SLM-5650A

Satellite Modem
Installation and Operation Manual

Comtech EF Data is an
AS9100 Rev B / ISO9001:2000
Registered Company

Part Number MN-SLM5650A Revision 2

IMPORTANT NOTE: The information contained in this document supersedes all previously published information regarding this product. This manual is subject to change without prior notice.

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Revision 2
December 12, 2008

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Registered Company

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

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PREFACE

Customer Support

Contact the Comtech EF Data Customer Support Department for:

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

A Customer Support representative may be reached at:

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

480.333.2200 (Main Comtech EF Data Number)
480.333.4357 (Customer Support Desk)
480.333.2161 FAX

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

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

For Online Customer Support:

An RMA number request can be requested electronically by contacting the Customer Support Department through the online support page at **www.comtechefdata.com/support.asp**:

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

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

About this Manual

This manual describes the installation and operation for the Comtech EF Data SLM-5650A Satellite Modem. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the SLM-5650A.

Reporting Comments or Suggestions Concerning this Manual

Comments and suggestions regarding the content and design of this manual are appreciated. To submit comments, please contact the Comtech EF Data Technical Publications department:

TechnicalPublications@comtechefdata.com

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*.

Conventions and References

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*

Metric Conversion

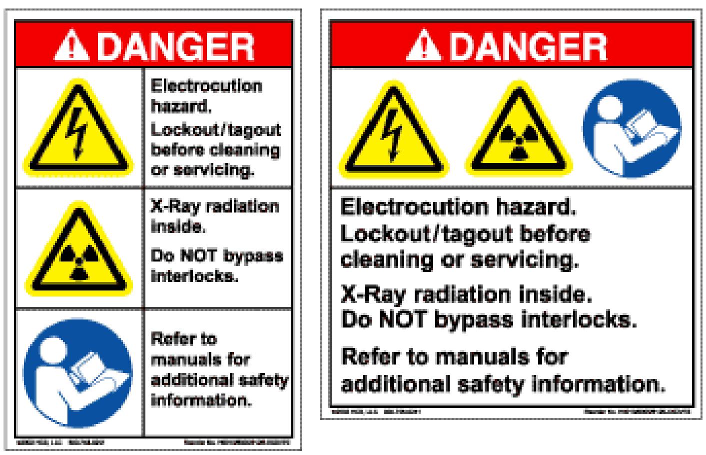
Metric conversion information is located on the inside back cover of this manual. This information is provided to assist the operator in cross-referencing non-Metric to Metric conversions.

Cautions and Warnings

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

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

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



Examples of Multi-Hazard Formats

Trademarks

Product names mentioned in this manual may be trademarks or registered trademarks of their respective companies and are hereby acknowledged.

Safety Compliance

EN 60950

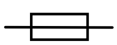
Applicable testing is routinely performed as a condition of manufacturing on all units to ensure compliance with safety requirements of EN60950.This equipment meets the Safety of Information Technology Equipment specification as defined in EN60950.

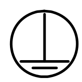
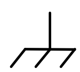
Low Voltage Directive (LVD)

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

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

International Symbols:

Symbol	Definition
~	Alternating Current
	Fuse

Symbol	Definition
	Protective Earth / Safety Ground
	Chassis Ground

NOTE

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

Warranty Policy

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

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

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

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

Limitations of Warranty

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

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

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

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

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

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

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

Exclusive Remedies

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

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

Chapter 1. INTRODUCTION

1.1 Overview

The SLM-5650A Satellite Modem (**Figure 1-1**) satisfies the requirements for applications that require state-of-the-art modulation and coding techniques to optimize satellite transponder bandwidth usage while retaining backward compatibility in government and military communications systems. The modem supports baseband data rates up to 155.52 Mbps, and its flexible modulation and **F**orward **E**rror **C**orrection (FEC) capabilities ensure that the throughput and BER over the satellite is optimized.

Figure 1-1. SLM-5650A Satellite Modem

The modem is compliant with the provisions of Department of Defense (DoD) Standard MIL-STD-188-165A, *Interoperability of SHF Satellite Communications PSK Modems (Frequency Division Multiple Access [FDMA] Operation*).

The modem is fully interoperable with legacy OM-73 modems and other Government owned Commercial Off-the-Shelf (COTS) and International Telecommunications Satellite Organization (Intelsat) compatible PSK modems.

The modem can be controlled and monitored from a variety of platforms, including its own front panel controls and indicators, a co-located Personal Computer (PC), and remote control systems such as the **V**ipersat **N**etwork **M**anagement **S**ystem (VNMS).

1.2 Features

The SLM-5650A incorporates the following features:

- MIL-STD-188-165A compliance (Types A, B, D, E, F)
- Intelsat IESS-308, -309, -310, and -315
- 64 kbps to 155.52 Mbps (Modulation-, code rate-, and interface-dependent)
- Selectable 70/140 MHz or 950 to 2000 MHz IF interfaces
- BPSK, QPSK, OQPSK, 8-PSK, and 16-QAM
- Adaptive Equalizer for high order modulation types
- FEC Rates: 5/16, 1/2, 2/3, 3/4, 5/6, 7/8, 17/18 and 1/1
- Viterbi and Reed-Solomon Codec
- Turbo Product Codec (Optional)
- Sequential FEC (Optional)
- EIA-530/422 Data Interface (built-in, to 20 Mbps)
- EIA-613/HSSI Data Interface (built-in, to 51.84 Mbps)
- Optional plug-in Data Interface supports Gigabit Ethernet and others
- Data Source Bit Synchronization (Clock recovery for input data without an associated transmit clock)
- Asymmetrical Loop Timing
- Full featured, built-in BER test-set
- Electrical and Ethernet Rx constellation monitor
- EIA-485 and EIA-232 interface for remote control
- Ethernet interface for remote control using HTTP, Telnet, and SNMP
- Flash upgrade capability

1.3 Options

How Enabled	Option
FAST	Variable data rates from 64 kbps to 5, 10, 20, or 52 Mbps
	8-PSK and 16-QAM
	Turbo Data Rates to 5, 10, 20, 52, and 155 Mbps
	Automatic Uplink Power Control (AUPC)
	ASYNC ESC
	Sequential FEC
	Demod Only
Hardware	Network Processor Interface (Card)
	Transec (Card)
	Gigabit Ethernet Interface (Card)
	G.703 Interface (Card)
	LVDS Interface (Card)

1.4 Modem Design

The modem was designed to accommodate a wide range of currently required features, and to be able to support both near- and far-term advances in software-defined radio technology as well as advances in FEC technology.

The user has the ability to:

- Add or change modular data interfaces and FEC assemblies
- Utilize an extensive array of built-in test capabilities
- Easily upgrade the modems capability in the field
- Easily upgrade the modems software in the field
- Have a wide range of flexible remote control options.

The user can expect:

- A highly reliable modem
- Low weight and low power dissipation
- A rugged, one-rack unit enclosure that defines state of the art.

The modem is designed for installation in fixed or mobile Earth Terminal (ET) facilities (sites) using Defense Satellite Communications System III (DSCS III), DSCS III/Satellite Life Enhancement Program (SLEP), Wideband Gap filler System (WGS), and commercial satellites.

1.5 Modem Description

Figure 1-2 depicts the functional block diagram for the SLM-5650A. The modem accepts signals from a selected digital signal source and modulates either a 70/140 MHz or L-Band Intermediate Frequency (IF) carrier with these signals. The demodulator will receive (Rx) a signal from either a 70/140 MHz or L-Band IF input interface, then demodulate the IF carrier. Clock and data are recovered and output on a selected data interface.

The transmit and receive functions are independent with respect to coding, interleaving, overhead, and scrambling. The modem will not allow simplex operation in the 70/140 and simplex operation in the L-Band IF interfaces at the same time. The modem will allow duplex operation in either one of the two IF interfaces.

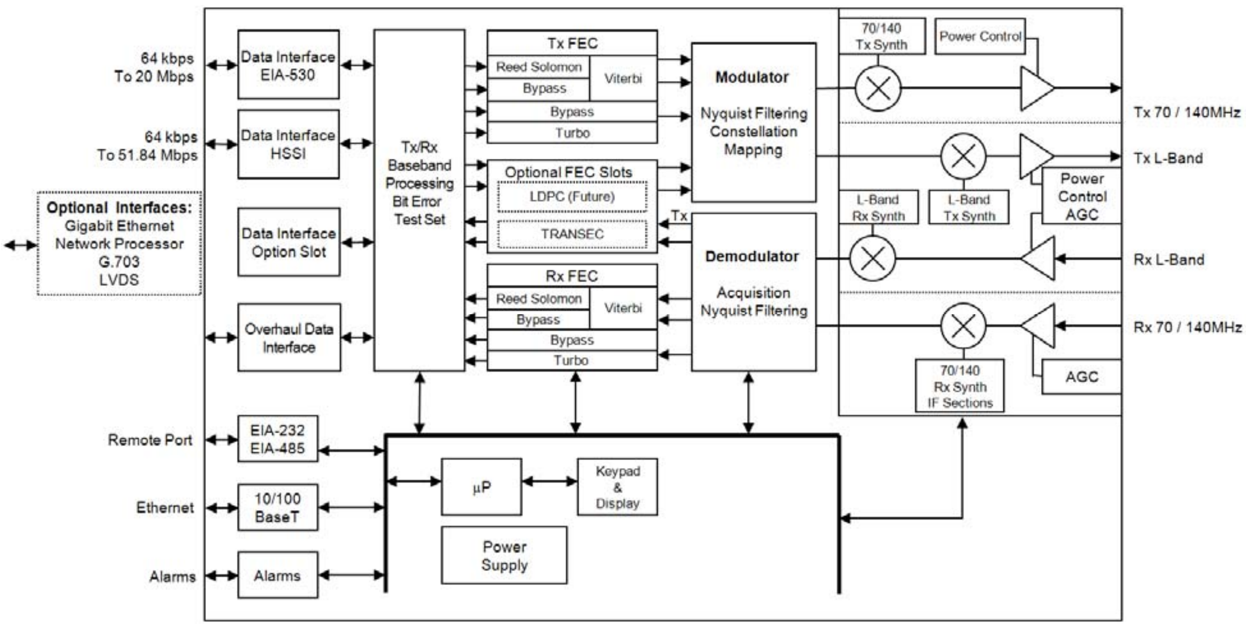


Figure 1-2. SLM-5650A Block Diagram

1.6 Operating Modes

The modem supports **Closed Network, Open Network** and **OM-73** modes of operation, described in detail in this section.

1.6.1 Closed Networks

Closed networks refer to private networks with modem operational parameters that do not need to interoperate with modems developed for commercial open networks, as specified under the IESS-308, IESS-309, and IESS-310.

The modem, however, is capable of operating in such closed networks over commercial satellites IAW Intelsat requirements for closed network operation.

A Comtech EF Data overhead channel is provided for use during Closed Network operation.

1.6.2 Open Networks (Intelsat)

Open networks refer to networks that must meet Intelsat specified **E**ffective **I**sotropic **R**adiated **P**ower (EIRP), EIRP stability, spurious emissions, intermodulation products, adjacent carrier interference, frequency tolerance, equalization, and modem parameters such as modulation, FEC, and scrambling.

The modem meets Intelsat certification requirements and is capable of operating in such open networks over commercial satellites IAW IESS-308, IESS-309, and IESS-310 requirements for open network operation.

In order to be fully compatible with commercial modems complying with IESS-308, IESS-309, and IESS-310, the modem supports the overhead framing integral to those modems.

IMPORTANT

No access is provided to the overhead channel data or alarms.

1.6.3 OM-73

OM-73 mode allows the SLM-5650A to be compatible with Linkabit's original OM-73 modem. This modem and it's operational capabilities have become a defacto standard when operating over DSCS satellites. All OM-73 modes listed in MIL-STD-188-165A are supported.

1.7 Data Interfaces

The SLM-5650A supports two native data interfaces as well as an option slot for an additional modular data interface. The two native interfaces are TIA/EIA-530/422 and TIA/EIA-613 (HSSI). The option interfaces available at this time are the Network Processor, Gigabit Ethernet, G.703, and LVDS. The modem will support only one interface at a time.

1.7.1 TIA/EIA-530

The TIA/EIA-530 interface supports the physical layer requirements for TIA/EIA-530. It also supports the TIA/EIA-422 electrical interface specification. This interface operates in duplex from 64 kbps to 20 Mbps.

1.7.2 TIA/EIA-613 (HSSI)

The TIA/EIA-613 interface supports the physical layer requirements for TIA/EIA-613. It also supports the TIA/EIA-612 electrical interface specification. This interface operates in duplex from 64 kbps to 51.84 Mbps.

1.7.3 Network Processor

The Network Processor (NP) interface is Comtech EF Data’s third generation IP router and Ethernet bridge device. The interface is designed to process more than 150,000 packets per second (pps) in Layer 2 or Layer 3 mode of operation. The NP Interface supports three primary operating modes: Layer 3 SCPC IP Router, Layer 3 Vipersat STDMA Router, and Layer 2 Ethernet Bridge.

1.7.4 10/100/1000 Base-T (Gigabit Ethernet)

The 10/100/1000 Base-T (Gigabit Ethernet, or GbE) interface performs a simple bridge function and passes IP packets, unaltered, in each direction between the LAN (10/100/1000 Base-T interface) and WAN (SLM-5650A modulator/demodulator). IP packet traffic is framed via HDLC encapsulation by the GBEI-5650A logic, and the GBEI-5650A is both the origination and termination point for HDLC encapsulation. HDLC CRC-16 verification is performed on all received (from WAN) HDLC frames.

1.7.5 T1/E1, T2/E2, G.703

The T1/E1, T2/E2, G.703 interface is designed for full duplex capability and is automatically configured for simplex transmit or simplex receive operation The interface operates at the digital hierarchy bit rates of 1.544, 2.048, 6.312, and 8.448 Mps as defined by ITU-T G.703.

1.7.6 LVDS

The Low Voltage Differential (LVDS) interface provides a physical and electrical interface between an SLM-5650A modulator or demodulator and signal sources operating with LVDS electrical characteristics.

1.8 Independent Tx and Rx Function

The Tx (modulator) and Rx (demodulator) sides of the modem are functionally independent and separately controllable. The baseband Tx and Rx sides of a communications channel passing through the modem are independently configurable, including the ability to select different parameters (to include data rate, modulation, and coding) in support of asymmetrical operation. **Note:** Data interfaces and IF interfaces are not independent.

> **Example**: If the TIA/EIA-530 interface is selected, DO NOT USE TIA/EIA-530 to transmit and a HSSI interface to receive. The same principle applies to the IF interfaces: if 70/140 is selected, DO NOT USE 70/140 to transmit and the L-Band interface to receive.

1.9 Interoperability

1.9.1 Interoperability with Legacy Modems

The modem is fully compatible and interoperable with all specified modes of operation of the following legacy modems:

- OM-73 (V)
- MD-1352 (P)/U (BEM-7650)
- MD-1340 (OM-73 interoperable mode only; orderwire not required)
- MD-1030B
- SLM-3650
- SLM-8650
- SLM-7650

Note: The remote control protocol will not be backwards compatible.

1.9.2 Protection Switches

Redundancy switching is accommodated with the following protection switches:

Compatible	CRS-300 1:10 Redundancy Switch CRS-311 1:1 Redundancy Switch
Non-compatible	SMS-300 SMS-450 SMS-7000 Modem Protection Switch

1.10 Summary of Specifications

Table 1-1. Summary of Specifications

Parameter	Specifications
Operating Frequency Range	52 to 88, 104 to 176, 950 to 2000 MHz (in 100 Hz steps).
Modulation Types	BPSK, QPSK, OQPSK, 8-PSK, 16-QAM.
Digital Data Rates	• 64 kbps to 5 Mbps, in 1 bps steps (EIA-530, EIA-613) • 64 kbps to 10 Mbps, in 1 bps steps (EIA-530, EIA-613) • 64 kbps to 20 Mbps, in 1 bps steps (EIA-530, EIA-613) • 64 kbps to 51.840 Mbps, in 1 bps steps (EIA-613, LVDS) • 64 kbps to 155.52 Mbps, in 1 bps steps (GBEI, Network Processor)
Symbol Rate Range	32 Ks/s to 64 Ms/s
EXT REF Input	TNC Connector, 1, 5, or 10 MHz selectable.
INT REF Stability	1×10^{-7}
Scrambling	V.35, OM-73, and Synchronous
IDR/IBS Framing Compatibility	Support for IBS and IDR framing. Allows basic IBS/IDR Open Network capable operation.
Built-in Test (BIT)	Fault and status reporting, BER performance monitoring, IF Loop-back, programmable test modes, built-in Fireberd emulation with all comprehensive BER measurements.
Summary Faults	Reported via Front Panel LEDs, 9-pin D-sub Alarm connector, relay contacts for Tx, Rx, Common equipment faults, and Tx and RX alarms. Open collector faults on the 15-pin D-sub Aux connector. Both data interfaces have open collector faults available.
Monitor and Control	EIA-485, EIA-232, 10/100 BASET Ethernet with HTTP, Telnet, and SNMP.
Modulator Specifications	
Output Power	+10 to -40 dBm, adjustable in 0.1 dB steps.
Output Return Loss	-14 dB (70/140 MHz) -9 dB (L-Band)
Output Impedance	50 Ω
Spurious	From Carrier ± TX SR TO 500 MHz –51 dBc (measured in a 10 kHz bandwidth).
Harmonics	From Carrier (CW) to the greater of the 12th harmonic or 4000 MHz –60 dBc.
Tx Clock Source	Rx, INT, Tx Terrestrial, and Data Source Sync.
Output Connections	• TNC for 52 to 88, 104 to 176 MHz • Type N for 950 to 2000 MHz
Modulation Timing Jitter	< 3 % of the modulation symbol period.
Modulation Phase Error	< 2 °
Modulator Spectral Inversion	Modem can invert the modulated spectrum.
Transmit Clock and Data Inversion	Modem can invert the Tx clock and data independently of each other. (EIA-530, EIA-613).

<table>
<tr><th colspan="4">Demodulator Specifications</th></tr>
<tr><td rowspan="3">Input Power</td><td rowspan="2">Desired Carrier</td><td>For 70/140 MHz:</td><td>+10 to -55 dBm</td></tr>
<tr><td>For L-Band:</td><td>+10 to -55 dBm (SR>3.2 MSPS)
+10 to $10 \cdot \log_{10}(SR/32000)$ -75 dBM
(SR≤3.2 MSPS) where SR is in symbols per second</td></tr>
<tr><td>Maximum Composite</td><td colspan="2">+20 dBm or +40 dBc</td></tr>
<tr><td colspan="2">Input Impedance</td><td colspan="2">50 Ω</td></tr>
<tr><td colspan="2">Input Connectors</td><td colspan="2">• TNC for 52 to 88, 104 to 176
• Type N for 950 to 2000 MHz</td></tr>
<tr><td colspan="2">Carrier Acquisition Range</td><td colspan="2">± 30 kHz, selectable</td></tr>
<tr><td colspan="2">Input Return Loss</td><td colspan="2">• -14 dB (70/140 MHz)
• -9 dB (L-Band)</td></tr>
<tr><td colspan="2">Buffer Clock</td><td colspan="2">INT, Tx Terrestrial, Rx Satellite</td></tr>
<tr><td colspan="2">Doppler Buffer</td><td colspan="2">128 to 4,194,304 bits,or 2 to 60 mSec</td></tr>
<tr><th colspan="4">Coding Options</th></tr>
<tr><td colspan="2">Uncoded</td><td colspan="2">1/1</td></tr>
<tr><td colspan="2">Viterbi</td><td colspan="2">K=7, 1/2, 3/4, and 7/8 rates</td></tr>
<tr><td colspan="2">Viterbi + Reed-Solomon</td><td colspan="2">Closed Network, per IESS-308, and IESS-309</td></tr>
<tr><td colspan="2">Trellis</td><td colspan="2">IESS-310</td></tr>
<tr><td colspan="2">Trellis + Reed-Solomon</td><td colspan="2">IESS-310</td></tr>
<tr><td colspan="2">Turbo</td><td colspan="2">Turbo Product Coding (TPC), per IESS-315</td></tr>
<tr><th colspan="4">Open Network Options</th></tr>
<tr><td colspan="2">IDR</td><td colspan="2">• INTELSAT IESS-308 (Framing only)
• INTELSAT IESS-310 (Framing only)</td></tr>
<tr><td colspan="2">IBS</td><td colspan="2">• INTELSAT IESS-310 (Framing only)
• INTELSAT IESS-309 (Framing only)</td></tr>
</table>

1.10.1 Performance

1.10.1.1 Acquisition and Timing Performance Requirements

The following reference E_b/N_0 is defined as the required E_b/N_0 corresponding to a BER of IE-3 with R-S FEC not enabled.

Table 1-2. Acquisition and Timing Performance Requirements

Parameter	Specification
Initial Acquisition	The modem achieves initial acquisition within the times as specified within ± 30 kHz at the reference E_b/N_0 • For baseband data rates between 64 kbps and ≤ 128 kbps, the maximum initial acquisition time is 500 seconds. • For Baseband data rates between 128kbps and ≤ 1544 kbps, the maximum initial acquisition time is 30 seconds. • For baseband data rates > 1544 kbps, the maximum initial acquisition time is 1.5 seconds.
Reacquisition	Reacquisition is achieved, as follows, after a period of up to 15 minutes of the absence of signal when the carrier returns to within 500 Hz of its original frequency. • For baseband data rates between 64 kbps and 128 kbps, the maximum reacquisition time shall be 45 seconds. • For baseband data rates between 128 kbps and 1544 kbps, the maximum reacquisition time shall be 20 seconds. • For baseband data rates greater than 1544 kbps, the maximum reacquisition time shall be 1 second.
BCI	With Tx and Rx random data, the mean time to loss of BCI due to falsely adding or deleting bits is at least 3 days at the reference E_b/N_0. In addition, the modem maintains BCI over 50 consecutive bits of all ones or zeros, which occur no more than once in 10,000 bits, without employing data scrambling.
System Retention	Synchronization and BCI are maintained for all E_b/N_0 above the reference E_b/N_0 (BPSK/QPSK/OQPSK/8-PSK) for signal loss of up to 50 modulation symbol periods, with a probability of at least 90 percent.
Receive Timing Jitter	The Rx output clock peak timing jitter cannot exceed ± 5 percent at the reference E_b/N_0 when the modulated signal meets the modulation timing jitter requirement.
Doppler	The modem meets the requirements with a Doppler shift, rate of change, and acceleration for satellite inclination up to ± 7° as presented in **Table 1-3**, and an additional 0.5 dB added to the reference E_b/N_0.

Table 1-3. Doppler Requirements

Parameter	C-Band	X-Band	Ku-Band	Ka-Band
Doppler Shift in Hz	± 2475	± 3535	± 6045	± 11,810
Doppler Rate of Change in Hz/sec	± 226	± 270	± 490	± 1046
Doppler Acceleration in Hz/sec^2	± 243	± 290	± 526	± 1124

1.10.1.2 Data Quality Performance

1.10.1.2.1 OM-73 Compatible Mode Performance

Operating in the OM-73-compatible mode, SLM-5650A BER vs. E_b/N_0 performance with differential encoding and data scrambling enabled does not exceed values shown in **Table 1-4** through **Table 1-9**.

1.10.1.2.2 MIL-STD-188-165A Compatible Mode Performance

Operating with BPSK, QPSK, or OQPSK modulation in the MIL-STD-188-165A compatible mode, SLM-5650A BER vs. E_b/N_0 performance with differential encoding and data scrambling enabled will not exceed values shown in **Table 1-4** (without Reed-Solomon) or **Table 1-5** (with Reed-Solomon) tested in an IF back-to-back configuration over the BER range 5 x 10^{-03} to 1 x 10^{-07}.

Operating with 8-PSK modulation and rate 2/3 pragmatic Trellis coding (without Reed-Solomon outer coding), SLM-5650A BER vs. E_b/N_0 performance is less than or equal to the values shown in **Table 1-6** when tested in an IF back-to-back configuration.

Operating with 8-PSK modulation, rate 2/3 pragmatic Trellis coding, and Reed-Solomon (219,201) outer coding, SLM-5650A BER vs. E_b/N_0 performance is better than or equal to the values shown in **Table 1-7** when tested in an IF back-to-back configuration.

1.10.1.2.3 IESS-308 Compatible Mode Performance

When operating in the IESS-308 Compatible Mode, SLM-5650A BER vs. E_b/N_0 performance is as specified in IESS-308.

1.10.1.2.4 IESS-309 Compatible Mode Performance

When operating in the IESS-309 Compatible Mode, SLM-5650A BER vs. E_b/N_0 performance is as specified in IESS-309.

1.10.1.2.5 IESS-310 Compatible Mode Performance

When operating in the IESS-310 Compatible Mode, SLM-5650A BER vs. E_b/N_0 performance is as specified in IESS-310.

1.10.1.2.6 16-QAM Coding Mode Performance

The SLM-5650A operating in the 16-QAM mode provides back-to-back BER vs. E_b/N_0 performance better than or equal to the values shown in **Table 1-8** when using the modulation formats indicated.

1.10.1.2.7 Turbo Coding Mode Performance

The SLM-5650A operating in the Turbo Code Mode provides back-to-back BER vs. E_b/N_0 performance better than or equal to the values shown in **Table 1-9** when using the modulation formats indicated.

1.10.1.2.8 Sequential Mode Performance

The SLM-5650A operating in the Sequential Mode provides back-to-back BER vs. E_b/N_0 performance better than or equal to the values shown in **Table 1-10** when using the modulation formats indicated.

1.10.1.3 BER

1.10.1.3.1 BPSK/QPSK/Offset QPSK BER Performance, Viterbi Decoding

Table 1-4 applies to BPSK, QPSK, and OQPSK rates.

Table 1-4. Viterbi Decoder BER

E_b/N_o (dB) Specifications Viterbi Decoder				
BER	**1/2**	**3/4**	**7/8**	**Uncoded**
10^{-3}	3.8	5.0	6.3	
10^{-4}	4.7	5.9	7.1	
10^{-5}	5.3	6.6	7.8	10.8
10^{-6}	5.9	7.2	8.4	11.6
10^{-7}	6.5	7.8	9.0	12.4
10^{-8}	7.1	8.3	9.5	13.0

1.10.1.3.2 BPSK/QPSK/Offset QPSK BER Performance, Viterbi Decoding and Reed-Solomon

Table 1-5 applies to BPSK, QPSK, and OQPSK rates.

Table 1-5. Viterbi Decoder with Reed-Solomon BER

E_b/N_o (dB) Specifications Viterbi Decoder with reed-Solomon			
BER	**1/2**	**3/4**	**7/8**
10^{-6}	4.1	5.6	6.7
10^{-7}	4.4	6.0	7.1
10^{-8}	5.0	6.3	7.5

1.10.1.3.3 8-PSK BER Performance, Trellis Decoder

Table 1-6 applies to 8-PSK with Trellis decoder rates.

Table 1-6. 8-PSK BER Performance, Trellis Decoder

E_b/N_o (dB) Specifications Viterbi Decoder		
BER	**2/3**	**5/6**
10^{-3}	6.5	8.7
10^{-4}	7.3	9.4
10^{-5}	8.1	10.1
10^{-6}	8.9	10.8
10^{-7}	9.6	11.6
10^{-8}	10.2	12.3

1.10.1.3.4 8-PSK BER Performance, Trellis Decoder and Reed-Solomon

Table 1-7 applies to 8-PSK with Trellis decoder and Reed-Solomon rates.

Table 1-7. 8-PSK BER Performance, Trellis Decoder with Reed-Solomon

E_b/N_o (dB) Specifications Viterbi Decoder		
BER	**2/3**	**5/6**
10^{-6}	6.2	8.2
10^{-7}	6.5	8.5
10^{-8}	6.7	8.9
10^{-9}	6.9	9.3
10^{-10}	7.2	9.7

1.10.1.3.5 16-QAM BER Performance, Viterbi Decoder and Reed-Solomon

Table 1-8 applies to 16-QAM with Viterbi decoder and Reed-Solomon rates.

Table 1-8. 16-QAM BER Performance, Viterbi Decoder with Reed-Solomon

E_b/N_o (dB) Specifications Viterbi Decoder		
BER	**3/4**	**7/8**
10^{-6}	8.2	9.5
10^{-7}	8.4	9.8
10^{-8}	8.6	10.1
10^{-9}	8.8	10.3
10^{-10}	9.0	10.6

1.10.1.3.6 BER Performance, Turbo Products Code Decoding

Table 1-9 applies to **T**urbo **P**roducts **C**ode (TPC) decoding rates.

Table 1-9. BER Performance, TPC Decoding

E_b/N_o (dB) Specifications											
BER	BPSK		QPSK/OQPSK				8-PSK			16-QAM	
	21/44	5/16	21/44	3/4	7/8	17/18	3/4	7/8	17/18	3/4	7/8
10^{-6}	3.3	2.5	3.3	3.9	4.3	6.8	6.5	7.1	10.0	7.6	8.2
10^{-7}	3.4	2.8	3.4	4.1	4.4	7.1	6.9	7.2	10.6	8.0	8.4
10^{-8}	3.5	3.1	3.5	4.3	4.5	7.4	7.2	7.3	11.2	8.4	8.5
10^{-9}	3.6	3.4	3.6	4.8	4.6	7.7	7.5	7.4	11.8	8.7	8.7
10^{-10}	3.7		3.7		4.7		7.8	7.5		9.0	8.8

1.10.1.3.7 BER Performance, Sequential Decoding

Table 1-10 applies to Sequential decoder with and without Reed-Solomon.

Table 1-10. BER Performance, Sequential Decoding

E_b/N_o (dB) Specifications					
DESCRIPTION	BER	BPSK	QPSK/OQPSK		
		1/2	1/2	3/4	7/8
Sequential – 64 kbps	10^{-5}	4.8	4.8	5.8	7.0
	10^{-6}	5.2	5.2	6.4	7.5
	10^{-7}	5.6	5.6	6.9	8.0
Sequential – 1544 kbps	10^{-5}	5.2	5.2	5.9	7.2
	10^{-6}	5.7	5.7	6.5	7.7
	10^{-7}	6.1	6.1	7.0	8.3
Sequential+RS (225,205)	10^{-6}	4.4	4.4	5.0	5.6
	10^{-7}	4.6	4.6	5.3	6.0
	10^{-8}	4.8	4.8	5.6	6.4

1.10.1.3.8 BER Performance with Symmetrical Adjacent Carriers

Operating in the presence of two adjacent symmetrical carriers (one lower in frequency and one higher in frequency with same modulation, data rate, and coding), the modem performance is not degraded more than as indicated in **Table 1-11 Column 3**, and **a)** and **b)** in this section. This performance is measured with the adjacent carriers center frequencies offset XR_s Hz from the center frequency of the carrier under test, where X is the spacing factor and R_s is the modulation symbol rate in Hz of the symmetrical carriers.

The BER of the test carrier is measured at the specified carrier Ratio of Energy per Symbol to Noise Power Density in a 1 Hz Bandwidth (E_s/N_0) Carrier to Noise Ratio (C/N) without the adjacent carriers.

The adjacent carriers are applied at the specified center frequencies and E_s/N_0 and the BER of the test carrier is measured. The change in BER is equal to the change in E_b/N_0 based on the characterization curve of the test carrier and the amount of **A**djacent **C**hannel **I**nterference (ACI) degradation. For modulation symbol rates below 38.4 ksps, this paragraph does not apply.

a) For X (spacing factor) = 1.2, the symmetric degradation shall be IAW one of the values in **Table 1-11 Column 3**, and corresponding test carrier E_s/N_0 in **Column 1**. Select a test carrier E_s/N_0 that will yield timely results based on modulation and coding used in the test configuration. The adjacent carriers E_s/N_0 shall be set to corresponding value in **Column 2**.

b) For the case of X (spacing factor) = 1.4, the degradation is less than 0.2 dB.

1.10.1.3.9 BER Performance with Asymmetrical Adjacent Carriers

Operating in the presence of two adjacent asymmetrical carriers, one lower in frequency and one higher in frequency, and each adjacent carrier symbol rate (R''_s) = 2.0 R'_s, the modem performance is not degraded more than indicated in **Table 1-11 Column 4**, and **a)** and **b)** in this section. Performance is measured with the adjacent carriers center frequencies offset (X/2) times ($R'_s + R''_s$) Hz from the test carrier center frequency, where X is the spacing factor and R'_s is the modulation symbol rate in Hz of the test carrier, and R''_s is the modulation symbol rate in Hz of each adjacent carrier. For modulation symbol rates below 38.4 ksps, this paragraph does not apply.

a) For X (spacing factor) = 1.2, and $R''_s = 2.0\ R'_s$, the asymmetric degradation shall be IAW one of the values in **Table 1-11 Column 4**, and the corresponding test carrier E_s/N_0 in **Column 1**. Select a test carrier E_s/N_0 that will yield timely results based on modulation and coding used in the test configuration. The adjacent carriers E_s/N_0 are set to the corresponding value in **Column 2**.

b) For the case of $(1.4/2)(R'_s + R''_s)$ Hz carrier spacing, the degradation is < 0.2 dB.

Table 1-11. Acceptable ACI Degradation with Spacing Factor of 1.2

Test Carrier E_s/N_0 (dB)	Adjacent Carriers E_s/N_0 (dB)	E_b/N_0 Degradation (dB) Symmetric Case	E_b/N_0 Degradation (dB) Asymmetric Case
5.5	18.5	≤ 0.36	≤ 0.41
6.0	19.0	≤ 0.38	≤ 0.43
8.0	21.0	≤ 0.48	≤ 0.56
8.4	21.4	≤ 0.51	< 0.60
10.0	23.0	≤ 0.64	≤ 0.77
12.0	25.0	≤ 0.88	≤ 1.10
12.7	25.7	≤ 0.99	≤ 1.21

1.11 Dimensional Envelope

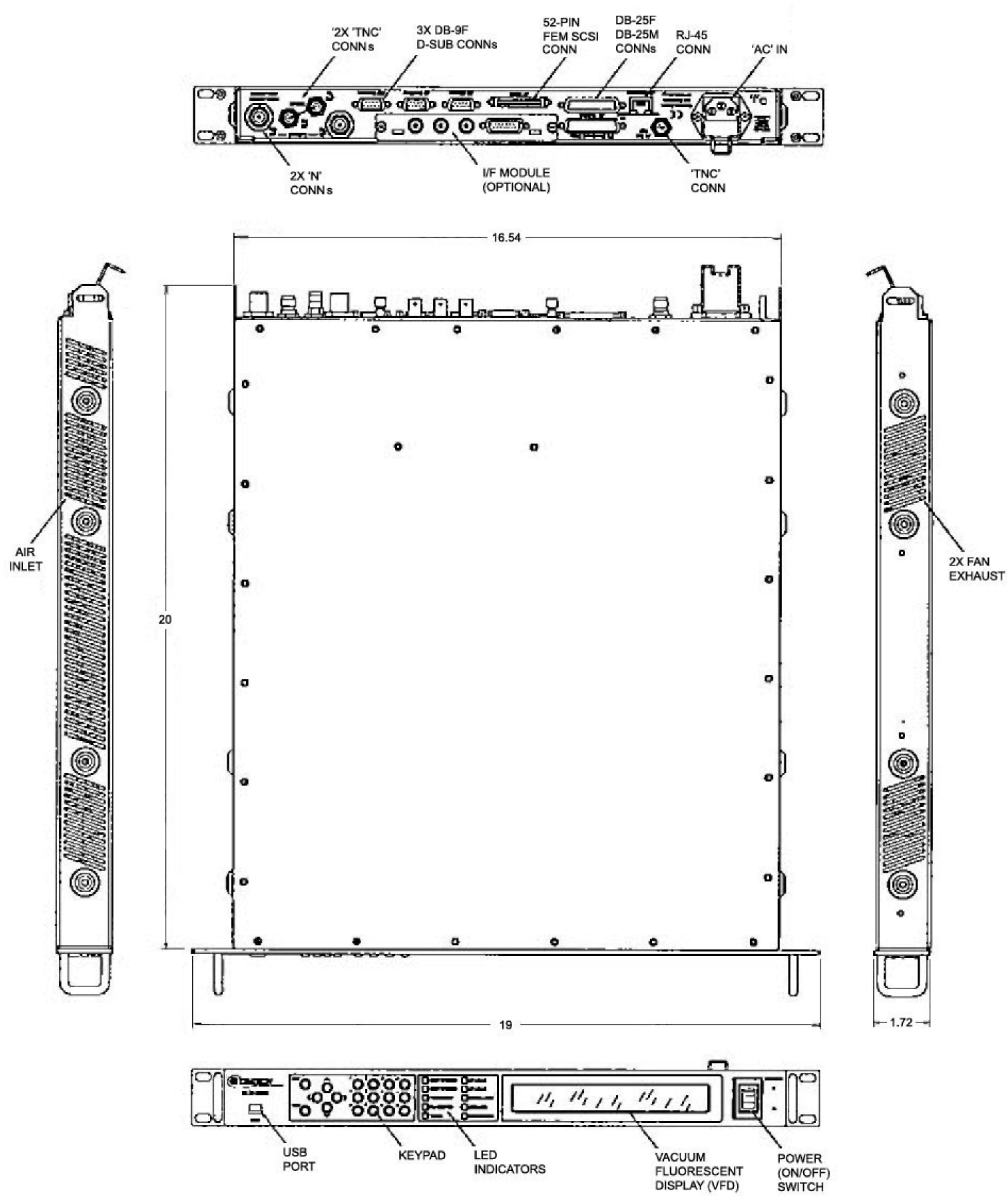


Figure 1-3. SLM-5650A Dimensional Envelope

Chapter 2. INSTALLATION

2.1 Unpacking and Inspection

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 SLM-5650A Satellite Modem and its Installation and Operation Manual are packaged and shipped in a pre-formed, reusable cardboard carton containing foam spacing for maximum shipping protection.

CAUTION

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

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, manual, and power cord from the carton.
4	**Save** the packing material for storage or reshipment purposes.
5	**Inspect** the equipment for any possible damage incurred during shipment.
6	**Check** the equipment against the packing list to ensure the shipment is correct.
7	**Refer** to the next section (Section 2.2) for installation instructions.

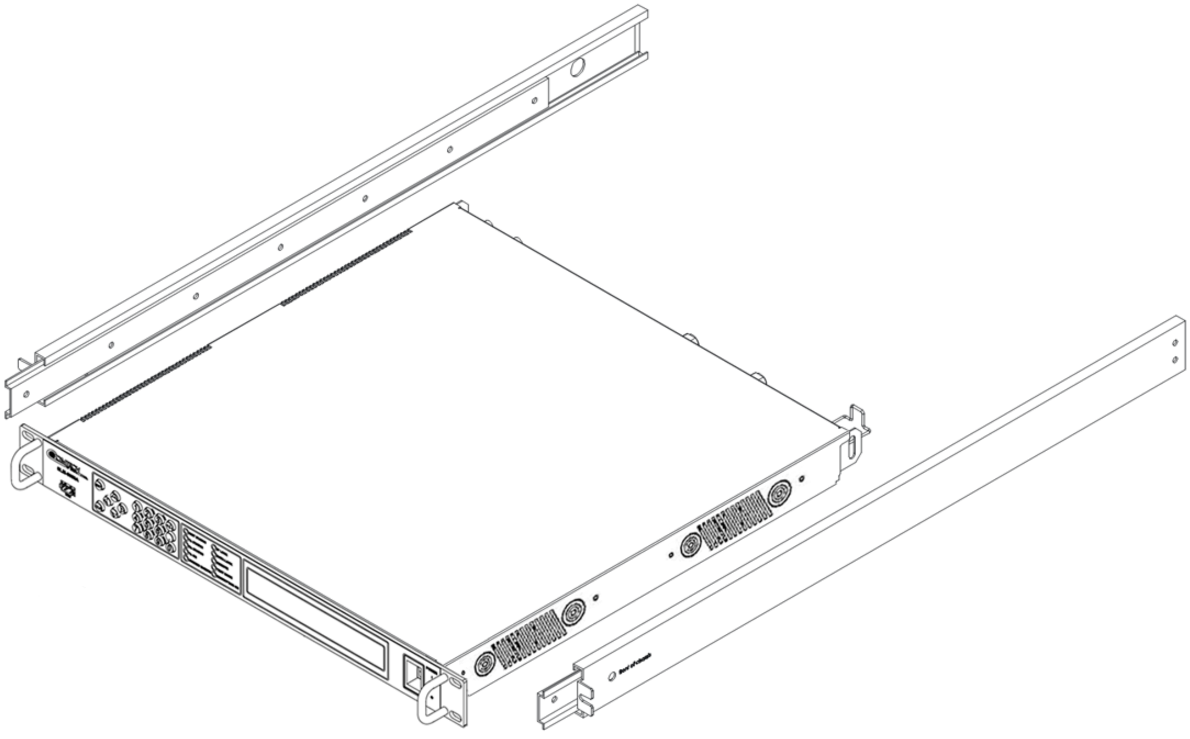
CAUTION

The equipment contains parts and assemblies sensitive to damage by Electrostatic Discharge (ESD). Use ESD precautionary procedures when touching, removing, or inserting PCBs.

2.2 Installation

2.2.1 Installation of Optional Side-Railings

Using standard shop tooling, install the optional side-railings (CEFD P/N FP/SL0006, shown in **Figure 2-1**) with customer-furnished standard shop hardware.

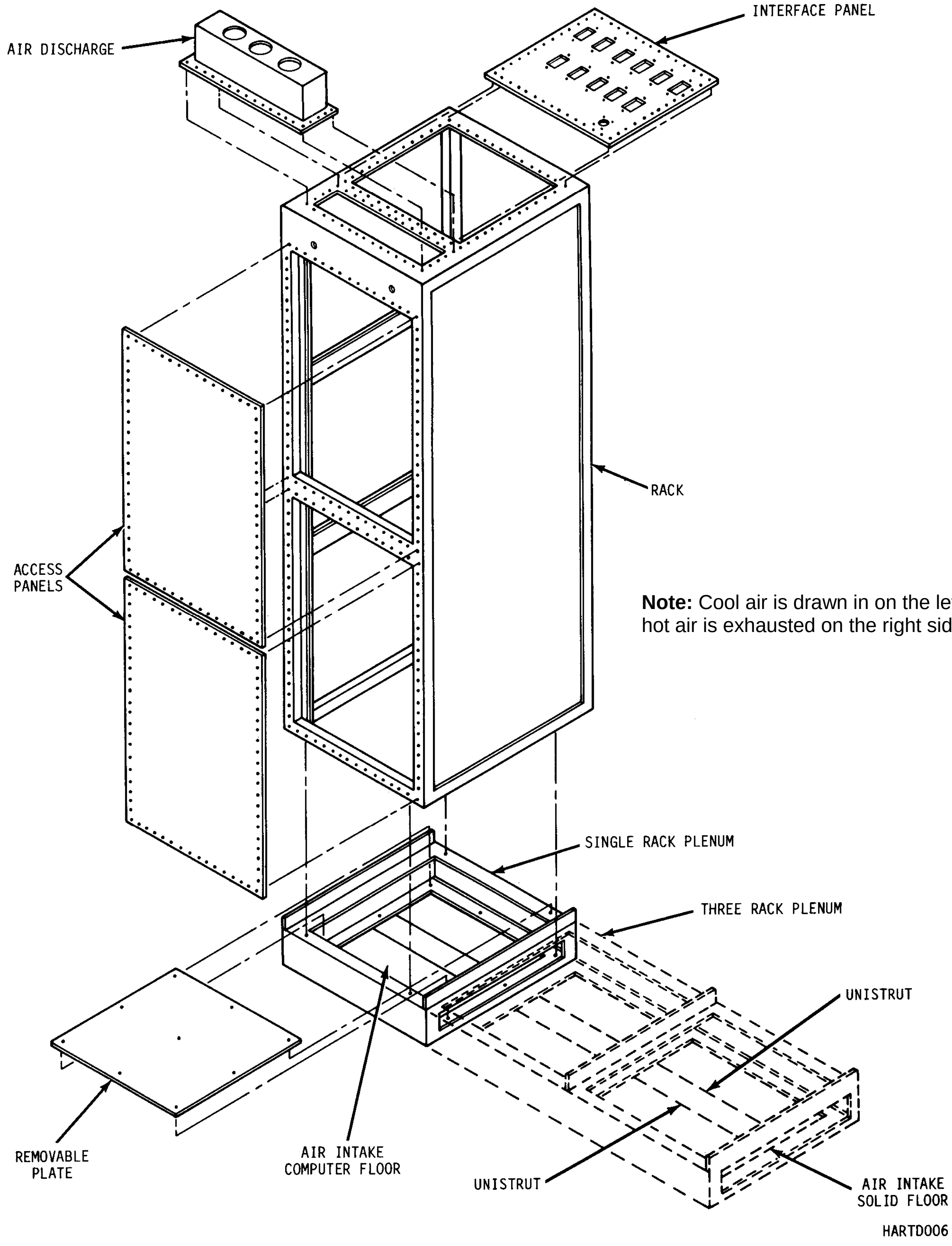


Quantity	Part Number	Description
1	FP/SL0006	Bearingless Rack Slide Set

Figure 2-1. Optional Side-Railings Installation (FP/SL0006)

2.2.2 Optional Installation Using a Typical Customer Rack

Step	Procedure
1	**Mount** the modem chassis in the assigned position of the equipment rack. Support the modem by either a rack-mounted shelf, or the two rear rack-mounted brackets supplied with the unit. **Note:** For a custom rack installation, refer to the rack drawing in **Figure 2-2**. Additional information can be obtained online from Comtech EF Data Customer Support – visit **www.comtechefdata.com**.
2	**Connect** the cables to the proper locations on the rear panel. Refer to **Chapter 3. REAR PANEL CONNECTOR PINOUTS** for detailed information regarding the available connectors on this modem.
3	Before turning the power switch on, become familiar with front panel operation as outlined in **Chapter 5. FRONT PANEL OPERATION**.
4	**Turn on** the power switch.
5	**Check** for the proper transmitter (Tx) output signal level and spectrum.
6	**Check** for proper receiver (Rx) input signal level and function.
7	If there is any problem with the installation, refer to **Appendix A. TROUBLESHOOTING** for possible solutions.



Note: Cool air is drawn in on the left side and hot air is exhausted on the right side.

Figure 2-2. Typical Customized Rack

Chapter 3. REAR PANEL CONNECTOR PINOUTS

3.1 Overview

Details about the connectors on the rear panel of the SLM-5650A, shown in **Figure 3-1**, are provided in the table and paragraphs that follow.

Figure 3-1. SLM-5650A Rear Panel (with optional Network Processor Interface installed)

Name	Ref Des	Connector Type	Function
EXT REF	J1	TNC	Modem Reference
Tx	J11	TNC	70/140 MHz
Rx	J3	TNC	70/140 MHz
Tx	J2	Type N	L-Band
Rx	J4	Type N	L-Band
Ethernet	J5	RJ-45	10/100 Base-T, Remote Control
EIA-530	J6	‘D’ 25-Pin Female	Data Input /Output, to 20 Mbps
HSSI	J7	52-Pin Female	Data Input /Output, to 51.84 Mbps
Overhead Data	P1	‘D’ 25-Pin Male	Not Used
Alarms	J8	‘D’ 9-Pin Female	Form-C Alarms
Auxiliary	J9	‘HD’ 15-Pin Female	
Remote	J10	‘D’ 9-Pin Female	Remote Interface
AC	–	IEC	Modem Power
Ground	–	10-32 stud	Chassis Grounding
Interface Option Slot	See 3.14	See 3.14	Supports optional data interfaces, including but not limited to interfaces such as the Network Processor Interface shown in Figure 3-1.

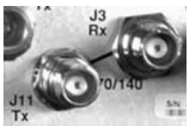
Note: To maintain compliance with the European EMC Directive (EN55022, EN50082-1) properly shielded cables are required for all data I/O.

3.2 External Reference (J1)

The J1 external reference uses a standard 50 Ω TNC female connector.

TNC Connector	Reference	Description	Direction
EXT REF	J1	External Reference 1, 5, 10 MHZ	Input

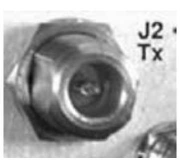
3.3 70 / 140 IF Interface Connectors (J11, J3)



The 70/140 IF Interfaces use standard 50 Ω TNC female connectors.

TNC Connector	Reference	Description	Direction
Rx	J3	52-88, 104-176 MHz Receive	Input
Tx	J11	52-88, 104-176 MHz Transmit	Output

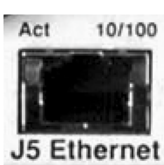
3.4 L-Band IF Interface Connectors (J4, J2)



The L-Band IF Interfaces use standard 50 Ω Type 'N' female connectors.

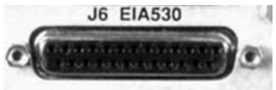
Type N Connector	Reference	Description	Direction
Rx	J4	950-2000 MHz Receive	Input
Tx	J2	950-2000 MHz Transmit	Output

3.5 Ethernet Remote Control Connector (J5)



The J5 Ethernet connection is an 8-pin 'RJ-45' type 10/100 Base-T connector. Remote control of the modem is provided using SNMP, HTTP or Telnet with this port.

3.6 EIA-530 Connector (J6)



The J6 EIA-530 data connection is a 25-pin ‘D’ type female (DB-25F) connector. This connector conforms to the EIA-530 pinout for EIA-422 operation only.

Pin #	Name
1	Ground
14	SD_B
2	SD_A
15	ST_A
3	RD_A
16	RD_B
4	RS_A
17	RT_A
5	CS_A
18	MOD FLT OC
6	DM_A
19	RS_B
7	Ground
20	Not Used
8	RR_A
21	DMD FLT OC
9	RT_B
22	DM_B
10	RR_B
23	Not Used
11	TT_B
24	TT_A
12	ST_B
25	Not Used
13	CS_B

3.7 HSSI Connector (J7)

Notes:

1. 52-pin connector.
2. These are non-HSSI defined signals. On Cisco routers there is no connection to those pins.

   Fault → Open
   No Fault → Ground

Pin #	Name
1	Ground
26	Ground
2	RT+
27	RT-
3	CA+
28	CA-
4	RD+
29	RD-
5	Not Used
30	Not Used
6	ST+
31	ST-
7	Ground
32	Ground
8	TA+
33	TA-
9	TT+
34	TT-
10	Not Used
35	Not Used
11	SD+
36	SD-
12	Not Used
37	Not Used
13	Ground
38	Ground
14	Not Used
39	Not Used
15	Not Used
40	Not Used
16	Not Used
41	Not Used
17	Not Used
42	Not Used
18	Not Used
43	Not Used
19	Ground
44	Ground
20	Not Used
45	Demod Fault – see Note 2
21	Mod Fault - see Note 2
46	Not Used
22	Not Used
47	Not Used
23	Not Used
48	Not Used
24	Not Used
49	Not Used
25	Ground
50	Ground
51	Ground
52	Ground

3.8 Alarms Connector (J8)

The J8 Alarms connection is a 9-pin 'D' type female (DB-9F) connector. Screw locks are provided for mechanical security on the mating connector. The alarm connector provides Form C contact closures for alarm reporting. The three Form C summary fault contacts are **Modulator**, **Demodulator**, and **Common Equipment.**

Pin #	Signal Function	Name
8	Unit Alarm is faulted	NO
3	Unit Alarm is not faulted	NC
7	Unit Alarm common	COM
5	Rx Alarm is faulted	NO
9	Rx Alarm is not faulted	NC
4	Rx Alarm common	COM
2	Tx Alarm is faulted	NO
6	Tx Alarm is not faulted	NC
1	Tx Alarm common	COM

3.9 Auxiliary Connector (J9)

The J9 Auxiliary connection is a 15-pin 'HD' type female (HD-15F) connector. Screw locks are provided for mechanical security on the mating connector. The auxiliary connector provides TTL open collector faults for the modulator and demodulator; a TTL input for external transmit carrier mute; an Analog demodulator Q and I constellation monitor; and a programmable DC voltage monitor for the demodulators AGC.

Pin #	Signal Function	Name
1	Demod I Channel	I
2	Spare	
3	Spare	
4	Reserved for Redundancy Switch	
5	Chassic Ground	GND
6	Demod Q Channel	Q
7	AGC Monitor Test Point	AGC
8	Spare	
9	Reserved for Redundancy Switch	
10	Ext Carrier Off	EXT
11	Reserved for Redundancy Switch	
12	Reserved for Redundancy Switch	
13	Tx TTL Fault	TxFLT
14	Rx TTL Fault	RxFLT
15	Reserved for Redundancy Switch	

3.10 Remote Connector (J10)

The J10 Remote connection is a 9-pin 'D' type subminiature female (DB-9F) connector. Screw locks are provided for mechanical security of the mating connector. The remote connector interfaces the M&C functions to a remote location; the remote location can be an M&C computer located away from the modem, but attached via cable to the remote connector. This DCE interface is user selectable for either EIA-232 or EIA-484.

Pinout				
EIA-232		**EIA-485**		
Pin #	**Name**	**Pin #**	**Name (2-Wire)**	**Name (4-Wire)**
5	GND	5	-Tx/Rx	-Tx
9		9	-Tx/Rx	-Rx
4		4	+Tx/Rx	+Tx
8	CTS	8	+Tx/RX	+Rx
3	TD	3		
7	RTS	7		
2	RD	2		
6	DSR	6		
1	GND	1		

* For EIA-485 2-Wire Operation:

- Only two wires are required
- Tie pins 4 and 8 together (both +)
- Tie pins 5 and 9 together (both -)

3.11 Overhead Data (P1)

The P1 Overhead Data interface connector is a 25-pin ‘D’ type male (DB-25M) connector. Screw locks are provided for mechanical security of the mating connector. This connector pinout allows for connection of EIA-422, EIA-485 and EIA-232 data interfaces for use with overhead framing. It also supports signaling for tactical applications.

Pin #	Signal Function	Name
1	EIA-422 Transmit Data “A”, Input	Tx Data A
14	EIA-422 Transmit Data “B”, Input	Tx Data B
2	EIA-422 Transmit Clock “A”, Output	Tx Clk A
15	EIA-422 Transmit Clock “B”, Output	Tx Clk B
3	EIA-422 Transmit Byte Sync “A”, Output	Tx Sync A
16	EIA-422 Transmit Byte Sync “B”, Output	Tx Sync B
4	EIA-422 Receive Data “A”, Output	Rx Data A
17	EIA-422 Receive Data “B”, Output	Rx Data B
5	EIA-422 Receive Clock “A”, Output	Rx Clk A
18	EIA-422 Receive Clock “B”, Output	Rx Clk B
6	EIA-422 Receive Byte Sync “A”, Output	Rx Sync A
19	EIA-422 Receive Byte Sync “B”, Output	Rx Sync B
7	Shield	Ground
20	EIA-485 Transmit Data “-“	485 Tx Data -
8	EIA-485 Transmit Data “+”	485 Tx Data +
21	EIA-422 Transmit Handover Sync “A”, Input	THS A
9	EIA-485 Receive Data “-“	485 Rx Data -
22	EIA-485 Receive Data “+”	485 Rx Data +
10	EIA-422 Transmit Handover Sync “B”, Input	THS B
23	EIA-232 Clear to Send	232 CTS
11	EIA-232 Receive Data	232 Rx Data
24	EIA-232 Request to Send	232 RTS
12	EIA-232 Transmit Data	232 Tx Data
25	EIA-422 Transmit Handover Control “A”, Input	THC A
13	EIA-422 Transmit Handover Control “B”, Input	THC B

*** For EIA-485 2-Wire Operation:**

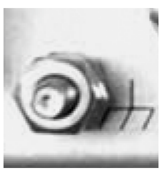
- Only two wires are required
- Tie pins 8 and 22 together (both +)
- Tie pins 9 and 20 together (both -)

3.12 AC Power Connector

A standard, detachable, non-locking, 3-prong power cord (IEC plug) supplies the Alternating Current (AC) power to the modem. Observe the following:

Input Power	65W maximum, 50W typical
Input Voltage	90 to 132 or 175 to 264 VAC Unit switches ranges automatically
Connector Type	I.E.C
Fuse Protection	1A slo-blo Line and neutral fusing 5 mm type fuses

3.13 Ground Connector (GND)



A #10-32 stud on the rear panel of the modem is used for connecting a common chassis ground among all equipment.

Note: The AC power connector provides the safety ground.

3.14 Data Interface Connector Pinouts

Refer to the appropriate chapter in this manual for data interface connector pinouts:

Interface Type	Chapter
Network Processor	MN-SLM5650A Chapter 8
Gigabit Ethernet	MN-SLM5650A Chapter 11
G.703	MN-SLM5650A Chapter 12
LVDS	MN-SLM5650A Chapter 13 *(Preliminary)*

Chapter 4. FLASH UPGRADING

4.1 Introduction

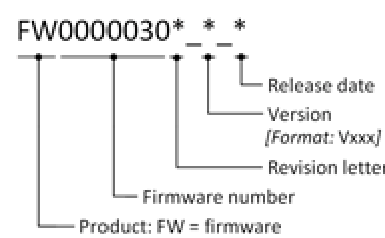
The SLM-5650A Satellite Modem stores its firmware in flash memory which allows the unit to upload firmware downloads from an external PC once Ethernet connectivity has been established.

Firmware upgrades may be obtained from Comtech EF Data on an as-needed basis. To obtain these upgrades, contact Comtech EF Data Customer Support to request access to the SLM-5650A firmware upgrade files online FTP site. The Customer Support representative will arrange for full firmware access information and download privileges at that time.

4.1.1 Firmware Numbers, File Versions, and Formats

All CEFD products are shipped configured with the current version firmware release. The most recent firmware versions are also available for download. If applicable, one version prior to the current release is also available for download. Be sure to identify and download the desired version of firmware.

The flashable files on the download server are organized by product prefix, firmware number (to verify the correct firmware number, see **Step 1** in **4.2 Bulk Firmware Ethernet FTP Upload Procedure**), revision letter if applicable, version, and release date.



As an example, the base modem bulk firmware for the SLM-5650A is **FW0000030*_*_*** (where the asterisks signify revision, version, and release date). Refer to the pertinent section in this chapter for the assigned Network Processor and TRANSEC Module firmware numbers.

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

For additional help with "zipped" file types, refer to "PKZIP for Windows", "WinZip", or "ZipCentral" help files. “PKZIP for DOS” is not supported due to file naming conventions.

4.2 Base Modem Bulk Firmware Upgrade – Ethernet FTP Upload Procedure

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

   The current base modem M&C version can be viewed at the top-level menu of the front panel display (press the **[CLR]** key several times to view). The firmware information can also be found within the **Utility: Firmware > Info > Image#1, Image#2** menu trees.

   Using serial remote control, the firmware revision levels may be obtained with the **<0/SWR?** query. For more information, refer to **Appendix C. REMOTE CONTROL.**

2. **Contact** Comtech EF Data Customer Support to request access to the SLM-5650A Bulk firmware upgrade files online FTP site. The Customer Support representative will arrange for full firmware access information and download privileges at that time.

3. **Create** a temporary directory (folder) on the PC:

   Windows: Select **File > New > Folder** and rename the “New Folder” to "temp" or another unused name. A "***c:\temp***" folder should now exist.

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

   CMD *prompt:* At the command prompt (c:\>) type "**MD temp**" or “**mkdir temp**” without quotes (**MD** and **mkdir** stand for ***make directory***). A "***c:\temp***" subdirectory should now exist, where **c:** is the drive letter used in the example.

4. **Download** the correct firmware file to this temporary folder (User access to the online FTP site must first be obtained from Comtech EF Data Customer Support).

   Refer to **4.1.1 Firmware Numbers, File Versions, and Formats** *for more information about the flash firmware data files.*

5. **Extract** the files to the temporary folder on the PC.

   A minimum of two files should be extracted:

   a. **FW0000030x.bin**, where "x" is the version of the bulk image file.

   b. **SLM-5650A_ReleaseNotes_Vx.pdf**, where “x” is the version of the Software Release notes.

6. **Connect** the client PC to the SLM-5650A modem 10/100 Ethernet M&C via a hub or a switch, or directly to a PC with a crossover cable.

7. **Send a “ping” command** to the modem to verify the communication and connection. Determine the IP address of the modem remotely or using the front panel:

   - Remotely - use the **<0/IPA?** command
   - Front panel - use the **Config: Remote > EthernetConfig > IP Address/Range** menu.
   - **Using DOS** to PING (and FTP): Click “**Start**” on the Windows toolbar, then select the “**Run...**” option. (Alternatively, use the “**DOS Prompt**” or “**Command Prompt**” icons in the **Start Menu**.)
   - **Using Win95 or Win98:** Type “**command**”.
   - **Using WinNT, Win2K or WinXP:** Type “**cmd**”.

Once in DOS, use “**cd c:\temp**” to change to the temporary directory created earlier. Use the “**dir**” command to list the downloaded files.

8. **Initiate** an FTP session with the modem. The example uses a DOS window.
   a. From the PC, type "ftp *xxx.xxx.xxx.xxx*" where "*xxx.xxx.xxx.xxx*" is the IP address of the SLM-5650A.
   b. Enter the **Admin User Name** (there will be no prompt for a password) to complete login.
   c. Verify the FTP transfer is binary by typing "bin".
   d. Type "prompt", then type "hash" to facilitate the file transfers.
9. **Transfer** the files:

   Type "put **fw0000030x**.bin bulk:” to begin the file transfers. The destination “bulk:” must be all lower-case. Approximately **one minute** is required to transfer the file.
10. **Verify** the file transfer:
    a. The PC should report that the file transfer has occurred, and the display on the modem will start reporting “PROGRAMMING FLASH SECTOR # xx – PLEASE WAIT”.
    b. Terminate the FTP session by typing "bye" and close the DOS window.
    c. Verify that the new file loaded using the procedure in Step 1.
11. **Change** the desired image to boot. From the SLM-5650 front panel menu: **Utility: Firmware > Select** (*use ◄ ► arrows to change to the other image),* then cycle power to reboot the modem.
12. **Verify** the new firmware versions are booting by observing the following messages on the modem display:

```
Comtech SLM-5650A Modem
Firmware Version: 1.1.x
```

Note: To load the second image, repeat **Steps 8 through 12**.

4.3 Network Processor Module Upgrade Procedure

1. **Contact** Comtech EF Data Customer Support to request access to the SLM-5650A Network Processor Module (also referred to as the "card") firmware upgrade files online FTP site. The Customer Support representative will arrange for full firmware access information and download privileges at that time.

2. **Create** a temporary directory (folder) on the PC:

   Windows**:* Select **File > New > Folder** and rename the "New Folder" to "temp" or another unused name. A "c:\temp***" folder should now exist.

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

   CMD** prompt:* At the command prompt (c:\>) type "**MD temp**" or "**mkdir temp**" without quotes (**MD** and **mkdir** stand for ***make directory). A "***c:\temp***" subdirectory should now exist, where **c:** is the drive letter used in the example.

3. **Download** the correct firmware file to this temporary folder (User access to the online FTP site must first be obtained from Comtech EF Data Customer Support).

   Refer to **4.1.1 Firmware Numbers, File Versions, and Formats** *for more information about the flash firmware data files.*

4. **Extract** the files in the temporary folder on the PC:

   FW0000051x.bin, where "x" is the version of the bulk image file.

5. **Connect** the client PC to the SLM-5650A modem Ethernet via a hub or a switch, via one of the four ports on the Network Processor Module, or directly to a PC with a crossover cable.

6. **Enable** the Network Processor Module. From the SLM-5650A front panel: **CONFIG: Mode > Interface >** *select* **Network Processor.**

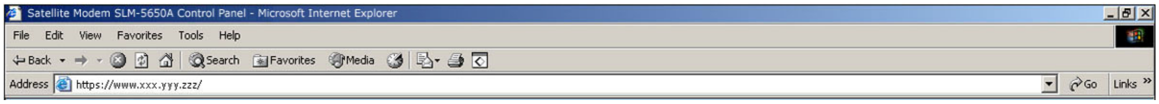
7. **Send a "ping" command** to the modem's **Traffic IP** to verify the communication and connection.

   Determine the IP address of the Network Processor Module: From the front panel, go to the **Config: Remote > EthernetConfig > Option Card Addr > Traffic IP** *menu, then select* **Yes****.

   **** Note:** *Although the message "***Changing Option Card IP Addr may cause the modem to reboot. Continue?"** *is displayed, reboot occurs* **only if the IP Address is changed**.

   - **Using DOS** to PING: Click "**Start**" on the Windows toolbar, then select the "**Run...**" option. (Alternatively, use the "**DOS Prompt**" or "**Command Prompt**" icons in the **Start Menu**.)
   - **Using Win95 or Win98**, type "**command**".
   - **Using WinNT, Win2K or WinXP**, type "**cmd**".

8. **Initiate a Web session** with the SLM-5650A Network Processor Module. From the PC, type *http://www.xxx.yyy.zzzz* (where "*www.xxx.yyy.zzz*" represents the IP address of the SLM-5650A Network Processor Module) into the **Address** area of the Web browser (the examples uses Internet Explorer Version 6.0; NP Web pages are shown with optional FAST Features installed):

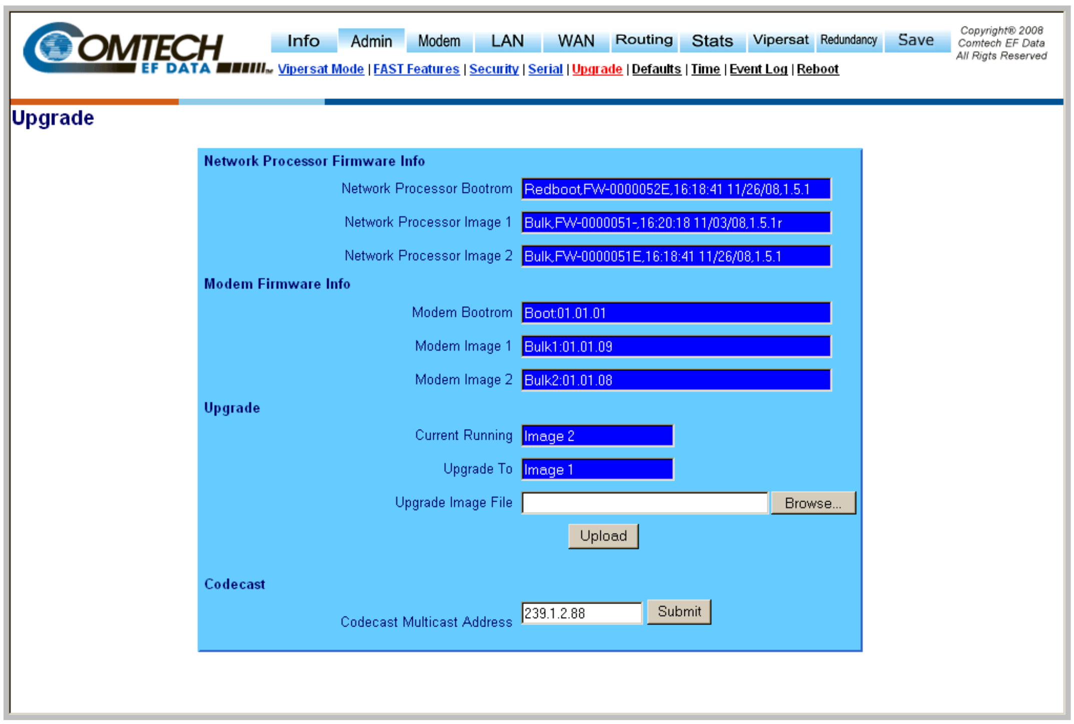


9. **To upgrade the Network Processor Bulk firmware:**

   a. When prompted, enter the User Name and Password:

      Factory Default User Name is: **comtech**
      Password is: **comtech**

   b. Select **Admin | Upgrade**:



   c. **Select Image1** or **Image2** from the **Upgrade To** list to select to select the specific slot that will have its firmware overwritten, then click [**Submit]**.

IMPORTANT

***The selection is not sent to the modem unless* [Submit] *is clicked*.**

   d. **Locate** the upgrade file, downloaded previously to the computer using Steps 2 through 4, by clicking **[Browse]** at the **Upgrade Image File** box.

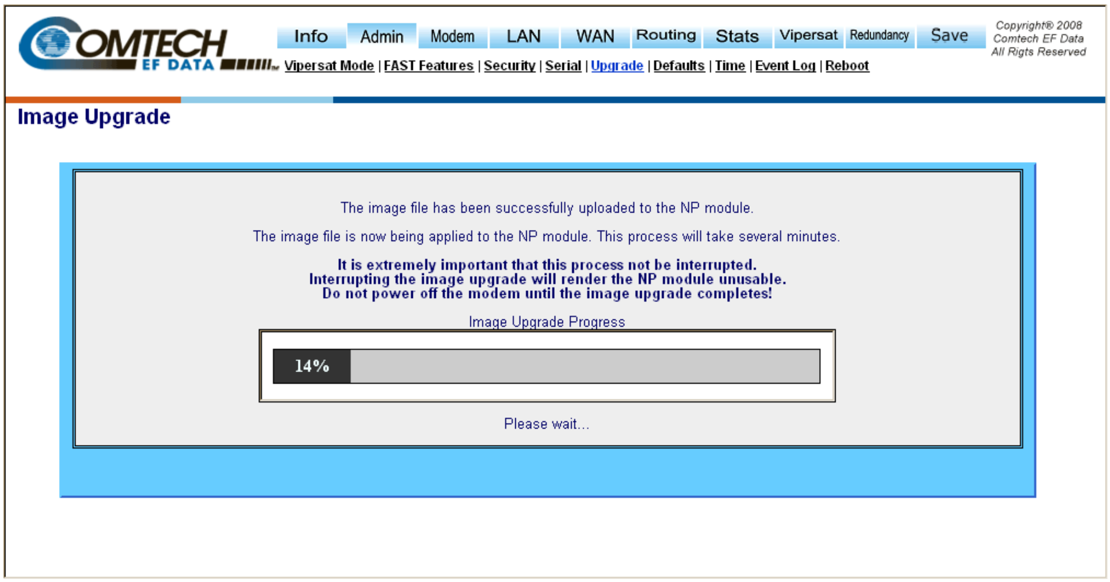
   e. **Select** the file, then click [**Upload]** to begin the upgrade process.

10. **Wait** while the file transfers. The Network Processor will download the upgrade file from the computer. Please allow sufficient time for the file to be loaded into the Network Processor – downloading will take approximately **five minutes**.

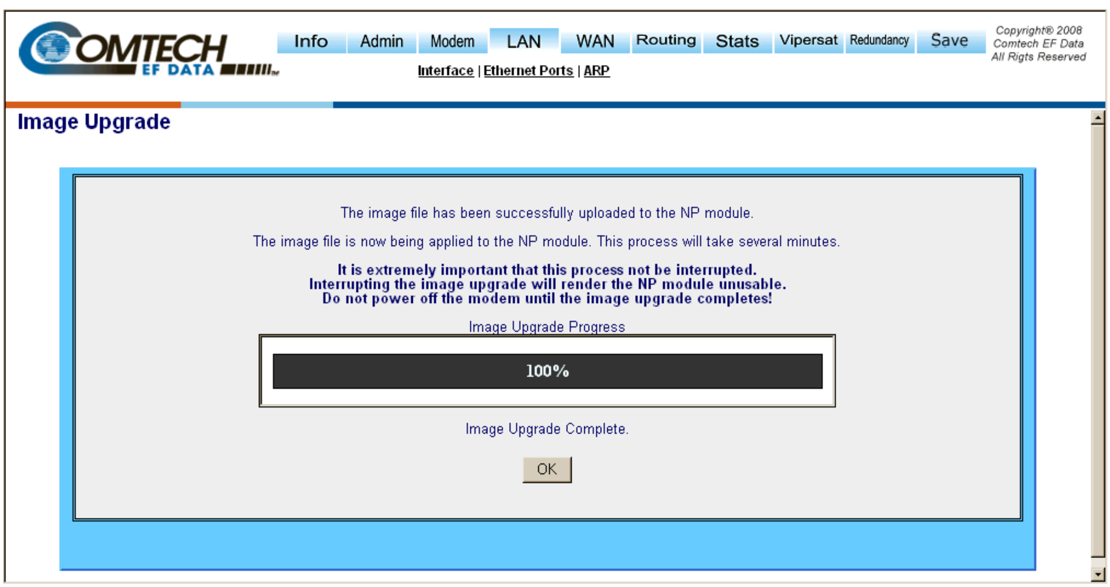
IMPORTANT

It is not necessary to wait five minutes before clicking* [OK]*, but you* MUST *wait five minutes before rebooting the modem.

