP Address:	192.168.000.101	(C0.A8.00.65)
Router IP Address:	192.168.000.102	(C0.A8.00.66)

BLANK PAGE

Appendix E. User Interface Connections

E.1 User Interface Connections

Supplied mating connectors can be used, but are not required.

E.2 Connector Kit part numbers

CEFD P/N	Description	Connector Location
1. CA/3446-9	MIL-STD-188-114A	J4
2. CONN0003-040	Shorting/default plug	JP1 & JP2
3. CNR102387-1	Dual Row header 10 Pin	J3
4. CNR102387-6	Dual Row Header 26 Pin	J4
5. TMR102548-6	Receptacle Contacts	J3 & J4
6. CN/MOL04F12	Conn Crimp 4 Terminal Housing	J3 & J16
7. TM/CPF08	Terminal crimp 18-24AWG for 2139	J3 & J16

E.2.1 J3 & J4 Interface Connectors located on PCB

- J3: Async Interface Connector - 10Pin Dual Row: Mfg (Samtec) P/N: TSW-1-05-7-G-D
- J4: Mil 188-114A Connector - 26Pin Dual Row: Mfg (Samtec) P/N: TSW-1-13-7-G-D
- MFG: Samtec connector information
    - TSW = Terminal strip series
    - -1 = .100" Centers
    - 05 or 13 = Number of pins per row
    - 7 = Straight pin version dimensions

Dimensions (inches)			
Style	A	B	C
-07	.100	0.430	0.430

- G = Gold plating
- D = Dual Row.

E.2.2 J3 & J4 Information on Supplied Interface Connectors

J3	Async Interface	10Pin Dual Row:	Mfg (Tyco) P/N: 102387-1
J4	Mil 188-114A	26Pin Dual Row:	Mfg (Tyco) P/N: 102548-6
J16	Receptacle Contacts		Mfg (Tyco) P/N: 1-87309-4

E.2.3 J3 & J16 Information on Supplied Interface Connectors for DC & BUC Power

J16	DC input Power	4 Pin Crimp Terminal Hsg	Mfg (Molex) P/N: 09-50-3041
J3	BUC/LNB input	4 Pin Crimp Terminal Hsg	Mfg (Molex) P/N: 09-50-3041

E.3 Part Number Active08-56-0106

3.96 mm (.156") Pitch KK® Crimp Terminal 2478, 18-24 AWG, Bag, Brass, 0.51µm (20µ") Selective Gold (Au)

E.3.1 Part Details

General	
Status	Active
Product Name	KK®
Molex Series	2478
Gender	Female
Wire Size [AWG]	18, 20, 22, 24
Wire Insulation Diameter	2.79mm (.110") max.
Packaging	Bag

Physical	
Contact	Brass (CuZn)
Contact Material Thickness	0.27mm (.011")
Plating Contact	0.5µm (20µ") Gold (Au) Selective
Plating in Crimp Area	Gold (Au) Flash Overall

Reference	
Mating Pins	1.14mm (.045") Round Pin, 1.14mm (.045") Square Pin
Termination	Good Crimps
990 Catalog Page	J-62
MX01 Catalog Page	D-3, L-52
Old Part Number	2478-1-(550)L

Maximum Current 5.0 A using 18 AWG wire.

Application Tooling for 2139		
Region	Description	Product Number
Americas	Extraction Tool	11-03-0016
Americas	Mini-Mac Applicator	11-18-2236

Appendix F. Ethernet Data Interface

F.1 Introduction

Just like the original Ethernet Bridge, the new Enhanced Ethernet Interface (EEI) makes connecting LANs via satellite easy to do. Simply select Ethernet as the terrestrial interface and connect the LAN into any of the four RJ-45 connectors on the back panel. With its multi-port interface, automatic Learning and Aging, Auto-Crossover, Auto-Polarity, Auto-Negotiation and embedded Quality of Service, the EEI offers true Plug-n-Play connectivity.

The EEI is backward-compatible with the original, and is configured easily for the same bridge-like operation. It allows all higher level protocols like DHCP, UDP, TCP, HTTP and FTP, etc., to pass transparently. Its line speed learning capability causes traffic to be forwarded immediately to the correct ports without unnecessary startup delay.

For more control over traffic, the EEI provides additional QoS controls and new features, such as port based priorities, strict priority queuing and operation in a FIFO-like mode.

The full duplex capability of the standard 10/100 EEI allows it to pass up to 20 Mbps for DMD1050TS, and when installed in a DMD50 or DMD2050, 52 Mbps in each direction over the satellite.

The DMD1050TS supports Radyne HDLC, Comtech HDLC and Managed 570 HDLC modes, offering compatibility with all other Comtech EF Data HDLC modes of operation.

F.2 Point-to-Point Applications

Figure F-1 shows a typical application, connecting a remote office to the corporate headquarters via satellite. Because the EEI places no restrictions on the IP addresses or subnet masks chosen for a particular implementation, there is no lengthy setup required and no need to change any existing network configurations. Simply connect the WAN port of each router to the Modem and the satellite network is up and running.

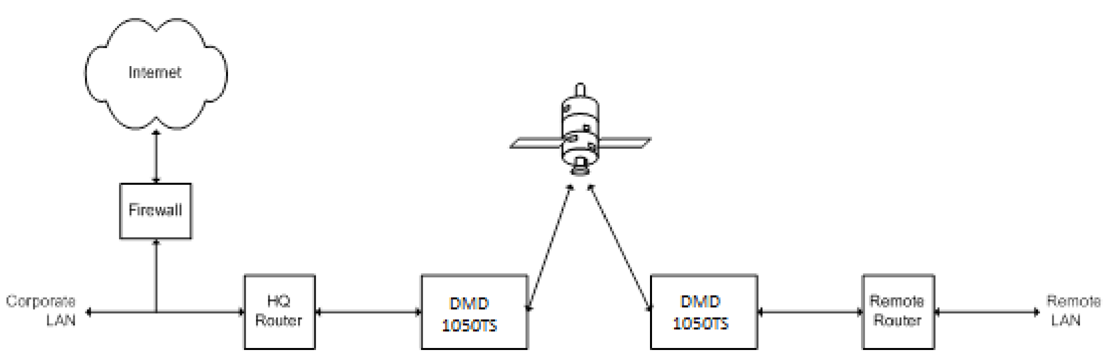


Figure F-1. Point-to-Point Applications

F.3 Transparent Operation

In some situations, the remote site may be simply PCs that need to be connected to a central office for e-mail, file transfers or Internet access. In these cases, it is often best to have all of the network IP addresses assigned dynamically by a Dynamic Host Configuration Protocol (DHCP) server. Because the EEI can be configured to work like a bridge and not like a router, the DHCP Requests and Responses required to bring the remote PCs online are passed across the satellite link transparently. As shown in Figure F-2, the four-port switch interface on the standard 10/100 EEI allows small remote networks to be set up without adding external switches or hubs.

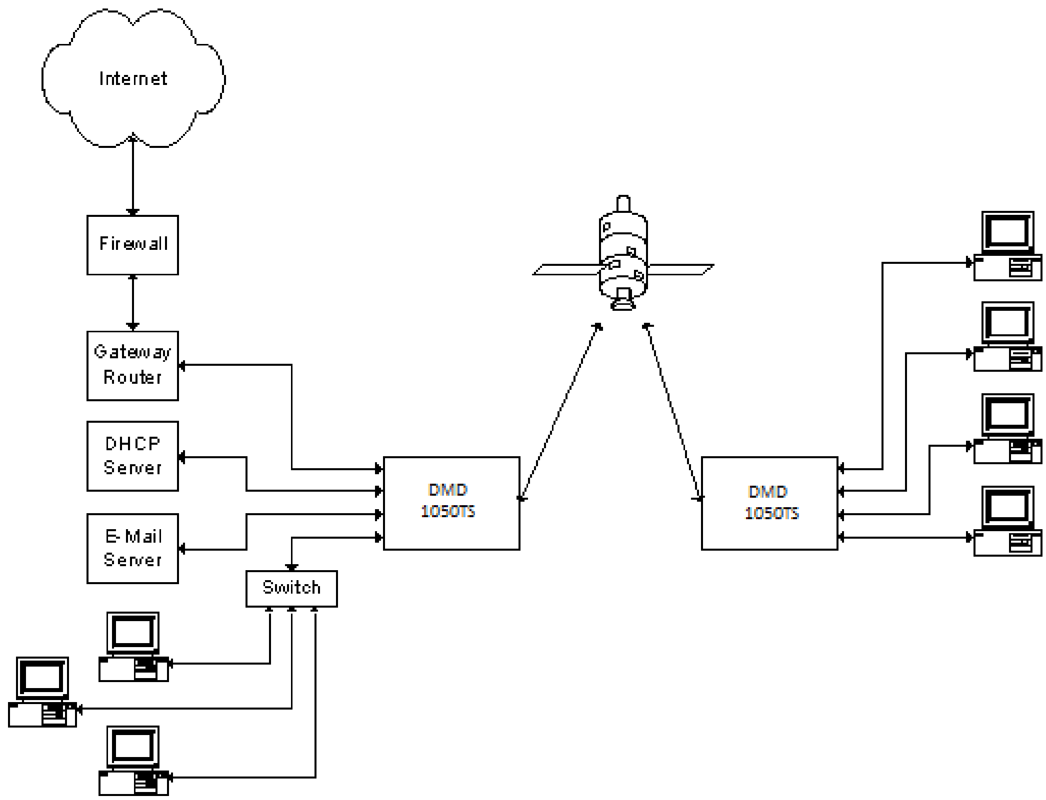


Figure F-2. Central Office Assigns Network Addresses and Controls all Services

F.4 Point-to-Multipoint Applications

In many instances, customers need to connect multiple remote sites to a central hub. Because of the EEI's multi-port interface and daisy chain capability, the hub router does not need to know that there are multiple return paths. As the network grows, you will not need to change the network configuration or buy additional router blades for the hub. Simply add the new hub demodulator to the end of the existing daisy chain. You can bring a new remote online without disrupting the existing traffic.

Figure F-3 shows how the DMD50, DMD20 and MD2401 multi demodulator can be used in the same network. They provide a large outbound carrier and various return carriers, typical of an internet café application.

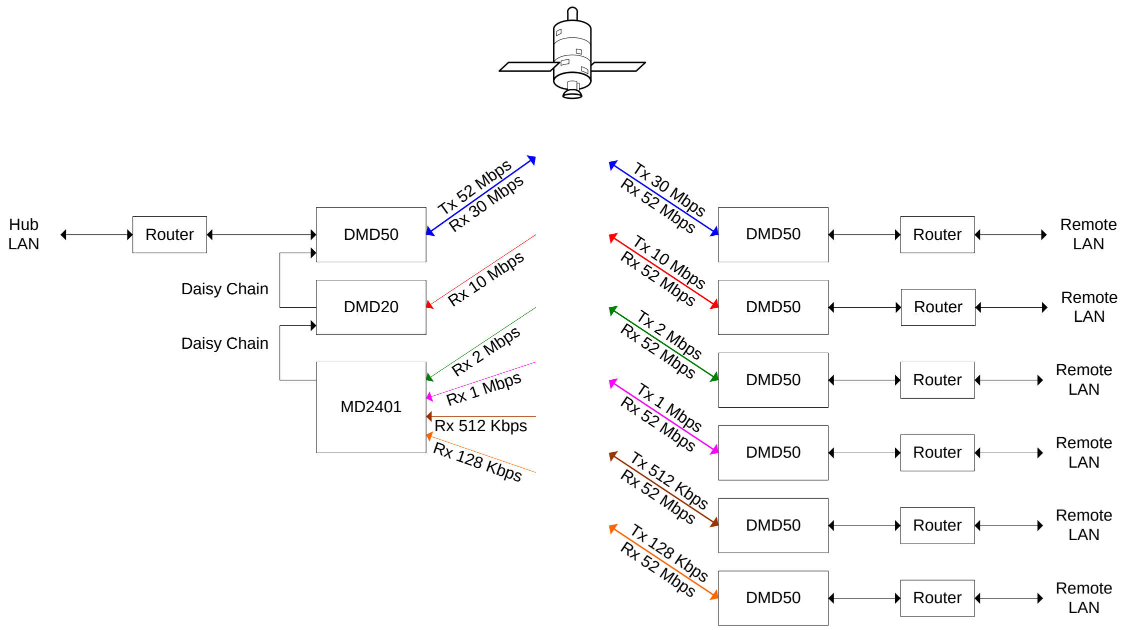


Figure F-3. Point to Multipoint – Large Outbound, Smaller Returns

F.5 High Speed Mesh Applications

As shown in Figure F-4, the unique daisy chain capability of the EEI also lends itself to mesh networks. You can add more nodes to the mesh system without additional router blades or disruption of the existing traffic.

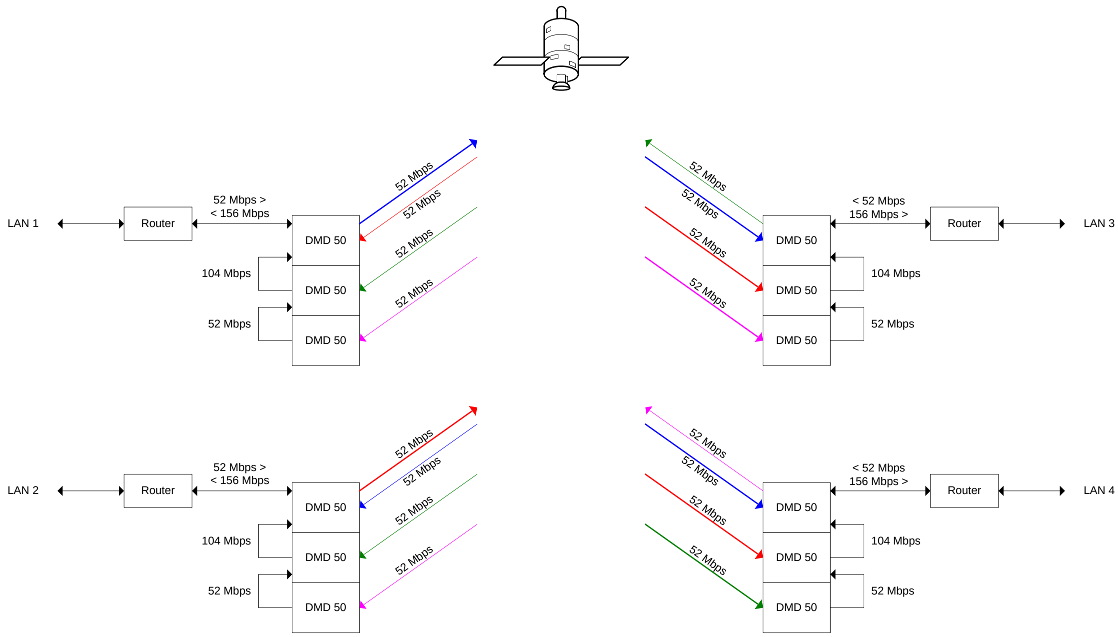


Figure F-4. High Speed Mesh

F.6 Low Speed Mesh Applications

For mesh applications with data rates lower than 5 Mbps, the combination of a DMD20 and an MD2401 Multi-Demodulator can provide a simple 8PSK with Turbo solution that requires no IP configuration or network setup. See Figure F-5.

When configured with the Ethernet option, the MD2401 automatically multiplexes the packets received from the multiple data streams onto a single 10/100 Ethernet port.

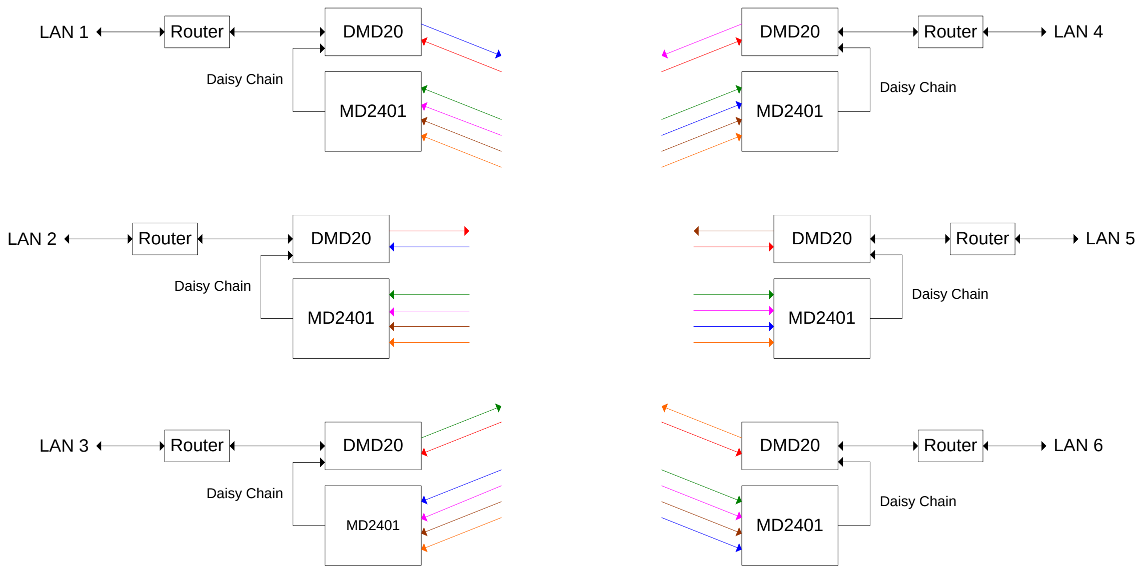


Figure F-5. Low Speed Mesh

F.7 Remote Monitor and Control via SNMP

SNMP is the most widely used protocol for network management available today. It provides a secure, open network standard, whereby you can use a PC with an MIB Browser to monitor and control almost any Cisco router, gateway or Radyne modem.

