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SDM-300L3

Satellite Modem
Installation and Operation Manual

Part Number MN/SDM300L3.IOM Revision 0

Errata A

Comtech EF Data Documentation Update

Subject:	Delete Operational Shock and Survivability Shock from Specifications
Date:	December 1, 2003
Document:	SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number:	MN/SDM300L3.EA0
Collating Instructions:	Attach this page to page 15-3

Comments:

Delete Operational Shock and Survivability Shock from Table 15-1. This information will be incorporated into the next revision.

Change Specifics:

Table 15-1. System Specification Summary

System Specifications	
Operating Frequency Range	950-1750MHz, in100 Hz steps
Digital Interfaces (Standard)	EIA-232, EIA-422, and V.35
Digital Interfaces (Optional)	G.703
Digital Data Rate	2.4 kbps to 5.0 Mbps, in 1 bit/s step (refer to: Digital Data Rate paragraph)
Symbol Rate	4.8 k symbols/s to 2.5 M symbols/s
Modulation/Demodulation	BPSK QPSK OQPSK 8PSK
Baseband Filtering	IESS, Comtech EF Data Closed, Comstream Closed, EFD Closed
Forward Error Correction (FEC)	Viterbi, K=7, 1/2, 3/4, 7/8 rates Sequential 1/2, 3/4, 7/8 rates Reed-Solomon Concatenated per Intelsat Reed-Solomon Concatenated per closed network Trellis 2/3 rate (8PSK) Turbo 1/2, 3/4, 21/44, and 5/16 rates Uncoded
Reed Solomon Interleaver	Depth 8, closed network; Depth 4 or 8 per IESS-308, 309, and 310
Plesiochronous/Doppler Buffer	1 to 99 ms, in 1 ms steps up to 2.6 Mbps 32 to 262,144 bits in 16 bit steps
Data Scrambling	IESS-308 (V.35 Intelsat), IESS-309/310, FDC, V.35 (EFD/CSC), Modified V.35, None
Differential Encoding/Decoding	ON/OFF
External Reference Input	1, 5, 10, 20 MHz (75Ω 0 to 20 dBm on 50Ω BNC Female) Note: Only 10 MHz allowed when operating with BUC and LNB requiring 10 MHz reference from modem.
Open Collector Fault Reporting	For redundancy switch operation or user reporting. Separate modulator and demodulator open collector up to 15 VDC maximum at 20 mA. Fault = collector Off and OK = collector On.
Test Modes, Loopback Data	Baseband: Near end and far end Interface: Near end and far end (Reed-Solomon or Overhead only)
Test Modes	Available only when TX and RX are both L-band:
IF Loopback	Disconnects the IF input from the RX input connector and couples it to a sample of the TX IF output. The IF output is not affected.
RF Loopback	Sets the demodulator frequency to the same value as the modulator. For the modem to lock, an external IF loop must be provided.
Prime Power	85 to 264 VAC, 47 to 63 Hz, 60 Watts maximum
Physical:	
Size	1 RU1.75H x 19W x 19.18D inches (4.44 x 48.26 x 48.72 cm)
Weight	14.5 lbs. Maximum (6.51 kg)
Mounting	Standard 19-inch (48.62 cm) rack mounts front and rear accepts standard rack mount slides (no slides with 150W BUC power supply option)
Environmental:	
Temperature	0 to +50°C (32 to 122°F)
Humidity	95% non-condensing
Agency Approvals	CE Mark

Errata B

Comtech EF Data Documentation Update

Subject: Change Output Unit Reference

Date: December 1, 2003
Document: SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number: MN/SDM300L3.EB0
Collating Instructions: Attach this page to page 15-4

Comments:

Change Output Unit Reference in Table 15-2. This information will be incorporated into the next revision.

Change Specifics:

Output Unit Reference:	On center conductor of L-Band output connector	
Frequency	10.0 MHz ± 0.02 ppm (Optional: 1.0 ppm)	
Stability	0.0 dBm, ± 3 dBm	
Power Level		
Phase Noise	dB/Hz	Frequency Offset
	-110	10 Hz
	-135	100 Hz
	-140	1 kHz
	-150	10 kHz
	-150	100 kHz

Errata C

Comtech EF Data Documentation Update

Subject:	Changes to Table 5-8 (Viterbi Reed-Solomon Modes)
Date:	December 1, 2003
Document:	SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number:	MN/SDM300L3.EC0
Collating Instructions:	Attach this page to page 5-9

Comments:

The following changes provide updated information for Table 5-8. This information will be incorporated into the next revision.

Change Specifics:

5.7 Reed-Solomon Modes

Reed-Solomon polynomial is compatible with Intelsat (IESS-308, IESS-309, IESS-310, and IESS-314). Table 5-8 shows the Reed-Solomon parameter used for various configurations.

Table 5-8. Viterbi Reed-Solomon Modes

Modem Menu [1,2]					Description				
Utility Modem Type	**Configuration Modulator TX or Demodulator RX Rate [3]**	**Utility Modulator or Demodulator [4]**	**Overhead Type**	**Scrambler**	**N**	**K**	**T**	**I**	**Mode**
D&I	8PSK 2/3	IES-310 ON + Intelsat Open	TCM/IDR Small carrier	309	219	201	9	4	IESS-310 Compliant (8PSK 2/3 only)
IDR	8PSK 2/3	IES-310 ON + Intelsat Open	TCM/IDR (T1, E1[5], T2[5], E2)	V.35	219	201	9	8	
EFD	QPSK OQPSK	EFD Closed	No Overhead	EFD MOD V.35	225	205	10	8	
EFD	8PSK 2/3	EFD CLOSED IESS-310 ON	No Overhead	EFD MOD V.35	219	201	9	4	
ASYNC	QPSK 8PSK 2/3	EFD CLOSED IESS-310 = Off	ASYNC Overhead	EFD MOD V.35	225	205	10	8	Non-IESS-310 Compliant 8PSK 2/3 only IESS-308/309 Compliant (Open) only
ASYNC	8PSK 2/3	EFD CLOSED IESS-310 ON	ASYNC Overhead	EFD MOD V.35	219	201	9	4	
VSAT IBS	QPSK BPSK	Intelsat Open	VSAT IBS (Compliant = No Overhead)	309	219	201	9	4	
309 IBS	QPSK	Intelsat Open	IBS	309	219	201	9	4	Non-IESS modes For All other Rate (BPSK, QPSK, OQPSK, [5]8PSK 5/6, [5]16QAM)
D&I	QPSK	Intelsat Open	IDR Small Carrier (D&I)	309	126	112	7	4	
IDR	QPSK	Intelsat Open	IDR, T1	Intelsat V.35	225	205	10	4	
IDR	QPSK	Intelsat Open	IDR, E1	Intelsat V.35	219	201	9	4	
IDR	QPSK	Intelsat Open	[5] IDR, T2	Intelsat V.35	194	178	8	4	
IDR	QPSK	Intelsat Open	[5] IDR, E2	Intelsat V.35	194	178	8	4	
IBS	QPSK	Intelsat Open	IBS	309	126	112	7	4	Legacy EFD (IBS)
IESS-314 Compliant (8PSK 2/3 only)			Same as IESS-310 Compliant 8PSK 2/3						

Where:

N = Coded Reed-Solomon block length (Number of bytes)
K = Uncoded Reed-Solomon block length (Number of bytes)
T = Maximum number of byte corrections (T =[N-K] /2)
I = Interleave Depth

Errata D

Comtech EF Data Documentation Update

Subject:	Changes to Figure 9-1 (SDM-300L Fault Tree)
Date:	December 1, 2003
Document:	SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number:	MN/SDM300L3.ED0
Collating Instructions:	Attach this page to page 9-3

Comments:

The following changes provide updated information for Figure 9-1 This information will be incorporated into the next revision.

Change Specifics:

Refer to Figure 9-1 for faults monitored by the modem, and the action taken at each occurrence of that fault.

	TX IF OUTPUT OFF	TX FAULT LED	TX FAULT RELAY 1	RX FAULT LED	RX FAULT RELAY 2	COM EQ FAULT LED	COM EQ FAULT RELAY 3	TX ALARM LED	TX ALARM RELAY #2 4	RX ALARM LED	RX ALARM RELAY #3 5	SPARE RELAY ALARM #1	PRIMARY ALARM RELAY 6 ** ***	SECONDARY ALARM RELAY 7 ** ** *	IBS BACKWARD ALARM ** ***	DEFERRED MAIN ALARM 8 *	TX AIS * ** ***	RX AIS * ** ***	D&I TERR BWA ***
MODULATOR FAULTS																			
IF SYNTHESIZER	X	X	X										X				X		X
DATA CLOCK SYN	X	X	X										X				X		X
I CHANNEL	X	X	X										X				X		X
Q CHANNEL	X	X	X										X				X		X
AGC	X	X	X										X				X		X
MODEM REF ACT								X	X										
MODULE	X	X	X										X				X		X
CONFIGURATION	X	X	X										X				X		X
MODEM REF PLL	X	X	X										X				X		X
DEMODULATOR FAULTS																			
CARRIER DETECT				X	X								X		X			X	
IF SYNTHESIZER				X	X								X		X			X	
I CHANNEL				X	X								X		X			X	
Q CHANNEL				X	X								X		X			X	
BER THRESHOLD										X	X			X		X			
MODULE				X	X								X		X			X	
CONFIGURATION				X	X								X		X			X	
LNB CURRENT										x	x			x		x			
OUTDOOR UNIT (BUC)																			
CURRENT								x	x										
VOLTAGE																			
TEMPERATURE (FSK MODE ON)																			
PLL LOCK (FSK MODE ON)								x	x				X						
CHECKSUM (FSK MODE ON)																			

FIGURE 9-1. SDM-300L FAULT TREE

Errata E

Comtech EF Data Documentation Update

Subject:	Changed reference specified in Output Phase Noise
Date:	December 1, 2003
Document:	SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number:	MN/SDM300L3.EE0
Collating Instructions:	Attach this page to page 15-4

Comments:

Changed reference specified in Output Phase Noise (Table 15-2). This information will be incorporated into the next revision.

Change Specifics:

Table 15-1. L-Band Modulator

Transmit Specifications	
Output Connector	Type N Female
Frequency Stability	± 0.02 ppm Optional: ± 1.0 ppm
Output Power Range	0 to -40 dBm in 0.1 dB steps
Output Power Accuracy	± 1.5 dB
Output Power Stability versus Temperature	± 1.0 dB
Output Power Offset	Adds offset of –99.0 to +99.0 dB in 0.1 dB steps to displayed IF output power.
Output Impedance	50 Ω
Output Return Loss	≥ 14 dB
Output Noise Floor	-130 dBc/Hz (20 MHz from carrier)
Output Phase Noise	see 15.5.6 Modulator Phase Noise
Spurious Emissions	-55 dBc, 55 to 2000 MHz in 4 kHz bandwidth
Carrier Suppression	< -30 dBc (test mode)
Harmonics of modulated carrier	< -55 dBc
Output Unit Reference: Frequency Stability Power Level Phase Noise	On center conductor of L-Band output connector 10.0 MHz ± 0.02 ppm (Optional: 1.0 ppm) 0.0 dBm, ± 3 dBm dB/Hz — Frequency Offset -50 — 1 Hz -80 — 10 Hz -110 — 100 Hz -140 — 1 kHz -150 — 10 kHz -150 — 100 kHz
Outdoor Unit (ODU) Supply Voltage. Supplied through TX IF center conductor and selectable On/Off via M&C control.	Standard unit is with no ODU supply. Optional ODU supplies: 24 VDC, 4.0 Amps maximum, universal AC input 100 W supply 48 VDC, 3.0 Amps maximum, universal AC input 150 W supply
ODU 10 MHz Reference	On center conductor of output Type N connector at 0 ± 3 dBm. Programmable On/Off.
Outdoor Unit Current	Min/Max programmable current limit and alarm if current falls outside the programmable threshold.
Outdoor Unit M&C	FSK TX and RX for M&C of the SierraCom or Terrasat BUC. **Note:** Refer to Chapter 16 for BUC/FSK Communications.
Spectral Sense	Normal or Inverted
Test Modes Pattern Generator	Inserts 2047 data pattern in place of TX data stream, with optional Overhead Card.
Test Modes, Carrier	CW Offset: single sideband Dual: dual sideband

Errata F

Comtech EF Data Documentation Update

Subject:	Changes to power consumption and fusing information
Date:	December 1, 2003
Document:	SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number:	MN/SDM300L3.EF0
Collating Instructions:	Attach this page to page xix

Comments:

The following changes provide updated information for page xix and Section 3.2.10. This information will be incorporated into the next revision.

Change Specifics:

ELECTRICAL SAFETY

The SDM-300L3 Satellite Modem has been shown to comply with the following safety standard:

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

The equipment is rated for operation over the range 85 to 264 volts AC. It has a maximum power consumption of 55 watts without BUC power supply. Input power increases to 175W with 100W, 24V BUC power supply at maximum load. Input power increases to 230W with 150W, 48V BUC power supply at maximum load.

FUSES

The SDM-300L3 Satellite Modem is fitted with two fuses, one each for line and neutral connections. These are contained within the body of the IEC power connector, behind a small plastic flap.

- Use T3.15A, 20mm fuses.

IMPORTANT

For continued operator safety, always replace the fuses with the correct type and rating.

3.2.10 AC Power Connector

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

Input Power	55W maximum, 40W typical without BUC power supply.
Input Voltage	90 to 132 or 175 to 264 VAC Unit switches ranges automatically
Connector Type	I.E.C
Fuse Protection	T3.15A 20 mm type fuses Line and neutral fusing

Errata G

Comtech EF Data Documentation Update

Subject: Changes baud rates for remote control port.

Date: December 1, 2003
Document: SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number: MN/SDM300L3.EG0
Collating Instructions: Attach this page to page A-1

Comments:

The following changes provide updated information for page A-1. This information will be incorporated into the next revision.

Change Specifics:

A.1 General

Remote controls and status information are transferred via an EIA-485 or EIA-232 serial communications link menu selection.

Commands and data are transferred on the remote control communications link as US ASCII-encoded character strings.

The remote control port baud rates can be selected from 110 to **19200** kbps.

Note: 38400 kbps is used for Reflash of unit

The remote communications link is operated in a half-duplex mode.

Communications on the remote link are initiated by a remote controller or terminal. The modem never transmits data on the link unless it is commanded to do so.

The modem must be placed in Remote Mode by entering the REM command prior to performing a configuration change.

Errata H

Comtech EF Data Documentation Update

Subject: Add Burst Modulator Operation

Date: December 1, 2003
Document: SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number: MN/SDM300L3.EH0
Collating Instructions: Attach this page to page 1-1

Comments:

The following changes provide updated information for page 1-1. This information will be incorporated into the next revision.

Change Specifics:

The SDM-300L3 Satellite Modem is designed to meet the requirements of the Satellite Digital Communications industry. The SDM-300L3 Satellite Modem is a high performance, full duplex modem compliant with IESS-308/309/310, FDC, and V.35 specifications, but also adds significant other features in Closed Network modes. It offers variable data rates from 2.4 kbps to 5.0 Mbps, in BPSK, QPSK, OQPSK, and 8PSK. Viterbi, Sequential, concatenated Reed-Solomon (RS), Trellis Coded Modulation (TCM), and Turbo Product Coding (TPC) are provided as Forward Error Correction (FEC) options. EIA-232, EIA-422, G.703, and V.35 (25-pin) interface types are available. The range of IF frequency simultaneously covers 950 to 1750 MHz.

Burst Modulator Operation: 19.2 kbps and/or 57.6 kbps 1/2 rate QPSK

Errata J

Comtech EF Data Documentation Update

Subject: Added Burst Mode Rate Ranges to Data Rate Table

Date: December 1, 2003
Document: SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number: MN/SDM300L3.EJ0
Collating Instructions: Attach this page to page 4-9

Comments:

The following changes provide updated information for page 4-9. This information will be incorporated into the next revision.

Change Specifics:

Code Rate	Data Rate Range
Non-Turbo Requirements	
BPSK 1/2	2.4 to 1250 kbps
{O}QPSK 1/2	4.8 to 2500 kbps
{O}QPSK 3/4	7.2 to 3750 kbps
QPSK 7/8	8.4 to 4375 kbps
8PSK 2/3	64.0 to 5000 kbps
BPSK 1/1	4.8 to 2500 kbps
{O}QPSK 1/1	9.6 to 5000 kbps
Turbo Requirements	
BPSK 21/44	2.4 to 1193.181 kbps
BPSK 5/16	2.4 to 781.25 kbps
{O}QPSK 1/2	4.8 to 2386.363 kbps
8PSK 3/4	384 to 5000 kbps
Burst Mode Data Ranges	
BPSK 5/16	2.4 to 781.25 kbps
{O}QPSK 1/2	4.8 to 2386.363 kbps
8PSK 3/4	384 to 5000 kbps

Errata K

Comtech EF Data Documentation Update

Subject: Added Burst Mode Rate Ranges to Data Rate Table

Date: December 1, 2003
Document: SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number: MN/SDM300L3.EK0
Collating Instructions: Attach this page to page 4-62

Comments:

The following changes provide updated information for page 4-62. This information will be incorporated into the next revision.

Change Specifics:

Code Rate	Data Rate Range
Non-Turbo Requirements	
BPSK 1/2	2.4 to 1250 kbps
{O}QPSK 1/2	4.8 to 2500 kbps
{O}QPSK 3/4	7.2 to 3750 kbps
QPSK 7/8	8.4 to 4375 kbps
8PSK 2/3	64.0 to 5000 kbps
BPSK 1/1	4.8 to 2500 kbps
{O}QPSK 1/1	9.6 to 5000 kbps
Turbo Requirements	
BPSK 21/44	2.4 to 1193.181 kbps
BPSK 5/16	2.4 to 781.25 kbps
{O}QPSK 1/2	4.8 to 2386.363 kbps
8PSK 3/4	384 to 5000 kbps
Burst Mode Data Ranges	
BPSK 5/16	2.4 to 781.25 kbps
{O}QPSK 1/2	4.8 to 2386.363 kbps
8PSK 3/4	384 to 5000 kbps

Errata L

Comtech EF Data Documentation Update

Subject:	Updated Firmware Number and Version Number
Date:	December 1, 2003
Document:	SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number:	MN/SDM300L3.EL0
Collating Instructions:	Attach this page to page A-1

Comments:

The following changes provide updated information for page A-1. This information will be incorporated into the next revision.

Change Specifics:

This appendix describes the remote control operation of the SDM-300L3.

Firmware number:	**FW/8460-1AR**
Software version:	**2.1.22**

Note: The firmware referenced in this manual may be an earlier version of the actual firmware supplied with the unit.

Errata M

Comtech EF Data Documentation Update

Subject: Add Burst Mode Requirements

Date: December 1, 2003
Document: SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number: MN/SDM300L3.EM0
Collating Instructions: Attach this page to page A-5

Comments:

The following changes provide updated information for page A-5. This information will be incorporated into the next revision.

Change Specifics:

Modulator Rate Preset Assignment	Command: Response: Status: Response:	<add/AMRx_nnnn_mmmm.mmm'cr' >add/AMRx_nnnn_mmmm.mmm'cr''lf'] <add/AMRx_'cr' >add/AMRx_nnnn_mmmm.mmm'cr''lf']	Where: x = A, B, C, D, or V [preset designator]. nnnn = 1/2 (QPSK 1/2 Turbo and non-Turbo), [coder rate], 3/4 (QPSK 3/4 Turbo and non-Turbo), 7/8 (QPSK 7/8), BP12 (BPSK 1/2), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2Turbo and non-Turbo), OQ34 (OQPSK 3/4 Turbo and non-Turbo), OQ78 (OQPSK 7/8), BPSK (BPSK1/1 Turbo and non-Turbo), QPSK (QPSK 1/1 Turbo and non-Turbo), OQSK (OQPSK 1/1 Turbo, and non-Turbo), 2144 (BPSK 21/44 Turbo Only), B516 (BPSK 5/16 Turbo Only), and 8P34 (8PSK 3/4 Turbo Only). mmmm.mmm = Data rate in kHz. **Burst Mode = nnnn=1/2** **mmmm.nnn =19.2 or 57.6 kbps**
Modulator Rate Variable Assignment & Selection	Command: Response: Status:	<add/SMRV_nnnn_mmmm.mmm'cr' >add/SMRV_nnnn_mmmm.mmm'cr' RF_OFF'cr''lf'] See MR command.	Where: mmmm.mmm = Data rate in kHz. nnnn = 1/2 (QPSK 1/2 Turbo and non-Turbo), [coder rate], 3/4 (QPSK 3/4 Turbo and non-Turbo), 7/8 (QPSK 7/8), BP12 (BPSK 1/2), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2 Turbo and non-Turbo), OQ34 (OQPSK 3/4Turbo and non-Turbo), OQ78 (OQPSK 7/8), BPSK (BPSK1/1 Turbo and non-Turbo), QPSK (QPSK 1/1 Turbo and non-Turbo), OQSK (OQPSK 1/1 Turbo, and non-Turbo), 2144 (BPSK 21/44 Turbo Only), B516 (BPSK 5/16 Turbo Only), and 8P34 (8PSK 3/4 Turbo Only). mmmm.mmm = Data rate in kHz. **Burst Mode = nnnn=1/2** **mmmm.nnn =19.2 or 57.6 kbps** Note: Setting the modulator turns off the RF transmitter.

Errata N

Comtech EF Data Documentation Update

Subject: Add Transmit Mode Selection

Date: December 1, 2003
Document: SDM-300L3 Satellite Modem Installation and Operation Manual, Rev. 0, dated August 1, 2002
Part Number: MN/SDM300L3.EN0
Collating Instructions: Attach this page to page A-15

Comments:

The following changes provide updated information for page A-15. This information will be incorporated into the next revision.

Change Specifics:

Transmit Mode Selection	Command: Response: Status: Response:	<add/TXM_xxxxx'cr' >add/TXM_xxxxx'cr''lf] <add/TXM_'cr' >add/TXM_xxxxx'cr''lf']	This command configures the modem receiove side to operate in burst mode or continuous mode. Where: xxxxx = Burst or CONT (Continuous)

SDM-300L3

Satellite Modem
Installation and Operation Manual

Comtech EF Data is an ISO 9001
Registered Company.

Part Number MN/SDM300L3.IOM
Revision 0
August 1, 2002

Comtech EF Data, 2114 West 7th Street, Tempe, Arizona 85281 USA, (480) 333-2200, FAX: (480) 333-2161.

Customer Support

Contact the Comtech EF Data Customer Support Department for:

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

A Customer Support representative may be reached at:

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

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

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

service@comtechefdata.com

Contact us via the web at www.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.)

For more information regarding the warranty policies, see, p. xix.

Table of Contents

Figures

Tables

About this Manual

This manual provides installation and operation information for the Comtech EF Data SDM-300L3 satellite modem. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the SDM-300L3.

Related Documents

The following documents are referenced in this manual:

- *Comtech EF Data UB-530 Universal Breakout Panel Installation and Operation Manual*

Conventions and References

Cautions and Warnings

CAUTION

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

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

IMPORTANT

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

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

ELECTRICAL SAFETY

The SDM-300L3 Satellite Modem has been shown to comply with the following safety standard:

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

The equipment is rated for operation over the range 85 to 264 volts AC. It has a maximum power consumption of 60 watts.

FUSES

The SDM-300L3 Satellite Modem is fitted with two fuses, one each for line and neutral connections. These are contained within the body of the IEC power 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.

IMPORTANT

For continued operator safety, always replace the fuses with the correct type and rating.

Environmental

The SDM-300L3 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.

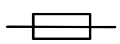
Installation

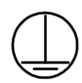
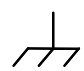
The installation and connection to the line supply must be made in compliance to local or national wiring codes and regulations.

The SDM-300L3 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 SDM-300L3 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
~	Alternating Current
	Fuse

Symbol	Definition
	Protective Earth
	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 SDM-300L3 Satellite 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 SDM-300L3 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

IMPORTANT

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

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

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

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

Warranty Policy

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

For equipment under warranty, the 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.

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Chapter 1. INTRODUCTION

The SDM-300L3 Satellite Modem is designed to meet the requirements of the Satellite Digital Communications industry. The SDM-300L3 Satellite Modem is a high performance, full duplex modem compliant with IESS-308/309/310, FDC, and V.35 specifications, but also adds significant other features in Closed Network modes. It offers variable data rates from 2.4 kbps to 5.0 Mbps, in BPSK, QPSK, OQPSK, and 8PSK. Viterbi, Sequential, concatenated Reed-Solomon (RS), Trellis Coded Modulation (TCM), and Turbo Product Coding (TPC) are provided as Forward Error Correction (FEC) options. EIA-232, EIA-422, G.703, and V.35 (25-pin) interface types are available. The range of IF frequency simultaneously covers 950 to 1750 MHz.

SDM-300L3 Satellite Modem

Refer to Figure 1-1 for a system block diagram.

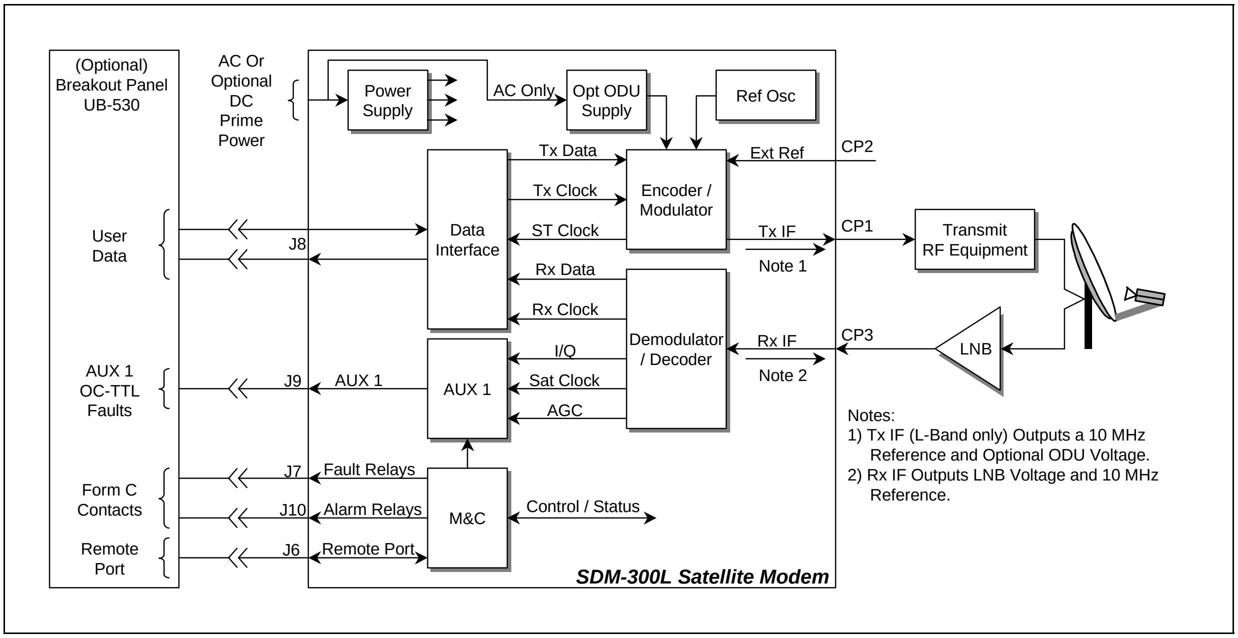

Figure 1-1. Block Diagram

Notes:

1. The UB-530 universal breakout panel (BOP) is an option for V.35, G703, EIA-232, and EIA-422.
2. When the modem is equipped with a 50-pin data I/O connector, the use of the BOP is required to interface the customer data connector to the modem.
3. Contact Comtech EF Data for information concerning universal breakout panels.

1.1 Overview

The SDM-300L3 utilizes advanced technology and digital signal processing techniques. This design eliminates circuitry to perform modem signal processing, resulting in higher reliability. The following lists the unit's features:

- 2.4 kbps to 5.0 Mbps
- Fully Accessible System Topology (FAST)
- Closed Network Capability
- Automatic Uplink Power Control (AUPC)
- Asynchronous (ASYNC) Channel Unit Overhead
- Reed-Solomon
- Turbo Product Coding
- FAST Acquisition
- Built-In Test
- BPSK, QPSK, OQPSK, and 8PSK
- BUC FSK Communications

1.2 Options Summary

A summary of the available options for the unit is provided. Contact Comtech EF Data Customer Support for upgrade information.

Option	Description & Comments	Availability	Install Option
Single Data/Code Rate		Yes	FAST
Low Rate Variable	≤ 512 kbps	Yes	FAST
Full Rate Variable	≤ 5.0 Mbps	Yes	FAST
OQPSK		Yes	FAST
8PSK	Requires Viterbi, Reed-Solomon Codec. Overhead card required for Open Network.	Yes	User
TX/RX L-Band ± 0.02 ppm	L-Band Modem with high stability reference.	Standard	Factory
TX only, L-Band ± 0.02 ppm	Hardware limited with high stability reference.	Yes	Factory
RX only, L-Band ± 1.0 ppm	Hardware limited with 1 ppm reference	Yes	Factory
TX/RX L-Band ± 1.0 ppm	L-Band modem with 1 ppm reference	Yes	Factory
Sequential or Viterbi Codec	Modem can be supplied with either: Viterbi, Sequential	Yes	FAST
TX Reed-Solomon Codec	Concatenates with Viterbi	Yes	User
RX Reed-Solomon Codec	Concatenates with Viterbi	Yes	User
Turbo Codec	Requires Reed-Solomon Codec removal.	Yes	User
Asymmetrical Loop Timing (SCT)		Yes	FAST
Asynchronous (Async/AUPC) Interface with 50 pin D Connector	Requires Overhead Card. Includes automatic uplink power control (AUPC)	Yes	User
AUPC (No ASYNC)	Requires Reed-Solomon cards	Yes	User or FAST
2xADPCM Voice (included with IBS or IDR)	Two voice channels in a 64 kbps IBS channel. Requiring Overhead card	Yes	User

Option	Description & Comments	Availability	Install Option
G.703 Interface. Note, For BNC or 15 pin D interface see UB-530 breakout panels.	Requires Overhead Card with 50 pin D Connector	Yes	User
G.703/ASYNC, Closed Network only	BNC-F connectors and ASYNC. Requires Overhead card	Yes	User
37-Pin Female D Connector	EIA-422/EIA-449 Interface and Mil-188-114	Yes	User
25-Pin Female D Connector	EIA-530 (RS-422), EIA-232 and V.35	Yes	User
34-Pin Female V.35	"Winchester" Connector with V.35	Yes	User
50-Pin Female D Connector for use Without Overhead card.	Includes EIA-422, EIA-232, and V.35 Use with redundancy switches	Yes	User
IBS Interface	Requires Overhead Card	Yes	User
IDR Interface	Requires Overhead Card	Yes	User
Drop & Insert Interface	Requires Overhead Card	Yes	User
Primary Power: Auto-ranging AC 85 to 264 VAC		Yes	Factory
Primary Power: 48 VDC (Modem only, No BUC)		Yes	Factory
ODU DC Power: 24V or 48V. Primary input = AC Only	100W @ 24V 150W @ 48V	Yes	Factory

1.3 Comtech EF Data Part Numbers

Part No.	Description	Remarks
PL/9066-3	RX only IF 1.0 ppm	Use with internal reference LNBs. Hardware limited version.
PL/9066-2	TX only IF 0.02 ppm	Hardware limited version
PL/9066-1	TX/RX IF 0.02 ppm	Full Duplex
PL/9066-5	TX/RX IF 1.0 ppm	Full Duplex (No BUCs)
PL/5727-1	25-pin EIA-530	Interface
PL/6031-1	37-pin EIA-449	Interface
PL/5305-2 PL/5509-2	50-pin	Interface With Overhead
PL/6167-1	50-pin	Interface No Overhead
PL/6032-1	34-pin	Interface V.35
PL/5305-2 PL/7838-1	G.703/ASYNC	Interface with Overhead Closed Network
PL/6284	TX Reed-Solomon	
PL/6285	RX Reed-Solomon	
PL/9394-1	TX/RX Turbo	
PS/AC65W01P01	90-264 VAC Modem PS	Modem only
PS/DC-DC5V65W	-48 VDC Modem PS	Modem only
KT/9567-2	90 – 264 VAC, 100W BUC P/S, 24V, CE Mark	24 VDC, 100W AC BUC Power Supply
KT/9567-3	90 – 264 VAC, 150 W BUC P/S, 48 VDC	48 VDC 150 W AC BUC Power Supply

1.4 FAST Accessible Options

Comtech EF Data FAST system allows immediate implementation of different options through the user interface keypad. Some FAST options are available through the basic platform unit, while others require that the unit be equipped with optional hardware or that the hardware be installed in the field. Refer to Table 1-1 for a listing of possible configurations.

The options available through the FAST architecture include:

- ASYNC/AUPC
- Viterbi Decoder
- Sequential Decoder
- 8PSK
- IDR *
- Reed-Solomon*
- 2xADPCM Voice
- Asymmetrical loop timing
- G.703 operation
- Variable data rates
- IBS*
- D&I
- OQPSK

* Optional hardware required.

Table 1-1. FAST Options and Required Configurations

HARDWARE	Single Data Rate	Low Variable Data rate(up to 512 k/bits)	High Variable Data rate (up to 4.375 M/bits)	Sequential Decoder	Viterbi Decoder	Asymetrical Loop Timing	BUC FSK; DISEQ	OQPSK	8 PSK	Reed-Solomon CODEC (Note 4)	ASYNC/AUPC Overhead	Open Network (IDR/IBS)	Drop and Insert	Turbo CODEC (Note 4)	G.703 Interface	2 x ADPCM Voice in 64 kbps
Basic Platform SDM-300L3	X			X (Note 1)	X (Note 1)		X									
FAST Option		X	X	X	X	X		X	X							
FAST Option with Reed-Solomon hardware										X						
FAST Option with Overhead hardware											X	X	X		X (Note 2)	X (Note 3)
Option withTurbo hardware														X		

Notes:

1. The basic modem is shipped with either Sequential or Viterbi decoder.
2. Requires G.703 Interface module and Overhead card.
3. Either IBS Option or IDR option includes 2xADPCM voice in 64 kbps IBS.
4. Either Reed-Solomon or Turbo Codec is installed, not both.

1.5 Compatibility

The SDM-300L3 is functionally compatible with many Comtech EF Data modems. When properly configured, the unit will interoperate with the following Comtech EF Data modems:

- CDM-550/550T (Turbo only)
- CDM-600 (Open Network and Turbo only)
- SDM-100/100A
- SDM-300/300A
- SDM-650B
- SDM-6000
- SDM-8000

1.6 Description of the Modulator

1.6.1 Overview

The modulator provides PSK modulated carriers within the 950 to 1750 MHz range. The types of modulation that encode the transmitted baseband data from the interface PCB are:

- BPSK
- QPSK
- OQPSK
- 8PSK

1.6.2 Description

The modulator is composed of eight basic subsections. These subsections are divided into the baseband processing section and the RF section of the modulator. The modulator controls all programmable functions on this module. Fault information from the modulator is sent to the M&C. Refer to Chapter 9 for a list of reported faults.

The major modulator subsections are:

- Scrambler/Differential Encoder
- Convolutional Encoder
- Programmable Vector Rotation
- I/Q Nyquist Filters
- Modulator
- RF Synthesizer
- Output Amplifier
- Output Level Control

If the modem is so equipped, the optional overhead or Reed-Solomon PCB first processes the data. The data is then sent to the scrambler for energy dispersal, and then to the differential encoder. The differential encoder is a 2-bit encoder, which allows for resolution of two of the four ambiguity states of the QPSK or OQPSK demodulator.

The data is sent to the convolutional encoder for encoding the baseband data. The code rates 1/2, 3/4, 7/8, and 2/3 are based on the symbol rate range of 2.4 kbps to 2.5 Mbps. For Viterbi codes, the convolutional encoder encodes the data at 1/2 rate. If the selected code rate is 3/4, then 2 of every 6 symbols are punctured. For 3 bits in, there are 4 symbols out.

- For Sequential codes, the convolutional encoder generates the parity bits from the input data stream, which allows for error correction at the far end of the link. The rate of the encoder may be 1/2, 3/4, and 7/8.

For example, the 7/8 rate puts out 8 symbols for every 7 bits in. In {O}QPSK mode, the data is split into two separate data streams to drive the I and Q channels of the modulator.

The baseband processing for the SDM-300L3 is the same as for the SDM-300L1 and SDM-300A modulator except that the digital modulation is not used. Instead, the baseband Nyquist filtered I and Q signals pass through D/A converters to drive an analog vector modulator.

The local oscillator input to the vector modulator is a single loop synthesizer incorporating a Direct Digital Synthesis (DDS) chip to accommodate 100 Hz steps over the range of 950 to 1750 MHz. The modulator output then passes through amplifiers and AGC incorporating programmable output level control and switched low pass filters for harmonic attenuation.

1.6.3 Description 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.

1.6.4 BPSK Encoding

The modulator converts transmitted baseband data into a modulated BPSK carrier at 2.4 kbps to 1.25 Mbps (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.
Uncoded (1/1 rate) BPSK operation also is allowed from 4.8 kbps to 2.5 Mbps.

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

1.6.5 QPSK Encoding

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

- 4.6 kbps to 5.0 Mbps (1/1 rate, uncoded)
- 4.8 kbps to 2.5 Mbps (1/2 rate)
- 7.2 kbps to 3.75 Mbps (3/4 rate)
- 8.4 kbps to 4.375 Mbps (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 1/1, 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	1.33	1.5
7/8	1.143	1.75

1.6.6 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

1.6.7 8PSK Encoding

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

- 64 kbps to 5.000 Mbps (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

1.7 Description of the Demodulator

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

1.7.1 Overview

The demodulator converts PSK modulated carriers within the 950 to 1750 MHz range to a demodulated baseband data stream. The converted modulation types are BPSK, QPSK, OQPSK, and 8PSK. The demodulator then performs FEC decoding on the data stream to produce the error corrected data output to the data interface.

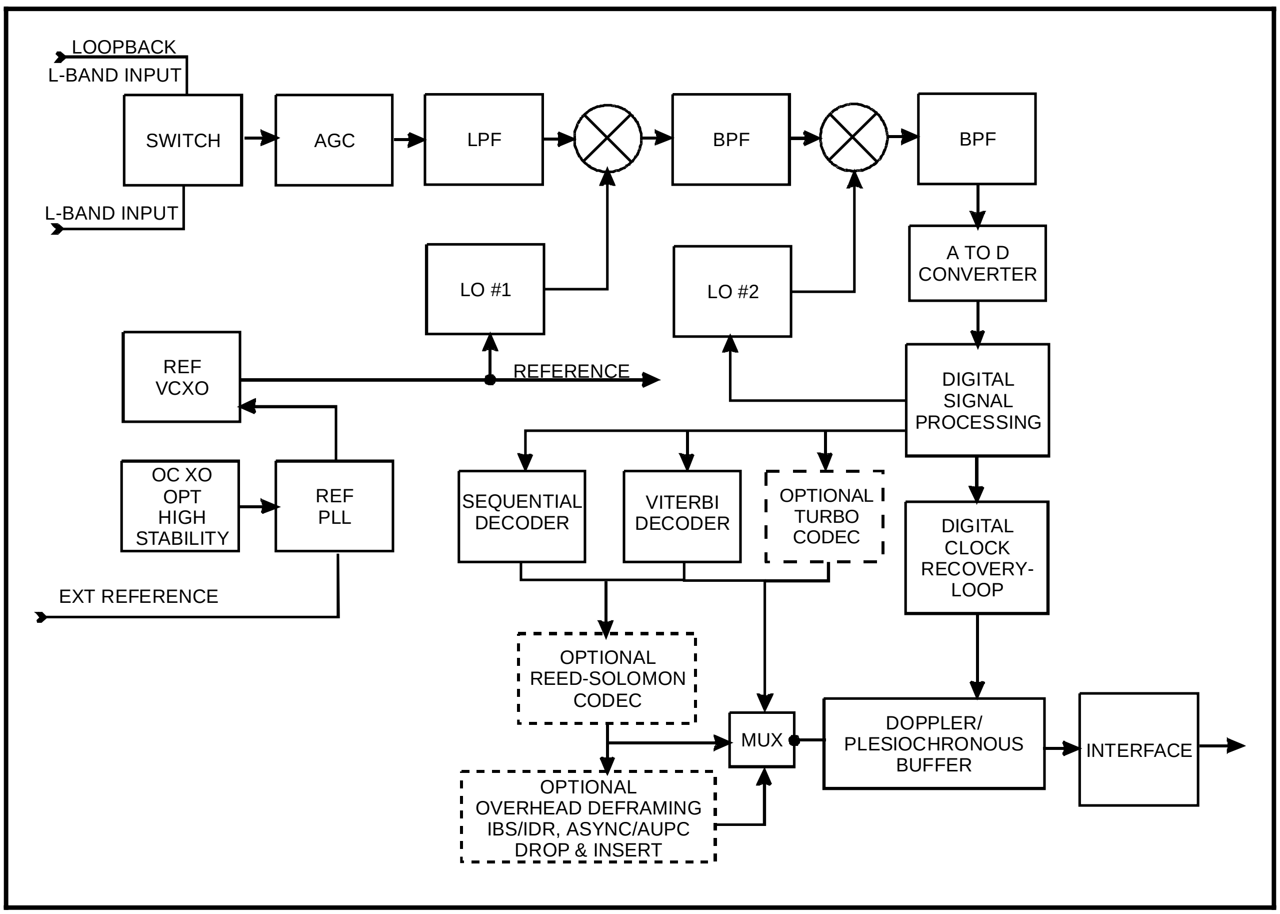

Figure 1-2. Demodulator Block Diagram

1.7.2 Functional Description

The demodulator functions as an advanced, digital, coherent-phase-lock receiver and decoder. Demodulator faults also are reported to the front panel. The demodulator consists of the following basic subsections.

- Digital Costas Loop
- RF Section
- Automatic Gain Control
- Analog-to-Digital (A/D) Converter
- Soft Decision Mapping
- Programmable Vector Rotation
- Digital Nyquist Filters
- FEC Decoder
- Digital Clock Recovery Loop
- Decoder

The modulated IF signal at 950 to 1750 MHz enters the RF module for conversion to an IF frequency. The IF is then sampled by an A to D converter and digitally demodulated. The I and Q data is then sent to the digital Nyquist filters, resulting in a filtered, digital representation of the received signal. The digital data is then sent to four separate circuits:

- Automatic Gain Control
- Carrier Recovery (Costas) Loop
- Clock Recovery Loop
- Soft Decision Mapping

The AGC provides a gain feedback signal to the RF section. This closed loop control ensures that the digital representation of the I and Q channels is optimized for the Costas and Clock loops, as well as the soft-decision mapping circuitry.

When the active decoder determines that the modem is locked, the M&C stops the sweep and begins the de-stress process. This involves fine tuning the DDS based on the phase error in the Costas loop. The de-stress process continues as long as the modem is locked. If the carrier is interrupted, the M&C resumes the sweep process.

The digital Costas loop, in conjunction with a Direct Digital Synthesizer (DDS), performs the carrier recovery function. The Costas loop consists of a Costas phase detector, loop filter, and DDS, all implemented digitally. The DDS performs the function of a Voltage-Controlled Oscillator (VCO) in an analog implementation, but can be easily programmed to the desired center frequency via the M&C. The output of the DDS is sent to the RF module and provides the reference to which the local oscillator is locked. The M&C sweeps the local oscillator (via DDS programming) through the user-specified sweep range.

The digital clock loop, in conjunction with another DDS, performs the clock recovery function. The clock loop consists of a phase detector, loop filter, and DDS, all implemented digitally. The DDS performs the function of a VCO in an analog implementation. The recovered data and symbol clocks are then used throughout the demodulator.

The soft decision mapper converts the digital I and Q data to 3-bit soft decision values. These values are then fed to the programmable vector rotation circuit, providing compatibility with spectrum reversal of the I and Q channels.

The output of the vector rotation circuit is then sent to the Viterbi decoder and optional Sequential decoder. The output is then sent to the optional Reed-Solomon or Overhead PCB. With the Turbo coding hardware option, the vector rotation circuit output is sent to the optional Turbo Codec for decoding.

1.8 Description of Monitor & Control

1.8.1 Overview

The Monitor & Control (M&C) monitors the modem and provides configuration updates to other modems within the modem when necessary. The modem configuration parameters are maintained in battery-backed RAM, which provides total recovery after power-down situation. The M&C functions include extensive fault and status reporting.

All modem functions are accessible through a local front panel interface and a remote communications interface.

A block diagram of the M&C is shown in Figure 1-3.

1.8.2 Functional Description

The M&C card is composed of the following subsections:

- Microcontroller with Universal Asynchronous Receiver/Transmitter (UART)
- Digital-to-Analog Converter (DAC)
- Read Only Memory (ROM)
- Analog-to-Digital Converter (ADC)
- Read Access Memory (RAM)
- Universal ASYNC
- User Interface
- Fault and Alarm Relays

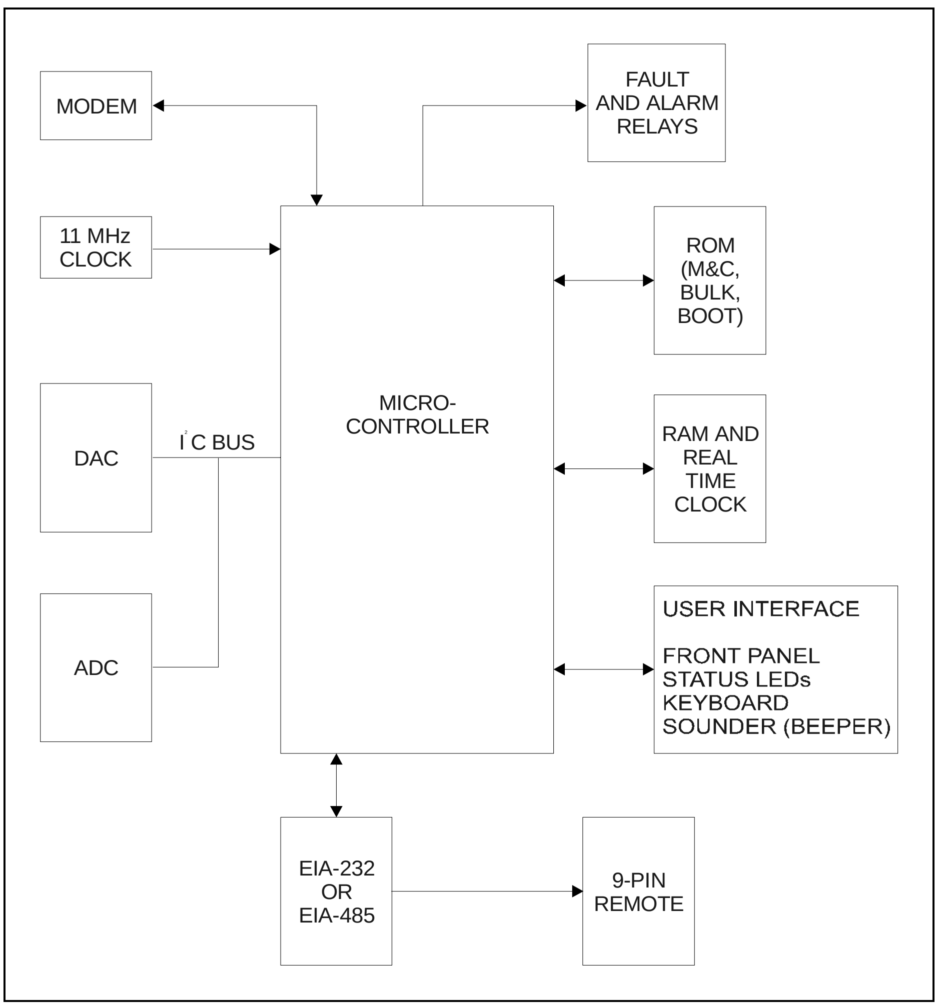

Figure 1-3. M&C Block Diagram

The heart of the M&C card is the Dallas 80C310 microcontroller operating at 11 MHz. This microcontroller contains 256 Kbytes of internal RAM. The ROM at U8 is 29F040 (512 Kbytes).

ROM access times must be equal to or greater than 150 ns. The RAM size can be 8 or 32 Kbytes. This RAM chip is internally battery-backed and contains a real time clock used by the M&C.

The non-volatile RAM on the M&C module allows the module to retain configuration information without prime power for 1 year (approximately). If the modem is powered down, the following sequence is carried out by the M&C microcontroller.

1. When power is applied to the M&C, the microcontroller checks the non-volatile memory to see if valid data has been retained. If valid data has been retained, the modem is reconfigured to the parameters maintained by the RAM.

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

The UART supports serial ASYNC communications channels (remote port) with a maximum data rate of 19200 bit/s. The UART is a built-in peripheral of the microcontroller. The communications type can be EIA-232, EIA-485 (2-wire), EIA-485 (4-wire), and software selectable.

The DAC supplies a voltage that controls the contrast of the display. The ADC monitors all the voltages from the power supply. The DAC and ADC are mapped to the microcontroller with an Integrated Circuit (IC) bus.

The user interface includes the following parts:

- Front panel
- Status LEDs
- Keyboard
- Sounder (beeper)

All functions are memory-mapped to the microcontroller.

1.9 Dimensional Envelope

Refer to Figure 1-2 for the unit's dimensional envelope drawing.

Note: Dimensions are listed in inches and centimeters are in parentheses.

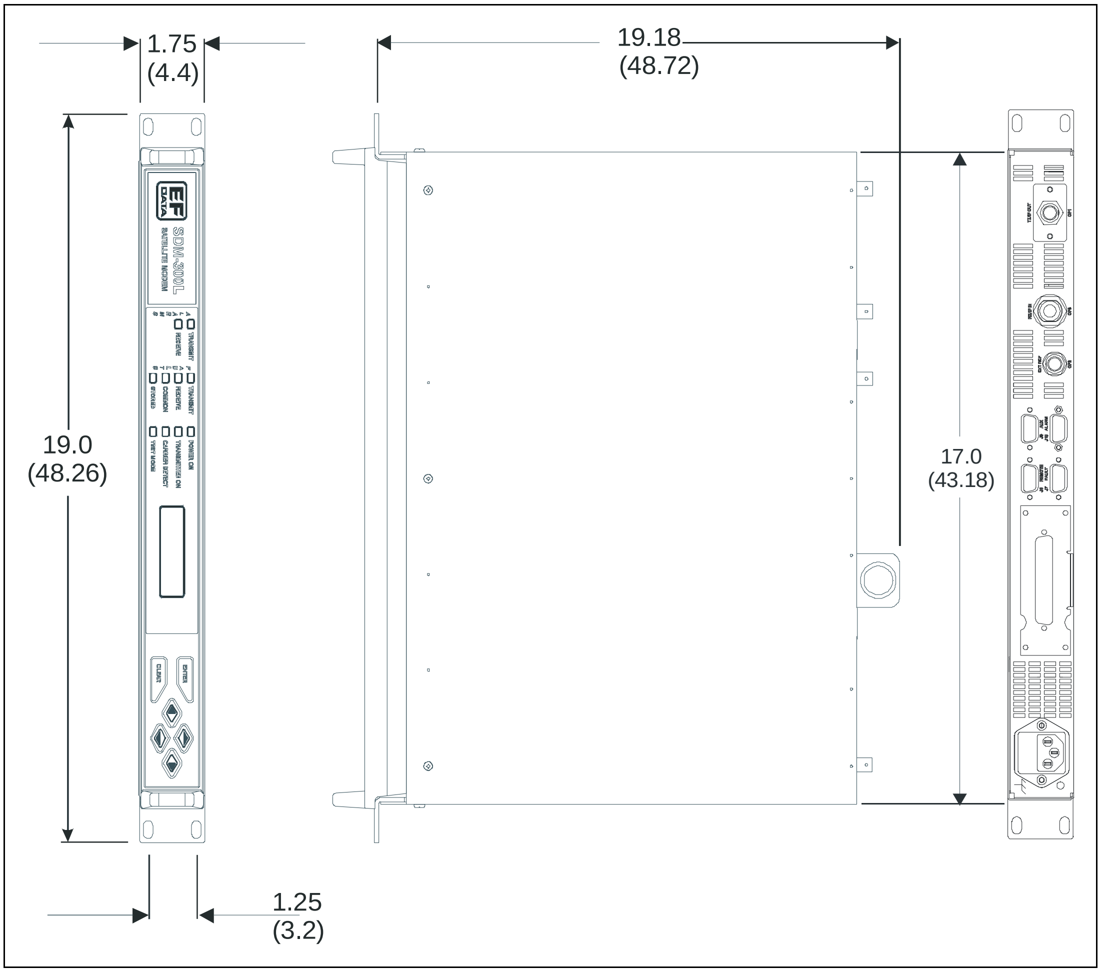

Figure 1-4. Dimensional Envelope Drawing

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2.0 INSTALLATION/ UPGRADES

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 into the container and cause damage to the modem.

Unpack the modem:

1. Cut the tape at the top of the carton indicated by OPEN THIS END.
2. Remove the cardboard/foam space covering the modem and caddypacks.
3. Remove the modem, caddypacks, 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:

2.2.1 Modem Installation (Optional)

Refer to Figure 2-1. Use the following mounting kit KT/6228-1.

OPTIONAL: MOUNTING KIT, KT/6228-1 (MODEM TO EQUIPMENT RACK)

QTY	Part Number	Description
2	FP/6138-1	Bracket, Rear Support
4	HW/10-32x1/2RK	Bolt, #10 Rack
2	HW/10-32X1/4 SHC	Screw, Socket 10-32 x 1/4inch

Tools Required:

Screw Driver	**Phillips**
5/32-inch	**SAE Allen Wrench**

1. Install the IDU rear support brackets as follows:

   a. Install provided rear support bracket onto the mounting rail of the rack. Fasten with provided bracket bolts.
   b. Fasten the provided #10 socket head screws to the rear-side mounting holes on either side of the chassis modem. Mount the modem into the equipment rack ensuring that the socket heads engage into the slots of the rear support brackets.

Note: It may be necessary to adjust the location of the rear mounting rails of the rack.

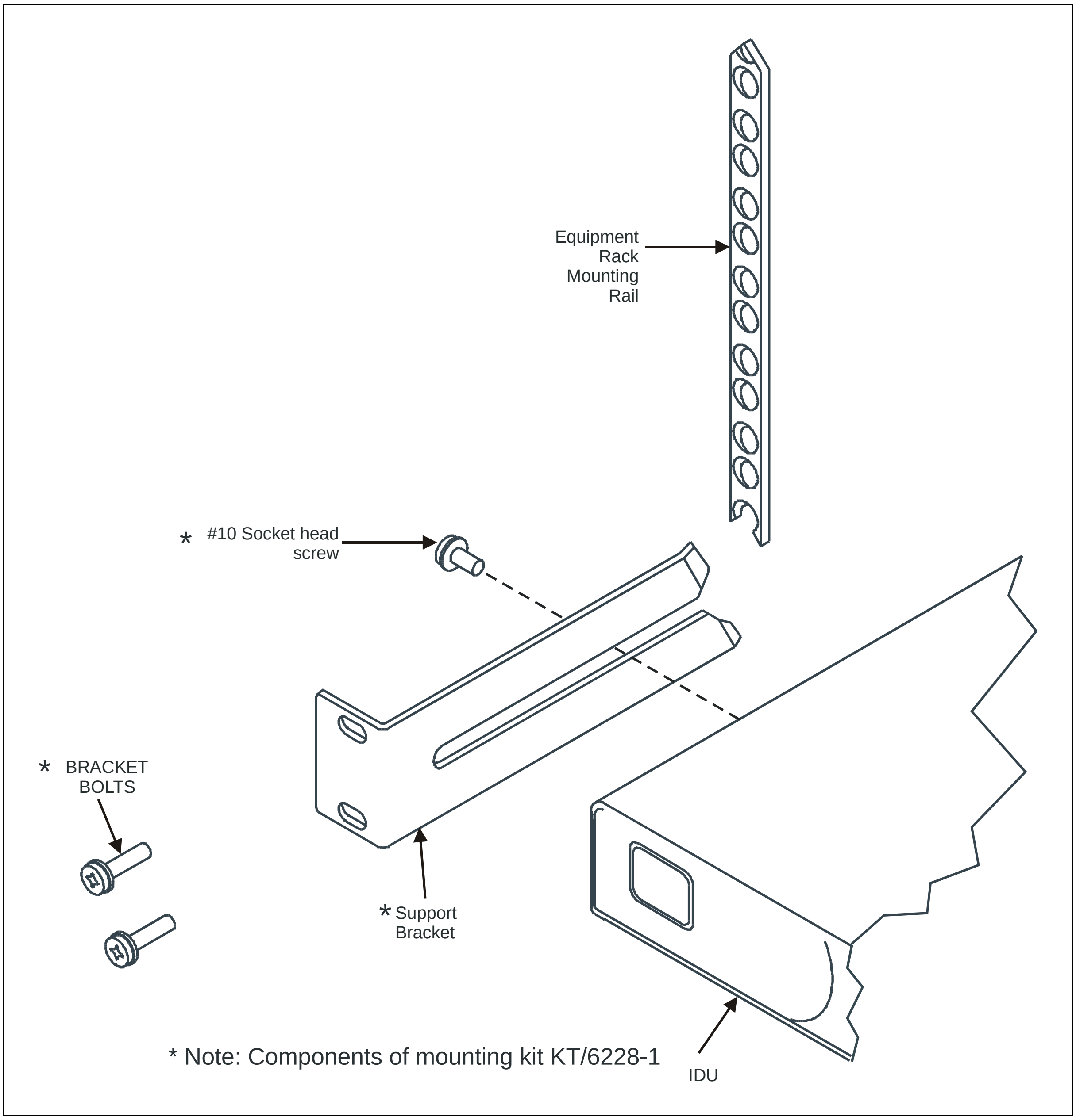


Figure 2-1. Installation of the Optional Mounting Bracket KT/6228-1

2.3 Software and Hardware Installation/Upgrades

2.3.1 Overhead Interface PCB Installation

The overhead interface PCB can be installed at the factory or in the field. The overhead interface PCB is required to access certain options and functionality of the modem. Observe the following:

- If the overhead interface PCB is installed at the factory, then the 50-pin interface relay card will be pre-installed or the G.703/ASYNC card.

- If the overhead interface PCB is installed in the field, then one of four connector/card combinations will have been shipped with the overhead interface PCB.

2.3.1.1 Installation

CAUTION

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

The following tool is required to install the overhead interface PCB:

Description	Application
Phillips ™ Screwdriver	To remove and replace cross-point screws.

Use the following information to install the overhead interface PCB as a daughter card on the main PCB. Refer to Figure 2-2 for the installation location of the overhead interface daughter card.

CAUTION

Turn the power off before installation. High current VDC is present. Failure to do so could result in damage to the modem components.

1. Turn off the modem and unplug the power supply.
2. Remove the rear panel retaining screws. Using the finger pulls, slide the main modem assembly out from the rear of the modem chassis.
3. Install the overhead interface PCB, face down, onto the main PCB by mating the male header connectors with the female header connectors in the position shown in Figure 2-2.
4. Align the overhead interface PCB standoffs with the main PCB mounting holes. Install the four mounting screws and washers.

CAUTION

The mounting hardware must be installed to provide proper grounding between the overhead interface PCB and the main PCB.

5. After completing the installation procedure turn on the modem. Select the desired modem option to use the overhead card.

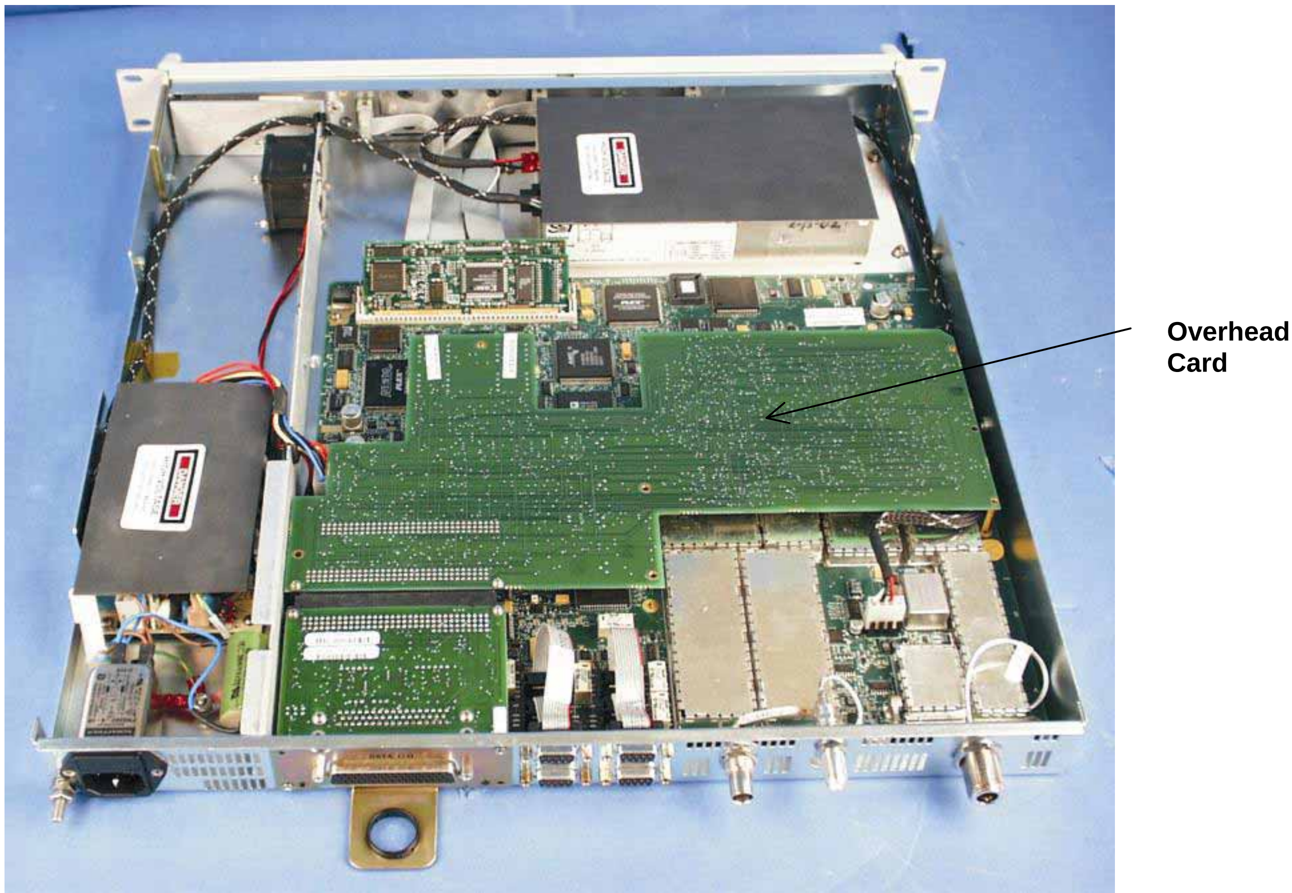


Figure 2-2. Overhead Interface PCB Installation

2.3.2 Reed-Solomon PCB

The TX/RX Reed-Solomon PCBs are installed in the same slots as the Turbo module.

CAUTION

Do not mix Reed-Solomon PCBs with Turbo PCB. Damage to the equipment may be the result.

2.3.2.1 Unpacking

CAUTION

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

1. Remove the Reed-Solomon PCB and mounting hardware from the cardboard caddypack and anti-static material.
2. Check the packing list to ensure the shipment is complete.
3. Inspect the Reed-Solomon PCB for any shipping damage.

2.3.2.2 Installation

The following tool is required to install the overhead interface PCB:

Description	Application
Phillips ™ Screwdriver	To remove and replace cross-point screws.

Use the following information to install the Reed-Solomon Codec PCB as a daughter card on the main PCB.

Refer Figure 2-3 for installation location of the Reed-Solomon daughter card.

CAUTION

Turn the power off before installation. High current VDC is present. Failure to do so could result in damage to modem components.

1. Turn off the modem and unplug the power supply.
2. Remove the rear panel retaining screws. Using the finger pulls, slide the main modem assembly out from the rear of the modem chassis.
2. Install the Reed-Solomon PCB to the main PCB by mating the male SIMM connectors with the female SIMM connectors in the position shown in Figure 2-3

4. After completing the above installation procedure turn on the modem. If the Reed-Solomon PCB was installed properly, the Utility Interface/Interface Module menu will display “OPT:Reed-Solomon” or “OPT:DI, Reed-Solomon” (if the D&I is also installed).