After [**Upload]** is clicked, the **Please Wait…** status window appears and displays, by scrolling percentage of completion, the file transfer progress:

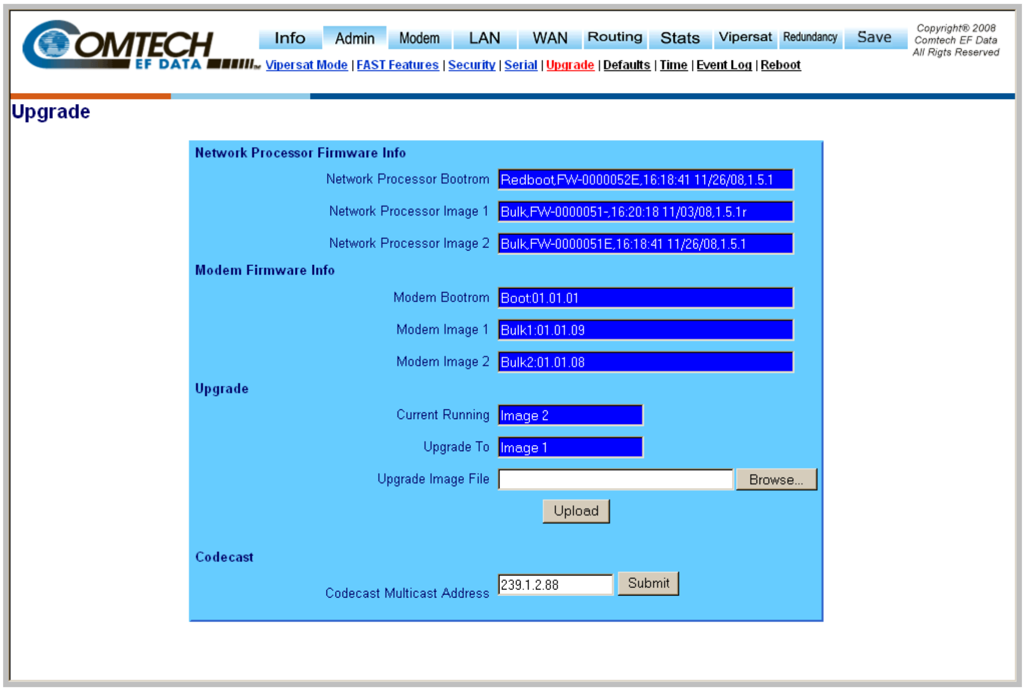


Once the transfer has completed, the **Image Upgrade Complete** message window is displayed:

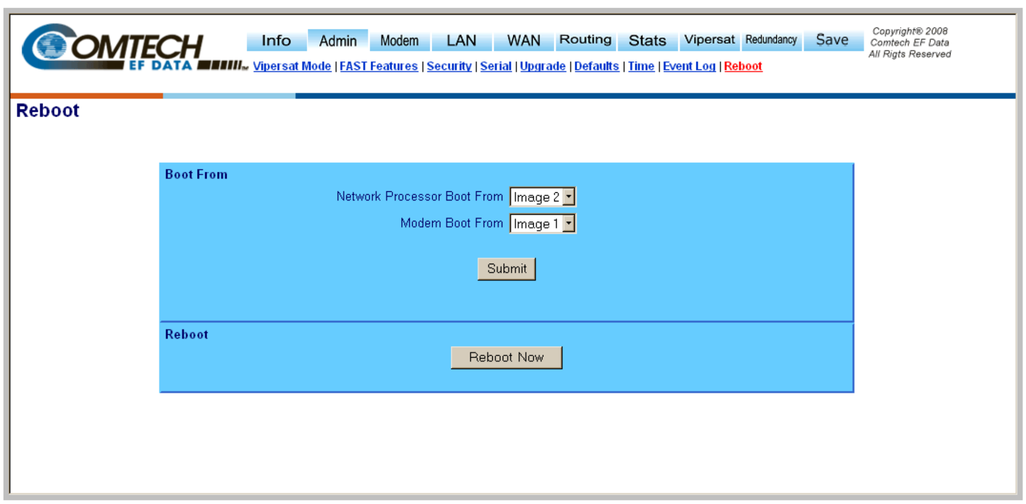


Click [**OK]** to return from the **Image Upgrade Complete** to the **Admin Reboot** page.

11. **Verify** that the new firmware is reported on the proper Network Processor Bulk slot, depending on the selections made in **Step 9**:



12. **Refresh** the browser page.
13. To load the second image, **repeat Steps 9 through 11**.
14. Go to **Admin | Reboot. Select Image 1** or **Image 2** as needed from the **Boot From** list to force the Network Processor to boot using firmware with the most recent build date, then click **[Submit]**.



15. IMPORTANT

***Save the settings using* Admin | Unit Config → [Save Now]** *before rebooting <u>to prevent loss of configuration settings</u>.*

16. After saving, click **[Reboot Now]** to boot the Network Processor with the new firmware.

4.4 TRANSEC Module Upgrade Procedure

1. **Contact** Comtech EF Data Customer Support to request access to the SLM-5650A TRANSEC Module firmware upgrade files online FTP site. The Customer Support representative will arrange for full firmware access information and download privileges at that time.

2. **Create** a temporary directory (folder) on the PC.

   Windows*:* Select **File > New > Folder** and rename the "New Folder" to "temp" or another unused name. A "***c:\temp***" folder should now exist.

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

   CMD *prompt:* At the command prompt (c:\>) type "**MD temp**" or "**mkdir temp**" without quotes (**MD** and **mkdir** stand for ***make directory***). A "***c:\temp***" subdirectory should now exist, where **c:** is the drive letter used in the example.

3. **Download** the correct firmware file to this temporary folder (User access to this online FTP site must first be obtained from Comtech EF Data Customer Support).

   Refer to **4.1.1 Firmware Numbers, File Versions, and Formats** *for more information about the flash firmware data files.*

4. **Extract** the files in the temporary folder on the PC:

   FW-0000058x.tar, where "x" is the version of the bulk image file.

5. **Connect** the client PC to the SLM-5650A modem Ethernet via a hub or a switch, or directly to a PC with a crossover cable.

6. **Enable** the TRANSEC Module. From the SLM-5650 front panel menu: **CONFIG: Transec > State:** *select* **Encrypted**.

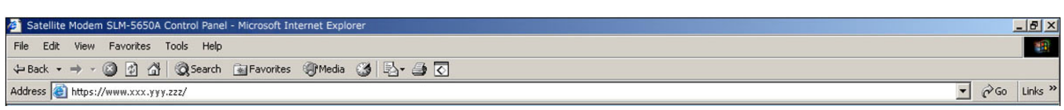
7. **Send a "ping" command** to the TRANSEC Module to verify the communication and connection.

   Determine the IP address of the TRANSEC Module from the front panel with the **Config: Transec > Module IP Address** *menus.*

   - **Using DOS** to PING: Click "**Start**" on the Windows toolbar, then select the "**Run...**" option. (Alternatively, use the "**DOS Prompt**" or "**Command Prompt**" icons in the **Start Menu**.)
   - **Using Win95 or Win98**, type "**command**".
   - **Using WinNT, Win2K or WinXP**, type "**cmd**".

8. **Initiate a Web session** with the SLM-5650A TRANSEC Module. The example uses Internet Explorer Version 6.0.

   a. From the PC, type *https://www.xxx.yyy.zzz* (where "www.xxx.yyy.zzz" represents the IP address of the TRANSEC Module) into the **Address** area of the Web browser:

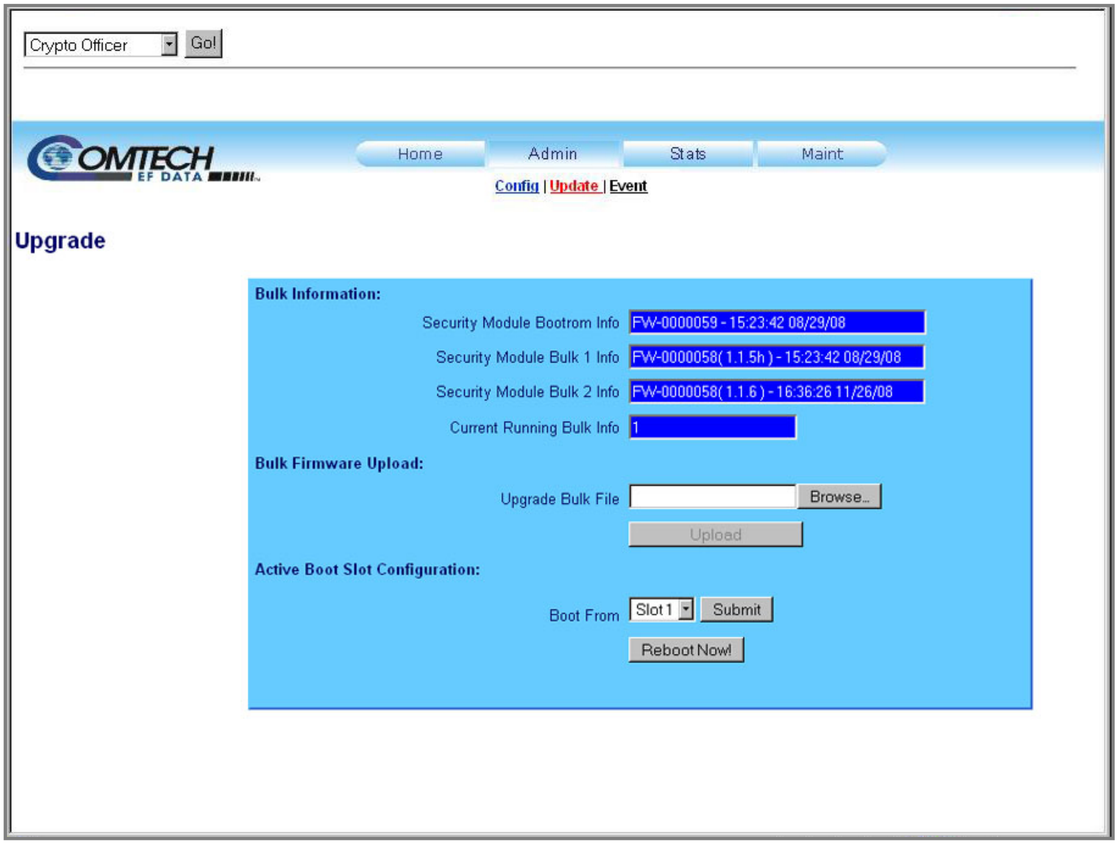


b. In the upper left corner of the Upgrade window, select **Crypto Officer** from the navigation list, then click **[Go!]**. When prompted, enter the User Name and Password:

Factory Default User Name is: **COMTECH**
Password is: **COMTECH**

9. **To upgrade the TRANSEC Module Bulk firmware:**

a. **Select Admin | Update.**



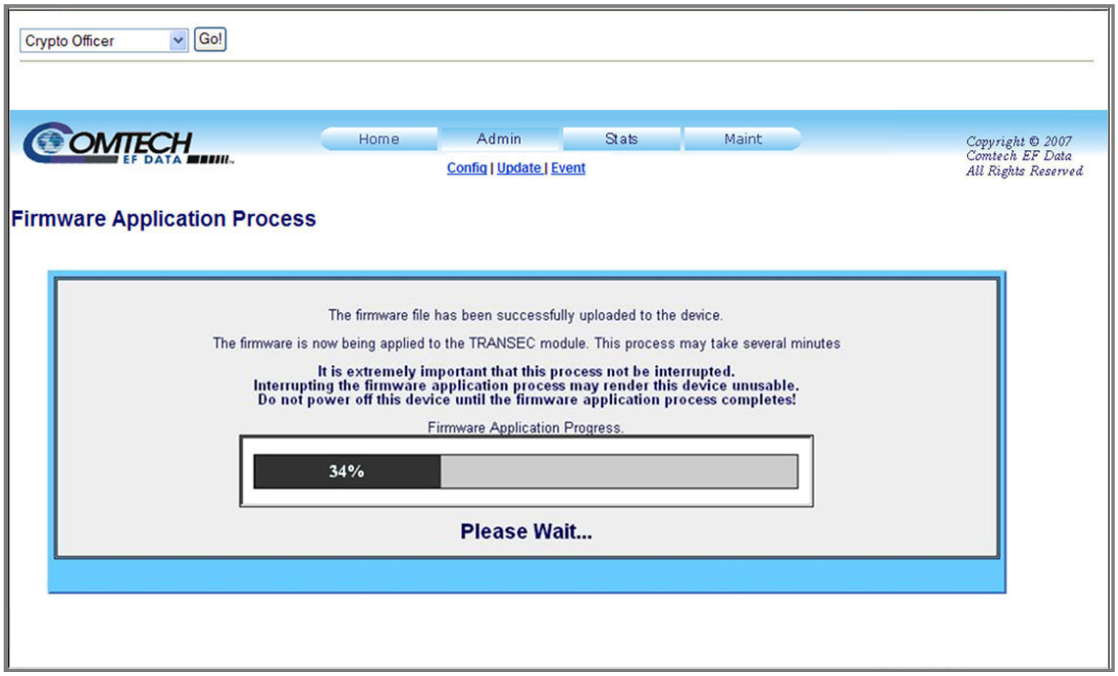
b. **Locate** the upgrade file, previously downloaded to the computer during Steps 2 through 4, by clicking **[Browse]** at the **Upgrade Bulk File** box.

c. **Select** the file, then click [**Upload]** to begin the upgrade process.

10. **Wait** while the file transfers.

The **Firmware Application Process** window appears after [**Upload]** is clicked. The TRANSEC Module will upload the upgrade file from the computer. Please allow sufficient time for the file to be uploaded – approximately **five minutes** is required for the process to be completed.

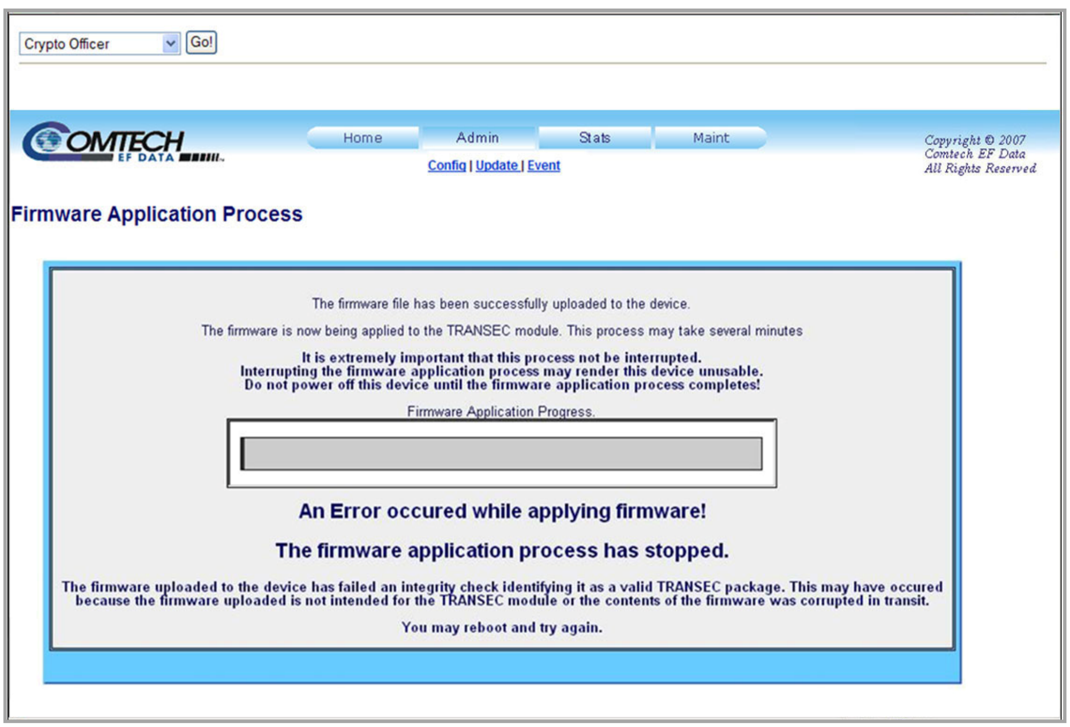
During the Firmware Application Process, a scrolling progress indicator displays the status of the upload in terms of percentage completion:



IMPORTANT

Any power failure during this process will result in failure of the TRANSEC Module.

In the event that an error occurs during the Firmware Application Process, the following message is displayed:

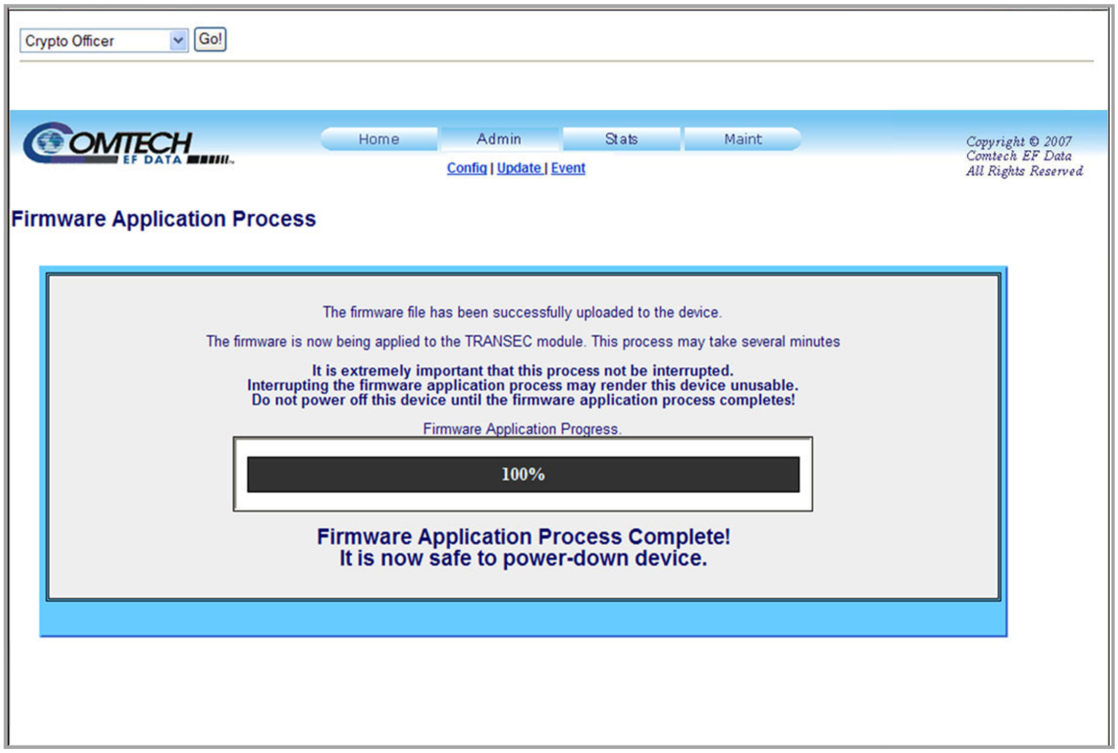


For troubleshooting purposes, three common reasons for disruption of the Firmware Application Process are:

- Power Failure
- Loss of Ethernet signal (e.g., disconnection of Ethernet cable)
- Attempting to load firmware other than the TRANSEC Module firmware (i.e., FW-0000058x.tar).

Should a failure occur, reboot the unit and restart the TRANSEC Module upgrade process as outlined in this section.

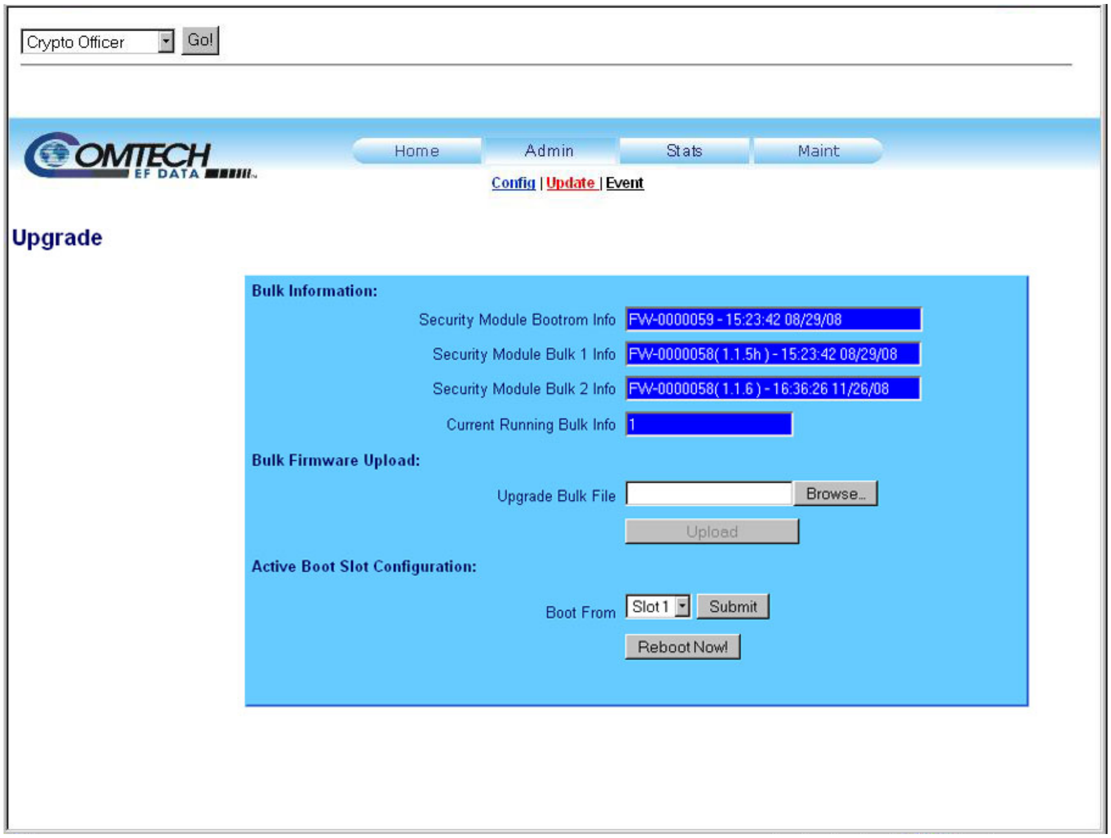
Once the Firmware Application Process has successfully completed the upload, the progress bar will reach 100%. The following message is then displayed:



11. To load the second image, **repeat Steps 9 through 10**.

12. **Verify** that the new firmware is reported on the proper **Security Module Bulk Info** slot, depending on the selections made in **Step 9**, then click [**Submit]**.

13. Click **[Reboot Now!]** to boot the TRANSEC Module with the new firmware.



The modem will reboot with the new firmware loaded as configured. It will be necessary to restart the SLM-5650A TRANSEC Module Web Server Interface session once the modem has returned online.

Chapter 5. FRONT PANEL OPERATION

5.1 Overview

The front panel operation of the SLM-5650A, the menus and their explanations, and clocking information are described in this chapter. For information about remote control operation, refer to **Appendix C. REMOTE CONTROL**.

5.2 Front Panel

The modem front panel enables the user to control modem configuration parameters and display the modem status.

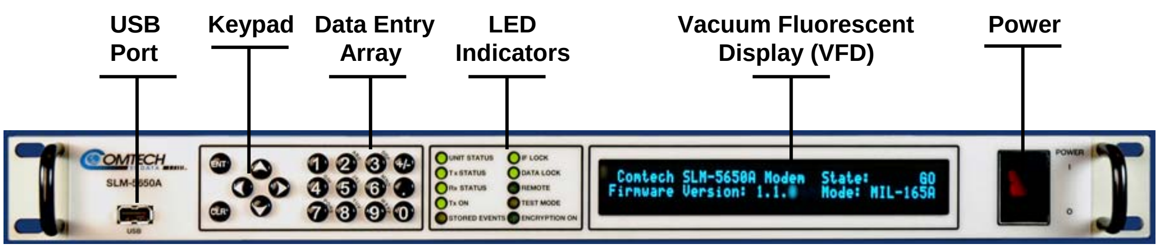


Figure 5-1. Modem Front Panel

As shown in **Figure 5-1**, the front panel features include (from left):

- USB Port for TRANSEC Key loading
- 6-button keypad for local control
- 12-button array for manual data entry
- 10 LEDs to provide overall status at a glance
- 40-character, 2-line Vacuum Fluorescent Display (VFD)
- Backlit On/Off power switch

5.2.1 Keypad with Data Entry Array

The front panel keypad controls the local operation of the modem. The keypad consists of 18 keys. Each key provides one or more logical functions.

[ENT] (Enter)	This key is used to select a displayed function, or to execute a modem configuration change.
[CLR] (Clear)	This key is used to back out of a selection, or to cancel a configuration change which has not been executed using **[ENT].** Pressing **[CLR]** generally returns the display to the previous selection.
‹ and ›	These keys are used to move to the next selection, or to move the cursor for certain functions.
∧ and ∨	These keys are used primarily to change configuration data (numbers), but are also used at times to move from one section to another.
Alphanumeric	These buttons are used to manually enter alphanumeric values. For multi-function buttons, each successive push selects the next choice. **For example:** The first time the '2' button is pushed, it will select a '2'; the second time, an 'A'; the third time, a 'B'; the forth time, a 'C'. Pushing the button a fifth time would start over with a '2'.
+/-	The +/- buttons permits user to change signs.

IMPORTANT

The keypad has an auto-repeat feature. If a key is held down for more than three seconds, the key action will repeat, automatically, at the rate of seven keystrokes per second.

Whenever a key is pressed, the modem responds by beeping:

- A single-beep indicates a valid entry and the appropriate action was taken.
- A double-beep indicates an invalid entry or a parameter is not available for operation.

5.2.2 LED Indicators

The 10 LEDs on the front panel indicate:

- General modem summary fault information
- Status
- Alarms

The individual LED Indicator operations are defined as follows:

LED	Color	Condition
Unit Status	Green	No Unit Faults or Stored Faults
	Red	A Unit Fault exists
	Orange	A Unit Alarm exists
Tx Status	Green	No Tx Traffic Faults or Alarms exists
	Orange	A Tx Traffic Alarm exists
	Red	A Traffic Fault exists
	Off	Demod Only
Rx Status	Green	No Rx Traffic Faults or Alarms exists
	Orange	A Rx Traffic Alarm exists
	Red	A Rx Fault exists
	Off	Demod Faults are masked
Tx On	Green	Transmitter is currently on. This indicator reflects the actual condition of the transmitter, as opposed to the programmed condition.
	Off	Transmitter is currently OFF.
Stored Events	Orange	Stored Events are logged.
	Off	No Stored Events.
IF Lock	Green	Demod has constellation lock.
	Off	No constellation lock.
Data Lock	Green	Decoder is locked.
	Off	Decoder is not locked.
Remote	Green	The Unit is in Remote Communication Mode.
	Off	The Unit is in Local Mode – remote monitoring is possible, but no remote control
Test Mode	Orange	A Test Mode is selected (Example: IF Loopback)
	Off	No Test Mode is selected.
Encryption On	Green	Encryption is Enabled.
	Off	Encryption is Disabled.

5.2.3 Vacuum Fluorescent Display (VFD)

The SLM-5650A features a **V**acuum **F**luorescent **D**isplay (VFD). The VFD is an active display showing two lines of 40 characters each. It produces a blue light, the brightness of which can be controlled by the User. Compared to a **L**iquid **C**rystal **D**isplay (LCD), it has greatly superior viewing characteristics and does not suffer problems of viewing angle or contrast.

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

5.3 Front Panel Menu

The user can fully control and monitor the operation of the SLM-5650A from the front panel, using the keypad and display. Nested menus are used, which display all available options, and prompt the user to carry out a required action.

All functions are accessible at the front panel by entering one of six predefined Function Select categories or levels:

- Configuration
- Monitor
- Test
- Save/Load
- Utility

5.3.1 Menu Matrix

SELECT:	Para	Function	Para	Selectable Parameters
Configuration	**5.4.1**			
		Tx	**5.4.1.1**	Mod, DataRate, Overhead, Frequency, Power, Clocking, Misc
		Rx	**5.4.1.2**	Demod, DataRate, Overhead, Frequency, Acquisition, Buffer, Misc, CnC
		Mode	**5.4.1.3**	Mode, FreqBand, Interface
		AUPC	**5.4.1.4**	Local, Remote, Async, Logging
		Transec	**5.4.1.5**	State, PassPhrase, Module IP Address, Gateway
		Ref	**5.4.1.6**	Internal, Ext-1 MHz, Ext-5 MHz, Ext-10 Mhz
		Mask	**5.4.1.7**	TxData, RxData, Eb/No Threshold, DemodFaults
		Reset	**5.4.1.8**	
		Remote	**5.4.1.9**	Mode, SerialConfig, EthernetConfig
Monitor	**5.4.2**			
		Alarms	**5.4.2.1**	Transmit, Receive, Unit
		Event-Log	**5.4.2.2**	View, Clear-All, ModemParameters
		Rx-Params	**5.4.2.3**	
		CnC	**5.4.2.4**	(Future)
		Stats	**5.4.2.5**	View, Clear-All, Config
		Gigabit IF Statistics	**5.4.2.6**	
Test	**5.4.3**			
		Carrier		Normal, Tx-CW, Tx-1,0
		Loopback		Normal, IF, I/O1
		Bert		Tx, Pattern, Errins, Reset, Rx
		LampTest		
Save/Load	**5.4.4**			
		Save/Load		Loc, Action
Utility	**5.4.5**			
		RT-CLK		
		RefAdjust		
		ID		
		Display		
		Temp		
		AGC		
		Alarm		
		PwrCal		
		Firmware	**5.4.5.1**	Information, Select
		FAST	**5.4.5.2**	

5.3.2 Opening Screen

This screen is displayed when power switch is in the On position:

```
Comtech SLM-5650A Modem    Status:      GO
Firmware Version x.x.x     Mode:     TURBO
```

The bottom line displays the internal software version and the selected mode of operation. Press **[ENT]** to go to the Main Menu screen.

IMPORTANT

Go to CONFIG: MODE and set the MODEM type, the FREQBAND, and the INTERFACE type prior to preceding with the rest of the modem configuration.

5.4 SELECT (Main) Menu

```
SELECT: Configure  Monitor  Test
        Save/Load Utility
```

The following selections are available:

Configure	Permits user to fully configure the modem.
Monitor	Permits user to monitor the alarm status of the unit, to view the log of stored events, and to display the Receive Parameters screen and clear all stored faults.
Test	Permits user to configure the modem into one of several Test modes.
Save/Load	Permits user to save and retrieve up to 10 different modem configurations.
Utility	Permits user to perform miscellaneous functions, such as setting the Real-Time Clock, adjusting the display brightness, etc.

SELECT: CONFIG

```
CONFIG:  Tx  Rx  Mode  AUPC Transec
         Ref  Mask  Reset  Remote (◄►E)
```

The following choices are presented:

Tx (Transmit)	Permits user to configure the Tx parameters. **This menu is not accessible if the modem has been set to Demod Only.**
Rx (Receive)	Permits user to configure the Rx parameters.
Mode	Permits user to configure the modem operating modes.
AUPC	Permits user to configure the AUPC parameters. **This menu is selectable only if the modem type has been set to AUPC.**
Transec	Permits user to configure the Transec Module operation.
Ref	Permits user to configure the modem reference.
Mask	Permits user to mask selected alarms.
Reset	Permits user to reset the modem to a default status.
Remote	Permits user to define whether the unit is being controlled locally or remotely as well as the communication parameters (see Important note).

IMPORTANT

The modem may be monitored over the remote control interface at any time. When in Local mode, however, configuration parameters may only be changed through the front panel.

5.4.1.1 CONFIG: Tx

```
Tx: Mod DataRate Overhead Frequency
    Power Clocking Misc            (◄ ►E)
```

Mod	Permits user to select: **FEC**, **Type**, **Rate**, **RS**, **Diff**, and **Scrambler**.
DataRate	Permits user to enter a selected data rate and view the symbol rate. (See **Appendix B. OPERATIONS GUIDE.**)
Overhead	Permits user to select the overhead type, view the overhead rate, select the Reed Solomon Code Word, and depth.
Frequency	Permits user to select the desired frequency and spectral inversion.
Power	Permits user to select desired output power level and state of the output.
Clocking	Permits user to select the transmit clock source and SCT reference.
Misc	Permits user to select CLK/DataPhase and BPSK Bit Ordering.

CONFIG: Tx → Mod

```
Mod: FEC:VIT   Type:QPSK  Rate:1/2
RS:Off  Diff:On  Scram:OM-73      (◄►E)
```

Select the **Mod** type using the ◄ ► arrow keys to scroll through all the choices, as follows. The user should then press [ENT].

FEC	(**VIT** or **NONE** are standard; **TURBO** or **SEQ** are optional): **VIT** (Viterbi) is a K=7 convolutional encoder. **NONE** means Uncoded. **TURBO** means Turbo Product Code, which is a block code. **SEQ** means Sequential Encoder/Decoder.
Type (Modulation)	(**BPSK**, **QPSK**, or **OQPSK** are standard; **8PSK** or **16QAM** are optional): **BPSK** stands for Bi Phase Shift Keying. **QPSK** stands for Quadrature Phase Shift Keying. **OQPSK** stands for Offset Quadrature Phase Shift Keying. **8PSK** stands for 8 Phase Shift Keying. **16QAM** stands for 16 Quadrature Amplitude Modulation.
Rate	Viterbi: 1/2, 2/3, 3/4, 5/6, or 7/8 Uncoded: 1/1 Turbo: 5/16, 21/44, 3/4, 7/8, or 17/18 Sequential:1/2, 3/4, 7/8
RS	Reed Solomon Encoder: **On** or **Off**
Diff	Differential Encoder: **On** or **Off**
Scram:	Scrambling is for energy dispersal: **V.35**, **MOD-V.35**, **IBS**, **TURBO**, **OM73**, **Synch**, or **Off**
V.35	ITU standard
MOD-V.35	EF Data Closed Network with Reed Solomon compatible (modified V.35)
IBS	Used for IESS-309 operation
Turbo	Synchronous scrambler synchronized to the Turbo block
OM73	Linkabit OM-73 modem compatibility mode
Synch	Synchronous scrambler synchronized to the Reed-Solomon.

IMPORTANT

When changing modulation type, the data rate must be set to a rate supported by the modulation type or the change to the modulation type will not be allowed. Some choices will only be visible if the modem is set to a compatible mode or if an option is installed or enabled.

CONFIG: Tx → DataRate

```
Tx Data Rate:   020000.000 kbps
    Sym Rate:   0266666.666 ksps (◄►▼▲E)
```

The user can enter the desired data rate in kilobits using step 1 or step 2 as follows:

1. Use the number keypad and enter the desired data rate (see **Appendix B. OPERATIONS GUIDE**).
2. Use the ◄ ►▼▲ arrow keys to scroll up and down to select the desired data rate. When scrolling data rate, the symbol rate will automatically be recalculated and displayed.

IMPORTANT

When entering the data rate, the following interactions need to be taken into account. If the modulation type selected is 8-PSK or 16-QAM the minimum data rate allowed is 256 kbps. When changing certain parameters like modem type, the data rate will default to 64 kbps or 256 kbps. The calculated symbol rate is displayed for the user. This is helpful for determining the occupied bandwidth required for the selected modulation type, code rate and overhead.

CONFIG: Tx → Overhead

```
Tx:  Overhead:None        Rate: N/A
     RS-CW:N/A            Depth:N/A (◄►E)
```

Select the desired **Overhead**, **Rate**, **RS-CW**, and **Depth** and then press [ENT].

Overhead	(IESS-308, IESS-309 are standard; AUPC is optional)
Rate	96 kbps (IESS-308), 1/15 (IESS-309 or AUPC), N/A (None)
RS-CW	126/112, 194/178, 208/192, 219/201, 220/200, 225/205, (Reed Solomon Code Word, N/K)
Depth	4, 8 or 16 (Interleaving depth)

IMPORTANT

Some selections will only be visible if the modem is set to a compatible mode or if an option is installed or enabled.

CONFIG: Tx → Frequency

```
Tx Frequency:  1955.0000 MHz
    Spectrum:  Normal              (◄►▲▼E)
```

Edit the **Tx Frequency**, using either step 1 or 2:

1. Key in the desired frequency using the numbered keypad.
2. Select the digit to be edited, using the ◄ ► arrow keys. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press [ENT]

7/140 MHz	52-88, 104-176 MHz (in 100 Hz steps)
L-Band	950-2000 MHz (in 100 Hz steps)
Spectrum	**Normal** or **Invert** (used to counteract frequency converters that invert the spectrum)

IMPORTANT

When entering an IF frequency, the M&C will check the occupied bandwidth calculated from the data rate, modulation type, code rate and overhead and will not allow an IF frequency to be entered if the occupied bandwidth falls outside of the minimum or maximum IF frequencies.

CONFIG: Tx → Power

```
Tx Power:  State:On   Level:-20.0
           Control:  Normal      (◄►▲▼E)
```

State	Permits user to select **On** or **Off**.
Level	Permits user to edit the Power Level from –40 dBm to +10 dBm in 0.1 dB steps by: 1. Keying in the desired number using the keypad. 2. Selecting the digit to be edited using the ◄ ► arrow keys. The value of the digit is then changed using the ▲▼arrow keys. 3. The user should then press **[ENT]**.
Control	Permits user to select **Normal**, **RTS**, or **VSAT**. **RTS** is an interface signaling control. It stands for Request to Send. If enabled, RTS can be used to control the output state of the modulator. Only available when using either the EIA-530 or HSSI interface. When **VSAT** is selected, the output state of the modulator is controlled by the demodulator carrier detect status. Modulator output will be enabled when the demodulator is detected, and disabled otherwise.

CONFIG: Tx → Clocking

```
Tx Clocking:  CLK Source: SCT     (◄ ►E)
             SCT Ref:   Reference
```

Select **Clk Source** or **SCT Ref**, then press **[ENT]**.

Clk Source	**SCT** or **Tx-Terr**: **SCT** stands for Send Clock Timing and is provided as an output to provide a clock reference for the user. **Tx-Terr** stands for the transmit clock input on the selected data interface.
SCT Ref	**Reference**, **DataSrcSync**, or **Looptiming:** If **Reference** is selected, SCT will be generated from the modem's 10 MHz reference (this could be derived from and external reference if selected. **DataSRCSync** stands for Data Source Synchronization. This is an operational mode where no clock is provided on the interface and a clock is generated such that it is phase locked to the incoming data stream. **Looptiming** is when the clock generated from the received carrier is used as a reference for generating SCT.

CONFIG: Tx → Misc

```
Tx Misc:  Clk/DataPhase  BitOrdering
                                   (◄ ►E)
```

Select **Clk/DataPhase** or **BitOrdering**, then press **[ENT]**.

ClkPhase / DataPhase	Tx Clock Phase: **Normal** or **Inverted** Tx Data Phase: **Normal** or **Inverted**
BitOrdering	Tx Bit Ordering (for BPSK compatibility): **Standard** or **Non-Standard**

5.4.1.2 CONFIG: Rx

```
Rx: Demod DataRate Overhead Frequency
    Acquisition Buffer Misc CnC  (◄ ►E)
```

Demod	Permits user to select **FEC**, **Type**, **Rate**, **RS**, **Diff**, and **Descrambler**.
DataRate	Permits user to enter a selected data rate. (See Appendix B. OPERATIONS GUIDE.)
Overhead	Permits user to select the overhead type, view the overhead rate, select the Reed Solomon Code Word, and depth.
Frequency	Permits user to select desired frequency and spectral inversion.
Acquisition	Permits user to select acquisition range and reacquisition time period.
Buffer	Permits user to select buffer reference clock source, recenter, the buffer size, Bit mode or millisecond mode and external Framing for Plesiochronous operation.
Misc	Permits user to select Clk and Data Phase, BPSK Bit Ordering, and Eb/No Threshold.
CnC	(Future)

Note: Framing is applicable only when using externally framed data, with the following formats: **T1** or **E1 G.704**; **T2 G.743**, **G.704**, **G.707**; and **E2 G.742**, **G.704**, **G.745**.

CONFIG: Rx → Demod

```
Demod: FEC:VIT   Type:BPSK  Rate:3/4
RS:N/A  Diff:On  Descram:OM-73      (◄►E)
```

Select the **Demod, Type, RS, Diff,** and **Descram**. Use the ◄ ► arrow keys to scroll through all the choices. The user should then press **[ENT]**.

FEC	(**VIT** or **NONE** are standard; **TURBO** or **SEQ** are optional): **VIT** (Viterbi) is a K=7 convolutional encoder. **NONE** means Uncoded. **TURBO** means Turbo Product Code, which is a block code. **SEQ** means Sequential Encoder/Decoder.
Type (Modulation)	(**BPSK**, **QPSK**, or **OQPSK** are standard; **8PSK** or **16QAM** are optional): **BPSK** stands for Bi Phase Shift Keying. **QPSK** stands for Quadrature Phase Shift Keying. **OQPSK** stands for Offset Quadrature Phase Shift Keying. **8PSK** stands for 8 Phase Shift Keying. **16QAM** stands for 16 Quadrature Amplitude Modulation.
Rate	Viterbi: 1/2, 2/3, 3/4, 5/6, or 7/8 Uncoded: 1/1 Turbo: 5/16, 21/44, 3/4, 7/8, or 17/18 Sequential:1/2, 3/4, 7/8
RS	Reed Solomon Decoder: **On** or **Off**
Diff	Differential Decoder: **On** or **Off**
Descram:	Descrambling: V.35, MOD-V.35, IBS, TURBO, OM73, Synch, or Off
V.35	ITU standard
MOD-V.35	EF Data Closed Network with Reed Solomon compatible (modified V.35)
IBS	Used for IESS-309 operation
Turbo	Synchronous descrambler synchronized to the Turbo block
OM73	OM-73 Linkabit modem compatibility mode
Synch	Synchronous descrambler synchronized to the Reed-Solomon frame.

IMPORTANT

When changing Modulation type the data rate must be set to a rate supported by the modulation type or the change to the modulation type will not be allowed. Some choices will only be visible if the modem is set to a compatible mode or if an option is installed or enabled.

CONFIG: Rx → DataRate

```
Rx Data Rate:   020000.000 kbps
    Sym Rate:   0266666.666 ksps (◄►▼▲E)
```

The user can enter the desired data rate using either Method 1 or Method 2 as follows:

Method	Procedure
1	Use the number keypad and enter the desired data rate (see **Appendix B. OPERATIONS GUIDE**.)
2	Use the ◄ ► ▼ ▲ arrow keys to scroll up and down to select the desired data rate or symbol rate. When scrolling data rate the symbol rate will be automatically recalculated and displayed.

IMPORTANT

When entering the data rate, the following interactions need to be taken into account. If the modulation type selected is 8-PSK or 16-QAM the minimum data rate allowed is 256 kbps. When changing certain parameters like modem type, the data rate will default to 64 kbps or 256 kbps. The calculated symbol rate is displayed for the user. This is helpful for determining the occupied bandwidth required for the selected modulation type, code rate and overhead.

CONFIG: Rx → Overhead

```
Rx:  Overhead:None      Rate: N/A
     RS-CW:N/A          Depth:N/A (◄►E)
```

Select the desired **Overhead**, **Rate**, **RS-CW**, and **Depth,** then press **[ENT]**.

Overhead	(**IESS-308**, **IESS-309** are standard; **AUPC** is optional)
Rate	96 kbps (IESS-308), 1/15 (IESS-309 or AUPC), N/A (none)
RS-CW	126/112, 194/178, 208/192, 219/201, 220/200, 225/205 (Reed Solomon Code Rate, N/K)
Depth	4, 8 or 16 (Deinterleaving depth)

IMPORTANT

Some selections will only be visible if the modem is set to a compatible mode or if an option is installed or enabled.

CONFIG: Rx → Frequency

```
Rx Frequency:  1955.0000 MHz
    Spectrum:  Normal           (◄►E)
```

Edit the **Rx Frequency** value using either Method 1 or Method 2:

Method	Procedure
1	Key in the desired frequency using the numbered keypad
2	Select the digit to be edited, using the ◄ ► arrow keys. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press **[ENT]**.

7/140 MHz	52-88, 104-176 MHz (in 100 Hz steps)
L-Band	950-2000 MHz (in 100 Hz steps)
Spectrum	**Normal** or **Invert** (used to counteract frequency converters that invert the spectrum)

IMPORTANT

When entering an IF frequency, the M&C will check the occupied bandwidth calculated from the data rate, modulation type, code rate and overhead, and will not allow an IF frequency to be entered if the occupied bandwidth falls outside of the minimum or maximum IF frequencies.

CONFIG: Rx → Acquisition

```
Acquisition:   Range: 0001.000 KHz
               Reacq: 000 Seconds (◄►▼▲E)
```

Edit the Rx Acquisition value using either Method 1 or Method 2:

Method	Procedure
1	Key in the desired frequency range using the numbered keypad
2	Select the digit to be edited, using the ◄ ► arrow keys. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press **[ENT]**.

Range	Demodulator Acquisition range: 0 to 60 kHz in 1 Hz steps
Reacq	Hold off time before the demodulator reverts to normal acquisition: 0 to 999 seconds. During the holdoff, the demodulator will stay centered on the last known frequency position of the carrier for faster reacquisition.

CONFIG: Rx → Buffer

```
Buffer:  Src:RX-Sat Center: Y/N   ExtClk
 Size:00001024  Mode:Bits  Framing (◄►E)
```

Src	**Rx-Sat**, **Int**, **Tx-Terr**, or **ExtClk**. **Rx-Sat** is the recovered clock from the received carrier. **Int** is a clock synthesized from the modems reference (internal or external). **Tx-Terr** is the transmit clock supplied by the user. **ExtClk** is the external clock supplied by the user when using the optional G.703 interface.
Center	By selecting center, the buffer can be manually centered. The buffer is automatically centered when the demodulator locks. Select **Yes** or **No.**
ExtClk	Sets the frequency of the external G.703 clock. Valid selections are **RxDataRate**, **5MHz**, **10 MHz**, or **20 MHz**.
Size	If Mode is set to **Bits**, the minimum size is 128 to a maximum of 4,194,304 in 16 bit steps. If Mode is set to **mSec** (milliseconds), the minimum size is 2 to a maximum of 60 in 1 mSec steps.
Mode	Buffer size format: **Bits** or **mSec**.
Framing:	If selected, this permits the buffer to operate in a plesiochronous mode when running externally framed data. If buffer mode is set to mSec and Rx data rate is 1544 kbps (T1), 2048 (E1), 6312 kbps (T2), or 8448 kbps (E2), then the selected framing card will be used to calculate the required buffer size so that the buffer will slip properly.
T1	G704 or None
E1	G704 or None
T2	G704, G743, G747, or None
E2	G704, G742, G745, or None

IMPORTANT

***While the framing selections show up in the menus regardless of which interface is plugged in, they will only have effect if the Buffer Mode is set to* mSec.**

CONFIG: Rx → Misc

```
Rx Misc:  Clk/DataPhase  BitOrdering
          Eb/No Threshold          (◄►E)
```

Select **Clk/DataPhase, BitOrdering or Eb/No Threshold**, then press **[ENT]**.

ClkPhase / DataPhase	Rx Clock Phase, Normal or Inverted Rx Data Phase, Normal or Inverted
BitOrdering	Rx Bit Ordering (for BPSK compatibility), Standard or Non-Standard
Eb/No Threshold	0.1 to 20 dB in 0.1 dB steps, this sets an Eb/No threshold such that when the received carrier Eb/No is less than the set value, the Rx threshold alarm is set.

5.4.1.3 CONFIG → Mode

```
 Mode: Modem:TURBO     FreqBand:L-Band
Interface:EIA-530      Mode:N/A    (◄►E)
```

Select **Modem Type**, **FreqBand**, or **Interface**, then press [**ENT**].

Modem:	
OM-73	Selects Linkabit OM-73 modem compatibility mode.
MIL-165A	Selects functionality defined by MIL-STD-188-165A.
IESS-308	Selects functionality defined by IESS-308, the Intelsat Intermediate Data Rate standard.
IESS-309	Selects functionality defined by IESS-309, the Intelsat Business Services standard.
IESS-310	Selects functionality defined by IESS-310, the Intelsat 8-PSK Intermediate Data Rate standard.
TURBO	Selects functionality defined by IESS-315 plus Comtech EF Data Turbo mode interoperability.
16QAM	Mode permits 16-QAM to be selected as a modulation type.
AUPC	Mode permits Automatic Uplink Power Control to be used.
TXBURST	Mode should be selected when unit is a Vipersat Remote Modem.
RXBURST	Mode should be selected when unit is a Vipersat Hub Modem.
Frequency Band	Permits user to select: 70/140 MHz (52 – 88 MHz, 104 – 176 MHz) or L-Band (950 – 2000 MHz)
Interface	Permits user to select: • EIA-530 (native interface, standard equipment) • HSSI (native interface, standard equipment) • Network Processor (optional data interface) • GigaBit Ethernet (optional data interface) • G.703 (BAL) (optional data interface) • G.703 (UNBAL) (optional data interface) • LVDS (optional data interface)
Mode	N/A (If Network Processor is not selected) Network Processor Working Mode: • RtrVSHub • RtrVSHEx • RtrVSRem • RtrVSREx • RtrMPHub • RtrMPRem • RtrPtoP • Bridge

IMPORTANT

When selecting an IF frequency band, both transmit and receive operate in the selected band. Operation of transmit in one IF frequency band and the receive in the other IF frequency band is not permitted.

When selecting a data interface type, a native interface can be selected even if an optional interface is installed, but an optional interface can only be selected if it is installed. Both transmit and receive must use the selected interface type. Transmitting using one interface type and receiving using another interface type is not permitted.

5.4.1.4 CONFIG: AUPC → Local

```
Local AUPC: Enable: Off Power Settings
Target Setting  Carrier Loss Action (◄►E)
```

Select either **Enable**, **Power Settings**, **Target Settings**, or **Power Loss Action**, then press **[ENT]**.

Enable	Permits user to enable AUPC on the local modem: **On** or **Off**.
Power Settings	Nominal Output Power: -40 to +10 dB Min Output Power: -40 to +10 dB Max Output Power: -40 to +10 dB
Target Setting	Eb/No: Permits user to set the Target Eb/No for AUPC. (Range: 3.2 to 16.0 dB.) Rate of Change: Permits user to set the maximum tracking rate. (Range: 0.5 to 6.0 dB per minute in 0.5 dB increments.)
Carrier Loss Action	Local permits user to set the action of the local modem when it loses carrier detect (Hold, Nominal, Maximum). Remote permits user to set the action of the local modem when the remote modem loses carrier detect (Hold, Nominal, Maximum).

CONFIG: AUPC → Remote

```
Remote AUPC: Enable: Off BasebandL: Off
Tx Pattern: Off BER: Loss         (◄►E)
```

Select either **Enable, BasebandL, or Tx Pattern,** then press **[ENT]**.

Enable	Permits user to view or modify the status of the remote modem's AUPC Enable: **On** or **Off**.
BasebandL	Permits user to view or modify the status of the remote modem's I/O Loopback #1 setting: **On** or **Off**.
Tx Pattern	Permits user to view or modify the status of the remote modem's Tx pattern substitution: **On** or **Off**. **Note:** In order to maintain compatibility with older Comtech EF Data modems, only 2047 pattern substitution is supported.
BER	Permits user to monitor BER of the remote modem. The remote modem shall have Tx Pattern set to **On** and the local modem shall be transmitting a 2047 pattern.

CONFIG: AUPC → ASYNC

```
ASYNC: TxBaud:1200 TxFormat:7E2 (◄►E)
Type:232    RxBaud:1200  RxFormat:7E2
```

Select either **TxBaud, TxFormat, Type, RxBaud or RxFormat,** then press **[ENT]**.

TxBaud	Permits user to select the Aync Channel Tx Baud Rate (110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200 or 38400).
TxFormat	Permits user to select the Aync Channel Tx Character Format (7N1, 7E1, 7O1, 7N2, 7E2, 7O2, 8N1, 8E1, 8O1, 8N2, 8E2 or 8O2).
Type	Permits user to Aync Channel communications protocol (232, 485-2W or 485-4W).
RxBaud	Permits user to select the Aync Channel Rx Baud Rate (110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200 or 38400).
RxFormat	Permits user to select the Aync Channel Rx Character Format (7N1, 7E1, 7O1, 7N2, 7E2, 7O2, 8N1, 8E1, 8O1, 8N2, 8E2 or 8O2).

IMPORTANT

Max Tx or Rx baud rate is limited to 1.875% of the primary data rate.

CONFIG: AUPC → Logging

```
AUPC Statistics: View   Clear-All
                 Config             (◄►E)
```

Select either **View, Clear-All, or Config,** then press **[ENT]**.

View	Permits user to view the stored AUPC statistics.
Clear-All	Permits user to clear all stored AUPC statistics.
Config	Permits user to set the interval that the statistics are stored. This ranges from 10 minutes to 90 minutes in 10 minute steps. The function can also be disabled.

5.4.1.5 CONFIG: Transec

```
TRANSEC: State: Encrypted  PassPhrase
Module IP Address    Gateway    (◄►E)
```

Select either **State**, **PassPhrase, Module IP Address**, or **Gateway**, then press **[ENT]**.

State	**Encrypted** or **Bypass**.
PassPhrase	Allow the entry of an Alphanumeric PassPhrase of 10 to 32 characters.
Module IP Address	Permits user to set the Transec Modules Management IP address and subnet Mask length.
Gateway	Permits user to set the TRANSEC Module's IP Gateway.

5.4.1.6 CONFIG: Ref

```
Reference: Internal Ext-1Mhz
           Ext-5Mhz Ext-10Mhz       (◄►E)
```

Select **Internal, Ext-1Mhz, Ext-5Mhz or Ext-1Mhz**, then press **[ENT]**.

Internal	Permits user to select : Internal high stability ovenized 10 MHz oscillator
Ext-1MHz	Permits user to select: An external 1 MHz reference (accepts sine wave or square wave and locks the internal reference to the 1 MHz)
Ext-5MHz	Permits user to select: An external 5 MHz reference (accepts sine wave or squarewave and locks the internal reference to the 5 MHz)
Ext-10MHz	Permits user to select: An external 10 MHz reference (accepts sinewave or squarewave and locks the internal reference to the 10 MHz)

5.4.1.7 CONFIG: Mask

```
Mask: TxData  RxData  Eb/No  Threshold
      DemodFaults(◄►E)
```

TxData	Permits user to select : Masked, Activity, or AIS, (this alarm monitors data activity on the transmit data interface).
RxData	Permits user to select : Masked, Activity, or AIS, (this alarm monitors the received data activity).
Eb/No Threshold	Permits user to select : Masked or Active, (this alarm monitors the receive Eb/No of the demodulator and compares it to the Eb/No threshold value).
Demod Faults	Permits user to select : Masked or Active, (this alarm will mask all demod faults and alarms).

IMPORTANT

When selecting masked for a given alarm, if the condition occurs the alarm will not be set. Activity or active means the alarm is enabled. AIS stands for Alarm Indication Signaling. This will put out all ones allowing the connected equipment to recognize that there is an alarm condition.

5.4.1.8 CONFIG: Remote

```
Remote Control:  Mode:Serial
   SerialConfig        EthernetConfig
    (◄►E)
```

Mode	Permits user to select **Local**, **Serial** or **Serial+Ethernet**. **Local** mode will limit the remote control to only be able to monitor the status of the modem.
SerialConfig	Permits user to select and configure **Interface**, **Format** and **Baudrate** for serial communications.
EthernetConfig	Permits user to select and configure **IP Address/Range**, **MAC**, **Gateway**, **SNMP** and **Option Card Addr** for communication using the Ethernet port.

CONFIG: Remote → SerialConfig

If **SerialConfig** was selected:

```
Remote Control:  Interface  Format
                 Baudrate       (◄►E)
```

CONFIG: Remote → SerialConfig → Interface

If **Interface** was selected:

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

Select **RS232**, **RS485-2W** (2-wire), or **RS485-4W** (4-wire), or TTL (Switching) using the ◄ ► arrow keys, then press **[ENT]**. The TTL (Switch) selection enables interoperation with the CRS-311 (1:1) or CRS-300 (1:N) switch.

```
Local M&C Bus Address:
                 0000
```

IMPORTANT

When selecting RS-232 the local M&C bus address displays, 0000. Addressing is not supported by RS-232 or TTL (Switch) because they are not multi-drop communication standards. If RS-485 is selected, the display will show address 0001 to 9999. This address can be changed using the front panel. The most significant digit is for Comtech EF Data redundancy switches.

CONFIG: Remote → SerialConfig → Format

If **Format** was selected:

```
Local M&C Bus Format:  8N1
                                    (▼▲E)
```

User may select character formats of **7N1**, **7E1**, **7O1**, **7N2**, **7E2**, **7O2**, **8N1** (default), **8E1**, **8O1**, **8N2**, **8E2,** or **8O2**.

CONFIG: Remote → SerialConfig → Baudrate

If **Baudrate** was selected:

```
Local M&C Bus Baud Rate:
             38400 Baud             (▼▲E)
```

User may select Baud Rates of **2400**, **4800**, **9600**, **19200**, **38400** (default), **57600,** or **115200**.

CONFIG: Remote → EthernetConfig

If Ethernet was selected:

```
Ethernet Config:  IP Address/Range   MAC
Gateway  SNMP  Option Card Addr   (◄►E)
```

IP Address/Range	Permits user to select the IP address .
MAC	Displays the modem's MAC address, this is programmed at the factory and is not user changeable. If installed, the Gigabit Ethernet interface's MAC address will also be displayed.
Gateway	The IP Gateway address is the default address that the modem will send all IP responses when the message originated from a source outside the modems local attached network.
SNMP	Permits user to select and control **Communities** or **Traps**.
Option Card Addr	Permits user to set the Option Card Ethernet interface's management IP address and subnet mask (range).

IMPORTANT

***For the address fields the value of the digit is changed using the ▲▼ arrow keys. The user should then press* [ENT].**

5.4.2 SELECT: Monitor

```
Monitor: Alarms  Event-Log  Rx-Params
  CnC  Stats  GigaBit I/F Stats
```

Alarms	Permits user to select and view **Transmit, Receive,** or **Unit** alarms.
Event-Log	Permits user to select **View** or **Clear-all** stored events and view ModemParametters.
Rx-Params	Permits user to view **FC, RSL, BERT, Buffer, Eb/No,** or **BER**.
CnC	(Future)
Stats	Permits user to select **View, Clear-All** or **Config** statistics.
GigaBit I/F	Permits user to select **View** or **Clear-All** Gigabit Interface link statistics.

5.4.2.1 Monitor: Alarms

Tx	**Permits user to view transmit alarms:**
Mod #1	Modulator symbol clock Phase Lock Loop status.
Mod #2	Modulator RF Synthesizer Phase Lock Loop status.
Mod #3	Modulator IQ activity status.
Mod #4	Modulator Nyquist filter Over range.
Tx Intf #1	Transmit data interface clock Phase Lock Loop status.
Tx Intf #2	Transmit data interface terrestrial clock activity status.
Tx Intf #3	Transmit data interface SCT (send clock timing) Phase Lock Loop status.
Tx Intf #4	Transmit data interface AIS (alarm indication signal) status.
Rx	**Permits user to view receive alarms:**
Demod #1	Demodulator carrier Phase Lock Loop status.
Demod #2	Demodulator FEC (forward error correction) lock status.
Demod #3	Demodulator RF Synthesizer Phase Lock Loop status.
Demod #4	Demodulator IQ activity status.
Demod #5	Composite Power exceeds 40 dBc.
Demod #6	Composite Power exceeds 20 dBm.
Rx Intf #1	Demultiplexer lock status.
Rx Intf #2	Doppler buffer status.
Rx Intf #3	Doppler buffer fill status.
Rx Intf #4	Doppler buffer overflow status.
Rx Intf #5	Doppler buffer underflow status.
Rx Intf #6	Doppler buffer Phase Lock Loop status.
Rx Intf #7	Doppler buffer reference clock activity status.
Rx Intf #8	Receive data interface AIS (alarm indication signal) status.
Rx Intf #9	Receive Eb/No lower than Eb/No threshold status.
Rx Intf #10	Internal BERT sync status.
Unit	**Permits user to view unit alarms:**
Unit #1	+ 5 volt power supply is out of tolerance.
Unit #2	+ 3.3 volt power supply is out of tolerance.
Unit #3	+ 2.5 volt power supply is out of tolerance.
Unit #4	+ 1.5 volt power supply is out of tolerance.
Unit #5	+ 12 volt power supply is out of tolerance.
Unit #6	- 12 volt power supply is out of tolerance.
Unit #7	+ 18 volt power supply is out of tolerance.
Unit #8	Cooling fan fault.
Unit #9	External reference activity status.
Unit #10	192 MHz clock Phase Lock Loop status.
Unit #11	10 MHz reference Phase Lock Loop status.
Unit #12	M&C FPGA configuration fault.
Unit #13	Modulator FPGA configuration fault.
Unit #14	Demodulator FPGA configuration fault.
Unit #15	Decoder FPGA configuration fault.
Unit #16	Transmit interface FPGA configuration fault.
Unit #17	Receive interface FPGA configuration fault.
Unit #18	FEC #1 FPGA configuration fault.
Unit #19	FEC #2 FPGA configuration fault.
Unit #20	Optional data interface card (module) FPGA configuration fault.
Unit #21	FPGA DCM Phase Lock Loop fault.
Unit #22	Network Processor mailbox communications error.
Unit #23	Transec mailbox communications error.

Monitor: Alarms → Transmit → Mod 1st Position

If Mod 1st character is selected:

```
Mod:  +---                    Mod symbol clk
Intf: ----                        not locked.
```

Monitor: Alarms → Transmit → Intf 1st Position

If Intf 1st character is selected:

```
Mod:  ----                       TXIntf data
Intf: +---                        not locked.
```

Monitor: Alarms → Receive → Demod 1st Position

If Demod 1st character is selected:

```
Demod: +---                       Demod IF not
Intf: ---------                         locked.
```

Monitor: Alarms → Receive → Intf 1st Position

If Intf 1st character is selected:

```
Demod: ----                       Demux not
Intf: +--------                      locked
```

Monitor: Alarms → Unit 1st Position

If Unit 1st character is selected:

```
Unit: +--------------- +5.0V Power is
      -----              out of range.
```

5.4.2.2 Monitor: Event-Log

```
Stored Events: View  Clear-All
               ModemParameters(◄ ►E)
```

View	Permits user to view the stored faults. The modem will store up to 255 fault events.
Clear-All	Permits user to clear all stored faults.
ModemParameters	Permits user to view the Current Temperature, Max Temp, Comp Power and Max Power.

IMPORTANT

To view the details of a stored fault, select an event number by first pressing* [ENT]. *Then, scroll through the listed faults for a description of the fault. If the faulted listed is* Power On *or* Power Off, *nothing will be displayed if that event is selected.

Monitor: Event-Log → View

```
Event 001:003  1:43:02  27/09/05
Mod:  ---- ++ --            (▼▲E)
```

5.4.2.3 Monitor: Rx-Params

```
Fc=+05917  RSL<-60.0 dBm   BERT=N/A
Buf=000%  Eb/No=Loss   BER <1.0E-12 (◄ ►E)
```

FC	Permits user to view the received carrier frequency offset in Hz. The range is the same as the acquisition range of the modem – 60 kHz.
RSL	Permits user to view the signal level of the received carrier in dBm. The range supported is +15 to –60 dBm.
BERT	Permits user to view the measured BER. This requires that the modem be set to **Test** mode for Rx. If a Fireberd is supplying a data pattern, only the **Test** mode for the Rx needs to be turned on. The Fireberd data pattern and the modems data pattern must match to work properly.
Buf	Permits user to view the buffer fill status in a percentage format.
Eb/No	Permits user to view the estimated Eb/No of the received carrier. The range is threshold to 20 dB Eb/No.
BER	Permits user to view the estimated BER based on the demodulator's measurement of the carrier to noise.

IMPORTANT

***The difference between BER and BERT is that BER is estimated in the demodulator, while BERT is measured when the* Test *mode is turned* ON.**

5.4.2.4 CnC (DoubleTalk® Carrier-in-Carrier®) (FUTURE)

5.4.2.5 Monitor: Statistics

```
Link Statistics: View  Clear-All
                Config       (◄ ►E)
```

View	Permits user to view the stored statistics. The statistics are limited to **minimum**, **average**, and **maximum Eb/No**.
Clear-All	Permits user to clear all stored statistics.
Config	Permits user to set the interval, ranging from 10 minutes to 90 minutes in 10 minute steps, that the statistics are stored. The function can also be disabled.

5.4.2.6 Monitor: GigaBit I/F Statistics

```
GigaBit Ethernet Card Statistics:
   View  Clear-All
```

View	Permits user to view the link statiscal counters.
Clear-All	Permits user to clear or reset the FPGA link error counter.

IMPORTANT

This menu will not appear unless a GigaBit Ethernet Interface is plugged into the modem.

5.4.3 SELECT: TEST

```
TEST: Carrier  Loopback  BERT
      LampTest                  (◄►E)
```

Carrier	**Permits user to select Carrier test modes:**
Normal	*Means:* Standard modem operation, not a test mode.
TX-CW	*Means:* A pure carrier which can be used for frequency and power measurements.
TX 1,0	*Means:* The modulator will produce an offset test carrier (single upper side band suppressed carrier). This test mode permits user to check for quadrature error in the modulator.
Loopback	**Permits user to select Loopback test modes:**
Normal	*Means:* Standard modem operation, not a test mode.
IF	*Means:* The output of the modulator is looped back to the demodulator (inside the modem) to verify transmit and receive configurations match as well as the data inputs and outputs.
I/01	*Means:* Baseband loopback which will loop the transmit data (after the interface) back to the receive data path interface. This mode is useful for checking interface cabling and clocking.
BERT	**Permits user to select BERT test modes:**
Tx	Permits user to either ignore the Tx data interface or use an internally generated PN pattern, or to function normally.
Pattern	Permits user to select test data patterns.
ErrIns	(Error Insert) Permits user to insert errors in the data stream to verify that the circuit is indeed connected and operational.
Reset	Permits user to clear the BER and Error displays while restarting the test.
Rx	Permits user to turn the bit error tester on. This will count any errors in the receive data stream and compare it to a time base. Errors are the absolute count of errors, which is very useful when the error insert mode is on.
LampTest	Permits user to perform a Lamp Test to ensure all front panel LEDs are working.

IMPORTANT

Carrier test modes, Loopback, and Tx BERT are not allowed when the modem is set to* Demod Only*.

5.4.3.1 TEST: BERT

```
BERT: Tx:Off Pattern:2047  ErrIns  (◄►E)
Reset Rx:Off Errs:=0000000 BER:NoSync
```

Tx	Permits user to turn the transmit test pattern generator **On or Off**.
Pattern	**Permits user to select a number of test data patterns:**
Mark	*Means:* All ones.
Space	*Means:* All zeros.
1:1	*Means:* A one followed by a zero and then repeats.
1:2	*Means:* A one followed by two zero's and then repeats.
2E15-1	A pseudo-random data pattern of 2^15 –1, compatible with standard BERTs.
2E20-1	A pseudo-random data pattern of 2^20 –1, compatible with standard BERTs.
2E23-1	A pseudo-random data pattern of 2^23 –1, compatible with standard BERTs.
MIL188	A modified pseudo-random data pattern of 2^11 –1, compatible with the MIL-188-165 test data pattern requirement of a continuous stream of 50 zero's every 10,000 bits. This pattern has 5 normal 2047 patterns, with the fifth patterns longest string of zero's (11) stretched an additional 39 bits to create a lack of transitions for 50 bits approximately every 10,000 bits.
2047	A pseudo-random data pattern of 2^11 –1, compatible with standard BERTs.
ErrIns	Permits user to insert a single error in the data stream, by pressing enter.
Reset	Permits user to restart the BER test and clear the error and BER displays.
Rx	Permits user to turn on the receive bit error test set.
Errs	Permits user to view the absolute number of errors counted.
BER	Permits user to view the bit error rate as measured by the modem.

IMPORTANT

The BER function can work with a firebird supplying the transmit data test pattern, while only turning on the Rx bit error rate tester. The transmit test pattern generator can be turned on at the far end of the link and as long as the test patterns match the Rx BERT can measure the BER of the link. An external bit error test set can be used even when the internal bit error test set is enabled. If AIS is enabled the data will be over written with all ones.

5.4.4 SELECT: Save/Load

```
Save/Load: Loc:0  Action: View
          Empty                (◄►E)
```

Loc	Permits user to select the location to either *save* or *load* a configuration. There are 10 locations available: 0 – 9.
Action	Permits user to select either *Save* or *Load* the selected location. **View** is the default setting that permits user to select the location before loading or saving. • To *save* a configuration, go through the modem's menus and configure all the necessary parameters. Then, select a location, select **Save**, then press **[ENT]**. • To *load* a saved configuration, select the desired configuration, select **Load**, then press **[ENT]**.

IMPORTANT

Resetting the modem will cause all configurations to be cleared!

5.4.5 SELECT: Utility

```
UTILITY: RT-Clk RefAdjust ID Display  Temp
     Agc Alarm PwrCal Firmware FAST (◄►E)
```

RT-Clk	Permits user to select and set the Real-Time Clock. Hours are in 24 hour time format. In accordance with international convention, the date is shown in DAY-MONTH-YEAR format.
RefAdjust	Permits user to select and adjust the internal high stability 10 MHz oscillator to counteract aging. The control value is in hex, not decimal and has a range of 000 to FFF. The typical cal point for a modem is nominally around 400.
ID	Permits user to name the communications link. This name can be a combination of alpha and numeric characters up to 24 characters in length. Additional characters supported are: (,), *, +, /, period, comma and space.
Display	Permits user to adjust the front panel display brightness. Settings are 25%, 50%, 75% or 100%.
Temp	Permits user to view the modem internal temperatures (RF, PS, M&C, Mod and Demod).
Agc	Permits user to select Minimum and Maximum voltage levels for the external AGC monitor voltage that is available on the AUX connector.
Alarm	Permits user to disable or enable the alarm.
PwrCal	Permits user to calibrate the L-Band board for Burst operation.
Firmware	Permits user to select which image will be loaded and view information on the Boot ROM, Image#1 or Image#2.
FAST	Permits user to load FAST codes and view the modem serial number plus the enabled FAST options.

Utility: RT-Clk

```
Edit Real-Time Clock:
15:34:25 27/09/05                (▼▲◄►E)
```

Utility: RefAdjust

```
Internal 10 MHz Ref Freq
Fine Adjust: 3F3              (▼▲◄►E)
```

Utility: AGC

```
AgcMan:  Min Value: 00.0 Volts
         Max Value: 10.0 Volts (◄►E)
```

Min Value	Permits user to specify the voltage to output on the External AGC voltage signal when the demodulator RSL is at its minimum level.
Max Value	Permits user to specify the voltage to output when the demodulator RSL is at it’s maximum level.

5.4.5.1 Utility: Firmware

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

Information	Permits user to select and view information on the firmware and software used by the modem.
Bootrom	Displays the release date, the Firmware number and the revision number.
Image#1/ Image#2	Displays the **Bulk, App, M&C, Mod, Demod, Decoder, Filters, TxIntfc, RxIntfc,** and **Turbo** information.
Select	Permits user to select and which image will be loaded into the modem.

Utility: Firmware → Information → Bootrom

```
Bootrom:      10/18/07
FW-0000029-     1.1.1
```

Utility: Firmware → Information → Image#1

```
Image#1: Bulk App M&C Mod Demod Decoder
Filters TxIntfc RxIntfc Turbo     (◄ ►E)
```

Image#	The following information is displayed: the firmware number including the revision, release date and version number. Both images have similar information, with only the revision and the release date being different
Bulk	FW-0000030C, 04/22/08, 1.1.4 (The bulk is the sum of all the individual pieces).
App	FW-0000031C, 04/18/08, 1.1.4
M&C	FW-0000032B, 02/29/08, 1.1.3
Mod	FW-0000033A, 02/18/08, 1.1.2
Demod	FW-0000034B, 02/28/08, 1.1.3
Decoder	FW-0000038A, 08/31/07, 1.1.2
Filters	FW-0000034B, 02/28/08,1.1.3
TxIntfc	FW-0000040B, 03/19/08, 1.1.3
RxIntfc	FW-0000041B, 04/17/08, 1.1.3
Turbo	FW-0000042B, 04/22/08, 1.1.3

Utility: Firmware → Select

```
Current Active Image#2
Next Reboot Image#1 #2          (◄ ►E)
```

IMPORTANT

To reboot the modem, cycle the power.

5.4.5.2 Utility: FAST

```
FAST: Configuration     S/N 000000012
      View Options               (◄ ►E)
```

Utility: FAST → Configuration

```
FAST Configuration:  Enter Modem Code
Enter NP Code     Demo Mode    (◄ ►E)
```

Modem Code	This is a 20-digit code, purchased from Comtech EF Data, that permits upgrading the modem functionality. Legal characters are hexadecimal, 0-F.
NP Code	This is a 20-digit code, purchased from Comtech EF Data, that permits upgrading of the optional Network Processor (NP) Interface Module (card). Legal characters are hexadecimal, 0-F.
Demo Mode	This is a unique Comtech EF Data feature that permits users to try out any capability of the installed hardware for up to 168 hours (seven 24-hour days).