Because the Enhanced Ethernet Interface offers a multi-port Ethernet interface and daisy chain capability, you can control every modem easily from one central location. This is true for modems in complex point to multi-point systems, as well. This all occurs without extensive network setup or additional equipment at every remote site.

Figure F-6 shows complete Monitor and Control of all Radyne equipment from a centrally located PC at the Hub.

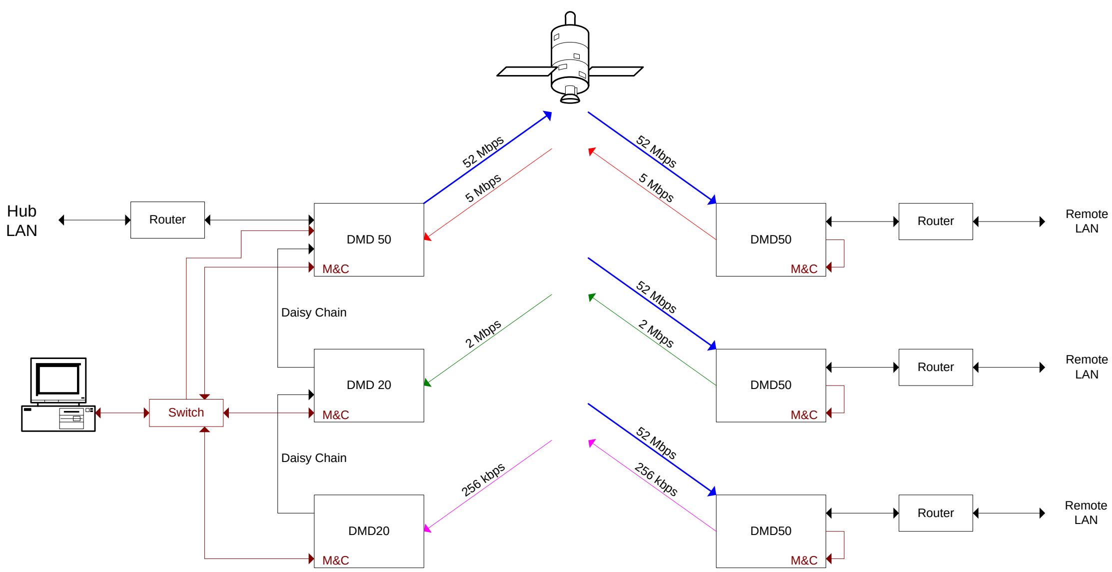


Figure F-6. Remote Monitor and Control

F.8 Enhanced Quality of Service (QoS)

Most networks are comprised of various types of real-time and non real-time services. With its four prioritized output queues, the EEI can insure that higher priority traffic, like voice and network controls, do not wait behind low priority traffic, such as bulk transfers and games. In addition, EEI gives you more control over how the QoS determination is made, and how the queues are processed. In all cases, the QoS determinations and queuing are performed at line speed.

Figure F-7 shows the prioritized queues and the traffic associated with those queues normally.

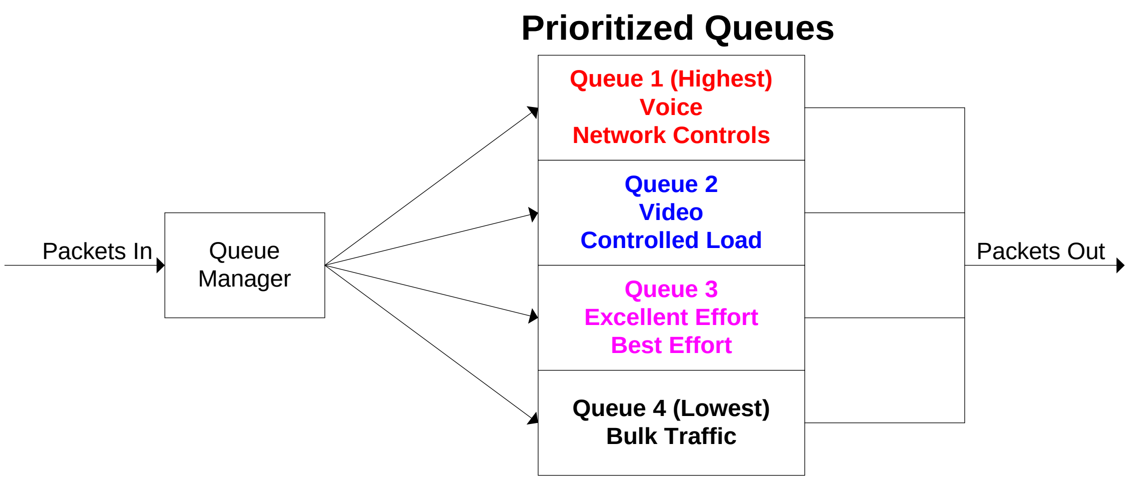


Figure F-7. Prioritized Traffic Queues

F.8.1 Normal QoS

With Normal QoS selected, information contained in the packet determines traffic priority and queuing. This type of QOS is the default on the original Ethernet Bridge. It is what most users require, typically.

Normal QoS uses this packet information:

- When a packet contains an optional IEEE802.3ac tag, the EEI uses the IEEE802.1p priority information embedded in the tag.
- When a packet does not contain the optional tag, priority is determined using either:
  - IPv4 Type of Service / Differentiated Service field
    - or -
  - IPv6 Traffic Class field

F.8.2 Port Based QoS

With Port Based QOS selected, the EEI ignores any QoS information embedded in the headers. Instead, priority and queuing are based on the port on which the traffic arrives. This type of QoS is used typically when the operator wants to control bandwidth allocation based on ports. However, it can be used to create a FIFO-like operation as well, where the data is transmitted in the exact order it is received. With Port Based QoS, Port 1 has the highest priority, and Port 2 on the standard 10/100 EEI.

F.8.3 Fair Weighted Queuing

A fair weighted priority scheme allows higher priority traffic to move quickly through the system, while making sure lower priority traffic does not stall indefinitely. Fair weighted queues are the default on the original Ethernet Bridge. When fair weighted queuing is selected, packets are transmitted at rates of 8, 4, 2 and 1, from the highest to lowest priority queues, respectively.

F.8.4 Strict Priority Queuing

A strict priority scheme means that the highest priority traffic is always transmitted first, even if the lower priority traffic is stalled indefinitely. When Strict Priority queuing is selected, packets in the highest priority queue are transmitted until that queue is empty. Then, packets from the next highest priority queue are transmitted until the queue is empty, or a higher priority packet arrives. If a higher priority packet arrives before a lower priority queue is empty, that packet is the next packet transmitted.

CAUTION
If Strict Priority Queuing is used, data in a lower priority queue might never be transmitted. Use with care.

F.8.5 Satellite Packet Error Checking

Packet error checking is a standard part of any terrestrial Ethernet system. It uses the Cyclic Redundancy Check (CRC) contained in the Ethernet wrapper. When a CRC error is encountered, the packet is discarded by the router, switch or hub in which the error was detected.

A similar method is used over the satellite link, where bit errors result in a corrupted packet with a bad CRC. For the majority of the situations, the standard process of discarding these packets when found is preferred, because the packet can be retransmitted.

However, there are some cases where the end device must receive the erred packet, rather than no packet at all. Examples of two such situations include cryptography use or an end device with added error correction capability. For these customers, the EEI can turn off the satellite packet error checking, and cause packets with bit errors to be output with a valid CRC, so that they pass through any routers or switches between the modem and the receiving device.

For all customers, the EEI maintains and reports satellite link statistics on total packets, erred packets and PER.

F.8.6 Automatic Learning and Aging

The Automatic Learning and Aging function allows the EEI to connect to a network without requiring extensive setup and programming. The learning process makes sure that local LAN traffic stays on the local LAN. Only traffic that is not destined for other equipment on the local LAN is forwarded over the satellite link.

The aging process allows equipment to be shut off, moved or removed from the network completely, without tying up resources or requiring operator intervention. For example, a user might carry a laptop from remote office to remote office, and use it to check e-mail at the corporate office. The EEI handles the apparent movement of the laptop's MAC address from one position in the network to another, automatically.

The learned address database maintained by the EEI can hold up to 1024 MAC addresses. When a new LAN address is learned, it is put in the database and an aging timer is started. The aging timer is reset and restarted every time this learned address communicates. Finally, when the learned address has been inactive for more than 5 minutes, it is removed from the database. All of the processing needed for learning, searching and aging occurs at line speed, without any unnecessary delay at startup.

F.8.7 Internal Buffer and Throttle

The EEI provides 120 Kb of internal data storage for Ethernet traffic buffering. When this buffer is almost full, industry standard backpressure, or an IEEE 802.3x Pause Frame, prevents the buffer from overrun. Together, the two provide an effective rate exchange and throttle between the Ethernet port and the satellite link.

F.8.8 Any Data Rate, Modulation Type, FEC or Application

The EEI can be used with the right DMD20, DMD50 or DMD2050 to provide a transparent satellite connection at data rates ranging from 4.8 kbps to 20 Mbps. EEI can be used with any available FEC and Modulation Type, including DVB-S. EEI offers plug and play connectivity, regardless of the protocols used to transfer data between applications:

- IPv4 or IPv6
- Older standards, such as UDP and TCP
- Newer standards, such as RTP for MPEG Video and HTTPS for secure Internet access
- The latest SCTP usage as a transport mechanization for SIP
- With or without IPSec, regardless of how it is used
- Proprietary acceleration, an open network standard or no acceleration at all
- 10/100BaseT

EEI will pass transparently, any data transmitted via Ethernet, from one end of the satellite link to the other.

BLANK PAGE

Appendix G. Strap Codes

G.1 Introduction

The Strap Code is a key that quickly sets many of the modem parameters. For quick setup, the Strap Codes are very helpful. Use Table G-1. Strap Codes (Dis = Disable), for a list of available strap codes.

When a Strap Code is entered, the modem is configured automatically for the code's corresponding data rate, overhead, code rate, framing, scrambler type and modulation. For example, on the Web interface page, <**Transmit**> <**General/IF**>**,** enter **26** in the **Strap Code:** field. The modem is then configured automatically to the parameters shown in Table G-1, in the highlighted row for Strap Code 26.

Table G-1. Strap Codes (Dis = Disable)

Strap Code (Decimal)	Data Rate (Kbps)	Overhead	Code Rate	Type	Framing Type	Scrambler Type	Reed-Solomon	Modulation	Mode
12	2048	16-15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
24	56	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
33	56	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
34	64	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
36	64	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
40	128	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
48	128	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
65	256	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
66	256	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
68	320	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
72	320	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
80	384	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
96	384	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
129	512	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
130	512	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
132	768	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
136	768	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
144	896	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
44	896	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
7	1344	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
11	1344	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT

Strap Code (Decimal)	Data Rate (Kbps)	Overhead	Code Rate	Type	Framing Type	Scrambler Type	Reed-Solomon	Modulation	Mode
13	1536	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
14	1536	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
19	1544	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
21	1544	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
22	1920	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
25	1920	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
26	2048	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
28	2048	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
37	2368	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
38	2368	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
41	48	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
69	6312	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
70	8448	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
73	3152	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
74	3152	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
76	3264	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
81	3264	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
97	1024	1	1/2	VIT	CNT	V.35 (IESS)	Dis	QPSK	CNT
98	1024	1	3/4	VIT	CNT	V.35 (IESS)	Dis	QPSK	CNT
134	192	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
137	192	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
138	320	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
140	320	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
100	448	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
146	448	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
104	576	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
148	576	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
152	640	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
161	640	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
162	704	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
164	704	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
193	832	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
194	832	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
196	896	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
208	896	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
224	960	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
15	960	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT

Strap Code (Decimal)	Data Rate (Kbps)	Overhead	Code Rate	Type	Framing Type	Scrambler Type	Reed-Solomon	Modulation	Mode
30	1088	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
39	1088	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
43	1152	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
46	1152	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
51	1216	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
53	1216	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
54	1280	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
57	1280	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
58	1344	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
67	1408	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
71	1408	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
75	1472	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
77	1472	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
78	1600	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
83	1600	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
85	1664	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
86	1664	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
89	1728	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
90	1728	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
92	1792	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
99	1792	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
102	1856	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
105	1856	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
106	2048	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
135	1984	16/15	1/2	VIT	IBS	IBS	Dis	QPSK	CNT
139	1984	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT
45	3088	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
141	3088	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
176	4000	1	1/2	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
116	4000	1	3/4	VIT	NONE	V.35 (IESS)	Dis	QPSK	CNT
60	1344	16/15	3/4	VIT	IBS	IBS	Dis	QPSK	CNT

BLANK PAGE

Appendix H. Software Upgrade Procedure

H.1 Software Upgrade Procedure

Use the terminal or the web interface to upgrade the board modem software.

H.2 Terminal Software Upgrade

You can do field upgrades to the modem’s feature set quickly and easily from the Terminal Port.

Purchased upgrades become part of the modem’s permanent configuration.

Demonstration upgrades enable the optional features for a 30-day evaluation period.

H.3 Required Equipment

The satellite modem board is the only equipment necessary for this procedure.

H.4 Upgrade Procedure

H.4.1 Find the available features

1. Use the GUI interface
2. Go to **System > Features**
3. Click **Features**

The screen shows all available features. Checked features are those already purchased and installed.

H.4.2 Find the Unit ID

1. Use the Terminal interface
2. Go to **Main > Features**
3. Find **Feature Id**

The **Feature Id** value on the top line is the 12-digit Unit ID. Example: 1 2 3 4 . 1 2 3 4 . 1 2 3 4

Your Sales Representative will ask you for the Unit ID and the desired feature set upgrades when taking your order.

H.4.3 Purchase the Upgrades

Contact CEFD and order the upgrades. Once the order is processed, you will receive a 12-digit feature set upgrade code. This code works only on the modem for which it was ordered.

H.4.4 Enter the Upgrade Code

CAUTION
Make sure to enter the code correctly. After three unsuccessful attempts to enter a code, the modem locks out the upgrade and demonstration capability. To continue after the lock out, you must cycle power on the modem.

1. Enter the upgrade code from the terminal port:
   a. On the **Enter Selection Number** line, type **45**
   b. Press **Enter**
   c. Enter the new code
   d. Press **Enter**

If the code entered is correct, the **CODE ACCEPTED** message shows. The modem upgrade is finished.

Otherwise, the **INVALID CODE** message shows. Repeat all of Step 1, and make sure the code entered is correct.

H.5 Demonstration Procedure

The procedure for enabling a 30-day demonstration of the options is similar to the procedure used for permanently upgrading the features. However, at the end of 30 days, the demonstration features are disabled automatically.

At the end of the demonstration period, the modem reverts to its permanent configuration automatically. Traffic interruption can occur, even if demonstration features were active. Operator intervention is necessary to restore the data paths.

To avoid this interruption in service, cancel the demonstration before the end of the period. See Section H.6 for instructions.

H.5.1 Find the Available Features

1. Use the GUI interface
2. Go to **System > Features**
3. Click **Features**

The screen shows all available features. Checked features are those already purchased and installed.

H.5.2 Find the Unit ID

1. Use the Terminal interface
2. Go to **Main > Features**
3. Find **Feature Id**

The **Feature Id** value on the top line is the 12-digit Unit ID. Example: 1 2 3 4 . 1 2 3 4 . 1 2 3 4

The Customer Service representative will ask you for the Unit ID and the desired feature set when taking your request for a demonstration.

H.5.3 Request a Demonstration

Contact Customer Service and request a demonstration. Once the request is processed, you will receive a 12-digit demonstration code. This code works once only, on the modem for which it was ordered.

H.5.4 Enter the Demonstration Code

CAUTION
Make sure to enter the code correctly. After three unsuccessful attempts to enter a code, the modem locks out the upgrade and demonstration capability. To continue, you must cycle power on the modem.

1. Enter the demonstration code from the terminal port:
   a. On the **Enter Selection Number** line, type **45**
   b. Press **Enter**
   c. Enter the new code
   d. Press **Enter**

If the code is entered correctly, the **CODE ACCEPTED** message shows.