Reed-Solomon Cards (TX or RX in Either Slot)

Figure 2-3. Reed-Solomon Codec Installation

2.3.3 Turbo Codec Installation

The Turbo Card is installed in the same slots as the Reed-Solomon PCBs. While the Reed-Solomon uses two cards (TX and RX), the Turbo Codec uses only a single card.

CAUTION

DO not mix Reed-Solomon PCBs with Turbo PCs. Damage to the equipment may be the result.

2.3.3.1 Unpacking

CAUTION

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

1. Remove the Turbo Codec PCB and mounting hardware from the cardboard caddypack and anti-static material.
2. Check the packing list to ensure the shipment is complete.
3. Inspect the Turbo PCBs for any shipping damage.

2.3.3.2 Installation

The following tool is required to install the overhead interface PCB:

Description	Application
Phillips ™ Screwdriver	To remove and replace cross-point screws.

Use the following information to install the Turbo Codec PCB as a daughter card on the main PCB.

Refer Figure 2-4 for installation location of the Turbo Codec PCB.

CAUTION

Turn the power off before installation. High current VDC is present. Failure to do so could result in damage to modem components.

1. Turn off the modem and unplug the power supply.
2. Remove the rear panel retaining screws. Using the finger pulls, slide the main modem assembly out from the rear of the modem chassis.
3. If required: Card 1 Overhead Board Removal – Remove the four rear panel screws around the 50-pin I/O switch module. Unplug the I/O module, then remove the seven mounting screws holding the Overhead board and carefully lift the board out.

4. If required: Reed-Solomon Removal – Remove the Reed-Solomon boards from the SIMM sockets by pushing the spring clips outward while rocking the board vertically, then lift the board out.
5. Turbo Codec Installation - Align the Turbo board with either of the SIMM sockets while holding it vertically with components toward Rear panel. Seat the connector into the socket and tilt the board toward the Front Panel until the spring clips lock the board into place.
6. Replace the top cover and reinstall the two side screws.
7. Turn on the AC power. Modem will reinitialize.

Notes:

1. In this configuration, the Modem allows only Data Rates and Formats valid for Turbo.
2. Open-network modem types cannot be selected.

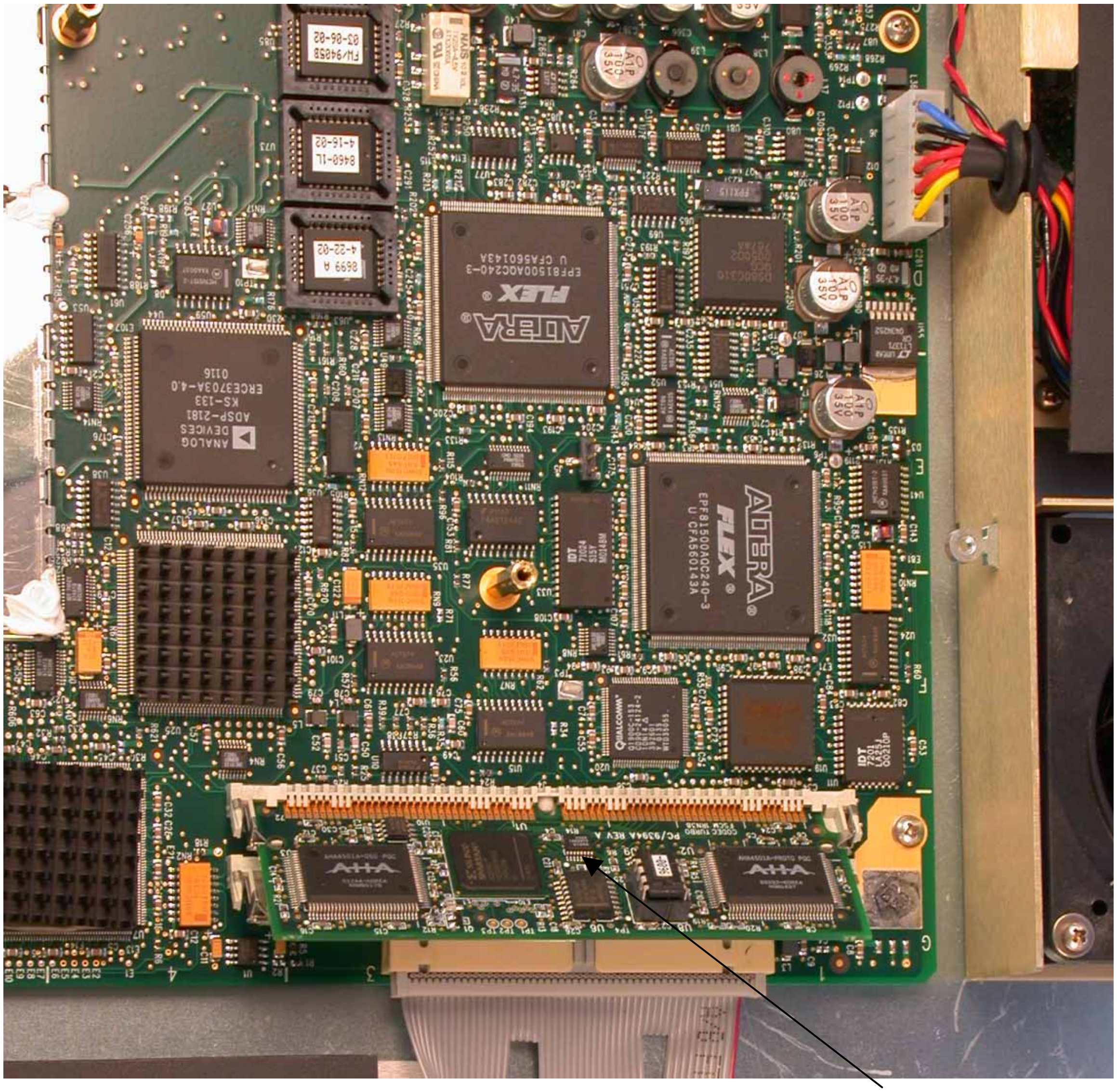


Figure 2-4. Turbo Codec Installation

2.4 Data I/O Interface Connector (J8) Removal/Installation

Note: The following procedures outline the removal and installation of the Data I/O connector (J8). These procedures are written with the assumption that the same configured connector will be reinstalled. However, the operator does have an option to install a different configured connector. Refer to Table 2-1 for a matrix explaining connector options.

Table 2-1. Connector (J8) Matrix

Modem Configuration	EIA-232	EIA-422/EIA449	V.35	Overhead
25-pin Connector	X	X	X	
34-pin Connector			X	
37-pin Connector		X		
50-pin Connector	X	X	X	X

To remove Data I/O Connector (J8), as follows:

1. (For Ribbon-Configured Connector PL/6031.) Remove Data I/O connector (J8) (Figure 2-5) as follows:

   a. Remove four screws securing the rear panel to the chassis.

   b. Pull out rear panel to gain access to disconnect connector (J8).

   c. Disconnect connector (J8) from the PCB.

   d. Remove the four screws securing connector (J8) to the rear panel.

   e. Remove the connector (J8).

2. Remove 50-pin Data I/O connector (J8) as follows:

   a. Remove the four screws securing the connector (J8) to the rear panel.

   b. Establish a grip on connector (J8) and pull backwards until separation of the connectors is obtained.

   c. Remove connector (J8).

To install Data I/O Connector (J8), as follows:

1. (For Ribbon-Configured Connector PL/6031.) Install Data I/O connector (J8) (Figure 2-5) as follows:

   a. Position connector (J8) in rear panel.

   CAUTION

   Use care when connecting the data I/O connector (J8) to the PCB. Damage to the connector pins may render the data I/O connector (J8) unserviceable. Misalignment can be the result.

   b. Connect connector (J8) to the PCB.

   c. Secure connector (J8) to the rear panel with four screws.

   d. Position the rear panel to mate with the chassis and secure with four screws.

2. Install 50-pin Data I/O connector (J8) as follows:

   CAUTION

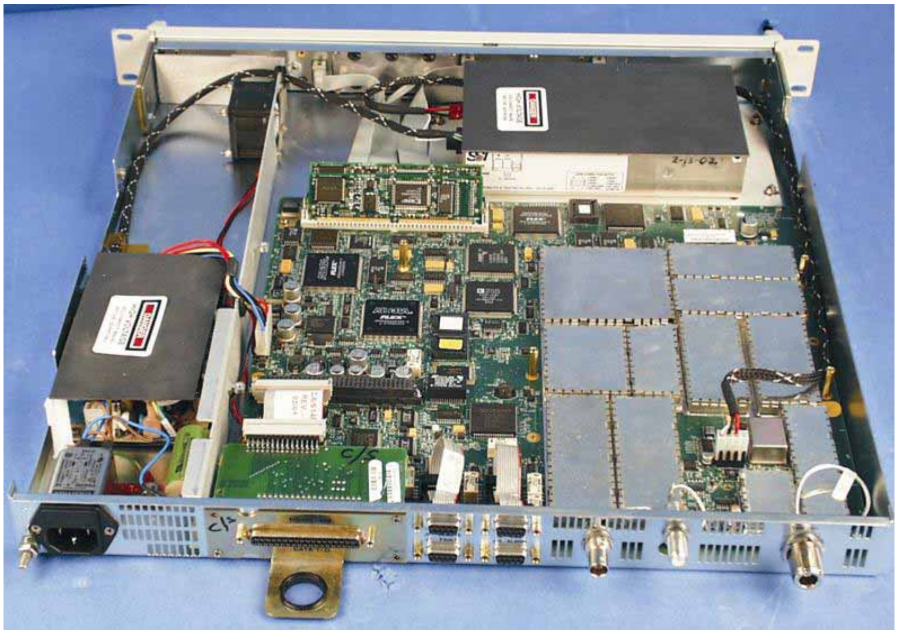
   Use care when connecting the Data I/O connector (J8) to the PCB. Damage to the connector pins may render the data I/O connector (J8) unserviceable. Misalignment can be the result.

   a. Connect connector (J8) to the PCB.

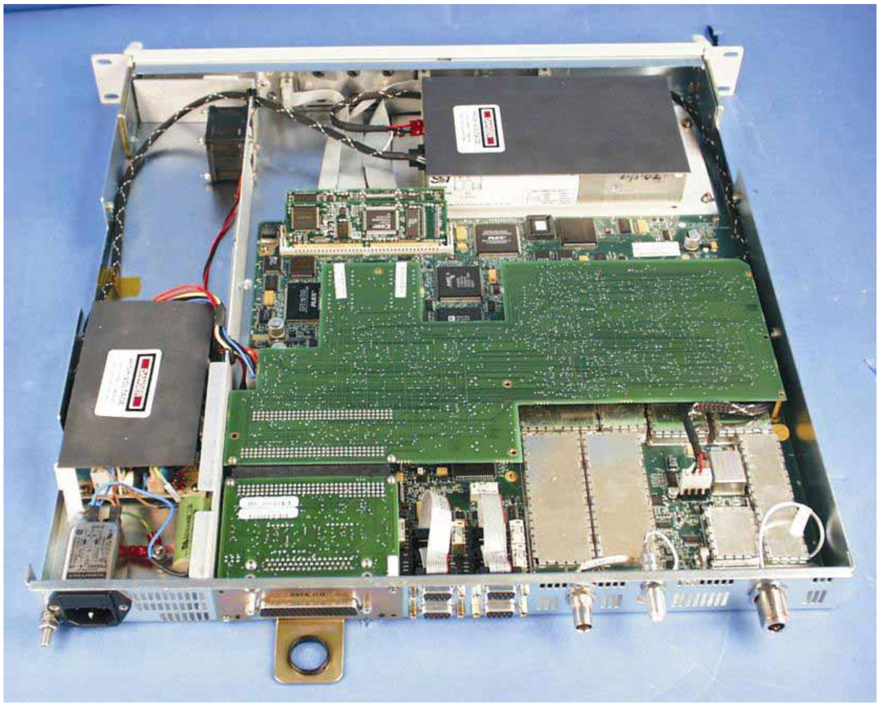
   b. Secure connector (J8) using four screws.

2.4.1 G.703/ASYNC Module

This module installs as the previous modules. Use the same installation steps. The G.703/ASYNC card requires the Overhead card.



For Ribbon-Configured Connector



For 50-Pin Connector with Overhead Interface Board

Figure 2-5. Data I/O Connector (J8) Removal/Installation

2.5 Hardware Upgrades

2.5.1 Main PCB Firmware Chips

The main PCB has one field-changeable flash memory chip for the M&C firmware. If necessary, this chip can be removed and a new chip added to allow for additional options, enhancements, or repairs. See Figure 2-6 for the locations of the field-changeable chips.

The bulk firmware for the FPGA downloads is stored in a non-replaceable flash memory device. Bulk firmware can be upgraded by reflashing the device through the remote control port as described in paragraph 2.7. The M&C firmware also can be upgraded by reflashing through the host por

2.5.2 Overhead Interface PCB Firmware Chips

The overhead interface PCB has four field-changeable firmware chips. If necessary, these chips can be removed and new chips added to allow for additional options, enhancements, or repairs. See Figure 2-7 for the locations of the field-changeable chips.

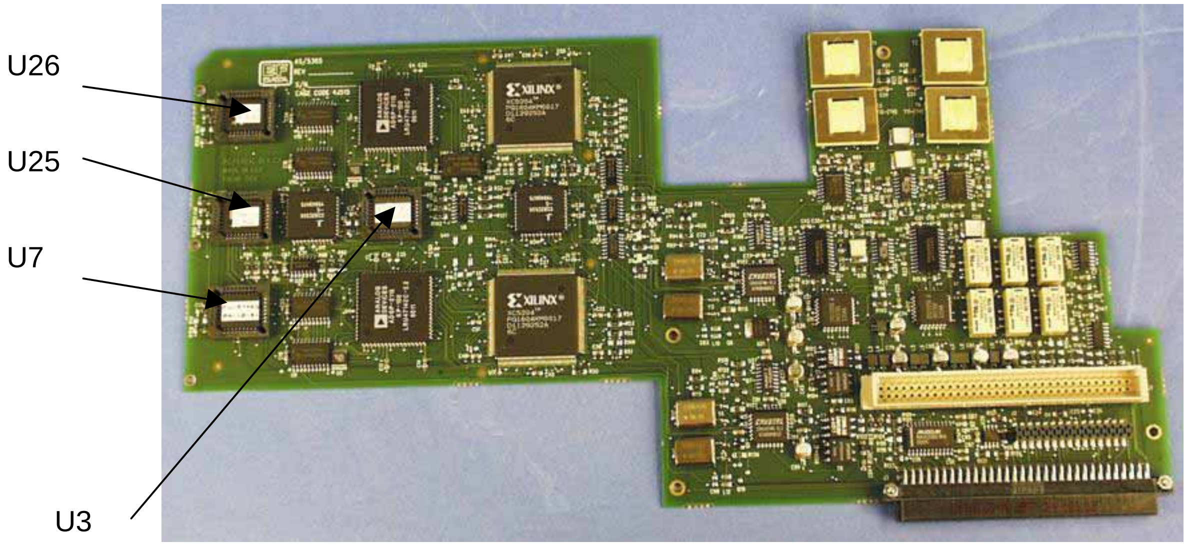


Figure 2-6. Overhead Board with Field-Changeable Chips

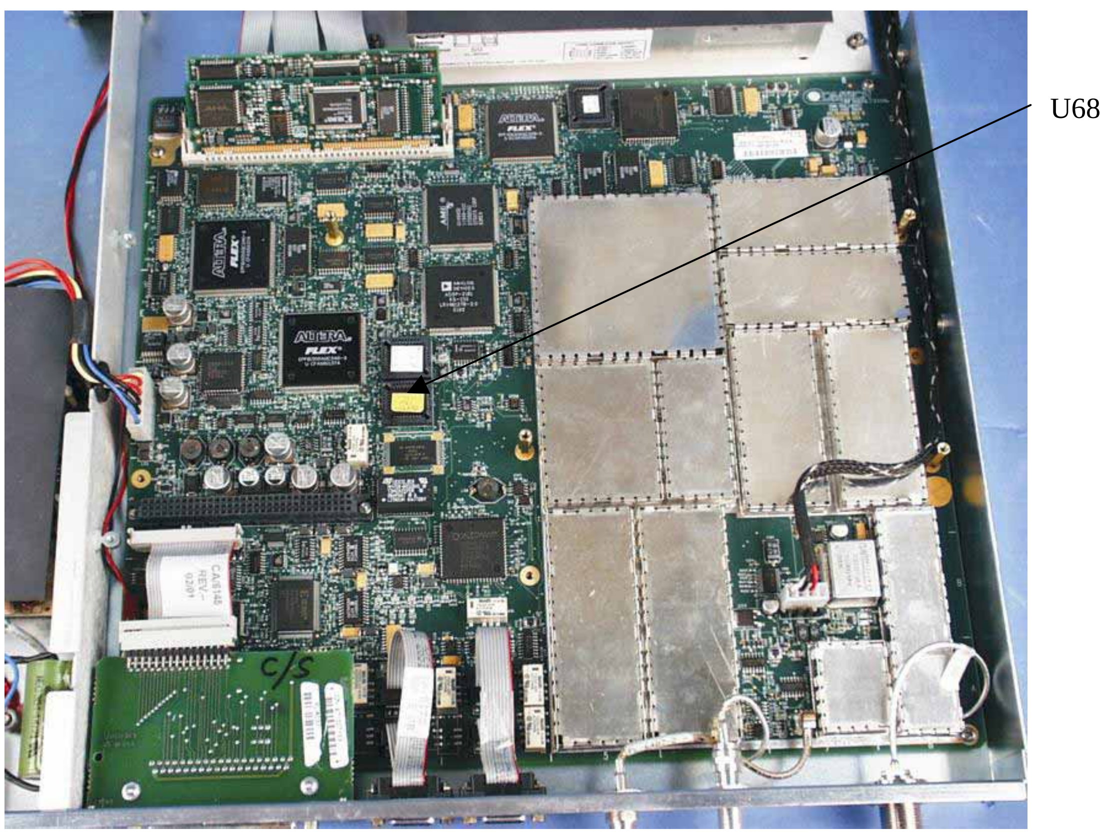


Figure 2-7. Main Board Field-Changeable Chips (Shown with Overhead Card Removed)

2.6 Flash Upgrading

The SDM-300L3 eliminates the need for physically replacing EPROMs to update firmware. Instead, the SDM-300L3 modem uses ‘flash memory’ technology internally, and new firmware can be uploaded to the unit from an external PC.

IMPORTANT

Performing a flash upgrade erases the non-volatile RAM, which is where the modem's configuration is stored. Users shall re-enter the desired configuration parameters.

The SDM-300L3 provides for flash upgrading the M&C firmware or the BULK firmware.

Note: While the M&C and BULK firmware downloads are independent processes, the modem may have to be upgraded to the latest releases of both the M&C and BULK for proper function.

Flash updating firmware is a simple process, and users can obtain updates by any of the following means:

- Download from the Comtech EF Data website: (http://www.comtechefdata.com)
- Request as E-mail attachments
- Request shipment on diskettes or cd-rom.

The upgrade is performed without opening the unit, by connecting the modem to the serial port of a computer and executing a flash uploader utility program.

The cable to connect the PC to the modem is the same as is used for normal EIA-232 remote control, and comprises three wires connected between two 9-pin ‘D’ type female connectors. Ensure this cable is connected and working properly before proceeding with a flash update.

WARNING

The Remote Control port EIA-232 lines used for Flash upgrading also are connected to the Primary 25-pin data connector (P3B), and are used when 1:N Redundancy Switch is connected. Ensure that NOTHING is connected to P3B pins 4, 21 and 22 – if these pins are used, the EIA-232 remote control port will not function, and Flash upgrading is impossible.

2.6.1 Downloading Flash Updates from the Web

The latest firmware releases and a free software utility are available on the Comtech EF Data web site (http://www.comtechefdata.com). This utility is designed to run under Windows 95/98 or Windows NT/2000/XP and provides all of the support required to perform a Comtech EF Data firmware reflash. If web downloading is not available or practical, contact the Customer Support department to obtain the firmware via an alternate method.

The downloadable firmware files are provided in both .zip or self extracting .exe formats. If your firewall does not permit downloading an .exe file, try the .zip file instead. The downloadable file contents are identical, usually comprising an uploader program, a help file, and a flashable data file.

2.6.1.1 How to Download Flash Upgrade Files

1. Create a new folder on the PC. This folder will be the destination folder for any flash upgrade files downloaded.
2. On the Comtech EF Data web site (http://www.comtechefdata.com/), click the "**downloads**" link.
3. Click the "**flash upgrades**" link for detailed downloading instructions.
4. Click the "**flash firmware data files**" link (located at the bottom of the instruction page). The flash firmware data files are organized by product.
5. Click the "**SDM300L3"** link.
6. Identify and download the latest M&C firmware file to the destination folder on the PC.
7. Repeat Step 6 for the BULK firmware file.

2.6.1.2 How to Perform a Flash Upgrade

Full on-line help is provided with the uploader program. If you experience a problem, or have a question, contact Comtech EF Data Customer Support for assistance.

1. On the PC, double-click the *.exe* or *.zip* flash upgrade file to uncompress its contents.
2. Identify and execute the uploader program.
3. Follow the instructions presented on the screen to select a firmware file and initiate the upload.

Following a successful upload process, the modem will automatically restart, running the new version of firmware.

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Chapter 3. CONNECTOR PINOUTS

3.1 Connector Overview

When a breakout panel, such as the UB-530, is not required, the rear panel connectors provide all necessary external connections between the modem and other equipment. Table 3-1 lists these connectors and Figure 3-1 show their locations.

Notes:

1. Refer to the Comtech EF Data *UB-530 Universal Breakout Panel Installation and Operation Manual* for connecting the UB-300 breakout panel.
2. Refer to the Comtech EF Data *UB-54 Breakout Panel Installation and Operation Manual* for connecting the UB-54 breakout panel in a MUX option configuration.

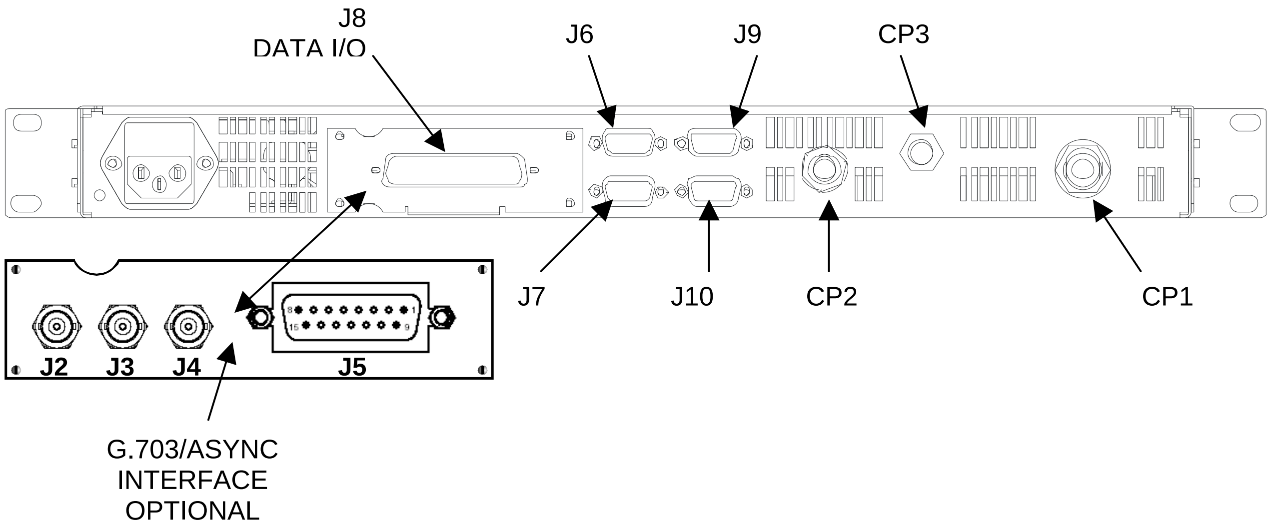

Figure 3-1. SDM-300L3 Rear Panel

Table 3-1. Modem Rear Panel Connectors

Name	Ref. Desig.	Connector Type	Function
TX/IF OUTPUT	CP1	Type N , Female	RF Output
EXT REF	CP2	BNC, Female	EXT REF IN
RF IF INPUT	CP3	Type F, Female	RF Input 75Ω
Data/I/O (Optional)	J2 J3 J4 J5	BNC, Female BNC, Female BNC, Female 15-pin D Female	G.703/ASYNC Closed Network
REMOTE	J6	9-pin D, Female	Remote Interface
FAULT	J7	9-pin D, Female	FORM C Fault Relay Contacts
DATA I/O (Customer-select)	J8	25-pin D, Female 34-pin, Female 37-pin D, Female 50-pin D, Female	Data Input/Output (standard modem) V.35 EIA-449 Data Input/Output (modem with ASYNC/AUPC/IDR/IBS/G.703 option)
AUX 1	J9	9-pin D, Female	(TTL) Faults Satellite Clock Demod I/Q Automatic Gain Control (AGC) Out
ALARMS	J10	9-pin D, Female	FORM C Alarm Relay Contacts
AC INPUT	NONE	IEC	
GROUND	NONE	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.

3.2 Connector Description

3.2.1 Remote Connector and Pinouts (J6)

The remote connector is a 9-pin subminiature female D connector (J6) located on the rear panel of the modem. Screw locks are provided for mechanical security of the mating connector.

The remote connector interfaces the M&C functions to a remote location. The remote location can be an M&C computer located away from the modem, but attached via cable to the remote connector. This DCE interface is user selectable for either EIA-232 or EIA-484.

Refer to Table 3-2 for pinout information.

Table 3-2. Remote Connector and Pinouts (J6)

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

*For 2-Wire Operation:

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

3.2.2 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 3-3 for pinout information.

Table 3-3. 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.

3.2.3 Data I/O Interface Connector (J8)

The Data I/O interface connector conducts data input and output signals to and from the modem, and connects to the customer's terrestrial equipment, breakout panel, or protection switch. The modem is currently available with a choice of four Data I/O connectors, as follows:

- 25-pin D connector is the standard connector shipped with a base platform modem.
- 50-pin D connector is the standard connector when the modem is ordered with the optional overhead PCB or if the overhead PCB has been installed in the field.
- 50-pin D that can be ordered with the basic modem, but it does not include the Overhead Card. This is used with breakout panels and switches.
- 37-pin D is an alternate connector available upon special request for the base platform modem.
- 34-pin Winchester is an alternate connector available upon special request for the base platform modem.
- G.703 T1, E1/ASYNC Interface Adapter is an alternate connector available upon special request for the basic platform modem.
- Eurocom Interface – Refer to Chapter XXXX.

The Data I/O pinout is different for each of the interface configurations. For pinout information, refer to the appropriate table as follows:

Standard: 25-pin D connector	Table 3-4
Optional: 34-pin Winchester connector	Table 3-5
Optional: 37-pin D connector	Table 3-6
Optional: 50-pin D connector	Table 3-7

Table 3-4. 25-Pin D Connector Pinouts

25-Pin D Connector			
Pin #	**EIA-422**	**EIA-232**	**V.35**
1	SHLD	SHLD	SHLD
2	SD-A	TXD	SD-A
3	RD-A	RXD	RD-A
4	RS-A	RTS	RTS
5	CS-A	CTS	CTS
6	DM-A	DSR	DSR
7	SIGGND	SIGGND	SIGGND
8	RR-A	DCD	RLSD
9	RT+B		SCR+B
10	RR-B		
11	TT+B		SCTE+B
12	ST+B		SCT+B
13	CS+B		
14	SD+B		SD+B
15	ST-A	ST	SCT-A
16	RD+B		RD+B
17	RT-A	RXC	SCR-A
18	LL	LL	LL
19	RS+B		
20*	MC-A	MC	MC-A
21	DF	DF	DF
22	DM+B		
23*	MC+B		MC-B
24	TT-A	TXC	SCTE-A
25	MF	MF	MF

***Note:** Use the MASTER clock for EXTERNAL clock input. This clock input should equal the data rate unless the Asymmetrical Loop Timing Option (ASLT) is available. The ASLT option allows selection of different clock rates that vary from the digital data rate. Refer to the Utility/Modem Type/Modem Options menu for the ASLT option information.

Table 3-5. 34-Pin Winchester Connector Pinouts (V.35)

Pin #	Name
A	SIGGND
B	SHLD
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)
c (CC)	MC-A
d (DD)	MC-B
m (MM)	Modulator Fault (MF)
n (NN)	Demodulator Fault (DF)
a(AA)	Serial Clock Transmit B (SCT+B)

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

The modem is available with a Winchester V.35 as the data I/O connector (PL/6032). 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 EF Data 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 EF Data 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).

Table 3-6. 37-Pin Connector Pinouts (Optional)

Pin #	EIA-422/MIL-188-144
1, 19	Shield
3	MF
4	SD-A
5	ST-A
6	RD-A
7	RS-A
8	RT-A
9	CS-A
11	DM-A
13	RR-A
16	MC-A
17	TT-A
20, 37	SIGGND
21	DF
22	SD+B
23	ST+B
24	RD+B
25	RS+B
26	RT+B
27	CS+B
29	DM+B
31	RR+B
34	MC+B
35	TT+B

There are jumpers on the PL/6031 EIA-422 interface. Place the jumpers on the center pin and the pin towards the Master Clock (MC) to allow an external clock input on pins 16 and 34.

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 Demand Assigned Multiple Access (DAMA) applications.

Table 3-7. 50-Pin Connector Pinouts

50-Pin D Connector				
Pin #	**IDR**	**IBS**	**Async**	**D&I**
1	GND	GND	GND	GND
2	GND	GND	GND	GND
3	AGC Out	AGC Out	AGC Out	AGC Out
4	EIA-422 TXOctA In		ESC TXDB In (EIA-485 only)	
5	EIA-422 TXOctB In	ESC TXDA In (EIA-232 only)	ESC TXDA In (EIA-485 and EIA-232)	ESC TXD In (EIA-232 only)
6	EIA-422 RXOctA Out		ESC RXDB Out (EIA-485 only)	
7	EIA-422 RXOctB Out	ESC RXDA Out (EIA-232 only)	ESC RXDA Out (EIA-485 and EIA-232)	ESC RXD Out (EIA-232 only)
8	BWO1_C	EIA-422 RX Oct A		
9	BWO2_C	EIA-422 RX Oct B		
10	BWO3_C	PRIMARY_C		PRIMARY_C
11	BWO4_C	SECONDARY_C		SECONDARY_C
12	BWAI 1	V.35/EIA-422 SCTE/TT-A	V.35/EIA-422 SCTE/TT A	
13	BWAI 2	V.35/EIA-422 SCTE/TT-B	V.35/EIA-422 SCTE/TT B	
14	BWAI 3	EIA-422 TX Oct A		
15	BWAI 4	EIA-422 TX Oct B		
16	Demod Fault C			
17	Def Maint Alrm			
18	G.703 SDB In	G.703 SDB In	G.703 SDB In	G.703 SDB In
19	EIA-422 ExtClkB In	V.35/EIA-422 EXCB In	V.35/EIA-422 EXCB In	EIA-422 EXCB In
20	G.703 RDB Out	G.703 RDB Out	G.703 RDB Out	G.703 RDB Out
21	EIA-422 8k TClkA Out	V.35/EIA-422 ST-A Out	V.35/EIA-422 ST-A Out	
22	EIA-422 8k TClkB Out	V.35/EIA-422 ST-B Out	V.35/EIA-422 ST-B Out	
23	EIA-422 8k RClkA Out	V.35/EIA-422 RT-A Out	V.35/EIA-422 RT-A Out	
24	EIA-422 8k RClkB Out	V.35/EIA-422 RT-B Out	V.35/EIA-422 RT-B Out	
25	BWO1_NC	ESC TCLK Out (EIA-232)		
26	BWO2_NC	ESC RCLK Out (EIA-232)		
27	BWO3_NC	PRIMARY_NC		PRIMARY_NC
28	BWO4_NC	SECONDARY_NC		SECONDARY_NC
29	Aud1-B In (or 64SDB)	V.35/EIA-422 RTS-B	V.35/EIA-422 RTS-B	
30	Aud1-B Out (or 64RTB)	V.35 RLSD/EIA-422 RR-B	V.35 RLSD/EIA-422 RR-B	
31	Aud2-B In (or 64STB)	V.35/EIA-422 CTS-B	V.35/EIA-422 CTS-B	
32	Aud2-B Out (or 64RDB)	V.35 DSR/EIA-422 DM-B	V.35 DSR/EIA-422 DM-B	
33	DF			
34	G.703 SDA In	G.703 SDA In	G.703 SDA In	G.703 SDA In
35	EIA-422 ExtClkA In	V.35/EIA-422 EXCA In	V.35/EIA-422 EXCA In	EIA-422 EXCA In
36	G.703 RDA Out	G.703 RDA Out	G.703 RDA Out	G.703 RDA Out
37	EIA-422 8k TXDA In	V.35/EIA-422 SD-A In	V.35/EIA-422 SD-A In	G.703 DDO-A Out
38	EIA-422 8k TXDB In	V.35/EIA-422 SD-B In	V.35/EIA-422 SD-B In	G.703 DDO-B Out
39	EIA-422 8k RXDA Out	V.35/EIA-422 RD-A Out	V.35/EIA-422 RD-A Out	G.703 IDI-A In
40	EIA-422 8k RXDB Out	V.35/EIA-422 RD-B Out	V.35/EIA-422 RD-B Out	G.703 IDI-B In
41	BWO1_NO	ESC DSR (EIA-232)		
42	BWO2_NO			
43	BWO3_NO	PRIMARY_NO		PRIMARY_NO
44	BWO4_NO	SECONDARY_NO		SECONDARY_NO
45	Aud1-A In (or 64SDA)	V.35/EIA-422 RTS-A	V.35/EIA-422 RTS-A	
46	Aud1-A Out (or 64RTA)	V.35 RLSD/EIA-422 RR-A	V.35 RLSD/EIA-422 RR-A	
47	Aud2-A In (or 64STA)	V.35/EIA-422 CTS-A	V.35/EIA-422 CTS-A	
48	Aud2-A Out (or 64RDA)	V.35 DSR/EIA-422 DM-A	V.35 DSR/EIA-422 DM-A	ESC DSR (EIA-232 only)
49	MF			
50	Demod Fault NO			

Notes:

1. IDR configuration connector pinouts:
   a. Backward alarm relay contacts are named for normal no fault conditions (BWOx-C connected to BWOx-NC if no fault).
   b. Backward alarm inputs should be grounded or pulled logic low to clear the alarm.
   c. Signals MF, DF, and DMA are open-collector, high-impedance (if faulted). A backup protection switch uses MF and DF if the modem is used in a redundant system.
   d. Relay contacts DF-C and DF-NO are named for faulted condition (DF-C connected to DF-NO, unless demodulator [Demod] fault).
2. D&I/ASYNC interface connector pinouts:
   a. With regard to alarm relay contacts, COMM is connected to NO when there is no fault. COMM is connected to NC in a faulted condition.
   b. Signals MF, DF, and DMA are open-collector, high-impedance (if faulted). A backup protection switch uses MF and DF if the modem is used in a redundant system.
3. The breakout panel provides the external connections between the modem and the terrestrial equipment when the modem has a 50-pin connection.

3.2.4 G.703 T1, E1/ASYNC Interface Adapter

The G.703 T1, E1/ASYNC Interface Adapter has three BNC connectors and a 15-pin subminiature D connector.

BNC connectors (SD (J2) and RD (J3) support the G.703 unbalanced 75Ω TX and RX data interfaces. BNC connector MC (J4) supports the 75Ω unbalanced Master Clock interface.

The 15-pin D connector (J5) supports the G.703 balanced TX and RX data, balanced Master Clock, Open Collector mod and demod fault, and ASYNC overhead data interfaces.

The following table shows the pinouts for the15-pin D connector.

IMPORTANT

This interface does not support either access to IBS or IDR overhead signals or does not support D&I functions.

Pin #	Signal
1	SD -
2	GND
3	RD-
4	GND
5	ETXB
6	ERXB
7	MC-
8	MC+
9	SD+
10	N.C.
11	RD+
12	ETXA
13	ERXA
14	MODFLT
15	DMDFLT

3.2.5 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 3-8 for pinout information.

Table 3-8. AUX 1 Connector and Pinouts (J9)

Pin #	Signal Function	Name
1	Satellite Clock -	SAT_CLK-
2	External TX Enabled	EXT_TX_EN
3	Satellite Clock +	SAT_CLK+
4	MODULATOR TTL Fault	MDFLTTTL
5	Ground	GRN
6	RX_Q	RX Q Channel Eye
7	DEMODULATOR TTL Fault	DMDFLTTL
8	RX 1 Channel Eye	RX_1
9	AGC Output	AGC

3.2.6 Alarms Connector and Pinouts (J10)

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

The alarm 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 3-9 for pinout information.

Table 3-9. 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

3.2.7 RF Output Connector (CP1)

CP1 is a 50Ω Type N connector for the TX IF signal. In normal operation, the output will be a QPSK (Optional: OQPSK or 8PSK) or BPSK modulated result of the Data I/O connector between 950 to 1750 MHz, in 100 Hz steps

3.2.8 External Reference (CP2)

CP2 is a BNC connector for an EXT REF. The input impedance is 75Ω. For normal operation, the desired carrier signal level is ≥ 0 dB. EXT REF frequencies are EXT 1, EXT 5, EXT 10, and EXT 20 MHz.

3.2.9 RF Input Connector (CP3)

CP3 is a 75Ω, Type F Female connector for an RX IF signal.

3.2.10 AC Power Connector

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

Input Power	55W maximum, 40W typical
Input Voltage	90 to 132 or 175 to 264 VAC Unit switches ranges automatically
Connector Type	I.E.C
Fuse Protection	1A slo-blo Line and neutral fusing 5 mm type fuses

3.2.11 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 4. FRONT PANEL OPERATION

4.1 Front Panel

The modem front panel (Figure 4-1) enables control of modem configuration parameters and displays the modem status.

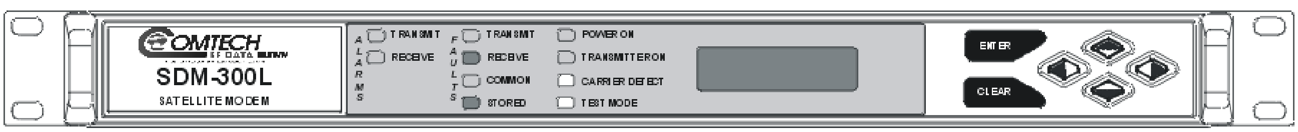

Figure 4-1. Front Panel View

The front panel features include:

- 32-character, 2-line LCD display
- 6-button keypad for local control
- 10 LEDs to provide overall status at a glance

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

- Configuration
- Monitor
- Faults/Alarms
- Stored Faults/Alarms
- Remote AUPC (ASYNC mode only)
- Utility

4.2 LED Indicators

The 10 LEDs on the front panel indicate:

- General modem summary faults
- Status
- Alarms

The indicators are defined in Table 4-1 as follows:

Table 4-1. LED Indicators

Name	LED	Meaning
Faults		
Transmit	Red	A fault condition exists in the transmit chain.
Receive	Red	A fault condition exists in the receive chain.
Common	Red	A common equipment fault condition exists.
Stored	Yellow	A fault has been logged and stored. The fault may or may not be active.
Status		
Power On	Green	Power is applied to the modem.
Transmitter On	Green	Transmitter is currently on. This indicator reflects the actual condition of the transmitter, as opposed to the programmed condition.
Carrier Detect	Green	Decoder is locked.
Test Mode	Yellow	Flashes when the modem is in a test configuration.
Alarms		
Transmit	Yellow	A transmit function is in an alarm condition.
Receive	Yellow	A receive function is in an alarm condition.

4.3 Front Panel Keypad

The front panel keypad permits local operation of the modem. The keypad consists of six keys (Figure 4-2).

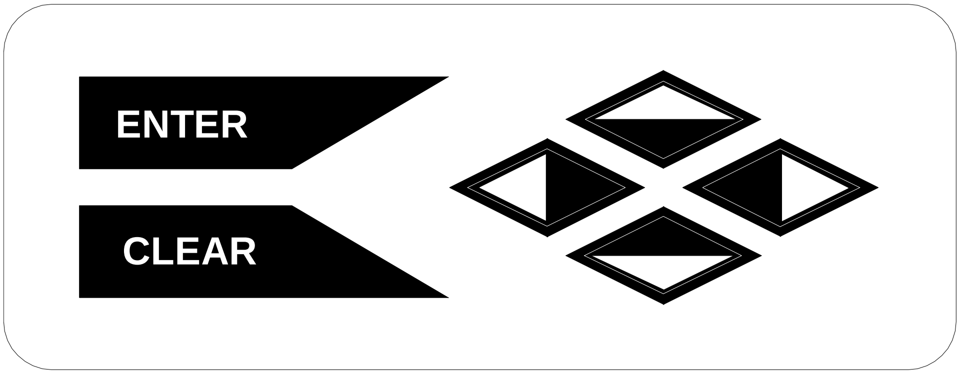

Figure 4-2. Keypad

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.

4.4 Menu System

Note: The menus show features and options that are not available. However, they are shown to preserve the menu structure and reserve the structure for the future. This does not imply an intent or obligation to add these features or options in the future.

Use the Main menu in Figure 4-3 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 model number and type.
- Line 2 is the version number of the firmware.

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
- Remote AUPC (ASYNC mode only)
- 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.

To view or change 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
- Local AUPC (ASYNC Mode or Local Modem AUPC only)
- MUX (Optional)
- Save
- Recall

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

Press [↑] or [↓] to change the parameters. After the display represents the correct parameters, press [ENTER] to execute the change. This action initiates the necessary programming by the modem.

To undo a parameter change prior to execution, press [CLEAR].

Notes:

1. Figure 4-3 list the front panel menu window selections.
2. Comtech EF Data recommends that selection of the desired Modem Type be made prior to making any other setting. This procedure is located in the Utility Modem Type menu.
3. 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.
4. 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.

4.4.5 REVISION EMULATION

To program an emulation mode from Version X.X.X through the current version, use the revision emulation feature in the Utility: Modem Type menu.

Software Version #	Firmware #	Rev.	Description of Change
2.1.12	FW/8460-1	M	Original issue

4.5 Menu Tree

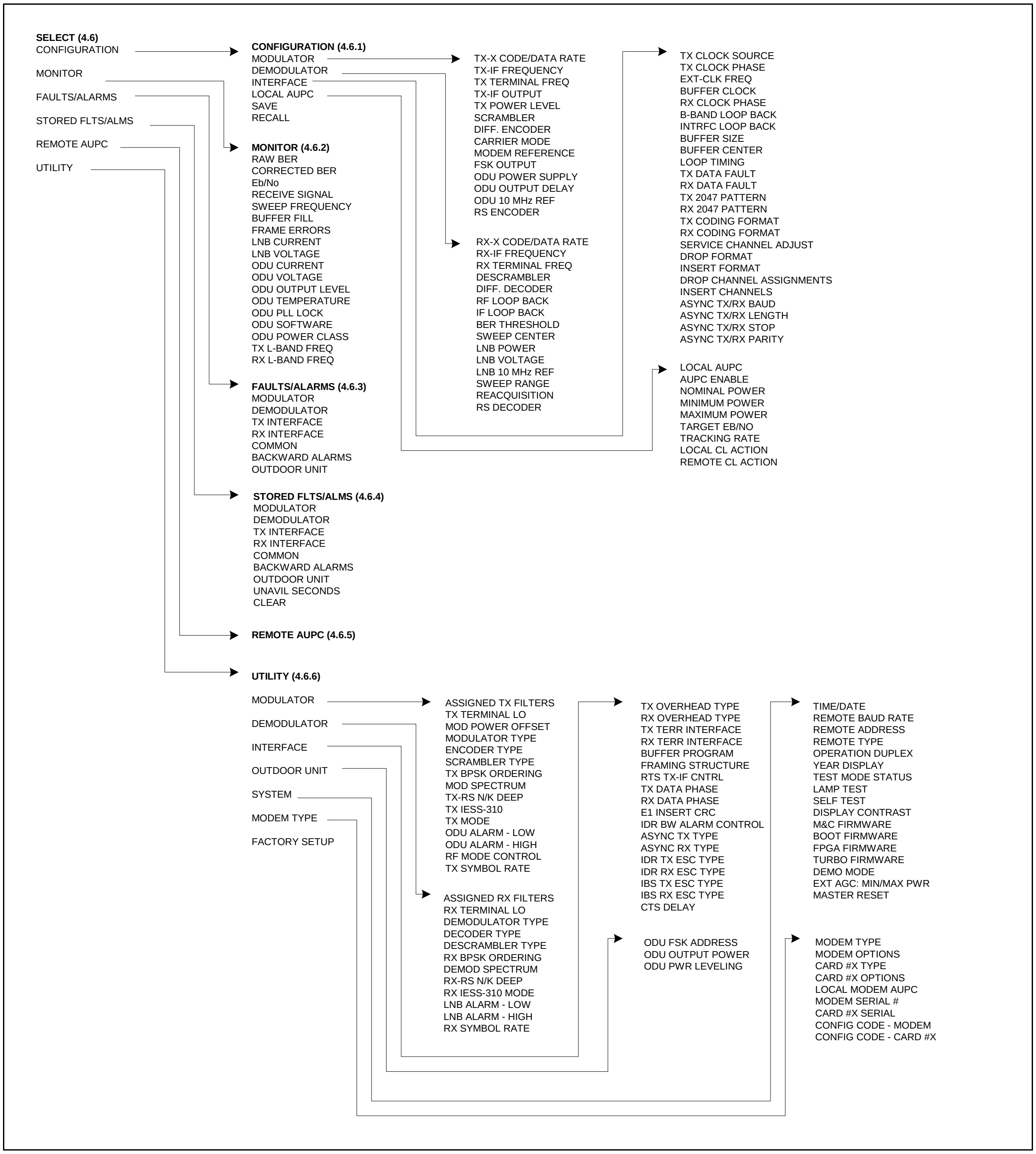

Figure 4-3. Menu Tree

4.6 OPENING SCREEN

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

```
SDM-300L3     CUSTOM
VER: X.X.X
```

Press [→] key to go to the any of the following FUNCTIONAL SELECT menu screens

- CONFIGURATION
- MONITOR
- FAULTS/ALARMS
- STORED FLTS/ALMS
- UTILITY

Note: At any time, pressing CLEAR will return to a main heading.

4.6.1 FUNCTION SELECT: CONFIGURATION

```
FUNCTIONAL SELECT
  CONFIGURATION
```

Press [→] key to go to any of the following sub-menus. Press <ENTER> to review or edit the menu.

CONFIGURATION MODULATOR	Permits the user to configure the modulator portion of the modem.
CONFIGURATION DEMODULATOR	Permits the user to configure the demodulator portion of the modem.
CONFIGURATION INTERFACE	Permits the user to configure the interface portion of the modem.
CONFIGURATION LOCAL AUPC	Permits the user to configure the AUPC parameters of the modem.
CONFIGURATION SAVE	Permits the user to save the configuration of the modem to non-volatile memory.
CONFIGURATION RECALL	Permits the user to configure the modem with a previously saved configuration.

4.6.1.1 FUNCTION SELECT: CONFIGURATION: MODULATOR

```
CONFIGURATION
MODULATOR
```

Press <ENTER > to review or edit the following sub-menus.

FUNCTION SELECT: CONFIGURATION: MODULATOR: TX-X CODE/DATA RATE

```
TX-A   QPSK  1/2
64.000 Kbps
```

```
TX-B   QPSK 1/2
128.000 Kbps
```

```
TX-C   QPSK 1/2
256.000 Kbps
```

```
TX-D   QPSK 1/2
512.000 Kbps
```

```
TX-V   QPSK 1/2
38.400 Kbps
```

Upon entry, the current transmitter rate is displayed with the flashing cursor on the first character of the code rate on line 1. Line 2 displays the data rate. Press [←] or [→] to make the selection. To select the currently defined variable data rate, select TX-V, and press <ENTER> twice.

To change the rate using the variable rate selection, press <ENTER> when TX-V is displayed. A flashing cursor is displayed on the first character of the coding type on line 1. Press [←] or [→] to move the flashing cursor, and [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press <ENTER> to execute the change.

Notes:

1. When the TX rate has been programmed, the transmitter is automatically turned off to prevent swamping of other channels. To turn the transmitter on, use the TX-IF Output function.
2. Code Rate 3/4 not compatible with a combination of a CSC Closed Modulator Type and Sequential Encoder.

Code Rate	Data Rate Range
Non-Turbo Requirements	
BPSK 1/2	2.4 to 1250 kbps
{O}QPSK 1/2	4.8 to 2500 kbps
{O}QPSK 3/4	7.2 to 3750 kbps
QPSK 7/8	8.4 to 4375 kbps
8PSK 2/3	64.0 to 5000 kbps
BPSK 1/1	4.8 to 2500 kbps
{O}QPSK 1/1	9.6 to 5000 kbps
Turbo Requirements	
BPSK 21/44	2.4 to 1193.181 kbps
BPSK 5/16	2.4 to 781.25 kbps
{O}QPSK 1/2	4.8 to 2386.363 kbps
8PSK 3/4	384 to 5000 kbps

Notes:

1. Max Symbol Rate = 2500 ksps
2. Max Data Rate for Low Var. Rate: 512 kbps.
3. OQPSK Option only: OQPSK 1/2, 3/4, and 7/8

FUNCTION SELECT: CONFIGURATION: MODULATOR: TX-IF FREQUENCY (CONDITIONAL)

```
TX-IF FREQUENCY
1200.0000 MHz
```

IMPORTANT

Conditional: This menu is displayed when LO is programmed to 0 under Utility: Modulator: TX Terminal LO menu.

Programs the modulator transmit frequency between 950 and 1750 MHz, in 100 Hz steps.

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 increment or decrement the digit at the flashing cursor. Press <ENTER> to execute the change.

Note: When the transmitter frequency is changed, the transmitter is automatically turned off to prevent the possible swamping of other channels. To turn the transmitter on, use the TX-IF Output function.

FUNCTION SELECT: CONFIGURATION: MODULATOR: TX TERMINAL FREQUENCY (CONDITIONAL)

```
TX TERMINAL FREQUENCY
5845.0000 MHz
```

IMPORTANT

Conditional: This menu is available only when TX Terminal LO and Mix are programmed under Utility: Modulator menu.

The reminder of the functions is the same as TX-IF Frequency.

Note: This menu permits programming the TX frequency of the satellite terminal, including the modem and ODU/BUC. When properly setup, it indicates the frequency radiated toward the satellite.

FUNCTION SELECT: CONFIGURATION: MODULATOR: TX-IF OUTPUT

```
TX-IF OUTPUT
OFF
```

Programs the modulator output On or Off. Upon entry, the current status of the output is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: MODULATOR: TX POWER LEVEL

```
TX POWER LEVEL
- 10.0 dBm
```

Programs the modulator output power level from 0 to -40 dBm

Upon entry, the current transmitter power level is displayed with the flashing cursor on the first character. Press [↑] or [↓] to increase or decrease the output power level in 0.1 dBm steps. Press <ENTER> to execute the change.

```
TX POWER LEVEL
-10.0 dBm (ADJ)
```

This menu appears when:

1. ODU Power Leveling is On (***Utility: Outdoor Unit***), or
2. The MOD Power Offset (***Utility: Modulator*** is ≠ 0 dB.).
3. (ADJ) appears after the power level in the TX Power Level screen when this menu is active.

Notes:

1. When Power Leveling is Enabled, manual changes to the output level are inhibited, and the menu indicates the TX Power Level TX by the modulator.
2. When MOD power offset is active the output power is adjusted [↑] and [↓] with arrow keys. However, the value indicated in the display is:

Modulator Power Level + Offset

FUNCTION SELECT: CONFIGURATION: MODULATOR: SCRAMBLER

```
SCRAMBLER
   ON
```

Programs the scrambler On or Off.

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

FUNCTION SELECT: CONFIGURATION: MODULATOR: DIFF. ENCODER

```
DIFF. ENCODER
     ON
```

Programs the differential encoder On or Off.

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

FUNCTION SELECT: CONFIGURATION: MODULATOR: CARRIER MODE

```
CARRIER MODE
NORMAL-MODULATED
```

Programs the modem for alternate carrier modes. All modes, except Normal-Modulated are ***Test Modes***. Four modes of operation are available:

NORMAL-MODULATED	This mode is normally selected.
CENTER-CW	Generates a CW-carrier at the current modulator frequency. This can be used to measure the output frequency.
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.
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.

Upon entry, the Center mode is displayed. To activate this test mode, press <ENTER>. Press [↑] or [↓] to select the desired mode. To return to the Configuration menu, press [CLEAR].

FUNCTION SELECT: CONFIGURATION: MODULATOR: MODEM REFERENCE

```
MODEM REFERENCE
INTERNAL
```

Select either: Internal, EXT1 MHz, EXT5 MHz, EXT 10MHz, EXT 20MHz, or Output 10 MHz.

IMPORTANT

Use only Internal or EXT 10 MHz with a Block Up Converter (BUC) or Outdoor Unit (ODU).

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

Note: If any EXT REF is selected for the modem reference and is disconnected or not present at CP3, an alarm is generated, and the modem switches to its Internal Clock.

FUNCTION SELECT: CONFIGURATION: MODULATOR: FSK OUTPUT

```
FSK OUTPUT
OFF
```

Note: FSK is operational only with a BUC or ODU that incorporates FSK capabilities.

Programs the FSK Output On or Off. Upon entry, the current status of the FSK Output is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

The modem will attempt to communiate with the ODU/BUC when the FSK is tuned On. When the communicateions are successful the Monitor menu willl indicate the ODU Output Level, ODU Temperature, ODU, PLL Lock, ODU Software, and ODU Power Class (for BUCs that support these parameters). If communications are not established then all of the following are indicated as faults under the ***Faults/Alarms: Outdoor Unit*** menu: Temperature, PLL Lock, and Checksum.

Every 10 seconds the modem will try to re-establish FSK communications. It is possible the address the modem is using to contast the ODU/BUC differs from the address in the ODU/BUC. Usually the default address = 1. Check this at the ODU FSK Address menu located under the ***Utility: Outdoor Unit*** menu.

FUNCTION SELECT: CONFIGURATION: MODULATOR: ODU POWER SUPPLY

```
ODU POWER SUPPLY
OFF
```

Programs the ODU Power Supply On or Off. DC power is transmitted up the center conductor of the TX-IF connector. Upon entry, the current status of the ODU Power is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: MODULATOR: ODU OUTPUT DELAY

```
ODU OUTPUT DELAY
 00.00 MIN SEC
```

Programs the ODU Output delay with 0.0 to 20.00 minutes. At power up, the M&C delays carrier turn On by the programmed time. During output delay timeout, the front panel carrier On LED flashes and the ODU output delay screen shows the remaining delay time.

Normally, when using this feature, the ODU 10MHz reference is On and the ODU Power Supply is On. This allows the ODU or BUC time to warm-up before the carrier is transmitted. Upon entry, the current status of the ODU Output Delay is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: MODULATOR: ODU 10 MHZ REF

```
ODU 10 MHz REF
      OFF
```

Programs the ODU 10 MHz REF On or Off. The reference is transmitted up the center conductor of the TX-IF connector.

Upon entry, the current status of the ODU 10 MHz REF is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: MODULATOR: RS ENCODER (CONDITIONAL)

```
RS ENCODER
   OFF
```

IMPORTANT

Conditional: Reed-Solomon option only.

Programs the Reed-Solomon Encoder On or Off.

Upon entry, the current status of the Reed-Solomon encoder is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

4.6.1.2 FUNCTION SELECT: CONFIGURATION: DEMODULATOR

```
CONFIGURATION
 DEMODULATOR
```

Press <ENTER> to review or edit the following sub-menus.

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: RX-X CODE/DATA RATE

```
RX-A QPSK 1/2
 64.000 Kbps
```

```
RX-B   QPSK 1/2
 128.000 Kbps
```

```
RX-C   QPSK 1/2
 256.000 Kbps
```

```
RX-D   QPSK 1/2
 512.000 Kbps
```

```
RX-V   QPSK 1/2
  38.400 Kbps
```

Upon entry, the current transmitter rate is displayed with the flashing cursor on the first character of the code rate on line 1. Line 2 displays the data rate. Press [←] or [→] to make the selection. To select the currently defined variable data rate, select RX-V, and press [ENTER] twice.

To change the rate using the variable rate selection, press [ENTER] when RX-V is displayed. A flashing cursor is displayed on the first character of the coding type on line 1. Press [←] or [→] to move the flashing cursor, and [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press [ENTER] to execute the change.

Notes:

1. When the RX rate has been programmed, the transmitter is automatically turned off to prevent swamping of other channels. To turn the transmitter on, use the RX-IF Output function.
2. Code Rate 3/4 not compatible with a combination of a CSC Closed Modulator Type and Sequential Encoder.

Code Rate	Data Rate Range
Non-Turbo Requirements	
BPSK 1/2	2.4 to 1250 kbps
{O}QPSK 1/2	4.8 to 2500 kbps
{O}QPSK 3/4	7.2 to 3750 kbps
QPSK 7/8	8.4 to 4375 kbps
8PSK 2/3	64.0 to 5000 kbps
BPSK 1/1	4.8 to 2500 kbps
{O}QPSK 1/1	9.6 to 5000 kbps
Turbo Requirements	
BPSK 21/44	2.4 to 1193.181 kbps
BPSK 5/16	2.4 to 781.25 kbps
{O}QPSK 1/2	4.8 to 2386.363 kbps
8PSK 3/4	384 to 5000 kbps

Notes:

1. Max Symbol Rate = 2500 ksps
2. Max Data Rate for Low Var. Rate: 512 kbps.
3. OQPSK Option only: OQPSK 1/2, 3/4, and 7/8

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: RX-IF FREQUENCY (CONDITIONAL)

```
RX-IF FREQUENCY
1200.0000 MHz
```

IMPORTANT

Conditional: This menu is displayed when LO is programmed to 0 under Utility: Demodulator: RX Terminal LO menu.

Programs the demodulator receive frequency between 950 and 1750 MHz, in 100 Hz steps.

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

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: RX TERMINAL FREQUENCY (CONDITIONAL)

```
RX TERMINAL FREQUENCY
4200.0000 MHz
```

IMPORTANT

Conditional: This menu is available only when RX Terminal LO and Mix are programmed under Utility: Demodulator menu.

The reminder of the functions is the same as RX-IF Frequency.

Note: This permits programming of the RX frequency of the satellite terminal, including the modem and LNB. When properly setup it indicates the satellite frequency of the desired RX carrier received from the satellite.

FUNCTION SELECT:CONFIGURATION:DEMODULATOR: DESCRAMBLER

```
DESCRAMBLER
    ON
```

Programs the descrambler On or Off.

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

FUNCTION SELECT:CONFIGURATION:DEMODULATOR: DIFF. DECODER

```
DIFF. DECODER
     ON
```

Programs the differential decoder On or Off.

Upon entry, the current status of the differential decoder is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: RF LOOP BACK

```
RF LOOP BACK
    OFF
```

IMPORTANT

This is a Test Mode.

Programs the modem for RF loopback operation. When RF loopback is turned on, the demodulator is programmed to the same frequency as the modulator. When RF loopback is turned off, the demodulator is tuned to the previous frequency. Refer to (Figure 4-4) for a block diagram of RF loopback operation.

Note: RF loopback nullifies IF loopback.

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

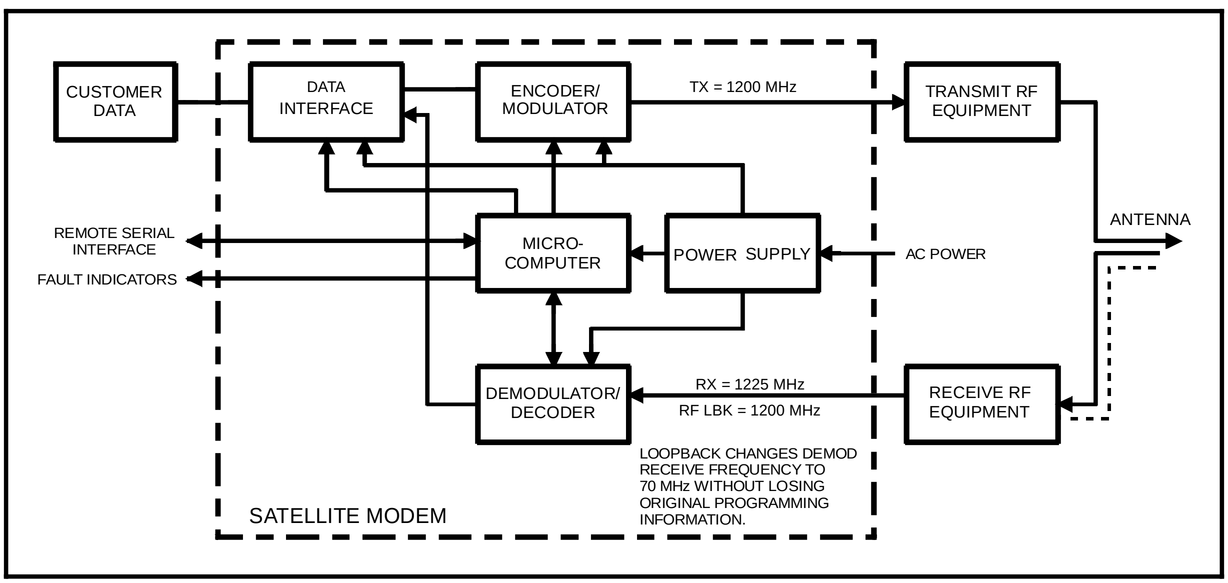

Figure 4-4. RF Loopback

Note: When RF loopback is turned on, the demodulator receive frequency is programmed to be the same frequency as the modulator transmit frequency. This test mode will verify the satellite link without changing the programmed frequency of the demodulator. When RF loopback is turned off, the demodulator is programmed back to the previous frequency.

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: IF LOOP BACK

```
IF LOOP BACK
    OFF
```

IMPORTANT

This is a Test Mode.

Programs the modem for IF loopback operation. When IF loopback is turned on, the demodulator input is connected to the modulator output through an internal attenuator and the modulator continues to TX a signal. The demodulator is programmed to the same frequency as the modulator. When IF loopback is turned off, the demodulator is tuned to the previous frequency and is reconnected to the IF input. Refer to Figure 4-5 for a block diagram of IF loopback operation.

Note: IF loopback nullifies RF loopback.

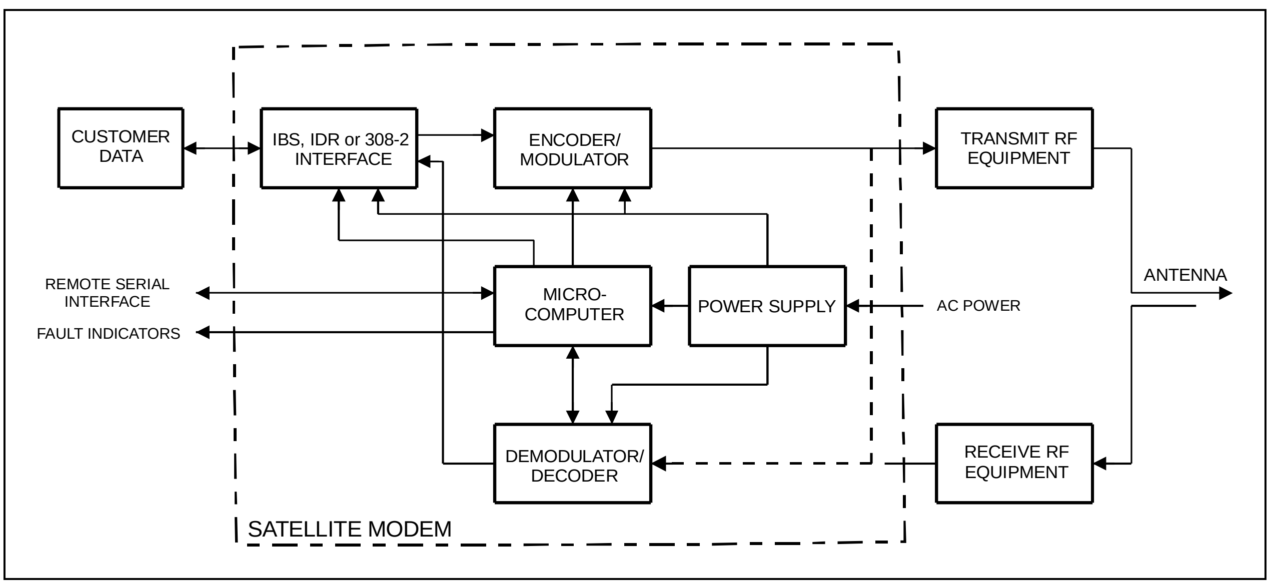

Figure 4-5. IF Loopback

Note: When IF loopback is turned on, the demodulator is looped back to the modulator inside the modem and the demodulator is programmed to the same frequency as the modulator. This test mode will verify the operation of the modem. When IF loopback is turned off, the demodulator is programmed back to the previous frequency and is reconnected to the IF input.