Utility: FAST → Configuration → View Options

```
View Options: 01    Installed
Full Range Data Rate
```

Options	Lists the options that the modem supports and identifies if they are enabled. There are 14 options, listed as 01 – 14:
01	Modem Data Rate, 5 Mbps, 10 Mbps, 20 Mbps, 52 Mbps, <155 Mbps.
02	8-PSK modulation
03	16-QAM modulation
04	16APSK/32APSK Modulation (**future**)
05	AUPC overhead (Automatic Uplink Power Control)
06	ASYNC ESC
07	Reed-Solomon Coding
08	Turbo FEC Option
09	Adv FEC Data Rate, 5 Mbps, 10 Mbps, 20 Mbps, 52 Mbps, <155 Mbps.
10	Network Processor I/F Card (Module)
11	Sequential Encode/Decoder
12	Transec Module
13	Carrier-In-Carrier (**future**)
14	NP QOS
15	NP Management Security
16	NP Vipersat
17	Demodulator Only

5.5 Display Screen Saver Status

Modem Status	The screen saver has two functions: One is to keep a fixed image from “burning” the screen; the second is to provide a running status of the modem by scrolling the information sideways. This function supports seven different status category updates:
01	Circuit Identification
02	Demodulator receive frequency offset from the nominal
03	Buffer fill status
04	Receive signal level
05	Estimated Eb/No
06	Estimated Corrected Bit error Rate
07	Bit Error Rate reported by the internal Bit Error Rate Test set

Chapter 6. ETHERNET MANAGEMENT

6.1 Introduction

The base modem is equipped with an RJ-45 10/100 Base-T Ethernet management interface, used for monitor and control purposes. This section provides a high-level overview of the functionality provided by this interface and references other chapters for further details.

6.2 Ethernet Management Interface Protocols

The modem 10/100 Base-T Ethernet Management Interface supports three (3) different management protocols:

- HTTP (Web Server) interface for complete product management
- SNMP with public and private MIB
- Telnet interface for remote product M&C

In general, the operation of each of these interfaces is essentially identical to the management interfaces that are available when the optional IP module is installed.

6.3 HTTP (Web Server) Interface

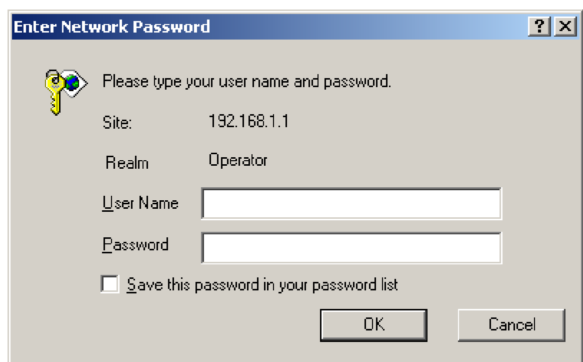
The embedded Web Server application provides the user with an easy to use interface to configure and monitor all aspects of the Base Modem. These web pages have been designed for optimal performance when using Microsoft's Internet Explorer 5.5 or higher.

Currently, Comtech EF Data offers three independent Web Server Interfaces with the SLM-5650A modem:

- **Base modem HTTP (Web Server) Interface** – for details, see **Chapter 7. WEB SERVER PAGES.**
- **Network Processor (NP) HTTP (Web Server) Interface** – available when the optional Network Processor (NP) Interface is installed. For details on this optional feature, see **Chapter 8.7 Network Processor (NP) HTTP (Web Server) Interface.**
- **TRANSEC Module HTTP (Web Server) Interface –** available when the optional TRANSEC Module is installed. For details on this optional feature, see **Chapter 10.2 TRANSEC Module HTTP (Web Server) Interface.**

All Web Server Interfaces are accessible, using a Web browser, by typing (depending on the interface) "http://www.xxx.yyy.zzz" or "https://www.xxx.yyy.zzz" in the browser's **Address** box, where "www.xxx.yyy.zzz" is the IP address of the modem or installed interface option.

The user is then prompted to type in a valid User Name and Password, similar to the dialogue box shown to the right:



HTTP Login Access Levels are defined as follows:

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

Default Name/Passwords are:

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

For detailed information on navigating a specific SLM-5650A Web Server Interface, refer to the pertinent chapter or section in this manual, as listed previously.

6.4 SNMP Interface

The *Simple Network Management Protocol* (SNMP) is an application-layer protocol designed to facilitate the exchange of management information between network devices. The SLM-5650A SNMP agent supports both SNMPv1 and v2c.

IMPORTANT

For proper SNMP operation, the SLM-5650A MIB files must be used with the associated version of the SLM-5650A base modem M&C. Please refer to the SLM-5650A SW Release Notes for information on the required FW/SW compatibility.

6.4.1 Management Information Base (MIB) Files

MIB files are used for SNMP remote management and consist of Object Identifiers (OID's). Each OID is a node that provides remote management of a particular function. A MIB file is a tree of nodes that is unique to a particular device.

There are three MIB files associated with the SLM-5650A:

MIB File/Name	Description
fw10874-2-.mib ComtechEFData MIB file	ComtechEFData MIB file gives the root tree for ALL Comtech EF Data products and consists of only the following OID: Name: comtechEFData Type: MODULE-IDENTITY OID: 1.3.6.1.4.1.6247 Full path: iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).comtechEFData(6247) Module: ComtechEFData
FW-0000049 SLM-5650A	MIB file consists of all of the OID's for management of the modem functions
FW-0000050 SLM-5650A Traps MIB file	Trap MIB file is provided for SNMPv1 traps common for base modems.

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

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

6.4.2 SNMP Community Strings

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

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

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

The user defines three Community Strings for SNMP access:

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

Note: Maximum number of characters for community strings shall not exceed 20. All printable ASCII characters, except '\' and '~' are allowed. No trailing spaces for community strings.

6.4.3 SNMP Traps

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

The modem supports both **SNMPv1** traps and **SNMPv2** notifications. Which style of traps the modem sends can be configured by the user using the slm5650SNMPTrapVersion OID.

The following are the MIB2 v1traps/v2 notifications that the modem supports:

MIB2 SNMPv1 trap: Authentication Failure	5
MIB2 SNMPv2 notifications: Authentication Failure	1.3.6.1.6.3.1.1.5.5

The Alarms and Faults v1 traps / v2 notifications that the modem supports are shown in the following tables:

Alarms and Faults **SNMPv1** traps:

slm5650TxTrafficAlarmV1	6247472
slm5650UnitAlarmV1	6247471
slm5650RedundancyStateV1	6247473
slm5650RedundancyStateV1	6247474

Alarms and Faults **SNMPv2** notifications:

slm5650UnitAlarmV2	1.3.6.1.4.1.6247.47.2.1.1
slm5650TxTrafficAlarmV2	1.3.6.1.4.1.6247.47.2.1.2
slm5650RxTrafficAlarmV2	1.3.6.1.4.1.6247.47.2.1.3
slm5650RedundancyStateV2	1.3.6.1.4.1.6247.47.2.1.4

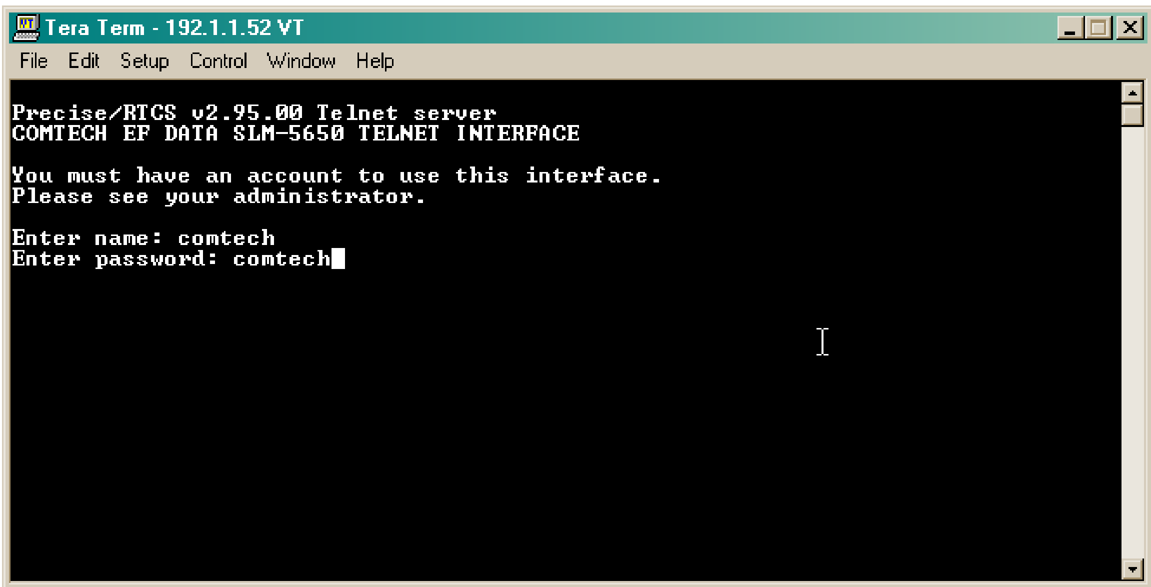
6.5 Telnet Interface

The modem provides a Telnet interface for two primary functions:

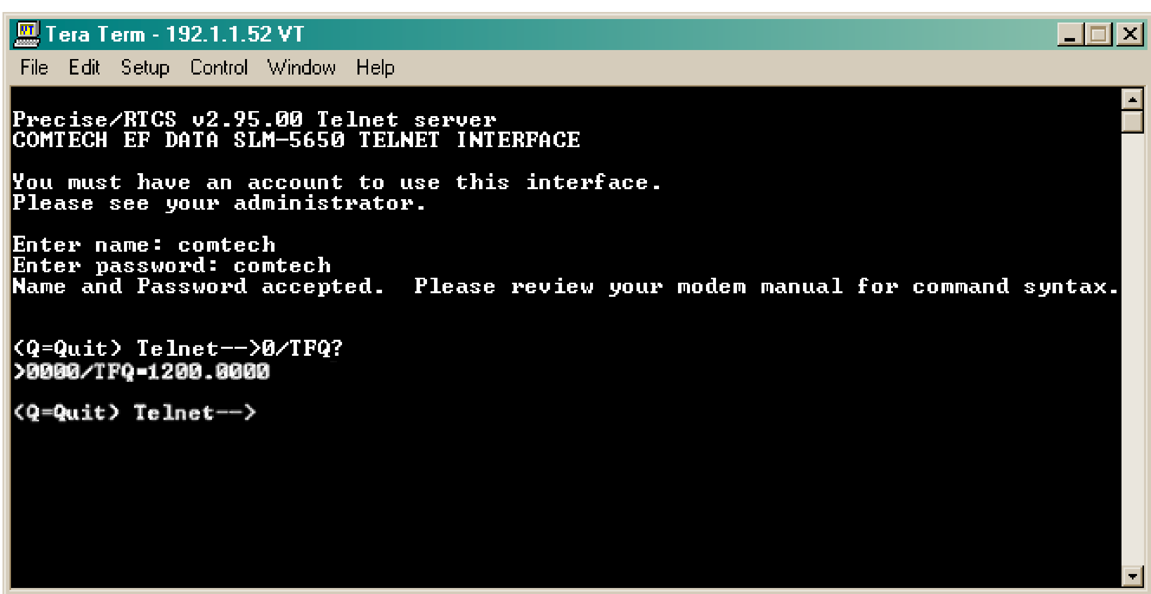
- Equipment M&C via the standard equipment Remote Control protocol.
- Equipment M&C via Comtech Monitor and Control System (CMCS) application.

The Telnet interface requires user login at the **Administrator** level and **Read/Write** level.

An example of the login process is shown as follows:



Once logged into the Telnet interface as the Administrator, the user can access the standard remote control interface as defined in **Appendix B. REMOTE CONTROL** and shown in the next example:

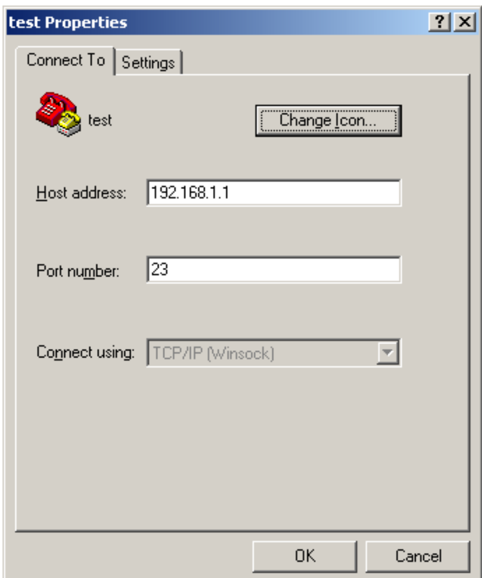


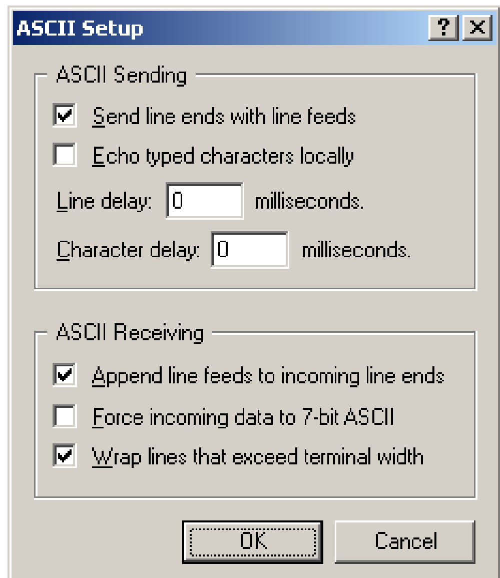
There is a disadvantage when using Windows DOS as Telnet Client. Since Windows DOS cannot translate a '\r' to a '\r\n' for the messages coming from Telnet Server, the multi-line command response (for example, FRW? response) will be displayed as one line, with the latter lines overwriting the previous lines.

In order to view the full response messages, CEFD recommends using HyperTerminal configured as Telnet Client. To do so, configure the HyperTerminal as follows:

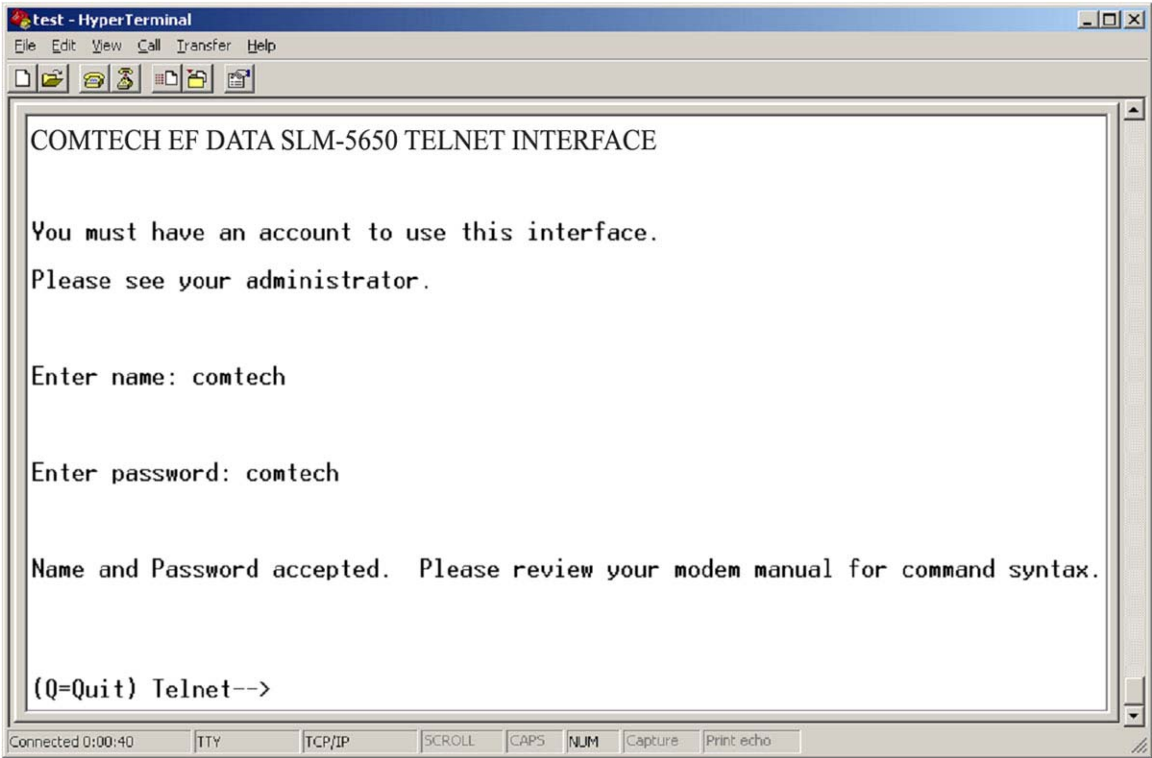
1. Connect using TCP/IP instead of COM1 or COM2 (example dialogue box shown at bottom left).

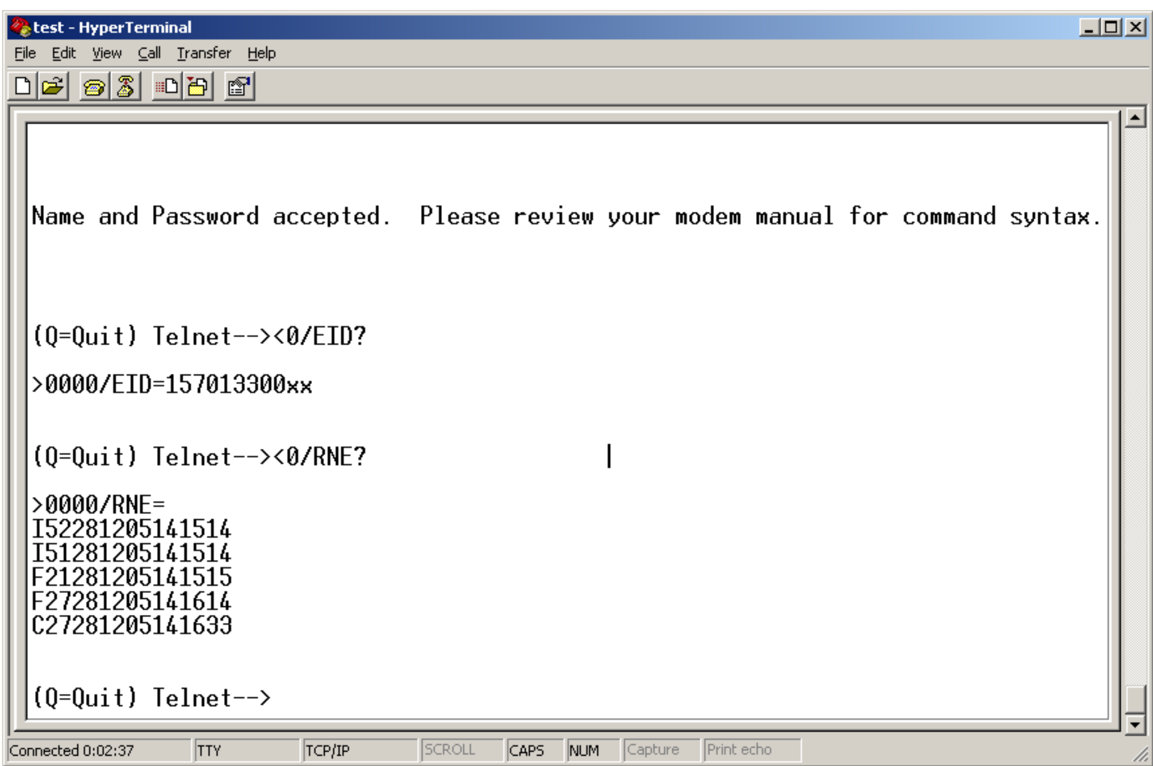
2. ASCII setup: check both the "Send line ends with line feeds" and "Append line feeds to incoming line ends" options (example diagloue box shown at bottom right).





Login and remote command execution via HyperTerminal configured as Telnet Client appears as per the following examples:





Notes:

Chapter 7. SLM-5650A WEB SERVER INTERFACE

7.1 Overview

This chapter describes the functionality of the SLM-5650A Satellite Modem Web Server (HTTP) Interface. Please refer to **Chapter 5. FRONT PANEL OPERATION,** and the Remote Commands Specifications tables found in **Appendix B. REMOTE CONTROL** for detailed descriptions of the configuration parameters featured on the individual Web pages shown in this chapter.

7.1.1 Web Server Introduction

The embedded Web Server application provides the user with an easy to use interface to configure and monitor all aspects of the SLM-5650A base modem. These Web pages have been designed for optimal performance when using Microsoft's Internet Explorer Version 5.5 or higher (the examples shown use Internet Explorer Version 6.0).

The user can fully control and monitor base operations of the SLM-5650A from the Web Server Interface. By rolling the cursor over the navigation tabs located at the top of each page the user can select from the available nested hyperlinks (shown at right).

For modems with installed upgrades (e.g., the Network Processor (NP) or TRANSEC modules), added Web interface functionality is afforded through the dedicated Web Server (HTTP) interfaces provided with those upgrades. In the case of the NP Web Server Interface, it is designed to be used in enhancement of the base model interface featured in this chapter. For more information on these supplemental Web Server interfaces, refer to **Chapter 8. NETWORK PROCESSOR (NP) INTERFACE** or **Chapter 10. TRANSEC MODULE**.

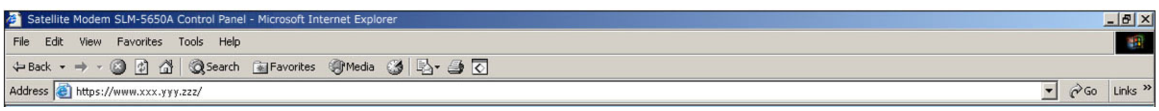
7.1.2 Web Server Menu Tree

The menu tree illustrates the options available through this interface:

Home	Admin	Config Mdm	Stats	Maint
Home	Access	Page 1	Modem Status	Unit Info
Contact	Remote	Page 2	Modem Logs	
Support		AUPC	Router Stats	

7.1.3 User Login

To initiate a Web session with the SLM-5650A Modem, from the PC type *http://www.xxx.yyy.zzzz* (where "*www.xxx.yyy.zzz*" represents the IP address of the SLM-5650A Satellite Modem) into the **Address** area of the Web browser:



The Login window will appear, and the user is prompted to type a User Name and Password.

HTTP Login Access Levels are defined as follows:

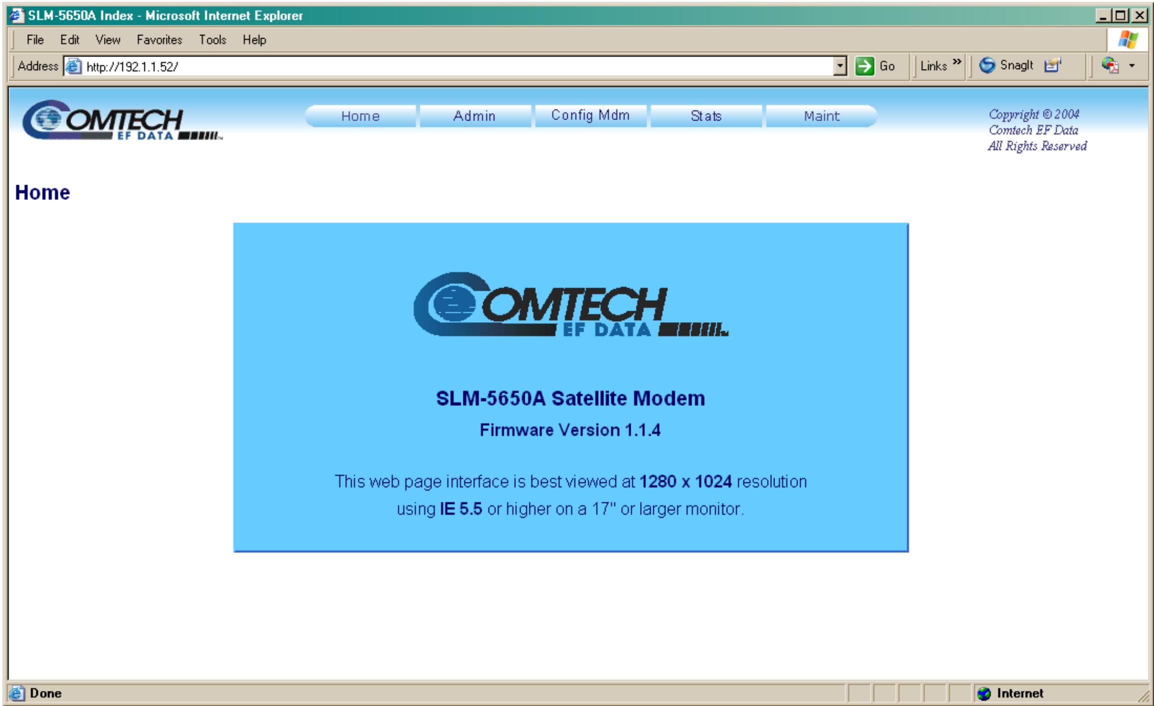
User Interface	User Login Access Level		
	Admin User	**Read/Write User**	**Read Only User**
Web	Full Access to all Web Pages	No Access to Admin or Encryption Web pages	No Access to Admin or Encryption Web pages
		Full Access for all other Web Pages	View Only Access for all other Web Pages, able to reset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

SLM-5650A Satellite Modem Web Server Default Name/Passwords are:

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

Type the User Name and Password, then click **[OK].**

Once the valid User Name and Password is accepted, the user will see the SLM-5650A Satellite Modem Web Server Interface "splash" page:



From this top level menu, the user has access to five (5) navigation tabs – **Home, Admin** (Administration), **Config Mdm** (Configure Modem), **Stats** (Statistics), and **Maint** (Maintenance)**.**

Click a tab or hyperlink to continue.

7.2 Web Server Page Descriptions

7.2.1 Home Page

7.2.1.1 Home | Home Page

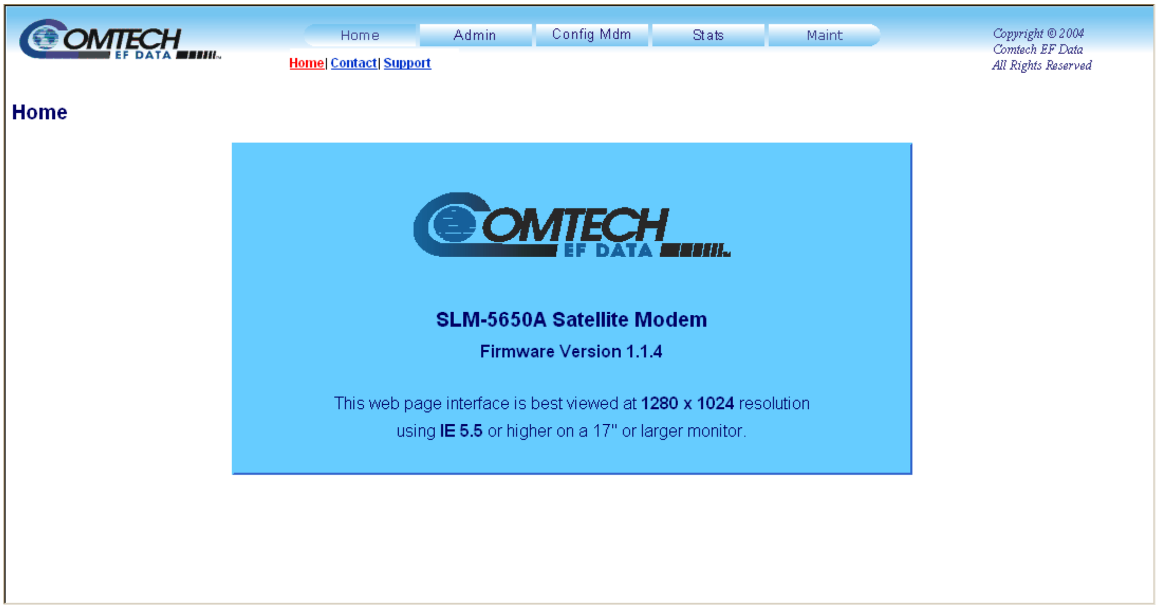


Figure 7-1. SLM-5650A Satellite Modem Home Page

From any location within the Web Server Interface, the user can select the **Home** hyperlink to return back to this top-level page.

7.2.1.2 Home | Contact Page

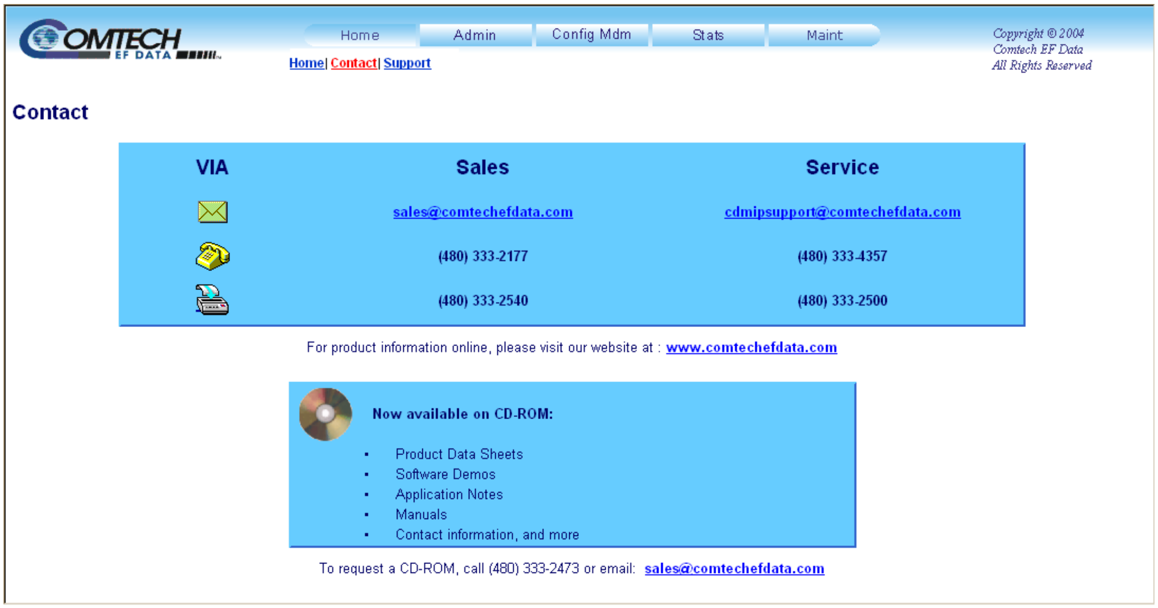


Figure 7-2. Home | Contact Information Page

The **'Home | Contact'** page (**Figure 7-2**) provides basic contact information to reach Comtech EF Data Sales and Customer Support via phone or automated e-mail links.

7.2.1.3 Home | Support Page

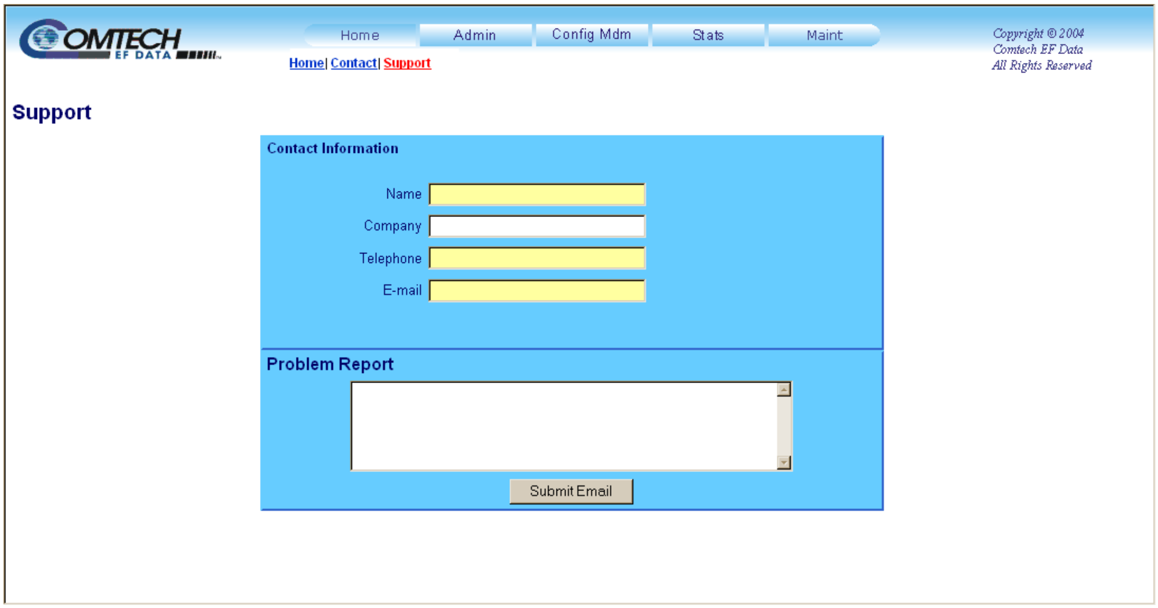


Figure 7-3. Home | Customer Support Page

The SLM-5650A **'Home | Support'** page (**Figure 7-3**) allows the user to compose an e-mail message for questions or problems with the modem.

The **Problem Report** area of the display allows up to 256 characters maximum.

The SLM-5650A Support Web Page uses SMTP (Simple Mail Transport Protocol) to send e-mail to Comtech EF Data Modem Support (cdmipsupport@comtechefdata.com). Once the **Contact Information** is entered and a message composed in the **Problem Report** text window, click [**Submit Email]** to send the message.

7.2.2 Admin Pages

The '**Admin'** pages provide the means to set up access parameters required to facilitate communication with the SLM-5650A Web Server.

7.2.2.1 Admin | Access Page

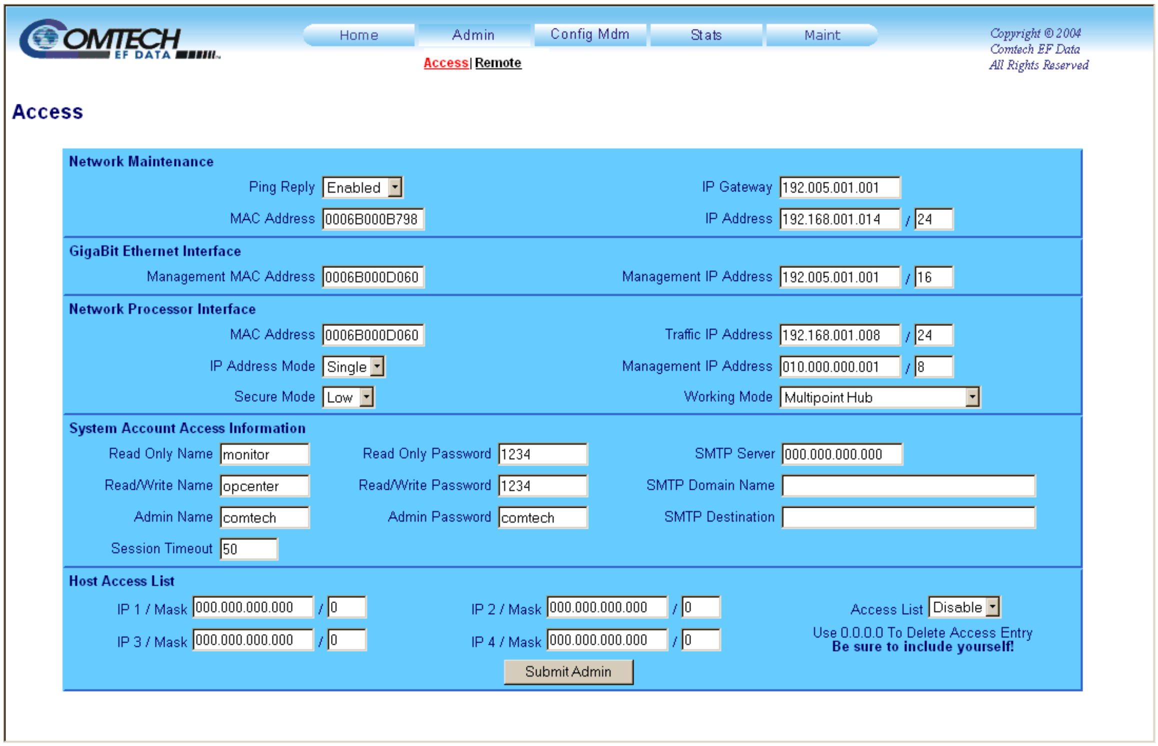


Figure 7-4. Admin | Access Page

The '**Admin | Access'** page (**Figure 7-4)** provides the means to set up User names, passwords, the e-mail server, and the host IP addresses to facilitate communication with the SLM-5650A Web Server.

For details pertaining to the configuration parameters available on this page, refer to **Chapter 5. FRONT PANEL OPERATION**.

Once the desired configuration settings have been made on this page, the user should then click [**Submit Admin]** to save these changes.

7.2.2.2 Admin | Remote Page

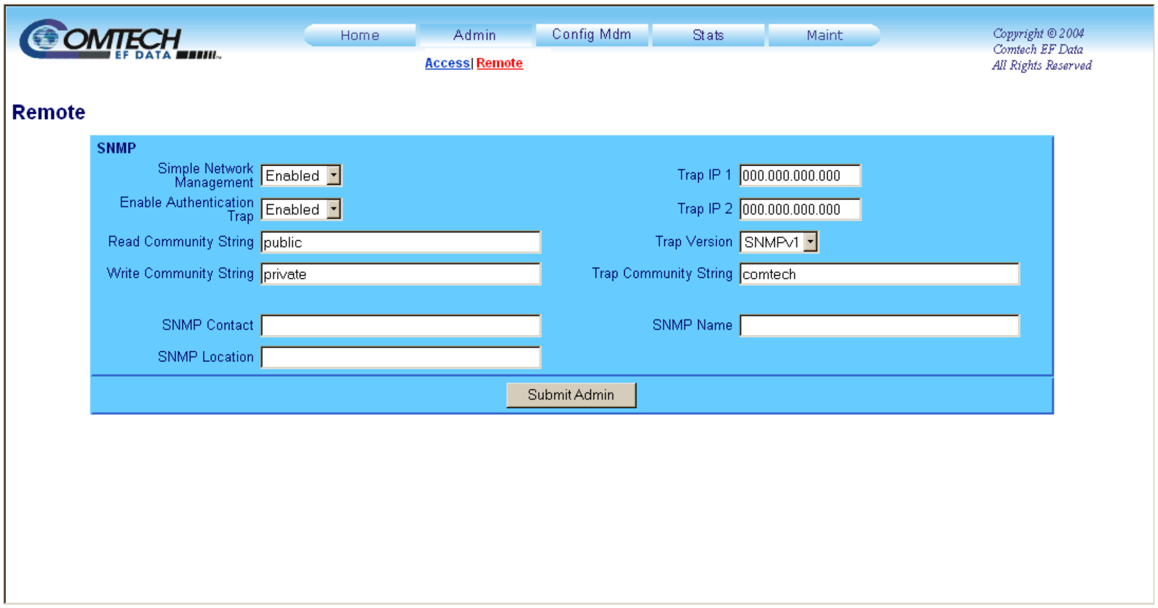


Figure 7-5. Admin | Remote Page

The '**Admin | Remote'** page (**Figure 7-5**) sets and returns administration information for the SLM-5650A Simple Network Management Protocol (SNMP) feature.

For details pertaining to the configuration parameters available on this page, refer to **Chapter 5. FRONT PANEL OPERATION** and **Chapter 6.4 SNMP INTERFACE**.

Once the desired configuration settings have been made on this page, the user should then click [**Submit Admin]** to save these changes.

7.2.3 Config Mdm (Modem Configuration) Pages

The '**Config Mdm**' pages (**Figure 7-6** through **Figure 7-8**) are used to configure the Modulator, Demodulator, and installed interfaces (including EIA-530, HSSI, Balanced and Unbalanced G.703, Gigabit Ethernet, Network Processor, and LVDS).

7.2.3.1 Config Mdm | Page 1

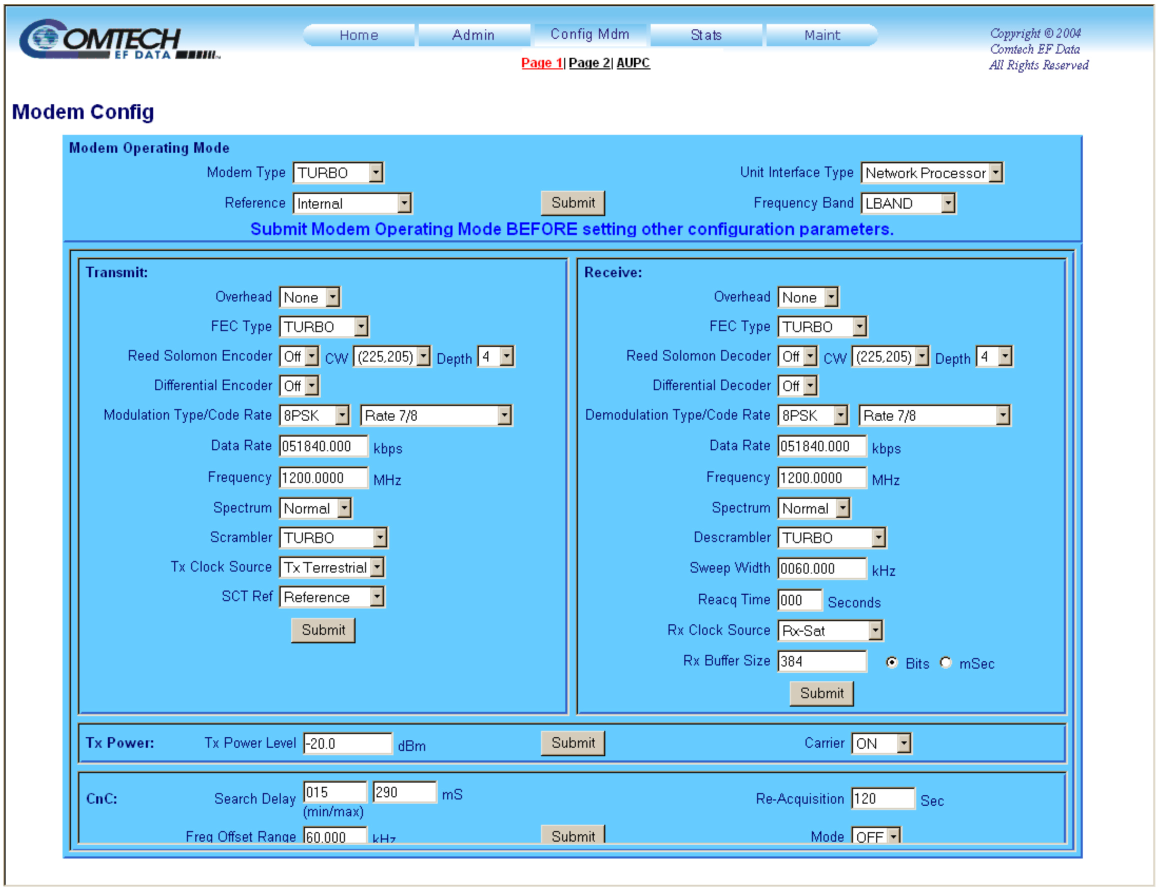


Figure 7-6. Config Mdm | Page 1

'**Config Mdm | Page 1'** (**Figure 7-6**) is used to configure modem configuration parameters including Modem Operating Mode; Transmit/Receive; and Tx Power Level.

For details pertaining to the configuration parameters available on this page, refer to **Chapter 5. FRONT PANEL OPERATION**.

Once the desired configuration settings have been made on this page, the user should then click **[Submit]** as needed to save those changes.

7.2.3.2 Config Mdm | Page 2

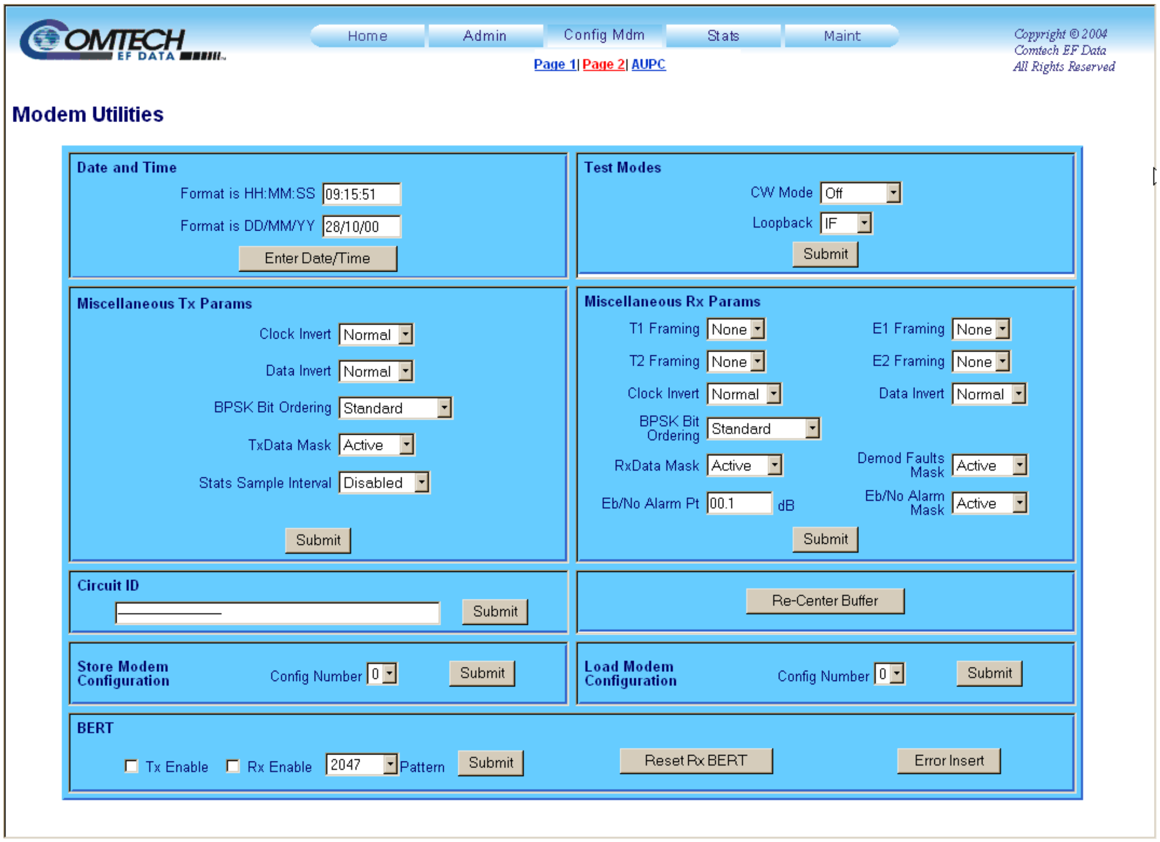


Figure 7-7. Config Mdm | Page 2

'**Config Mdm | Page 2'** (**Figure 7-7**) is used to configure modem operating parameters including Date and Time; Redundancy; Test Mode; Miscellaneous Tx and Rx Parameters; Circuit ID; and Configurations.

For details pertaining to the configuration parameters available on this page, refer to **Chapter 5. FRONT PANEL OPERATION**.

Once the desired configuration settings have been made on this page, the user should then click **[Submit]** as needed to save those changes.

7.2.3.3 Config Mdm | AUPC (Automatic Uplink Power Control)

The **A**utomatic **U**plink **P**ower **C**ontrol (AUPC) feature page (**Config Mdm | AUPC**, **Figure 7-8)** enables the modem to automatically adjust its output power to maintain the Eb/No of the remote end of the satellite link constant; this provides protection against rain fading, a particularly severe problem with Ku-band links. To accomplish this, the framed (EDMAC) mode of operation must be used, and the distant end modem constantly sends back information about the demodulator Eb/No using reserved bytes in the overhead structure.

Using the Eb/No, the local modem adjusts its output power, and a closed-loop feedback system is created over the satellite link. A benefit of this feature is that whenever EDMAC/AUPC operation is selected, the remote demodulator's Eb/No can be viewed from the front panel display of the local modem.

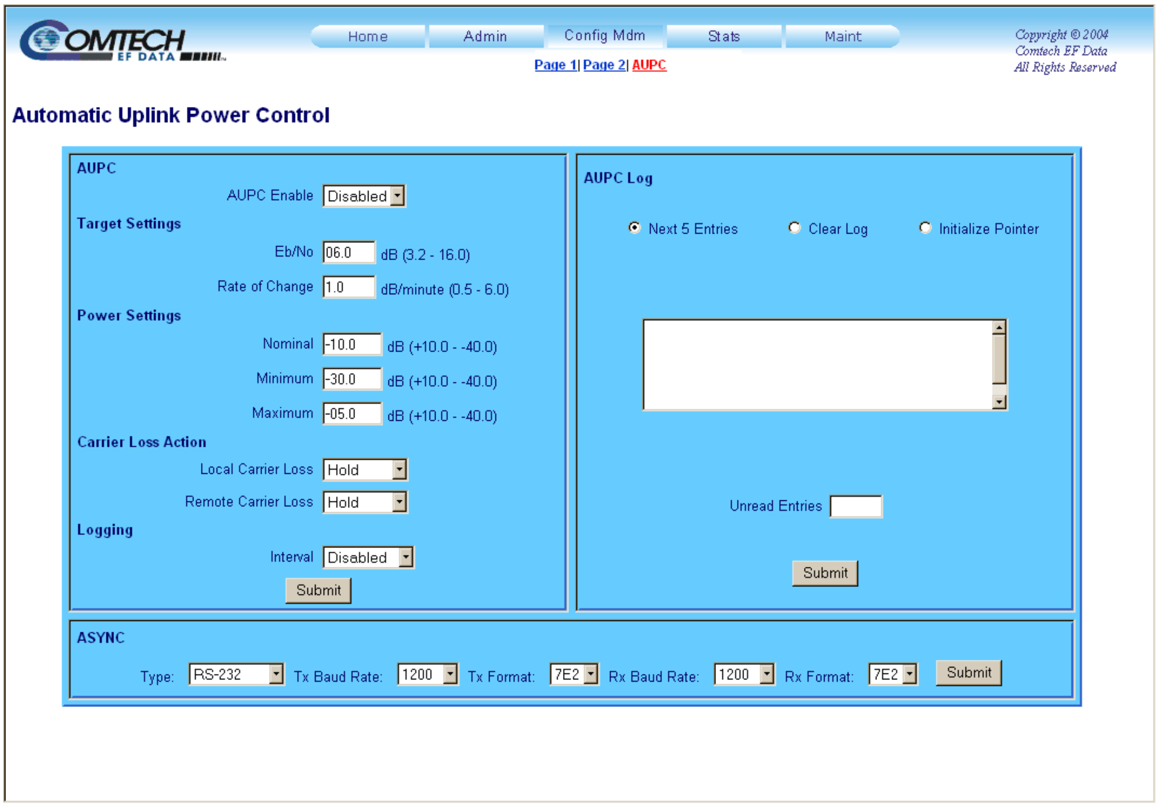


Figure 7-8. Config Mdm | AUPC page

7.2.4 Stats (Statistics) Pages

The **Stats (Statistics)** pages provide the user with 'read only' status window: General operating and configuration information about the modem; Installed Options (FAST, assorted Interface modules, etc.); Alarms; Tx and Rx Parameters; and Ethernet information.

7.2.4.1 Stats | Modem Status Page

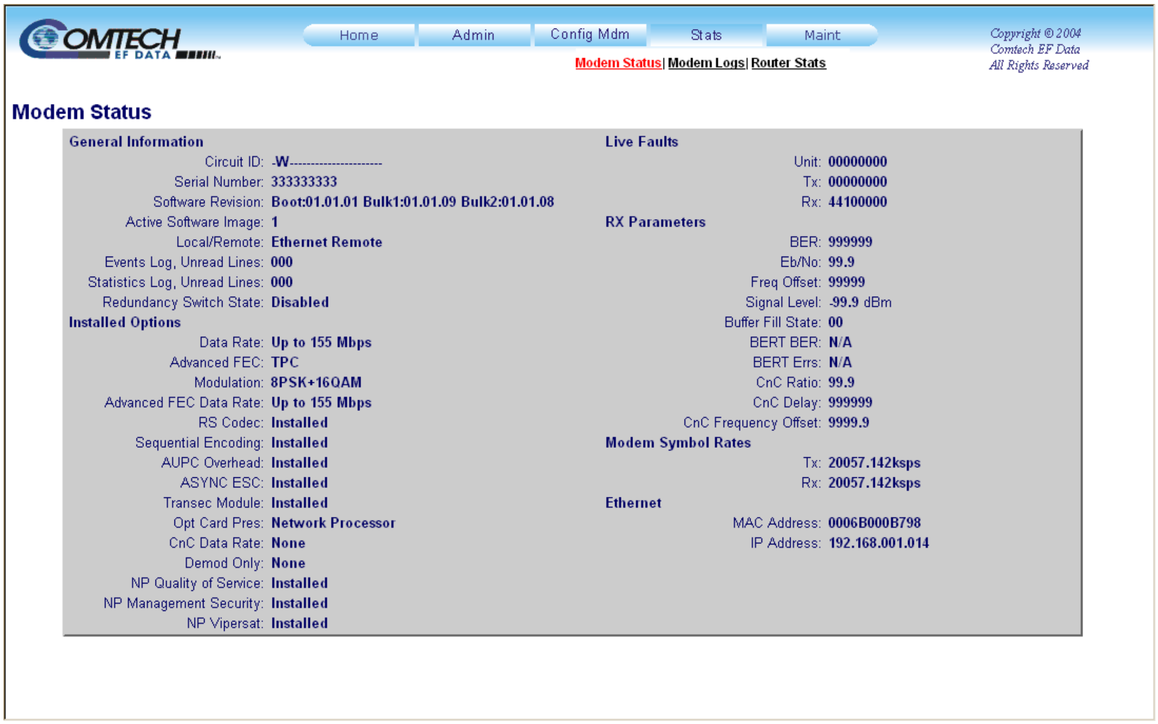


Figure 7-9. Stats | Modem Status Page

The **'Stats | Modem Status'** page (**Figure 7-9)** is the default page displayed once the user clicks on the **Stats** tab.

7.2.4.2 Stats | Modem Logs Page

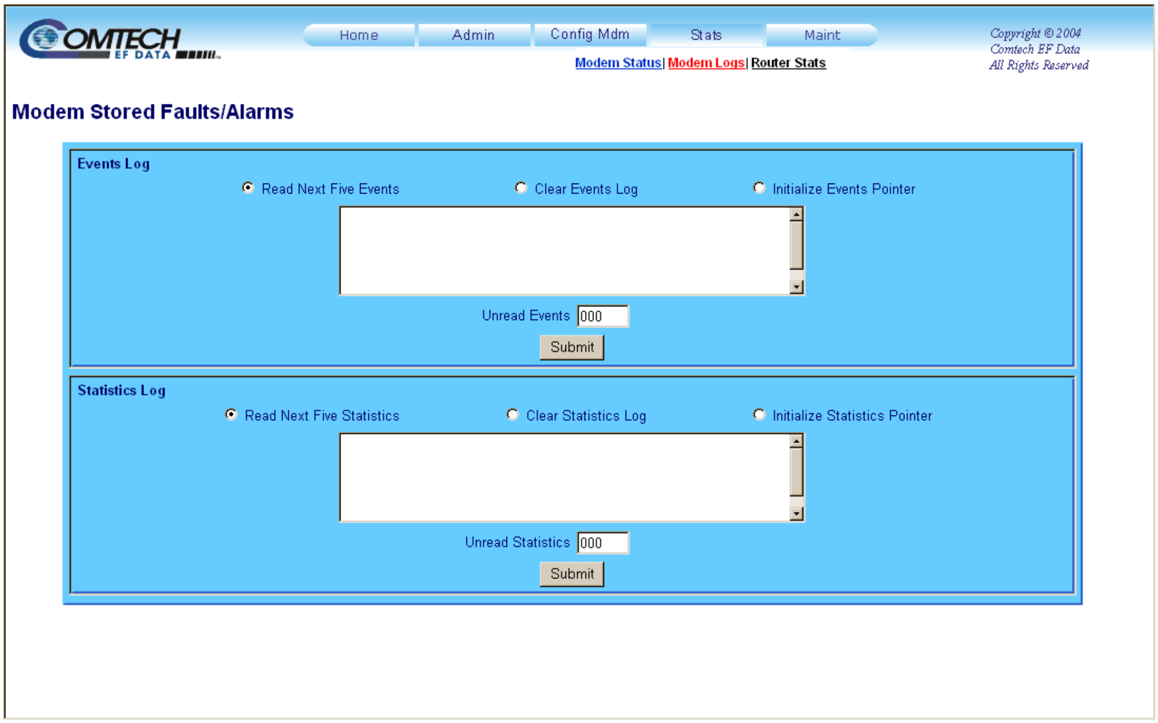


Figure 7-10. Stats | Modem Logs Page

The **Stats | Modem Logs** page (**Figure 7-10)** provides the user with control over how Faults and Alarms are processed by the unit.

For details on the configuration parameters available for this page, refer to **Chapter 5. FRONT PANEL OPERATION.**

7.2.4.3 Stats | Router Stats Page

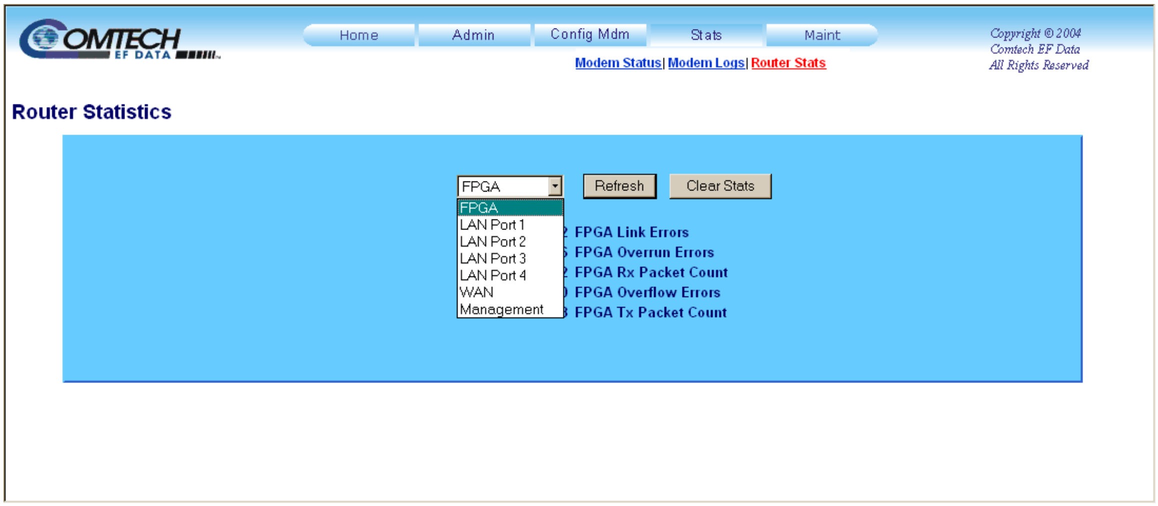
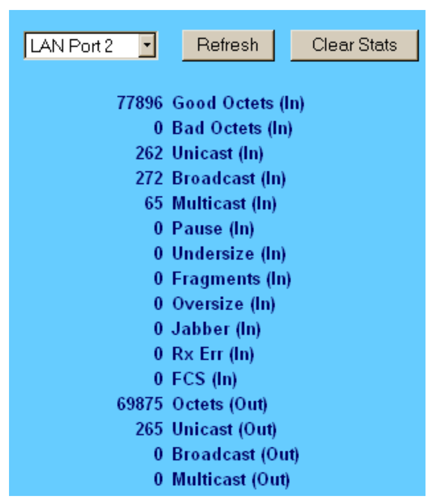


Figure 7-11. Stats | Router Stats Page

The **Stats | Router Stats** page (**Figure 7-11)** provides the user with statistics for the modem FPGA or the Ethernet operating statistics for modem WAN and M&C ports, and the Network Processor Module LAN ports 1 through 4.

The user may select one of seven features to query from the dropdown bar, then click [**Refresh]** to display the attribute statistics for that feature. For example, LAN Port 2 on the available Network Processor Module has been queried, and the resultant statistics are shown to the right:



Click [**Clear Stats]** to reset the statistics counts for the visible display.

Seven selectable pages, available via the dropdown bar, are defined on the next page in **Table 7-1**.

Table 7-1. Available Router Stats Pages

Stats / Feature Page		Attribute	Description
FPGA		FPGA Link Errors	The count of received frames that did not match the proprietary HDLC address, bad HDLC CRC, bad alignment, and under run.
		FPGA Overrun Errors	Count of received frames that exceeded max frame length of 2K bytes in length.
		FPGA Rx Packet count	Total number of received frames.
		FPGA Overflow Errors	Count of received frames that overflowed the HDLC buffer.
		FPGA TX Packet counts	Total Number of transmitted frames.
(Ethernet)	LAN Port 1 (NP Module Traffic Port marked as 1) LAN Port 2 (NP Module Traffic Port marked as 2) LAN Port 3 (NP Module Traffic Port marked as 3) LAN Port 4 (NP Module Traffic Port marked as 4) WAN (Traffic port connected to satellite interface) Management (Management port for accessing M&C)	Good Octets (in)	Total good Ethernet frames received, that is frames that are not bad frames.
		Bad Octets (in)	Total bad Ethernet frames received.
		Unicast (in)	The number of good frames received that have a Unicast destination GMAC address
		Broadcast (in)	The number of good frames received that have a broadcast destination GMAC address.
		Multicast (in)	The number of good frames that have multicast destination GMAC address. Note: this address not included 802.3 Flow Control messages counted in Pause (In) or does it included Broadcast frames counted in Broadcast (in).
		Pause (in)	The number of good Flow Control frames received.
		Undersize (In)	Total frames received with length of less than 64 octets but with valid FCS.
		Framents (in)	Total frames received with length of less than 64 octets but with invalid FCS.
		Oversized (in)	Total frames received with length of more than Maxsize (1643 in bridge mode and 1522 in all other modes) but with valid FCS.
		Jabber (in)	Total frames received with length of more than Maxsize (1643 in bridge mode and 1522 in all other modes) but with invalid FCS.
		Rx Err (in)	Total frames received with RxErr signal from PHY.
		FCS (in)	Total Frames received with a CRC error not counted in Fragments (In), Jabber (In) or RxErr (In).
		Octets (Out)	Total Ethernet frames sent from this GMAC
		Unicast (Out)	The number of frames sent that have a Unicast destination GMAC address.
		Broadcast (out)	The number of frames sent that have a Broadcast destination GMAC address.
		Multicast (Out)	The number of frames sent that have a Multicast destination GMAC address.

7.2.5 Maint (Maintenance) | Unit Info

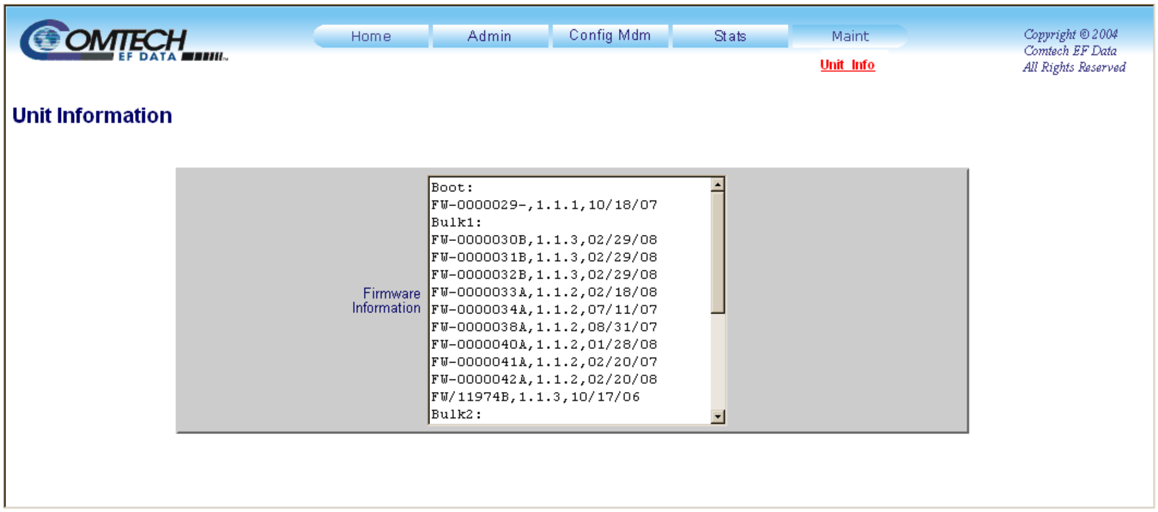


Figure 7-12. Maint | Unit Information Page

The **Maint: Unit Info** page (**Figure 7-12)** provides the user a scrollable ‘read-only’ status window containing the unit’s firmware information for Boot, Active and Inactive Bulks.

For details about the information provided on this page, refer to **Chapter 5. FRONT PANEL OPERATION.**

Chapter 8. NETWORK PROCESSOR (NP) INTERFACE

8.1 Introduction

The optional SLM-5650A Network Processor (NP) data interface module (also referred to as the "NP Module" or the "card"), shown in **Figure 8-1**, is Comtech EF Data's third generation IP router and Ethernet bridge device.

The NP Module supports three primary operating modes:

- Layer 3 SCPC IP Router
- Layer 3 Vipersat STDMA Router
- Layer 2 Ethernet Bridge

The NP Module is designed to process more than 150,000 packets per second (pps) in Layer 2 or Layer 3 mode of operation. It provides four RJ-45 connectors for user data, wired as described in **Table 8-1**. The NP module also has a single RJ-11 console interface for board bring-up and factory use only.

IMPORTANT

To prevent network failure, the user should have no more than one ***Ethernet connection to a*** single external switch ***at any time.***

The user interfaces for management and control of the NP are via the built-in Web server (HTTP or HTTPS) or Telnet servers (port 23 and 7001), using any of the four RJ-45 connectors.

Figure 8-1. Network Processor (NP) Interface Module

8.2 Physical Description

Dimensions	4.5 W x 6.8 D x .85 H inches (11.43 W x 17.27 D x 2.16H cm)
Connectors (See **Figure 8-2**)	SLM-5650A connection: (1) 96-pin DIN receptacle
	LAN interface: (4) RJ-45 connectors, female, 100Ω
	Console interface for board bring-up and factory use only: (1) RJ-11 connector
Indicators	Link Status and Activity Light-Emitting Diodes (LEDs)

8.3 General Specifications

Data Framing	10/100/1000 Base-T Interface: RFC-894 “Ethernet”
Data Framing Format (WAN)	CEFD proprietary
Electrical Properties	Per IEEE 802.3ab
Packet Types	Burst, distributed, or IPV4
Signal Types	Serial data
Voltage Level	Per IEEE- 802.3ab
Packet Latency	50 ms maximum
Cable Length, Maximum	100 meters CAT 5 cable, patch cords and connecting hardware, per ISO/IEC 11801:1995 and ANSI/EIA/TIA-568-A (1995)
Hot Pluggable (cable)	Yes
Hot Pluggable (card)	No

8.4 Functional Hardware Description

The NP Module employs the very high performance Intel IXP2350 network processor/32-bit micro controller with four (4) embedded Micro Engines to perform the high-speed Layer 3 routing functions.

A functional block diagram is provided in **Figure 8-2**. The front-end of the NP Module design incorporates a Gigabit Ethernet (GbE) switch device that provides all Layer 2 management. The back-end of the NP Module design incorporates an FPGA to provide the WAN framing and deframing, plus the interface into the main SLM-5650A modem design.

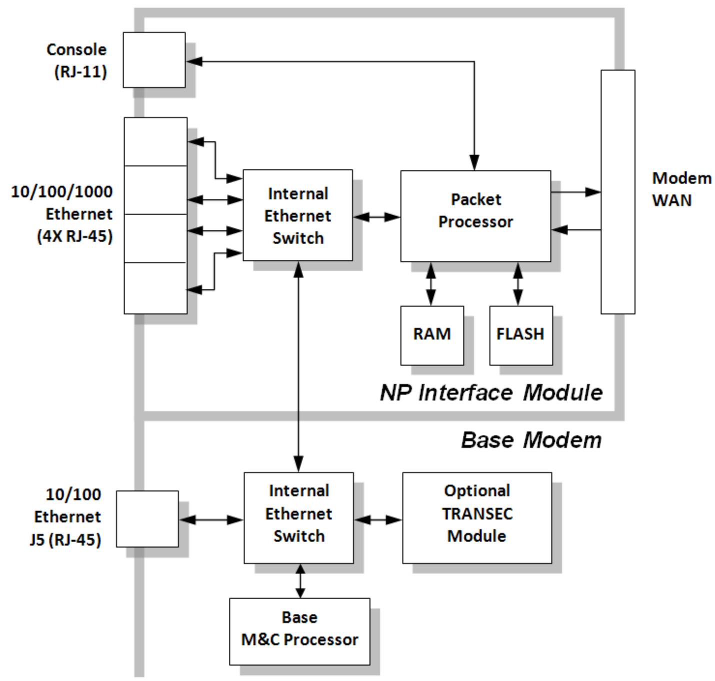


Figure 8-2. NP Module Block Diagram

8.5 Connector Pinout

The LAN interface is comprised of four IEEE 802.3ab 10/100/1000 Base-T copper interfaces via four female RJ-45 connectors wired as shown in **Table 8-1**.

Table 8-1. Connector Pinout

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

8.6 NP Module Removal and Installation

1. Ensure the unit is POWERED OFF. Serious injury or damage to the equipment could result if the unit is powered during module removal or installation.

2. Care must be taken not to damage the module's components during removal or installation.

8.6.1 Removal of the Interface Module:

Step	Procedure
1	**Turn off** the power to the modem.
2	**Disconnect** the RJ-45 cable(s) from the Interface Module.
3	**Loosen** the (two) captive thumb screws securing the module to the chassis.
4	**Remove** the module by pulling it *straight out* until it is clear of the chassis slot .

8.6.2 Installation of the Interface Module:

Step	Procedure
1	**Install** the Interface Module by inserting it *straight into* the chassis slot, using the chassis' internal card guides, until it plugs securely into the internal card receptacle.
2	**Secure** the module to the chassis using the (two) captive thumb screws.
3	**Connect** the RJ-45 cable(s) to the module.
4	**Turn on** the power to the modem.

8.7 NP Module Web Server (HTTP) Interface

The following sections describe the functionality that is unique to the SLM-5650A NP Module Web Server (HTTP) Interface.

8.7.1 Web Server Introduction

The embedded NP Module Web Server Interface integrates a good portion of the SLM-5650A standard Web Server Interface functionality (outlined in detail in the previous chapter) with the configuration and monitoring features unique to the Network Processor Interface. Accordingly, the NP Module Web Server provides an easy-to-use interface for configuring and monitoring most aspects of the SLM-5650A modem and all Network Processor parameters.

The user can fully control and monitor operation of the Network Processor from the NP Module Web Server Interface. By rolling the cursor over the tabs located at the top of each page, the user can select from the available nested hyperlinks (as shown to the right).

The pages in the NP Module Web Server Interface have been designed to work using either Microsoft's Internet Explorer Version 6.0 or higher, or Mozilla Firefox Version 2.0 or higher (the examples shown use Internet Explorer Version 6.0).

8.7.2 Web Server Menu Tree

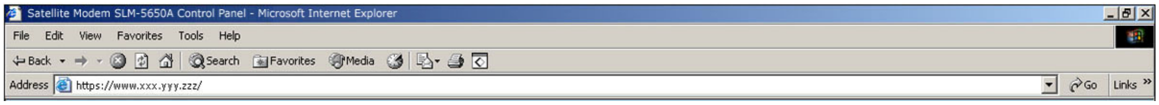
The following menu tree illustrates the options available through this interface:

Info	Admin	Modem	LAN	WAN	Routing	Stats	Vipersat*	Redundancy	Save
Home	Vipersat Mode*	Config	Interface	QoS*	Routes	Ethernet Tx	Vipersat	1:1 Redundancy	Save
Contact	FAST Features	Monitor	Ethernet Ports	QoS Stats*		Ethernet Rx	STDMA		
Logoff	Security	Events	ARP	Loopback Test		IP	Stats		
	Serial	Stats				WAN	Switching		
	Upgrade	Utility				Clear All	DPC		
	Defaults						Home State		
	Time								
	Event Log								
	Reboot								

Note: * indicates a FAST Feature that is available on the interface only after that option has been purchased. Refer to **Sect. 8.7.4.2.2 Admin | FAST Features** for more information.

8.7.3 User Login

To initiate a Web session with the SLM-5650A NP Module, from a Web browser type *http://www.xxx.yyy.zzzz* (where "*www.xxx.yyy.zzz*" represents the IP address of the NP Module) into the browser's **Address** area:



The Login window will appear, and the user is prompted to type a User Name and Password.

Network Processor default User Name: **comtech**

Network Processor default Password: **comtech**

Type the User Name and Password, then click **[OK].**

Once the valid User Name and Password is accepted, the user will see the SLM-5650A Network Processor Web Server Interface "splash" page:

From this top level page, depending on the unit configuration and FAST Features purchased, the user has access to up to 10 navigation tabs – **Info** (Information), **Admin** (Administration), **Modem**, **LAN**, **WAN**, **Routing**, **Stats** (Statistics), **Vipersat**, **Redundancy**, and **Save**.

Click a tab or hyperlink to continue.

