SNM-1010

Data/Control Modem
Operation and Maintenance Manual

Part Number MN/SNM1010.OM **Revision 2**

Errata A

Comtech EF Data Documentation Update

Subject:	MIDAS Node Installation
Date:	June 21, 2002
Document:	SNM-1010 Data/Control Modem Installation and Operation Manual, Rev. 2, dated April 30, 2002
Part Number:	MN/SNM1010.EA2
Collating Instructions:	Attach this page to page 2-14

Comments:

The following addition provides MIDAS Node installation procedures. Change will be added at the time of the next revision.

Change Specifics: Add page to existing manual.

2.4 MIDAS Node Installation

IMPORTANT

After facility installation (including IDUs, ODUs, and appropriate cabling) is completed, connect the SNM-1010 Data/Control modem to the MIDAS Network as a node via the satellite. Perform the following steps to accomplish this connection. If difficulties are encountered, contact MIDAS Network Customer Support department for assistance.

1. Connect a terminal to the User Port connection (J8) of the modem. Use HyperTerminal (or equivalent) to configure the:

   - Node Address (NA)
   - Inbound Control Channel Frequency (ICF)
   - Outbound Control Channel Frequency (OCF)

2. HyperTerminal shall be configured as follows:

   a. Rate: 19200, 8, N, 1
   b. Hardware Flow Control
   c. ANSI Emulation

3. Perform the following:

Set the NA to a unique number from 1 to 9999.	This is the node identifier that the NMS Controller at the Hub site uses to communicate with the node. Refer to section 3.7.4.
Set the ICF of the node modem.	The ICF frequency set at the node modem is the same frequency as the Hub sites continuous mode OCF. Refer to section 3.7.5.
Set the OCF of the node modem.	The OCF frequency set at the node modem is the same frequency as the Hub sites burst mode ICF. Refer to section 3.7.6.

SNM-1010

Data/Control Modem
Operation and Maintenance Manual

Comtech EFData is an ISO 9001
Registered Company.

Part Number MN/SNM1010.OM
Revision 2
April 30, 2002

Comtech EFData, 2114 West 7th Street, Tempe, Arizona 85281 USA, 480.333.2200, FAX: 480.333.2161.

Network Customer Support

The Network Customer Support Plan identifies the steps to be followed in resolving the Customer's concern.

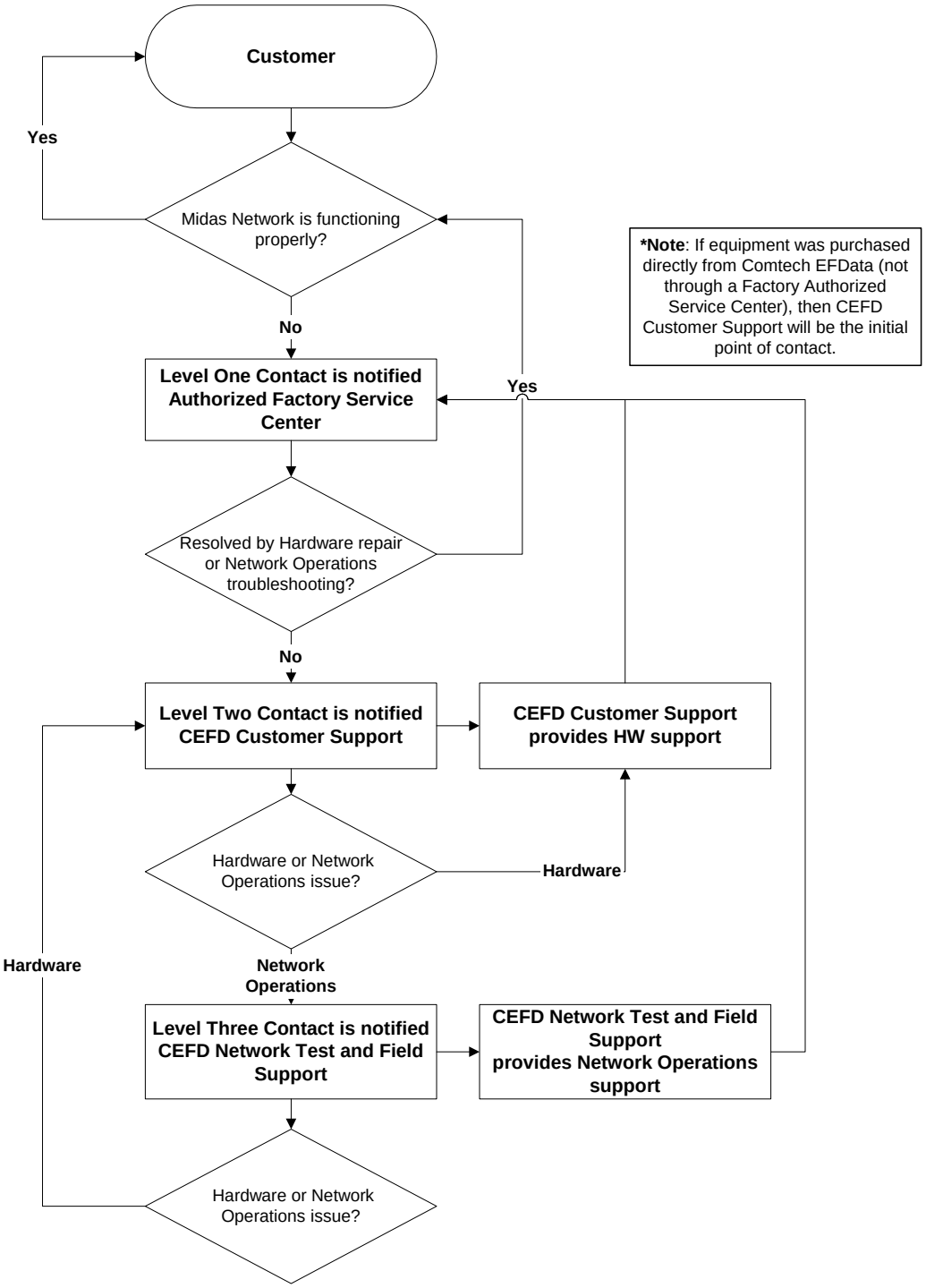
The resolution efforts will follow these levels of contact:

- **Level One Contact** – Factory Authorized Service Center.
- **Level Two Contact** – Comtech EF Data Customer Support.
- **Level Three Contact** – Network Test and Field Support

Procedural Steps

Step	Procedure
1	The **Customer** raises a concern with the **Level One Contact**.
2	The **Level One Contact** will perform ***Hardware*** repairs and ***Network Operations*** troubleshooting in accordance with the Comtech EF Data Service Center agreement.
3	If the **Level One Contact** is unable to resolve the concern, then the **Level One Contact** will inform the **Level Two Contact** of the concern in accordance with the instructions found within the attached Comtech EF Data Customer Support Department's document.
4	The **Level Two Contact** will enter the concern into the Comtech EF Data database and determine whether the concern is a ***Hardware*** concern or a ***Network Operations*** concern
5	The **Level Two Contact** will interface with the **Level One Contact** and provide the appropriate hardware support and enter all correspondence into the Comtech EF Data database.
6	If the **Level Two Contact** determines that the concern is a ***Network Operations*** concern, then the **Level Two Contact** will inform the **Level Three Contact**.
7	The **Level Three Contact** will interface with the **Level One Contact** and provide the appropriate support and enter all correspondence into the Comtech EF Data database.
8	If the **Level Three Contact** determines that there is a ***Hardware*** failure then the **Level Three Contact** will inform the **Level Two Contact**. Go to Step 5.

Network Support Customer Plan



See the Comtech EF Data website at http://www.comtechefdata.com for contact information for a Factory Authorized Service Center. Contact the Factory Authorized Service Center for:

- Product support
- Information on upgrading or returning a product

Contact the Comtech EF Data Customer Support Department for:

- Product support or training
- 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)
480.333.2500 FAX

or, E-Mail can be sent to the Customer Support Department at:

service@comtechefdata.com

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

2. Request a Return Material Authorization (RMA) number from the Comtech EF Data Customer Support Department.

3. Be prepared to supply the Customer Support representative with the model number, serial number, and a description of the problem.

4. To ensure that the product is not damaged during shipping, pack the product in its original shipping carton/packaging.

5. Ship the product back to Comtech EF Data. (Shipping charges should be prepaid.)

Table of Contents

Figures

Tables

About this Manual

This manual describes the operation and maintenance of the Comtech EF Data SNM-1010 Data/Control Modem. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the Comtech EF Data SNM-1010 Data/Control Modem.

Related Documents

Comtech EF Data Specification, *SP/5747 DAMA Control Channel Messaging*

Conventions and References

Cautions and Warnings

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

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

IMPORTANT indicates a statement that is associated with the task being performed. .

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 English to Metric conversions.

Recommended Standard Designations

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

Trademarks

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

Reporting Comments or Suggestions Concerning this Manual

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

Overview of Changes to Previous Revisions

Chapter 1-	Revised to reflect current specifications. Added Data Rate and Symbol Rate table. Revised Table 1-1.
Chapter 3 -	Revised to reflect current revison and firmware.
Chapter 4 -	Revised Figures 4-2 and 4-4. Add Turbo Product Codec description.
Chapter 5-	Revised Table 5-2 SNM-1010 Fault Tree.
Appendix A-	Revised Remote Control Specifications to reflect current version and firmware.

Electrical Safety

The SNM-1010 Modem has been shown to comply with the following safety standard:

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

The equipment is rated for operation over the range 100 - 240 volts AC. It has a maximum power consumption of 40 watts, and draws a maximum of 400 mA.

Observe the following instructions:

Fuses

The SNM-1010 is fitted with two fuses - one each for line and neutral connections. These are contained within the body of the IEC power inlet connector, behind a small plastic flap.

- For 230 volt AC operation, use T0.75A, 20mm fuses.
- For 115 volt AC operation, use T1.25A fuses, 20mm fuses.

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

Environmental

The SNM-1010 must not be operated in an environment where the unit is exposed to extremes of temperature outside the ambient range 0 to 50°C (32 to 122°F), precipitation, condensation, or humid atmospheres above 95% RH, altitudes (un-pressurised) greater than 2000 metres, excessive dust or vibration, flammable gases, corrosive or explosive atmospheres.

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

Installation

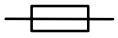
The installation and connection to the line supply must be made in compliance to local or national wiring codes and regulations.

The SNM-1010 is designed for connection to a power system that has separate ground, line and neutral conductors. The equipment is not designed for connection to power system that has no direct connection to ground.

The SNM-1010 is shipped with a line inlet cable suitable for use in the country of operation. If it is necessary to replace this cable, ensure the replacement has an equivalent specification.

Examples of acceptable ratings for the cable include HAR, BASEC and HOXXX-X. Examples of acceptable connector ratings include VDE, NF-USE, UL, CSA, OVE, CEBEC, NEMKO, DEMKO, BS1636A, BSI, SETI, IMQ, KEMA-KEUR and SEV.

International Symbols:

Symbol	Definition		Symbol	Definition
~	Alternating Current			Protective Earth
	Fuse			Chassis Ground

Telecommunications Terminal Equipment Directive

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

EMC (Electromagnetic Compatibility)

In accordance with European Directive 89/336/EEC, the SNM-1010 Modem has been shown, by independent testing, to comply with the following standards:

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

(Also tested to FCC Part 15 Class B)

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

Additionally, the SNM-1010 has been shown to comply with the following standards:

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

In order that the Modem continues to comply with these standards, observe the following instructions:

- Connections to the transmit and receive IF ports (BNC female connectors) should be made using a good quality coaxial cable - for example RG58/U (50 Ω or RG59/U (75 Ω).

- All 'D' type connectors attached to the rear panel must have back-shells that provide continuous metallic shielding. Cable with a continuous outer shield (either foil or braid, or both) must be used, and the shield must be bonded to the back-shell.

- The equipment must be operated with its cover on at all times. If it becomes necessary to remove the cover, the user should ensure that the cover is correctly re-fitted before normal operation commences

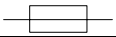
European EMC Directive

In order to meet the European Electro-Magnetic Compatibility (EMC) Directive (EN55022, EN50082-1), properly shielded cables for DATA I/O are required. More specifically, these cables must be shielded from end-to-end, ensuring a continuous ground shield.

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:

	Alternating Current.
	Fuse.
	Safety Ground.
	Chassis Ground.

Note: For additional symbols, refer to “Cautions and Warnings” listed earlier in this preface.

Warranty Policy

This Comtech EF Data product is warranted against defects in material and workmanship for a period of two year 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 customer is responsible for freight to Comtech EF Data and all related custom, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges **only** for return of the equipment from the factory to the customer. 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.

Limitations of Warranty

The foregoing warranty shall not apply to defects resulting from improper installation or maintenance, abuse, unauthorized modification, or operation outside of environmental specifications for the product, or, for damages that occur due to improper repackaging of equipment for return to Comtech EF Data.

No other warranty is expressed or implied. Comtech EF Data specifically disclaims the implied warranties of merchantability and fitness for particular purpose.

Exclusive Remedies

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.

Disclaimer

Comtech EF Data has reviewed this manual thoroughly in order that it will be an easy-to-use guide to your equipment. All statements, technical information, and recommendations in this manual and in any guides or related documents are believed reliable, but the accuracy and completeness thereof are not guaranteed or warranted, and they are not intended to be, nor should they be understood to be, representations or warranties concerning the products described. Further, Comtech EF Data reserves the right to make changes in the specifications of the products described in this manual at any time without notice and without obligation to notify any person of such changes.

If you have any questions regarding your equipment or the information in this manual, please contact the Comtech EF Data Customer Support Department.

Chapter 1. INTRODUCTION

This chapter provides an overview of the SNM-1010 Data/Control modem, referred to in this manual as “the modem.”

Figure 1-1.
SNM-1010 Data/Control Modem

1.1 Overview

The SNM-1010 Data/Control Modem (Figure 1-2) is a fully integrated digital satellite data modem and Demand Assigned Multiple Access (DAMA) controller. Utilizing the latest digital signal processing techniques, it is designed to function as a self-contained indoor unit that operates within manufacturer's Bandwidth-on-Demand (BOD) Multimedia Integrated Digital Access System (MIDAS).

An SNM-1010 Data/Control Modem consists of the following components:

- SDM-300A Based-Modem
- DAMA Assignemnt Controller (DAC)
- Terrestrial data interface (Synchronous Data)

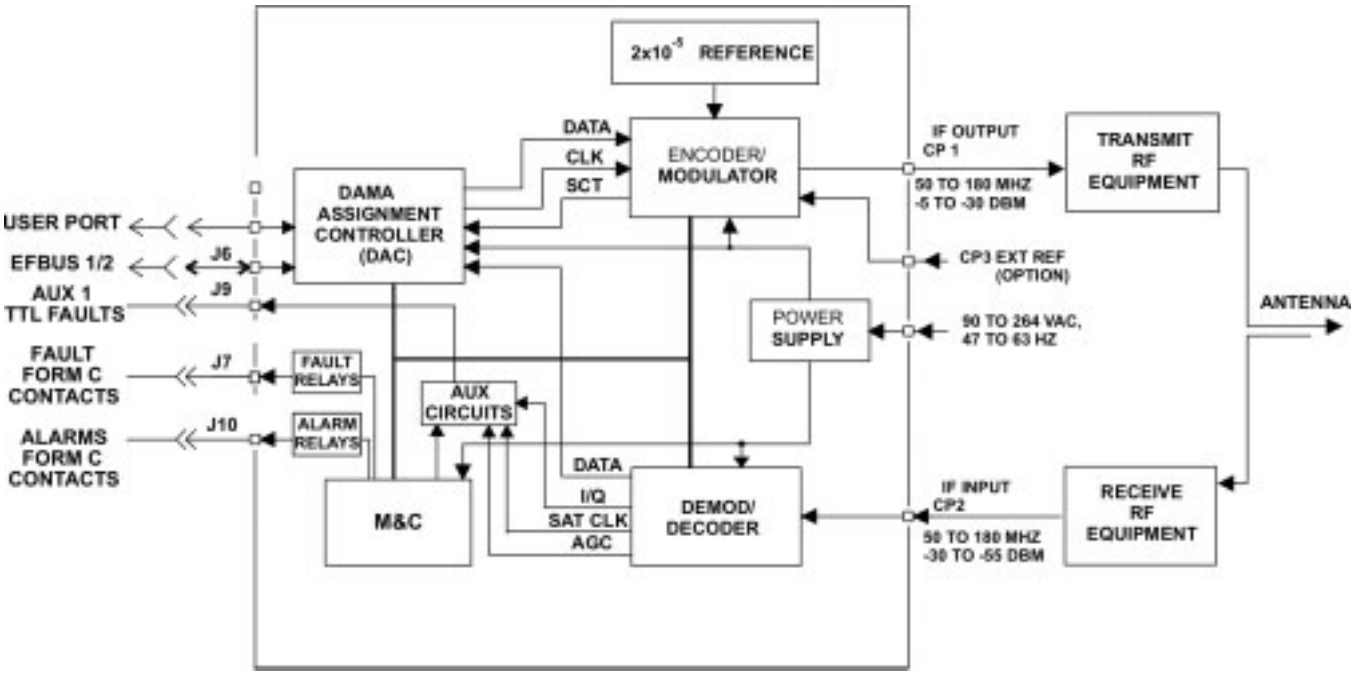


Figure 1-2. SNM-1010 Block Diagram

1.1.1 Additional Features

The modem contains the following additional features:

- Integrated data modem and DAMA controller in a 1RU package
- Burst mode and Continuous mode modulator
- Continuous mode demodulator
- 2.4 kbps to 5.0 Mbps in continuous traffic mode
- Fast acquisition
- Operational parameters stored in EEPROM
- 50/180 MHz operation
- Software stored in flash for easy update

1.1.2 Description

The SNM-1010 incorporates two operating modes (See Figure 1-3):

Internal	In Internal mode, it operates as the controller, receiving the continuous outbound control channel from the Network Management System (NMS) and transmitting to the NMS on the inbound control channel in burst mode.
Traffic Mode	When required, it switches to traffic mode to carry user data. It switches back to the control mode, once the traffic connection is terminated.

Note: The modem operates at an IF frequency range of 50 to 180 MHz.

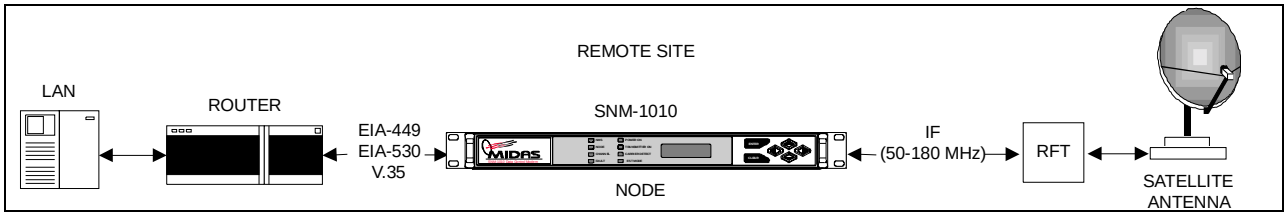


Figure 1-3. SNM-1010 Control/Traffic Mode

The SNM-1010 is housed in a 1-Rack Unit (1RU) rack-mountable chassis. Cooling is provided by a fan mounted on the rear panel. The SNM-1010 is capable of operating in either burst transmit with continuous receive, or continuous transmit/receive mode.

- *Burst mode* is used by the SNM-1010 at the remote, when it is transmitting to the NMS over the inbound control channel. The burst mode data rate is shown in the following listing.

Burst Mode Data Rates
19.2 kbit/s at FEC rate 1/2 QPSK

- *Continuous mode* is used for receiving the outbound control channel at the remote. It is also used for traffic circuits. Data rates available for traffic circuits are shown in the following listing.

SNM-1010 2,400 5,000,000

Modulation Type	Encoding Type	Data Rate (bit/s)		Symbol Rate (sym/s)	
		Minimum	Maximum	Minimum	Maximum
BPSK 1/2	Viterbi	2,400	1,250,000	4,800	2,500,000
QPSK/OQPSK 1/2	Viterbi	4,800	2,500,000	4,800	2,500,000
QPSK/OQPSK 3/4	Viterbi	7,200	3,750,000	4,800	2,500,000
QPSK/OQPSK 7/8	Viterbi	8,400	4,375,000	4,800	2,500,000
8PSK 2/3	Viterbi	9,600	5,000,000	4,800	2,500,000
BPSK 1/2	Sequential	2,400	1,250,000	4,800	2,500,000
QPSK/OQPSK 1/2	Sequential	4,800	2,500,000	4,800	2,500,000
QPSK/OQPSK 3/4	Sequential	7,200	3,750,000	4,800	2,500,000
QPSK/OQPSK 7/8	Sequential	8,400	4,375,000	4,800	2,500,000
BPSK 1/2	Viterbi and Reed-Solomon	2,400	1,138,888	4,800	2,500,000
QPSK/OQPSK 1/2	Viterbi and Reed-Solomon	4,373	2,277,777	4,800	2,500,000
QPSK/OQPSK 3/4	Viterbi and Reed-Solomon	6,560	3,416,666	4,800	2,500,000
QPSK/OQPSK 7/8	Viterbi and Reed-Solomon	7,653	3,986,111	4,800	2,500,000
8PSK 2/3	Viterbi and Reed-Solomon	8,746	4,555,555	4,800	2,500,000
BPSK 1/2	Sequential and Reed-Solomon	2,400	1,138,888	4,800	2,500,000
QPSK/OQPSK 1/2	Sequential and Reed-Solomon	4,373	2,277,777	4,800	2,500,000
QPSK/OQPSK 3/4	Sequential and Reed-Solomon	6,560	3,416,666	4,800	2,500,000
QPSK/OQPSK 7/8	Sequential and Reed-Solomon	7,653	3,986,111	4,800	2,500,000
BPSK 5/16	Turbo	2,400	781,250	4,800	2,500,000
BPSK 21/44	Turbo	2,400	1,193,000	4,800	2,500,000
QPSK/OQPSK 3/4	Turbo	7,200	3,750,000	4,800	2,500,000
8PSK 3/4	Turbo	384,000	5,000,000	4,800	2,500,000
BPSK 1/1	Uncoded	4,800	2,500,000	4,800	2,500,000
QPSK/OQPSK 1/1	Uncoded	9,600	5,000,000	4,800	2,500,000

1.2 Options

Table 1-1. Options

Option	Part No.	Hardware Required	FAST
90-264 VAC	KT/8000-3	X	
-48 VDC	KT/8000-4	X	
EIA-530	KT/7327-1	X	
EIA-449	KT/6740-1	X	
V.35	PL/7178-1	X	
50Ω	PL/6093-3	X	
75Ω	PL/6093-1	X	
AUPC with Reed-Solomon	PL/6284, PL/6285	X	X
Turbo Codec	PL/9394-1	X	
OQPSK	SS/SNM1010-0022		X
Asymmetrical Loop Timing	SS/SNM1010-0006		X

1.3 Personality Module

The following connectors are available through the personality modules:

- DIN and 37 pin connector (User Port & EIA-449)
- DIN and 25 pin connector (User Port & EIA-530)
- DIN and Manchester connector (User Port & V.35)

1.4 User Port

The user port is used for software download. User port commands are available to change the user port to a maintenance (service) port and vice-versa. The power ON default functionality is that of user port.

1.5 Call Setup and Teardown Performance

The SNM-1010 significantly improves call setup and teardown performance. The requirements for different phases of call setup and teardown are as follows (refer to Figure 1-4 for the call setup and termination phases):

Phase	Nominal Time
Modem programming to switch from control to traffic mode	< 6 sec
Carrier acquisition (Traffic carrier)	See 1.8
Modem programming to switch from traffic to control mode	< 6 sec
Carrier acquisition (Outbound control channel)	< 5 sec

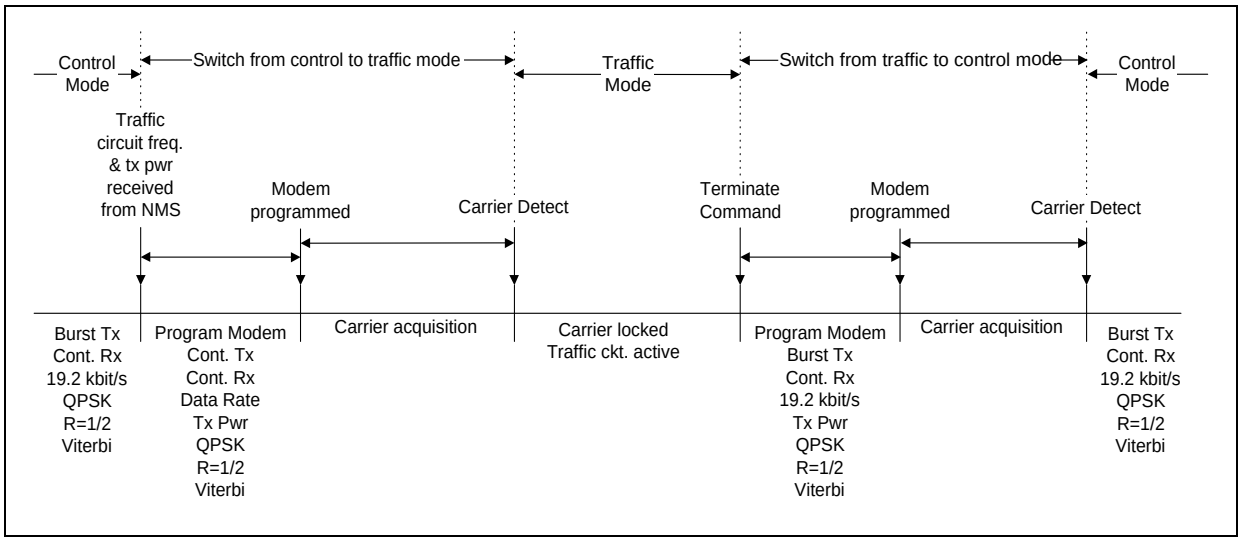


Figure 1-4. Call Setup & Termination Phases

1.5.1 Maximum Inter-call Delay

The maximum inter-call delay (i.e. maximum delay from the end of a call to the start of a new call) is:

- < 2 seconds for calls terminated due to RTS deactivation.
- < 4 seconds for call terminated due to loss of carrier. (Assumes operator configurable carrier loss timeout is set to 2 seconds.)

1.6 Specifications

This section includes the following specifications:

- General specifications
- Environmental specification
- DAC
- Burst mode operating specifications
- Continuous mode operating specifications
- Bit Error Rate (BER) specifications

1.6.1 General Specifications

Refer to Table 1-2 for general specifications

Table 1-2. General Specifications

General Specifications	
Operating Frequency Range	50 to 180 MHz Synthesized in 1 Hz steps
Modulation Types	8PSK BPSK QPSK OQPSK (FAST Upgrade) (Front panel selection)
Output Power	-5 to -30 dBm, adjustable in 0.1 dB steps
Output Spurious	-55 dBc in-band (0 to 500 MHz)
Output Impedance	75Ω (50Ω optional)
Output Return Loss	20 dB
Data Clock Source	Internal or External. External clock ± 100 PPM and < 5% jitter
Output Frequency Stability	± 10 PPM
Input Power (Desired Carrier) (Adjacent Carriers) (Maximum Total)	-30 to -55 dBm +30 dBc total power within 10 MHz from desired carrier -5 dBm
Input Impedance	75Ω (or 50Ω optional)
Input Return Loss	≥ 20 dB
Carrier Acquisition Range	± 35 kHz maximum
Clock Acquisition Range	± 100 PPM
AGC Output	0 to 10V at 10 mA maximum Default Levels: 0V for –60 dBm 10V for –25 dBm Levels can be programmed in 0.5V increments.
Operating Channel Spacing	Less than 0.5 dB degradation operating with two adjacent like channels (each 10 dB higher at 1.3 times the symbol rate) A single adjacent carrier spaced 1.4 times the symbol rate, up to +20 dBm

Table 1-3. General Specifications (Continued)

General Specifications	
Baseband Interface	EIA-422/449 V.35 EIA-232 (Field-selectable)
Elastic Buffer	32 to 262144 bits, selectable from front panel in bits or ms
Digital Data Rate	2.4 kbps to 5.0 Mbps in 1 bit/s steps (front panel selection)
Scrambling/Descrambling Types	IESS 309 (Synchronous 2^{15}) International Telephone and Telegraph Consultative Committee (CCITT) V.35 Comtech EF Data /Comstream compatible Fairchild compatible
Forward Error Correction	Viterbi K = 7: Rate 1/2, 3/4, 7/8, 2/3 Reed-Solomon: Rate 225/205 Turbo: Rate 5/16, 21/44, 3/4 Sequential: Rate 1/2, 3/4, 7/8 (Code rates selectable from front panel)
M&C	Front panel display (16 character by 2 rows), backlit
Filter Mask Types	INTELSAT/EUTELSAT Closed net (Comtech EF Data) Closed net (Fairchild compatible), SDM-51 compatible
Loopback Modes	Baseband (near end and far end) Interface (near end and far end) IF Loopback (near end) RF Loopback (far end)
Diagnostic Features	IF Loopback RF Loopback Baseband Loopback Interface Loopback Fault monitoring (includes current and stored faults) BER monitoring Input IF power monitoring Buffer fill status monitoring Remote control via user/maintenance port

1.6.2 Environmental and Physical Specifications

Refer to Table 1-4 for Environmental and Physical Specifications.

Table 1-4. Enivironmental and Physical Specifications

Parameter	Specifications
Power	Prime power 90 to 264 VAC, 47 to 63 Hz, 40W maximum, fused at 2A Optional: 38 to 64 VDC
Temperature: Operating Storage	 0 to 50°C (32 to 122° F) -55 to +70° C (-67 to 158° F)
Humidity	0 to 95% non-condensing
Mounting	Standard 19-inch (48.3 cm) rack mounts Note: Front and rear accepts standard rack mount slides
Operational Shock	When any one corner of the modem is dropped from 1 cm onto a hard surface, the modem will not take any errors or faults MIL-STD-167-1
Survivability Shock and Vibration	MIL-STD-810D Method 514.4, Procedure 8, 1 hour/axis
Size	1 rack unit (1RU) 1.75" H x 19.0" W x 15.7" D (4.4 H x 48 W x 40 D cm)
Weight	9 lbs. Maximum (4 kg Maximum)
Shipping: Weight Size	 15 lbs. (7 kg) 20 x 21 x 9 inch (51 x 53 x 23 cm)

1.6.3 DAC Specifications

The DAC performs all of the DAMA control functions for the remote site. The DAC provides a set of interfaces for communicating with an operator for data call requests, etc., and for controlling external traffic modems. (Refer to Sections 4.1 and 4.2.)

The DAC communicates with the NMS for call control and M&C.

1.6.4 Burst Mode Modulator Specifications

Refer to Table 1-5 for Burst Mode Modulator Operating Specifications.

Table 1-5. Burst Mode Modulator Operating Specifications

Modulator Specifications	
Operating Frequency Range	50 to 180 MHz
Type of Modulation	QPSK
Operating Channel Spacing	Less than 0.5 dB degradation operating with 2 adjacent-like channels, each 10 dB higher at 1.3 times the symbol rate, or a minimum of 1.2 times the specified acquisition range
Phase Noise	In accordance with IESS-308
Digital Data Rate	QPSK, R=1/2, 19.2 kbit/s
Forward Error Correction	Convolutional encoding, soft-decision K=7 Viterbi decoding
Data Scrambling	Selectable or none, 2^{15}-1, synchronous

1.6.5 Continuous Mode Specifications

Refer to Table 1-6 for Continuous Mode Operating Specifications.

Table 1-6. Continuous Mode Operating Specifications

Modulator Specifications	
Operating Frequency Range	50 to 180 MHz, in 1 Hz steps.
Type of Modulation	8PSK, QPSK, OQPSK, and BPSK
Operating Channel Spacing	Less than 0.5 dB degradation operating with 2 adjacent-like channels, each 10 dB higher at 1.3 times the symbol rate, or a minimum of 1.2 times the specified acquisition range
Bit Error Rate	Refer to
Phase Noise	In accordance with IESS-308
Digital Data Rate	Refer to Section 5.1
Forward Error Correction	Viterbi: K=7, 1/2, 2/3, 3/4, and 7/8 rates Sequential: 1/2, 3/4, and 7/8 rates Reed-Solomon: 225/205 Turbo: BPSK 5/16, 21/44 QPSK/OQPSK/8PSK 3/4
Data Scrambling	IESS-308 (V.35), IESS-309, or None
Demodulator Specifications	
Input Power (Desired Carrier)	-30 to -55 dBm (composite) +30 dB power within 2 MHz from desired carrier +40 dB power outside of 2 MHz from desired carrier -5 dBm maximum composite
Carrier Acquisition Range	± 35 kHz, selectable
Clock Acquisition Range	± 100 PPM
Acquisition Time	< 1 second
Directed Sweep: Sweep Range Sweep Center	 0 to 70000 Hz -35000 to +35000 Hz

1.7 Bit Error Rates (BER)

1.7.1 Viterbi/Sequential Closed Network Connection BER (with Reed-Solomon)

Table 1-7 lists the Viterbi/Sequential decoder with Reed-Solomon specifications for the E_b/N_0 required to achieve 10^{-6} to 10^{-10} BER for different configurations.

Table 1-7. Viterbi/Sequential Decoder with RS

Eb/N0 (dB) Specification			
BER	**1/2 Rate**	**3/4 Rate**	**7/8 Rate**
10^{-6}	4.1	5.6	6.7
10^{-7}	4.2	5.8	6.9
10^{-8}	4.4	6.0	7.1
10^{-10}	5.0	6.3	7.5

1.7.2 Sequential Decoder BER (56 kbit/s)

Table 1-8 lists the sequential specifications for the E_b/N_0 required to achieve 10^{-3} to 10^{-8} BER at 56 kbit/s. All values are for operating in BPSK, QPSK, and OQPSK modes

Table 1-8. Sequential BER Data (56 kbit/s)

	Specification			Typical		
BER	**1/2 Rate**	**3/4 Rate**	**7/8 Rate**	**1/2 Rate**	**3/4 Rate**	**7/8 Rate**
10^{-3}		4.6 dB	5.5 dB		4.1 dB	5.0 dB
10^{-4}	4.1 dB	5.1 dB	6.1 dB	3.6 dB	4.6 dB	5.6 dB
10^{-5}	4.5 dB	5.5 dB	6.6 dB	4.0 dB	5.0 dB	6.1 dB
10^{-6}	5.0 dB	5.9 dB	7.3 dB	4.5 dB	5.4 dB	6.8 dB
10^{-7}	5.4 dB	6.4 dB	7.8 dB	4.9 dB	5.9 dB	7.4 dB
10^{-8}	5.8 dB	6.8 dB	8.4 dB	5.3 dB	6.3 dB	7.9 dB

1.7.3 Sequential Decoder BER (1544 kbit/s)

Table 1-9 lists the sequential specifications for the E_b/N_0 required to achieve 10^{-3} to 10^{-8} BER at 1544 kbit/s. All values are for operating in BPSK, QPSK, and OQPSK modes.

Table 1-9. Sequential Decoder BER Data (1544 kbit/s)

	Specification			Typical		
BER	**1/2 Rate**	**3/4 Rate**	**7/8 Rate**	**1/2 Rate**	**3/4 Rate**	**7/8 Rate**
10^{-3}	4.8 dB	5.2 dB	6.0 dB	4.3 dB	4.7 dB	5.5 dB
10^{-4}	5.2 dB	5.7 dB	6.4 dB	4.7 dB	5.2 dB	5.9 dB
10^{-5}	5.6 dB	6.1 dB	6.9 dB	5.1 dB	5.6 dB	6.4 dB
10^{-6}	5.9 dB	6.5 dB	7.4 dB	5.4 dB	6.1 dB	6.9 dB
10^{-7}	6.3 dB	7.0 dB	7.9 dB	5.8 dB	6.5 dB	7.4 dB
10^{-8}	6.7 dB	7.4 dB	8.4 dB	6.2 dB	6.9 dB	7.9 dB

1.7.4 Viterbi 8PSK BER

Table 1-10 lists the 8PSK specification for performance with noise and with/without Reed-Solomon. All values are for operating in 8PSK mode.

Table 1-10. 8PSK Specification

2/3 8PSK with RS			2/3 8PSK without RS	
BER	**Spec**	**Typical**	**Spec**	**Typical**
10^{-4}	6.1	5.6	7.3	6.4
10^{-5}	6.3	5.8	8.2	7.2
10^{-6}	6.5	6.1	9.0	8.0
10^{-7}	6.7	6.35	9.8	8.8
10^{-8}	6.9	6.6	10.4	9.6

1.7.5 Performance with Noise Turbo Product Codec (Optional)

Table 1-11. Noise Turbo Product Codec

BER	QPSK/OQPSK	BPSK		8PSK
	3/4 Rate	21/44 Rate	5/16 Rate	3/4 rate
10^{-6}	3.9	2.8	*see Note*	7.0
10^{-7}	4.1	3.1	*see Note*	7.3
10^{-8}	4.3	3.3	*see Note*	7.6
10^{-9}	4.8	3.7	4.0	8.0

Note: 5/16 BPSK is included for compatibility with other equipment but implementation limitations prohibit optimum performance at low Eb/No. Performance is virtually error free above 4 dB Eb/No. Performance below 4dB Eb/No is not guaranteed.