Otherwise, the **INVALID CODE** message shows. Repeat all of Step 1, and make sure the code entered is correct.

H.6 Cancel Demonstration Mode

You can cancel demonstration mode at any time. The modem then returns to normal operation.

You cannot restart a canceled demonstration. You must get a new demonstration code and start a new demonstration.

H.6.1 Cancel a Demonstration Mode

1. Go to the Terminal Port **Main Menu**
2. Type **19**
3. Press **Enter**
4. On the **Enter Selection Number** line, type **45**
5. Press **Enter**
6. Use the numeric keypad to enter **0000 0000 0000**
7. Press **Enter**

The modem ends the demonstration immediately. The feature set reverts to the permanent configuration.

H.7 Web Browser Software Upgrade

You can upgrade features through the Web Browser interface.

H.8 Monitor and Control

You can monitor and control all modem settings through the Web Browser interface. User rights control your level of access.

1. From the **Modem Introduction** page, click the **MONITOR & CONTROL** tab
2. If prompted, enter your **Username** and **Password**
3. Press **Enter**

The screen shows enabled features.

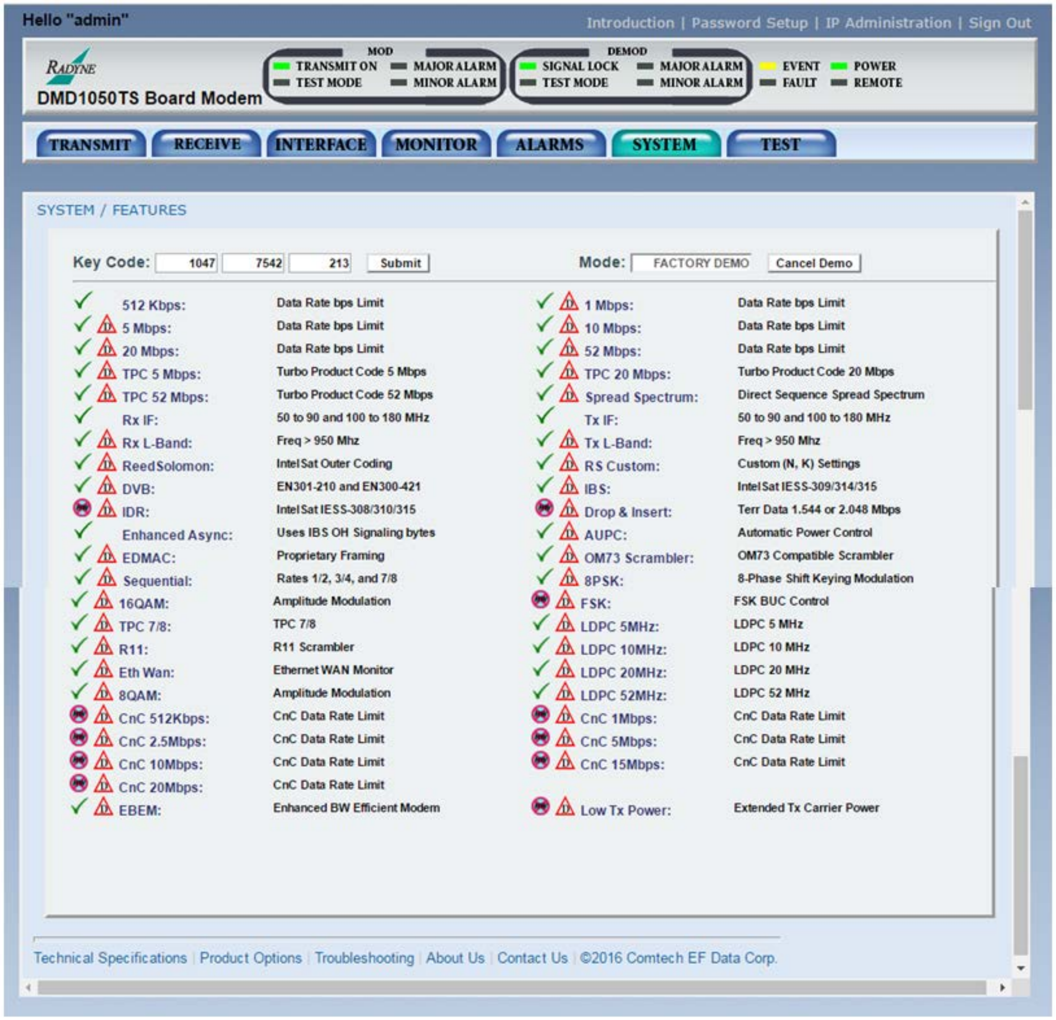


Figure H-1. Web Browser Menu Example

Each feature has symbols that show its status. The symbols include:

	Installed
	No hardware available; Requires hardware for upgrade
	Feature is in Demo Mode and will expire
	Key Code Required
	Call customer service Feature is enabled, but the required hardware is not detected or has failed

BLANK PAGE

Appendix I. Information Throughput Adaptation (ITA) Operation

I.1 Information Throughput Adaptation (ITA) Operation

ITA, also known as Adaptive Coding and Modulation (ACM), allows the DMD1050TS to mitigate downlink rain-fades by means of adapting the throughput of the modem effectively decreasing the modulation and coding by fixing the symbol rate and changing data rate to keep a constant power spectral density. When ITA is operating using the DMD1050TS partner modem indicates the highest possible data rate constrained to a fixed symbol rate.

ITA turns fade margin into increased link capacity – gains of 100% or more are possible, compared to traditional static Frequency Division Multiple Access (FDMA) links. This is accomplished by automatically adapting the modulation type and FEC code rate to give highest possible information throughput. ITA maximizes throughput regardless of link conditions (noise or other impairments, clear sky, rain fade, etc). Initial setup is easy, and then requires no further user intervention. With a static traditional FDMA system, severe rain fading can cause the total loss of the link, and zero throughput. ITA keeps the link up (with lower information throughput) – and can yield much higher system availability. ITA in the DMD1050TS used in conjunction with the EBEM framing unit adjusting the IP traffic in either IP Only or mixed serial IP mode.

I.1.1 Properties of ITA on the DMD1050TS

- The DMD1050TS output power remains constant before, during, and after state changes.
- The DMD1050TS output spectral density remains constant before, during, and after state changes.
- When ITA is enabled, the DMD1050TS will automatically constrain the dynamic bit rate to conform to the limitations of the terrestrial interface that is selected for use in the DMD1050TS configuration.
- ITA can only be enabled when the DMD1050TS is operating in the EBEM mode.
- Operation of ITA and AUPC are mutually exclusive, both cannot be active at the same time.
- The code rate block size will remain fixed for the duration of the ITA operation, independent of the bit rate.
- When the link is set up for ITA, the symbol rate is entered by the operator, at a resolution of 1 sps. The DMD1050TS will automatically calculate the data rate.
- The embedded channel is used for exchanging ITA messages between DMD1050TS modems.

I.1.2 Basic Setup (Example)

The modems will be initially configured in the lowest modulation and coding rate for the characteristic of the link. ITA uses a combination or composite data rate (serial + Ethernet) that will allow selection of any ITA waveforms. This means that all combinations of modulation and code rate have enough Ethernet bandwidth to achieve proper configuration and that all modulation and code rates are of the same block size. The setup will cover each of the four modulations and each of the five code rates by selecting various combinations. Table I-1 is a rank ordering of modulation and coding rates entered by the operator, by Es/No requirement. The bits/Symbol provides an indication of the efficiency of the particular combination selected. The test case ITA waveforms are shown in Table I-1.

Table I-1. ITA Waveforms and Selection

Modulation	Code Rate	Bits/Symbol	Typical Eb/No	Required Es/No	Selected Test Cases
16APSK	0.95	3.800	10.25	16.05	*
8PSK	0.95	2.850	9.31	13.86	
16APSK	0.875	3.500	8.40	13.84	*
8PSK	0.875	2.650	7.50	11.69	
16APSK	0.75	3.000	6.59	11.37	
16APSK	0.667	2.667	5.64	9.90	
8PSK	0.75	2.250	5.64	9.16	*
QPSK	0.95	1.900	6.18	8.96	
8PSK	0.667	2.000	4.70	7.71	
QPSK	0.875	1.750	4.81	7.24	
16APSK	0.5	2.000	4.01	7.02	*
BPSK	0.95	0.950	6.12	5.90	
QPSK	0.75	1.500	3.55	5.31	
8PSK	0.5	1.500	3.16	4.92	
QPSK	0.667	1.330	2.97	4.22	*
BPSK	0.875	0.875	4.78	4.20	
BPSK	0.75	0.750	3.52	2.27	
QPSK	0.5	1.000	2.07	2.07	
BPSK	0.667	0.667	2.95	1.19	*
BPSK	0.5	0.500	2.06	-0.95	

Initial configuration is the lowest modulation and coding combination. In this example, the lowest combination is the BPSK Turbo 2/3 Rate. Selecting a serial rate of 2048k and a symbol rate of 640k allows all possible combinations (except BPSK 1/2, which will be relevant later), to be achieved within a common block size. The initial configuration was selected from the initial modem setup parameters, as shown in Table I-2. The ITA configuration is then entered in the web screens, as shown in Figure I-1 through Figure I-6.

I.1.2.1 Initial DMD1050TS Modem Setup

Table I-2. Initial Modem Setup

FW: F05280-AH28 REV 4.4.28 (7/06 9:47)					
	DMD2050E MENU SETTINGS (UUT)			DMD2050E MENU SETTINGS (Reference)	
MAIN MENU	**MENU OPTION**	**PARAMENTER**	**VALUE**	**PARAMENTER**	**VALUE**
INTERFACE	TX SETUP	TERR INTERFACE	MIL-188-114A	TERR INTERFACE	MIL-188-114A
INTERFACE	RX SETUP	TERR INTERFACE	MIL-188-114A	TERR INTERFACE	MIL-188-114A
MODULATOR	NETWORK-SPEC	NETWORK SPEC	EBEM	NETWORK SPEC	EBEM
MODULATOR	IF	FREQUENCY (MHz)	137.5 MHz	FREQUENCY (MHz)	142.5 MHz
MODULATOR	IF	POWER (dBm)	-25	POWER (dBm)	-25
MODULATOR	IF	CARRIER	ON	CARRIER	ON
MODULATOR	IF	SPECTRUM	NORMAL	SPECTRUM	NORMAL
MODULATOR	IF	MODULATION	BPSK	MODULATION	BPSK
MODULATOR	IF	SPECTRAL MASK	MIL188 165A	SPECTRAL MASK	MIL188 165A
MODULATOR	DATA	DATA RATE (bps)	2048000	DATA RATE (bps)	2048000
MODULATOR	DATA	INNER FEC	TURBO 2/3	INNER FEC	TURBO 2/3
MODULATOR	DATA	IFEC INTERLEAVE	DISABLED	IFEC INTERLEAVE	DISABLED
MODULATOR	DATA	DIFF CODING	DISABLED	DIFF CODING	DISABLED
MODULATOR	DATA	SCRAMBLER SEL	EBEM	SCRAMBLER SEL	EBEM
MODULATOR	DATA	SCRAMBLER CTRL	ENABLED	SCRAMBLER CTRL	ENABLED
MODULATOR	DATA	SAT FRAMING	EBEM	SAT FRAMING	EBEM
MODULATOR	DATA	OVERHEAD CHAN	OFF	OVERHEAD CHAN	OFF
MODULATOR	DATA	EMBEDDED CHAN	ENABLED	EMBEDDED CHAN	ENABLED
MODULATOR	DATA	ENCRYPTION	DISABLED	ENCRYPTION	DISABLED
MODULATOR	DATA	ETH RATE (bps)	640000	ETH RATE (bps)	640000
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
MODULATOR	ITA	ITA OPTION	DISABLED	ITA OPTION	DISABLED
MODULATOR	ITA	(see ITA submenu Setup)	N/A	(see ITA submenu Setup)	N/A
MODULATOR	REED-SOLOMON	ENABLE/DISABLE	DISABLE	ENABLE/DISABLE	DISABLE
DEMODULATOR	NETWORK-SPEC	NETWORK SPEC	EBEM	NETWORK SPEC	EBEM
DEMODULATOR	IF	FREQUENCY (MHz)	142.5 MHz	FREQUENCY (MHz)	137.5 MHz
DEMODULATOR	IF	SPECTRUM	NORMAL	SPECTRUM	NORMAL
DEMODULATOR	IF	MODULATION	BPSK	MODULATION	BPSK
DEMODULATOR	IF	SPECTRAL MASK	MIL188 165A	SPECTRAL MASK	MIL188 165A
DEMODULATOR	DATA	DATA RATE (bps)	2048000	DATA RATE (bps)	2048000
DEMODULATOR	DATA	INNER FEC	TURBO 2/3	INNER FEC	TURBO 2/3
DEMODULATOR	DATA	IFEC INTERLEAVE	DISABLED	IFEC INTERLEAVE	DISABLED
DEMODULATOR	DATA	DIFF CODING	DISABLED	DIFF CODING	DISABLED
DEMODULATOR	DATA	SCRAMBLER SEL	EBEM	SCRAMBLER SEL	EBEM
DEMODULATOR	DATA	SCRAMBLER CTRL	ENABLED	SCRAMBLER CTRL	ENABLED
DEMODULATOR	DATA	SAT FRAMING	EBEM	SAT FRAMING	EBEM
DEMODULATOR	DATA	OVERHEAD CHAN	OFF	OVERHEAD CHAN	OFF
DEMODULATOR	DATA	EMBEDDED CHAN	ENABLED	EMBEDDED CHAN	ENABLED
DEMODULATOR	DATA	ENCRYPTION	DISABLED	ENCRYPTION	DISABLED
DEMODULATOR	DATA	ETH RATE (bps)	640000	ETH RATE (bps)	640000
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
DEMODULATOR	ITA	ITA OPTION	DISABLED	ITA OPTION	DISABLED
DEMODULATOR	ITA	(see ITA submenu Setup)	N/A	(see ITA submenu Setup)	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
DEMODULATOR	REED-SOLOMON	ENABLE/DISABLE	DISABLE	ENABLE/DISABLE	DISABLE
INTERFACE	RX SETUP	BUFF SIZE (msec)	0	BUFF SIZE (msec)	0
INTERFACE	RX SETUP	BUFFER CLK SRC, PRIORITY, SRC DEPTH	RX SAT, 1, 1	BUFFER CLK SRC, PRIORITY, SRC DEPTH	RX SAT, 1, 1
INTERFACE	RX SETUP	BUFFER CLOCK POL	NORMAL	BUFFER CLOCK POL	NORMAL
MONITOR	RX BUFFER RESET	PRESS ENTER TO RECENTER	ENTER	PRESS ENTER TO RECENTER	ENTER