8.7.4 Web Server Page Descriptions

8.7.4.1 Info (Information) Pages

8.7.4.1.1 Info | Home

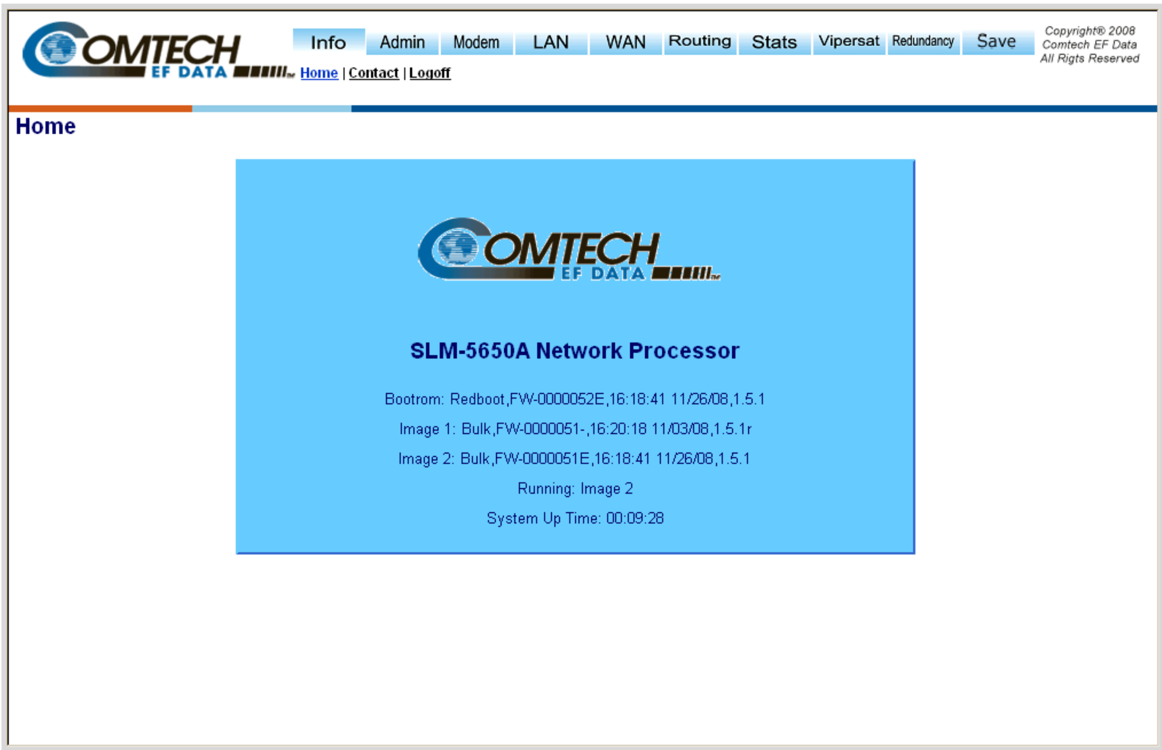


Figure 8-3. Info | Home Page

The **Info | Home** page (**Figure 8-3**) identifies pertinent information about the SLM-5650A Network Processor, including the installed firmware for the Bootrom, Image 1, and Image 2.

8.7.4.1.2 Info | Contact

Figure 8-4. Info | Contact page

The **Info | Contact** page (**Figure 8-4**) provides the basic contact information for Comtech EF Data Sales and Service via e-mail links, phone, or fax.

8.7.4.1.3 Info | Log Off

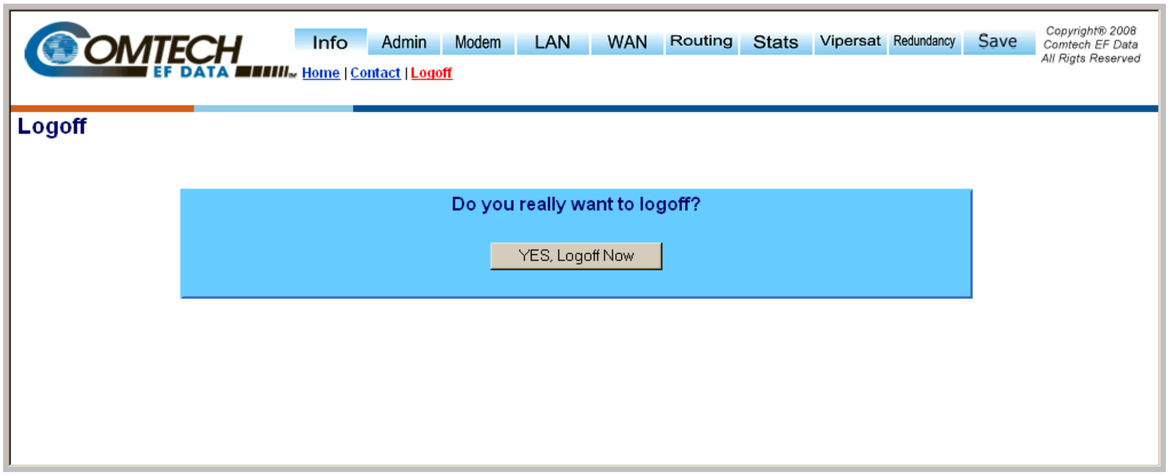


Figure 8-5. Info | Logoff page

The Network Processor currently allows only one connection to the NP Module Web Server Interface. Use the **Info | Logoff** page (**Figure 8-5**) to formally disconnect from the interface.

IMPORTANT

Upon disconnection, you will be required to close the Web browser so as to delete the Network Processor's security cookie.

8.7.4.2 Admin (Administration) Pages

8.7.4.2.1 Admin | Vipersat Mode (FAST Feature required)

Figure 8-6. Admin | Vipersat Working Modes page

The **Admin | Vipersat Mode** page (**Figure 8-6**) allows the user to specify how the modem/Network Processor is to behave in Vipersat or non-Vipersat working modes. Once the role of a particular modem in the network is determined, this single point of configuration is intended to simplify deployment.

Vipersat Modes

This FAST Feature-enabled page allows the user to select the following Vipersat modes:

- **Vipersat Hub Router**
- **Vipersat Hub Expansion Router**
- **Vipersat Remote Router**
- **Vipersat Remote Expansion Router**

For details on configuration and use of the NP Module Web Server Interface's Vipersat pages, please consult adjunct Comtech EF Data publication **MN-0000035 – *Vipersat SLM-5650A Satellite Network Modem Router User Guide***.

Non-Vipersat Multipoint Modes

- **Multipoint Hub Router** – When in static SCPC (non-Vipersat mode), the user has the option of configuring the modems into a hub and spoke network with a shared outbound at the hub. All of the modems at the hub should be put in “Multipoint Hub Router” mode.

  Note: If a modem at the remote is configured to be a Hub router there will be significant degradation to network performance due to the potential for routing loops.

- **Multipoint Remote Router** – Select Multipoint Remote Router for all remote modems in a non-Vipersat multipoint network. A Remote router would be classified as a modem which receives the shared outbound and transmits back to the hub on a dedicated SCPC channel.

Non-Vipersat Point-to-Point Mode

- **Point-to-Point Router –** Select for use in a Point-to-Point SCPC link where there are different IP subnets on either side of the link.

Non-Vipersat Bridging Mode

- **Gigabit Ethernet Bridge –** Select for use in a Point-to-Point SCPC link when you wish to bridge traffic (no IP network routing).

  Note: This mode is currently only compatible with the Gigabit Ethernet bridge card for the SLM-5650A.

Click **[Submit]** once the appropriate selection is made.

8.7.4.2.2 Admin | FAST Features

Note: This section depicts the NP Module Web Server Interface with **Vipersat** and **Quality of Service (QoS)** installed on the SLM-5650A. *If the SLM-5650A does not have these options installed, the* **Qos** *and* **Qos Stats** *hyperlinks located under the* **WAN** *navigation tab, and the hyperlinkslocated under the* **Vipersat** *navigation tabe will not be visible/available to the user.*

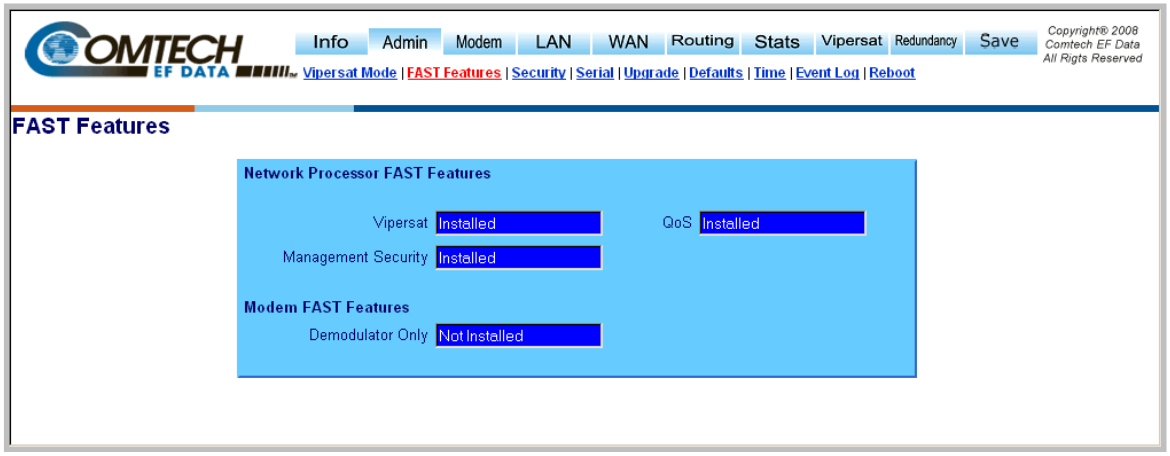


Figure 8-7. Admin | FAST Features page

The *read-only* **Admin | FAST Features** page (**Figure 8-7**) displays these FAST Features as **Installed** or **Not Installed**.

Network Processor *and* Modem FAST Features

Comtech EF Data offers **Vipersat** and **Quality of Service (QoS)** functionality as optional FAST Features for the Network Processor. To install these options, a modem FAST code must be purchased by contacting Comtech EF Data Customer Support.

Once the 20-digit modem FAST code is obtained, the purchased FAST feature(s) is installed via the SLM-5650A front panel (**Utility: FAST → Configuration →** *Enter modem code*). See **Chapter 5. FRONT PANEL OPERATION** for detailed information on installing FAST Features.

IMPORTANT

Upgrading the FAST features will cause a modem reboot and reconfiguration of all modem parameters.

8.7.4.2.3 Admin | Security (Account Information)

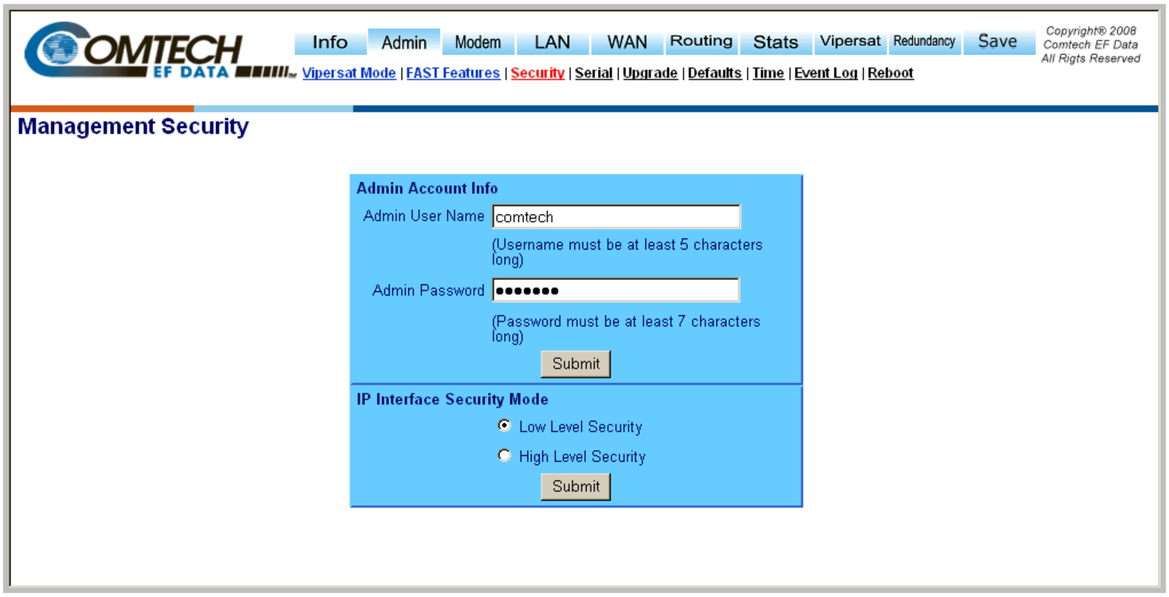


Figure 8-8. Admin | Management Security page

Admin Account Info

The login process requires a name and password as defined by the systems administrator of the controlling equipment. This name and password is associated to the name and password of an administrator account.

Through the **Admin |Security** page (**Figure 8-8)**, the Admin user has access to change all parameters on the Network Processor as well as base modem parameters. However, the Admin user does **not** have access to the TRANSEC module parameters; this functionality is only available to a separate *Crypto Officer* login provided directly on the TRANSEC Module Web Server Interface. See **Chapter 10. TRANSEC MODULE** for further information.

IP Interface Security Mode

The **IP Interface Security Mode** level may be set to **Low** or **High Level Security** via this page:

- **Low Level Security** – In this mode, the user can access the NP Interface using standard or secure Web access (HTTP or HTTPS). The base modem M&C can be accessed using the NP Module's RJ45 connectors in addition to the base modem's M&C connector.
- **High Level Security –** In this mode, the user can access the NP Interface via either the TRANSEC Web Server pages using secure Web access (HTTPS), or through secure Web access (HTTPS) directly to the NP Web Server Interface. The base modem M&C can be accessed only using the TRANSEC Web Server Interface via secure Web access (HTTPS).

Set the desired **Admin Account Info** and **IP Interface Security Mode**, then click **[Submit]** to save these settings.

8.7.4.2.4 Admin | Serial (Serial Port Information)

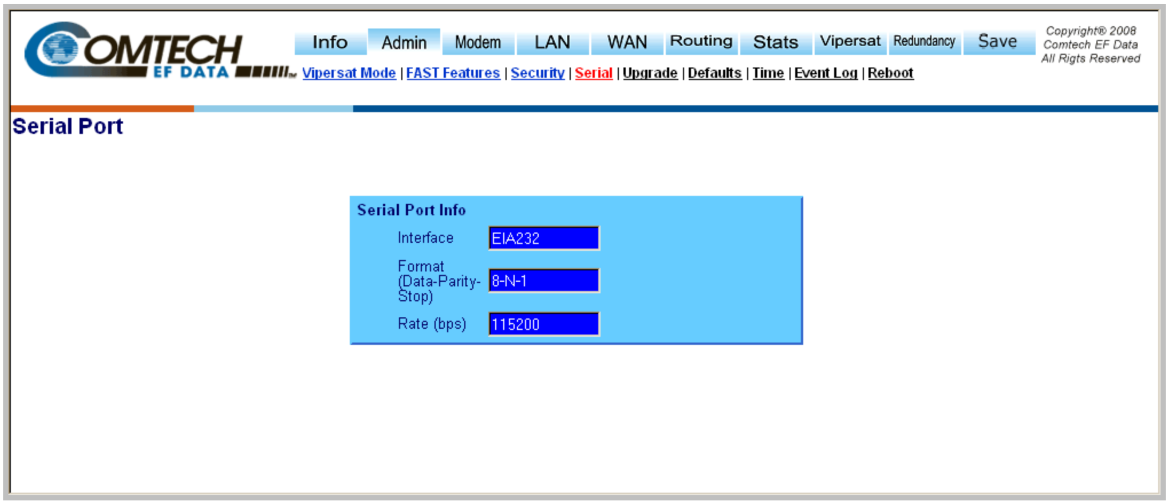


Figure 8-9. Admin | Serial Port Info page

Note: The information provided on the *read-only* **Serial Port** page (**Figure 8-9**) is for ***factory use only***:

- **Interface** – Displays modem serial remote interface type.
- **Format (Data – Parity – Stop) –** Displays modem serial remote data format setting.
- **Rate –** Displays modem serial remote baud rate.

8.7.4.2.5 Admin | Upgrade

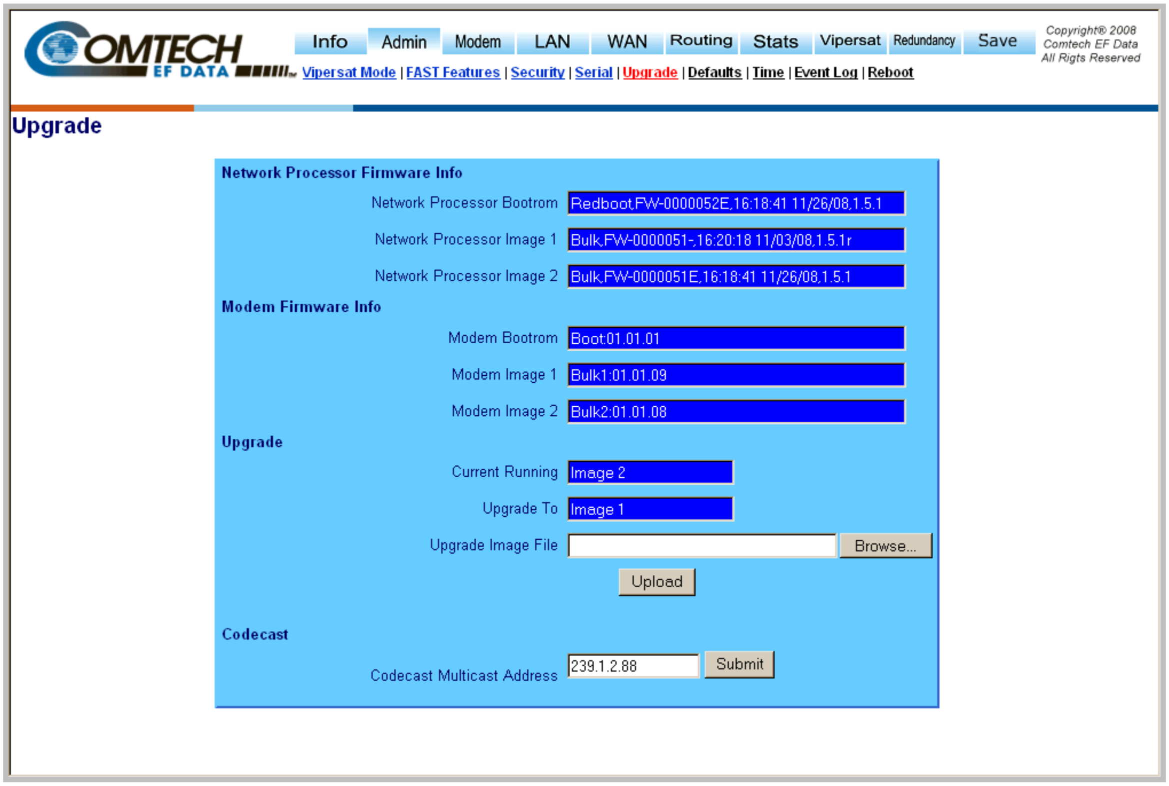


Figure 8-10. Admin | Upgrade page

Network Processor Firmware Info

This section displays the installed Network Processor Firmware (all information is *read only*):

- **Network Processor Bootrom –** a single bootrom that initializes the hardware and loads the full bulk image as selected by the user.
- **Network Processor Image 1 –** a full copy of software image stored in slot 1.
- **Network Processor Image 2 –** a full copy of software image stored in slot 2.

Modem Firmware Info

These fields display installed SLM-5650A base modem firmware for the Bootrom, Image 1, and Image 2 (all information is *read only*).

Upgrade

Please see **Chapter 4. FLASH UPGRADING** for complete details on using the NP Module Web Server Interface for upgrading the base modem, Network Processor and TRANSEC module firmware.

- **Current Running** (*read only*) **–** displays current Network Processor Firmware Image.
- **Upgrade To** – when upgrading, the field allows the user to select the Network Processor Firmware Image that will be overwritten with the new image. Click **[Submit]** once the proper selection has been made.

- **Upgrade Image File –** click **[Browse]** to locate the bulk image on the local computer's file system, then click **[Upload]** to upload the image.

Codecast

- **Codecast Multicast Address –** *For detailed information about this feature, refer to Comtech Vipersat Networks, Inc. document* **Vload x.x.x Vipersat Load Utility User Guide (***P/N 22117).*

8.7.4.2.6 Admin | Defaults

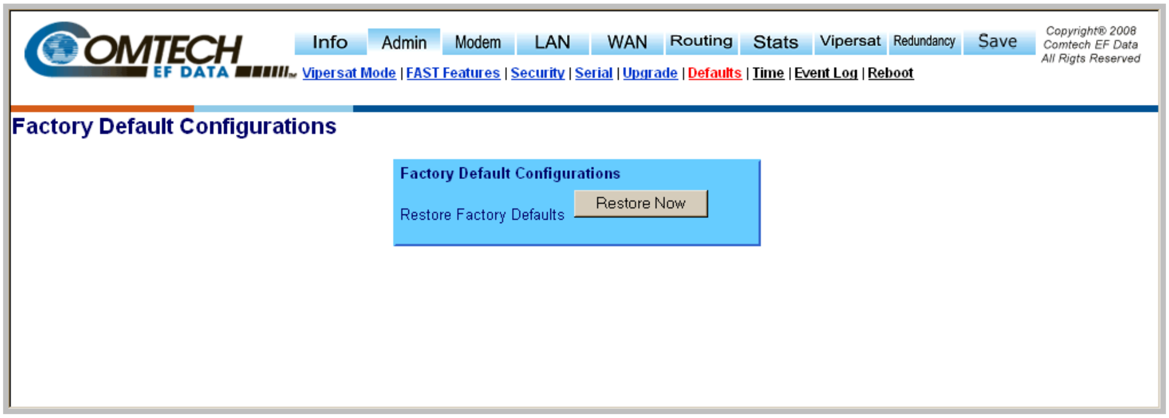
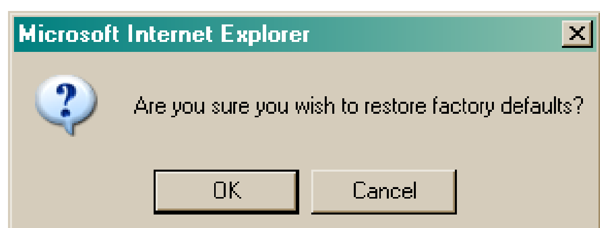


Figure 8-11. Admin | Defaults page

Use the **Admin | Defaults** page (**Figure 8-11**) to restore all previously-configured modem parameters to their **Factory Default Configuration** settings.

Click **[Restore Now]** to begin the restoration process. At the user prompt (shown at right), click **OK** to complete the process, or **Cancel** to abort the command.



8.7.4.2.7 Admin | Time (Date and Time)

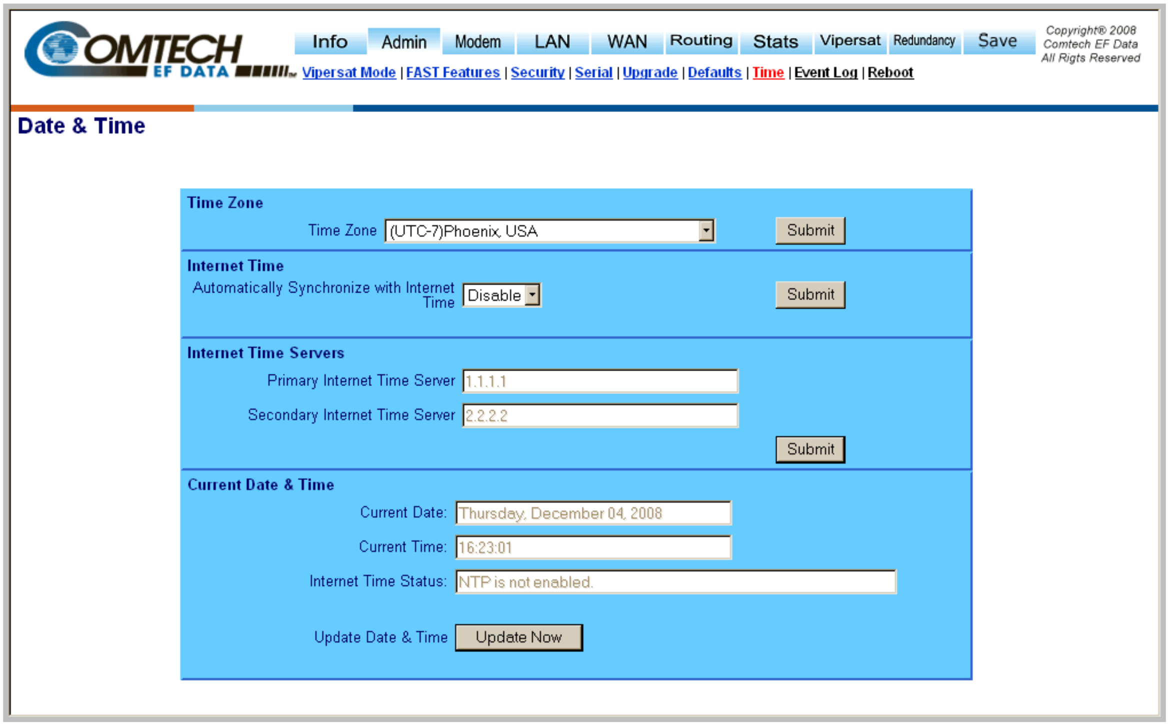


Figure 8-12. Admin | Time (Date & Time) page

Time Zone

Allows the user to select the time zone of the modem.

Click **[Submit]** once the desired time zone has been selected.

Internet Time

Automatically Synchronize time using network time protocol.

Click **[Submit]** once time synchronization has been **Enabled** or **Disabled**.

Internet Time Servers

- **Primary Internet Time Server** – IP address of primary network time server.
- **Secondary Internet Time Server** – IP address of secondary network time server.

Click **[Submit]**.

Current Date & Time

- **Current Date** – The current date of the modem is set from the modems front panel and kept current using a battery back-up clock. This means that the date will be correct even if the modem loses power.
- **Current Time** – The current time of the modem is set from the modems front panel and kept current using a battery back-up clock. This means that the time will be correct even if the modem loses power.
- **Internet Time Status** – Status of network time server (if NTP is enabled).

8.7.4.2.8 Admin | Event Log

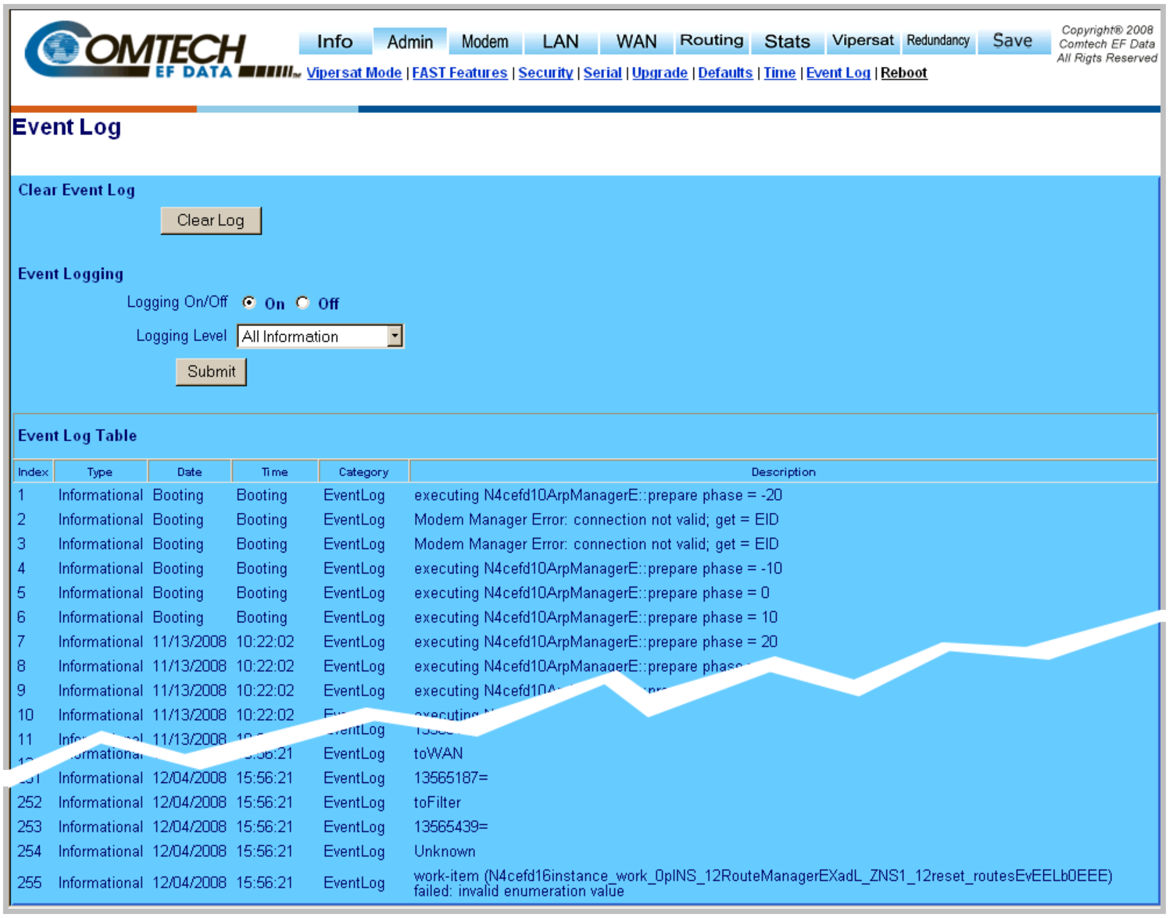


Figure 8-13. Admin | Event Log page

The **Admin | Event Log** page (**Figure 8-13**) provides a logging mechanism for the NP Module only. It functions as a monitoring/troubleshooting aid to help determine the health of the interface, as well as troubleshoot any issues found in the field.

Clear Event Log

- Click **[Clear Log]** to delete all existing log entries. The event log is reset to one (1) entry: "**Eventlog Cleared**".

Event Logging

- **Logging On/Off –** Enables/disables logging of event messages.
- **Logging Level** – Allows the user to filter the maximum level of message to be displayed. Choices are **Errors Only**, **Errors and Warnings**, and **All Information**.
- Click **[Submit]** to execute these settings.

Event Log Table

- **Index –** Event log entries 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 accordance with international convention, the date is shown in DAY/MONTH/YEAR format**.**
- **Time –** Displays the time of day that the event was logged.
- **Category –** ***For use by Customer Support.***
- **Description –** Provides a brief description of the action logged.

8.7.4.2.9 Admin | Reboot

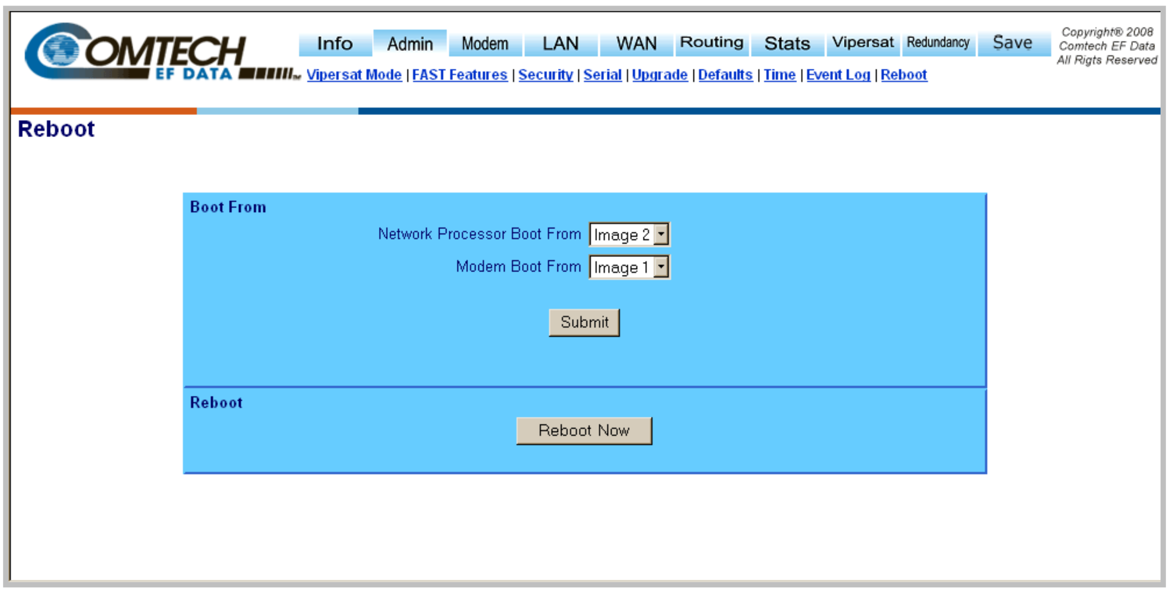


Figure 8-14. Admin | Reboot page

Boot From

- **Network Processor Boot From –** Select the Network Processor image you would like to boot from: 1 or 2
- **Modem Boot From** – Select the Modem boot image you would like to boot from: 1 or 2

Once the selections have been made, **[Submit]** ***MUST*** be clicked for changes to take effect.

Reboot

- **[Reboot Now] –** Clicking this button causes the entire modem to reboot; this includes the base modem, Network Processor and TRANSEC module.

8.7.4.3 Modem Pages

The **Modem** pages allow the user to configure the primary **Transmit** parameters and primary **Receive** parameters of the SLM-5650ASatellite Modem.

8.7.4.3.1 Modem | Config (Modem Configuration)

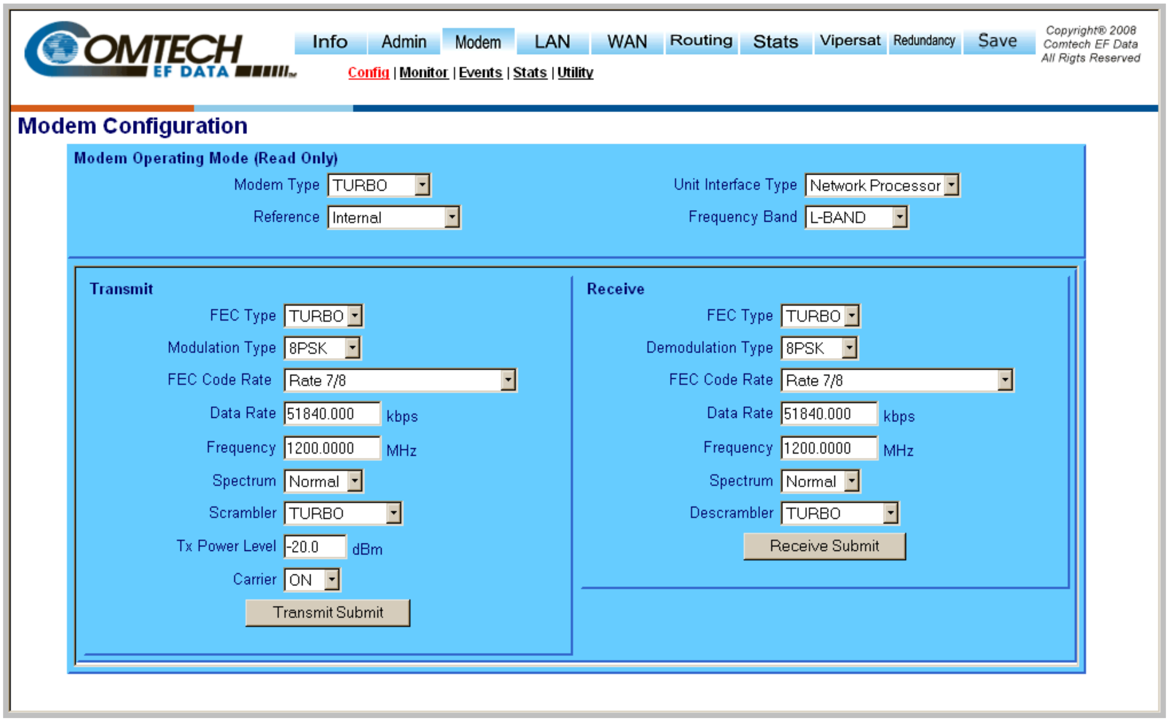


Figure 8-15. Modem | Modem Configuration page

Modem Operating Mode

- **Modem Type** *(Read Only)*

Modem Type	Comments
OM-73	Selects Linkabit OM-73 modem compatibility mode.
MIL-165A	Selects functionality defined by MIL-STD-188-165A.
IESS-308	Selects functionality defined by IESS-308, the Intelsat Intermediate Data Rate standard.
IESS-309	Selects functionality defined by IESS-309, the Intelsat Business Services standard.
IESS-310	Selects functionality defined by IESS-310, the Intelsat 8-PSK Intermediate Data Rate standard.
TURBO	Selects functionality defined by IESS-315 plus Comtech EF Data Turbo mode interoperability.
16-QAM	This mode allows 16-QAM to be selected as a modulation type.
AUPC	This mode allows Automatic Uplink Power Control to be used.
TX-BURST	This mode should be selected when unit is a Vipersat Remote Modem.
RX-BURST	This mode should be selected when unit is a Vipersat Hub Modem.

- **Reference (Read Only)**

Reference Type	Comment – Permits User to Select…
Internal	…Internal high stability ovenized 10 MHz oscillator
Ext-1MHz	…An external 1 MHz reference, (accepts sine wave or square wave and locks the internal reference to the 1 MHz)
Ext-5MHz	…An external 5 MHz reference, (accepts sine wave or square wave and locks the internal reference to the 5 MHz)
Ext-10MHz	…An external 10 MHz reference, (accepts sine wave or square wave and locks the internal reference to the 10 MHz)

- **Unit Interface Type** *(Read Only)*

Unit Interface Type	Comments
EIA-530	Native interface, standard equipment
HSSI	Native interface, standard equipment
Gigabit Ethernet	Optional data interface
Network Processor	Optional data interface

- **Frequency Band** *(Read Only)*

Frequency Band	Comments
70/140 MHz	(52 – 88 MHz, 104 – 176 MHz)
L-Band	(950 – 2000 MHz)

Transmit

- **FEC Type**

FEC Type	Comments
Viterbi (standard)	K=7 convolutional encoder.
None (standard)	Uncoded.
Turbo (optional)	Turbo means Turbo Product Code, which is a block code.
Trellis (not shown)	Trellis operation is not a displayed choice. Trellis supported in IESS-310 mode and MIL-STD-188-165A mode, which for the encoder is just a specific mapping of the constellation.

- **Modulation Type**

Interface Type	Comments
BPSK	Bi Phase Shift Keying
QPSK	Quadrature Phase Shift Keying.
OQPSK (standard)	Offset Quadrature Phase Shift Keying.
8PSK	8 Phase Shift Keying
16QAM (optional)	16 Quadrature Amplitude Modulation.

- **FEC Code Rate**

FEC Type	Comments
Viterbi	1/2, 2/3, 3/4, 5/6, or 7/8
Uncoded	1/1
Turbo	5/16, 21/44, 3/4, 7/8, or 17/18

- **Data Rate (kbps)**

  Enter Transmit Data Rate (in kbps).

- **Frequency (MHz)**

  Enter Frequency: 52-88, 104-176 MHz (in 100 Hz steps) or 950-2000 MHz (in 100 Hz steps)

- **Spectrum**

Select	Comments
Normal	Used to counteract frequency converters that invert the spectrum
Invert	

- **Scrambler**

  Scrambling is for energy dispersal.

Select	Comments
V.35	ITU standard
M-V.35	Comtech EF Data Closed Network with Reed Solomon compatible (modified V.35)
IBS	Used for IESS-309 and AUPC operation
Turbo	Synchronous scrambler synchronized to the Turbo block
OM73	Linkabit OM-73 modem compatibility mode
Synch	Synchronous scrambler synchronized to the Reed-Solomon.
Off	

- **Tx Power Level (dBm)**

  Permits the user to edit the Power Level from –40 dBm to +10 dBm (in 0.1 dB steps).

- **Carrier**

Select	Comments
On	
RTS	RTS is an interface signaling control. It stands for Request to Send. If enabled RTS can be used to control the output state of the modulator. Only available when using either the EIA-530 or HSSI interface.
VSAT	VSAT mode ties control of the Transmit Signal to the status of the Receiver. If the receiver is Locked the Transmitter is Enabled. If the receivers is Unlocked the Transmitter will be disabled.
Off	

IMPORTANT

1. ***When changing Modulation type the data rate must be set to a rate supported by the modulation type or the change to the modulation type will not be allowed. Some choices will only be visible if the modem is set to a compatible mode or if an option is installed or enabled***
2. ***When entering the data rate, the following interactions need to be taken into account. If the modulation type selected is 8-PSK or 16-QAM the minimum data rate allowed is 256 kbps. When changing certain parameters like modem type, the data rate will default to 64 kbps or 256 kbps. The calculated symbol rate is displayed for the user. This is helpful for determining the occupied bandwidth required for the selected modulation type, code rate and overhead.***
3. ***When entering an IF frequency, the M&C will check the occupied bandwidth calculated from the data rate, modulation type, code rate and overhead and will not allow an IF frequency to be entered if the occupied bandwidth falls outside of the minimum or maximum IF frequencies.***

Click **[Transmit Submit]**.

Receive

- **FEC Type**

FEC Type	Comments
Viterbi (standard)	K=7 convolutional encoder.
None (standard)	Uncoded.
Turbo (optional)	Turbo means Turbo Product Code, which is a block code.
Trellis (not shown)	Trellis operation is not a displayed choice. Trellis supported in IESS-310 mode and MIL-STD-188-165A mode, which for the encoder is just a specific mapping of the constellation.

- **Demodulation Type**

Interface Type	Comments
BPSK	Bi Phase Shift Keying
QPSK	Quadrature Phase Shift Keying.
OQPSK (standard)	Offset Quadrature Phase Shift Keying.
8PSK	8 Phase Shift Keying
16QAM (optional)	16 Quadrature Amplitude Modulation.

- **FEC Code Rate**

FEC Type	Comments
Viterbi	1/2, 2/3, 3/4, 5/6, or 7/8
Uncoded	1/1
Turbo	5/16, 21/44, 3/4, 7/8, or 17/18

- **Data Rate (kbps)**

Enter Receive Data Rate (in kbps).

- **Frequency (MHz)**

Enter Frequency: 52-88, 104-176 MHz (in 100 Hz steps) or 950-2000 MHz (in 100 Hz steps)

- **Spectrum**

Select	Comments
Normal	Used to counteract frequency converters that invert the spectrum
Invert	

- **Descrambler**

Scrambling is for energy dispersal.

Select	Comments
V.35	ITU standard
M-V.35	Comtech EF Data Closed Network with Reed Solomon compatible (modified V.35)
IBS	Used for IESS-309 and AUPC operation
Turbo	Synchronous scrambler synchronized to the Turbo block
OM73	Linkabit OM-73 modem compatibility mode
Synch	Synchronous scrambler synchronized to the Reed-Solomon.
Off	

IMPORTANT

1. ***When changing Demodulation type the data rate must be set to a rate supported by the demodulation type or the change to the demodulation type will not be allowed. Some choices will only be visible if the modem is set to a compatible mode or if an option is installed or enabled.***
2. ***When entering the data rate, the following interactions need to be taken into account. If the modulation type selected is 8-PSK or 16-QAM the minimum data rate allowed is 256 kbps. When changing certain parameters like modem type, the data rate will default to 64 kbps or 256 kbps. The calculated symbol rate is displayed for the user. This is helpful for determining the occupied bandwidth required for the selected modulation type, code rate and overhead.***
3. ***When entering an IF frequency, the M&C will check the occupied bandwidth calculated from the data rate, modulation type, code rate and overhead and will not allow an IF frequency to be entered if the occupied bandwidth falls outside of the minimum or maximum IF frequencies.***

Click **[Receive Submit]**.

8.7.4.3.2 Modem | Monitor (Modem Status)

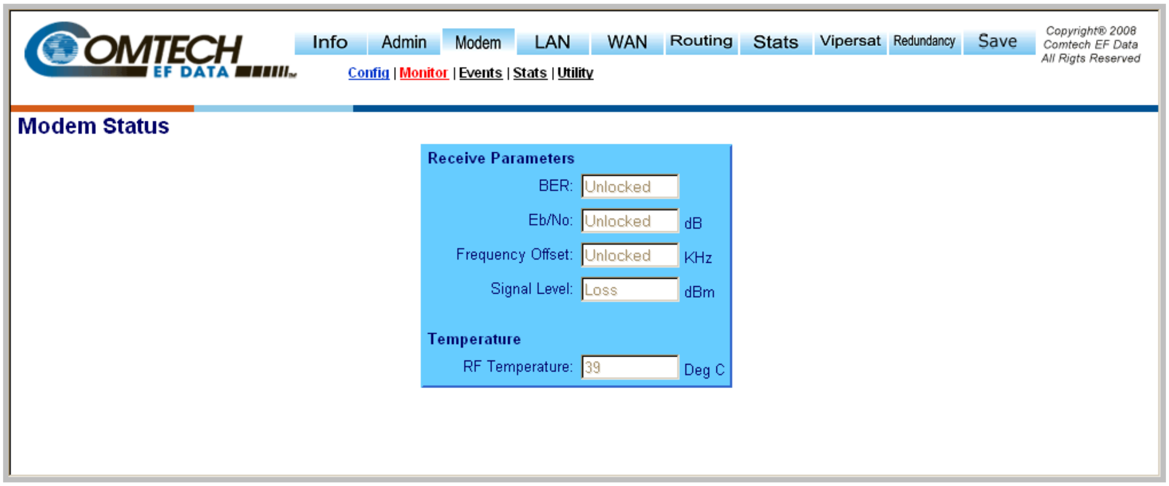


Figure 8-16. Modem | Modem Status page

Receive Parameters

Displays the current link values the modem is reporting for the following categories:

- **BER** – Permits the user to view the estimated BER based on the demodulator's measurement of the carrier to noise.
- **Eb/No** – Permits the user to view the estimated Eb/No of the received carrier. The range is threshold to 20 dB Eb/No.
- **Frequency Offset** – Permits the user to view the received carrier frequency offset in Hz. The range is the same as the acquisition range of the modem, 60 kHz.
- **Receive Signal Level** – Permits the user to view the signal level of the received carrier in dBm. The range supported is +15 to –60 dBm.

Temperature

Reports the temperature of the modem.

8.7.4.3.3 Modem | Events (Modem Events Log)

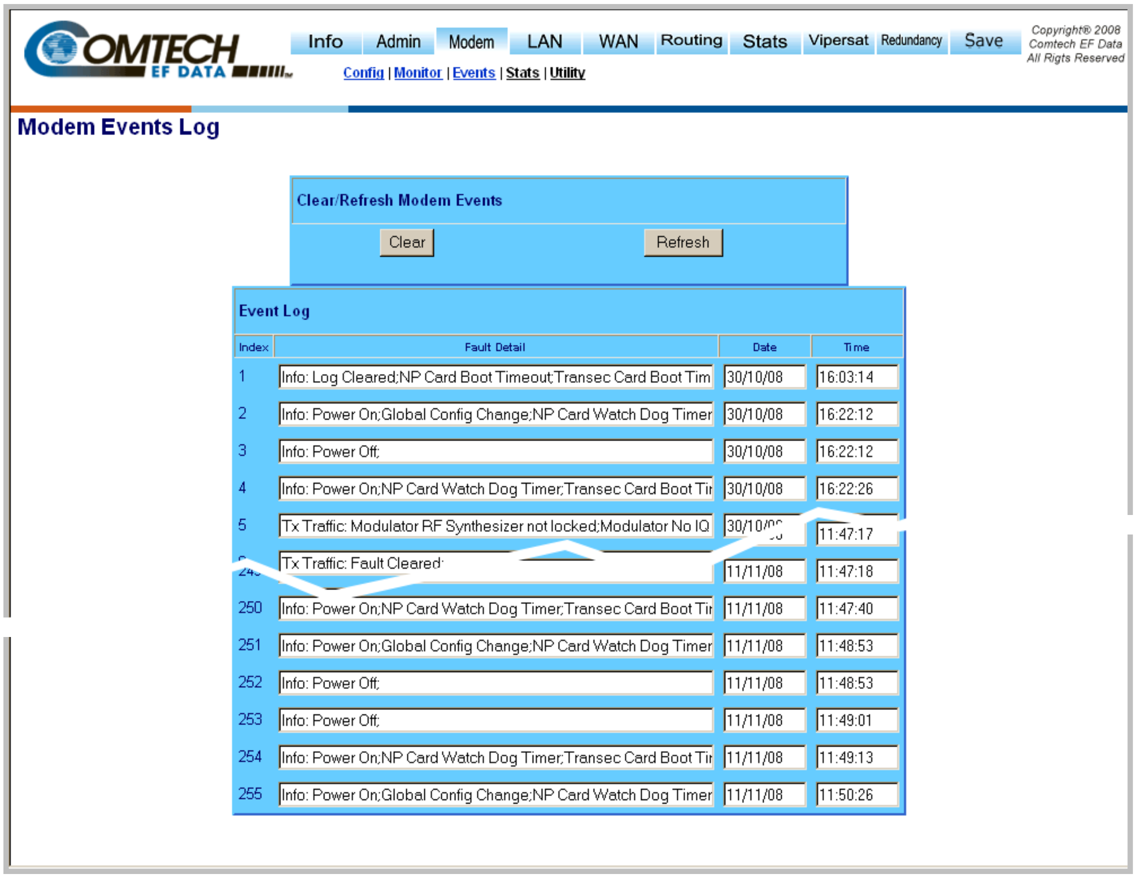


Figure 8-17. Modem | Modem Events Log page

When a fault condition occurs, it is time-stamped and put into the log. Similarly, when the fault condition clears, this is also recorded. All information on this page is *read only*.

Click **[Clear]** to delete all log entries.

Click **[Refresh]** to refresh the view of log entries, allowing the most recent log entries to display.

8.7.4.3.4 Modem | Stats (Modem Statistics Log)

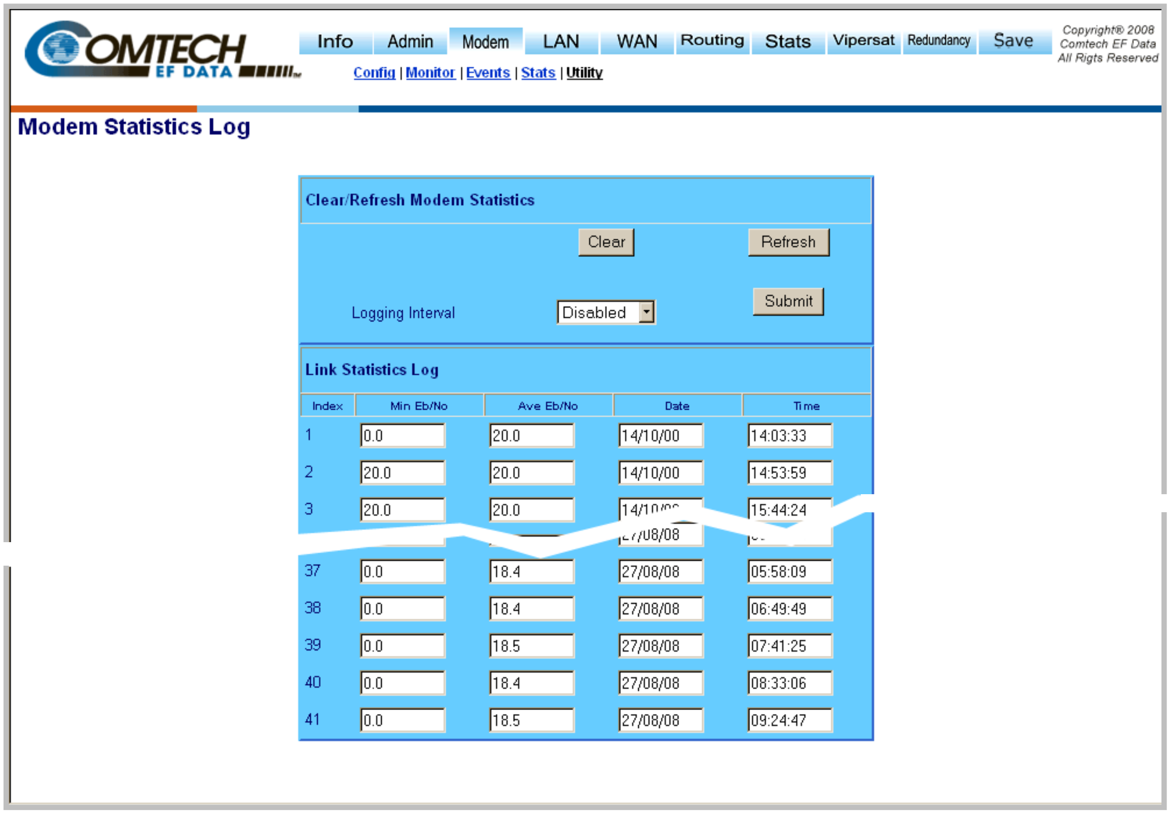


Figure 8-18. Modem | Modem Statistics Log page

Clear/Refresh Modem Statistics

Link Statistics Log

Allows the user to view the following modem statistics (all information is *read only*):

- **Minimum measured E_b/N_0 during the configured time interval.**
- **Average measured E_b/N_0 during the configured time interval.**
- **Date of the log entry.**
- **Time of the log entry.**

Click **[Clear]** to delete all log entries.

Click **[Refresh]** to refresh the view of log entries, allowing the most recent log entries to display.

Logging Interval

Permits the user to set the interval that the statistics are stored. This ranges from 10 minutes to 90 minutes in 10 minute steps. The function can also be disabled.

Click **[Submit].**

8.7.4.3.5 Modem | Utility (Modem Utilities)

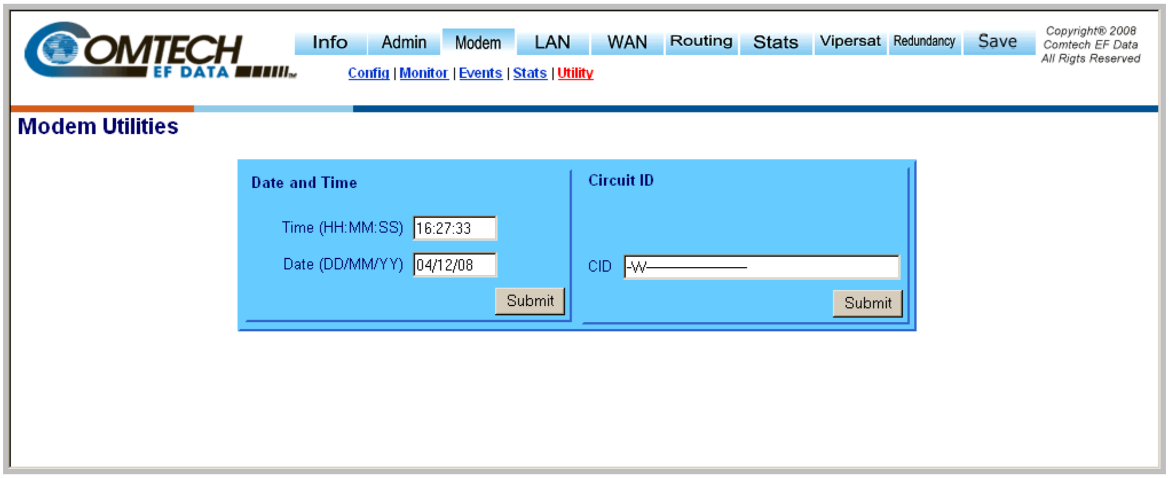


Figure 8-19. Modem | Modem Utilities page

Date and Time

Allows the user to set the Date and Time of the modem:

- **Time (HH: MM: SS) –** Hours in 24 hour time format
- **Date (DD/MM/YY) –** In accordance with international convention, the date is set in DAY/MONTH/YEAR format**.**

Click **[Submit].**

Circuit ID

- **CID –** Permits the user to name the communication link. This name can be a combination of alpha and numeric characters up to 24 characters in length. Additional characters supported are: (,), *, +, /, period, comma and space.

Click **[Submit]**.

8.7.4.4 LAN Pages

8.7.4.4.1 LAN | Interface

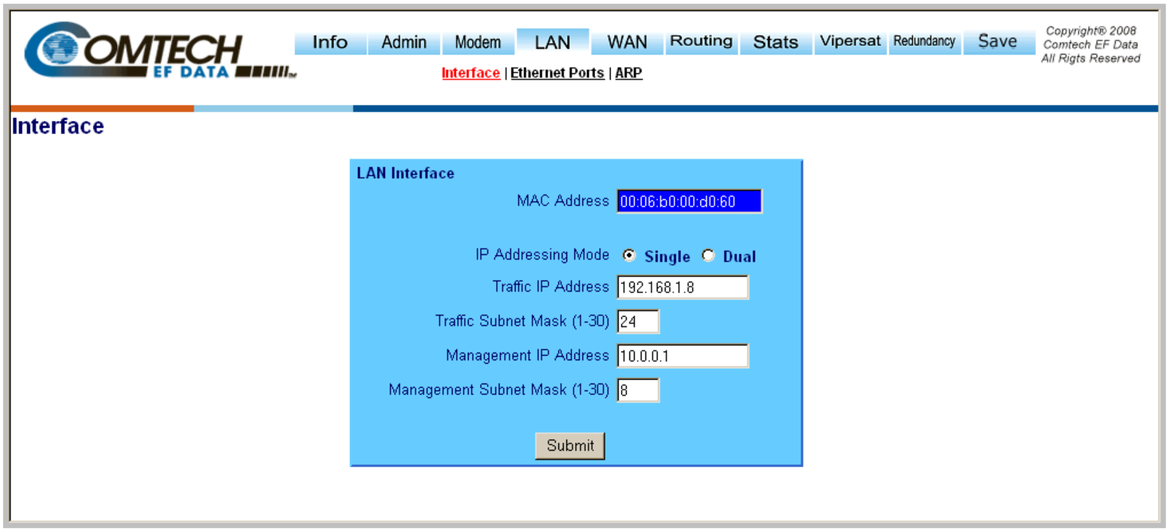


Figure 8-20. LAN | Interface page

The **LAN | Interface** page (**Figure 8-20**) allows the user to view the MAC address of the Network Processor and set the IP address and mask of the Network Processor:

MAC Address (read only)

The MAC is set at the factory to a guaranteed unique address that cannot be modified by the user.

IP Addressing Mode

- **Single:** In this mode Traffic IP address should used as M&C and as well as Nexthop IP address for adjacent routers.
- **Dual:** In this mode Management IP address is used as M&C access to NP module and Traffic IP address is used as Nexthop IP address for adjacent Routers.

Traffic IP Address

This is the IP address of the NP Module only. Once set to a valid value, it is the address that should be used for management and control connectivity as well as the next hop address for other routers in the user's network based on IP addressing mode.

Traffic Subnet Mask

The subnet mask is used in conjunction with the Traffic IP address to determine the subnet locally attached to by the LAN interfaces.

Management IP Address

This is the IP address of the NP Module only. Once set to a valid value, it is the address that should be used for management and control connectivity when IP Addressing Mode was set to **Dual.**

Management Subnet mask

The subnet mask is used in conjunction with the Management IP address to determine the subnet locally attached to by the LAN interfaces.

Click **[Submit]**.

8.7.4.4.2 LAN | Ethernet Ports

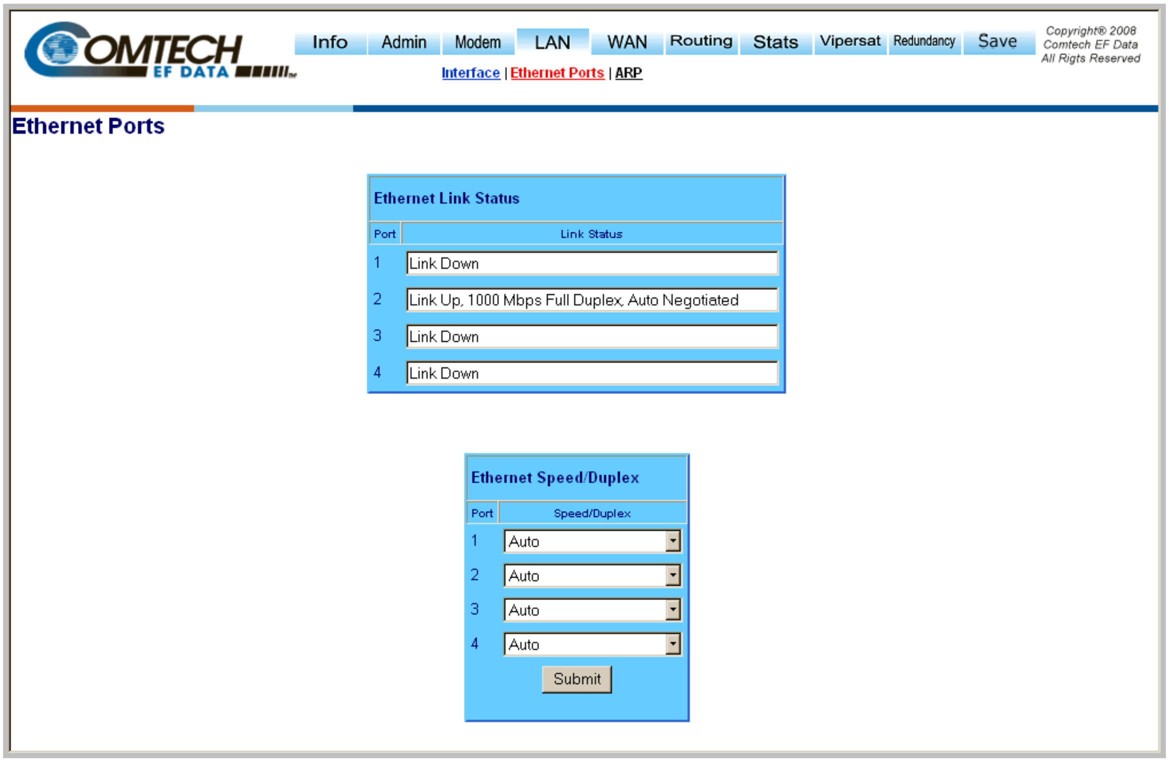


Figure 8-21. LAN Ethernet Ports page

The **LAN | Ethernet Ports** page (**Figure 8-21**) allows the user to view the current status of the Ethernet ports and set each port to auto-negotiate or for manual configuration.

Note: Only the Network Processor Ethernet ports are represented in this screen. The base modem Ethernet port statistics and port information will be set from the modem's front panel.

Ethernet Link Status

The status is displayed for each Network Processor Ethernet port (all information is *read only*).

Ethernet Speed/Duplex

The user has the option of configuring each port to one of the following states:

- Auto
- 1000 Full
- 100 Full
- 10 Full
- 100 Half
- 10 Half

Click **[Submit]**.

8.7.4.4.3 LAN | ARP (ARP Table)

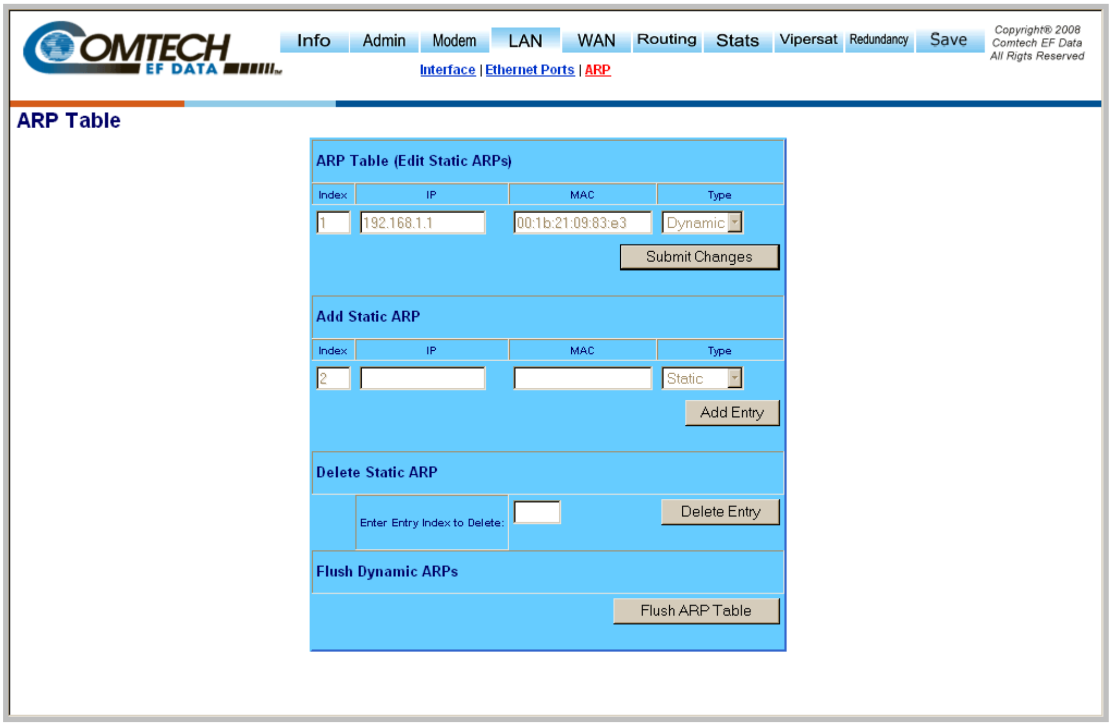


Figure 8-22. LAN ARP page

ARP Table (Edit Static ARPs)

This item displays all current ARP entries (both Static and Dynamic). The user is able to directly edit any of the current static ARP entries.

- **Index** – This is the internal table index (cannot be edited)
- **IP** – Entry IP Address, format XXX.XXX.XXX.XXX
- **MAC** – Entry MAC Address, format YY:YY:YY:YY:YY:YY
- **Type** – Entry Type: Static or Dynamic (cannot be edited)

Click **[Submit Changes]**.

Add Static ARP

This item allows the user to directly add a static ARP entry. Note that the index will automatically increment to the next available number.

Click **[Add Entry].**

Delete Static ARP

Enter Entry Index to Delete

Click **[Delete Entry].**

Flush Dynamic ARPs

Click **[Flush ARP Table].**

8.7.4.5 WAN Pages

Note: This section depicts the NP Module Web Server Interface with **Quality of Service (QoS)** and **Vipersat** installed on the SLM-5650A. QoS and Vipersat are FAST Feature options which must be purchased from Comtech EF Data. Refer to **Sect. 8.7.4.2.2 Admin | FAST Features** for more information.

If the SLM-5650A does not have the* QoS *option installed, the* QoS *hyperlinks outlined in this section will not be visible/available to the user. When* QoS *is* disabled*, a separate* QoS *status page is shown.

8.7.4.5.1

WAN | QoS (Quality of Service)

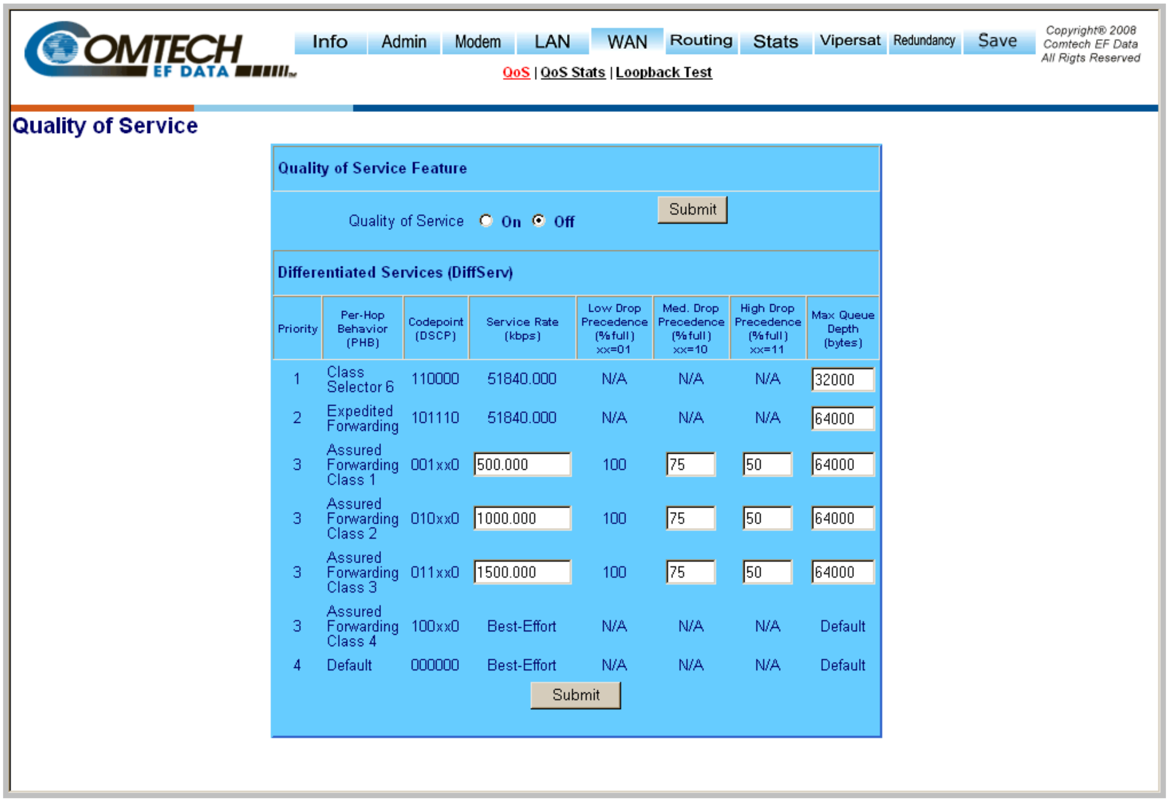


Figure 8-23. WAN | Quality of Service page

Quality of Service

Select **On** or **Off**, then click **[Submit]** to enable/disable the Quality of Service feature.

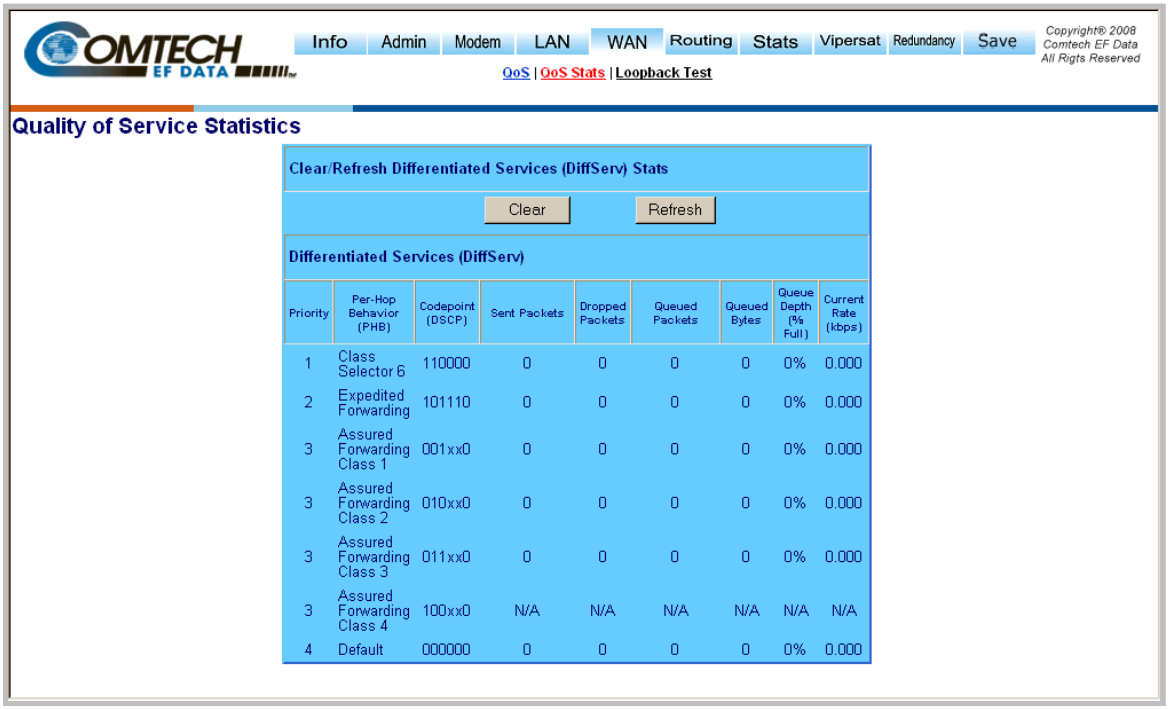
Differential Services (DiffServ)

The user has the option of configuring each queue to one of the following attributes. The minimum / maximum value range is shown in brackets:

- **Committed Information Rate (kbps)** [0.000 / (Tx Data Rate)]
- **Med. Drop Precedence (% full)** [20 / 90]
- **Med. Drop Precedence (% full)** [10 / 80]
- **Max Queue Depth (bytes)** [1500 / 64000]

Click **[Submit]** after all values have been adjusted to save settings.