1.8 Acquisition Time

Viterbi **6 dB E_b/N_0 with ± 3 kHz Frequency Uncertainty**			
Code Rate	**Data Rate**	**T_{acq}**	**$P(t < T_{acq})$**
1/2	< 9.6 kbps	< 10 sec	95%
1/2	≥ 9.6 < 64 kbps	< 5 sec	95%
1/2	≥ 64 < 196 kbps	< 1 sec	95%
1/2	≥ 196 < 512 kbps	< 10 sec	95%
1/2	≥ 512 < 1000 kbps	< 2.5 sec	95%
1/2	≥ 1 < 2.5 Mbps	< 1 sec	95%
Sequential **6 dB E_b/N_0 with ± 3 kHz Frequency Uncertainty**			
Code Rate	**Data Rate**	**T_{acq}**	**$P(t < T_{acq})$**
1/2	< 9.6 kbps	< 10 sec	95%
1/2	≥ 9.6 < 64 kbps	< 5 sec	95%
1/2	≥ 64 < 196 kbps	< 1 sec	95%
1/2	≥ 196 < 512 kbps	< 17 sec	95%
1/2	≥ 512 < 1000 kbps	< 2.5 sec	95%
1/2	≥ 1 < 2.5 Mbps	< 1 sec	95%

1.9 Typical Spectral Occupancy

Figure 1-5 shows a typical spectral occupancy curve using the Comtech EFData filter mask.

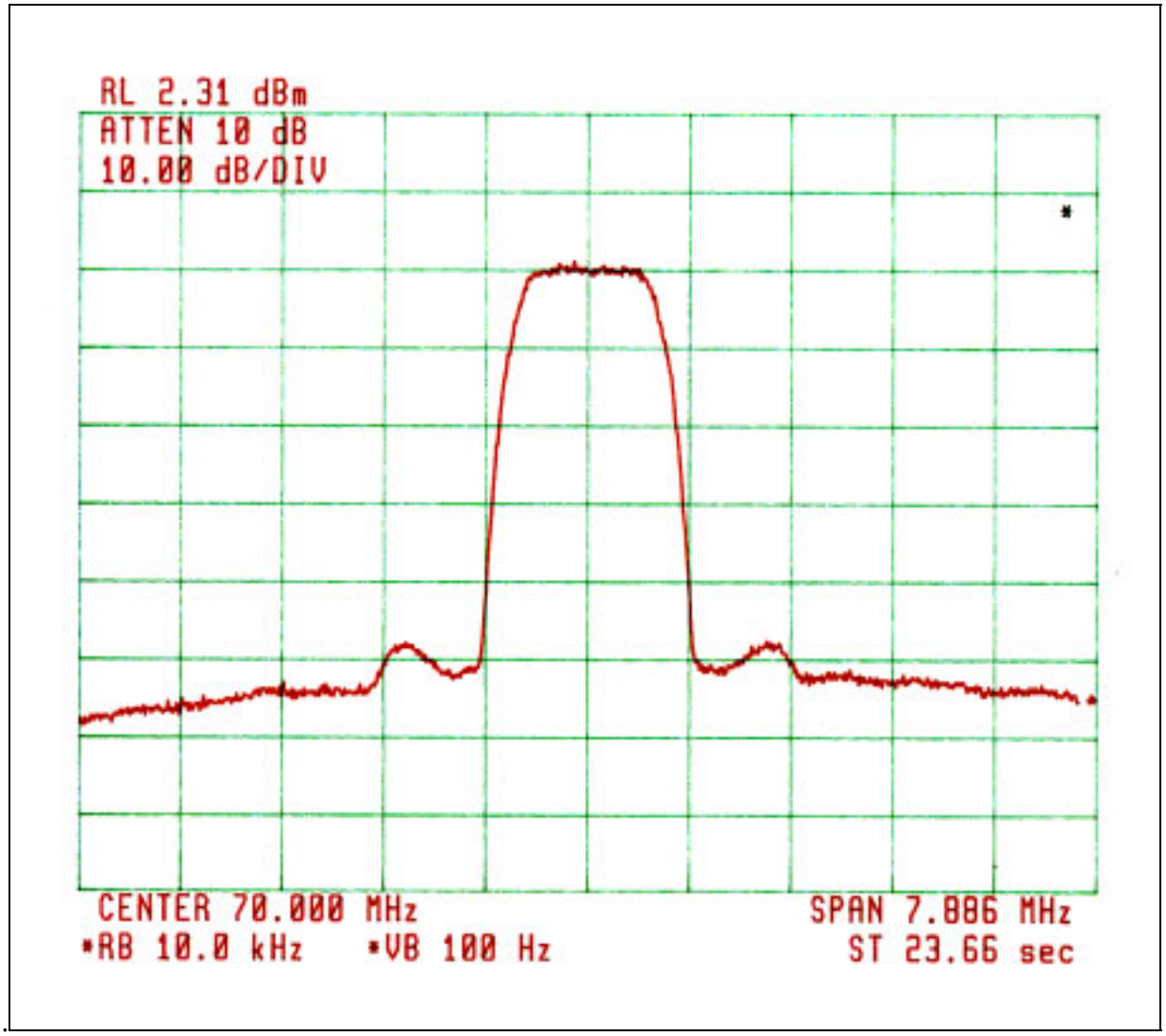


Figure 1-5. Typical Spectral Occupancy

1.10 Dimensional Envelope

Note: All dimensions are in English units, (meters are provided in the parentheses).

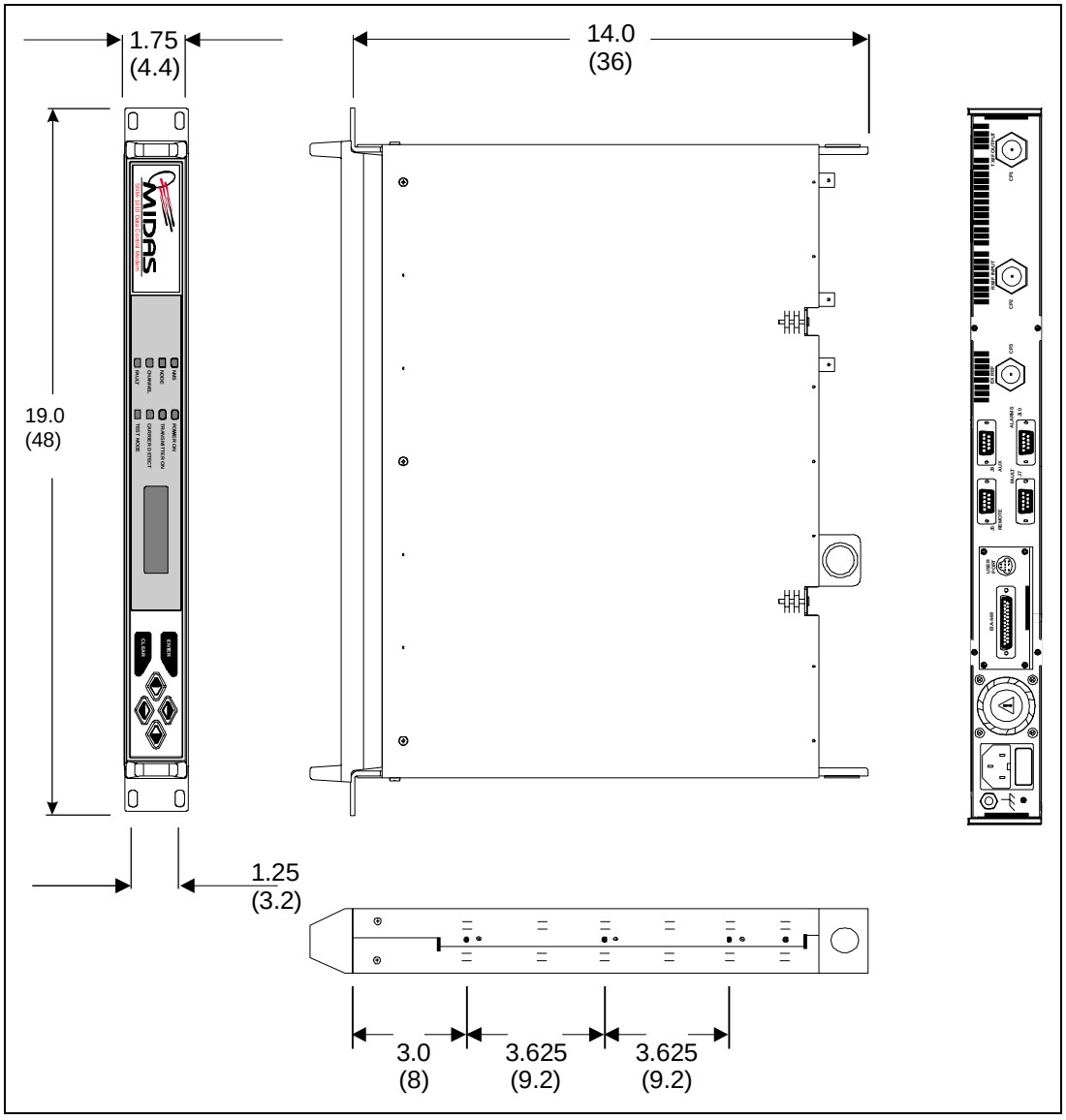


Figure 1-6. SNM-1010 Dimenional Envelope

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Chapter 2. INSTALLATION

This chapter provides unpacking and installation instructions, and a description of external connections.

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

2.1 Unpacking

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

Do not use any cutting tool that will extend more than 1 inch (2.54 cm) into the container. This can cause damage to the modem.

Unpack the modem as follows:

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 Section 2.2 for installation instructions.

2.2 Installation

The modem arrives fully assembled from the factory. After unpacking the modem, install the modem as follows:

1. If required, install the mounting bracket in equipment rack (Figure 2-1). Install and tighten the bracket bolts.

2. Loosen the screw with flat washer located on the left side of modem chassis. Mount the modem chassis into the equipment rack and slide the screw with flat washer through the slot of the mounting bracket. Tighten the screw sufficiently to allow the modem chassis to slide in the bracket.

3. Connect the cables to the proper locations on the rear panel. Refer to Section 2.4 for connector pinouts, placement, and function.

4. Connect the primary power cable to the power source. Before turning on the power switch, become familiar with the front panel operation in Chapter 3.

5. If problems exist with the installation, refer to Chapter 5 for troubleshooting information.

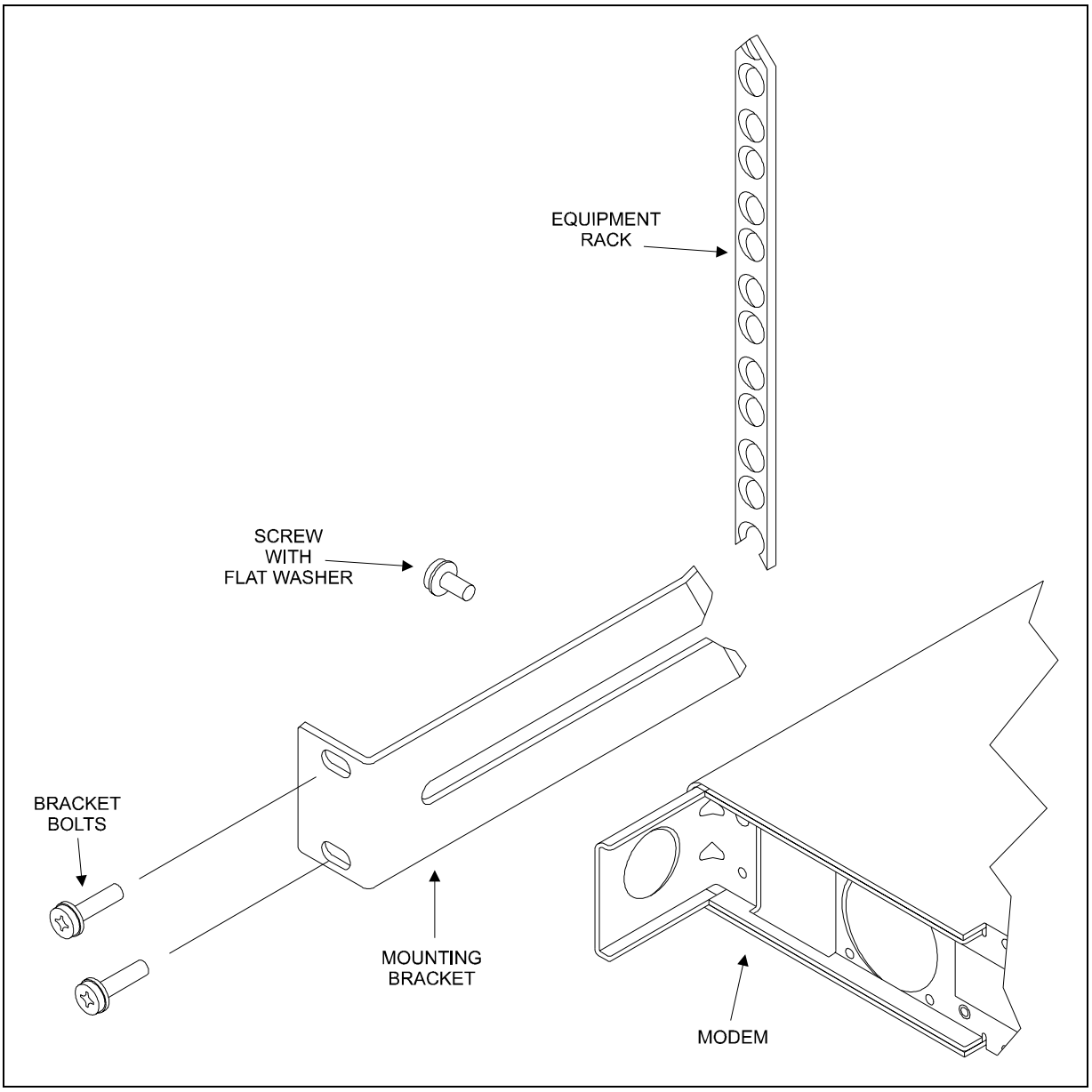


Figure 2-1. Installation of the Mounting Bracket

2.3 Rear Panel Connections

The rear panel connectors provide all necessary external connections between the modem and other equipment. Figure 2-2 provides a layout of the SNM-1010 rear panel, and Table 2-1 lists these connectors.

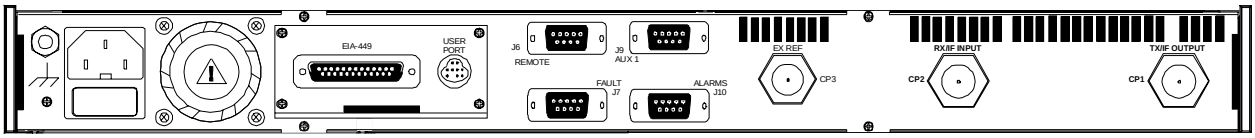


Figure 2-2. SNM-1010 Rear Panel

Table 2-1. Rear Panel Connectors

Connection	REF DES	Description
REMOTE	J6	Not currently used.
FAULT	J7	The FAULT connector, provides Form C contact closures for fault reporting.
AUXILIARY 1	J9	The AUX 1 connector, provides MOD and DEMOD (TTL) faults, satellite clock, satellite I&Q, and Automatic Gain Control (AGC) output voltage.
ALARM	J10	Not currently used. The ALARM connector, provides FORM C contact closures for the purpose of fault reporting.
DATA INTERFACE	-	The DATA INTERFACE provides a DCE connection when the SNM-1010 is used to carry data. Option EIA-449, V.35, EIA-530
USER PORT	-	The USER PORT allows a remote site user to request set up of a data call. It also is used for DAC software upgrades.
TX IF OUTPUT	CP1	The TX IF OUTPUT is a BNC jack that provides a connection for the transmit IF signal.
RX IF INPUT	CP2	The RX IF INPUT is a BNC jack that provides a connection for the receive IF signal.
EX REF	CP3	The EX REF is a BNC connector for an external reference. The input impedance is 75Ω
AC POWER	-	The AC POWER accepts input power for the SNM-1010. (± 48 VDC optional)
GROUND CONNECTOR	-	The GROUND CONNECTOR (GRN), provides a common chassis ground connection among all of the equipment, via a #10-32 stud.

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

2.3.1 Fault Connector and Pinouts (J7)

The fault connector provides Form C contact closures for fault reporting. The three Form C summary fault contacts, ratings 1A maximum at 24 VDC, 0.5A at 120 VAC, are Modulator, Demodulator, and Common Equipment.

The fault interface connection is a 9-pin subminiature female D connector (J7) located on the rear panel of the modem. Screw locks are provided for mechanical security on the mating connector. Refer to Table 2-2 for pinout information.

Table 2-2. Fault Connector and Pinouts (J7)

Pin #	Signal Function	Name
1	Common equipment is not faulted	NO
2		COM
3	Common equipment is faulted	NC
4	Modulator is not faulted	NO
5		COM
6	Modulator is faulted	NC
7	Demodulator is not faulted	NO
8		COM
9	Demodulator is faulted	NC

Note: A connection between the common (COM) and normally open (NO) contacts indicates no fault.

2.3.2 Auxiliary 1 Connector and Pinouts (J9)

The auxiliary 1 (AUX 1) connector provides:

- MOD and DEMOD (TTL) faults
- Satellite clock
- Satellite I&Q
- Automatic Gain Control (AGC) output voltage

The faults are open collector levels that indicate a modulator or demodulator failure. A logic "1" indicates the faulted condition.

AGC_OUT is a programmable voltage, 0 to 10V, for a receive signal level between -25 and -60 dBm.

AUX 1 connection is a 9-pin female D connector (J9) located on the rear panel of the modem. Screw locks are provided for mechanical security on the mating connector. Refer to Table 2-3 for pinout information

Table 2-3. AUX 1 Connector and Pinouts (J9)

Pin #	Signal Function	Name
1	Satellite Clock -	SAT_CLK-
2	No Connection	NC
3	Satellite Clock +	SAT_CLK+
4	MODULATOR TTL Fault	MDFLTTTL
5	Ground	GRN
6	RX Q Channel Eye	RX_Q
7	DEMODULATOR TTL Fault	DFFLTTTL
8	RX 1 Channel Eye	Rx_1
9	Agc Output	AGC

2.3.3 Alarms Connector and Pinouts (J10)

The alarms connector provides Form C contact closures for alarm reporting. The two Form C summary fault contacts are Modulator and Demodulator.

The alarms connection is a 9-pin female D connector (J10) located on the rear panel of the modem. Screw locks are provided for mechanical security on the mating connector. Refer to Table 2-4 for pinout information.

Table 2-4. Alarms Connector and Pinouts (J10)

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

- Alarm 1 = Not used
- Alarm 2 = TX
- Alarm 3 = RX

Refer to Chapter 5 for a discussion of monitored alarms. To obtain a system summary alarm, connect all the Form C contacts in parallel.
Refer to Chapter 5 for a discussion of monitored faults. To obtain a system summary fault, connect all the Form C contacts in parallel.

2.3.3 Terrestrial Data Interface

2.3.3.1 EIA-449 Specifications

Refer to Table 2-5 for EIA-449 specifications.

Table 2-5. EIA-449 Specifications

Parameter	Specification
Circuit Supported	SD, ST, TT, RD, RT, DM, RR, RS, CS, MC
Amplitude (RD, RT, ST, DM, RR)	± 2V differential into 100Ω
Impedance (RD, RT, ST, DM, RR)	Less than 100Ω, differential
Impedance (SD, TT, MC)	4kΩ True when B positive with respect to A False when A positive with respect to B
Phasing (RD, RT)	False-to-true transition of RT nominally in center of RD data bit
Symmetry (ST, TT, RT)	50% ± 5%

2.3.3.2 EIA-449 37-Pin D Connector Pinouts

The EIA-449 interface (Table 2-6) is provided on a 37-pin D female connector (DCE). Refer to the following listing for parameters.

Connector Type	37-pin D subminiature, female
Signal Type	EIA-449

Table 2-6. EIA-449 37-Pin Connector Pinouts

Signal Function	Name	EIA-449 Pin #	V.35 Pin #	EIA-530 Pin #	I/O
Send Data -	SD-A	4	P	2	I
Send Data +	SD-B	22	S	14	I
Send Timing -	ST-A	5	Y	15	O
Send Timing +	ST-B	23	AA	12	O
Receive Data -	RD-A	6	R	3	O
Receive Data +	RD-B	24	T	16	O
Request to Send -	RS-A	7	C	4	I
Request to Send +	RS-B	25		19	I
Receiver Timing -	RT-A	8	V	17	O
Receiver Timing +	RT-B	26	X	9	O
Clear to Send -	CS-A	9	D	5	O
Clear to Send +	CS-B	27		13	O
Data Mode -	DM-A	11	E	6	O
Data Mode +	DM-B	29		22	O
Receiver Ready -	RR-A	13	F	8	O
Receiver Ready +	RR-B	31		10	O
Terminal Timing -	TT-A	17	U	24	I
Terminal Timing +	TT-B	35	W	11	I
Master Clock - (Input)	MC-A	16	CC	20	I

Table 2-6. EIA-449 37-Pin Connector Pinouts (Continued)

Signal Function	Name	EIA-449 Pin #	V.35 Pin #	EIA-530 Pin #	I/O
Master Clock + (Input)	MC-B	34	DD	23	I
Demod Fault	DF	21	NN	21	O
Mod Fault	MF	3	MM	25	O
Local Loopback	LL	10		18	I
Signal Ground	SG	1, 19, 20, 37	AB	1,7	–

Notes:

1. There are jumpers on the EIA-449 terrestrial interface assembly. Place the jumpers on the center pin and the pin towards the Master Clock (MC), to allow an external clock on pins 16 and 34.
2. If desired, place the jumpers on the TR side to allow an external clock input on pins 12 and 30. Place the jumpers on the TR side for DAMA applications.

2.3.3.3 V.35 Specifications

Refer to Table 2-7 for V.35 specifications.

Table 2-7. V.35 Specifications

Parameter	Specification
Circuit Supported	SD, SCT, SCTE, RD, SCR, DSR, RLSD, RTS, CTS, MC
Amplitude (RD, SCR, SCT, SD, SCTE)	± 55V-pk ± 20% differential, into 100Ω
Amplitude (CTS, DSR, RLSD)	±10 ± 5V into ± 5000 ± 2000Ω
Impedance (RD, SCR, SCT)	100, ± 255 > 20Ω, differential
Impedance (SD, SCTE)	100, ± 10Ω, differential
Impedance (RTS)	5000, ± 2000Ω, < 2500 pF
DC Offset (RD, SCR, SCT)	± 0.6V maximum, 1000Ω termination to ground
Polarity (SD, SCT, SCTE, RD, SCR)	True when B positive with respect to A False when A positive with respect to B
Polarity (RTS, CTS, DSR, RLSD)	True when < -3V with respect to ground False when > +3V with respect to ground
Phasing (SCTE, SCR)	False-to-True transition nominally in center of data bit
Symmetry (SCT, SCTE, SCR)	50%, ± 5%

2.3.3.4 V.35 Connector Pinouts

Refer to table 2-8 for connector pinouts.

Table 2-8. 34-Pin Female Winchester Connector Pinouts (V.35)

Pin #	Name
A	Ground
B	Ground
C	Request to Send (RTS)
D	Clear to Send (CTS)
E	Data Set Ready (DSR)
F	Receive Line Signal Detect (RLSD)
P	Send Data A (SD A)
R	Receive Data A (RD A)
S	Send Data B (SD B)
T	Receive Data B (RD B)
U	Serial Clock Transmit External A (SCTE A)
V	Serial Clock Receive A (SCR A)
W	Serial Clock Transmit External B (SCTE B)
X	Serial Clock Receive B (SCR B)
Y	Serial Clock Transmit A (SCT A)
a (AA)	Serial Clock Transmit B (SCT B)
c (CC)	External Reference Clock A (EXC A)
d (DD)	External Reference Clock B (EXC B)
m (MM)	Modulator Fault (MF)
n (NN)	Demodulator Fault (DF)

Note: Pins H, J, K, L, M, N, Z, b (BB), e (EE), f (FF), h (HH), j (JJ), k (KK), l (LL) have no connection.

The SNM-1010 is available with a female Winchester V.35 as the data I/O connector. There is a jumper on the unit that either opens or closes the CC line. The interface is shipped with jumpers in positions 2 and 3, because:

1. Comtech EFData has determined that several locations use Fireberd™ test equipment and a conflict will occur if CC is connected between the modem and the Fireberd™.

2. Placing the jumper in positions 2 and 3 opens up the CC line, because the TTC/Fireberd™ test equipment interfaces use the line for DTE/DCE control.

3. Grounding pin CC at the Fireberd™ interface will change the Fireberd ™ to a DCE device.

4. Comtech EFData uses the CC and DD for the input master clock (same as the external clock input to the modem). To input an external clock, change the jumper to positions 1 and 2 (the pin closest to the Winchester connector).

2.3.3.5 EIA-530 Specifications

Refer to table 2-9 for EIA-530 specifications.

Table 2-9. EIA-530 Specifications

Parameter	Specification
Circuit Supported	BA, DB, DA, BB, DD, CC, CF, CA, CB,
Amplitude (BB, DD, DB, CC, CF)	± 2V differential into 100Ω
Impedance (BB, DD, DB, CC, CF)	Less than 100Ω, differential
Impedance (BA, DA, CD)	4kΩ True when B positive with respect to A False when A positive with respect to B
Phasing (BB, DD)	False-to-true transition of RT nominally in center of RD data bit
Symmetry (DB, DH, DD)	50% ± 5%

2.3.3.6 EIA-530 25-Pin D Connector Pinouts

Table 2-10. 25-Pin D Female Connector Pinouts

Pin #	EIA-530
1	SHLD
2	BA
3	BB
4	CA
5	CB
6	CC
7	AB
8	CF
9	DD
10	CF
11	DA
12	DB
13	CB
14	BA
15	ST
16	BB
17	DD
18	LL
19	CA
20*	CD
21	DF
22	CC
23*	CD
24	DA
25	MF

***Note:** Use the MASTER clock for EXTERNAL clock input. This clock input should equal the data rate

2.3.4 User Port

The User Port provides for serial communications with the modem to allow user requests for traffic channel assignments. The user has access to any traffic modem at the site. The interface is provided on a 9-pin mini-DIN female connector (DCE) located on the rear panel of the SNM-1010. Refer to the following listing for User Port specifications.

Connector Type	9-pin mini-DIN
Signal Type	EIA-232
Rate	19.2 kbit/s, 8 bits-no parity-1stop

Note: Refer to Chapter 3 for a description of the software communications parameters and for detailed message format information.

Pinout and signal levels are described in Table 2-11.

Table 2-11. SNM-1010 User Port Pinout and Signals

Signal Function	Name	Pin #	I/O	Signal Level
Receiver Ready	RR	1	O	EIA-232
Receive Data	RD	2	O	EIA-232
Send Data	SD	3	I	EIA-232
Terminal Ready	TR	4	I	EIA-232
Signal Ground	SG	5		
Data Mode	DM	6	O	EIA-232
Request to Send	RS	7	I	EIA-232
Clear to Send	CS	8	O	EIA-232
Incoming Call	IC	9	O	EIA-232

2.3.5 TX IF Output Connector (CP1)

CP1 is a BNC connector for the transmit IF signal. The output impedance is 75Ω (50Ω optional), and the output power level is -5 to -30 dBm. In normal operation, the output will be an 8PSK, QPSK, OQPSK, or BPSK-modulated result of the Terrestrial Data connector between 50 and 180 MHz, in 1 Hz steps.

2.3.6 RX IF Input (CP2)

CP2 is a BNC connector for the receive IF signal. The input impedance is 75Ω (Optional: 50Ω). For normal operation, the desired carrier signal level should be between -30 and -55 dBm. Signals between 50 and 180 MHz are selected and demodulated to produce clock and data at the Terrestrial Data connector.

2.3.7 External Reference (CP3)

CP3 is a BNC connector for an EX REF. The input impedance is 75Ω. For normal operation, the reference signal is ≥ 0 dBm.

2.3.8 Power

2.3.8.1 AC Power

The AC power is supplied to the SNM-1010 by a standard, detachable, non-locking, 3-prong power cord. Refer to the following listing for AC power specifications.

Input power	50W max.
Input voltage	90 to 264 VAC, 47 to 63Hz. Note: Unit switches ranges automatically.
Connector type	IEC
Fuse protection	1A slo-blo line and neutral fusing 5 mm type fuses.

2.3.8.2 DC Power

For DC supplied units, the DC Power is supplied by terminal lugs installed on the back panel. Refer to the following table for specifications.

Input power	50W max.
Input voltage	38 to 64 VDC.
Connector type	Terminal Lug
Fuse protection	1A slo-blo 5 mm type fuses.

2.3.9 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.

Chapter 3. OPERATION

3.1 Front Panel

The front panel of the SNM-1010 (Figure 3-1) provides for monitoring modem configuration and status.

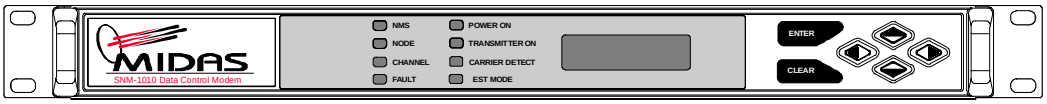


Figure 3-1. SNM-1010 Front Panel View

The front panel features include:

- 32- character, two-line LCD display.
- Six-button keypad for local control.
- Eight LEDs to provide overall status at a glance.

These functions are accessible at the front panel by entering one of five pre-defined function select categories or levels:

- Configuration (monitor mode only).
- Monitor.
- Faults/Alarms.
- Stored Faults/Alarms.
- Utility (monitor mode only).

3.1.1 LED Indicators

In addition to the LCD, the LEDs provide the modem status. The LEDs support three states:

- ON
- OFF
- Flashing

Table 3-1. SNM-1010 Front Panel Indicators

LED	Color	Description
POWER ON	Green	Power is applied to the modem.
FAULT	Red	A fault condition exists.
TEST MODE	Yellow	Flashes when the unit is in a test configuration.
TRANSMITTER ON	Green	Transmitter is currently (ON). Indicates the actual condition of the transmitter, as opposed to the programmed condition. In control mode, the indicator blinks since the transmitter is operating in the burst mode. In traffic mode, the indicator is solid green.
CARRIER DETECT	Green	(ON) Decoder is locked.
NODE	Green	Indicates the node has been enabled or disabled by the NMS. It is (ON) if the node is enabled, (OFF) if the node is disabled.
NMS	Green	(OFF) Node did not receive timing or ACKNOWLEDGE messages from the NMS. (FLASHING) Node received timing message from the NMS, but no ACKNOWLEDGE message was received. (ON) Node received timing and ACKNOWLEDGE from the NMS.
CHANNEL	Green	Indicates the Data Channel status. (FLASHING) call setup proceeding. (ON) Data circuit is active. (OFF) Data circuit is inactive.

3.1.2 Front Panel Keypad

The front panel keypad operates in monitor mode only, and permits local operation of the modem. The keypad consists of six keys (Figure 3-2).

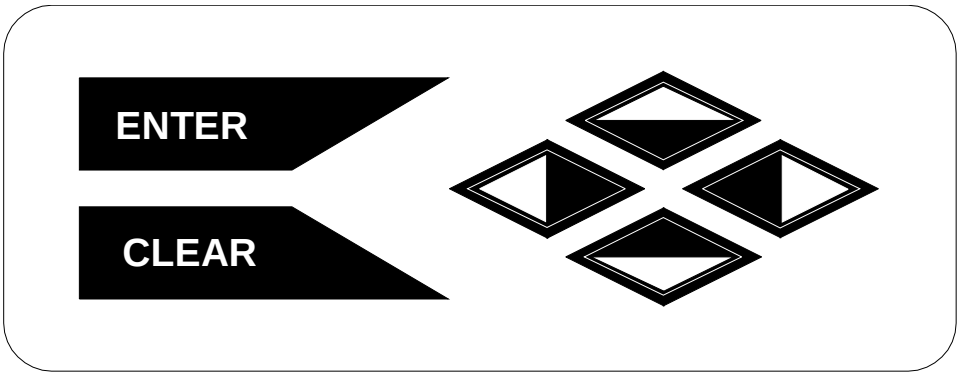


Figure 3-2. Keypad

Each key provides one or more logical functions. These functions are defined in the following table.

ENTER	This key is used to select a displayed function or to execute a modem configuration change.
CLEAR	This key is used to back out of a selection or to cancel a configuration change which has not been executed using [ENTER]. Pressing [CLEAR] generally returns the display to the previous selection.
Left and Right Diamond Keys	These keys are used to move to the next selection or to move the cursor for certain functions. **Note:** Throughout this chapter, [←] and [→] are used to indicate left and right diamond keys.
Top and Bottom Diamond Keys	These keys are used primarily to change configuration data (numbers). At times, they are also used to move from one section to another. **Note:** Throughout this chapter, [↑] and [↓] are used to indicate top and bottom diamond keys.

The modem responds by beeping whenever a key is pressed:

- 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.

3.2 Menu System

Use the Main menu in Figure 3-3 as a quick reference for accessing the modem functions. When the modem power is applied, the base level of the menu system displays the sign-on message:

- Line 1 of the sign-on message is the modem type.
- Line 2 is the node address.

Notes:

1. Menus or commands that are specific to certain modem configurations are only accessible after selecting the appropriate modem configuration. This prevents incompatible parameters from accidentally being selected.
2. All of the windows are accessible in the Custom mode. Take caution not to select incompatible parameters, as the modem does not shut out incompatible command choices in the Custom mode.

3.3 Front Panel Menu

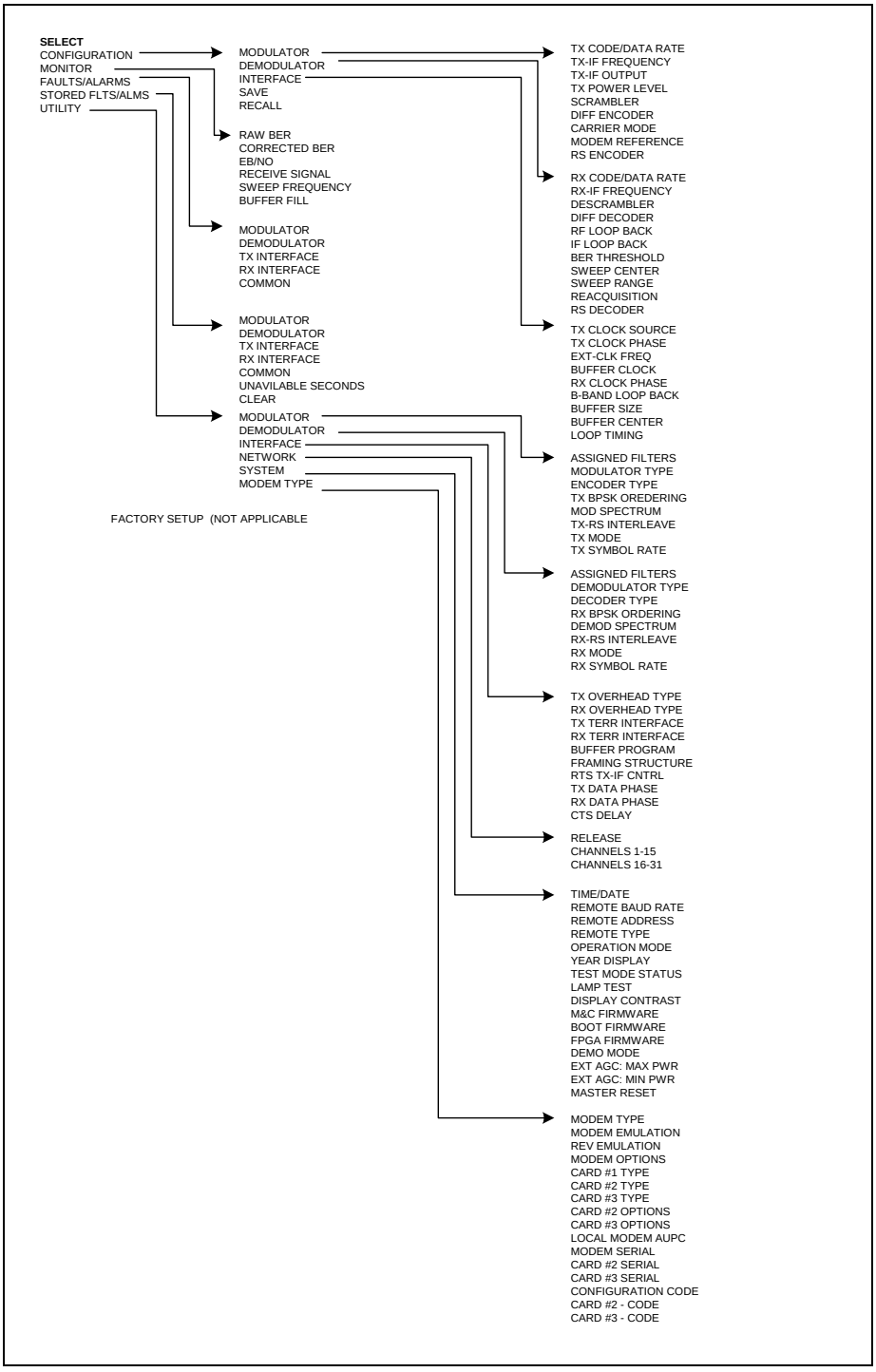
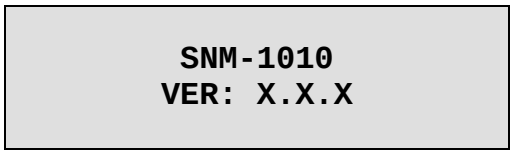


Figure 3-3. Main Menu

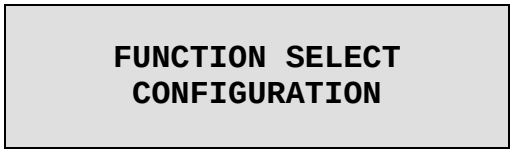
3.4 Front Panel Menus (Windows)

The following menu tree shows the modem functions that are available for an SNM-1010 Data/Control modem. The default settings used by the DAMA Controller when operating as a control modem are shown underlined.