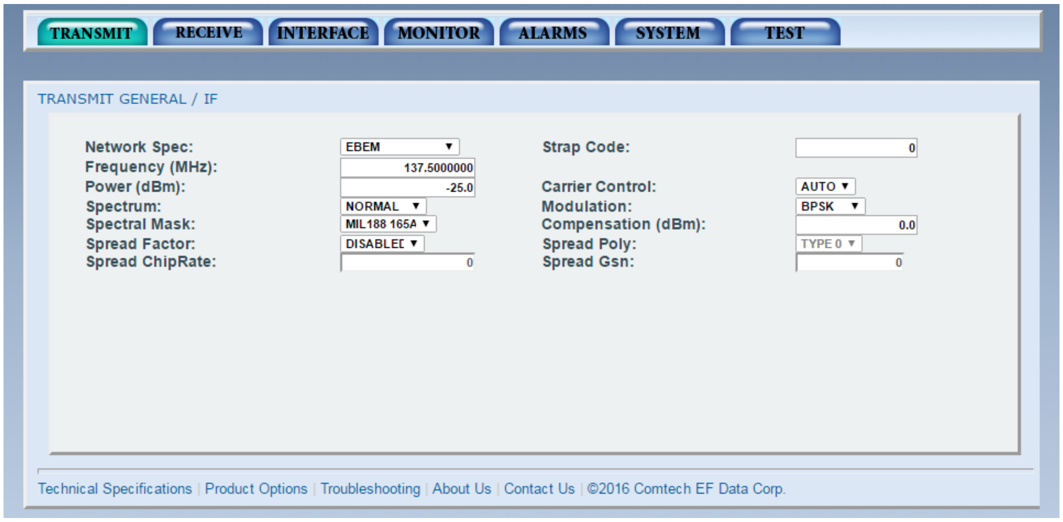


Figure I-1. Initial Setup DMD1050TS, Modulator IF

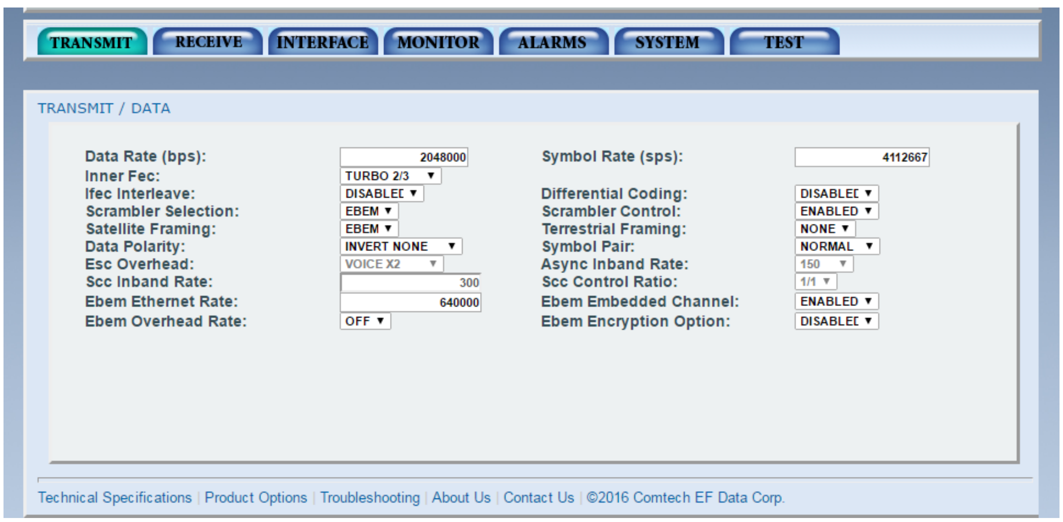


Figure I-2. Initial Setup DMD1050TS, Modulator Data

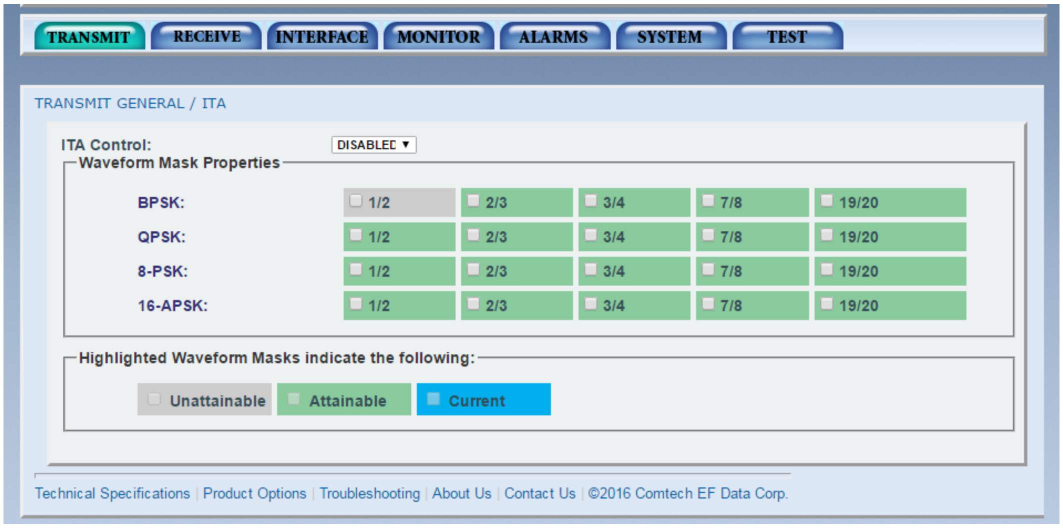


Figure I-3. Initial Setup DMD1050TS, Modulator ITA

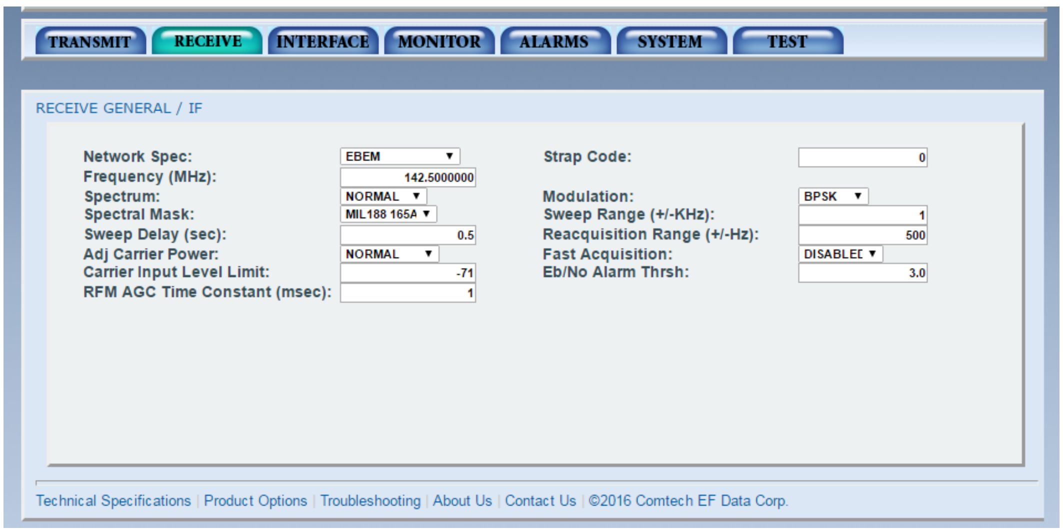


Figure I-4. Initial Setup DMD1050TS, Demodulator IF

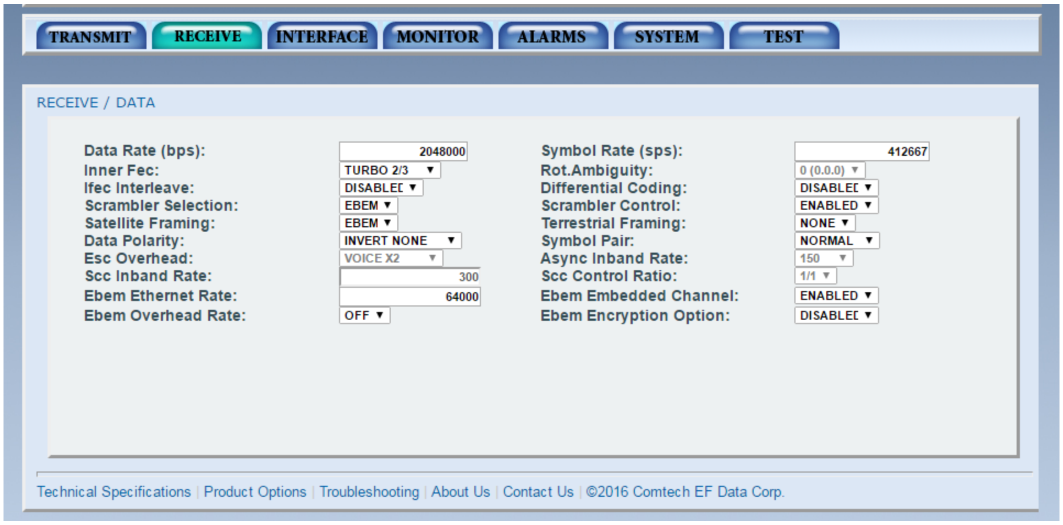


Figure I-5. Initial Setup DMD1050TS, Demodulator Data

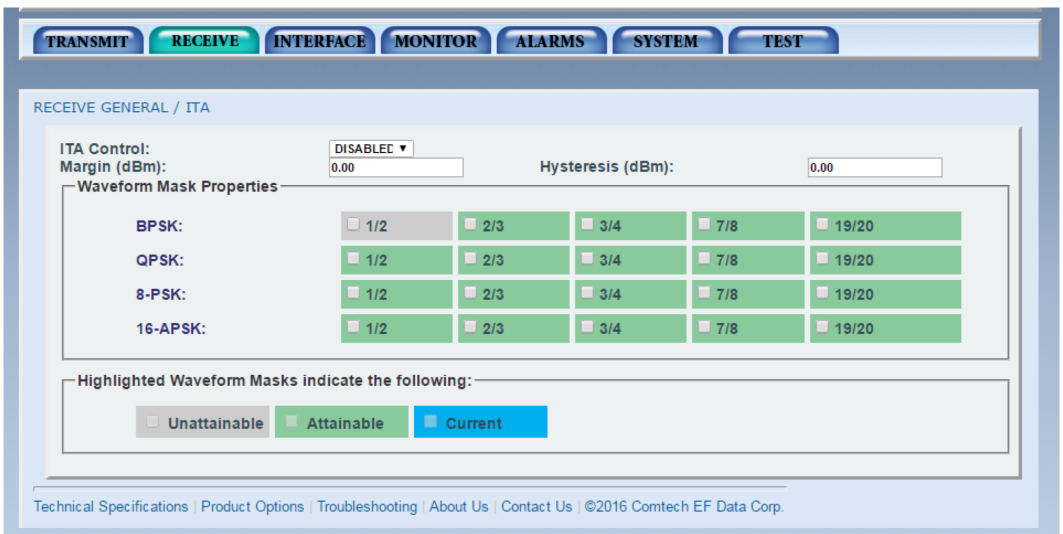


Figure I-6. Initial Setup DMD1050TS, Demodulator ITA

At this point, verify that both serial traffic and Ethernet traffic is properly passing through the system.

Enable and setup the ITA function of the modems as shown in Table I-3. Once the ITA Option has been enabled, the ITA waveform will mask

Table I-3. ITA Setup

FW: F05280-AH28 REV 4.4.28 (7/06 9:47)					
DMD2050E MENU SETTINGS (UUT)				DMD2050E MENU SETTINGS (Reference)	
MAIN MENU	**MENU OPTION**	**PARAMENTER**	**VALUE**	**PARAMENTER**	**VALUE**
INTERFACE	TX SETUP	TERR INTERFACE	MIL-188-114A	TERR INTERFACE	MIL-188-114A
INTERFACE	RX SETUP	TERR INTERFACE	MIL-188-114A	TERR INTERFACE	MIL-188-114A
MODULATOR	NETWORK-SPEC	NETWORK SPEC	EBEM	NETWORK SPEC	EBEM
MODULATOR	IF	FREQUENCY (MHz)	137.5 MHz	FREQUENCY (MHz)	142.5 MHz
MODULATOR	IF	POWER (dBm)	-25	POWER (dBm)	-25
MODULATOR	IF	CARRIER	ON	CARRIER	ON
MODULATOR	IF	SPECTRUM	NORMAL	SPECTRUM	NORMAL
MODULATOR	IF	MODULATION	BPSK	MODULATION	BPSK
MODULATOR	IF	SPECTRAL MASK	MIL188 165A	SPECTRAL MASK	MIL188 165A
MODULATOR	DATA	DATA RATE (bps)	2048000	DATA RATE (bps)	2048000
MODULATOR	DATA	INNER FEC	TURBO 2/3	INNER FEC	TURBO 2/3
MODULATOR	DATA	IFEC INTERLEAVE	DISABLED	IFEC INTERLEAVE	DISABLED
MODULATOR	DATA	DIFF CODING	DISABLED	DIFF CODING	DISABLED
MODULATOR	DATA	SCRAMBLER SEL	EBEM	SCRAMBLER SEL	EBEM
MODULATOR	DATA	SCRAMBLER CTRL	ENABLED	SCRAMBLER CTRL	ENABLED
MODULATOR	DATA	SAT FRAMING	EBEM	SAT FRAMING	EBEM
MODULATOR	DATA	OVERHEAD CHAN	OFF	OVERHEAD CHAN	OFF
MODULATOR	DATA	EMBEDDED CHAN	ENABLED	EMBEDDED CHAN	ENABLED
MODULATOR	DATA	ENCRYPTION	DISABLED	ENCRYPTION	DISABLED
MODULATOR	DATA	ETH RATE (bps)	640000	ETH RATE (bps)	640000
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
MODULATOR	ITA	ITA OPTION	ENABLED	ITA OPTION	ENABLED
MODULATOR	ITA	(see ITA submenu Setup)	N/A	(see ITA submenu Setup)	N/A
MODULATOR	REED-SOLOMON	ENABLE/DISABLE	DISABLE	ENABLE/DISABLE	DISABLE
DEMODULATOR	NETWORK-SPEC	NETWORK SPEC	EBEM	NETWORK SPEC	EBEM
DEMODULATOR	IF	FREQUENCY (MHz)	142.5 MHz	FREQUENCY (MHz)	137.5 MHz
DEMODULATOR	IF	SPECTRUM	NORMAL	SPECTRUM	NORMAL
DEMODULATOR	IF	MODULATION	BPSK	MODULATION	BPSK
DEMODULATOR	IF	SPECTRAL MASK	MIL188 165A	SPECTRAL MASK	MIL188 165A
DEMODULATOR	DATA	DATA RATE (bps)	2048000	DATA RATE (bps)	2048000
DEMODULATOR	DATA	INNER FEC	TURBO 2/3	INNER FEC	TURBO 2/3
DEMODULATOR	DATA	IFEC INTERLEAVE	DISABLED	IFEC INTERLEAVE	DISABLED
DEMODULATOR	DATA	DIFF CODING	DISABLED	DIFF CODING	DISABLED
DEMODULATOR	DATA	SCRAMBLER SEL	EBEM	SCRAMBLER SEL	EBEM
DEMODULATOR	DATA	SCRAMBLER CTRL	ENABLED	SCRAMBLER CTRL	ENABLED
DEMODULATOR	DATA	SAT FRAMING	EBEM	SAT FRAMING	EBEM
DEMODULATOR	DATA	OVERHEAD CHAN	OFF	OVERHEAD CHAN	OFF
DEMODULATOR	DATA	EMBEDDED CHAN	ENABLED	EMBEDDED CHAN	ENABLED
DEMODULATOR	DATA	ENCRYPTION	DISABLED	ENCRYPTION	DISABLED
DEMODULATOR	DATA	ETH RATE (bps)	640000	ETH RATE (bps)	640000
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
DEMODULATOR	ITA	ITA OPTION	ENABLED	ITA OPTION	ENABLED
DEMODULATOR	ITA	(see ITA submenu Setup)	N/A	(see ITA submenu Setup)	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
DEMODULATOR	REED-SOLOMON	ENABLE/DISABLE	DISABLE	ENABLE/DISABLE	DISABLE
INTERFACE	RX SETUP	BUFF SIZE (msec)	0	BUFF SIZE (msec)	0
INTERFACE	RX SETUP	BUFFER CLK SRC, PRIORITY, SRC DEPTH	RX SAT, 1, 1	BUFFER CLK SRC, PRIORITY, SRC DEPTH	RX SAT, 1, 1
INTERFACE	RX SETUP	BUFFER CLOCK POL	NORMAL	BUFFER CLOCK POL	NORMAL
MONITOR	RX BUFFER RESET	PRESS ENTER TO RECENTER	ENTER	PRESS ENTER TO RECENTER	ENTER

The ITA Menu Functions and their descriptions are shown in Table I-4 and Table I-5.