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: BER THRESHOLD

```
BER THRESHOLD
    NONE
```

Sets 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.

Upon entry, the current setting of the BER threshold is displayed. Press [↑] or [↓] to select the desired setting. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: SWEEP CENTER

```
SWEEP CENTER
 +    0 Hz
```

Programs 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 -75000 to +75000 Hz.

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: SWEEP RANGE

```
SWEEP RANGE
 60000  Hz
```

Programs the overall travel of the sweep width range during acquisition in the directed sweep mode. The sweep width may be set from 0 to 1,000,000 Hz. When set at 60000 Hz, the modem is in the default 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.

Upon entry, the current programmed setting is displayed. Press [←] or [→] to move the flashing cursor. Press [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: REACQUISITION

```
REACQUISITION
  0 SECONDS
```

Programs 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.

Upon entry, the current programmed setting is displayed with a flashing cursor on the first character. Press [←] or [→] to move the flashing cursor. Press [↑] or [↓] to increment or decrement the digit at the flashing cursor. Select the number of seconds desired for the reacquisition mode. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: LNB POWER

```
LNB POWER
   OFF
```

Programs the LNB Power On or Off. The LNB voltage is transmitted up the center conductor of the RF-IF connector.

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

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: LNB VOLTAGE

```
LNB VOLTAGE
  13 VDC
```

Programs the LNB Power at 13, 18, or 24 VDC.

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

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: LNB 10 MHZ REF

```
LNB 10 MHz REF
     OFF
```

Programs the LNB 10 MHz REF to On or OFF. The LNB 10 MHz reference is transmitted out the center conductor of the RF-IF connector.

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

FUNCTION SELECT: CONFIGURATION: DEMODULATOR: RS DECODER

```
RS DECODER
   OFF
```

Programs the Reed-Solomon decoder On, Off, or Correction_Off.

Upon entry, the current 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. This is the Normal operating Mode.**
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 a Test Mode.**
OFF	**The RS decoder is normally disabled (off position). To execute any of the Reed-Solomon decoder modes, enter the desired Reed-Solomon decoder and select the desired mode. This is a Test Mode.**

Press [ENTER] to execute the change.

IMPORTANT

If none of the proper overhead types or data rates apply, the Reed-Solomon decoder in the On state will be rejected (double beep). With the Reed-Solomon decoder turned On (not off or Correction_ Off), the corrected BER will be reported from the outer decoder (Reed-Solomon decoder).

4.6.1.3 FUNCTION SELECT: CONFIGURATION INTERFACE

```
CONFIGURATION
  INTERFACE
```

Press <ENTER > to review or edit the following sub-menus.

FUNCTION SELECT: CONFIGURATION: INTERFACE: TX CLOCK SOURCE

```
TX CLOCK SOURCE
TX TERRESTRIAL
```

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 is also the fallback clock).
	Note: When loop timing is enabled, SCT (LOOP) is displayed instead of SCT (INTERNAL).
EXT. CLOCK/DATA CLOCK	Sets the TX clock to operate from the external reference clock (Ext Clock). TX Data Rate and Ext Clock frequency shall match or unless the ASLT option is installed. The correct frequency must be programmed into EXT-CLK FREQ.

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

FUNCTION SELECT: CONFIGURATION: INTERFACE: TX CLOCK PHASE

```
TX CLOCK PHASE
     AUTO
```

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

Note: AUTO is the default.

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

FUNCTION SELECT: CONFIGURATION: INTERFACE: EXT-CLK FREQ

```
EXT-CLK FREQ
1544.000 KHz
```

Programs the EXT REF clock input frequency between 8.000 kHz and 10000.000 kHz.

Notes:

1. When an ODU or BUC is operated with an EXT REF, 10 MHz is required.
2. The clock rate shall 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 EXT REF on CP3 only allows for 1, 5, 10, and 20 MHz EXT REF input.

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

FUNCTION SELECT: CONFIGURATION: 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. (Bypasses the buffer.)
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.

FUNCTION SELECT: CONFIGURATION: INTERFACE: RX CLOCK PHASE

```
RX CLOCK PHASE
NORMAL
```

Programs the RX clock phase to Normal or Inverted.

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

FUNCTION SELECT: CONFIGURATION: INTERFACE: B-BAND LOOP BACK

```
B-BAND LOOP BACK
      OFF
```

IMPORTANT

This is a Test Mode.

Programs the modem for baseband loopback operation. 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 4-6 for a block diagram of baseband loopback operation.

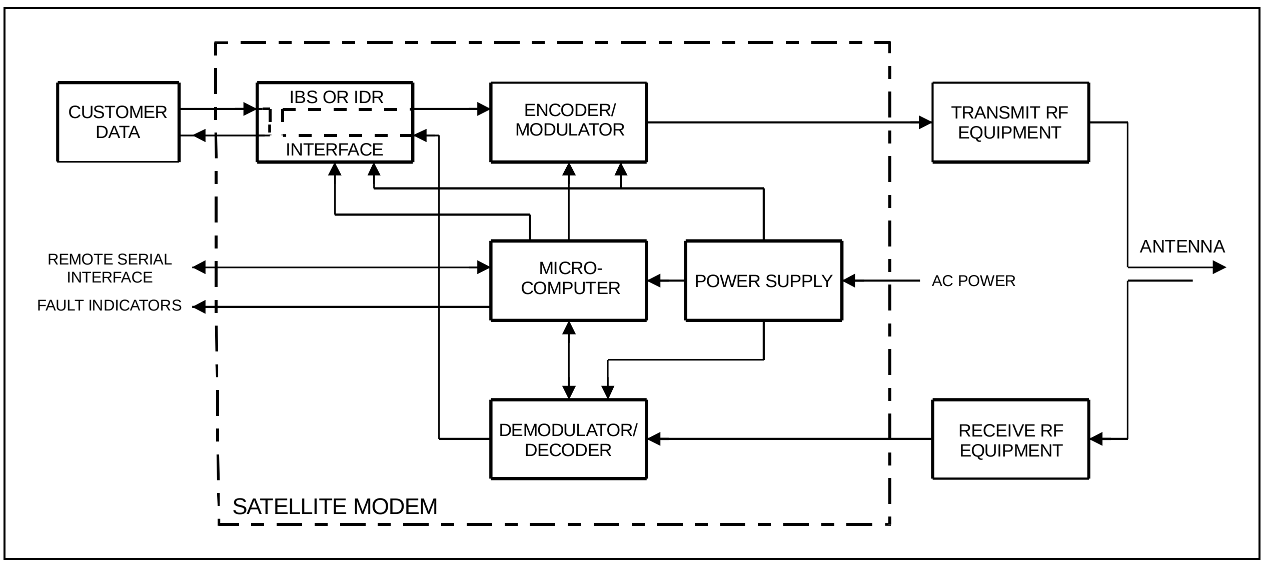

Figure 4-6. Baseband Loopback

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. The baseband loopback is not bi-directional in D&I.

FUNCTION SELECT: CONFIGURATION: INTERFACE: INTRFC LOOP BACK (CONDITIONAL)

```
INTRFC LOOP BACK
OFF
```

IMPORTANT

This is a Test Mode. Conditional: This menu is only available when the overhead interface PCB or Reed-Solomon PCB is installed.

Programs the modem for Interface Loopback operation. When INTERFACE LOOPBACK is turned on, data is looped back at the modem side of the interface. This is a bi-directional loop back of the data after the base band data has had the overhead added. Refer to Figure 4-7 for the interface loopback block diagram.

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

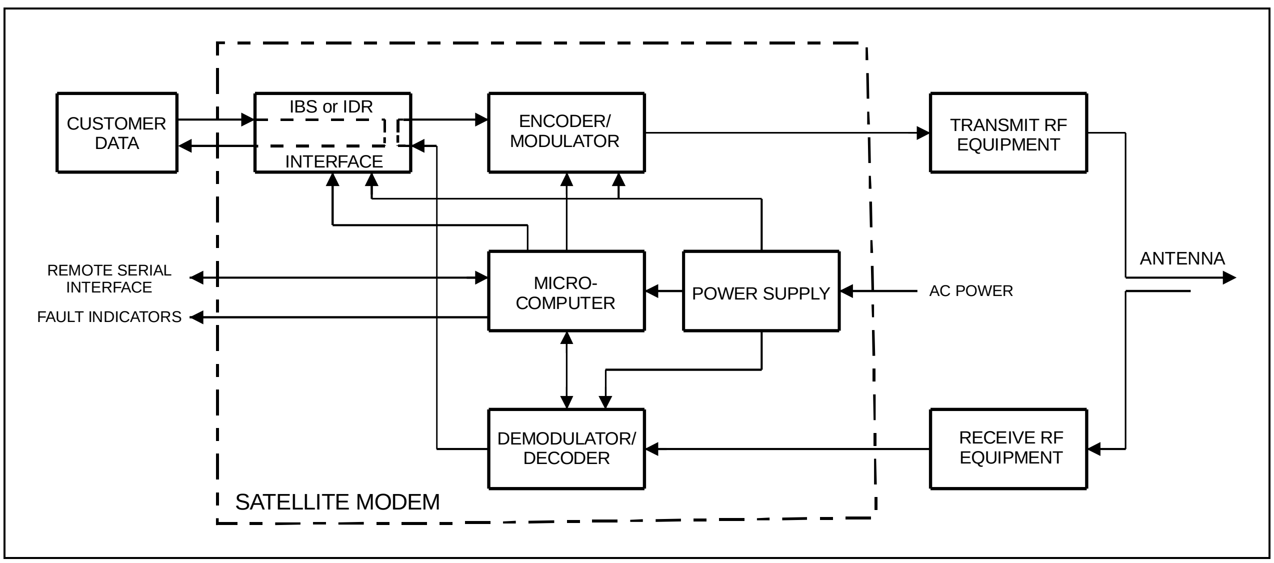

Figure 4-7. Interface Loopback

Note: When interface loopback is turned on, data is looped back on the modem side of the interface. This test mode will verify the internal channel unit interface operation.

FUNCTION SELECT: CONFIGURATION: INTERFACE: BUFFER SIZE (CONDITIONAL)

IMPORTANT

Conditional: The Bits or Milliseconds menu is displayed depending upon whether Bits or Milliseconds is selected under the Utility: Interface Buffer Program menu.

```
BUFFER SIZE
 384 BITS
```

```
 BUFFER SIZE
6 MILLI SECONDS
```

Sets the size of the buffer in either Bits or Milliseconds..

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 ≤ 2.6 Mbps or 0 (Bypass).
- If selecting bits, choose from 32 to 262144 bits, in increments of 16 bits.
- Press [ENTER] to execute the change.

When D&I is selected for modem type, the buffer units are automatically set to ms. The user may select as follows:

- nn = 7.5, 15, or 30 ms for E1CAS format.
- nn = 6, 12, 24, or 30 ms for T1IBS/T1S/T1ESFS format.
- nn = 1, 2, 4, 8, 16, or 32 ms for all other D&I formats.

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.

FUNCTION SELECT: CONFIGURATION: INTERFACE: BUFFER CENTER

```
BUFFER CENTER
   YES/NO
```

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

Press <ENTER> twice to center the buffer.

FUNCTION SELECT: CONFIGURATION: INTERFACE: LOOP TIMING

```
LOOP TIMING
    OFF
```

The On setting programs the transmit clocking to the RX satellite clock. TX and RX data rates must be equal unless the asymmetrical loop timing (ASLT) option is enabled. SCT is phase locked to the RX Satellite clock.

FUNCTION SELECT: CONFIGURATION: INTERFACE: TX DATA FAULT (CONDITIONAL)

```
TX DATA FAULT
    NONE
```

IMPORTANT

Conditional: This menu is only available when the overhead interface PCB is installed.

Transmit data fault. Press [↑] or [↓] to select one of the following modes:

NONE	**The transmit interface fault Data/AIS is not activated.**
ALARM INDICATION SIGNAL (AIS)	**Sets transmit interface fault Data/AIS to monitor a fault condition of all 1s from customer data input to the modem.**
DATA	**Sets transmit interface fault Data/AIS to monitor a fault condition of all 1s or 0s. This is referred to as a data-stable condition, which means that the data is not transitioning.**

Upon entry, the current TX data fault that is being monitored is displayed. Press [↑] or [↓] to make the selection. Press [ENTER] to execute the change.

FUNCTION SELECT: CONFIGURATION: INTERFACE: RX DATA FAULT (CONDITIONAL)

```
RX DATA FAULT
    NONE
```

IMPORTANT

Conditional: This menu is only available when the overhead interface PCB is installed.

Receive data fault. Selects a receive interface fault monitor of NONE, AIS, or DATA. The data monitored for RX data is coming from the satellite. Refer to TX DATA FAULT for a description of function choices.

Upon entry, the current, monitored RX DATA FAULT is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: INTERFACE: TX 2047 PATTERN (CONDITIONAL)

```
TX 2047 PATTERN
      OFF
```

IMPORTANT

The is a Test Mode. Conditional: This menu is only available when the overhead interface PCB is installed.

Programs the transmitter to On or Off to insert a 2047 pattern instead of the normal transmit data.

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

FUNCTION SELECT: CONFIGURATION: INTERFACE: RX 2047 PATTERN (CONDITIONAL)

```
RX 2047 PATTERN
      OFF
```

IMPORTANT

The is a Test Mode. Conditional: This menu is only available when the overhead interface PCB is installed.

Programs the modem to receive a 2047 pattern as the normal receive data, and allows the BER monitor to work on that 2047 pattern.

Upon entry, the current status is displayed. Press [↑] or [↓] to select on or off. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: INTERFACE: TX CODING FORMAT (CONDITIONAL)

```
TX CODING FORMAT
      OFF
```

IMPORTANT

Conditional: This menu is only available when the TX G.703 interface is programmed. This requires that the optional Overhead card is installed.

Programs the transmitter for AMI, B8ZS, or HDB3 coding of the baseband data.

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

FUNCTION SELECT: CONFIGURATION: INTERFACE: RX CODING FORMAT (CONDITIONAL)

```
RX CODING FORMAT
      OFF
```

IMPORTANT

Conditional: This menu is only available when the RX G.703 interface is programmed. This requires installation of the optional Overhead Card.

Programs the receiver for AMI, B8ZS, or HDB3 coding.

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

FUNCTION SELECT: CONFIGURATION: INTERFACE: SERVICE CHANNEL ADJUST (CONDITIONAL)

```
SERVICE CHANNEL
    ADJUST
```

IMPORTANT

Conditional: This menu is only available when IDR has been selected for modem type in the Utility menu and the Overhead Card is installed.

This configuration function is used to set service channel audio levels at TX-1, TX-2, RX-1, or RX-2.

Upon entry, press [←] or [→] to select the desired service channel. To adjust the service channel level (+10.0 to -20.0 dBm), press <ENTER>. Press [↑] or [↓] to adjust the service channel. Press <ENTER> to execute the change.

```
CHANNEL: TX-1
LEVEL = -5 dBm
```

```
CHANNEL: TX-2
LEVEL = -5 dBm
```

```
CHANNEL: RX-1
LEVEL = -5 dBm
```

```
CHANNEL: RX-2
LEVEL = -5 dBm
```

FUNCTION SELECT: CONFIGURATION:INTERFACE: DROP FORMAT (CONDITIONAL)

```
DROP FORMAT
    T1
```

IMPORTANT

This menu is only available when the optional D&I have been selected for Modem Type in the Utility menu and the Overhead Card is installed.

Upon entry, the current drop data channel signal is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

This configuration is used to select the desired drop data channel signaling. The choices are:

- E1_CCS (E1 Common Channel Signaling)
- E1-CAS (E1 Channel Associated Signaling)
- E1_IBS (E1 International Business Service)
- E1_31_TS (E1 No Multiframe Sync Alignment)
- T1 (T1 Data)
- T1_IBS (T1 International Business Service)
- T1_ESF (T1 Extended Super Frame)
- T1_ESF_S (Special Signaling)
- T1_S (Special Signaling)

FUNCTION SELECT: CONFIGURATION: INTERFACE: INSERT FORMAT (CONDITIONAL)

```
INSERT FORMAT
     T1
```

IMPORTANT

Conditional: This menu is only available when optional D&I have been selected for Modem Type in the Utility menu and the Overhead Card is installed.

Selects the desired insert data channel signaling. The choices are:

- E1_CCS (E1 Common Channel Signaling)
- E1-CAS (E1 Channel Associated Signaling)
- E1_31_TS (E1 No Multiframe Sync Alignment)
- E1_IBS (E1 International Business Service)
- T1 (T1 Data)
- T1_IBS (T1 International Business Service)
- T1_ESF (T1 Extended Super Frame)
- T1_ESF_S (Special Signaling)
- T1_S (Special Signaling)

FUNCTION SELECT: CONFIGURATION: INTERFACE: DROP CHANNEL ASSIGNMENTS (CONDITIONAL)

```
DROP CHANNEL
ASSIGNMENTS
```

IMPORTANT

Conditional: This menu is only available when the optional D&I have been selected for Modem Type in the Utility menu and the Overhead Card is installed.

Programs the drop channels into the following desired time slot:

- DROP SAT CHANNEL TERR (For T1, T1_ESF, T1_S, T1_ESF_S)
- DROP SAT T-SLOT TERR (For all other formats)

Note: Dropping time slot 0 is not permitted for E1_CLS, T1_CAS, or E1_31_TS.Use time slot 16 only in E1_31_TS. The number of drop channels is data rate dependent. The number of drop channels is DR/64 kbps. Thus, when the data rate is 64 kbps, there is only one drop channel. When the data rate is 1920 kbps, there are 30 drop channels.

Upon entry, drop channel 1 and the current time slot are displayed. Press [↑] or [↓] to select the drop channel to be programmed.

Press <ENTER> to begin programming. Press [↑] or [↓] to select the time slot for each available drop channel by incrementing or decrementing the digit at the flashing cursor. Press <ENTER> to execute the change.

```
DROP SAT ----->   1
CHANNEL TERR ->   1
```

```
DROP SAT ----->   1
T-SLOT TERR ->    1
```

FUNCTION SELECT: CONFIGURATION: INTERFACE: INSERT CHANNEL ADJUSTMENTS (CONDITIONAL)

```
INSERT CHANNEL
 ASSIGNMENTS
```

IMPORTANT

Conditional: This menu is only available when the optional D&I are installed has been selected for Modem Type in the Utility menu and the Overhead Card is installed.

Programs the satellite channels into the following desired terrestrial frame slot:

- INSERT SAT CHANNEL TERR (For T1, T1_ESF, T1_S, T1_ESF_S)
- INSERT SAT T-SLOT TERR (For all other formats)

Note: The number of satellite channels inserted is data rate independent. The number of channels is DR/64 kbps. When the data rate is 64 kbps only one channel is inserted. When the data rate is 1920 kbps, 30 channels are inserted.

Upon entry, satellite channel 1 and the current terrestrial frame slot are displayed. Press [↑] or [↓] to select the satellite channel to be programmed. Press [ENTER] to choose the satellite channel to be programmed. Press [↑] or [↓] to select the terrestrial frame slot for each available satellite channel by incrementing or decrementing the digit at the flashing cursor. If a time slot is unused, select NI (Not Inserted). Press [ENTER] to execute the change.

```
INSERT SAT --->   1
CHANNEL TERR ->   1
```

```
INSERT SAT --->   1
T-SLOT TERR ->    1
```

FUNCTION SELECT: CONFIGURATION: INTERFACE: ASYNC TX BAUD (CONDITIONAL)

```
ASYNC TX BAUD
  110 bps
```

IMPORTANT

Conditional: The menu is only available when Modem Type = ASYNC and requires that the Overhead Card is installed.

Programs the ASYNC overhead transmit baud rate for 110 to 38400 bit/s.

Upon entry, the current status of the ASYNC TX baud rate is displayed. Press [↑] or [↓] to select one of the following baud rates (bps): 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400.

Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: INTERFACE: ASYNC RX BAUD (CONDITIONAL)

```
ASYNC RX BAUD
  110 bps
```

IMPORTANT

Conditional: The menu is only available when Modem Type = ASYNC and requires that the Overhead Card is installed.

Programs the ASYNC overhead transmit baud rate for 110 to 38400 bit/s.

Upon entry, the current status of the ASYNC TX baud rate is displayed. Press [↑] or [↓] to select one of the following baud rates (bps): 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400.

Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: INTERFACE: ASYNC TX LENGTH (CONDITIONAL)

```
ASYNC TX LENGTH
    7 BITS
```

IMPORTANT

Conditional: The menu is only available when Modem Type = ASYNC and requires that the Overhead Card is installed.

Programs the ASYNC overhead transmit word length for 5, 6, 7, or 8 bits.

Upon entry, the current status of the ASYNC TX word length is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: INTERFACE: ASYNX RX LENGTH (CONDITIONAL)

```
ASYNC RX LENGTH
    7 BITS
```

IMPORTANT

Conditional: The menu is only available when Modem Type = ASYNC and requires that the Overhead Card is installed.

Programs the ASYNC overhead receive word length for 5, 6, 7, or 8 bits.

Upon entry, the current status of the ASYNC RX word length is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: INTERFACE: ASYNC TX STOP (CONDITIONAL)

```
ASYNC TX STOP
   2 BITS
```

IMPORTANT

Conditional: The menu is only available when Modem Type = ASYNC and requires that the Overhead Card is installed.

Programs the ASYNC overhead transmit stop bits for 1 or 2.

Upon entry, the current status of the ASYNC TX stop bits is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: INTERFACE: ASYNC RX STOP (CONDITIONAL)

```
ASYNC RX STOP
   2 BITS
```

IMPORTANT

Conditional: The menu is only available when Modem Type = ASYNC and requires that the Overhead Card is installed.

Programs the ASYNC overhead receive stop bits for 1 or 2.

Upon entry, the current status of the ASYNC RX stop bits makes the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: INTERFACE: ASYNC TX PARITY (CONDITIONAL)

```
ASYNC TX PARITY
     EVEN
```

IMPORTANT

Conditional: The menu is only available when Modem Type = ASYNC and requires that the Overhead Card is installed.

Programs the ASYNC overhead transmit parity for Even, Odd, or None.

Upon entry, the current status of the ASYNC TX parity is displayed. Press [↑] or [↓] to make the selection. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: INTERFACE: ASYNC RX PARITY (CONDITIONAL)

```
ASYNC RX PARITY
     EVEN
```

IMPORTANT

Conditional: Only available for the ASYNC option.

Programs the ASYNC overhead receive parity for Even, Odd, or None.

4.6.1.4 FUNCTION SELECT: CONFIGURATION: LOCAL AUPC (CONDITIONAL)

```
CONFIGURATION
  LOCAL AUPC
```

IMPORTANT

Conditional: This menu is displayed when Local Modem AUPC = ON located under the Utility: Modem Type menu.

The menu is available in several modes:

Self-Monitoring AUPC with 1 Modem:	**In this mode ASYNC is not used. This does not require the Overhead card or the Reed-Solomon cards.**
Remote AUPC between 2 Modems:	**The optional Overhead card is installed and the Modem Type is ASYNC located under the Utility: Modem Type menu. In this mode ASYNC is available or,** **The optional Reed-Solomon cards are installed and the Modem Type is AUPC located under Utility: Modem Type menu.**

Press <ENTER> to review or edit sub-menus that follow. The selections are On or Off.

FUNCTION SELECT: CONFIGURATION: LOCAL AUPC: AUPC ENABLE (CONDITIONAL)

```
AUPC ENABLE
    OFF
```

IMPORTANT

Conditional: This menu is displayed when Local Modem AUPC = ON located under the Utility: Modem Type menu.

Programs the AUPC On or Off.

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

FUNCTION SELECT: CONFIGURATION: LOCAL AUPC: NOMINAL POWER (CONDITIONAL)

```
NOMINAL POWER
 -10.0 dBm
```

IMPORTANT

Conditional: This menu is displayed when Local Modem AUPC = ON located under the Utility: Modem Type menu.

Programs the nominal power value of the AUPC. The nominal power value can range from 0 to -40 dBm, in 0.5 dBm steps.

Upon entry, the current nominal power value is displayed. Press [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press <ENTER> to execute the change.

FUNCTION SELECT: CONFIGURATION: LOCAL AUPC: MINIMUM POWER (CONDITIONAL)

```
MINIMUM POWER
 -30.0 dBm
```

IMPORTANT

Conditional: This menu is displayed when Local Modem AUPC = ON located under the Utility: Modem Type menu.

Programs the minimum power level of the AUPC. The minimum power level can range from 0 to -40 dBm, in 0.5 dBm steps.

FUNCTION SELECT: CONFIGURATION: LOCAL AUPC: MAXIMUM POWER (CONDITIONAL)

```
MAXIMUM POWER
 -5.0 dBm
```

IMPORTANT

Conditional: This menu is displayed when Local Modem AUPC = ON located under the Utility: Modem Type menu.

Programs the maximum power level of the AUPC. The maximum power level can range from 0 to -40 dBm, in 0.5 dBm steps.

FUNCTION SELECT: CONFIGURATION: LOCAL AUPC: TARGET EB/NO (CONDITIONAL)

```
TARGET EB/NO
  6.0 dB
```

IMPORTANT

Conditional: This menu is displayed when Local Modem AUPC = ON located under the Utility: Modem Type menu.

Manufacturer does not recommend a setting greater than 15.5 dB.

Programs the E_b/N_0 target set point. The E_b/N_0 target set point ranges from 3.2 to 16.0 dB, in 0.1 dB steps

FUNCTION SELECT: CONFIGURATION: LOCAL AUPC: TRACKING RATE (CONDITIONAL)

```
TRACKING RATE
5.0 dB/Min
```

IMPORTANT

Conditional: This menu is displayed when Local Modem AUPC = ON located under the Utility: Modem Type menu.

Programs the maximum tracking rate of the AUPC.

Maximum tracking rate can range from 0.5 to 6.0 dBm/minute, in 0.5 dBm/minute steps.

FUNCTION SELECT: CONFIGURATION: LOCAL AUPC: LOCAL CL ACTION (CONDITIONAL)

```
LOCAL CL ACTION
HOLD
```

IMPORTANT

Conditional: This menu is displayed when Local Modem AUPC = ON located under the Utility: Modem Type menu.

Programs the Local Carrier Loss action (CL) for HOLD, NOMINAL, or MAXIMUM. The modulator at the local carrier end moves to this value upon carrier loss.

HOLD	**Upon Carrier Loss (CL) the carrier level remains at the level just before carrier loss.**
NOMINAL	**Upon CL the TX Carrier Level reverts to the Nominal Power Level programmed under Configuration: Local AUPC: Nominal Power**
MAXIMUM	**Upon CL the TX Carrier Level is programmed to the level programmed under Configuration: Local AUPC: Maximum Power.**

FUNCTION SELECT:CONFIGURATION:LOCAL AUPC: REMOTE CL ACTION (CONDITIONAL)

```
REMOTE CL ACTION
      HOLD
```

IMPORTANT

Conditional: This menu is displayed when Local Modem AUPC = ON located under the Utility: Modem Type menu.

Programs the Remote Carrier Loss action (CL) for HOLD, NOMINAL, or MAXIMUM. The modulator carrier at the local end moves to this value upon carrier loss at the remote end. This only applies to remote AUPC between two carriers.

HOLD	**Upon Carrier Loss (CL) the carrier level remains at the level just before carrier loss.**
NOMINAL	**Upon CL the TX Carrier Level reverts to the Nominal Power Level programmed under Configuration: Local AUPC: Nominal Power**
MAXIMUM	**Upon CL the TX Carrier Level is programmed to the level programmed under Configuration: Local AUPC: Maximum Power.**

4.6.1.5 FUNCTION SELECT: CONFIGURATION: SAVE

```
CONFIGURATION
SAVE
```

CONFIGURATION SAVE: 1, 2, 3, 4 or 5

The Configuration Save menu allows programming of configuration parameters into non-volatile 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.

4.6.1.6 FUNCTION SELECT: CONFIGURATION: RECALL

```
CONFIGURATION
RECALL
```

CONFIGURATION RECALL: 1, 2, 3, 4 or 5

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.

4.6.2 FUNCTION SELECT: MONITOR

```
FUNCTION SELECT
    MONITOR
```

Press <ENTER > to review or edit the following sub-menus.

FUNCTION SELECT: MONITOR: RAW BER

```
RAW BER
2.4 E-3
```

Displays the current BER or “No Data” (if carrier is not locked).
Range: < m.m E-e to > m.m E-e.

Notes:

1. Low limit is based on performance.
2. High limit is based on data/code rate.

Press[←] or [→] to move the flashing cursor, and [↑] or [↓] to increment or decrement the selected kbps. Press <ENTER> to execute the change.

FUNCTION SELECT: MONITOR: CORRECTED BER

```
CORRECTED BER
 4.0  E-3
```

Displays the current corrected BER or “No Data” (if carrier is not locked).
Range: 1.0 E-3 to 1.0 E-12.

Notes:

1. Low limit is based on performance.
2. High limit is 1.0 E-12.

Press[←] or [→] to move the flashing cursor, and [↑] or [↓] to increment or decrement the selected kbps. Press <ENTER> to execute the change.

FUNCTION SELECT: MONITOR:EB/NO

```
EB/NO
16.0 dB
```

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

Notes:

1. Low limit is based on the data rate.
2. High limit is 16.0 dB.

Press[←] or [→] to move the flashing cursor, and [↑] or [↓] to increment or decrement the selected kbps. Press <ENTER> to execute the change.

FUNCTION SELECT: MONITOR: RECEIVE SIGNAL

```
RECEIVE SIGNAL
-45.0dBm
```

Displays the current receive signal level.
Range: -135 dBm + 10 log (SR) to -85 dBm + 10log (SR)

Press[←] or [→] to move the flashing cursor, and [↑] or [↓] to increment or decrement the selected kbps. Press <ENTER> to execute the change.

FUNCTION SELECT: MONITOR: SWEEP FREQUENCY

```
SWEEP FREQUENCY
+     0 Hz
```

Displays the current offset frequency or “No Data” (if carrier is not locked).
Range: -500,000 to +500,000 Hz.

Press[←] or [→] to move the flashing cursor, and [↑] or [↓] to increment or decrement the selected kbps. Press <ENTER> to execute the change.

FUNCTION SELECT: MONITOR: BUFFER FILL

```
BUFFER FILL
    50%
```

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

FUNCTION SELECT: MONITOR: FRAME ERRORS (CONDITIONAL)

```
FRAME ERRORS
  n.n E-e
```

```
2047 ERRORS
  n.n E-e
```

IMPORTANT

Conditional: This menu available only when the optional Overhead Card is installed.

Displays the current framing pattern bit error rate or "No Data" (if carrier is not locked). Monitors the currently selected READ_ERROR function.
Range: < mm.m E-e to > mm.m E-e.

Notes:

1. Low limit is based on performance.
2. High limit is based on the data/code rate.

Frame Errors	**Measured when framed modes of operation are active.**
2047 Errors	**Measured when the RX 2047 PATTERN (under the Configuration: Interface menu) is tuned On.**

FUNCTION SELECT: MONITOR: LNB CURRENT

```
LNB CURRENT
  XXX mA
```

Monitors the LNB current or "LNB POWER OFF."
Current displayed is 0 to 500 mA in 1 mA increments.

FUNCTION SELECT: MONITOR: LNB VOLTAGE

```
LNB VOLTAGE
 XX VOLTS
```

Monitors the LNB voltage or "LNB VOLTAGE OFF."
Voltage displayed is 0 to 24 VDC, in 1volt increments.

FUNCTION SELECT: MONITOR: ODU CURRENT

```
ODU CURRENT
  XXXX mA
```

Monitors the ODU current or "ODU POWER OFF."
Current displayed is 0 to 5000 mA in 1 mA increments.

FUNCTION SELECT: MONITOR: ODU VOLTAGE

```
ODU VOLTAGE
XX.X VOLTS
```

Monitors the ODU voltage or "ODU POWER OFF."
Voltage displayed is 0 to 64 volts, in 0.1 volt increments.

FUNCTION SELECT: MONITOR: ODU OUTPUT LEVEL (CONDITIONAL)

```
ODU OUTPUT LEVEL
xx.xx dBm
```

IMPORTANT

Conditional: This menu is displayed when the FSK and ODU POWER SUPPLY are On under the Configuration: Modulator menu.

Displays ODU output power as reported by an FSK capable BUC.

FUNCTION SELECT: MONITOR: ODU OUTPUT LEVEL (OPTIONAL) (CONDITIONAL)

```
ODU OUTPUT LEVEL
xx.xx/xx.xxT dBm
```

IMPORTANT

Conditional: This menu is displayed when FSK and ODU POWER SUPPLY are On, under the Configuration: Modulator menu, and Power Leveling is On under the Utility: Outdoor Unit menu.

Displays ODU output power, as reported by an FSK capable BUC, and the ODU output power target (T), that was set when Power Leveling was turned On.

FUNCTION SELECT: MONITOR: ODU TEMPERATURE (CONDITIONAL)

```
ODU TEMPERATURE
+ XX°C/OK
```

IMPORTANT

Conditional: This menu is displayed when FSK and ODU POWER SUPPLY are ON under the Configuration: Modulator menu.

Displays ODU (BUC) temperature of 00 ± 99°C of an FSK capable BUC.

FUNCTION SELECT: MONITOR: ODU PLL LOCK (CONDITIONAL)

```
ODU PLL LOCK
OK/UNLOCKED
```

IMPORTANT

Conditional: This menu is displayed when FSK and ODU POWER SUPPLY are ON under the Configuration: Modulator menu.

Displays the ODU PLL Lock status of an FSK capable BUC. The ODU PLL requires that the ODU 10 MHz reference is On under the ***Configuration: Modulator*** menu.

FUNCTION SELECT: MONITOR: ODU SOFTWARE (CONDITIONAL)

```
ODU SOFTWARE
 VER: XX
```

IMPORTANT

Conditional: This menu is displayed when FSK and ODU POWER SUPPLY are ON under the Configuration: Modulator menu.

Displays the ODU current software version 0 to 15 of an FSK capable BUC.

FUNCTION SELECT: MONITOR: ODU POWER CLASS (CONDITIONAL)

```
ODU POWER CLASS
  XX   WATTS
```

IMPORTANT

Conditional: This menu is displayed when FSK and ODU POWER SUPPLY are ON under the Configuration: Modulator menu.

Displays the Power Class from 0 to 60 watts of an FSK capable BUC.

FUNCTION SELECT: MONITOR: TX L-BAND FREQ (CONDITIONAL)

```
TX L-Band FREQ
1200.0000 MHz
```

IMPORTANT

Conditional: This menu is displayed when the TX Terminal LO (frequency) and Mix are programmed under the Utility: Modulator TX Terminal LO menu.

Displays the TX L-Band frequency within 950 to 1750 MHz.

FUNCTION SELECT: MONITOR: RX L-BAND FREQ (CONDITIONAL)

```
RX L-Band FREQ
1200.0000 MHz
```

IMPORTANT

Conditional: This menu is displayed when the RX Terminal LO (frequency) and Mix is programmed under the Utility: Demodulator RX Terminal LO menu.

Displays the TX L-Band frequency with 950 to 1750 MHz.

4.6.3 FUNCTION SELECT: FAULTS/ALARMS

```
FUNCTION SELECT
FAULTS/ALARMS
```

Press <ENTER > to review or edit the following sub-menus.

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.

FUNCTION SELECT: FAULTS/ALARMS: MODULATOR

```
    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.**

FUNCTION SELECT: FAULTS/ALARMS: DEMODULATOR

```
  DEMODULATOR
-------
```

CARRIER DETECT	**Carrier detect fault. Indicates the decoder is not locked.**
IF SYNTHESIZER	**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.**
LNB CURRENT	**LNB Current fault.**

FUNCTION SELECT: FAULTS/ALARMS: TX INTERFACE

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

TX DROP	**Drop interface hardware fault. Typically indicates that the drop interface PLL is not locked (D&I only). (Overhead Card only.)**
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. (Overhead Card only.)** **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	**IDR TX audio for channel 1 is clipped. (Overhead Card only.)**
TX AUDIO 2 CLIP	**IDR TX audio for channel 2 is clipped. (Overhead Card only.)**
CONFIGURATION	**TX interface configuration fault.** **Indicates the TX interface cannot execute a programmed configuration parameter.**

FUNCTION SELECT: FAULTS/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. (Overhead Card only.)** **Note: AIS is an alarm, not a switching fault.**
FRAME BER	**Frame BER fault. Indicates that the frame BER exceeds 1^{-3}.**
BACKWARD ALARM	**Backward alarms.**
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. (Overhead Card only.)**
RX 2047 LOCK	**RX 2047 lock alarm. Indicates the RX 2047 data pattern is not locked. (Overhead Card only.)** **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	**Insert interface hardware fault. Typically indicates the insert interface PLL is not locked. This fault is only available when D&I are selected for modem type.**
RX AUDIO 1 CLIP	**IDR RX audio for channel 1 is clipped. (Overhead Card only.)**
RX AUDIO 2 CLIP	**IDR RX audio for channel 2 is clipped. (Overhead Card only.)**
CONFIGURATION	**Configuration alarm**

FUNCTION SELECT: FAULTS/ALRMS: COMMON

```
     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	**Built in self test fault.**
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.**

FUNCTION SELECT: FAULTS/ALARMS: BACKWARD ALARMS (CONDITIONAL)

```
   BACKWARD ALARMS
--------------
```

IMPORTANT

Only available with IDR selected and Overhead Card is installed.

BW Alarm RX #4	**Receive backward alarm #4 indicator.**
BW Alarm RX #3	**Receive backward alarm #3 indicator.**
BW Alarm RX #2	**Receive backward alarm #2 indicator.**
BW Alarm RX #1	**Receive backward alarm #1 indicator.**
BW Alarm TX #4	**Transmit backward alarm #4 indicator.**
BW Alarm TX #3	**Transmit backward alarm #3 indicator.**
BW Alarm TX #2	**Transmit backward alarm #2 indicator.**
BW Alarm TX #1	**Transmit backward alarm #1 indicator.**

FUNCTION SELECT: FAULTS/ALARMS: OUTDOOR UNIT

```
      OUTDOOR UNIT
-----
```

Note: Faults are only displayed if active.

		Fault Active - When:
Current	**Displays a current fault.**	**ODU (BUC) Power is On and Low or/High Current Alarm set.**
Voltage	**Displays a voltage fault.**	**ODU (BUC) Power is On and ODU Voltage deviates more than 20% from nominal.**
Temperature	**Displays a temperature fault.**	**ODU (BUC) Power is On and FSK is ON.**
PLL Lock	**Displays PLL Lock fault.**	**ODU (BUC) Power is On and FSK is ON.**
Checksum	**Displays checksum fault.**	**ODU (BUC) Power is On and FSK is ON.**

4.6.4 FUNCTION SELECT: STORED FLTS/ALMS

```
FUNCTION SELECT
STORED FLTS/ALMS
```

Press <ENTER > to review or edit the following sub-menus.

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

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. Refer to Faults and Alarms menus for fault explanations. UNAVAL SECONDS fault information. 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. Also 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's 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.

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.

FUNCTION SELECT: STORED FLTS/ALMS: MODULATOR

```
  MODULATOR  X
STORED TIME/DATE
```

Displays the stored date and time of a fault or alarm, such as:

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

FUNCTION SELECT: STORED FLTS/ALMS: DEMODULATOR

```
  DEMODULATOR  X
STORED TIME/DATE
```

Displays the stored date and time of a fault or alarm, such as:

- CARRIER DETECT
- IF SYNTHESIZER
- I CHANNEL
- Q CHANNEL
- BER THRESHOLD
- MODULE
- CONFIGURATION
- LNB CURRENT

FUNCTION SELECT:STORED FLTS/ALMS:TX INTERFACE

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

Displays the stored date and time of a fault or alarm, such as:

- TX DROP
- TX DATA/AIS
- TX CLK PLL
- TX CLK ACTIVITY
- TX AUDIO 1 CLIP
- TX ADUIO 2 CLIP
- CONFIGURATION

FUNCTION SELECT: STORED FLTS/ALMS: RX INTERFACE

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

Displays the stored date and time of a fault or alarm, such as:

- BUFFER UNDERFLOW
- BUFFER OVERFLOW
- RX DATA/AIS
- FRAME BER
- BACKWARD ALARM
- BUFFER CLK PLL
- BUFFER CLK ACT
- DEMUX LOCK
- RX 2047 LOCK
- BUFFER FULL
- RX INSERT
- RX AUDIO 1 CLIP
- RX AUDIO 2 CLIP
- CONFIGURATION

FUNCTION SELECT: STORED FLTS/ALMS: COMMON

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

Displays the stored date and time of a fault or alarm, such as:

- BATTERY/CLOCK
- -12 VOLT SUPPLY
- +12 VOLT SUPPLY
- +5 VOLT SUPPLY
- SELF TEST
- CONTROLLER
- INTERFACE MODULE

FUNCTION SELECT: STORED FLTS/ALMS: BACKWARD ALRMS (CONDITIONAL)

```
 BACKWARD ALRMS   X
STORED TIME/DATE
```

IMPORTANT

Conditional: Only available with IDR selected for Modem Type.

Displays the stored date and time of a fault or alarm, such as:

- BW ALRM RX #4
- BW ALRM RX #3
- BW ALRM RX #2
- BW ALRM RX # 1
- BW ALRM TX #4
- BW ALRM TX #3
- BW ALRM TX #2
- BW ALRM TX # 1

FUNCTION SELECT: STORED FLTS/ALMS: OUTDOOR UNIT

```
OUTDOOR UNIT  X
_ _ _ _ _
```

Displays the stored outdoor unit fault or alarm, such as:

• CURRENT	ODU POWER ON ONLY
• VOLTAGE	ODU POWER ON ONLY
• TEMPERATURE	FSK ONLY
• PLL LOCK	FSK ONLY
• CHECKSUM	FSK ONLY

FUNCTION SELECT: STORED FLTS/ALMS: UNAVAILABLE SECONDS (CONDITIONAL)

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

IMPORTANT

Conditional: This is available only with the Reed-Solomon option.

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

FUNCTION SELECT: STORED FLTS/ALARMS: CLEAR

```
CLEAR  ??
STORED FAULTS
```

To clear the currently logged stored faults, press [ENTER] when the “Clear Stored Faults/Yes?” selection is displayed.

4.6.5 FUNCTION SELECT: REMOTE AUPC (CONDITIONAL)

```
FUNCTION SELECT
  REMOTE AUPC
```

IMPORTANT

Conditional: This menu is available when either the ASYNC or AUPC selection is made from the Modem Type menu, located under the Utility: Modem Type menu.

Requires either the Overhead Card installed with the ASYNC/AUPC option or the Reed-Solomon Card with AUPC option.

To view or change the Remote AUPC functions, enter the Remote AUPC menu from the Function Select menu on the front panel. After entering the Remote AUPC menu, press [←] or [→] to select the Configuration or Monitor menu. Enter the selected menu by pressing [ENTER]. Press [←] or [→] to view the selected configuration parameters.

FUNCTION SELECT: REMOTE AUPC: CONFIGURATION (CONDITIONAL)

```
  REMOTE AUPC
CONFIGURATION
```

IMPORTANT

Conditional: This menu is available when either the ASYNC or AUPC selection is made from the Modem Type menu, located under the Utility: Modem Type menu.

Requires either the Overhead Card installed with the ASYNC/AUPC option or the Reed-Solomon Card with AUPC option.

FUNCTION SELECT: REMOTE AUPC: CONFIGURATION: AUPC ENABLE (CONDITIONAL)

```
AUPC ENABLE
    OFF
```

IMPORTANT

Conditional: This menu is available when either the ASYNC or AUPC selection is made from the Modem Type menu, located under the Utility: Modem Type menu.

Requires either the Overhead Card installed with the ASYNC/AUPC option or the Reed-Solomon Card with AUPC option.

Programs the AUPC feature On or Off at the far end of the link. This requires that modems at both ends of the link are locked to function. This program is for control or last known status.

FUNCTION SELECT: REMOTE AUPC: CONFIGURATION: B-BAND LOOP BACK (CONDITIONAL)

```
B-BAND LOOP BACK
      OFF
```

IMPORTANT

Conditional: This menu is available when either the ASYNC or AUPC selection is made from the Modem Type menu, located under the Utility: Modem Type menu.

Requires either the Overhead Card installed with the ASYNC/AUPC option or the Reed-Solomon Card with AUPC option.

Programs the remote baseband loopback On or Off at the far end of the link. Modems at both ends of the link shall be locked.

Note: This program is for control or last known status.

FUNCTION SELECT: REMOTE AUPC: CONFIGURATION: TX 2047 PATTERN (CONDITIONAL)

```
TX 2047 PATTERN
      OFF
```

IMPORTANT

Conditional: This menu is available when either the ASYNC or AUPC selection is made from the Modem Type menu, located under the Utility: Modem Type menu.

Requires either the Overhead Card installed with the ASYNC/AUPC option or the Reed-Solomon Card with AUPC option.

Programs the remote TX 2047 pattern On or Off at the far end of the link. Modems at both ends of the link shall be locked.

Note: This program is for control or last known status.

FUNCTION SELECT: REMOTE AUPC: CONFIGURATION: REMOTE AUPC: MONITOR (CONDITIONAL)

```
REMOTE AUPC
  MONITOR
```

IMPORTANT

Conditional: This menu is available when either the ASYNC or AUPC selection is made from the Modem Type menu, located under the Utility: Modem Type menu.

Requires either the Overhead Card installed with the ASYNC/AUPC option or the Reed-Solomon Card with AUPC option.

FUNCTION SELECT: REMOTE AUPC: CONFIGURATION: REMOTE AUPC: MONITOR: 2047 ERRORS (CONDITIONAL)

```
2047 ERRORS
n.n E-e
```

IMPORTANT

Conditional: This menu is available when either the ASYNC or AUPC selection is made from the Modem Type menu, located under the Utility: Modem Type menu.

Requires either the Overhead Card installed with the ASYNC/AUPC option or the Reed-Solomon Card with AUPC option.

Receive 2047 BER. This is a monitor point that displays the current RX 2047 BER at the far end of the link. Modems at both ends of the link shall be locked.

If no data is available, “No Data” is displayed.

4.6.6 FUNCTION SELECT: UTILITY

```
FUNCTION SELECT
UTILITY
```

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

4.6.6.1 FUNCTION SELECT: UTLITY: FIXED MODEM RATE

```
UTILITY
FIXED MODEM RATE
```

FUNCTION SELECT: UTLITY: FIXED MODEM RATE: CODE RATE/DATA RATE (CONDITIONAL)

```
CR: _______________

DR: _____________Kb
```

IMPORTANT

This menu is displayed when the modem has the Single Data Rate option and the code/data rates are not programmed.

- If CR/DR is blank, user is allowed to enter code and data rate one time.
- If CR/DR is displayed, then fixed code/data rate is shown

4.6.6.2 FUNCTION SELECT: UTILITY: MODULATOR

```
UTILITY
MODULATOR
```

Select information to view using the [←] [→] arrow keys, then press ENTER.

FUNCTION SELECT: UTLITY: MODULATOR: ASSIGN TRANSMIT FILTERS

Note: Alternating the setting in the following menus, changes the settings in the menus that appear under the ***Configuration: Modulator*** menus.

```
TX-A   QPSK 1/2
 64.000 Kbps
```

```
TX-B   QPSK 1/2
128.000 Kbps
```

```
TX-C   QPSK 1/2
256.000 Kbps
```

```
TX-D   QPSK 1/2
512.000 Kbps
```

```
TX-V   QPSK 1/2
 38.400 Kbps
```

Select one of four (A, B, C, or D) pre-defined transmitter code/data rate combinations or a variable rate selection (V).

Code Rate	Data Rate Range
Non-Turbo Requirements	
BPSK 1/2	2.4 to 1250 kbps
{O}QPSK 1/2	4.8 to 2500 kbps
{O}QPSK 3/4	7.2 to 3750 kbps
QPSK 7/8	8.4 to 4375 kbps
8PSK 2/3	64.0 to 5000 kbps
BPSK 1/1	4.8 to 2500 kbps
{O}QPSK 1/1	9.6 to 5000 kbps
Turbo Requirements	
BPSK 21/44	2.4 to 1193.181 kbps
BPSK 5/16	2.4 to 781.25 kbps
{O}QPSK 1/2	4.8 to 2386.363 kbps
8PSK 3/4	384 to 5000 kbps

Notes:
1. Max Symbol Rate = 2500 ksps
2. Max Data Rate for Low Var. Rate: 512 kbps.
3. OQPSK Option only: OQPSK 1/2, 3/4, and 7/8

Upon entry, the current transmitter rate is displayed with the flashing cursor on the first character of the code rate on line 1. Line 2 displays the data rate. Press [←] or [→] to make the selection. To select the currently defined variable data rate, select TX-V, and press <ENTER> twice.

To change the rate using the variable rate selection, press <ENTER> when TX-V is displayed. A flashing cursor is displayed on the first character of the coding type on line 1. Press [←] or [→] to move the flashing cursor, and [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press <ENTER> to execute the change.

Notes:
1. When the TX rate has been programmed, the transmitter is automatically turned off to prevent swamping of other channels.
2. To turn the transmitter on, use the TX-IF Output function.
3. Code Rate 3/4 not compatible with a combination of a CSC Closed Modulator Type and Sequential Encoder.

FUNCTION SELECT: UTILITY: MODULATOR: TX TERMINAL LO

```
TX TERMINAL LO
0 MHz   MIX:-
```

Valid selections entered into this menu make it possible to directly program the frequency transmitted from the satellite terminal using the ***Configuration: Modulator***: ***Terminal Frequency*** menu. The combination of the LO and MIX determine the terminal frequency displayed. (When the terminal frequency mode is active, the actual TX L-Band frequency is displayed under the ***Function Select: Monitor*** menu.)

Utility Modulator TX Terminal LO Menu		
LO	**MIX**	**Configuration: Modulator Menu (Effect On)**
0	+ or -	The TX IF Frequency menu appears and the modem is programmed over the L-Band range of frequencies.
3000 - 65000	+	The TX Terminal Frequency menu appears and the modem is programmed: TX Terminal Frequency = LO + L-Band Frequency
3000 - 65000	-	The TX Terminal Frequency menu appears and the modem is programmed : TX Terminal Frequency = LO – L-Band Frequency

The sign of the Mix, + or **-**, is determined as follows:

Mix = “+” when LO < terminal (satellite) operating frequency of the ODU or BUC.
Mix = “**-**“ when LO > terminal (satellite) operating frequency of the ODU or BUC.

Examples:

LO = 4900 MHz Mix = “+”

TX Terminal Frequency (Max) = 4900 + 1750 = 6650 MHz

TX Terminal Frequency (Min) = 4900 + 950 = 5850 MHz

LO = 15450 MHz Mix = “**-**“

TX Terminal Frequency (Max) = 15450 - 950 = 14500 MHz

TX Terminal Frequency (Min) = 15450 - 1750 = 13700 MHz

FUNCTION SELECT: UTILITY: MODULATOR: MOD POWER OFFSET

```
MOD POWER OFFSET
   + 0.0 dB
```

Modulator power offset adjusts. Offsets the modulator output power readout in the Configuration menu. This feature does not actually change the modulator power level, but displays an offset value in the monitor. The modulator power offset range is -99.9 to +99.9 dB, in 0.1 dB steps.

Note: Anything except 0.0 dB will cause (ADJ) to be displayed in the TX Power Level menu.

FUNCTION SELECT: UTILITY: MODULATOR: MODULATOR TYPE

```
MODULATOR TYPE
INTELSAT OPEN
```

Transmit filter type select. Select INTELSAT OPEN, EFD CLOSED, CSC CLOSED, FDC CLOSED, or SDM-51 COMPATIBLE network filtering.

Notes:

1. TX filter type is selectable only when CUSTOM is selected for the modem type in the ***Utility: Modem Type*** menu.
2. CSC CLOSED Modulator Type is not compatible with a 3/4 Code Rate and Sequential Encoder Type combination.

FUNCTION SELECT: UTILITY: MODULATOR: ENCODER TYPE

```
ENCODER TYPE
  VITERBI
```

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

Notes:

1. A Sequential Encoder Type and a 3/4 Code Rate combination are not compatible with a CSC CLOSED Modulator Type.
2. Change only when Modem Type (under ***Utility: Modem*** Type) is EFD, ASYNC, or Custom.

FUNCTION SELECT: UTILITY: MODULATOR: SCRAMBLER TYPE

```
SCRAMBLER TYPE
INTELSAT V.35
```

This menu is status only and displays:

- With Overhead and IBS Scrambler ON: IBS SYNC
- With RS Scrambler On: EFD MOD V.35 or IBS SYNC
- With Turbo Scrambler On: TURBO SYNC

Intelsat V.35, FDC MOD V.35, ITU V.35, or Off.

Scrambler Type	Description
Intelsat V.35	Self-SYNC scrambling per IESS-308.
FDC MOD V.35	Compatible with Fairchild modems.
ITU V.35	Closed Network Viterbi and Sequential with No Reed-Solomon.
OFF	Scrambling is disabled.
IBS SYNC	Intelsat per IESS-309.
EF MOD V.35	Comtech EFD proprietary scrambling for Closed Network with Reed-Solomon On.
Turbo SYNC	Turbo SYNC - scrambler

FUNCTION SELECT: UTILITY: MODULATOR: TX BPSK ORDERING

```
TX BPSK ORDERING
    STANDARD
```

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

FUNCTION SELECT: UTILITY: MODULATOR: MOD SPECTRUM

```
MOD SPECTRUM
   NORMAL
```

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

FUNCTION SELECT: UTILITY: MODULATOR: TX-RS N/K DEEP (CONDITIONAL)

```
TX-RS N/K DEEP
225/205      8
```

IMPORTANT

Conditional: This menu is active when Reed-Solomon (RS) is installed and RS is On (under Configuration: Modulator).

N/K is status only.

Deep is interleaver depth and is programmable to a depth of 4, 8, or 16.

FUNCTION SELECT: UTILITY:MODULATOR: TX IESS-310 MODE (CONDITIONAL)

```
TX IESS-310 MODE
      OFF
```

IMPORTANT

Conditional: Only available when 8PSK option and RS option are installed and selected.

An On indication enables 8PSK 2/3 with Reed-Solomon.

FUNCTION SELECT: UTILITY: MODULATOR: TX MODE

```
  TX MODE
CONTINUOUS
```

Selection of TX Mode IN Continuous or Burst.

FUNCTION SELECT: UTILITY: MODULATOR: ODU ALARM - LOW

```
ODU ALARM - LOW
     0 MA
```

Sets ODU Alarm – Low within 0 to 4000 mA, in 1 mA steps. An alarm is produced whenever the ODU or BUC current falls below the programmed limit.

FUNCTION SELECT: UTILITY: MODULATOR: ODU ALARM - HIGH

```
ODU ALARM - HIGH
    4000 mA
```

Sets ODU Alarm – High within 0 to 4000 mA, in 1 mA steps. An alarm is produced whenever the ODU/BUC current exceeds the programmed limit. The low limit shall be less than the high limit.

FUNCTION SELECT: UTILITY: MODULATOR: RF MODE CONTROL

```
RF MODE CONTROL
    NORMAL
```

This menu control several operational variations of the Transmitted (TX) L-Band. This menu allows Front Panel selection of the RF Mode setting that was previously available from the remote port using RS-232/485 communications.

Selection	Operation
Normal Mode	
Power (prime Power)	The TX carrier is tuned Off when prime power is applied to the modem.
COMM	The TX carrier is tuned Off if prime power is applied and remote port communications is not detected after 10 seconds.
Carrier Detect (CD)	The TX carrier is tuned Off when CD is not detected.

Notes:

1. For the RF ON Condition: the TX-IF shall be programmed On.
2. For RTS TX-IF, when enabled overrides CD.

This command allows for enabling or disabling of the TX carrier output depending on the described conditions. One application for command is the operation of demand network systems.

FUNCTION SELECT: UTILITY: MODULATOR: TX SYMBOL RATE

```
TX SYMBOL RATE
 64.000 Ksps
```

Status only: 4.800 to 2500 ksps. Provides symbol rate corresponding to the data rate, code rate(s), modulation and overhead (framing) programmed into the modulator.

4.6.6.3 FUNCTION SELECT: UTILITY: DEMODULATOR

```
  UTILITY
DEMODULATOR
```

Select information to view using the [←] [→] arrow keys, then press <ENTER>.

FUNCTION SELECT:UTILITY:DEMODULATOR: ASSIGN RECEIVE FILTERS

Note: Alternating the setting in the following menus, changes the settings in the menus that appear under the ***Configuration: Demodulator*** menus.

```
RX-A   QPSK 1/2
 64.000 Kbps
```

```
RX-B   QPSK 1/2
 128.000 Kbps
```

```
RX-C   QPSK 1/2
 256.000 Kbps
```

```
RX-D   QPSK 1/2
 512.000 Kbps
```

```
RX-V   QPSK 1/2
 38.400 Kbps
```

Select one of four (A, B, C, or D) pre-defined receiver code/data rate combinations or a variable rate selection (V).

Code Rate	Data Rate Range
Non-Turbo Requirements	
BPSK 1/2	2.4 to 1250 kbps
{O}QPSK 1/2	4.8 to 2500 kbps
{O}QPSK 3/4	7.2 to 3750 kbps
QPSK 7/8	8.4 to 4375 kbps
8PSK 2/3	64.0 to 5000 kbps
BPSK 1/1	4.8 to 2500 kbps
{O}QPSK 1/1	9.6 to 5000 kbps
Turbo Requirements	
BPSK 21/44	2.4 to 1193.181 kbps
BPSK 5/16	2.4 to 781.25 kbps
{O}QPSK 1/2	4.8 to 2386.363 kbps
8PSK 3/4	384 to 5000 kbps

Upon entry, the current receive rate is displayed with the flashing cursor on the first character of the code rate on line 1. Line 2 displays the data rate. Press [←] or [→] to make the selection. To select the currently defined variable data rate, select TX-V, and press [ENTER] twice.

To change the rate using the variable rate selection, press [ENTER] when TX-V is displayed. A flashing cursor is displayed on the first character of the coding type on line 1. Press [←] or [→] to move the flashing cursor, and [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press [ENTER] to execute the change.

Notes:

1. When the RX rate has been programmed, the receiver is automatically turned off to prevent swamping of other channels. To turn the receiver on, use the RX-IF Output function.
2. Code Rate 3/4 not compatible with a combination of a CSC Closed Modulator Type and Sequential Encoder.

FUNCTION SELECT:UTILITY: DEMODULATOR: RX TERMINAL LO

```
RX TERMINAL LO
O MHz   MIX: -
```

Valid selections entered into this menu make it possible to directly program the frequency received by the satellite terminal using the ***Configuration: Demodulator: Terminal Frequency*** menu. The combination of the LO and MIX determine the terminal frequency displayed. (When the terminal frequency mode is active, the actual RX L-Band frequency is displayed under the ***Function Select: Monitor*** menu.)

Utility Modulator RX Terminal LO Menu		
LO	**MIX**	**Configuration: Demodulator Menu (Effect on)**
0	+ or -	The RX IF Frequency menu appears and the modem is programmed over the L-Band range of frequencies.
3000 - 65000	+	The RX Terminal Frequency menu appears and the modem is programmed: TX Terminal Frequency = LO + L-Band Frequency
3000 - 65000	-	The RX Terminal Frequency menu appears and the modem is programmed : RX Terminal Frequency = LO – L-Band Frequency

The sign of the Mix, + or **-**, is determined as follows:

Mix = “+” when LO < terminal (satellite) operating frequency of the LNB.
Mix = “**-**“ when LO > terminal (satellite) operating frequency of the LNB.

Examples:

LO = 11300 MHz Mix = “+”

RX Terminal Frequency (Max) = 11300 + 1750 = 13050 MHz

RX Terminal Frequency (Min) = 11300 + 950 = 12250 MHz

LO = 5150 MHz Mix = “**-**“

TX Terminal Frequency (Max) = 5150 - 950 = 4200 MHz

TX Terminal Frequency (Min) = 5150 - 1750 = 3400 MHz

FUNCTION SELECT: UTILITY: DEMODULATOR: DEMODULATOR TYPE (CONDITIONAL)

```
DEMODULATOR TYPE
 INTELSAT OPEN
```

IMPORTANT

Conditional: RX FILTER TYPE is selectable only when Custom is selected for modem type in the Utility: Modem Type menu.

Receive filter type select. Select Type INTELSAT OPEN, EFD CLOSED, CSC CLOSED, or FDC CLOSED network receive filtering.

FUNCTION SELECT: UTILITY: DEMODULATOR: DECODER TYPE (CONTIONAL)

```
DECODER TYPE
  VITERBI
```

IMPORTANT

Conditional: Changes only when Modem Type (under Utility: Modem Type) is in either EFD, Custom, or ASYNC mode.

Decoder type selection. Select VITERBI, SEQUENTIAL, or TURBO decoder type. The modem must have the proper hardware enabled.

FUNCTION SELECT: UTILITY: DEMODULATOR: DESCRAMBLER TYPE

```
DESCRAMBLER TYPE
 INTELSAT V.35
```

This menu is status only and displays:

- With Overhead and IBS Descrambler ON: IBS SYNC
- With RS Descrambler On: EFD MOD V.35 or IBS SYNC
- With Turbo Descrambler On: TURBO SYNC

Intelsat V.35, FDC MOD V.35, ITU V.35, or Off.

Descrambler Type	Description
Intelsat V.35	Self-SYNC scrambling per IESS-308.
FDC MOD V.35	Compatible with Fairchild modems.
ITU V.35	Closed Network Viterbi and Sequential with No Reed-Solomon.
OFF	Descrambling is disabled.
IBS SYNC	Intelsat per IESS-309.
EF MOD V.35	Comtech EFD proprietary descrambling for Closed Network with Reed-Solomon On.
Turbo SYNC	Turbo SYNC - Descrambler

FUNCTION SELECT: UTILITY: DEMODULATOR: RX BPSK ORDERING

```
RX BPSK OREDERING
    STANDARD
```

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

FUNCTION SELECT: UTILITY: DEMODULATOR: DEMOD SPECTRUM

```
DEMOD SPECTRUM
    NORMAL
```

Programmable vector rotation. Select Normal or Inverted for spectrum reversal of the I and Q baseband channels.

FUNCTION SELECT: UTILITY: DEMODULATOR: RX-RS N/K DEEP (CONDITIONAL)

```
RX-RS N/K DEEP
 225/205     8
```

IMPORTANT

Conditional: This menu is active only when Reed-Solomon (RS) is installed and RS Option is On (under Configuration: Demodulator).

N/K is status only.

Deep is interleaver depth and is programmable to a depth of 4, 8, or 16.

FUNCTION SELECT: UTILITY: DEMODULATOR: RX IESS-310 MODE (CONDITIONAL)

```
RX IESS-310 MODE
      OFF
```

IMPORTANT

Conditional: **Note:** ***Only available when the 8PSK option is selected and Reed-Solomon option is installed and selected.***

Selection of On or Off used for 8PSK 2/3 with Reed-Solomon.

FUNCTION SELECT: UTILITY: DEMODULATOR: LNB ALARM - LOW

```
LNB ALARM - LOW
     0 mA
```

Status Only. Programmable within 0 to 500 mA, in 1 mA steps.

An alarm is generated whenever the LNB current falls below the programmed limit.

FUNCTION SELECT: UTILITY: DEMODULATOR: LNB ALARM - HIGH

```
LNB ALARM - HIGH
     500 mA
```

Status Only. Programmable within 0 to 500 mA, in 1 mA steps. An alarm is generated whenever the LNB current exceeds the programmed limit.

Note: The low limit must be less than the high limit.

FUNCTION SELECT: UTILITY: DEMODULATOR: RX SYMBOL RATE

```
RX SYMBOL RATE
 64.000 Ksps
```

Status Only. Programmable with 4.800 to 2500 ksps. Provides the symbol rate corresponding to the data rate, code rate(s), modulation, and overhead (framing) programmed into the demodulator.

4.6.6.4 FUNCTION SELECT: UTILITY: INTERFACE

```
UTILITY
INTERFACE
```

Select information to view using the [←] [→] arrow keys, then press ENTER.