3.4.1 OPENING SCREEN



3.4.2 FUNCTION SELECT:CONFIGURATION



The main level of the menu system is Function Select. To access this level from the sign-on message, press the [←] or [→] keys. From the Function Select menu, select one of the functional categories:

- Configuration
- Monitor
- Faults/Alarms
- Stored Faults/Alarms
- Utility

Press [←] or [→] to move from one selection to another. When line 2 displays the desired function, select that level by pressing [ENTER]. After entering the appropriate functional level, press [←] or [→] to move to the desired function.

3.4.2.1 CONFIGURATION:MODULATOR

```
CONFIGURATION
MODULATOR
```

To view the modem's configuration, enter the Configuration level from the Function Select menu. Once in the Configuration menu, press [←] or [→] to scroll through the Configuration menu selection:

- Modulator
- Demodulator
- Interface
- Save
- Recall

Press [ENTER] to select the desired Configuration menu option. To view the options for the selected configuration parameters, press [←] or [→].

3.4.2.1.1 MODULATOR:CODE/DATA RATE

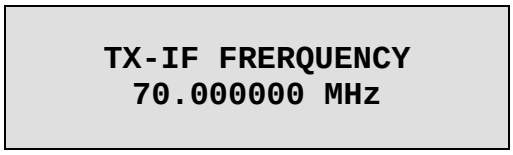
```
TX-X        QPSK 1/2
     XX.XX KBPS
```

Filter: A, B, C, D, and V.

Code Rate	Data Rate Range	
BPSK 1/2	2.4 to 1250 kbps	
QPSK 1/2	4.8 to 2500 kbps	
QPSK 3/4	7.2 to 3750 kbps	
QPSK 7/8	8.4 to 4375 kbps	
OQPSK 1/2	4.8 to 2500 kbps	
OQPSK 3/4	7.2 to 3750 kbps	
OQPSK 7/8	8.4 to 4375 kbps	
8PSK 2/3	64 to 5000 kbps	
BPSK 1/1	4.8 to 2500 kbps	
QPSK/OQPSK 1/1	9.6 to 5000 kbps	
QPSK/OQPSK 1/1	2.4 to 1250 kbps	
BPSK 5/16	2.4 to 781.25 kbps	*see Note 3*
BPSK 21/44	2.4 to 1193 kbps	*see Note 3*
8PSK 3/4	384 to 5000 kbps	*see Note 3*

Notes:
1. Max Symbol Rate: 2500 kbps.
2. Max Data Rate for Low Var Rate: 512 kbps
3. Turbo only.

3.4.2.1.2 MODULATOR:TX-IF FREQUENCY

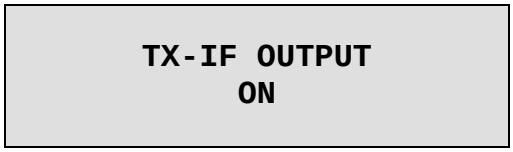


Displays the modulator TX IF frequency between 50 and 180 MHz, in 1 Hz steps.

The DAC sets this from the OCF setting. Refer to paragraph 3.7.6.

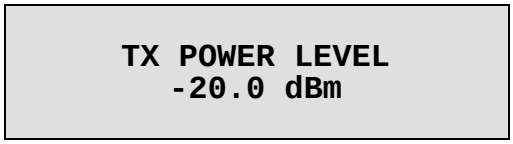
Upon entry, the current transmitter frequency is displayed with the flashing cursor on the first character. Press [←] or [→] to move the flashing cursor, and [↑] or [↓] to increase or decrease the digit at the flashing cursor. Press <ENTER> to execute the change.

3.4.2.1.3 MODULATOR:TX-IF OUTPUT



Displays the modulator output status, either On or Off.

3.4.2.1.4 MODULATOR:TX POWER LEVEL

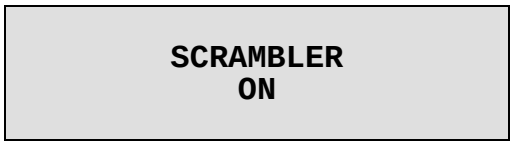


Displays the modulator output level from:

- -5.0 to –30.0 dBm

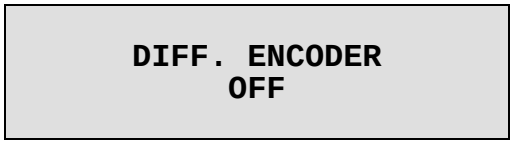
Upon entry, the current output power level is displayed with the flashing cursor on the first character. Press [←] or [→] to move the flashing cursor, and [↑] or [↓] to increase or decrease the digit at the flashing cursor. Press <ENTER> to execute the change.

3.4.2.1.5 MODULATOR:SCRAMBLER



Displays the scrambler status, either On or Off.

3.4.2.1.6 MODULATOR:DIFF. ENCODER



Displays the differential encoder status, either On or Off.

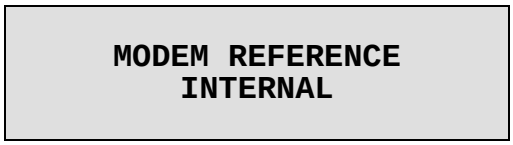
3.4.2.1.7 MODULATOR: CARRIER MODE

Displays the carrier mode of operation as follows:

Normal-Modulated	This setting used for normal operation.
Center-CW	Generates a carrier at the current modulator frequency. This can be used to measure the output frequency.
Offset-CW	Generates a single, upper, side-band-suppressed carrier signal. The upper side-band is at one-quarter of the symbol rate from the carrier. When inverted spectrum is selected, this generates a single, lower, side-band-suppressed carrier.
Dual-CW	Generates a dual side-band suppressed carrier signal. Side-bands are at one-half of the symbol rate from the carrier. This is used to check the channel balance and carrier null.

Upon entry, the current carrier mode is displayed with the flashing cursor on the first character. Press [↑] or [↓] to change the carrier mode. Press <ENTER> to execute the change.

3.4.2.1.8 MODULATOR:MODEM REFERENCE



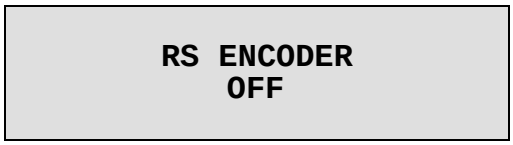
Displays the following references to the modulator:

- INTERNAL
- EXT1, EXT5, EXT10 and EXT20 MHz external reference (CP3)
- EXT10 MHz Output

Note: If any external reference is selected for the modem reference and then is no input to CP3, the modem will detect an alarm and switch to the INTERNAL clock.

Upon entry, the current modem reference is displayed with the flashing cursor on the first character. Press [↑] or [↓] change the modem reference. Press <ENTER> to execute the change.

3.4.2.1.9 MODULATOR:RS ENCODER



Note: Reed-Solomon option only.

Displays the RS encoder status, either On or Off.

Notes:

1. Programming the Reed-Solomon encoder automatically turns off the RF transmitter, because of symbol rate changes.
2. If none of the proper overhead types and data rates apply, the Reed-Solomon encoder program in the On state will be rejected (double beep).

3.4.2.2 CONFIGURATION:DEMODULATOR

```
CONFIGURATION
DEMODULATOR
```

3.4.2.2.1 DEMODULATOR:CODE/DATA RATE

```
RX-X QPSK 1/2
XX.XX   kbps
```

Filter: A, B, C, D, and V.

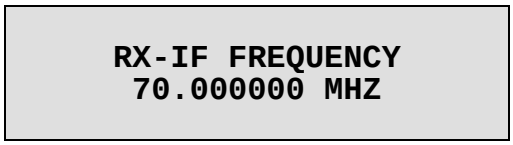
Code Rate	Data Rate Range	
BPSK 1/2	2.4 to 1250 kbps	
QPSK 1/2	4.8 to 2500 kbps	
QPSK 3/4	7.2 to 3750 kbps	
QPSK 7/8	8.4 to 4375 kbps	
OQPSK 1/2	4.8 to 2500 kbps	
OQPSK 3/4	7.2 to 3750 kbps	
OQPSK 7/8	8.4 to 4375 kbps	
8PSK 2/3	64 to 5000 kbps	
BPSK 1/1	4.8 to 2500 kbps	
QPSK/OQPSK 1/1	9.6 to 5000 kbps	
QPSK/OQPSK 1/1	2.4 to 1250 kbps	
BPSK 5/16	2.4 to 781.25 kbps	*see Note 3*
BPSK 21/44	2.4 to 1193 kbps	*see Note 3*
8PSK 3/4	384 to 5000 kbps	*see Note 3*

Notes:

1. Max Symbol Rate: 2500 kbps.
2. Max Data Rate for Low Var Rate: 512 kbps
3. Turbo only.

Upon entry, the current transmitter rate is displayed. Press [↑] or [↓] change the assigned filter. Press <ENTER> to execute the change.

3.4.2.2.2 DEMODULATOR:RX-IF FREQUENCY



Displays the demodulator receive frequency, between 50 and 180 MHz, in 1 Hz steps.

The DAC sets this from the ICF setting. Refer to paragraph 3.7.5

Upon entry, the RX-IF Frequency is displayed. Press [↑] or [↓] change the assigned filter. Press <ENTER> to execute the change.

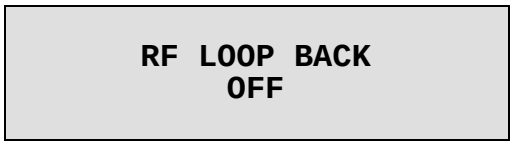
3.4.2.2.3 DEMODULATOR:DESCRAMBLER

Displays the descrambler status, either On or Off.

3.4.2.2.4 DEMODULATOR:DIFF.DECODER

Displays the differential decoder status, either On or Off.

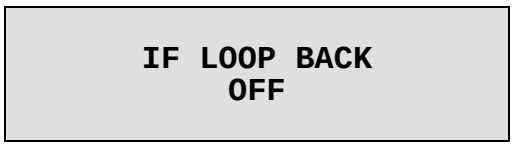
3.4.2.2.5 DEMODULATOR:RF LOOP BACK



Displays the RF loop back status, either On or Off.

Note: Not recommended to turn On after initial installation with the MIDAS System.

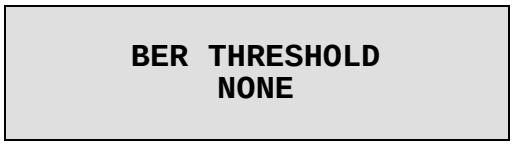
3.4.2.2.6 DEMODULATOR:IF LOOP BACK



Displays the IF loop back status, either On or Off.

Note: Not recommended to turn On after initial installation with the MIDAS System.

3.4.2.2.7 DEMODULATOR:BER THRESHOLD



Displays the BER threshold .

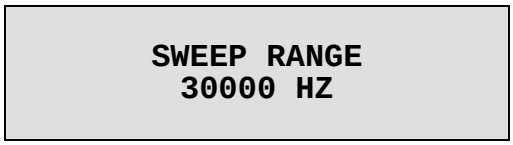
If the BER threshold set is exceeded, a receive fault will be indicated by the modem status indicators. BER threshold may be set from 1.0 E-3 to 1.0 E-8, or may be disabled by specifying NONE.

3.4.2.2.8 DEMODULATOR:SWEEP CENTER

Displays the sweep center frequency for the directed sweep function. When in directed sweep, the value from the sweep monitor screen (when the modem was last locked) should be entered for the sweep center frequency. The sweep center frequency can be set in the range from –35000 to +35000 Hz.

Upon entry, the current sweep center frequency is displayed with the flashing cursor on the first character. Press [←] or [→] to move the flashing cursor, and [↑] or [↓] to increase or decrease the digit at the flashing cursor. Press <ENTER> to execute the change.

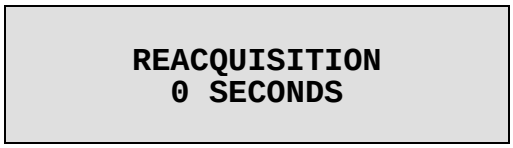
3.4.2.2.9 DEMODULATOR:SWEEP RANGE



Displays the overall travel of the sweep width range during acquisition in the directed sweep mode. The sweep width may be set from 0 to 70000 Hz.

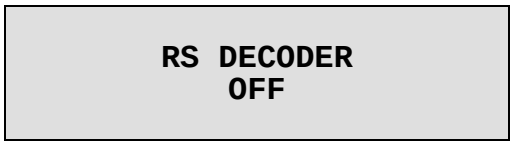
When set at 70000 Hz, the modem is in Normal acquisition mode. The smaller the range, the faster the modem will lock, provided the receive carrier center frequency is within the RX-IF frequency sweep range.

3.4.2.2.10 DEMODULATOR:REACQUISITION



Displays the sweep reacquisition mode time duration. This is the time that the modem will remain in a narrow sweep after loss of acquisition. After this timer runs out, the modem will return to the normal acquisition sweep. The reacquisition time is 0 to 999 seconds.

3.4.2.2.11 DEMODULATOR:RS DECODER



Note: Reed-Solomon option only.

Displays the RS decoder status, either On or Off. Press <ENTER> to execute the change.

Upon entry, the status of the Reed-Solomon decoder is displayed Use [↑] or [↓] to select one of the following modes:

On	Enables the Reed-Solomon decoder to provide data error corrections.
Correction _Off	Turns Off the Reed-Solomon decoder data error correction circuitry. Data flow is then routed through normal data paths without error corrections. This is used to compare the BER of a SATLINK with or without Reed-Solomon decoding.
Off	Reed-Solomon is Off when the modem is operating in "Control Mode." To execute any of the Reed-Solomon decoder modes, enter the desired Reed-Solomon decoder and select the desired mode.

3.4.2.3 CONFIGURATION:INTERFACE

```
CONFIGURATION
INTERFACE
```

3.4.2.3.1 INTERFACE:TX CLOCK SOURCE

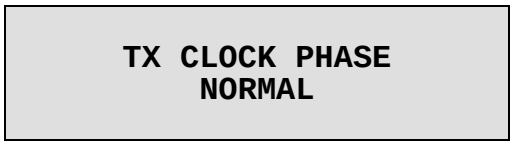
```
TX CLOCK SOURCE
SCT (INTERNAL)
```

Programs the clock source for the modem transmitter clock to the following configurations:

TX TERRESTRIAL	Sets the TX clock to recover timing from the incoming clock/data.
SCT (INTERNAL)	Sets the TX clock to operate from the modem internal clock (this also is the fallback clock). Note: When loop timing is enabled, SCT (LOOP) is displayed instead of SCT (INTERNAL).
EXT CLOCK	Sets the TX clock to operate from the EXT-CLK clock. Transmit clock source must be phase/frequency locked to the data that is being transmitted. The correct frequency must be programmed into EXT-CLK FREQ.

Upon entry, the current TX clock source is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

3.4.2.3.2 INTERFACE:TX CLOCK PHASE



Programs the TX clock phase to AUTO, NORMAL, INVERT.

Upon entry, the current TX clock phase is displayed. Press [↑] or [↓] to make the selection. When AUTO is s elected, the modem will automatically select NORMAL or INVERT to properly phase the TX clock with the TX data. Press <ENTER> to execute the change.

3.4.2.3.3 INTERFACE:EXT-CLK FREQ

Programs the external reference clock input frequency between 8.0 kHz and 10.0 MHz.

Note: The clock rate must be equal to the data rate unless the asymmetrical loop timing option is present.

This clock frequency can be any multiple of 600 Hz from 2.4 to 64 kHz, and can be any multiple of 8 kHz from 64 kHz to 4.376 MHz. This can be used for the Doppler/plesiochronous buffer reference. It can be a reference to SCT.

Use the master clock input on J8 for the external master reference. The EX REF on CP3 only allows for 1, 5, 10, and 20 MHz external reference input.

Upon entry, the current setting for the external reference is displayed. Press [←] or [→] to increment or decrement the digit at the flashing cursor. Press [ENTER] to execute the change.

3.4.2.3.4 INTERFACE:BUFFER CLOCK

```
BUFFER CLOCK
RX  (SATELLITE)
```

Programs the interface buffer output clock to one of the following modes:

RX (SATELLITE)	Sets the output buffer clock to the satellite clock. (This is a Bypass.)
SCT (INTERNAL)	Sets the buffer clock to operate from the modem internal clock. This is also the fallback clock.
EXT. CLOCK	Sets this clock source to the external clock.
TX TERRESTRIAL	Sets the buffer output clock to recover timing from the incoming TX data clock.
INSERT CLOCK	Selects the recovered clock from the insert send data input received from the terrestrial equipment.

Upon entry, the current setting of the plesiochronous buffer clock is displayed. Press [↑] or [↓] to make the selection. Press [ENTER] to execute the change.

3.4.2.3.5 INTERFACE:RX CLOCK PHASE

```
RX CLOCK PHASE
NORMAL
```

Programs the RX clock phase to Normal or Inverted.

Upon entry, the status of the RX Clock is displayed. Press [↑] or [↓] to make the selection. Press [ENTER] to execute the change.

3.4.2.3.6 INTERFACE:B-BAND LOOP BACK

B-BAND LOOP BACK OFF

Programs the modem for baseband loopback operation, On or Off.

When baseband loopback is turned on, the data and timing signals are switched from the demodulator to the modulator on the modem side of the interface. The DTE baseband signals are also looped back from the transmitter data and clock to receiver data and clock on the customer side of the interface. This is a bi-directional loopback of the baseband data. Refer to figure 3-4 for a block diagram of baseband loopback operation.

Upon entry, the status is displayed. Press [↑] or [↓] to make the selection. Press [ENTER] to execute the change.

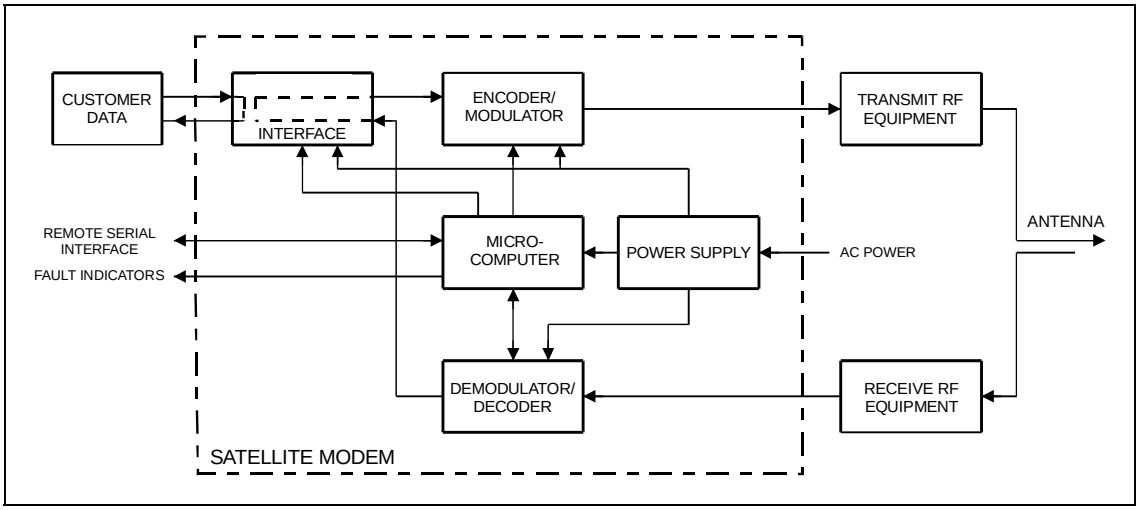


Figure 3-4. Baseband Loopback

Note: When baseband loopback is turned on, data is looped back on the customer side of the interface. This is a bi-directional loopback of the baseband data. This test mode will verify the customer equipment and cabling between the modem and the customer equipment.

3.4.2.3.7 INTERFACE:BUFFER SIZE

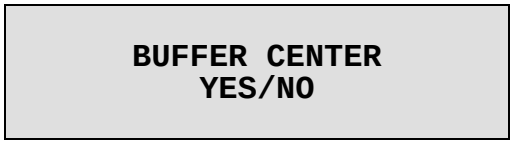
Sets the size of the buffer, 32 to 262144 bits, 1 to 99 mS , or 0 (Bypass)

Upon entry, the current buffer length is displayed. Press [↑] or [↓] to select the desired buffer size. The buffer size is displayed in seconds or bits. Enter the Utility Interface menu to change the buffer units to seconds or bits.

- If selecting seconds, choose from 1 to 99 ms, in increments of 1 ms, or 0 (Bypass).
- If selecting bits, choose from 32 to 262144 bits, in increments of 16 bits.
- Press [ENTER] to execute the change.

Note: To have the modem calculate the plesiochronous shift, set the buffer units to ms. When a specific buffer depth is desired, set the buffer units to bits. Select bits or ms from the Utility Interface menu.

3.4.2.3.8 INTERFACE:BUFFER CENTER



This configuration function is used to center the buffer. Choosing YES centers the buffer.

Press <ENTER> twice to center the buffer.

3.4.2.3.9 INTERFACE:LOOP TIMING

The SCT output will become phase-locked to the RX satellite clock.

Note: TX and RX data rates must be equal unless the asymmetrical loop timing option is enabled.

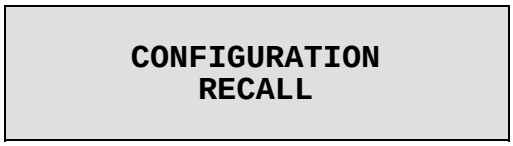
Upon entry, the status is displayed. Press [↑] or [↓] to make the selection. Press [ENTER] to execute the change.

3.4.2.4 CONFIGURATION:SAVE

The Configuration Save menu allows programming of configuration parameters into memory on the M&C. There are five memory locations that may be used to store specific configuration setups that are used frequently. After changing the configuration parameters to the desired settings, enter the Configuration Save menu and select memory location 1 through 5.

Press [ENTER] to execute the save.

3.4.2.5 CONFIGURATION:RECALL



The Configuration Recall menu allows the user to recall a previously saved configuration setup. Upon entry, select memory location 1 through 5 by pressing [↑] or [↓].

Press [ENTER] to execute the recall.

3.4.3 FUNCTION SELECT:MONITOR

```
MONITOR
```

3.4.3.1 MONITOR:RAW BER

```
RAW BER
NO DATA
```

Displays the current BER or "No Data" (if carrier is not locked).

Range: < m.m E-e to > m.m E-e.

Note: Low limit is based on performance. High limit is based on data/code rate.

3.4.3.2 MONITOR:CORRECTED BER

```
CORRECTED BER
NO DATA
```

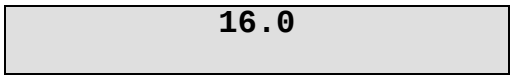
Displays the current corrected BER or "No Data" (if carrier is not locked).

Range: 1.0 E-3 to 1.0 E-12.

Note: Low limit is based on performance. High limit is 1.0 E-12

3.4.3.3 MONITOR:EB/NO

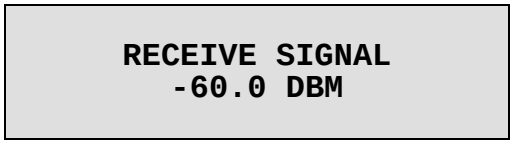
```
EB/NO
```



Displays the current E_b/N_0 or "No Data" (if carrier is not locked).
Range: 2.0 to 16.0 dB.

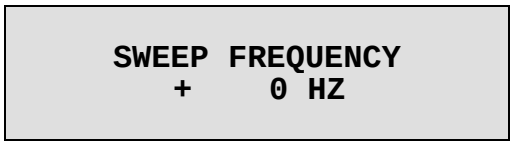
Note: Low limit is based on the data rate. High limit is 16.0 dB.

3.4.3.4 MONITOR:RECEIVE SIGNAL



Displays the current receive signal level.
Range: -25.0 to -60.0 dBm.

3.4.3.5 MONITOR:SWEEP FREQUENCY



Displays the current offset frequency or "No Data" (if carrier is not locked).
Range: -35,000 to +35,000 Hz.

3.4.3.6 MONITOR:BUFFER FILL

Displays the current plesiochronous buffer fill status percent.
Range: 1 to 99%.

3.4.4 FUNCTION SELECT:FAULTS/ALARMS

```
FUNCTION SELECT
FAULTS/ALARMS
```

The Faults/Alarms menu is accessible from the Function Select menu. The Faults/Alarms are similar to monitor functions, as they display the current fault status of the group being displayed.

Press [←] or [→] to move between the following Faults/Alarms groups:

- Modulator
- Demodulator
- Transmit Interface
- Receive Interface
- Common Equipment

Line 2 of the display shows the current Faults/Alarms status in real time. For each parameter monitored, fault status is displayed as one of the following:

- "–" indicates that no fault or alarm exists.
- "+" indicates that a fault exists, and will cause switching in a redundant system.
- Reversed contrast "+" indicates an active alarm.

Unlike faults, alarms do not cause switching to occur. To display labels for individual faults or alarms, press [ENTER].

Press [←] or [→] to move the flashing cursor to make the selection. The label for that Fault/Alarm is then displayed on line 1 of the display. Press [CLEAR] to exit this level of operation and return to the previous level.

The following sections outline the faults and alarms monitored and displayed in each group.

3.4.4.1 FAULTS AND ALARMS:MODULATOR

IF SYNTHESIZER	Modulator IF synthesizer fault.
DATA CLOCK SYN	Transmit clock synthesizer fault. Indicates the internal Voltage Controlled Oscillator (VCO) has not locked to the incoming data clock.
I CHANNEL	I channel data activity fault.
Q CHANNEL	Q channel data activity fault.
AGC LEVEL	TX IF AGC level fault.
MODEM REF ACT	MODEM REF activity alarm.
MODEM REF PLL	MODEM REF PLL not locked.
MODULE	Modulator module fault.
CONFIGURATION	Modulator configuration fault.

3.4.4.2 FAULTS AND ALARMS:DEMODULATOR

CARRIER DETECT **IF SYNTHESIZER**	Carrier detect fault. Indicates the decoder is not locked. Demodulator IF synthesizer fault. Indicates the IF synthesizer is not locked.
I CHANNEL	I channel activity fault. Indicates a loss of activity in the I channel of the quadrature demodulator.
Q CHANNEL	Q channel activity fault. Indicates a loss of activity in the Q channel of the quadrature demodulator.
BER THRESHOLD	Secondary alarm result of the BER threshold set in the DEMOD Configuration menu.
MODULE	Demodulator/decoder module fault.
CONFIGURATION	Demodulator/decoder configuration fault.

3.4.4.3 FAULTS AND ALARMS:TX INTERFACE

```
TX INTERFACE
---------
```

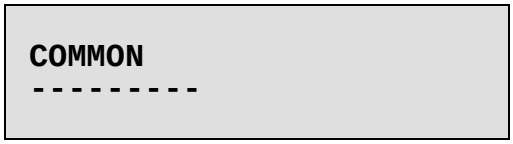
TX DROP	Not Aplicable.
TX DATA/AIS	Data or AIS. When data fault is selected in the Interface Configuration menu, the fault indicates a data stable condition. This indicates the data is all 1s or 0s (i.e., data is not transitioning). When AIS is selected, the alarm indicates the data is all 1s from customer data input to the modem. When None is selected in the Interface Configuration menu, the TX Data/AIS Fault/Alarm is not activated. Note: AIS is an alarm, not a switching fault.
TX CLK PLL	Transmitter phase-locked loop fault. Indicates the transmitter Phase-Locked Loop (PLL) is not locked.
TX CLK ACTIVITY	Activity detector alarm of the selected interface transmit clock. The interface will fall back to the internal clock when this alarm is active.
TX AUDIO 1 CLIP	Not Applicable.
TX AUDIO 2 CLIP	Not Applicable.
CONFIGURATION	TX interface configuration fault. Indicates the TX interface cannot execute a programmed configuration parameter.

3.4.4.4 FAULTS AND ALARMS:RX INTERFACE

```
RX INTERFACE
---------
```

BUFFER UNDERFLOW	Buffer underflow alarm. Indicates that a buffer underflow has occurred.
BUFFER OVERFLOW	Buffer overflow alarm. Indicates that a buffer overflow has occurred.
RX DATA/AIS	Data or AIS. When data fault is selected in the Configuration Interface menu, the fault indicates a data stable condition. This indicates the data coming from the satellite is all 1s or 0s (i.e., data is not transitioning). When AIS is selected, the Alarm indicates the data is all 1s from the satellite. When None is selected in the Configuration Interface menu, the RX Data/AIS Fault/Alarm is not activated. Note: AIS is an alarm, not a switching fault.
FRAME BER	Frame BER fault. Indicates that the frame BER exceeds 1^{-3}.
BACKWARD ALARM	Not Applicable.
BUFFER CLK PLL	Buffer clock phase-locked loop fault. Indicates the buffer clock PLL is not locked.
BUFFER CLK ACT	Activity detector alarm of the selected interface receive clock. The interface will fall back to the satellite clock when this fault is active.
DEMUX LOCK	DEMUX lock fault. Indicates that the DEMUX is not locked.
RX 2047 LOCK	RX 2047 lock alarm. Indicates the RX 2047 data pattern is not locked. Note: This alarm is only active if RX 2047 is ON.
BUFFER FULL	Buffer full alarm. Indicates the buffer is less than 10% or greater than 90% full.
RX INSERT	Not Applicable.
RX AUDIO 1 CLIP	Not Applicable.
RX AUDIO 2 CLIP	Not Applicable.
CONFIGURATION	Configuration alarm.

3.4.4.5 FAULTS AND ALARMS:COMMON



BATTERY/CLOCK	Battery or clock fault.
-12V SUPPLY	-12V power supply fault.
+12V SUPPLY	+12V power supply fault.
+5V SUPPLY	+5V power supply fault.
SELF TEST	Not Applicable.
CONTROLLER	Controller fault. Typically indicates the controller has gone through a power on/off cycle.
INTERFACE MODULE	Interface module fault. Typically indicates that the interface module is missing or will not program.

3.4.5 FUNCTION SELECT:STORED FLTS/ALMS

```
FUNCTION SELECT
STORED FLTS/ALAMS
```

The modem stores the first 10 (Flt0 through Flt9) occurrences of fault status changes in each of the following major fault categories:

- Modulator
- Demodulator
- Transmit Interface
- Receive Interface
- Common Equipment

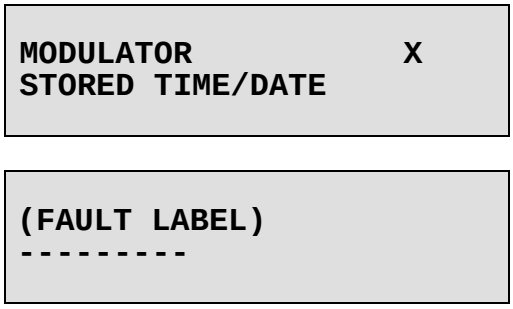
Each fault status change is stored with the time and date of the occurrence of the fault. Stored faults may be viewed by entering the stored faults level from the Select menu.

Stored faults are not maintained through controller power-on reset cycle. However, the last known time is maintained in nonvolatile Random Access Memory (RAM). On power-up, a common equipment fault is logged (Flt0) with that last known time and date. In addition, on power-up, an additional common equipment fault is logged (Flt1) to indicate the power-up time and date. The power-down and power-up times are logged as common equipment fault 0 and common equipment fault 1, respectively.

On entering the stored faults level, press [←] or [→] to move between the fault groups and the "Clear Stored Faults ?" selections. The time and date of the first stored fault status (Flt0) for the selected group will be displayed alternately on line 2 of the display. Press [↑] or [↓] to cycle through the selected group has stored fault status (Flt0 through Flt9). To display the fault status associated with the displayed time and date, press [ENTER]. To identify the fault, press [←] or [→] to move the flashing cursor. To clear the currently logged stored faults, press [ENTER] when the "Clear Stored Faults/Yes?" selection is displayed.

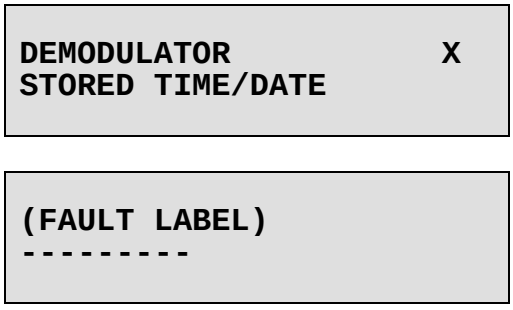
Note: Faults are stored in time sequence, with the oldest fault status change stored in Flt0, and the most recent in Flt9. Only the first 10 fault status changes are stored. All stored faults, which have not been used, indicate "No Fault" on the display.

3.4.5.1 STORED FLTS/ALMS:MODULATOR



IF SYNTHESIZER
DATA CLOCK SYN
I CHANNEL
Q CHANNEL
AGC LEVEL
MODEM REF ACT
MODEM REF PLL
MODULE
MODULE CONFIGURATION

3.4.5.2 STORED FLTS/ALMS:DEMODULATOR



CARRIER DETECT
IF SYNTHESIZER
I CHANNEL
Q CHANNEL
BER THRESHOLD
MODULE
CONFIGURATION

3.4.5.3 STORED FLTS/ALMS:TX INTERFACE

```
TX INTERFACE          X
STORED TIME/DATE
```

```
(FAULT LABEL)
---------
```

TX DROP	(Not Applicable)
TX DATA/AIS	
TX CLK PLL	
TX CLK ACTIVITY	
TX AUDIO 1 CLIP	(Not Applicable)
TX AUDIO 2 CLIP	(Not Applicable)
CONFIGURATION	

3.4.5.4 STORED FLTS/ALMS:RX INTERFACE

```
RX INTERFACE          X
STORED TIME/DATE
```

```
(FAULT LABEL)
---------
```

BUFFER UNDERFLOW	
BUFFER OVERFLOW	
RX DATA/AIS	
FRAME BER	
BACKWARE ALARM	(Not Applicable)
BUFFER CLK PLL	
BUFER CLK ACT	
DEMUX LOCK	
RX 2047 LOCK	
BUFFER FULL	
RX INSERT	(Not Applicable)
RX AUDIO 1 CLIP	(Not Applicable)
RX AUDIO 2 CLIP	(Not Applicable)
CONFIGURATION	

3.4.5.5 STORED FLTS/ALMS:COMMON

```
COMMON              X
STORED TIME/DATE
```

```
(FAULT LABEL)
---------
```

BATTERY/CLOCK
-12 VOLT SUPPLY
+12 VOLT SUPPLY
+5 VOLT SUPPLY
SELF TEST (Not Applicable)
CONTROLLER
INTERFACE MODULE

3.4.5.6 STORED FLTS/ALMS:UNAVL SECONDS

```
UNAVAL SECONDS        X
STORED TIME/DATE
```

Note: Reed-Solomon option only.

A fault is indicated if the Reed-Solomon Codec could not correct bit errors in one block of serialized data in any given second.

3.4.5.7 STORED FLTS/ALMS:CLEAR

```
CLEAR ??
STORED FAULTS
```

3.4.6 FUNCTION SELECT:UTILITY

```
FUNCTION SELECT
UTILITY
```

The Function Select Utility menu is divided into the following categories:

- Modulator
- Demodulator
- Interface
- Network
- System
- Modem Type
- Factory Setup

The menu information includes:

- Filter Types
- Terrestrial Interface Types
- Mod/Demod Types
- Time/Date
- Encoder/Decoder Types
- Modem Types
- Current Firmware
- Test Mode Status
- Overhead Type
- Revision Emulation
- Lamp Test

Provisions are also made for assigning data and code rates to the modulator and demodulator.

After entering the Utility menu, press [←] or [→] to select the desired sub-menu, and press [ENTER].

Notes:

1. The Utility Factory Setup menu is for Comtech EF Data service personnel only. Entering this menu without authorization may cause the modem to operate incorrectly.
2. Changes in the Utility menu may cause changes in other front panel menus.

3.4.6.1 UTILITY:MODULATOR

UTILITY
MODULATOR

3.4.6.1.1 MODULATOR:CODE/DATA RATE

ASSIGN
TRANSMIT FILTERS

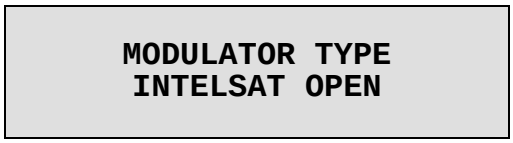
Filter: A, B, C, D, and V.

Code Rate	Data Rate Range	
BPSK 1/2	2.4 to 1250 kbps	
QPSK 1/2	4.8 to 2500 kbps	
QPSK 3/4	7.2 to 3750 kbps	
QPSK 7/8	8.4 to 4375 kbps	
OQPSK 1/2	4.8 to 2500 kbps	
OQPSK 3/4	7.2 to 3750 kbps	
OQPSK 7/8	8.4 to 4375 kbps	
8PSK 2/3	64 to 5000 kbps	
BPSK 1/1	4.8 to 2500 kbps	
QPSK/OQPSK 1/1	9.6 to 5000 kbps	
QPSK/OQPSK 1/1	2.4 to 1250 kbps	
BPSK 5/16	2.4 to 781.25 kbps	*see Note 3*
BPSK 21/44	2.4 to 1193 kbps	*see Note 3*
8PSK 3/4	384 to 5000 kbps	*see Note 3*

Notes:

1. Max Symbol Rate: 2500 kbps.
2. Max Data Rate for Low Var Rate: 512 kbps
3. Turbo only.

3.4.6.1.2 MODULATOR:MODULATOR TYPE



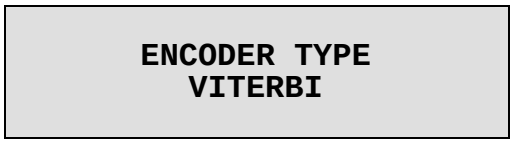
Transmit filter type select. Select one of the following for network filtering:

Note: Change in EFD, ASYNC, or Custom modem types only.