Table I-4. Transmit ITA Functions

Function	ITA Available Options	Description
ITA Option	{DISABLED, ENABLED}	Enable or disable the ITA Function.
BPSK 1/2	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
BPSK 2/3	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
BPSK 3/4	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
BPSK 7/8	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
BPSK 19/20	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
QPSK 1/2	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
QPSK 2/3	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
QPSK 3/4	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
QPSK 7/8	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
QPSK 19/20	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
8PSK 1/2	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
8PSK 2/3	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
8PSK 3/4	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
8PSK 7/8	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
8PSK 19/20	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
16APSK 1/2	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
16APSK 2/3	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
16APSK 3/4	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
16APSK 7/8	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
16APSK 19/20	{NOT SELECTED, SELECTED}	Used to select the mod/code rate

Table I-5. Receive ITA Functions

Function	AUPC Available Options	Description
ITA Option	{DISABLED, ENABLED}	Enable or disable the ITA Function.
BPSK 1/2	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
BPSK 2/3	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
BPSK 3/4	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
BPSK 7/8	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
BPSK 19/20	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
QPSK 1/2	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
QPSK 2/3	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
QPSK 3/4	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
QPSK 7/8	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
QPSK 19/20	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
8PSK 1/2	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
8PSK 2/3	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
8PSK 3/4	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
8PSK 7/8	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
8PSK 19/20	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
16APSK 1/2	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
16APSK 2/3	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
16APSK 3/4	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
16APSK 7/8	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
16APSK 19/20	{NOT SELECTED, SELECTED}	Used to select the mod/code rate
ITA MARGIN		
ITA HYSTERESIS		

Table I-6. ITA Waveform Masks (Modulator UUT)

DMD1050TS Menu Settings (UUT)			
Main Menu	Menu Option	Parameter	Value
MODULATOR	ITA	BPSK 1/2	NOT SELECTSED
MODULATOR	ITA	BPSK 2/3	SELECTED
MODULATOR	ITA	BPSK 3/4	NOT SELECTSED
MODULATOR	ITA	BPSK 7/8	NOT SELECTSED
MODULATOR	ITA	BPSK 19/20	NOT SELECTSED
MODULATOR	ITA	QPSK 1/2	NOT SELECTSED
MODULATOR	ITA	QPSK 2/3	SELECTED
MODULATOR	ITA	QPSK 3/4	NOT SELECTSED
MODULATOR	ITA	QPSK 7/8	NOT SELECTSED
MODULATOR	ITA	QPSK 19/20	NOT SELECTSED
MODULATOR	ITA	8PSK 1/2	NOT SELECTSED
MODULATOR	ITA	8PSK 2/3	NOT SELECTSED
MODULATOR	ITA	8PSK 3/4	SELECTED
MODULATOR	ITA	8PSK 7/8	NOT SELECTSED
MODULATOR	ITA	8PSK 19/20	NOT SELECTSED
MODULATOR	ITA	16APSK 1/2	SELECTED
MODULATOR	ITA	16APSK 2/3	NOT SELECTSED
MODULATOR	ITA	16APSK 3/4	NOT SELECTSED
MODULATOR	ITA	16APSK 7/8	SELECTED
MODULATOR	ITA	16APSK 19/20	SELECTED

Table I-7. ITA Waveform Masks (Demodulator UUT)

DMD1050TS Menu Settings (UUT)			
Main Menu	Menu Option	Parameter	Value
DEMODULATOR	ITA	BPSK 1/2	NOT SELECTSED
DEMODULATOR	ITA	BPSK 2/3	SELECTED
DEMODULATOR	ITA	BPSK 3/4	NOT SELECTSED
DEMODULATOR	ITA	BPSK 7/8	NOT SELECTSED
DEMODULATOR	ITA	BPSK 19/20	NOT SELECTSED
DEMODULATOR	ITA	QPSK 1/2	NOT SELECTSED
DEMODULATOR	ITA	QPSK 2/3	SELECTED
DEMODULATOR	ITA	QPSK 3/4	NOT SELECTSED
DEMODULATOR	ITA	QPSK 7/8	NOT SELECTSED
DEMODULATOR	ITA	QPSK 19/20	NOT SELECTSED
DEMODULATOR	ITA	8PSK 1/2	NOT SELECTSED
DEMODULATOR	ITA	8PSK 2/3	NOT SELECTSED
DEMODULATOR	ITA	8PSK 3/4	SELECTED
DEMODULATOR	ITA	8PSK 7/8	NOT SELECTSED
DEMODULATOR	ITA	8PSK 19/20	NOT SELECTSED
DEMODULATOR	ITA	16APSK 1/2	SELECTED
DEMODULATOR	ITA	16APSK 2/3	NOT SELECTSED
DEMODULATOR	ITA	16APSK 3/4	NOT SELECTSED
DEMODULATOR	ITA	16APSK 7/8	SELECTED
DEMODULATOR	ITA	16APSK 19/20	SELECTED

Table I-8. ITA Waveform Masks (Reference Modulator)

DMD1050TS Menu Settings (Reference)			
Main Menu	Menu Option	Parameter	Value
MODULATOR	ITA	BPSK 1/2	NOT SELECTSED
MODULATOR	ITA	BPSK 2/3	SELECTED
MODULATOR	ITA	BPSK 3/4	NOT SELECTSED
MODULATOR	ITA	BPSK 7/8	NOT SELECTSED
MODULATOR	ITA	BPSK 19/20	NOT SELECTSED
MODULATOR	ITA	QPSK 1/2	NOT SELECTSED
MODULATOR	ITA	QPSK 2/3	SELECTED
MODULATOR	ITA	QPSK 3/4	NOT SELECTSED
MODULATOR	ITA	QPSK 7/8	NOT SELECTSED
MODULATOR	ITA	QPSK 19/20	NOT SELECTSED
MODULATOR	ITA	8PSK 1/2	NOT SELECTSED
MODULATOR	ITA	8PSK 2/3	NOT SELECTSED
MODULATOR	ITA	8PSK 3/4	SELECTED
MODULATOR	ITA	8PSK 7/8	NOT SELECTSED
MODULATOR	ITA	8PSK 19/20	NOT SELECTSED
MODULATOR	ITA	16APSK 1/2	SELECTED
MODULATOR	ITA	16APSK 2/3	NOT SELECTSED
MODULATOR	ITA	16APSK 3/4	NOT SELECTSED
MODULATOR	ITA	16APSK 7/8	SELECTED
MODULATOR	ITA	16APSK 19/20	SELECTED

Table I-9. ITA Waveform Masks (Reference Demodulator)

DMD1050TS Menu Settings (Reference)			
Main Menu	Menu Option	Parameter	Value
MODULATOR	ITA	BPSK 1/2	NOT SELECTSED
MODULATOR	ITA	BPSK 2/3	SELECTED
MODULATOR	ITA	BPSK 3/4	NOT SELECTSED
MODULATOR	ITA	BPSK 7/8	NOT SELECTSED
MODULATOR	ITA	BPSK 19/20	NOT SELECTSED
MODULATOR	ITA	QPSK 1/2	NOT SELECTSED
MODULATOR	ITA	QPSK 2/3	SELECTED
MODULATOR	ITA	QPSK 3/4	NOT SELECTSED
MODULATOR	ITA	QPSK 7/8	NOT SELECTSED
MODULATOR	ITA	QPSK 19/20	NOT SELECTSED
MODULATOR	ITA	8PSK 1/2	NOT SELECTSED
MODULATOR	ITA	8PSK 2/3	NOT SELECTSED
MODULATOR	ITA	8PSK 3/4	SELECTED
MODULATOR	ITA	8PSK 7/8	NOT SELECTSED
MODULATOR	ITA	8PSK 19/20	NOT SELECTSED
MODULATOR	ITA	16APSK 1/2	SELECTED
MODULATOR	ITA	16APSK 2/3	NOT SELECTSED
MODULATOR	ITA	16APSK 3/4	NOT SELECTSED
MODULATOR	ITA	16APSK 7/8	SELECTED
MODULATOR	ITA	16APSK 19/20	SELECTED

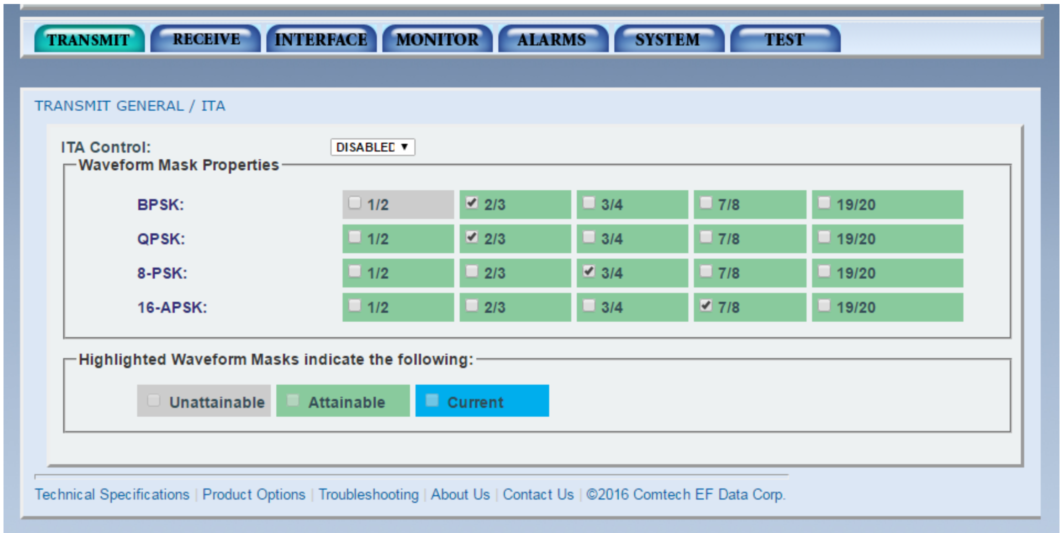


Figure I-7. Initial Setup DMD1050TS, Modulator ITA

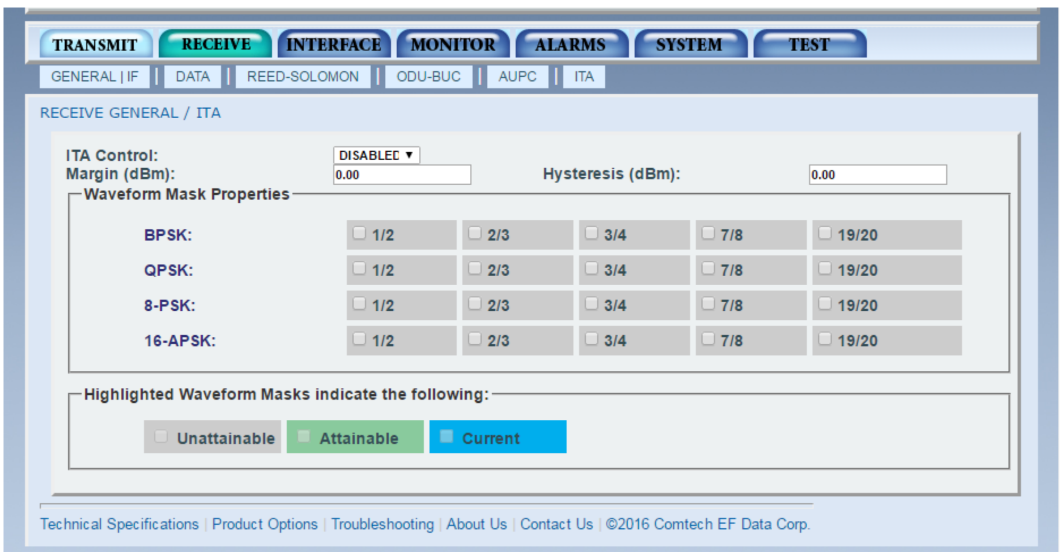


Figure I-8. Initial Setup DMD1050TS, Demodulator ITA

To setup ITA Mode, first select all the appropriate waveforms you are intending to run. Waveforms marked "unattainable" are not allowed because the current symbol rate cannot be obtained based on the current serial rate selected. The remaining Ethernet rate will be less than zero. Set the same waveforms in both the TX ITA and RX ITA functions so they match.

Adjust uplink power to a moderate value of approximately 16 dB C/N at 8.3 MSPS.

On the receiver, set the margin to 1 dB and leave the hysteresis at 0.

Next, enable the ITA control. The Web page status will indicate and the indicator for the current waveform will follow what the system is currently operating at. This is the case in both the transmission and receives functions. This will start the process of adaptation. At 16 dB Es/No, the mod/cod will ramp up every thirty seconds until the threshold value is reached.

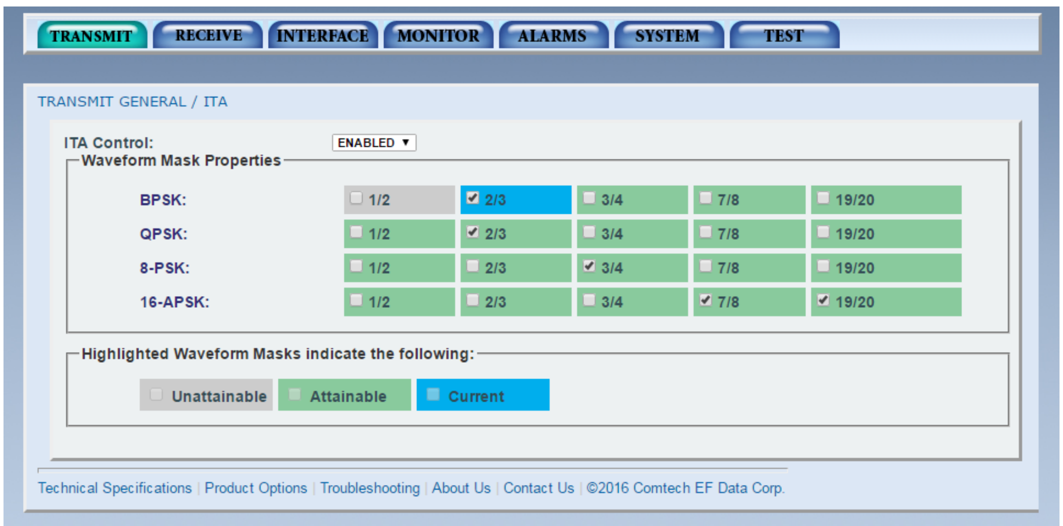


Figure I-9. Initial Setup DMD1050TS, Modulator ITA (Enabled)

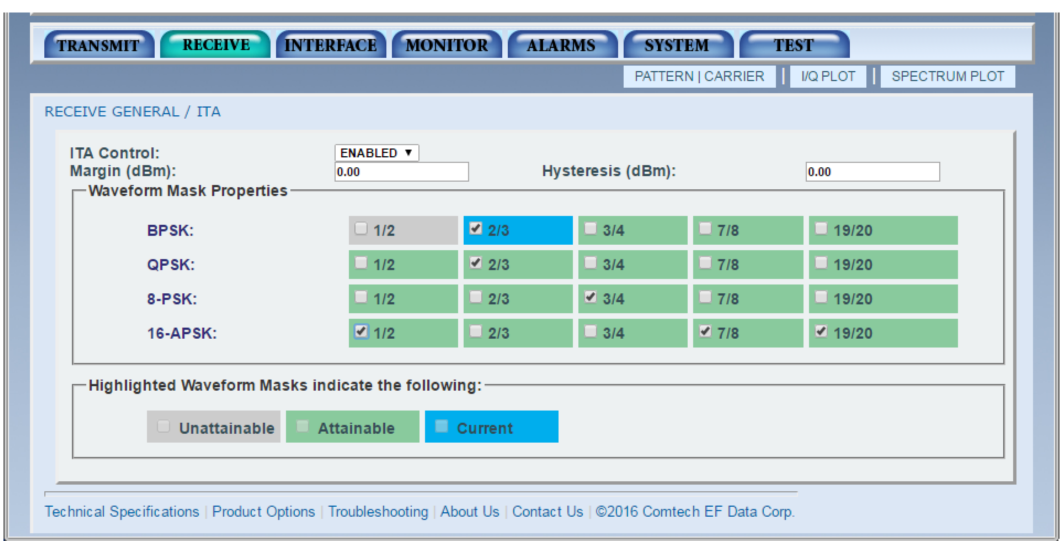


Figure I-10. Initial Setup DMD1050TS, Demodulator ITA (Enabled)