FUNCTION SELECT: UTILITY: INTERFACE: TX OVERHEAD TYPE

```
TX OVERHEAD TYPE
NONE
```

Select None, IDR, IBS, DROP & INSERT, or ASYNC for TX overhead type.

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

FUNCTION SELECT: UTILITY: INTERFACE: RX OVERHEAD TYPE

```
RX OVERHEAD TYPE
NONE
```

Select None, IDR, IBS, DROP & INSERT, or ASYNC for TX overhead type.

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

FUNCTION SELECT: UTILITY: INTERFACE: TX TERR INTERFACE (CONDITIONAL)

```
TX TERR INTERFACE
      RS422
```

IMPORTANT

Conditional: G.703 is available only when the overhead interface card is installed.

Displays the TX interface type EIA-232, EIA-422, V.35, or G.703.

FUNCTION SELECT: UTILITY: INTERFACE: RX TERR INTERFACE (CONDITIONAL)

```
RX TERR INTERFACE
      RS422
```

IMPORTANT

Conditional: G.703 is available only when the overhead interface card is installed.

Displays the RX interface type EIA-232, EIA-422, V.35, or G.703.

FUNCTION SELECT: UTILITY: INTERFACE: BUFFER PROGRAM

```
BUFFER PROGRAM
     BITS
```

Allows selection of either Bits or Milliseconds for the receive buffer.

- For the modem to calculate buffer size, select Milliseconds.
- For a specific buffer depth, select Bits.

IMPORTANT

This menu indicates whether the Bits or Milliseconds menu is displayed under Configuration: Interface Buffer Size.

FUNCTION SELECT:UTILITY:INTERFACE: FRAMING STRUCTURE

```
  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 .

FUNCTION SELECT: UTILITY: INTERFACE: FRAMING STRUCTURE: INTERFACE: FRAMING STRUCTURE: T1 FRAMING

```
T1 FRAMING
STRUCTURE:  G.704
```

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.

FUNCTION SELECT: UTILITY: INTERFACE: FRAMING STRUCTURE: E1 FRAMING

```
E1 FRAMING
STRUCTURE:  G.704
```

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.

FUNCTION SELECT:UTILITY: INTERFACE: RTS TX-IF CNTRL

```
RTS TX-IF CNTRL
OFF
```

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

FUNCTION SELECT: UTILITY: INTERFACE: TX DATA PHASE

```
TX DATA PHASE
   NORMAL
```

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

FUNCTION SELECT: UTILITY: INTERFACE: RX DATA PHASE

```
RX DATA PHASE
   NORMAL
```

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

FUNCTION SELECT: UTILITY: INTERFACE: E1 INSERT CRC (CONDITIONAL)

```
E1 INSERT CRC
     ON
```

IMPORTANT

Conditional: This menu is displayed if the optional Overhead card is installed and the optional D&I feature is enabled.

E1 INSERT CRC enables function. Use this option to turn the CRC-4 on the insert side of the E1 ON or OFF. The default for this function is ON. If the equipment cannot use the CRC-4 signal, disable the signal by selecting OFF.

FUNCTION SELECT:UTILITY:INTEFACE:
IDR BACKWARD ALARM CONTROL (CONDITIONAL)

IDR BACKWARD ALARM CONTROL

IMPORTANT

Conditional: This selection is available only when Modem Type = IDR is enabled and the Overhead card is installed.

Controls IDR monitor and alarm functions when not using a communications link. Use this option to select ON or OFF for the RX and TX alarms.

Press [↑] or [↓] to select the backward alarm RX or TX numbers 1 through 4. Press [ENTER] to execute the change.

BW ALARM RX #4 ON	BW ALARM TX #4 ON
BW ALARM RX #3 ON	BW ALARM TX #3 ON
BW ALARM RX #2 ON	BW ALARM TX #2 ON
BW ALARM RX #1 ON	BW ALARM TX #1 ON

FUNCTION SELECT: UTILITY: INTERFACE: ASYNC TX TYPE (CONDITIONAL)

```
ASYNC TX TYPE
   RS232
```

IMPORTANT

Conditional: This menu is available only with Modem Type = ASYNC is enabled and the Overhead card is installed.

Select EIA-232, EIA-485(4-WIRE), or EIA-485(2-WIRE) for ASYNC overhead type.

FUNCTION SELECT: UTILITY: INTERFACE: ASYNC RX TYPE (CONDITIONAL)

```
ASYNC RX TYPE
   RS232
```

IMPORTANT

Conditional: This menu is available only with Modem Type = ASYNC is enabled and the Overhead card is installed.

Select EIA-232, EIA-485(4-WIRE), or EIA-485(2-WIRE) for ASYNC overhead type.

FUNCTION SELECT: UTILITY: INTERFACE: IDR TX ESC TYPE (CONDITIONAL)

```
IDR TX ESC TYPE
 2-32K  AUDIO
```

IMPORTANT

Conditional: This menu is available only with Modem Type = IDR is enabled and the Overhead card is installed.

Select 2-32K Audio or 64K Data for the IDR TX ESC type.

FUNCTION SELECT: UTILITY: INTERFACE: IDR RX ESC TYPE (CONDITIONAL)

```
IDR RX ESC TYPE
 2-32K  AUDIO
```

IMPORTANT

Conditional: This menu is available only with Modem Type = IDR is enabled and the Overhead card is installed.

Select 2-32K Audio or 64K Data for the IDR RX ESC type.

FUNCTION SELECT: UTILITY: INTERFACE: IBS TX ESC TYPE (CONDITIONAL)

```
IBS TX ESC TYPE
 2-32K  AUDIO
```

IMPORTANT

Conditional: This menu available only with optional Overhead card and Modem Type = IBS.

Select 2-32K Audio or Off for IBS TX ESC type. Selecting 2-32k audio will multiplex two 32 kbps ADPCM audio channels into 64 kbps payload data with IBS framing.

FUNCTION SELECT: UTILITY: INTERFACE: IBS RX ESC TYPE (CONDITIONAL)

```
IBS RX ESC TYPE
2-32K  AUDIO
```

IMPORTANT

Conditional: This menu available only with optional Overhead card and Modem Type = IBS.

Select 2-32K Audio or Off for IBS RX ESC type. Selecting 2-32k audio will multiplex two 32 kbps ADPCM audio channels into 64 kbps payload data with IBS framing.

FUNCTION SELECT: UTILITY: INTERFACE: CTS DELAY

```
CTS DELAY
0 SECONDS
```

Sets the delay in seconds (0 to 60) for the Clear To Send (CTS) signal to become active after RTS is applied.

4.6.6.5 FUNCTION SELECT: UTILITY: OUTDOOR UNIT (CONDITIONAL)

```
UTILITY
OUTDOOR UNIT
```

IMPORTANT

Conditional: ***This menu is available only when ODU Power Supply, FSK, and TX-IF Output are On.***

FUNCTION SELECT: UTILITY: OUTDOOR UNIT: ODU FSK ADDRESS (CONDITIONAL)

```
ODU FSK ADDRESS
1
```

IMPORTANT

Conditional: ***This menu is available only when ODU Power Supply, FSK, and TX-IF Output are On.***

Selects the address the modem will use to communicate with an FSK capable ODU. Address shall be within 1 to 15. This does not change the address in the ODU. It allows the user to match the address in the modem's FSK communication link to the one in the ODU.

Press [↑] or [↓] to select the ODU FSK Address. Press [ENTER] to execute the change.

FUNCTION SELECT: UTILITY: OUTDOOR UNIT: ODU OUTPUT POWER (CONDITIONAL)

```
ODU OUTPUT POWER
      OFF
```

IMPORTANT

Conditional: ***This menu is available only when ODU Power Supply, FSK, and TX-IF Output are On.***

Turns RF power at ODU/BUC On or Off. Select ODU Output Power On or Off.
Press [↑] or [↓] to select the ODU Output Power. Press [ENTER] to execute the change.

FUNCTION SELECT: UTILITY: OUTDOOR UNIT: ODU PWR LEVELING (CONDITIONAL)

```
ODU PWR LEVELING
      OFF
```

IMPORTANT

Conditional: This menu is available only when ODU Power Supply and TX-IF Output are On.

When Power Leveling is On the Modem TX-IF Output is continually adjusted to maintain the ODU Power level set by selecting ODU PWR Leveling = On. In the On mode the modem Auto adjusts the ODU Power Level. This requires an FSK capable ODU (BUC). The Monitor menu shows the actual BUC Power and (T) Target Power. Press [↑] or [↓] to select the ODU Power Leveling. Press [ENTER] to execute the change.

4.6.6.6 FUNCTION SELECT: UTILITY:SYSTEM

```
UTILITY
SYSTEM
```

Select information to view using the [←] [→] arrow keys, then press <ENTER>.

FUNCTION SELECT: UTILITY: 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.

FUNCTION SELECT: UTILITY: SYSTEM: REMOTE BAUD RATE

```
REMOTE BAUD RATE
9600 bps    EVEN
```

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

To change the modem baud rate and/or 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 can be set from 150 to 19200 bps.

FUNCTION SELECT: UTILITY: SYSTEM: REMOTE ADDRESS

```
REMOTE ADDRESS
      1
```

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

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

Note: Address 0 is reserved has a Global Address.

FUNCTION SELECT: UTILITY: SYSTEM: REMOTE TYPE

```
  REMOTE TYPE
RS485  (2-WIRE)
```

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

FUNCTION SELECT: UTILITY: SYSTEM: OPERATION MODE

```
OPERATION MODE
    DUPLEX
```

Programs the modem for DUPLEX, TX ONLY, or RX ONLY operation.

Note: When TX ONLY or RX ONLY is selected, the appropriate faults are masked from the Faults and Stored Faults menus.

FUNCTION SELECT: UTILITY: SYSTEM: YEAR DISPLAY

```
YEAR DISPLAY
 2 - DIGIT
```

Displays the year in either 2-digits or 4-digits.

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

FUNCTION SELECT: UTILITY: SYSTEM: TEST MODE STATUS

```
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
- CARRIER MODE
- RX 2047 Pattern (requires Overhead card)
- TX 2047 Pattern (requires Overhead card)
- IF LOOP BACK

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

FUNCTION SELECT: UTILITY: SYSTEM: LAMP TEST

```
LAMP TEST ??
PRESS ENTER
```

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

FUNCTION SELECT: UTILITY: SYSTEM: SELF TEST

```
SELF TEST
   OFF
```

Select OFF, AUTO, or RUN. After completion of the test, SELF TEST (“PASSED” or “FAILED”) is displayed.

- OFF bypasses built-in self test.
- AUTO initiates built-in self test when turning on modem.
- RUN initializes self test.

FUNCTION SELECT: UTILITY: SYSTEM: DISPLAY CONTRAST

```
DISPLAY CONTRAST
  LEVEL:  64
```

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.

FUNCTION SELECT: UTILITY: SYSTEM: M&C FIRMWARE

```
 M&C FIRMWARE
FW/NNNNNN-DDR
```

Displays the M&C module firmware version.

```
M&C FIRMWARE
 MM/DD/YYYY
```

Press <ENTER> to display the month, day, and year.

FUNCTION SELECT: UTILITY: SYSTEM: BOOT FIRMWARE

```
BOOT FIRMWARE
FW/NNNNNN-DDR
```

Displays the M&C module firmware version.

```
BOOT FIRMWARE
 MM/DD/YYYY
```

Press <ENTER> to display the month, day, and year.

```
BOOT FIRMWARE
VER: x.x.x
```

Press <ENTER> to display the version number.

FUNCTION SELECT: UTILITY: SYSTEM: FPGA FIRMWARE

```
FPGA FIRMWARE
FW/NNNNNN-DDR
```

Displays the FPGA module firmware version.

```
FPGA FIRMWARE
MM/DD/YYYY
```

Press <ENTER> to display includes the month, day, and year.

```
TURBO FIRMWARE
FW/NNNNR
```

Note: This menu is displayed only when the Turbo option is installed.
Displays the Turbo module firmware version.

FUNCTION SELECT: UTILITY: SYSTEM: DEMO MODE

```
DEMO MODE
   OFF
```

Displays the status of the Demo Mode as either On or Off. Enables all the FAST options for the hardware installed for 1 hour.

FUNCTION SELECT: UTILITY: SYSTEM: EXT AGC: MAX PWR

```
EXT AGC:  MAX PWR
   0.0 Volts
```

Sets the AGC voltage for a RX signal. 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.

FUNCTION SELECT: UTILITY: SYSTEM: EXT AGC: MIN POWER

```
EXT AGC:  MIN PWR
   10.0 Volts
```

Sets the AGC voltage for a RX signal. 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.

FUNCTION SELECT: UTILITY: SYSTEM: MASTER RESET

```
MASTER RESET
 HARD/SOFT
```

Master reset function.

CAUTION

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

Select <ENTER>once to access HARD or SOFT.

1. Press [←] or [→] to make the selection.
2. Press <ENTER>.
3. Press [→] five times to move the cursor to YES.
4. 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

4.6.6.7 FUNCTION SELECT: UTILITY: MODEM TYPE

```
UTILITY
MODEM TYPE
```

Select information to view using the [←] [→] arrow keys, then press <ENTER>.

FUNCTION SELECT: UTILITY: MODEM TYPE: MODEM TYPE

```
MODEM TYPE
CUSTOM
```

Several selections from this menu require optional hardware and software. (Also, refer to Chapter 5.)

Modem Type	Description
Custom	Access to all modems. Use caution, incompatible configuration parameters are possible.
EFD	Closed Network operation
IBS	IESS-309 compliant with RS = 112/126 and interoperable with legacy EFD equipment programmed to IBS Modem Type.
IDR	IESS-308 compliant operation
309 IBS	IESS-309 compliant operation
VSAT IBS	VSAT IBS operation (No Overhead Card) with RS = 201/219.
AUPC	AUPC – The TX and RX Reed-Solomon cards. Provides AUPC operation only and No ASYNC channel.
ASYNC	ASYNC (/AUPC) – requires the installation of an Overhead card. Provides AUPC operation and a separate ASYNC channel.
D&I	IESS-308-5 Drop & Insert operation

When the modem is changed from one type of operation to another, the modem will be reset to the default configuration of the new modem type. The RF-IF Output shall be tuned 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 locate which modem operations are allowed.

CAUTION

Use caution when modifying the Custom Type. This type accepts all changes to the modem, including incompatible parameters changes. Only experienced modem operators familiar with all the controls shall use Custom type.

FUNCTION SELECT: UTILITY: MODEM TYPE: MODEM OPTIONS

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

Status Only.

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:

Option	Code	Legend
HIGH POWER (*see Note*)	(0 or +)	0 = Not Installed, Not Upgradeable
HIGH STABILITY	(0 or +)	- = Not Installed, FAST Upgradeable
ASLT	(- or +)	+ = Installed
VITERBI	(- or +)	x = Not Installed, Field Upgradeable
SEQUENTIAL	(- or +)	
SINGLE RATE	(- or +)	
LOW RATE VAR	(- or +)	
FULL RATE VAR	(- or +)	
CARD #1 PCB	(x or +)	
CARD #2 PCB	(x or +)	
CARD #3 PCB	(x or +)	
8PSK	(- or +)	
TX only	(0 or +)	
RX only	(0 or +)	
OQPSK	(- or +)	
TX/RF L-BAND	(0 or +)	

IMPORTANT

The actual choices displayed in the sub-menus may vary according to which FAST options have been enabled. Where a FAST option affects a menu, this is shown in the descriptive text.

Note: There are no power options for the L-Band modem.

FUNCTION SELECT: UTILITY: MODEM TYPE: CARD #1 TYPE

```
CARD #1 TYPE
OVERHEAD 01
```

Status Only.

Displays one of the following:

- OVERHEAD 01
- NOT INSTALLED

FUNCTION SELECT: UTILITY: MODEM TYPE: CARD #2 TYPE

```
CARD #2 TYPE
REED SOLOMON 03
```

Status Only.

Displays one of the following:

- REED SOLOMON 02
- REED SOLOMON 03
- TURBO
- NOT INSTALLED

FUNCTION SELECT: UTILITY: MODEM TYPE: CARD #3 TYPE

```
CARD #3 TYPE
REED SOLOMON 02
```

Status Only.

Displays one of the following:

- REED SOLOMON 02
- REED SOLOMON 03
- TURBO
- NOT INSTALLED

FUNCTION SELECT: UTILITY: MODEM TYPE: CARD #1 OPTIONS (CONDITIONAL)

```
CARD #1 OPTIONS
+++++
```

Status Only. Menu appears when Card #1 is installed.

Displays one of the following:

OVERHEAD 01 LIST:

G.703	(- or +)
IBS	(- or +)
ASYNC/AUPC	(- or +)
D&I	(- or +)
IDR	(- or +)

FUNCTION SELECT: UTILITY: MODEM TYPE: CARD #2 OPTIONS (CONDITIONAL)

```
CARD #2 OPTIONS
+
```

Status Only. Menu appears only when Card #2 is installed.

Displays one of the following:

REED SOLOMON 02 LIST:	
INTELSAT	(- or +)
AUPC	(- or +)
REED SOLOMON 03 LIST:	
INTELSAT	(- or +)
AUPC	(- or +)
TURBO LIST:	
AUPC	(- or +)

FUNCTION SELECT: UTILITY: MODEM TYPE: CARD #3 OPTIONS (CONDITIONAL)

```
CARD #3 OPTIONS
-
```

(Status Only.) Menu appears when Card #3 is installed.

Displays one of the following:

REED SOLOMON 02 LIST:	
INTELSAT	(- or +)
AUPC	(- or +)
REED SOLOMON 03 LIST:	
INTELSAT	(- or +)
AUPC	(- or +)
TURBO LIST:	
AUPC	(- or +)

FUNCTION SELECT: UTILITY: MODEM TYPE: LOCAL MODEM AUPC

```
LOCAL MODEM AUPC
      OFF
```

Selecting Local Modem AUPC = ON enables the Configuration: Local AUPC: menu where programming for self-monitoring AUPC with one modem or remote AUPC between two modems is performed. These modes automatically adjust the TX Power Level from the modulator to compensate for rain fades.

The *self monitoring* does not require the ASYNC/AUPC option and the Overhead card to be installed or the AUPC Option and Reed-Solomon cards installed to operate.

AUPC *between two modems* does require either the ASYNC/AUPC option and the Overhead Card or the AUPC option and the Reed-Solomon cards.

Notes:

1. When the Overhead card with the ASYNC/AUPC option is installed, and the self-monitoring Local Modem AUPC mode is needed, do not select ASYNC as the Modem Type.
2. When the Reed-Solomon card with AUPC option is installed, select AUPC from the Modem Type menu (under ***Utility: Modem Type*** menu) when AUPC between two modems is needed.
3. The Modem must be configured for Duplex operation and the demodulator locked to the modulator signal.

FUNCTION SELECT: UTILITY: MODEM TYPE: MODEM SERIAL

```
MODEM SERIAL #
  012345678
```

Status Only.

Displays the modem serial number.

FUNCTION SELECT: UTILITY: MODEM TYPE: CARD #1 SERIAL

```
CARD #1 SERIAL #
012345678
```

Status Only.

Displays the CARD #1 serial number.

FUNCTION SELECT: UTILITY: MODEM TYPE: CARD #2 SERIAL

```
CARD #2 SERIAL #
012345678
```

Status Only.

Displays the CARD #2 serial number.

FUNCTION SELECT: UTILITY: MODEM TYPE: CARD #3 SERIAL

```
CARD #3 SERIAL #
012345678
```

Status Only.

Displays the CARD #3 serial number.

FUNCTION SELECT: UTILITY: MODEM TYPE: CONFIGURATION CODE - MODEM

```
CONFIGURATION
CODE - MODEM
```

Comtech EF Data-supplied code. Press <ENTER>

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

On entry, the current configuration code is displayed with the flashing cursor on the first character. Press [←] or [→] to move the flashing cursor. Press [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press <ENTER> to execute the change.

Entering this code enables the corresponding modem option. To purchase an option, contact an Comtech EF Data marketing representative for more information.

FUNCTION SELECT: UTILITY: MODEM TYPE: CONFIGURATION CODE – CARD #1 (CONDITIONAL)

```
CONFIGURATION
CODE – CARD #1
```

IMPORTANT

This menu appears only if the Overhead card is installed.

Comtech EF Data-supplied code. Press <ENTER>

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

On entry, the current configuration code is displayed with the flashing cursor on the first character. Press [←] or [→] to move the flashing cursor. Press [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press <ENTER> to execute the change.

Entering this code enables the corresponding modem option. To purchase an option, contact an Comtech EF Data marketing representative for more information.

FUNCTION SELECT: UTILITY: MODEM TYPE: CONFIGURATION CODE – CARD #2 (CONDITIONAL)

```
CONFIGURATION
CODE – CARD #2
```

IMPORTANT

This menu appears only if the Overhead card is installed.

Comtech EF Data-supplied code. Press <ENTER>

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

On entry, the current configuration code is displayed with the flashing cursor on the first character. Press [←] or [→] to move the flashing cursor. Press [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press <ENTER> to execute the change.

Entering this code enables the corresponding modem option. To purchase an option, contact an Comtech EF Data marketing representative for more information

FUNCTION SELECT: MODEM TYPE: CONFIGURATION CODE – CARD #3 (CONDITIONAL)

```
CONFIGURATION
CODE – CARD #3
```

Comtech EF Data-supplied code. Press <ENTER>

IMPORTANT

This menu appears only if the Overhead card is installed.

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

On entry, the current configuration code is displayed with the flashing cursor on the first character. Press [←] or [→] to move the flashing cursor. Press [↑] or [↓] to increment or decrement the digit at the flashing cursor. Press <ENTER> to execute the change.

Entering this code enables the corresponding modem option. To purchase an option, contact an Comtech EF Data marketing representative for more information.

4.6.6.8 FUNCTION SELECT: UTILITY: FACTORY SET-UP

```
    UTILITY
 FACTORY SET-UP
```

CAUTION

This configuration is used for factory alignment. Unauthorized persons should not change factory setup. Doing so can cause modem failure.

4.7 SDM-300L Custom Modem Defaults

Refer to Table 4-2 for custom modem defaults.

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

- Address/Parity/Baud Rate
- Remote Type
- EXT AGC MIN Power
- EXT AGC Max Power
- Display Contrast

Table 4-2. SDM-300L Custom Modem Defaults

Modulator		Demodulator	
Data Rate	A	Date Rate	A
TX Rate A	64 kbps, QPSK 1/2	RX Rate A	64 kbps, QPSK 1/2
TX Rate B	128 kbps, QPSK 1/2	RX Rate B	128 kbps, QPSK 1/2
TX Rate C	256 kbps, QPSK 1/2	RX Rate C	256 kbps, QPSK 1/2
TX Rate D	512 kbps, QPSK 1/2	RX Rate D	512 kbps, QPSK 1/2
TX Rate V	38.4 kbps, QPSK 1/2	RX Rate V	38.4 kbps, QPSK 1/2
TX-IF Frequency	1200.0000 MHz	RX-IF Frequency	1200 .0000MHz
TX Terminal Frequency	5845.0000 MHz	RX Terminal Frequency	4200.0000 MHz
TX-IF Output	Off	Descrambler	On
Power Output	-10 dBm	Differential Encoder	On
Scrambler	On	RF Loop Back	Off
Differential Encoder	On	IF Loop Back	Off
Carrier Mode	Normal-Modulated	BER Threshold	None
Modem Reference	Internal	Sweep Center	0 Hz
FSK Output	Off	Sweep Range	60000 Hz
ODU Power Supply	Off	Reacquisition	0 seconds
ODU Output Delay	00.00 Min Sec	LNB Power	Off
ODU 10 MHz REF	Off	LNB Voltage	13 VDC
RS Encoder	Off	LNB 10 MHz REF	Off
		RS Decoder	Off
Interface			
TX Clock Source	TX Terrestrial	TX Coding Format	AMI
TX Clock Phase	Auto	RX Coding Format	AMI
EXT-CLK Frequency	1544 kHz	Channel, Level (TX/RX)	-5 dBm
Buffer Clock	RX (Satellite)	Drop Format	T1
RX Clock Phase	Normal	Insert Format	T1
Buffer Size	384 bit/s	Drop SAT	Channel Terr, others T-Slot Terr
B-Band Loopback	Off	Insert SAT	Channel Terr, other T-Slot Terr
INTRFC Loop Back	Off	ASYNC TX Baud	110 kbps
Buffer Size	384 Bits 6 Milliseconds	ASYNC RX Baud	110 kbps
Loop Timing	Off	ASYNC TX Length	7 bps
TX Data Fault	None	ASYNC RX Length	7 bps
RX Data Fault	None	ASYNC TX Stop	2 bps
TX 2047 Pattern	Off	ASYNC RX Stop	2 bps
RX 2047 Pattern	Off	ASYNC TX Parity	Even
		ASYNC RX Parity	Even
Configuration Local AUPC			
AUPC Enabled	Off	Target E_b/N_0	6.0 dB
Nominal Power	-10.0 dB	Tracking Rate	0.5 dB/min
Minimum Power	-30.0 dBm	Local CL Action	Hold
Maximum Power	-5.0 dBm	Remote CL Action	Hold

Table 4-2. SDM-300L Custom Modem Defaults (Continued)

Function Select Monitor			
RAW BER	2.4 E-3	ODU Voltage	0 mA
Corrected BER	4.0 E-3	ODU Output Level	xx.xx dBm
E_b/N_0	16.0 dB	ODU Output Level	xx.xx/xx.xxT dBm
Receive Signal	-45 dBm	ODU Temperature	s xx Deg.C/00R
Sweep Frequency	0 Hz	ODU PLL Lock	OK/INLOCKED
Buffer Fill	50%	ODU Software	Ver: xx
Frame Errors	n.n E-e	ODU Power Class	xx watts
LNB Current	0 mA	TX L-Band Freq	1200 .0000 MHz
LNB Voltage	0 mA	RX L-Band Freq	1200 .0000 MHz
ODU Current	0 mA		
Function Select Remote AUPC			
AUPC Enable	Off	TX 2047 Pattern	Off
B-Band Loopback	Off	2047 Errors	n.n E-e
Utility			
Modulator		**Demodulator**	
Data Rate	A	Date Rate	A
TX Rate A	64 kbps, QPSK 1/2	RX Rate A	64 kbps, QPSK 1/2
TX Rate B	128 kbps, QPSK 1/2	RX Rate B	128 kbps, QPSK 1/2
TX Rate C	256 kbps, QPSK 1/2	RX Rate C	256 kbps, QPSK 1/2
TX Rate D	512 kbps, QPSK 1/2	RX Rate D	512 kbps, QPSK 1/2
TX Rate V	38.4 kbps, QPSK 1/2	RX Rate V	38.4 kbps, QPSK 1/2
TX Terminal LO	0 MHz MIX:	RX Terminal LO	0 MHz Mix:
MOD Power Offset	0 dB	Demodulator Type	INTERNAL Open
Modulator Type	INTELSAT Open	Decoder Type	Viterbi
Encoder Type	Viterbi	Descrambler Type	Intelsat V.35
Scrambler Type	Intelsat V.35	RX BPSK Ordering	Standard
TX BPSK Ordering	Standard	DEMOD Spectrum	Normal
MOD Spectrum	Normal	RX-RS N/K Deep	225/205 8
TX-RS N/K Deep	225/205 8	RX-IESS-310 Mode	Off
TX-IESS-310 Mode	Off	LNB Alarm – Low	0 mA
TX Mode	Continuous	LNB Alarm – High	500 mA
ODU Alarm – Low	0 mA	RX Symbol Rate	64.000 ksps
ODU Alarm – High	2000 mA		
RF Mode Control	Normal		
TX Symbol Rate	64.0000 ksps		

Table 4-2. SDM-300L Custom Modem Defaults (Continued)

Utility Interface			
TX Overhead Type	None	E1 Insert CRC	On
RX Overhead Type	None	Backward Alarm RX #X	On
TX Terr Interface	RS422	ASYNC TX Type	RS232
RX Terr Interface	RS422	ASYNC RX Type	RS232
Buffer Program	Bits	IDR TX ESC Type	2-32k Audio
Framing Structure	T1 Framing Structure: G.704 E1 Framing Structure: G.704	IDR RX ESC Type	2-32k Audio
RTS TX-IF CNTRL	Off	IBS TX ESC Type	Off
TX Data Phase	Normal	IBS RX ESC Type	Off
RX Data Phase	Normal	CTS Delay	0 seconds
Utility Outdoor Unit			
ODU FSK Address	1	ODU PWR Leveling	Off
ODU Output Power	Off		
Utility System			
Time	12:00:00 AM	Self Test	Off
Date	7/04/76	Display Contrast	64
Remote Baud Rate	9600 bit/s	M&C Firmware	FW/NNNNNN-DDR MM/DD/YYYY
Remote Address	1	Boot Firmware	FW/NNNNNN-DDR MM/DD/YYYY Version:
Remote Type	RS485 (2-Wire)	FPGA Firmware	FW/NNNNNNR MM/DD/YYYY
		Turbo Firmware	FW/NNNNR
Operational Mode	Duplex	Demo Mode	Off
Year Display	2-Digit	EXT AGC: Min Pwr	0 volts
		EXT AGC: Max Pwr	10 volts
Utility Modem Type			
Modem Type	Custom	Card #1	Overhead 01
Rev Emulation	Current	Card #2	Reed-Solomon 02
Intelsat Data	50 Pin	Card #3	Reed-Solomon 03
NRZ Data I/O	RS-422	Local Modem AUPC	Off

Chapter 5. MODEM TYPE

This section provides additional detail about the Modem Type setting located under the ***Function Select: Utility: Modem*** Type menu.

5.1 Modem Type

This section provides additional detail information about the Modem Type setting located under the Utility: Modem Type menu.

Refer to Table 5-1 for configuring the modem to the following types of operation. Each type allows the user to operate the modem under the requirements of the configuration specifications listed below.

Table 5-1. Modem Type Selection

Configuration	Specification
IDR (Intermediate Data Rate)	IESS-308
IBS (INTELSAT Business Service)	IESS-309, Legacy EFD equipment when RS=ON, K/N =112/126
309 IBS	IESS-309, when RS=ON, K/N = 201/219
VSAT IBS	INTELSAT compliant mode with NO Overhead and RS = 201/219
D&I (Drop & Insert)	IESS-308-5
ASYNC	Asynchronous Overhead, including AUPC
AUPC	AUPC on Reed-Solomon Card, No Async
EFD	Closed Network
Custom	Access all modes

5.2 IDR Operation

To operate the modem in the IDR configuration, the following cards must be installed in the modem:

- Overhead G.703/IDR/IBS/ASYNC/AUPC/D&I card
- 50-pin D relay adapter card

The IDR option is a FAST feature that must be enabled using the front panel and the Utility Modem Type menu. Table 5-2 lists the parameters that are accessible once the IDR modem type is enabled.

Table 5-2. IDR Parameter Settings

Parameter	Front Panel Setting	Reference Menu
Modem Type	IDR	Utility Modem Type
TX Data/Code Rate	TX-V, QPSK 3/4	Configuration Modulator
TX-IF Output	ON	Configuration Demodulator
RX Data/Code Rate	RX-V, QPSK 3/4	Configuration Demodulator
TX Clock Source	TX Terrestrial, Internal, Ext. Reference	Configuration Interface
Buffer Clock Source	Satellite, TX Terrestrial, Internal, Ext. Reference	Configuration Interface
TX Coding Format	AMI, B8ZS, HDB3, or B6ZS	Configuration Interface
RX Coding Format	AMI, B8ZS, HDB3, or B6ZS	Configuration Interface
Backward Alarm Control	TX-1, TX-2, TX-3, TX-4 RX-1, RX-2, RX-3, RX-4 ON or OFF	Utility Interface
Service Channel Adjust	TX-1, TX-2, RX-1, RX-2 levels	Configuration Interface

The IDR modem type is an open network application, primarily used for voice circuits. IDR has a fixed overhead structure.

5.3 IBS Operation

To operate the modem in the IBS configuration, the following cards shall be installed in the modem:

- Overhead G.703/IDR/IBS/ASYNC/AUPC/D&I card
- 50-pin D relay adapter card

The IBS option is a FAST feature that shall be enabled using the front panel and the Utility: Modem Type menu. Table 5-3 lists the parameters that are accessible once the IBS modem type is enabled.

The IBS modem type is an open network application, primarily used for data circuits. IBS has a variable overhead structure that is dependent on the transmitted data rate.

TABLE 5-3. IBS PARAMETER SETTINGS

Parameter	Front Panel Setting	Reference Menu
Modem Type	IBS (*see Note*)	Utility Modem Type
TX Data/Code Rate	TX-V, QPSK 1/2, or 3/4	Configuration Modulator
TX-IF Output	ON	Configuration Demodulator
RX Data/Code Rate	RX-V, QPSK 1/2, or 3/4	Configuration Demodulator
TX Clock Source	TX Terrestrial, Internal, Ext. Reference	Configuration Interface
Buffer Clock Source	Satellite, TX Terrestrial, Internal, Ext. Reference	Configuration Interface
TX Coding Format	AMI, B8ZS, or HDB3	Configuration Interface
RX Coding Format	AMI, B8ZS, or HDB3	Configuration Interface

Note: This mode of operation is IESS-309 compliant for all modes with Viterbi coding = On and Reed-Solomon = Off. It also is interoperable with EFD legacy equipment that is set to Modem Type = IBS with RS = On (K/N = 112/126) or RS = Off.

5.3.1 309 IBS Operation

This mode is for IESS-309 (IBS) operation when Reed-Solomon is tuned On. Operation is the same as outlined in Paragraph 5.3, except, Reed-Solomon is On and K/N = 201/219.

5.3.2 VSAT IBS Operation

This is for IESS-309 operation with No Overhead framing. Operation is the same as in Paragraph 5.3, except framing is tuned Off when RS = On and K/N = 201/219.

5.4 D&I Operation

To operate the modem in the Drop & Insert configuration, the following cards must be installed in the modem:

- Overhead G.703/IDR/IBS/ASYNC/AUPC/D&I card
- 50-pin D relay adapter card

The D&I option is a FAST feature that must be enabled using the front panel and the Utility Modem Type menu. Table A-5 lists the parameters that are accessible once the D&I modem type is enabled.

TABLE 5-4. D&I PARAMETER SETTINGS

Parameter	Front Panel Settings	Reference Manual
Modem Type	D&I	Utility - Modem Type
TX Data/Code Rate	TX-V, QPSK 1/2 (NX64)	
TX-IF Output	ON	Configuration - Demodulator
RX Data/Code Rate	RX-V, QPSK 1/2 (NX64) Table 5-3	Configuration - Demodulator
TX Clock Source	TX Terrestrial	Configuration - Interface
Buffer Clock Source	Insert Clock	Configuration - Interface
TX Coding Format	HDB3	Configuration - Interface
RX Coding Format	HDB3	Configuration - Interface
Drop Format	E1CCS/E1CAS (E1)	Configuration - Interface
Insert Format	E1CCS/E1CAS (E1)	Configuration - Interface

In D&I operation, the transmit data rate is a fractional portion of the trunk T1 or E1 terrestrial input. The N stands for the number of 64 kbps time slots available for transmission. Table A-6 shows the allowable TX data rates for D&I with the corresponding number of time slots available for each data rate.

TABLE 5-5. N X 64 CHART

Time Slots	TX Data Rate	Time Slots	TX Data Rate
1	64 kbps	10	640 kbps
2	128 kbps	12	768 kbps
3	192 kbps	15	960 kbps
4	256 kbps	16	1024 kbps
5	320 kbps	20	1280 kbps
6	384 kbps	24	1536 kbps
8	512 kbps	30	1920 kbps

5.5 ASYNC/AUPC Operation

To operate in the Asynchronous/AUPC configuration, the following cards must be installed in the modem:

- Overhead G.703/IDR/IBS/ASYNC/AUPC/D&I card
- 50-pin D relay adapter card

The ASYNC/AUPC option is a FAST feature that must be enabled using the front panel and the Utility Modem Type menu. Table A-7 lists that are accessible once the ASYNC/AUPC modem type is enabled.

TABLE 5-6. ASYNCHRONOUS PARAMETER SETTINGS

Parameter	Front Panel Setting	Reference Menu
Modem Type	ASYNC	Utility Modem Type
TX Data/Code Rate	TX-V, BPSK 1/2 or QPSK 1/2, 3/4, or 7/8	Configuration Monitor
TX-IF Output	ON	Configuration Demodulator
RX Data/Code Rate	RX-V, BPSK 1/2 or QPSK 1/2, 3/4, or 7/8	Configuration Demodulator
Encoder Type	Viterbi/Sequential	Utility Modulator
Decoder Type	Viterbi/Sequential	Utility Demodulator
ASYNC TX Baud	110 to 38400 bit/s	Configuration Interface
ASYNC RX Baud	110 to 38400 bit/s	Configuration Interface
ASYNC TX Length	5 to 8 bits	Configuration Interface
ASYNC RX Length	5 to 8 bits	Configuration Interface
ASYNC TX Stop	1 or 2 bits	Configuration Interface
ASYNC TX Parity	Even or Odd	Configuration Interface
ASYNC RX Parity	Even or Odd	Configuration Interface
Local AUPC	ON or OFF	Configuration Local AUPC
Nominal Power	-5 to -30 dBm	Configuration Local AUPC
Minimum Power	-5 to -30 dBm	Configuration Local AUPC
Maximum Power	-5 to -30 dBm	Configuration Local AUPC
Tracking Rate	0.5 to 6.0 dBm/min.	Configuration Local AUPC
Remote AUPC	ON or OFF	Function Remote AUPC
AUPC Enable	ON or OFF	Function Remote AUPC
Baseband Loopback	ON or OFF	Function Remote AUPC

Asynchronous Overhead with AUPC is a closed network application that gives the user the ability to communicate from the hub site to the remote site through the added overhead. The user can use the AUPC feature that remotely controls the remote modem’s power level, according to parameters programmed by the user. The user also can remotely monitor and control the remote modem by sending remote commands over the link via the overhead. This can be done by a local terminal or Monitor and Control system.

5.5.1 AUPC Operation (with Reed-Solomon)

AUPC only operation between two modems, with No ASYNC, is available with the AUPC option with Reed-Solomon cards installed. This eliminates the need for the Overhead card in applications where Closed Network operation in not required and when the ASYNC channel is not required. Setup is similar to the operation of Section 5.5, except, ASYNC parameters are not available.

5.6 Closed Network Operation (Comtech EF Data)

The modem does not require any additional hardware installed to operate in EFD Closed Network configuration. The basic modem configuration, which includes the 25-pin D Data I/O connector, supports V.35, EIA-422, and EIA-232 data with no overhead. The EFData closed network configuration allows the SDM-300A to be compatible with any EFData closed network application.

The modem can be compatible with other closed network applications by selecting different modulator and demodulator types. Fairchild and Comstream compatible closed network systems can be supported with the modem. When selecting these modulator and demodulator types, the modem becomes compatible with Fairchild or Comstream closed network modems that may be at the distant end of the link.

The modem can also support SDM-51 receive-only Remote Space Link Controlled (SLRC) modems. These receive-only modems are used in closed network applications where a small amount of overhead is used for monitor and control functions by the transmitting modem. The modem would become a transmit-only modem when the SDM-51 compatible modulator type has been selected.

To operate the modem in the SDM-51 compatible configuration, the modem does not require any additional hardware installed. The 25-pin D Data I/O connector supports either EIA-422 or EIA-232 data that is used in the SDM-51, SDM-52, or SDR-54 receive-only modems. Refer to Table 5-7 for EFD Closed Network parameter settings.

TABLE 5-7. EFD CLOSED NETWORK PARAMETER SETTINGS

Parameter	Front Panel Setting	Reference Menu
Modem Type	EFD	Utility Modem Type
TX Data/Code Rate	TX-V, QPSK 1/2	Configuration Modulator
TX-IF Output	ON	Configuration Modulator
RX Data/Code Rate	RX-V, QPSK 1/2	Configuration Demodulator
TX Clock Source	TX Terrestrial	Configuration Interface
Buffer Clock Source	Satellite Clock	Configuration Interface
Modulator Type	EFD Closed (All modulator types are accessible)	Utility Modulator
Encoder Type	Viterbi or Sequential	Utility Modulator
Demodulator type	EFD Closed (All modulator types are accessible)	Utility Demodulator
Decoder Type	Viterbi or Sequential	Utility Demodulator
TX Overhead Type	None	Utility Interface
RX Overhead Type	None	Utility Interface
Interface Type	EIA-422, EIA-232, V.35, G.703 *(see Note)*	Utility Interface
Buffer Program	Bits or Milliseconds	Utility Interface
RTS TX-IF Cntrl	OFF or ON	Utility Interface
CTS Delay	0 Seconds	Utility Interface

Note: To use G.703, the modem must have the required G.703 Overhead board installed.

5.7 Custom Operation

Note: If the modem serves as the backup unit for a rack of modems having different hardware and FAST options, then the backup modem shall have all of the features and hardware found in the other modems.

Operating in Custom mode allows access to all front panels menus, including the Utility menus. The Custom operation mode is mainly used when the modem must function with no overhead in an open network application. For example, to use the modem in the IDR mode of operation with overhead (IESS308-2), the following steps are taken:

1. Select the IDR modem type, so that the modem loads the IDR default parameter.

2. Select the Custom modem type, which allows Access to the modulator and demodulator overhead type.

3. Select NONE for the overhead types.

A protection switch can make use of the Custom operation mode when the modem is configured as a backup modem. Because the backup modem is operating in Custom Mode, the switch can program all the backup modem parameters. Thus, the one backup modem can be made compatible with all of the various application types found in the rack.

5.8 Reed-Solomon Modes

Reed-Solomon polynomial is compatible with Intelsat (IESS-308, IESS-309, IESS-310, and IESS-314). Table 5-8 shows the Reed-Solomon parameter used for various configurations.

Table 5-8. Reed-Solomon Modes

Modem Menu [1,2]					Description				
Utility Modem Type	**Configuration Modulator TX or Demodulator RX Rate [3]**	**Utility Modulator or Demodulator [4]**	**Overhead Type**	**Scrambler**	**N**	**K**	**T**	**I**	**Mode**
D&I	8PSK 2/3	IES-310 ON + Intelsat Open	TCM/IDR Small carrier	309	219	201	9	4	IESS-310 Compliant (8PSK 2/3 only)
IDR	8PSK 2/3	IES-310 ON + Intelsat Open	TCM/IDR (T1, E1[5], T2[5], E2)	V.35	219	201	9	8	
EFD	QPSK	EFD Closed	No Overhead	EFD MOD V.35	225	205	10	8	Non-IESS-310 Compliant 8PSK 2/3 only IESS-308/309 Compliant (Open) only Non-IESS modes For All other Rate (BPSK, QPSK, OQPSK, [5]8PSK 5/6, [5]16QAM)
EFD	8PSK 2/3	EFD CLOSED IESS-310 ON	No Overhead	EFD MOD V.35	219	201	9	4	
ASYNC	QPSK	EFD CLOSED	ASYNC Overhead	EFD MOD V.35	225	205	10	8	
ASYNC	8PSK 2/3	EFD CLOSED IESS-310 ON	ASYNC Overhead	EFD MOD V.35	219	201	9	4	
VSAT IBS	QPSK	Intelsat Open	VSAT IBS (Compliant = No Overhead)	309	219	201	9	4	
309 IBS	QPSK	Intelsat Open	IBS	309	219	201	9	4	
D&I	QPSK	Intelsat Open	IDR Small Carrier (D&I)	309	126	112	7	4	
IDR	QPSK	Intelsat Open	IDR, T1	Intelsat V.35	225	205	10	4	
IDR	QPSK	Intelsat Open	IDR, E1	Intelsat V.35	219	201	9	4	
IDR	QPSK	Intelsat Open	[5] IDR, T2	Intelsat V.35	194	178	8	4	
IDR	QPSK	Intelsat Open	[5] IDR, E2	Intelsat V.35	194	178	8	4	
IBS	QPSK	Intelsat Open	IBS	309	126	112	7	4	Legacy EFD (IBS)
IESS-314 Compliant (8PSK 2/3 only)			Same as IESS-310 Compliant 8PSK 2/3						

Where:

N = Coded Reed-Solomon block length (Number of bytes)
K = Uncoded Reed-Solomon block length (Number of bytes)
T = Maximum number of byte corrections (T =[N-K] /2)
I = Interleave Depth

Notes:

1. For IESS-308/309 compliant operation, it is necessary to enable INTELSAT OPEN under both the Utility: Modulator and Utility: Demodulator menus before selecting an open network type from the Modem Type menu under Utitlity:Modem Type.
2. For IESS-310 (8PSK 2/3) compliant operation, it is necessary to make the selections in the previous step and select TX IESS-310 Mode = On under the Utility: Modulator menu and select RX IESS-310 Mode = ON under Utility: Demodulator menu.
3. Data Rate is TX-X or RX-X under Configuration: Modulator or Configuration: Demodulator menus.
4. When the modulator type is not 8PSK, the IESS-310 ON/OFF selection has no effect.
5. Not part of the SDM-300L modem. Shown to complete rates under 10 Mbps.

Chapter 6. CLOCKING AND RX BUFFERING SETTINGS

6.1 Clocking Options

Clocking of the data from the terrestrial equipment to the satellite (and vice versa) will depend on the application. This section describes the most common options and recommended configurations.

6.1.1 EIA-232, EIA-422, or V.35 Master/Master

Refer to Figure 6-1 for:

- Clocking block diagram
- Transmit clock options
- Buffer clock options
- V.35 timing signals
- EIA-422 timing signals

6.1.2 EIA-232, EIA-422, or V.35 Master/Slave

Refer to Figure 6-2 for:

- Clocking block diagram
- Transmit clock options
- Buffer clock options
- V.35 timing signals
- EIA-422 timing signals

The use of loop timing in the modem is an option for both EIA-422 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 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.

6.2 IDR/IBS G.703 Master/Master

Use this application when both earth stations have high stability clocks and the received data is to be clocked to the local network. Refer to Figure 6-3 for:

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

The disadvantage of the master/master application is that the receive data will slip, as the clocks will not be synchronized. If the buffer is properly set up, the slips will be an exact frame length, causing minimum loss of data. By using very high stability clocks, the expected time between slips can be several days.

Loss of the buffer clock will mean the buffer will not be emptied and data will not be available. The buffer clock will normally revert to the low stability internal reference automatically.

6.2.1 IDR/IBS G.703 Master/Slave

Use this application when the far end earth station does not have local access to a high stability reference clock, or when it is not required to synchronize with a local clock. Refer to Figure 6-4 for:

- Clocking block diagram
- Transmit clock options
- Buffer clock options for using external loop timing

Modem loop timing does not apply for G.703 operation. The terrestrial equipment must select loop timing to recover the clock off the receive data and use that recovered clock for the transmit data.

The disadvantage of the master/slave application is that the signal received at the slave station is subject to Doppler shift. The length of the buffer at the master end will need to be twice the length that is normally required, compensating for the Doppler shift on the outward and return paths.

6.2.2 D&I G.703 Master/Master

In the D&I configuration, the most typical clocking option is the master/master application. Refer to Figure 6-5 for:

- Blocking diagram
- Transmit clock options
- Buffer Clock Options

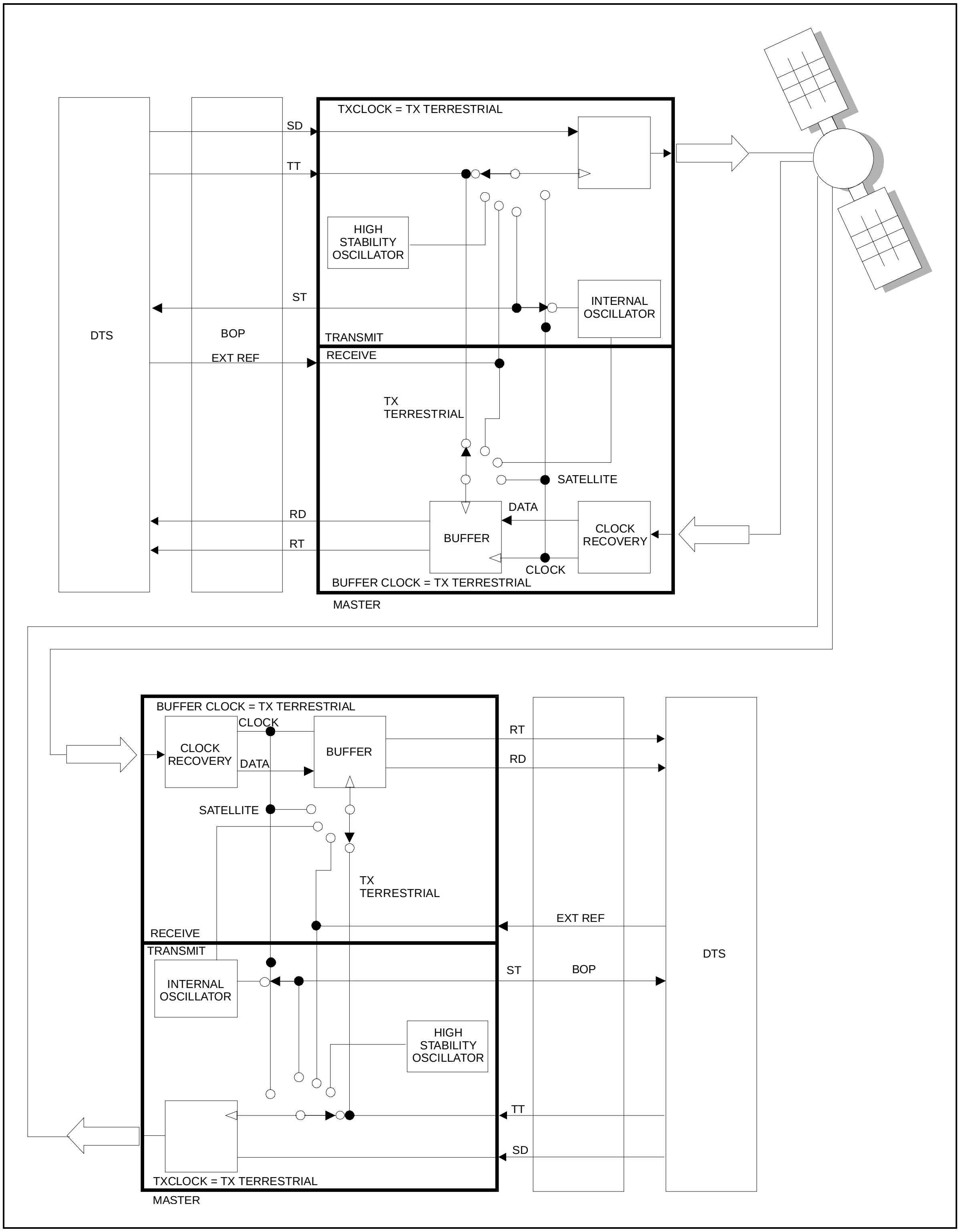

Figure 6-1. EIA-422, EIA-232, OR V.35 MASTER/MASTER CLOCKING DIAGRAM

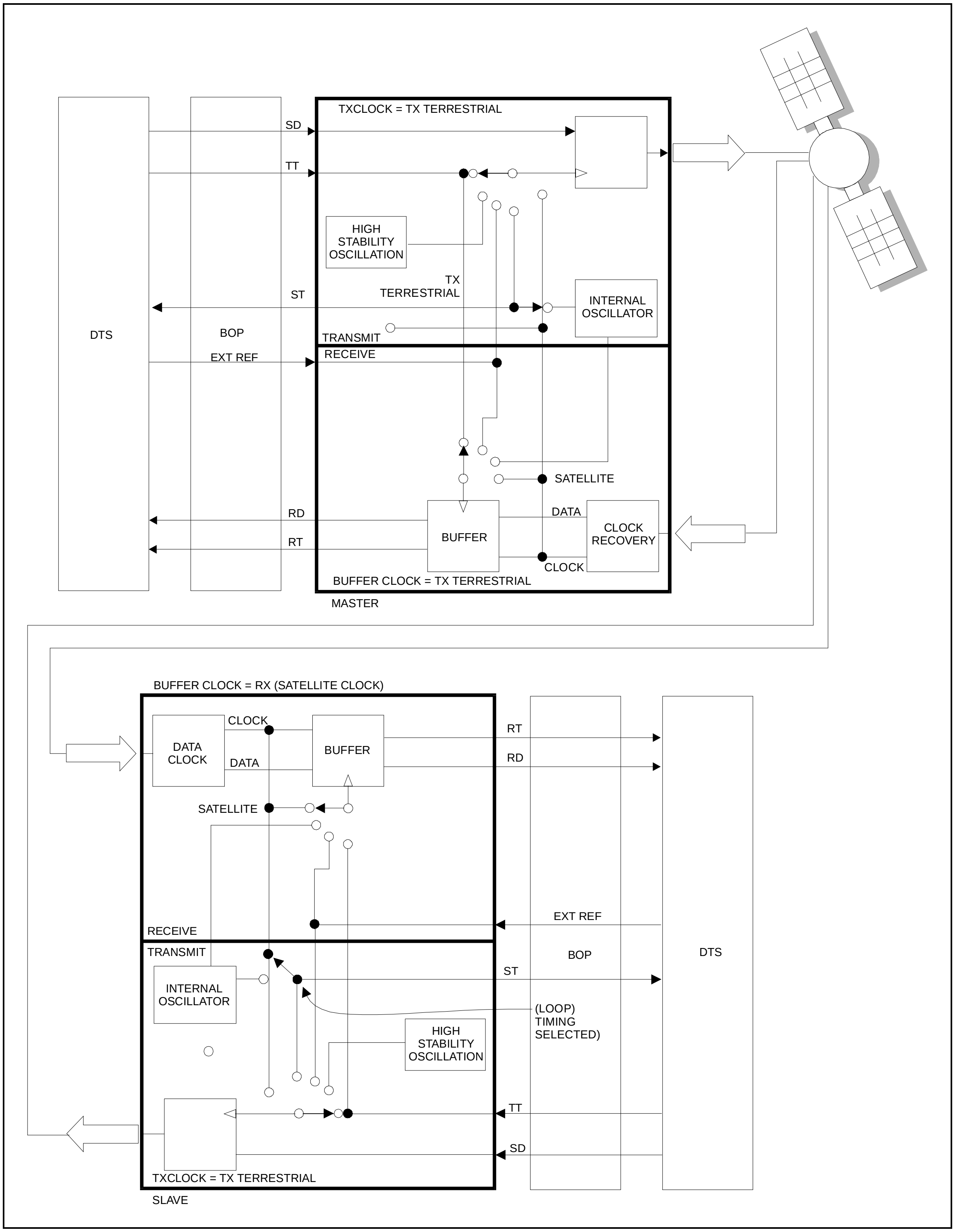

FIGURE 6-2. EIA-422, EIA-232, OR V.35 MASTER/SLAVE CLOCKING DIAGRAM

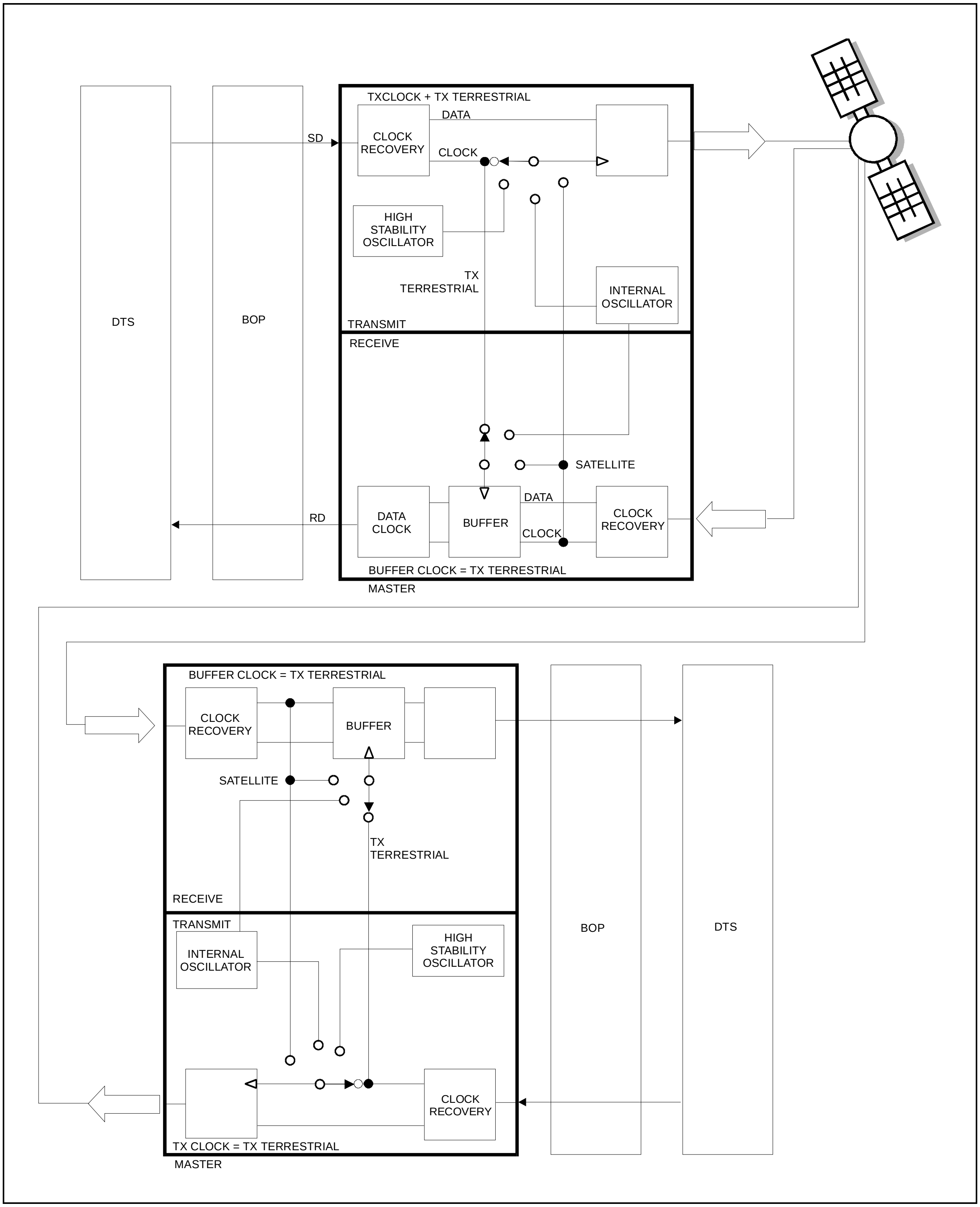

FIGURE 6-3. IDR/IBS G.703 MASTER/MASTER CLOCKING DIAGRAM

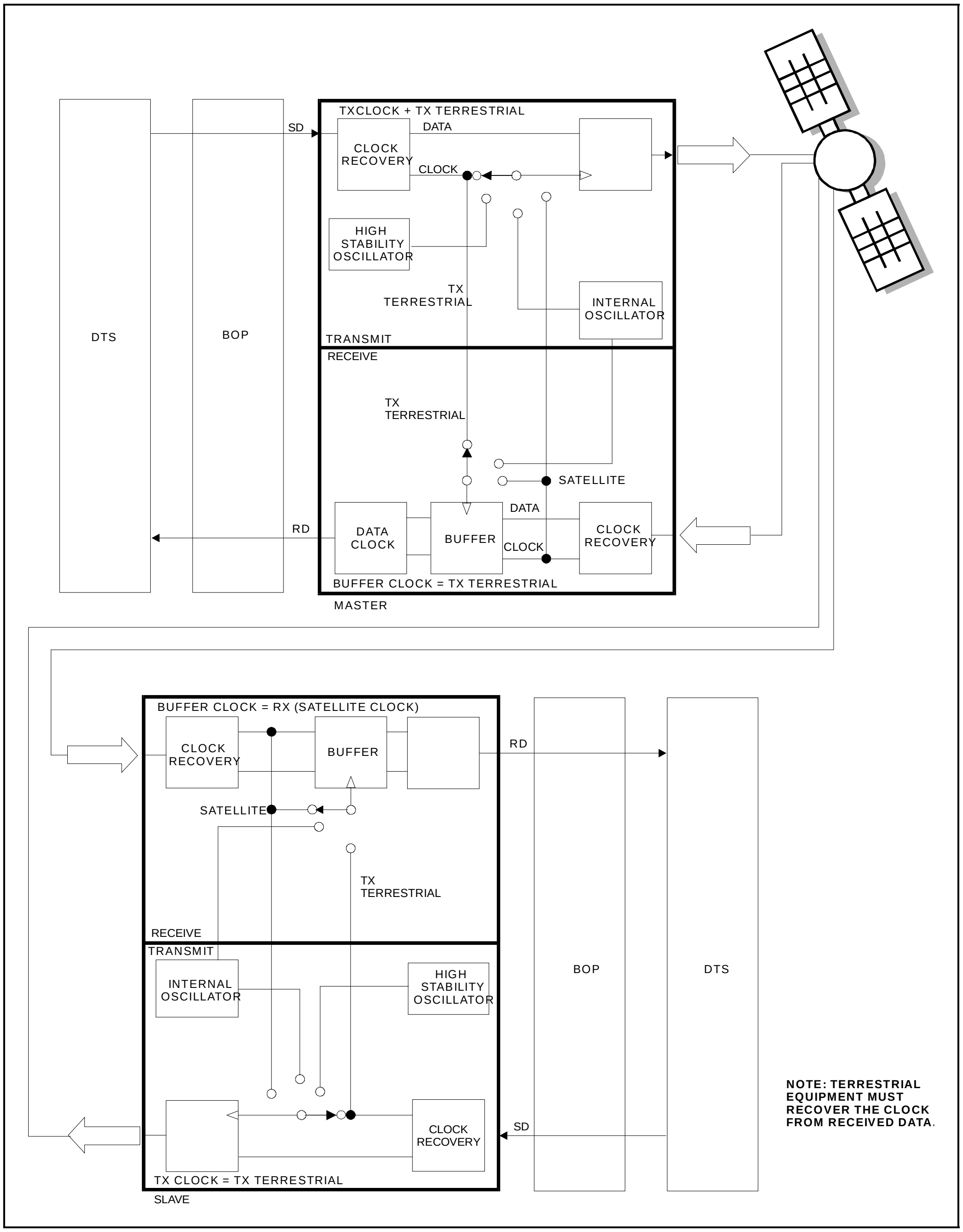

FIGURE 6-4. IDR/IBS G.703 MASTER/SLAVE CLOCKING DIAGRAM

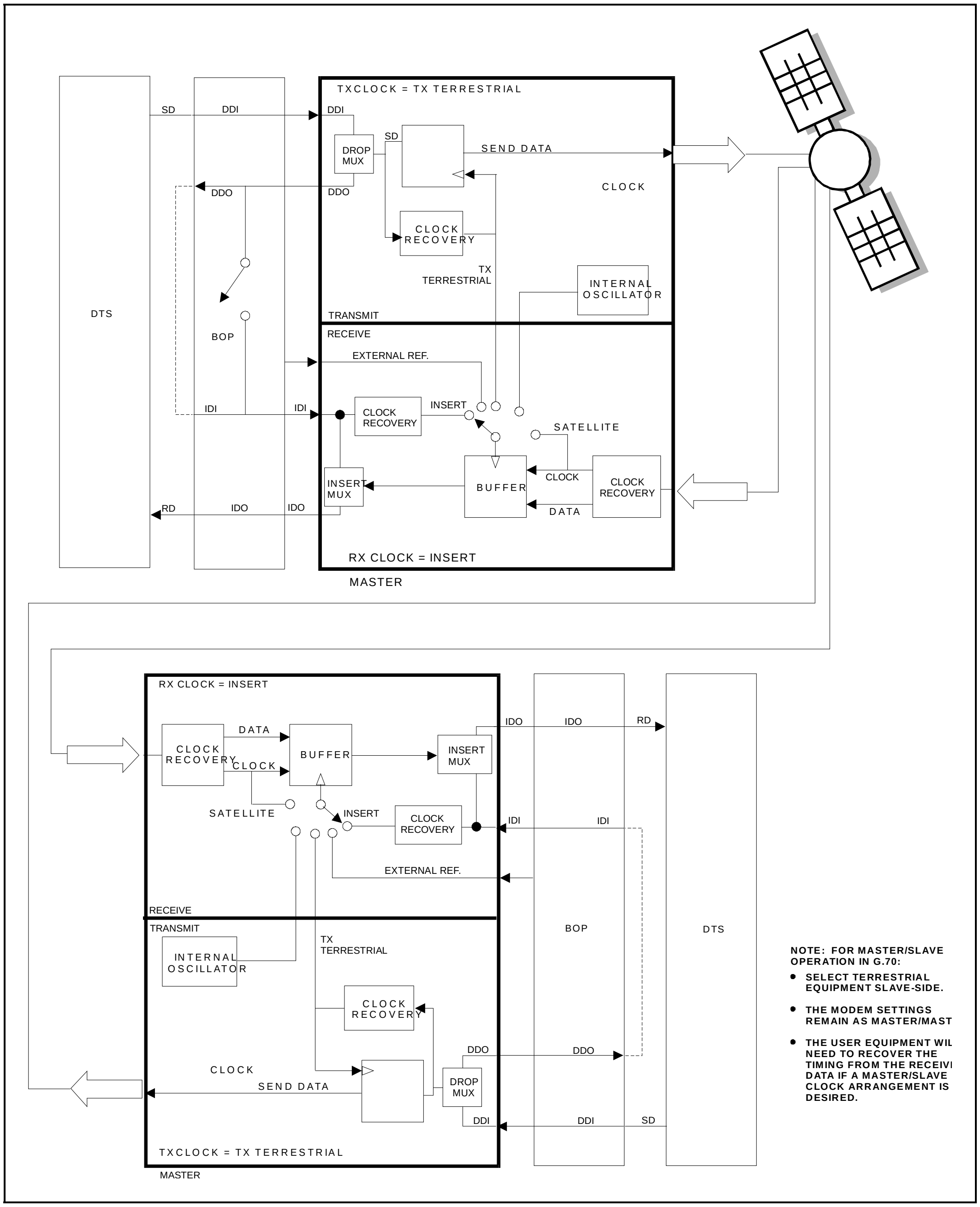

FIGURE 6-5. D&I G.703 MASTER/MASTER CLOCKING DIAGRAM

6.3 Buffering

The purpose of a receive buffer is two reasons:

- Plesiochronous buffering of two dissimilar clock frequencies (normally the far end transmit clock verses the local network clock). The clocks may be very close in frequency to each other and will normally slip at a constant rate. Figure 6-6 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 6-7) 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.