INTELSAT OPEN	FDC CLOSED
EFD CLOSED	SDM-51 COMPATIBLE
CSC CLOSED	

Note: TX filter type is selectable only when CUSTOM is selected for the modem type in the Utility Modem Type menu.

3.4.6.1.3 MODULATOR:ENCODER TYPE



Encoder type selection. Select VITERBI, SEQUENTIAL, or TURBO encoder type.

Notes:

1. Change in EFD, ASYNC, or Custom modem types only.
2. A Sequential Encoder Type and a 3/4 Code Rate combination is not compatible with a CSC CLOSED Modulator Type.

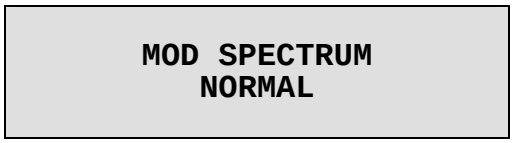
Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change.

3.4.6.1.4 MODULATOR:TX BPSK ORDERING

Transmit BPSK bit ordering selection. Select STANDARD or NON-STANDARD

Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change.

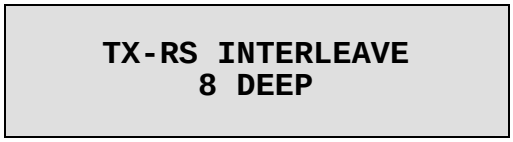
3.4.6.1.5 MODULATOR:MOD SPECTRUM



Programmable vector rotation allows the operator to select NORMAL or INVERT for spectrum reversal of the I and Q baseband channels.

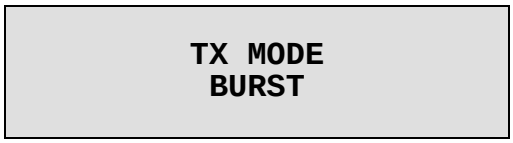
Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change

3.4.6.1.6 MODULATOR:TX-RS INTERLEAVE



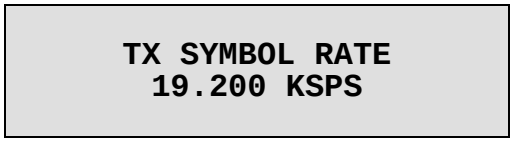
Selection of 4, 8, or 16 deep. Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change.

3.4.6.1.7 MODULATOR:TX MODE



Selection of BURST or CONTINUOUS. Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change.

3.4.6.1.8 MODULATOR:TX SYMBOL RATE



Status only. Selects TX Symbol Data rate.

3.4.6.2 UTILITY:DEMODULATOR

```
UTILITY
DEMODULATOR
```

3.4.6.2.1 DEMODULATOR:CODE/DATA RATE

```
ASSIGN
TRANSMIT FILTERS
```

Filter: A, B, C, D, and V.

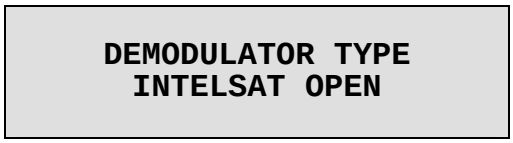
Code Rate	Data Rate Range	
BPSK 1/2	2.4 to 1250 kbps	
QPSK 1/2	4.8 to 2500 kbps	
QPSK 3/4	7.2 to 3750 kbps	
QPSK 7/8	8.4 to 4375 kbps	
OQPSK 1/2	4.8 to 2500 kbps	
OQPSK 3/4	7.2 to 3750 kbps	
OQPSK 7/8	8.4 to 4375 kbps	
8PSK 2/3	64 to 5000 kbps	
BPSK 1/1	4.8 to 2500 kbps	
QPSK/OQPSK 1/1	9.6 to 5000 kbps	
QPSK/OQPSK 1/1	2.4 to 1250 kbps	
BPSK 5/16	2.4 to 781.25 kbps	*see Note 3*
BPSK 21/44	2.4 to 1193 kbps	*see Note 3*
8PSK 3/4	384 to 5000 kbps	*see Note 3*

Notes:

1. Max Symbol Rate: 2500 kbps.
2. Max Data Rate for Low Var Rate: 512 kbps
3. Turbo only.

Upon entry, the current transmitter rate is displayed.

3.4.6.2.2 DEMODULATOR: DEMODULATOR TYPE



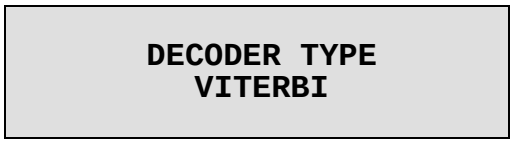
Transmit filter type select. Select one of the following for network filtering:

Note: Change in EFD, ASYNC, or Custom modem types only.

INTELSAT OPEN	FDC CLOSED
EFD CLOSED	SDM-51 COMPATIBLE
CSC CLOSED	

Note: TX filter type is selectable only when CUSTOM is selected for the modem type in the Utility Modem Type menu.

3.4.6.2.3 DEMODULATOR:DECODER TYPE



Decoder type selection. Select VITERBI, SEQUENTIAL, or TURBO decoder type.

Notes:

1. Change in EFD, ASYNC, or Custom modem types only.
2. A Sequential Decoder Type and a 3/4 Code Rate combination is not compatible with a CSC CLOSED Modulator Type.

Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change.

3.4.6.2.4 DEMODULATOR:RX BPSK ORDERING

Receive BPSK bit ordering selection. Select STANDARD or NON-STANDARD

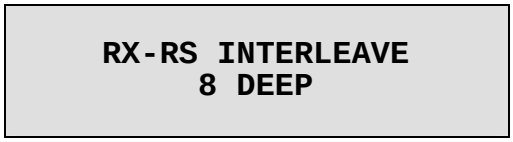
Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change.

3.4.6.2.5 DEMODULATOR:DEMOD SPECTRUM

Programmable vector rotation allows the operator to select NORMAL or INVERT for spectrum reversal of the I and Q baseband channels.

Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change.

3.4.6.2.6 DEMODULATOR:RX-RS INTERLEAVE



Selection of 4, 8, or 16 deep.

Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change .

3.4.6.2.7 DEMODULATOR:RX MODE

```
RX MODE
CONTINUOUS
```

Selection of BURST or CONTINUOUS.

Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change..

3.4.6.2.8 DEMODULATOR:RX SYMBOL RATE

```
RX SYMBOL RATE
19.200 KSPS
```

Status only.

Selects RX Symbol Data rate, with 4.800 to 2500.000 ksps.

3.4.6.3 UTILITY:INTERFACE

```
UTILITY
INTERFACE
```

3.4.6.3.1 INTERFACE:TX OVERHEAD TYPE

```
TX OVERHEAD TYPE
NONE
```

Select None or AUPC for TX overhead type.

Note: Overhead types are selectable only when Custom is selected for modem type in the Utility Modem Type menu.

3.4.6.3.2 INTERFACE:RX OVERHEAD TYPE

Select None or AUPC for RX overhead type.

Note: Overhead types are selectable only when Custom is selected for modem type in the Utility Modem Type menu.

3.4.6.3.3 INTERFACE:TX TERR INTERFACE

Displays the TX interface type RS-232, RS-422, or V.35.

3.4.6.3.4 INTERFACE:RX TERR INTERFACE

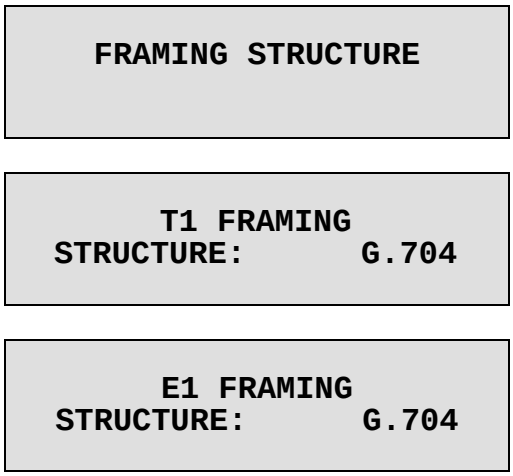
Displays the RX interface type RS-232, RS-422, or V.35.

3.4.6.3.5 INTERFACE:BUFFER PROGRAM

Buffer unit program function. Select MILLI-SECONDS or BITS.

Note: To have the modem calculate the plesiochronous shift, set the buffer units to MILLI-SECONDS. For a specific buffer depth, set the buffer units to BITS.

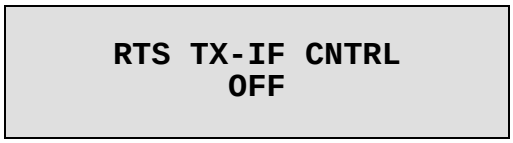
3.4.6.3.6 INTERFACE:FRAMING STRUCTURE



Displays the currently selected framing type and structure of the data. This function is used with the buffer program in ms for plesiochronous buffer slips.

Upon entry, the framing type (T1 or E1) is displayed on Line 1. The framing structure of each type (None or G.704) is displayed on Line 2. Press [←] or [→] and [↑] or [↓] to select framing structure and type. Press [ENTER] to execute the change.

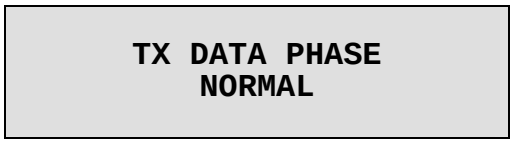
3.4.6.3.7 INTERFACE:RTS TX-IF CNTRL



Programs the modem to allow a Request To Send (RTS) signal to enable the output when data is ready for transmission.

Press[←], [→], [↑], or [↓] to move the flashing cursor. Press [ENTER] to execute the change.

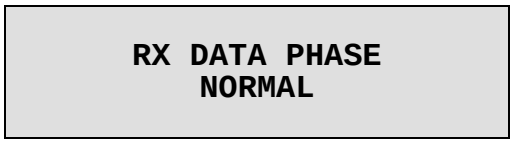
3.4.6.3.8 INTERFACE:TX DATA PHASE



TX data phase relationship. Use this option to select Normal or Invert for the TX data relationship to the selected TX clock.

Upon entry, press [↑] or [↓] to make the selection. Press [ENTER] to execute the change.

3.4.6.3.9 INTERFACE:RX DATA PHASE



RX data phase relationship. Use this option to select Normal or Invert for the RX data relationship to the selected RX clock.

Upon entry, press [↑] or [↓] to make the selection. Press [ENTER] to execute the change.

3.4.6.3.10 INTERFACE:CTS DELAY

Sets the delay in seconds (0 to 60) for the Clear To Send (CTS) signal.

3.4.6.4 UTILITY:NETWORK

```
SNM 1010
NA  2000
```

3.4.6.4.1 NETWORK:RELEASE

```
SNM 1010
REL 4.3.X p cc14
```

Status only.

Shows installed version of DAC code and code's CRC in hexadecimal.

e.g. rel 4.3.0 p cc14

3.4.6.4.2 NETWORK: CHANNELS 1 -15

```
CHANNELS 1 – 15
---------------
```

3.4.6.4.3 NETWORK: CHANNELS 16 - 31

```
CHANNELS 16 – 31
---------------
```

Status only.

- = Traffic Modem Not Installed
I = Traffic Modem Idle
O = Traffic Modem Offline
C = Call in Progress
S = Connecting Call
D = Disconnecting Call

3.4.6.5 UTILITY:SYSTEM

```
UTILITY
SYSTEM
```

3.4.6.5.1 SYSTEM:TIME/DATE

```
TIME: 12:00:00AM
DATE: 7/04/1976
```

Time of day and date display/set function.

The current time and date in the modem's memory are displayed when selected.

To change the modem time and/or date, press [ENTER].

- Press [←] or [→] to position the cursor over the parameter to be changed.
- Press [↑] or [↓] to change the parameter.
- Once the parameters are displayed as desired, press [ENTER] to set the time and date.

3.4.6.5.2 SYSTEM:REMOTE BAUD RATE

```
REMOTE BAUD RATE
19.200 BPS NONE
```

The parity and baud rate settings of the modem are displayed.

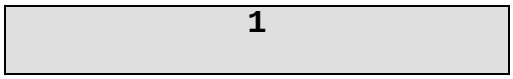
To change the modem parity, press [ENTER].

- Press [←] or [→] to position the cursor over the parameter to be changed.
- Press [↑] or [↓] to change the parameter.
- Once the parameters are displayed as desired, press [ENTER] to set the baud rate and parity.
- The parity can be set to EVEN, ODD, or NONE.

The baud rate is 19200 bit/s.

3.4.6.5.3 SYSTEM:REMOTE ADDRESS

```
REMOTE ADDRESS
```

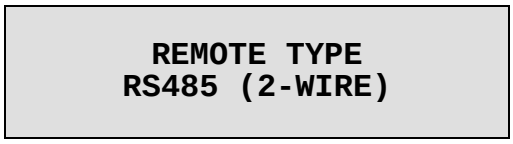


The current modem address is displayed (1 to 255).

Note: 0 is reserved as a global address.

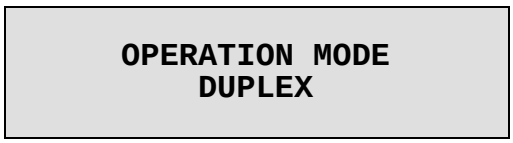
To change the remote address, press [ENTER]. Press [↑] or [↓] to make the selection. Press [ENTER] to execute the change.

3.4.6.5.4 SYSTEM:REMOTE TYPE



Select EIA-485 (2-Wire), EIA-485 (4-Wire), or EIA-232.

3.4.6.5.5 SYSTEM:OPERATION MODE



Programs the modem for DUPLEX, TRANSMIT ONLY, or RECEIVE ONLY operation.

Upon entry, the operational status may be changed. Press [↑] or [↓] to make the selection. Press [ENTER] to execute the change.

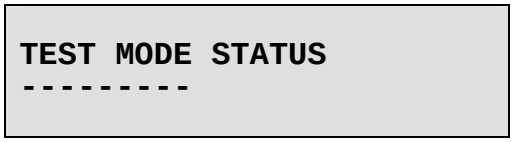
Note: When TRANSMIT ONLY or RECEIVE ONLY are selected, the appropriate faults are masked from the Faults and Stored Faults menus.

3.4.6.5.6 SYSTEM:YEAR DISPLAY

Selects the display for the year in either 2-digit or 4-digit format.

Upon entry, the year display may be changed. Press [↑] or [↓] to make the selection. Press [ENTER] to execute the change

3.4.6.5.7 SYSTEM:TEST MODE STATUS

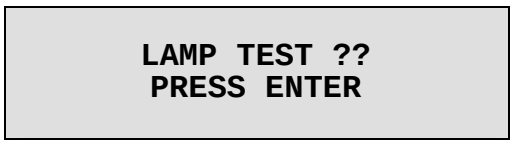


Test mode status indicator. The following modem test points are listed and display a "+" when a test mode is active:

- RS CORR OFF
- INTRFC LOOP BACK
- B-BAND LOOP BACK
- RF LOOP BACK
- IF LOOP BACK
- CARRIER MODE
- RX 2047 Pattern
- TX 2047 Pattern

To view the test modes, press [ENTER]. Press [↑] or [↓] to make the selection.

3.4.6.5.8 SYSTEM:LAMP TEST ??



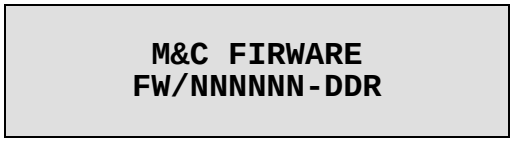
Lamp test function. Press [ENTER] to turn the front panel indicators on for 3 seconds.

3.4.6.5.9 SYSTEM:DISPLAY CONTRAST

Sets the contrast setting of the Front Panel menu.

Press [ENTER] to begin. Press [↑] or [↓] to increment or decrement the number at the flashing cursor, from 0 to 100. Press [ENTER] to execute the change.

3.4.6.5.10 SYSTEM:M&C FIRMWARE



Displays the M&C module FW/6535-3 firmware version.

The display includes the month, day, and year.

3.4.6.5.11 SYSTEM:BOOT FIRMWARE

Displays the boot module FW/6536 firmware version.

The display includes the month, day, and year.

3.4.6.5.12 SYSTEM:FPGA FIRMWARE

Displays the FPGA module FW/6094 firmware version.

The display includes the month, day, and year.

3.4.6.5.13 SYSTEM:DEMO MODE

```
DEMO MODE
   OFF
```

Displays the Demo Mode On or Off.

3.4.6.5.14 SYSTEM:EXT AGC: MAX PWR

```
EXT AGC: MAX PWR
   0.0 VOLTS
```

Sets the AGC voltage for a receive signal level of -60.0 dBm. The voltage range is 0.0 to 10.0V, in 0.5V steps.

Upon entry, the current external AGC voltage level is displayed. Press [↑] or [↓] to increment or decrement the AGC voltage level in 0.5V steps. Press [ENTER] to execute the change.

Note: For any receive signal level between -25.0 and -60.0 dBm, the software will interpolate the required AGC voltage.

3.4.6.5.15 SYSTEM:EXT AGC: MIN PWR

```
EXT AGC: MIN PWR
   10.0 VOLTS
```

Sets the AGC voltage for a receive signal level of -25.0 dBm. The voltage range is 0.0 to 10.0V, in 0.5V steps.

Upon entry, the current external AGC voltage level is displayed. Press [↑] or [↓] to increment or decrement the AGC voltage level in 0.5V steps. Press [ENTER] to execute the change.

Note: For any receive signal level between -25.0 and -60.0 dBm, the software will interpolate the required AGC voltage.

3.4.6.5.16 SYSTEM:MASTER RESET

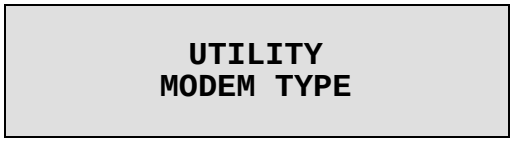
Initiating a hard reset will reset the modem and place the default configuration settings in ROM. Initiating a soft reset will reset the modem hardware, but saves the current configuration settings.

Select [ENTER] once to access HARD or SOFT.
Press [←] or [→] to make the selection. Press [ENTER].
Press [→] five times to move the cursor to YES. Select YES and press [ENTER] again.

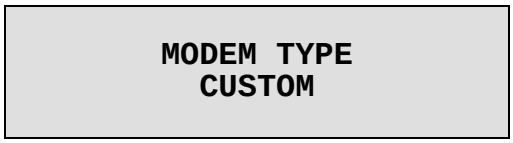
Note: The following parameters do not revert to default settings after a hard reset:

- Address
- Parity
- Baud Rate
- Remote Type
- Ext AGC: Min Pwr
- Ext AGC: Max Pwr
- Display Contrast

3.4.6.6 UTILITY:MODEM TYPE



3.4.6.6.1 MODEM TYPE:MODEM TYPE



Selects the following types of modem operation:

- CUSTOM Selections are made from the Front Panel menu
- EFD Closed Network Operation
- ASYNC Asynchronous

When the modem is changed from one type of operation to another, the modem will be reset to the default configurations of the new modem type. The RF-IF Output must be turned on to get the modem to lock.

- If the existing modem type is the same as the type entered, the modem will not change any parameters.
- If the modem type is changed to Custom, no parameters will be changed.
- If the modem will not allow the modem type selection, that type of operation may not be an available option.
- Select MODEM OPTIONS and OVERHEAD OPTIONS to see which modem operations are allowed.

3.4.6.6.2 MODEM TYPE:MODEM EMULATION

```
MODEM EMULATION
DISABLED
```

Selects the following types of modem emulation:

SDM-100	VER:	15.7.1
SDM-300		6.2.2
SDM-308-4		4.03
SDM-308-4		6.05
SDM-308-4		6.08
SDM-308-4		7.03
SDM-309		6.04
SDM-650		4.12A
SDM-650		4.16
SDM-6000		5.1.1

or Disabled

Upon entry, the current modem emulation is displayed. Press [↑] or [↓] to change the display. Press [ENTER] to execute the change.

3.4.6.6.3 MODEM TYPE:REVISION EMULATION

```
REV EMULATION
CURRENT VERSION
```

Programs an emulation mode of a previous functional revision. This allows the user to select the CURRENT VERSION or FUNCTIONAL X.

Note: The number displayed in the CURRENT VERSION position increases with each software version change.

Upon entry, the CURRENT VERSION is displayed. Press [↑] or [↓] to select the FUNCTIONAL version. Press [ENTER] to execute the change.

Notes:

1. Programming a current version (default) allows all features and options (if installed) to operate normally.
2. Programming a FUNCTIONAL version (X) eliminates any changes that affect the later version. Only functional changes are affected by the revision emulation feature.
3. A correction change (e.g., VER 3.1.2) remains fixed in accordance with the latest version. Since the revision emulation default is the current version, program the functional version at the start of each operation.
4. The revision emulation feature does not affect some interface changes for the direct operation of the modem (Configuration save/recall, test mode screen in the Utility/System, all factory setup modes, etc.).

3.4.6.6.4 MODEM TYPE:MODEM OPTIONS

```
MODEM OPTIONS
-------------
```

Displays the installed modem options.

If the option is installed, a "+" symbol is displayed. To view the available options press [ENTER]. Observe for the flashing cursor. Press the [←] [→] arrows to move from one symbol to the next. The first line will display the option. The second line will display the status:

HIGH POWER	(0)	0 = Not Installed, Not Upgradeable
HIGH STABILITY	(0)	- = Not Installed, FAST Upgradeable
ASLT	(-)	+ = Installed
VITERBI	(+)	X = Not Installed, Field Upgradeable
SEQUENTIAL	(+)	
SINGLE RATE	(-)	
LOW RATE VAR	(-)	
FULL RATE VAR	(+)	
CARD #1 PCB	(+)	
CARD #2 PCB	(X)	
CARD #3 PCB	(X)	
8PSK 2/3	(+)	
TX ONLY	(0)	
RX ONLY	(0)	

3.4.6.6.5 MODEM TYPE:CARD #1 TYPE

```
CARD #1 TYPE
DAC 01
```

Status Only.

Displays either of the following:

- DAC 01
- NOT INSTALLED

3.4.6.6.6 MODEM TYPE:CARD #2 TYPE

```
CARD #2 TYPE
NOT INSTALLED
```

Status Only.
Displays either of the following:

- REED-SOLOMON
- TURBO
- NOT INSTALLED

3.4.6.6.7 MODEM TYPE:CARD #3 TYPE

```
CARD #3 TYPE
NOT INSTALLED
```

Status Only.
Displays either of the following:

- REED-SOLOMON
- TURBO
- NOT INSTALLED

3.4.6.6.8 MODEM TYPE:CARD #2 OPTIONS

```
CARD #2 OPTIONS
-
```

Status Only.
Displays either of the following:

- REED-SOLOMON
  - INTELSAT
  - AUPC
- TURBO
  - AUPC

3.4.6.6.9 MODEM TYPE:CARD #3 OPTIONS

```
CARD #3 OPTIONS
-
```

Status Only.
Displays either of the following:

- REED-SOLOMON
  - INTELSAT
  - AUPC

3.4.6.6.10 MODEM TYPE:LOCAL MODEM AUPC

```
LOCAL MODEM AUPC
      OFF
```

Configures the modem for the self-monitoring Local Modem AUPC mode and for local TX power control (self-monitoring) due to severe rain fade.

Notes:

1. The self-monitoring Local Modem AUPC mode is not used when the ASYNC/AUPC is selected as the Modem Type.
2. Used for local control (self-monitoring) due to severe rain fade.

3.4.6.6.11 MODEM TYPE:MODEM SERIAL

```
MODEM SERIAL #
123456789
```

Status Only

3.4.6.6.12 MODEM TYPE:CARD #2 SERIAL

```
CARD #2 SERIAL #
123456789
```

Status Only.

3.4.6.6.13 MODEM TYPE:CARD #3 SERIAL

```
CARD #3 SERIAL #
123456789
```

Status Only.

3.4.6.6.14 MODEM TYPE:CONFIGURATION CODE - MODEM

```
CONFIGURATION
CODE - MODEM
```

```
1)AAAAAAAAAA
2)AAAAAAAAAA
```

If installed, Status Only
Comtech EF Data supplied code.

3.4.6.6.15 MODEM TYPE:CONFIGURATION CODE – CARD #2

```
CONFIGURATION
CODE – CARD #2
```

```
1)AAAAAAAAAA
2)AAAAAAAAAA
```

Status Only

3.4.6.6.16 MODEM TYPE:CONFIGURATION CODE – CARD #3

```
CONFIGURATION
CODE – CARD #3
```

```
1)AAAAAAAAAA
2)AAAAAAAAAA
```

Status Only

3.4.6.6.17 UTILITY:FACTORY SETUP

```
UTILITY
FACTORY SET-UP
```

Not Applicable.

3.5 User Port Operation

The User Port allows the user at the remote site to communicate with the remote control SNM-1010 to request the setup and termination of circuits, send and receive service messages, and configure the SNM-1010. The remote control SNM-1010 modem always has an address of zero.

The User Port uses a 9-pin mini-DIN female connector on the rear of the SNM-1010. The port is configured as a DCE with the pin definitions as shown in the following listing.

Signal Function	Name	Pin #	I/O	Signal Level
Receiver Ready	RR	1	O	EIA-232-C
Receive Data	RD	2	O	EIA-232-C
Send Data	SD	3	I	EIA-232-C
Terminal Ready	TR	4	I	EIA-232-C
Signal Ground	SG	5		
Data Mode	DM	6	O	EIA-232-C
Request to Send	RS	7	I	EIA-232-C
Clear to Send	CS	8	O	EIA-232-C
Incoming Call	IC	9	O	EIA-232-C

The interface operates at 19.2 kbps, 8 data bits, no parity 1 stop bit,. Levels are in accordance with EIA-232. The User Port can also be accessed using an optional Public Switched Telephone Network (PSTN) dial-up modem.

3.6 Remote Dial-Up Capability

The SNM-1010 User Port can be accessed via an external PC modem. A user dials into an SNM-1010 from a remote location using the following items:

- Personal computer
- Auto-interface speed-detect modem
- Modem terminal software capable of emulating an ANSI terminal

3.6.1 User Port Modem

The remote dial-up was tested using a US Robotics, Inc. external Sportster™ 28.8 modem with V.34 and V.32bis at the User Port. Recommended dip switch settings for this modem are described in the following listing.

Pin 1	Down	Data Terminal Override
Pin 2	Up	Verbal Result Codes
Pin 3	Up	Suppress Result Codes
Pin 4	Down	No Echo, Off-line Commands
Pin 5	Up	Auto Answer On
Pin 6	Up	Carrier Detect Normal
Pin 7	Up	Load NOVRAM Defaults
Pin 8	Up	Dumb Mode

The US Robotics, Inc. external Sportster™ 28.8 modem or a similar modem should be used at the User Port.

3.6.2 Remote Site Modem

The remote dial-up was tested using a US Robotics, Inc. external or internal Sportster™ 28.8 modem with V.34 and V.32bis at the remote site. Recommended dip switch settings for this modem are the factory default settings.

The US Robotics, Inc. external or internal Sportster™ 28.8 modem or a similar modem should be used at the remote site.

On the PC, modem setting requirements include the following:

ANSI emulation
19.2, 8, N, 1
Software flow control XON/XOFF
1 ms character pacing for ASCII uploads

3.7 SNM-1010 Commands

The commands described in this section are used to set SNM-1010 functional parameters within a DAMA environment.

3.7.1 Character Set

The interface responds to ASCII characters in the range of 0x00 to 0x7F. The 8th bit (most significant) is not generated on the transmit side and is ignored on the receive side.

3.7.2 Status Lines and Flow Control

The interface ignores all status inputs.

3.7.3 Message Structure

A message is either a command or a response. Each message is made up of three elements:

- Prefix (Optional entry)
- Message body
- End character

3.7.3.1 Prefix

The prefix is the channel number in ASCII decimal. An SNM-1010 does not manage or control any external traffic modems. The channel number can be omitted or zero (0) can be used with the same result.

3.7.3.2 Message Body

The message body is made up of individual commands and fields.

Certain conventions are used to improve the readability of the commands presented in this document. These conventions do not appear in the commands themselves. Conventions used in the command names and descriptions include the following characters.

[...] Square brackets are used to indicate that the enclosed items are optional. (The square brackets themselves do not appear in the message.)

<...> Angle brackets are used to enclose the names of other syntactical elements. (When those elements appear in an actual message, the actual element is used and the angle brackets are omitted.)

'...' Single quotes are used to enclose an ASCII character for illustration of syntax elements. (The single quotes themselves do not appear in the message.)

3.7.3.3 End Character

The end character for both command and response messages is a carriage return (represented by "cr").

3.7.3.4 Case Sensitivity

Messages are not case sensitive. However, the DCE generates responses and results in uppercase text.

3.7.3.5 Delimiters

Commas and semicolons are valid delimiters that may be used interchangeably with no difference in behavior.

3.7.3.6 End Character

Each message is ended with a single character which signals the end of the message:

"]" End bracket for responses.

3.7.3.7 Queries

The interface can be queried by issuing a valid command without a value at the end. This will result in the return of the currently set value.

Example (assume a previously sent command as shown):

ICF 70.4567'cr' — sets inbound control IF frequency to 70.4567 MHz.

Now a query:

ICF'cr'

Response from interface:

ICF 70.4567 — inbound control IF frequency is 70.4567 MHz.

3.7.4 Node Address (NA)

This command sets the node number for the remote control channel mode SNM-1010 controller.

3.7.4.1 Command Format

NA <node_number>'cr'

<node_number>	Range of 1 to 9999 and must be unique in the network. Unpredictable results will occur if two nodes are online and both have been assigned the same node number. The node number will generally be defined by the provisioning documents that establish remote sites and circuits.

3.7.4.2 Local Command Responses

node address = <node_number>	

3.7.5 Receive Control Channel Frequency (ICF)

This command sets the receive (NMS to remote) control channel IF frequency at the remote node.

3.7.5.1 Command Format

ICF <frequency>'cr'

<channel_number>	The channel number for the command. 0 is used for the remote control channel.
<frequency>	Entered in MHz. Range of 50 to 90 MHz, or 100 to 180 MHz Resolution of 100 Hz. Formatting is pseudo-floating point. Example: ICF 70.4567 sets receive control IF frequency to 70.4567 MHz.

3.7.5.2 Local Command Responses

ICF= <frequency>, <control channel offset>, <traffic channel offset>	

3.7.6 Transmit Control Channel Frequency (OCF)

This command sets the transmit (remote to NMS) control channel IF frequency at the remote node.

3.7.6.1 Command Format

OCF <frequency>'cr'

<channel_number>	The channel number for the command. 0 is used for the remote control channel.
<frequency>	Entered in MHz. Range of 50 to 90 MHz, or 100 to 180 MHz. Resolution of 100 Hz. Formatting is pseudo-floating point. Example: OCF 70.1234 sets transmit control IF frequency to 70.1234 MHz.

3.7.6.2 Local Command Responses

OCF= <frequency>, <control channel offset>, <traffic channel offset>	

3.7.7 Transmitter On (RF_ON)

This command enables the SNM-1010 transmitter.

3.7.7.1 Command Format

RF_ON'cr'

3.7.7.2 Local Command Responses

None.

3.7.8 Transmitter Off (RF_OFF)

This command disables the SNM-1010 transmitter.

3.7.8.1 Command Format

RF_OFF'cr'

3.7.8.2 Local Command Responses

None.

3.7.9 Transmit Power (TX)

This command sets the SNM-1010 transmit power.

3.7.9.1.1 Command Format

TX <tx_power>'cr'

<tx_power>	In the range of +5 to -30 dBm, in 0.1 dBm steps. The format for TX_power is [+] XX.X with an implied minus sign.

3.7.9.2 Local Command Responses

transmit power = <tx_power>	

3.7.10 SNM-1010 DAC Software Revision (VER)

This command queries the SNM-1010 DAC board for its current software revision number.

3.7.10.1 Command Format

VERSION'cr' or VER'cr'

3.7.10.2 Local Command Responses

DAC VERSION: X.Y.ZZZ.CCCC	Where: X.Y = SNM-1010 DAC software release number. ZZZ = Revision level for the release. CCCC = Checksum

3.7.11 Node to NMS Service Messages (NMS_MSG)

This command permits the transmission of up to 28 ASCII text characters to the NMS.

3.7.11.1 Command Format

NMS_MSG 'text string to be transmitted to the NMS''cr'

3.7.11.2 Local Command Responses

None.

3.7.12 SNM-1010 Mode (MD)

This command sets the SNM-1010 mode.

3.7.12.1 Command Format

MD <mode>'cr'

<mode>	INT Remote Control Channel-Internal Traffic Remote Control Channel-Internal Traffic mode — the modem acts as a stand-alone Data/Control modem.

3.7.12.2 Local Command Responses

mode = <mode>	

3.7.13 Built-In Diagnostic Tests (EFD_DIAG)

Note: These tests shall be performed by qualified personnel only.

This command starts the DAC Diagnostic software:

EFD_DIAG'cr'

is 0 to select the SNM-1010 control channel.

Wait several seconds. The User Port will display:

Diagnostic Test, Press F1 for Help.
>

Enter an ANSI F1 function key character sequence to display the diagnostic main menu:

F1: Help Screen
F2: Transfer Control to Flash Loader
F3: Transfer Control to PDREM Ram
F4: Restore Area 1 Defaults
F5: Restore Area 2 Defaults

1: Run Ram test
2: Run NOVRAM cycle power test
3: Run Chip Select test
4: Run EFBUS1 to EFBUS2 loopback test
5: Run EFBUS2 to EFBUS1 loopback test
6: Run Service Terminal loopback test
7: Alarm Input Test

To leave the diagnostic tests and return to SNM-1010 operational code, enter an ANSI F4 function key character sequence.

CAUTION

Selecting any menu selection other than "F4" may cause unpredictable operation of the SNM-1010.

3.7.13.1.1 Help Screen

To display the menu selection for the Comtech EF Data diagnostics, select menu option "F1" by entering an ANSI F1.

3.7.13.2 Flash Updates

Select menu option “F2” by entering an ANSI F2. This will begin the flash update procedure, causing the User Port to display:

```
> > Xfer Control to Flash Loader

READY FOR FLASH CODE. START ASCII UPLOAD WITH S/W FLOW CONTROL
USE ctrl z KEY TO COMPLETE THE DOWNLOAD OR ctrl c TO ABORT
```

The SNM-1010 then waits for an Intel hex format software download properly terminated with an end of record marker.

Using the ASCII file upload utility on the PC terminal emulation program, upload the appropriate Intel hex file. The User Port will display the following progress messages as the update proceeds:

```
    Sending Flash Setup Commands ...
    Erasing sector
    Sending Flash Setup Commands ...
.....
```

When the file transfer to the SNM-1010 has completed, enter ‘CTRL Z’ from the PC terminal program.

Note: Making any entry other than ‘CTRL Z’ will cause a failure of the file transfer.

If the SNM-1010 FLASH update is successful, the User Port will display:

```
Flash programming complete
```

The SNM-1010 will reset and begin to execute SNM-1010 operational code.

The User port will display an error message for any errors that occur during the programming sequence. Possible error message are listed in the following listing.

DAC FLASH WRITE FAILURE	Failure in flash programming.
DAC FLASH ERASE FAILURE	Failure in erasing a Flash sector.
DAC FLASH TIME OUT	Flash part not responding with the correct programming status.
DAC FLASH PROGRAMMING FAILURE	An error was found in the upload data.

The download process can be terminated with a ‘CTRL C’.

3.7.13.3 PDREM Ram

To load a RAM-based version of a remote debugger, select menu option “F3” by entering an ANSI F3.

3.7.13.4 Area1 Defaults

To cause the SNM-1010 to execute SNM-1010 code stored in FLASH AREA 1, select menu option “F4” by entering an ANSI F4.

3.7.13.5 Area2 Defaults

To cause the SNM-1010 to execute SNM-1010 code stored in FLASH AREA 2, select menu option “F5” by entering an ANSI F5.

3.7.13.6 Ram Test

To perform a write/read/compare operation on locations 70000H to 7FFFFH of SNM-1010 DRAM with a 55AA pattern, select menu option “1”.

3.7.13.7 NOVRAM Cycle Power Test “2”

To test the SNM-1010 NOVRAM, perform the following steps.

1. Power up the SNM-1010.

2. Select menu option “2” (NOVRAM test). This test will fail due to the unknown content of NOVRAM, and will store a pre-set pattern into NOVRAM.

3. Cycle the power and select menu option “2” again. If the test does not pass, the SNM-1010 NOVRAM has failed.

3.7.13.8 Chip Select Test

To test the SNM-1010 Quad Pack A-D and the 1550 UART, select menu option “3”. Verify that the User Port displays “Chip Select Test Pass”.

3.7.13.9 Service Terminal Loopback Test

To perform a loopback test of the Service Terminal port using a PC terminal emulation program, select menu option “6”.

3.7.13.10 EFBUS Loopback Test

Same as above, except select option "4 or "5".

3.7.14 Echo (ECHO)

This command enables/disables echo of characters sent to the SNM-1010 user port.

3.7.14.1 Command Format

ECHO <state>	'ON' enables character echo 'OFF' disables character echo

3.7.14.2 Local Command Responses

ECHO <state>	

3.7.15 Modem Command Sequence

This command permits the use of the User Port to communicate with the SNM-1010 using M&C commands similar to those used for the SDM-300A base modem.