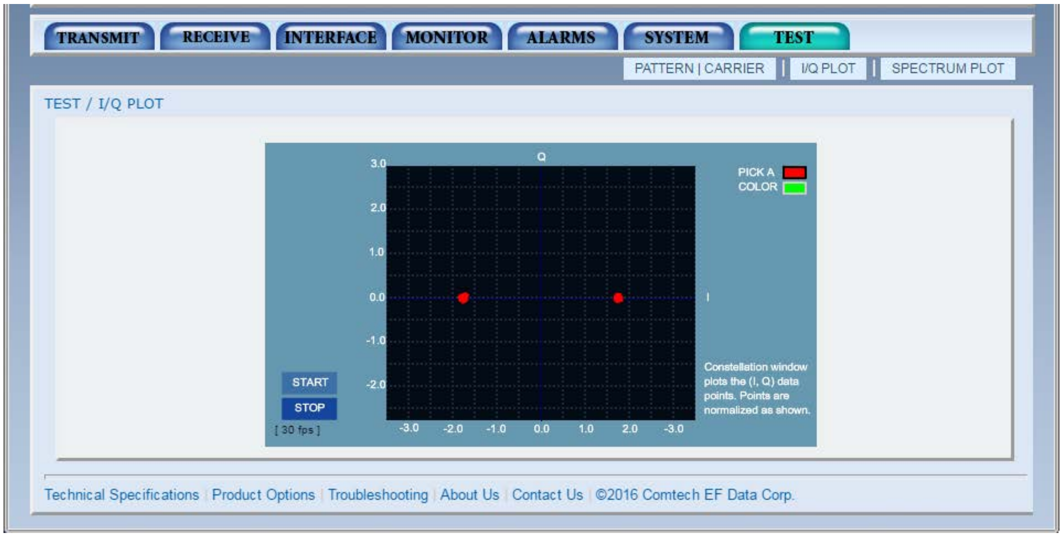


Figure I-11. DMD1050TS I/Q for BPSK 2/3

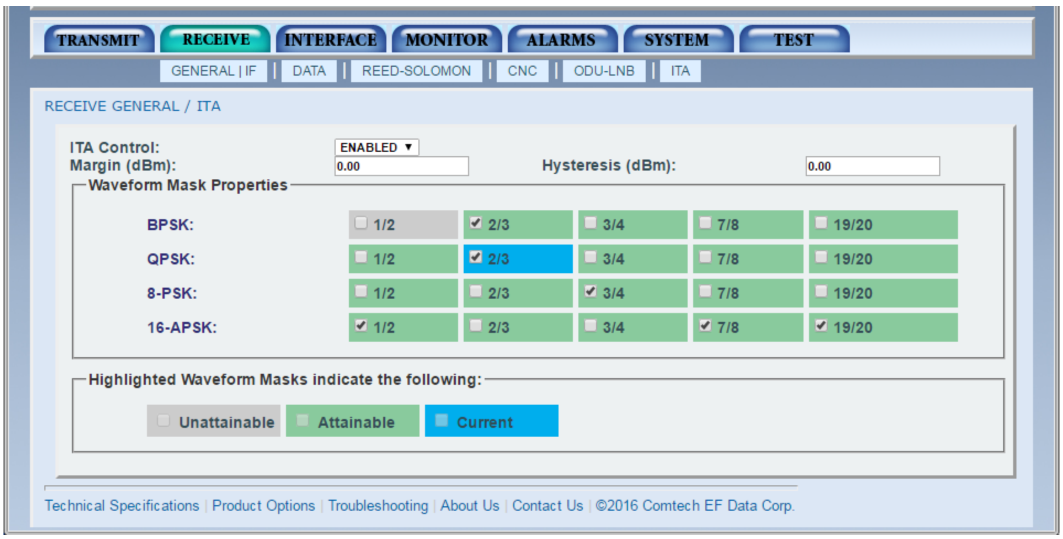


Figure I-12. DMD1050TS ITA Status for QPSK 2/3

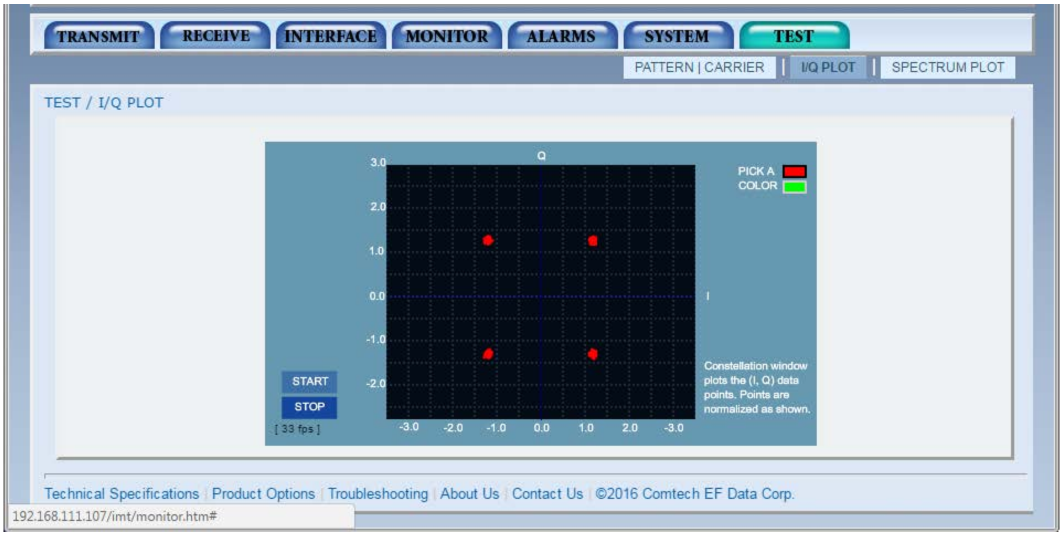


Figure I-13. DMD1050TS I/Q for QPSK 2/3

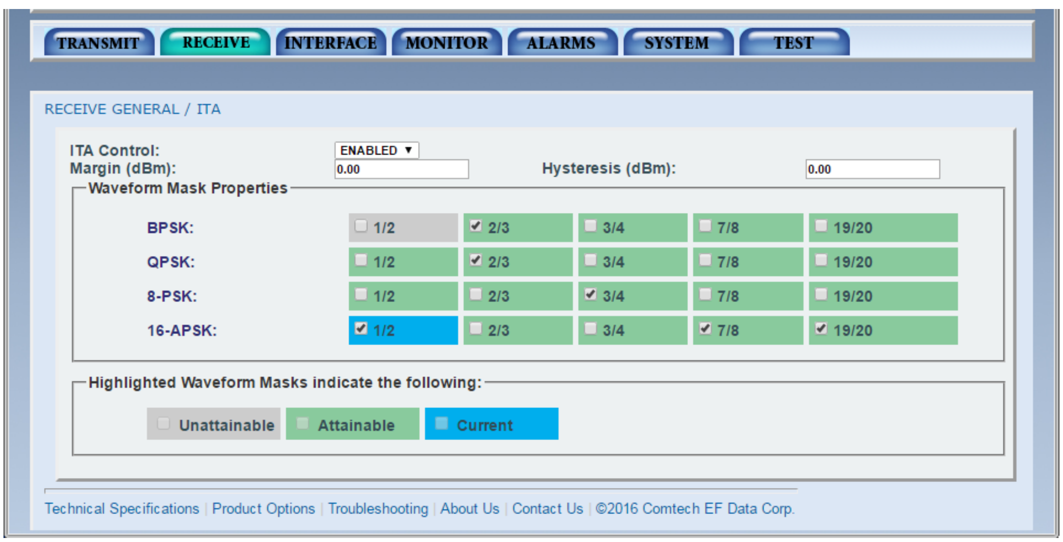


Figure I-14. DMD1050TS ITA Status for 16APSK 1/2

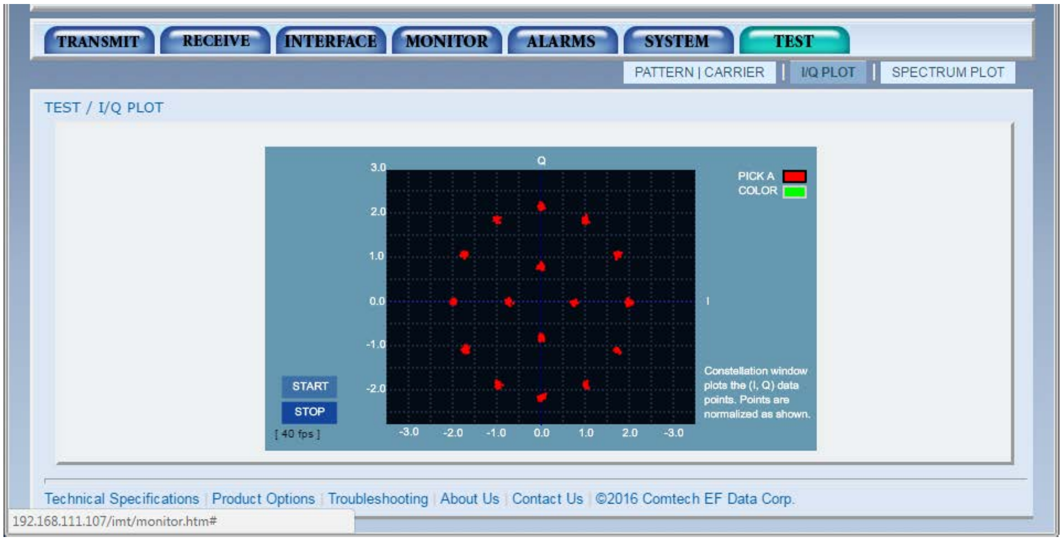


Figure I-15. DMD1050TS I/Q for 16APSK 1/2

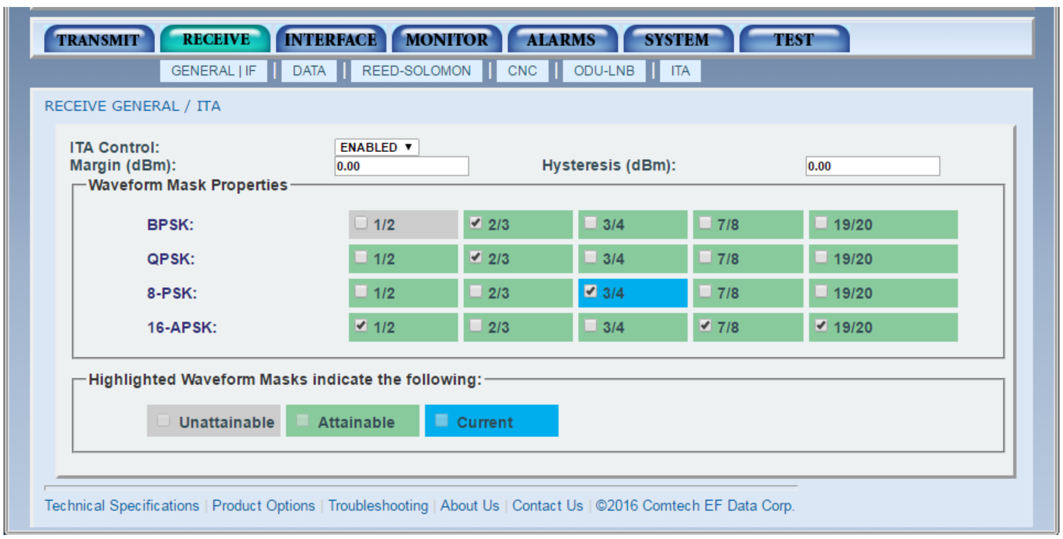


Figure I-16. DMD1050TS ITA Status for 8PSK 3/4

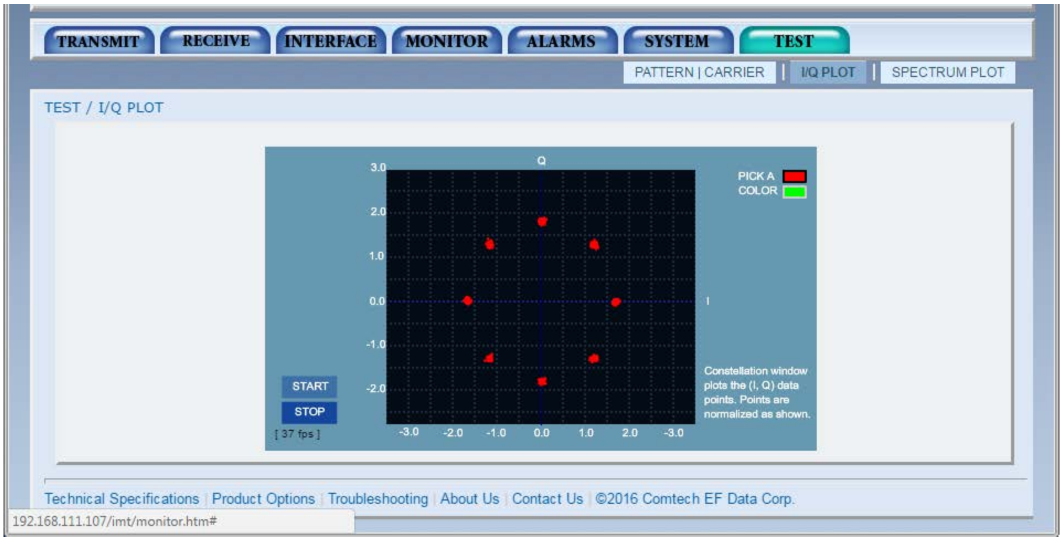


Figure I-17. DMD1050TS I/Q for 8PSK 3/4

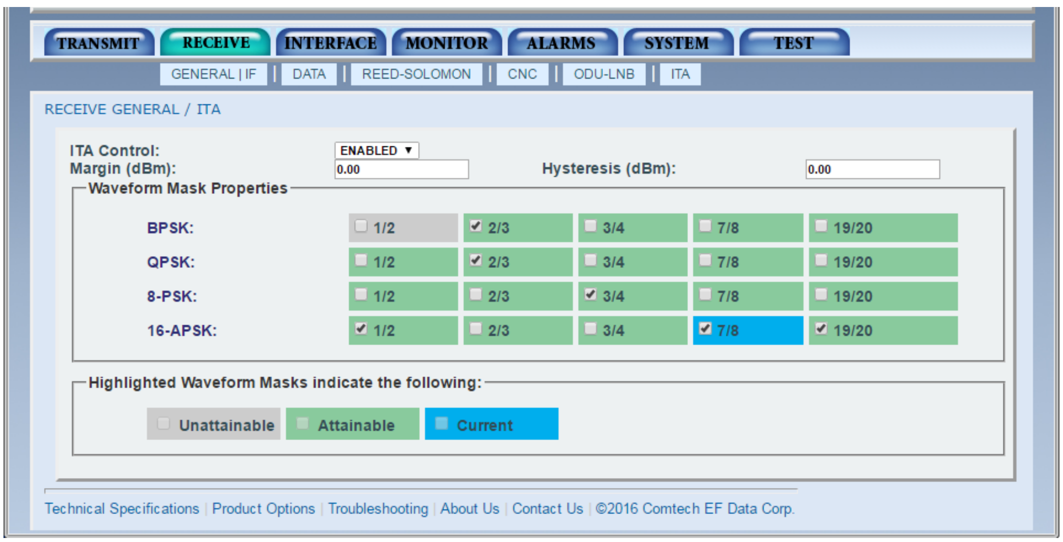


Figure I-18. DMD1050TS ITA Status for 16APSK 7/8

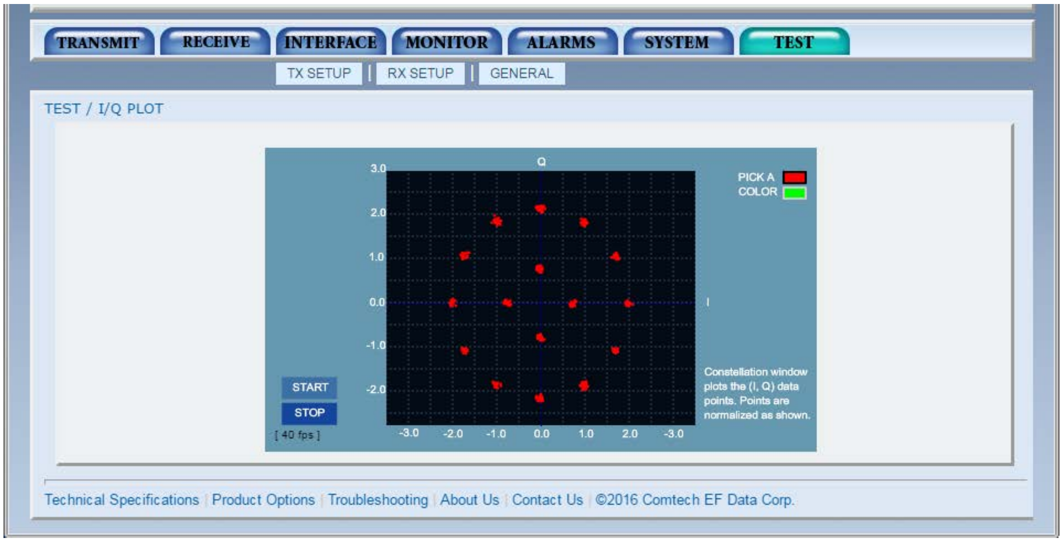


Figure I-19. DMD1050TS I/Q for 16APSK 7/8

At this point, changing the noise source level will dynamically change the selected waveforms. You can simulate fades by attenuating the receive signal to the system.