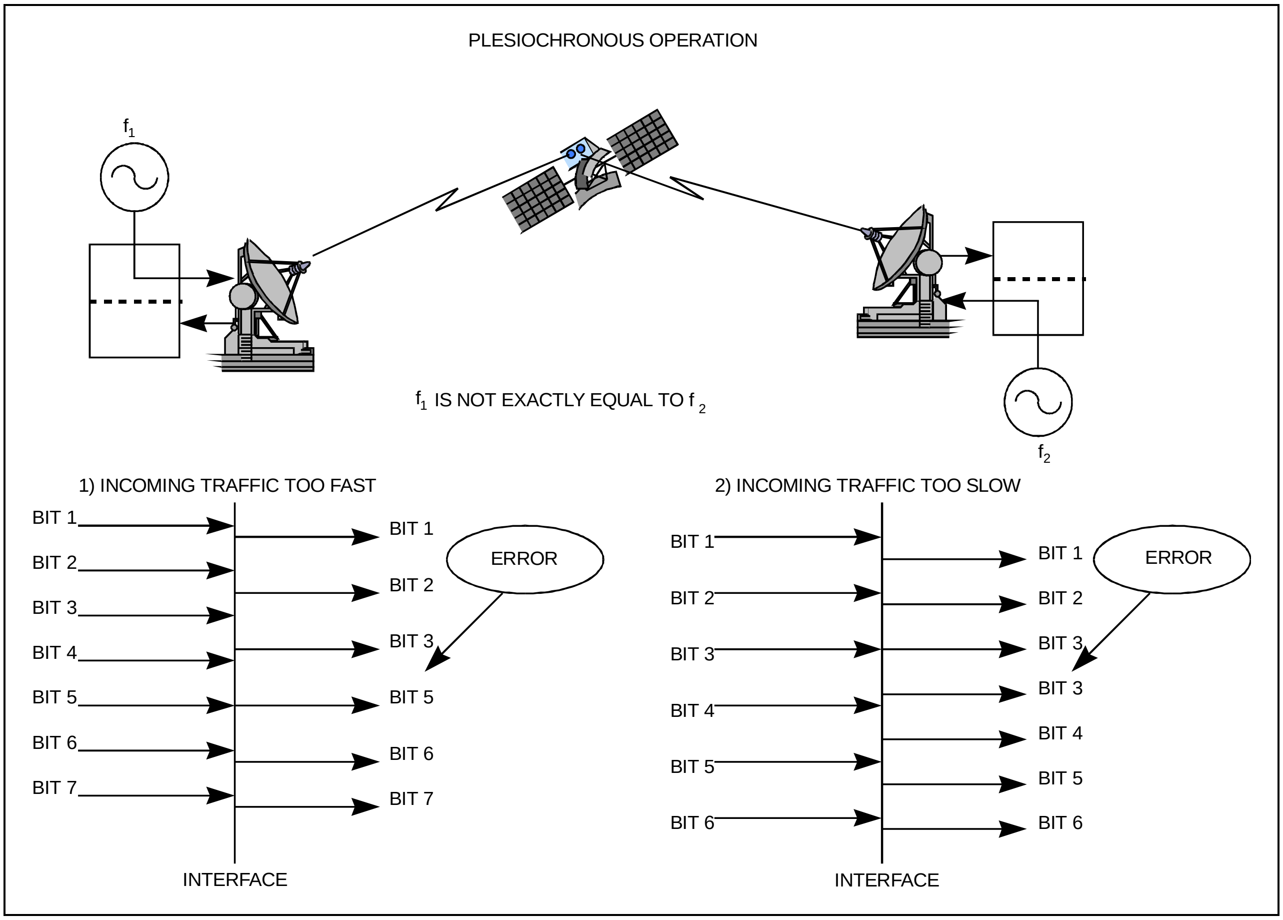

FIGURE 6-6. CLOCK SLIP

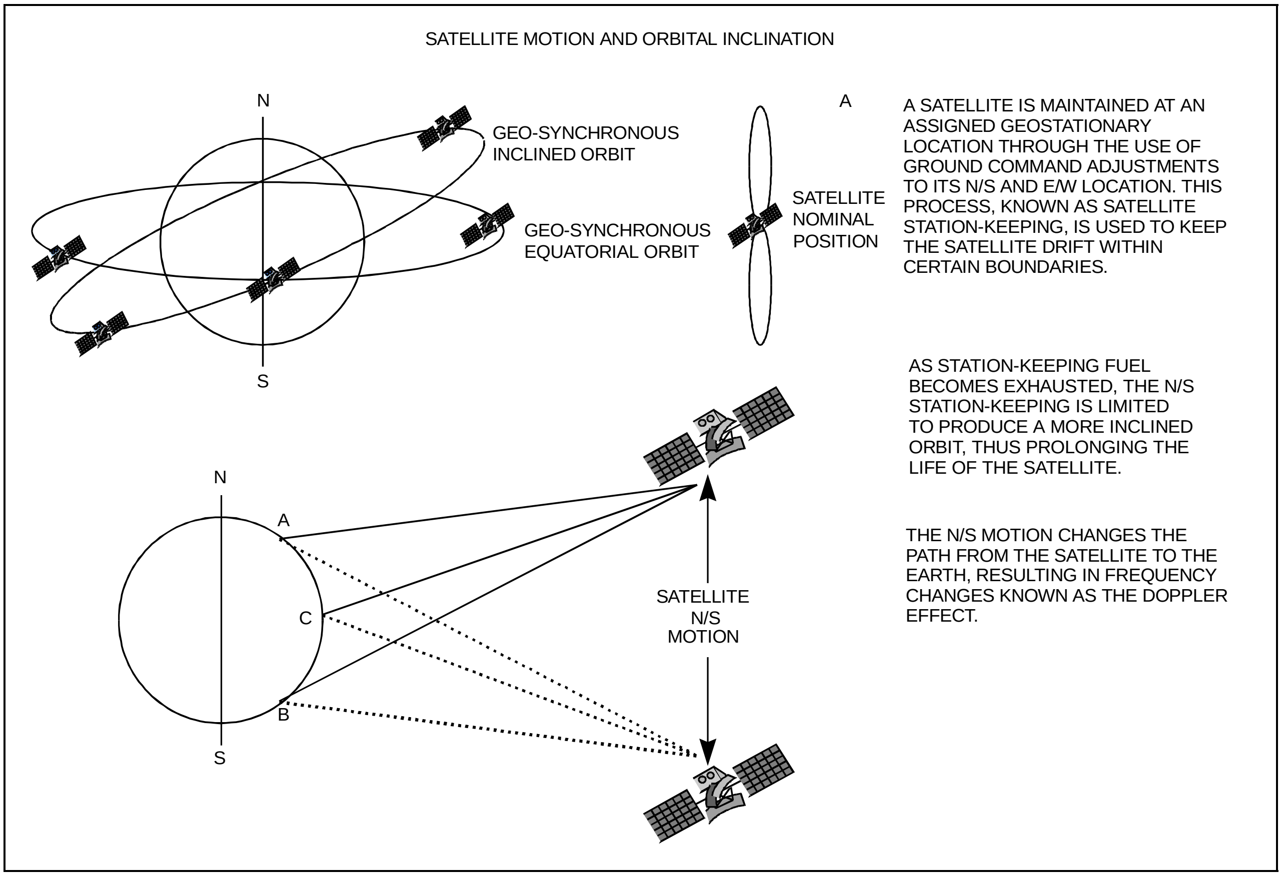

FIGURE 6-7. DOPPLER SHIFT

6.3.1 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

6.4 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.

6.5 Plesiochronous

The stability of station reference clocks is normally 1 x 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 x 10^{-9}**
Local (buffer) clock	**1 x 10^{-11}**
Minimum clock slip	**40 days**

Buffer Depth = (40 x 24 x 60 x 60) x (1 x 10^{-9} + 1 x 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.

6.6 Frame/Multiframe Length

The depth of the receive buffer required is applicable to all unframed data.

When the data is framed (such as 2048 kbps G732 or 1544 kbps G733), it is desirable to provide slips in predefined locations. The advantage of organized slip locations (in relation to the frame) is that multiplexing equipment does not lose sync and outages on any channel are kept to a minimum.

A 2048 kbps frame structure commonly used is G732. This has a frame length of 256 bits with 16 frames per multiframe (4096 bits total, or 2 ms).

6.6.1 Multiples of the Frame Length

If this setting is set to NONE, the user can choose any buffer depth.

6.6.2 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. Using the examples from the three previous sections, the total buffer depth (end to end) will be:

> Doppler + Plesiochronous (rounded up to the nearest multiframe)
> 1.15 ms + 6.98 ms = 8.13 ms

If the frame length is 2 ms, then the nearest multiframe will be 10 ms, or 20,480 bits.

6.6.3 Converting Between Bits and Seconds

Bits to Seconds	1/Data Rate x Bits = Seconds.
Seconds to Bits	Data Rate x Seconds = Bit.

CHAPTER 7. FEC AND TURBO

7.1 Introduction

The SDM-300L3 is equipped with several Forward Error Correction (FEC) encoders and decoders:

- Viterbi
- Sequential
- Reed-Solomon (Concatenated per Intelsat)
- Reed-Solomon (Concatenated per Closed Network)
- Trellis (FAST option)
- Turbo Codec
- Uncoded

The constraint lengths and encoding polynomials are not only Open Network compatible, but also are Closed Network compatible with the vast majority of existing modems.

THE SDM-300L3 can be fitted with a Turbo Product Codec. Turbo Product Coding is small SIMM module that can be fitted to the unit at time of manufacturing.

7.2 Coding

The SDM-300L3 can have any of the following configurations:

- Basic SDM-300L (Sequential or Viterbi Decoder)
- FAST options (Sequential or Viterbi Decoder)
- FAST options with Reed-Solomon hardware (Sequential or Viterbi Decoder)
- FAST options with Overhead hardware (Sequential or Viterbi Decoder)
- Turbo hardware.

7.3 Turbo Product Codec (Hardware Option)

7.3.1 Introduction

Comtech EF Data implements the FEC Codec based on TPC. A Turbo Product Code is a two 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, or 8PSK TPC modes the demod and decoder can remain synchronized ***2 – 3 dB below*** the Viterbi/Reed-Solomon or TCM cases.

Table 7-1. Available TPC Modes

Code Rate/Modulation	Data Rate Range
Rate 21/44 BPSK	4.8 kbps to 1193 Mbps
Rate 5/16 BPSK	4.8 kbps to 781.25 kbps
Rate 1/2 QPSK/OQPSK	4.8 kbps to 2386 Mbps
Rate 3/4 QPSK/OQPSK	7.2 kbps to 3750 kbps
Rate 3/4 8PSK	384 kbps to 5.0 Mbps

7.3.2 Mod/Demod 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. Table 7-2 shows, the processing delays for the major FEC types, including the three TPC modes:

Table 7-2. Turbo Product Coding processing delay comparison

FEC Mode (64 kbps data rate)	Mod/Demod delay, ms
Viterbi, Rate 1/2	12
Sequential, Rate 1/2	74
Viterbi Rate 1/2 with Reed Solomon	266
Sequential Rate 1/2 with Reed Solomon	522
Turbo Product Coding, Rate 3/4, {O}QPSK	**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.

7.3.3 Comparison of all TPC Modes

Note: For additional data, refer to Appendix C, for BER specifications.

Mode	Eb/No at BER = 10^{-6}	Eb/No at BER = 10^{-8}	Spectral Efficiency	Symbol Rate	Occupied * Bandwidth for 1 Mbps Carrier
QPSK Rate 1/2 Viterbi *	6.0 dB	7.2 dB	1.00 bps/Hz	1.0 x bit rate	1190 kHz
BPSK Rate 21/44 Turbo	3.0 dB	3.3 dB	0.48 bps/Hz	2.1 x bit rate	2493 kHz
BPSK Rate 5/16 Turbo	< 4.0 dB	< 4.0 dB	0.31 bps/Hz	3.2 x bit rate	3808 kHz
{O}QPSK Rate 1/2 Turbo	3.0 dB	3.5 dB	1.00 bps/Hz	1.0 x bit rate	1190 kHz
{O}QPSK Rate 3/4 Turbo	3.9 dB	4.3 dB	1.50 bps/Hz	0.67 x bit rate	793 kHz
8PSK Rate 2/3 TCM ** and RS (IESS-310)	6.1 dB	6.6 dB	1.82 bps/Hz	0.56 x bit rate	666 kHz
8PSK Rate 3/4 Turbo	7.0 dB	8.0 dB	2.25 bps/Hz	0.44 x bit rate	529 kHz

* 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 SDM-300L3 transmit filtering.

** Included for comparative purposes.

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.

7.4 Uncoded Operation (No FEC)

There are occasions where a user may wish to operate a satellite link with no forward error correction of any kind. For this reason, the SDM-300L3 offers this uncoded mode for three modulation types - BPSK, QPSK and OQPSK. However, the user should be aware of some of the implications of using this approach.

PSK demodulators have two inherent undesirable features. The first of these is known as ‘phase ambiguity’, and is due to the fact the demodulator does not have any absolute phase reference, and in the process of carrier recovery, the demodulator can lock up in any of K phase states, where K = 2 for BPSK, K = 4 for {O}QPSK. Without the ability to resolve these ambiguous states there would be a 1-in-2 chance that the data at the output of the demodulator would be wrong, in the case of BPSK. For QPSK, the probability would be 3 in 4.

The problem is solved in the case of BPSK by differentially encoding the data prior to transmission, and then performing the inverse decoding process. This is a very simple process, but has the disadvantage that it doubles the receive BER. For every bit error the demodulator produces, the differential decoder produces two.

The problem for QPSK is more complex, as there are 4 possible lock states, leading to 4 ambiguities. When FEC is employed, the lock state of the FEC decoder can be used to resolve two of the four ambiguities, and the remaining two can be resolved using serial differential encoding/decoding. However, when no FEC is being used, an entirely different scheme must be used. Therefore, in QPSK, a parallel differential encoding/decoding technique is used, but has the disadvantage that it again doubles the receive BER.

OQPSK is a different situation again, where the ambiguities result not only from not having an absolute phase reference, but also not knowing which of the two parallel paths in the demod, I or Q, contains the half-symbol delay. Another type of differential encoding is used, but yet again the error rate is doubled, compared to ideal.

NOTE: Whenever uncoded operation is selected, the modem automatically uses the differential encoder/decoder appropriate for the modulation type. It cannot be disabled.

The second problem inherent in PSK demodulators is that of ‘data false locking’.
In order to accomplish the task of carrier recovery, the demodulator must use a non-linear process. A second-order non-linearity is used for BPSK, and a fourth-order non-linearity is used for QPSK. When data at a certain symbol rate is used to modulate the carrier, the demodulator can lock at incorrect frequencies, spaced at intervals of one-quarter of the symbol rate away from the carrier. Fortunately, when FEC decoding is used, the decoder synchronization state can be used to verify the correct lock point has been achieved, and to reject the false locks.

However, if uncoded operation is used, there is no way to recognize a data false lock. The demodulator will indicate that it is correctly locked, but the data out will not be correct.

CAUTION

Comtech EF Data strongly cautions users when using uncoded operation. If the acquisition sweep width exceeds one quarter of the symbol rate, there is a very high probability that the demodulator will false lock.

As an example, if 64 kbps QPSK uncoded is used, the symbol rate will be half of this rate, or 32 ksymbols/second. One quarter of this equals 8 kHz. Therefore, the absolute maximum acquisition sweep range, which should be considered, is ± 8 kHz. If there is any frequency uncertainty on the incoming carrier, this should be subtracted from the sweep width. The problem becomes progressively better with increasing symbol rate.

CAUTION

Comtech EF Data is not responsible for incorrect operation if the user does not adhere to these guidelines when using uncoded operation.

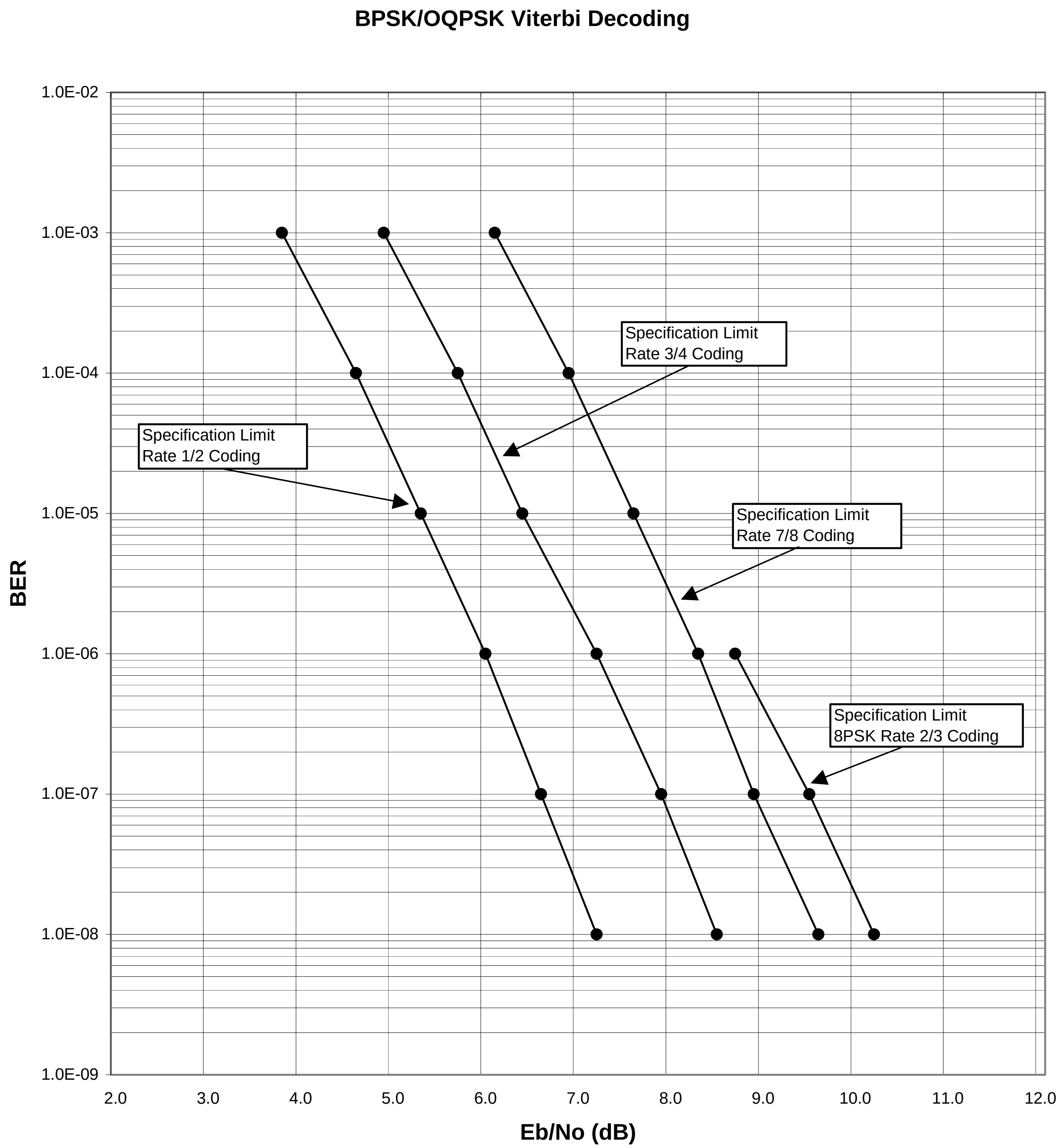

Figure 7-1. Viterbi Decoder

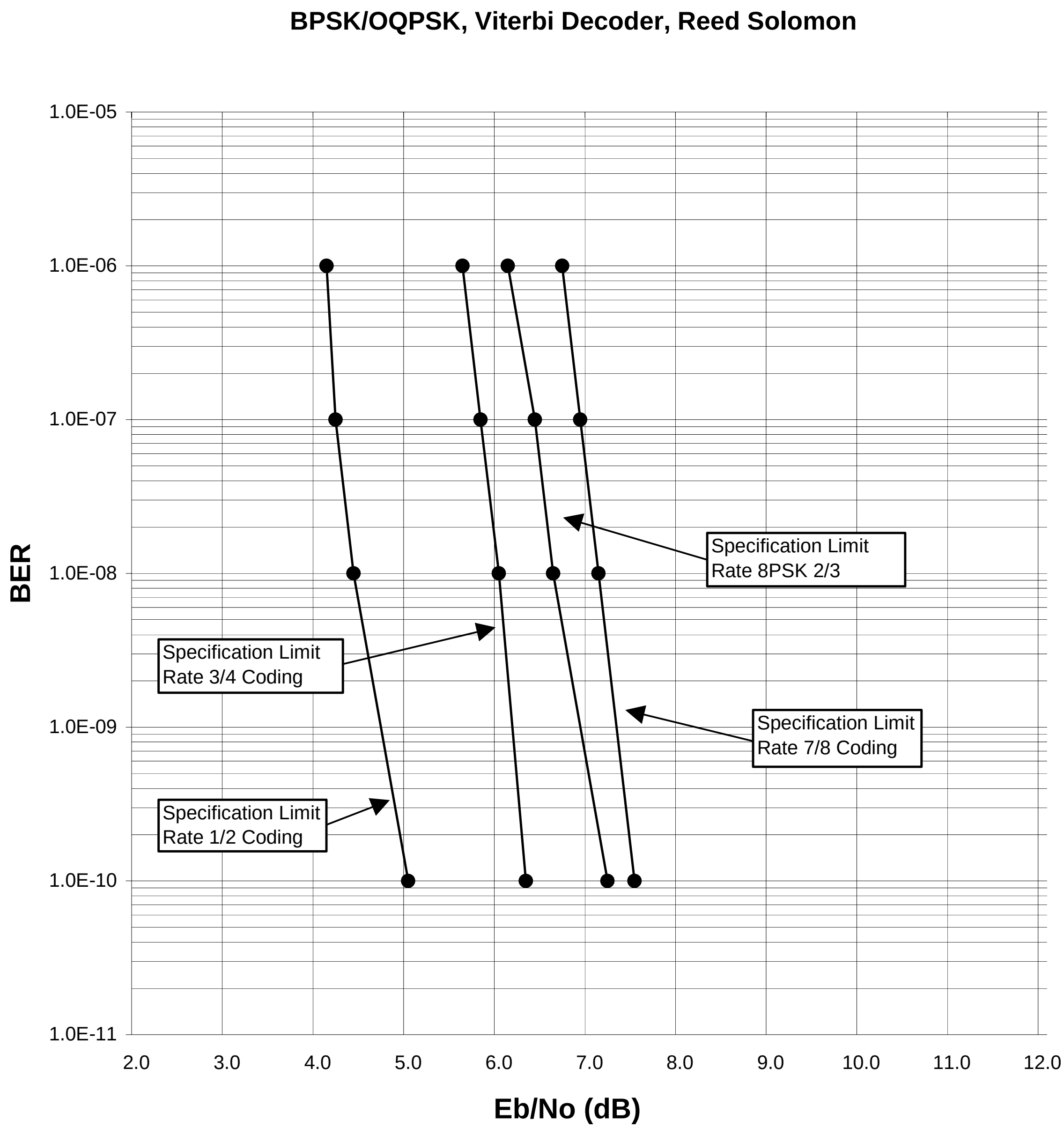

Figure 7-2. Viterbi Decoder and Reed-Solomon

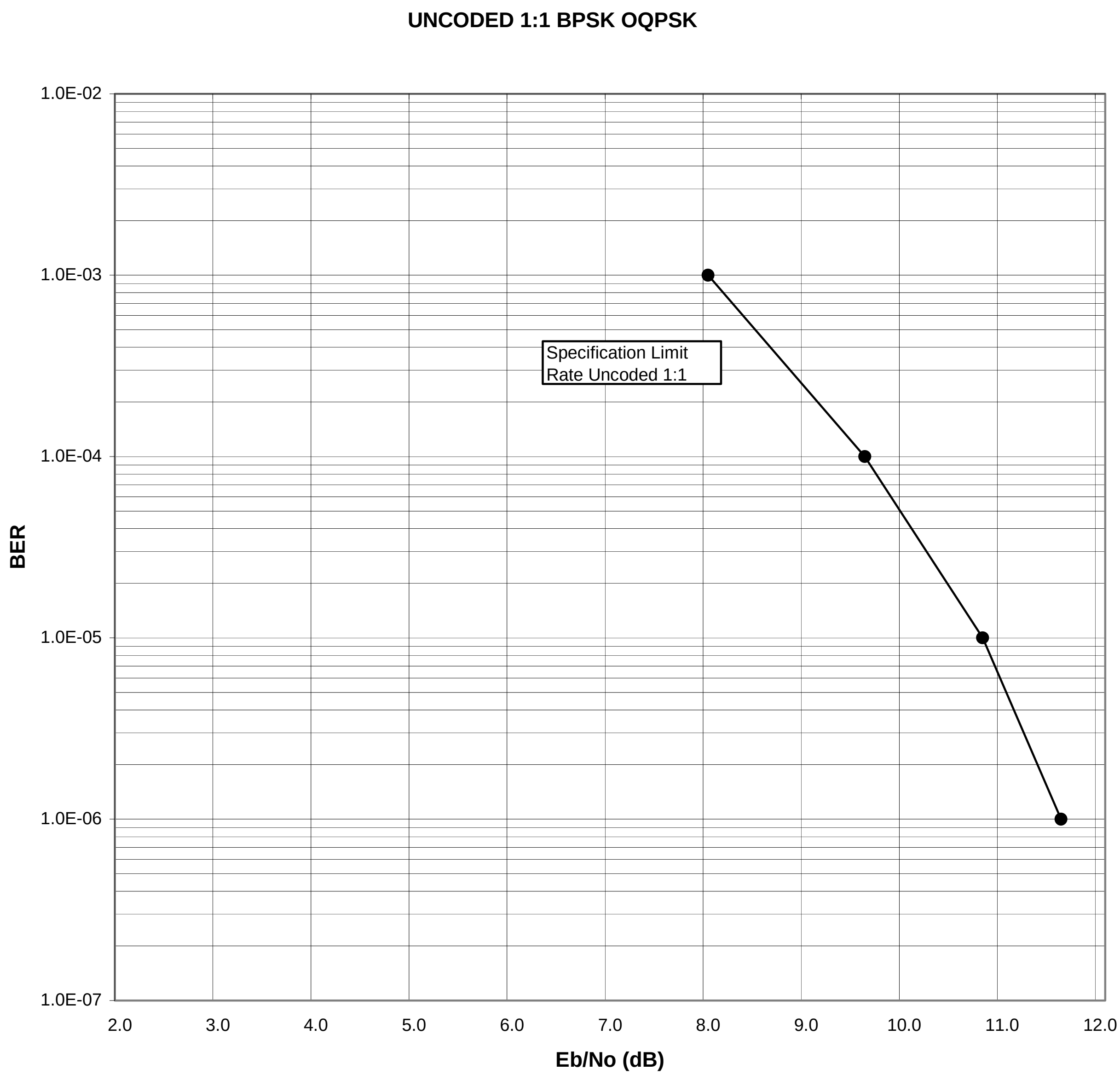

Figure 7-3. BPSK and (O)QPSK BER Performance

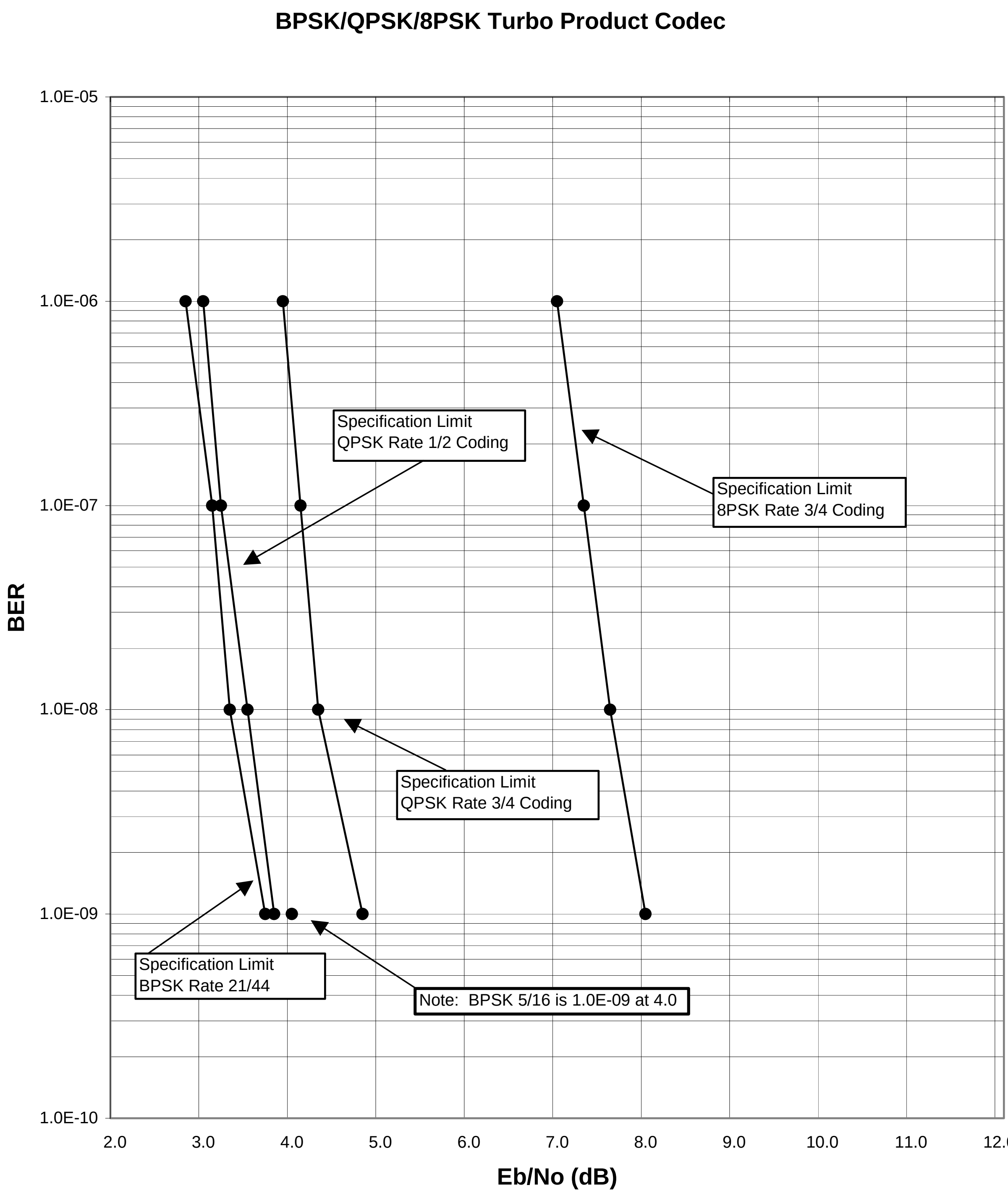

Figure 7-4. Turbo Product Codec

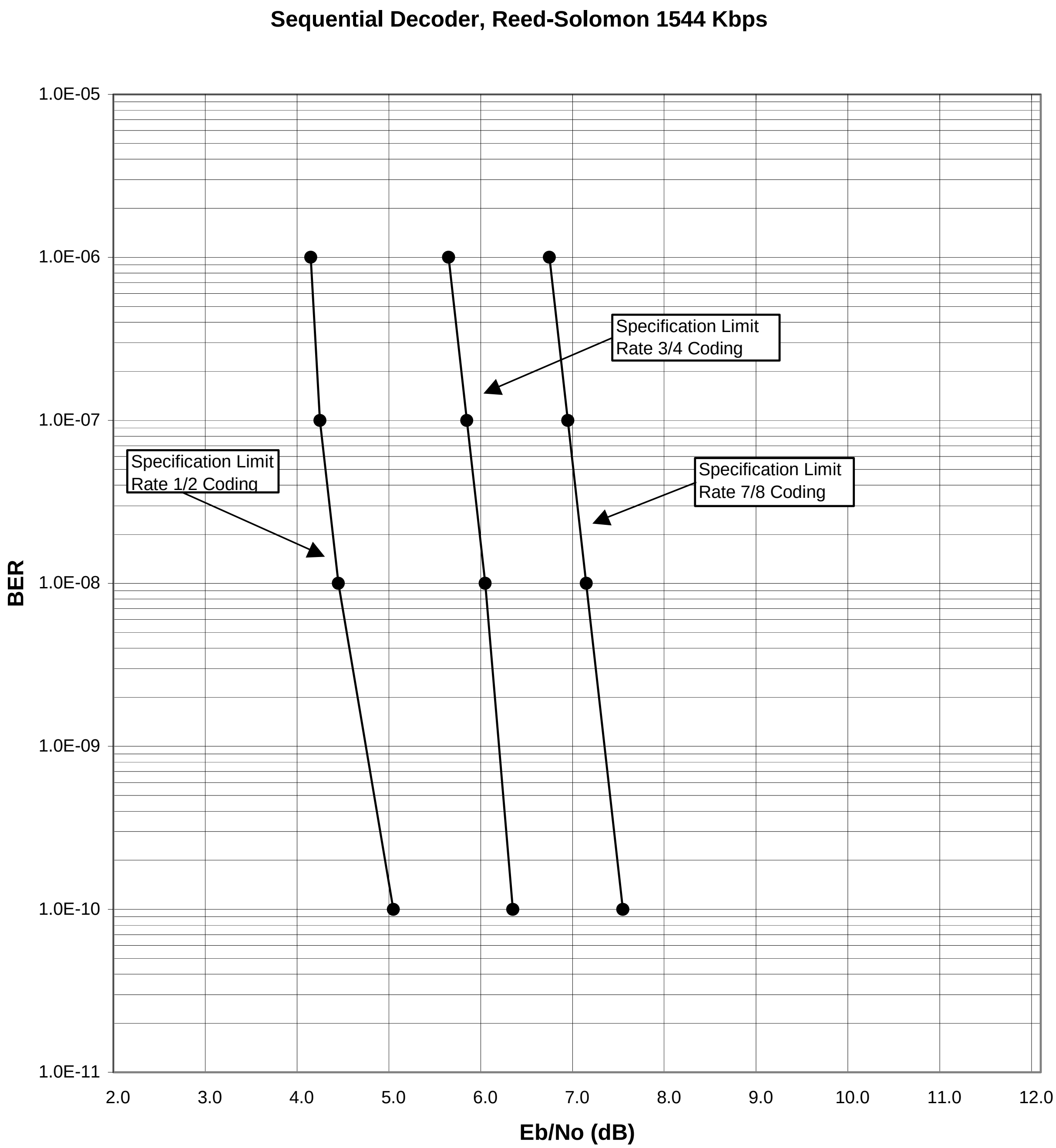

Figure 7-5. Sequential Decoder, Reed-Solomon, and 1544 kbps

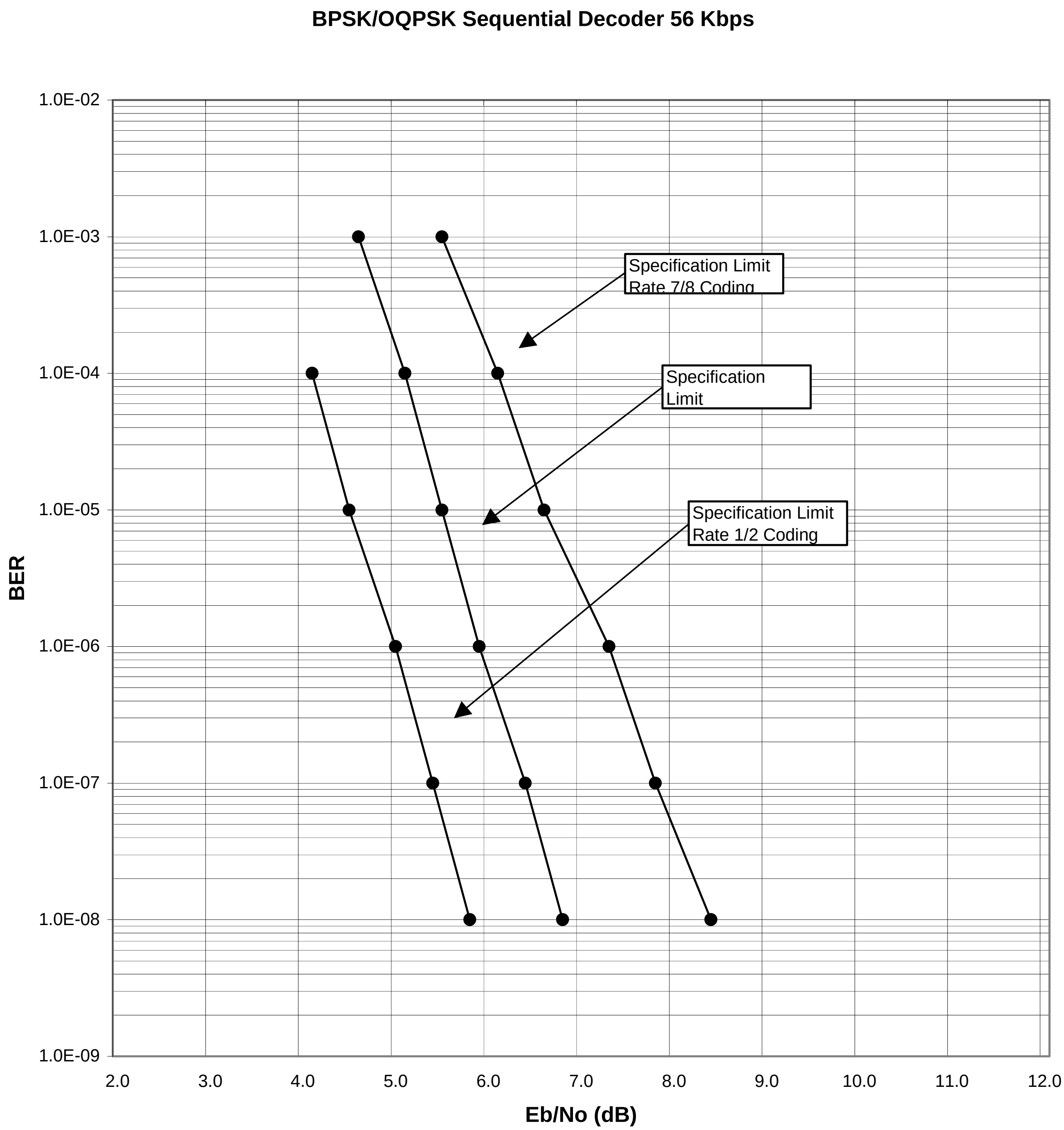

Figure 7-6. Sequential Decoder and 56 kbps

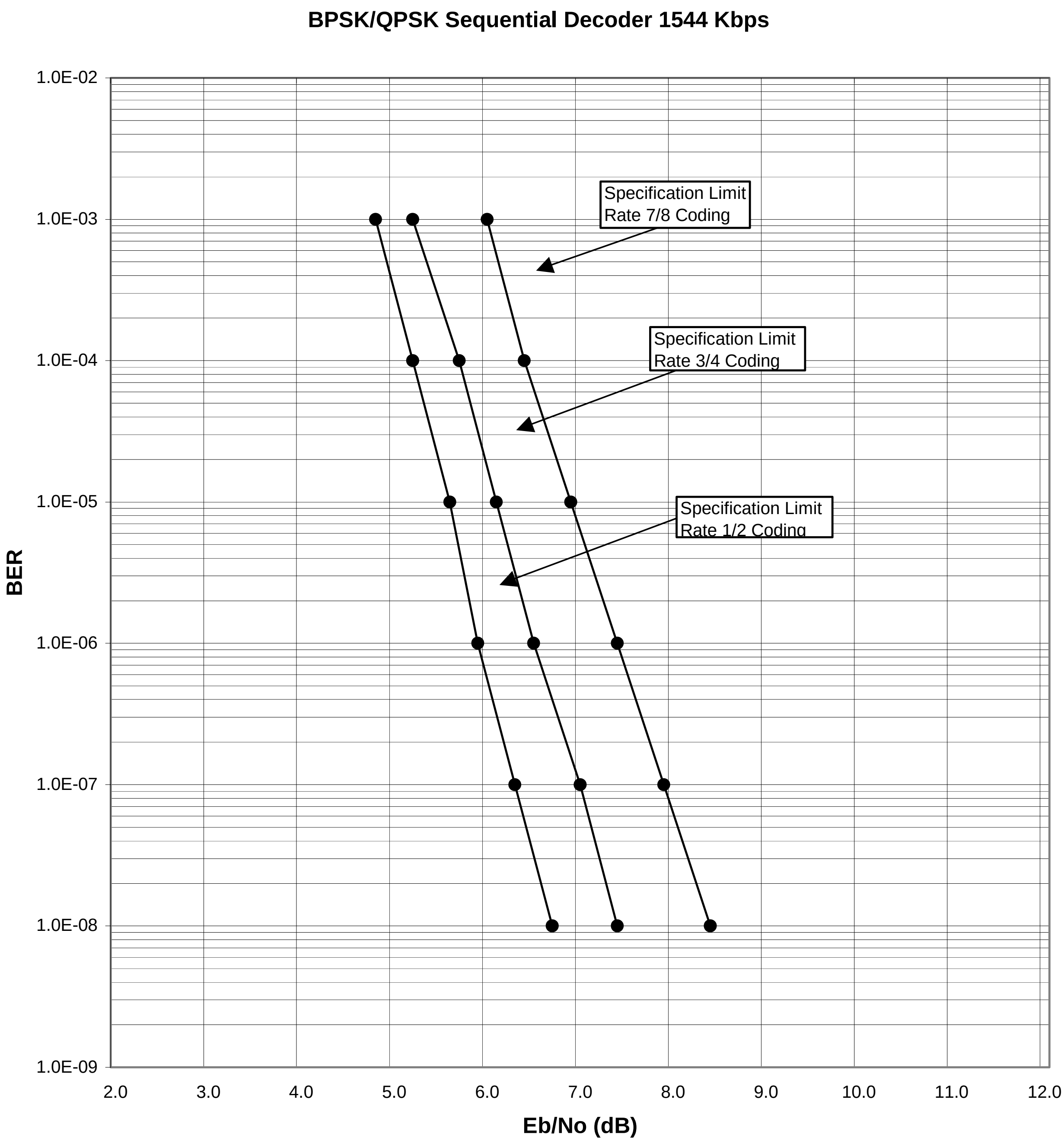

Figure 7-7. Sequential Decoder and 1544 kbps

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Chapter 8. SYSTEM CHECKOUT

8.1 System Checkout

CAUTION

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

The modem comes equipped with an internal self-test feature. This feature is designed to provide the operator with maximum confidence that the modem is operational without installing external equipment.

A 2047 pattern is generated by the modem and routed through all sections. Placing the modem in IF and baseband loopbacks accomplish this. Pseudo Gaussian noise is introduced to the modulated IF section allowing the modem to check its indicated E_b/N_0 against the known E_b/N_0 of the demodulated input.

• If this measurement falls outside of a specified window:	The modem declares a failed test.
• If an overhead card and/or Reed-Solomon card are installed:	The signal is routed through the card, verifying their operation.
• Faults, if any:	Stored in the Stored Fault menu.

8.1.1 Interface Checkout

Use the following procedure and the test setup in Figure 5-1to inspect the interface.

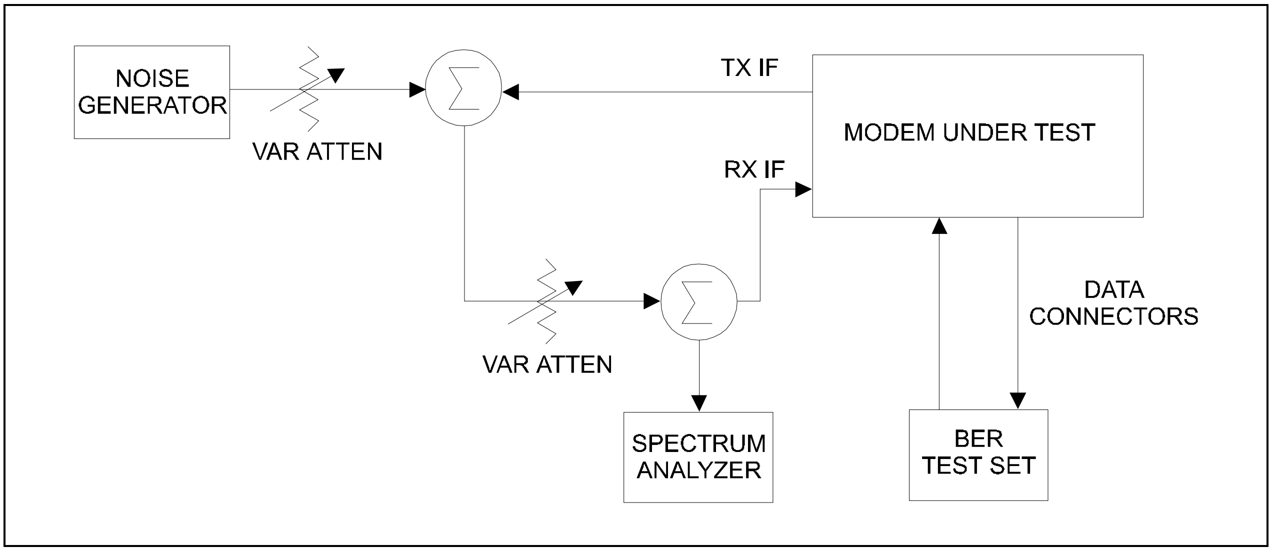


Figure 8-1. Fault Isolation Test Setup

1. Connect a BER test set to the appropriate modem data connector.

2. Set up the modem for baseband loopback operation by using the Configuration Interface front panel menu . The modem will run error free.

3. Change the modem from baseband loopback to interface loopback operation by using the Configuration Interface front panel menu. The modem will run error free.

8.1.2 Modulator Checkout

Use the following procedure to check out the modulator:

1. Set up the equipment as shown in Figure 8-1.

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.

4. Measure the E_b/N_0 with a receiver that is known to be properly operating. Refer to Table 8-1 and Figure 8-2 to check for proper E_b/N_0 level. The (S+N)/N is measured by taking the average level of the noise and the average level of the modem spectrum top. Use this measurement for the first column on Table 8-1. 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.

5. Connect a spectrum analyzer to the modem. Ensure the IF output meets the appropriate mask and spurious specifications. Measure the power output at different levels and frequencies.

   A typical output spectrum is shown in Figure 8-3.

6. To check the frequency and phase modulation accuracy:

   a. Set the modem to the continuous wave Normal mode by using the Carrier Mode front panel menu. This sets the Carrier mode in the off condition. A pure carrier should now be present at the IF output. This should only be used for frequency measurements. In this mode, spurious and power measurements will be inaccurate.

   b. Set the modem to the continuous wave Offset mode by using the Carrier Mode front panel menu. This generates a single, upper side-band-suppressed carrier signal. Ensure the carrier and side-band suppression is < -35 dBc.

Table 8-1. Conversion to S/N and Eb/N0 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

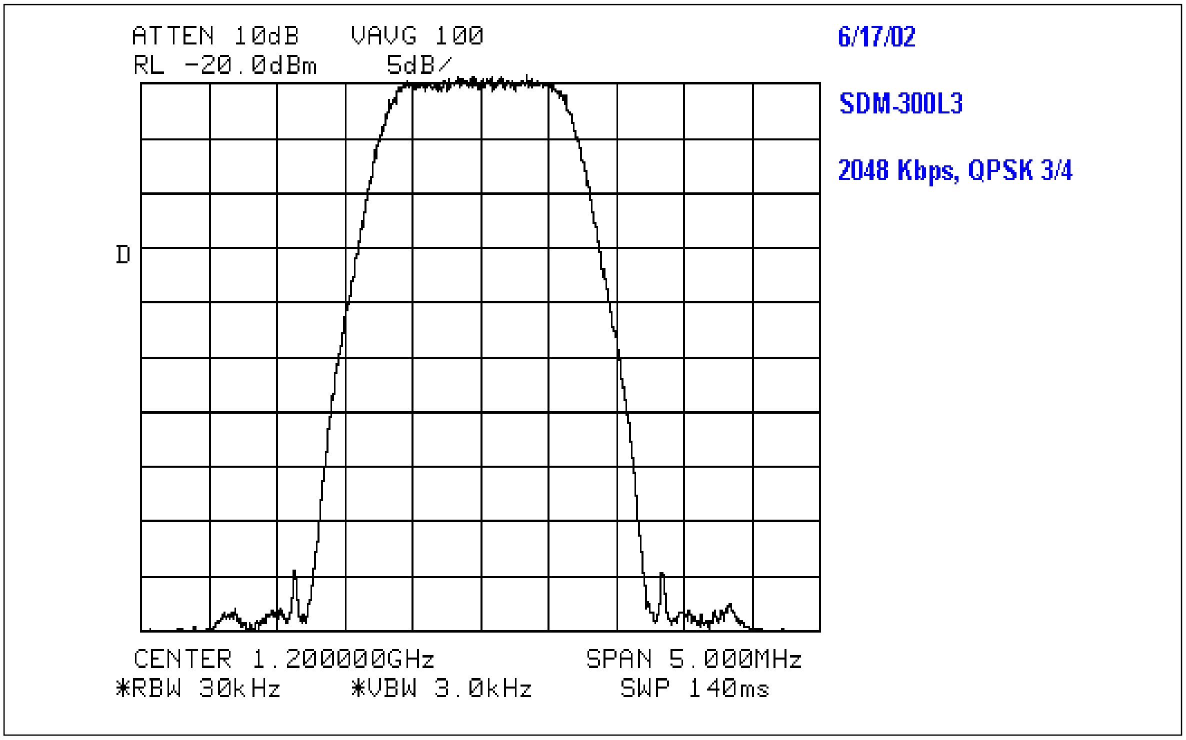


Figure 8-2. Typical Output Spectrum

8.1.3 Demodulator Checkout

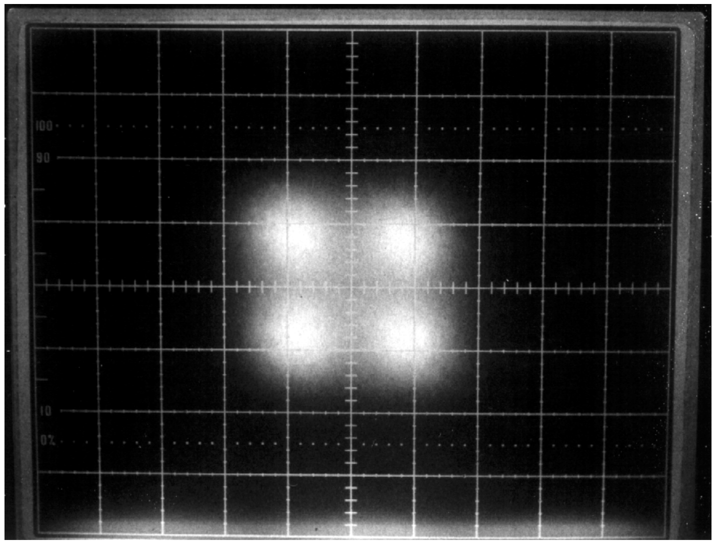
Use the following procedure to test the demodulator.

1. Set up the equipment.

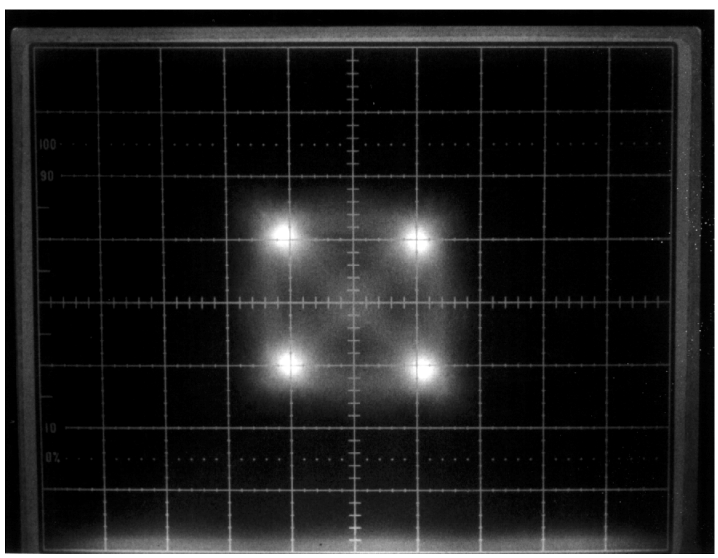
2. Set up the modem with an external IF loop and level. Use a properly operating modulator, and ensure that power levels, data rates, code rates, etc., are compatible.

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 8-4. These test points are available on the auxiliary connector (J9, pins 6 and 8). It is not necessary to open the modem to look at these test points.



WITH NOISE



WITHOUT NOISE

Figure 8-3. Typical Eye Constellations

Chapter 9. FAULT ISOLATION

9.1 Fault Isolation

The modem's design allows a technician to repair a faulty modem on location.

CAUTION

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
- Backward Alarms

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).

9.1.1 System Faults/Alarms

System faults are reported in the “Faults/Alarms ” menu, and stored faults are reported in the “Stored Flts/Alms” menu.

9.1.2 Faults/Alarms Display

General fault, status, and alarm information are indicated by 10 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 yellow 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.

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.

9.1.3 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
- Backward alarm

9.1.3.1 Faults Tree

Refer to Figure 9-1 for faults monitored by the modem, and the action taken at each occurrence of that fault.

	TX IF OUTPUT OFF	TX FAULT LED	TX FAULT RELAY 1	RX FAULT LED	RX FAULT RELAY 2	COM EQ FAULT LED	COM EQ FAULT RELAY 3	TX ALARM LED	TX ALARM RELAY #2 4	RX ALARM LED	RX ALARM RELAY #3 5	SPARE RELAY ALARM #1	PRIMARY ALARM RELAY 6 ** ***	SECONDARY ALARM RELAY 7 ** ** *	IBS BACKWARD ALARM ** ***	DEFERRED MAIN ALARM 8 *	TX AIS * ** ***	RX AIS * ** ***	D&I TERR BWA ***
MODULATOR FAULTS																			
IF SYNTHESIZER	X	X	X										X				X		X
DATA CLOCK SYN	X	X	X										X				X		X
I CHANNEL	X	X	X										X				X		X
Q CHANNEL	X	X	X										X				X		X
AGC	X	X	X										X				X		X
MODEM REF ACT								X	X										
MODULE	X	X	X										X				X		X
CONFIGURATION	X	X	X										X				X		X
MODEM REF PLL	X	X	X										X				X		X
DEMODULATOR FAULTS																			
CARRIER DETECT				X	X								X		X			X	
IF SYNTHESIZER				X	X								X		X			X	
I CHANNEL				X	X								X		X			X	
Q CHANNEL				X	X								X		X			X	
BER THRESHOLD										X	X			X		X			
MODULE				X	X								X		X			X	
CONFIGURATION				X	X								X		X			X	
LNB CURRENT				X	X								X		X			X	
OUTDOOR UNIT (BUC)																			
CURRENT																			
VOLTAGE																			
TEMPERATURE																			
PLL LOCK								x	x				X						
CHECKSUM																			

FIGURE 9-1. SDM-300L FAULT TREE

	TX IF OUTPUT OFF	TX FAULT LED	TX FAULT RELAY 1	RX FAULT LED	RX FAULT RELAY 2	COM EQ FAULT LED	COM EQ FAULT RELAY 3	TX ALARM LED	TX ALARM RELAY #2 4	RX ALARM LED	RX ALARM RELAY #3 5	SPARE RELAY ALARM #1	PRIMARY ALARM RELAY 6 ** ***	SECONDARY ALARM RELAY 7 ** ***	IBS BACKWARD ALARM ** ***	DEFERRED MAIN ALARM 8 *	TX AIS * ** ***	RX AIS * ** ***	D& I TERR BWA ***
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						
CONTROLLER						X	X						X				X	X	
SELF TEST						X													
INTERFACE MODULE						X	X						X				X	X	
BACKWARD ALARMS (IDR ONLY)																			
BW ALARM RX #4										X	X					X			
BW ALARM RX #3										X	X					X			
BW ALARM RX #2										X	X					X			
BW ALARM RX #1										X	X					X			
BW ALARM TX #4								X	X										
BW ALARM TX #3								X	X										
BW ALARM TX #2								X	X										
BW ALARM TX #1								X	X										

Figure 9-1. SDM-300L3 Fault Tree (Continued)

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 *****
*	IDR only.	
**	IBS only.	
***	D&I only.	
****	A connection between the common and N.C. contacts indicate fault.	
*****	Signal is open collector high impedance if faulted.	
+	A connection between the common and N.O. contacts indicate alarm.	

Figure 9-1. SDM-300L3 Fault Tree (Continued)

9.1.3.2 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. In the IDR type configuration, the data rate must reflect any overhead bits that are added. In the IBS type, the internal reference is changed to account for the IBS overhead of 16/15. A standard IDR type configuration operating at Rev. 2 would be programmed to the input data rate. An IDR type operating at Rev. 3 would be programmed to reflect the 96 kbit/s of overhead. A 1544 kbit/s Rev. 3 IDR is programmed to 1640 kbit/s. An IBS type would be programmed for the input data rate to the channel unit. The modem accounts for the overhead because of the change in internal reference. Use interface loopback for isolating the problem. Verify the frequency of the input data clock to be within the lock range of 100 PPM.
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
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.
MODEM REF PLL	Modem REF PLL Indicates phase lock loop is unable to lock to EXT REF.

9.1.3.3 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 Adaptive Broadband 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 Adaptive Broadband Customer Support Department.
CONFIGURATION	Modulator/Demodulator Configuration fault. Indicates a fault in either the Modulator or Demodulator state.
LNB CURRENT	LNB Current fault. Indicates a fault in LNB Current..

9.1.3.4 Outdoor Unit

Fault/Alarm	Possible Problem and Action
CURRENT	ODU Current fault.
VOLTAGE	ODU Voltage fault.
TEMPERATURE	ODU Temperature fault.
PLL LOCK	PLL Lock fault. Indicates the PLL is not locked to the reference of the interface transmit clock recovery oscillator. Contact the Comtech EF Data Customer Support Department.
CHECKSUM	Checksum fault.

9.1.3.5 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.
INTERFACE	Interface module fault. Indicates a problem in programming the interface card.

9.1.3.6 Backward Alarms Faults

Fault/Alarm	Possible Problem and Action
BW ALARM RX4	Receive backward alarm #4. The distant end of the link is sending backward alarm #4. This indicates trouble at the distant end, which may be a result of improper transmission at the near end of the link. The modem will signal this event by setting the deferred maintenance alarm (open collector). This alarm is a monitor function. The modem reports and records the event, but takes no other action. Refer to Chapter 2 for the backward alarm theory of operation. If the user does not wish to monitor the backward alarm faults, the backward alarm inputs must be grounded at the breakout panel. Refer to Chapter 2 for breakout panel pinouts.
BW ALARM RX3	Receive backward alarm #3. Refer to BW Alarm RX4 for details.
BW ALARM RX2	Receive backward alarm #2. Refer to BW Alarm RX4 for details.
BW ALARM RX1	Receive backward alarm #1. Refer to BW Alarm RX4 for details.
BW ALARM TX4	Transmit backward alarm #4. The modem is being instructed to send backward alarm #4 to the distant end of the link. This alarm is controlled by wiring the backward alarm inputs of the modem to the demod fault relay and/or other fault outputs in the receive system (see IESS-308 for clarification). The simplest implementation for single destination service is to wire the demod fault relay between ground and the four backward alarm inputs (see Chapter 3 for clarification). This sends all four backward alarms in the event of any major (prompt) receive fault. This particular alarm is transmitted, reported, and recorded, but the modem takes no other action. In most cases, this will be sent due to some receive problem with the modem, so a real fault will probably be occurring if backward alarms are being sent. The transmit backward alarms are a symptom of trouble, not a cause.
BW ALARM TX3	Transmit backward alarm #3. Refer to BW Alarm TX4 for details.
BW ALARM TX2	Transmit backward alarm #2. Refer to BW Alarm TX4 for details.
BW ALARM TX1	Transmit backward alarm #1. Refer to BW Alarm TX4 for details.

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Chapter 10. OPEN NETWORK OPERATIONS

10.1 Introduction

This section summarizes the functionality and specifications of the various Open Network operating modes, such as:

- IBS
- IDR
- Drop & Insert (D&I)
- 2xADPCM Voice in 64 kbps IBS

10.2 IBS

IBS operation adds a proportional overhead (1/15) to the terrestrial data. The terrestrial data and clock are passed through the baseband loopback relay and are translated from the selected baseband format to Transistor-Transistor Logic (TTL). The data is scrambled synchronously with the multiframe sync in the multiplexer. The scrambler is enabled using the front panel.

External input and output for an ESC in EIA-232 format is provided on the interface. The ESC runs asynchronously at approximately 1/2000 of the terrestrial data rate. If the ESC clock is used, the channel runs at 1/512 of the terrestrial data rate. The overhead containing framing, the ESC channel, and faults from the modem are multiplexed with dejittered terrestrial data. The multiplexed data stream is output to the modulator through the interface loopback device.

The receive data from the demodulator is input through the same interface loopback device. The receive data is demultiplexed and synchronously descrambled by the demultiplexer. The backward alarm is reported to the M&C and output by Form C relay contact. The ESC is output by an EIA-232 driver. The terrestrial data output from the demultiplexer is input to a plesiochronous buffer.

The front panel interface provides four clock selections clocking the data out of the buffer:

- Internal Clock (SCT)
- RX Recovered Clock (RXCLK)
- External Reference Clock (EXT)
- High Stability Clock (HI STAB)
- TX Clock Dejittered (TXCLK)

If either RXCLK or EXT is selected and then fails, the interface automatically switches to SCT as the source.

AIS is detected in the receive data and reported to the M&C.

The receive data and selected clock are translated to the levels of the selected baseband interface and output through the baseband loopback relay.

The octet path is used for transferring a clock pulse to the distant end terrestrial equipment. The clock pulse rate is the IBS data rate ÷ 8.

Refer to Figure 10-1 for a block diagram of the IBS interface.