8.7.4.5.2 WAN | QoS Stats (Quality of Service Statistics)



Priority	Per-Hop Behavior (PHB)	Codepoint (DSCP)	Sent Packets	Dropped Packets	Queued Packets	Queued Bytes	Queue Depth (% Full)	Current Rate (kbps)
1	Class Selector 6	110000	0	0	0	0	0%	0.000
2	Expedited Forwarding	101110	0	0	0	0	0%	0.000
3	Assured Forwarding Class 1	001xx0	0	0	0	0	0%	0.000
3	Assured Forwarding Class 2	010xx0	0	0	0	0	0%	0.000
3	Assured Forwarding Class 3	011xx0	0	0	0	0	0%	0.000
3	Assured Forwarding Class 4	100xx0	N/A	N/A	N/A	N/A	N/A	N/A
4	Default	000000	0	0	0	0	0%	0.000

Figure 8-24. WAN | Quality of Service Statistics page

Clear / Refresh Differentiated Services (DiffServ) Stats

Click **[Clear]** to clear queue statistics.

Click **[Refresh]** to update queue statistics.

Differential Services (DiffServ)

This status section displays the following attributes (all information is *read only*):

- **Per-Hop Behavior (PHB) –** Traffic class that determines how packets will be forwarded.
- **Codepoint (DSCP) –** Codepoint value in Type of Service (ToS) byte in IP header.
- **Sent Packets –** Number of packets sent from queue associated with PHB class.
- **Dropped Packets –** Number of packets dropped in queue associated with PHB class.
- **Queued Packets** – Number of packets in queue associated with PHB class.
- **Queued Bytes** – Number of bytes in queue associated with PHB class.
- **Queue Depth (% Full)** – Percentage (%) full for queue associated with PHB class.
- **Bandwidth (kbps)** – Current data rate for queue associated with PHB class.

8.7.4.5.3 WAN | Loopback Test

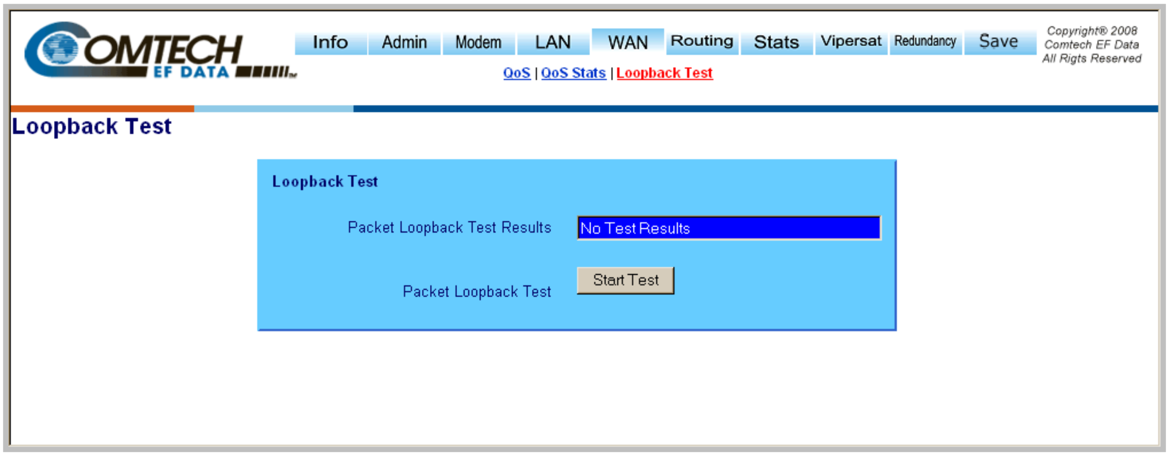


Figure 8-25. WAN | Loopback Test page

The **WAN | Loopback Test** page (**Figure 8-25**) is very useful for testing NP Module M&C, WAN Interface, and IF Iinterface integrity.

Packet Loopback Test Results

This message window displays the results of the completed Loopback Test.

Packet Loopback Test

By clicking **[Start Test]**, the NP module sends 100 multicast packets towards the WAN interface, and enables the IF Loopback. All packets returned from the IP Loopback will count by the NP Module, and are displayed in the Packet Loopback Test Results window.

8.7.4.6 Routing Page

8.7.4.6.1 Routing | Routes

Figure 8-26. Routing | Routes page

Using the **Routing | Routes** page (**Figure 8-26**), static routes can be entered into the IP Module to route IP traffic over the satellite or to another device on the local LAN. Route entries can be in any combination of Unicast and Multicast routes.

Route Table (Edit)

- **Index** – 1 to 256 to identify the route entry.
- **Route Description** – String label provided to help users maintain their network.
- **Destination IP/Mask** – Parameters used to define the route to the destination network.
- **Interface** – There are two valid values for routing to a destination network – **toWAN** and **toLAN**:
    - **toWAN** should be selected when the route to the destination network is over the satellite link. The **toWAN** routes do not need a Next Hop IP address.
    - **toLAN** should be used when the route to the destination network is attached to the LAN interface.
- **Next Hop IP** – When the route is of type **toLAN**, the Next Hop IP address is used to define the locally attached router's IP address. which can be used to route to the destination network. This is the case when there is another subnet addressed to the modem on the LAN side.

Click **[Submit Changes]**.

Add New Route

This section is used to add a route entry to the route table.

Click **[Add Entry]** to add the route. The route will be immediately added to the route table for processing.

Delete Route

The user should enter which route table entry to delete when a route is no longer needed.

Click **[Delete Entry]** to delete a route table entry.

8.7.4.7 Stats (Statistics)

8.7.4.7.1 Stats | Ethernet Tx

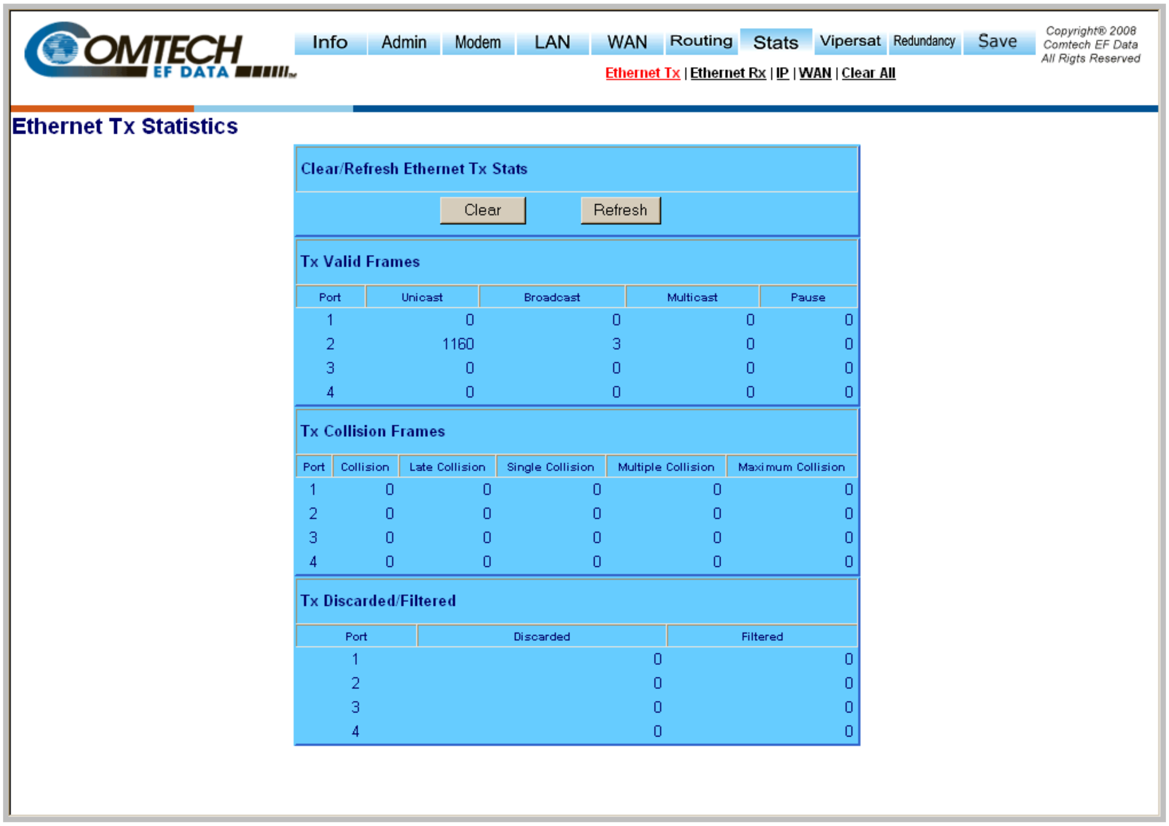


Figure 8-27. Stats | Ethernet Tx Statistics page

Clear/Refresh Ethernet Tx Stats

Click **[Clear]** to delete all statistics.

Click **[Refresh]** to refresh the view, allowing the most recent statistics to display.

Tx Valid Frames

- **Port –** The corresponding Ethernet port on the NP Module.
- **Unicast –** Number of valid unicast frames transmitted.
- **Broadcast –** Number of valid broadcast frames transmitted.
- **Multicast –** Number of valid multicast frames transmitted.
- **Pause –** Number of PAUSE frames transmitted.

Tx Collision Frames

- **Port –** The corresponding Ethernet port on the NP Module.
- **Collision –** Total number of collisions encountered while attempting to transmit.

- **Late Collision –** Number of frames dropped due to excessive collisions on the Ethernet.
- **Single Collision –** Number of transmitted frames that encountered a single collision before transmission.
- **Multiple Collision –** Number of transmitted frames that encountered more than one collision before transmission.
- **Maximum Collision –** Number of frames that are not transmitted because they encountered maximum collisions.

Tx Discarded/Filtered

- **Port –** The corresponding Ethernet port on the NP Module.
- **Discarded –** Number of Tx frames discarded.
- **Filtered –** Number of Tx frames filtered.

8.7.4.7.2 Stats | Ethernet Rx

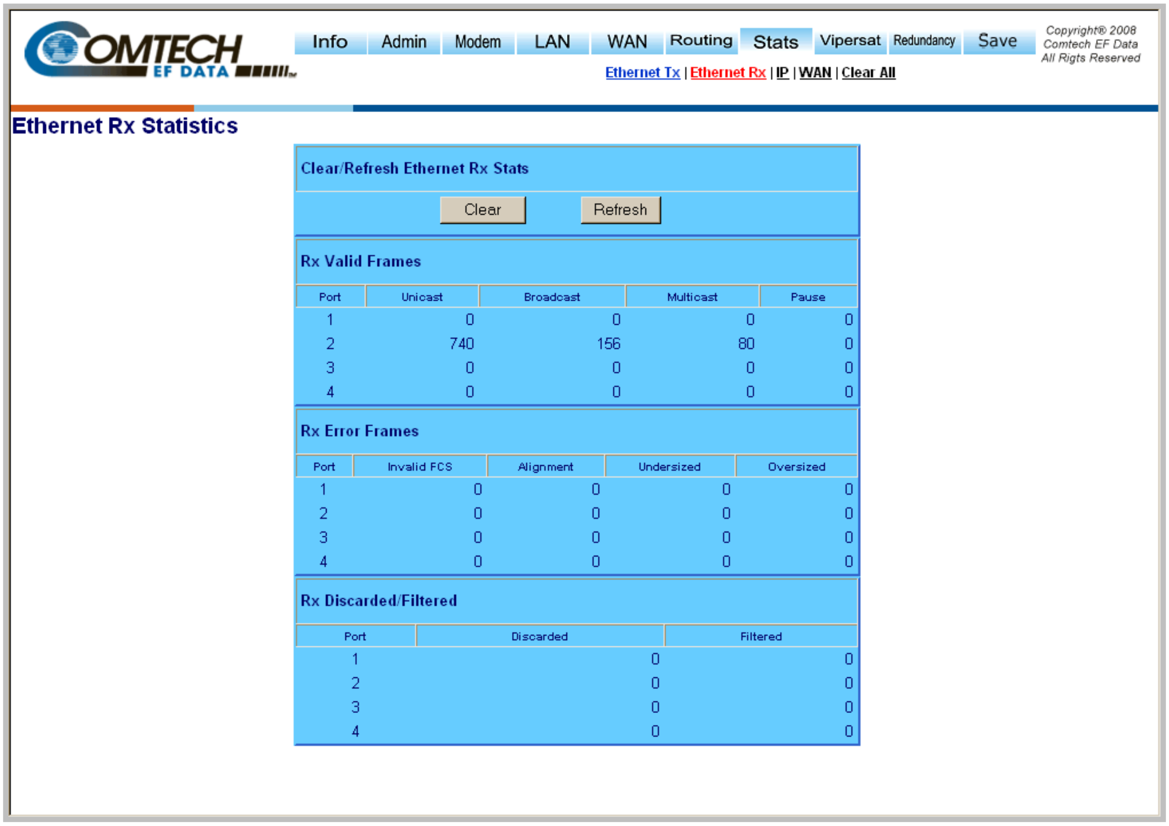


Figure 8-28. Stats | Ethernet Rx Statistics page

Clear/Refresh Ethernet Rx Stats

Click **[Clear]** to delete all statistics.

Click **[Refresh]** to refresh the view, allowing the most recent statistics to display.

Rx Valid Frames

- **Port –** The corresponding Ethernet port on the NP Module.
- **Unicast –** Number of valid unicast frames received.
- **Broadcast –** Number of valid broadcast frames received.
- **Multicast –** Number of valid multicast frames received.
- **Pause –** Number of PAUSE frames received.

Rx Error Frames

- **Port –** The corresponding Ethernet port on the NP Module.
- **Invalid FCS –** Number of frames that have an Invalid Frame Check Sequence.
- **Alignment –** Number of frames that are both misaligned and contain a CRC error.
- **Undersized –** Number of undersized (runt) frames received by the Ethernet device.
- **Oversized –** Number of oversized frames received by the Ethernet device.

Rx Discarded/Filtered

- **Port –** The corresponding Ethernet port on the NP Module.
- **Discarded –** Number of Rx frames discarded.
- **Filtered –** Number of Rx frames filtered.

8.7.4.7.3 Stats | IP

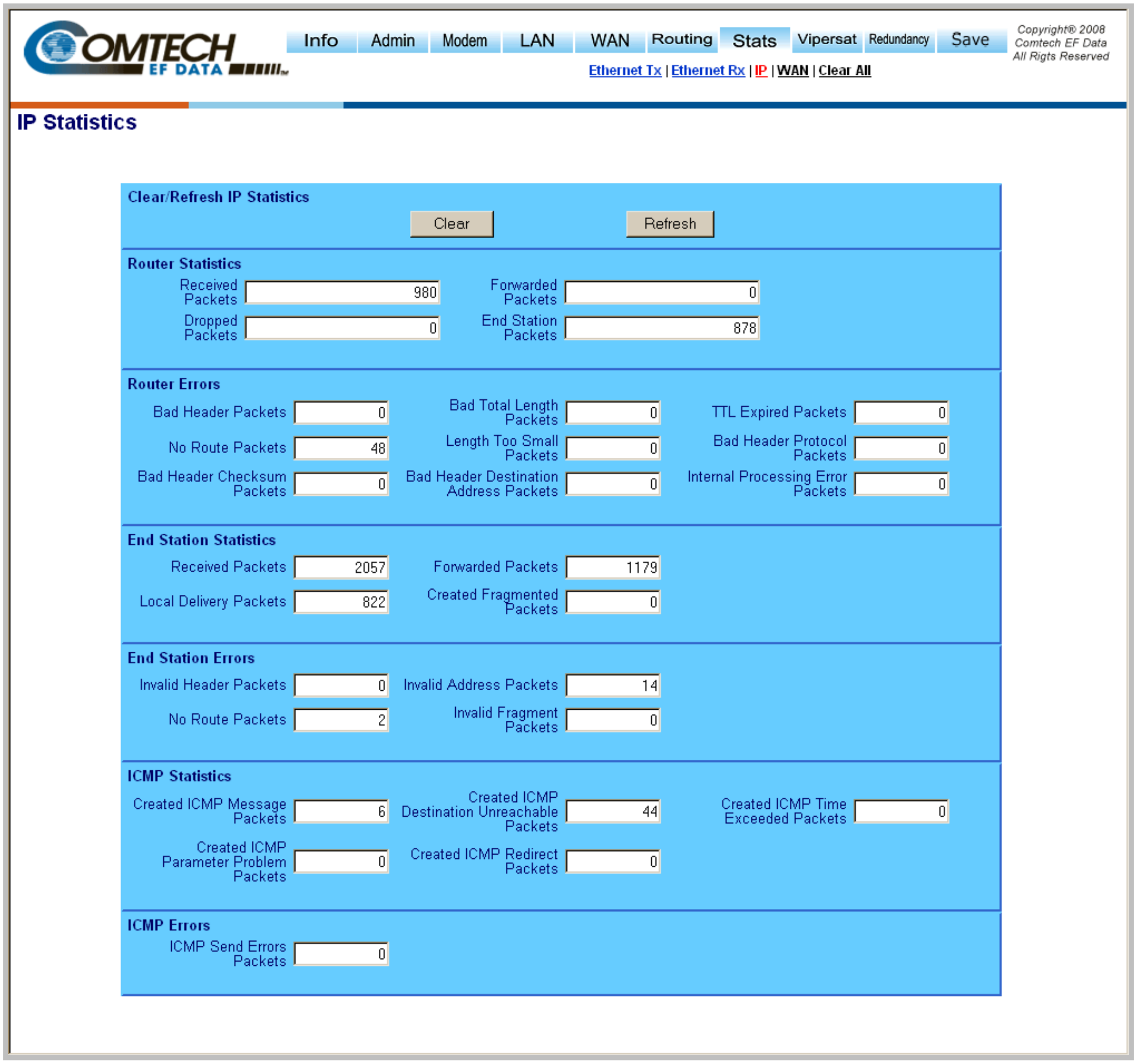


Figure 8-29. Stats | IP Statistics page

Clear/Refresh IP Statistics

Click **[Clear]** to delete all statistics.

Click **[Refresh]** to refresh the view, allowing the most recent statistics to display.

Router Statistics

- **Received Packets –** Total packets received by router.
- **Forwarded Packets –** Total packets forwarded by router.
- **Dropped Packets –** Total packets dropped by router.
- **End Station Packets –** Total packets directed to Network Processor.

Router Errors

- **Bad Header Packets –** Total packets dropped due to incorrect length or IP Header Checksum.
- **Bad Total Length Packets –** IP length (as specified in packet header) was greater than payload received in the Ethernet packet. This would indicate the packet was truncated before arriving.
- **TTL Expired Packets –** Total Dropped Packets due to Time–To-Live counter expired (TTL limits the number of router hops before a packet reaches its destination).
- **No Route Packets –** Total Dropped Packets due to no Route for the destination network in the Route Table. These are packets that are directed to the Network Processor's MAC address and the NP Module will reply to the sender with an ICMP 'Destination not unreachable' message.
- **Length Too Small Packets –** IP length (as specified in packet header) was less than payload received in the Ethernet packet.

End Station Statistics

- **Received Packets –** Total packets destined to the NP Module.
- **Forwarded Packets –** Total packets sent by the NP Module.
- **Local Delivery Packets –** Number of packets delivered to management applications running on the NP Module.
- **Created Fragmented Packets –** Number of IP fragments created by the NP Module because the packet being sent exceeds the maximum transmit unit (MTU).

End Station Errors

- **Invalid Header Packets –** Total End Station packets dropped due to incorrect length or IP Header. Checksum.
- **Invalid Address Packets –** Number of IP packets dropped by the NP Module because of an invalid destination address.
- **No Route Packets –** Number of IP packets dropped by the NP Module because no "route destination" matched in the route table.
- **Invalid Fragment Packets –** Number of IP fragments dropped by the NP Module because IP fragments could not be reassembled.

ICMP Statistics

- **Created ICMP Message Packets –** Total ICMP message packets.
- **Created ICMP Destination Unreachable Packets –** Total ICMP Destination Unreachable message packets.
- **Created ICMP Time Exceeded Packets –** Total ICMP Time Exceeded message packets.
- **Created ICMP Parameter Problem Packets –** Total ICMP Parameter Problem message packets.
- **Created ICMP Redirect Packets –** Total ICMP Redirect message packets.

ICMP Errors

- **ICMP Send Errors Packets –** Number of ICMP packets dropped by the NP Module because of an unknown ICMP error.

8.7.4.7.4 Stats | WAN

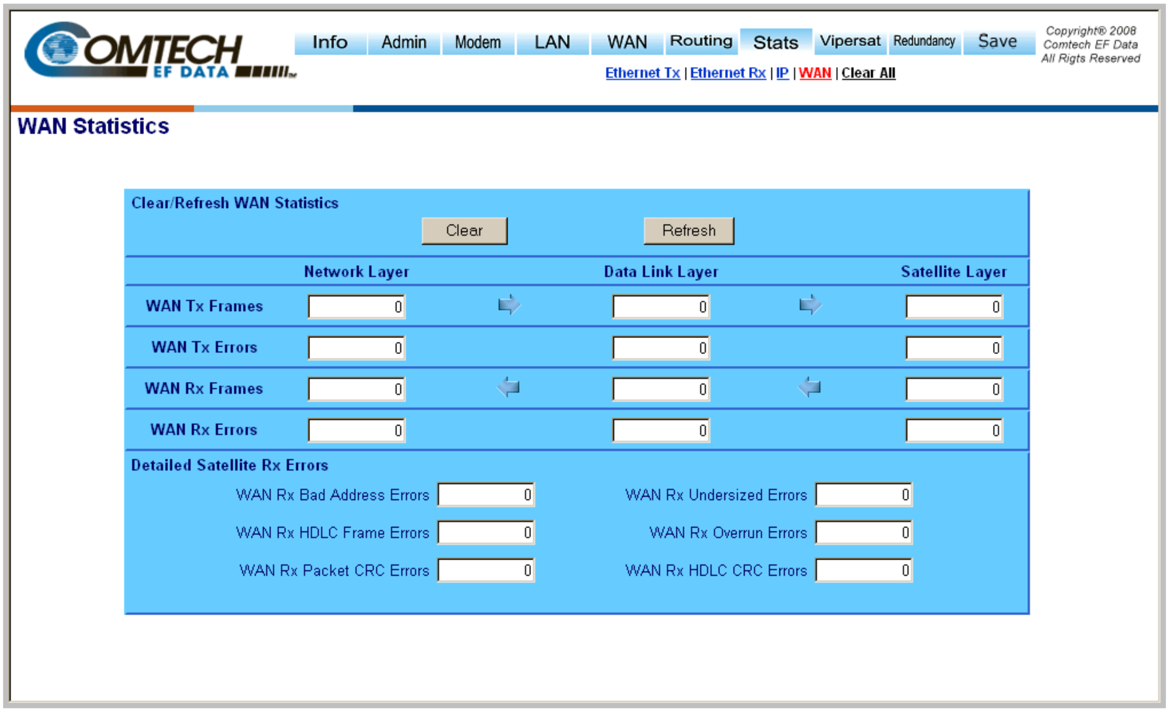


Figure 8-30. Stats | WAN Statistics page

Clear/Refresh WAN Statistics

Click **[Clear]** to delete all statistics.

Click **[Refresh]** to refresh the view, allowing the most recent statistics to display.

WAN Tx Frames

- **Network Layer –** Total packets sent to data link layer.
- **Data Link Layer: –** Total frames sentto satellite layer.
- **Satellite Layer –** Total frames sent over satellite.

WAN Tx Errors

- **Network Layer –** Total network layer Tx errors.
- **Data Link Layer –** Total data link layer Tx errors.
- **Satellite Layer –** Total satellite layer Tx errors.

WAN Rx Frames

- **Network Layer –** Total packets received from data link layer.
- **Data Link Layer –** Total frames received from satellite layer.
- **Satellite Layer –** Total frames received over the satellite.

WAN Rx Errors

- **Network Layer –** Total network layer Rx errors.
- **Data Link Layer –** Total data link layer Rx errors.
- **Satellite Layer –** Total satellite layer Rx errors.

Detailed Satellite Rx Errors

- **WAN Rx Bad Address Errors –** The count of received frames that did not match the proprietary HDLC address.
- **WAN Rx Undersized Errors –** The count of received undersized frames.
- **WAN Rx HDLC Frame Errors –** Total number of received frame with HDLC header errors.
- **WAN Rx Overrun Errors –** Count of received frames that exceeded max frame length of 2K bytes in length or overflowed the HDLC buffer.
- **WAN Rx Packet CRC Errors –** Number of received frames that failed frame’s CRC check.
- **WAN Rx HDLC CRC Errors –** Number of received frames that failed HDLC header’s CRC check.

8.7.4.7.5 Stats | Clear All

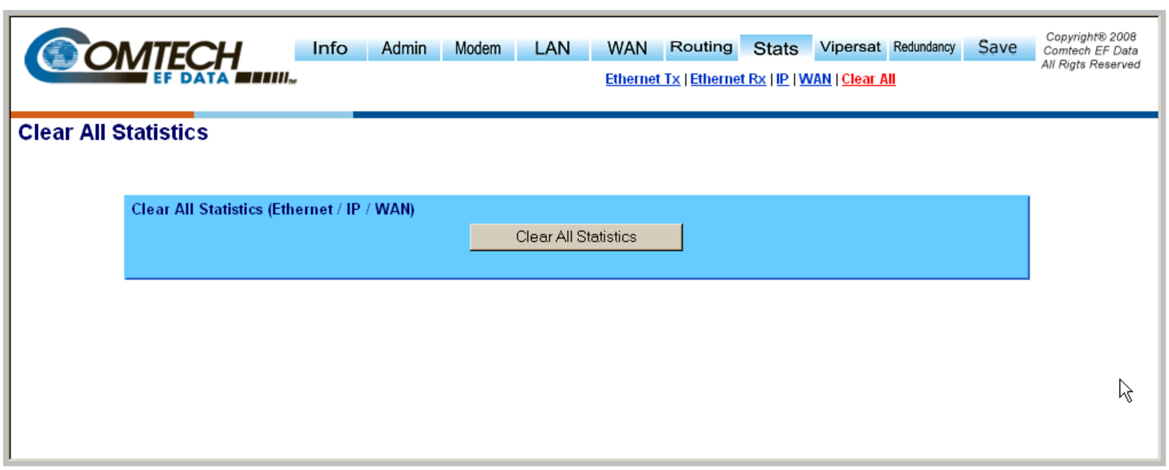


Figure 8-31. Stats | Clear All Statistics page

By clicking **[Clear All Statistics]**, the user may simultaneously clear the statistics for the Ethernet Tx, Ethernet Rx, IP, and WAN Stats pages.

8.7.4.8 Vipersat

Note: This section depicts the NP Module Web Server Interface with Vipersat installed on the SLM-5650A. Vipersat is a FAST Feature option which must be purchased from Comtech EF Data. Refer to **Sect. 8.7.4.2.2 Admin | FAST Features** for more information.

For details on configuration and use of these optional pages (**Figure 8-32**), please consult adjunct Comtech EF Data publication **MN-0000035 – *Vipersat SLM-5650A Satellite Network Modem Router User Guide***.

If the SLM-5650A does not have this option installed, the hyperlinks associated with the Vipersat navigation tab will not be visible/available to the user.

Figure 8-32. Vipersat pages

8.7.4.9 Redundancy page

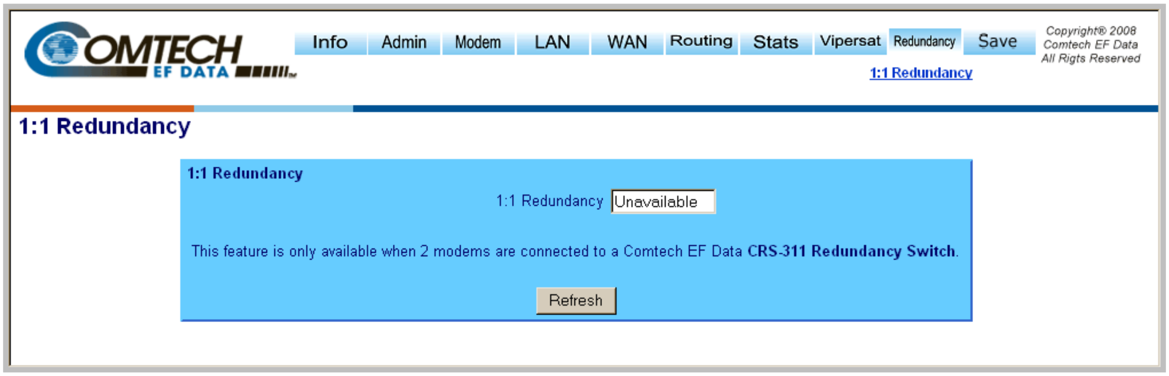


Figure 8-33. Redundancy page

The SLM-5650A Satellite Modem, when connected to a Comtech EF Data CRS-311 1:1 Redundancy Switch, provides fully-automatic protection of IP packet traffic in the case of equipment failure.

The **Redundancy** page provides the user with *read-only* status information on the configured redundant configuration. If the user selects the Redundancy tab without a 1:1 Redundant Configuration, per **Figure 8-33** the **1:1 Redundancy status** is displayed as **Unavailable**.

Refer to **Appendix F. 1:1 REDUNDANCY** for detailed information on the use of the SLM-5650A Satellite Modem in redundant operations.

8.7.4.10 Save page

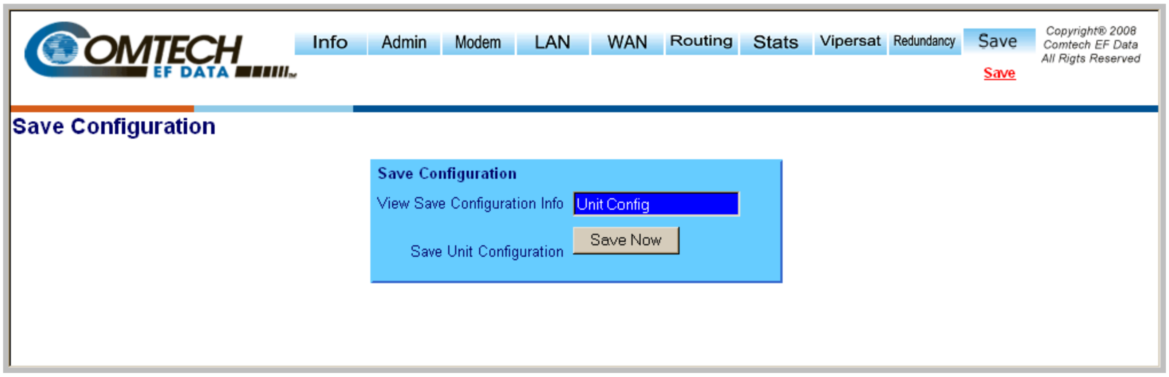


Figure 8-34. Save page

The **Save** page (**Figure 8-34**) saves the current Unit configurations to Flash, thereby making all configuration changes made via NP Module Web Server Interface permanent until the user either initiates and saves a new round of settings updates, or restores all settings to the original factory defaults via the **Admin | Defaults** page (see **Sect. 8.7.4.2.6** for full details).

Click **[Save Now]** to begin the save process. At the user prompt (shown at right), click **OK** to complete the process, or **Cancel** to abort the command.

IMPORTANT

In order to make any Network Processor modifications permanent, the Unit Configuration* must *be saved before rebooting the unit.

Chapter 9. NP MODULE TELNET OPERATION

9.1 Overview

This chapter defines the user menu system connected to the SLM-5650A Satellite Modem NP (Network Processor) Module via Telnet. The Telnet interface closely follows the form and function of the NP Module Web Service Interface (see **Chapter Sect. 8.7 NP Module Web Server (HTTP) Interface**), which itself is an enhanced version of the SLM-5650A Base Modem Web Server Interface (see **Chapter 7. SLM-5650A WEB SERVER INTERFACE**). Refer to either of those chapters for full descriptions and explanations of command functionality.

9.2 Telnet User Access

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

The serial console and Telnet functionality are defined as follows:

User Interface	User Interface Functionality
Serial console	***Factory use only.***
Telnet Menu (Port 23)	Access to Telnet menu.

Hard-coded user names/passwords are as follows:

User Interface	User Interface Functionality
Serial console	***Factory use only.***
Telnet Menu (Port 23)	comtech/comtech

9.2.1 Telnet Operational Guidelines

IMPORTANT

1. ***The NP MODULE allows, at most, seven (7) concurrent logins to the Telnet menu via multiple Telnet sessions. The user name and password is the same as the web server's user name and password:***

```
COMTECH EF DATA Network Processor Telnet Menu

Enter name: comtech
Enter password:
```

2. ***The Telnet menu allows a Telnet logout to end a Telnet session by entering "L". The user will be prompted if the Telnet session should be ended:***

```
This will end your console session.
     Are you sure? (Y/N)
```

3. ***Any changes made to the NP Module will be lost if the NP Module is reset or loses power unless the changes are saved to permanent storage. The parameters can be saved by issuing the Save command "S" from any menu. The user will be prompted to make sure that all changes should be made permanent:***

```
All changes will become permanent.
     Are you sure? (Y/N)
```

9.2.2 Telnet Menu Functionality

The Telnet interface allows the user to change operating parameters similar to those found on the Web Server Interfaces, and also the monitoring, configuration, and control operations available via the front panel menus available on the SLM-5650A Satellite Modem (see **Chapter 5. FRONT PANEL OPERATION**).

For in-depth descriptions of the command functionality outlined in this chapter, please refer to Chapters 5, 7, or 8.

9.2.2.1 Common Navigation Features

With some exceptions, the Telnet menus illustrated in this chapter have the following navigational aids:

Menu Options/Fields	Entry	Description
Save Parameters to Flash	**S**	Allows user to save the current configuration of the NP Module to permanent storage. This configuration will be restored on each successive power cycle.
Logout of Telnet Session	**L**	Allows user to log out of the Telnet session.
Exit Menu	**X**	Allows user to exit the current menu and return to the parent menu. Alternately, the user may press the **Esc** key to perform the same action.

Elsewhere, when the **Entry** column for a tabulated menu feature is designated as *[RO]*, this designates that menu option/field as a *read-only* feature.

9.2.3 Main Menu page

```
                              Main Menu

Administration..............................................................A
Satellite Modem Configuration...............................................M
LAN.........................................................................N
WAN.........................................................................W
Route Table.................................................................R
Redundancy Configuration....................................................E
Operations and Maintenance..................................................O









Save Parameters to Flash....................................................S
Logout of Telnet Session....................................................L
```

The *Main Menu* page has the following options/fields:

Menu Options/Fields	Entry	Description
Administration	**A**	The Administration menu provides a basic set of standard admin functions to the NP Module.
Satellite Modem Configuration	**M**	The Satellite Modem Configuration option displays nested menus that allows the user to configure and monitor the satellite base modem.
LAN	**N**	The LAN menu allows the user to change the IP address and view the ARP (Address Resolution Protocol) table.
WAN	**W**	The WAN menu allows the user to configure QoS (Quality of Service) and DiffServ (Differentiated Services).
Route Table	**R**	The Route Table menu allows the user to configure the Unicast/Multicast routing tables.
Redundancy Configuration	**E**	The Redundancy Configuration Menu allows the user to view the 1:1 IP redundancy status.
Operations and Maintenance	**O**	The Operations & Maintenance menu allows the user to configure various options used to control and maintain the system. This menu also provides diagnostic tools for troubleshooting and statistics.

9.2.4 Administration Menu page (A)

```
                              Administration Menu

Information.................................................................I
System Working Mode...........[ Point To Point Router ].....................W
Fast Feature Code...........................................................F
Security....................................................................A
Serial Port.................................................................P
Restore Factory Defaults....................................................D
Set Time....................................................................T
Event Log...................................................................E
Boot Network Processor From...[ 2 ].........................................N
Boot Base Modem From..........[ 1 ].........................................M
Reboot Now..................................................................R






Save Parameters to Flash....................................................S
Logout of Telnet Session....................................................L
Exit Menu...................................................................X
```

The *Administration Menu* page, activated from the *Main Menu*, contains the following options or fields:

Menu Options/Fields	Entry	Description
Information	**I**	Displays information for NP and Modem Bootrom running status, load images, and current configuration status.
System Working Mode	**W**	Prompts user to select: *Vipersat modes:* **0 – Vipersat Hub**, **1 – Vipersat Hub Expansion**, **2 – Vipersat Remote**, **3 – Vipersat Remote Expansion** *Non-Vipersat modes:* **4 – Multipoint Hub Router**, **5 – Multipoint Remote Router**, **6 – Point to Point Router** *Bridge mode:* **7 – Gigabit Ethernet Bridge**
FAST Feature Code	**F**	Displays currently installed FAST options.
Security	**A**	Allows user to set admin user name and password, and set IP Interface Security Mode.
Serial Port	**P**	Displays current serial port operating parameters.
Restore Factory Defaults	**D**	Allows user to restore factory default configuration settings.
Set Time	**T**	Allows user to configure automatic time synchronization through Network Time Protocol (NTP).
Event Log	**E**	Displays summary of faults and events.
Boot Network Processor From [#]	**N**	Prompts user to enter NP boot image: **1 – Image 1** **2 – Image 2**
Boot Base Modem From [#]	**M**	Prompts user to enter modem boot image: **1 – Image 1** **2 – Image 2**
Reboot Now	**R**	Prompts user to enter **Y** to reboot, **N** to exit command without rebooting.

9.2.4.1 Administration Menu | Information page (I)

This *read-only* page displays the information for NP and Modem bulk images, and current NP running bulk image:

```
                  SLM 5650 Network Processor - System Images

NP Bootrom:        Redboot,FW-0000052E,16:18:41 11/26/08,1.5.1
NP Image 1:        Bulk,FW-0000051E,16:18:41 11/26/08,1.5.1
NP Image 2:        Bulk,FW-0000051E,16:18:41 11/26/08,1.5.1
Running:           Image 2


Modem Bootrom:     Boot:01.01.01
Modem Image 1:     Bulk1:01.01.09
Modem Image 2:     Bulk2:01.01.08






                        Press Any Character to Continue
_
```

Press any character to return to the *Administration Menu* page.

9.2.4.2 Administration Menu | FAST Feature Code page (F)

This *read-only* page displays currently installed FAST options:

```
                                Fast Features

Vipersat Feature..............[ Installed ]
Qos Feature...................[ Installed ]
Management Security...........[ Not Installed ]
TRANSEC Option................[ Not Installed ]
Demodulator Only..............[ Not Installed ]









Save Parameters to Flash..........................................................S
Logout of Telnet Session..........................................................L
Exit Menu.........................................................................X
_
```

9.2.4.3 Administration Menu | Security page (A)

The High Security setting will disable ***the Telnet menu interface. Do not enable High Security if using Telnet, or connectivity will be lost!***

```
                              Security Menu

Admin User Name (at least 5 chars)...[ comtech ]............................A
Admin Password  (at least 7 chars)...[ ******* ]............................P
IP Interface Security Mode...........[ Low Level Security ].................M










Save Parameters to Flash....................................................S
Logout of Telnet Session....................................................L
Exit Menu...................................................................X
_
```

Menu Options/Fields	Entry	Description
Admin User Name	**A**	Allows user to set the Admin User name (minimum of five characters permitted).
Admin Password	**P**	Allows user to set the Admin User’s password (minimum of seven characters permitted).
IP Interface Security Mode	**M**	Prompts user to select the IP Interface Security Level: **0 – Low Level Security** • HTTP and Telnet allowed **1 – High Level Security** • Only HTTPS allowed

9.2.4.4 Administration Menu | Serial Port page (P)

This *read-only* page displays the information for the ***factory use only*** serial port:

```
                              Serial Port Info

Interface.....................[ EIA232 ]
Format (Data-Parity-Stop)....[ 8-N-1  ]
Rate (bps)....................[ 115200 ]









Save Parameters to Flash....................................................S
Logout of Telnet Session....................................................L
Exit Menu...................................................................X
_
```

9.2.4.5 Administration Menu | Restore Factory Defaults page (D)

Select '**D**' from the *Administration Menu* to restore all previously-configured modem parameters to their **Factory Default Configuration** settings. The user is prompted:

`Are you sure you wish to continue? (Y or N)`

Press '**Y'** to begin the restoration process, or '**N**' to abort the command and return to the previous menu.

9.2.4.6 Administration Menu | Set Time page (D)

```
                              Time Control

Time Zone........................[ UTC-7    ]................................Z
Automatic Synchronize............[ Disabled ]................................T
Primary Internet Time Server.....[ 1.1.1.1 ].................................P
Secondary Internet Time Server...[ 2.2.2.2 ].................................Q
Current Date.....................[ Friday, December 12, 2008 ]
Current Time.....................[ 12:07:52 ]
Internet Time Status.............[ NTP is not enabled. ]
Update Date & Time...........................................................D









Save Parameters to Flash.....................................................S
Logout of Telnet Session.....................................................L
Exit Menu....................................................................X
```

Menu Options/Fields	Entry	Description
Time Zone	**Z**	See **Chapter Sect. 8.7.4.2.7 Admin | Time (Date and Time)** for full details on this page's functionality.
Automatic Synchronize	**T**	
Primary Internet Time Server	**P**	
Secondary Internet Time Server	**Q**	
Current Date	*[RO]*	
Current Time	*[RO]*	
Internet Time Status	*[RO]*	
Update Date & Time	**D**	

9.2.4.7 Administration Menu | Event Log page (E)

As the system is polled for summary events and faults, the following message appears:

```
Please wait for the event log to appear
     This may take up to a minute
```

When ready, the *Administration Menu | Event Log* page displays a scrollable list as per the following example:

```
                              System Event Log

    Type            Date        Time        Category        Description
 1) Informational   12/12/200811:56:58   EventLog        Cleared

(A)dd Entry - (M)odify Entry - (D)elete Entry
(P)revious Page - (N)ext Page
Logging On/Off................[ On ]..........................................O
Logging Level.................[ All Information ]............................L
Clear Event Log.................................................................C

Exit Menu.......................................................................X
```

Menu Options/Fields	Entry	Description
Add Entry	**A**	See **Chapter Sect. 8.7.4.2.8 Admin | Event Log** for full details on this page's functionality.
Modify Entry	**M**	
Delete Entry	**D**	
Logging On/Off	**O**	
Logging Level	**L**	
Clear Event Log	**C**	

9.2.4.8 Administration Menu | Reboot Now page (R)

IMPORTANT

Before rebooting, the user must remember to SAVE PARAMETERS TO FLASH (Select 'S' from the* Administration Menu*); otherwise, all changes made prior to reboot will be lost.

Select '**R**' from the *Administration Menu* to reboot the system. The user is prompted:

```
Are you sure you wish to continue? (Y or N)
```

Press '**Y'** to begin the reboot process, or '**N'** to abort the command and return to the previous menu.

Note: Pressing **'Y'** causes the entire modem to reboot; this includes the base modem, NP Module, and TRANSEC Module.

9.2.5 Satellite Modem Configuration page

```
                                  Modem Menu

Modem Type...................[ TURBO ]
Interface....................[ Network Processor ]
Reference....................[ Internal ]
Frequency Band...............[ L-BAND ]...................................B
Modulator Settings........................................................M
Demodulator Settings......................................................D
Receive Monitor...........................................................R
Events....................................................................E
Stats.....................................................................T
Utility...................................................................U







Save Parameters to Flash..................................................S
Logout of Telnet Session..................................................L
Exit Menu.................................................................X
_
```

The *Satellite Modem Configuration (Modem Menu)* page, activated from the *Main Menu*, contains the following options/fields:

Menu Options/Fields	Entry	Description
Modem Type	*[RO]*	Displays modem type
Interface	*[RO]*	Displays installed interface
Reference	*[RO]*	Displays active reference (internal / external)
Frequency Band	**B**	Prompts user to select: **0** – **70/140 MHz** **1 – L-Band**.
Modulator Settings	**M**	Allows user to configure modulator operating parameters
Demodulator Settings	**D**	Allows user to configure demodulator operating parameters
Receive Monitor	**R**	*Read-only* – displays active Rx operating parameters
Events	**E**	Displays the Modem Event Log and allows user to set or adjust display parameters for logging
Stats	**T**	Displays the System Event Log and allows user to set or adjust display parameters for logging
Utility	**U**	Allows user to select/set: **T** - Time (in HH:MM:SS format) **D** - Date (in DD/MM/YY format), or **C** - Circuit ID (exactly 24 characters).

9.2.5.1 Satellite Modem Configuration | Modulator Menu page (M)

```
                               Modulator Menu

FEC Type......................[ Turbo ]....................................T
Modulation....................[ 8-PSK ]....................................M
FEC Code Rate.................[ 7/8 ].......................................C
Data Rate.....................[ 51.84 Mbps ]...............................D
Frequency.....................[ 1.2 GHz ]..................................F
Spectrum......................[ Normal ]...................................I
Scrambler.....................[ TURBO ]....................................R
Power Level...................[ -20 dB ]...................................P
Carrier.......................[ ON ]......................................A









Save Parameters to Flash....................................................S
Logout of Telnet Session....................................................L
Exit Menu...................................................................X
_
```

The *Satellite Modem Configuration | Modulator Menu* page contains the following options/fields:

Menu Options/Fields	Entry	Description
FEC Type	**T**	Prompts the user to select: **0 – None 1 – Viterbi** **2 – Turbo 3 – Sequential**
Modulation	**M**	Prompts the user to select: **0 – BPSK 1 – QPSK** **2 – OQPSK 3 – 8-PSK** **4 – 16-QAM**
FEC Code Rate	**C**	Prompts the user to select: **0 – 1/1 1 – 1/2** **2 – 3/4 3 – 7/8** **4 – 2/3 5 – 5/6** **6 – 21/44 7 – 5/16** **8 – 17/18**
Data Rate	**D**	Allows user to edit Data Rate using ← → arrow keys.
Frequency	**F**	Allows user to edit Frequency using ← → arrow keys.
Spectrum	**I**	Prompts user to select: **0 – Normal** **1 – Inverted**
Scrambler	**R**	Prompts the user to select: **0 – Off 1 – Om73** **2 – V.35 3 – Modified V.35** **4 – SYNC 5 – IBS** **6 – TURBO**
Power Level	**P**	Allows user to edit Power Level using ← → arrow keys.
Carrier	**A**	Prompts the user to select: **0 – OFF** **1 – ON** **2 – RTS**

9.2.5.2 Satellite Modem Configuration | Demodulator Menu page (D)

```
                              Demodulator Menu

FEC Type......................[ Turbo ].....................................T
Demodulation..................[ 8-PSK ].....................................M
FEC Code Rate.................[ 7/8 ]......................................C
Data Rate.....................[ 51.84 Mbps ]................................D
Frequency.....................[ 1.2 GHz ]...................................F
Spectrum......................[ Normal ]....................................I
Descrambler...................[ TURBO ].....................................R









Save Parameters to Flash....................................................S
Logout of Telnet Session....................................................L
Exit Menu...................................................................X
_
```

The *Satellite Modem Configuration | Demodulator Menu* page contains the following options/fields:

Menu Options/Fields	Entry	Description
FEC Type	**T**	Prompts the user to select: **0 – None** **1 – Viterbi** **2 – Turbo** **3 – Sequential**
Demodulation	**M**	Prompts the user to select: **0 – BPSK** **1 – QPSK** **2 – OQPSK** **3 – 8-PSK** **4 – 16-QAM**
FEC Code Rate	**C**	Prompts the user to select: **0 – 1/1** **1 – 1/2** **2 – 3/4** **3 – 7/8** **4 – 2/3** **5 – 5/6** **6 – 21/44** **7 – 5/16** **8 – 17/18**
Data Rate	**D**	Allows user to edit Data Rate using ← → arrow keys.
Frequency	**F**	Allows user to edit Frequency using ← → arrow keys.
Spectrum	**I**	Prompts user to select: **0 – Normal** **1 – Inverted**
Descrambler	**R**	Prompts the user to select: **0 – Off** **1 – Om73** **2 – V.35** **3 – Modified V.35** **4 – SYNC** **5 – IBS** **6 – TURBO**

9.2.5.3

Satellite Modem Configuration | Receive Monitor page (R)

This *read-only* page displays the Rx parameters:

```
                              Receive Parameters

BER............................[ 1.0E-11 ]
Eb/No  (dB)....................[ 20 dB ]
Frequency Offset (Khz).......[ 0 Hz ]
Signal Level (dBm)............[ -40 dB ]
RF Temperature (Deg C).......[ 48 ]










Save Parameters to Flash.....................................................S
Logout of Telnet Session.....................................................L
Exit Menu....................................................................X
```

9.2.5.4 Satellite Modem Configuration | Events page (E)

As the system is polled for summary events and faults, the following message appears:

```
Please wait for the event log to be read
        This may take up to a minute
```

When ready, the *Satellite Modem Configuration | Events* page displays a scrollable list as per the following example:

```
                              Modem Event Log

     Date       Time       Fault Detail
 1> 301008     160314     Info: Log Cleared;NP Card Boot Timeout;Transec Card Boot
 Timeout;
 2> 301008     162212     Info: Power On;Global Config Change;NP Card Watch Dog
 Timer;NP Card Boot Timeout;Transec Card Boot Timeout;
 3> 301008     162212     Info: Power Off;
 4> 301008     162226     Info: Power On;NP Card Watch Dog Timer;Transec Card Boot
 Timeout;





(A)dd Entry - (M)odify Entry - (D)elete Entry
(P)revious Page - (N)ext Page
Clear Event Log..............................................................C
Exit Menu....................................................................X
```

Menu Options/Fields	Entry	Description
Add Entry	**A**	See **Chapter Sect. 8.7.4.3.3 Modem | Events** for full details on this page's functionality.
Modify Entry	**M**	
Delete Entry	**D**	
Clear Event Log	**C**	
Previous Page	**P**	Allows user to navigate, on a per-page basis, between the start and end of the Event Log.
Next Page	**N**	

9.2.5.5 Satellite Modem Configuration | Stats page (T)

As the system is polled for summary events and faults, the following message appears:

`Please wait for the event log to be read`
`This may take up to a minute`

When ready, the *Satellite Modem Configuration | Stats* page displays a scrollable list of as per the following example:

```
                                System Event Log

   Min Eb/N0      Avg Eb/N0       Date      Time
 1)                               141000    140333
 2)                               141000    145359
 3)                               141000    154424
 4)                               141000    163449
 5)                               141000    172515
 6)                               141000    181540
 7)                               141000    190606
 8)                               141000    195631
 9)                               141000    204657
10)                               141000    213722
11)                               141000    222748
12)                               141000    231813
13)                               151000    000839

(A)dd Entry - (M)odify Entry - (D)elete Entry
(P)revious Page - (N)ext Page
Logging Level................[ Disabled ]....................................L
Clear Event Log...............................................................C

Exit Menu.....................................................................X
_
```

Menu Options/Fields	Entry	Description
Add Entry	**A**	See **Chapter Sect. 8.7.4.3.4 Modem | Stats** for full details on this page's functionality.
Modify Entry	**M**	
Delete Entry	**D**	
Logging Level	**L**	
Clear Event Log	**C**	
Previous Page	**P**	Allows user to navigate, on a per-page basis, between the start and end of the Stats Log.
Next Page	**N**	

9.2.5.6 Satellite Modem Configuration | Utility page (U)

```
                              Modem Utility Menu

Time (HH:MM:SS)..................[ 12:10:47 ]...................................T
Date (DD/MM/YY)..................[ 12/12/08 ]...................................D
Circuit ID (exactly 24 chars)...[ SATELLITE-MODEM--------- ]...................C




Save Parameters to Flash.........................................................S
Logout of Telnet Session.........................................................L
Exit Menu........................................................................X
```

Menu Options/Fields	Entry	Description
Time	**T**	Allows user to set the time in HH:MM:SS format.
Date	**D**	Allows user to set the date in International format (DD/MM/YY).
Circuit ID	**C**	Allows the user to define a name for the Circuit ID. **Note:** This ID must consist of exactly 24 characters in UPPER CASE ONLY. No spaces are permitted in this ID; use a dash [-] instead.

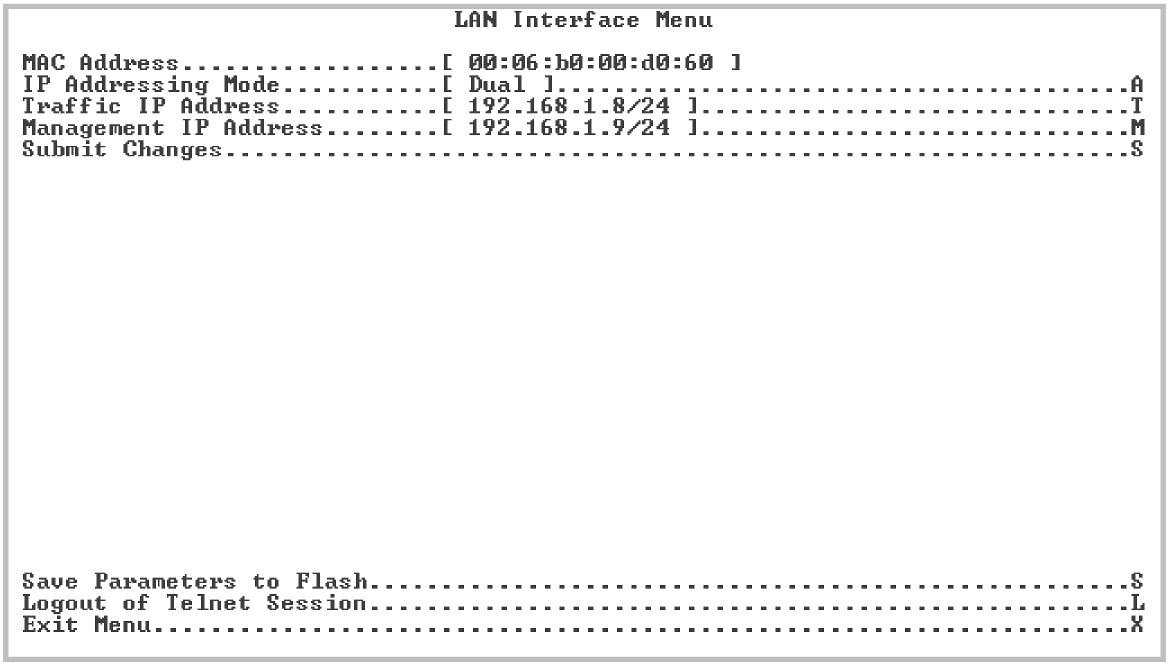
9.2.6 LAN Menu page (N)

```
                              LAN Menu

Interface..............................................................I
Ethernet Ports.........................................................E
ARP Menu...............................................................A









Save Parameters to Flash...............................................S
Logout of Telnet Session...............................................L
Exit Menu..............................................................X
_
```

The *LAN Menu*, activated from the *Main Menu*, contains the following options/fields:

Menu Options/Fields	Entry	Description
Interface	**I**	The LAN Interface menu allows the user to view the MAC address of the Network Processor and set the IP address and mask of the Network Processor:
Ethernet Ports	**E**	The Ethernet Ports menu allows the user to view the current status of the Ethernet ports and set each port to auto-negotiate or for manual configuration.
ARP Menu	**A**	The ARP Menu allows the user to view and edit the ARP (Address Resolution Protocol) table.

9.2.6.1 LAN Menu | Interface page (I)



Menu Options/Fields	Entry	Description
IP Addressing Mode	**A**	Prompts user to select: **0** – **Single** (Traffic IP Address only) **1 – Dual** (Traffic and Management IP Addresses)
Traffic IP Address	**T**	Allows user to edit the Traffic IP Address using the ←→ arrow keys.
Management IP Address	**M**	Allows user to edit the Management IP Address using the ←→ arrow keys.
Submit Changes	**?**	Changes the IP Addresses.

9.2.6.2 LAN Menu | Ethernet Ports Menu page (E)

```
                              Ethernet Ports Menu

Port 1 Link Status...........[ Link Down ]
Port 2 Link Status...........[ Link Up, 1000 Mbps Full Duplex, Auto Negotiated ]
Port 3 Link Status...........[ Link Down ]
Port 4 Link Status...........[ Link Down ]
Manual Port Configuration.....................................................M

Save Parameters to Flash......................................................S
Logout of Telnet Session......................................................L
Exit Menu.....................................................................X
```

Read-only Ethernet link status is provided for NP Module Ports 1 through 4. To manually change the Ethernet Speed/Duplex Configurations for each port, press '**M**'.

9.2.6.2.1 LAN Menu | Ethernet Ports Menu | Manual Port Configuration (M)

```
                      Ethernet Speed/Duplex Configuration

    Speed/Duplex Config
 1) Auto
 2) Auto
 3) Auto
 4) Auto

(A)dd Entry - (M)odify Entry - (D)elete Entry
(P)revious Page - (N)ext Page

Save Parameters to Flash......................................................S
Logout of Telnet Session......................................................L
Exit Menu.....................................................................X
```

Refer to **Chapter Sect. 8.7.4.4.2 LAN | Ethernet Ports** for an overview of page functionality. On per-port basis, NP Module Ports 1 through 4 can be configured to:

0 – Auto
1 – 10 Mbps Half Duplex
2 – 10 Mbps Full Duplex
3 – 100 Mbps Half Duplex
4 – 100 Mbps Full Duplex
5 – 1000 Mbps Full Duplex

9.2.6.3 LAN Menu | ARP Menu (A)

```
                                   ARP Table

    IP                        Mac                      Type
 1) 192.168.1.11              00:01:02:03:04:05        static
 2) 192.168.1.1               00:1b:21:09:83:e3        dynamic


(A)dd Entry - (M)odify Entry - (D)elete Entry
(P)revious Page - (N)ext Page

Save Parameters to Flash.....................................................S
Logout of Telnet Session.....................................................L
Exit Menu....................................................................X
```

Menu Options/Fields	Entry	Description
Add entry	**A**	Refer to **Chapter Sect. 8.7.4.4.3 LAN | ARP (ARP Table)** for an overview of command functionality.
Modify Entry	**M**	
Delete Entry	**D**	
Previous Page	**P**	Allows user to navigate, on a per-page basis, between the start and end of the ARP Table.
Next Page	**N**	

9.2.7 WAN Menu page (W)

```
                                  WAN Menu

QoS Feature...................[ Enabled ]....................................Q
Global Conf Display..........................................................A
Class Selector 6.............................................................C
Expedited Forwarding.........................................................E
Assured Forwarding Class 1...................................................1
Assured Forwarding Class 2...................................................2
Assured Forwarding Class 3...................................................3
Assured Forwarding Class 4...................................................4
Default......................................................................D
Clear (reset) Statistics.....................................................R










Save Parameters to Flash.....................................................S
Logout of Telnet Session.....................................................L
Exit Menu....................................................................X
```

The *WAN Menu* page, activated from the *Main Menu*, contains the following options/fields:

Menu Options/Fields	Entry	Description
QoS Feature	**Q**	Prompts user to select: **0** – **Disabled** **1 – Enabled**
Global Con Display	**A**	See **Chapter Sect. 8.7.4.5 WAN Pages** for an overview of command functionality and/or information presented on these pages.
Class Selector 6	**C**	
Expedited Forwarding	**E**	
Assured Forwarding Class 1	**1**	
Assured Forwarding Class 2	**2**	
Assured Forwarding Class 3	**3**	
Assured Forwarding Class 4	**4**	
Default	**D**	Provides user with *read-only* display of the DiffServ default queue.
Clear (reset) Statistics	**R**	Allows user to reset all DiffServ statistics.

9.2.8 Routing Table page (R)

```
                              Routing Table

    Description      Destination IP  Mask Interface Next Hop IP
 1) tosatellite      172.16.0.0      16   toWAN     0.0.0.0


<A>dd Entry - <M>odify Entry - <D>elete Entry
<P>revious Page - <N>ext Page

Save Parameters to Flash.....................................................S
Logout of Telnet Session.....................................................L
Exit Menu....................................................................X
```

Using the *Routing Table* page, activated from the *Main Menu*, static routes can be entered into the IP Module to route IP traffic over the satellite or to another device on the local LAN. Route entries can be in any combination of Unicast and Multicast routes. The *Routing Table* page contains the following options/fields:

Menu Options/Fields	Entry	Description
Add entry	**A**	Refer to **Chapter Sect. 8.7.4.6.1 Routing | Routes** for an overview of command functionality.
Modify Entry	**M**	
Delete Entry	**D**	
Previous Page	**P**	Allows user to navigate, on a per-page basis, between the start and end of the Routing Table.
Next Page	**N**	

9.2.9 Redundancy Configuration page (E)

```
          1:1 Redundancy Menu <Requires CRS-311 Redundancy Switch>

1:1 Redundancy.........................[ Available ]
1:1 Redundancy State...................[ Online ]
Traffic IP Address.....................[ 172.16.131.1 ]
Local Unit Management IP Address.......[ 172.16.131.115 ]
Redundant Unit Management IP Address...[ 172.16.131.149 ]











Save Parameters to Flash...............................................S
Logout of Telnet Session...............................................L
Exit Menu..............................................................X
```

The SLM-5650A Satellite Modem, when connected to a Comtech EF Data CRS-311 1:1 Redundancy Switch, provides fully-automatic protection of IP packet traffic in the case of equipment failure.

The *Redundancy Configuration* page, activated from the *Main Menu*, provides the user with *read-only* status information on the configured redundant configuration.

If the user selects the Redundancy tab without a 1:1 Redundant Configuration, the **1:1 Redundancy** status is displayed as **Unavailable**.

Refer to **Appendix F. 1:1 REDUNDANCY** for detailed information on the use of the SLM-5650A Satellite Modem in redundant operations.

9.2.10 Operations & Maintenance page (O)

```
                          Operations and Maintenance

Statistics.............................................................T
Ping/TraceRoute Target IP....[ 192.168.1.9 ]...........................I
Ping Above Address.....................................................P
Max Trace Route Hops.........[ 10 ]....................................M
Trace Route Above Address..............................................R
Base Management Port.........[ 49152 ].................................B
Debug Menu.............................................................D


Save Parameters to Flash...............................................S
Logout of Telnet Session...............................................L
Exit Menu..............................................................X
```

The *Operations & Maintenance* page, activated from the *Main Menu*, contains the following options/fields:

Menu Options/Fields	Entry	Description
Statistics	**T**	Provides user with *read-only* access to Ethernet Tx/Rx, LAN, WAN operating statistics; allows user to clear existing statistics.
Ping/TraceRoute Target IP	**I**	Allows user to edit target IP address for ping and trace route using the ←→ arrows keys.
Ping Above Address	**P**	Allows user to ping on IP Address.
Max Trace Route Hops	**M**	Allows user to set the maximum number of trace route hops using the ←→ arrows keys.
Trace Route Above Address	**R**	Allows user to trace route on IP address.
Base Management Port	**B**	Allows user to edit the Vipersat base management UDP/TCP port using the ←→ arrows keys.
Debug Menu	**D**	Password-restricted for ***factory use only***.

Note: Ping and Trace Route are only available through the Telnet *Operations & Maintenance Menu* page. For ping and trace route to work, the user must enter a target IP address. The user can then choose to issue a Ping or Trace Route to the Target IP Address. When doing a Trace Route, the maximum trace route hops can also be specified.

9.2.10.1 Operations & Maintenance | Statistics Page (T)

```
                                  Statistics

Ethernet TX.............................................................T
Ethernet RX.............................................................R
IP......................................................................I
WAN.....................................................................W


Clear Ethernet Statistics (Tx & Rx).....................................1
Clear IP Statistics.....................................................2
Clear Wan Statistics....................................................3








Save Parameters to Flash................................................S
Logout of Telnet Session................................................L
Exit Menu...............................................................X
```

Menu Options/Fields	Entry	Description
Ethernet TX	**T**	Refer to **Chapter Sect. 8.7.4.7 Stats (Statistics)** for an overview of the information provided on these *read-only* pages.
Ethernet RX	**R**	
IP	**I**	
WAN	**W**	
Clear Ethernet Statistics (Tx & Rx)	**1**	Allows user to clear all statistics.
Clear IP Statistics	**2**	
Clear WAN Statistics	**3**	

Chapter 10. TRANSEC MODULE

10.1 Overview

The SLM-5650 is fully compatible and interoperable in all specified modes of operation with the following Transmission Security (TRANSEC) equipment currently used by the Government:

- KIV-19 Provisional
- KG-95-1 Provisional

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

10.2 TRANSEC Module HTTP (Web Server) Interface

The user can fully control and monitor operation of the SLM-5650A TRANSEC Module from its Web Server Interface. By rolling the cursor over the tabs located at the top of each page (shown at right), the user can select from the available nested hyperlinks.

The pages in the SLM-5650A Network Processor (NP) Interface have been designed for optimal performance when using Microsoft's Internet Explorer Ver. 6.0 or higher (the examples shown use Internet Explorer Ver. 6.0).

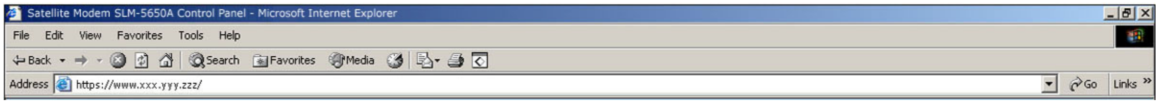
10.2.1 Web Server Menu Tree

The menu tree illustrates the options available through this interface:

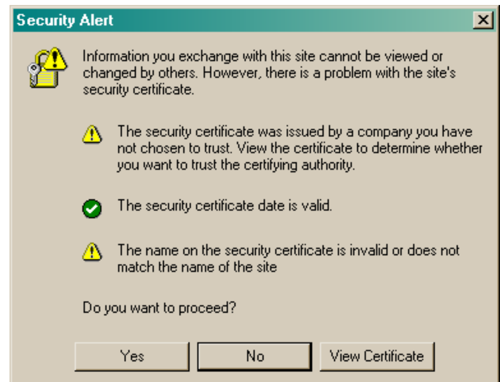
Interface Navigator Drop-down menu	Page Navigation Tabs			
	Home	Admin	Stats	Maint
Crypto Officer	Home	Config	Module Status	Unit Info
Network Operator	Contact	Update		
Operator		Event		

10.2.2 Access the TRANSEC Module Web Server "Splash" Page

From the PC, type *https://www.xxx.yyy.zzz* (where "www.xxx.yyy.zzz" represents the IP address of the SLM-5650A TRANSEC Module) into the **Address** area of the Web browser.



The user may be prompted with a Security Alert. Should the advisory appear, click **[Yes]** to proceed.



The user will then see the TRANSEC Module "splash" page (shown here in **Figure 10-1**).

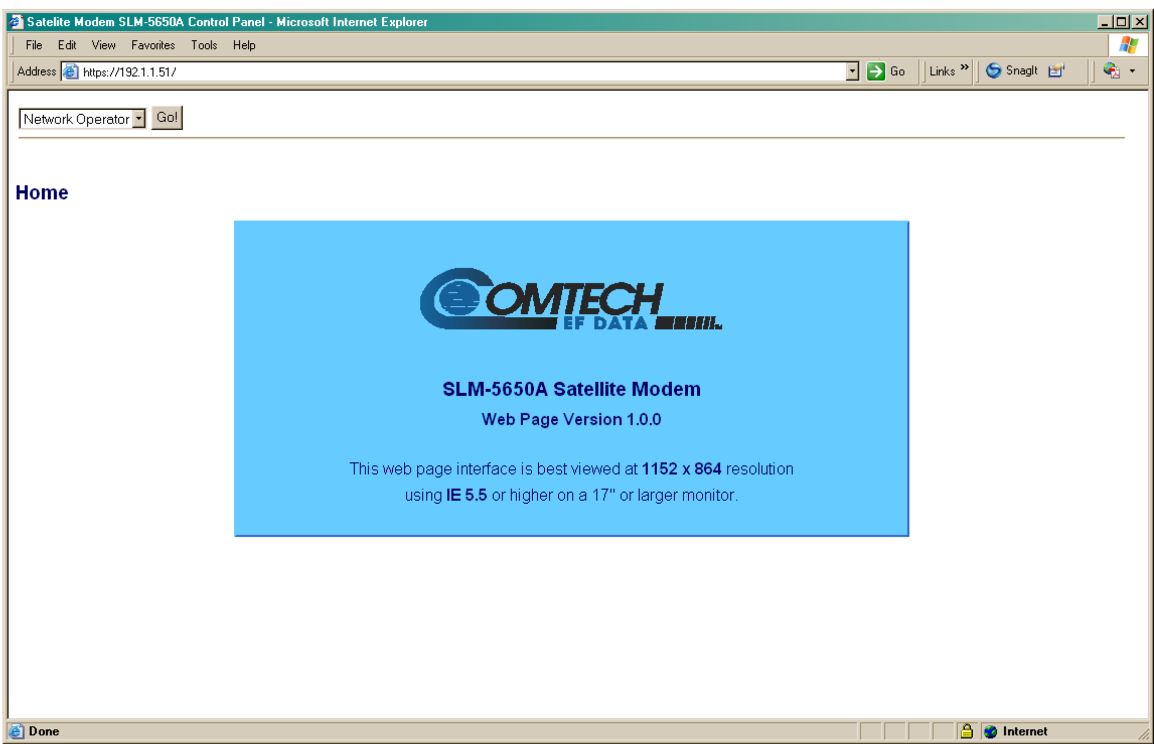


Figure 10-1. TRANSEC Module Web Server Interface – "Splash" page

The user may select three modes of operation from the drop-down menu located in the top left-hand corner of all TRANSEC Module Web Server Interface pages:

- **Crypto Officer:** Connects the user to the secure TRANSEC Module Web Server Interface (User Name and Password required).
- **Modem Operator:** Causes the Base Modem Web Server Interface to be accessible in the lower browser pane.
- **Network Operator:** Connects the user to the secure Network Processor (NP) Web Server Interface (User Name and Password required). For details on using this interface see **Chapter 8.7 NP Module Web Server Interface.**

10.2.3 Access the TRANSEC Module Web Server Pages

To continue to the TRANSEC Module Web Server Interface pages, select **Crypto Officer** from the drop-down, then click **[Go!].** The Login window will appear, and the user is prompted to type a User Name and Password.

HTTP Login Access Levels are defined as follows:

User Interface	User Login Access Level		
	Admin User	**Read/Write User**	**Read Only User**
Web	Full Access to all Web Pages	No Access to Admin	No Access to Admin
		Full Access for all other Web Pages	View Only Access for all other Web Pages

TRANSEC default User Name / Passwords are:

Admin	comtech / comtech
Read/Write	*Future release*
Read Only	*Future release*

Type the User Name and Password, then click **[OK].**

10.2.4 Home Pages

10.2.4.1 Home | Home

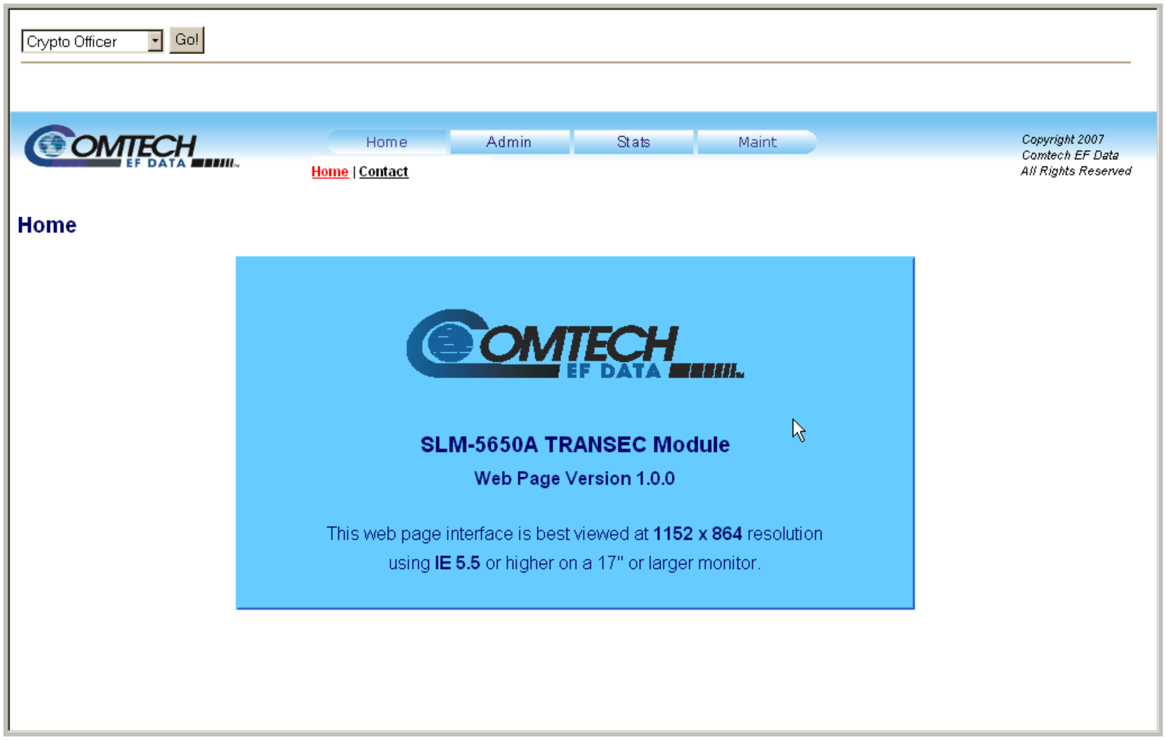


Figure 10-2. Home | Home page

10.2.4.2 Home | Contact Page

The **Contact** page provides basic contact information to reach Comtech EF Data Sales and Customer Support via phone or e-mail.