BLANK PAGE

Appendix J. Compatibility with Other DMD Modems

J.1 Compatibility with Other DMD Modems

BLANK PAGE

Table J-1. Compatibility with Other DMD Modems

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
Legacy Modes									
BPSK	Viterbi	1/2	2.4 – 5,000	Standard	Standard	Standard	2.4 – 15,000	Standard	Standard
QPSK	Viterbi	1/2	4.8 – 10,000	Standard	Standard	Standard	4.8 – 30,000	Standard	Standard
		3/4	7.2 – 15,000	Standard	Standard	Standard	7.2 – 45,000	Standard	Standard
		7/8	8.4 – 17,500	Standard	Standard	Standard	8.4 – 52,000	Standard	Standard
	Viterbi + RS	1/2	4.8 – 10,000 * R / N	RS Feature	RS Feature	RS Feature	4.8 – 30,000 * R / N	RS Feature	Standard
		3/4	7.2 – 15,000 * R / N	RS Feature	RS Feature	RS Feature	7.2 – 45,000 * R / N	RS Feature	Standard
		7/8	8.4 – 17,500 * R / N	RS Feature	RS Feature	RS Feature	8.4 – 52,000 * R / N	RS Feature	Standard
	Sequential	1/2	4.8 – 2,048	Sequential Feature	Sequential Feature	Sequential Feature	4.8 – 2,048	Sequential Feature	Sequential Feature
		3/4	7.2 – 2,048	Sequential Feature	Sequential Feature	Sequential Feature	7.2 – 2,048	Sequential Feature	Sequential Feature
		7/8	8.4 – 2,048	Sequential Feature	Sequential Feature	Sequential Feature	8.4 – 2,048	Sequential Feature	Sequential Feature
OQPSK	Viterbi	1/2	4.8 – 10,000	Standard	Standard	Standard	4.8 – 30,000	Standard	Standard
		3/4	7.2 – 15,000	Standard	Standard	Standard	7.2 – 45,000	Standard	Standard
		7/8	8.4 – 17,500	Standard	Standard	Standard	8.4 – 52,000	Standard	Standard
	Viterbi + RS	1/2	4.8 – 10,000 * R / N	RS Feature	RS Feature	RS Feature	4.8 – 10,000 * R / N	RS Feature	Standard
		3/4	7.2 – 15,000 * R / N	RS Feature	RS Feature	RS Feature	7.2 – 15,000 * R / N	RS Feature	Standard
		7/8	8.4 – 17,500 * R / N	RS Feature	RS Feature	RS Feature	8.4 – 17,500 * R / N	RS Feature	Standard
	Sequential	1/2	4.8 – 2,048	Sequential Feature	Sequential Feature	Sequential Feature	4.8 – 2,048	Sequential Feature	Sequential Feature
		3/4	7.2 – 2,048	Sequential Feature	Sequential Feature	Sequential Feature	7.2 – 2,048	Sequential Feature	Sequential Feature
		7/8	8.4 – 2,048	Sequential Feature	Sequential Feature	Sequential Feature	8.4 – 2,048	Sequential Feature	Sequential Feature
8PSK	Trellis	2/3	9.6 – 20,000	8PSK Feature	8PSK Feature	8PSK Feature	9.6 – 52,000	8PSK Feature	Standard
	Trellis + RS	2/3	9.6 – 20,000 * R / N	8PSK + RS Feature	8PSK + RS Feature	8PSK + RS Feature	9.6 – 52,000	8PSK + RS Feature	Standard
16QAM	Viterbi	3/4	14.4 – 20,000	16QAM Feature	16QAM Feature	16QAM Feature	14.4 – 52,000	16QAM Feature	Standard
		7/8	16.8 – 20,000	16QAM Feature	16QAM Feature	16QAM Feature	16.8 – 52,000	16QAM Feature	Standard
	Viterbi + RS	3/4	14.4 – 20,000 * R / N	16QAM + RS Feature	16QAM + RS Feature	16QAM + RS Feature	14.4 – 52,000	16QAM + RS Feature	Standard

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
		7/8	16.8 – 20,000 * R / N	16QAM + RS Feature	16QAM + RS Feature	16QAM + RS Feature	16.8 – 52,000	16QAM + RS Feature	Standard
DVB Modes									
BPSK	Viterbi	1/2	2.4 – 4,608	DVB Feature	DVB Feature	DVB Feature	2.4 – 4,608	DVB Feature	DVB Feature
		2/3	3.2 – 6,144	DVB Feature	DVB Feature	DVB Feature	3.2 – 6,144	DVB Feature	DVB Feature
		3/4	3.6 – 6,912	DVB Feature	DVB Feature	DVB Feature	3.6 – 6,912	DVB Feature	DVB Feature
		5/6	4.0 – 7,680	DVB Feature	DVB Feature	DVB Feature	4.0 – 7,680	DVB Feature	DVB Feature
		7/8	4.2 – 8,064	DVB Feature	DVB Feature	DVB Feature	4.2 – 8,064	DVB Feature	DVB Feature
QPSK	Viterbi	1/2	4.8 – 9,216	DVB Feature	DVB Feature	DVB Feature	4.8 – 9,216	DVB Feature	DVB Feature
		2/3	6.4 – 12,288	DVB Feature	DVB Feature	DVB Feature	6.4 – 12,288	DVB Feature	DVB Feature
		3/4	7.2 – 13,824	DVB Feature	DVB Feature	DVB Feature	7.2 – 13,824	DVB Feature	DVB Feature
		5/6	8.0 – 15,359	DVB Feature	DVB Feature	DVB Feature	8.0 – 15,359	DVB Feature	DVB Feature
		7/8	8.4 – 16,127	DVB Feature	DVB Feature	DVB Feature	8.4 – 16,127	DVB Feature	DVB Feature
8PSK	Trellis	2/3	9.6 – 18,431	8PSK + DVB Feature	8PSK + DVB Feature	8PSK + DVB Feature	9.6 – 18,431	8PSK + DVB Feature	DVB Feature
		5/6	12.0 – 20,000	8PSK + DVB Feature	8PSK + DVB Feature	8PSK + DVB Feature	12.0 – 20,000	8PSK + DVB Feature	DVB Feature
		8/9	12.8 – 20,000	8PSK + DVB Feature	8PSK + DVB Feature	8PSK + DVB Feature	12.8 – 20,000	8PSK + DVB Feature	DVB Feature
16QAM	Trellis	3/4	14.4 – 20,000	16QAM + DVB Feature	16QAM + DVB Feature	16QAM + DVB Feature	14.4 – 20,000	16QAM + DVB Feature	DVB Feature
		7/8	16.8 – 20,000	16QAM + DVB Feature	16QAM + DVB Feature	16QAM + DVB Feature	16.8 – 20,000	16QAM + DVB Feature	DVB Feature
TPC Modes									
BPSK	TPC	5/16	1.5 – 3,125	TPC Feature + HW16	TPC Feature + HW18	—	1.5 – 9,375	TPC Feature + HW16	Standard
		21/44	2.3 – 4,773	TPC Feature + HW14	TPC Feature	TPC Feature	2.3 – 14,318	TPC Feature + HW14	Standard
	TPC (SHORT)	7/8-S	4.2 – 8,750	TPC Feature + HW15	—	—	4.2 – 20,000	TPC Feature + HW15	—
QPSK	TPC	21/44	4.6 – 9,545	TPC Feature + HW14	TPC Feature	TPC Feature	4.6 – 20,000	TPC Feature + HW14	Standard
		3/4	7.2 – 15,000	TPC Feature + HW14	TPC Feature	TPC Feature	7.2 – 20,000	TPC Feature + HW14	Standard
		7/8	8.4 – 17,500	TPC Feature + HW14	TPC Feature	TPC Feature	8.4 – 20,000	TPC Feature + HW14	Standard
		0.495	64.0 – 6,132	TPC Feature + HW15	—	—	64.0 – 6,132	TPC Feature + HW15	—
		0.793	64.0 – 6,132	TPC Feature + HW15	—	—	64.0 – 6,132	TPC Feature + HW15	—

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
	TPC (SHORT)	7/8-S	64.0 – 17,500	TPC Feature + HW15	—	—	64.0 – 20,000	TPC Feature + HW15	—
OQPSK	TPC	21/44	4.6 – 9,545	TPC Feature + HW-2	TPC Feature	TPC Feature	4.6 – 20,000	TPC Feature + HW14	Standard
		3/4	7.2 – 15,000	TPC Feature + HW-2	TPC Feature	TPC Feature	7.2 – 20,000	TPC Feature + HW14	Standard
		7/8	8.4 – 17,500	TPC Feature + HW-2	TPC Feature	TPC Feature	8.4 – 20,000	TPC Feature + HW14	Standard
		0.495	64.0 – 6,132	TPC Feature + HW15	—	—	64.0 – 6,132	TPC Feature + HW15	—
		0.793	64.0 – 6,132	TPC Feature + HW15	—	—	64.0 – 6,132	TPC Feature + HW15	—
	TPC (SHORT)	7/8-S	64.0 – 17,500	TPC Feature + HW15	—	—	64.0 – 20,000	TPC Feature + HW15	—
8PSK	TPC	3/4	10.8 – 20,000	8PSK + TPC Feature + HW14	8PSK + TPC Feature	8PSK + TPC Feature	10.8 – 20,000	8PSK + TPC Feature + HW14	Standard
		7/8	12.6 – 20,000	8PSK + TPC Feature + HW14	8PSK + TPC Feature	8PSK + TPC Feature	12.6 – 20,000	8PSK + TPC Feature + HW14	Standard
		0.495	64.0 – 6,132	8PSK + TPC Feature + HW15	—	—	64.0 – 6,132	8PSK + TPC Feature + HW15	—
		0.793	64.0 – 6,132	8PSK + TPC Feature + HW15	—	—	64.0 – 6,132	8PSK + TPC Feature + HW15	—
		0.750	—	—	—	—	20,000.1 – 52,000	8PSK + TPC Feature + HW15	—
		0.875	—	—	—	—	20,000.1 – 52,000	8PSK + TPC Feature + HW15	—
8QAM	TPC	3/4	10.8 – 20,000	8QAM + TPC Feature + HW16	8QAM + TPC Feature + HW18	—	10.8 – 20,000	8QAM + TPC Feature + HW16	Standard
		7/8	12.6 – 20,000	8QAM + TPC Feature + HW16	8QAM + TPC Feature + HW18	—	12.6 – 20,000	8QAM + TPC Feature + HW16	Standard
16QAM	TPC	3/4	14.4 – 20,000	16QAM + TPC Feature + HW14	16QAM + TPC Feature	16QAM + TPC Feature	14.4 – 20,000	16QAM + TPC Feature + HW14	Standard

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
		7/8	16.8 – 20,000	16QAM + TPC Feature + HW14	16QAM + TPC Feature	16QAM + TPC Feature	16.8 – 20,000	16QAM + TPC Feature + HW14	Standard
		0.495	64.0 – 6,132	16QAM + TPC Feature + HW15	—	—	64.0 – 6,132	16QAM + TPC Feature + HW15	—
		0.793	64.0 – 6,132	16QAM + TPC Feature + HW15	—	—	64.0 – 6,132	16QAM + TPC Feature + HW15	—
		0.750	—	—	—	—	20,000.1 – 52,000	16QAM + TPC Feature + HW15	—
		0.875	—	—	—	—	20,000.1 – 52,000	16QAM + TPC Feature + HW15	—

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
165B Turbo Modes[1]									
BPSK	Turbo	1/2	64 – 4,965[2]	—	EBEM Feature + HW17	—	64 – 14,910	EBEM Feature + HW17	Standard
		2/3	64 – 6,614[2]	—	EBEM Feature + HW17	—	64 – 19,860	EBEM Feature + HW17	Standard
		3/4	64 – 7,436[2]	—	EBEM Feature + HW17	—	64 – 22,329	EBEM Feature + HW17	Standard
		7/8	64 – 8,673[2]	—	EBEM Feature + HW17	—	64 – 26,031	EBEM Feature + HW17	Standard
		19/20	64 – 9,412[2]	—	EBEM Feature + HW17	—	64 – 28,248	EBEM Feature + HW17	Standard
QPSK	Turbo	1/2	64 – 9,905[2]	—	EBEM Feature + HW17	—	64 – 29,730	EBEM Feature + HW17	Standard
		2/3	64 – 13,180[2]	—	EBEM Feature + HW17	—	64 – 39,558	EBEM Feature + HW17	Standard
		3/4	64 – 14,811[2]	—	EBEM Feature + HW17	—	64 – 44,454	EBEM Feature + HW17	Standard
		7/8	64 – 17,253[2]	—	EBEM Feature + HW17	—	64 – 52,000	EBEM Feature + HW17	Standard
		19/20	64 – 18,716[2]	—	EBEM Feature + HW17	—	64 – 52,000	EBEM Feature + HW17	Standard
8PSK	Turbo	1/2	256 – 14,811[2]	—	EBEM Feature + HW17	—	256 – 44,454	EBEM Feature + HW17	Standard
		2/3	256 – 19,691[2]	—	EBEM Feature + HW17	—	256 – 52,000	EBEM Feature + HW17	Standard
		3/4	256 – 22,119[2]	—	EBEM Feature + HW17	—	256 – 52,000	EBEM Feature + HW17	Standard
		7/8	256 – 25,746[2]	—	EBEM Feature + HW17	—	256 – 52,000	EBEM Feature + HW17	Standard
		19/20	256 – 27,911[2]	—	EBEM Feature + HW17	—	256 – 52,000	EBEM Feature + HW17	Standard
16APSK	Turbo	1/2	256 – 19,691[2]	—	EBEM Feature + HW17	—	256 – 52,000	EBEM Feature + HW17	Standard
		2/3	256 – 26,150[2]	—	EBEM Feature + HW17	—	256 – 52,000	EBEM Feature + HW17	Standard
		3/4	256 – 29,356[2]	—	EBEM Feature + HW17	—	256 – 52,000	EBEM Feature + HW17	Standard
		7/8	256 – 34,145[2]	—	EBEM Feature + HW17	—	256 – 52,000	EBEM Feature + HW17	Standard
		19/20	256 – 37,008[2]	—	EBEM Feature + HW17	—	256 – 52,000	EBEM Feature + HW17	Standard

[1] The 165B Turbo Modes are calculated with the embedded channel *DISABLED* on a singe interface without multiplexing to provide the absolute maximum that the modem can be configured.
[2] Max STANAG rates reflect the maximum user payload with the embedded channel ENABLED. This is either Ethernet or Mixed Mode with the serial MIL-STD-188-114A and is limited to 20 Mbps.

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
LDPC Modes									
BPSK	HP-LDPC	1/2	2.4 – 5,000	LDPC Feature + HW16	LDPC Feature + HW18	LDPC Feature + HW20	2.4 – 15,000	LDPC Feature + HW16	LDPC Feature
	ULL-LDPC	1/2	2.4 – 4,933	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 – 14,799	LDPC Feature + HW19	LDPC Feature
QPSK	HP-LDPC	1/2	4.8 – 10,000	LDPC Feature + HW16	LDPC Feature + HW18	LDPC Feature + HW20	4.8 – 20,000	LDPC Feature + HW16	LDPC Feature
		2/3	6.4 – 13,333	LDPC Feature + HW16	LDPC Feature + HW18	LDPC Feature + HW20	6.4 – 20,000	LDPC Feature + HW16	LDPC Feature
		3/4	7.2 – 15,000	LDPC Feature + HW16	LDPC Feature + HW18	LDPC Feature + HW20	7.2 – 20,000	LDPC Feature + HW16	LDPC Feature
	ULL-LDPC	1/2	4.7 – 9,866	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 20,000	LDPC Feature + HW19	LDPC Feature
		2/3	6.3 – 13,078	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 20,000	LDPC Feature + HW19	LDPC Feature
		3/4	7.0 – 14,685	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 – 20,000	LDPC Feature + HW19	LDPC Feature
OQPSK	HP-LDPC	1/2	4.8 – 10,000	LDPC Feature + HW16	LDPC Feature + HW18	LDPC Feature + HW20	4.8 – 20,000	LDPC Feature + HW16	LDPC Feature
		2/3	6.4 – 13,333	LDPC Feature + HW16	LDPC Feature + HW18	LDPC Feature + HW20	6.4 – 20,000	LDPC Feature + HW16	LDPC Feature
		3/4	7.2 – 15,000	LDPC Feature + HW16	LDPC Feature + HW18	LDPC Feature + HW20	7.2 – 20,000	LDPC Feature + HW16	LDPC Feature
	ULL-LDPC	1/2	4.7 – 9,866	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 20,000	LDPC Feature + HW19	LDPC Feature
		2/3	6.3 – 13,078	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 20,000	LDPC Feature + HW19	LDPC Feature
		3/4	7.0 – 14,685	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 – 20,000	LDPC Feature + HW19	LDPC Feature
8PSK	HP-LDPC	2/3	9.6 – 20,000	8PSK + LDPC Feature + HW16	8PSK + LDPC Feature + HW18	8PSK + LDPC Feature + HW20	9.6 – 20,000	8PSK + LDPC Feature + HW20	LDPC Feature
		3/4	10.8 – 20,000	8PSK + LDPC Feature + HW16	8PSK + LDPC Feature + HW18	8PSK + LDPC Feature + HW20	10.8 – 20,000	8PSK + LDPC Feature + HW16	LDPC Feature
8QAM	HP-LDPC	2/3	9.6 – 20,000	8QAM + LDPC Feature + HW16	8QAM + LDPC Feature + HW18	8QAM + LDPC Feature + HW20	9.6 – 20,000	8QAM + LDPC Feature + HW16	LDPC Feature
		3/4	10.8 – 20,000	8QAM + LDPC Feature + HW16	8QAM + LDPC Feature + HW18	8QAM + LDPC Feature + HW20	10.8 – 20,000	8QAM + LDPC Feature + HW16	LDPC Feature
16QAM	HP-LDPC	3/4	14.4 – 20,000	16QAM + LDPC Feature + HW16	16QAM + LDPC Feature + HW18	16QAM + LDPC Feature + HW20	14.4 – 20,000	16QAM + LDPC Feature + HW16	LDPC Feature
TX Direct Sequence Spread Spectrum									