Refer to Section 9.0 for a subset of the SDM-300A type M&C remote commands that are useful on an SNM-1010.

3.7.15.1 Command Format (MC)

<channel_no> MC 'modem command string"cr'

<channel_no>	Prefix channel number. (Optional) Valid range: 0 (or omitted)
MC	The command string following the 'MC' command is issued directly to the SNM-1010. Refer to Section 9.0.

3.7.15.2 Local Command Responses

>1/'response''cr'	

3.7.16 Data Call

The user can initiate a data call by either specifying the destination data channel address and grade of service information or by specifying a pre-defined circuit id.

3.7.16.1 "Dialed" Data Call (DD)

The user initiates the data call by specifying the destination data channel address and the desired grade of service.

3.7.16.1.1 Command Format

<channel_no> DD <phone_number> <tx_data> <tx_code> <tx_mod> <origin_clock> <rx_data> <rx_code><rx_mod> <dest_clock> [<grade_of_service>]'cr'

<channel_no>	Prefix channel number. (Optional) Valid range: 0 (or omitted)
DD	Dialed data call.
<phone_number>	Destination data channel address (phone number). Max. length: 32 characters. Valid characters: '1', '2', '3', '4', '5', '6', '7', '8', '9', '0', '*', '#', 'A', 'B', 'C', 'D', '-', '(' or ')' Note: The '-' and '('or')' characters are not part of the number and are used to increase readability. They are stripped out and not passed to the NMS.
<tx_data> and <rx_data>	Data rates, defined in kbps. Step size: 1 bit/s. Maximum value: 8192.000 kbps. Examples: 64 is 64 kbps, 64.001 is 64.001 kbps, 1024.1 is 1.0241 Mbit/s, etc. Note: The decimal point is not required and the entered number is rounded to the nearest 1 bit/s value.
<tx_code> and <rx_code>	Codes. Values: Code Rate — Code 1/2 — 1 2/3 — 2 3/4 — 3 5/6 — 5 7/8 — 7 5/16 — A 21/44 — B

<tx_mod> and <rx_mod>	Modulation. Values: Modulation Type — Code BPSK — B QPSK — Q OQPSK — O 8PSK — 8
<origin_clock> and <dest_clock>	Clock Source. Values: Clock Source — Code Terrestrial (TT) — T Internal (ST) — I Satellite (RT) — S
<grade_of_service>	Optional coding method indicator. Values: Coding Method — Code Viterbi — V (default) Sequential — S Turbo — T

3.7.16.1.2 Local Command Responses

<none>	Command received OK, will be sent to the NMS.
Error <code> : <description>	Code — Description 9 — Channel <Channel No.> Invalid 20 — Not enough parameters.

3.7.16.2 Pre-defined Data Circuit Call (DC)

The user initiates a data call by specifying a pre-defined circuit. The circuit must be pre-defined at the NMS.

3.7.16.2.1 Command Format

<channel_no> DC <circuit_id>'cr'

<channel_no>	Prefix channel number. (Optional) Valid range: 0 (or omitted)
DC	Pre-defined data circuit call.
<circuit_id>	Pre-defined circuit id at the NMS. Valid range: 1 through 9999.

3.7.16.2.2 Local Command Responses

<none>	Command received OK, will be sent to the NMS.	
Error <code> : <description>	Code	Description
	9	Channel <channel No.> Invalid
	20	Not enough parameters

3.7.17 Terminate (TE)

The terminate command terminates an active call.

3.7.17.1 Command Format

TE'cr'

<channel_no)	Prefix channel number. (Optional) Valid range: 0 (or omitted)
TE	Terminate active call.

3.7.17.2 Local Command Responses

<none>	Command received OK, will be sent to the NMS.	
Error <code> : <description>	Code	Description
	9	Channel Invalid
	24	Channel not active

3.7.18 Port Redirection

The operation of the User Port may be switched to the Service Port mode. The Service Port operation contains information to be used for debugging purposes. To redirect the User Port to the Service Port type:

'!<cr>'

3.7.19 Debugging with the User Port

Debug messages at the user/service port can be enabled and disabled.

3.7.19.1 Command Format

DEB
Example:

```
User Port > DEB

DAC debug commands:
  1: SYS debug    2: MSG debug      3: ROUTER debug
  4: HDLC debug   5: C/SDAC debug   6: MODEM debug
  7: DICA debug   8: VFDU debug     9: DTCP debug
User Port >
```

3.7.19.2 Initiate Modem Command Debug

Enter “DEB 6” for the Modem debug submenus:

```
User Port > DEB 6
MODEM debug:
  1:sdmMsg=0, 2:mcpMsg=0,
User Port >
```

To enable l:sdmMsg, enter “DEB 6 1 1”

```
User Port > DEB 6 1 1
MODEM debug:
  1:sdmMsg=1, 2:mcpMsg=0,
User Port >
```

IMPORTANT

Notice that sdmMsg=1 (enabled). The redirection command described in Section 8.3.18 can be used to toggle the display of messages On or Off.

3.8 Clocking Options

Methods of clocking the data from the terrestrial equipment to the satellite (and vice versa) will depend upon the application. The two most common options and recommended configurations are described in the following paragraphs.

Notes:

1. The clocking options are available only when the modem is in the continuous mode.
2. Clock settings in the SNM-1010 are set automatically when the operating mode is selected.

3.8.1 Master/Master

This application is used when both earth stations incorporate high stability clocks and the incoming data will be clocked to the local network. The disadvantage of the master/master application is that the incoming data will slip, because the clocks will not be synchronized.

However, if the buffer is properly set up, the slips will be an exact frame length, causing minimum data loss. Use of very high stability clocks can result in several days between the expected slips. Loss of the buffer clock means 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 when the selected clock is lost.

Figure 3-5 provides the following information:

- Clocking block diagram
- Transmit clock options
- Buffer clock options

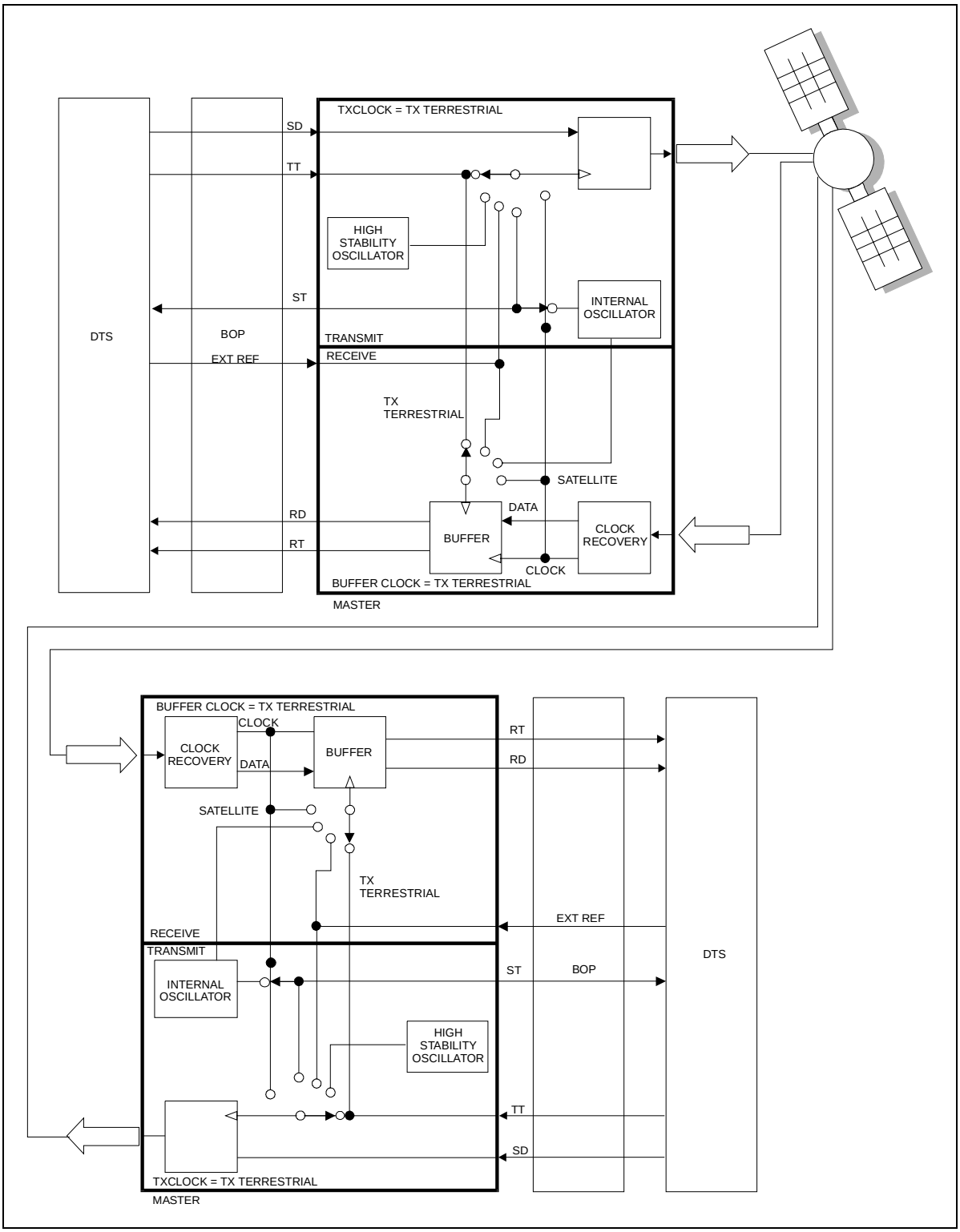


Figure 3-5. EIA-449, EIA-530, and V.35 Master/Master Clocking Block Diagram

3.8.2 Master/Slave

This application is used where the far end earth station does not have local access to a high stability reference clock, or where synchronization with a local clock is not required.

The disadvantage of the master/slave application is that the signal received at the slave station is subject to Doppler shift.

Note: To properly compensate for the Doppler shift on the outbound and return paths, the length of the buffer at the master end must be twice the normally required length.

3.8.3 EIA-449, V.35 or EIA-530 Master/Slave

Refer to Figure 3-6 for:

- Clocking block diagram
- Transmit clock options
- Buffer clock options
- V.35 timing signals
- EIA-449 timing signals
- EIA-530 timing signals

The use of loop timing in the modem is an option for both EIA-449 and V.35 operation.

SCT (LOOP): 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 of the modem. The SCT (LOOP) indication serves as a reminder that the SCT internal clock is now the recovered clock, not the internal oscillator. Select SCT (LOOP) when the terrestrial equipment does not provide a transmit terrestrial clock.

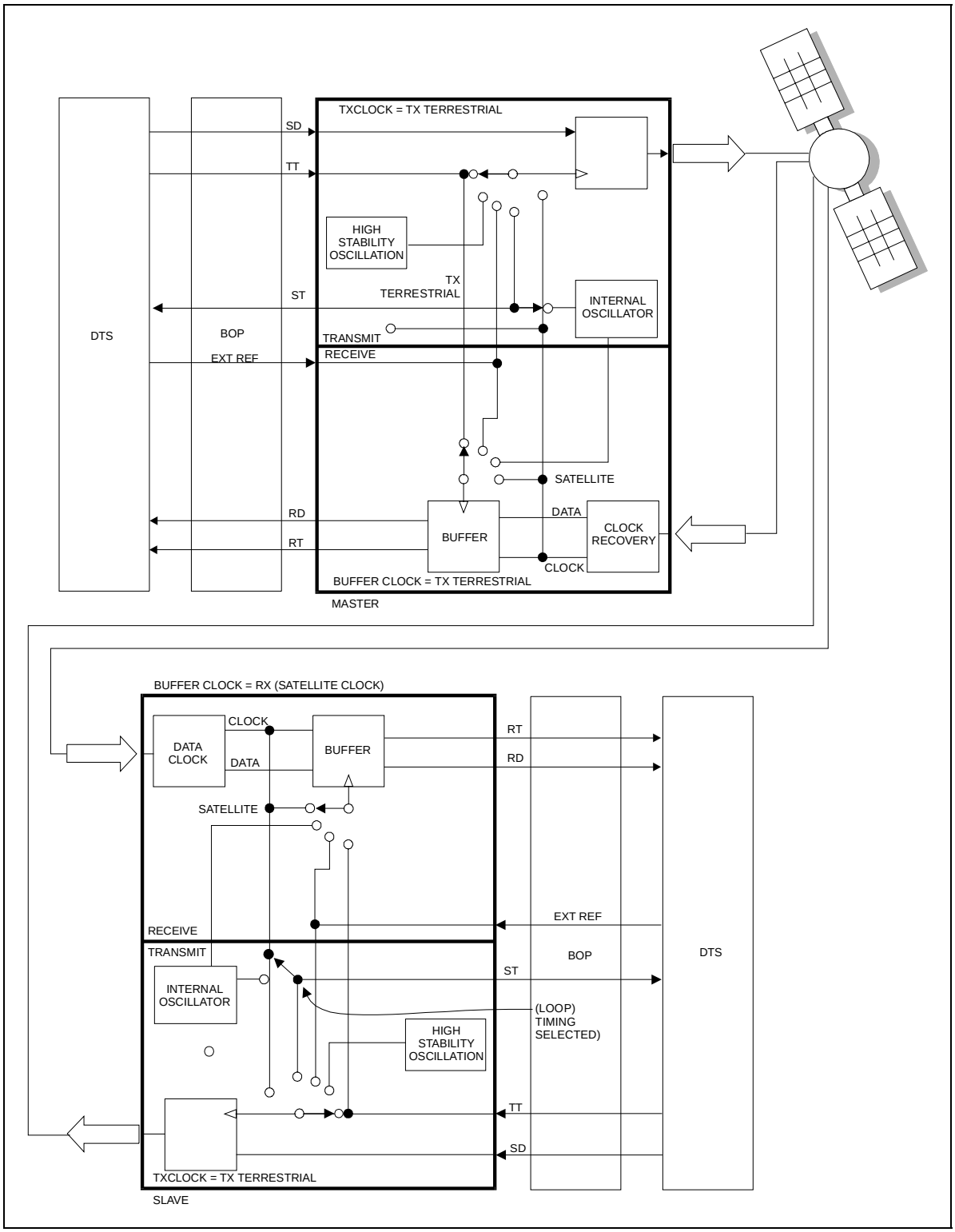


Figure 3-6. Master/Slave Clocking Block Diagram

3.8.4 Transmit Clock Source

Select the Transmit Clock from the following sources.

- Continuous mode:
  - ♦ Serial Clock Transmit (SCT) (internal) ± 10 PPM (from modulator).
  - ♦ Terrestrial. Must be better than ± 130 PPM.
  - ♦ External. Must be better than ± 100 PPM (must be locked to data).
  - ♦ Receive Satellite Clock (Loop Timing). Receive data rate must be the same as the transmit data rate. Must be better than ± 100 PPM.
- Burst mode:
  - ♦ SCT (internal) ± 10 PPM (from modulator).
  - ♦ External. Must be better than ± 100 PPM (must be locked to data).

3.8.4.1 Transmit Clock Source Specifications

Refer to the following listing for Transmit Clock Source specifications.

External Clock Frequency Range	Must equal data rate
External Clock Amplitude	Per selected interface specification
External Clock Impedance	Per selected interface specification

3.8.4.2 Transmit Clock Switching Due to Failure of Selected Clock

The modem will automatically switch the transmit clock source to SCT on failure of the selected clock.

3.8.5 Doppler Buffer Clock Source

The operator can select the Doppler Buffer Clock from the following sources.

- Continuous mode:
  - ♦ Transmit Terrestrial Clock (must be within 100 PPM of nominal)
  - ♦ Receive Satellite Clock (must be within 100 PPM of nominal)
  - ♦ External Clock
  - ♦ SCT, internal
- Burst mode operation does not support Doppler Buffer capability

3.8.5.1 Doppler Buffer Clock Source Specifications

Refer to the following listing for Doppler Buffer Clock Source specification.

Receive Clock Switching Due to Failure of Selected Clock	Upon failure of the selected clock, the modem automatically switches the receive clock source to internal.
Receive Clock Phase Adjustment	Operator-selectable to normal or inverted.
Receive Doppler Buffer	Operator-selectable to any capacity in the range of 64 through 65536 bit/s, in 16-bit steps (also selectable in ms).
Buffer Centering	The operator sets the buffer to 50%. After receive signal acquisition or a buffer overflow/underflow, the modem automatically sets the buffer to 50%.
Loopback Modes	Operator-selectable interface loopback test modes include: • Baseband • Near end • Far end

3.9 Buffering

There are two reasons for a receive buffer:

- Plesiochronous buffering of two dissimilar clock frequencies (normally the far end transmit clock versus the local network clock). The clocks may be very close in frequency to each other and will normally slip at a constant rate. Figure 3-7 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.

- Doppler buffer of the signal of the satellite. The Doppler shift results from the "figure 8" (Figure 3-8) station-keeping movement performed by the satellite in space over a period of one day. Doppler shift should not result in a clock slip, as the buffer will constantly fill and empty.

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.

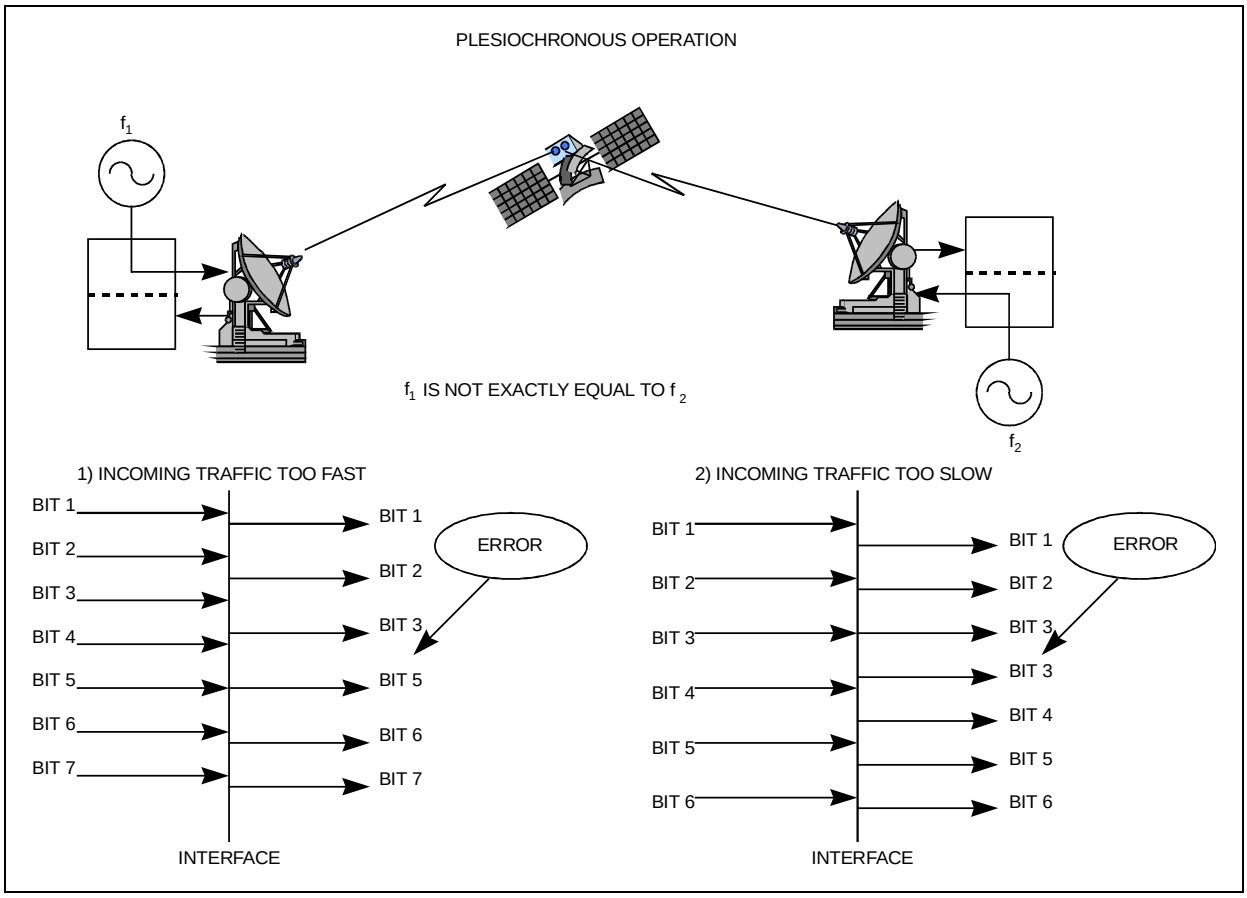


Figure 3-7. Clock Slip

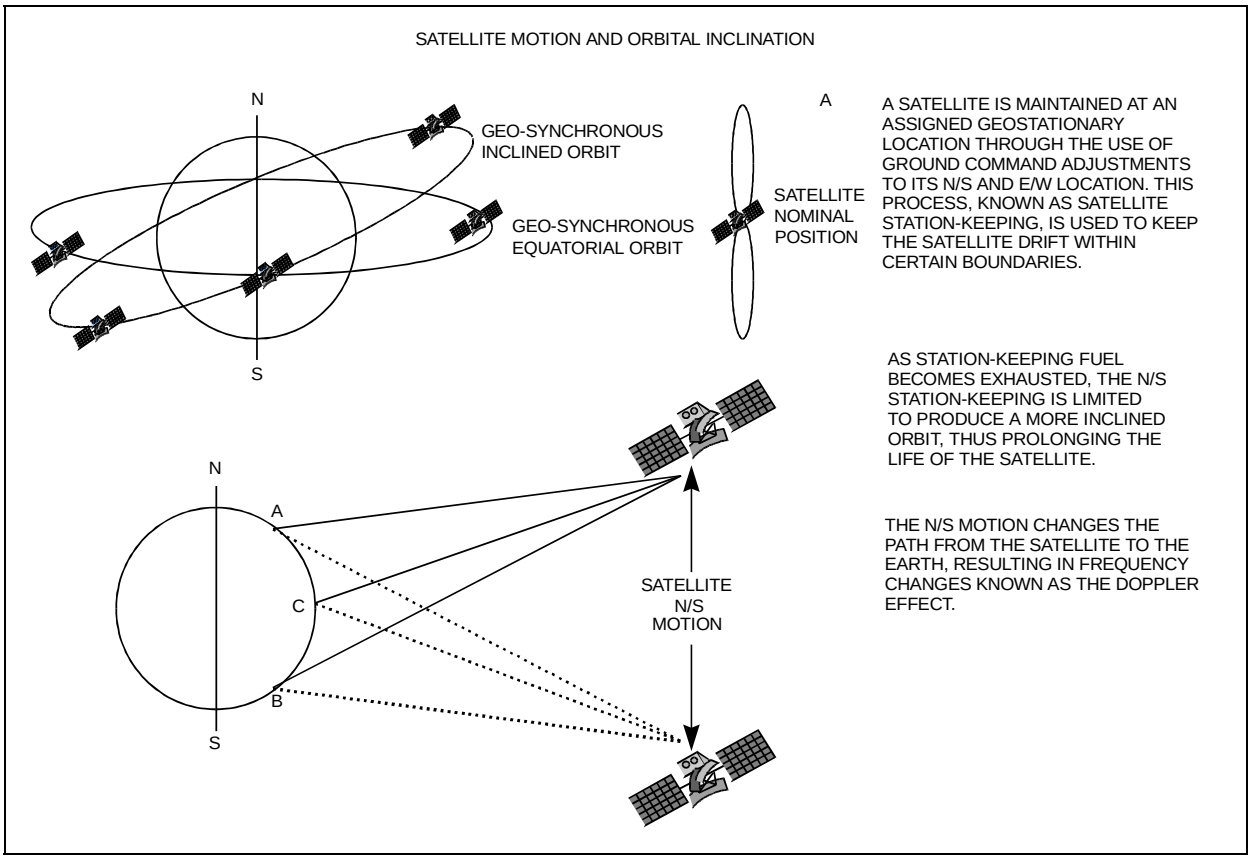


Figure 3-8. Doppler Shift

3.9.1 Buffer Size

The depth of the receive buffer will depend on four parameters:

- Doppler shift caused by satellite
- Stability of each clock (plesiochronous/Doppler operation)
- Frame/Multiframe length of multiplexed data format
- Allowable time between clock slips

3.9.1.1 Doppler

A geostationary satellite should be positioned directly over the equator and orbit with a 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 and 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.

3.9.1.2 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) will 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.

3.9.1.3 Total Buffer Length

T1 and E1 framing structure under G.704 is available. When this is selected the buffer length is restricted to the size of the buffer. An example of the total buffer depth (end to end) is as follows:

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.

3.9.2 Converting Between Bits and Seconds

3.9.2.1 Bits to Seconds

1/Data Rate x Bits = Seconds.

3.9.2.2 Seconds to Bits

Data Rate x Seconds = Bits.

4. THEORY OF OPERATION

This chapter describes the theory of operation for the following printed circuit boards (PCBs) contained in the SNM-1010.

- DAC
- Monitor & Control (M&C) Board
- Terrestrial Data Interface
- Modulator
- Demodulator

4.1 Demand Assignment Controller (DAC)

The DAC implements DAMA control inbound/outbound signaling and DAMA remote signaling/traffic applications within the SNM-1010. The DAC is capable of remotely controlling in-circuit reconfiguration of the DAMA microcontroller code.

The DAC performs the following functions:

- Decodes a network control HDLC encoded data stream from the demodulator
- Encodes a burst signal using HDLC encoding
- Synchronizes transmit burst to control slot time
- Controls the data interface
- Controls the modem M&C board via a serial link
- Supports two EIA-232 user interface ports

The SNM-1010 interfaces with the DAC through an interface bus connector. Eleven external and internal interfaces are provided as permanent installations on the DAC board.

A block diagram of the DAC is shown in Figure 4-1.

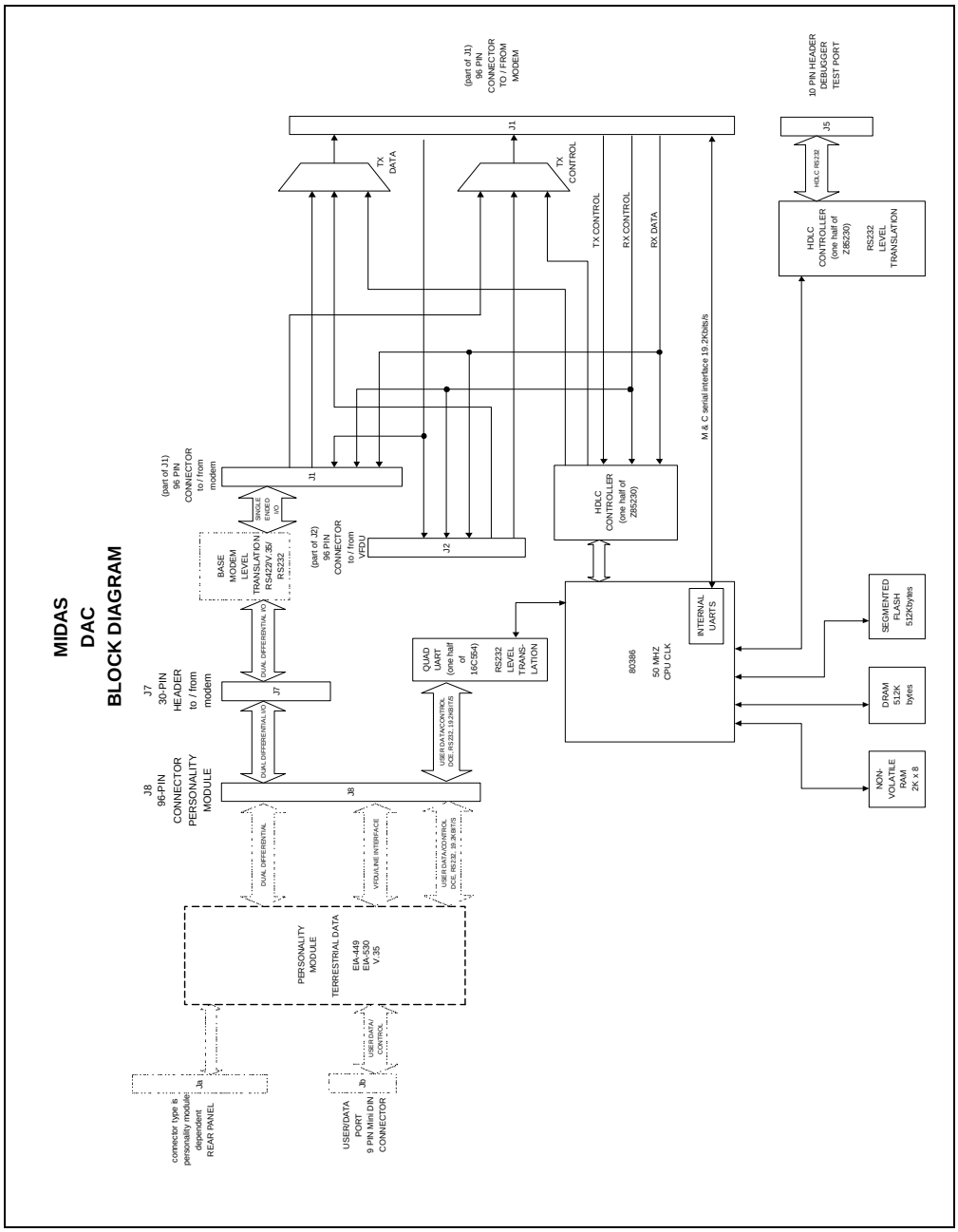


Figure 4-1. DAC Block Diagram

4.1.1 Specifications

Refer to the following listing for specifications.

Physical Size	5.3 x 7 inches (13.46 x 17.78 cm) The DAC board fits into the SNM-1010 1RU chassis.
Power Requirements	+5 VDC
Operating Temperature	0 to +50° C (32 to 122° F)

4.1.2 Theory of Operation

To ensure a high level of integration and DOS compatibility with I/O peripherals, the DAC uses the Intel 80386EX embedded microcontroller. This 16/32 bit microcontroller performs DAMA controller functions (and other functions) under control of a real time, multi-tasking operating system.

The DAC uses non-volatile configuration memory with unlimited read/write access to satisfy memory reconfiguration requirements. Flash ROM is used for program storage. NVRAM storage maintains the configuration parameters during power-down conditions.

HDLC synchronous serial ports are implemented with a Z85230 serial communications controller device. This device supports the SNM-1010 control channel satellite channel interface and the HDLC external serial port.

The 80386EX DMA channels are used for the satellite channel interface receive functions. Additional asynchronous ports are implemented with 16C450/16C550 compatible UART devices, to provide M&C of modems under the SNM-1010, via either the modem microcontroller or a PC.

4.1.2.1 User Port

The User port serial interface is a 9-pin mini-DIN female connector (DCE) on the rear panel of the SNM-1010. The interface operates at 19.2 kbit/s, 8 data bits, no parity,1 stop bit. The interface levels are EIA-232. The interface allows the user to configure the SNM-1010 and to request the establishment and termination of data circuits.

Note: Refer to Appendix A for a description of the software communications parameters and detailed message format information.

4.1.2.2 Terrestrial Data Interface

The Terrestrial Data Interface is only used when the SNM-1010 is operating in traffic mode.

The interface is provided on J7, a 30-pin header, via J8, the 96-pin personality module interconnect, and is part of the interface specific personality module connected to the appropriate type of connector (DCE) on the rear panel of the MIDAS modem. The interface levels are software selectable between V.35, EIA-530, and EIA-449. The signal interface is described in section 2.4.3. Refer to the Comtech EF Data document SP/5747 (DAMA Control Channel Messaging) for a description of the software communications parameters and for detailed message format information.

4.2 Monitor and Control

The modem uses a sophisticated microcontroller module to perform M&C functions. This module is located on the demodulator board. The M&C monitors the modem and provides configuration updates to other modules within the modem as required.

The modem configuration parameters are maintained in battery-backed RAM. The RAM provides for total recovery after a power-down situation.

Notes:

1. Extensive fault monitoring and status gathering are provided.
2. Modem functions are accessible through a user port interface.

4.2.1 Non-Volatile Memory

Non-volatile memory on the M&C module allows it to retain configuration information without prime power for at least one year. Should the modem be powered down, the following sequence is carried out when power is reapplied to the M&C:

1. The microcontroller checks the non-volatile memory RAM to see if data has been retained. If data has been retained, the modem is reconfigured to that information.

2. If non-volatile memory fails the data test, a default configuration from ROM is loaded into the system.

4.2.2 User Port

Modem functions can be remotely controlled and monitored via the User port on the back panel. Refer to Appendix A.

4.2.3 M&C Theory of Operation

The M&C module is built around the Intel 80C32 microcontroller, operating at 11.0592 MHz. The microsystem is designed to support up to 512 kilobytes (Kb) of read-only code memory, and up to 32 Kb of non-volatile, random-access data memory.

4.3 Modulator

The SNM-1010 modulator performs filtered modulation onto a variable frequency/amplitude carrier in the following modulation:

- Binary Phase Shift Keying (BPSK)
- Quadrature Phase Shift Keying (QPSK)
- Offset Quadrature Phase Shift Keying (OQPSK)
- Eight Phase Shift Keying (8PSK)

The modulator also provides the following functions:

- Encodes data for the appropriate decoder
- Scrambles data
- Monitors and displays the modulator status without interrupting service
- Provides source control timing
- Appends a burst preamble for detection by the demodulator (burst mode)
- The SNM-1010 creates a modulated carrier within the 50 through 180 MHz range from the digital data stream provided by the interface section.

Control mode	The following modulation type is available when the modem is operating in the burst-transmit/continuous-receive control mode. • QPSK
Data mode	The following modulation types are available when the modem is operating in the continuous data mode. • 8PSK • BPSK • QPSK • OQPSK

The following subsections make up the modulator:

- Scrambler
- Convolutional encoder
- Preamble and postamble generator (burst mode only)
- Modulator
- Output amplifier
- RF synthesizer
- SCT synthesizer

A block diagram of the modulator is shown in Figure 4-2.

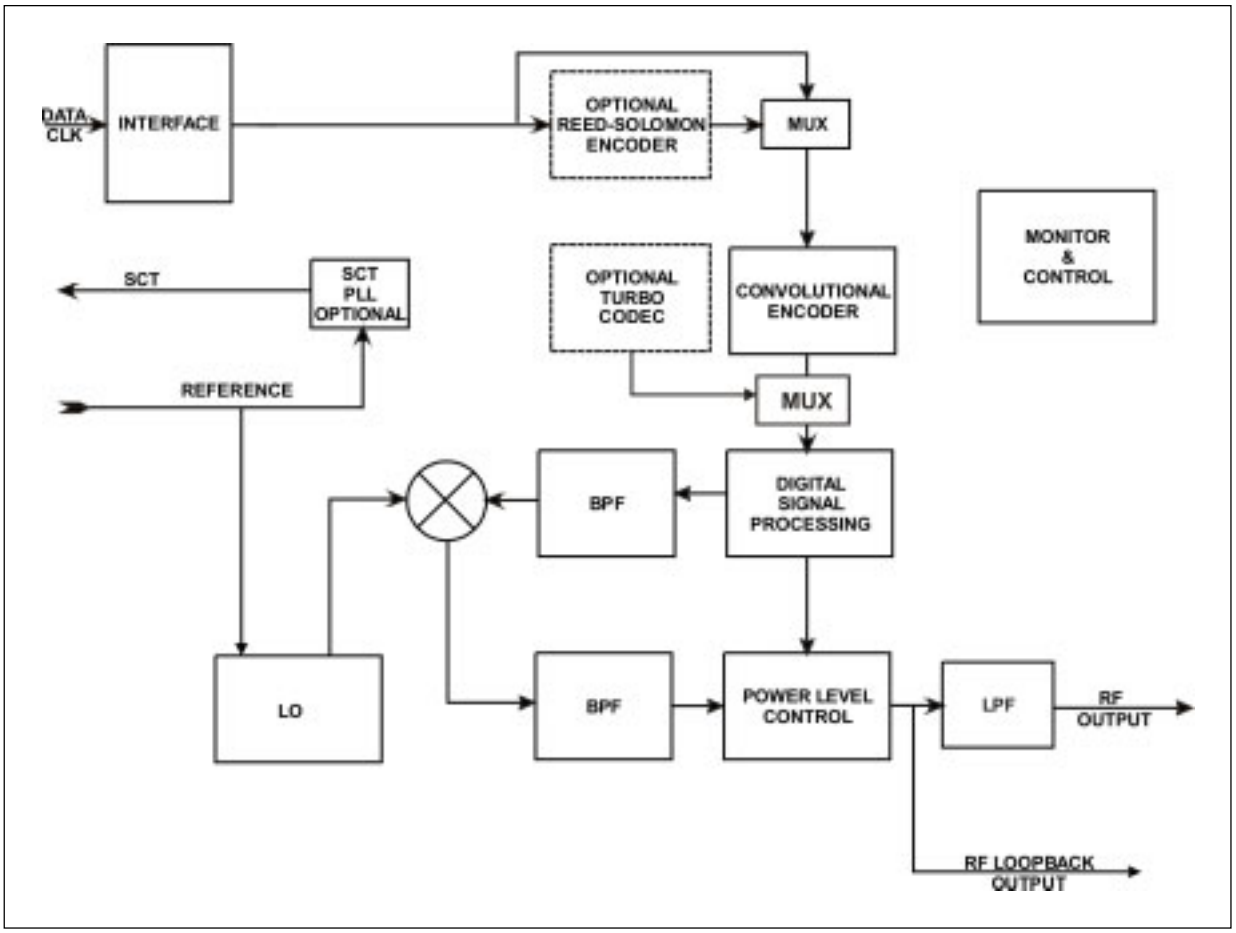


Figure 4-2. Modulator Block Diagram

4.3.1 Theory of Operation

The modulator is composed of two basic sections: the baseband processing section, and the RF section. The modem M&C controls all programmable functions in both sections.