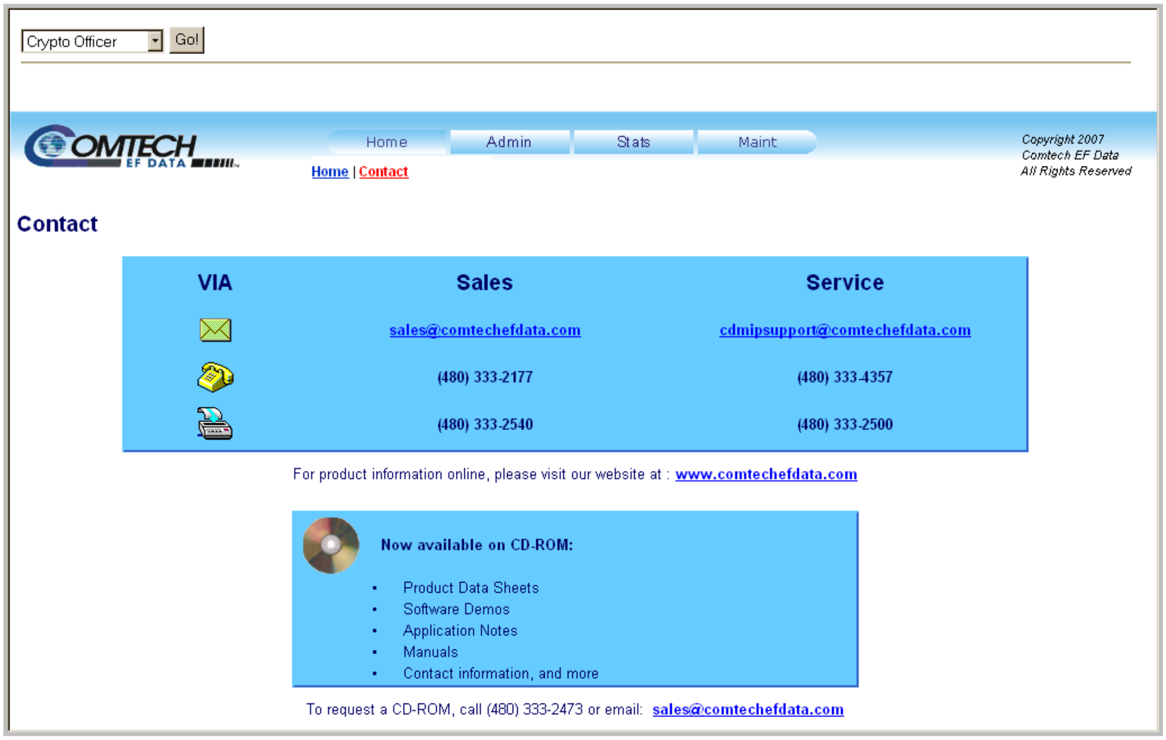


Figure 10-3. Home | Contact page

10.2.5 Admin (Administrative) Pages

The **Admin** page provides configuration, firmware upgrade, and events log management capabilities.

10.2.5.1 Admin | Config

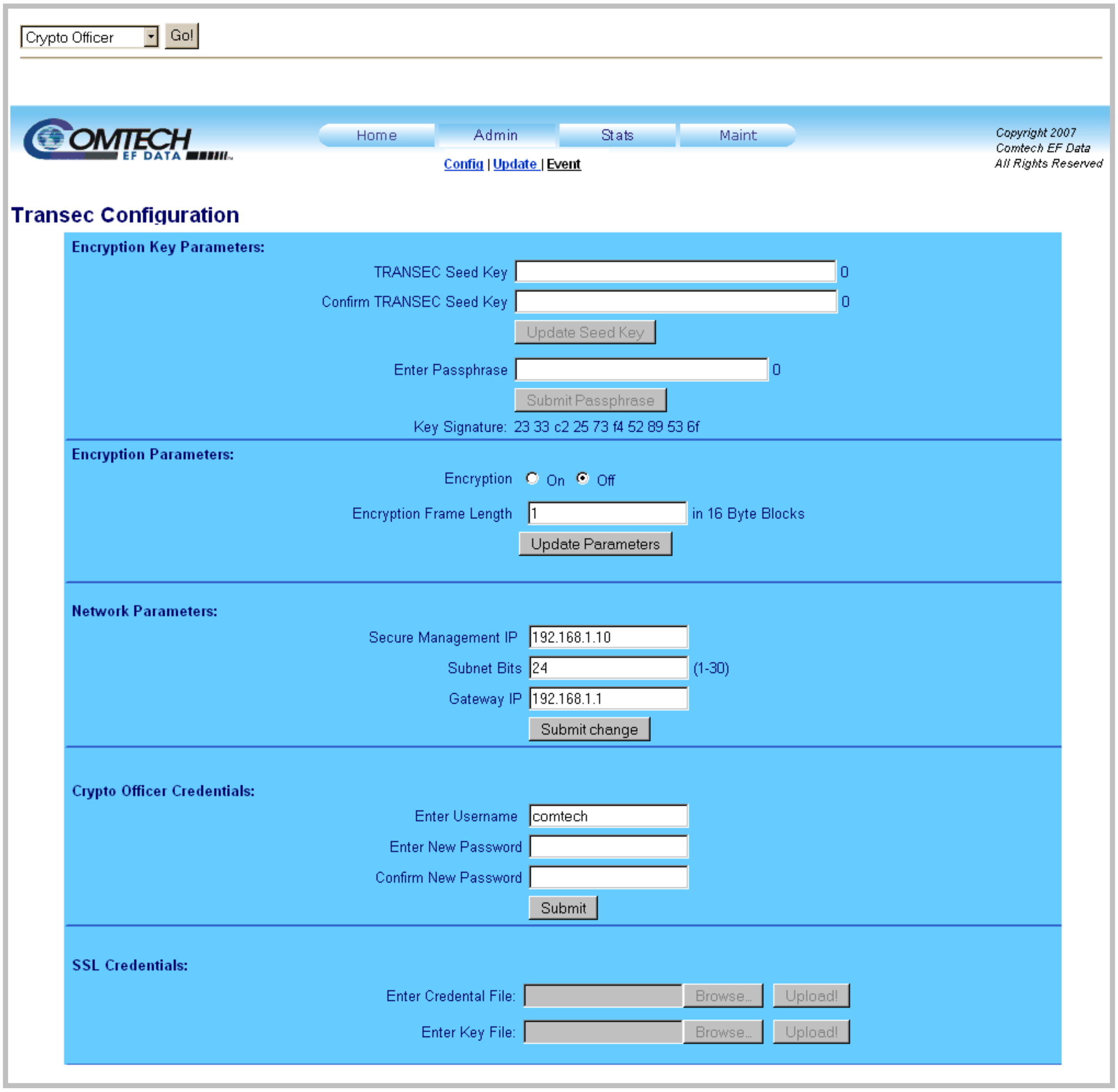


Figure 10-4. Admin | Config page

Select **Admin | Config** to display the **TRANSEC Configuration** page.

Encryption Key Parameters

- **TRANSEC Seed Key** – (*Write only*) Allows the user to enter a 32-character Seed Key for use in generating a Transmission Encryption Key (TEK) when the TRANSEC Module is given a Passphrase (described below).
- **Confirm TRANSEC Seed Key** – (*Write only*) The user re-enters the TRANSEC Seed Key in this field to ensure that the Seed Key entered is accurate.
- **Enter Passphrase** – (*Write only*) Accepts a 10- to 32-character Passphrase that is combined with the previously entered Seed Key to generate Transmission Encryption Keys.
- **Key Signature** – (*Read only*) This is a value generated by the Seed Key and Passphrase, independent of the transmission encryption keys, which allows the user to validate that the intended Seed Key/Passphrase pair has been entered.

  NOTE: The Transmission Encryption Keys are updated only when a Passphrase is submitted.

Encryption Parameters

- **Encryption (On/Off)** – Enables/Disables encryption in the TRANSEC Module.

  Encryption '**On**' causes the data traffic to be encrypted by the TRANSEC Module using the current TEKs. This encrypted data is then deliverd 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.

- **Encryption Frame Length** – This field allows the user to specify the length of the AES 256 encryption frame. Acceptable range is from 1 (fast acquisition, high overhead) to 255 (slower acquisition, low overhead).
- **Update Parameters** – Click [**Update Parameters]** to implement the changes entered in the 'Encryption' and/or "Encryption Frame Length' fields.

Network Parameters

- **Secure Management IP –** Allows the user to change the IP address of the TRANSEC Module to suit their own operational environment.

  NOTE: If this field changes, it will be necessary to repeat the process in **Section 10.2.2**, using the newly-designated IP address, to regain access to the TRANSEC Web Interface.

- **Subnet Bits –** Allows the user to modify the IP subnet mask of the TRANSEC Module to suit their own operational environment.
- **Gateway IP –** Allows the user to modify the default gateway of the TRANSEC Module to suit their own operational environment.

NOTE: The IP address entered in the field must match the subnet of the Secure Management IP. If it does not then the Gateway IP field will default to 0.0.0.0.

- **Submit Changes –** Click **[Submit Changes]** to apply changes entered in the "Secure Management IP", "Gateway IP" and "Submit Changes" to the TRANSEC Module.

10.2.5.2 Admin | Update

Refer to **Chapter 4. FLASH UPGRADING** for instructions regarding the use of the TRANSEC Module Firmware Update page, and for detailed information on the procedures associated with TRANSEC Module firmware update process.

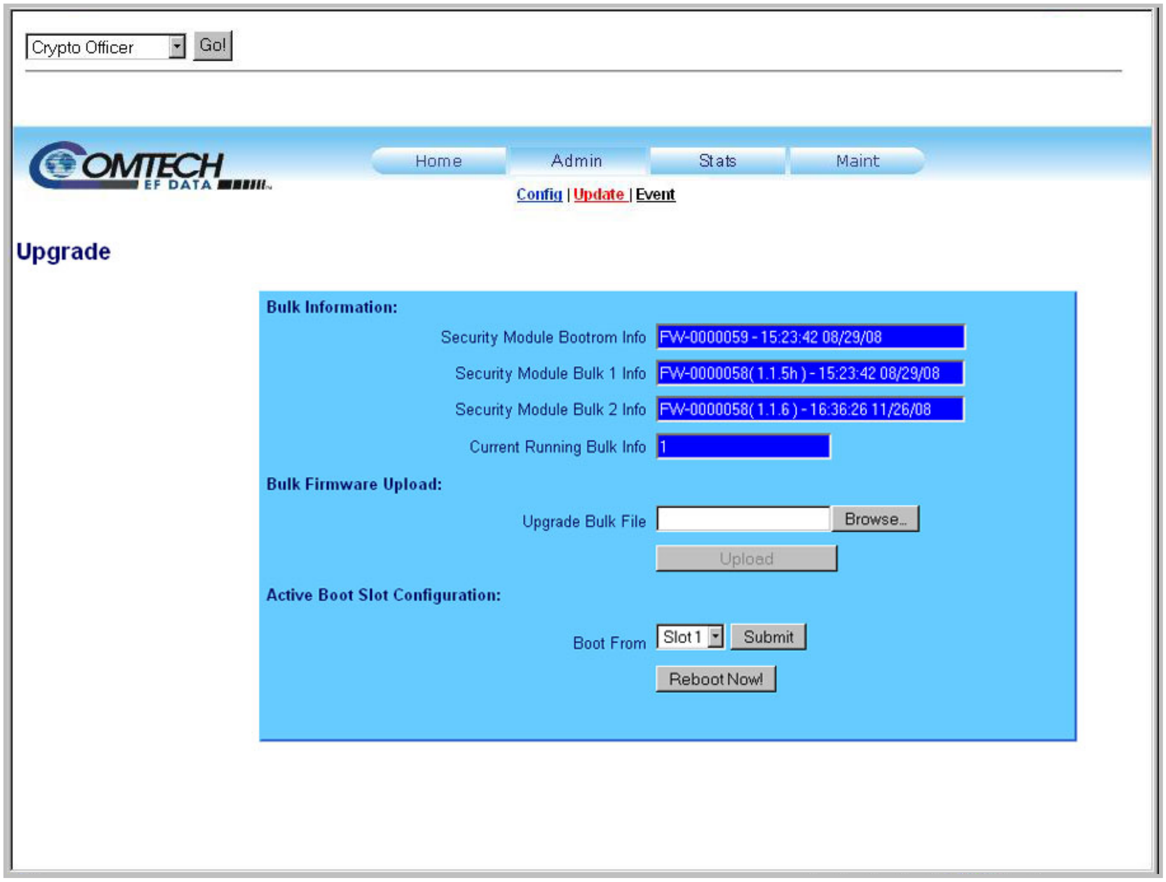


Figure 10-5. Admin | Update page

10.2.5.3 Admin | Event

Select **Admin | Event** to display the **Security Module Event Log** page. This page provides a logging mechanism for the TRANSEC Module only. It functions as a monitoring/troubleshooting aid to help determine the health of the module, as well as troubleshoot any issues found in the field.

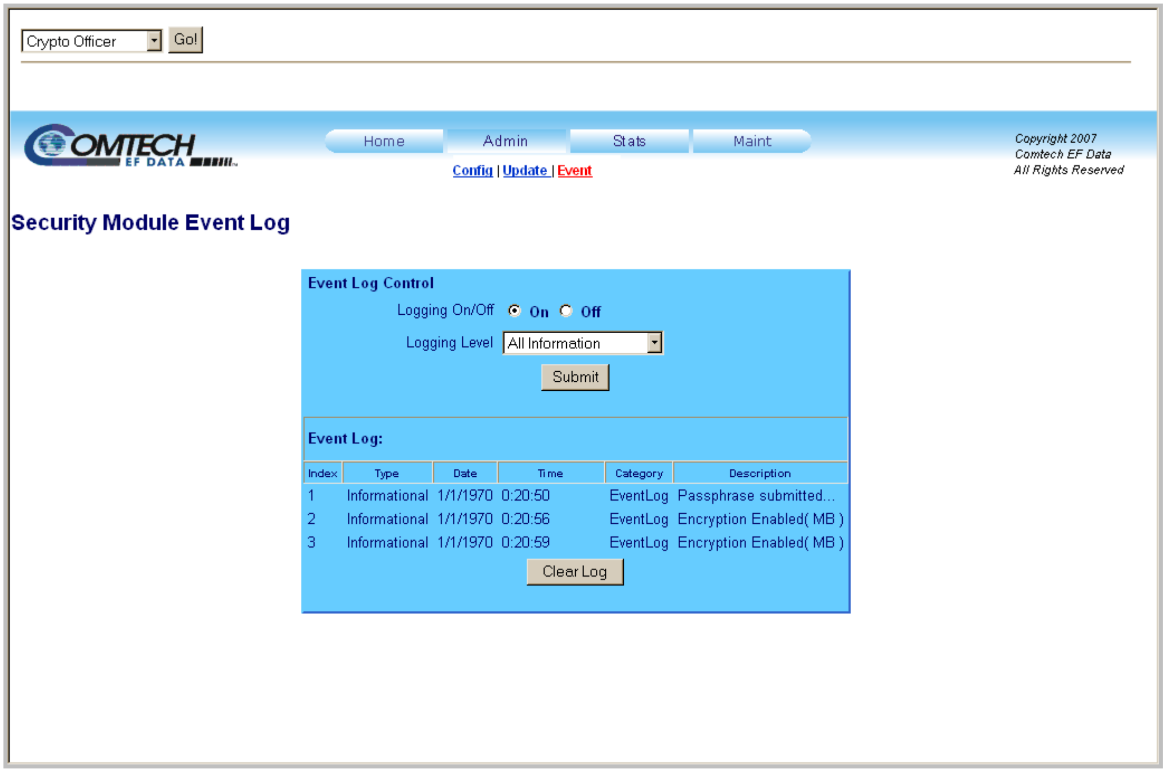


Figure 10-6. Admin | Event page

Event Log Control

- **Logging On/Off –** Enables/disables logging of event messages.
- **Logging Level** – Allows the user to filter the maximum level of message to be displayed. Choices are Errors Only, Errors and Warnings, and All Information.
- Click **[Submit]** to execute these settings.

Event Log

- **Index –** This column numbers the event messages in the order they are received.
- **Type –** This column describes the severity of the event. Refer to **Table 10-1**at the end of this section for an overview of the event types and their recommended user responses.
- **Date –** This column displays the date that the event was logged. In accordance with international convention, the date is shown in DAY/MONTH/YEAR format**.**
- **Time –** This column displays the time of day that the event was logged.
- **Category –** All messages in this log are categorized as EventLog.

- **Description –** This column provides a brief description of the action logged.
- **Clear Log –** Click **[Clear Log]** to clear the event log of all messages. The event log is reset to zero entries.

Table 10-1. 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, etc.	Minimum. Event logged is for user reference only.
Warning *(future)*	Status change that the system might not accept or expect; e.g., attempting to enter an non-matching Encryption Key password, entering an invalid remote command, etc.	*Moderate.* User should consult the pertinent sections of this manual to troubleshoot, then repeat command or procedure as needed.
Minor *(future)*	**Error condition** that the system should be able to recover from without affecting the operation of the system; e.g., encountering a software 'bug', etc.	*Moderate.* User should report issues when convenient to Comtech EF Data Customer Support (i.e., via the means available through the SLM-5650A TRANSEC Module Web Interface **Home | Contact** page, or by using the SLM-5650 Web Server Interface **Home | Support** e-mail interface, etc.).
Major *(future)*	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 *(future)*	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.**

10.2.6 Stats (Statistics) | Module Status Page

Select **Stats | Module Status** to display the **Security Module Status** page.

Figure 10-7. Stats | Module Status page

Encryption Parameters

- **AES256 Firmware Version –** Identifies the version of the AES 256 core.
- **Encryption Frame Length –** Displays the currently configured AES 256 frame length.
- **Unit –** Displays the fault status of the TRANSEC Module.
- **Board Temp –** Displays the temperature of the TRANSEC Module.
- **TRANSEC Clock Status** – Displays the DCM locked status for the AES-156 core.

Transmit Status

- **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; Encryption off).
- **Crypto Traffic –** Displays a short message from the Crypto core that indicates whether or not it has aqcuired cryptography.

- **BIST Done –** Indicates whether or not the TRANSEC Built-in Self Test (BIST) was performed for the TRANSEC Tx.

Receive Status

- **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.
- **BIST Done –** Indicates whether or not the TRANSEC Built-in Self Test (BIST) was performed for the TRANSEC Rx.

10.2.7 Maint (Maintenance) | Unit Info Page

Select **Maint | Unit Info** to display the read-only **Unit Information** page.

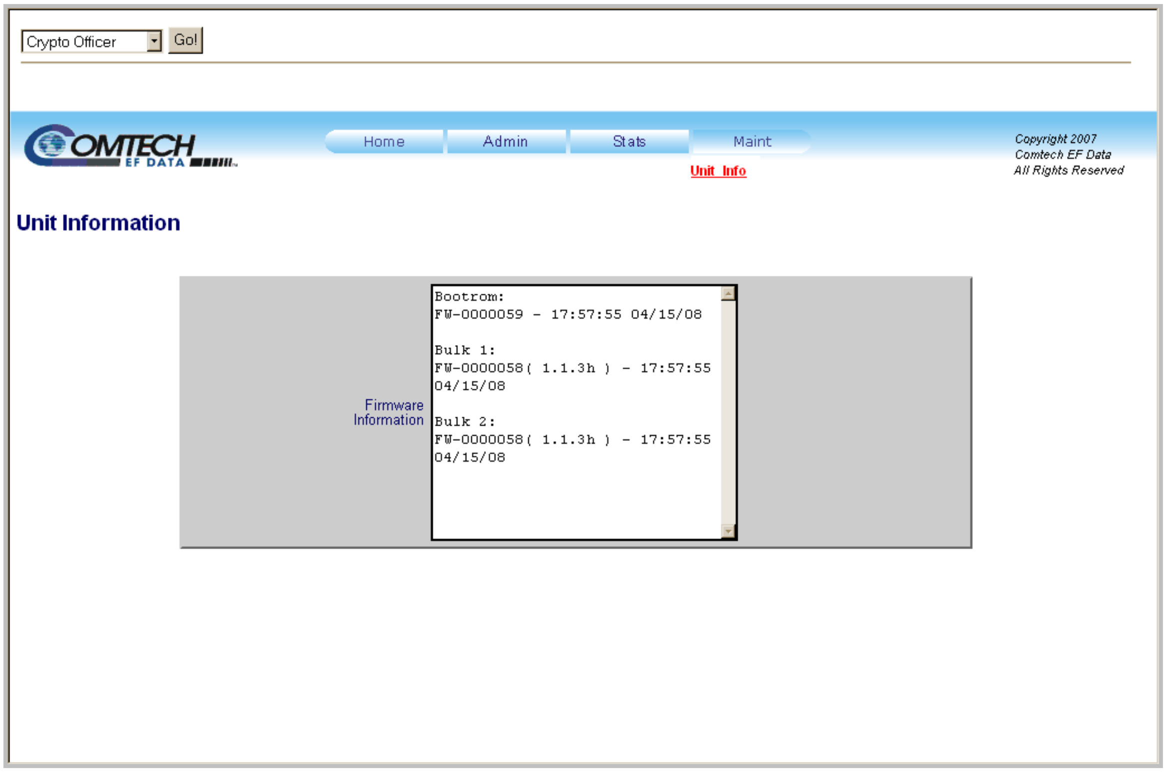


Figure 10-8. Maint | Unit Info page

Scroll through the displayed information to verify that the correct firmware is applied to the unit.

Chapter 11. 10/100/1000 Base-T (GbE) INTERFACE

11.1 Introduction

The 10/100/1000 Base-T Ethernet – or Gigabit Ethernet (GbE) – Interface Module, shown in **Figure 11-1**, acts as an Ethernet bridge for data traffic. **M**onitor and **C**ontrol (M&C) information is not supported on the GbE Interface but is available through the 10/100 Base-T remote port of the modem. A functional block diagram is depicted in **Figure 11-2**.

The GbE Interface supports data rates from 64 kbps to 155.52 Mbps. IP traffic entering the GbE Interface is encapsulated in HDLC protocol for transmission over the satellite link. HDLC CRS-16 verification is performed on all received (from WAN) HDLC frames. The GbE module user interface is a single IEEE 802.3ab 1000 Base-T copper compliant female RJ-45 connector, wired as described in **Table 11-2**.

Figure 11-1. 10/100/1000 Base-T (GbE) Interface Module (AS/11985)

11.2 Physical Description

The GbE Interface is implemented on a 4.5 W x 6.8 D x .85 H inches (11.43 W x 17.27 D x 2.16H cm) PCB. Connectivity to the SLM-5650A is accomplished with a 96-pin DIN receptacle. The LAN interface consists of an RJ-45 connector with link status and link activity Light-Emitting Diode (LED) indicators.

11.3 General Specifications

Table 11-1. Interface Specifications

General Specifications		
Data Framing		10/100/1000 Base-T Interface: RFC-894 “Ethernet”
Data Framing Format (WAN)		HDLC (Standard Single Channel)
Connector		RJ-45 female, 100Ω
Electrical Properties		Per IEEE 802.3ab
Packet Types		Burst, distributed, or IPV4
Signal Types		Serial data
Voltage Level		Per IEEE- 802.3ab
Packet Latency		50 ms maximum
Flow Control		None
Cable Length, Maximum		100 meters CAT 5 cable, patch cords and connecting hardware, per ISO/IEC 11801:1995 and ANSI/EIA/TIA-568-A (1995)
Hot Pluggable	Cable	Yes
	Module	NO
LEDs		Link Status, link activity
Ingress Packet Filtration Parameters		MAC, IP address match value configuration for media and management packets, UDP port for media packets
Egress Packet Parameters		Destination IP address and UDP port for media packets
Packet Filtration Parameters (generic)		IP address match value configuration for management packets
1000 Base-T Link Statistics		Ingress good octets Ingress bad octets Ingress unicast packets Ingress broadcast packets Ingress multicast packets Ingress pause packets Ingress undersize packets Ingress fragments Ingress oversize packets Ingress jabber Ingress Rx errors Ingress Frame Check Sequence Errors Egress oclets Egress unicast packets Egress broadcast packets Egress multicast packets

Monitor & Control	
WAN Port Statistics	Ingress good oclets Ingress bad oclets Ingress unicast packets Ingress broadcast packets Ingress multicast packets Ingress pause packets Ingress undersize packets Ingress fragments Ingress oversize packets Ingress jabber Ingress Rx errors Ingress Frame Check Sequence Errors Egress oclets Egress unicast packets Egress broadcast packets Egress multicast packets HDLC link errors Rx packet count Tx packet count
Management Port Statistics	Ingress good oclets Ingress bad oclets Ingress unicast packets Ingress broadcast packets Ingress multicast packets Ingress pause packets Ingress undersize packets Ingress fragments Ingress oversize packets Ingress jabber Ingress Rx errors Ingress Frame Check Sequence Errors Egress oclets Egress unicast packets Egress broadcast packets Egress multicast packets
Controlled Functions	TX data rate Rx data rate Tx enable/disable Rx enable/disable Management IP Address and Mask

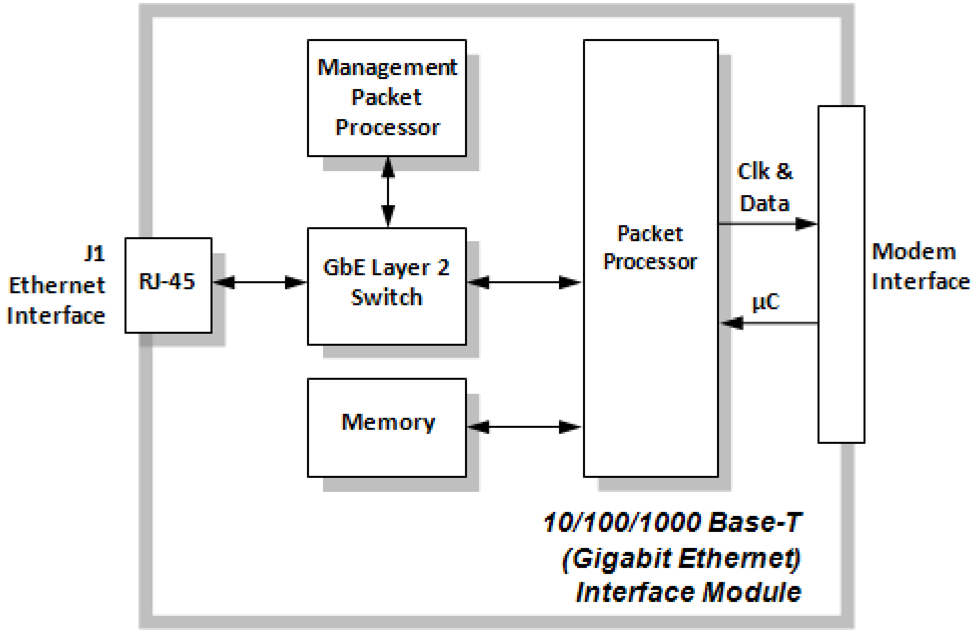


Figure 11-2. GbE Interface Functional Block Diagram

11.4 Connector Pinout

The GbE Interface is comprised of one IEEE 802.3ab 1000Base-T copper interface via a single 'RJ-45' type female connector (J1). The LAN interface supports 10/100/1000 Base-T operation.

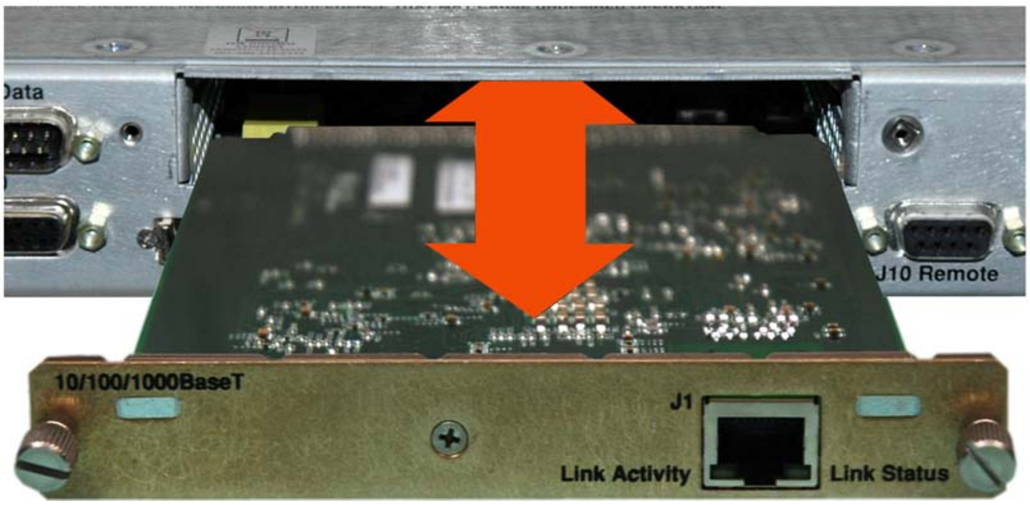
Table 11-2. Connector Pinout

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

11.5 10/100/1000 Base-T (GbE) Interface Module Removal and Installation

WARNING

1. ***Ensure the unit is in a Power Off mode. Serious injury or damage to the equipment could result.***
2. ***Care must be taken not to damage the module's components during removal or installation.***



Removal of the Interface Module:

Step	Procedure
1	**Turn off** the power to the modem.
2	**Disconnect** the RJ-45 cable from the Interface Module.
3	**Loosen** the (two) captive screws securing the module to the chassis.
4	**Pull** the module *straight out* until it is clear of the chassis slot.

Installation of the Interface Module:

Step	Procedure
1	**Insert** the Interface Module *straight into* the slot, using the chassis' internal card guides, until it plugs securely into the internal card receptacle.
2	**Secure** the module to the chassis using the (two) captive screws.
3	**Connect** the RJ-45 cable to the Interface Module.
4	**Turn on** the power to the modem.

Notes:

Chapter 12. T1/E1, T2/E2, G.703 INTERFACE

12.1 Introduction

The T1/E1, T2/E2, G.703 Interface Module, shown in **Figure 12-1**, provides physical and electrical connection between the external terrestrial device and the internal circuitry of the SLM-5650A's modulator and demodulator. By convention, a modem is **D**ata **C**ommunications **E**quipment (DCE), where Tx data enters the data interface and Rx data exits it. The plug-in interface has full duplex capability.

The T1/E1, T2/E2, G.703 Interface Module affords balanced or unbalanced operation, and provides:

- Two (2) G.703 Interfaces:
  - Balanced T1/E1 and T2
  - Unbalanced T1/E1, T2/E2
- External Clock Input

Figure 12-1 shows the Interface Module, looking at the rear panel. **Figure 12-2** provides a functional block diagram of the interface.

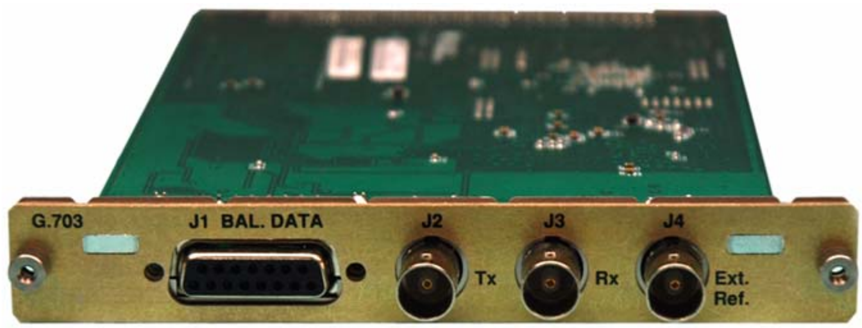


Figure 12-1. T1/E1, T2/E2, G.703 Interface Module (AS/11579)

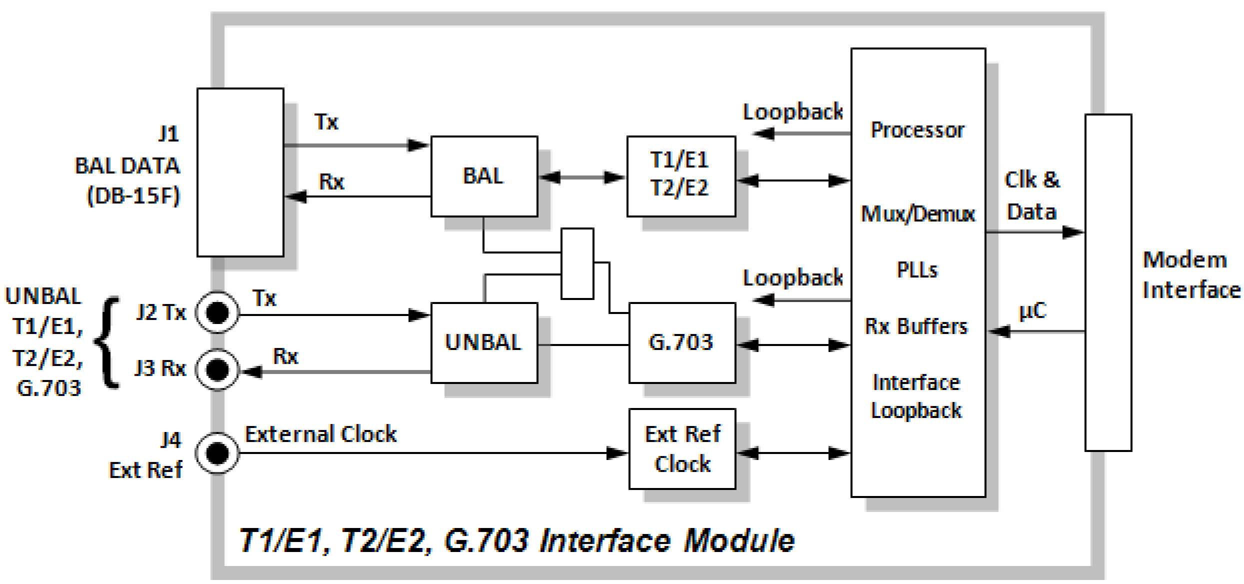


Figure 12-2. T1/E1, T2/E2, G.703 Interface Functional Block Diagram

12.2 Summary of Specifications

<table>
<tr><th colspan="3">Item</th><th colspan="3">Requirements</th></tr>
<tr><td rowspan="13">GENERAL</td><td colspan="2">Interface</td><td colspan="3">Balanced and Unbalanced G.703 ports, T1/E1, T2/E2
Note: Selection of a data rate requires TX and RX having the same data rate.</td></tr>
<tr><td colspan="2">External Clock Input</td><td colspan="3">One input</td></tr>
<tr><td rowspan="6">Rx Buffer</td><td rowspan="2">G.703 Frame Types</td><td colspan="3">Note: Programmable in 0.5 ms increments..</td></tr>
<tr><td>Type</td><td>Bits</td><td>Bytes</td></tr>
<tr><td>T1</td><td>G.704</td><td>9264</td><td>192</td></tr>
<tr><td>E1</td><td>G.704</td><td>512</td><td>64</td></tr>
<tr><td>T2</td><td>G.704
G.743
G.747</td><td>12624
2352
1680</td><td>1578
294
210</td></tr>
<tr><td>E2</td><td>G.704
G.745
G.742</td><td>2112
2112
1696</td><td>264
264
212</td></tr>
<tr><td colspan="2">Minimum Buffer Size for any rate</td><td colspan="3">0.5 ms</td></tr>
<tr><td colspan="2">Maximum Buffer Size:
G.751
G.752
G.753</td><td colspan="3">
61 ms
44 ms
61 ms</td></tr>
<tr><td colspan="2">Clock Options</td><td colspan="3">Tx Clock = Tx, Rx (satellite), or External
Rx Clock = Tx, Rx, External, or Internal</td></tr>
<tr><td colspan="2">Acquisition Range</td><td colspan="3">Programmed Tx data rate ± 100 ppm</td></tr>
<tr><td colspan="2">Test</td><td colspan="3">Baseband Loopback (at interface)
Interface Loopback (through interface card)
2047 test pattern generator</td></tr>
<tr><td rowspan="3">INTERFACES</td><td colspan="2">G.703 Unbalanced
Connector Type
Signals Supported
Data Rate
Tx and Rx Data Rates
Line Coding
Pulse Mask
Impedance</td><td colspan="3">1 channel supporting T1/E1, T2/E2, and G.703
BNC, female
ITU-T-G.703 SD, RD
1544, 2048, 6312, and 8448 kbps
Tx and Rx data rates are programmed the same
HDB3, B8ZS, B6ZS, HDB3, AMI (Common)
ITU-T-G.703
75 Ω Unbalanced, 150 Ω Balanced Per ITU-T-G.703</td></tr>
<tr><td colspan="2">External Clock Input
Connector
Impedance
Return Loss per G.703
Input Amplitude
Input Frequency
Signal Characteristics</td><td colspan="3">
BNC, female
75 Ω ± 5%
Synchronization XXXXX Interface
0.5 to 5.0 V peak to peak
1, 2, 5, 10, 20, 1.544, 2.048, 6.312, and 8.448 MHz
Sine wave or square with duty cycle of 50 ± 10%</td></tr>
<tr><td colspan="2">Alarms</td><td colspan="3">Loss of Signal
All 1's</td></tr>
<tr><td rowspan="2">PHYSICAL and ENVIRONMENTAL</td><td colspan="2">Physical</td><td colspan="3">4.5 W x 6.8 D x .85 H inches (11.43 W x 17.27 D x 2.16H cm)</td></tr>
<tr><td colspan="2">Environmental
Temperature
Humidity</td><td colspan="3">
0 to 50 °C (32 to 122°F)
0 to 95% non-condensing</td></tr>
</table>

12.3 Connector Pinouts

The G.703 Interface supports the following rates: T1, T2, E1, E2, and Balanced /Unbalanced G.703. It supports differential and single-ended operation.

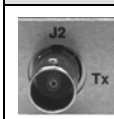
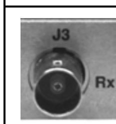
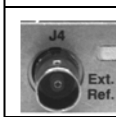
12.3.1 J1 Connector – DB-15F (G.703 Balanced)

Table 12-1. J1 Connector Pinout

Connector		Pin #	G.703 (Non-D&I)	Direction
	J1	1	SD_A G.703	In
		2	Ground	–
		3	RD_A G.703	Out
		4	Ground	–
		5		
		6		
		7		
		8		
		9	SD_B G.703	In
		10		
		11	RD_B G.703	Out
		12		
		13		
		14		
		15		

12.3.2 J2 through J4 Connectors – BNC (G.703 Unbalanced)

Table 12-2. 75Ω BNC Connectors (G.703 Unbalanced)

Connector		Description	Characteristics
	J2	Tx Data G.703 (Input)	BNC 75Ω Female
	J3	Rx Data G.703 (Output)	BNC 75Ω Female
	J4	Ext Clock Ref (Input)	BNC 75Ω Female

12.4 T1/E1, T2/E2, G.703 Interface Module Removal and Installation

WARNING

1. ***Ensure the unit is in a Power Off mode. Serious injury or damage to the equipment could result.***
2. ***Care must be taken not to damage the module's components during removal or installation.***

Removal of the Interface Module:

Step	Procedure
1	**Turn off** the power to the modem.
2	**Disconnect** all cables (DB-15 and BNC) from the Interface Module.
3	**Loosen** the (two) captive screws securing the module to the chassis.
4	**Pull** the module *straight out* until it is clear of the chassis slot.

Installation of the Interface Module:

Step	Procedure
1	**Insert** the Interface Module *straight into* the slot, using the chassis' internal card guides, until it plugs securely into the internal card receptacle.
2	**Secure** the module to the chassis using the (two) captive screws.
3	**Connect** all cables (DB-15 and BNC) to the Interface Module.
4	**Turn on** the power to the modem.

Notes:

Chapter 13. LOW VOLTAGE DIFFERENTIAL (LVDS) INTERFACE

13.1 Introduction

The Low Voltage Differential (LVDS) Interface Module, shown in **Figure 13-1**, provides a physical and electrical interface between SLM-5650A modulator or demodulator signal sources operating with LVDS electrical characteristics. A functional block diagram **(TBD)** is depicted in **Figure 13-2**.

The LVDS module user data interface, designated as “J1” on the module, is a single Type ‘D’ 25-pin female (DB-25F) connector, wired as described in **Table 13-2**.

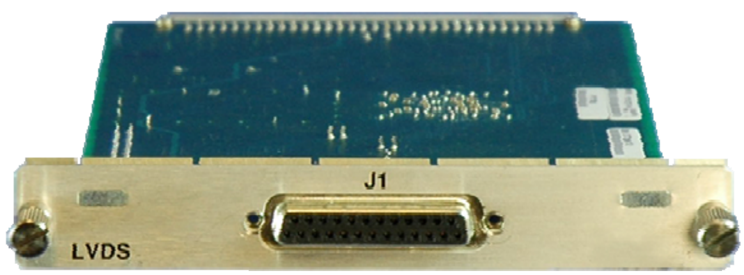


Figure 13-1. Low Voltage Differential (LVDS) Interface Module (PL/12272-1)

13.2 Physical Description (FUTURE)

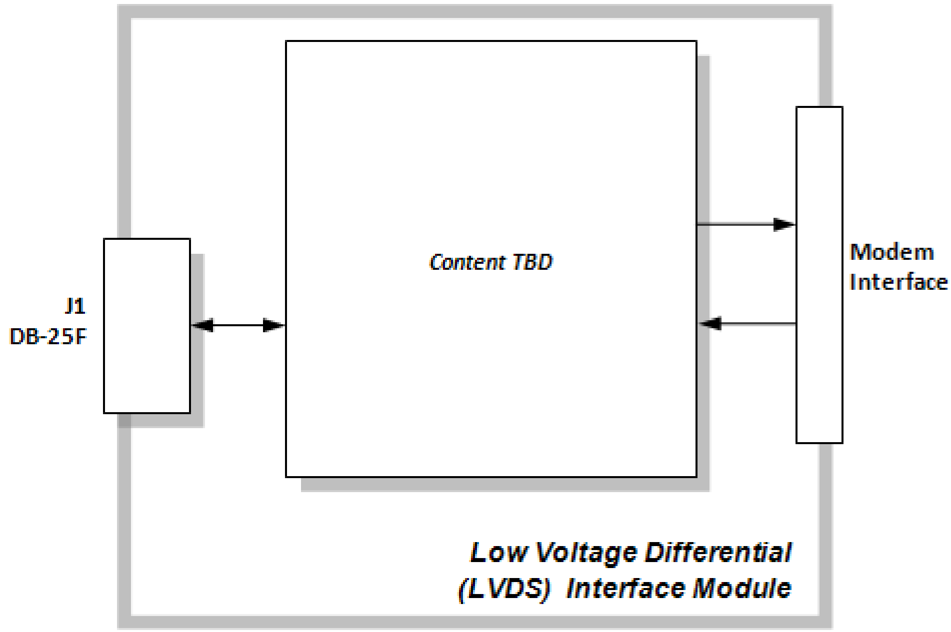


Figure 13-2. LVDS Interface Functional Block Diagram (FUTURE)

13.3 General Specifications (FUTURE)

Table 13-1. Interface Specifications

General Specifications	

13.4 J1 Connector Pinout

The LVDS module user data interface (J1) is a single Type 'D' 25-pin female (DB-25F) connector.

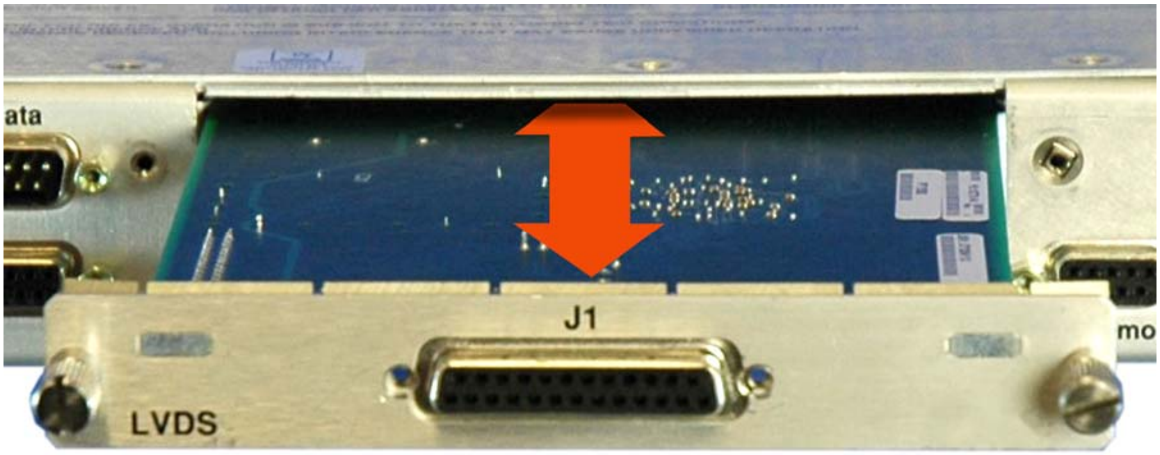
Table 13-2. Connector Pinout (J1)

Pin #	Description	Direction
1	Gnd	–
14	SD_P	In
2	SD_N	In
15	SCT_N	Out
3	RX_DATA_N	Out
16	RX_DATA_P	Out
4	RTS_N	In
17	LVDS_RX_CLK_N	Out
5	Spare	–
18	Reserved	–
6	Spare	–
19	RTS_P	In
7	Gnd	–
20	Spare	–
8	RR_N	Out
21	Spare	–
9	LVDS_RX_CLK_P	Out
22	Spare	–
10	RR_P	Out
23	Spare	–
11	TT_P	In
24	TT_N	In
12	SCT_P	Out
25	Reserved	–
13	Spare	–

13.5 LVDS Interface Module Removal and Installation

WARNING

1. ***Ensure the unit is in a Power Off mode. Serious injury or damage to the equipment could result.***
2. ***Care must be taken not to damage the module's components during removal or installation.***



Removal of the Interface Module:

Step	Procedure
1	**Turn off** the power to the modem.
2	**Disconnect** the DB-25M cable from the Interface Module.
3	**Loosen** the (two) captive screws securing the module to the chassis.
4	**Pull** the module *straight out* until it is clear of the chassis slot.

Installation of the Interface Module:

Step	Procedure
1	**Insert** the Interface Module *straight into* the slot, using the chassis' internal card guides, until it plugs securely into the internal card receptacle.
2	**Secure** the module to the chassis using the (two) captive screws.
3	**Connect** the DB-25M cable to the Interface Module.
4	**Turn on** the power to the modem.

Appendix A. TROUBLESHOOTING

A.1 Overview

Information pertaining to system checkout and fault isolation and identification is provided in this chapter.

A.2 System Checkout

System checkout entails following the test instructions provided for the interface PCB, modem PCB, TURBO PCB, and L-Band IF PCB. The instructions include tables and test points for ensuring that the E_b/N_0, typical output spectrums, typical eye patterns, and constellations are correct. If a test failure occurs, refer to the fault isolation checkout procedures provided in this appendix.

IMPORTANT

This section provides instructions for checking the modem setup within the earth station. Due to the complexity of the modem circuitry, the checkout procedure should be used only as a basic guideline. More complicated maintenance tests are beyond the scope of this manual.

CAUTION

This equipment contains parts and assemblies sensitive to damage by ESD. Use ESD precautionary procedures when touching, removing, or inserting PCBs.

A.2.1 Interface Checkout

Use the test setup in **Figure A-1** and the procedure that follows to verify the data interface.

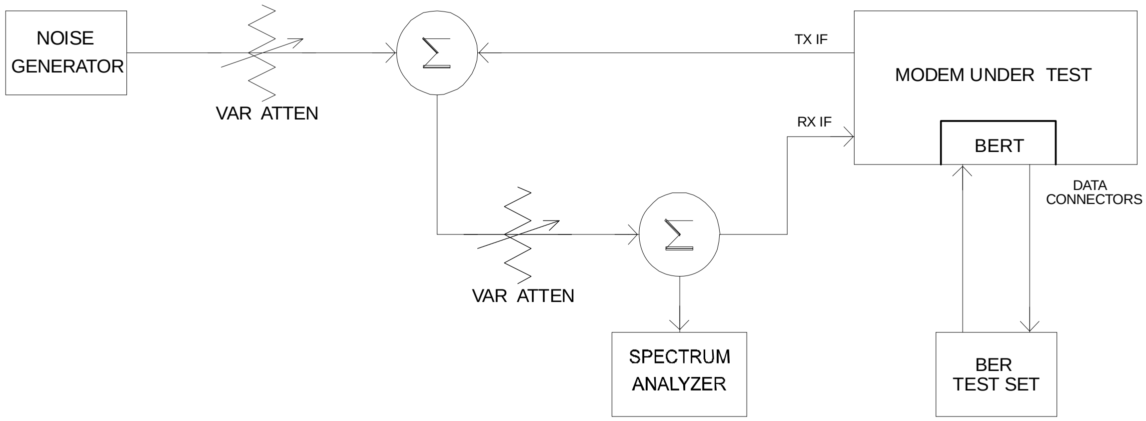


Figure A-1. Fault Isolation Test Setup

Notes:

1. Ensure the correct data and IF interface is selected and configured for the proper mode of operation.
2. Connect a BER test set to the appropriate modem data connector as shown in **Figure A-1**.
3. Set up the modem for baseband loopback operation by selecting I/O1 (**Test: Loopback → I/O1**) from the front panel menu. The modem will run error-free.

A.2.2 Modulator Checkout

Use the following procedure for modulator checkout:

Step	Procedure
1	Set up the equipment as shown in **Figure A-1** using 70/140 MHz IF interface. Refer to **Chapter 1. INTRODUCTION** for the modulator specifications.
2	Set up the modem for IF loopback operation by using **Test: Loopback → IF** from the front panel menu, or use an external IF loop.
3	Clear all TX faults, Stored Faults, and Alarms using **Monitor: Event-Log → Clear-All** from the front panel menu.
4	Measure the E_b/N_0 with a receiver that is known to be properly operating. a. Refer to **Table A-1** and **Figure A-2** to check for proper E_b/N_0 level. The (S+N)/N is measured by taking the average level of the noise and the average level of the modem spectrum top. b. Use this measurement for the first column on **Table A-1**. c. Read across the page to find the S/N and E_b/N_0 for the specific code rate. **Note:** Once the demodulator has locked to the incoming signal, using **Monitor: Rx-Params** from the front panel menu displays frequency offset, signal level, BERT data (if enabled), buffer status, E_b/N_0, and corrected BER.
6	Connect a spectrum analyzer to the modem as shown in **Figure A-1**. Ensure the IF output meets the appropriate mask and spurious specifications. Measure the power output at different levels and frequencies. **Note:** A typical output spectrum is shown in **Figure A-3**.
7	Check the frequency and phase modulation accuracy as follows: a. Set the modem to the continuous wave mode by using **Test: Carrier → Tx-CW** from the front panel menu. This sets the Carrier modulation in the OFF condition. A pure carrier should now be present at the IF output. This should only be used for frequency measurements. Spurious and power measurements should be taken with the modulation on. b. Set the modem to the continuous wave Offset mode by using **Test: Carrier → Tx-1,0** from the front panel menu. This generates a single upper side band and suppressed carrier signal. Ensure the carrier and side-band suppression are < -30 dBc.
8	Repeat steps 2-7 using the L-Band IF interface.

Table A-1. Conversion to S/N and E_b/N_0 Chart

(dB) (S+N)/N	Code S/N	Rate 1/2 E_b/N_0	Code S/N	Rate 3/4 E_b/N_0	Code S/N	Rate 7/8 E_b/N_0
4.0	1.8	1.8	1.8	0.0	1.8	-0.6
4.5	2.6	2.6	2.6	0.8	2.6	0.2
5.0	3.3	3.3	3.3	1.6	3.3	0.9
5.5	4.1	4.1	4.1	2.3	4.1	1.6
6.0	4.7	4.7	4.7	3.0	4.7	2.3
6.5	5.4	5.4	5.4	3.6	5.4	3.0
7.0	6.0	6.0	6.0	4.3	6.0	3.6
7.5	6.6	6.6	6.6	4.9	6.6	4.2
8.0	7.3	7.3	7.3	5.5	7.3	4.8
8.5	7.8	7.8	7.8	6.1	7.8	5.4
9.0	8.4	8.4	8.4	6.7	8.4	6.0
9.5	9.0	9.0	9.0	7.2	9.0	6.6
10.0	9.5	9.5	9.5	7.8	9.5	7.1
10.5	10.1	10.1	10.1	8.3	10.1	7.7
11.0	10.6	10.6	10.6	8.9	10.6	8.2
11.5	11.2	11.2	11.2	9.4	11.2	8.8
12.0	11.7	11.7	11.7	10.0	11.7	9.3
12.5	12.2	12.2	12.2	10.5	12.2	9.8
13.0	12.8	12.8	12.8	11.0	12.8	10.3
13.5	13.3	13.3	13.3	11.5	13.3	10.9
14.0	13.8	13.8	13.8	12.1	13.8	11.4
14.5	14.3	14.3	14.3	12.6	14.3	11.9
15.0	14.9	14.9	14.9	13.1	14.9	12.4
15.5	15.4	15.4	15.4	13.6	15.4	12.9
16.0	15.9	15.9	15.9	14.1	15.9	13.5
16.5	16.4	16.4	16.4	14.6	16.4	14.0
17.0	16.9	16.9	16.9	15.2	16.9	14.5
17.5	17.4	17.4	17.4	15.7	17.4	15.0
18.0	17.9	17.9	17.9	16.2	17.9	15.5
18.5	18.4	18.4	18.4	16.7	18.4	16.0
19.0	18.9	18.9	18.9	17.2	18.9	16.5
19.5	19.5	19.5	19.5	17.7	19.5	17.0
20.0	20.0	20.0	20.0	18.2	20.0	17.5

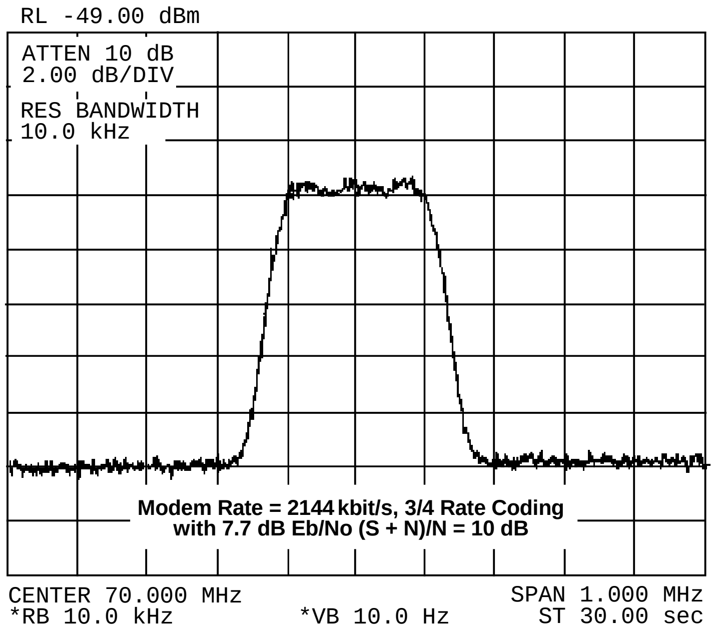


Figure A-2. Typical Output Spectrum – With Noise

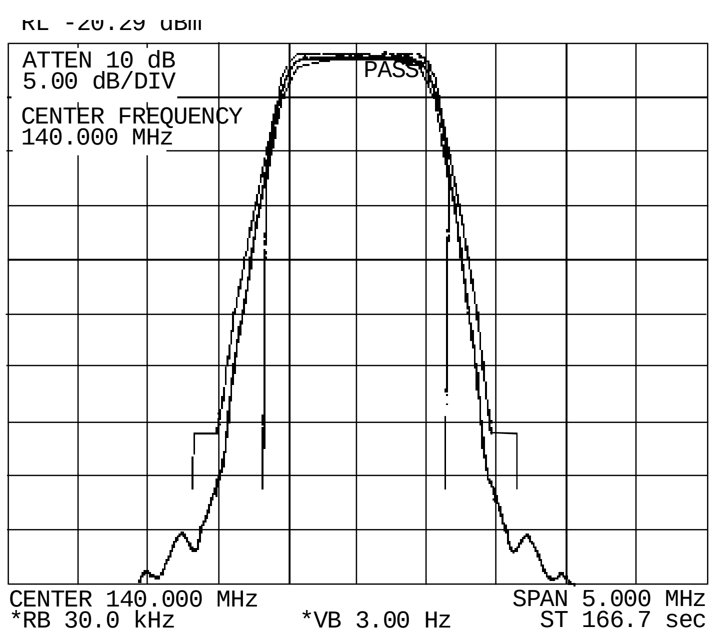
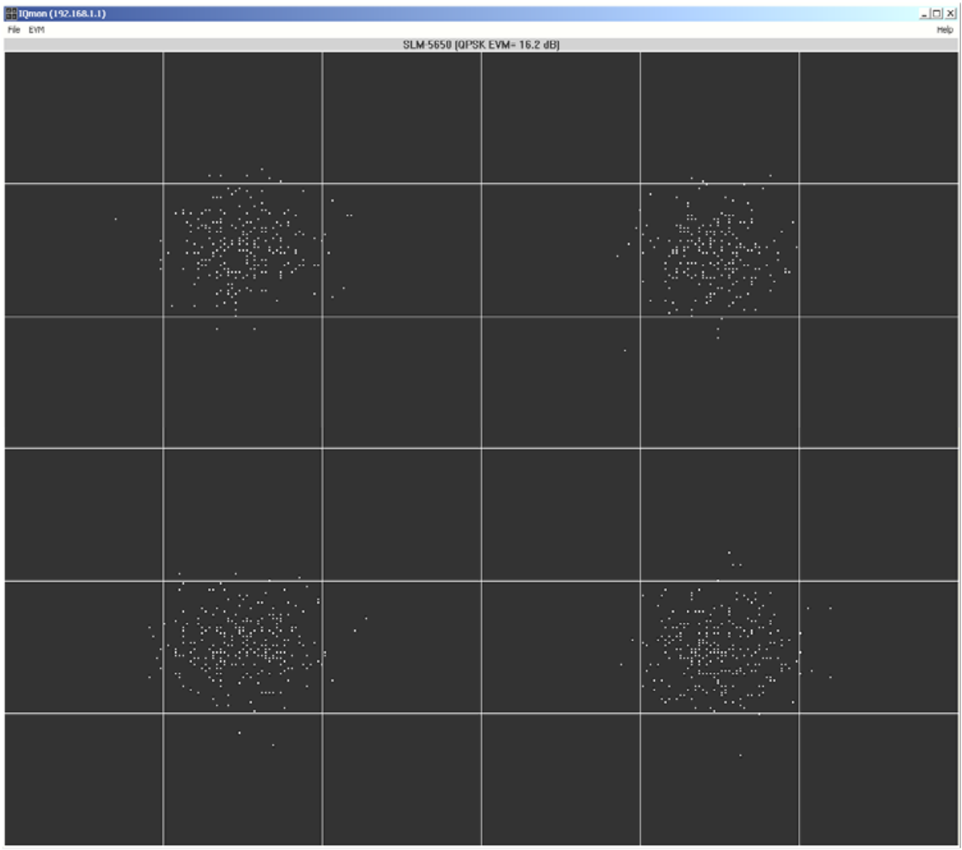


Figure A-3. Typical Output Spectrum – Without Noise

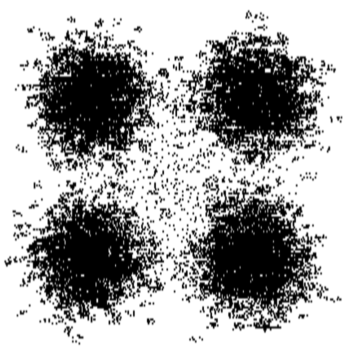
A.2.3 Demodulator Checkout

Use the following procedure for demodulator checkout:

Step	Procedure
1	Set up the equipment as shown in **Figure A-1** using the 70/140 MHz IF interface.
2	Set up the modem with an external IF loop and level. Use a properly operating modulator, and ensure that power levels, data rates, code rates, etc. are compatible.
3	Allow the modem to lock up. a. Depending on the data rate and overhead type, lock-up may take several seconds. b. When the GREEN IF and Data Lock LED are ON and any fault has been cleared (where applicable), the modem will run at the specified error rate. c. Run the Rx power level (input amplitude) over the full range and offset the Tx frequency from the nominal Rx frequency by up to ±30 kHz. d. Ensure the modem still runs within the specified error rate.
4	Set up the modem to check the constellation by hooking an oscilloscope that is set in the X-Y mode to J9 pins 3 and 8. An alternative method is to use a computer and the IQ Mon program with an Ethernet connection to the modem. Typical constellation patterns are shown with noise (**Figure A-4**) and without noise (**Figure A-5**).

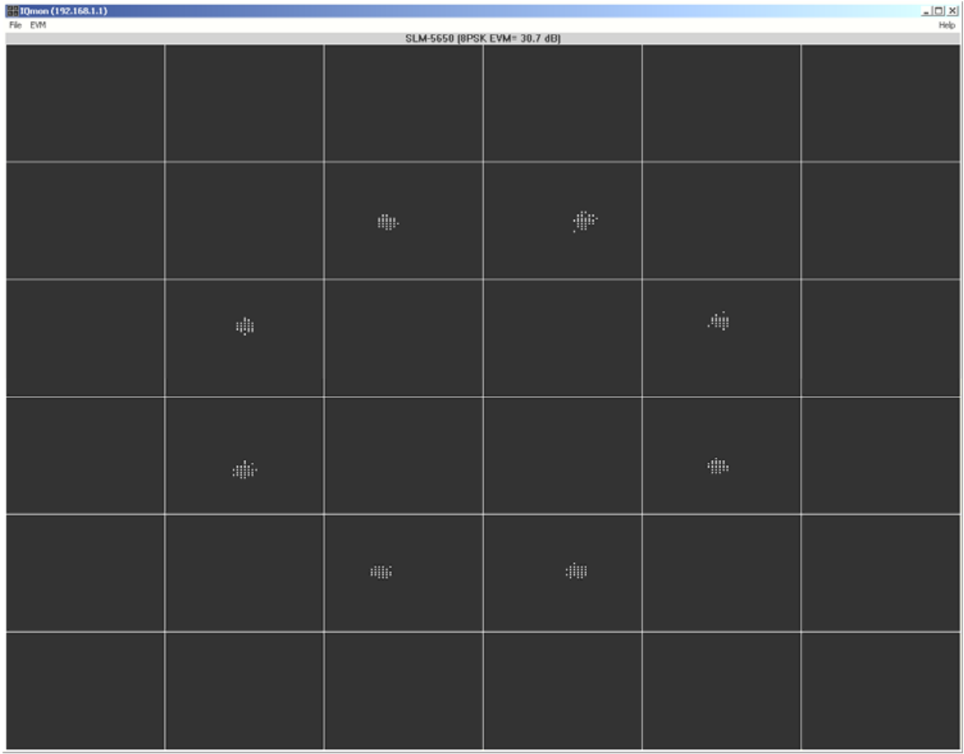


PC version IQ monitor with noise

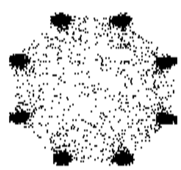


Oscilloscope WITH NOISE

Figure A-4. Typical Constellation Patterns – With Noise



PC version IQ monitor WITHOUT NOISE



Oscilloscope WITHOUT NOISE

Figure A-5. Typical Constellation Patterns – Without Noise

A.3 Fault Isolation

The design of the modem allows for removal and replacement of some faulty components in the field. The optional interface PCB's can be removed from the modem through the rear panel, without requiring special tools. The TURBO PCB and power supply can be replaced if the top cover is removed.

CAUTION

This equipment contains parts and assemblies sensitive to damage by ESD. Use ESD precautionary procedures when touching, removing, or inserting PCBs.

The fault monitoring capability of the modem assists the operator in determining which PCB has failed. If possible, replace the faulty PCB and return the damaged board to the Comtech EF Data Customer Support Department for repair. If not, return the complete modem.

The fault isolation procedure lists the following categories of faults or alarms:

- Modulator
- Demodulator
- Transmit Interface
- Receive Interface
- Unit (Common Equipment)

Notes:

1. Each fault or alarm category includes possible problems and the appropriate action required to repair the modem.
2. If any of the troubleshooting procedures mentioned earlier in this chapter do not isolate the problem, and Comtech EF Data Customer Support assistance is necessary, have the following information available for the representative:
    - Modem configuration. Modem configuration includes the modulator, demodulator, interface, or local AUPC sections.
    - Faults (active or stored).

A.4 System Faults/Alarms

System faults are reported in **Monitor: Alarms** from the front panel menu, and stored faults are reported in the **Monitor: Event-Log** menu. To determine the appropriate action for repairing the modem, refer to **Table A-2** and the list of possible problems.

Table A-2. SLM-5650A Fault Tree

FAULT TYPE		TX IF OUTPUT OFF	TX STATUS LED	TX FAULT RELAY (1)	RX STATUS LED	RX FAULT RELAY (2)	UNIT STATUS LED	UNIT FAULT RELAY (3)	AUDIBLE ALARM	TX AIS	RX AIS
MODULATOR FAULTS	NONE		GREEN								
	MOD SYMBOL CLOCK PLL	X	RED	X					X	X	
	MOD SYNTHESIZER PLL	X	RED	X					X	X	
	MOD I/Q ACTIVITY	X	RED	X					X	X	
	MOD FILTER CLIPPING	X	RED	X					X	X	
	TX INTERFACE CLOCK PLL		RED	X					X	X	
	TX INTF CLOCK ACTIVITY		ORANGE	X						X	
	TX INTERFACE SCT PLL		RED	X					X	X	
	TX INTERFACE DATA AIS		ORANGE	X							
DEMODULATOR FAULTS	NONE				GREEN						
	DEMOD CARRIER LOCK				RED	X			X		X
	DEMOD DECODER LOCK				RED	X			X		X
	DEMOD SYNTHESIZER PLL				RED	X			X		X
	DEMOD I/Q ACTIVITY				RED	X			X		X
	DEMUX LOCK				RED	X			X		X
	BUFFER				RED	X			X		X
	BUFFER FILL				ORANGE	X					
	BUFFER OVERFLOW				ORANGE	X					
	BUFFER UNDERFLOW				ORANGE	X					
	BUFFER PLL				RED	X			X		X
	BUFFER CLK REF ACTIVITY				ORANGE	X					
	RX INTERFACE DATA AIS				ORANGE	X					
	Eb/No THRESHOLD				ORANGE	X					
	BERT SYNC LOSS				ORANGE	X					
UNIT FAULTS	NONE	X					GREEN				

FAULT TYPE		TX IF OUTPUT OFF	TX STATUS LED	TX FAULT RELAY (1)	RX STATUS LED	RX FAULT RELAY (2)	UNIT STATUS LED	UNIT FAULT RELAY (3)	AUDIBLE ALARM	TX AIS	RX AIS
	+5.0V POWER	X					RED	X	X		
	+3.3V POWER	X					RED	X	X		
	+2.5V POWER	X					RED	X	X		
	+1.5V POWER	X					RED	X	X		
	+12V POWER	X					RED	X	X		
	-12V POWER	X					RED	X	X		
	+18V POWER	X					RED	X	X		
	COOLING FAN						RED	X	X		
	EXTERNAL REF ACTIVITY						ORANGE	X	X		
	192 MHZ CLOCK PLL	X					RED	X	X		
	10 MHZ REF PLL	X					RED	X	X		
	M&C FPGA CONFIG	X					RED	X	X		
	MOD FPGA CONFIG	X					RED	X	X		
	DEMOD FPGA CONFIG						RED	X	X		
	DECODER FPGA CONFIG						RED	X	X		
	TX INTF FPGA CONFIG	X					RED	X	X		
	RX INTF FPGA CONFIG						RED	X	X		
	FEC #1 FPGA CONFIG	X**					RED	X	X		
	FEC #2 FPGA CONFIG	X**					RED	X	X		
	OPTION CARD FPGA CONFIG						RED	X	X		
	FPGA DCM phase Lock Loop Fault						RED	X	X		
	NP MAILBOX COMM ERROR						RED	X	X		
	TRANSEC MAILBOX COMM ERROR						RED	X	X		

Legend		
Test Note	**Fault/Alarm Relay**	**Test Points Connector/Pins**
1	TX FAULT	J8/Pin 2 (NO), 1 (COM), 6 (NC) ****
2	RX FAULT	J8/Pin 5 (NO), 4 (COM), 9 (NC) ****
3	UNIT FAULT	J8/Pin 8 (NO), 7 (COM), 3 (NC) ****
**	The IF output is only affected if that particular FEC card is currently passing traffic.	
****	A connection between the common and N.O. contacts indicate no fault/alarm.	

A.5 LED Display and Description

Note: For complete information on the front panel LEDs display, description, and function, see **Chapter 5. FRONT PANEL OPERATION**.

The ten LEDs located on the modem's front panel indicate status, fault, and alarm information.

COLOR	LED STATUS
GREEN	A **GREEN** COLOR indicates no faults or alarms currently exist.
ORANGE	A **ORANGE** COLOR indicates an alarm currently exists. It is stored in the Event Log memory.
RED	A **RED** COLOR indicates a fault currently exists. It is stored in the Event Log memory.

A total of 255 occurrences of any fault can be stored. Each fault or stored fault indicated by a front panel LED could be one of many faults. Use the Fault or Stored Fault front panel menu to determine which fault has occurred.

Alarms are considered minor faults. Alarms are shown in the Fault or Stored Fault front panel menu by a reversed-contrast "+" that appears at the display panel (white on black).

LED	Description
Tx On	Modulator output status. If illuminated, output is turned on.
IF LOCK	Demodulator Carrier Detect. If illuminated, the carrier is locked
DATA LOCK	Decoder Data lock. If illuminated, the decoder is locked.
REMOTE	Modem remote control status. If the LED is **green**, the modem is in remote control; if **off**, the modem is in local control.
TEST MODE	Modem test mode indicator. If illuminated, a test mode is enabled.

Appendix B. OPERATIONS GUIDE

B.1 Overview

This appendix provides a reference guide for the end user for the following operation parameters:

- Operation Mode Data Rate Ranges
- Clocking Options
- Buffering

B.2 Modes

The following tables show the data rate ranges available for various modes.