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
BPSK	HP-LDPC-OFF	1/2	2.4 – 5,000	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 – 15,000	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x2		2.4 – 2,500	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 – 7,500	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x4		2.4 – 1,250	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 – 3,750	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x8		2.4 – 625	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 – 1,875	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x16		2.4 – 313	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 – 937	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	HP-LDPC-OFF	1/2	2.4 – 4,933	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 – 4,933	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x2		2.4 – 2,467	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 – 2,466	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x4		2.4 – 1,233	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 – 1,233	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x8		2.4 - 617	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 - 616	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x16		2.4 - 308	LDPC Feature + HW19	—	LDPC Feature + HW20	2.4 - 308	LDPC Feature + HW19	DSSS Feature + LDPC Feature
QPSK	HP-LDPC-OFF	1/2	4.8 – 10,000	LDPC Feature + HW19	—	LDPC Feature + HW20	4.8 – 10,000	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x2		4.8 – 5,000	LDPC Feature + HW19	—	LDPC Feature + HW20	4.8 – 5,000	LDPC Feature + HW19	DSSS Feature + LDPC Feature

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
	FACTOR x4		4.8 – 2,500	LDPC Feature + HW19	—	LDPC Feature + HW20	4.8 – 2,500	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x8		4.8 – 1,250	LDPC Feature + HW19	—	LDPC Feature + HW20	4.8 – 1,250	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x16		4.8 - 625	LDPC Feature + HW19	—	LDPC Feature + HW20	4.8 – 625	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	HP-LDPC-OFF	1/2	4.7 – 9,866	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 9,866	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x2		4.7 – 4,933	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 4,933	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x4		4.7 – 2,467	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 2,466	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x8		4.7 – 1,233	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 1,233	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x16		4.7 - 617	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 616	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	HP-LDPC-OFF	2/3	6.3 – 13,078	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 13,078	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x2		6.3 – 6,539	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 6,539	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x4		6.3 – 3,270	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 3,269	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x8		6.3 – 1,635	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 1,634	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x16		6.3 0 817	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 0 817	LDPC Feature + HW19	DSSS Feature +

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
									LDPC Feature
	HP-LDPC-OFF	3/4	7.0 – 14,685	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 – 14,686	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x2		7.0 – 7,342	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 – 7,342	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x4		7.0 – 3,671	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 – 3,671	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x8		7.0 – 1,836	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 – 1,835	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x16		7.0 - 918	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 - 917	LDPC Feature + HW19	DSSS Feature + LDPC Feature
OQPSK	HP-LDPC-OFF	1/2	4.8 – 10,000	LDPC Feature + HW19	—	LDPC Feature + HW20	4.8 – 10,000	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x2		4.8 – 5,000	LDPC Feature + HW19	—	LDPC Feature + HW20	4.8 – 5,000	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x4		4.8 – 2,500	LDPC Feature + HW19	—	LDPC Feature + HW20	4.8 – 2,500	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x8		4.8 – 1,250	LDPC Feature + HW19	—	LDPC Feature + HW20	4.8 – 1,250	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x16		4.8 – 625	LDPC Feature + HW19	—	LDPC Feature + HW20	4.8 – 625	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	HP-LDPC-OFF	1/2	4.7 – 9,866	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 9,866	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x2		4.7 – 4,933	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 4,933	LDPC Feature + HW19	DSSS Feature + LDPC Feature

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
	FACTOR x4		4.7 – 2,467	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 2,466	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x8		4.7 – 1,233	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 1,233	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x16		4.7 – 617	LDPC Feature + HW19	—	LDPC Feature + HW20	4.7 – 616	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	HP-LDPC-OFF	2/3	6.3 – 13,078	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 13,078	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x2		6.3 – 6,539	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 6,539	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x4		6.3 – 3,270	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 3,269	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x8		6.3 – 1,635	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 1,634	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x16		6.3 – 817	LDPC Feature + HW19	—	LDPC Feature + HW20	6.3 – 817	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	HP-LDPC-OFF	3/4	7.0 – 14,685	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 – 14,686	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x2		7.0 – 7,342	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 – 7,342	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x4		7.0 – 3,671	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 – 3,671	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x8		7.0 – 1,836	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 – 1,835	LDPC Feature + HW19	DSSS Feature + LDPC Feature
	FACTOR x16		7.0 - 918	LDPC Feature + HW19	—	LDPC Feature + HW20	7.0 - 917	LDPC Feature + HW19	DSSS Feature +

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
									LDPC Feature
Satellite Framing									
ALL	IDR 96K	—	T1/E1 / T2/E2	IDR Feature, Framing Only + HW9 for IESS	IDR Feature for Framing	IDR Feature, Framing Only + HW9 for IESS	T1/E1 / T2/E2 / T3/E3	IDR Feature, Framing Only + HW9 for IESS	IDR Feature for Framing
	IBS 1/15	—	N x 64, 64 – 1536, 2048	IBS Feature + HW9 for IESS	IBS Feature (Framing Only)	IBS Feature (Framing Only)	N x 64, 64 – 1536, 2048	IBS Feature	IBS Feature
	EF AUPC	—	Less than 20,000	AUPC Feature	AUPC Feature	AUPC Feature	Less than 20,000	AUPC Feature	Standard
	EDMAC	—	—	EDMAC Feature Framing Only	EDMAC Feature Framing Only	EDMAC Feature Framing Only	—	EDMAC Feature Framing Only	EDMAC Feature Framing Only
	SCC	—	—	Enhanced Async Feature	Enhanced Async Feature (Framing Only)	Enhanced Async Feature	—	Enhanced Async Feature	Enhanced Async Feature
	EFFICIENT D&I	—	N x 64, 64 – 1536, 2048	Drop and Insert Feature	Drop and Insert Feature (Framing Only)	Drop and Insert Feature	N x 64, 64 – 1536, 2048	IDR Feature, Framing Only + HW9 for IESS	Drop and Insert Feature (Framing Only)
	EBEM	—	—	—	EBEM Feature + HW5	—	—	—	—
Ethernet HDLC Framing									
ALL	RADYNE	—	—	Standard + HW22	Standard (10/100)	Standard (10/100)	—	Standard + HW22	Standard (10/100/1000)
	COMTECH	—	—	Standard + HW22	Standard (10/100)	—	—	Standard + HW22	Standard (10/100/1000)
	MANAGED 570	—	—	Standard + HW22	Standard (10/100)	—	—	Standard + HW22	Standard (10/100/1000)
TRANSEC (HW28) Counter Mode (Interoperable with MD-1366)[3]									
BPSK	Turbo	1/2	64 – 4,965[4]	—	EBEM Feature + HW28	—	64 – 14,901	EBEM Feature + HW28	Standard
		2/3	64 – 6,614[4]	—	EBEM Feature + HW28	—	64 – 19,848	EBEM Feature + HW28	Standard

[3] When running TRANSEC, the 165B Turbo Modes require the embedded channel to be *ENABLED* and calculated on a single interface without multiplexing to provide the absolute maximum that the modem can be configured. The TRANSEC itself does not expand the user data, only the application of the embedded channel.

[4] Max STANAG rates reflect the maximum user payload with the embedded channel ENABLED. This is either Ethernet or Mixed Mode with the serial MIL-STD-188-114A and is limited to 20 Mbps.

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
		3/4	64 – 7,436[4]	—	EBEM Feature + HW28	—	64 – 22,320	EBEM Feature + HW28	Standard
		7/8	64 – 8,673[4]	—	EBEM Feature + HW28	—	64 – 26,019	EBEM Feature + HW28	Standard
		19/20	64 – 9,412[4]	—	EBEM Feature + HW28	—	64 – 28,236	EBEM Feature + HW28	Standard
QPSK	Turbo	1/2	64 – 9,905[4]	—	EBEM Feature + HW28	—	64 – 29,715	EBEM Feature + HW28	Standard
		2/3	64 – 13,180[4]	—	EBEM Feature + HW28	—	64 – 39,540	EBEM Feature + HW28	Standard
		3/4	64 – 14,811[4]	—	EBEM Feature + HW28	—	64 – 44,433	EBEM Feature + HW28	Standard
		7/8	64 – 17,253[4]	—	EBEM Feature + HW28	—	64 – 51,756	EBEM Feature + HW28	Standard
		19/20	64 – 18,716[4]	—	EBEM Feature + HW28	—	64 – 52,000	EBEM Feature + HW28	Standard
8PSK	Turbo	1/2	256 – 14,811[4]	—	EBEM Feature + HW28	—	256 – 44,433	EBEM Feature + HW28	Standard
		2/3	256 – 19,691[4]	—	EBEM Feature + HW28	—	256 – 52,000	EBEM Feature + HW28	Standard
		3/4	256 – 22,119[4]	—	EBEM Feature + HW28	—	256 – 52,000	EBEM Feature + HW28	Standard
		7/8	256 – 25,746[4]	—	EBEM Feature + HW28	—	256 – 52,000	EBEM Feature + HW28	Standard
		19/20	256 – 27,911[4]	—	EBEM Feature + HW28	—	256 – 52,000	EBEM Feature + HW28	Standard
16APSK	Turbo	1/2	256 – 19,691[4]	—	EBEM Feature + HW28	—	256 – 52,000	EBEM Feature + HW28	Standard
		2/3	256 – 26,150[4]	—	EBEM Feature + HW28	—	256 – 52,000	EBEM Feature + HW28	Standard
		3/4	256 – 29,356[4]	—	EBEM Feature + HW28	—	256 – 52,000	EBEM Feature + HW28	Standard
		7/8	256 – 34,145[4]	—	EBEM Feature + HW28	—	256 – 52,000	EBEM Feature + HW28	Standard
		19/20	256 – 37,008[4]	—	EBEM Feature + HW28	—	256 – 52,000	EBEM Feature + HW28	Standard

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
TRANSEC (HW28) Block Mode (Interoperable with SLM-5650A) HW-27 Frame Expansion: (3 + 16 * N) / (16 * N), N = 1⋯16									
BPSK	TPC	5/16	1.5 – 2,632	TPC Feature + HW27	TPC Feature + HW27	—	1.5 – 7,895	TPC Feature + HW27	Standard
		21/44	2.3 – 4,019	TPC Feature + HW27	TPC Feature + HW27	TPC Feature + HW27	2.3 – 12,057	TPC Feature + HW27	Standard

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
QPSK	TPC	21/44	4.6 – 8,038	TPC Feature + HW27	TPC Feature + HW27	TPC Feature + HW27	4.6 – 20,000	TPC Feature + HW27	Standard
		3/4	7.2 – 12,632	TPC Feature + HW27	TPC Feature + HW27	TPC Feature + HW27	7.2 – 20,000	TPC Feature + HW27	Standard
		7/8	8.4 – 14,737	TPC Feature + HW27	TPC Feature + HW27	TPC Feature + HW27	8.4 – 20,000	TPC Feature + HW27	Standard
OQPSK	TPC	21/44	4.6 – 8,038	TPC Feature + HW27	TPC Feature + HW27	TPC Feature + HW27	4.6 – 20,000	TPC Feature + HW27	Standard
		3/4	7.2 – 12,632	TPC Feature + HW27	TPC Feature + HW27	TPC Feature + HW27	7.2 – 20,000	TPC Feature + HW27	Standard
		7/8	8.4 – 14,737	TPC Feature + HW27	TPC Feature + HW27	TPC Feature + HW27	8.4 – 20,000	TPC Feature + HW27	Standard
8PSK	TPC	3/4	10.8 – 18,947	8PSK + TPC Feature + HW27	8PSK + TPC Feature + HW27	8PSK + TPC Feature + HW27	10.8 – 20,000	8PSK + TPC Feature + HW27	Standard
		7/8	12.6 – 20,000	8PSK + TPC Feature + HW27	8PSK + TPC Feature + HW27	8PSK + TPC Feature + HW27	12.6 – 20,000	8PSK + TPC Feature + HW27	Standard
8QAM	TPC	3/4	10.8 – 18,974	8PSK + TPC Feature + HW27	8PSK + TPC Feature + HW27	8PSK + TPC Feature + HW27	10.8 – 20,000	8PSK + TPC Feature + HW27	Standard
		7/8	12.6 – 20,000	8PSK + TPC Feature + HW27	8PSK + TPC Feature + HW27	8PSK + TPC Feature + HW27	12.6 – 20,000	8PSK + TPC Feature + HW27	Standard
16QAM	TPC	3/4	14.4 – 20,000	16QAM + TPC Feature + HW27	16QAM + TPC Feature + HW27	16QAM + TPC Feature + HW27	14.4 – 20,000	16QAM + TPC Feature + HW27	Standard
		7/8	16.8 – 20,000	16QAM + TPC Feature + HW27	16QAM + TPC Feature + HW27	16QAM + TPC Feature + HW27	16.8 – 20,000	16QAM + TPC Feature + HW27	Standard
BPSK	HP-LDPC	1/2	2.4 – 4,211	LDPC Feature + HW27	LDPC Feature + HW27	LDPC Feature + HW27	2.4 – 12,632	LDPC Feature + HW27	LDPC Feature
	ULL-LDPC	1/2	2.4 – 4,154	LDPC Feature + HW27	—	LDPC Feature + HW27	2.4 – 12,463	LDPC Feature + HW27	LDPC Feature
QPSK	HP-LDPC	1/2	4.8 – 8,421	LDPC Feature + HW27	LDPC Feature + HW27	LDPC Feature + HW27	4.8 – 20,000	LDPC Feature + HW27	LDPC Feature
		2/3	6.4 – 11,228	LDPC Feature + HW27	LDPC Feature + HW27	LDPC Feature + HW27	6.4 – 20,000	LDPC Feature + HW27	LDPC Feature
		3/4	7.2 – 12,632	LDPC Feature + HW27	LDPC Feature + HW27	LDPC Feature + HW27	7.2 – 20,000	LDPC Feature + HW27	LDPC Feature
	ULL-LDPC	1/2	4.7 – 8,308	LDPC Feature + HW27	—	LDPC Feature + HW27	4.7 – 20,000	LDPC Feature + HW27	LDPC Feature
		2/3	6.3 – 11,013	LDPC Feature + HW27	—	LDPC Feature + HW27	6.3 – 20,000	LDPC Feature + HW27	LDPC Feature

Modulation	Code	Rate	Data Rate Range (kbps)	DMD20 / DMD20 LBST HW1 + HW6	DMD1050 / DMD1050T / DMD1050TS HW3 + HW8	OM20 HW1 + HW6	Data Rate Range (kbps)	DMD50 / DMD2050 HW2 + HW7	DMD2050E / DMD2050EU HW2 + HW7 + HW24
		3/4	7.0 – 12,366	LDPC Feature + HW27	—	LDPC Feature + HW27	7.0 – 20,000	LDPC Feature + HW27	LDPC Feature
OQPSK	HP-LDPC	1/2	4.8 – 8,421	LDPC Feature + HW27	LDPC Feature + HW27	LDPC Feature + HW27	4.8 – 20,000	LDPC Feature + HW27	LDPC Feature
		2/3	6.4 – 11,228	LDPC Feature + HW27	LDPC Feature + HW27	LDPC Feature + HW27	6.4 – 20,000	LDPC Feature + HW27	LDPC Feature
		3/4	7.2 – 12,632	LDPC Feature + HW27	LDPC Feature + HW27	LDPC Feature + HW27	7.2 – 20,000	LDPC Feature + HW27	LDPC Feature
	ULL-LDPC	1/2	4.7 – 8,308	LDPC Feature + HW27	—	LDPC Feature + HW27	4.7 – 20,000	LDPC Feature + HW27	LDPC Feature
		2/3	6.3 – 11,013	LDPC Feature + HW27	—	LDPC Feature + HW27	6.3 – 20,000	LDPC Feature + HW27	LDPC Feature
		3/4	7.0 – 12,366	LDPC Feature + HW27	—	LDPC Feature + HW27	7.0 – 20,000	LDPC Feature + HW27	LDPC Feature
8PSK	HP-LDPC	2/3	9.6 – 16,842	8PSK + LDPC Feature + HW27	8PSK + LDPC Feature + HW27	8PSK + LDPC Feature + HW27	9.6 – 20,000	8PSK + LDPC Feature + HW27	LDPC Feature
		3/4	10.8 – 18,947	8PSK + LDPC Feature + HW27	8PSK + LDPC Feature + HW27	8PSK + LDPC Feature + HW27	10.8 – 20,000	8PSK + LDPC Feature + HW27	LDPC Feature
8QAM	HP-LDPC	2/3	9.6 – 16,842	8QAM + LDPC Feature + HW27	8QAM + LDPC Feature + HW27	8QAM + LDPC Feature + HW27	9.6 – 20,000	8QAM + LDPC Feature + HW27	LDPC Feature
		3/4	10.8 – 18,947	8QAM + LDPC Feature + HW27	8QAM + LDPC Feature + HW27	8QAM + LDPC Feature + HW27	10.8 – 20,000	8QAM + LDPC Feature + HW27	LDPC Feature
16QAM	HP-LDPC	3/4	14.4 – 20,000	16QAM + LDPC Feature + HW27	16QAM + LDPC Feature + HW27	16QAM + LDPC Feature + HW27	14.4 – 20,000	16QAM + LDPC Feature + HW27	LDPC Feature

2114 WEST 7TH STREET TEMPE ARIZONA 85281 USA
480 • 333 • 2200 PHONE
480 • 333 • 2161 FAX