4.3.1.1 Burst Mode

When a transmission is initiated, the modulator issues a pure carrier for 96 clock cycles, followed by a clock training sequence for 352 clock cycles. A 31-bit unique word is then transmitted.

The user data is transmitted into the modem. When the modulator detects the end of the user data stream, the modulator flushes the convolutional encoder (6 bits), then transmits the unique word prime twice (62 bits). The packet is complete and the modulator is ready for the next packet.

Data to be transmitted comes from the DAC. At this point, the data signal is clean and free of jitter. The data signal goes to the scrambler, which provides energy dispersal. There is no need for a differential encoder in burst mode, as the ambiguities are resolved using the unique word. The data signal passes to the 1/2 rate Viterbi K=7 convolutional encoder.

The output of the encoder generates two separate data streams to drive the in-phase and quadrature channels of the modulator. The data signal passes through a set of variable-rate digital Nyquist filters. There are activity detectors on both the In-phase and Quadrature (I&Q) channel Nyquist filters.

The digital Nyquist filters are followed by Digital-to-Analog converters and reconstruction filters. These filters provide proper spectral shaping and equalization. The filters are under control of the M&C.

The I&Q filtered data signals are applied to the RF modulator, which converts them to a modulated carrier. The spectral shape is identical to that of the input data streams, but is double-sided about the carrier frequency.

The RF synthesizer provides the proper frequencies to convert the modulator IF to the desired output frequency in the 50 through 180 MHz range. The synthesizer has multiple loops, and incorporates a Direct Digital Synthesis (DDS) chip to accommodate 100 Hz steps over a range of 130 MHz. The RF section has a frequency stability of $\pm 1 \times 10^{-5}$.

The signal from the power combiner is sent to the output amplifier, which amplifies the low-level signal from the modulator section to the proper level for output from the module. The amplifier contains circuitry which provides programmable control of the output level over a range of -5.0 to -30.0 dBm, in 0.1 dB graduated steps. Power leveling is provided at ± 1.0 dB to maintain the stability of the output level over time and temperature.

4.3.1.2 Continuous Mode

Data to be transmitted comes from the DAC card. It includes a clock that is synchronous with the data. At this point, the data signal is clean and free of jitter. The data signal goes to the scrambler, which provides energy dispersal. It then goes to a differential encoder. The data signal passes to the Viterbi K = 7 convolutional encoder. When the modulator is in the QPSK mode, the output of the encoder generates two separate data streams to drive the I&Q channels of the modulator. One channel can be inverted, causing a spectral inversion.

When the modulator is in the BPSK mode, the two data streams are multiplexed into one data stream to drive the In-phase channel of the modulator. If in Viterbi mode, the BPSK bit ordering can be selected to conform to either standard: (I0 Q0, I1 Q1) or (Q0I0, Q1 I1). Figure 4-3. shows a timing diagram and schematic diagram explaining BPSK ordering.

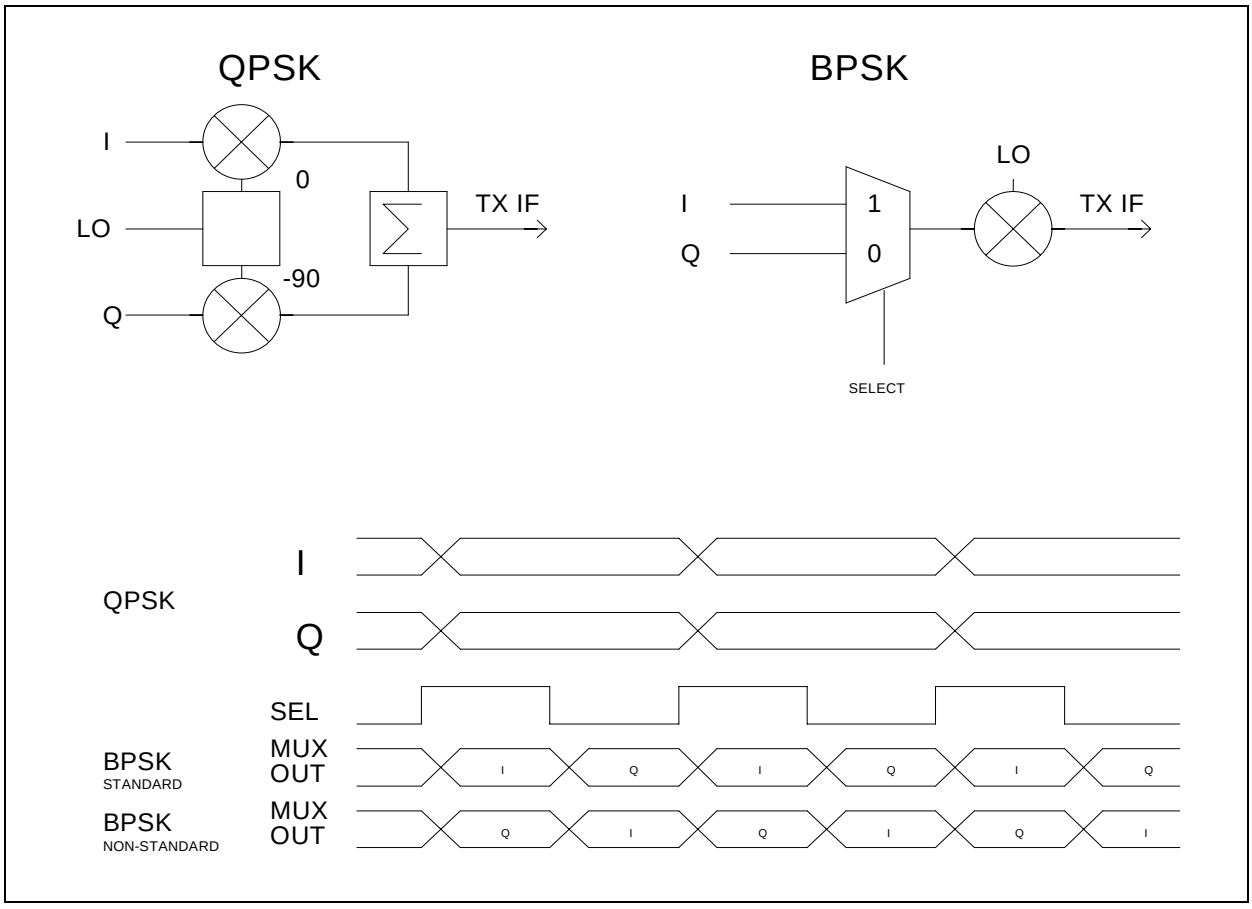


Figure 4-3. BPSK Ordering

From the encoder, the data signal passes through a set of variable-rate digital Nyquist filters. There are four filter sets that can normally be selected: INTELSAT Open Network, Comtech EF Data Closed, Comstream Compatible Closed, and Fairchild Compatible Closed.

There are activity detectors on both the I&Q channel Nyquist filters. The digital Nyquist filters are followed by Digital-to-Analog converters and reconstruction filters. These filters provide proper spectral shaping and equalization. The filters are under control of the M&C. Symbol rates from 19.2 to 128 kbit/s can be achieved without requiring the filter to be changed.

The I&Q filtered data signals are applied to the RF modulator, which converts them to a modulated carrier. The spectral shape is identical to that of the input data streams, but is double-sided about the carrier frequency.

The RF synthesizer provides the proper frequencies to convert the modulator IF to the desired output frequency in the 50 through 180 MHz range. The synthesizer has multiple loops, and incorporates a DDS chip to accommodate 100 Hz steps over a range of 130 MHz. The RF section has a frequency stability of $\pm 1 \times 10^{-5}$.

The signal from the power combiner is sent to the output amplifier, which amplifies the low level signal from the modulator section to the proper level for output from the module. The amplifier contains circuitry which provides programmable control of the output level over a range of -5.0 to -30.0 dBm, in 0.1 dB graduated steps. Power leveling is provided at ± 1.0 dB to maintain the stability of the output level over time and temperature.

Fault information from the modulator is sent to the M&C, including:

- Synthesizers out-of-lock
- RF output leveled
- Input data clock activity
- I channel digital filter activity
- Q channel digital filter activity

4.3.2 Theory of Modulation Types

The modulation types for the modem include BPSK, QPSK, OQPSK, or 8PSK.

The PSK data transmission encoding method uses the phase modulation technique. This method varies the phase angle of the carrier wave to represent a different bit value for the receiver. The higher levels of modulation are required for an operating range that has a limited bandwidth.

The order of modulation is represented by mPSK, where "m" relates to the number of discrete phase angles. Refer to the following list for a brief description of the modulation types.

- BPSK: 2 discrete phase angles represent the 2 possible states of a symbol.
- QPSK, OQPSK: 4 discrete phase angles represent the 4 possible states of a symbol.
- 8PSK: 8 discrete phase angles represent the 8 possible states of a symbol.

Note: The code rate determines the number of symbols per bit.

4.3.2.1 BPSK Encoding

The modulator converts transmitted baseband data into a modulated BPSK carrier at 2.4 kbit/s to 1.25 Mbit/s (1/2 rate). Using vector analysis of the constellation pattern, BPSK represents one symbol with the carrier phase either at 0° or 180°. The 1/2 rate encoding at the convolutional encoder provides two symbols output for every bit input.

Code Rate	Symbols/Bit	Bits/Hz
1/2	2	0.5

4.3.2.2 QPSK Encoding

The modulator converts transmitted baseband data into a modulated QPSK carrier at the following parameters:

- 4.8 kbit/s to 2.5 Mbit/s (1/2 rate)
- 7.2 kbit/s to 3.75 Mbit/s (3/4 rate)
- 8.4 kbit/s to 4.375 Mbit/s (7/8 rate)

Using vector analysis of the constellation pattern, QPSK represents a symbol with the carrier phase angle at 45°, 135°, 225°, or 315°. The 1/2, 3/4, and 7/8 rates encoded at the convolutional encoder provide the desired input/output bit rates.

Code Rate	Symbols/Bit	Bits/Hz
1/2	2	1
3/4	1.5	1.33
7/8	1.143	1.75

4.3.2.3 OQPSK Encoding

The modulator PCB converts the transmitted baseband data into a modulated OQPSK carrier within the same parameters as QPSK.

The OQPSK modulation is mainly different from QPSK by offsetting the I and Q channel modulation signals. This offset prevents the RF envelope from going through zero. Under certain conditions, this may allow less back –off in the High Power Amplifier (HPA) system. The 1/1, 1/2, 3/4, and 7/8 rates encoded at the Convolutional encoder provide the desired input/output bit rates.

Code Rate	Symbols/Bit	Bits/Hz
1/1	1	2
1/2	2	1
3/4	1.333	1.5
7/8	1.143	1.75

4.3.2.4 8PSK Encoding

The modulator converts transmitted baseband data into modulated 8PSK carrier at the following parameters:

- 64 kbit/s to 5.0 Mbit/s (2/3 rate)

Using vector analysis of the constellation pattern, 8PSK represents a symbol with carrier phase angles at 22.5°, 67.5°, 112.5°, 157.5°, 202.5°, 247.5°, 292.5°, and 337.5°. The 2/3 rate encoding provides the desired input/output bit rates.

Code Rate	Symbol/Bit	Bit/s Hz
2/3	1.5	2

4.4 Demodulator

The demodulator converts PSK modulated carriers within the 50 to 180 MHz range to a demodulated baseband data stream. The converted modulation types are BPSK, QPSK/OQPSK, and 8PSK. The demodulator then performs FEC on the data stream using Viterbi or Sequential decoding algorithms.

A block diagram of the demodulator is shown in Figure 4-4.

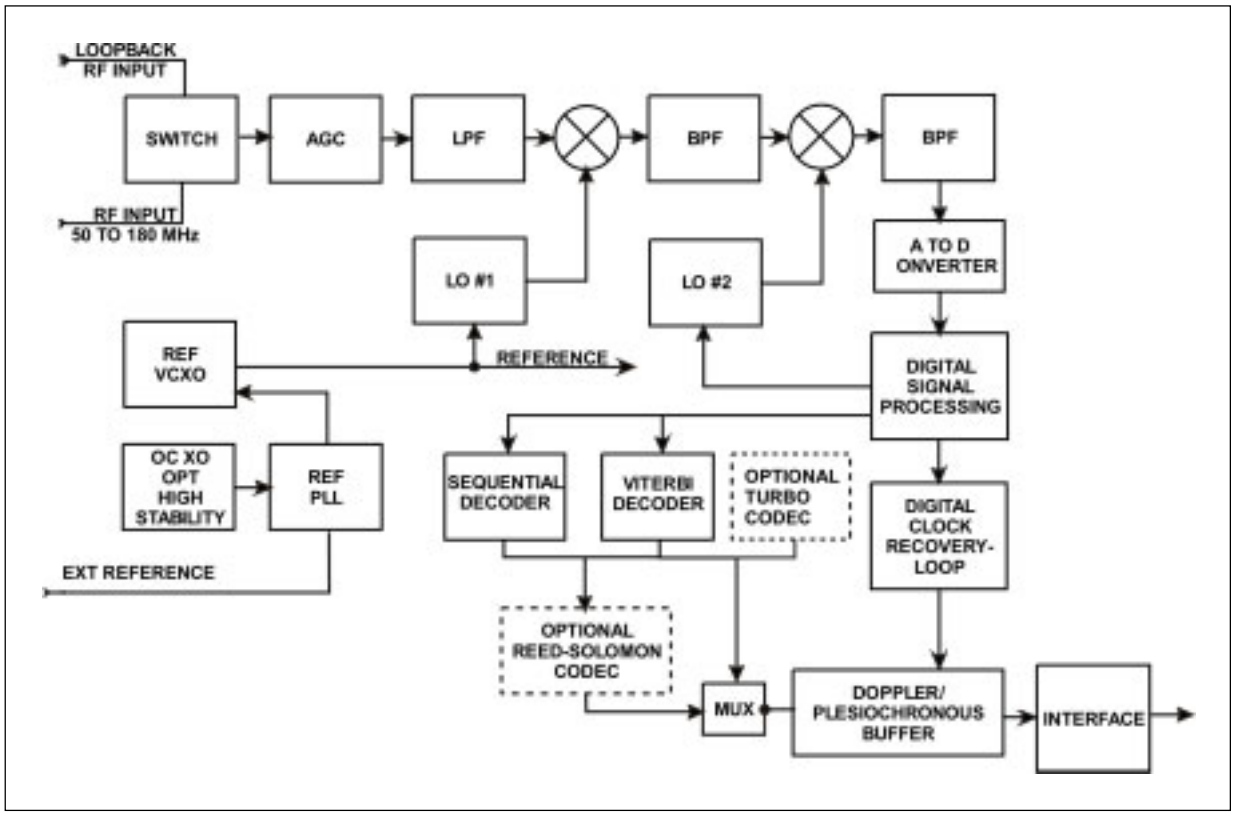


Figure 4-4. Demodulator Block Diagram

4.4.1 Theory of Operation

The demodulator card functions as an advanced, fully digital, coherent phase-lock receiver, and a Viterbi decoder.

4.4.1.1 Continuous Mode

The demodulator consists of the following subsections:

- RF synthesizer
- IF amplifier
- Quadrature demodulator
- Identical anti-aliasing filters
- Analog-to-Digital converters
- Digital Nyquist filters
- Costas loop
- Clock loop
- AGC
- AOC
- Ambiguity resolver
- Soft-decision decoder
- V.35 descrambler
- BER monitor

The modulated signal enters the RF module, where it is converted from an IF signal at 50 through 180 MHz to I&Q baseband channels. The synthesizer has multiple loops, and incorporates a DDS chip to accommodate 100 Hz steps over a range of 130 MHz. The RF section has a frequency stability of $\pm 1 \times 10^{-5}$.

The two channels are then passed through identical anti-aliasing filters Analog-to-Digital converters, and digital Nyquist filters. The result is a filtered, digital representation of the received signal. A Costas loop maintains the phase lock during the message. A phase-lock loop maintains the data clock. The soft-decision mapper converts the I&Q samples to
soft-decision values. The soft-decision values are then fed to the Viterbi decoder where error detection and correction are performed.

The I&Q channels also are used to calculate the AGC and AOC voltages. The AGC and AOC are fed back to the RF module.

The data from the output of the Viterbi decoder is descrambled with a V.35 descrambler, and routed to the interface card. Additionally, a summary fault relay provides a FORM C output located on the demodulator board.

During acquisition, the demodulator sweeps the range around the nominal IF frequency. These parameters (sweep width and offset) can be set by the user. As the demodulator sweeps through a carrier, the data is fed to the selected decoder, which resolves the ambiguities of the incoming data. When the decoder generates a lock signal, the demodulator stops sweeping. If the signal level is within the operating range of the demodulator, the modem declares lock.

Notes:

1. After the demodulator is locked, BER and frequency offset monitoring are available via the remote interface.
2. For QPSK applications, the demodulator has the ability to lock to a carrier that has gone through a spectral inversion.
3. For BPSK Viterbi mode, the bit ordering can be changed so that the modem is compatible to either format.

4.5 Turbo Product Codec (Hardware Option)

4.5.1 Introduction

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 industry wide, 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 Reed Solomon 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 RS approach, and consequently, decoding delays are significantly reduced. Furthermore, the traditional concatenated RS 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 demod 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 higher-order modulation TPC modes the demod and decoder can remain synchronized ***2 – 3 dB below*** the Viterbi/Reed-Solomon or TCM cases.

With this release of this modem, Comtech EF Data now provides the best Forward Error Correction technology currently available, offering a broad range of TPC code rates, combined with the entire range of modulation types, BPSK, QPSK, OQPSK, and 8PSK.

Below is a listing of all the available TPC modes and rates:

Table 4-1. Available TPC Modes

Modulation Type	Encoding Type	Data Rate (bps)		Symbol Rate (sym/s)	
		Minimum	Maximum	Minimum	Maximum
BPSK 5/16	Turbo	2,400	781,250	4,800	2,500,000
BPSK 21/44	Turbo	2,400	1,193,000	4,800	2,500,000
QPSK/OQPSK 3/4	Turbo	7,200	3,750,000	4,800	2,500,000
8PSK 3/4	Turbo	384,000	5,000,000	4,800	2,500,000

4.5.2 End-to-End Processing Delay

In many cases, FEC methods that provide increased coding gain do so at the expense of increased processing delay. However, with TPC, this increase in delay is very modest. The table below shows, for the modem, the processing delays for the major FEC types, including the three TPC modes:

Table 4-2. Turbo Product Coding Processing Delay Comparison

FEC Mode (64 kbps data rate)	End-to-end delay, ms
Viterbi, Rate 1/2	12
Sequential, Rate 1/2	74
Viterbi Rate 1/2 + Reed Solomon	266
Sequential Rate 1/2 + Reed Solomon	522
Turbo Product Coding, Rate 3/4, QPSK/OQPSK	**79**
Turbo Product Coding, Rate 21/44, BPSK	**64**
Turbo Product Coding, Rate 5/16, BPSK	**48**

Note that in all cases, the delay is inversely proportional to data rate, so for 128 kbps, the delay values would be half of those shown above.

It can be clearly seen that the concatenated Reed-Solomon cases increase the delay very significantly (due mainly to interleaving/de-interleaving), while the TPC cases yield delays which are less than or equal to Sequential decoding.

It can be seen that the 8PSK Rate 3/4 Turbo performance closely approaches that of the Rate 2/3 TCM/Reed-Solomon case – the BER performance is within approximately 0.4 dB. However, it should be noted that the Rate 3/4 Turbo mode is ***20% more bandwidth efficient*** than the TCM case. The additional advantages of Turbo (lower delay, performance during fades etc) should also be considered.

4.5.3 Comparison of all TPC Modes

Mode	Eb/No at BER = 10^{-6} Guaranteed (Typical in parentheses)	Eb/No at BER = 10^{-8} Guaranteed (Typical in parentheses)	Spectral Efficiency	Symbol Rate	Occupied Bandwidth for 1 Mbps Carrier (*see Note 1*)
QPSK Rate 1/2 Viterbi (*see Note 1*)	6.0 dB (5.5 dB)	7.3 dB (6.8 dB)	1.00 bits/Hz	1.0 x bit rate	1190 kHz
BPSK Rate 21/44 Turbo	2.9 dB (2.6 dB)	3.3 dB (3.0 dB)	0.48 bits/Hz	2.1 x bit rate	2493 kHz
BPSK Rate 5/16 Turbo	2.4 dB (2.1 dB)	2.8 dB (2.5 dB)	0.31 bits/Hz	3.2 x bit rate	3808 kHz
QPSK/OQPSK Rate 1/2 Turbo (*see Note 3*)	3.5 dB (3.2 dB)	3.6 dB (3.4 dB)	1.00 bits/Hz	1.0 x bit rate	1190 kHz
QPSK/OQPSK Rate 3/4 Turbo	3.8 dB (3.3 dB)	4.4 dB (4.0 dB)	1.50 bits/Hz	0.67 x bit rate	793 kHz
8PSK Rate 2/3 TCM and RS (IESS-310) (*see Note 2*)	6.5 dB (6.2 dB)	6.9 dB (6.6 dB)	1.82 bits/Hz	0.56 x bit rate	666 kHz
8PSK Rate 3/4 Turbo	6.7 dB (6.3 dB)	7.4 dB (7.0 dB)	2.25 bits/Hz	0.44 x bit rate	529 kHz

Notes:

1. The occupied bandwidth is defined at the width of the transmitted spectrum taken at the –10 dB points on the plot of power spectral density. This equates to 1.19 x symbol rate for the modem transmit filtering.

2. Included for comparative purposes

3. Future Provision

Chapter 5. MAINTENANCE

5.1 System Checkout

This equipment contains parts and assemblies sensitive to damage by ESD. Use ESD precautionary procedures when touching, removing, or inserting PCBs.

The fault isolation procedure lists the following categories of faults or alarms.

- Modulator
- Demodulator
- Transmit Interface
- Receive Interface
- Common Equipment

Note: Each fault or alarm category includes possible problems and the appropriate action required to repair the modem.

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).

5.1.1 System Faults/Alarms

System faults are reported in the “Faults/Alarms” menu, and stored faults are reported in the “Stored Flts/Alms” menu. Refer to Chapter 3 for more information. To determine the appropriate action for repairing the modem, refer to and the list of possible problems.

Table 5-1. SNM-1010 Fault Tree

	TX IF OUTPUT OFF	TX FAULT RELAY (1)	RX FAULT RELAY (2)	FAULT LED	COM EQ FAULT RELAY (3)	TX ALARM RELAY #2 (4)	RX ALARM RELAY #3 (5)	SPARE RELAY ALARM #1	PRIMARY ALARM RELAY (6)	SECONDARY ALARM RELAY (7)	IBS BACKWARD ALARM	DEFERRED MAIN ALARM (8)
MODULATOR FAULTS												
IF SYNTHESIZER	X	X		X					X			
DATA CLOCK SYN	X	X		X					X			
I CHANNEL	X	X		X					X			
Q CHANNEL	X	X		X					X			
AGC	X	X		X					X			
MODEM REF ACT				X		X				X		
MODEM REF PLL	X	X		X					X			
MODULE	X	X		X					X			
CONFIGURATION	X	X		X								
DEMODULATOR FAULTS												
CARRIER DETECT			X	X					X		X	
IF SYNTHESIZER			X	X					X		X	
I CHANNEL			X	X					X		X	
Q CHANNEL			X	X					X		X	
BER THRESHOLD				X			X			X		X
MODULE			X	X					X		X	
CONFIGURATION			X	X								

Legend		
Note	**Fault/Alarm Relay**	**Test Points Connector/Pins**
1	TX FAULT	Pin 4 (NO), 5 (COM), 6 (NC) *
2	RX FAULT	Pin 7 (NO), 8 (COM), 9 (NC) *
3	COM EQ FAULT	Pin 1 (NO), 2 (COM), 3 (NC) *
4	TX ALARM #2	Pin 4 (NO), 5 (COM), 6 (NC) *
5	RX ALARM #3	Pin 7 (NO), 8 (COM), 9 (NC) *
6	PRIMARY ALARM	Pin 43 (NO), 10 (COM), 27 (NC) *
7	SECONDARY ALARM	Pin 44 (NO), 11 (COM), 28 (NC) *
8	DEF MAINT ALARM	Pin 17 **
*	A connection between the common and N.O. contacts indicate no fault/alarm.	
**	Signal is open collector high impedance if faulted.	

Table 5-1. SNM-1010 Fault Tree (Continued)

	TX IF OUTPUT OFF	TX FAULT RELAY (1)	RX FAULT RELAY (2)	FAULT LED	COM EQ FAULT RELAY (3)	TX ALARM RELAY #2 (4)	RX ALARM RELAY #3 (5)	SPARE RELAY ALARM #1	PRIMARY ALARM RELAY (6)	SECONDARY ALARM RELAY (7)	IBS BACKWARD ALARM	DEF MAIN ALARM (8)
TX INTERFACE FAULTS												
TX DROP	Not Applicable											
TX DATA/AIS				X		X				X		X
TX CLK PLL	X	X		X					X			
TX CLK ACTIVITY				X		X			X			
TX AUDIO 1 CLIP	Not Applicable											
TX AUDIO 2 CLIP	Not Applicable											
CONFIGURATION	X	X		X								
RX INTERFACE FAULTS												
BUFFER UNDERFLOW							X					
BUFFER OVERFLOW							X					
RX DATA/AIS							X			X		X
FRAME BER			X	X					X		X	
BACKWARD ALARM	Not Applicable											
BUFFER CLK PLL			X	X					X			
BUFFER CLK ACT				X			X		X			
DEMUX LOCK			X	X					X		X	
RX 2047 LOCK				X			X					
BUFFER FULL				X			X					
RX INSERT	Not Applicable											
RX AUDIO 1 CLIP	Not Applicable											
RX AUDIO 2 CLIP	Not Applicable											
CONFIGURATION			X	X								

Legend		
Test Note	**Fault/Alarm Relay**	**Test Points Connector/Pins**
1	TX FAULT	Pin 4 (NO), 5 (COM), 6 (NC) *
2	RX FAULT	Pin 7 (NO), 8 (COM), 9 (NC) *
3	COM EQ FAULT	Pin 1 (NO), 2 (COM), 3 (NC) *
4	TX ALARM #2	Pin 4 (NO), 5 (COM), 6 (NC) *
5	RX ALARM #3	Pin 7 (NO), 8 (COM), 9 (NC) *
6	PRIMARY ALARM	Pin 43 (NO), 10 (COM), 27 (NC) *
7	SECONDARY ALARM	Pin 44 (NO), 11 (COM), 28 (NC) *
8	DEF MAIN ALARM	Pin 17 **
*	A connection between the common and N.O. contacts indicate no fault/alarm.	
**	Signal is open collector high impedance if faulted.	

Table 5-1. SNM-1010 Fault Tree (Continued)

	TX IF OUTPUT OFF	TX FAULT RELAY (1)	RX FAULT RELAY (2)	FAULT LED	COM EQ FAULT RELAY (3)	TX ALARM RELAY #2 (4)	RX ALARM RELAY #3 (5)	SPARE RELAY ALARM #1	PRIMARY ALARM RELAY (6)	SECONDARY ALARM RELAY (7)	IBS BACKWARD ALARM	DEFERRED MAINTN ALARM (8)
COMMON EQUIP FAULTS												
BATTERY/CLOCK				X						X		X
-12V POWER SUPPLY				X	X				X			
+12V POWER SUPPLY				X	X				X			
+5V SUPPLY				X	X				X			
SELF TEST	Not Applicable											
CONTROLLER				X	X				X			
INTERFACE MODULE				X	X				X			

Legend		
Test Note	**Fault/Alarm Relay**	**Test Points Connector/Pins**
1	TX FAULT	Pin 4 (NO), 5 (COM), 6 (NC) *
2	RX FAULT	Pin 7 (NO), 8 (COM), 9 (NC) *
3	COM EQ FAULT	Pin 1 (NO), 2 (COM), 3 (NC) *
4	TX ALARM #2	Pin 4 (NO), 5 (COM), 6 (NC) *
5	RX ALARM #3	Pin 7 (NO), 8 (COM), 9 (NC) *
6	PRIMARY ALARM	Pin 43 (NO), 10 (COM), 27 (NC) *
7	SECONDARY ALARM	Pin 44 (NO), 11 (COM), 28 (NC) *
8	DEF MAINT ALARM	Pin 17 **
*	A connection between the common and N.O. contacts indicate no fault/alarm.	
**	Signal is open collector high impedance if faulted.	

5.1.2 Faults/Alarms Display

General fault, status, and alarm information are indicated by 8 LEDs located on the modem's front panel.

A fault (red LED) indicates a fault that currently exists in the modem.

When a fault occurs, it is stored in the stored fault memory, and indicated by the single red LED.

The LED is turned off when the fault clears. If the fault clears, the occurrence is also stored.

A total of 10 occurrences of any fault can be stored. Each fault or stored fault indicated by a front panel LED could be one of many faults. To determine which fault has occurred, use the Fault or Stored Fault front panel menu. Refer to Chapter 3 for information on the Fault or Stored Fault front panel menu.

Alarms are considered minor faults which will not switch the modem offline in a redundant system. Alarms are shown in the Fault or Stored Fault front panel menu by a reversed contrast (white on black) character that appears at the display panel.

5.1.3 Faults/Alarms Analysis

This section describes the possible problems and actions to take for the following faults:

- Modulator
- Demodulator
- Transmit interface
- Receive interface
- Common equipment

5.1.3.1 Modulator Faults

Fault/Alarm	Possible Problem and Action
IF SYNTHESIZER	Modulator IF synthesizer fault. This is considered a major alarm, and will turn off the modulator output. Return the modem for repair.
DATA CLOCK SYN	Transmit data clock synthesizer fault. This fault indicates that the internal clock VCO has not locked to the incoming data clock, or the internal clock synthesizer has not locked to the internal reference. This is considered a major alarm, and will turn off the modulator output. Ensure the proper data rate has been set up and selected, and the incoming data rate matches the modem selections.
I CHANNEL	Activity alarm for the I channel digital filter. This alarm is considered a major alarm, and will turn off the modulator IF output. An alarm in this position indicates either a fault in the scrambler, or if the scrambler is disabled, the alarm indicates a loss of incoming data. If the fault is active with the scrambler turned off, check for input data at the DATA I/O connector.
Q CHANNEL	Activity alarm for the Q channel digital filter. Use the I channel procedure.
AGC LEVEL	Output power AGC level fault. Indicates the level at the modulator output is not the programmed level.
MODEM REF ACT	Modem REF ACT fault. Indicates incorrect EXT REF frequency input.
MODEM REF PLL	Modem REF PLL Indicates phase lock loop is unable to lock to EXT REF.
MODULE	Modulator module fault. Typically indicates that the modulator module is missing or will not program.
CONFIGURATION	Modulator/Demodulator Configuration fault. Indicates a fault in either the Modulator or Demodulator state.

5.1.3.1.1 Modulator Checkout

Use the following procedure to check out the modulator:

1. Refer to section 4.3.3 for modulator specifications.

2. Set up the modem for operation by using the Configuration Modulator and Demodulator front panel menus.

3. Clear all TX faults by correct use of data and clock selection (Chapter 4).

4. Measure the E_b/N_0 with a receiver that is known to be properly operating. Refer to Table 5-1 and Figure 5-1 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. Use this measurement for the first column on Table 5-2. Read across the page to find the S/N and E_b/N_0 for the specific code rate.

   Once the demodulator has locked to the incoming signal, the Monitor menu will display signal level, raw BER, corrected BER, and E_b/N_0. Refer to Chapter 1 for examples of BER performance curves.

   Typical output spectrum are shown in Figure 5-1 and Figure 5-2.

Table 5-2. Conversion to S/N and E_b/N_0 Chart

(dB)	Code	Rate 1/2	Code	Rate 3/4	Code	Rate 7/8
(S+N)/N	S/N	E_b/N_0	S/N	E_b/N_0	S/N	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

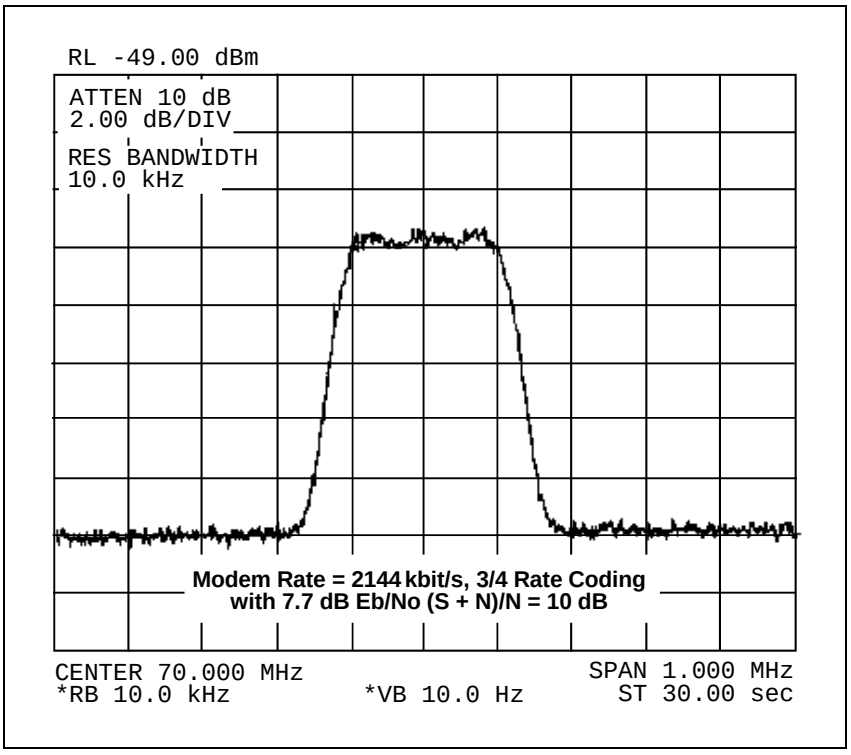


Figure 5-1. Typical Output Spectrum (with Noise)

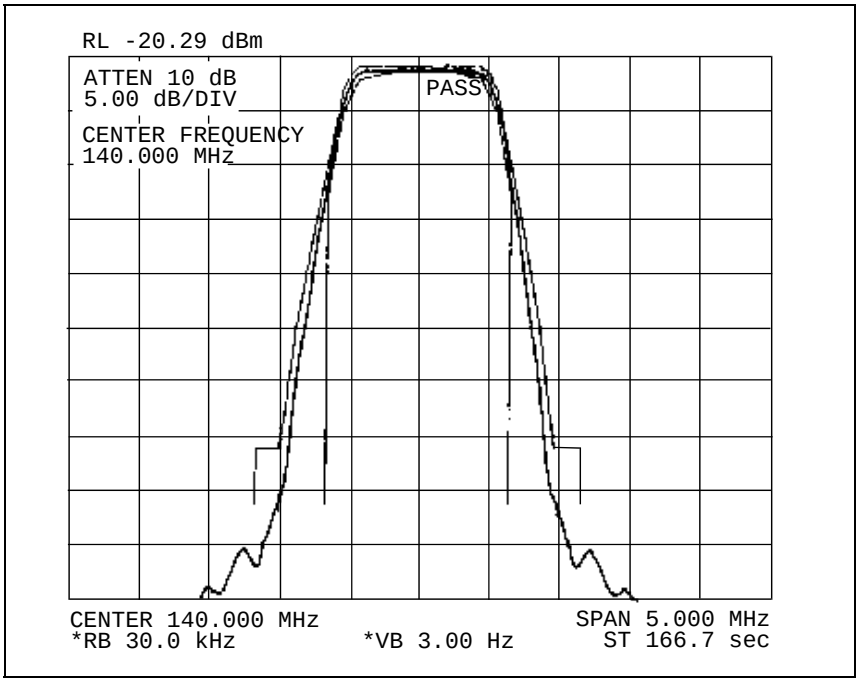


Figure 5-2. Typical Output Spectrum (without Noise)

5.1.3.2 Demodulator Faults

Fault/Alarm	Possible Problem and Action
CARRIER DETECT	Carrier detect fault. Indicates the decoder is not locked. This is the most common fault displayed in the modem. Any problem from the input data on the modulator end of the circuit to the output of the decoder can cause this alarm. First, ensure the demodulator has an RF input at the proper frequency and power level. Ensure the demodulator data rate is properly programmed. Refer to the fault isolation procedure for Data Clock Syn in the modulator section. Verify the frequency of the data transmitted from the modulator is within 100 PPM.
IF SYNTHESIZER	Demodulator IF synthesizer fault. Indicates the demodulator IF synthesizer is faulted. This fault is a hardware failure. Contact the Comtech EF Data Customer Support Department.
I CHANNEL	Indicates a loss of activity in the I channel of the quadrature demodulator. Typically indicates a problem in the modulator side of the circuit. Check for proper RF input to the demodulator. If the input to the demodulator is correct, then the problem is in the baseband processing.
Q CHANNEL	Indicates a loss of activity in the Q channel of the quadrature demodulator. Follow the same procedure for the I channel fault.
BER THRESHOLD	Indicates the preset BER threshold has been exceeded. Setting of this alarm is done in the Utility menu. This is an alarm based on the corrected BER reading on the front panel.
MODULE	Demodulator module fault. Typically indicates that the demodulator module is missing or will not program. Contact the Comtech EF Data Customer Support Department.
CONFIGURATION	Modulator/Demodulator Configuration fault. Indicates a fault in either the Modulator or Demodulator state.