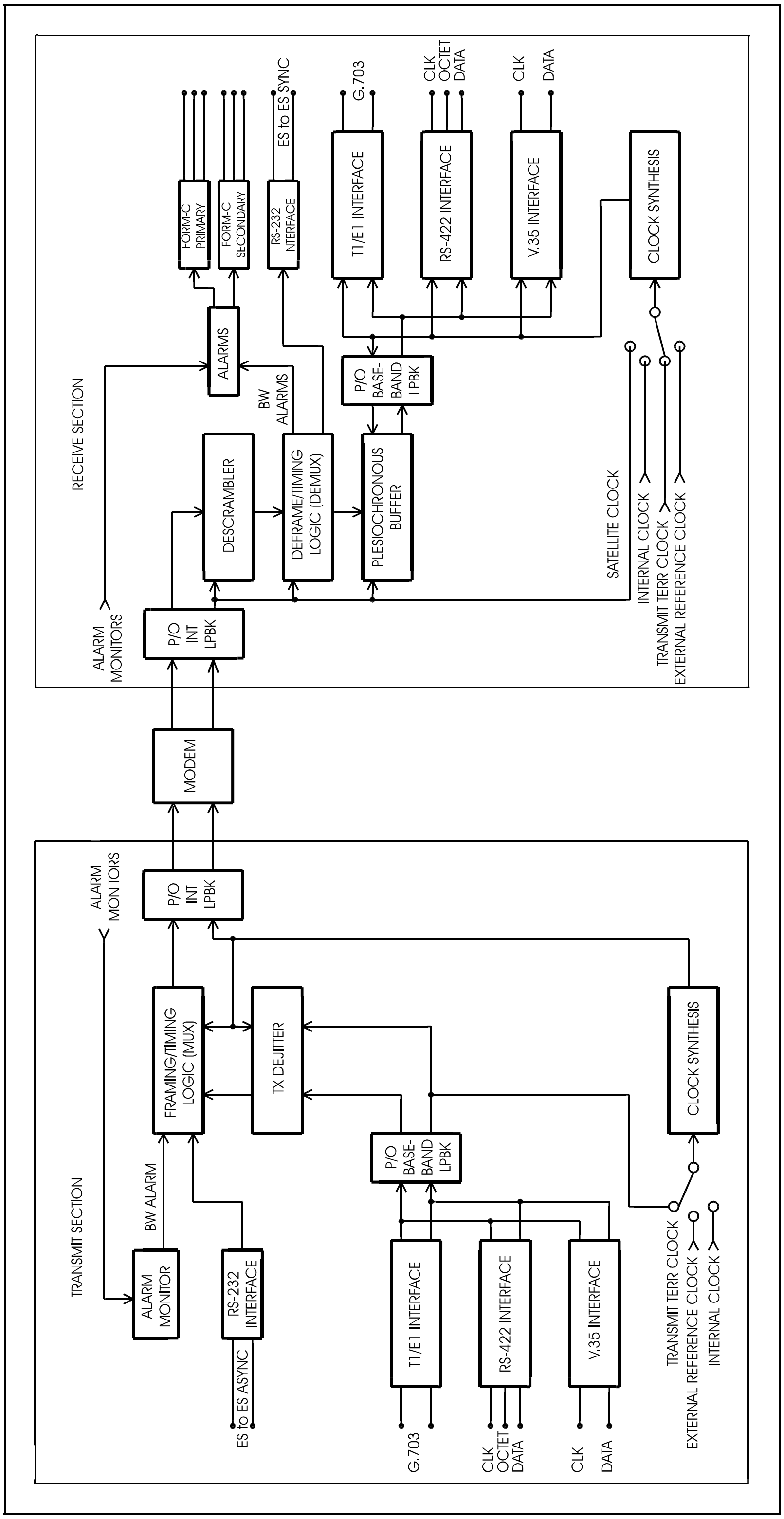


Figure 10-1. IBS Interface Block Diagram

10.2.1 IBS Modem Defaults

Table 10-1. IBS Modem Defaults

Modulator		Demodulator	
Data Rate	A	Data Rate	A
TX Rate A	64 kbps, QPSK 1/2	RX Rate A	64 kbps, QPSK 1/2
TX Rate B	256 kbps, QPSK 1/2	RX Rate B	256 kbps, QPSK 1/2
TX Rate C	768 kbps, QPSK 1/2	RX Rate C	768 kbps, QPSK 1/2
TX Rate D	2048 kbps, QPSK 1/2	RX Rate D	2048 kbps, QPSK 1/2
TX Rate V	128 kbps, QPSK 1/2	RX Rate V	128 kbps, QPSK 1/2
IF Frequency	1200 MHz	IF Frequency	1200 MHz
IF Output	OFF	Decoder Type	Viterbi
Mod Power Offset	0 dB	Differential Decoder	ON
Power Output	-10 dBm	Demodulator Type	Open Net]
Differential Encoder	ON	IF Loopback	OFF
Modulator Type	INTELSAT Open Net	RF Loopback	OFF
Encoder Type	Viterbi	Sweep Center Freq.	0 Hz
CW Mode	Normal (OFF)	Sweep Range	60000 Hz
Mod Power Fixed	0 dB	Sweep Reacquisition	0 seconds
Mod Spectrum	Normal	BER Threshold	NONE
		Demod Spectrum	Normal
Interface			
TX Clock Source	TX Terrestrial	Buffer Size	384
Buffer Clock Source	Receive Satellite	IBS Scrambler	ON
TX Clock Phase	Auto	IBS Descrambler	ON
RX Clock Phase	Normal	Frame Structure T1	G.704
EXT REF Freq.	1544 kHz	Frame Structure E1	G.704
Baseband Loopback	OFF	Frame Structure T2	G.743
Interface Loopback	OFF	Frame Structure E2	G.742
TX Coding Format	AMI	Loop Timing	OFF
RX Coding Format	AMI	TX Overhead Type	IBS
TX 2047	OFF	RX Overhead Type	IBS
RX 2047	OFF	TX Terr Interface	G.703
TX Data/AIS Fault	NONE	RX Terr Interface	G.703
RX Data/AIS Fault	NONE	TX Data Phase	Normal
Buffer Programming	Bits	RX Data Phase	Normal

10.3 IDR

IDR operation adds 96 kbps overhead to the terrestrial data. The terrestrial data rates supported are:

- 1.544 Mbps (T1) + 96k = 1640 Mbps on the data rate menu
- 2.048 Mbps (E1) + 96k = 2144 Mbps on the data rate menu

The terrestrial data is passed through the baseband loopback relay and is translated from the G.703 format to TTL with a recovered clock.

Overhead data can include two ADPCM audio channels or one 64 kbps data channel, four backward alarms, and an EIA-422 format 8 kbps synchronous data channel multiplexed with the dejittered terrestrial data. If the 64 kbps option is selected, the data path is through the normal ADPCM audio path. The audio or 64 kbps option is selected from the Utility Interface menu, using the IDR TX ESC TYPE and IDR RX ESC TYPE commands.

The interface for the audio is a 600Ω transformer-balanced input. The ADPCM audio channels are encoded according to CCITT G.721.

The backward alarms are level-translated to TTL by threshold comparators set to 2.5V. A 1K pull-up resistor to +5V is connected to each alarm input.

The multiplexed data stream is output to the modulator through the interface loopback device. The receive data from the demodulator is input through the same interface loopback device. The receive data is demultiplexed to produce:

- Receive terrestrial data
- 2 ADPCM audio channels or one 64 kbps data channel
- 4 backward alarms
- 8 kbps synchronous data channel
- 1 octet path

The 8 kbps synchronous data channel is formatted for EIA-422. The terrestrial data output from the DEMUX is input to a plesiochronous buffer. The front panel interface provides four clock selections clocking the data out of the buffer:

- Internal Clock (SCT)
- RX Recovered Clock (RXCLK)
- External Reference Clock (EXT)
- TX Clock (TXCLK)

If either RXCLK or EXT is selected and then fails, the interface automatically switches to SCT recovered clock as the source.

The AIS is detected in the receive data and reported to the M&C. The M&C control inserts AIS into the TX data path.

The receive data and selected clock are translated to conform to the G.703 interface, and output through the baseband loopback relay.

Four sets of transmit and receive backward alarms are available to implement the structure defined in IESS-308. Backward alarms are sent to the distant side of an IDR link to signal that trouble has occurred at the receive side (which may have resulted from an improper transmission).

The octet path is used for transferring a clock pulse to the distant end terrestrial equipment. In IDR applications, this is the ESC EIA-422 data rate divided by 8 (for example, 8 kbps ÷ 8 = 1 kbps). If the octet path is used, then the clock pulse must be 1 kbps; otherwise, it can be ignored.

Implementation is straightforward in a simple, single destination link. INTELSAT specifies that any major failure of the downlink chain is to generate a backward alarm. The modem has a demodulator fault relay which de-energizes in the event of a receive fault.

The fault tree for this signal includes the appropriate overhead framing faults in order for this relay to be connected to the appropriate backward alarm input. This signal also includes faults in the downlink chain, since major problems with the antenna, Low Noise Amplifier (LNA), down converter, and other components will cause an interruption in service and fault the modem. Refer to Chapter 2 for connection information.

The desired faults must be hardwired into either the UB-300 breakout panel or the SMS-7000 data switch module in order to take advantage of the backward alarm capabilities. Otherwise, the user can turn them OFF under the Utility/Interface/IDR Backward Alarm control or ground them out at the connector.

Refer to Figure 10-2 for a block diagram of the IDR interface.

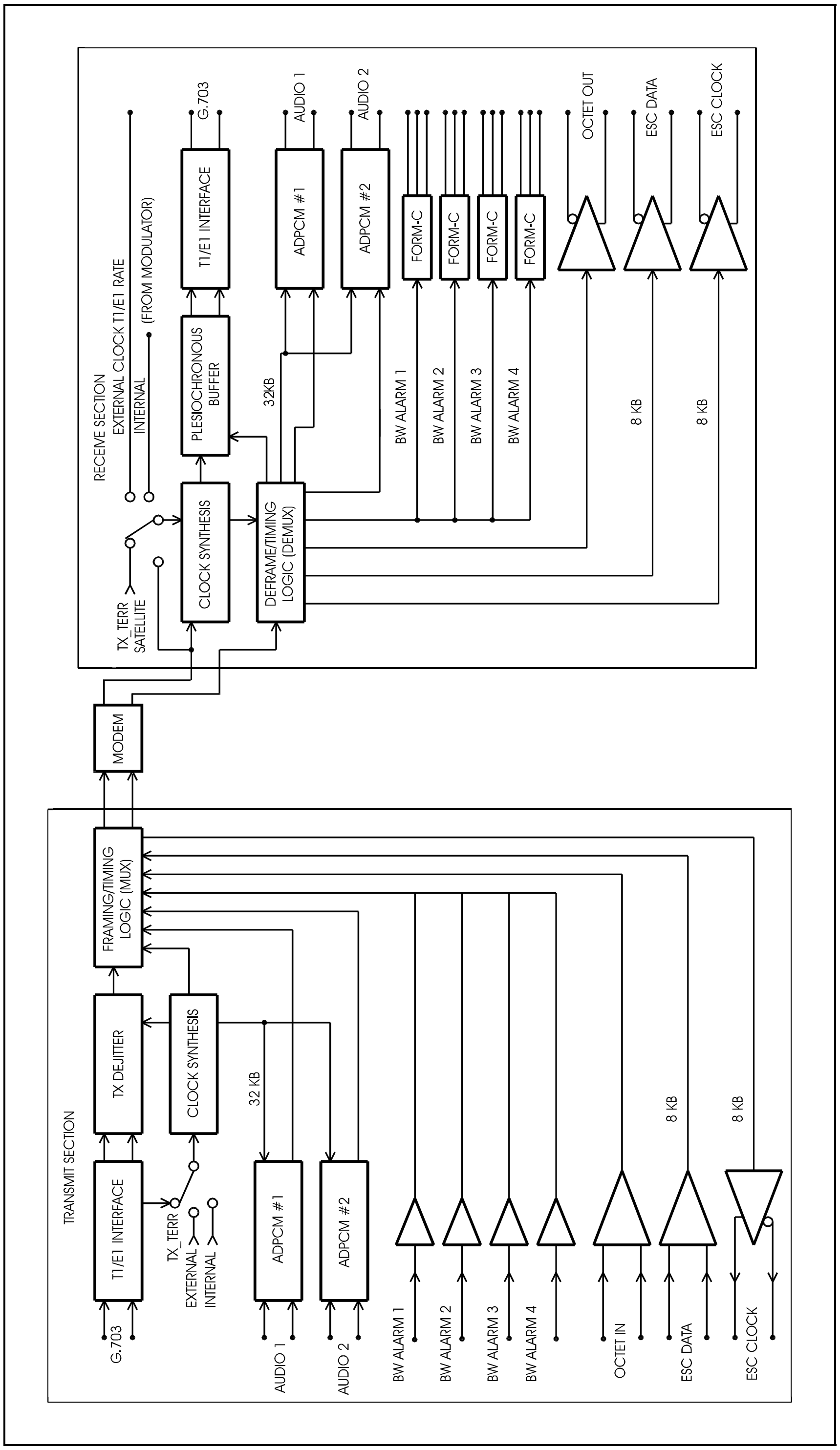


Figure 10-2. IDR Interface Block Diagram

10.3.1 IDR Modem Defaults

Table 10-2. IDR Modem Defaults

Modulator		Demodulator	
Data Rate	A	Data Rate	A
TX Rate A	1640 kbps, QPSK 3/4	RX Rate A	1640 kbps, QPSK 3/4
TX Rate B	2144 kbps, QPSK 3/4	RX Rate B	2144 kbps, QPSK 3/4
TX Rate C	6408 kbps, QPSK 3/4	RX Rate C	6408 kbps, QPSK 3/4
TX Rate D	8544 kbps, QPSK 3/4	RX Rate D	8544 kbps, QPSK 3/4
TX Rate V	1640 kbps, QPSK 3/4	RX Rate V	1640 kbps, QPSK 3/4
IF Frequency	70 MHz	IF Frequency	70 MHz
IF Output	OFF	Demodulator Type	Open Net
Mod Power Offset	0 dB	V.35 Scrambler	ON
Power Output	-10 dBm	Differential Decoder	ON
Scrambler	ON	Decoder Type	Viterbi
Differential Encoder	ON	IF Loopback	OFF
Modulator Type	INTELSAT Open Net	RF Loopback	OFF
Encoder Type	Viterbi	Sweep Center Freq.	0 Hz
CW Mode	Normal (OFF)	Sweep Range	60000 Hz
Mod Power Fixed	0 dB	Sweep Reacquisition	0 seconds
Mod Spectrum	Normal	BER Threshold	NONE
		Demod Spectrum	Normal
Interface			
TX Clock Source	TX Terrestrial	Buffer Size	384
Buffer Clock Source	Receive Satellite	IBS Scrambler	ON
TX Clock Phase	Auto	IBS Descrambler	ON
RX Clock Phase	Normal	Frame Structure T1 Data	G.704
External Reference Freq.	1544 kHz	Frame Structure E1 Data	G.704
Baseband Loopback	OFF	Frame Structure T2 Data	G.743
Interface Loopback	OFF	Frame Structure E2 Data	G.742
TX Coding Format	AMI	Loop Timing	OFF
RX Coding Format	AMI	TX Overhead Type	IDR
TX 2047	OFF	RX Overhead Type	IDR
RX 2047	OFF	TX Terr Interface	G.703
TX Data/AIS Fault	NONE	RX Terr Interface	G.703
RX Data/AIS Fault	NONE	TX Data Phase	Normal
Buffer Programming	Bits	RX Data Phase	Normal

10.4 Drop & Insert (D&I)

The D&I MUX works in conjunction with the interface card to enable the modem to transmit or receive fractional parts of a T1 data stream.

- Refer to Figure 10-3 for a block diagram of the D&I with asynchronous overhead.

The D&I option provides fully compliant baseband processing in accordance with INTELSAT IESS-308 Rev. 6 for the terrestrial information rate of 2048 kbps (E1). N x 64 kbps data rates are allowed over the satellite link (see the specifications for N = X). The interface also supports IESS-308 Rev. 6 transmission and reception parameters with a G.703 1544 kbps (T1) terrestrial interface. The interface module provides interface to transmission level framing compliant to IESS-309 data type 2. Control parameters including T1 or E1 may be set by the customer in the Configuration Interface menu either from the front panel or remotely through the EIA-232 interface.

Selection of the transmit and receive data rates may be made in 64 kbps increments and may be independent of each other. The actual satellite rates are 16/15 of the transmit or receive data rate to include overhead per IESS-308 Rev. 6 (this is transparent to the user).

Select the actual terrestrial time slots to be transmitted or received under the Configuration Interface menu. The user can select (either from the front panel or through the EIA-232 interface) any time slots from 1 to 31 for E1, or channels from 1 to 24 for T1. The E1 access to time slot 0 is not allowed.

Time slots may be selected in arbitrary order. Some time slots contain framing information instead of data. This allows for greater flexibility in the selection process. The configuration menu allows time slots to be selected for transmission or reception up to the maximum permitted limits by the particular transmit or receive data rate.

The satellite overhead includes an ESC. Use of this channel is not specified by IESS-308 and IESS-309. Comtech EF Data uses the ESC to implement a sampled EIA-232 data link, which works at data rates up to 1/2000 of the satellite rate.

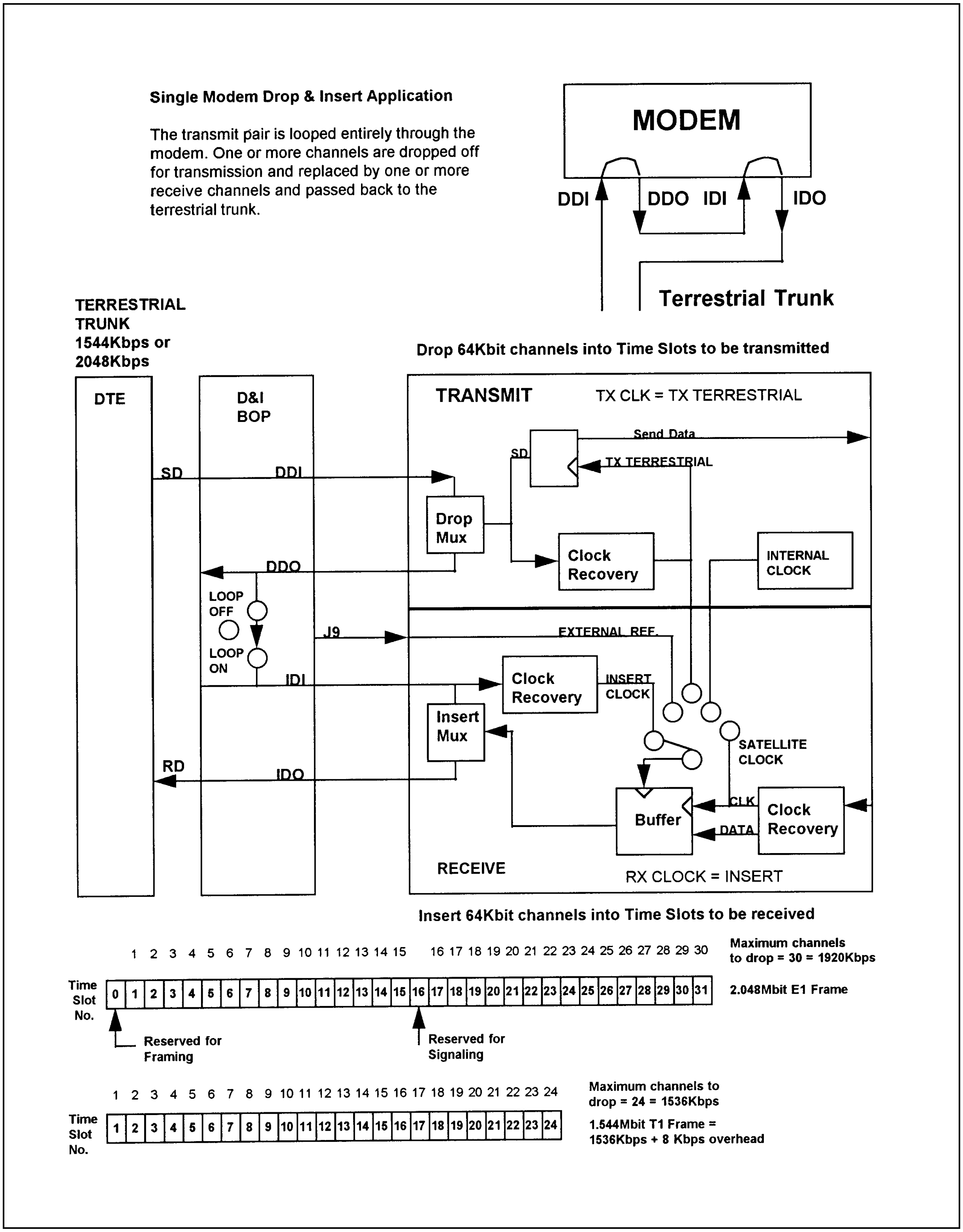


Figure 10-3. D&I with Asynchronous Overhead Data Flow

10.4.1 Description of D&I Operation

The main features of the D&I option are as follows:

- Data interface
- Transmit MUX
- Receive DEMUX
- ESC
- Backward Alarm

10.4.1.1 Data Interface

Data interface contains transformer-balanced data interfaces that support CCITT G.703 parameters and dejitter. This is compatible with AT&T Digital Speech Interpolation (DSI) service. Data inputs and outputs named are listed below:

- Data Inputs — Drop send data input A and B (DSD-A and DSD-B)
  Insert send data input A and B (ISD-A and ISD-B)
- Data Outputs — Drop receive data output A and B (DRD-A and DRD-B)
  Insert receive data output A and B (IRD-A and IRD-B)

The system is frequently used with the drop receive data output signal (DRD-A, -B) looped to feed the insert send data input signal (ISD-A, -B). This is accomplished at the far end of any redundancy switching in order to allow transmit and receive chains to be switched independently. The zero substitution codes (Alternate Mark Inversion [AMI], B8ZS, and HDB3) are user-selectable during configuration.

A data loopback function on the insert data is available in this section. This enables the user to determine that the T1 or E1 data parameters correctly match those of this interface. The drop data is always hard-wired into loopback.

10.4.1.2 Transmit MUX

The data stream is TX MUX with a 1/15 overhead channel and the resultant information rates are interfaced to the Mod/Demod/Coder sections of the modem. A phase-locked loop generates the output clock (with overhead), using the input clock as a reference. The input clock is normally the recovered clock from the data interface. If a valid input signal is not present, the interface falls back to a 10^{-5} accuracy reference clock generated in the modem, and will transmit a valid IESS-308 framing pattern. If this occurs, the link will remain open at the far end and a fault will be signaled.

The transmit data will be replaced with an all 1s pattern (AIS) in the event of certain failures, in accordance with IESS-308. As a test mode, the transmit data can be replaced with a 2047 pattern. This selection overrides the AIS. Only user data bits are replaced with the pattern, while the Engineering Service Channel (ESC) (including framing and alarms) will operate normally.

The composite MUX data stream is normally fed to the modem for further processing (scrambling and K=7 Viterbi encoding). The composite data stream may be looped back at this point as a test function, called interface loopback, when the transmit data rate matches the receive data rate. This allows the operator to test the entire interface as the ESC is looped to itself through the DEMUX. The plesiochronous buffer may also be checked, since user data passes through this circuit.

10.4.1.3 Receive DEMUX

The receive data with overhead is processed in the DEMUX. This circuit checks and synchronizes to the frame pattern and separates the user data from the Engineering Service Channel (ESC). If the DEMUX is receiving a correct and synchronized signal, it will signal the modem that the MUX system is locked (MUXlock) and passing data. This is indicated by interrogating the modem, a green LED on the interface and sending the signal into the receive fault tree in accordance with IESS-308. Under certain fault conditions defined by IESS-308, the receive user data will be replaced by a pattern with all 1s, and a fault will be signaled.

10.4.1.4 Plesiochronous Buffer

Data from the DEMUX section is fed into a plesiochronous buffer. This buffer size is user-selectable in bit increments that correspond to the length of an IESS-308 satellite superframe. The increments range from 1 to 32 ms. Refer to the interface specifications for a list of valid entries for each of the selected formats. The buffer automatically centers on resumption of service, either from the front panel or remotely. The startup buffer will overfill when centering to match the satellite frame to the terrestrial frame with a maximum slide of 0.5 ms. In general; manual centering will not be plesiochronous.

The fill status is available as a monitor and is accurate to 1%. Overflows or underflows are stored in the stored fault section of the M&C status registers, along with the date and time of the incident (which are provided by the modem internal clock). These are stored in battery-backed RAM.

A normal selection is to have the data clocked out of the buffer by an external clock. This procedure removes the Doppler from the receive satellite data.

The operator may select from four other clock sources as a backup:

- Insert clock (D&I mode only)
- RX satellite
- Internal clock source
- TX terrestrial

Problems occurring on any of the selected clocks will cause the modem to substitute the satellite clock and a fault will be signaled.

10.4.1.5 Engineering Service Channel (ESC)

The ESC uses certain bits of the satellite overhead to implement an EIA-232 data channel. The two types of available data channels are asynchronous and synchronous.

The asynchronous channel works by over-sampling input and output EIA-232 data, so that a clock signal is not required. Data rates up to 1/2000 of the satellite rate may be used. Synchronous data channels are also allowed at a rate of 1/512 of the data rate of the modem. The synchronous channel requires use of the TX clock provided by the modem for operation.

10.4.1.6 Backward Alarm

A backward alarm signal is included in the D&I overhead. The signal is sent to the distant side of a satellite link to indicate trouble with the receive side, which may be a result of improper transmission. The M&C computer monitors the receive side of the link. In the event of trouble, the M&C sends an alarm over the transmit side to the distant end. This alarm signal indirectly includes faults in the downlink chain, since major problems with the antenna, Low Noise Amplifier (LNA), or down converter, etc., will cause an interruption in service and fault the modem. Reception of a backward alarm is indicated as one of the events that cause a secondary alarm. The modem may be interrogated from the front panel or by using the EIA-485 or EIA-232 interface to identify the cause of the alarm.

10.4.2 D&I Framing Formats

The D&I framing formats used in the modem can be divided into T1 and E1 categories, as follows:

T1_ESF	T1 Extended Super Frame
T1	T1 D4 Framing
T1_ESF_S	T1 Extended Super Frame Special
T1_S	T1 D4 Framing Special
T1_IBS	T1 IBS Non Fractional, Full 1.544M
E1_CCS	E1 Common Channel Signaling
E1_CAS	E1 Channel Associated Signaling
E1_IBS	E1 IBS Non Fractional, Full 2M
E1_31_TS	E1 31 Time Slots

Each format is further explained in Figure 10-4 and Figure 10-5.

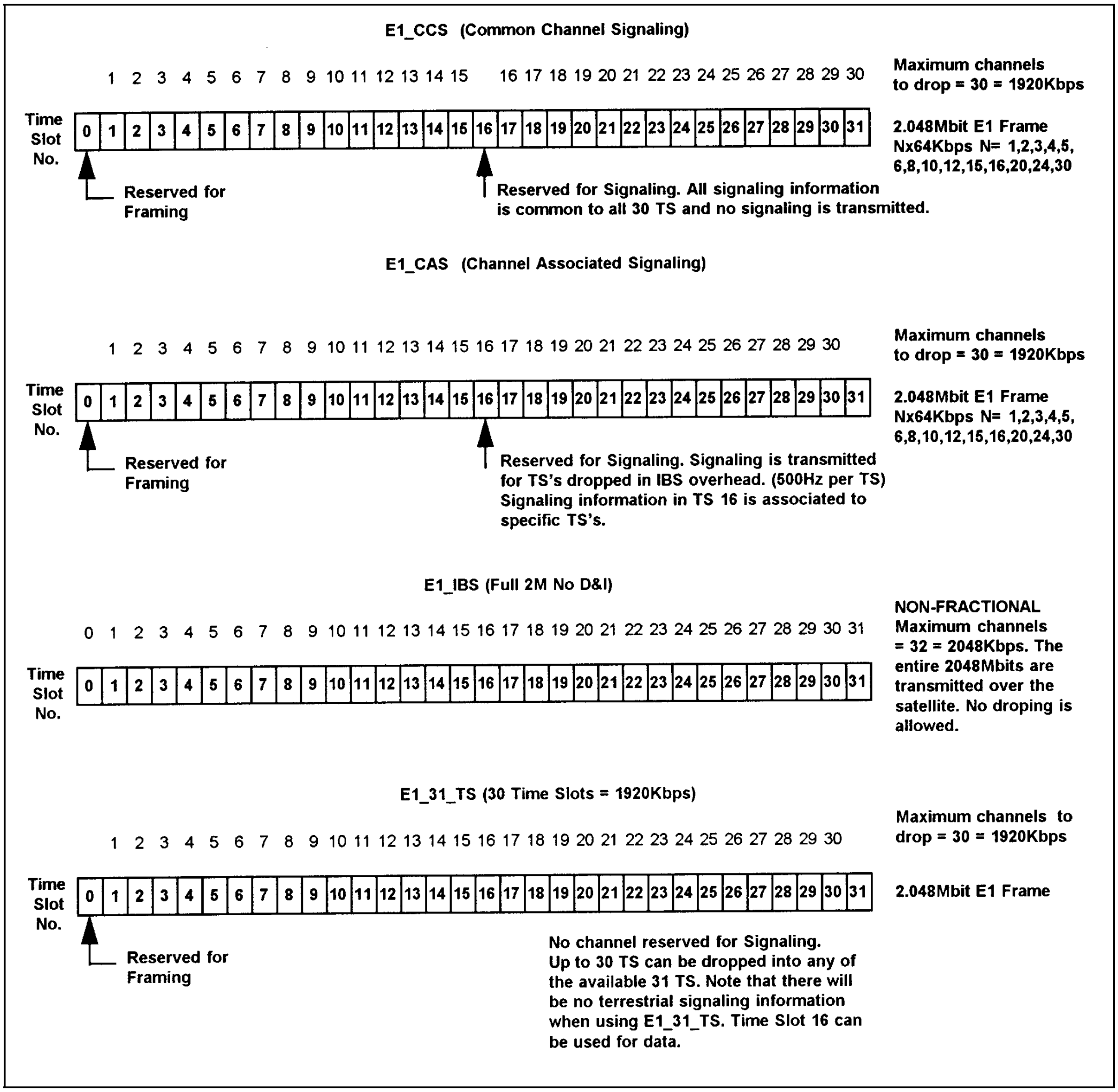


Figure 10-4. E1 Framing Formats

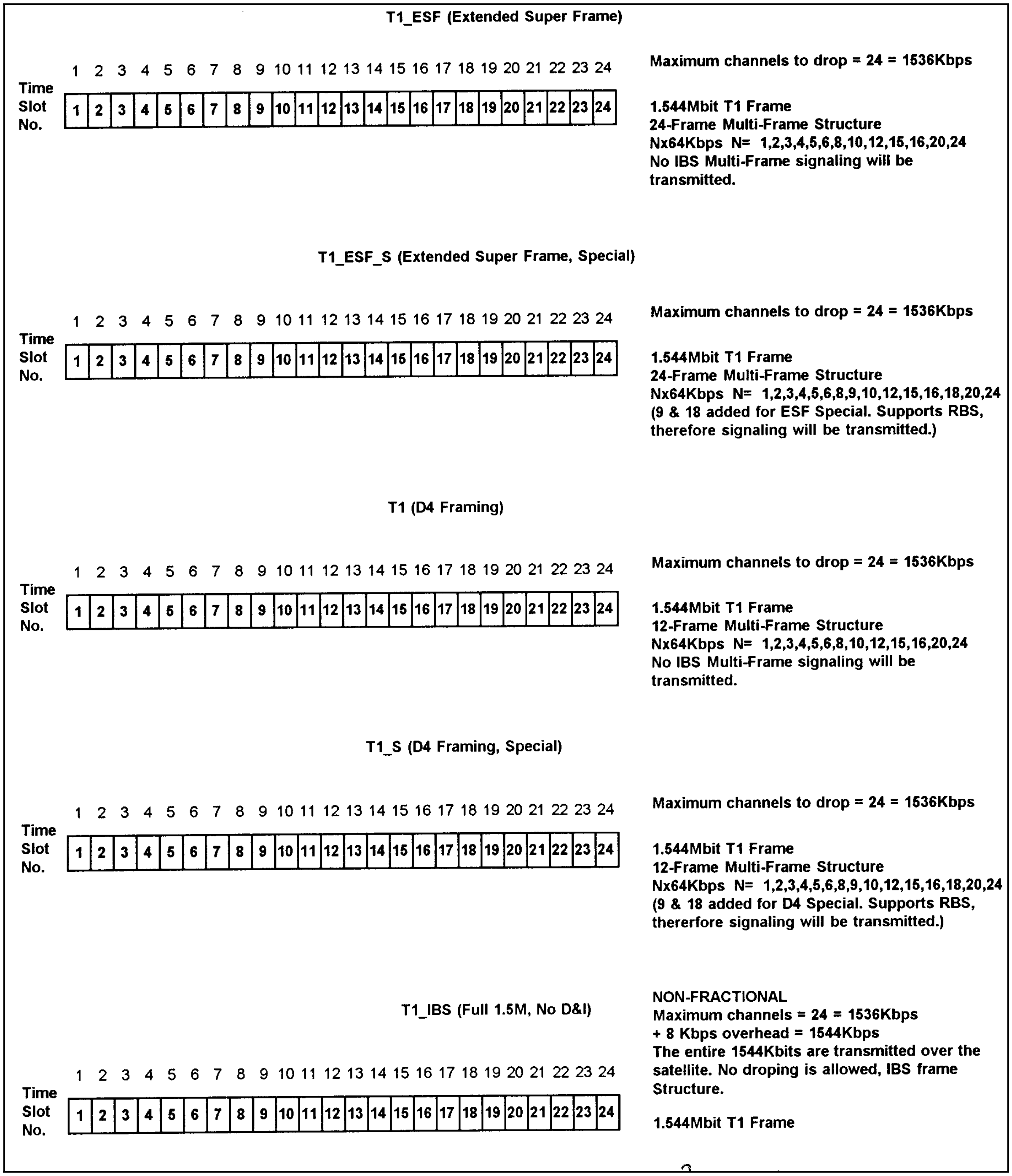


Figure 10-5. T1 Framing Formats

10.4.3 D&I Modem Defaults

Table 10-3. D&I Modem Faults

Modulator		Demodulator	
Data Rate	A	Data Rate	A
TX Rate A	64 kbps, QPSK 1/2	RX Rate A	64 kbps, QPSK 1/2
TX Rate B	256 kbps, QPSK 1/2	RX Rate B	256 kbps, QPSK 1/2
TX Rate C	768 kbps, QPSK 1/2	RX Rate C	768 kbps, QPSK 1/2
TX Rate D	2048 kbps, QPSK 1/2	RX Rate D	2048 kbps, QPSK 1/2
TX Rate V	128 kbps, QPSK 1/2	RX Rate V	128 kbps, QPSK 1/2
IF Frequency	70 MHz	IF Frequency	70 MHz
IF Output	OFF	Decoder Type	Viterbi
Mod Power Offset	0 dB	Differential Decoder	ON
Power Output	-10 dBm	Demodulator Type	Open Net
Differential Encoder	ON	IF Loopback	OFF
Modulator Type	INTELSAT Open Net	RF Loopback	OFF
Encoder Type	Viterbi	Sweep Center Freq.	0 Hz
CW Mode	Normal (OFF)	Sweep Range	60000 Hz
Mod Power Fixed	0 dB	Sweep Reacquisition	0 seconds
Mod Spectrum	Normal	BER Threshold	NONE
		Demod Spectrum	Normal
Interface			
TX Clock Source	TX Terrestrial	Buffer Size	1 mS
Buffer Clock Source	Insert	Frame Structure T1 Data	G.704
TX Clock Phase	Auto	Frame Structure E1 Data	G.704
RX Clock Phase	Normal	Frame Structure T2 Data	G.743
External Reference Freq.	1544 kHz	Frame Structure E2 Data	G.742
Baseband Loopback	OFF	Loop Timing	OFF
Interface Loopback	OFF	TX Overhead Type	D&I
TX Coding Format	AMI	RX Overhead Type	D&I
RX Coding Format	AMI	TX Terr Interface	G.703
TX 2047	OFF	RX Terr Interface	G.703
RX 2047	OFF		
IBS Scrambler	ON	IBS Descrambler	ON
Drop Data Format	T1	Insert Data Format	T
TX Data/AIS Fault	NONE		
RX Data/AIS Fault	NONE	TX Data Phase	Normal
Buffer Programming	MS	RX Data Phase	Normal

Note: When selecting E1_CAS or E1_CCS D&I data format, the defaults in the D&I data channels are offset by 1 from 16 and up. When programming from E1_CAS or E1_CCS to any other format, the D&I channels are defaulted to straight through.

10.5 2xADPCM Voice in 64 kbps IBS

2xADPCM Voice in 64 kbps IBS operation is an optional feature available with the IBS option or the IDR option. This mode is a hybrid cross between IDR and IBS where the two 32 kbps ADPCM voice channels that are part of the IDR ESC circuits are mapped into a single 64 kbps IBS channel to provide two full-duplex voice channels.

Adjustment of the voice channel levels is made the same as in IDR operation. When this mode is active the two voice channels completely use the 64 kbps IBS channel and the only data channel provided is the IBS ESC overhead channel that operates in 1/2000 x 64 kbps and described in the IBS section.

To operate in this mode (refer to Chapter 4):

- Set the Modem Type to IBS mode.
- Place the modem in the IBS Audio mode. (See IBS TX and/or RX ESC Type to 2-32k Audio menu, located under the ***Utility: Interface*** menu.)
- Adjustment of the voice channel levels is made from the Service Channel Adjust (under the ***Configuration: Interface*** menu).

Chapter 11. ASYNCHRONOUS INTERFACE/AUPC

11.1 Asynchronous Interface/AUPC

The asynchronous (ASYNC) interface option provides the interface for terrestrial data and a single ASYNC overhead channel. Typically used for earth-station-to-earth-station communication, the overhead channel is MUXed onto the data and transmitted at an overhead rate of 16/15 of the main channel. The AUPC feature works with the ASYNC option to allow remote communication between a local modem and a remote modem.

Refer to Figure 11-1 for a modem block diagram with the ASYNC/AUPC interface option.

G.703, EIA-422, or V.35 interfaces are available for terrestrial data input and output. These interfaces can be selected via the front panel.

EIA-485 or EIA-232 interfaces are available for ASYNC channel input and output. These interfaces can also be selected from the front panel. Fixed 1/15 overhead is added to the data when an ASYNC channel is being used. With the ASYNC channel enabled, the terrestrial data rate can be from 8 to 2048 kbps. The ASYNC channel I/O protocol can be as follows:

Baud	110 to 38400
Data Bits	5 to 8
Parity	odd, even, or none
Stop Bits	1 or 2

Note: Certain combinations of baud rate, data rate, parity, and stop bits will limit the maximum baud rate allowed for continuous throughput based on terrestrial data rate.

ASYNC overhead is a 1/15 rate overhead channel composed of the following:

- Framing information
- EIA-232 or EIA-485 data
- Valid data flags
- AUPC information (if installed)
- Parity bits

The rate of asynchronous data transfers may be selected by the operator, with the maximum rate available limited to 1.875% of the synchronous data rate.

Note: The asynchronous overhead structure is an Comtech EF Data standard, and is not compatible with IBS or IDR overhead formats.

The ASYNC interface PCB also provides its own Doppler buffer, which has a maximum depth of 32 ms at the highest terrestrial data rate. Buffer fill status can be checked in the Monitor menu on the front panel of the modem. Depth selection and centering of the buffer are provided in the Configuration Interface menu.

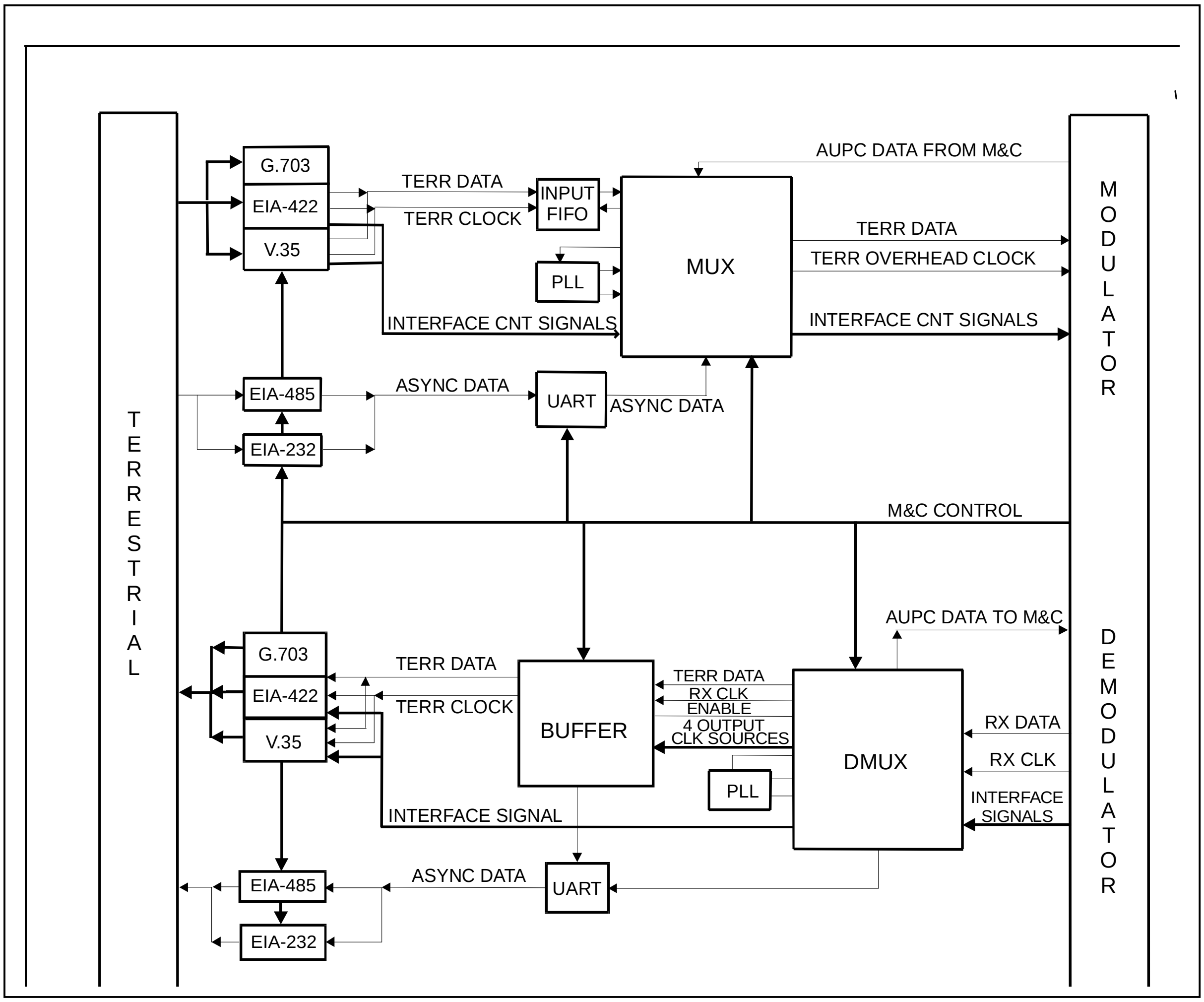


Figure 11-1. ASYNC/AUPC Block Diagram

11.2 AUPC

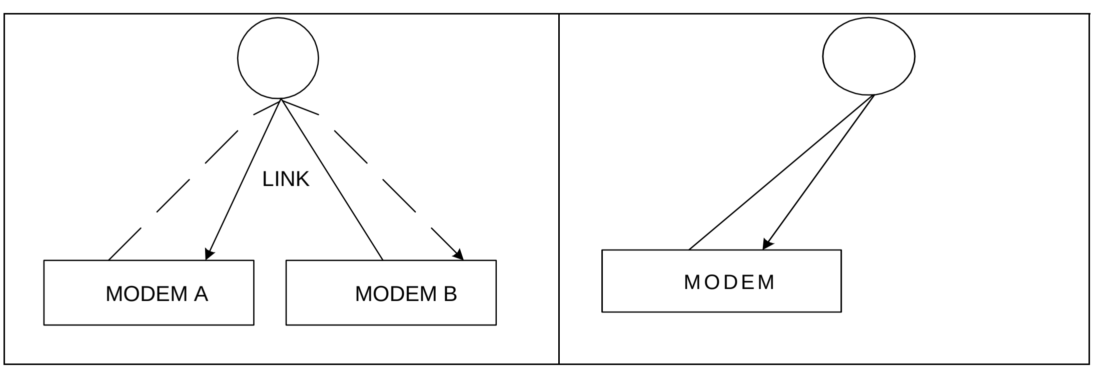
There are two modes of AUPC location:

AUPC between two modems	**Maintains a target Eb/No programmed into the modem at each end.**
Self-Monitoring AUPC with one modem	**Maintains a target Eb/No for a modem that receives its own carrier from the satellite.**

The menu below is enabled by selecting Local Modem AUPC = ON, located under the ***Utility: Modem Type*** menu. This menu sets the AUPC parameters for both the self monitoring with one modem and the AUPC between two modems.

Table 11-1. Setting AUPC Parameters

AUPC ENABLE	Enables the AUPC to function locally. (***Configuration: Local AUPC*** menu)
NOMINAL POWER	Output power level. Can be used for problem conditions, if chosen.
MINIMUM POWER	Sets minimum output power to be used.
MAXIMUM POWER	Sets maximum output power to be used.
TARGET NOISE	Desired E_b/N_0 of the local modem.
TRACKING RATE	Sets speed at which modems will adjust to output power.
LOCAL CL ACTION	Defines action that local modem will take if it loses carrier (Maximum, Minimum, or Hold).
REMOTE CL ACTION	Defines action that local modem will take if remote modem reports carrier loss (Maximum, Minimum, or Hold).



AUPC Between Two Modems

Self-Monitoring AUPC with One Modem

With Local AUPC On, set modems (A and B), if modem A loses carrier:

1. Modem A sets its output power (MAXIMUM, MINIMUM, OR HOLD) as specified by LOCAL CL ACTION.

2. Modem A then sends a “lost carrier” command to modem B.

3. Modem B sets its output power (MAXIMUM, MINIMUM, OR HOLD) as specified by REMOTE CL ACTION.

4. Once modem A has reacquired the carrier, it sends commands to modem B to achieve the desired E_b/N_0. During this time, modem B sends commands to modem A to increase or decrease power to maintain modem B’s target E_b/N_0.

Notes:

1. Modem B will not make changes to modem A if the E_b/N_0 is within 0.5 dB of the target noise.
2. Modem B will not control modem A transmitting output level if the target noise for modem B is set within 15.5 to 16.0 dB and the receive signal to the modem is sufficient that the receive noise is 16 dB or better.
3. Modem A will be transmitting at the maximum output if the local carrier loss action is set to maximum.
4. Caution shall be observed when setting the target E_b/N_0 above 15.5 dB, the maximum limit is established at 16.0 dB.
5. Local carrier loss always takes priority over remote carrier loss.
6. The RX AUPC link is dead when the carrier is lost.

11.2.1 AUPC – Between Two Modems

This mode of AUPC operation allows each of the two modems to operate in a closed link to control the output of the other modem in a manner that preserves a target Eb/No.

Hardware	Corresponding Software (FAST)
Overhead Card	ASYNC/AUPC. This provides AUPC and an ASYNC channel.
TX and RX Reed-Solomon Cards	AUPC. An ASYNC channel is not available.

Selecting ASYNC from the Modem Type menu when the Overhead Card is installed or by selecting AUPC from the Modem Type menu the Reed-Solomon cards are installed enables APUC operation. The Modem type is located under the Utility: Modem Type menu.

To operate, AUPC is enabled on both modems and they are setup as described in Table 11-1.

11.2.1.1 Remote AUPC

This feature allows the user to monitor and control a remote modem location using the front panel or serial port of the local modem. The operator can set or reset the following commands:

- Baseband loopback
- TX 2047 pattern
- AUPC enable

11.2.1.1.1 Remote Modem AUPC Configuration and Monitor

The menu for this feature is remote AUPC, which is at the same level as the Configuration and Monitor menus. The menus are structured as follows:

Menu	Description
Function Select Remote AUPC	Press <ENTER> to proceed.
Remote AUPC Configuration	Press <ENTER> to proceed.
AUPC Enable	Select On to enable Remote AUPC.
B-Band LoopBack	Select On to place the unit at the distant end of the link in loopback.
TX 2047 Pattern	Select On for the distant end to TX a 2047 pattern. Select Off to stop the pattern distant end.
Remote AUPC Monitor	Press <ENTER> to proceed.
2047 Error	This indicates the BER at the distant end measured from the 2047 pattern. This requires that the 2047 pattern is tuned On at the near end.

11.2.2 Self-Monitoring Local Modem AUPC Control

This AUPC mode allows the modem to adjust its carrier power to maintain a target Eb/No while it monitors its own carrier returned through the satellite. This is often used in broadcast applications where a hub maintains control of the outbound carrier that is delivered to many remotes. This requires that the Earth Station is located within the satellite footprint.

The self-monitoring AUPC does not require any special hardware or software options. However, if the Overhead Card or Reed-Solomon Cards are installed, do not select either the ASYNC or AUPC from the Modem Type menu located under the Utility: Modem Type menu, because these are used for AUPC between two modems.

To setup the modem for the self-monitoring operation, enter the Local Modem AUPC menu located under the Utility Modem Type menu and select On. This enables the Configuration: Local AUPC menu to permit adjustment of the AUPC parameters described in Table 11-1.

Notes:

1. Comtech EF Data does not recommend increasing the power to the satellite without consulting with the satellite controller.
2. Be careful not to set carrier output too high when there is a loss of carrier due to severe weather and the CL loss action is set to Maximum.
3. Do not use the distant end RX signal to compensate for local rain fade unless allowances are made for a narrow window for TX level changes.

11.3 ASYNC

The modem supports terrestrial data interfaces and the ASYNC Overhead interfaces.

11.3.1 Terrestrial Data Interfaces

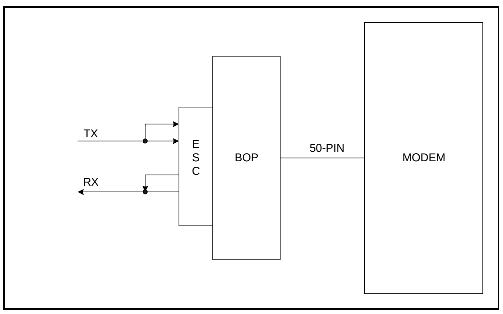
Two I/O interfaces are provided for the terrestrial data source: EIA-422 and V.35. The operator must select the terrestrial interface type from the front panel under the Utility Interface menu. Once selected, I/O data is routed to and from the appropriate drivers and receivers.

11.3.2 ASYNC Data Interfaces

The EIA-485 and EIA-232 I/O interfaces are provided for the ASYNC data source. The operator must select the ASYNC data interface type from the front panel under the Utility Interface menu. Once selected, the I/O data is routed to and from the appropriate drivers and receivers.

EIA-485 (2-wire) requires connecting the TX + and RX + as one wire and tying TX and RX for the second wire at the Data I/O/ This connection is not facilitated inside the modem with relays.

Example:



11.3.3 MUX Operation

The MUX receives terrestrial and ASYNC data from the selected receivers. The terrestrial data flows into a small *"First In/First Out"* (FIFO) buffer. The FIFO buffer aids in the rate exchange between the terrestrial data rate and the overhead rate. The terrestrial clock or an internal clock can clock the data into the MUX.

ASYNC data is received by the RX section of a Universal Asynchronous Receiver/ Transmitter (UART) programmed by the M&C for the correct data protocol. The incoming ASYNC data is sampled with a 16x clock in the middle of the bit time.

AUPC data is received from a serial M&C interface. The overhead clock is generated from the terrestrial data clock by a phase-locked loop. Inside the multiplexer, overhead bits (1/16) are added to create a sub-frame, frame, and multi-frame structure. The AUPC data from the M&C interface and the ASYNC data are inserted into the framing structure. The framed data is output to the modulator card on the modem at the overhead rate.

11.3.4 DEMUX Operation

The DEMUX section functions in a "reverse" manner to the MUX side. Data, including overhead, is received from the Demod card in the modem at the overhead rate.

The DEMUX locates the framing in the overhead and locks to the frame sync pattern generated by the multiplexer on the transmitting end. Once locked to the framing, the terrestrial data is clocked into the Doppler buffer with the overhead clock and an enable line.

The ASYNC channel data is stripped out of the frame structure, and is buffered in the TX portion of a UART. The UART then transmits the data with the selected protocol to the appropriate drivers to the end user. The AUPC data is also stripped from the frame structure and is sent to the M&C via a serial interface.

11.3.5 Buffer Operation

The buffer has two serial interfaces to the M&C interface. The first serial interface is used to download the desired buffer size. The second serial interface is used to provide the M&C with the information necessary to calculate the fill status of the buffer. Three discrete lines are provided:

- One line to center the buffer on command.
- Two lines to indicate either an overflow or underflow condition.

The Doppler buffer receives data clocked by the overhead clock from the Demod and an enable line from the DEMUX. The data is stored in RAM. Four options are allowed to clock the data out of the buffer:

- TX
- RX
- Internal
- External

Based on this selection, terrestrial data is clocked out of the buffer to the selected drivers and on to the end user.

11.3.6 Loop Timing Operation

The appropriate RX buffer clock choice for loop timing is RX Satellite. This will clock out the data from the modem using the recovered clock from the demodulator IF input. The SCT clock output will be phase-locked to the RX Satellite clock when loop timing is selected. The operator can use the clock developed from the RX Satellite IF for clocking data into the user device. This would be using RX timing. The operator also can use the ST clock, which is now phased-locked to the receiver, to clock the user data (Send Data) to the modem.

11.3.7 Baseband Loopback Operation

A baseband loopback option is provided. When selected, the input terrestrial data and clock from the operator are looped back to the user as the output terrestrial data and clock. The terrestrial data and clock output from the DEMUX are also looped to the terrestrial data and clock input at the MUX.

11.3.8 Non-ASYNC Operation

The ASYNC interface has pass-through capability. If ASYNC is turned off in the Configuration Interface menu, then a standard G.703, EIA-422, or V.35 interface is selected. The modem will operate as a standard G.703, EIA-422, or V.35 interface with no overhead. Instead of changing jumpers on the interface PCB to change polarities for various signals, polarity inversion is available in the Utility Interface menu for the following signals:

- Send Data (SD)
- Terminal Timing (TT)
- Request to Send (RS)
- Receive Data (RD)
- Receive Timing (RT)
- Receiver Ready (RR)
- Data Mode (DM)
- Monitor and Control (MC)
- Send Timing (ST)

11.4 ASYNC Channel EIA-485 2- and 4-Wire Operation

The ASYNC interface is compatible with either a 2- or 4-wire interface for the EIA-485 channel. The 2- or 4-wire operation is selected via the front panel.

- In the 2-wire mode, the EIA-485 receivers are disabled whenever the data is to be transmitted down the 2-wire interface.

- In the 4-wire mode, the receiver is always on.

The receive modem controls the transmit and receive data in two wire operation. EIA-485 (2 wire) must be turned on in the UTILITY/INTERFACE menu.

The output driver will be turned on when the receive demux on the overhead card detects ASYNC data. The input driver will be turned off at the same time. This prevents the receive data from transmitting back to the originating modem.

- For EIA-485 two wire, loop the highs (TX+, RX+) and then loop the lows (TX-, RX-) at the connector for two-wire operation. These loops are not accomplished inside the modem.

- EIA-485 four wire circuits will become 2 wire when you attach any device that is EIA-485 two wire.

  For example: The modem Async overhead at a site that has an RF terminal, must be set to TX EIA-485 (two wire) because the RF terminal is only EIA-485 two wire.

11.4.1 Valid ASYNC Baud Rates

The ASYNC baud rates are limited by the terrestrial data rates. The following table shows the relationships between data and baud rates.

If DR ≤ 15.999K	Maximum baud rate is 150
If DR ≤ 31.999K	Maximum baud rate is 300
If DR ≤ 63.999K	Maximum baud rate is 600
If DR ≤ 127.999K	Maximum baud rate is 1200
If DR ≤ 255.999K	Maximum baud rate is 2400
If DR ≤ 511.999K	Maximum baud rate is 4800
If DR ≤ 1023.999K	Maximum baud rate is 9600
If DR ≤ 2047.999K	Maximum baud rate is 19200
If DR ≤ 2048.999K	Maximum baud rate is 38400

The following table lists examples.

If DR = 8.000K	Baud rate can be 150 or lower
If DR = 16.000K	Baud rate can be 300 or lower
If DR = 32.000K	Baud rate can be 600 or lower
If DR = 64.000K	Baud rate can be 1200 or lower
If DR = 128.000K	Baud rate can be 2400 or lower
If DR = 256.000K	Baud rate can be 4800 or lower
If DR = 512.000K	Baud rate can be 9600 or lower
If DR = 1024.000K	Baud rate can be 19200 or lower
If DR = 2048.000K	Baud rate can be 38400 or lower

11.4.2 Front Panel Operation

For information on the additional front panel operations that are specific to the ASYNC interface. The following menus are affected:

- Configuration Interface
- Configuration Local AUPC
- Utility Interface
- Remote AUPC Configuration
- Remote AUPC Monitor

11.4.3 ASYNC Remote Operation

Remote modems can be controlled over the ASYNC channel from the local (or “hub”) modem. Refer to Table 11-2 for a list of combinations:

Table 11-2. ASYNC REMOTE OPERATION

Configuration #	Local Modem	To Remote Modem	Table #
1	EIA-232	EIA-232	Table 11-3
2	EIA-232	EIA-485 (4-wire)	Table 11-44
3	EIA-232	EIA-485 (2-wire)	Table 11-5
4	EIA-485 (4-wire)	EIA-232	Table 11-6
5	EIA-485 (4-wire)	EIA-485 (4-wire)	Table 11-77
6	EIA-485 (4-wire)	EIA-485 (2-wire)	Table 11-88
7	EIA-485 (2-wire)	EIA-232	Table 11-99
8	EIA-485 (2-wire)	EIA-485 (4-wire)	Table 11-1010

For each of the above combinations, front panel control settings and pinouts for local and remote cables are listed in the following sections:

Before remote ASYNC communications can be implemented, the following must occur:

- At both the local and remote modems, front panel configuration parameters must be set for each type of configuration.
- Industry-standard cables must be used at both modems.

To implement remote ASYNC operation, use the configuration information found in the applicable section and perform the following steps:

1. Set the jumpers on the remote modem M&C/Display PCB according to the information found in the applicable configuration section.
2. Set the local modem front panel controls according to the information found in the applicable configuration section.
3. Connect the local modem 25-pin ASYNC connection (via breakout panel or Y cable) to the terminal using the pinout information found in the applicable configuration section. Refer to Figure 11-2.
4. Set the remote modem front panel controls according to the information found in the applicable configuration section.
5. Connect the remote modem 25-pin ASYNC connection (via breakout panel or Y cable) to the 9-pin J6 port at the rear of the modem using the pinout information found in the applicable configuration section. Refer to Figure 11-2 and Figure 11-3.

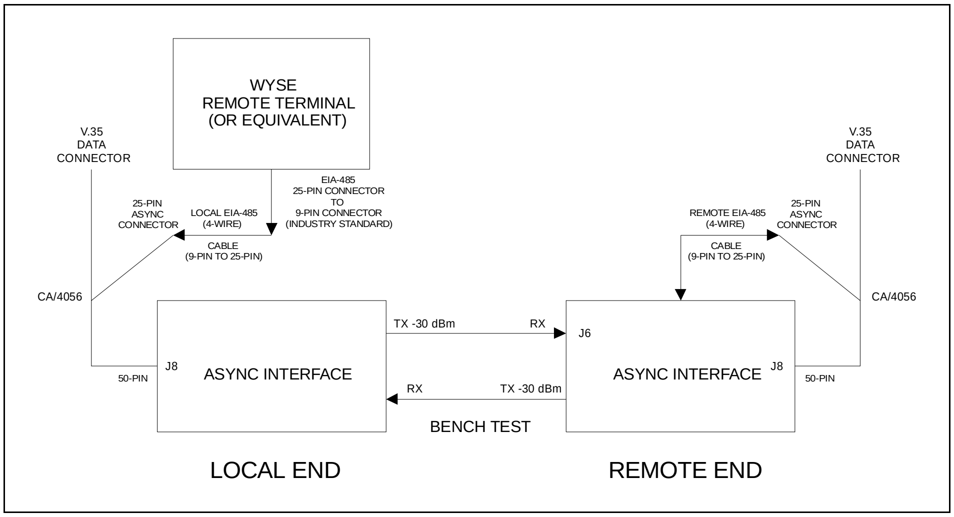


Figure 11-2. Remote ASYNC Connection Diagram for Y-Cable

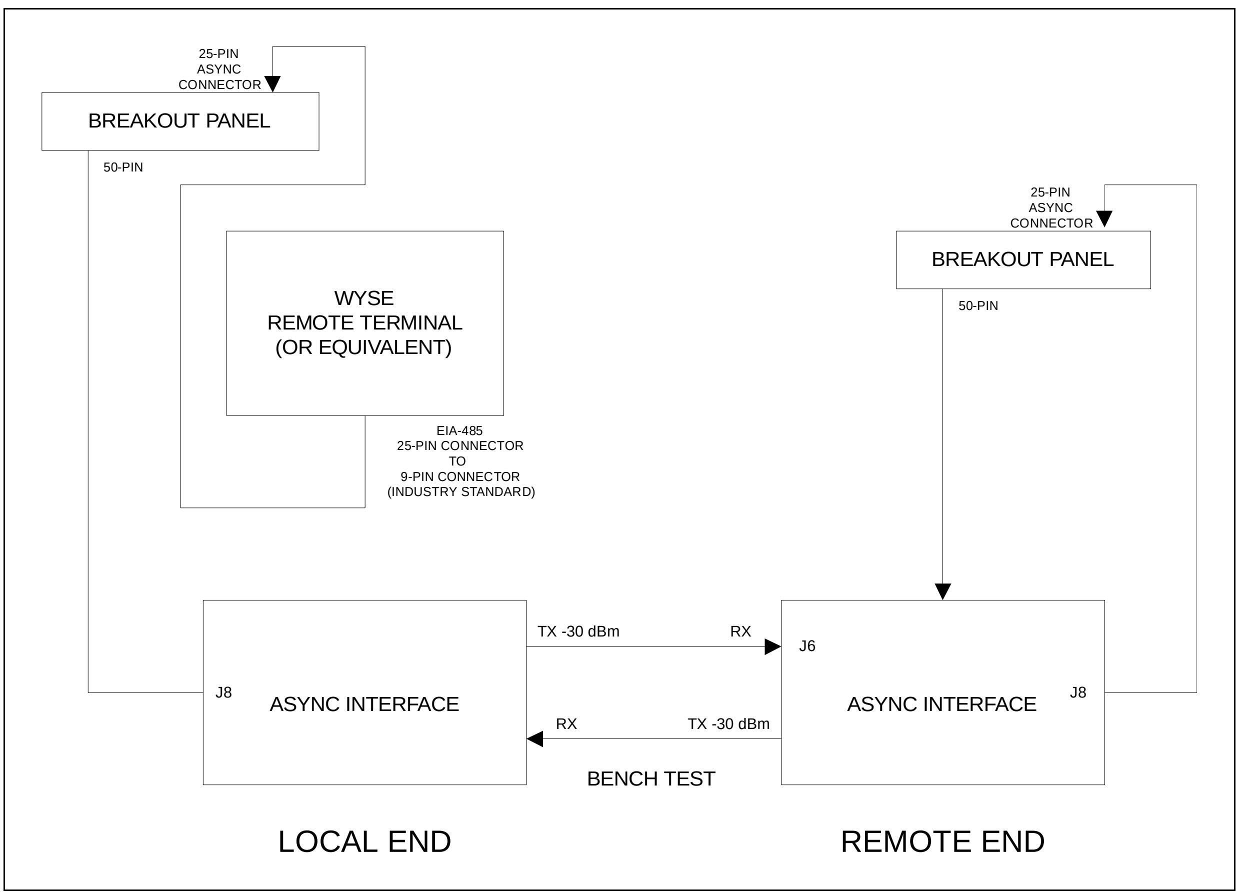


Figure 11-3. Remote ASYNC Connection Diagram for Breakout Panel

11.4.3.1 Configuration #1 (Local EIA-232 to Remote EIA-232)

Table 11-3. Local EIA-232 to Remote EIA-232

#1. Local End Modem Settings for EIA-232	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-232
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
#1. Remote End Modem Settings for EIA-232	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-232
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
Utility System Menu	
Remote Baud Rate	Equal to ASYNC TX and RX baud rate
Parity	Even
Address	1 to 255

The local end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the EIA-232 remote terminal (WYSE or laptop computer). The pinout of the local cable is listed in the following table.

#1. Local End EIA-232			
9-Pin Female Connector		**25-Pin Male Connector**	
RX	2	3	TX
TX	3	2	RX
GND	5	7	GND

The remote end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the 9-pin female connector, J6, at the rear of the modem. The pinout of the remote cable is listed in the following table.