Table B-1. OM-73 Mode

Modulation Type	Data Rate (kbps)		Symbol Rate (ksps)	
	Min	Max	Min	Max
BPSK 1/1	64	8472	64	10000
BPSK 1/2	64	15000	128	30000
BPSK 3/4	64	22500	85.333	29999.999
BPSK 7/8	64	26250	73.142	30000
QPSK 1/1	64	20000	32	10000
QPSK 1/2	64	30000	64	30000
QPSK 3/4	64	45000	42.666	30000
QPSK 7/8	64	51840	36.571	29622.857
OQPSK 1/1	64	20000	32	10000
OQPSK 1/2	64	30000	64	30000
OQPSK 3/4	64	45000	42.666	30000
OQPSK 7/8	64	51840	36.571	29622.857

Table B-2. MIL-STD-188-165A Mode

Modulation Type	R-S Code Word	R-S Depth	Data Rate (kbps)		Symbol Rate (ksps)	
			Min	Max	Min	Max
BPSK 1/1	Off	N/A	64	8472	64	10000
BPSK 1/2	Off	N/A	64	15000	128	30000
BPSK 3/4	Off	N/A	64	22500	85.333	29999.999
BPSK 7/8	Off	N/A	64	26250	73.142	30000
QPSK 1/1	Off	N/A	64	20000	32	10000
QPSK 1/2	Off	N/A	64	30000	64	30000
QPSK 3/4	Off	N/A	64	45000	42.666	30000
QPSK 7/8	Off	N/A	64	51840	36.571	29622.857
OQPSK 1/1	Off	N/A	64	20000	32	10000
OQPSK 1/2	Off	N/A	64	30000	64	30000
OQPSK 3/4	Off	N/A	64	45000	42.666	30000
OQPSK 7/8	Off	N/A	64	51840	36.571	29622.857
8-PSK 2/3	Off	N/A	256	51840	128	25920
8-PSK 5/6	Off	N/A	256	51840	102.4	20736
BPSK 1/2	126,112	4, 8	64	13333.333	144	29999.999
	219,201			13767.123	139.462	
	225,205			13666.666	140.487	29999.998
	220,200			13636.363	140.8	29999.999
BPSK 3/4	126,112	4, 8	64	20000	96	30000
	219,201			20650.684	92.975	29999.998
	225,205			20500	93.658	29999.999
	220,200			20454.545	93.867	
BPSK 7/8	126,112	4, 8	64	23333.333	82.826	30000
	219,201			24092.465	79.692	29999.999
	225,205			23916.666	80.278	29999.999
	220,200			23863.636	80.457	30000
QPSK 1/2	126,112	4, 8	64	26666.666	72	29999.999
	219,201			27534.246	69.371	
	225,205			27333.333	70.243	
	220,200			27272.727	70.4	30000
QPSK 3/4	126,112	4, 8	64	40000	48	30000
	219,201			41301.369	46.487	29999.999
	225,205			41000	46.829	30000
	220,200			40909.090	46.933	
QPSK 7/8	126,112	4, 8	64	46666.666	41.143	30000
	219,201			48184.931	39.846	29999.999
	225,205			47833.333	40.139	
	220,200			47727.272	40.229	30000
OQPSK 1/2	126,112	4, 8	64	26666.666	72	29999.999
	219,201			27534.246	69.371	
	225,205			27333.333	70.243	
	220,200			27272.727	70.4	30000
OQPSK 3/4	126,112	4, 8	64	40000	48	30000
	219,201			41301.369	46.487	29999.999

Modulation Type	R-S Code Word	R-S Depth	Data Rate (kbps) Min	Data Rate (kbps) Max	Symbol Rate (ksps) Min	Symbol Rate (ksps) Max
	225,205			41000	46.829	30000
	220,200			40909.090	46.933	
OQPSK 7/8	126,112	4, 8	64	46666.666	41.143	30000
	219,201			48184.931	39.846	29999.999
	225,205			47833.333	40.139	
	220,200			47727.272	40.229	30000
8-PSK 2/3	126,112	4, 8	256	51840	144	29160
	219,201				139.462	28241.194
	225,205				140.487	28448.78
	220,200				140.8	28512
8-PSK 5/6	126,112	4, 8	256	51840	115.2	23328
	219,201				111.57	22592.955
	225,205				112.39	22759.024
	220,200				112.64	22809.6

Table B-3. MIL-STD-188-165A Mode – Sequential

Modulation Type	R-S Code Word	R-S Depth	Data Rate (kbps)		Symbol Rate (ksps)	
			Min	Max	Min	Max
BPSK 1/2	OFF	N/A	64	1067	128	2134
	126/112	4/8		1171	144	2634.750
	219,201			1171	139.463	2551.731
	225,205			1171	140.488	2570.488
	220,200			1171	140.800	2576.200
QPSK 1/2	OFF	N/A	64	2500	64	2500
	126/112	4/8		2222.222	72	
	219,201			2294.520	69.731	
	225,205			2277.777	70.243	
	220,200			2272.727	70.400	
QPSK 3/4	OFF	N/A	64	3750	42.667	2500
	126/112	4/8		3333.333	48	
	219,201			3441.780	46.487	
	225,205			3416.666	46.829	
	220,200			3409.090	46.933	
QPSK 7/8	OFF	N/A	64	4375	36.571	2500
	126/112	4/8		3888.888	41.142	
	219,201			4015.410	39.846	
	225,205			3986.111	40.139	
	220,200			3977.272	40.228	
OQPSK 1/2	OFF	N/A	64	2500	64	2500
	126/112	4/8		2222.222	72	
	219,201			2294.520	69.731	
	225,205			2277.777	70.243	
	220,200			2272.727	70.400	
OQPSK 3/4	OFF	N/A	64	3750	42.667	2500
	126/112	4/8		3333.333	48	
	219,201			3441.780	46.487	
	225,205			3416.666	46.829	
	220,200			3409.090	46.933	
OQPSK 7/8	OFF	N/A	64	4375	36.571	2500
	126/112	4/8		3888.888	41.142	
	219,201			4015.410	39.846	
	225,205			3986.111	40.139	
	220,200			3977.272	40.228	

Table B-4. IESS-308 Mode – Standard Higher Rates

Modulation Type	Overhead	R-S Code Word	R-S Depth	Data Rate (kbps)	Symbol Rate (ksps)
QPSK 1/2	IESS-308	Off	N/A	1544	1640
				2048	2144
				6312	6408
				8448	8544
		194,178	4, 8, 16	1544	1778.787
				2048	2328.09
				6312	6975.371
				8448	9303.371
		219,201	4, 8, 16	1544	1778.269
				2048	2327.403
				6312	6973.254
				8448	9300.537
		225,205	4, 8, 16	1544	1790.634
				2048	2343.805
				6312	7023.805
				8448	9368.195
		126,112	4, 8, 16	1544	1833
				2048	2400
				6312	7197
				8448	9600
		208,192	4, 8, 16	1544	1776.708
				2048	2325.333
				6312	6966.875
				8448	9292
QPSK 3/4	IESS-308	Off	N/A	1544	1029.333
				2048	1365.333
				6312	4208
				8448	5632
				32064	21376
				34368	22912
				44736	29824
		194,178	4, 8, 16	1544	1217.858
				2048	1584.06
				6312	4682.247
				8448	6324.247
				32064	23393.438
				34368	25067.506
		219,201	4, 8, 16	1544	1217.512
				2048	1583.602
				6312	4680.836
				8448	6232.358
				32064	23386.269
				34368	25059.821
		225,205	4, 8, 16	1544	1225.756
				2048	1594.537
				6312	4714.537
				8448	6277.463
				32064	23557.463
				34368	25243.317
				1544	1254
				2048	1632
		126,112	4, 8, 16	6312	4830
		126,112	4, 8, 16	8448	6432
				32064	24144
				34368	25872
				1544	1216.472

Modulation Type	Overhead	R-S Code Word	R-S Depth	Data Rate (kbps)	Symbol Rate (ksps)
		208,192	4, 8, 16	2048	1582.222
				6312	4676.583
		208,192	4, 8, 16	8448	626.667
				32064	23364.667
QPSK 3/4	IESS-308			34368	25036.667
QPSK 7/8	IESS-308	Off	N/A	1544	882.286
				2048	1170.286
				6312	3606.857
				8448	4827.428
				32064	20040.571
				34368	21473.714
				44736	27922.857
		194,178	4, 8, 16	1544	1057.592
				2048	1371.48
				6312	4027.069
				8448	5357.355
				32064	20065.233
				34368	21500.148
				44736	27957.265
		219,201	4, 8, 16	1544	1057.296
				2048	1371.087
				6312	4025.859
				8448	5355.736
				32064	20059.087
				34368	21493.561
				44736	27948.691
		225,205	4, 8, 16	1544	1064.362
				2048	1380.46
				6312	4054.743
				8448	5394.397
				32064	20205.826
				34368	26150.843
				44736	28153.422
		126,112	4, 8, 16	1544	1088.571
				2048	1412.571
				6312	4153.714
				8448	5526.857
				32064	20708.571
				34368	22189.714
				44736	28854.857
		208,192	4, 8, 16	1544	1056.405
				2048	1369.905
				6312	4022.214
				8448	5350.857
				32064	20040.571
				34368	21473.714
				44736	27922.857

Table B-5. IESS-308 Mode - Extended

Modulation Type	Overhead	R-S Code Word	R-S Depth	Data Rate (kbps)		Symbol Rate (ksps)	
				Min	Max	Min	Max
QPSK 1/2	None	Off	N/A	64	30000	64	30000
		126,112	4, 8, 16		26666.666	72	29999.999
		219,201			27534.246	69.371	29999.999
		194,178			27525.773	69.573	30000
		225,205			27333.333	70.243	29999.999
		208,192			27559.809	69.667	30000
	IESS-309	Off	N/A		8448	68.267	9011.2
		126,112	4, 8, 16			76.8	10137.6
		194,178				74.403	9821.196
		225,205				74.927	9890.341
		208,192				74.311	9809.067
QPSK 3/4	None	Off	N/A	64	45000	42.666	30000
		126,112	4, 8, 16		40000	48	30000
		219,201			41301.369	46.487	29999.999
		194,178			41288.65	46.502	30000
		225,205			41000	46.829	30000
		208,192			41339.713	46.444	30000
	IESS-309	Off	N/A		8448	45.511	6007.467
		126,112	4, 8, 16			51.2	6758.4
		219,201				49.587	6545.449
		194,178				49.602	6547.464
		225,205				49.951	6593.561
		208,192				49.541	6539.378
QPSK 7/8	None	Off	N/A	64	51840	36.571	29622.857
		126,112	4, 8, 16		46666.666	41.143	30000
		219,201			48184.931	39.846	29999.999
		194,178			48170.103	38.859	30000
		225,205			47833.333	40.139	29999.999
		208,192			48229.665	39.81	29999.999
	IESS-309	Off	N/A		8448	39.01	4827.428
		126,112	4, 8, 16			43.886	5792.914
		219,201				42.503	5610.385
		194,178				42.516	5612.112
		225,205				42.818	5561.624
		208,192				42.463	5604.181
OQPSK 1/2	None	Off	N/A	64	30000	64	30000
		126,112	4, 8, 16		26666.666	72	29999.999
		219,201			27534.246	69.371	29999.999
		194,178			27525.773	69.573	30000
		225,205			27333.333	70.243	29999.999
		208,192			27559.809	69.667	30000
	IESS-309	Off	N/A		8448	68.267	901.2
		126,112	4, 8, 16			76.8	10137.6
		219,201				74.38	9818.173
		194,178				74.403	9821.196
		225,205				74.927	9890.341
		208,192				74.311	9809.067
OQPSK 3/4	None	Off	N/A	64	20000	42.666	30000
		126,112	4, 8, 16		40000	48	30000
		219,201			41301.369	46.487	29999.999
		194,178			41288.65	46.502	30000
		225,205			41000	46.829	30000
		208,192			41339.713	46.444	30000
	IESS-309	Off	N/A		8448	45.511	6007.467
		126,112	4, 8, 16		8448	51.2	6758.4
		219,201			8448	49.587	6545.449
		194,178			8448	49.602	6547.464
		225,205			8448	49.951	6593.561
		208,192			8448	49.541	6539.378

Modulation Type	Overhead	R-S Code Word	R-S Depth	Data Rate (kbps)		Symbol Rate (ksps)	
				Min	Max	Min	Max
OQPSK 7/8	None	Off	N/A	64	20000	36.571	29622.857
		126,112	4, 8, 16		46666.666	41.143	30000
		219,201			48184.931	39.846	29999.999
		194,178			48170.103	38.859	30000
		225,205			47833.333	40.139	29999.999
		208,192			48229.665	39.81	29999.999
	IESS-309	Off	N/A		8448	39.01	4827.428
		126,112	4, 8, 16			43.886	5792.914
		219,201				42.503	5610.385
		194,178				42.516	5612.112
		225,205				42.818	5561.624
		208,192				42.463	5604.181

Table B-6. IESS-309 Mode – Extended (Closed Network)

Modulation Type	Overhead	R-S Code Word	R-S Depth	Data Rate (kbps)		Symbol Rate (ksps)	
				Min	Max	Min	Max
BPSK 1/2	None	Off	N/A	64	15000	128	30000
		219,201	4, 8, 16		13767.123	139.462	29999.999
	IESS-309	Off	N/A		8448	136.533	18022.4
		219,201	4, 8, 16		8448	148.76	19636.346
BPSK 3/4	None	Off	N/A	64	22500	85.333	29999.999
		219,201	4, 8, 16		20650.684	92.975	29999.999
	IESS-309	Off	N/A		8448	91.022	12014.933
		219,201	4, 8, 16		8448	99.173	13090.898
QPSK 1/2	None	Off	N/A	64	30000	64	30000
		219,201	4, 8, 16		27534.246	69.371	29999.999
	IESS-309	Off	N/A		8448	68.267	9011.2
		219,201	4, 8, 16		8448	74.38	9818.173
QPSK 3/4	None	Off	N/A	64	20000	42.666	30000
		219,201	4, 8, 16		41301.369	46.487	29999.999
	IESS-309	Off	N/A		8448	45.511	6007.467
		219,201	4,8, 16		8448	49.587	6545.449
OQPSK 1/2	None	Off	N/A	64	30000	64	30000
		219,201	4, 8, 16		27534.246	69.371	29999.999
	IESS-309	Off	N/A		8448	68.267	9011.2
		219,201	4, 8, 16		8448	74.38	9818.173
OQPSK 3/4	None	Off	N/A	64	20000	42.666	30000
		219,201	4, 8, 16		41301.369	46.487	29999.999
	IESS-309	Off	N/A		8448	45.511	6007.467
		219,201	4, 8, 16		8448	49.587	6545.449

Table B-7. IESS-310 Mode – Extended Rates

Modulation Type	Overhead	R-S Code Word	R-S Depth	Data Rate (kbps)	Symbol Rate (ksps)
8-PSK 2/3	None	219,201	4, 8, 16	256	139.463
				51840	28241.194
	IESS-309			256	148.76
				8448	4909.087
				1544	937.134
				2048	1211.701
				6312	3534.627
				8448	4698.269
				32064	17563.701
				34368	18818.866
				44736	24467.104

Table B-8. Turbo Code Mode

Modulation Type	Data Rate (kbps)		Symbol Rate (ksps)	
	Min	Max	Min	Max
BPSK 21/44	64	30545.454	134.095	63999.999
BPSK 5/16	64	20000	204.8	64000
QPSK 17/18	64	120888.888	33.882	63999.999
QPSK 21/44	64	61090.909	67.047	63999.999
QPSK 3/4	64	96000	42.666	64000
QPSK 7/8	64	112000	36.571	64000
OQPSK 17/18	64	120888.888	33.882	63999.999
OQPSK 21/44	64	61090.909	67.047	63999.999
OQPSK 3/4	64	96000	42.666	64000
OQPSK 7/8	64	112000	36.571	64000
8-PSK 17/18	256	155520	90.352	54889.411
8-PSK 3/4	256	144000	113.777	64000
8-PSK 7/8	256	155520	97.523	59245.714
16-QAM 3/4	256	155520	85.333	51840
16-QAM 7/8	256	155520	73.143	44434.285

Table B-9. 16-QAM Mode

<table>
<tr><th rowspan="2">Modulation Type</th><th rowspan="2">R-S Code Word</th><th rowspan="2">R-S Depth</th><th colspan="2">Data Rate (kbps)</th><th colspan="2">Symbol Rate (ksps)</th></tr>
<tr><th>Min</th><th>Max</th><th>Min</th><th>Max</th></tr>
<tr><td rowspan="3">16-QAM 3/4</td><td>None</td><td>None</td><td rowspan="3">256</td><td rowspan="3">51840</td><td>85.333</td><td>17280</td></tr>
<tr><td>219,201</td><td rowspan="2">4, 8, 16</td><td>92.975</td><td>18827.462</td></tr>
<tr><td>208,192</td><td>92.889</td><td>18810</td></tr>
<tr><td rowspan="3">16-QAM 7/8</td><td>None</td><td>None</td><td rowspan="3">256</td><td rowspan="3">51840</td><td>73.143</td><td>14811.428</td></tr>
<tr><td>219,201</td><td rowspan="2">4, 8, 16</td><td>79.692</td><td>16137.825</td></tr>
<tr><td>208,192</td><td>79.619</td><td>16122.857</td></tr>
</table>

Note: 16-QAM 3/4 requires Reed-Solomon to be **ON** in order to automatically resolve data ambiguities.

Table B-10. AUPC Mode

Modulation Type	R-S Code Word	R-S Depth	Data Rate (kbps)		Symbol Rate (ksps)	
			Min	Max	Min	Max
BPSK 1/1	OFF	N/A	64	7942.500	68.266	8472
BPSK 1/2	OFF	N/A	64	14062.500	136.533	30000
BPSK 3/4	OFF	N/A	64	21093.750	91.022	30000
BPSK 7/8	OFF	N/A	64	24609.375	78.019	30000
QPSK 1/1	OFF	N/A	64	18750	34.133	10000
QPSK 1/2	OFF	N/A	64	28125	68.266	30000
QPSK 3/4	OFF	N/A	64	42187.500	45.511	30000
QPSK 7/8	OFF	N/A	64	49218.750	39.009	30000
OQPSK 1/1	OFF	N/A	64	18750	34.133	10000
OQPSK 1/2	OFF	N/A	64	28125	68.266	30000
OQPSK 3/4	OFF	N/A	64	42187.500	45.511	30000
OQPSK 7/8	OFF	N/A	64	49218.750	39.009	30000
8PSK 2/3	OFF	N/A	64	51840	136.533	27648
8PSK 5/6	OFF	N/A	64	51840	109.226	22118.400
16QAM 3/4	OFF	N/A	64	51840	91.022	18432
16QAM 7/8	OFF	N/A	64	51840	78.019	15798.857
BPSK 1/2	225,205	8	256	12812.500	149.853	30000
BPSK 3/4	225,205	8	256	19218.750	99.902	30000
BPSK 7/8	225,205	8	256	22421.875	85.630	30000
QPSK 1/2	225,205	8	256	25625	74.926	30000
QPSK 3/4	225,205	8	256	38437.500	49.951	30000
QPSK 7/8	225,205	8	256	44843.750	42.815	30000
OQPSK 1/2	225,205	8	256	25625	74.926	30000
OQPSK 3/4	225,205	8	256	38437.500	49.951	30000
OQPSK 7/8	225,205	8	256	44843.750	42.815	30000
8PSK 2/3	225,205	8	256	51250	149.853	30000
8PSK 5/6	225,205	8	256	51840	119.882	24276.292
16QAM 3/4	225,205	8	256	51840	99.902	20230.243
16QAM 7/8	225,205	8	256	51840	85.630	17340.209

Table B-11. AUPC Mode - Sequential

Modulation Type	R-S Code Word	R-S Depth	Data Rate (kbps)		Symbol Rate (ksps)	
			Min	Max	Min	Max
BPSK 1/2	OFF	N/A	64	1171	136.533	2498.133
QPSK 1/2	OFF	N/A	64	2048	68.266	2184.533
QPSK 3/4	OFF	N/A	64	2048	45.511	1456.355
QPSK 7/8	OFF	N/A	64	2048	39.009	1248.304
OQPSK 1/2	OFF	N/A	64	2048	68.266	2184.533
OQPSK 3/4	OFF	N/A	64	2048	45.511	1456.355
OQPSK 7/8	OFF	N/A	64	2048	39.009	1248.304
BPSK 1/2	225,205	8	64	1067	149.853	2498.341
QPSK 1/2	225,205	8	64	2048	74.926	2397.658
QPSK 3/4	225,205	8	64	2048	49.951	1598.439
QPSK 7/8	225,205	8	64	2048	42.815	1370.09
OQPSK 1/2	225,205	8	64	2048	74.926	2397.658
OQPSK 3/4	225,205	8	64	2048	49.951	1598.439
OQPSK 7/8	225,205	8	64	2048	42.815	1370.09

Table B-12. AUPC Mode - Turbo

Modulation Type	Data Rate (kbps)		Symbol Rate (ksps)	
	Min	Max	Min	Max
BPSK 21/44	64	13423.295	143.034	29999.998
BPSK 5/16	64	8789.062	218.453	29999.998
QPSK 17/18	64	51840	36.141	29274.352
QPSK 21/44	64	26846.590	71.517	29999.998
QPSK 3/4	64	42187.500	45.511	30000
QPSK 7/8	64	49218.750	39.009	30000
OQPSK 17/18	64	51840	36.141	29274.352
OQPSK 21/44	64	26846.590	71.517	29999.998
OQPSK 3/4	64	42187.500	45.511	30000
OQPSK 7/8	64	49218.750	39.009	30000
8PSK 17/18	256	51840	96.376	19516.235
8PSK 3/4	256	51840	121.362	24576
8PSK 7/8	256	51840	104.025	21065.142
16QAM 3/4	256	51840	91.022	18432
16QAM 7/8	256	51840	78.019	15798.857

B.3 Clocking Options

Clocking of the data from the terrestrial equipment to the satellite (and vice versa) will depend on the application. This section describes the most common options and recommended configurations.

SCT (INTERNAL) clock no longer applies when the modem has loop timing on. The TX clock source is now recovered from the RX satellite data. This recovered clock is put out on the ST line and is used to clock the terrestrial equipment. The transmit terrestrial clock is now essentially the same as the RX satellite clock, except that it has been buffered by the terrestrial equipment.

Select **TX TERRESTRIAL** for the TX clock source when in loop timing, if the user equipment is being slaved off the modem.

B.3.1 IDR/IBS G.703 Master/Master

Use this application when both earth stations have high stability clocks and the received data is to be clocked to the local network. Refer to **Figure B-1** for:

- Clocking block diagram
- Transmit clock options
- Buffer clock options

The disadvantage of the master/master application is that the receive data will slip, as the clocks will not be synchronized. If the buffer is properly set up, the slips will be an exact frame length, causing minimum loss of data. By using very high stability clocks, the expected time between slips can be several days.

Loss of the buffer clock will mean the buffer will not be emptied and data will not be available. The buffer clock will normally revert to the low stability internal reference automatically.

B.3.2 IDR/IBS G.703 Master/Slave

Use this application when the far end earth station does not have local access to a high stability reference clock, or when it is not required to synchronize with a local clock. Refer to **Figure B-2** for:

- Clocking block diagram
- Transmit clock options
- Buffer clock options for using external loop timing

Modem loop timing does not apply for G.703 operation. The terrestrial equipment must select loop timing to recover the clock off the receive data and use that recovered clock for the transmit data.

The disadvantage of the master/slave application is that the signal received at the slave station is subject to Doppler shift. The length of the buffer at the master end will need to be twice the length that is normally required, compensating for the Doppler shift on the outward and return paths.

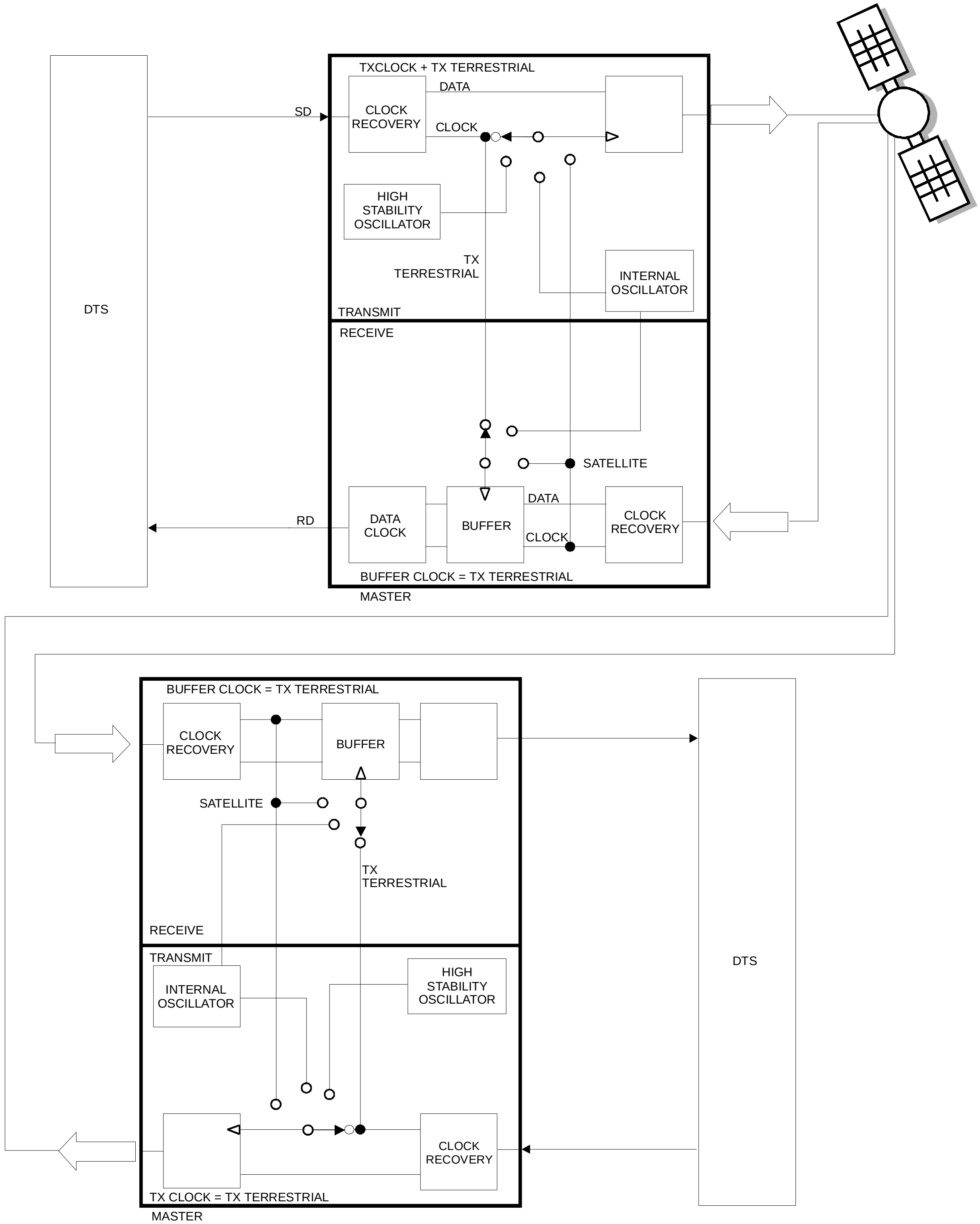


Figure B-1. IDR/IBS G.703 Master/Master Clocking Diagram

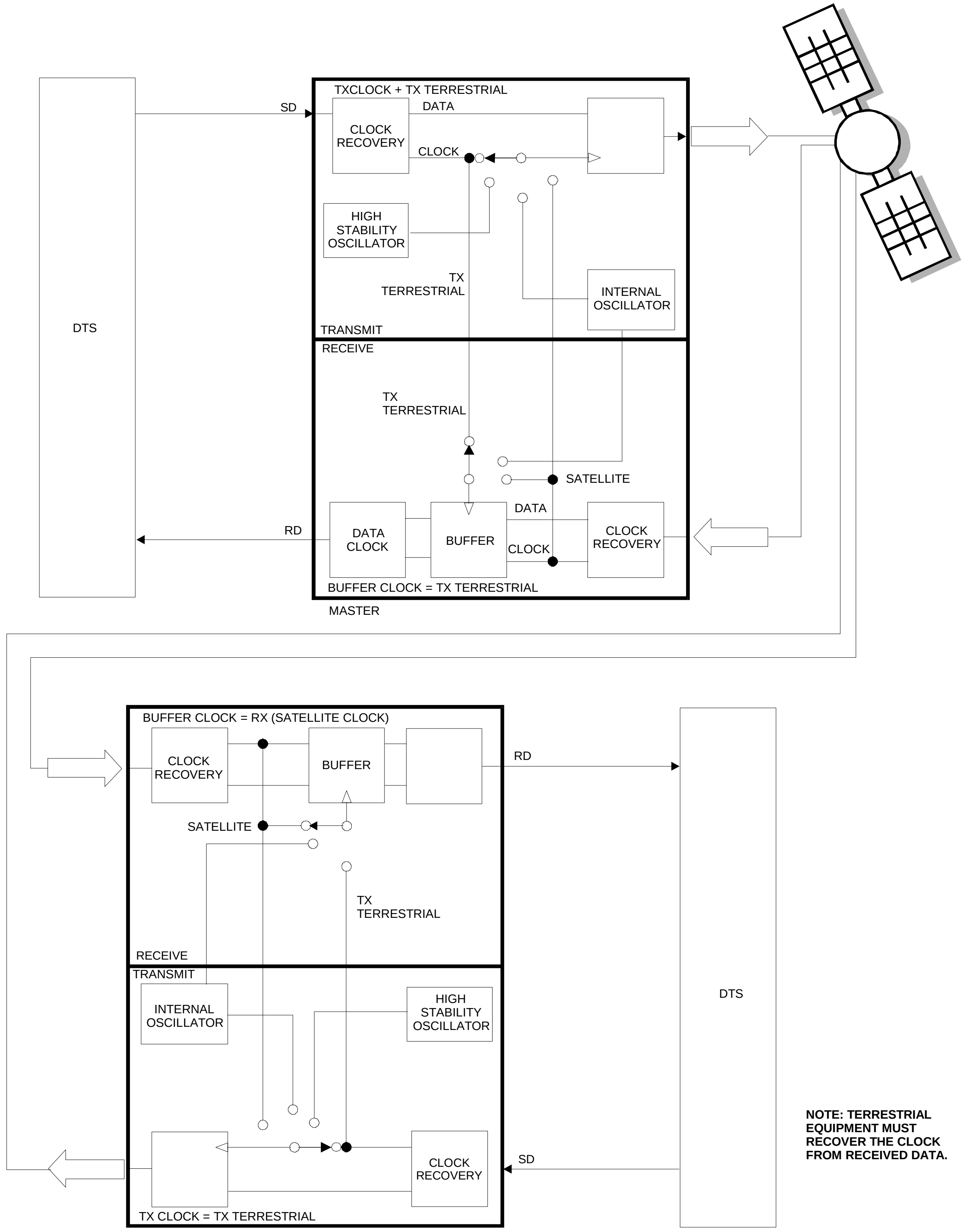


Figure B-2. IDR/IBS G.703 Master/Slave Clocking Diagram

B.4 Buffering

There are two reasons for a receive buffer:

1. Plesiochronous buffering of two dissimilar clock frequencies (normally the far end transmit clock verses the local network clock). The clocks may be very close in frequency to each other and will normally slip at a constant rate. **Figure B-3** shows plesiochronous operation for dissimilar clocks. If incoming traffic is too fast, an occasional bit will be lost. If incoming traffic is too slow, an occasional bit will be repeated.

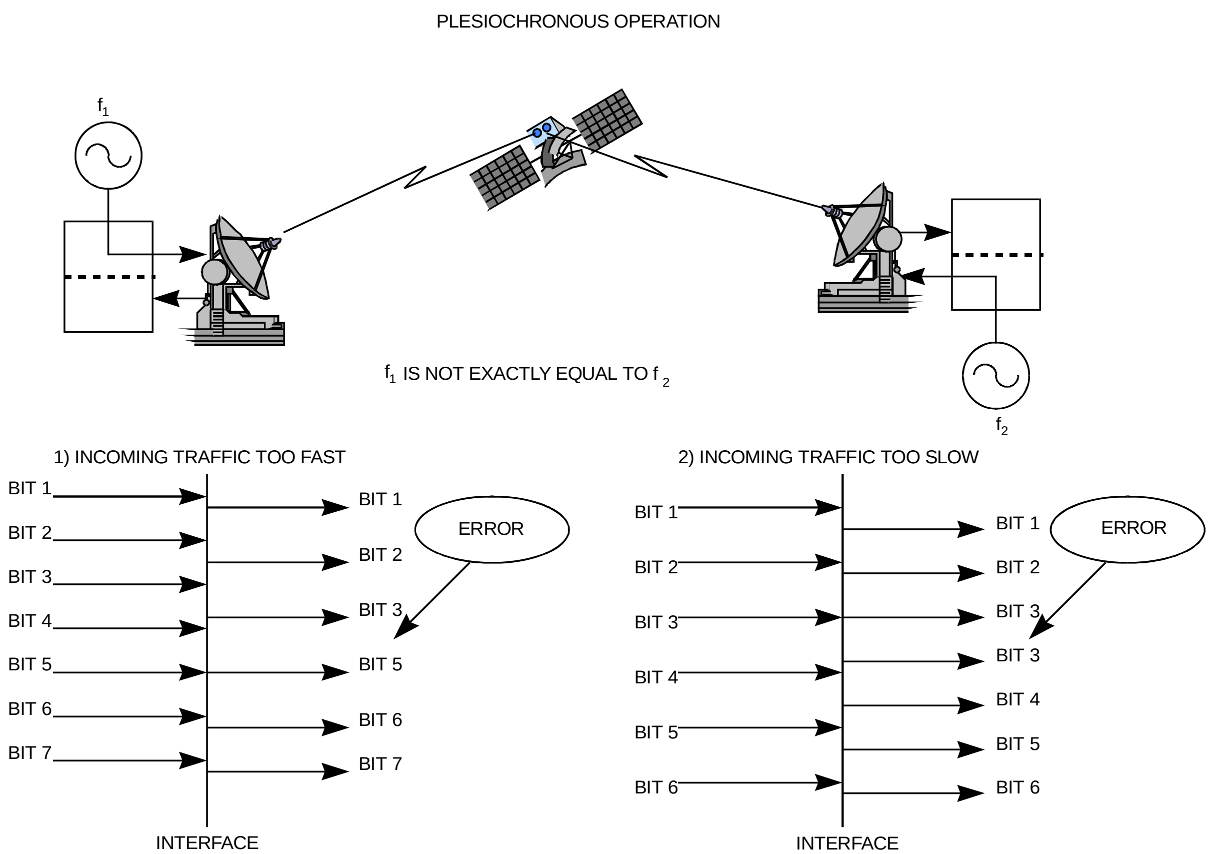


Figure B-3. Clock Slip

2. Doppler buffer of the signal of the satellite. The Doppler shift results from the "Figure 8" station keeping movement performed by the satellite in space over a period of one day (**Figure B-4**). Doppler shift should not result in a clock slip, as the buffer will constantly fill and empty.

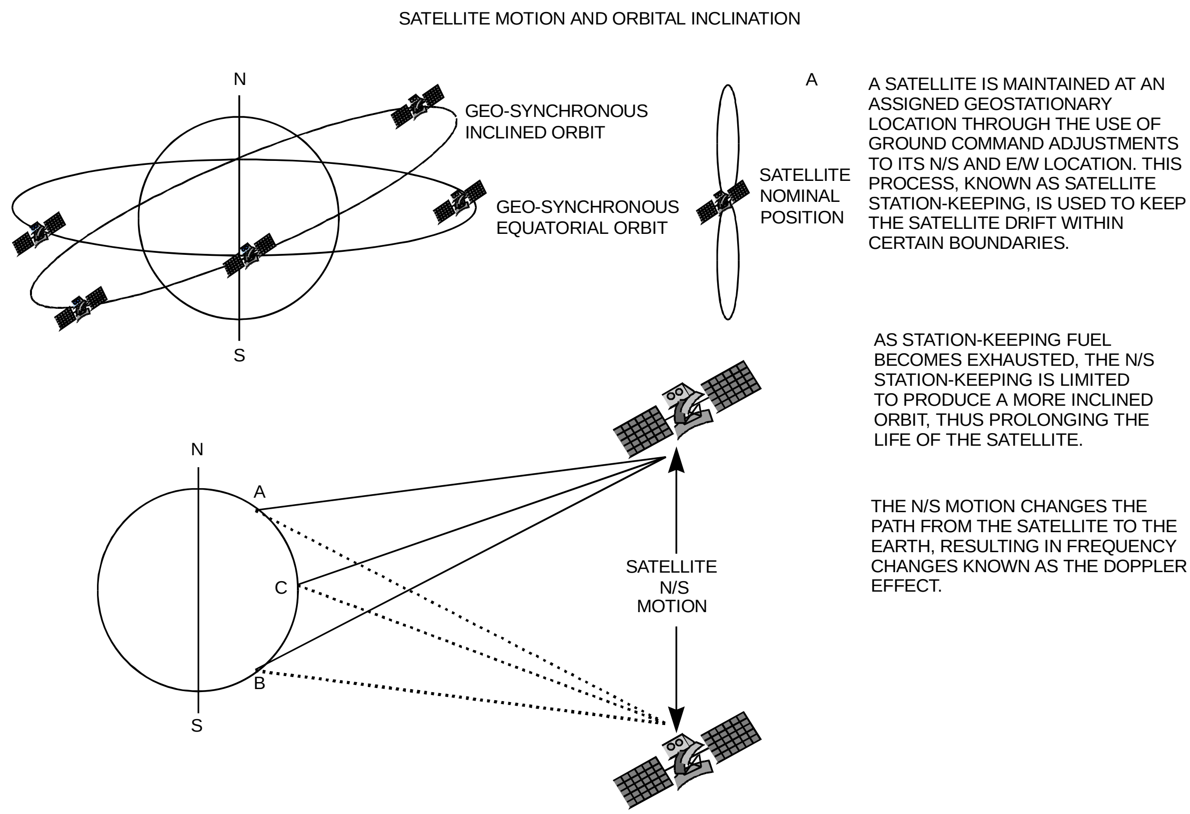


Figure B-4. Doppler Shift

If the two earth stations are configured as master/slave, then the buffer need only be configured for Doppler operation. The buffer will then have sufficient capacity for the Doppler shift on the outward and return paths.

A buffer set up for Doppler operation only will typically require less depth than one intended for both Doppler and plesiochronous operation.

B.4.1 Buffer Size

The depth of the receive buffer will depend on four parameters:

1. Doppler shift caused by satellite
2. Stability of each clock (plesiochronous/Doppler operation)
3. Frame/Multiframe length of multiplexed data format
4. Allowable time between clock slips

B.4.1.1 Doppler

A geostationary satellite should be positioned directly over the equator and orbit with duration of 24 hours. In practice, the exact inclination of the satellite (relative to the equator) is influenced by the earth, moon, and sun's gravity, as well as solar wind. Station-keeping motors are required to maintain the orbital position.

When viewed from the earth, the satellite appears to prescribe an ellipse in space, degrading to a "Figure 8" as the angle of inclination increases. The orbit of the satellite can result in a peak-to-peak altitude variation of ± 2% (85 km), while the station keeping of a newly launched satellite will typically be ± 0.1° (150 km). The total effect will be 172 km relative to the nominal 42,164 km radius.

Depending upon the location of the earth station relative to the satellite, the variation in propagation delay will typically be 1.15 ms (up to satellite and back down), therefore a buffer depth of 2 ms is sufficient to cope with most commercial satellites.

Since station-keeping involves using fuel in the motors, the "lifetime" of the satellite can be extended by allowing the satellite to drift into a wider "Figure 8" and using the motor less often.

The older satellites will be found in a more inclined orbit with the station keeping varying in latitude by as much as ± 4°. The total effect of the inclined orbit may result in a typical variation in path delay of 35 ms.

B.4.1.2 Plesiochronous

The stability of station reference clocks is normally 1×10^{-12} (derived from a cesium standard). While the stability is exceptionally high, the two clocks are not in synchronization with each other and will eventually pass by each other.

The clock used for the transmit signal is passed over the satellite, but will not be used at the receive earth station where a national network derives its time locally. A buffer will fill up with data using the clock from the satellite and will empty using the local clock. The object of the buffer is to ensure that the buffer overflows or underflows at regular, determinable intervals (typically every 40 days).

The buffer depth required (from center to end) would be:

Minimum slip period (seconds) ∗ [stability of far end (transmit) clock + stability of local clock]

For example:

Far end (transmit) clock stability	**1×10^{-9}**
Local (buffer) clock	**1×10^{-11}**
Minimum clock slip	**40 days**

Buffer Depth = $(40 \times 24 \times 60 \times 60) \times (1 \times 10^{-9} + 1 \times 10^{-11}) = 3.49$ ms

Because the buffer

will either fill or empty (depending on the frequency relationship of the two clocks), the total buffer depth will be 2 x 3.49 ms = 6.98 ms.

B.4.1.3 Frame/Multiframe Length

The depth of the receive buffer required is applicable to all unframed data.

When the data is framed (such as 2048 kbps G732 or 1544 kbps G733), it is desirable to provide slips in predefined locations. The advantage of organized slip locations (in relation to the frame) is that multiplexing equipment does not lose sync and outages on any channel are kept to a minimum.

A 2048 kbps frame structure commonly used is G732. This has a frame length of 256 bits with 16 frames per multiframe (4096 bits total, or 2 ms).

B.4.1.3.1 Multiples of the Frame Length

If this setting is set to **NONE**, the user can choose any buffer depth.

B.4.1.4 Total Buffer Length

T1 and E1 framing structure under G.704 are available. When this is selected, the buffer length is restricted to the size of the buffer. Using the examples from the three previous sections, the total buffer depth (end to end) will be:

Doppler + Plesiochronous (rounded up to the nearest multiframe)
1.15 ms + 6.98 ms = 8.13 ms

If the frame length is 2 ms, then the nearest multiframe will be 10 ms, or 20,480 bits.

B.4.1.4.1 Converting Between Bits and Seconds

Bits to Seconds	1/Data Rate x Bits = Seconds
Seconds to Bits	Data Rate x Seconds = Bit

Appendix C. REMOTE CONTROL

C.1 Overview

This section describes the protocol and message command set for remote monitor and control of the SLM-5650A Satellite Modem.

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

C.2 R S-485

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

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

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

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

RS-485 (full duplex) summary:

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

C.3 RS-232

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

C.4 Basic Protocol

Whether in RS-232 or RS-485 mode, all data is transmitted as asynchronous serial characters suitable for transmission and reception by a UART. In this case, the asynchronous character format supported is 8N1. The baud rate may vary between 2400 and 57,600 baud.

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

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

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

C.5 Packet Structure

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

Example: <0135/TFQ=70.2345{CR}

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

Example: >0654/RSW=32{CR}{LF}

C.5.1 Start Of Packet

Controller-to-Target: This is the character ‘<’ (ASCII code 60).

Target-to-Controller: This is the character ‘>’ (ASCII code 62).

Because this is used to provide a reliable indication of the start of packet, these two characters may not appear anywhere else within the body of the message.

C.5.2 Address

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

IMPORTANT

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

C.5.3 Instruction Code

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

C.5.4 Instruction Code Qualifier

This is a single character, which further qualifies the preceding instruction code. Code Qualifiers obey the following rules:

1. ***From Controller-to-Target***, the only permitted values are:

Symbol	Definition
= **(ASCII code 61)**	The ‘=’ code is used as the Assignment Operator (AO) and is used to indicate that the parameter defined by the preceding byte should be set to the value of the argument (s) which follow it. **Example:** in a message from Controller-to-Target, TFQ=0950.0000 would mean “set the transmit frequency to 950 MHz.”
? **(ASCII code 63)**	The ‘?’ code is used as the Query Operator (QO) and is used to indicate that the Target should return the current value of the parameters defined by the preceding byte. **Example:** in a message from Controller-to-Target, TFQ? Would mean “return the current value of the transmit frequency.”

2. ***From Target-to-Controller***, the only permitted values are:

Symbol	Definition
= **(ASCII code 61)**	The '=' code is used in two ways: a. If the Controller has sent a query code to a Target (**Example:** TFQ? (meaning 'what's the Transmit frequency?'), the Target would respond with TFQ=xxxx.xxxx, where xxxx.xxxx represents the frequency in question. b. If the Controller sends an instruction to set a parameter to a particular value, then, providing the value sent is valid, the Target will acknowledge the message by replying with TFQ=(with no message arguments)
? **(ASCII code 63)**	If the Controller sends an instruction to set a parameter to a particular value, then, if the value sent is not valid, the Target will acknowledge the message by replying (for example) with TFQ? (with no message arguments). This indicates that there was an error in the message sent by the Controller.
! **(ASCII code 33)**	If the Controller sends an instruction code which the Target does not recognize, the Target will acknowledge the message by echoing the invalid instruction, followed by the ! character with: **Example:** XYZ!
***** **(ASCII code 42)**	If the Controller sends an instruction to set a parameter to a particular value, then, if the value sent is valid, BUT the modulator will not permit that particular parameter to be changed at this time, the Target will acknowledge the message by replying (for example) with TFQ* (with message arguments).
# **ASCI code 35)**	If the Controller sends a correctly formatted command, BUT the modulator is not in remote mode, it will not allow reconfiguration and will respond with TFQ#

C.5.5 Message Arguments

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

C.5.6 End Of Packet

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

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

C.6 Remote Commands / Queries

Index Notes: Under **CODE,** *XXX*^{A} indicates command/query valid only when the SLM-5650A modem type has been set to **AUPC;** *XXX*^{O} indicates a command/ query valid only with installed optional interface. Where **Column 'C'** = Command; **Column 'Q'** = Query; columns marked '**X**' designate instruction code as *Command only*, *Query only*, or *Command/Query*.

CODE	C	Q	PAGE
A			
ACT^{A}	**X**	**X**	C-32
AET^{A}	**X**	**X**	C-29
AMN^{A}	**X**	**X**	C-29
AMT^{A}	**X**	**X**	C-29
AMX^{A}	**X**	**X**	C-29
ANP^{A}	**X**	**X**	C-29
ARB^{A}	**X**	**X**	C-33
ARF^{A}	**X**	**X**	C-33
ASI^{A}	**X**	**X**	C-31
ATB^{A}	**X**	**X**	C-32
ATF^{A}	**X**	**X**	C-32
B			
BBR		**X**	C-19
BEI	**X**		C-19
BER		**X**	C-21
BFS		**X**	C-21
BRS	**X**		C-18
BRX	**X**	**X**	C-18
BTX	**X**	**X**	C-18
C			
CAA^{A}	**X**		C-31
CAE	**X**		C-26
CAS	**X**		C-27
CFO		**X**	C-28
CID	**X**	**X**	C-19
CLD	**X**		C-20
COM	**X**	**X**	C-18
CST	**X**		C-19

CODE	C	Q	PAGE
D			
DAY	**X**	**X**	C-20
E			
E1F^{O}	**X**	**X**	C-39
E2F^{O}	**X**	**X**	C-40
EBA	**X**	**X**	C-20
EBN		**X**	C-21
EID		**X**	C-23
ERF^{O}	**X**	**X**	C-40
ERR		**X**	C-18
G			
GBM^{O}	**X**	**X**	C-37
GIP^{O}	**X**	**X**	C-38
I			
IAP^{A}	**X**		C-31
IEP	**X**		C-25
IMG	**X**	**X**	C-22
IPA	**X**	**X**	C-17
ISP	**X**		C-27
ITF	**X**	**X**	C-6
L			
LCL^{A}	**X**	**X**	C-29
LOP	**X**	**X**	C-18
LPC^{A}	**X**	**X**	C-28
LRS	**X**	**X**	C-22
LUF		**X**	C-24

CODE	C	Q	PAGE
M			
MGC	**X**	**X**	C-34
MIP^{O}	**X**	**X**	C-36
MIS^{O}	**X**	**X**	C-37
MOM	**X**	**X**	C-6
MRC	**X**	**X**	C-17
MSK	**X**	**X**	C-26
N			
NFW^{O}		**X**	C-37
NUA^{A}		**X**	C-31
NUE		**X**	C-25
NUS		**X**	C-27
P			
PAT	**X**	**X**	C-19
R			
RBM	**X**	**X**	C-17
RBO	**X**	**X**	C-16
RBS	**X**	**X**	C-17
RCB	**X**		C-20
RCI	**X**	**X**	C-15
RCK	**X**	**X**	C-16
RCL^{A}	**X**	**X**	C-30
RCR	**X**	**X**	C-13
RCW	**X**	**X**	C-14
RDD	**X**	**X**	C-15
RDF	**X**	**X**	C-16
RDI	**X**	**X**	C-15
RDR	**X**	**X**	C-13
RDS	**X**	**X**	C-15

CODE	C	Q	PAGE
REA	**X**	**X**	C-16
RFB	**X**	**X**	C-6
RFM	**X**	**X**	C-12
RFO		**X**	C-21
RFQ	**X**	**X**	C-13
RFT	**X**	**X**	C-12
RIM^{O}	**X**	**X**	C-36
RIP^{O}	**X**	**X**	C-36
RMD	**X**	**X**	C-13
RNA^{A}		**X**	C-31
RNE		**X**	C-26
RNS		**X**	C-27
RPB^{A}	**X**	**X**	C-30
RPC^{A}	**X**	**X**	C-30
RPE^{A}		**X**	C-30
RPL^{A}	**X**	**X**	C-30
RRD	**X**	**X**	C-14
RRS	**X**	**X**	C-14
RSI	**X**	**X**	C-14
RSL		**X**	C-21
RSW	**X**	**X**	C-16
RTC^{O}	**X**	**X**	C-39
RXF		**X**	C-25
S			
SCT	**X**	**X**	C-11
SMI^{O}	**X**	**X**	C-38
SNO		**X**	C-22
SSI	**X**	**X**	C-27
SWR		**X**	C-22

CODE	C	Q	PAGE
T			
T1F^{O}	**X**	**X**	C-39
T2F^{O}	**X**	**X**	C-40
TBO	**X**	**X**	C-11
TCI	**X**	**X**	C-11
TCK	**X**	**X**	C-10
TCR	**X**	**X**	C-8
TCW	**X**	**X**	C-9
TDE	**X**	**X**	C-10
TDF	**X**	**X**	C-11
TDI	**X**	**X**	C-11
TDR	**X**	**X**	C-8
TFM	**X**	**X**	C-7
TFQ	**X**	**X**	C-8
TFT	**X**	**X**	C-7
TIM	**X**	**X**	C-20
TMD	**X**	**X**	C-7
TMP		**X**	C-22
TPL	**X**	**X**	C-10
TRD	**X**	**X**	C-9
TRS	**X**	**X**	C-8
TSC	**X**	**X**	C-10
TSI	**X**	**X**	C-9
TTC^{O}	**X**	**X**	C-39
TXF		**X**	C-24
TXO	**X**	**X**	C-12

INSTRUCTION CODE QUALIFIER NOTE: The following codes are used in the 'Response to Command' column (*as per Sect. C.5.4*):

=	Message ok	*	Message ok, but not permitted in current mode
?	Received ok, but invalid arguments found	#	Message ok, but unit is not in Remote mode

Priority System = MOM (Highest priority), RFB, ITF, TFM, TFT, TMD, TCR, and TDR (Lowest Priority), indicated by **shading**. Any change to a higher priority parameter can override any of the parameters of lower priority.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Modem Operating Mode	**MOM=**	**1 byte, value 0 thru 9**	**Command or Query.** **Modem Operating Mode, where:** **x=Defines the operating mode, where:** **0=OM-73** **1=Mil-165A** **2=IESS-308** **3=IESS-309** **4=IESS-310** **5=TURBO** **6=16QAM** **7=AUPC** **8=RXBURST** **9=TXBURST** **Example: MOM=0 (sets OM-73 operating mode)**	**MOM=** **MOM?** **MOM*** **MOM#**	**MOM?**	**MOM=x** **(see description of arguments)**
Modem RF Band	**RFB=**	**1 byte, value 0 or 1**	**Command or Query.** **Modem RF Band, where:** **x=Defines the RF band, where:** **0=70/140 MHz Band** **1=L-Band (950 MHz – 2000 MHz)** **Example: RFB=0 (sets 70/140 Band)**	**RFB=** **RFB?** **RFB *** **RFB #**	**RFB?**	**RFB =x** **(see description of arguments)**
Interface Type	**ITF=**	**1 byte, value 0 thru 7**	**Command or Query.** **Interface Type, where:** **x=Defines the interface type, where:** **0=EIA-530** **1=HSSI** **2=Unbalance G.703** **3=Balanced G.703** **4=GigaBit Ethernet Interface** **6=Network Processor Card** **7=LVDS Interface** **Example: ITF=0 (sets EIA-530 interface type)**	**ITF=** **ITF?** **ITF*** **ITF#**	**ITF?**	**ITF=x** **(see description of arguments)**

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Overhead Type	TFM=	1 byte, value of 0 thru 2, 4	Command or Query. Tx Overhead Type, where: 0=None (Unframed) 1=IBS 2=IDR 4=AUPC Depending on Modem mode, not all of these selections will be valid. Example: TFM=0 (selects Unframed mode)	TFM= TFM? TFM* TFM#	TFM?	TFM=x (see description of arguments)
Tx FEC Type	TFT=	1 byte, value of 0 thru 3	Command or Query. Tx FEC coding type, where: 0=None (Uncoded) 1=Viterbi 2=Turbo 3=Sequential Example: TFT=2 (which is Turbo coding)	TFT= TFT? TFT* TFT#	TFT?	TFT=x (see description of arguments)
Tx Modulation Type	TMD=	1 byte, value of 0 thru 4	Command or Query. Tx Modulation type, where: 0=BPSK 1=QPSK 2=OQPSK 3=8PSK 4=16QAM Depending on FEC type, not all of these selections will be valid. Example: TMD=1 (which is QPSK)	TMD= TMD? TMD* TMD#	TMD?	TMD=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Code Rate	**TCR=**	**1 byte, value of 0 thru 8**	**Command or Query** **Tx Code Rate, where:** **0 = 1/1 (Uncoded)** **1 = 1/2** **2 = 3/4** **3 = 7/8** **4 = 2/3** **5 = 5/6** **6 = 21/44** **7 = 5/16** **8 = 17/18** **Depending on FEC type, not all of these selections will be valid.** **Example: TCR=1 (which is Rate 1/2)**	**TCR=** **TCR?** **TCR*** **TCR#**	**TCR?**	**TCR=x** **(see description of arguments)**
Tx Data Rate	**TDR=**	**10 bytes**	**Command or Query.** **Tx Data rate, in kbps.** **Resolution=1 bps.** **Example: TDR=002047.999 (which is 2047.999 kbps)**	**TDR=** **TDR?** **TDR*** **TDR#**	**TDR?**	**TDR=xxxxxx.xxx** **(see description of arguments)**
Tx Frequency	TFQ=	9 bytes	Command or Query. Tx Frequency, 52 to 88 MHz, 104 to 176 MHz, and 950 MHz to 2000 MHz. Resolution=100Hz. **Example:** TFQ=0140.9872	TFQ= TFQ? TFQ* TFQ#	TFQ?	TFQ=xxxx.xxxx (see description of arguments)
Tx Reed-Solomon Encoding	TRS=	1 byte, value of 0 or 1	Command or Query. Tx RS encoding 0=Off 1=On Depending on Modem mode, not all of these selections will be valid. **Example:** TRS=0 (RS encoding is Off)	TRS= TRS? TRS* TRS#	TRS?	TRS=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Reed-Solomon Code Word	TCW=	1 byte, value of 0 to 5	Command or Query. Tx RS encoding 0 = RS(225,205,10) 1 = RS(219,201,9) 2 = RS(208,192,8) 3 = RS(194,178,8) 4 = RS(126,112,7) 5 = RS(220,200,10) Depending on Modem mode, overhead type, and data rate, not all of these selections will be valid. **Example:** TCW=0 (This is a 'don't care' if RS is Off under TRS)	TCW= TCW? TCW* TCW#	TCW?	TCW=x (see description of arguments)
Tx Reed-Solomon Interleaver Depth	TRD=	1 byte, value of 0 to 2	Command or Query. Tx RS encoding 0 = Interleaver Depth 4 1 = Interleaver Depth 8 2 = Interleaver Depth 16 Depending on Modem mode, overhead type, and data rate, not all of these selections will be valid. **Example:** TRD=0 (This is a 'don't care' if RS is Off under TRS)	TRD = TRD? TRD * TRD #	TRD?	TRD =x (see description of arguments)
Tx Spectrum Invert	TSI=	1 byte, value of 0 or 1	Command or Query. Tx Spectrum Invert selection, where: 0=Normal, 1=Tx Spectrum Inverted **Example:** TSI=0 (which is normal)	TSI= TSI? TSI* TSI#	TSI?	TSI=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Scrambler	TSC=	1 byte, value of 0 thru 6	Command or Query. Tx Scrambler state, where: 0 = Off 1 = OM-73 Scrambler 2 = V.35 Scrambler 3 = Modified V.35 (EFData Closed Network) 4 = Reed-Solomon Synchronous Scrambler 5 = IBS Overhead Synchronous Scrambler 6 = TURBO Scrambler Depending on Modem mode, FEC type, overhead type, and RS state, not all of these selections will be valid. **Example:** TSC=1 (OM-73 Scrambler On)	TSC= TSC? TSC* TSC#	TSC?	TSC=x (see description of arguments)
Tx Differential Encoding	TDE=	1 byte	Command or Query. Tx Differential Encoding, where: x=Tx Differential Encoding, where: 0=Off 1=On Depending on FEC type or Modulation Type, not all of these selections will be valid. **Example:** TDE=1 (selects Tx Differential Encoding On)	TDE= TDE? TDE* TDE#	TDE?	TDE=x (see description of arguments)
Tx Power Level	TPL=	5 bytes	Command or Query. Tx Output power level, where: s=sign (+ / -) xx.x = Tx Output power level, +10.0 and –40.0 dBm. **Example:** TPL=-13.4	TPL= TPL? TPL* TPL#	TPL?	TPL=sxx.x (see description of arguments)
Tx Clock Source	TCK=	1 byte	Command or Query. Tx Clock Source, where: x=Tx Clock Source, where: 0=SCT 1=Tx Terrestrial **Example:** TCK=1 (selects Tx Terrestrial Clock Source)	TCK= TCK? TCK* TCK#	TCK?	TCK=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx SCT Reference	SCT=	1 byte, value of 0 thru 2	Command or Query. SCT Clock Reference, where: x=SCT Clock Reference, where: 0=Internal 1=Data Source Synchronized 2=Loop Timing (Rx-Satellite Clock) **Example:** SCT=0 (selects Internal Modem Reference)	SCT = SCT? SCT* SCT#	SCT?	SCT=x (see description of arguments)
Tx Clock Invert	TCI=	1 byte, value of 0 or 1	Command or Query. Invert Transmit Clock, where: x=Invert Transmit Clock, where: 0=Normal 1=Inverted **Example:** TCI=1 (selects Inverted TX Clock)	TCI = TCI? TCI* TCI#	TCI?	TCI=x (see description of arguments)
Tx Data Invert	TDI=	1 byte, value of 0 or 1	Command or Query. Invert Transmit Data, where: x=Invert Transmit Data, where: 0=Normal 1=Inverted **Example:** TDI=1 (selects Inverted TX Data)	TDI = TDI? TDI* TDI#	TDI?	TDI=x (see description of arguments)
Tx Data Fault	TDF=	1 byte, value of 0 thru 2	Command or Query. Transmit Data Fault, where: x=Transmit Data Fault, where: 0=None 1=DATA 2=AIS **Example:** TDF=0 (selects Data Fault = None)	TDF = TDF? TDF* TDF#	TDF?	TDF=x (see description of arguments)
Tx BPSK Data Ordering	TBO=	1 byte, value of 0 or 1	Command or Query. Invert Transmit BPSK Data Ordering, where: x=Invert Transmit BPSK Data Ordering, where: 0=Standard 1=Non-Standard **Example:** TBO=1 (selects Inverted BPSK Ordering)	TBO = TBO? TBO* TBO#	TBO?	TBO=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Carrier State	TXO=	1 byte, value of 0 thru 3	Command or Query. Tx Carrier State, where: 0=OFF due to front panel or remote control command 1=ON 2=RTS 3=OFF due to ext H/W Tx Carrier Off command (not a valid argument when used as a command) **Example:** TXO=1 (Tx Carrier ON)	TXO= TXO? TXO* TXO#	TXO?	TXO=x (see description of arguments)

Priority System = MOM (Highest priority), RFB, ITF, RFM, RFT, RMD, RCR, and RDR (Lowest Priority), indicated by **shading**. Any change to a higher priority parameter can override any of the parameters of lower priority.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Framing Mode	**RFM=**	**1 byte, value of 0 thru 2, 4**	**Command or Query.** **Rx Overhead Type, where:** **0=None (Unframed)** **1=IBS** **2=IDR** **4=AUPC** **Depending on Modem mode, not all of these selections will be valid.** **Example: RFM=0 (selects Unframed mode)**	**RFM=** **RFM?** **RFM*** **RFM#**	**RFM?**	**RFM=x** **(see description of arguments)**
Rx FEC Type	**RFT=**	**1 byte, value of 0 thru 3**	**Command or Query.** **Rx FEC coding type, where:** **0=None (Uncoded)** **1=Viterbi** **2=Turbo** **3=Sequential** **Example: RFT=2 (which is Turbo coding)**	**RFT=** **RFT?** **RFT*** **RFT#**	**RFT?**	**RFT=x** **(same format as command argument)**

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Demod type	**RMD=**	**1 byte, value of 0 thru 4**	**Command or Query.** **Rx Modulation type, where:** **0=BPSK** **1=QPSK** **2=OQPSK** **3=8PSK** **4=16QAM** **Depending on FEC type, not all of these selections will be valid.** **Example: RMD=1 (which is QPSK)**	**RMD=** **RMD?** **RMD*** **RMD#**	**RMD?**	**RMD=x** **(see description of arguments)**
Rx FEC Code Rate	**RCR=**	**1 byte, value of 0 thru 8**	**Command or Query** **Rx FEC Code Rate, where:** **0 = 1/1 (Uncoded)** **1 = 1/2** **2 = 3/4** **3 = 7/8** **4 = 2/3** **5 = 5/6** **6 = 21/44** **7 = 5/16** **8 = 17/18** **Depending on FEC type, not all of these selections will be valid.** **Example: RCR=1 (which is Rate 1/2)**	**RCR=** **RCR?** **RCR*** **RCR#**	**RCR?**	**RCR=x** **(see description of arguments)**
Rx Data Rate	**RDR=**	**10 bytes**	**Command or Query.** **Rx Data rate, in kbps.** **Resolution=1 bps.** **Example: RDR=002047.999 (which is 2047.999 kbps)**	**N/A**	**RDR?**	**RDR=xxxxxx.xxx** **(see description of arguments)**
Rx Frequency	RFQ=	9 bytes	Command or Query. Rx Frequency, 52 to 88 MHz, 104 to 176 MHz, and 950 MHz to 2000 MHz. Resolution=100Hz. **Example:** RFQ=0140.9872	RFQ= RFQ? RFQ* RFQ#	RFQ?	RFQ=xxxx.xxxx (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Reed-Solomon Decoding	RRS=	1 byte, value of 0 or 1	Command or Query. Rx RS encoding 0=Off 1=On Depending on Modem mode, not all of these selections will be valid. **Example:** RRS=0 (RS encoding is Off)	RRS= RRS? RRS* RRS#	RRS?	RRS=x (see description of arguments)
Rx Reed-Solomon Code Word	RCW=	1 byte, value of 0 to 5	Command or Query. Rx RS encoding 0 = RS(225,205,10) 1 = RS(219,201,9) 2 = RS(208,192,8) 3 = RS(194,178,8) 4 = RS(126,112,7) 5 = RS(220,200,10) Depending on Modem mode, overhead type, and data rate, not all of these selections will be valid. **Example:** RCW=0 (This is a 'don't care' if RS is Off under TRS)	RCW = RCW? RCW * RCW #	RCW?	RCW=x (see description of arguments)
Rx Reed-Solomon Interleaver Depth	RRD=	1 byte, value of 0 to 2	Command or Query. Rx RS encoding 0 = Interleaver Depth 4 1 = Interleaver Depth 8 2 = Interleaver Depth 16 Depending on Modem mode, overhead type, and data rate, not all of these selections will be valid. **Example:** RRD=0 (This is a 'don't care' if RS is Off under RRS)	RRD = RRD? RRD * RRD #	RRD?	RRD =x (see description of arguments)
Rx Spectrum Invert	RSI=	1 byte, value of 0 or 1	Command or Query. Rx Spectrum Invert, where: 0=Normal 1=Rx Spectrum Invert **Example:** RSI=0 (selects Normal)	RSI= RSI? RSI* RSI#	RSI?	RSI=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Descrambler	RDS=	1 byte, value of 0 thru 6	Command or Query. Rx Scrambler state, where: 0 = Off 1 = OM-73 Scrambler 2 = V.35 Scrambler 3 = Modified V.35 (EFData Closed Network) 4 = Reed-Solomon Synchronous Scrambler 5 = IBS Overhead Synchronous Scrambler 6 = TURBO Scrambler Depending on Modem mode, FEC type, overhead type, and RS state, not all of these selections will be valid. **Example:** RDS=1 (OM-73 Scrambler On)	RDS= RDS? RDS* RDS#	RDS?	RDS=x (see description of arguments)
Rx Differential Decoding	RDD=	1 byte, value of 0 or 1	Command or Query. Rx Differential Decoding, where: x=Rx Differential Decoding, where: 0=Off 1=On Depending on FEC type or Modulation Type, not all of these selections will be valid. **Example:** RDD=1 (selects Rx Differential Decoding On)	RDD= RDD? RDD* RDD#	RDD?	RDD=x (see description of arguments)
Rx Clock Invert	RCI=	1 byte, value of 0 or 1	Command or Query. Invert Receive Clock, where: x=Invert Receive Clock, where: 0=Normal 1=Inverted **Example:** RCI=1 (selects Inverted RX Clock)	RCI = RCI? RCI* RCI#	RCI?	RCI=x (see description of arguments)
Rx Data Invert	RDI=	1 byte, value of 0 or 1	Command or Query. Invert Receive Data, where: x=Invert Receive Data, where: 0=Normal 1=Inverted **Example:** RDI=1 (selects Inverted RX Data)	RDI = RDI? RDI* RDI#	RDI?	RDI=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Data Fault	RDF=	1 byte, value of 0 thru 2	Command or Query. Receive Data Fault, where: x= Receive Data Fault, where: 0=None 1=DATA 2=AIS **Example:** RDF=0 (selects Data Fault = None)	RDF = RDF? RDF* RDF#	RDF?	RDF=x (see description of arguments)
Rx BPSK Data Ordering	RBO=	1 byte, value of 0 or 1	Command or Query. Invert Receive BPSK Data Ordering, where: x=Invert Receive BPSK Data Ordering, where: 0=Standard 1=Non-Standard **Example:** RBO=1 (selects Inverted BPSK Ordering)	RBO = RBO? RBO* RBO#	RBO?	RBO=x (see description of arguments)
Rx Demod Acquisition Sweep Range	RSW=	8 bytes	Command or Query. Rx acquisition sweep range of demodulator, in kHz, ranging from 0 to 60 kHz. **Example:** RSW=0060.000 (selects 60 kHz)	RSW= RSW? RSW* RSW#	RSW?	RSW=xxxx.xxx (see description of arguments)
Rx Reacquisition Time	REA=	3 bytes	Command or Query. Rx reacquisition time, in Seconds, ranging from 0 to 999. **Example:** REA=000 (selects 0 seconds)	REA= REA? REA* REA#	REA?	REA=xxx (see description of arguments)
Rx Clock Source	RCK=	1 byte, value of 0 thru 3	Command or Query. Rx Clock Source , where: x=Rx Clock Source, where: 0=Rx Satellite 1=Internal 2=Tx-Terrestrial 3=External Clock (only valid with the G.703 Option Card) **Note:** Commands as well as queries are not allowed when either the GigaBit Ethernet or NP card has been selected as the current interface type. **Example:** RCK=2 (selects Tx-Terrestrial)	RCK= RCK? RCK* RCK#	RCK?	RCK=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Buffer Programming Mode	RBM=	1 byte, value of 0 or 1	Command or Query. Rx Buffer Programming Mode, where: 0 = Buffer Size is programmed in Bits. 1 = Buffer Size is programmed in milliseconds. **Note:** Commands as well as queries are not allowed when either the GigaBit Ethernet or NP card has been selected as the current interface type. **Example:** RBM=0	RBM= RBM? RBM* RBM#	RBM?	RBM=x (see description of arguments)
Rx Buffer Size	RBS=	8 bytes	Command or Query. Rx Buffer Size (in either bits or milliseconds, see RBM command), where: xxxxxxxx=Rx Buffer Size **Note:** Commands as well as queries are not allowed when either the GigaBit Ethernet or NP card has been selected as the current interface type. **Example:** RBS=00000512	RBS= RBS? RBS* RBS#	RBS?	RBS=xxxxxxxx (see description of arguments)
Modem Reference Clock	MRC=	1 byte, value of 0 thru 3	Command or Query. Modem Reference Clock (For Frequency Accuracy), where: 0=Internal 1=External 1 MHz 2=External 5 MHz 3=External 10 MHz	MRC= MRC? MRC* MRC#	MRC?	MRC=x (see description of arguments)
IP Address	IPA=	18 bytes, numerical	Command or Query. Used to set the IP address and network prefix for the 10/100 BaseTx Ethernet management port, in the format: xxx.xxx.xxx.xxx.yy, where: xxx.xxx.xxx.xxx is the IP address, and yy is the network prefix (0-31) **Example:** 010.006.030.001.24	IPA= IPA? IPA* IPA#	IPA?	IPA= xx.xxx.xxx.xxx.yy (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Carrier Only Test Modes	COM=	1 byte, value of 0 thru 2	Command or Query. Test Mode, where: 0= Normal Mode (no test) 1=Tx CW 2=Tx Alternating 1,0 Pattern **Example:** COM=1 (CW Mode)	COM= COM? COM* COM#	COM?	COM=x (see description of arguments)
LoopBack Test Modes	LOP=	1 byte, value of 0 thru 2	Command or Query. Loopback Test Modes, where: 0=Normal Mode (no test) 1=IF Loopback 2=I/O Loopback #1 **Example:** LOP=1 (IF Loopback)	LOP= LOP? LOP* LOP#	LOP?	LOP=x (see description of arguments)
Tx BERT State	BTX=	1 byte, value of 0 or 1	Command or Query. Tx BERT State, where: 0=Off 1=On **Example:** BTX=1 (Tx BERT On)	BTX= BTX? BTX* BTX#	BTX?	BTX=x (see description of arguments)
Rx BERT State	BRX=	1 byte, value of 0 or 1	Command or Query. Rx BERT State, where: 0=Off 1=On **Example:** BRX=1 (Rx BERT On)	BRX= BRX? BRX* BRX#	BRX?	BRX=x (see description of arguments)
Rx BERT Reset	BRS=	None	Command only. Reset Rx BERT **Example:** BRS=	BRS= BRS? BRS* BRS#	N/A	N/A
Rx BERT Errors	N/A	7 bytes	Query only. Read the total number of Bit Errors. **Example:** ERR=9999999	N/A	ERR?	N/A

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx BERT BER	N/A	6 bytes	Query only. Unit returns the value of the BERT BER in the form a.b x 10^{-c}. First three bytes are the value. Last two bytes are the exponent. Returns 0.0E00 if the BERT is not synchronized to a pattern. **Example:** BBR=4.9E12	N/A	BBR?	BBR=a.bEcc (see description of arguments)
BERT Pattern	PAT=	1 byte, value of 0 thru 8	Command or Query. BERT Pattern, where: 0=2047 1=Mark 2=Space 3=1:1 4=1:2 5=2^15-1 6=2^20-1 7=2^23-1 8=MIL-188 **Example:** PAT=0 (2047 Pattern)	PAT= PAT? PAT* PAT#	PAT?	PAT=x (see description of arguments)
Insert Tx BERT Error	BEI=	None	Command only. Insert single bit error in Tx BERT **Example:** BEI=	BEI= BEI? BEI* BEI#	N/A	N/A
Circuit ID String	CID=	24 bytes	Command or Query. Sets or queries the user-defined Circuit ID string, which is a fixed length of 24 characters. Valid characters include: Space ( ) * + – , . / 0 9 and A thru Z	CID= CID? CID* CID#	CID?	CID=x (see description of arguments)
Configuration Save	CST=	1 byte	Command only. Command causes the modem to store the current configuration in Configuration Memory location defined by the one-byte argument (0 to 9). **Example:** CST=4 (store the current configuration in location 4)	CST= CST? CST* CST#	N/A	N/A

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Configuration Load	CLD=	1 byte	Command only. Causes the modem to retrieve a previously stored configuration from Configuration Memory location defined by the one-byte argument (0 to 9). **Example:** CLD=4 (retrieve modem configuration from location 4)	CLD= CLD? CLD* CLD#	N/A	N/A
ReCenter Buffer	RCB=	None	Command only. Forces the software to recenter the receive Plesiochronous/Doppler buffer. **Note:** This command is not allowed when either the GigaBit Ethernet or NP card has been selected as the current interface type. **Example:** RCB= (ReCenter buffer)	RCB= RCB? RCB* RCB#	N/A	N/A
RTC Date	DAY=	6 bytes	Command or Query. A date in the form ddmmyy, where dd = day of the month (01 to 31), mm = month (01 to 12) yy = year (00 to 99) **Example:** DAY=240457 (April 24, 2057)	DAY= DAY? DAY* DAY#	DAY?	DAY=ddmmyy (see description of arguments)
RTC Time	TIM=	6 bytes	Command or Query. A time in the form hhmmss, indicating the time from midnight, where: hh = hours (00 to 23) mm = minutes (00 to 59) ss = seconds (00 to 59) **Example:** TIM=231259 (23 hours:12 minutes:59 seconds)	TIM= TIM? TIM* TIM#	TIM?	TIM=hhmmss (see description of arguments)
Eb/No Alarm Point	EBA=	4 bytes	Command or Query. Eb/No alarm point in dB, with a range between 0.1 and 20 dB. Resolution=0.1 dB **Example:** EBA=12.3	EBA= EBA? EBA* EBA#	EBA?	EBA=xx.x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Eb/No	N/A	4 bytes	Query only. Unit returns the value of Eb/No, between 0 and 20 dB, resolution 0.1 dB. Returns 99.9 if demod is unlocked. **Example:** EBN=12.3 (which is Eb/No = 12.3 dB) For values greater than 20.0 dB, the reply will be: EBN=+020	N/A	EBN?	EBN=xxxx (see description of arguments)
Rx Signal Level	N/A	5 bytes	Query only. Unit returns the value of the Rx signal level, in dBm, between +15.0 and –60.0 dBm, in the form: sxx.x **Examples:** RSL=+99.9 (RSL > +15.0 dBm) RSL=+15.0 RSL=-60.0 RSL=-99.9 (RSL < -60.0 dBm)	N/A	RSL?	RSL=sxx.x (see description of arguments)
Rx Frequency Offset	N/A	5 bytes	Query only. Unit returns the value of the measured frequency offset of the carrier being demodulated. Values range from ± 0 to ± 30 kHz, 100 Hz resolution. Returns 99999 if the demodulator is unlocked. **Example:** RFO=+02.3 (which is + 2.3 kHz)	N/A	RFO?	RFO=xxxxx (see description of arguments)
Buffer Fill State	N/A	2 bytes	Query only. xx = value of the buffer fill state, between 1 to 99%. Returns 00 if demodulator is unlocked. **Example:** BFS=33 (which is 33%)	N/A	BFS?	BFS=xx (see description of arguments)
Rx BER	N/A	6 bytes	Query only. Unit returns the value of the estimated corrected BER in the form a.b x 10^{-cc}. First three bytes are the value. Last two bytes are the exponent. Returns 99999 if the demodulator is unlocked. **Example:** BER=4.8E03 (which is BER = 4.8 x 10^{-3})	N/A	BER?	BER=a.bEcc (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Local/Remote Status	LRS=	1 byte, value of 0, 1, or 3	Command or Query. Local/Remote status, where: 0=Local 1=Serial Remote Control 3=Serial + Ethernet Remote Control **Example:** LRS=1 (which is Serial Remote)	LRS= LRS? LRS* LRS#	LRS?	LRS=x (see description of arguments)
Software Revision	N/A	43 bytes	Query only. Unit returns the value of the internal software revision installed in the unit, in the form: Boot:xx.yy.zz Bulk1:xx.yy.zz Bulk2:xx.yy.zz **Example:** SWR=Boot:01.01.01 Bulk1:01.01.01 Bulk2:01.01.01	N/A	SWR?	SWR=Boot:xx.yy.zz Bulk1:xx.yy.zz Bulk2:xx.yy.zz (see description of arguments)
Software Image	IMG=	1 bytes, value of 1 or 2	Command or Query. Next Reboot Image, where: 1 = Bulk Image #1 2 = Bulk Image #2 **Example:** IMG=1 (Image #1 will be active after next reboot)	IMG= IMG? IMG* IMG#	IMG?	IMG=x (see description of arguments)
Serial Number	N/A	9 bytes	Query only. Used to query the unit 9-digit serial number. Unit returns its S/N in the form xxxxxxxxx. **Example:** SNO=176500143	N/A	SNO?	SNO=xxxxxxxxx (see description of arguments)
Temperature	N/A	3 bytes	Query only. Unit returns the value of the internal temperature, in the form of xxx (degrees C). **Example:** TMP=+26	N/A	TMP?	TMP=xxx (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Equipment ID	N/A	17 bytes	Query only. Unit returns information concerning the equipment identification, and the option field, in the form aaaabcdefghijklmx where: aaaa = defines the modem model number (565A in this case) b = Advanced FEC: 0 = None, 1 = TPC, 2 = TPC + DVB-S2 c = Advanced FEC Data Rate: 0 = Base (5,000 kbps), 1 = 10,000 kbps, 2 = 20,000 kbps, 3 = 51,840 kbps, 4 = 155,520 kbps d = Option Card: 0 = None, 1 = G.703, 2 = GigaBit Ethernet, 4 = Network Processor, 5 = LVDS e = Data Rate Option: 0 = Base (5,000 kbps), 1 = 10,000 kbps, 2 = 20,000 kbps, 3 = 51,840 kbps, 4 = 155,520 kbps f = Higher-order modulation: 0 = None, 1 = 8PSK, 2 = 8PSK and 16QAM, 3 = 8PSK+16QAM and 16APSK/32APSK g = Reed-Solomon Codec Option: 0 = None, 1 = Installed h = Transec Module: 0 = None, 1 = Installed i = AUPC Option: 0 = None, 1 = Installed j = ASYNC Engineering Service Channel: 0 = None, 1 = Installed k = Demod Only l = CnC Data Rate: 0 = None m = Sequential Encoding/Decoding Option: 0 = None, 1 = Installed x = spare **Example:** EID=565A0000000000000 indicates SLM-5650A with no options installed	N/A	EID?	EID=aaaabcdefghijklmx (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Live Unit Faults	N/A	8 bytes	Query only. Live Unit Faults are returned as a 32 bit Hexadecimal value. Bit values are defined as follows: 80000000 = +5.0V Power 40000000 = +3.3V Power 20000000 = +2.5V Power 10000000 = +1.5V Power 08000000 = +12V Power 04000000 = -12V Power 02000000 = +18V Power 01000000 = Cooling Fan 00800000 = Ext Reference Activity 00400000 = 192 MHz Clock not locked 00200000 = 10 MHz Ref Clock not locked 00100000 = M&C FPGA not loaded 00080000 = Mod FPGA not loaded 00040000 = Demod FPGA not loaded 00020000 = Decoder FPGA not loaded 00010000 = Tx Interface FPGA not loaded 00008000 = Rx Interface FPGA not loaded 00004000 = FEC #1 FPGA not loaded 00002000 = FEC #2 FPGA not loaded 00001000 = Option Card FPGA not loaded 00000800 = FPGA DCM not locked 00000400 = NP Card Mailbox Comm Error 00000200 = FIPS Card Mailbox Comm Error **Example:** LUF=00000000 indicates No Unit Faults	N/A	LUF?	LUF=xxxxxxxx (see description of arguments)
Live Tx Faults	N/A	8 bytes	Query only. Live Tx Faults are returned as a 32 bit Hexadecimal value. Bit values are defined as follows: 80000000 = Modulator Symbol Clock not locked 40000000 = Modulator RF Synthesizer not locked 20000000 = Modulator No IQ Activity 10000000 = Modulator Nyquist Filter Clipping 08000000 = Interface data clock PLLs not locked 04000000 = Interface Terrestrial Clock No Activity 02000000 = Interface SCT PLL not locked 01000000 = Interface No Data Activity **Example:** TXF=00000000 indicates No Tx Faults	N/A	TXF?	TXF=xxxxxxxx (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Live Rx Faults	N/A	8 bytes	Query only. Live Rx Faults are returned as a 32 bit Hexadecimal value. Bit values are defined as follows: 80000000 = Demodulator IF not locked 40000000 = Demodulator Data Decoder not locked 20000000 = Demodulator RF Synthesizer not locked 10000000 = Demodulator No IQ Activity 08000000 = Interface De-Multiplexers not locked 04000000 = Interface Buffer Fault 02000000 = Interface Buffer about to slip 01000000 = Interface Buffer has overflowed 00800000 = Interface Buffer has underflowed 00400000 = Interface Buffer Clock PLL not locked 00200000 = Interface Buffer Clock Reference Activity 00100000 = Interface Data/AIS 00080000 = Eb/No Threshold exceeded 00040000 = Composite Power > 40 dBc 00020000 = Composite Power > 20 dBm 00010000 = BERT Sync Loss **Example:** RXF=00000000 indicates No Rx Faults	N/A	RXF?	RXF=xxxxxxxx (see description of arguments)
Number of Unread stored Events	N/A	3 bytes	Query only. Unit returns the Number of stored Events, which remain Unread, in the form xxx. **Note:** This means unread over the remote control. **Example:** NUE=126	N/A	NUE?	NUE=xxx (see description of arguments)
Initialize Events Pointer	IEP=	None	Command only. Resets internal pointer to allow RNE? queries to start at the beginning of the stored events log.	IEP= IEP#	N/A	N/A

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Retrieve next 5 unread Stored Events	N/A	110 bytes	Query only. Unit returns the oldest 5 Stored Events which have not yet been read over the remote control. Reply format: {CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where Sub-body= Axxxxxxxxddmmyyhhmmss, A being the fault type where: 1=Unit 2=Rx Traffic 3=Tx Traffic 4=Info xxxxxxxx is the Fault Code number, as in LUF?, TXF?, RXF?, or Info Code, which is: 00000000=Power Off 00000001=Power On 00000002=Log Cleared 00000004=Global Config Change 00000005=NP Card Watch Dog Timer If there are less than 5 events to be retrieved, the remaining positions are padded with zeros. If there are no new events, the response is RNE*.	N/A	RNE?	RNE={CR}Axxxxxxxxddmmyyhhmmss{CR}Axxxxxxxxddmmyyhhmmss{CR}Axxxxxxxxddmmyyhhmmss{CR}Axxxxxxxxddmmyyhhmmss {CR}Axxxxxxxxddmmyyhhmmss (see description for details of arguments)
Clear All Stored Events	CAE=	None	Command only. Forces the software to clear the software events log. **Example:** CAE= **Note:** This command takes no arguments	CAE= CAE? CAE* CAE#	N/A	N/A
Modem Alarm Mask	MSK=	6 bytes	Command or Query. Alarm mask conditions, in the form abcdef, where: a=spare (must be set to 0) b=spare (must be set to 0) c=spare (must be set to 0) d=spare (must be set to 0) e=Demod Faults (0 = unmasked, 1 = masked) f=Eb/No Threshold Alarm (0 = unmasked, 1 = masked) **Example:** MSK=000001	MSK= MSK? MSK* MSK#	MSK?	MSK=abcdef (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Statistics Sample Interval	SSI=	1 byte	Command or Query. Used to set the sample interval for the Statistics Logging Function. SSI=x, where x = 0 to 9 in 10 minute steps. **Note:** Setting this parameter to 0 disables the statistics logging function. **Example:** SSI=3 sets the logging inverval to 30 minutes	SSI= SSI? SSI* SSI#	SSI?	SSI=x (see description of arguments)
Number of Unread stored Statistics	N/A	3 bytes	Query only. Unit returns the Number of stored Statistics, which remain Unread, in the form xxx. **Note:** This means unread over the remote control. **Example:** NUS=126	N/A	NUS?	NUS=xxx (see description of arguments)
Initialize Statistics Pointer	ISP=	None	Command only. Resets internal pointer to allow RNS? queries to start at the beginning of the stored statistics log.	ISP= ISP#	N/A	N/A
Retrieve next 5 unread Stored Statistics	N/A	105 bytes	Query only. Unit returns the oldest 5 Stored Statistics which have not yet been read over the remote control. Reply format: {CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where Sub-body= AA.ABB.Bddmmyyhhmmss, AA.A = Minimum Eb/No during sample period. “Loss” is displayed if carrier was lost during the sample period. BB.B = Average Eb/No during sample period. “Loss” is displayed if carrier was lost during the entire sample period. If there are less than 5 events to be retrieved, the remaining positions are padded with zeros. If there are no new events, the response is RNS*.	N/A	RNS?	RNS={CR}AA.ABB.Bddmmyyhhmmss{CR}AA.ABB.Bddmmyyhhmmss{CR}AA.ABB.Bddmmyyhhmmss{CR}AA.ABB.Bddmmyyhhmmss{CR}AA.ABB.Bddmmyyhhmmss (see description for details of arguments)
Clear All Stored Statistics	CAS=	None	Command only. Forces the software to clear the software statistics log. **Example:** CAS= **Note:** This command takes no arguments	CAS= CAS? CAS* CAS#	N/A	N/A

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Configured FAST Options	N/A	16 bytes	Query only. Unit returns information concerning the Configured FAST Options, and the option field, in the form abcdexxxxxxxxxxx where: a = QOS: 0 = Not Installed, 1 = Installed b = Header Compression: 0 = Not Installed, 1 = Installed c = Payload Compression: 0 = Not Installed, 1 = Installed d = Management Security: 0 = Not Installed, 1 = Installed e = Vipersat Compatibility: 0 = Not Installed, 1 = Installed x = spare	N/A	CFO?	CFO=abcdexxxxxxxxxxx (see description for details of arguments)

C.6.1 Automatic Uplink Power Control (AUPC) Remote Control Commands / Queries

The following instruction codes are valid only when the SLM-5650A modem type has been set to **AUPC**.