5.1.3.2.1 Demodulator Checkout

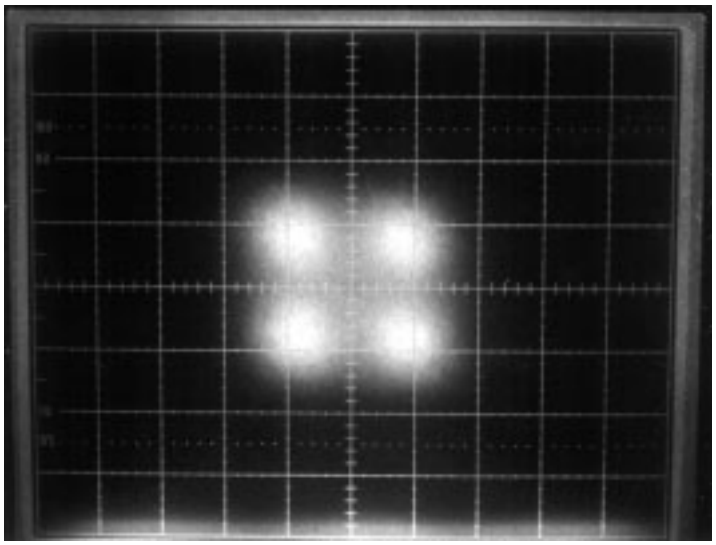
Use the following procedure to test the demodulator.

1. Refer to section 4.4.2 for the demodulator specifications.

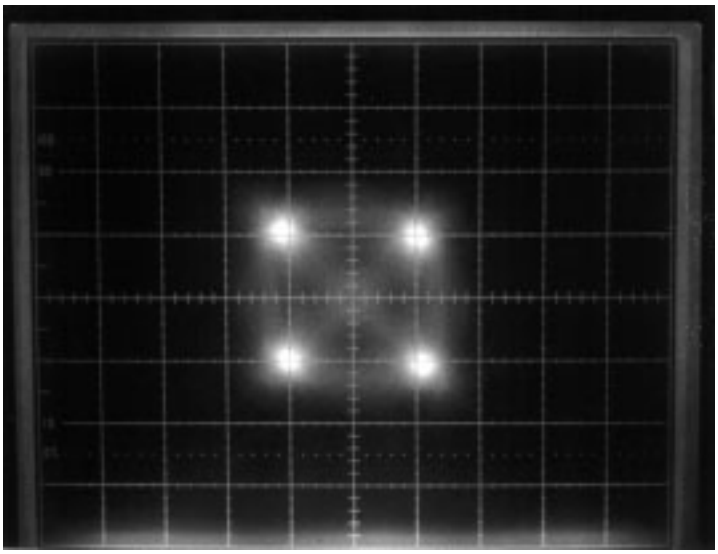
2. Set up the modem with an external IF loop and level. Use a properly operating modulator, and ensure that power levels, data rates, code rates, etc., are compatible.

3. Allow the modem to lock up. Depending on the data rate and overhead type, lock up may take several seconds. When the green carrier detect LED is on and the DEMUX lock fault has been cleared (where applicable), the modem will run at the specified error rate. Run the TX power level (input amplitude) over the full range, and offset the TX frequency from the RX frequency by 35 kHz. Ensure the modem still runs within the specified error rate.

4. Set up the modem to check the constellation patterns with an oscilloscope that is set in the X-Y mode. Typical constellation patterns with noise and without noise are shown in Figure 5-3. These test points are available on the auxiliary connector (J9, pins 6 and 8). It is not necessary to open the modem to gain access to these test points.



WITH NOISE



WITHOUT NOISE

Figure 5-3. Typical Eye Constellations

5.1.3.3 Transmit Interface Faults

Fault/Alarm	Possible Problem and Action
TX DROP	Not Applicable
TX DATA/AIS	Data or incoming AIS. When the AIS is selected in the Interface Utility menu for TX data fault, the transmit interface fault TX data/AIS is monitoring a fault condition of all 1s from customer data input to the modem. When data is selected in the Interface Utility menu for TX data fault, the TX interface fault TX data/AIS is monitoring a fault condition of all 1s or 0s. This is referred to as a data-stable condition (data is not transitioning). This fault indicates there is trouble in the chain sending data to the modem. The modem passes this signal transparently, and takes no other action. This indication is a monitor function only, and aids in isolating the trouble source in a system.
TX CLOCK PLL	Transmitter phase-locked loop fault. Indicates the transmitter PLL is not locked to the reference of the interface transmit clock recovery oscillator. Contact the Comtech EF Data Customer Support Department.
TX CLOCK ACT	Activity detector alarm of the selected interface transmit clock. Indicates the selected TX clock is not being detected. Check the signal of the selected TX clock source to verify the signal is present. The interface will fall back to the internal clock when this alarm is active.
CONFIGURATION	Modulator/Demodulator Configuration fault. Indicates a fault in either the Modulator or Demodulator state.

5.1.3.4 Receive Interface Faults

Fault/Alarm	Possible Problem and Action
BUFFER UNDERFLOW	Buffer underflow alarm. Indicates the plesiochronous buffer has underflowed. Buffer underflow is normally a momentary fault (there are clock problems if this alarm is continuously present). This alarm is included in this section to be consistent with the fault reporting system and to be correctly registered in the stored fault memory. The time and date of the first 10 receive buffer underflow faults are stored in battery-backed memory as an aid to troubleshooting. The interval between stored overflow/underflow events can be used to determine relative clock accuracies.
BUFFER OVERFLOW	Buffer overflow alarm. Indicates the plesiochronous buffer has overflowed. The problems and actions in the buffer underflow section apply to this alarm.
RX DATA/AIS	Data or incoming AIS. The data monitored for RX data is coming from the satellite. When the AIS is selected for RX data fault in the Interface Utility menu, the RX data/AIS is monitoring an alarm condition of all 1s from the satellite. When data is selected for RX data fault in the Interface Utility menu, the RX data/AIS is monitoring a fault condition of all 1s or 0s. This is referred to as a data-stable condition (data is not transitioning). The fault indicates trouble in receiving data from the satellite. The modem passes this signal transparently, and can close a FORM C contact. The indication is a monitor function only to help isolate the source of trouble in a system.
FRAME BER	The receive decoded error rate has exceeded 10^{-3} over a 60-second period measured on the framing bits. This is defined as a major (prompt) receive alarm by INTELSAT specifications IESS-308. In a redundant system, a switch-over will be attempted. Since some data must be correctly received to indicate this fault, receive AIS will not be substituted. This fault is to be sent as a backward alarm to the distant end. This must be wired externally, as faults other than from the modem may need to enter the fault tree.

Fault/Alarm	Possible Problem and Action
BUFFER CLK PLL	Buffer clock phase-locked loop fault. The buffer synthesizer is the wrong frequency or will not lock. Ensure the selected buffer clock source is at the proper frequency and level. If the fault continues, contact the Comtech EF Data Customer Support Department.
BUFFER CLK ACT	Activity detector alarm of the selected interface receive clock. The interface will fall back to the satellite clock when this fault is active.
DEMUX_LOCK	Demultiplexer synchronization lock fault. This fault means that the demultiplexer is unable to maintain valid frame and multiframe alignment. The usual cause is invalid or absent receive data. This is a major (prompt) alarm. The alarm will cause insertion of receive AIS (all 1s) and the switch-over will be attempted. This fault is to be sent as a backward alarm to the distant end. This fault will occur when no carrier is present, but will probably never occur with a correct signal.
RX 2047 LOCK	RX 2047 lock alarm. Indicates the RX 2047 data test pattern is not being received by the decoder. The alarm probably indicates the transmitter is not set correctly.
BUFFER FULL	Buffer full alarm. Indicates the buffer is < 10% or > 90% full.
CONFIGURATION	Modulator/Demodulator Configuration fault. Indicates a fault in either the Modulator or Demodulator state.

5.1.3.5 Common Equipment Faults

Fault/Alarm	Possible Problem and Action
BATTERY/CLOCK	M&C battery voltage or clock fault. Indicates a low voltage in the memory battery. Typically, this fault will be active when a modem has been hard reset or the firmware has been changed. When a hard reset has been executed or the firmware has been changed, this fault will typically be active when the modem is first turned on.
-12 VOLT SUPPLY	-12V power supply fault. Indicates a high or low voltage condition. Level is ± 5%. Check for a short on the -12V line from the power supply or on any of the plug-in boards.
+12 VOLT SUPPLY	+12 VDC power supply fault. Use the same procedure as with -12V fault.
+5 VOLT SUPPLY	+5V power supply fault. Use the same procedure as with a -12V fault. The +5V supply requires a minimum load of 1A.
CONTROLLER	Controller fault. Indicates a loss of power in the M&C card. Typically indicates the controller has gone through a power on/off cycle.
INTFC MODULE	Interface Module fault.

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Appendix A. REMOTE CONTROL SPECIFICATIONS

A.1 Remote Control Channel Mode Configuration Commands/Responses

The commands listed in this appendix are SDM-300A base modem M&C remote commands that can be used on an SNM-1010 with an "MC" prefix.

Status queries are always safe. However, exercise caution when issuing an SDM-300A M&C command. Some commands can produce an undesireable result if executed on an active/installed SNM-1010 MIDAS node.

For example; the IF Loopback command "MC IFL_ON" will cause the SNM-1010 to disengage from the MIDAS control channel. Reconnecting the control channel would only be possible by taking the modem out of IF Loopback via the front panel or a local M&C command.

A.2 Abnormal Condition Responses

If a satellite modem receives a message which does not match the established protocol or cannot be implemented, a negative acknowledgment message is sent in response. The possible message formats are:

```
<channel_no> ?ER1_PARITY ERROR'cr''lf']
```

(Error message for received parity errors.)

```
<channel_no> ?ER2_INVALID PARAMETER'cr''lf']
```

(Error message for a recognized command which cannot be implemented or has parameters which re out-of-range.)

```
<channel_no> ?ER3_UNRECOGNIZABLE COMMAND'cr''lf']
```

(Error message for unrecognizable command or bad command syntax.)

```
<channel_no> ?ER4_MODEM IN LOCAL MODE'cr''lf']
```

(Modem in local error, use the REM command to go to remote mode.)

```
<channel_no> ?ER5_HARD CODED PARAMETER'cr''lf']
```

(Error message indicating that the parameter is hardware dependent and may not be changed remotely.)

A.3 Modulator Commands/Responses

Modulator Frequency	Command: Response: Status: Response:	MC MF_nnn.nnnn'cr' MF_nnn.nnnn'cr' RF_OFF'cr''lf'] MC MF_'cr' MF_nnn.nnnn'cr''lf']	Where: nnn.nnnn = Frequency in MHz, 50.0000 to 180.0000, in 1 Hz steps. Note: When the modulator frequency is programmed, the RF output is switched OFF.
RF Output (IF Output)	Command: Response: Status: Response:	MC RF_xxx'cr' RF_xxx'cr''lf'] MC RF_'cr' RF_xxx'cr''lf']	Where: xxx = ON or OFF.
Modulator Rate Preset Assignment	Command: Response: Status: Response:	MC AMRx_nnnn_mmm.mmm'cr' AMRx_nnnn_mmm.mmm'cr''lf'] MC AMRx_'cr' AMRx_nnnn_mmm.mmm'cr''lf'] *See Warning in A.1.*	Where: x = A, B, C, D or V (Preset designator). In TX Burst mode, nnnn = 1/2, or 3/4 (Coder rate). In TX continuous mode, nnnn = 1/2 (QPSK 1/2), [coder rate], 3/4 (QPSK 3/4), 7/8 (QPSK 7/8), BP12 (BPSK 1/2), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2), OQ34 (OQPSK 3/4), OQ78 (OQPSK 7/8), OQSK (OQPSK 1/1), BPSK (BPSK 1/1) (QPSK (QPSK 1/1), 2144 (BPSK 21/44), B516 (BPSK 5/16), 8P34 (8PSK 3/4). mmm.mmm = Data rate in kHz.
Modulator Rate Preset Selection	Command: Response: Status:	MC SMRx_'cr' SMRx_'cr' RF_OFF'cr''lf'] (See MR command.) *See Warning in A.1.*	Where: x = A, B, C, D, or V (Preset designator). Note: Setting the modulator rate turns the RF transmitter OFF.
Modulator Rate Variable Assignment and Selection	Command: Response: Status:	MC SMRV_nnnn_mmm.mmm'cr' SMRV_nnnn_mmm.mmm'cr' RF_OFF'cr''lf'] (See MR command.) *See Warning in A.1.*	Where: In TX Burst mode, nnnn = 1/2 or 3/4 (Coder rate). In TX Continuous mode, nnnn = 1/2 (QPSK 1/2), [coder rate], 3/4 (QPSK 3/4), 7/8 (QPSK 7/8), BP12 (BPSK 1/2), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2), OQ34 (OQPSK 3/4), OQ78 (OQPSK 7/8), OQSK (OQPSK 1/1), BPSK (BPSK 1/1) (QPSK (QPSK 1/1), 2144 (BPSK 21/44), B516 (BPSK 5/16), 8P34 (8PSK 3/4). mmm.mmm = Data rate in kHz. Note: Setting the modulator turns the RF transmitter OFF.

Set Modulator Power Offset	Command: Response: Status: Response:	MC MPO_snn.n'cr' MPO_snn.n'cr''lf'] MC MPO_'cr' MPO_snn.n'cr''lf']	Where: snn.n = +99.0 to -99.0, in 0.1 dB increments. Note: The modulator power offset is added to the nominal power level to adjust the transmit power range.
Set Modulator Output Power Level	Command: Response: Status: Response:	MC MOP_snnn.n'cr' MOP_snnn.n'cr''lf'] MC MOP_'cr' MOP_snnn.n'cr''lf']	Where: snnn.n = -30.0 to -5.0, in 0.1 steps (nominal range in dBm). Note: The nominal power range is modified relative to the value specified by the modulator power offset (MPO_).
Scrambler Enable	Command: Response: Status: Response:	MC SE_xxx'cr' SE_xxx'cr''lf'] MC SE_'cr' SE_xxx'cr''lf']	Where: xxx = ON or OFF.
Differential Encoder Enable	Command: Response: Status: Response:	MC DENC_xxx'cr' DENC_xxx'cr''lf'] MC DENC_'cr' DENC_xxx'cr''lf']	Where: In TX Burst mode, xxx = OFF. In TX Continuous mode, xxx = ON or OFF.
Modulator Type	Command: Response: Status: Response:	MC MT_xxxx'cr' MT_xxxx'cr''lf'] MC MT_'cr' MT_xxxx'cr''lf']	Where: In TX Burst mode, xxxx = INTL (INTELSAT Open Network). In TX Continuous mode, xxxx = INTL (INTELSAT Open Network), EFD (Comtech EF Data Closed Network), CSC (Comstream Closed Network), FDC (Fairchild Closed Network), or SDM51 (SDM51 Compatible).
Modulator Encoder Type	Command: Response: Status: Response:	MC MET_xxx'cr' MET_xxx'cr''lf'] MC MET_'cr' MET_xxx'cr''lf']	Where: In TX Burst mode, xxx = VIT (K-7 Viterbi Encoder). In TX Continuous mode, xxx = VIT(K-7 Viterbi Encoder) SEQ (Sequential Encoder) TUR (Turbo)
Modem Reference Clock	Command: Response: Status: Response:	MC MRC_xxxxx'cr' MRC_xxxxx'cr''lf'] MC MRC_'cr' MRC_xxxxx'cr''lf']	Where: xxxxx = INT (INTERNAL), EXT1 (EXTERNAL 1 MHz), EXT5 (EXTERNAL 5 MHz), EXT10 (EXTERNAL 10 MHz), EXT20 (EXTERNAL 20 MHz), OUT10 (OUTPUT 10 MHz).
Modulator Spectrum Rotation	Command: Response: Status: Response:	MC MSR_xxx'cr' MSR_xxx'cr''lf'] MC MSR_'cr' MSR_xxx'cr''lf']	Where: xxx = NRM (normal spectrum), INV (inverted spectrum).
Reed-Solomon Encoder Enable	Command: Response: Status: Response:	MC RSEN_xxx'cr' RSEN_xxx'cr'lf'] MC RSEN_'cr' RSEN_xxx'cr'lf']	Where: xxx = ON or OFF.

Transmit BPSK Data Ordering for Continuous Mode	Command: Response: Status: Response:	MC TDA_xxx'cr' TDA_xxx'cr''lf'] MC TDA_'cr' TDA_xxx'cr''lf']	Where: xxx = NRM (Standard) or INV (Non-Standard).
Carrier Only Mode	Command: Response: Status: Response:	MC COM_xxxxxx'cr' COM_xxxxxx'cr''lf'] MC COM_xxxxxx'cr' COM_xxxxxx'cr''lf']	Where: xxxxxx = OFF (NORMAL-MODULATED), DUAL (DUAL-CW), OFFSET (OFFSET-CW), CENTER (CENTER-CW).
Modulator Preamble for Burst Mode	Command: Response: Status: Response:	MC MPRE_n'cr' MPRE_n'cr''lf'] MC MPRE_'cr' MPRE_n'cr''lf']	Where: n = 1 (Preamble 1) or 2 (Preamble 2).
Reed-Solomon Interleave Value	Command: Response: Status: Response:	MC TRSI_xx'cr' TRSI_xx'cr''lf'] MC TRSI_'cr' TRSI_xx'cr''lf']	Where: xx = 4, 8, or 16.
TX 8PSK 2/3 IESS-310 Operation	Command: Response: Status: Response:	MC T310_xxx'cr' T310_xxx'cr''lf'] MC T310_'cr' T310_xxx'cr''lf']	Where: xxx = ON or OFF.
Bulk Modulator Configuration	Command: Response:	BMC_BMNOP,xxx.x,yyy.yyyy,DDDD,zzzz.zzz'cr' BMC_BMNOP,xxx.x,yyy.yyyy,DDDD,zzzz.zzz'cr''lf']	Where: B = Modulator set to Burst (B) or Continuous (C). M = Scrambler status set to OFF (1) or ON (0). N = Differential Encoder status set to 0 or 1. O = Reed-Solomon Encoder status set to 0 or 1 (always 0). P = IF Output 0 (off) or 1 (on). xxx.x = Output power setting: -5.0 to -30.0 dBm, in 0.1 steps. yyy.yyyy = Output IF frequency: 50.0 to 180.0 MHz. DDDD = Code Rate: '1/2', '3/4' ,'7/8', or 'BP12'. zzzz.zzz = Data Rate: 4.800 to 2000.0 kbps (limited by Code Rate).

A.4 Demodulator Commands/Responses

Set Demodulator Frequency	Command: Response: Status: Response:	MC DF_nnn.nnnn'cr' DF_nnn.nnnn'cr''lf'] MC DF_'cr' DF_nn.nnnn'cr''lf']	Where: nnn.nnnn = Frequency in MHz, 50.0000 to 180.0000, in 1 Hz steps.
Demodulator Rate Preset Assignment	Command: Response: Status: Response: *See Warning in A.1.*	MC ADRx_nnnn_mmm.mmm'cr' ADRx_nnnn_mmm.mmm'cr''lf'] MC ADRx_'cr' ADRx_nnnn_mmm.mmm'cr''lf']	Where: x = A, B, C, D, or V (Preset designator). In RX Continuous mode nnnn = 1/2 (QPSK 1/2), [coder rate], 3/4 (QPSK 3/4), 7/8 (QPSK 7/8), BP12 (BPSK 1/2), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2), OQ34 (OQPSK 3/4), OQ78 (OQPSK 7/8), OQSK (OQPSK 1/1), BPSK (BPSK 1/1) (QPSK (QPSK 1/1), 2144 (BPSK 21/44), B516 (BPSK 5/16), 8P34 (8PSK 3/4). mmm.mmm = Data rate in kHz.
Demodulator Rate Preset Selection	Command: Response: Status: *See Warning in Section 9.0.*	MC SDRx_'cr' SDRx_'cr''lf'] (See DR command.)	Where: x = A, B, C, D, or V (Preset designator).
Demodulator Rate Variable Assignment and Selection	Command: Response: Status: *See Warning in A.1.*	MC SDRV_nnnn_mmm.mmm'cr' SDRV_nnnn_mmm.mmm'cr''lf'] (See DR command.)	Where: In RX Continuous mode, nnnn = 1/2 (QPSK 1/2), [coder rate], 3/4 (QPSK 3/4), 7/8 (QPSK 7/8), BP12 (BPSK 1/2), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2), OQ34 (OQPSK 3/4), OQ78 (OQPSK 7/8), OQSK (OQPSK 1/1), BPSK (BPSK 1/1) (QPSK (QPSK 1/1), 2144 (BPSK 21/44), B516 (BPSK 5/16), 8P34 (8PSK 3/4). mmm.mmm = Data rate in kHz.
Descrambler Enable	Command: Response: Status: Response:	MC DE_xxx'cr' DE_xxx'cr''lf'] MC DE_'cr' DE_xxx'cr''lf']	Where: xxx = ON or OFF.
Differential Decoder Enable	Command: Response: Status: Response:	MC DDEC_xxx'cr' DDEC_xxx'cr''lf'] MC DDEC_'cr' DDEC_xxx'cr''lf']	Where: In RX Continuous mode, xxx = ON or OFF.
RF Loopback	Command: Response: Status: Response:	MC RFL_xxx'cr' RFL_xxx'cr''lf'] MC RFL_'cr' RFL_xxx'cr''lf']	Where: xxx = ON or OFF.

IF Loopback	Command: Response: Status: Response:	MC IFL_xxx'cr' IFL_xxx'cr''lf'] MC IFL_'cr' IFL_xxx'cr''lf']	Where: xxx = ON or OFF.
Sweep Center Frequency	Command: Response: Status: Response:	MC SCF_snnnnn'cr' SCF_snnnnn'cr''lf'] MC SCF_'cr' SCF_snnnnn'cr''lf']	Where: snnnnn = -35000 to +35000, in 1 Hz steps. Note: In RX Continuous mode only.
Sweep Width Range	Command: Response: Status: Response:	MC SWR_nnnnn'cr' SWR_nnnnn'cr''lf'] MC SWR_'cr' SWR_nnnnn'cr''lf']	Where: nnnnn = 0 to 70000, in 1 Hz steps. Note: In RX Continuous mode only.
Sweep Reacquisition	Command: Response: Status: Response:	MC SR_xxx'cr' SR_xxx'cr''lf'] MC SR_'cr' SR_xxx'cr''lf']	Where: xxx = 0 to 999 (number of seconds).
Demodulator Spectrum Rotation	Command: Response: Status: Response:	MC DSR_xxx'cr' DSR_xxx'cr''lf'] MC DSR_'cr' DSR_xxx'cr''lf']	Where: xxx = NRM (normal spectrum), INV (inverted spectrum).
Reed-Solomon Decoder Enable	Command: Response: Status: Response:	MC RSDE_xxx'cr' RSDE_xxx'cr'lf'] MC RSDE_'cr' RSDE_xxx'cr'lf']	Where: xxx = ON, OFF, or CORR_OFF.
Bit Error Rate Threshold	Command: Response: Status: Response:	MC BERT_xxxx'cr' BERT_xxxx'cr''lf'] MC BERT_'cr' BERT_xxxx'cr''lf']	Where: xxxx = None or 1E-n (where n = 3, 4, 5, 6, 7, or 8 [exponent of threshold]).
Demodulator Type	Command: Response: Status: Response:	MC DT_xxxx'cr' DT_xxxx'cr''lf'] MC DT_'cr' DT_xxxx'cr''lf']	Where: In RX Continuous mode, xxxx = INTL (INTELSAT Open Network), EFD (Comtech EF Data Closed Network), CSC (Comstream Closed Network), or FDC (Fairchild Closed Network).
Demodulator Decoder Type	Command: Response: Status: Response:	MC DDT_xxx'cr' DDT_xxx'cr''lf'] MC DDT_'cr' DDT_xxx'cr''lf']	Where: In RX Continuous mode: xxx = VIT (K-7 Viterbi Encoder) SEQ (Sequential Encoder) TUR (Turbo)
Reed-Solomon Interleave Value	Command: Response: Status: Response:	MC RRSI_xx'cr' RRSI_xx'cr''lf'] MC RRSI_'cr' RRSI_xx'cr''lf']	Where: xx = 4, 8, or 16.
RX 8PSK 2/3 IESS-310 Operation	Command: Response: Status: Response:	MC R310_xxx'cr' R310_xxx'cr''lf'] MC R310_'cr' R310_xxx'cr''lf']	Where: xxx = ON or OFF.

Receive BPSK Data Ordering	Command: Response: Status: Response:	MC RDA_xxx'cr' RDA_xxx'cr''lf'] MC RDA_'cr' RDA_xxx'cr''lf']	Where: xxx = NRM (Standard) or INV (Non-Standard). Note: In RX Continuous mode only.
Bulk Demodulator Configuration	Command: Response:	BDC_BMNO,yyy.yyyy,ttttt,uuuuu,DDDD, zzzz.zzz'cr' BDC_BMNO,yyy.yyyy,ttttt,uuuuu,DDDD, zzzz.zzz 'cr''lf']	Where: B = Modulator set to Burst (B) or Continuous (C). M = Descrambler status OFF (0) or ON (1). N = Differential Decoder status 0 or 1. O = Reed Solomon Decoder status 0 or 1 (always 0). yyy.yyyy = Input IF frequency 50.0 to 180.0 MHz. ttttt = Sweep Center Frequency -35000 to +35000. uuuuu = Sweep Frequency Range 0 to 70000. DDDD = Code Rate '1/2','3/4','7/8', or 'BP12'. zzzz.zzz = Data Rate 4.800 to 2000.0 kbps (limited by Code Rate).
Maximum Packet Size	Command: Response:	BPS,xxxxxxxx'cr' BPS,xxxxxxxx'cr''lf']	Where: xxxxxxxx = user length in bits, range of 2 to 16777216 bits (QPSK/OQPSK 1/2, Burst mode). This command specifies the maximum user data packet length that the SNM-1010 will accept in Burst mode. If the received packet is longer that the specified length, the modem assumes that the packet has been corrupted and enters the acquisition mode.

A.5 Interface Commands/Resposnes

Transmit Clock	Command: Response: Status: Response:	MC TC_xxx'cr' TC_xxx'cr''lf'] MC TC_'cr' TC_xxx'cr''lf']	Where: xxx = INT (Internal SCT Clock), EXT (External TX Terrestrial Clock), or SAT (Receive Satellite Clock).
Transmit Clock Phase	Command: Response: Status: Response:	MC TCP_xxxx'cr' TCP_xxxx'cr''lf'] MC TCP_'cr' TCP_xxxx'cr''lf']	Where: In TX Burst mode, xxxx = NRM (Normal Clock Phasing) or INV (Inverted Clock Phasing). In TX Continuous mode, xxxx = NRM (Normal Clock Phasing), INV (Inverted Clock Phasing), or AUTO (Automatic Clock Phasing).
Buffer Clock	Command: Response: Status: Response:	MC BC_xxx'cr' BC_xxx'cr''lf'] MC BC_'cr' BC_xxx'cr''lf']	Where: xxx = INT (Internal SCT Clock), EXT (External TX Terrestrial Clock), SAT (Receive Satellite Clock), or REF (External Reference Clock). Note: In RX Continuous mode only.
Receive Clock Phase	Command: Response: Status: Response:	MC RCP_xxxx'cr' RCP_xxxx'cr''lf'] MC RCP_'cr' RCP_xxxx'cr''lf']	Where: xxxx = NRM (normal clock phasing) or INV (inverted clock phasing).
Baseband Loopback	Command: Response: Status: Response:	MC BBL_xxx'cr' BBL_xxx'cr''lf'] MC BBL_'cr' BBL_xxx'cr''lf']	Where: xxx = ON or OFF.

A.5.1 Interface Buffer Size

Buffer size programming is supported in two formats: bits or ms. The selected format shall be chosen using the buffer programming command (IBP_), shown in the following listing.

Interface Buffer Size (bit format)	Command: Response: Status: Response:	MC IBS_nnnnn'cr' IBS_nnnnn'cr''lf'] MC IBS_'cr' IBS_nnnnn'cr''lf']	Where: nnnnn = 64 to 65536, in 16-bit increments. Note: In RX Continuous mode only.
Interface Buffer Size (ms format)	Command: Response: Status: Response:	MC IBS_nn'cr' IBS_nn'cr''lf'] MC IBS_'cr' IBS_nn'cr''lf']	Where: nn = 0 to 50 (buffer size in ms). Note: In RX Continuous mode only.
Interface Buffer Center	Command: Response:	MC IBC_'cr' IBC_'cr''lf']	Note: In RX Continuous mode only.
Interface Buffer Programming	Command: Response: Status: Response:	MC IBP_xxx'cr' IBP_xxx'cr''lf'] MC IBP_'cr' IBP_xxx'cr''lf']	Where: xxx = bits or ms. Note: In RX Continuous mode only.

A.6 System Commands/Repsonses

Time of Day	Command: Response: Status: Response:	MC TIME_hh:mmxx'cr' TIME_hh:mmxx'cr''lf'] MC TIME_'cr' TIME_hh:mmxx'cr''lf']	Where: hh = 1 to 12 (hours). mm = 00 to 59 (minutes). xx = AM or PM.
Date	Command: Response: Status: Response:	MC DATE_mm/dd/yy'cr' DATE_mm/dd/yy'cr''lf'] MC DATE_'cr' DATE_mm/dd/yy'cr''lf']	Where: mm = 1 to 12 (month). dd = 1 to 31 (day). yy = 00 to 99 (year).
Remote Operation	Command: Response:	MC REM_'cr' REM_'cr''lf']	The modem will respond to any status request at any time. However, the modem must be in Remote mode to change configuration parameters.
Clear Stored Faults	Command: Response:	MC CLSF_'cr' CLSF_'cr''lf']	This command is used to clear all stored faults logged by the modem.
Modem Operation Mode	Command: Response: Status: Response:	MC MOM_xxxxxxx'cr' MOM_xxxxxxx'cr''lf'] MC MOM_'cr' MOM_xxxxxxx'cr''lf'] *See Warning in Section 9.0.*	Where: xxxxxxx = TX_only, RX_only, or duplex. This command configures the modem for simplex or duplex operation modes. When transmit only mode is selected, receive faults are inhibited. When receive only mode is selected, transmit faults are inhibited.
RTS TX-IF Control Mode	Command: Response: Status: Response:	MC RTSM_xxx'cr' RTSM_xxx'cr''lf'] MC RTSM_'cr' RTSM_xxx'cr''lf']	Where: xxx = ON or OFF. Note: In TX Continuous mode only. This command configures the modem for the RTS TX-IF control mode. If ON is selected, the TX-IF output will only be turned ON if the incoming RTS signal is asserted. The TX-IF output has to be programmed ON. There should be no major modulator faults present. If OFF is selected, the TX-IF output will operate normally, ignoring the RTS signal.
Online LED Display	Command: Response:	LED,AAAAA'cr' LED,AAAAA'cr''lf']	Where: AAAAA = OFF, ON, or FLASH

A.6.1 Modem Type Commands/Responses

Transmit Mode Selection	Command: Response: Status: Response:	MC TXM_xxxxx'cr' MC TXM_xxxxx'cr"lf'] MC TXM_'cr' MC TXM_xxxxx'cr"lf'] *See Warning in A.1.*	Where: xxxxx = BURST or CONT (Continuous). This command configures the modem transmit side to operate in Burst or Continuous mode. The is 0 for the remote control mode SNM-1010.
Receive Mode Selection	Command: Response: Status: Response:	MC RXM_xxxxx'cr' MC RXM_xxxxx'cr"lf'] MC RXM_'cr' MC RXM_xxxxx'cr"lf'] *See Warning in A.1.*	Where: xxxxx = CONT (Continuous). This command configures the modem receive side to operate in Burst or Continuous mode. The is 0 for the remote control mode SNM-1010.

A.7 Configuration Status

Modulator Configuration Status	Status: Response:	MC MCS_'cr' MCS_'cr' RF_xxx'cr' MF_nnn.nnnn'cr' MR_nnnn_mmm.mmm'cr' AMRA_nnnn_mmm.mmm'cr' AMRB_nnnn_mmm.mmm'cr' AMRC_nnnn_mmm.mmm'cr' AMRD_nnnn_mmm.mmm'cr' AMRV_nnnn.mmm.mmm'cr' MPO_snn.n'cr'Modulator MOP_snnn.n'cr' SE_xxx'cr' DENC_xxx'cr' MT_xxxx'cr' MET_xxx'cr' TDA_xxx'cr' (Note 1) COM_xxx'cr' TXM_xxxxx'cr' MPRE_n'cr' (Note 2) RSEN_xxx'cr"lf'] (Note 1)	RF Output (ON/OFF) Modulator Frequency Modulator Rate Preset A Assignment Preset B Assignment Preset C Assignment Preset D Assignment Preset V Assignment Power Offset Modulator Output Power Scrambler Enable (ON/OFF) Differential Encoder (ON/OFF) Modulator Type Modulator Encoder Type Transmit BPSK Data Ordering Carrier Only Mode (ON/OFF) Transmit Mode Modulator Preamble Reed-Solomon Encoder The modulator configuration status command causes a block of data to be returned by the addressed modem. The block of data reflects the current configuration status of the modulator module. Notes: 1. Status only returned in Transmit Burst mode. 2. Status only returned in Transmit Continuous mode.

Modulator/ Coder Configuration Program Status	Status: Response:	MC MCP_'cr' MCP_'cr' MOM_xxxxxxx'cr' MT_xxxx'cr' MET_xxx'cr' MF_nnn.nnnn'cr' MR_nnnn_mmm.mmm'cr' MPO_snn.n'cr' MOP_snnn.n'cr' SE_xxx'cr' DENC_xxx'cr' TDA_xxx'cr' (Note 1) TC_xxx'cr' TCP_xxxx'cr' BBL_xxx'cr' RTSM_xxx'cr' (Note 2) TXM_xxxxx'cr' (Note 2) MPRE_n'cr' (Note 2) RSEN_xxx'cr' (Note 1) RF_xxx'cr"lf']	Modem Operation Mode Modulator Type Modulator Encoder Type Modulator Frequency Modulator Rate Modulator Power Offset Modulator Output Power Scrambler Enable (ON/OFF) Differential Encoder (ON/OFF) Transmit BPSK Data Ordering Transmit Clock (Source) Transmit Clock Phase Baseband Loopback RTS TX-IF Control Mode Transmit Mode Modulator Preamble Reed-Solomon Encoder RF Output (ON/OFF) This command is used by the Comtech EF Data M:N protection switch to collect information necessary for configuring backup modems. Notes: 1. Status only returned in Transmit Continuous mode. 2. Status only returned in Transmit Burst mode.
Demodulator Configuration Status	Status: Response:	MC DCS_'cr' DCS_'cr' DF_nnn.nnnn'cr' DR_nnnn_mmm.mmm'cr' ADRA_nnnn_mmm.mmm'cr' ADRB_nnnn_mmm.mmm'cr' ADRC_nnnn_mmm.mmm'cr' ADRD_nnnn_mmm.mmm'cr' ADRV_nnnn.mmm.mmm'cr' DE_xxx'cr' DDEC_xxx'cr' RFL_xxx'cr' IFL_xxx'cr' SCF_snnnnn'cr' (Note 1) SWR_nnnnn'cr' (Note 1) BERT_xxxx'cr' DT_xxxx'cr' DDT_xxx'cr' RDA_xxx'cr' (Note 1) RXM_xxxxx'cr' RSDE_xxx'cr"lf'] (Note 1)	Demodulator Frequency Demodulator Rate Preset A Assignment Preset B Assignment Preset C Assignment Preset D Assignment Preset V Assignment Descrambler Enable (ON/OFF) Differential Decoder (ON/OFF) RF Loopback (ON/OFF) IF Loopback (ON/OFF) Sweep Center Frequency Sweep Width Range BER Threshold Demodulator Type Demodulator Decoder Type Receive BPSK Data Ordering Receive Mode Reed-Solomon Decoder The demodulator configuration status command causes a block of data to be returned by the addressed modem. The block of data reflects the current configuration of the demodulator. Notes: 1. Status only returned in Receive Continuous mode.

Demodulator/Decoder Configuration Program Status	Status: Response:	MC DCP_'cr' DCP_'cr' MOM_xxxxxxx'cr' BERT_xxxx'cr' DT_xxxx'cr' DDT_xxx'cr' DF_nnn.nnnn'cr' DR_nnnn_mmm.mmm'cr' DE_xxx'cr' DDEC_xxx'cr' RFL_xxx'cr' IFL_xxx'cr' SCF_snnnnn'cr' (Note 1) SWR_nnnnn'cr' (Note 1) RDA_xxx'cr' (Note 1) BC_xxx'cr' (Note 1) RCP_xxxx'cr' BBL_xxx'cr' IBP_xxx'cr' (Note 1) IBS_nnnnn'cr' (Note 1) RXM_xxxxx'cr' RSDE_xxx'cr''lf']	 Modem Operation Mode BER Threshold Demodulator Type Demodulator Decoder Type Demodulator Frequency Demodulator Rate Descrambler Enable (ON/OFF) Differential Decoder (ON/OFF) RF Loopback (ON/OFF) IF Loopback (ON/OFF) Sweep Center Frequency Sweep Width Range Receive BPSK Data Ordering Buffer Clock (Source) Receive Clock Phase Baseband Loopback Interface Buffer Programming Interface Buffer Size Receive Mode Reed-Solomon Decoder This command is used by the M:N protection switch to collect information necessary for configuring backup modems. Notes: 1. Status only returned in Receive Continuous mode.
Interface Configuration Status	Status: Response:	MC ICS_'cr' ICS_'cr' TC_xxx'cr' TCP_xxxx'cr' RCP_xxxx'cr' BBL_xxx'cr' BC_xxx'cr' (Note 1) IBP_xxx'cr' (Note 1) IBS_nnnnn'cr' (Note 1) RTSM_xxx'cr''lf'] (Note 2)	 Transmit Clock (Source) Transmit Clock Phase Receive Clock Phase Baseband Loopback Buffer Clock (Source) Interface Buffer Programming Interface Buffer Size RTS TX-IF Control Mode The interface configuration status command causes a block of data to be returned by the addressed modem. The block reflects the current configuration of the interface. Notes: 1. Status only returned in Receive Continuous mode. 2. Status only returned in Transmit Continuous mode.