#1. Remote End EIA-232			
9-Pin Male Connector		**25-Pin Male Connector**	
RX	2	2	RX
TX	3	3	TX
GND	5	7	GND

11.4.3.2 Configuration #2 (Local EIA-232 to Remote EIA-485 [4-Wire])

Table 11-4. Local EIA-232 to Remote EIA-485 (4-Wire)

#2. Local End Modem Settings for EIA-232 (4-Wire)	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-232
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
#2. Remote End Modem Settings for EIA-485 (4-Wire)	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-485 (4-wire)
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
Utility System Menu	
Remote Baud Rate	Equal to ASYNC TX and RX baud rate
Parity	Even
Address	1 to 255

The local end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the EIA-232 (4-wire) remote terminal (WYSE or laptop computer). The pinout of the local cable is listed in the following table.

#2. Local End EIA-232			
9-Pin Female Connector		**25-Pin Male Connector**	
RX	2	3	TX
TX	3	2	RX
GND	5	7	GND

The remote end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the 9-pin female connector, J6, at the rear of the modem. The pinout of the remote cable is listed in the following table.

#2. Remote End EIA-485 (4-Wire) Twisted Pair			
9-Pin Male Connector		**25-Pin Male Connector**	
TX+	4	16	RX+
TX-	5	3	RX-
RX+	8	14	TX+
RX-	9	2	TX-

11.4.3.3 Configuration #3 (Local EIA-232 to Remote EIA-485 [2-Wire])

Table 11-5. Local EIA-232 to Remote EIA-485 (2-Wire)

#3. Local End Modem Settings for EIA-232	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-232
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
#3. Remote End Modem Settings for EIA-485 (2-Wire)	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-485 (2-wire)
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
Utility System Menu	
Remote Baud Rate	Equal to ASYNC TX and RX baud rate
Parity	Even
Address	1 to 255

The local end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the EIA-232 remote terminal (WYSE or laptop computer). The pinout of the local cable is listed in the following table.

#3. Local End EIA-232			
9-Pin Female Connector		25-Pin Male Connector	
RX	2	3	TX
TX	3	2	RX
GND	5	7	GND

The remote end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the 9-pin female connector, J6, at the rear of the modem. The pinout of the remote cable is listed in the following table.

#3. Remote End EIA-485 (2-Wire)			
9-Pin Male Connector		25-Pin Male Connector	
TX/RX+	4	14, 16	TX+, RX+
TX/RX-	5	2, 3	TX-, RX-

11.4.3.4 Configuration #4 (Local EIA-485 [4-Wire] to Remote EIA-232)

Table 11-6. Local EIA-485 (4-Wire) to Remote EIA-232

#4. Local End Modem Settings for EIA-485 (4-Wire)	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-485 (4-wire)
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	110 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
#4. Remote End Modem Settings for EIA-232	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-232
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
Utility System Menu	
Remote Baud Rate	Equal to ASYNC TX and RX baud rate
Parity	Even
Address	1 to 255

The local end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the EIA-485 (4-wire) remote terminal (WYSE or laptop computer). The pinout of the local cable is listed in the following table.

#4. Local End EIA-485 (4-Wire) Twisted Pair			
9-Pin Female Connector		25-Pin Male Connector	
TX+	4	14	TX+
TX-	5	2	TX-
RX+	8	16	RX+
RX-	9	3	RX-

The remote end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the 9-pin female connector, J6, at the rear of the modem. The pinout of the remote cable is listed in the following table.

#4. Remote End EIA-232			
9-Pin Male Connector		25-Pin Male Connector	
RX	2	2	RX
TX	3	3	TX
GND	5	7	GND

11.4.3.5 Configuration #5 (Local EIA-485 [4-Wire] to Remote EIA-485 [4-Wire])

Table 11-7. Local EIA-485 (4-Wire) to Remote EIA-485 (4-Wire)

#5. Local End Modem Settings for EIA-485 (4-Wire)	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-485 (4-wire)
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
#5. Remote End Modem Settings for EIA-485 (4-Wire)	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-485 (4-wire)
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
Utility System Menu	
Remote Baud Rate	Equal to ASYNC TX and RX baud rate
Parity	Even
Address	1 to 255

The local end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the EIA-485 (4-wire) remote terminal (WYSE or laptop computer). The pinout of the local cable is listed in the following table.

#5. Local End EIA-485 (4-Wire) Twisted Pair			
9-Pin Female Connector		**25-Pin Male Connector**	
TX+	4	14	TX+
TX-	5	2	TX-
RX+	8	16	RX+
RX-	9	3	RX-

The remote end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the 9-pin female connector, J6, at the rear of the modem. The pinout of the remote cable is listed in the following table.

#5. Remote End EIA-485 (4-Wire) Twisted Pair			
9-Pin Male Connector		**25-Pin Male Connector**	
TX+	4	16	RX+
TX-	5	3	RX-
RX+	8	14	TX+
RX-	9	2	TX-

11.4.3.6 Configuration #6 (Local EIA-485 [4-Wire] to Remote EIA-485 [2-Wire])

Table 11-8. Local EIA-485 (4-Wire) to Remote EIA-485 (2-Wire)

#6. Local End Modem Settings for EIA-485 (4-Wire)	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-485 (4-wire)
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
#6. Remote End Modem Settings for EIA-485 (2-Wire)	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-485 (2-wire)
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 *(See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
Utility System Menu	
Remote Baud Rate	Equal to ASYNC TX and RX baud rate
Parity	Even
Address	1 to 255

The local end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the EIA-485 (4-wire) remote terminal (WYSE or laptop computer). The pinout of the local cable is listed in the following table.

#6. Local End EIA-485 (4-Wire) Twisted Pair			
9-Pin Female Connector		25-Pin Male Connector	
TX+	4	14	TX+
TX-	5	2	TX-
RX+	8	16	RX+
RX-	9	3	RX-

The remote end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the 9-pin female connector, J6, at the rear of the modem. The pinout of the remote cable is listed in the following table.

#6. Remote End EIA-485 (2-Wire)			
9-Pin Male Connector		25-Pin Male Connector	
TX/RX+	4	14, 16	TX+, RX+
TX/RX-	5	2, 3	TX-, RX-

11.4.3.7 Configuration #7 (Local EIA-485 [2-Wire] to Remote EIA-232)

Table 11-9. Local EIA-485 (2-Wire) to Remote EIA-232

#7. Local End Modem Settings for EIA-485 (2-Wire)	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-485 (2-wire)
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 (*See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
#7. Remote End Modem Settings for EIA-232	
Utility Interface Menu	
ASYNC TX and RX Type	EIA-232
Configuration Interface Menu	
ASYNC TX and RX Baud Rate	150 to 38400 (*See A.4.6)*
ASYNC TX and RX Length	7 bits
ASYNC TX and RX Parity	Even
ASYNC TX Stop	2 bits
Utility System Menu	
Remote Baud Rate	Equal to ASYNC TX and RX baud rate
Parity	Even
Address	1 to 255

The local end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the EIA-485 (2-wire) remote terminal (WYSE or laptop computer). The pinout of the local cable is listed in the following table.

#7. Local End EIA-485 (2-Wire)			
9-Pin Female Connector		25-Pin Male Connector	
TX/RX+	4	14, 16	TX+/RX+
TX/RX-	5	2, 3	TX-/RX-

In addition, the following table lists the pinout for the WYSE terminal cable using an EIA-232 to EIA-485 converter.

#7. Local End WYSE Cable With Converter			
25-Pin Male Connector		9-Pin Male Connector	
TX-/RX-	2, 5	5	TX/RX-
TX+/RX+	14, 17	4	TX/RX+
(See Note)	18, 21		

Note: Disables RD during TD.

The remote end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the 9-pin female connector, J6, at the rear of the modem. The pinout of the remote cable is listed in the following table.

#7. Remote End EIA-232			
9-Pin Male Connector		25-Pin Male Connector	
RX	2	2	RX
TX	3	3	TX
GND	5	7	GND

11.4.3.8 Configuration #8 (Local EIA-485 [2-Wire] to Remote EIA-485 [4-Wire])

Table 11-10. Local EIA-485 (2-Wire) to Remote EIA-485 (4-Wire)

#8. Local End Modem Settings for EIA-485 (2-Wire)		
Utility Interface MENU		
ASYNC TX and RX Type	EIA-485 (2-wire)	
Configuration Interface Menu		
ASYNC TX and RX Baud Rate	150 to 38400	*(See A.4.6)*
ASYNC TX and RX Length	7 bits	
ASYNC TX and RX Parity	Even	
ASYNC TX Stop	2 bits	
#8. Remote End Modem Settings for EIA-485 (4-Wire)		
Utility Interface Menu		
ASYNC TX and RX Type	EIA-485 (4-wire)	
Configuration Interface Menu		
ASYNC TX and RX Baud Rate	150 to 38400	*(See A.4.6)*
ASYNC TX and RX Length	7 bits	
ASYNC TX and RX Parity	Even	
ASYNC TX Stop	2 bits	
Utility System Menu		
Remote Baud Rate	Equal to ASYNC TX and RX baud rate	
Parity	Even	
Address	1 to 255	

The local end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the EIA-485 (2-wire) remote terminal (WYSE or laptop computer). The pinout of the local cable is listed in the following table.

#8. Local End EIA-485 (2-Wire)			
9-Pin Female Connector		25-Pin Male Connector	
TX/RX+	4	14, 16	TX+/RX+
TX/RX+	5	2, 3	TX-/RX-

In addition, the following table lists the pinout for the WYSE terminal cable using an EIA-232 to EIA-485 converter.

#8. Local End WYSE Cable With Converter			
25-Pin Male Connector		9-Pin Male Connector	
TX-/RX-	2, 5	5	TX/RX-
TX+/RX+	14, 17	4	TX/RX+
(See Note)	18, 21		

Note: Disables RD during TD.

The remote end cable connects the 25-pin female ASYNC connector (on either the breakout panel or the Y cable) to the 9-pin female connector, J6, at the rear of the modem. The pinout of the remote cable is listed in the following table.

#8. Remote End EIA-485 (4-Wire) Twisted Pair			
9-Pin Male Connector		25-Pin Male Connector	
TX+	4	16	RX+
TX-	5	3	RX-
RX+	8	14	TX+
RX-	9	2	TX-

11.4.4 ASYNC/AUPC Modem Defaults

Table 11-11. ASYNC/AUPC Modem Defaults

Modulator		Demodulator	
Data Rate	A	Data Rate	A
TX Rate A	64 kbps, QPSK 1/2	RX Rate A	64 kbps, QPSK 1/2
TX Rate B	256 kbps, QPSK 1/2	RX Rate B	256 kbps, QPSK 1/2
TX Rate C	768 kbps, QPSK 1/2	RX Rate C	768 kbps, QPSK 1/2
TX Rate D	2048 kbps, QPSK 1/2	RX Rate D	2048 kbps, QPSK 1/2
TX Rate V	128 kbps, QPSK 1/2	RX Rate V	128 kbps, QPSK 1/2
IF Frequency	70 MHz	IF Frequency	70 MHz
IF Output	OFF	Descrambler	ON
TX Power Level	+0 dBm	Differential Decoder	ON
Scrambler	ON	RF Loop Back	OFF
Differential Encoder	ON	IF Loop Back	OFF
CW Mode	Normal (OFF)	BER Threshold	NONE
RS Encoder	OFF	Sweep Center Freq.	0 Hz
Modulator Type	EFD Closed	Sweep Range	60000 Hz
Encoder Type	Viterbi	Sweep Reacquisition	0 seconds
Mod Spectrum	Normal	RS Decoder	OFF
Mod Power Fixed	0 dB	Demodulator Type	EFD Closed
		Decoder Type	Viterbi
		Demod Spectrum	Normal
Interface			
TX Clock Source	TX Terrestrial	Frame Structure E1 Data	G.704
Buffer Clock Source	RX Satellite	Frame Structure T2 Data	G.743
TX Clock Phase	Auto	Frame Structure E2 Data	G.742
RX Clock Phase	Normal	TX Terr Interface	G.703
EXT-REF Frequency	1544.000 kHz	RX Terr Interface	G.703
Baseband Loopback	OFF	TX Data Phase	Normal
Interface Loopback	OFF	RX Data Phase	Normal
Loop Timing	OFF	Async TX Baud	110 bps
TX Data/AIS Fault	NONE	Async RX Baud	110 bps
RX Data/AIS Fault	NONE	Async TX Length	7 Bits
TX 2047 Pattern	OFF	Async RX Length	7 Bits
RX 2047 Pattern	OFF	Async TX Stop	2 Bits
TX Coding Format	AMI	Async RX Stop	2 Bits
RX Coding Format	AMI	Async TX Parity	EVEN
Buffer Programming	Bits	Async RX Parity	EVEN
Buffer Size	384	TX Overhead Type	Async
Frame Structure T1 Data	G.704	RX Overhead Type	Async
Local AUPC			
AUPC ENABLE	OFF	Target Noise	6.0 dB
Nominal Power	+0.0 dBm	Tracking Rate	0.5 dB/MIN
Minimum Power	-20.0 dBm	Local CL Action	Hold
Maximum Power	+5 dBm	Remote CL Action	Hold

CHAPTER 12. ASYMMETRICAL LOOP TIMING

12.1 Asymmetrical Loop Timing

Asymmetrical Loop Timing is the same timing method that is designed into the SDM-650B TROJAN interfaces. Refer to Figure 12-1 and Figure 12-2 for TX and RX Asymmetrical Loop Timing block diagram. There are two advantages for using Asymmetrical Loop Timing:

- Versatility: The user can select different transmit and receive data rates, yet still clock the send data with the receive satellite clock.

- Fits easily into on site clocking schemes: The user may clock the send data with a clock that is not necessarily operating at the same rate as the data rate.

The send timing may only be referenced from an external clock source that is equal to the data rate in the basic modem.

The asymmetrical clock loop reference must be one of the following:

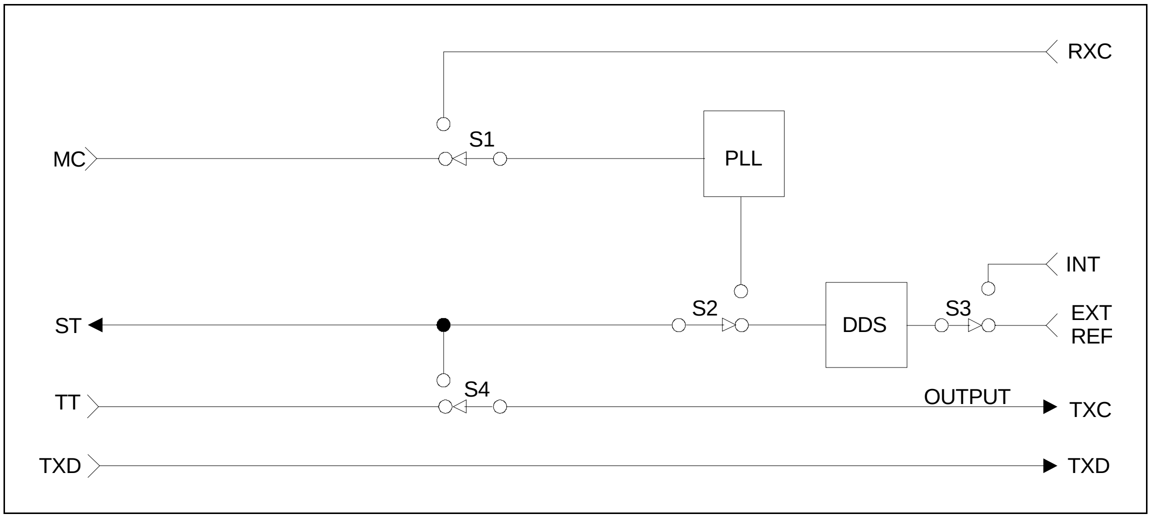
- Transmit terrestrial clock
- External clock input
- Receive clock input

Notes:

1. The clock inputs are as follows:
   a. ≥ 64 kHz shall be divisible by 8 kHz.
   b. ≥ 32 kHz but < 64 kHz shall be divisible by 600 Hz or 8 kHz.
   c. < 32 kHz shall be divisible by 600 Hz.

2. The transmit clock source can be the same at the RX digital data rate or EXT CLOCK if they are ± 100 PPM. This is provided on the basic unit, with or without the asymmetrical loop timing option.

The transmit data is normally clocked into the modem with the Terminal Timing (TT) clock in typical EIA-422 operation. The received data is clocked out with the Receive Timing (RT) clock. The asymmetrical loop timing option allows the transmit and receive data to be clocked with the same, or a multiple of the same clock. The added benefit is that the transmit and receive data rates do not have to be the same.

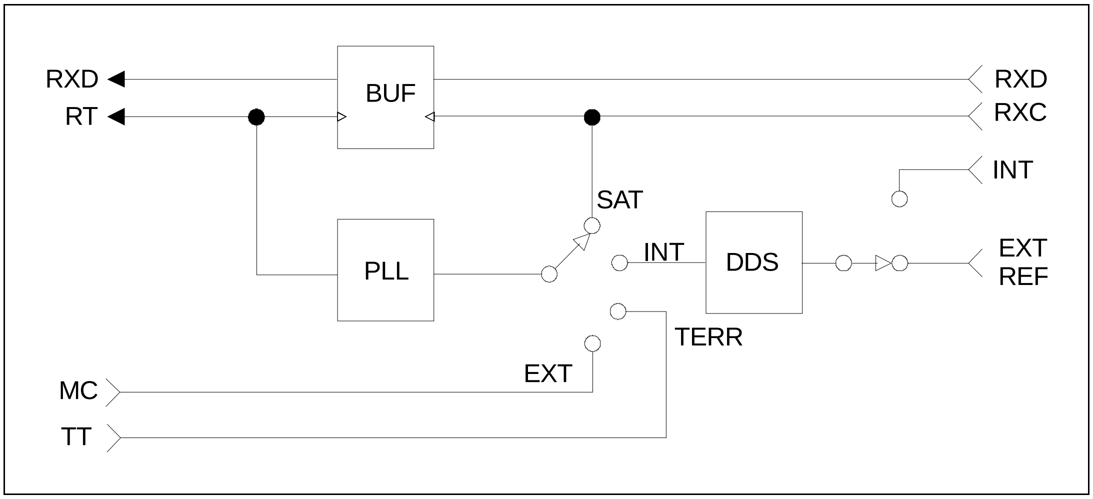


Clock Selection	S1 set to:	S2 set to:	S3 set to:	S4 set to:
TX TERR (TT)		DDS	INT	TT
INT (SCT)		DDS	INT	ST
SCT (INT)		DDS	EXT REF (See Note 2)	ST
SCT (LOOP)		DDS	EXT REF (See Note 2)	ST
INT (LOOP) (See Note 1)	RXC	PLL		ST
EXT CLOCK	MC	PLL		ST

Notes:

1. When CONFIGURATION INTERFACE → LOOP TIMING is set to ON, SCT (INT) will change to read: SCT (LOOP).
2. When CONFIGURATION MOD → MOD REF is set to EXT MOD, S3 will switch to the EXT REF position.

Figure 12-1. Transmit Section of the Asymmetrical Loop Timing Block Diagram



Note: PLL will be bypassed when the RX data rate is set to the TX data rate. This will disable the Asymmetrical Mode.

Figure 12-2. Receive Section of the Asymmetrical Loop Timing Block Diagram

Example:

Master/Slave Clocking Setup:

1. Master site has a 10 MHz clock that is needed as the clock source.
2. Unequal data rates: 4.096 Mbps and 2.152 Mbps (numbers divisible by 8).

Master Site Option:

1. Set Configuration/Modulator/Modem Reference to EXT 10 MHz.
2. Set Configuration/Interface/TX Clock Source to SCT (Internal).

Note: The SCT clock is slaved off the 10 MHz input. The 10 MHz reference should be placed into CP3 of the modem.

3. Set Configuration/Interface/Buffer Clock to SCT (Internal).

Slave Site:

1. Set Configuration/Interface/Loop Timing to ON.

2. Set Configuration/Interface/TX Clock Source to SCT (LOOP).

Or TX Terrestrial, Only if the user equipment can provide the proper slaved clock to the modem.

3. Set Configuration/Interface/Buffer Clock to RX Satellite (Buffer Bypass).

Chapter 13. G.703

13.1 G.703

G.703 data is either in AMI, B8ZS (8 zero) suppression, or HDB3 (3 zero) suppression formats. There is not a coexisting clock that is on a separate line for G.703 data. The clock is derived from the data stream within the modem and in the user equipment. Loop timing, if desired, must occur in the customer equipment for the link to operate in Master/Slave. The modem cannot do loop timing in G.703 operation because the modem does not emit an ST signal for the Transmit Clock Source modem can be placed in loop timing under EIA-422 or V.35 operation. Therefore, a master/slave relationship easily occurs. This causes the receive clock to be placed on the ST line to the terrestrial equipment. The customer equipment can then clock the transmit data to the modem using the ST line that has been derived from the RX recovered clock.

13.1.1 G.703 Specifications

Table 13-1. G.703 Specifications

Parameter	Specification
Primary Data Circuits Supported	T1 SD, RD E1 SD, RD
Interface Type	Transformer coupled symmetrical pair
Data Rates	T1 1544 kbps ± 100 bps E1 2048 kbps ± 130 bps
Pulse Width	T1 324 ± 50 Ns E1 244 ± 25 Ns
SD Amplitude	T1 3V +0.3/-1.5V-pk into 100Ω E1 3V +0.3/-1.5V-pk into 120Ω
RD Amplitude	T1 3V +0.3/-1.5V-pk into 100Ω E1 3V +0.3/-1.5V-pk into 120Ω
Pulse Mask	T1 G.703.2 E1 G.703. 6
Jitter Attenuation	T1 G.824 E1 G.823
Line Code	AMI, B8ZS, B6ZS, HDB3

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CHAPTER 14. FULLY ACCESSIBLE SYSTEM TOPOLOGY (FAST)

14.1 FAST System Theory

FAST is an enhancement feature available only in Comtech EF Data products, enabling on-location upgrade of the operating feature set—in the rack—without removing a modem from the setup. When service requirements change, the operator can upgrade the topology of the modem to meet those requirements within minutes after confirmation by Comtech EF Data. This accelerated upgrade can be accomplished only because of FAST's extensive use of programmable devices incorporating Comtech EF Data-proprietary signal processing techniques. These techniques allow the use of a unique access code to enable configuration of the available hardware. The access code can be purchased at any time from Comtech EF Data. Once obtained, the access code is loaded into the unit through the front panel keyboard or the rear remote port.

With the exclusive FAST technology, operators have maximum flexibility for enabling functions, as they are required. FAST allows an operator to order a modem precisely tailored for the initial application, reducing risk and cost overruns during the application integration process.

14.1.1 Implementation

FAST is factory-implemented in the modem at the time of order. Hardware options for basic modems can be ordered and installed either at the factory or in the field. The operator can select options that can be activated easily in the field, depending on the current hardware configuration of the modem.

14.1.1.1 Activation Procedure

Obtain Modem Serial Number

1. Press [CLEAR] to return to the Main menu.
2. Use [←] and [→] to select Function Select menu.
3. Press [ENTER].
4. Use [←] and [→] to select Utility Modem Type menu.
5. Press [ENTER].
6. Use [←] and [→] to select Modem Serial # menu.
7. Record serial number: ______________________________

Select Features:

1. Use [←] and [→] to select Modem Options menu.
2. Press [ENTER].
3. Scroll through the Modem Options and check off all features that display a "+" sign as follows:

HIGH POWER	[ ]	SINGLE RATE	[ ]
HIGH STABILITY	[ ]	LOW RATE VOLTAGE	[ ]
ASLT	[ ]	FULL RATE VARIABLE	[ ]
VITERBI	[ ]	CARD #1 PCB	[ ]
SEQUENTIAL	[ ]	CARD #2 PCB	[ ]

Notes:

1. If the menu displays a "0", the unit will need to be returned to the manufacturer for the desired hardware upgrade.
2. If the unit displays an "X," the unit can be upgraded in the field.
3. If the unit displays a "+", the feature is installed.
4. If the unit displays a "-," the feature is FAST accessible.

4. Press [CLEAR].

5. Use [←] and [→] to select CARD #1 (Overhead Card) menu.

6. Record Card #1 serial number, if displayed:_______________

7. Use [←] and [→] select CARD #2 (Reed-Solomon Card) menu.

8. Record Card #2 serial number, if displayed:_______________

9. Press [CLEAR].

10. Contact a Comtech EF Data sales representative to order features.

11. Comtech EF Data Customer Support personnel will verify the order and provide an invoice and instructions.

Entering Access Codes from the Front Panel

1. Press CLEAR to return to **Main** menu.

2. Use the [←] [→] keys to go to the **Function Select: Utility** menu.

3. Press <ENTER>.

4. Go to **Utility: Modem Type** menu.

5. Press <ENTER>.

6. Go to **Configuration Code-Modem** menu.

7. Press <ENTER>.

8. Menu should display as follows:

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

9. To enter the code, press <ENTER> and use the [↑] [↓] keys to select an alphanumeric character. Use [→] to move to the next character or to move to the next line. Repeat this procedure until all 20 characters of the code have been entered.

10. After completing entry of the 20-character code, press <ENTER>. The unit should display **Modem Initialization** and will reboot to the factory default settings with the new option available.

11. If a wrong or invalid code is entered, the unit will display **Wrong Code Entered!** and no changes will occur. Please retry the code, verify that the code is correct, or request assistance from Comtech EF Data Customer Support.

Entering Access Codes from the Remote Control Port

1. Establish remote communication with the unit. Display will show **REMOTE MODE** (if applicable).

2. Enter the following commands as needed to enable the option related to each board:

Main Board:	*<x/CCMD_code*	
Overhead board:	*<x/CCOD_code*	*x = address*
Mux/Demux Board:	*<x/CCMX_code*	
TX-Reed-Solomon:	*<x/CCTR_code*	*code = 20 digit configuration code*
RX-Reed-Solomon:	*<x/CCRR_code*	

3. The modem should re-initialize and boot up to the factory default settings.

Note: If the unit is an SDR-54/54A, the power should be cycled to re-initialize the unit and enable the option(s).

Verify Upgrade

1. Press [CLEAR] to return to the Main menu.

2. Use [←] and [→] to select Function Select Utility menu.

3. Press [ENTER].

4. Use [←] and [→] to select Utility Modem Type menu.

5. Press [ENTER].

6. Use [←] and [→] to select Modem Options menu.

7. Press [ENTER].

8. Use [←] and [→] to scroll through features. Visually check selected features for a “+” sign. If a “+” sign is evident, the upgrade is completed.

9 If upgrade is incorrect, the menu display will exhibit “WRONG CODE ENTERED.” Repeat procedures. Contact Comtech EF Data Customer Support personnel for further instructions, if the error message remains.

CHAPTER 15 . SPECIFICATIONS

15.1 Specifications

The SDM-300L3 satellite modem specifications are divided into sections as follows.

- Specifications Summary
- BER Specifications
- Modem Specifications
- Demodulator Specifications
- Interface Specifications
- Terrestrial Interface Types
- System Specifications
- BUC/FSK Communications (Refer to Chapter 16)

Figure 15-1 shows a block diagram of the modem in a typical application.

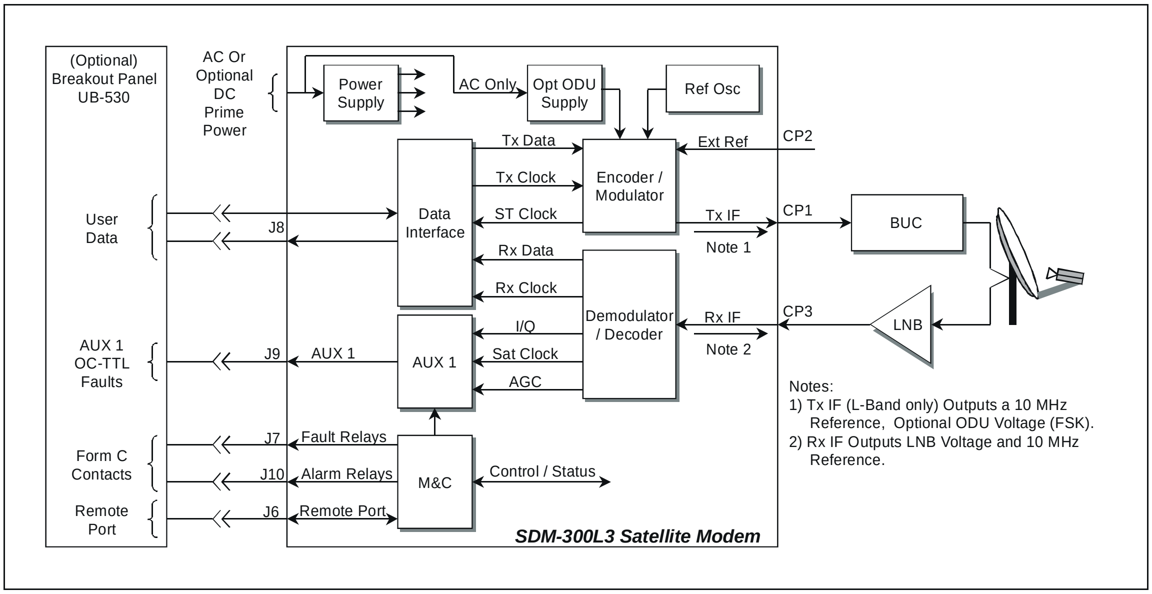

Figure 15-1. Block Diagram

15.2 Specification Summary

Table 15-1. System Specification Summary

System Specifications	
Operating Frequency Range	950-1750MHz, in100 Hz steps
Digital Interfaces (Standard)	EIA-232, EIA-422, and V.35
Digital Interfaces (Optional)	G.703
Digital Data Rate	2.4 kbps to 5.0 Mbps, in 1 bit/s step (refer to: Digital Data Rate paragraph)
Symbol Rate	4.8 k symbols/s to 2.5 M symbols/s
Modulation/Demodulation	BPSK QPSK OQPSK 8PSK
Baseband Filtering	IESS, Comtech EF Data Closed, Comstream Closed, EFD Closed
Forward Error Correction (FEC)	Viterbi, K=7, 1/2, 3/4, 7/8 rates Sequential 1/2, 3/4, 7/8 rates Reed-Solomon Concatenated per Intelsat Reed-Solomon Concatenated per closed network Trellis 2/3 rate (8PSK) Turbo 1/2, 3/4, 21/44, and 5/16 rates Uncoded
Reed Solomon Interleaver	Depth 8, closed network; Depth 4 or 8 per IESS-308, 309, and 310
Plesiochronous/Doppler Buffer	1 to 99 ms, in 1 ms steps up to 2.6 Mbps 32 to 262,144 bits in 16 bit steps
Data Scrambling	IESS-308 (V.35 Intelsat), IESS-309/310, FDC, V.35 (EFD/CSC), Modified V.35, None
Differential Encoding/Decoding	ON/OFF
External Reference Input	1, 5, 10, 20 MHz (75Ω 0 to 20 dBm on 50Ω BNC Female) Note: Only 10 MHz allowed when operating with BUC and LNB requiring 10 MHz reference from modem.
Open Collector Fault Reporting	For redundancy switch operation or user reporting. Separate modulator and demodulator open collector up to 15 VDC maximum at 20 mA. Fault = collector Off and OK = collector On.
Test Modes, Loopback Data	Baseband: Near end and far end Interface: Near end and far end (Reed-Solomon or Overhead only)
Test Modes	Available only when TX and RX are both L-band:
IF Loopback	Disconnects the IF input from the RX input connector and couples it to a sample of the TX IF output. The IF output is not affected.
RF Loopback	Sets the demodulator frequency to the same value as the modulator. For the modem to lock, an external IF loop must be provided.
Prime Power	85 to 264 VAC, 47 to 63 Hz, 60 Watts maximum
Physical:	
Size	1 RU1.75H x 19W x 19.18D inches (4.44 x 48.26 x 48.72 cm)
Weight	14.5 lbs. Maximum (6.51 kg)
Mounting	Standard 19-inch (48.62 cm) rack mounts front and rear accepts standard rack mount slides (no slides with 150W BUC power supply option)
Environmental:	
Temperature	0 to +50°C (32 to 122°F)
Humidity	95% non-condensing
Operational Shock	MIL-STD-167-1. 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.
Survivability Shock and Vibration	MIL-STD-810D Method 514.4, Procedure 8, 1 hour/axis
Agency Approvals	CE Mark

15.3 L-Band Modulator Specification Summary

Table 15-2. L-Band Modulator

Transmit Specifications	
Output Connector	Type N Female
Frequency Stability	± 0.02 ppm Optional: ± 1.0 ppm
Output Power Range	0 to -40 dBm in 0.1 dB steps
Output Power Accuracy	± 1.5 dB
Output Power Stability versus Temperature	± 1.0 dB
Output Power Offset	Adds offset of –99.0 to +99.0 dB in 0.1 dB steps to displayed IF output power.
Output Impedance	50 Ω
Output Return Loss	≥ 14 dB
Output Noise Floor	-130 dBc/Hz (20 MHz from carrier)
Output Phase Noise	see 15.5.6 Modulator Phase Noise
Spurious Emissions	-55 dBc, 55 to 2000 MHz in 4 kHz bandwidth
Carrier Suppression	< -30 dBc (test mode)
Harmonics of modulated carrier	< -55 dBc
Output Unit Reference: Frequency Stability Power Level Phase Noise	On center conductor of L-Band output connector 10.0 MHz ± 0.02 ppm (Optional: 1.0 ppm) 0.0 dBm, ± 3 dBm dB/Hz — Frequency Offset -50 — 1 Hz -80 — 10 Hz -110 — 100 Hz -140 — 1 kHz -150 — 10 kHz -150 — 100 kHz
Outdoor Unit (ODU) Supply Voltage. Supplied through TX IF center conductor and selectable On/Off via M&C control.	Standard unit is with no ODU supply. Optional ODU supplies: 24 VDC, 4.0 Amps maximum, universal AC input 100 W supply 48 VDC, 3.0 Amps maximum, universal AC input 150 W supply
ODU 10 MHz Reference	On center conductor of output Type N connector at 0 ± 3 dBm. Programmable On/Off.
Outdoor Unit Current	Min/Max programmable current limit and alarm if current falls outside the programmable threshold.
Outdoor Unit M&C	FSK TX and RX for M&C of the SierraCom or Terrasat BUC. **Note:** Refer to Chapter 16 for BUC/FSK Communications.
Spectral Sense	Normal or Inverted
Test Modes Pattern Generator	Inserts 2047 data pattern in place of TX data stream, with optional Overhead Card.
Test Modes, Carrier	CW Offset: single sideband Dual: dual sideband

15.4 Demodulator Specification Summary

Table 15-3. Demodulator Specification

Receive Specifications	
Input Connector	Type F Female
Input Impedance	75 Ω
Input Return Loss	≥ 10 dB
Minimum Input Level, Desired Carrier	-135 dBm + 10*Log (Symbol Rate), see curve
Input Level AGC	50 dBc, see curve
Input Composite Power: Symbol Rate > 64 Ksym/s < 64 Ksym/s Absolute maximum	+30 dBc within 10 MHz of desired +40 dBc with respect to receive signal +50 dBc with respect to receive signal -5 dBm
Acquisition Range	± 500 kHz, programmable in 1Hz increments.
BER Performance (BER vs Eb/N0)	See BER performance tables Notes: BER specified is for IF loop-back with added noise.
LNB 10 MHz Reference	On center conductor of L-band input connector, selectable ON/OFF. Level: -3 ± 3 dBm. Source: 1. Internal High Stability Reference 2. REF EXT Supplied at 10 MHz Performance: For phase noise, refer to L-Band Modulator 10 MHz. Frequency stability is the same as the modulator.
LNB Voltage	On center conductor of L-band input connector, selectable ON/OFF: 13 and 18 volts per DiSEq 4.2 and 24 VDC at 500 mA, maximum
LNB Current	Programmable MIN and MAX current alarms
LNB Band Control	22kHz tone outbound from L-band connector per DiSEq 4.2.
Test Modes Pattern Monitor	Detects the presence of 2047 data pattern in RX stream and reports BER.
Monitored Signals	Receive signal level Raw BER Corrected BER range 10-3 to 10-12 Eb/N0, 2.0 to 16.0 dB Rx frequency offset –500 kHz to +500 kHz Buffer fill status, 1 to 99% in 1% steps

15.5 L-Band Modulator Specifications

15.5.1 Digital Data Rate

The digital data rate is selectable in 1 bit/s steps. The modem automatically calculates and sets the symbol rate. Data rates entered that exceed the data rate or symbol rate specification are rejected at entry.

The symbol rate range is 4.8 to 2500 kHz.

Table 15-4. Modulator Digital Data Rates

Modulation Type	Encoding Type	Data Rate Range	
BPSK 1/2	Viterbi	2.4 kbps	1.25 Mbps
{O}QPSK 1/2	Viterbi	4.8 kbps	2.5 Mbps
{O}QPSK 3/4	Viterbi	7.2 kbps	3.75 Mbps
{O}QPSK 7/8	Viterbi	8.4 kbps	4.375 Mbps
8PSK 2/3	Viterbi	512 kbps	5.0 Mbps
BPSK 1/2	Sequential	2.4 kbps	1.25 Mbps
QPSK 1/2	Sequential	4.8 kbps	2.5 Mbps
QPSK 3/4	Sequential	7.2 kbps	3.75 Mbps
QPSK 7/8	Sequential	8.4 kbps	4.375 Mbps
BPSK 1/2	Viterbi and Reed-Solomon	2.4 kbps	1.138 Mbps
{O}QPSK 1/2	Viterbi and Reed-Solomon	4.8 kbps	2.277 Mbps
{O}QPSK 3/4	Viterbi and Reed-Solomon	7.2 kbps	3.416 Mbps
{O}QPSK 7/8	Viterbi and Reed-Solomon	8.4 kbps	3.986 Mbps
8PSK 2/3	Trellis and Reed-Solomon	512 kbps	4.555 Mbps
BPSK 1/2	Sequential and Reed-Solomon	2.4 kbps	1.138 Mbps
QPSK 1/2	Sequential and Reed-Solomon	4.8 kbps	2.277 Mbps
QPSK 3/4	Sequential and Reed-Solomon	7.2 kbps	3.416 Mbps
QPSK 7/8	Sequential and Reed-Solomon	8.4 kbps	3.986 Mbps
BPSK 5/16	Turbo	2.4 kbps	781.25 kbps
BPSK 21/44	Turbo	2.4 kbps	1193 kbps
{O}QPSK 1/2	Turbo	4.8 kbps	2386 kbps
{O}QPSK 3/4	Turbo	7.2 kbps	3750 kbps
8PSK 3/4	Turbo	384 kbps	5.0 Mbps

Table 15-4. Modulator Digital Data Rates (Continued)

Modulation Type	Encoding Type	Data Rate Range	
BPSK 1/2	ASYNC	2.4 kbps	1024 kbps
QPSK 1/2, 3/4	IBS	64 kbps	2048 kbps
QPSK 1/2, 3/4	D&I	64 kbps	1920 kbps
QPSK 1/2, 3/4	ASYNC	4.8 kbps	2048 kbps
QPSK 3/4	ASYNC	7.2 kbps	2048 kbps
QPSK 7/8	ASYNC	8.4 kbps	2048 kbps
BPSK 1/2	ASYNC and Reed-Solomon	2.4 kbps	1024 kbps
QPSK 1/2, 3/4	IBS and Reed-Solomon	64 kbps	2048 kbps
QPSK 1/2, 3/4	D&I and Reed-Solomon	64 kbps	1920 kbps
QPSK 1/2, 3/4	ASYNC and Reed-Solomon	4.8 kbps	2048 kbps
QPSK 3/4	ASYNC and Reed-Solomon	7.2 kbps	2048 kbps
QPSK 7/8	ASYNC and Reed-Solomon	8.4 kbps	2048 kbps
QPSK 3/4	IDR, T1	1544 kbps	Fixed Rate
QPSK 3/4	IDR, E1	2048 kbps	
QPSK 3/4	IDR, T1, and Reed-Solomon	1544 kbps	Fixed Rate
QPSK 3/4	IDR, E1, and Reed-Solomon	2048 kbps	
8PSK 2/3	IBS	512 kbps	2048 kbps
QPSK 1/2	D&I	64 kbps	1920 kbps
8PSK 2/3	ASYNC	512 kbps	2048 kbps
8PSK 2/3	IBS and Reed-Solomon	512 kbps	2048 kbps
QPSK 1/2	D&I and Reed-Solomon	64 kbps	1920 kbps
8PSK 2/3	ASYNC and Reed-Solomon	512 kbps	2048 kbps
8PSK 2/3	IDR, T1	1544 kbps	Fix Rate
8PSK 2/3	IDR, E1	2048 kbps	
8PSK 2/3	IDR, T1, and Reed-Solomon	1544 kbps	Fix Rate
8PSK 2/3	IDR, E1, and Reed-Solomon	2048 kbps	
BPSK 1/1	None	4.8 kbps	2.5 Mbps
{O}QPSK 1/1	None	9.6 kbps	5.0 Mbps

15.5.2 Modulation and Encoding Types

The following combinations of modulation and forward error correction encoding are available.

Table 15-5. Modulation and Encoding Types

Encoder	Code Rate	Reed-Solomon	Modulation
Viterbi, K7	1/2		BPSK
Viterbi, K7	1/2	225/205 Closed	BPSK
Viterbi, K7	1/2, 3/4, 7/8		QPSK, OQPSK
PTCM	2/3		8PSK
Viterbi, K7	1/2, 3/4, 7/8	225/205 [4] IDR T1 225/205 [8] No Overhead, ASYNC Overhead 219/201 [4] VSAT IBS, IBS, IDR E1 126/112 [4] IDR Small Carrier, SDM-300 Legacy	QPSK QPSK/OQPSK QPSK QPSK
PTCM (RS EFD Compatible)	2/3	225/205 [ ] Closed or IDR T1 126/112 [ ] IBS and D&I 219/201 [ ] IDR E1	8PSK
PTCM (RS IESS-310 Compatible)	2/3	219/201 [4] No Overhead, 219/201 [4] IBS and D&I 219/201 [8] IDR T1/E1	8PSK
Sequential	1/2		BPSK
Sequential	1/2	225/205 [ ] Closed	BPSK
Sequential	1/2, 3/4, 7/8		QPSK, OQPSK
Sequential	1/2, 3/4, 7/8	225/205 [ ] Closed	QPSK, OQPSK
Uncoded	1/1		BPSK, QPSK,OQPSK
Turbo Product	21/44, 5/16		BPSK
Turbo Product	1/2, 3/4		QPSK,OQPSK
Turbo Product	3/4		8PSK

Note: Interleaver depths are selectable at: 4, 8, or 16. The values shown are default or Open Network specified.

15.5.3 Scrambling Types

When scrambling is enabled, it is applied to the modulator data according to the programmed modulator type as listed in the following table. When scrambling is disabled, no scrambling is applied to the modulator data.

Table 15-6. Scrambling Types

Modulation Type	FEC or Framing	Scrambling
EFD Closed, CSC Closed	Sequential	ITU V.35
EFD Closed, CSC Closed, FDC Closed	Viterbi	ITU V.35 Intelsat Modified
EFD Closed	Viterbi/RS Concatenated	EFD Modified V.35
EFD Closed	Turbo	2^{12-1} Synchronous
EFD Closed	ASYNC	2^{15-1} Synchronous
FDC Closed	Sequential	FDC Modified V.35
Intelsat Open	Viterbi IDR	ITU V.35 Intelsat Modified
Intelsat Open	Viterbi IDR with RS	ITU V.35 Intelsat Modified
Intelsat Open	IBS, D&I, IESS-310	2^{15-1} Synchronous

15.5.4 Modulator Frequency Reference

SCT, RX Bit Clock, and IF output are locked to the Frequency Reference.

Internal (Standard)	Stability over the operating temperature range = ± 0.02 PPM.
External Reference Input (Standard)	The External frequency reference connector is located on the back panel. This allows the Frequency Reference to be locked to an external reference frequency standard. Impedance 75Ω Frequency 1, 5, 10 or 20 MHz (10 MHz required if supplying 10 MHz reference to BUC or LNB) Amplitude≥ +0 dBm < +20 dBm DC offset Capacitively coupled Connector BNC female (50Ω)
Reference Frequency Output	The External frequency reference connector can be used as an output. When selected from the front panel, this output can be used to lock other equipment to the Internal High Stability Reference of the selected modem. The output is 10 MHz, the level is +5 ± 5 dBm.
Calibration	Front panel programmable adjustment for aging.

15.5.5 Modulator Spurious Emissions

Spurious emissions are measured relative to the power of an unmodulated carrier. The measurement is done with the carrier on in continuous mode and modulated by the correct data/clock signal. Spurious emissions measured in a 4 kHz bandwidth at the TX IF output are –55 dBc from 55 MHz to 2 GHz.

15.5.6 Modulator Phase Noise

1. The phase noise of the TX IF output carrier is no worse than:

dBc/Hz	Distance from Carrier
-63.0	100 Hz
-73.0	1 kHz
-83.0	10 kHz
-93.0	100 kHz

2. Fundamental AC line spurious is -42 dBc or lower.
3. The sum of all the single sideband spurious, from 0 to 0.75 x symbol rate, is -42 dBc or lower.

15.5.7 Modulator IF Output Spectrum Shape

The modem meets the following TX output spectral mask specifications. The desired mask is selectable from the front panel or remotely.

- INTELSAT/EUTELSAT
- Closed net (CEFD and CSC)
- Closed net (Fairchild compatible)
- Closed net (SDM 51, SDM 52)

15.5.8 L-Band INMARSAT Spurious Emissions

Note: The item below may require a special VCO to meet the specification. If so, an optional “INMARSAT” version will be generated and the Inmarsat Emissions is added to the Future Items list. This may require operation at a lower transmit power level. Outside of 1610 to 1680 MHz the requirements are the same as the L-Band Spurious Emissions requirement. When operated over the Inmarsat frequency range of 1626 to 1660 MHz the spurious emissions in a range from 1610 to 1680 MHz are $\geq$ -60 dBc.

15.5.9 Differential Encoder

The differential encoder takes care of one set of ambiguities due to the error correction codes being transparent.

- On or off

15.5.10 BPSK Bit Ordering

The encoder has the ability to select whether I is the first bit or Q is the first bit in the symbol word grouping for compatibility with any system. For standard operation Q is the first bit.

- Viterbi (Standard/Non-Standard)
- Sequential (Standard/Non-Standard)
- Turbo – Fixed order only

15.5.11 Interleaver (Reed-Solomon Codec)

- OQPSK, QPSK - Depth 4 (IBS, IDR, D&I)
- 8PSK - Depth 4 (No Overhead, IBS, D&I) (IESS-310)
- Depth 8 (Closed Network, Async)
- 8PSK - Depth 8 (IDR) (IESS-310)

15.5.12 Modulator Transmit Frequency (IF)

The range of the output IF the operator from 950 to 1750 MHz in 100 Hz steps can select spectrum.

15.5.13 Transmit Frequency Change Time

The time between the end of a remote command and the end of the modem reply for frequency change and synthesizer lock will be < 500 ms

15.5.14 Modulator Transmit IF Output Switch

When set to off, no signal present at the output is greater than -60 dBm, measured in a 4 kHz bandwidth from 55 MHz to 2.4 GHz.

15.5.15 Modulator Transmit IF Power

The TX IF power is operator selectable from 0 to -40 dBm, in 0.1 dB steps, with an accuracy of ± 1.5 dB. The maximum drift from room temperature value over the specified temperature range is ± 1.0 dB.

15.5.16 Modulator Power Offset

An offset to the displayed IF output power may be entered from -99.0 to +99.0 dB, in 0.1 dB steps.

15.5.17 Modulator I / Q Imbalance

- The modulator will have less than 4° RMS phase error.
- The modulator will have less than 0.25 dB amplitude imbalance.

15.5.18 Modulator Output Noise Floor

The Modulator Output Noise Floor shall be -130dBc/Hz (20 MHz from carrier).

15.5.19 Modulator Spectrum Rotation

The operator can select Normal or Inverted spectrum of the Modulator Output.

15.5.20 Modulator Output Return Loss

- Carrier Frequency < 1350 MHz: > 14dB at 50Ω 950 to 1350 MHz
- Carrier Frequency > 1350 MHz: > 14dB at 50Ω 1350 to 1750 MHz

15.5.21 L-Band ODU Reference Signal

The IDU shall provide a synthesizer reference on the center conductor of the L-Band output connector. The signal will be 10 MHz with a stability of ± 0.02 ppm. at 0.0 dBm, ± 3 dB.

15.5.22 L-Band ODU Control and Monitor

The IDU shall provide an FSK signal for monitor and control of the SierraCom or Herley BUC. (Refer to Chapter 16.)

15.5.23 Modulator Transmit IF Test Modes

The following TX IF test modes are available to the operator. Spurious emissions in the following test modes will be ≤ -30 dBc.

- CW: Outputs a single carrier at the defined frequency
- Offset: Single sideband signal with one sideband suppressed ≤ -25 dBc and carrier suppressed ≤ -35 dBc (harmonics of modulation rate are present).
- Dual sideband: Suppressed carrier ≤ -35 dBc

15.5.24 L-Band ODU Supply Voltage

Standard configuration is without a power supply for the external ODU or outdoor unit. Two power options are available:

- 24V at 100W
- 48V at 150W

During power up of the modem, the ODU supply voltage initially powers up in the OFF condition. During modem initialization, the ODU supply voltage is turned ON in a manner that safely limits the current going to the ODU. The modem is protected for all short, open and loaded conditions. The modem is programmable to turn the ODU supply voltage ON / OFF.

15.5.25 ODU DC Current Sense

The indoor unit shall sense the magnitude of DC current delivered to the ODU and provide programmable minimum and maximum current thresholds. An alarm is produced when the sensed current to the ODU either falls below the minimum programmed threshold or exceeds the maximum-programmed threshold. The value shall be for each threshold is 0 to 4000 mA.

15.6 Encoding

15.6.1 BPSK Encoding

The modulator converts transmitted baseband data into a modulated BPSK carrier. Using vector analysis of the constellation pattern, BPSK represents one symbol with the carrier phase either at 0° or 180°. The encoding characteristics for BPSK are provided in the following table.

Code Rate	Symbols/Bit	Bps/Hz
1/1	**1**	**2**
1/2	**2**	**0.5**
5/16	**3.2**	**0.3125**
21/44	**2.1**	**0.477**

15.6.1 QPSK Encoding

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

4.8 kbps to 2.5 Mbps (1/2 rate)
7.2 kbps to 3.75 Mbps (3/4 rate)
8.4 kbps to 4.375 Mbps (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 provide the desired input/output bit rates.

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

15.6.2 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 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

15.6.3 8PSK Encoding

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

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 rate encoding provides the desired input/output bit rates.

Code Rate	Symbol/Bit	Bit/s Hz
2/3	1.5	2
3/4	1.333	2.25

15.7 L-Band Demodulator Specifications

15.7.1 Digital Data Rate

The digital data rate is selectable in 1 bit/s steps. The modem automatically calculates and sets the symbol rate. Data rates entered that exceed the data rate or symbol rate specification are rejected at entry.

The symbol rate range is 4.8 to 2500 kHz.

Table 15-7. Demodulator Digital Data Rate

Demodulation Type	Encoding Type	Data Rate Range	
BPSK 1/2	Viterbi	2.4 kbps	1.25 Mbps
{O}QPSK 1/2	Viterbi	4.8 kbps	2.5 Mbps
{O}QPSK 3/4	Viterbi	7.2 kbps	3.75 Mbps
{O}QPSK 7/8	Viterbi	8.4 kbps	4.375 Mbps
8PSK 2/3	Viterbi	512 kbps	5.0 Mbps
BPSK 1/2	Sequential	2.4 kbps	1.25 Mbps
QPSK 1/2	Sequential	4.8 kbps	2.5 Mbps
QPSK 3/4	Sequential	7.2 kbps	3.75 Mbps
QPSK 7/8	Sequential	8.4 kbps	4.375 Mbps
BPSK 1/2	Viterbi and Reed-Solomon	2.4 kbps	1.138 Mbps
{O}QPSK 1/2	Viterbi and Reed-Solomon	4.8 kbps	2.277 Mbps
{O}QPSK 3/4	Viterbi and Reed-Solomon	7.2 kbps	3.416 Mbps
{O}QPSK 7/8	Viterbi and Reed-Solomon	8.4 kbps	3.986 Mbps
8PSK 2/3	Trellis and Reed-Solomon	512 kbps	4.555 Mbps
BPSK 1/2	Sequential and Reed-Solomon	2.4 kbps	1.138 Mbps
QPSK 1/2	Sequential and Reed-Solomon	4.8 kbps	2.277 Mbps
QPSK 3/4	Sequential and Reed-Solomon	7.2 kbps	3.416 Mbps
QPSK 7/8	Sequential and Reed-Solomon	8.4 kbps	3.986 Mbps
BPSK 5/16	Turbo	2.4 kbps	781.25 kbps
BPSK 21/44	Turbo	2.4 kbps	1193 kbps
{O}QPSK 1/2	Turbo	4.8 kbps	2386 kbps
{O}QPSK 3/4	Turbo	7.2 kbps	3750 kbps
8PSK 3/4	Turbo	384 kbps	5.0 Mbps

Table 15-7. Demodulator Digital Data Rate (Continued)

Modulation Type	Encoding Type	Data Rate Range	
BPSK 1/2	ASYNC	2.4 kbps	1024 kbps
QPSK 1/2, 3/4	IBS	64 kbps	2048 kbps
QPSK 1/2, 3/4	D&I	64 kbps	1920 kbps
QPSK 1/2, 3/4	ASYNC	4.8 kbps	2048 kbps
QPSK 3/4	ASYNC	7.2 kbps	2048 kbps
QPSK 7/8	ASYNC	8.4 kbps	2048 kbps
BPSK 1/2	ASYNC and Reed-Solomon	2.4 kbps	1024 kbps
QPSK 1/2, 3/4	IBS and Reed-Solomon	64 kbps	2048 kbps
QPSK 1/2, 3/4	D&I and Reed-Solomon	64 kbps	1920 kbps
QPSK 1/2, 3/4	ASYNC and Reed-Solomon	4.8 kbps	2048 kbps
QPSK 3/4	ASYNC and Reed-Solomon	7.2 kbps	2048 kbps
QPSK 7/8	ASYNC and Reed-Solomon	8.4 kbps	2048 kbps
QPSK 3/4	IDR, T1	1544 kbps	Fixed Rate
QPSK 3/4	IDR, E1	2048 kbps	
QPSK 3/4	IDR, T1, and Reed-Solomon	1544 kbps	Fixed Rate
QPSK 3/4	IDR, E1, and Reed-Solomon	2048 kbps	
8PSK 2/3	IBS	512 kbps	2048 kbps
QPSK 1/2	D&I	64 kbps	1920 kbps
8PSK 2/3	ASYNC	512 kbps	2048 kbps
8PSK 2/3	IBS and Reed-Solomon	512 kbps	2048 kbps
QPSK 1/2	D&I and Reed-Solomon	64 kbps	1920 kbps
8PSK 2/3	ASYNC and Reed-Solomon	512 kbps	2048 kbps
8PSK 2/3	IDR, T1	1544 kbps	Fix Rate
8PSK 2/3	IDR, E1	2048 kbps	
8PSK 2/3	IDR, T1, and Reed-Solomon	1544 kbps	Fix Rate
8PSK 2/3	IDR, E1, and Reed-Solomon	2048 kbps	
BPSK 1/1	None	4.8 kbps	2.5 Mbps
{O}QPSK 1/1	None	9.6 kbps	5.0 Mbps

15.7.2 Demodulation and FEC Decoding Types

The following combinations of demodulation and forward error correction decoding are available.

Table 15-8. L-Band Demodulation and FEC Decoding Types

Decoder	Code Rate	Reed Solomon	Modulation
Viterbi, K7	1/2		BPSK
Viterbi, K7	1/2	225/205 Closed	BPSK
Viterbi, K7	1/2 ,3/4, 7/8		QPSK, OQPSK
PTCM	2/3		8PSK
Viterbi, K7	1/2, 3/4, 7/8	225/205 [4] IDR T1 225/205 [8] No Overhead, ASYNC Overhead 219/201 [4] VSAT IBS, IBS, IDR E1 126/112 [4] IDR Small Carrier, SDM-300 Legacy	QPSK, OQPSK
PTCM (RS EFD Compatible)	2/3	225/205 [ ] Closed or IDR T1, 126/112 [ ] IBS and D&I, 219/201 [ ] IDR E1	8PSK
PTCM (RS IESS-310 Compatible)	2/3	219/201 [4] No Overhead, 219/201 [4] IBS and D&I, 219/201 [8] IDR T1/E1	8PSK
Sequential	1/2		BPSK
Sequential	1/2	225/205 [ ] Closed	BPSK
Sequential	1/2. 3/4, 7/8		QPSK, OQPSK
Sequential	1/2, 3/4, 7/8	225/205 [ ] Closed	QPSK, OQPSK
Uncoded	1/1		BPSK, QPSK
Turbo Product	21/44, 5/16		BPSK
Turbo Product	1/2, 3/4		QPSK, OQPSK
Turbo Product	3/4		8PSK

Note: Interleaver depths are selectable at: 4, 8, or 16. The values shown are default or Open Network specified.

15.7.3 Descrambling Types

When descrambling is enabled, it is applied to the demodulator data according to the programmed demodulator type as listed in Table 15-9. When descrambling is disabled, no descrambling is applied to the demodulator data.

Table 15-9. Descrambling Types

Demodulator Type	FEC or Framing	Descrambling
EFD Closed, CSC Closed	Sequential	ITU V.35
EFD Closed, CSC Closed, FDC Closed	Viterbi	ITU V.35 INTELSAT Modified
EFD Closed	Viterbi/RS Concatenated	EFD Modified V.35
EFD Closed	Turbo	2^{12-1} Synchronous
EFD Closed	ASYNC	2^{15-1} Synchronous
FDC Closed	Sequential or Viterbi	FDC Modified V.35
INTELSAT Open	Viterbi IDR	ITU V.35 INTELSAT Modified
INTELSAT Open	Viterbi IDR with RS	ITU V.35 INTELSAT Modified
INTELSAT Open	IBS, D&I, IESS-310	2^{15-1} Synchronous

15.7.4 Differential Decoder

The differential decoder takes care of one set of ambiguities due the error correction codes being transparent.

- On or Off

15.7.5 BPSK Bit Ordering

The decoder has the ability to select whether I is the first bit or Q is the first bit in the symbol word grouping for compatibility with any system. For standard mode Q is the first bit.

- Viterbi (Standard/Non-Standard)
- Sequential (Standard/Non-Standard)
- Turbo – fixed order only

15.7.6 Deinterleaver (Reed-Solomon Codec)

- OQPSK, QPSK – Depth 4 (IBS, IDR, D&I)
- 8PSK – Depth 4 (No overhead, IBS, D&I) (IESS-310)
- Depth 8 (Closed Network, Async)
- 8PSK – Depth 8 (IDR) (IESS-310)

15.7.7 Demodulator Spectrum Rotation

The operator can select Normal, Inverted, or Auto-Detect of the spectrum for the Demodulator Input.

15.7.8 Receive Frequency

The range of the input spectrum is from 950 to 1750 MHz, in 100 Hz steps.
The actual value of offset from the programmed frequency is available to the operator on the front panel as well as the remote port. The resolution of this value is 1 Hz. Monitor accuracy is ± 0.01 PPM.

15.7.9 Input Overload

The modem will not be damaged by a continuous receive input of +20 dBm.

15.7.10 Demodulator Input Return Loss

The demodulator input return loss shall be ≥ 10 dB into a 75Ω load.

15.7.11 LNB Prime Power

The DC input on the center conductor of the L-Band connector shall be selectable for OFF, 13V, 18V, and 24V.

15.7.12 LNB Band Control

The IDU shall provide a 22 kHz tone outbound of L-Band input connector per DiSEq 4.2.

15.7.13 LNB Reference Signal

The modem shall be capable of providing a 10 MHz reference, that is On/Off-selectable, on the center conductor of the RX input connector. The following build options will be allowed:

- Option 1: 1.0 ppm for use with rack mount converters or internally referenced LNBs.
- Option 2: 0.02 ppm for use with externally referenced LNBs.

15.7.14 Receive Input Power (Composite)

The modem can operate to its specified performance under all the following conditions:

- The sum of all carriers is ≤ -5 dBm.
- The sum of all carriers within 10 MHz from the desired is ≤ +30 dBc.
- The sum of all carriers is ≤ +40 dBc with respect to the desired carrier for symbol rates ≤ 64 Ks/s.
- The sum of all carriers is ≤ +50 dBc with respect to the desired carrier for symbol rates ≥ 64 Ks/s.

15.7.15 Demodulator Input Shape

The modem can be set to match any of the following spectral mask specifications.

- Closed net (Comtech EF Data)
- Closed net (Comstream)
- Closed net (Fairchild compatible)

15.7.16 Receive Input Power (Desired Carrier)

The modem can meet the specified BER and automatically adjust to a receive input power. The minimum input signal level is –135 dBm + 10 log (Symbol Rate). E.g. (-98 dBm @ 4.8 Ks/s). The maximum desired input signal level is –85 dBm + 10 log (symbol rate). Monitor accuracy is ± 7.5 dB. See Figure 15-2.

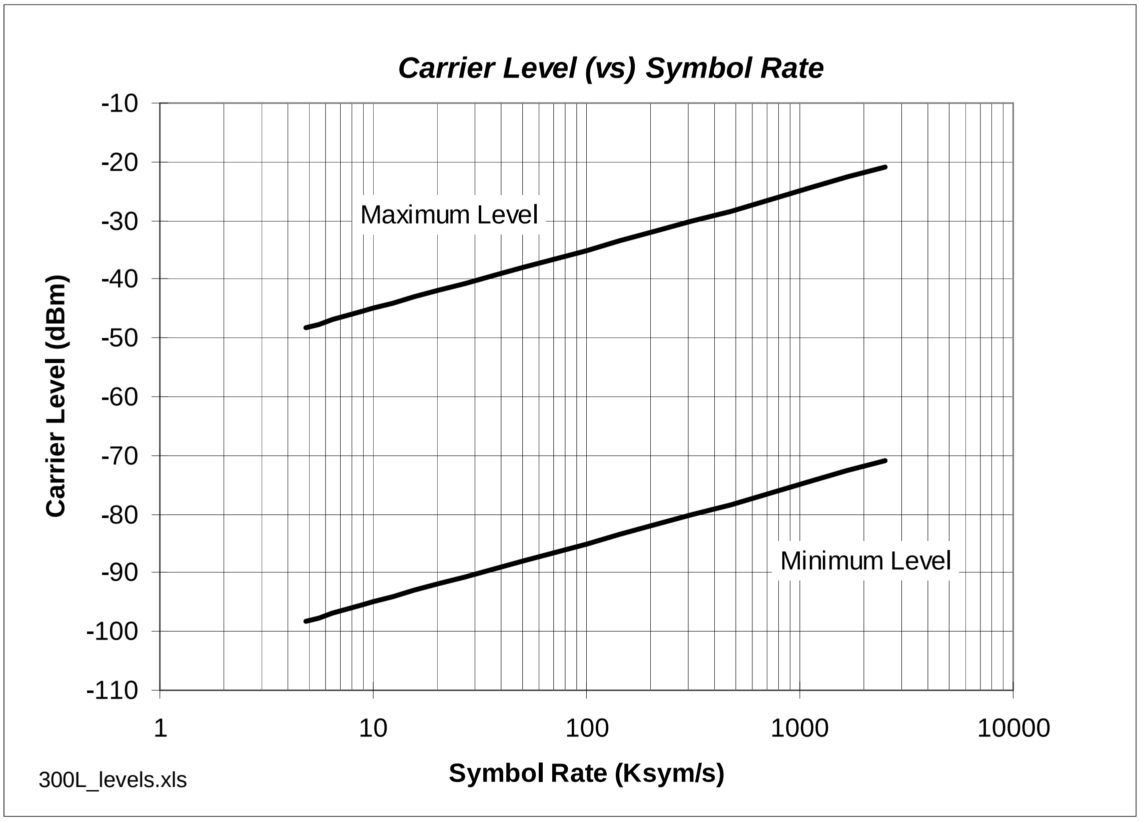

Figure 15-2. Carrier Level vs Symbol Rate

15.7.17 Demodulator Channel Spacing/Adjacent Carrier Performance

The modem BER will be degraded less than 0.5 dB with the following receive signal:

- Two like-modulated carriers spaced 1.3 times the symbol rate from the receive frequency, and/or 1.2 times the acquisition range, whichever is larger.
- Each adjacent carrier up to 10 dBc higher in power than the desired carrier.
- A single adjacent carrier spaced 1.4 times the symbol rate, up to +20 dBc.