Note: Always wait three (3) seconds between consecutive remote modem command/query polls. If Local AUPC is not enabled, queries will return the last known condition. A request for status from the remote modem will then be transmitted, ensuring that the next query will return current status.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
AUPC Local Enable	LPC=	1 byte, value of 0 or 1	Command or Query. Local AUPC Control, where: 0=Off 1=On **Note:** When Local AUPC Control is enabled, modulator output power is automatically controlled by the modem. Power output commands via TPL are not allowed during this mode; although, queries will function as normal. **Example:** LPC=1 (Turn on Local AUPC Control)	LPC= LPC? LPC* LPC#	LPC?	LPC=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
AUPC Nominal Power Level	ANP=	5 bytes	Command or Query. Nominal Tx Output power level, where: s=sign (+ / -) xx.x = Tx Output power level, +10.0 and –40.0 dBm. **Example:** ANP=-13.4	ANP= ANP? ANP* ANP#	ANP?	ANP=sxx.x (see description of arguments)
AUPC Maximum Power Level	AMX=	5 bytes	Command or Query. Maximum Tx Output power level, where: s=sign (+ / -) xx.x = Tx Output power level, +10.0 and –40.0 dBm. **Example:** AMX=-13.4	AMX= AMX? AMX* AMX#	AMX?	AMX=sxx.x (see description of arguments)
AUPC Minimum Power Level	AMN=	5 bytes	Command or Query. Minimum Tx Output power level, where: s=sign (+ / -) xx.x = Tx Output power level, +10.0 and –40.0 dBm. **Example:** AMN=-13.4	AMN= AMN? AMN* AMN#	AMN?	AMN=sxx.x (see description of arguments)
AUPC Eb/N0 Target Set Point	AET=	4 bytes	Command or Query. AUPC Eb/N0 Target, where: xx.x = AUPC Eb/N0 Target, 3.2 to 16.0 dB. **Example:** AET=13.4	AET= AET? AET* AET#	AET?	AET=xx.x (see description of arguments)
AUPC Maximum Tracking Rate	AMT=	3 bytes	Command or Query. AUPC Maximum Tracking Rate, where: x.x = Maximum Tracking Rate, 0.5 to 6.0 dBm/minute in increments of .5. **Example:** AMT=0.5	AMT= AMT? AMT* AMT#	AMT?	AMT=x.x (see description of arguments)
AUPC Local Carrier Loss Action	LCL=	1 byte, values of 0 thru 2	Command or Query. Tx Output Power level setting when local carrier is lost, where: 0=Hold current output power level 1=Goto Nominal output power level 2=Goto Maximum output power level **Example:** LCL=0	LCL= LCL? LCL* LCL#	LCL?	LCL=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
AUPC Remote Carrier Loss Action	RCL=	1 byte, values of 0 thru 2	Command or Query. Tx Output Power level setting when remote carrier is lost, where: 0=Hold current output power level 1=Goto Nominal output power level 2=Goto Maximum output power level **Example:** RCL=0	RCL= RCL? RCL* RCL#	RCL?	RCL=x (see description of arguments)
Remote Modem AUPC Enable	RPC=	1 byte, values of 0 or 1	Command or Query. Remote Modem AUPC Control, where: 0=Off 1=On **Example:** RPC=1 (Turn on remote modem AUPC Control)	RPC= RPC? RPC* RPC#	RPC?	RPC=x (see description of arguments)
Remote Modem Pattern Substitution	RPB=	1 byte, values of 0 or 1	Command or Query. Remote Modem Tx Pattern Substitution, where: 0=Off 1=On **Note:** For compatibility reasons, only the 2047 Tx pattern can be turned On or Off at the remote modem.. **Example:** RPB=1 (Turn on remote modem AUPC Control)	RPB= RPB? RPB* RPB#	RPB?	RPB=x (see description of arguments)
Remote Modem I/O Loopback	RPL=	1 byte, values of 0 or 1	Command or Query. Remote Modem I/O Loopback Mode, where: 0=Off 1=On **Example:** RPL=1 (Turn on remote modem AUPC Control)	RPL= RPL? RPL* RPL#	RPL?	RPL=x (see description of arguments)
Remote Modem BERT BER	N/A	6 bytes	Query only. Unit returns the value of the remote modem's BERT BER in the form a.b x 10^{-c}. First three bytes are the value. Last two bytes are the exponent. Returns 0.0E00 if the BERT is not synchronized to a pattern. **Example:** RPE=4.0E06	N/A	RPE?	RPE=a.bEcc (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
AUPC Log Sample Interval	ASI=	1 byte	Command or Query. Used to set the sample interval for the AUPC Logging Function. SSI=x, where x = 0 to 9 in 10 minute steps. **Note:** Setting this parameter to 0 disables the logging function. **Example:** ASI=3 sets the logging inverval to 30 minutes	ASI= ASI? ASI* ASI#	ASI?	ASI=x (see description of arguments)
Number of Unread AUPC Log Entries	N/A	3 bytes	Query only. Unit returns the Number of AUPC Log Entries, which remain Unread, in the form xxx. **Note:** This means unread over the remote control. **Example:** NUS=126	N/A	NUA?	NUA=xxx (see description of arguments)
Initialize AUPC Log Pointer	IAP=	None	Command only. Resets internal pointer to allow RNA? queries to start at the beginning of the stored statistics log.	IAP= IAP#	N/A	N/A
Retrieve next 5 unread AUPC Log Entries	N/A	155 bytes	Query only. Unit returns the oldest 5 AUPC Log Entries which have not yet been read over the remote control. Reply format: {CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where Sub-body= AA.ABB.BCCC.CEEE.Eddmmyyhhmmss: AA.A = Minimum Eb/No during sample period. BB.B = Average Eb/No during sample period. CCC.C = Max Output Power during sample period. EEE.E = Average Output Power during sample period. If there are less than 5 events to be retrieved, the remaining positions are padded with zeros. If there are no new events, the response is RNA*.	N/A	RNA?	RNA={CR}AA.ABB.BCCC.CEEE.Eddmmyyhhmmss{CR}AA.ABB.BCCC.CEEE.Eddmmyyhhmmss{CR}AA.ABB.BCCC.CEEE.Eddmmyyhhmmss{CR}AA.ABB.BCCC.CEEE.Eddmmyyhhmmss{CR}AA.ABB.BCCC.CEEE.Eddmmyyhhmmss (see description for details of arguments)
Clear All AUPC Log Entries	CAA=	None	Command only. Forces the software to clear the software AUPC log. **Note:** This command takes no arguments. **Example:** AAS=	CAA= CAA? CAA* CAA#	N/A	N/A

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
ASYNC ESC Type	ACT=	1 byte	Command or Query. ASYNC ESC Type, where: 0=RS-232 1=RS-485 2-Wire 2=RS-485 4-Wire **Example:** ACT=0 sets the ASYNC ESC to RS-232	ACT= ACT? ACT* ACT#	ACT?	ACT=x (see description of arguments)
ASYNC ESC Tx Baud Rate	ATB=	1 byte	Command or Query. Baud Rate, where: 0=110 1=150 2=300 3=600 4=1200 5=2400 6=4800 7=9600 8=19200 9=38400 **Example:** ATB=0 sets the ASYNC ESC Tx Baud Rate to 110 Baud	ATB= ATB? ATB* ATB#	ATB?	ATB=x (see description of arguments)
ASYNC ESC Tx Format	ATF=	2 bytes	Command or Query. Async Format, where: 00=7 Bits, No Parity, 1 Stop Bit 01=7 Bits, Even Parity, 1 Stop Bit 02=7 Bits, Odd Parity, 1 Stop Bit 03=7 Bits, No Parity, 2 Stop Bits 04=7 Bits, Even Parity, 2 Stop Bits 05=7 Bits, Odd Parity, 2 Stop Bits 06=8 Bits, No Parity, 1 Stop Bit 07=8 Bits, Even Parity, 1 Stop Bit 08=8 Bits, Odd Parity, 1 Stop Bit 09=8 Bits, No Parity, 2 Stop Bits 10=8 Bits, Even Parity, 2 Stop Bits 11=8 Bits, Odd Parity, 2 Stop Bits **Example:** ATF=00 sets the ASYNC ESC Tx Format to 7N1	ATF= ATF? ATF* ATF#	ATF?	ATF=xx (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
ASYNC ESC Rx Baud Rate	ARB=	1 byte	Command or Query. Baud Rate, where: 0=110 1=150 2=300 3=600 4=1200 5=2400 6=4800 7=9600 8=19200 9=38400 **Example:** ARB=0 sets the ASYNC ESC Rx Baud Rate to 110 Baud	ARB= ARB? ARB* ARB#	ARB?	ARB=x (see description of arguments)
ASYNC ESC Rx Format	ARF=	2 bytes	Command or Query. Async Format, where: 00=7 Bits, No Parity, 1 Stop Bit 01=7 Bits, Even Parity, 1 Stop Bit 02=7 Bits, Odd Parity, 1 Stop Bit 03=7 Bits, No Parity, 2 Stop Bits 04=7 Bits, Even Parity, 2 Stop Bits 05=7 Bits, Odd Parity, 2 Stop Bits 06=8 Bits, No Parity, 1 Stop Bit 07=8 Bits, Even Parity, 1 Stop Bit 08=8 Bits, Odd Parity, 1 Stop Bit 09=8 Bits, No Parity, 2 Stop Bits 10=8 Bits, Even Parity, 2 Stop Bits 11=8 Bits, Odd Parity, 2 Stop Bits **Example:** ARF=0 sets the ASYNC ESC Rx Format to 7N1	ARF= ARF? ARF* ARF#	ARF?	ARF=xx (see description of arguments)

C.6.2 Modem Global Configuration Commands / Queries

<table>
<tr><th>Parameter Type</th><th>Command (Instruction Code and Qualifier)</th><th>Arguments for Command or Response to Query</th><th colspan="2">Description of Arguments</th><th>Response to Command</th><th>Query (Instruction Code and Qualifier)</th><th>Response to Query</th></tr>
<tr><td rowspan="2">Global Configuration</td><td rowspan="2">MGC=</td><td rowspan="2">177 bytes, with numerical entries, fixed values and delimiters</td><td colspan="2">Command or Query.

Global Configuration of SLM-5650A, in the form:

abcdeeeeeefghijabbbbbbklmnoooooo.ooopppp.ppppqcdestuvwxyyy.yz
ABCDEFGHHff.fffIJKLLLLLLL.LLLMMMM.MMMMNgggPQRSTUVWXYZ
ZZZ.ZZZAAABCDDDDDDDDEE.EFGHIJKLMNNN.NOOO.OPPP.PQQ.
QR.RSTUVWXXYZZ where:</td><td rowspan="2">MGC=
MGC?
MGC*
MGC#</td><td rowspan="2">MGC?</td><td rowspan="2">MGC=abcdeeeeeefghijabb
bbbbklmnoooooo.ooopppp.
ppppqcrestuvwxyyy.yzABC
DEFGHHff.fffIJKLLLLLLL.LL
LMMMM.MMMMNgggPQR
STUVWXYZZZZ.ZZZAAAB
CDDDDDDDDEE.EFGHIJK
LMNNN.NOOO.OPPP.PQ
Q.QR.RSTUVWXXYZZ
(see description of arguments)</td></tr>
<tr><td>a = Modem Operating Mode
b = Modem RF Band
c = Modem Interface Type
d = Modem Reference Clock
eeeeee = Modem Alarm Mask
f = Carrier Only Test Modes
g = Loopback Test Modes
h = Tx BERT State
i = Rx BERT State
j = BERT Pattern
a = CnC Mode
bbbbbb = CnC Mode
k = expansion byte
l = Tx FEC Type
m = Tx Modulation Type
n = Tx Code Rate
oooooo.ooo = Tx Data Rate
pppp.pppp = Tx Frequency
q = Tx Overhead Type
c = NP Bridge Mode
r = expansion byte
e = NP Secure Mode
s = Tx Reed-Solomon state
t = Tx Reed-Solomon code word
u = Tx Reed-Solomon interleaver depth
v = Tx Spectrum Invert
w = Tx Scrambler
x = Tx Differential Encoder
yyy.y = Tx Power Level
z = Tx Clock Source
A = Tx SCT Reference
B = Tx Clock Invert
C = Tx Data Invert
D = Tx Data Fault</td><td>same as MOM
same as RFB
same as ITF
same as MRC
same as MSK
same as COM
same as LOP
same as BTX
same as BRX
same as PAT
same as CNM
same as CSD

same as TFT
same as TMD
same as TCR
same as TDR
same as TFQ
same as TFM
same as GBM

same as MIS
same as TRS
same as TCW
same as TRD
same as TSI
same as TSC
same as TDE
same as TPL
same as TCK
same as SCT
same as TCI
same as TDI
same as TDF</td></tr>
</table>

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments		Response to Command	Query (Instruction Code and Qualifier)	Response to Query
			E = Tx BPSK Data Ordering	same as TBO			
			F = Tx Carrier State	same as TXO			
			G = Tx Ternary Code	same as TTC			
			HH = expansion bytes				
			ff.fff = CnC Freq Offset Range	same as CCF			
			I = Rx FEC Type	same as RFT			
			J = Rx Modulation Type	same as RMD			
			K = Rx Code Rate	same as RCR			
			LLLLLL.LLL = Rx Data Rate	same as RDR			
			MMMM.MMMM = Rx Frequency	same as RFQ			
			N = Rx Overhead Type	same as RFM			
			ggg = CnC Re-Acq Time	same as CRA			
			P = Rx Reed-Solomon state	same as RRS			
			Q = Rx Reed-Solomon code word	same as RCW			
			R = Rx Reed-Solomon interleaver depth	same as RRD			
			S = Rx Spectrum Invert	same as RSI			
			T = Rx Descrambler	same as RDS			
			U = Rx Differential Decoder	same as RDD			
			V = Rx Clock Invert	same as RCI			
			W = Rx Data Invert	same as RDI			
			X = Rx Data Fault	same as RDF			
			Y = Rx BPSK Data Ordering	same as RBO			
			ZZZZ.ZZZ = Rx Demod Acq Sweep Range	same as RSW			
			AAA = Rx Reacquisition Time	same as REA			
			B = Rx Clock Source	same as RCK			
			C = Rx Buffer Programming Mode	same as RBM			
			DDDDDDDD = Rx Buffer Size	same as RBS			
			EE.E = Eb/No Alarm Point	same as EBA			
			F = Statistics Sample Interval	same as SSI			
			G = Rx Ternary Code	same as RTC			
			H = Receive T1 Framing	same as T1F			
			I = Receive E1 Framing	same as E1F			
			J = Receive T2 Framing	same as T2F			
			K = Receive E2 Framing	same as E2F			
			L = External Buffer Clock Reference	same as ERF			
			M = AUPC Local Enable	same as LPC			
			NNN.N = AUPC Nominal Power Level	same as ANP			
			OOO.O = AUPC Maximum Power Level	same as AMX			
			PPP.P = AUPC Minimum Power Level	same as AMN			
			QQ.Q = AUPC Eb/No Target Level	same as AET			
			R.R = AUPC Max Tracking Rate	same as AMT			
			S = AUPC Local Carrier Loss Action	same as LCL			
			T = AUPC Local Carrier Loss Action	same as RCL			
			U = AUPC Log Sample Interval	same as ASI			
			V = AUPC ESC Type	same as ACT			

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments		Response to Command	Query (Instruction Code and Qualifier)	Response to Query
			W = AUPC ESC Tx Baud Rate XX = AUPC ESC Tx Format Y = AUPC ESC Rx Baud Rate ZZ = AUPC ESC Rx Format Fill unused expansion bytes with ‘x’	same as ATB same as ATF same as ARB same as ARF			

C.6.3 Network Processor (NP) Interface Module Remote Control Commands / Queries

The following commands are valid only when the optional Network Processor Interface Module is installed in the SLM-5650A.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Router Ethernet Interface Traffic IP Address and Range	RIP=	18 bytes	Command or Query. Used to set the IP address and network prefix for the NP Interface Traffic port, in the format: aaa.bbb.ccc.ddd.ee, where: aaa.bbb.ccc.ddd is the IP address, and ee is the network prefix (0-31) **Example:** RIP=010.006.030.001.24	RIP= RIP? RIP* RIP#	RIP?	RIP=aaa.bbb.ccc.ddd.ee (see description of arguments)
Router Ethernet Interface Management IP Address and Range	MIP=	18 bytes	Command or Query. Used to set the IP address and network prefix for the NP Interface Management port, in the format: aaa.bbb.ccc.ddd.ee, where: aaa.bbb.ccc.ddd is the IP address, and ee is the network prefix (0-31) **Example:** MIP=010.006.030.001.24	MIP= MIP? MIP* MIP#	MIP?	MIP=aaa.bbb.ccc.ddd.ee (see description of arguments)
Router IP Address Mode	RIM=	1 byte, value of 0 or 1	Command or Query. Used to set the NP Card’s IP address mode where: 0 = Single IP Address, and 1 = Dual IP Address **Example:** RIM=0	RIM= RIM? RIM* RIM#	RIM?	RIM=a (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Router Working Mode	GBM=	1 byte	Command or Query. Used to set the NP Card's Working Mode where: 1 = Vipersat Hub 2 = Vipersat Hub Expansion 3 = Vipersat Remote 4 = Vipersat Remote Expansion 5 = Multipoint Hub 6 = Multipoint Remote 7 = Point to Point 8 = GigaBit Bridge **Example:** GBM=7	GBM= GBM? GBM* GBM#	GBM?	GBM=a (see description of arguments)
Modem IP Interface Security Mode	MIS=	1 byte, value of 0 or 1	Command or Query. Used to set the modem IP Interface security level where: 0 = Normal or Low Level Security, and 1 = High Level Security **Example:** MIS=0	MIS= MIS? MIS* MIS#	MIS?	MIS=a (see description of arguments)
Router Firmware Version	N/A	11 bytes	Query Only. Router Firmware Version, in the form aa.bb.cc.dd where: aa = platform bb = major version cc = minor version dd = maintenance version **Example:** 01.04.01.aw	N/A	NFW?	aa.bb.cc.dd (see description of arguments)

C.6.4 TRANSEC Card Remote Control Commands / Queries

The following commands are valid only when the optional TRANSEC card is installed in the SLM-5650A.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Transec Ethernet Interface Management IP Address and Range	SMI=	18 bytes	Command or Query. Used to set the IP address and network prefix for the Transec Management port, in the format: aaa.bbb.ccc.ddd.ee, where: aaa.bbb.ccc.ddd is the IP address, and ee is the network prefix (0-31) **Example:** 010.006.030.001.24	N/A	SMI?	SMI=aaa.bbb.ccc.ddd.ee (see description of arguments)

C.6.5 10/100/1000 Base-T (Gigabit Ethernet) Interface Module Remote Control Commands / Queries

The following commands are valid only when the optional 10/100/1000 Base-T (Gigabit Ethernet) Interface Module is installed in the SLM-5650A.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
GigaBit Ethernet Interface Management IP Address and Range	GIP=	18 bytes	Command or Query. Used to set the IP address and network prefix for the GigaBit Ethernet Interface Management port, in the format: aaa.bbb.ccc.ddd.ee, where: aaa.bbb.ccc.ddd is the IP address, and ee is the network prefix (0-31) **Example:** 010.006.030.001.24	N/A	GIP?	GIP=aaa.bbb.ccc.ddd.ee (see description of arguments)

C.6.5.1 G.703 Interface Module Remote Control Commands / Queries

The following commands are valid only when the optional G.703 Interface Module is installed in the SLM-5650A.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Ternary Code	TTC=	1 byte, value of 0 thru 3	Command or Query. Tx Ternary Code, where: 0=AMI 1=B8ZS 2=B6ZS 3=HDB3 **Example:** TTC=3 (Set Tx Ternary Code to HDB3)	TTC= TTC? TTC* TTC#	TTC?	TTC=x (see description of arguments)
Rx Ternary Code	RTC=	1 byte, value of 0 thru 3	Command or Query. Rx Ternary Code, where: 0=AMI 1=B8ZS 2=B6ZS 3=HDB3 **Example:** RTC=3 (Set Rx Ternary Code to HDB3)	RTC= RTC? RTC* RTC#	RTC?	RTC=x (see description of arguments)
Receive T1 Framing	T1F=	1 byte, value of 0 or 1	Command or Query. Receive T1 Framing, where: 0=None 1=G.704 **Note:** Commands as well as queries are not allowed when either the GigaBit Ethernet or NP card has been selected as the current interface type. **Example:** T1F=0	T1F= T1F? T1F* T1F#	T1F?	T1F=x (see description of arguments)
Receive E1 Framing	E1F=	1 byte, value of 0 or 1	Command or Query. Receive T1 Framing, where: 0=None 1=G.704 **Note:** Commands as well as queries are not allowed when either the GigaBit Ethernet or NP card has been selected as the current interface type. **Example:** E1F=0	E1F= E1F? E1F* E1F#	E1F?	E1F=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Receive T2 Framing	T2F=	1 byte, value of 0, 1, 3, or 5	Command or Query. Receive T2 Framing, where: 0=None 1=G.704 3=G.743 5=G.747 **Note:** Commands as well as queries are not allowed when either the GigaBit Ethernet or NP card has been selected as the current interface type. **Example:** T2F=0	T2F= T2F? T2F* T2F#	T2F?	T2F=x (see description of arguments)
Receive E2 Framing	E2F=	1 byte, value of 0, 1, 2, or 4	Command or Query. Receive E2 Framing, where: 0=None 1=G.704 2=G.742 4=G.745 **Note:** Commands as well as queries are not allowed when either the GigaBit Ethernet or NP card has been selected as the current interface type. **Example:** E2F=0	E2F= E2F? E2F* E2F#	E2F?	E2F=x (see description of arguments)
External Buffer Clock Reference	ERF=	1 byte, value of 0 thru 3	Command or Query. External Buffer Clock Reference, where: 0=External Clock equals Rx Data Rate 1=5 MHz External Clock 2=10 MHz External Clock 3=20 MHz External Clock **Example:** ERF=0	ERF= ERF? ERF* ERF#	ERF?	ERF=x (see description of arguments)

Appendix D. MODEM OPTIONS

D.1 Forward Error Correction Options

As standard, the SLM-5650A Modem is equipped with three Forward Error Correction encoders/decoders: Viterbi, concatenated Reed-Solomon, and Trellis (available with the 8-PSK FAST option). The constraint lengths and encoding polynomials are not only Open Network compatible, but are also Closed Network compatible with the vast majority of existing modems from other manufacturers. The SLM-5650A also provides the capability to disable all FEC, allowing the modem to run uncoded.

Turbo Coding represents a very significant development in the area of FEC, and optionally, the SLM-5650A may be fitted with the Turbo Product Codec. There are four speed grades of the Turbo FEC; these data rate capabilities are as follows:

Low Rate	64 kbps to 5 Mbps
Low Rate	64 kbps to 10 Mbps
Low Rate	64 kbps to 20 Mbps
High Rate	64 kbps to 51.84 Mbps
High Rate	64 kbps to 155.52 Mbps

D.2 Viterbi

The combination of convolutional coding and Viterbi decoding has become an almost universal standard for satellite communications. The SLM-5650A complies with the Intelsat IESS 308 and 309 standards for Viterbi decoding with a constraint length of seven. This is a *de facto* standard, which means inter-operability with other manufacturer’s equipment. It provides very useful levels of coding gain, and its short decoding delay and error-burst characteristics make it particularly suitable for low data rate coded voice applications. It has a short constraint length, fixed at 7, for all code rates. (The constraint length is defined as the number of output symbols from the encoder that are affected by a single input bit.)

By choosing various coding rates (Rate 1/2, 3/4 or 7/8) the user can trade off coding gain for bandwidth expansion. Rate 1/2 coding gives the best improvement in error rate, but doubles the transmitted data rate, and hence doubles the occupied bandwidth of the signal. Rate 7/8 coding, at the other extreme, provides the most modest improvement in performance, but only expands the transmitted bandwidth by 14 %. A major advantage of the Viterbi decoding method is that the performance is independent of data rate, and does not display a pronounced threshold effect (i.e., does not fail rapidly below a certain value of Eb/No). Note that in BPSK mode, the SLM-5650A permits code rates of 1/2, 3/4, and 7/8.

Because the method of convolutional coding used with Viterbi, the encoder does not preserve the original data intact, and is called *non-systematic*.

Table D-1. Viterbi Decoding Summary

FOR	AGAINST
Good BER performance - very useful coding gain.	Higher coding gain possible with other methods
Almost universally used, with *de facto* standards for constraint length and coding polynomials	
Shortest decoding delay (~100 bits) of any FEC scheme - good for coded voice, VOIP, etc	
Short constraint length produce small error bursts - good for coded voice.	
No pronounced threshold effect - fails gracefully.	
Coding gain independent of data rate.	

D.3 Reed-Solomon Outer Codec

The concatenation of an outer Reed-Solomon (R-S) Codec with a Viterbi decoder first became popular in the early 1990s. It permits significant improvements in error performance without significant bandwidth expansion.

The coding overhead added by the R-S outer Codec is typically around 10%, which translates to a 0.4 dB power penalty for a given link. Reed-Solomon codes are block codes (as opposed to Viterbi and Sequential, which are convolutional), and in order to be processed correctly the data must be framed and de-framed. Additionally, R-S codes are limited in how well they can correct errors that occur in bursts.

This, unfortunately, is the nature of the uncorrected errors from Viterbi decoders, which produce clusters of errors that are multiples of half the constraint length. For this reason, the data must be interleaved following R-S encoding, and is then de-interleaved prior to decoding. This ensures that a single burst of errors leaving the Viterbi decoder is spread out over a number of interleaving frames, so errors entering the R-S decoder do not exceed its capacity to correct those errors.

D.4 Closed Network Modes

A 225,205 or 220,200 code is used in closed network mode. For a rate of 225,205 data is put into blocks of 225 bytes, of which 205 bytes are data, and 20 bytes are FEC overhead. The code was chosen because it is compatible with legacy Comtech EF Data modems.

For closed network Viterbi Reed Solomon, an interleaver depth of 4 or 8 is used. The increase in coding gain is at the expense of delay. The interleaving/de-interleaving delay and the delay through the decoder itself can be as high as 25 kbps. At low data rates, this equates to an appreciable part of a second, when combined with the round trip delay makes it highly unsuitable for voice applications. Additionally, the de-interleaver frame synchronization method can add significantly to the time taken for the demodulator to declare acquisition.

Table D-2. Open Network Modes

Code Rate	Mode
225, 205 219, 201 208, 192 194, 178 126, 112	IESS-308
219, 201	IESS-309 IBS, VSAT-IBS and Extended
219, 201	IESS-310

A characteristic of concatenated R-S coding is the very pronounced threshold effect. For any given modem design, there will be a threshold value of Eb/No below which the demodulator cannot stay synchronized. This may be due to the carrier-recovery circuits, or the synchronization threshold of the primary FEC device, or both. In the SLM-5650A, and Rate 1/2 operation, this threshold is around 4 dB Eb/No. Below this value, operation is not possible, but above this value, the error performance of the concatenated R-S system produces exceptionally low error rates for a very small increase in Eb/No.

CAUTION

Care should be taken not to operate the demodulator near its sync threshold. Small fluctuations in Eb/No may cause total loss of the link, with the subsequent need for the demodulator to re-acquire the signal.

Table D-3. Concatenated RS Coding Summary

FOR	AGAINST
Exceptionally good BER performance - several orders of magnitude improvement in link BER under given link conditions.	Very pronounced threshold effect - does not fail gracefully in poor Eb/No conditions. Additional coding overhead actually degrades sync threshold, and reduces link fade margin.
Very small additional bandwidth expansion	Significant processing delay (~25 kbps) - not good for voice, or IP applications
Interoperable with legacy Intelsat networks	Adds to demod acquisition time.

D.5 Trellis Coding (FAST Option)

In the other FEC methods described here, the processes of coding and modulation are independent - the FEC codec has no knowledge of, or interaction with the modulator. However, there are schemes in which the coding and modulation are combined together, where the encoder places FEC symbols in a precise manner into the signal constellation. This can yield an overall improvement in performance, and is used in higher-order modulation schemes, such as 8-PSK, 16-PSK, 16-QAM, etc.

When convolution coding is used, the overall *coded modulation* approach is referred to as Trellis Coded Modulation (TCM). Ungerboeck was an early pioneer, and developed optimum mapping and decoding schemes. However, the decoding scheme was seen as complex, and expensive, and Qualcomm Inc. developed a variation on the theme, which uses a Viterbi decoder at the core, surrounded by adjunct processing. The scheme is able to achieve performance very close to the optimum Ungerboeck method, but with far less complexity, and is called *pragmatic Trellis Coded Modulation*.

Intelsat recognized that, as more and more high power transponders are put in to service, the transponders are no longer *power limited*, but *bandwidth limited.* In order to maximize transponder capacity, they looked at 8-PSK as a method of reducing the occupied bandwidth of a carrier, and adopted Qualcomm's pragmatic TCM, at Rate 2/3.

A Rate 2/3 8-PSK/TCM carrier occupies only 50% of the bandwidth of a Rate 1/2 QPSK carrier. However, the overall coding gain of the scheme is not adequate by itself, and so Intelsat's IESS-310 specification requires that the scheme be concatenated with an outer RS codec. When combined, there is a threshold value of Eb/No of around 6 dB, and above approximately 7 dB, the bit error rate is better than 1×10^{-8}.

The detractions of the concatenated RS approach apply here also, along with more stringent requirements for phase noise and group delay distortion – the natural consequences of the higher-order modulation.

The SLM-5650A fully implements the IESS-310 specification at data rates up to 51.84 Mbps. In accordance with the specification, the R-S outer code cannot be disabled.

Table D-4. 8-PSK/TCM Coding Summary

FOR	AGAINST
Exceptionally bandwidth efficient compared to QPSK	Needs concatenated RS outer codec to give acceptable coding gain performance
Interoperable with legacy Intelsat networks	Demodulator acquisition threshold much higher than for QPSK
	8-PSK is more sensitive to phase noise and group delay distortion than QPSK

D.6 Turbo Product Codec (FAST Option)

Turbo coding is an FEC technique developed within the last few years, which delivers significant performance improvements compared to more traditional techniques. Two general classes of Turbo Codes have been developed, Turbo Convolutional Codes (TCC), and Turbo Product Codes (TPC, a block coding technique). Comtech EF Data has chosen to implement an FEC codec based on TPC. A Turbo Product Code is a 2 or 3 dimensional array of block codes. Encoding is relatively straightforward, but decoding is a very complex process requiring multiple iterations of processing for maximum performance to be achieved.

Unlike the popular method of concatenating a R-S codec with a primary FEC codec, Turbo Product Coding is an entirely stand-alone method. It does not require the complex interleaving/de-interleaving of the R-S approach, and consequently, decoding delays are significantly reduced. Furthermore, the traditional concatenated R-S schemes exhibit a very pronounced threshold effect – a small reduction in Eb/No can result in total loss of demod and decoder synchronization. TPC does not suffer from this problem – the demodulator and decoder remain synchronized down to the point where the output error rate becomes unusable. This is considered to be a particularly advantageous characteristic in a fading environment. Typically, in QPSK, 8-PSK and 16-QAM TPC modes the demod and decoder can remain synchronized ***2– 3dB below*** the Viterbi/Reed-Solomon or TCM cases**.**

Table D-5. Available TPC Modes

TPC Code Rate/Modulation	Data Rate Range
Rate 5/16 BPSK	64 kbps to 20 Mbps
Rate 21/44 BPSK	64 kbps to 30.545454 Mbps
Rate 21/44 QPSK, OQPSK	64 kbps to 61.090909 Mbps
Rate 3/4 QPSK, OQPSK	64 kbps to 96.0 Mbps
Rate 3/4 8-PSK	256 kbps to 144 Mbps
Rate 3/4 16-QAM	256 kbps to 155.52 Mbps
Rate 7/8 QPSK, OQPSK	64 kbps to 112 Mbps
Rate 7/8 8-PSK	256 kbps to 155.52 Mbps
Rate 7/8 16-QAM	256 kbps to 155.52 Mbps
Rate 17/18 QPSK, OQPSK	64 kbps to 120.888888 Mbps
Rate 17/18 8-PSK	256 kbps to 155.52 Mbps

D.7 Sequential (FAST Option)

Although the method of convolutional coding and Sequential decoding appears to be very similar to the Viterbi method, there are some fundamental differences. To begin with, the convolutional encoder is said to be systematic – it does not alter the input data, and the FEC overhead bits are simply appended to the data. Furthermore, the constraint length, k, is much longer (Rate 1/2, k=36. Rate 3/4, k= 63. Rate 7/8, k=87). This means that when the decoding process fails (i.e., when its capacity to correct errors is exceeded) it produces a burst of errors which is in multiples of half the constraint length.

An error distribution is produced which is markedly different to that of a Viterbi decoder. This gives rise to a pronounced threshold effect. A Sequential decoder does not fail gracefully – a reduction in Eb/No of just a few tenths of a dB can make the difference between acceptable BER and a complete loss of synchronization.

The decoding algorithm itself (called the Fano algorithm) uses significantly more path memory (4 kbps in this case) than the equivalent Viterbi decoder, giving rise to increased latency. Furthermore, a fixed computational clock is used to process input symbols, and to search backwards and forwards in time to determine the correct decoding path. At lower data rates, there are sufficient number of computational cycles per input symbol to permit the decoding process to perform optimally. However, as the data rate increases, there are fewer cycles available, leading to a reduction in coding gain. For data rates above ~1 Mbps, Viterbi should be considered the better alternative. The practical upper limit at this time is 2.048 Mbps.

Table D-6. Sequential Decoding Summary

FOR	AGAINST
Higher coding gain (1-2 dB) at lower data rates, compared to Viterbi.	Pronounced threshold effect - does not fail gracefully in poor Eb/No conditions.
	Higher processing delay than Viterbi (~4 k bits) - not good for low-rate coded voice.
	Upper data rate limit approximately 2Mbps
	Coding gain varies with data rate - favors lower data rates.

Appendix E. APPLICATION EXAMPLES

E.1 OSPFv2 in a Shared Outbound Satellite Network

The challenges and proposed solutions for using Open Shortest Path First (OSPF) in a shared outbound/split path satellite network (such as Vipersat) are examined in this appendix.

E.1.1 Satellite Shared Outbound Network Overview

A shared outbound network saves satellite bandwidth and reduces operating expenses by allowing multiple remote terminals to share the same channel from a hub ground station.

Figure E-1 illustrates a satellite shared outbound network. Notably, the outbound interface at the hub is not the same interface at which return traffic received. This is referred to as “split path.”

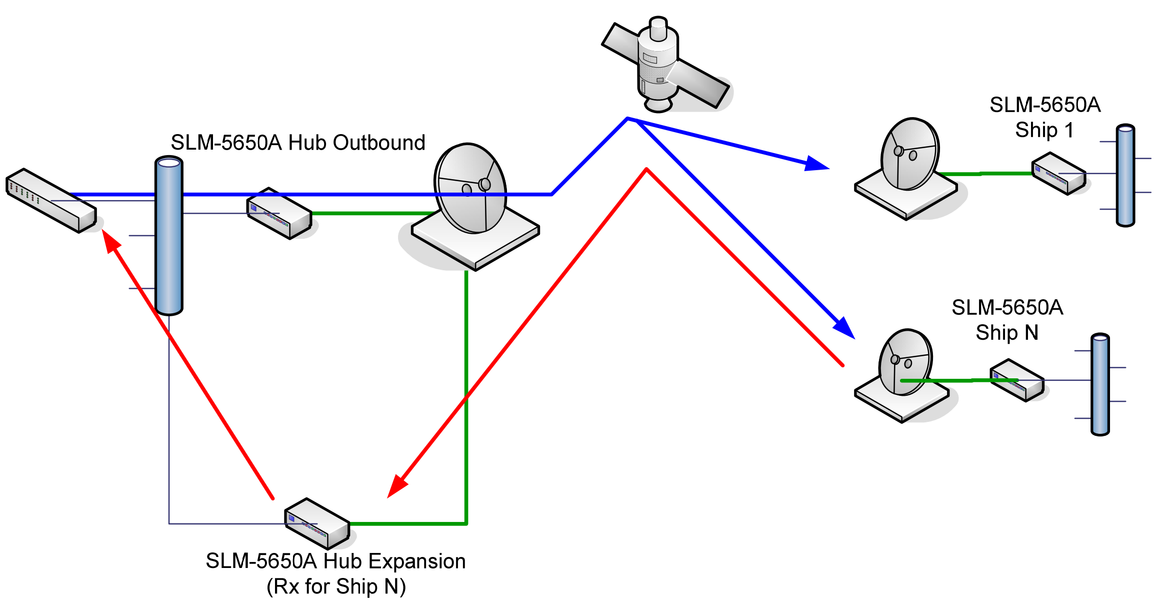


Figure E-1. Satellite Shared Outbound Network

E.1.2 OSPF Basics

While a complete explanation of OSPFv2 is beyond the scope of this document, it is important to describe certain critical features of the OSPF protocol that impact a shared outbound satellite network.

- OSPF requires that the communication channel between the interfaces that connect any two given OSPF nodes must have ability to pass traffic *bi-directionally*.
- A router running the OSPF algorithm will send out "Hello" packets on each interface, when the response from a node on the *same subnet as the interface* is received, OSPF will create a the neighbor adjacency with that node.
- In this way, the subnets and segments of the OSPF network are discovered, mapped and an OSPF database is created. This database is used by all OSPF routers to determine open shortest paths to all remote networks. OSPF nodes that do not follow these rules will not be added to a router's neighbor adjacency database.

E.1.3 Challenges

Use of a split path violates the requirement whereby OSPF messaging is sent and received on the same interface. Therefore, the hub modems will not achieve "neighbor adjacency" with any of the remote routers. This means that running OSPF on the hub routers will not add any value.

In the example diagram, the SLM-5650A NP Router is essentially a two-port router, thereby requiring that another OSPF node always be in place "downstream" at the remote.

However, if this downstream router is running OSPF, could the high costs associated with a satellite link be managed and reduced by specifically configuring the router interface? Such a configuration would allow the overall OSPF network to control whether traffic should pass to the satellite link, or to a lower-cost link, such a terrestrial fiber, based upon availability. The possibility of such a solution is examined in the following use case.

E.1.4 Maritime Use Case

The maritime use case presents the application of OSPFv2 as part of a deployed network of routers that includes the SLM-5650A Network Processor (NP).

The primary objective of this use case is to describe the process of automatically re-routing traffic when alternative transmission links are available in a maritime environment. Specifically, the satellite link should be used when at sea, and the high-speed terrestrial link should be used when at shore. This switch should occur automatically.

If other communication links such as ship-to-ship or back-up lower-speed satellite networks are available, then the OSPF routing protocol will select the best path as defined by link cost.

E.1.4.1 Use Case: At Shore

As depicted in **Figure E-2**, the shipboard OSPF network will automatically re-route packets destined to non-shipboard networks over the high-speed, low-cost network.

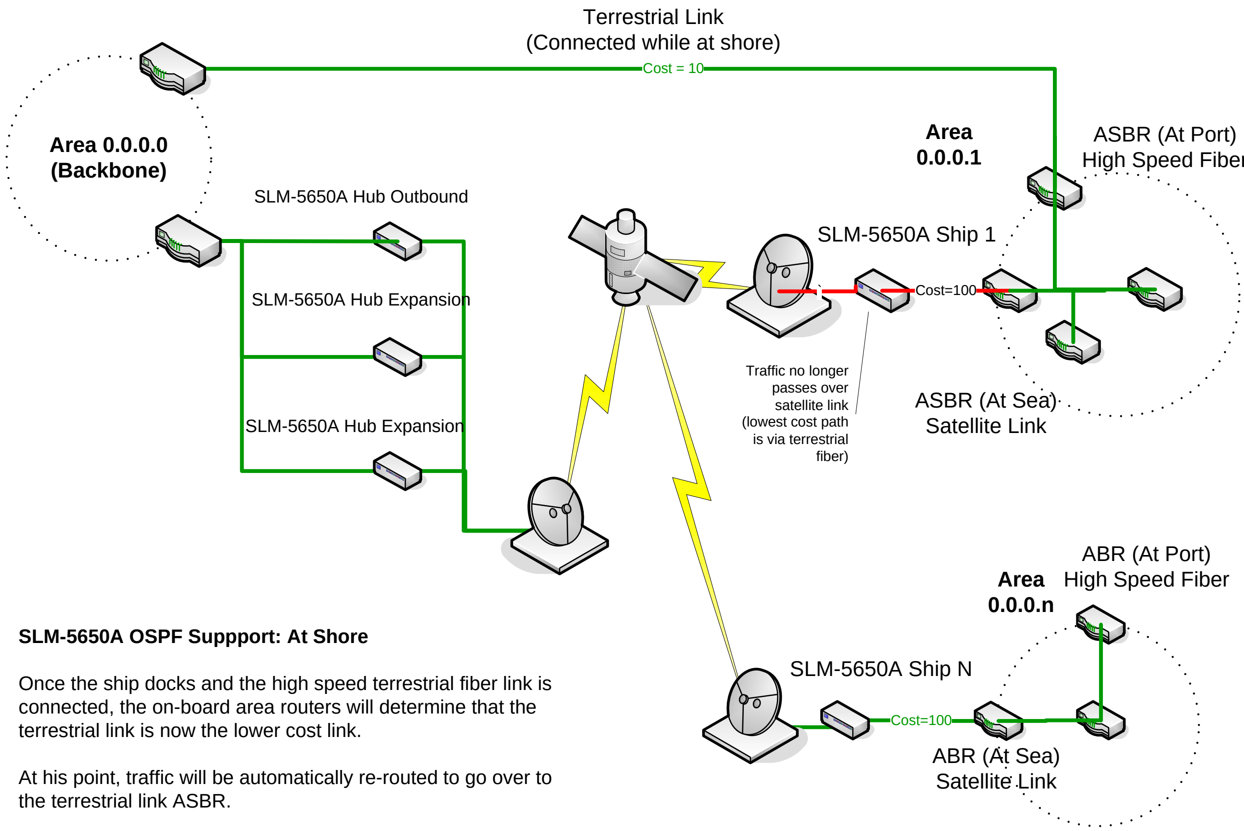


Figure E-2. OSPF Support at Shore

E.1.4.2 Use Case: At Sea

When at sea, all traffic will be routed to the satellite network. If other communication links such as ship-to-ship or backup lower-speed satellite networks are available, then the OSPF routing protocol will select the best path as defined by link cost.

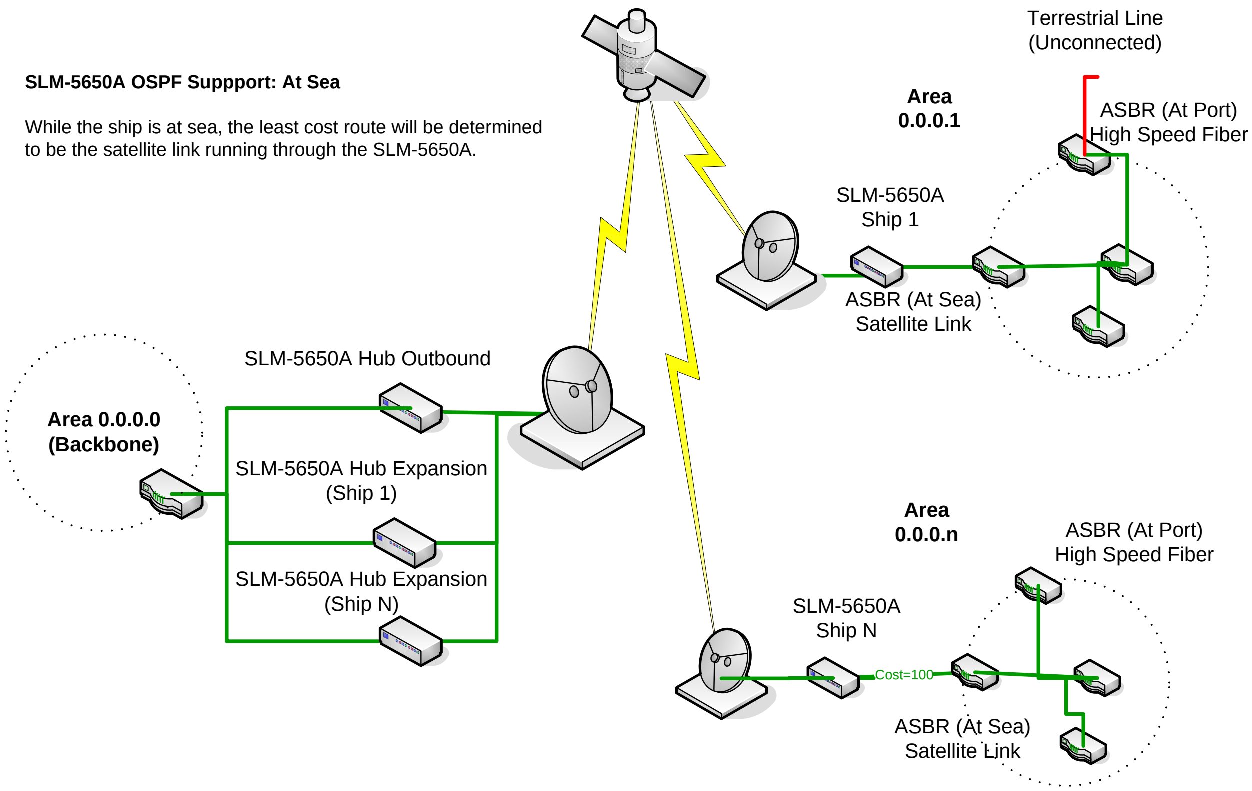


Figure E-3. OSPF Support at Sea

E.1.5 Proposed Solution

The following section describes a proposed solution that has undergone prototyping and lab-testing.

E.1.5.1 Test Network

To demonstrate how OSPFv2 can be used in a large-scale Vipersat deployment, the test network illustrated in **Figure E-4** was created.

After prototyping a number of options, it was determined that OSPF could be used with a Vipersat and shared outbound topology by enabling a feature commonly found on modern routers: IP tunneling.

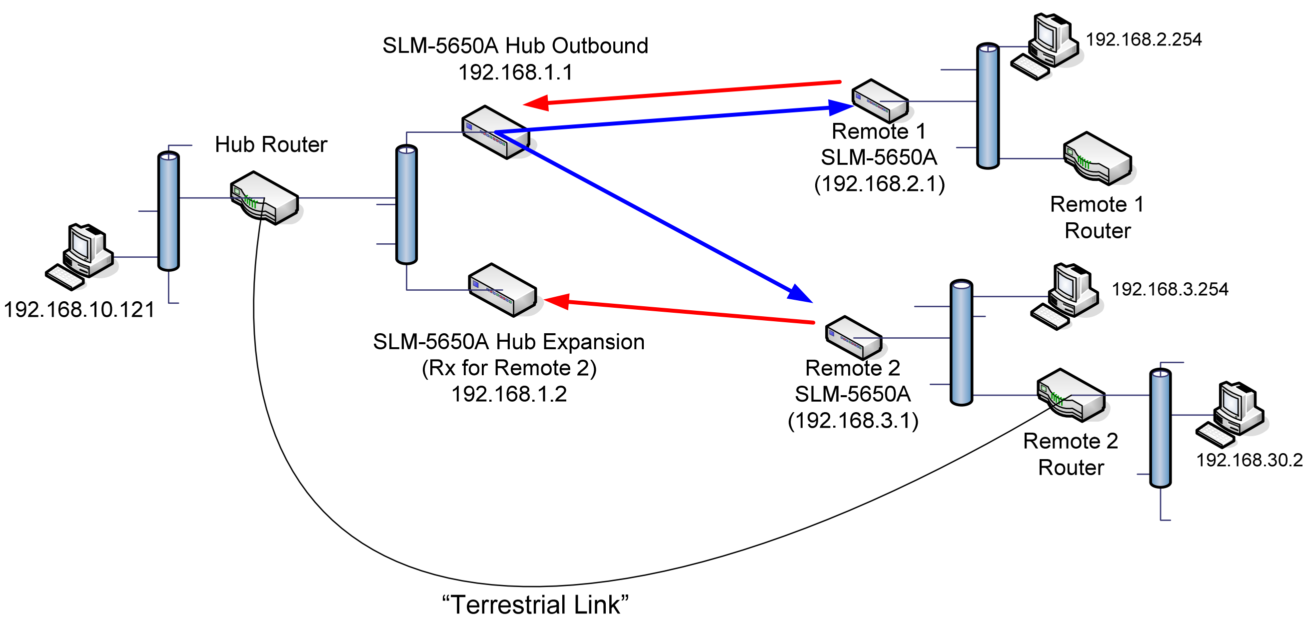


Figure E-4. OSPF Laboratory Test Network

E.1.5.2 Test Solution

If an IP tunnel is configured from each of the remote ASBR routers to the OSPF routers at the hub, the two routers will attain neighbor adjacency. All of the necessary OSPF messages will be exchanged to include the remote shipboard network into the OSPF domain.

This configuration allows the network to automatically reconfigure to the lower-cost terrestrial link when connected and automatically return to the higher-cost satellite link when the terrestrial link is disconnected.

It is recommended that the hub OSPF router be a backbone router (area 0.0.0.0), and each of the shipboard networks be a single OSPF area. This will reduce the amount of OSPF messaging required to be transmitted over the satellite network.

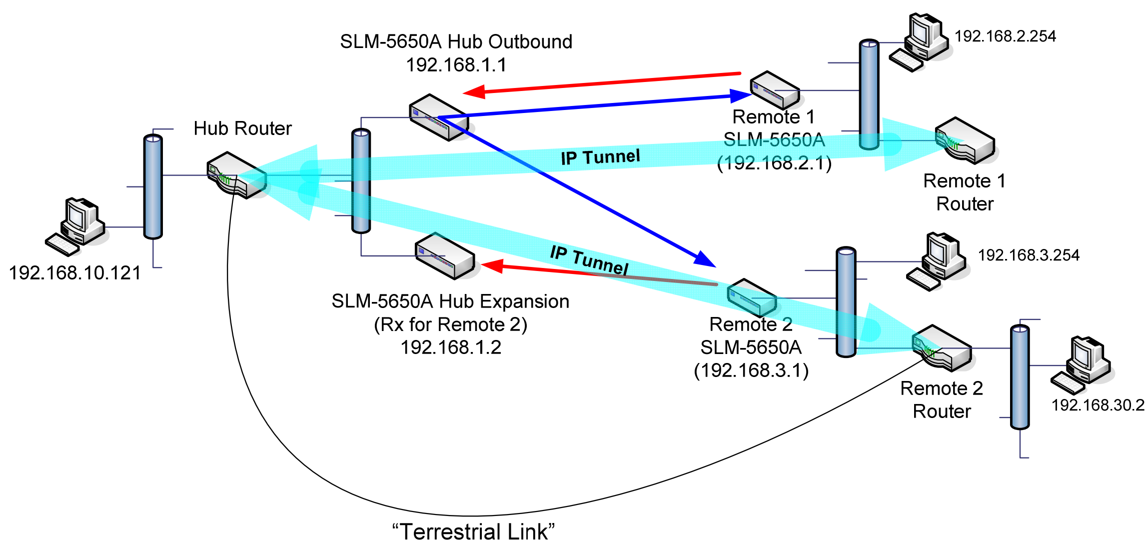


Figure E-5. OSPF Test Solution

E.1.6 Summary

The proposed solution using router-configurable IP tunneling to connect the remotes to the hub OSPF router satisfies the use case with minimal operator configuration.

While the addition of an IP tunnel will add overhead, the overall reduction in satellite bandwidth using the dynamic shared bandwidth functionality of Vipersat will more than offset the added overhead. Load switching, used in conjunction with OSPF, will allow the bandwidth to be automatically returned to the pool once a lower-cost terrestrial link is connected.

Advantages

- Allows for automatic path selection via OSPF in a split path configuration with minimal impact to the network.
- Because each ship is its own area, there will be a reduced amount of OSPF traffic over the satellite.
- If the operator uses Vipersat load switching at the remote i.e. shipboard SLM-5650A NP, then once the terrestrial link is connected, traffic will be redirected to fiber link and the load-switching algorithm will free the satellite link and return it to STDMA operation. This will free up significant satellite bandwidth automatically for use by other ships still at sea.
- Satellite link availability will still be available to the participating OSPF routers because periodic LSA and Hello packets will not be received on the router interface in case of satellite outage.
- Reduces the number of OSPF nodes in the network

Disadvantages

- Because IP tunnels are set up from the remote ASBR to the hub backbone router, an additional 20-byte IP header will be added to all packets traversing the satellite interface.
- An IP tunnel will have to be configured for each ship to the hub OSPF router.

Notes:

Appendix F. 1:1 REDUNDANCY

F.1 Installation

The SLM-5650A Satellite Modem, when connected to a Comtech EF Data CRS-311 1:1 Redundancy Switch, provides fully automatic protection of IP packet traffic in the case of equipment failure. Redundancy is provided for both routed and bridged traffic; however, configurations differ between routed and bridged modes of operation. For more information on installation, consult the ***CRS-311 1:1 Redundancy Switch Installation and Operation Manual***.

In routed mode, Ethernet Port 1 on the CRS-311 must be used. This is a requirement since CRS-311 Port 1 allows the modems to share parameters. Optionally, Ports 2-4 can be used for user traffic, but these ports are disconnect for the offline modem.

In bridged mode, Ethernet Ports 2-4 on the CRS-311 can be used. However, Port 1 MUST NOT be used, since Port 1 is designated specifically for routed mode.

F.2 TTL (Switch) Configuration

To use 1:1 redundancy, the SLM-5650A must have communications configured to TTL (Switch) in order to communicate with the CRS-311.

Using the SLM-5650A front panel menu, the user must set the serial interface on each of the modems to TTL for operation with the CRS-311.

To set the serial interface:

Step	Procedure
1	From the SLM-5650A front panel menu, navigate to **Config: Remote → SerialConfig**.
2	Set **Interface** to **TTL (SWITCH)**.
3	Set **Format** to **8N1**.
4	Set **Baudrate** to **9600** Baud**.**
5	Verify that Traffic Modem is **ONLINE** and the Redundant Modem is **OFFLINE**.

For detailed information on using the front panel menus, see **Chapter 5. FRONT PANEL OPERATION.**

F.3 Routed Mode Configuration

Routed redundancy is provided by a Dual IP Addresses scheme. The user must verify that the modems are in Dual IP Address Mode. In routed mode, a single IP address should NOT be used and will be automatically overwritten by the modem.

To verify the Dual IP Address Mode on the Online Modem:

Step	Procedure
1	From the SLM-5650A front panel, navigate to **Config: Remote → EthernetConfig → Option Card Addr →Network Proc**.
2	Verify that the **Mode** is set to **DUAL.**

A traffic IP Address is used as the gateway for networked devices. The traffic IP address always "floats" with whichever modem is online. The traffic IP address on the offline modem is inactivated.

To enter the "shared" traffic IP address on the Online Modem:

Step	Procedure
1	From the SLM-5650A front panel, navigate to **Config: Remote → EthernetConfig → Option Card Addr →Network Proc**.
2	Set the **Traffic IP** Address of the **Online** Modem *only*.
3	Verify that the **Traffic IP** Address also appears on the **Offline** Modem.

NOTE: The Traffic IP Address for both modems is "shared", but only the Online Modem activates the Traffic IP Address.

In addition, each modem must be given a unique Management IP Address that does not float with Online/Offline status. The modem uses the Management IP Addresses to mirror parameters. Upon boot up, the offline modem requests a parameter update from the Online Modem. The Online Modem sends the parameter update to offline modem using the LAN. In addition, when the user saves the online Network Processor parameters, the Online Modem sends parameter updates to the offline modem. The offline modem receives parameter updates, updates itself, and saves parameters in flash.

To enter the Management IP Address on the **Online** Modem:

Step	Procedure
1	From the SLM-5650A front panel, navigate to **Config: Remote → EthernetConfig → Option Card Addr →Network Proc**.
2	Set the Management IP Address (**Mgmt IP**) of the **Online** Modem.

To enter the Management IP Address on the **Offline** Modem:

Step	Procedure
1	From the SLM-5650A front panel, navigate to **Config: Remote → EthernetConfig → Option Card Addr →Network Proc**.
2	Set the Management IP Address (**Mgmt IP**) of the **Offline** Modem.

NOTE: The Management IP Addresses must be *unique* for both modems, but must be on the *same subnet*.

The Online Modem always sends a gratuitous ARP for the Traffic IP Address when it comes online. This causes networked device on the LAN to update their ARP tables and start sending their IP traffic to the Online Modem.

The Offline Modem always filters all IP packets received from the WAN that are destined to LAN. This keeps duplicate IP packets off of the LAN. In addition, the offline Network Processor changes all its WAN routes so that their "Next Hop IP Address" is the Online Modem's management IP address. This allows remote access to the offline Network Processor from both the LAN interface and WAN interface.

F.4 Bridged Mode Configuration

Bridged redundancy is provided by a single IP address scheme.

To verify Single IP Address Mode on the **Online** Modem:

Step	Procedure
1	From the SLM-5650A front panel, navigate to **Config: Remote → EthernetConfig → Option Card Addr →Network Proc**.
2	Verify that the **Mode** appears as **Single**.

To verify Single IP Address Mode on the **Offline** Modem:

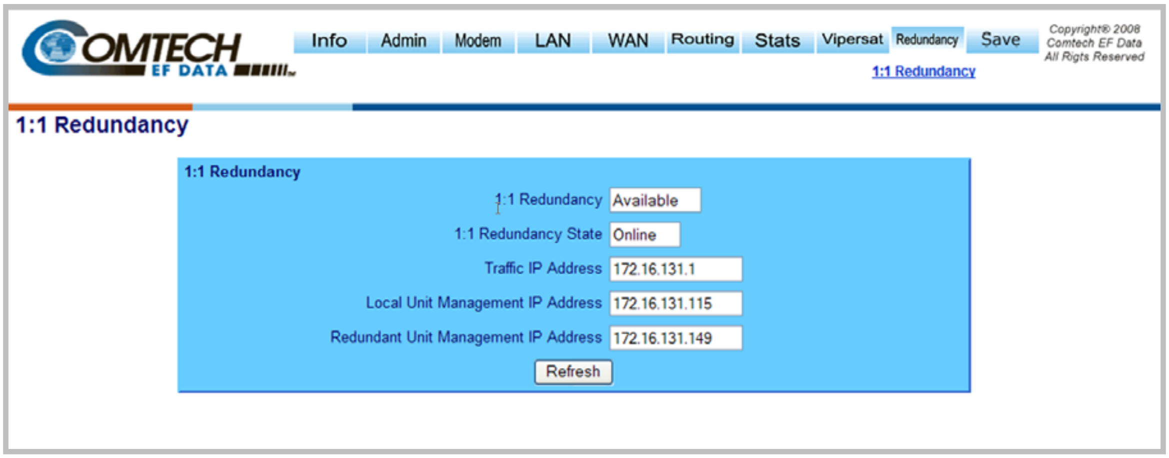
Step	Procedure
1	From the SLM-5650A front panel, navigate to **Config: Remote → EthernetConfig → Option Card Addr →Network Proc**.
2	Set the **Traffic IP** Address of the **Online** Modem *only*.
3	Verify that the **Traffic IP** Address also appears on the **Offline** Modem.

In bridged mode, the CRS-311 will keep the Online Modem's Ethernet Ports 2-4 turned **on**. The CRS-311 will keep the Offline Modem's Ethernet Ports 2-4 turned **off**. The traffic IP address is only accessible on the Online Modem; there is **NO** access to the Offline Modem.

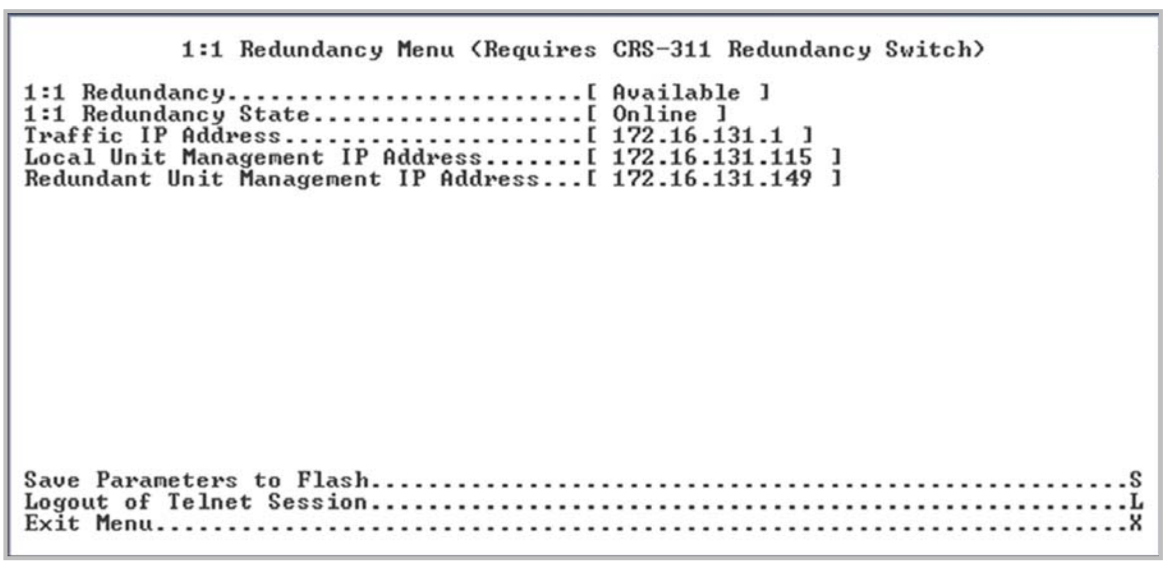
Furthermore, in bridged mode, the parameter backup mechanism is not being supported. The user must make sure that all parameters match in the Online and Offline modems.

F.5 1:1 Redundancy Status

The status of 1:1 Redundancy can be viewed using the Network Processor Module's Web Server and Telnet User interfaces, shown here in **Figure F-1**. The parameters displayed on both interfaces are ***read-only***.



Web Server Interface



Telnet Interface

Figure F-1. 1:1 Redundancy Status View (by Interface)

For more information on these user interfaces, refer to **Chapter 8.7 NP Module Web Server Interface** or **Chapter 9. NP MODULE TELNET OPERATION**.

METRIC CONVERSIONS

Units of Length

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

Temperature Conversions

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

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

Units of Weight

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

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