A.7.1 Modem Faults Status

Modem Faults Status (Summary)	Status: Response:	MC MFS_'cr' MFS_'cr' DMD_xxx'cr' MOD_xxx'cr' ITX_xxx'cr' IRX_xxx'cr' CEQ_xxx'cr''lf']	RX Continuous Mode: Demodulator (FLT/OK) Modulator (FLT/OK) Interface Transmit Side (FLT/OK) Interface Receive Side (FLT/OK) Common Equipment (FLT/OK)
Modulator Status	Status: Response:	MC MS_'cr' MS_'cr' RF_xxx'cr' MOD_xxx'cr' SYN_xxx'cr' DCS_xxx'cr' AGC_xxx'cr' SFLT_xx'cr''lf']	TX Burst Mode: RF Output (ON/OFF) Actual Status, Not Configured Module (OK/FLT) IF Synthesizer (OK/FLT) Data Clock Synthesizer (OK/FLT) AGC Level (OK/FLT) Number of Stored Faults Logged (0 through 10)
	Response:	MS_'cr' RF_xxx'cr' MOD_xxx'cr' SYN_xxx'cr' DCS_xxx'cr' ICH_xxx'cr' QCH_xxx'cr' AGC_xxx'cr' SFLT_xx'cr''lf']	TX Continuous Mode: RF Output (ON/OFF) Actual Status, Not Configured Module (OK/FLT) IF Synthesizer (OK/FLT) Data Clock Synthesizer (OK/FLT) I Channel (OK/FLT) Q Channel (OK/FLT) AGC Level (OK/FLT) Number of Stored Faults Logged (0 through 10)
Demodulator Status	Status: Response:	MC DS_'cr' DS_'cr' MOD_xxx'cr' CD_xxx'cr' SYN_xxx'cr' ICH_xxx'cr' QCH_xxx'cr' DSCR_xxx'cr' BERT_xxx'cr' SFLT_xx'cr''lf']	RX Continuous Mode: Demod Module (OK/FLT) Carrier Detect (OK/FLT) IF Synthesizer Lock (OK/FLT) I Channel (OK/FLT) Q Channel (OK/FLT) Descrambler (OK/FLT) BER Threshold (OK/FLT) Number of Stored Faults Logged (0 through 10)

Interface Transmit Side Status	Status: Response: Response:	MC ITXS_'cr' ITXS_'cr' CLK_xxx'cr' SFLT_xx'cr''lf'] ITXS_'cr' CLK_xxx'cr' SFLT_xx'cr''lf']	TX Burst Mode: Selected Transmit Clock Activity (OK/FLT) Number of Stored Faults Logged (0 through 10) TX Continuous Mode: Selected Transmit Clock Activity (OK/FLT) Number of Stored Faults Logged (0 through 10)
Interface Receive Side Status	Status: Response:	MC IRXS_'cr' IRXS_'cr' CLK_xxx'cr' UNFL_xxx'cr' OVFL_xxx'cr' SFLT_xx'cr''lf']	Selected Buffer Clock Activity (OK/FLT) Buffer Underflow (OK/FLT) Buffer Overflow (OK/FLT) Number of Stored Faults Logged (0 through 10)
Common Equipment Status	Status: Response:	MC CES_'cr' CES_'cr' M&C_xxx'cr' INT_xxx'cr' BAT_xxx'cr' +5_xxx'cr' +12_xxx'cr' -12_xxx'cr' MODE_xxxxxx'cr' SFLT_xx'cr''lf']	M&C Module (OK/FLT) Data Interface Module (OK/FLT) Battery/Clock (OK/FLT) +5V Power Supply (OK/FLT) +12V Power Supply (OK/FLT) -12V Power Supply (OK/FLT) Mode (LOCAL or REMOTE) Number of Stored Faults Logged (0 through 10) The common equipment status command causes the return of a block of data indicating the common equipment status.

A.7.2 Error Performance Status

Raw BER	Status: Response:	MC RBER_'cr' RBER_xm.mE-ee'cr''lf']	Where: x = < or > (data modifier to indicate that the error rate is less than or greater than the returned value). m.m = 1.0 to 9.9 (error rate mantissa). ee = 1 to 99 (error rate exponent). Notes: 1. The 'x' (< or >) parameter is only returned if the error rate has exceeded the computational resolution of the system. 2. 'No Data' is returned if the error rate cannot be calculated. 3. 'Sampling' is returned if not enough data is currently available to calculate the error rate.
Corrected BER	Status: Response:	MC CBER_'cr' CBER_xm.mE-ee'cr''lf']	Where: x = < or > (data modifier to indicate that the error rate is less than or greater than the returned value). m.m = 1.0 to 9.9 (error rate mantissa). ee = 1 to 99 (error rate exponent). Notes: 1. The 'x' (< or >) parameter is only returned if the error rate has exceeded the computational resolution of the system. 2. 'No Data' is returned if the error rate cannot be calculated. 3. 'Sampling' is returned if not enough data is currently available to calculate the error rate.

E_b/N_0 Status	Status: Response:	MC EBN0_'cr' EBN0_xnn.ndB'cr''lf']	Where: x = < or > (data modifier to indicate that the E_b/N_0 is less than or greater than the returned value). nn.n = 1.0 to 99.9 (E_b/N_0 value). Notes: 1. The 'x' (< or >) parameter is only returned if the E_b/N_0 has exceeded the computational resolution of the system. 2. 'No Data' returned if the E_b/N_0 cannot be calculated. 3. 'Sampling' returned if not enough data available to calculate the E_b/N_0.
Modulator Rate Status	Status: Response:	MC MR_'cr' MR_nnnn_mmm.mmm'cr''lf']	Where: In TX Burst mode, nnnn = 1/2 or 3/4 (Coder rate). In TX Continuous mode, nnnn = 1/2, 3/4, 7/8, or BP12 (Coder rate). mmm.mmm = Data rate in kHz.
Demodulator Rate Status	Status: Response:	MC DR_'cr' DR_nnnn_mmm.mmm'cr''lf']	Where: In RX Continuous mode, nnnn = 1/2, 3/4, 7/8. mmm.mmm = Data rate in kHz.
Receive Signal Level Status	Status: Response:	MC RSL_'cr' RSL_xsnn.ndBm'cr''lf']	Where: x = < or > (data modifier to indicate that the receive signal level is less than or greater than the returned value). s = + or - (receive signal level sign). nn.n = 0.0 to 99.9 (receive signal level magnitude). Notes: 1. The 'x' (< or >) parameter is only returned if the level has exceeded the computational resolution of the system. 2. 'No Data' is returned if the level cannot be calculated. 3. 'Sampling' is returned if not enough data is currently available to calculate the level.

Current Sweep Value	Status: Response:	MC CSV_'cr' CSV_snnnnn'cr''lf']	Where: x = < or > (data modifier to indicate that the sweep offset value is less than or greater than the returned value). s = + or - (sweep offset from center). nnnnn = 0 to 35000. This command returns the current sweep offset value. Notes: 1. The 'x' (< or >) parameter is only returned if the level has exceeded the computational resolution of the system. 2. 'No Data' is returned if the level cannot be calculated. 3. 'Sampling' is returned if not enough data is currently available to calculate the level. 4. In RX Continuous mode only.

A.8 Stored Faults

Information on stored faults is returned when requested. If no stored fault exists for a given fault number, the words 'NO FAULT' will be returned instead of the normal time/date and status information.

The following symbols are used to define the stored faults status commands.

- # Fault number (0 through 9), '0' is the first fault stored.
- hh Hours in 24-hour format.
- mm Minutes.
- ss Seconds.
- MM Month.
- DD Day.
- YY Year.

Modulator Stored Faults	Status: Response:	MC MSF_#'cr' MSF_# hh:mm:ss MM/DD/YY'cr' MOD_xxx'cr' SYN_xxx'cr' DCS_xxx'cr' AGC_xxx'cr"lf']	TX Burst Mode: Module (OK/FLT). IF Synthesizer (OK/FLT). Data Clock Synthesizer (OK/FLT). AGC Level (OK/FLT).
	Response:	MSF_# hh:mm:ss MM/DD/YY'cr' MOD_xxx'cr' SYN_xxx'cr' DCS_xxx'cr' ICH_xxx'cr' QCH_xxx'cr' AGC_xxx'cr"lf']	TX Continuous Mode: Module (OK/FLT). IF Synthesizer (OK/FLT). Data Clock Synthesizer (OK/FLT). I Channel (OK/FLT). Q Channel (OK/FLT). AGC Level (OK/FLT).
Demodulator Stored Faults	Status: Response:	MC DSF_#'cr' DSF_# hh:mm:ss MM/DD/YY'cr' MOD_xxx'cr' CD_xxx'cr' SYN_xxx'cr' ICH_xxx'cr' QCH_xxx'cr' DSCR_xxx'cr' BERT_xxx'cr"lf']	RX Continuous Mode: Demod module (OK/FLT). Carrier Detect (OK/FLT). IF Synthesizer Lock (OK/FLT). I Channel (OK/FLT). Q Channel (OK/FLT). Descrambler (OK/FLT). BER Threshold (OK/FLT).
Common Equipment Stored Faults	Status: Response:	MC CSF_#'cr' CSF_# hh:mm:ss MM/DD/YY'cr' M&C_xxx'cr' INT_xxx'cr' BAT_xxx'cr' +5_xxx'cr' +12_xxx'cr' -12_xxx'cr"lf']	 Monitor and Control Module (OK/FLT). Data Interface Module (OK/FLT). Battery/Clock (OK/FLT). +5V Power Supply (OK/FLT). +12V Power Supply (OK/FLT). -12V Power Supply (OK/FLT).

Bulk Consolidated Analog Status	Status: Response:	MC BCAS_'cr' BCAS_p1,p2,p3, . . . pn'cr''lf']	This command is similar to the 'BCS_' command, but returns modem analog parameters.

Where: 'pn' is the last parameter returned.

	Parameter Number	Parameter Name (Command Reference)	Description
	1	**Receive Signal Level** (ref. 'RSL_' command).	p1 = xsnn.n, receive signal level in dBm.
	2	**Raw BER** (ref. 'RBER_' command).	p2 = xm.mE-ee.
	3	**Corrected BER** (ref. 'CBER_' command).	p3 = xm.mE-ee.
(Note 1)	4	**E_b/N_0** (ref. ' EBN0 _' command).	p4 = xnn.n, E_b/N_0 in dB.
	5	**Current Sweep Value** (ref. 'CSV_' command).	p5 = snnnnn, sweep offset value in Hz.

Notes:
1. Status only returned in Continuous mode.
2. Parameters 2 through 5 are dependent on carrier acquisition. If the decoder is not locked, empty data blocks are returned (,,,,).

Bulk Consolidated Status	Status: Response:	MC BCS_'cr' BCS_p1,p2,p3, . . . pn'cr''lf']	This command causes bulk modem status to be returned. To reduce the length of the response, message parameter data are returned without identifiers. However, parameter identification can be determined by order of return. Each status parameter (except for the last parameter) is terminated with a comma (','). The last parameter has the standard message termination sequence ('cr''lf']). Most of the data returned is formatted the same way as that returned by any single command status request (refer to Section A.3.2 for examples).

Where: 'pn' is the last parameter returned.

	Parameter Number	Parameter Name (Command Reference)	Description
	1	**Modulator RF Output** (ref. 'RF_' command).	p1 = n, where 'n' is '0' (OFF) or '1' (ON).
	2	**Modulator IF Frequency** (ref. 'MF_' command).	p2 = nnn.nnnn, IF frequency in MHz.
	3	**Modulator Rate** (ref. 'MR_' command).	p3 = nnnn_mmm.mmm, code rate/data rate in kbps.
	4	**Modulator Preset A assignment** (ref. 'ARMA_' command).	p4 = nnnn_mmm.mmm, code rate/data rate in kbps.
	5	**Modulator Preset B assignment** (ref. 'ARMB_' command).	p5 = nnnn_mmm.mmm, code rate/data rate in kbps.
	6	**Modulator Preset C assignment** (ref. 'ARMC_' command).	p6 = nnnn_mmm.mmm, code rate/data rate in kbps.
	7	**Modulator Preset D assignment** (ref. 'ARMD_' command).	p7 = nnnn_mmm.mmm, code rate/data rate in kbps.
	8	**Modulator Preset V assignment** (ref. 'ARMV_' command).	p8 = nnnn_mmm.mmm, code rate/data rate in kbps.
	9	**Modulator Power Offset** (ref. 'MPO_' command).	p9 = snn.n, modulator power offset in dB.
	10	**Modulator Output Power Level** (ref. 'MOP_' command).	p10 = snn.n, transmitter output power level in dBm.
	11	**Scrambler Enable** (ref. 'SE_' command).	p11 = n, where 'n' is '0' (OFF) or '1' (ON).
	12	**Differential Encoder Enable** (ref. 'DENC_' command).	p12 = n, where 'n' is '0' (OFF) or '1' (ON).
	13	**Modulator Type** (ref. 'MT_' command).	p13 = n, where 'n' is '0' (EFD), '1' (INTL), '2'(CSC), '3' (FDC), or '4' (SDM51).
	14	**Modulator Encoder Type** (ref. 'MET_' command).	p14 = n, where 'n' is '0' (SEQ) or '1' (VIT).
(Note 1)	15	**Transmit BPSK Data Ordering** (ref. 'TDA_' command).	p15 = n, where 'n' is '0' (NRM), '1' (INV).
	16	**Carrier Only Mode ON/OFF.**	p16 = n, where 'n' is '0' (OFF) or '1' (ON).

Bulk
Consolidated Status
(continued

Where: 'pn' is the last parameter returned.

	Parameter Number	Parameter Name (Command Reference)	Description
	17	**Demodulator IF Frequency** (ref. 'DF_' command).	p17 = nnn.nnnn, demodulator IF frequency in MHz.
	18	**Demodulator Rate** (ref. 'DR_' command).	p18 = nnnn_mmm.mmm, code rate/data rate in kbps.
	19	**Demodulator Preset A Assignment** (ref. 'ADRA_' command).	p19 = nnnn_mmm.mmm, code rate/data rate in kbps.
	20	**Demodulator Preset B Assignment** (ref. 'ADRB_' command).	p20 = nnnn_mmm.mmm, code rate/data rate in kbps.
	21	**Demodulator Preset C Assignment** (ref. 'ADRC_' command).	p21 = nnnn_mmm.mmm, code rate/data rate in kbps.
	22	**Demodulator Preset D Assignment** (ref. 'ADRD_' command).	p22 = nnnn_mmm.mmm, code rate/data rate in kbps.
	23	**Demodulator Preset V Assignment** (ref. 'ADRV_' command).	p23 = nnnn_mmm.mmm, code rate/data rate in kbps.
	24	**Descrambler Enable** (ref. 'DE_' command).	p24 = n, where 'n' is '0' (OFF) or '1' (ON).
	25	**Differential Decoder Enable** (ref. 'DDEC_' command).	p25 = n, where 'n' is '0' (OFF) or '1' (ON).
	26	**RF Loopback** (ref. 'RFL_' command).	p26 = n, where 'n' is '0' (OFF) or '1' (ON).
	27	**IF Loopback** (ref. 'IFL_' command).	p27 = n, where 'n' is '0' (OFF) or '1' (ON).
(Note 1)	28	**Sweep Center Frequency** (ref. 'SCF_' command).	p28 = snnnnn, sweep center frequency in Hz.
(Note 1)	29	**Sweep Width Range** (ref. 'SWR_' command).	p29 = nnnnn, sweep range in Hz.
	30	**BER Threshold** (ref. 'BERT_' command).	p30 = xxxx, BER threshold.
	31	**Demodulator Type** (ref. 'DT_' command).	p31 = n, where 'n' is '0' (EFD), '1' (INTL), '2' (CSC), or '3' (FDC).
	32	**Demodulator Decoder Type** (ref. 'DDT_' command).	p32 = n, where 'n' is '0' (SEQ) or '1' (VIT).
(Note 1)	33	**Receive BPSK Data** (ref. 'RDA_' command).	p33 = n, where 'n' is '0' (NRM),or '1' (INV).
	34	**Transmit Clock Source** (ref. 'TC_' command).	p34 = n, where 'n' is '0' (INT), '1' (REF), or '2' (EXT).

Bulk
Consolidated Status
(continued

Where: 'pn' is the last parameter returned.

	Parameter Number	Parameter Name (Command Reference)	Description
	35	**Transmit Clock Phase** (ref. 'TCP_' command).	p35 = n, where 'n' is '0' (NRM), '1' (INV), or '2' (AUTO).
(Note 1)	36	**Buffer Clock Source** (ref. 'BC_' command).	p36 = n, where 'n' is '0' (INT), '1' (REF), '2' (EXT), or '3' (SAT).
	37	**Receive Clock Phase** (ref. 'RCP_' command).	p37 = n, where 'n' is '0' (NRM) or '1' (INV).
	38	**Baseband Loopback** (ref. 'BBL_' command).	p38 = n, where 'n' is '0' (OFF) or '1' (ON).
(Note 1)	39	**Interface Buffer Programming** (ref. 'IBP_' command).	p39 = n, where 'n' is '0' (BITS) or '1' (MS).
(Note 1)	40	**Interface Buffer Size** (ref. 'IBS_' command).	p40 = nnnnnn, buffer size in bits or milliseconds.
	41	**Modem Operation Mode** (ref. 'MOM_' command).	p41 = n, where 'n' is '1' (TX_ONLY), '2' (RX_ONLY), or '3' (DUPLEX).
	42	**Modem Remote/Local Mode.**	p42 = n, where 'n' is '0' (LOCAL) or '1' (REMOTE).
	43	**Not valid.**	
	44	**Not valid.**	
	45	**Not valid.**	
	46	**Not valid.**	
	47	**Not valid.**	
	48	**Not valid.**	
	49	**Not valid.**	
	50	**Not valid.**	
	51	**Not valid.**	
	52	**Not valid.**	
	53	**Not valid.**	
	54	**Not valid.**	
(Note 3)	55	**Not valid.**	
	56	**Transmit Mode Selection (ref. 'TXM_' command).**	p56 = n, where 'n' is '1' (BURST) or '2' (CONTINUOUS).
(Note 2)	57	**Modulator Preamble Selection** (ref. 'MPRE_' command).	p57 = n, where 'n' is '1' (PREAMBLE) or '2' (PREAMBLE 2).

Bulk
Consolidated Status
(continued

Where: 'pn' is the last parameter returned.

	Parameter Number	Parameter Name (Command Reference)	Description
	58	**Receive Mode Selection** (ref. 'RXM_' command).	p58 = n, where 'n' is '2' (CONTINUOUS)
(Note 1)	60	**Reed-Solomon Encoder Enable** (ref. 'RSEN_' command).	p60 = n, where 'n' is '0' (OFF,) or '1' (ON).
(Note 1)	61	**Reed-Solomon Decoder Enable** (ref. 'RSDE_' command).	p61 = n, where 'n' is '0' (OFF), '1' (ON), or '2' (CORR_OFF).

Notes:
1. Parameters only valid in Transmit and Receive Continuous mode.
2. Parameters only valid in Transmit Continuous mode.
3. For any parameter other than the last parameter that is not returned, a comma (',') will be returned.

Bulk Consolidated Status Faults	Status: Response:	MC BCSF_'cr' BCSF_abcdefghijkl'cr''lf']	This command causes all modem fault status information to be returned. To reduce the length of the response, fault status is embedded into the bit structure of the characters that are returned. Faults are indicated by a binary 1 in the designated bit position. Where: Character a: Modulator fault status character 1. Bit 6 = 1 always. Bit 5 = Modulator module fault. Bit 4 = RF output status. Actual not programmed status (1 = ON, 0 = OFF). Bit 3 through Bit 0 = Binary representation (0 to 10) of the number of modulator stored faults. Character b: Modulator fault status character 2. Bit 6 = 1 always. Bit 5 = IF Synthesizer. Bit 4 = Data Clock Synthesizer. Bit 3 = reserved. Bit 2 = reserved. Bit 1 = AGC Level. Bit 0 = reserved. Note**:** In TX Burst mode only. Character b: Modulator fault status character 2. Bit 6 = 1 always. Bit 5 = IF Synthesizer. Bit 4 = Data Clock Synthesizer. Bit 3 = I Channel. Bit 2 = Q Channel. Bit 1 = AGC Level. Bit 0 = reserved. Note**:** In TX Continuous mode only. Character c: Modulator fault status character 3. Bit 6 = 1 always. Bit 5 = reserved. Bit 4 = reserved. Bit 3 = reserved. Bit 2 = reserved. Bit 1 = reserved. Bit 0 = reserved. Character d: Demodulator fault status character 1. Bit 6 = 1 always. Bit 5 = Demod module fault. Bit 4 = Carrier detect status (0 for decoder lock). Bit 3 through Bit 0 = Binary representation (0 to 10) of the number of demodulator stored faults. Note**:** In RX Continuous mode only. Character e: Demodulator fault status character 2. Bit 6 = 1 always. Bit 5 = IF Synthesizer Lock. Bit 4 = I Channel. Bit 3 = Q Channel. Bit 2 = Descrambler. Bit 1 = BER threshold. Bit 0 = reserved. Note**:** In RX Continuous mode only.

			Character f: Demodulator fault status character 3. Bit 6 = 1 always. Bit 5 = reserved. Bit 4 = reserved. Bit 3 = reserved. Bit 2 = reserved. Bit 1 = reserved. Bit 0 = reserved. Character g: Interface transmit side faults character 1. Bit 6 = 1 always. Bit 5 = reserved. Bit 4 = reserved. Bit 3 through Bit 0 = Binary representation (0 to 10) of the number of interface transmit side stored faults. Character h: Interface transmit side faults character 2. Bit 6 = 1 always. Bit 5 = Selected Transmit Clock Activity. Bit 4 = reserved. Bit 3 = reserved. Bit 2 = reserved. Bit 1 = reserved. Bit 0 = reserved. Note**:** In TX Burst mode only. Character i: Interface receive side faults character 1. Bit 6 = 1 always. Bit 5 = reserved. Bit 4 = reserved. Bit 3 through Bit 0 = Binary representation (0 to 10) of the number of interface receive side stored faults. Character j: Interface receive side faults character 2. Bit 6 = 1 always. Bit 5 = Selected Buffer Clock Activity. Bit 4 = Buffer Underflow. Bit 3 = Buffer Overflow. Bit 2 = reserved. Bit 1 = reserved. Bit 0 = reserved. Note**:** In RX Continuous mode only. Character k: Common equipment fault status character 1. Bit 6 = 1 always. Bit 5 = Monitor and Control Module. Bit 4 = Interface Module. Bit 3 through Bit 0 = Binary representation (0 to 10) of the number of common equipment stored faults. Character l: Common equipment fault status character 2. Bit 6 = 1 always. Bit 5 = Battery/Clock. Bit 4 = +5V power supply. Bit 3 = +12V power supply. Bit 2 = -12V power supply. Bit 1 = reserved. Bit 0 = reserved. Character m: Interface Reed-Solomon unavailable seconds. Bit 6 = 1 always. Bit 5 = not used. Bit 4 = not used. Bit 3 through Bit 0 = reserved.
Change	Status:	MC CS_'cr'	This command indicates that a change has or has not occurred

Status	Response:	CS_x'cr''lf']	on either the BCS_ or the BCSF_ response since the last BCS_ or BCSF_ poll. Where: the x character is defined as follows: @ = no change since last BCS_ and BCSF_ polls. A = BCS_ response has changed since last BCS_ poll. B = BCSF_ response has changed since last BCSF_ poll. C = Both responses have changed since last BCS_ and BCSF_ polls.
Equipment Type	Status: Response:	MC ET_'cr' ET_ttttttt_xxx.yyy.zzz'cr''lf']	This command returns the equipment type and the software version of the addressed device. Where: tttttttt = Equipment type. xxx.yyy.zzz = Software version.
Modem Monitor and Control Firmware Information	Status: Response:	MC MCFI_'cr' MCFI_'cr' VER_xxx.yyy.zzz'cr' FW/nnnnnn-ddr'cr' mm/dd/yy'cr''lf']	Where: xxx.yyy.zzz = Software version number (0.0.0 to 999.999.999). nnnnnn = Firmware number (0 to 999999). dd = Firmware dash number (0 to 99). r = Firmware revision (-, or A to Z).
Modem Data ROM Firmware Information	Status: Response:	MC DFI_'cr' DFI_'cr' DSP_FW/nnnnnn-ddr'cr' DSP_mm/dd/yy'cr' FPGA_FW/nnnnnn-ddr'cr' FPGA_mm/dd/yy'cr''lf']	Where: nnnnnn = Firmware number (0 to 999999). dd = Firmware dash number (0 to 99). r = Firmware revision (-, or A to Z).

A.9 Unsolicited Responses

The following strings are generated by the DCE to reflect events which are not directly related to commands typed from the DTE. They generally reflect the results of an earlier command.

To ensure that a response is never inserted in the midst of another string, the following strings will not start until any transmission in progress has been completed. However, if a partial line has been entered from the DTE to the DCE, this strict sequence control causes indefinite waiting by the response string. The response string shall wait until the partial line is completed.

A.9.1 Messages from NMS

CONGESTION	Channel cannot be assigned because there is no satellite spectrum space available.
BUSY	Destination end is busy.
NO CONNECT <error code>	NMS was not able to complete the connection. Error Type Failure Terminate. Invalid Request.
CONNECT	Received when a connection is made.
DISCONNECT <result code>	Received when a connection is broken. Result Type — Code Path Ok. — 0 Calling Party Busy. — 1 Failure Terminate. — 2 Invalid Request. — 3 Normal Termination. — 4 Network Busy. — 5 Critical Fault. — 6

<channel no> CS <calling phone number> <called phone number> <status> <cause> <subcause>	Call Status <phone number> Calling phone number <dest node> Destination Node Id <dest channel> Destination Channel No. <status> Description 0 Path Ok 1 Channel busy 2 Failure 3 Invalid phone number 4 Normal Termination 5 Network Busy 6 Critical Fault <cause> and <subcause> Information only
MM <phone_no> <message>	Multipoint Message <phone_no> Source connection phone number or zero. <message> Message from source node.

A.9.2 List of Cause Codes

The complete list of *Cause* codes is given below. These are primarily used to determine what description of the call termination is included in the completed call log. The NMS and Node columns define whether the cause code is generated by the NMS or the Node, or whether both may generate it.

Value	Name	NMS	Node	Description
0x00	cause_Unknown	x	x	No more detail available
0x01	cause_NodeChanBusy	x	x	Calling or called Node/Ch is busy
0x02	cause_HuntGrpBusy	x		All numbers in hunt group are busy
0x03	cause_NoAnsTimer		x	No answer timer expired before going offhook
0x04	cause_NoCarrier	x		Carrier lock was never achieved
0x05	cause_CarrierLost	x		Carrier lock was achieved, but then lost
0x06	cause_ISDNFault	x		ISDN faults to be defined
0x07	cause_ModemProg	x		General Modem Programming failure
0x08	cause_IncompType	x		Incompatible modem types: voice/data, voice/ISDN
0x09	cause_NotInCircuit	x		The specified node is not online
0x0A	cause_InvalidNum	x		Number has invalid length, characters or is not defined
0x0B	cause_DoesNotExist	x		The specified node/channel/circuit is not in database
0x0C	cause_NotOnline	x		The specified node is not online
0x0D	cause_NotEnabled	x		The specified node or channel is not enabled
0x0E	cause_UserHangUp		x	User went on hook
0x0F	cause_NodeHangUp		x	Call terminated from user port on remote node
0x10	cause_RTSDrop	x		Call terminated when RTS went inactive
0x11	cause_NMSOperator	x		Call terminated by NMS
0x12	cause_CallTimer	x		Call term by the maximum call duration timer
0x13	cause_NoBandwidth	x		No bandwidth available
0x14	cause_NoPower	x		No power is available
0x15	cause_SequenceError	x		Commands sent out of sequence
0x16	cause_PreEmption	x		Pre-empted to free resources for high-priority call
0x17	cause_NoPowerNoBW	x		No power and no bandwidth available
0x18	cause_IncompVoiceCap	x		Attempt to mix G.728 + G.729 voice circuit
0x19	cause_IncompPhNum		x	Calling side PPTREQ # not equal PTTASSIGN #
0x1A	cause_InvalidVfduCmd		x	VFDU Card rejected DAC Command
0x1B	cause_NotInCall	x		MPDRequest, target node/chan not a member
0x1C	cause_InvalidMember		x	MPDRequest, action not allowed for this member
0x1D	cause_RequestInProg		x	MPDRequest, call member is busy with a request
0x1E	cause_AlreadyInCall		x	MPDRequest, cannot add node/chan already in call
0x1F	cause_NoReturn	x		MPDRequest, return off attempt with no return active

A.9.3 Cause and Subcause Codes Generated By NMS

The list of ***Cause*** and corresponding ***Subcause*** codes, which are generated by the NMS, is given below. These are used to give the maximum level of detail possible in describing why a call terminated. It is used primarily for diagnostic purposes. Note that each ***Cause*** code has its own list of ***Subcause*** definitions; a ***Subcause*** from one *Cause* cannot be used with another, unless it is also defined under that ***Cause***. Some Cause values have no Subcause list; these would always use ***subcause_Unknown***, which is defined with a value of 0. Even where sub causes are listed***, subcause_Unknown*** is still valid.

Example

Cause	Subcause	Name	Status	Description
0x01		cause_NodeChanBusy	term_Busy	Calling or called node/Ch is busy
	0x07	subcause_CannotCallSelf		Calling party attempted to call themselves
0x02		cause_HuntGrpBusy	term_Busy	All numbers in hunt group are busy
0x08		cause_IncompType	term_Invalid	Incompatible modem types; voice/data, voice/ISDN
	0x05	subcause_VoiceDataConf		Attempt to connect voice and data modems
0x09		cause_NotInCircuit	term_Invalid	The specified node/chan is not part of the circuit
0x0A		cause_InvalidNum	term_Invalid	Number has invalid length, characters or is not defined
	0x07	subcause_CannotCallSelf		A node/channel cannot call itself
	0x0F	subcause_NotDefined		The number is not in the database
0x0B		cause_DoesNotExist	term_Invalid	The specified node/channel/circuit is not in database
	0x01	subcause_ChanError		Channel is not in database
	0x02	subcause_NodeError		Node is not in database
	0x03	subcause_CircuitError		Circuit is not in database
0x0C		cause_NotOnLine	term_Invalid	Node is not responding to the NMS
	0x01	subcause_ChanError		Channel is not online
	0x02	subcause_NodeError		Node is not online
0x0D		cause_NotEnabled	term_Invalid	The specified node/channel/circuit is not enabled
	0x01	subcause_ChanError		Channel is not enabled
	0x02	subcause_NodeError		Node is not enabled
	0x04	subcause_AccessTime		Channel is not available, outside its access time
0x11		cause_NMSOperator	term_Normal	Call terminated by NMS
0x13		cause_NoBandwidth	term_NetworkBusy	No bandwidth available
0x14		cause_NoPower	term_NetworkBusy	No power is available
	0x03	subcause_NoPowerAtSite		No power at the site
	0x04	subcause_NoPowerAtSat		No power at the site
0x15		cause_SequenceError	term_Invalid	Messages sent out of sequence by node
	0x0D	subcause_NoPathStatus		Path status not received from one or both nodes
	0x0E	subcause_InvalidMsg		An invalid message received during call sequence
0x16		cause_PreEmption	term_FailureRetry	Pre-empted to free resources for high-priority call
0x17		cause_NoPowerNoBW	term_NetworkBusy	No power and no bandwidth available
	0x03	subcause_NoPowerAtSite		No power at the site
	0x04	subcause_NoPowerAtSat		No power at satellite
0x1B		cause_NotInCall	term_FailureRetry	The specified node/chan is not part of the call
0x1C		cause_InvalidMember	term_FailureRetry	Request not legal for this call member
	0x20	subcause_Chairman		Request not legal for the call Chairman
	0x21	subcause_Forward		Request not legal for the forward transmitter
	0x22	subcause_Return		Request not legal for the return transmitter
0x1D		cause_RequestInProg	term_FailureRetry	This member already has a request pending
0x1E		cause_AlreadyInCall	term_FailureRetry	Attempt to add a member already in the call
0x1F		cause_NoReturn	term_FailureRetry	Attempt to turn off return, with no return active

A.9.4 Cause and Subcause Codes Generated By Node

Example				
Cause	**Subcause**	**Name**	**Status**	**Description**
0x00		cause_Unknown	term_PathOk	
0x01		cause_NodeChanBusy	term_Busy	Called node/channel is busy
0x04		cause_NoCarrier	term_FailureRet	Carrier lock was never achieved
0x05		cause_CarrierLost	term_FailureRet	Carrier lock was achieved, but then lost
0x06		cause_ISDNFault	term_FailureRet	ISDN faults to be defined
	0x00-0x0D	reserved		
0x0E		subcause_InvalidRate		Invalid data rate for ISDN call
	0x0F-0xFF	reserved		
0x07		cause_ModemProg	term_FailureRet	General Modem Programming failure
	0x00	subcause_Unknown		Generic subcause code
	0x01	subcause_InvalidOpCode		Internal error code
	0x02	subcause_OpCodeFault		Internal error code
	0x03	subcause_InvalidResponseBuffer		Internal error code
	0x04	subcause_InvalidParm		Internal error code
	0x05	subcause_InvalidChan		Channel number out of range
	0x06	subcause_AccessDenied		Channel access denied
	0x07	subcause_ChannelOffline		Channel went offline
	0x08	subcause_InvalidRequestBuffer		Internal error code
	0x09	subcause_InvalidNodeStartupCode		Internal error code
	0x0A	subcause_InvalidNodeDisableOption		Internal error code
	0x0B	subcause_InvalidNodeStatusOption		Internal error code
	0x0C	subcause_InvalidTxFreq		Invalid transmit frequency
	0x0D	subcause_InvalidRxFreq		Invalid receive frequency
	0x0E	subcause_InvalidRate		Invalid Modulation ,code rate, data rate selection
	0x0F	subcause_InvalidPower		Invalid power level
	0x10	subcause_InvalidTxClock		Invalid transmit clock selection
	0x11	subcause_ChannelLocked		Channel already processing call
	0x12	subcause_ModemFault		Channel not responding to periodic status request
	0x13	subcause_NoCarrier		Carrier Not Detected
	0x14	subcause_InvalidParmBuffer		Internal error code
	0x15	subcause_CallNotActive		Call not in progress
	0x16	subcause_ModemNotPresent		Internal error code
	0x17	subcause_ModemFaultDetected		Modem offline
	0x18	subcause_InvalidEncoderType		Invalid Encoder Selection
	0x19	subcause_InvalidDecoderType		Invalid Decoder Selection
	0x1A	subcause_InvalidBus		Channel not defined on specific bus
	0x1B	subcause_InvalidSweep		Invalid demodulator sweep rate range
	0x1C	subcause_NoBufferAvail		Internal error code
	0x1D	subcause_InvalidDEncoder		Invalid differential encoder selection
	0x1E	subcause_InvalidDDecoder		Invalid differential decoder selection
	0x1F	subcause_ChannelNotInitialized		Internal error code
	0x20	subcause_ InvalidTransmitMode		Invalid Transmit Mode selection
	0x21	subcause_ InvalidBuffersize		Invalid Modem buffer size
	0x22	subcause_ InvalidAupcOption		Invalid Aupc Option
	0x23	subcause_ InvalidAupcNominalPower		Invalid Aupc Nominal Power
	0x24	subcause_ InvalidAupcMax		Invalid Aupc Max Power
	0x25	subcause_ InvalidAupcMin		Invalid Aupc Min Power
	0x26	subcause_ InvalidAupcSP		Invalid Aupc Set Point
	0x27	subcause_ InvalidAupcMaxRate		Invalid Aupc Max Rate
	0x28	subcause_ InvalidLocalAction		Invalid Aupc Local Action
	0x29	subcause_ InvalidRemoteAction		Invalid Aupc Remote Action
	0x30	subcause_ InvalidModemType		Internal error code
	0x31	subcause_ InvalidFramingType		Invalid Framing Selection
0x18		cause_IncompVoiceCap	term_FailureRet	Attempt to mix G.728 + G.729 voice circuit
0x19		cause_IncompPhNum	term_FailureRet	Calling side PPTREQ # not equal PTTASSIGN #

Example				
Cause	**Subcause**	**Name**	**Status**	**Description**
0x1A		cause_InvalidVfduCmd	term_FailureRet	VFDU Card rejected DAC Command
0x03		cause_NoAnsTimer	term_Normal	No answer timer expired without going offhook
0x0E		cause_UserHangUp	term_Normal	User went on hook
0x0F		cause_NodeHangUp	term_Normal	Call terminated from user port on remote node
0x10		cause_RTSDrop	term_Normal	Call terminated when RTS went inactive
0x12		cause_CallTimer	term_Normal	Call term by the maximum call duration timer

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

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