15.8 Bit Error Rate Performance

15.8.1 Performance With Noise, Viterbi Decoder, and Closed Network

Required Eb/No

BER	BPSK and {O}QPSK			2/3 8PSK
	1/2 Rate	3/4 Rate	7/8 Rate	
10^{-3}	3.8	4.9	6.1	-
10^{-4}	4.6	5.7	6.9	-
10^{-5}	5.3	6.4	7.6	-
10^{-6}	6.0	7.2	8.3	8.7
10^{-7}	6.6	7.9	8.9	9.5
10^{-8}	7.2	8.5	9.6	10.2

15.8.2 Performance with Noise, Viterbi Decoder, and Reed-Solomon (Optional)

Required Eb/No

BER	BPSK and {O}QPSK			2/3 8PSK
	1/2 Rate	3/4 Rate	7/8 Rate	
10^{-6}	4.1	5.6	6.7	6.1
10^{-7}	4.2	5.8	6.9	6.4
10^{-8}	4.4	6.0	7.1	6.6
10^{-10}	5.0	6.3	7.5	7.2

15.8.3 Performance With BPSK and {O}QPSK BER Performance

Required Eb/No

Eb/No (db) Specification	
BER	1/1
10^{-3}	8.0
10^{-4}	9.6
10^{-5}	10.8
10^{-6}	11.6
10^{-7}	12.4

15.8.4 Performance with Noise Turbo Product Codec (Optional)

Required Eb/No

	QPSK		BPSK		8PSK
BER	1/2 Rate	3/4 Rate	21/44 Rate	5/16 Rate	3/4 Rate
10^{-6}	3.0	3.9	2.8	*	7.0
10^{-7}	3.2	4.1	3.1	*	7.3
10^{-8}	3.5	4.3	3.3	*	7.6
10^{-9}	3.8	4.8	3.7	4.0	8.0

* 5/16 BPSK included for compatibility with other equipment but implementation limitations prohibit optimum performance at low Eb/No. Performance is virtually error free above 4dB Eb/No. performance below 4.0 dB Eb/No is not guaranteed for 5/16 BPSK.

15.8.5 Performance With Noise, 1544 kbps Sequential Decoder and Reed Solomon(Optional)

Required Eb/No

BPSK and QPSK			
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

Note: OQPSK with Sequential is not available.

15.8.6 Performance With Noise, 56 kbps Sequential Decoder (Optional)

Required Eb/No

BPSK and QPSK			
BER	1/2 Rate	3/4 Rate	7/8 Rate
10^{-3}		4.6	5.5
10^{-4}	4.1	5.1	6.1
10^{-5}	4.5	5.5	6.6
10^{-6}	5.0	5.9	7.3
10^{-7}	5.4	6.4	7.8
10^{-8}	5.8	6.8	8.4

Note: OQPSK with Sequential is not available.

15.8.7 Performance With Noise, 1544 kbps Sequential Decoder (Optional)

Required Eb/No

BPSK and QPSK			
BER	**1/2 Rate**	**3/4 Rate**	**7/8 Rate**
10^{-3}	4.8	5.2	6.0
10^{-4}	5.2	5.7	6.4
10^{-5}	5.6	6.1	6.9
10^{-6}	5.9	6.5	7.4
10^{-7}	6.3	7.0	7.9
10^{-8}	6.7	7.4	8.4

Note: OQPSK with Sequential is not available.

15.8.8 BER Threshold

1. The modem will have a programmable BER threshold function.
2. This allows the operator to set the threshold from 1.0 E-3 to 1.0 E-8.
3. The actions resulting from this alarm are detailed in the Monitored Faults section.

15.9 Acquisition Time

The acquisition times apply for QPSK only.

Viterbi 6 dB E_b/N_0 with ± 35 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 < 190 kbps	< 1 sec	95%
1/2	≥ 190 < 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 ± 35 kHz Frequency Uncertainty			
Code Rate	**Data Rate**	**T_{acq}**	**P (t < T_{acq})**
1/2	2.4 < 4.8 kbps	< 20 sec	95%
1/2	≥ 4.8 < 9.6 kbps	< 10 sec	95%
1/2	≥ 9.6 < 64 kbps	< 5 sec	95%
1/2	≥ 64 < 190 kbps	< 1 sec	95%
1/2	≥ 190 < 512 kbps	< 17 sec	95%
1/2	≥ 512 < 1000 kbps	< 2.5 sec	95%
1/2	≥ 1 < 2.5 Mbps	< 1 sec	95%
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	3 sec	95%
1/2	≥ 9.6 ≤ 64 kbps	2 sec	95%
1/2	≥ 64 ≤ 190 kbps	1 sec	95%
1/2	≥ 190 < 512 kbps	3 sec	95%
1/2	≥ 512 < 1000 kbps	2 sec	95%
1/2	≥ 1000 ≤ 25 Mbps	1 sec	95%

Note: Acquisition time with Turbo coding TBD.

15.9.1 Receive Carrier Acquisition Range

1. The modem will automatically lock to a correctly formatted carrier, which is within $\frac{\text{Acquisition Range}}{2}$ of the displayed RX frequency.
2. The operator can adjust the acquisition range from 0 to 1 MHz, in 1 Hz steps.
3. The operator can adjust the center of the acquisition range from -500 to +500 kHz, in 1 Hz steps.

15.9.2 Receive Carrier Reacquisition

1. The modem can be programmed to delay the acquisition process upon loss of lock. This will minimize the acquisition time for a brief loss of the carrier.
2. This delay can be programmed from 0 to 999 seconds in 1 second steps.

15.9.3 AGC Output

A programmable DC output, proportional to the receive signal level, is available at the rear panel at 10 mA maximum, 0 to 10V. Default levels are 0V for minimum signal level and 10V for maximum signal level. The low level (0V) can be programmed from 0 to 10V in 0.5V increments. The high level can be programmed from 0 to 10V in 0.5V increments.

15.9.4 Doppler Tracking Performance

The modem will track the Doppler shown below with less than 0.5 dB degradation for symbol rates ≥ 64 Ksym/s. The performance applies only to the QPSK rates 1/2, 3/4, and 7/8 with Viterbi decoding or Viterbi with Reed Solomon decoding.

•	Doppler Offset	15 Hz
•	Doppler Rate	20 Hz/sec
•	Doppler Acceleration	35 Hz/sec^2

The demodulator must lock to the carrier with Doppler applied. BER is measured after demodulator is locked to the carrier.
E_b/N_0 values in the table include the 0.5 dB added to account for degradation:

Error Criteria	QPSK 1/2	QPSK 3/4	QPSK 7/8	Coding
BER $\leq 10^{-6}$	6.5	7.7	8.8	Viterbi
4×10^{7} Bits with no Errors	6.5	7.7	8.8	Viterbi with Reed-Solomon

15.10 Interface Specifications

15.10.1 TX Clock Switching Due to Failure of Selected Clock

The modem will automatically switch the TX clock source to SCT internal on failure of terminal timing.

15.10.2 TX Clock Phase Adjustment

The operator can set the TX clock phase to Normal, Inverted, or Auto Mode.

15.10.3 TX Data Phase Adjustment

The operator can set the TX data phase to Normal or Inverted.

15.10.4 Transmit Clock Source

The transmit clock can be selected by the operator from the following sources.
Terrestrial. Must be ± 100 PPM of the programmed rate, ≤ 5% jitter.
SCT (internal). Same as selected frequency reference.

15.10.5 Send Clock Timing Source

The send clock timing output can be generated from the Frequency Reference (either via the front panel or remotely). In this mode, the send clock timing will have the accuracy of the selected internal or external reference.

1. If loop timing is selected, the send clock timing is referenced to the receive satellite clock. The RX and TX data rates must be programmed to the same value, and the send clock timing will have the accuracy of the receive satellite clock (± 100 PPM max).
2. If the Asymmetrical Loop Timing (ASLT) option is selected, either via the front panel or remotely, the send clock timing output is referenced to the receive satellite clock. The RX and TX data rates must be a multiple of 1 kHz if the data rate is ≥ 64 kbps and ≤ 5 Mbps, or a multiple of 600 Hz it the data rate is ≥ 2.5 kbps and < 64 Mbps.

15.10.6 Doppler/Plesiochronous Buffer Clock Source

The operator from the following sources can select the Doppler/Plesiochronous buffer clock reference.

- The RX satellite clock (Bypass Mode).
- The TX terrestrial clock (TT). Must be within ± 100 PPM of the nominal receive data rate. Or, with the Asymmetric Timing Option, it can be any multiple of 1 kHz as long as it is ≥ 64 kHz ≤ 5 MHz or any multiple of 600 Hz as long as it is ≥ 2.4 kHz ≤ 64 kHz.
- The external clock (Master Clock) input, must be within ± 100 PPM of the programmed value. Or, with the Asymmetric Timing Option, it can be any multiple of 1 kHz as long as it is ≥ 64 kHz ≤ 5 MHz or any multiple of 600 Hz as long as it is ≥ 2.4 kHz ≤ 64 kHz.
- SCT/Internal, ± 10 PPM or per high stability option.

15.10.7 RX Clock Switching Due to Failure of Selected Clock

The modem will automatically switch the receive clock source to RX satellite on failure of the selected clock.

15.10.8 RX Clock Phase Adjustment

The operator can set the RX clock phase to Normal or Inverted.

15.10.9 RX Clock Jitter

The RX clock will have less than 2% jitter RMS for a BER of 10-7 or less.

15.10.10 RX Data Phase Adjustment

The operator can set the RX data phase to Normal or Inverted.

15.10.11 Buffer Centering

The operator can set the buffer to 50%. The modem will automatically set the buffer to 50% after receive signal acquisition or a buffer overflow/underflow.

15.10.12 Receive Doppler/Plesiochronous Buffer Size

The receive Doppler buffer size can be set by the operator from:

1. Bypass.
2. 32 to 262144 bits, in 16 bit steps for all data rates.
3. Selectable in ms, from 1 to 99 in 1 ms steps, for data rates < 2.6 Mbps.
4. Selectable Frame Format G.704 or None.

15.10.13 Switch Faults

• **Modulator Fault**	Open collector output, 15V maximum, 20 mA maximum current sink, fault is open circuit
• **Demodulator Fault**	Open collector output, 15V maximum, 20 mA maximum current sink, fault is open circuit

15.11 Decoding

15.11.1 BPSK Decoding

Using vector analysis of the constellation pattern, BPSK represents one symbol with the carrier phase either at 0° or 180°. The characteristics for BPSK are provided in the following table.

Code Rate	Symbols/Bit	Bits/Hz
1/1	1	2
1/2	2	0.5
5/16	3.2	0.3125
21/44	2.1	0.477

15.11.2 QPSK Decoding

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

4.8 kbps to 2.5 Mbps (1/2 rate)
7.2 kbps to 3.75 Mbps (3/4 rate)
8.4 kbps to 4.375 Mbps (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 provide the desired input/output bit rates.

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

15.11.3 OQPSK Decoding (Optional)

The demodulator 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 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

15.11.4 8PSK Decoding

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

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 rate encoding provides the desired input/output bit rates.

Code Rate	Symbol/Bit	Bit/s Hz
2/3	1.5	2
3/4	1.333	2.25

15.12 Terrestrial Interface Types

The following interface types are available with electrical properties indicated in the following subsections:

Modem Configuration	EIA-232	EIA-422/ EIA-449	V.35	Overhead	G.703
25-pin Connector	X	X	X		
34-pin Connector			X		
37-pin Connector		X			
50-pin Connector	X	X	X	X	X
50-pin Connector (Optional)	X	X	X		

G.703: BNC-F and DB-9.DB9 for ASYNC

15.12.1 EIA-232 Specification

Circuit Supported	TXD, TXC, ST, RXD, RXC, DSR, DCD, CTS, LL, RTS, MC
Driver Amplitude (RXD, RXC, ST, CTS, DM, DSR)	0 / Space / ON (True): 10V, ± 5V 1 / Mark / OFF (False): -10V, ± 5V
Receiver Amplitude (TXD, TXC, RTS, LL, MC)	0 / Space / ON (True): Minimum +1V 1 / Mark / OFF (False): Maximum -1V
Impedance	5000, ± 2000Ω < 2500 pF
Data Rate	9.6 to 120 kbps

TXD	Send Data
RXD	Receive Data
RTS	Request to Send
CTS	Clear to Send
DM	Data Mode
DSR	Receiver Ready
MC	Master Clock
LL	Local Loopback
ST	Send Timing
RXC	Receive Timing
TXC	Terminal Timing
MF	Mod Fault (TTL)
DF	Demod Fault (TTL)

15.12.2 V.35 Specification V.10, V.11 Specification, Circuit Supported

Circuit Supported	SD, SCT, SCTE, RD, SCR, DSR, RLSD, RTS, CTS, MC, DSR, LL
Driver Amplitude (RD, SCR, SCTE, CTS, RLSD, DSR, SCTE)	± 0.5V-PK, ± 20% differential, into 100Ω
Amplitude (SCT, SD, RTS, LL, MC)	± 0.2V Minimum into 100Ω
Polarity (SD, SCT, SCTE, RD, SCR)	1 (True) when B positive with respect to A 0 (False) when A positive with respect to B
Polarity (RTS, CTS, DSR, RLSD)	1 (True) when < -0.2V with respect to ground 0 (False) when > +0.2V with respect to ground
Phasing (SCTE, SCR)	0 to 1 (False-to-True) transition nominally in center of data bit
Symmetry (SCT, SCTE, SCR)	50%, ± 5%

SD-A, SD-B	Send Data
SCT-A, SCT-B	Serial Clock Transmit
RD-A, RD-B	Receive Data
SCR-A, SCR-B	Serial Clock Receive
SCTE-A, SCTE-B	Transmitter Signal Timing
MC-A, MC-B	Master Clock
RTS	Request to Send
CTS	Clear to Send
DSR	Data Set Ready
RLSD	Receive Line Signal Detect
LL	Local Loopback
MF	Mod Fault (ttl)
DF	Demod Fault (ttl)

Note: All other specifications are per CCITT V.10 and V.11.

15.12.3 EIA-449/EIA-422 Mil-188-114A 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)	< 100Ω, differential
Impedance (SD, TT, MC)	4k Ω 1 / Mark / OFF (True) when B is positive with respect to A 0 / Space / ON (False) when A is positive with respect to B
Phasing (RD, RT)	0 to 1 (False-to-true) transition of RT nominally in center of RD data bit
Symmetry (ST, TT, RT)	50% ± 5%

SD-A, SD-B	Send Data
ST-A, ST-B	Send Timing
RD-A, RD-B	Receive Data
RS-A, RS-B	Request to Send
RT-A, RT-B	Receive Timing
CS-A, CS-B	Clear to Send
DM-A, DM-B	Data Mode
RR-A, RR-B	Receiver Ready
TT-A, TT-B	Terminal Timing
MC-A, MC-B	Master Clock
MF	Mod Fault (ttl)
DF	Demod Fault (ttl)

15.12.4 Optional G.703 with ASYNC (Requires optional Overhead Card)

ASYNC: See ASYNC Specifications.

Primary Data Circuits Supported	T1 SD, RD E1 SD, RD
Interface Type	Transformer coupled symmetrical pair
Data Rates	T1 1544 kbps, ± 100 bit/s E1 2048 kbps, ± 130 bit/s
Pulse Width	T1 324, ± 50 Ns E1 244, ± 25 Ns
SD Amplitude	T1 3V +0.3/-1.5V-pk into 100Ω E1 3V +0.3/-1.5V-pk into 120Ω
RD Amplitude	T1 3V +0.3/-1.5V-pk into 100Ω E1 3V +0.3/-1.5V-pk into 120Ω
Pulse Mask	T1 G.703.2 E1 G.703.6
Jitter Attenuation	T1 G.824 E1 G.823
Line Code	AMI (T1 or E1) B8ZS (T1 only) HDB3 (E1 only)

15.13 Asynchronous Overhead Specification (Optional)

The operator can select EIA-232 or EIA-485 for both the transmit and receive asynchronous overhead data type.

Primary Data Rates Supported	
G.703	1544 kbps SD, RD 2048 kbps SD, RD
EIA-422	9.6 kbps to 2.048 Mbps
V.35	9.6 kbps to 2.048 Mbps
EIA-232	9.6 kbps to 120 kbps
Asynchronous ESC	
Maximum Data Rate	1.875% of primary data rate
Channel Interface	EIA-232 2-wire EIA-485 half-duplex / 4-wire EIA-485 full-duplex
Connector	25-pin D on breakout panel (UB-300)
Available Baud Rates	110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 bit/s
Protocol Format	5, 6, 7, or 8 data bits Even, odd, or no parity 1 or 2 stop bits
EIA-232 Specification	
Circuits Supported	SD, RD (RTS, CTS connected by break-out panel)
Amplitude (RD, CTS)	0 / Space / ON (True): 10V, ± 5V 1 / Mark / OFF (False): -10V, ± 5V
Amplitude (SD, RTS)	0 / Space / ON (True): Minimum +1V 1 / Mark / OFF (False): Maximum -11V
Impedance	5000, ± 2000Ω < 2500 pF
EIA-485 Specification	
Circuits Supported	SD, RD (differential pair)
Amplitude	-7 to +12V from either A or B terminals to ground Mark (logic 1): A is negative with respect to B Space (logic 0): A is positive with respect to B 1.5 to 5V differential between A and B terminals
AUPC Specification	
Target Power Levels	-5 to -30 dBm (+5 to -20 dBm for high power option)
Target Eb/N0 Level	3.2 to 16.0 dB in 0.1 dB steps
Tracking Rate	0.5 to 6.0 dB/min in 0.5 dB/min steps
Local and Remote Carrier Loss Setting (local has priority)	Maximum - go to highest power output level Nominal - go to preprogrammed output level Hold - no action
AUPC Test Modes	2047 test pattern for remote BER monitoring Remote baseband loopback test

15.13.1 Asynchronous Baud Rates

The operator can select the following baud rates for both the TX and RX asynchronous overhead.

110	**2400**
150	**4800**
300	**9600**
600	**19200**
1200	**38400**

15.13.2 Asynchronous Overhead Data Format

The operator can select the following data formats for both the TX and RX asynchronous overhead.

Word Length	Stop Bits	Parity
5, 6, 7, or 8 bits	1 or 2 bits	Odd, Even, or None

15.13.3 Asynchronous Overhead Parameters

Table 15-10. ASYNC Overhead Parameters

Local Automatic Uplink Power Control (AUPC)	AUPC functions are available through the use of the optional Async overhead channel or the optional Reed-Solomon cards. The operator can select local AUPC to be enabled or disabled.
AUPC Power Levels	The operator can select from 0 to -40 dBm in 0.5 dBm steps, for the nominal, minimum, and maximum transmit power levels. Changes in the power level shall not interrupt the carrier.
AUPC Target Noise Level	The operator can select the E_b/N_0 target setpoint from 3.2 to 16.0 dB in 0.1 dBm steps.
AUPC Tracking Rate	The operator can select the maximum tracking rate from 0.5 to 6.0 dBm/minute in 0.5 dBm/minute steps.
AUPC Carrier Loss Action	The operator can select transmit power level to Maximum, Nominal, or Hold for both local and remote carrier loss. Note: Local carrier loss has priority over remote carrier loss.
Remote AUPC	The operator can select remote AUPC to be enabled or disabled. The operator can also select a remote transmit 2047 test pattern and a remote baseband loopback to be enabled or disabled. The operator can monitor the remote AUPC 2047 bit error rate.

15.13.4 AUPC with Reed-Solomon Option

The AUPC function is supported, without the overhead card when the Reed-Solomon card is installed. The ASYNC overhead channel is not supported by the AUPC on the Reed-Solomon card.

Note: The ASYNC requires the overhead card.

15.13.5 Turbo AUPC

Self monitoring AUPC is provided.

15.14 IBS (Optional with Overhead Card)

Primary Data Rates Supported	
G.703 EIA-422 V.35	1544 kbps SD, RD 2048 kbps SD, RD N x 64 kbps SD, RD (up to 2048 kbps) N x 64 kbps SD, RD (up to 2048 kbps)
Engineering Service Channel	
Earth Station-to-Earth Station Channel	EIA-232 data synchronous at 1/512 of the primary data EIA-232 data asynchronous at 1/2000 of the primary data
EIA-232 Specification	
Circuit Supported	SD, ST, RD, RT, DSR (RTS, CTS connected by break-out panel)
Amplitude (RD, RT, CTS, ASR)	True: 10V, ± 5V False: -10V, ± 5V
Amplitude (SD, ST, RTS)	True: Minimum +1V False: Maximum -11V
Impedance	5000, ± 2000Ω < 2500 pF
Faults and Alarms	
Satellite Backward Alarm	1 (per IESS-309)
Receive BWA Output	Enabled onto terrestrial secondary alarm

15.14.1 IBS Primary Data Interfaces

G.703	Accepts and outputs primary data through the 50-pin connector using G.703. The data rate must be at T1 or E1 rates only.
EIA-422	Accepts and outputs primary data through the 50-pin connector using EIA-422. The data rate must be at data rate multiples of 64 kbps up to a maximum of 2048 kbps.
V.35	Accepts and outputs primary data through the 50-pin connector using EIA-422. The data rate must be at data rate multiples of 64 kbps up to a maximum of 2048 kbps.

15.14.2 IBS Clock and Dejitter

Performs clock and data recovery on the G.703 format. Clock dejitter and data encoding/decoding is done as with the IDR configuration.

15.14.3 IBS Framing

Multiplexes/demultiplexes the primary data in compliance with the standard IESS-309 overhead ratio of 1/15 (4 overhead bytes per 60 data bytes) and provides the rate exchanged transmit clock to the modulator portion of the base modem.

15.14.4 IBS Engineering Service Channel

Bi-directional processing of the components of the ESC channel, including the asynchronous or synchronous EIA-232 data channel, and fault/alarm indications.

15.14.5 IBS Scrambling

Provides the synchronous scrambling/descrambling of the satellite-framed data specified in IESS-309. Base modem scrambling/descrambling is assumed to be disabled in this mode.

15.15 Drop and Insert (Optional with Overhead Card)

Primary Data Rates Supported	
G.703	1544 kbps SD, RD, DDO, IDI 2048 kbps SD, RD, DDO, IDI
Satellite Data Rates Supported (all have 16/15 overhead)	N x 64 kbps N = 1-6, 8, 10, 12, 15, 16, 20, or 24 (T1) (add 9 or 18 for T1, using special IBS superframe) N = 1-6, 8, 10, 12, 15, 16, 20, 24, or 30 (E1_CCS) N = 1, 2, 4, 6, 8, 12, 16, 24, 30 (E1_CAS)
Terrestrial Framing Supported	G.732 / G.733, G.704
Satellite Overhead Rate	16/15 of data rate per IESS-308 Rev. 6 and IESS-309 Rev. 3, or higher
Timeslot Selection Range	1 to 24 (all T1 modes) 1 to 30 (E1_CAS and E1_CCS) 1 to 31 (E1_31TS) Arbitrary order, non-contiguous available
Plesiochronous Buffer Sizes	7.5, 15, and 30 ms (E1_CAS) 6, 12, 24, and 30 ms (T1_S, and T1_ESF_S) 1, 2, 4, 8, 16, and 32 ms (all other modes)
Buffer Clock Reference	Derived from Insert Data In (Insert Clock) External (EIA-422) SCT from modulator
Asynchronous Engineering Service Channel	
ESC Data Interface Type	EIA-232, Asynchronous
ESC Data Rate	1/2000 of primary data rate
ESC Data Circuits Supported	SD, RD, DSR
Synchronous Engineering Service Channel	
ESC Data Interface Type	EIA-232, synchronous to primary data
ESC Data Rate	1/512 of primary data rate
ESC Data Circuits Supported	SD, ST, RD, RT, DSR
Faults and Alarms	
Satellite Backward Alarms	1 (per IESS-309)
Receive BWA Output	Enabled onto secondary alarm

15.15.1 D&I Primary Data Interfaces

When configured for D&I operation, multiplexing/demultiplexing follows the IBS satellite frame structure and ESC features, but with the following changes:

- Accepts and outputs primary data through the 50-pin connector using G.703. The data rate must be at T1 or E1 rates only.
- This includes additional links for Drop Data Out and Insert Data In. Clock recovery, dejitter, and encoding/decoding are performed as before.

15.15.2 D&I Framing

The IBS satellite framing/deframing is applied only to selected time slots of the data's G.704 terrestrial structure.

15.16 IDR (Optional with Overhead Card)

Primary Data Rates Supported	
G.703	1544 kbps SD, RD 2048 kbps SD, RD
Engineering Service Channel	
ESC Audio	2 duplex ADPCM channels
Audio Encoding	CCITT G.721
Audio Interface Type	600Ω transformer-balanced 4-wire
Audio Input Level	-20 to +10 dBm for 0 dBm, 1 dB steps
Audio Output Level	-20 to +10 dBm for 0 dBm, 1 dB steps
Audio Filtering	Internal 300 to 3400 Hz input and output
ESC Data Interface Type	EIA-422
ESC Data Rate	8 kbps, also 64 kbps if ADPCM audio is not used
ESC Data Circuits Supported	SD, ST, RD, RT, Octet in, Octet out
Data Signal Phasing	Per EIA-449, data changes on the rising clock transition, is sampled on the falling clock edge
Octet Timing	Octet high in with every 8th bit, aligns with frame bit d8
Faults and Alarms	
Backward Alarms Supported	4 input, 4 output
Backward Alarm Inputs	1KΩ pull up to +5V, set below 2V to clear
Backward Alarm Outputs	FORM C Relay, NO, NC, C
Demodulator Fault Relay	NO, C contacts available for backward alarm inputs
Deferred Maintenance Alarm	Open collector, high impedance if faulted, 15V maximum, 20 mA maximum

15.16.1 IDR Primary Data Interfaces

When configured for IDR operation, the board performs these functions:

- Receives and performs clock and data recovery on incoming G.703 T1 and E1 pseudo-ternary data.
- Clock dejitter is performed per G.823 and G.824, and any data decoding (AMI, B8Z5, or HDB3) required per G.703 is also done.

15.16.2 IDR Framing

Multiplexes in compliance with the standard IESS-308 96 kbps ESC overhead onto the data and provides both the data and rate exchanged clock to the modulator portion of the base modem.

- Performs the corresponding demultiplexing of RX satellite data received from the demodulator portion of the modem.
- Resulting G.703 data is optionally encoded (AMI, B8Z5, or HDB3) before being output on the 50-pin connector.

15.16.3 IDR Engineering Service Channel

Bi-directional processing of the components of the ESC channel, including the ADPCM audio channels, 8 kbps data channel, and fault indications specified by IESS-403 and IESS-308.

Option of using the ADPCM portion of the satellite overhead for a single 64 kbps ESC data channel in addition to (and with the same format as) the 8 kbps data channel.

15.16.4 Optional: Dual 32 Kpps ADPCM (2XASPCM Audio)

With this option, the two 32 kpps ADPCM voice Codecs provide a 64 kpps data stream in place of normal 64 kbps terrestrial data. This operating mode uses IBS 1/15 overhead framing.

15.17 System Specifications

15.17.1 Loopback Modes

The operator can select one of the following interface loopback test modes.

- Baseband: Near end and far end.
- Interface: Near end and far end (Reed-Solomon or Overhead only).

15.17.2 Test Modes

The following receive IF test modes are available.

IF loopback	Disconnects the IF input from the receive input connector and couples it to a sample of the transmit IF output. The IF output is not affected. Note: The TX and RX data rates must be the same for the modem to lock.
RF loopback	Sets the demodulator frequency to the same value as the modulator. For the modem to lock, an external IF loop must be provided. Note: The TX and RX data rates must be the same for the modem to lock.
BIST (Built in Self Test)	The modem has the ability to generate 2^11-1 (2047) PN data and pass the data through the Interface, Modulator and Demodulator sections of the modem. The modem can generate noise in the IF path to simulate a satellite environment. The true BER can then be measured by the modems built in BER monitor. The operator can invoke this feature on power up or and the result checked against specification and a fault is flagged if the unit fails. The feature can be turned off at the front panel if so desired to minimize initialization time. The RF output is off during this self-test.
2047 Pattern Generator (must have overhead card installed and activated)	Inserts an Industry Standard 2047 pattern in lieu of the transmit data stream.
2047 Pattern Monitor (must have overhead card installed and activated)	Monitors the RX data for 2047 pattern. If 2047 pattern is present, this test mode provides an indication of Bit Error Rate (BER). The RX data is not interrupted.

15.17.3 Remote Control

All modem functions can be controlled remotely through the remote connector on the rear panel. See the Remote Specification for the complete command and response structures and syntax.

Interface type:

- EIA-485 (4- or-2-wire) or EIA-232
- Baud Rate Range: 150 to 19.2 kbps
- ASCII characters
- 11 bits per character
    - 7 information bits, 1 parity bit (odd/even) or 8 information bits, no parity bit
    - 2 stop bits
    - 1 start bit

For exact remote control information, refer to the latest firmware appropriate for this piece of equipment.

15.17.4 Modem Remote Address

The modem will have the ability to be programmed for a remote address. This will range from 0 to 255. All other addresses are unique, and should not have more than one modem assigned on a given EIA-485/232 bus.

Note: The value of zero is defined as global.

15.17.5 Monitored Signals

The operator can display/read one of the following, continually updated, performance monitors.

- Receive signal level in the receive signal range ± 5dB accuracy
- Raw BER
- Corrected BER, range 1.0 E-3 to 1.0 E-12
- $E_b/N_{0,}$.1 dB resolution, ± 0.5 dB accuracy, range 2.0 to 16.0 dB
- RX frequency offset, 1 Hz resolution range -35 to +35 kHz
- Buffer fill status, 1% resolution, 1% to 99%
- Frame Errors or 2047 BER * Only when Overhead Board is installed
- BUC Current
- LNB Current
- TX Reed-Solomon n/k and interleaver depth
- RX Reed-Solomon n/k and interleaver depth

15.18 Stored Faults

All faults listed above will be stored in battery backed memory for up to 10 occurrences of each fault, along with the time and date of when the fault occurred, and, where applicable, when it cleared. All faults can be cleared by operator command.

15.19 Stored Configurations

Five memories are available for storing the current modem configuration. These are maintained through a power off cycle.

15.20 Interoperability Modes

The modem shall have interoperability modes that allow end-to-end operation with other modems in Closed Network modes.

Mode	P300	DMD 2400	CM 701	FDC[1]	CDM-550	CDM-600
Sequential						
BPSK 1/2	X	X	X	X	X	X
[2]QPSK 1/2, 7/8	X	X	X	X	X	X
QPSK 3/4	X	N/A	N/A	N/A	X	X
8PSK 2/3	X	N/A	N/A	N/A	N/A	X
Viterbi						
BPSK 1/2	X	X	X	X	X	X
QPSK 1/2, 3/4, 7/8	X	X	X	X	X	X
8PSK 2/3	X	N/A	N/A	N/A	N/A	X
Viterbi with Reed-Solomon						
BPSK 1/2	X	X	X	X	N/A	Open only
QPSK 1/2 3/4, 7/8	X	X	X	X	N/A	Open only
8PSK 2/3	X	X	X	X	N/A	Open only
Sequential with Reed-Solomon	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Turbo						
BPSK 21/44, 5/16	N/A	N/A	N/A	N/A	X	X
QPSK 1/2, 3/4	N/A	N/A	N/A	N/A	X	X
8PSK 3/4	N/A	N/A	N/A	N/A	N/A	X

[1] Maintain existing _ No new development.

[2] Sequential QPSK 3/4 is excluded for Radyne Comstream.

Chapter 16. BUC FSK COMMUNICATIONS

16.1 Introduction

The modulator includes capability to communicate with an ODU Block Up Converter (BUC) using an FSK signal multiplexed onto the IF output connector along with the TX IF signal, 10 MHX reference, and DC power to the BUC. The M&C implements commands to control BUC functions and to query the BUC for configuration or status information.

FSK Transmitter	
Frequency	650 kHz ± 5 %
FSK Deviation	± 60 kHz nominal (+60 kHz mark)
Deviation Tolerance	± 50 kHz minimum, ± 70 kHz maximum
Output Level	-5 to –15 dBm
Start Tone Time	10 ms minimum
Output Impedance	50 Ω
Start Time	710 kHz
FSK Receiver	
Locking Range	± 32.5 kHz
Input Sensitivity	-15 dBm (50Ω)
Transmission Protocol	
Baud Rate	9600 bps
Data Bits	8
Parity	None
Stop Bits	1
Message Rate	1 every 40 msec
BUC Response Time	12 msec, typical
Maximum Response Time	40 msec
Note: If the BUC does not respond within the maximum response time the IDU should cyclically repeat the command.	

On power-up, the TX carrier is Off until the BUC is commanded to turn the carrier on (unless the unit is commanded into the power On mode at the factory). The BUC does not allow the carrier to be turned On unless the PLL is locked, and automatically turns the carrier Off in the event the PLL goes out-of-lock. If the PLL then comes back into lock, the BUC restores the carrier to the most recent requested state by the IDU. The carrier enable/disable function is implemented by switching On/Off the switched regulators of the BUC amplifier chains (a “sleep mode”).

The BUC is equipped with a calibrated power sensor for measuring the power delivered to the antenna for rated output to 20 dB backed off. This value, in dBm, is available via the M&C for power level monitoring and AGC.

Refer to BUC manufacturer specifications for reported power accuracy.

16.1.1 Transmission Interface

Each transmitted data packet consists of 7 bytes of information. The BUC only accepts a command if the first data byte contains the appropriate address. Commands are only executed if the checksum coincides, but a status response is sent if the address is correct and the command number is within the valid range.

16.2 Message Structure

16.2.1 Command Message Structure (IDU to ODU)

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 to 0x0f
2	Command	Request Status TX On/Off Change Address Set Carrier Frequency	0x01 0x02 0x03 0x04
3	Data Byte 1	Not used if command: = 0x01 TX control if command: = 0x02 New address if command: = 0x03 Carrier Frequency if command: = 0x04	0xAA 0=Off, 1=On 0x01 to 0x0f MSbyte
4	Data Byte 2	Not used if command: = 0x01 Not used if command: = 0x02 Not used if command: = 0x03 Carrier Frequency if command: = 0x04	0XAA 0xAA 0xAA LSbyte
5	Data Byte 3	Not Used	0xAA
6	Data Byte 4	Not Used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

16.2.2 Response Message Structure (BUC to IDU)

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 to 0xf0
2	Level Byte 1	MSbyte of TX output power	
3	Level Byte 2	LSbyte of TX output power	
4	Temperature	Temperature in °C	
5	Status Byte 1	Bit 0: Temperature out-of-range Bit 1: PLL out-of-lock Bit 2: Checksum error Bit 3: TX Status Bits 4 thru 7: Power Class	1: OOR, 0: Normal 1: OOL, 0: Normal 1: error in command message, 0: Normal 1: TX ON, 0: TX Off 0x1 to 0xf
6	Status Byte 2	Bits 0 – 3: Not used Bits 4 –7: Software version	0xAA 0x0 to 0xf
7	Checksum	Algebraic sum of bytes 1 - 6	

Data Field Definitions

TX Power Level	Unsigned integer in 1/100 dBm
Carrier Frequency	Unsigned integer in MHz.
Termperature	Signed character in °C

16.3 Power Class

Includes all power levels for C- and Ku-Bands.

Value	Power
0x1	2 watt
0x2	4 watt
0x3	5 watt
0x4	8 watt
0x5	10 watt
0x6	16 watt
0x7	20 watt
0x8	25 watt
0x9	40 watt
0xa	60 watt

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Appendix A. REMOTE CONTROL OPERATION

This appendix describes the remote control operation of the SDM-300L3.

Firmware number:	FW/8460-1M
Software version:	2.1.12

Note: The firmware referenced in this manual may be an earlier version of the actual firmware supplied with the unit.

A.1 General

Remote controls and status information are transferred via an EIA-485 or EIA-232 serial communications link menu selection.

Commands and data are transferred on the remote control communications link as US ASCII-encoded character strings.

The remote control port baud rates can be selected from 110 to 38400 kbps.

The remote communications link is operated in a half-duplex mode.

Communications on the remote link are initiated by a remote controller or terminal. The modem never transmits data on the link unless it is commanded to do so.

The modem must be placed in Remote Mode by entering the REM command prior to performing a configuration change.

A.2 Message Structure

The ASCII character format used requires 11 bits/character:

- 1 start bit
- Information and Parity bits (select one)
- 7 information bits and 1 parity bit (Odd/Even) or 8 information bits (None)
- 2 stop bits

Messages on the remote link fall into the categories of commands and responses. Commands are messages which are transmitted to a satellite modem, while responses are messages returned by a satellite modem in response to a command.
The general message structure is as follows:

- Start Character
- Device Address
- Command/Response
- End of Message Character

A.2.1 Start Character

A single character precedes all messages transmitted on the remote link. This character flags the start of a message. This character is:

“<” for commands
“>” for responses

A.2.2 Device Address

The device address is the address of the one satellite modem which is designated to receive a transmitted command, or which is responding to a command.
Valid device addresses are 1 to 3 characters long, and in the range of 1 to 255.

Note: Address 0 is reserved as a global address which simultaneously addresses all devices on a given communications link. Devices do not acknowledge global commands.
Each satellite modem which is connected to a common remote communications link must be assigned its own unique address. Addresses are software selectable at the modem, and must be in the range of 1 to 255.

A.2.3 Command/Response

The command/response portion of the message contains a variable-length character sequence which conveys command and response data.
If a satellite modem receives a message addressed to it which does not match the established protocol or cannot be implemented, a negative acknowledgment message is sent in response. This message is:

```
>add/?ER1_parity error'cr''lf']
```

(Error message for received parity errors.)

```
>add/?ER2_invalid parameter'cr''lf']
```

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

```
>add/?ER3_unrecognizable
command'cr''lf']
```

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

```
>add/?ER4_modem in local
mode'cr''lf']
```

(Modem in local error; send the REM command to go to remote mode.)

```
>add/?ER5_hard coded
parameter'cr''lf']
```

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

Note: "add" is used to indicate a valid 1 to 3 character device address in the range between 1 and 255.

Example: Command: <3/REM_
Response: >3/REM_

A.2.4 End Character

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

"cr" Carriage return character for commands
"]" End bracket for responses

A.3 Configuration Commands/Responses

A.3.1 Modulator Configuration Commands

Modulator Frequency	Command: Response: Status: Response:	<add/MF_nnnnn.nnnn'cr' >add/MF_nnnnn.nnnn'cr' RF_OFF'cr''lf'] <add/MF_'cr' >add/MF_nnnnn.nnnn'cr''lf']	Where: nnnnn.nnnn = Frequency in MHz, 950.0000 to 1750.0000 in 100 Hz steps for non-terminal frequency display. For terminal frequency mode, the range will be determined by the LO frequency and high/low Mix of the ODU. Note: When the modulator frequency is programmed, the RF output is switched off.
RF Output (IF Output)	Command: Response: Status: Response:	<add/RF_xxx'cr' >add/RF_xxx'cr''lf'] <add/RF_'cr' >add/RF_xxx'cr''lf']	Where: xxx = ON or OFF.
Modulator Rate Preset Assignment	Command: Response: Status: Response:	<add/AMRx_nnnn_mmmm.mmm'cr' >add/AMRx_nnnn_mmmm.mmm'cr''lf'] <add/AMRx_'cr' >add/AMRx_nnnn_mmmm.mmm'cr''lf']	Where: x = A, B, C, D, or V [preset designator]. nnnn = 1/2 (QPSK ½ Turbo and non-Turbo), [coder rate], 3/4 (QPSK 3/4 Turbo and non-Turbo), 7/8 (QPSK 7/8), BP12 (BPSK ½), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2Turbo and non-Turbo), OQ34 (OQPSK 3/4 Turbo and non-Turbo), OQ78 (OQPSK 7/8), BPSK (BPSK1/1 Turbo and non-Turbo), QPSK (QPSK 1/1 Turbo and non-Turbo), OQSK (OQPSK 1/1 Turbo, and non-Turbo), 2144 (BPSK 21/44 Turbo Only), B516 (BPSK 5/16 Turbo Only), and 8P34 (8PSK 3/4 Turbo Only). mmmm.mmm = Data rate in kHz.
Modulator Rate Preset Selection	Command: Response: Status:	<add/SMRx_'cr' >add/SMRx_'cr' RF_OFF'cr''lf'] See MR command.	Where: x = A, B, C, D, or V (preset designator). Note: Setting the modulator rate turns off the RF transmitter.
Modulator Rate Variable Assignment & Selection	Command: Response: Status:	<add/SMRV_nnnn_mmmm.mmm'cr' >add/SMRV_nnnn_mmmm.mmm'cr' RF_OFF'cr''lf'] See MR command.	Where: mmmm.mmm = Data rate in kHz. nnnn = 1/2 (QPSK ½ Turbo and non-Turbo), [coder rate], 3/4 (QPSK 3/4 Turbo and non-Turbo), 7/8 (QPSK 7/8), BP12 (BPSK 1/2), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2 Turbo and non-Turbo), OQ34 (OQPSK 3/4Turbo and non-Turbo), OQ78 (OQPSK 7/8), BPSK (BPSK1/1 Turbo and non-Turbo), QPSK (QPSK 1/1 Turbo and non-Turbo), OQSK (OQPSK 1/1 Turbo, and non-Turbo), 2144 (BPSK 21/44 Turbo Only), B516 (BPSK 5/16 Turbo Only), and 8P34 (8PSK 3/4 Turbo Only). Note: Setting the modulator turns off the RF transmitter.
Set Modulator Power Offset	Command: Response: Status: Response:	<add/MPO_snn.n'cr' >add/MPO_snn.n'cr''lf'] <add/MPO_'cr' >add/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	Command: Response:	<add/MOP_snn.n'cr' >add/MOP_snn.n'cr''lf']	Where: snn.n = -30.0 to –5.0, in 0.1 steps (nominal range in dBm) for the non TX L-Band modem and –40.0 to 0.0, in 0.1 steps for the TX L-Band modem.

Power Level	Status: Response:	<add/MOP_'cr' >add/MOP_snn.n'cr''lf']	Notes: 1. The nominal power range is modified relative to the value specified by the modulator power offset (MPO_). 2. The MOP_ command will return status only when local AUPC is enabled.
Scrambler Enable	Command: Response: Status: Response:	<add/SE_xxx'cr' >add/SE_xxx'cr''lf'] <add/SE_'cr' >add/SE_xxx'cr''lf']	Where: xxx = ON or OFF.
Differential Encoder Enable	Command: Response: Status: Response:	<add/DENC_xxx'cr' >add/DENC_xxx'cr''lf'] <add/DENC_'cr' >add/DENC_xxx'cr''lf']	Where: xxx = ON or OFF.
Modulator Type	Command: Response: Status: Response:	<add/MT_xxxx'cr' >add/MT_xxxx'cr''lf'] <add/MT_'cr' >add/MT_xxxx'cr''lf']	Where: xxxx = INTL (INTELSAT OPEN NETWORK), EFD (EF DATA CLOSED NETWORK), CSC (COMSTREAM CLOSED NETWORK), FDC (FAIRCHILD CLOSED NETWORK), SDM51 (SDM51 COMPATIBLE).
Modulator Encoder Type	Command: Response: Status: Response:	<add/MET_xxx'cr' >add/MET_xxx'cr''lf'] <add/MET_'cr' >add/MET_xxx'cr''lf']	Where: xxx = VIT (K-7 VITERBI ENCODER), SEQ (SEQUENTIAL ENCODER) or TUR (TURBO).
Modem Reference Clock	Command: Response: Status: Response:	<add/MRC_xxxxx'cr' >add/MRC_xxxxx'cr''lf'] <add/MRC_'cr' >add/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:	<add/MSR_xxx'cr' >add/MSR_xxx'cr''lf'] <add/MSR_'cr' >add/MSR_xxx'cr''lf']	Where: xxx = NRM (normal spectrum), INV (inverted spectrum).
Reed-Solomon Encoder Enable	Command: Response: Status: Response:	<add/RSEN_xxx'cr' >add/RSEN_xxx'cr''lf'] <add/RSEN_'cr' >add/RSEN_xxx'cr''lf']	Where: xxx = ON or OFF.
Transmit BPSK Data Ordering	Command: Response: Status: Response:	<add/TDA_xxx'cr' >add/TDA_xxx'cr''lf'] <add/TDA_'cr' >add/TDA_xxx'cr''lf']	Where: xxx = NRM (STANDARD), INV (NON-STANDARD).
Carrier Only Mode	Command: Response: Status: Response:	<add/COM_xxxxxx'cr' >add/COM_xxxxxx'cr''lf'] <add/COM_'cr' >add/COM_xxxxxx'cr''lf']	Where: xxxxxx = OFF (NORMAL-MODULATED), DUAL (DUAL-CW), OFFSET (OFFSET-CW), CENTER (CENTER-CW).
Reed-Solomon Interleave Value	Command: Response: Status: Response:	<add/TRSI_xx'cr' >add/TRSI_xx'cr''lf'] <add/TRSI_'cr' >add/TRSI_xx'cr''lf']	Where: xx = 4, 8, or 16.
TX 8PSK 2/3 IESS-310 Operation	Command: Response: Status: Response:	<add/T310_xxx'cr' >add/T310_xxx'cr''lf'] <add/T310_'cr' >add/T310_xxx'cr''lf']	Where: xxx = ON or OFF.
TX FSK Output	Command: Response: Status: Response:	<add/FSK_xxx'cr' >add/FSK_xxx'cr''lf'] <add/FSK_'cr' >add/FSK_xxx'cr''lf']	Where: xxx = ON or OFF.

ODU Power	Command: Response: Status: Response:	<add/ODU_xxx'cr' >add/ODU_xxx'cr''lf'] <add/ODU_'cr' >add/ODU_xxx'cr''lf']	Where: xxx = ON or OFF.
ODU Reference Enable	Command: Response: Status: Response:	<add/ODUR_xxx'cr' >add/ODUR_xxx'cr''lf'] <add/ODUR_'cr' >add/ODUR_xxx'cr''lf']	Where: xxx = ON or OFF.
ODU Power Monitor Low Current Threshold	Command: Response: Status: Response:	<add/ODUL_xxxx'cr' >add/ODUL_xxxx'cr''lf'] <add/ODUL_'cr' >add/ODUL_xxxx'cr''lf']	Where: xxx = 0 to 4000 in 100 mA steps
ODU Power Monitor High Current Threshold	Command: Response: Status: Response:	<add/ODUH_xxxx'cr' >add/ODUH_xxxx'cr''lf'] <add/ODUH_'cr' >add/ODUH_xxxx'cr''lf']	Where: xxx = 0 to 4000 in 100 mA steps

A.3.2 Demodulator Configuration Commands

Set Demodulator Frequency	Command: Response: Status: Response:	<add/DF_nnnnn.nnnn'cr' >add/DF_nnnnn.nnnn'cr''lf'] <add/DF_'cr' >add/DF_nnnnn.nnnn'cr''lf']	Where: nnnnn.nnnn = Frequency in MHz, 950.0000 to 1750.0000 in 100 Hz steps steps for non-terminal frequency display. For terminal frequency mode, the range will be determined by the LO frequency and high/low Mix of the ODU.
Demodulator Rate Preset Assignment	Command: Response: Status: Response:	<add/ADRx_nnnn_mmmm.mmm'cr' >add/ADRx_nnnn_mmmm.mmm'cr''lf'] <add/ADRx_'cr' >add/ADRx_nnnn_mmmm.mmm'cr''lf']	Where: x = A, B, C, D, or V [preset designator]. nnnn = 1/2 (QPSK 1/2 Turbo and non-Turbo), [coder rate], 3/4 (QPSK 3/4Turbo and non-Turbo), 7/8 (QPSK 7/8), BP12 (BPSK 1/2), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2Turbo and non-Turbo), OQ34 (OQPSK 3/4 Turbo and non-Turbo), OQ78 (OQPSK 7/8), BPSK (BPSK1/1 Turbo and non-Turbo), QPSK (QPSK 1/1 Turbo and non-Turbo), OQSK (OQPSK 1/1 Turbo, and non-Turbo), 2144 (BPSK 21/44 Turbo Only), B516 (BPSK 5/16 Turbo Only), and 8P34 (8PSK 3/4 Turbo Only). mmmm.mmm = Data rate in kHz.
Demodulator Rate Preset Selection	Command: Response: Status:	<add/SDRx_'cr' >add/SDRx_'cr''lf'] See DR command.	Where: x = A, B, C, D, or V (preset designator).
Demodulator Rate Variable Assignment & Selection	Command: Response: Status:	<add/SDRV_nnnn_mmmm.mmm'cr' >add/SDRV_nnnn_mmmm.mmm'cr''lf'] See DR command.	Where: nnnn = 1/2 (QPSK 1/2 Turbo and non-Turbo), [coder rate], 3/4 (QPSK 3/4 Turbo and non-Turbo), 7/8 (QPSK 7/8), BP12 (BPSK ½), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2 Turbo and non-Turbo), OQ34 (OQPSK 3/4 Turbo and non-Turbo), OQ78 (OQPSK 7/8), BPSK (BPSK1/1 Turbo and non-Turbo), QPSK (QPSK 1/1 Turbo and non-Turbo), OQSK (OQPSK 1/1 Turbo, and non-Turbo), 2144 (BPSK 21/44 Turbo Only), B516 (BPSK 5/16 Turbo Only), and 8P34 (8PSK 3/4 Turbo Only). mmmm.mmm = Data rate in kHz

Descramble Enable	Command: Response: Status: Response:	<add/DE_xxx'cr' >add/DE_xxx'cr''lf'] <add/DE_'cr' >add/DE_xxx'cr''lf']	Where: xxx = ON or OFF.
Differential Decoder Enable	Command: Response: Status: Response:	<add/DDEC_xxx'cr' >add/DDEC_xxx'cr''lf'] <add/DDEC_'cr' >add/DDEC_xxx'cr''lf']	Where: xxx = ON or OFF.
IF Loopback TX L-Band modem	Command: Response: Status: Response:	<add/IFL_xxx'cr' >add/IFL_xxx'cr''lf'] <add/IFL_'cr' >add/IFL_xxx'cr''lf']	Where: xxx = ON or OFF.
Sweep Center Frequency	Command: Response: Status: Response:	<add/SCF_snnnnn'cr' >add/SCF_snnnnn'cr''lf'] <add/SCF_'cr' >add/SCF_snnnnn'cr''lf']	Where: snnnnn = -75000 to +75000, in 1 Hz steps.
Sweep Width Range	Command: Response: Status: Response:	<add/SWR_nnnnnn'cr' >add/SWR_nnnnnn'cr''lf'] <add/SWR_'cr' >add/SWR_nnnnnn'cr''lf']	Where: nnnnnn = 0 to 150000, in 1 Hz steps.
Sweep Reacquisi-tion	Command: Response: Status: Response:	<add/SR_xxx'cr' >add/SR_xxx'cr''lf'] <add/SR_'cr' >add/SR_xxx'cr''lf']	Where: xxx = 0 to 999 (number of seconds).
Bit Error Rate Threshold	Command: Response: Status: Response:	<add/BERT_xxxx'cr' >add/BERT_xxxx'cr''lf'] <add/BERT_'cr' >add/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:	<add/DT_xxxx'cr' >add/DT_xxxx'cr''lf'] <add/DT_'cr' >add/DT_xxxx'cr''lf']	Where: xxxx = INTL (INTELSAT OPEN NETWORK), EFD (EF DATA CLOSED NETWORK), CSC (COMSTREAM CLOSED NETWORK), FDC (FAIRCHILD CLOSED NETWORK).
Demodulator Decoder Type	Command: Response: Status: Response:	<add/DDT_xxx'cr' >add/DDT_xxx'cr''lf'] <add/DDT_'cr' >add/DDT_xxx'cr''lf']	Where: xxx = VIT (K-7 VITERBI ENCODER), SEQ (SEQUENTIAL ENCODER) or TUR (TURBO).
Demodulator Spectrum Rotation	Command: Response: Status: Response:	<add/DSR_xxx'cr' >add/DSR_xxx'cr''lf'] <add/DSR_'cr' >add/DSR_xxx'cr''lf']	Where: xxx = NRM (normal spectrum), INV (inverted spectrum).
Reed-Solomon Decoder Enable	Command: Response: Status: Response:	<add/RSDE_xxx'cr' >add/RSDE_xxx'cr'lf'] <add/RSDE_'cr' >add/RSDE_xxx'cr'lf']	Where: xxx = ON, OFF, or CORR_OFF.
Receive BPSK Data Ordering	Command: Response: Status: Response:	<add/RDA_xxx'cr' >add/RDA_xxx'cr''lf'] <add/RDA_xxx'cr' >add/RDA_xxx'cr''lf']	Where: xxx = NRM (STANDARD), INV (NON-STANDARD).
Reed-Solomon Interleave Value	Command: Response: Status: Response:	<add/RRSI_xx'cr' >add/RRSI_xx'cr''lf'] <add/RRSI_'cr' >add/RRSI_xx'cr''lf']	Where: xx = 4, 8, or 16.
RX 8PSK 2/3 IESS-310 Operation	Command: Response: Status: Response:	<add/R310_xxx'cr' >add/R310_xxx'cr''lf'] <add/R310_'cr' >add/R310_xxx'cr''lf']	Where: xxx = ON or OFF.
LNB Power	Command: Response: Status: Response:	<add/LNB_xxx'cr' >add/LNB_xxx'cr''lf'] <add/LNB_'cr' >add/LNB_xxx'cr''lf']	Where: xxx = ON or OFF.

LNB Voltage	Command: Response: Status: Response:	<add/LNBV_xxx'cr' >add/LNBV_xxx'cr''lf'] <add/LNBV_'cr' >add/LNBV_xxx'cr''lf']	Where: xxx = 13,18, or 24 Volts
LNB Reference Enable	Command: Response: Status: Response:	<add/LNBR_xxx'cr' >add/LNBR_xxx'cr''lf'] <add/LNBR_'cr' >add/LNBR_xxx'cr''lf']	Where: xxx = ON or OFF.
LNB Power Monitor Low Current Threshold	Command: Response: Status: Response:	<add/LNBL_xxx'cr' >add/LNBL_xxx'cr''lf'] <add/LNBL_'cr' >add/LNBL_xxx'cr''lf']	Where: xxx = 0 to 500 in 1 mA steps
LNB Power Monitor High Current Threshold	Command: Response: Status: Response:	<add/LNBH_xxx'cr' >add/LNBH_xxx'cr''lf'] <add/LNBH_'cr' >add/LNBH_xxx'cr''lf']	Where: xxx = 0 to 500 in 1 mA steps

A.3.3 Interface Configuration Commands

Interface Transmit Overhead Type	Command: Response: Status: Response:	<add/ITOT_xxxxx'cr' >add/ITOT_xxxxx'cr''lf'] <add/ITOT_'cr' >add/ITOT_xxxxx'cr''lf']	Where: xxxxx = NONE, IDR, IBS, DI, ASYNC, AUPC, or FLEX.
Interface Receive Overhead Type	Command: Response: Status: Response:	<add/IROT_xxxxx'cr' >add/IROT_xxxxx'cr''lf'] <add/IROT_'cr' >add/IROT_xxxxx'cr''lf']	Where: xxxxx = NONE, IDR, IBS, DI, ASYNC, AUPC, or FLEX.
TX Driver Type	Command: Response: Status: Response:	<add/TXDR_xxxxx'cr' >add/TXDR_xxxxx'cr''lf'] <add/TXDR_'cr' >add/TXDR_xxxxx'cr''lf']	Where: xxxxx = G703, V35, RS422, or RS232.
RX Driver Type	Command: Response: Status: Response:	<add/RXDR_xxxxx'cr' >add/RXDR_xxxxx'cr''lf'] <add/RXDR_'cr' >add/RXDR_xxxxx'cr''lf']	Where: xxxxx = G703, V35, RS422, or RS232.
Transmit Clock	Command: Response: Status: Response:	<add/TC_xxx'cr' >add/TC_xxx'cr''lf'] <add/TC_'cr' >add/TC_xxx'cr''lf']	Where: xxx = INT (internal SCT clock), EXT (external TX terrestrial clock), REF (external clock-reference frequency).
External Clock-Reference Frequency	Command: Response: Status: Response:	<add/ERF_nnnnn.n'cr' >add/ERF_nnnnn.n'cr''lf'] <add/ERF_'cr' >add/ERF_nnnnn.n'cr''lf']	Where: nnnnn.n = 8.0 to 10000.0 (external clock frequency in kHz).
Transmit Clock Phase	Command: Response: Status: Response:	<add/TCP_xxxx'cr' >add/TCP_xxxx'cr''lf'] <add/TCP_'cr' >add/TCP_xxxx'cr''lf']	Where: xxxx = NRM (normal clock phasing), INV (inverted clock phasing), AUTO (automatic clock phasing).
Buffer Clock	Command: Response: Status: Response:	<add/BC_xxx'cr' >add/BC_xxx'cr''lf'] <add/BC_'cr' >add/BC_xxx'cr''lf']	Where: xxx = INT (internal SCT clock), EXT (external TX terrestrial clock), SAT (receive satellite clock), REF (external clock-reference frequency), INS (insert clock).
Receive Clock Phase	Command: Response: Status: Response:	<add/RCP_xxx'cr' >add/RCP_xxx'cr''lf'] <add/RCP_'cr' >add/RCP_xxx'cr''lf']	Where: xxx = NRM (normal clock phasing), INV (inverted clock phasing).
Baseband Loopback	Command: Response: Status: Response:	<add/BBL_xxx'cr' >add/BBL_xxx'cr''lf'] <add/BBL_'cr' >add/BBL_xxx'cr''lf']	Where: xxx = ON or OFF.

Interface Loopback	Command: Response: Status: Response:	<add/ILB_xxx'cr' >add/ILB_xxx'cr''lf'] <add/ILB_'cr' >add/ILB_xxx'cr''lf']	Where: xxx = ON or OFF.
Interface Loop Timing	Command: Response: Status: Response:	<add/ILT_xxx'cr' >add/ILT_xxx'cr''lf'] <add/ILT_'cr' >add/ILT_xxx'cr''lf']	Where: xxx = ON or OFF.
Interface Buffer Size	Buffer size programming is supported in two formats; bits, or milli-seconds. The selected format must be chosen using the buffer programming command (IBP_). If the buffer is to be programmed in milli-seconds and plesiochronous slips are required use the receive framing structure command (IRFS_) to define the proper framing format. Note: For Drop & Insert: Only milli-seconds format is allowed.		
Interface Buffer Size (Bit Format)	Command: Response: Status: Response:	<add/IBS _nnnnnn'cr' >add/IBS _nnnnnn'cr''lf'] <add/IBS _'cr' >add/IBS _nnnnnn'cr''lf']	Where: nnnnnn = 32 to 262144, in 16 bit increments.
Interface Buffer Size (Milli-second Format)	Command: Response: Status: Response:	<add/IBS _nn'cr' >add/IBS _nn'cr''lf'] <add/IBS _'cr' >add/IBS _nn'cr''lf']	Where: nn = 0 to 99 (buffer size in milli-seconds). Note: For Drop & Insert: 1. nn = 7.5, 15, or 30 (milli-seconds) for E1CAS format. 2. nn = 6, 12, 24, or 30 (milli-seconds) for T1S/T1ESFS format. 3. nn = 1, 2, 4, 8, 16, or 32 (milli-seconds) for all other D&I formats.
Interface Buffer Center	Command: Response:	<add/IBC_'cr' >add/IBC_'cr''lf']	
Interface Buffer Program-ming	Command: Response: Status: Response:	<add/IBP_xxxx'cr' >add/IBP_xxxx'cr''lf'] <add/IBP_'cr' >add/IBP_xxxx'cr''lf']	Where: xxxx = BITS or MS (milli-seconds). Note: For Drop & Insert: Only milli-seconds format is allowed.
Interface Receive Farming Structure	Command: Response: Status: Response:	<add/IRFS_ff_ssss'cr' >add/IRFS_ff_ssss'cr''lf'] <add/IRFS_ff'cr' >add/IRFS_ff_ssss'cr''lf']	Where: ff = T1 or E1 (frame type). ssss = NONE or G704 (framing structure).
Interface Substitute Pattern	Command: Response: Status: Response:	<add/ISP_xxxxxx'cr' >add/ISP_xxxxxx'cr''lf'] <add/ISP_'cr' >add/ISP_xxxxxx'cr''lf'	Where: xxxxxx = ON or OFF. Note: Transmit 2047 Pattern.
Interface Read Error Select	Command: Response: Status: Response:	<add/IRE_xxxxxx'cr' >add/IRE_xxxxxx'cr''lf'] <add/IRE_'cr' >add/IRE_xxxxxx'cr''lf']	Where: xxxxxx = ON or OFF. Note: Receive 2047 Pattern.
Interface Coding Format Transmit	Command: Response: Status: Response:	<add/ICFT_xxxx'cr' >add/ICFT_xxxx'cr''lf'] <add/ICFT_'cr' >add/ICFT_xxxx'cr''lf']	Where: xxxx = AMI, HDB3, or B8ZS.
Interface Coding Format Receive	Command: Response: Status: Response:	<add/ICFR_xxxx'cr' >add/ICFR_xxxx'cr''lf'] <add/ICFR_'cr' >add/ICFR_xxxx'cr''lf']	Where: xxxx = AMI, HDB3, or B8ZS.
Transmit Data Fault	Command: Response: Status: Response:	<add/TDF_xxxx'cr' >add/TDF_xxxx'cr''lf'] <add/TDF_'cr' >add/TDF_xxxx'cr''lf']	Where: xxxx = NONE, DATA, or AIS.
Receive Data Fault	Command: Response: Status: Response:	<add/RDF_xxxx'cr' >add/RDF_xxxx'cr''lf'] <add/RDF_'cr' >add/RDF_xxxx'cr''lf']	Where: xxxx = NONE, DATA, or AIS.

Interface Service Channel Level	Command: Response: Status: Response:	<add/ISCL_xxx_snn'cr' >add/ISCL_xxx_snn'cr''lf'] <add/ISCL_xxx'cr' >add/ISCL_xxx_snn'cr''lf']	Where: xxx = TX1, TX2, RX1, or RX2 (service channel designator). nnn = -20 to +10 in steps of 1 (service channel level in dBm).
IDR Backward Alarm Enable	Command: Response: Status: Response:	<add/BW_xxx_nnn'cr' >add/BW_xxx_nnn'cr''lf'] <add/BW_xxx'cr' >add/BW_xxx_nnn'cr''lf']	Where: xxx = TX1, TX2, TX3, TX4, RX1, RX2, RX3, or RX4 (backward alarm designator). nnn = ON or OFF.
Drop Data Format	Command: Response: Status: Response:	<add/DDF_xxxxxx'cr' >add/DDF_xxxxxx'cr''lf'] <add/DDF_'cr' >add/DDF_xxxxxx'cr''lf']	Where: xxxxxx = T1, T1ESF, T1IBS, E1CCS, E1CAS, E1IBS, E131TS, T1S, or T1ESFS.
Insert Data Format	Command: Response: Status: Response:	<add/IDF_xxxxxx'cr' >add/IDF_xxxxxx'cr''lf'] <add/IDF_'cr' >add/IDF_xxxxxx'cr''lf']	Where: xxxxxx = T1, T1ESF, T1IBS, E1CCS, E1CAS, E1IBS, E131TS, T1S, or T1ESFS.
Insert E1 CRC Enable	Command: Response: Status: Response:	<add/ICRC_xxx'cr' >add/ICRC_xxx'cr''lf'] <add/ICRC_'cr' >add/ICRC_xxx'cr''lf']	Where: xxx = ON or OFF.
Drop Channels Assignment	Command: Response: Status: Response:	<add/DCA_dd;cc'cr' >add/DCA_dd;cc'cr''lf'] <add/DCA_dd'cr' >add/DCA_dd;cc'cr''lf']	Where: dd = 1 to N (over the satellite drop channel) N = (Modulator Data Rate) divided by (64 kbps). cc = 1 to 24 (terrestrial channel number for T1 data formats). cc = 1 to 31 (terrestrial time slot number for E1 data formats). Note: This command is not valid when the drop data format is specified as E1CAS and the modulator data rate is set to 1920.0 kbps.
Bulk Drop Channels Assignment	Command: Response: Status: Response:	<add/BDCA_dd;cc_dd;cc_dd;cc_dd;cc......'cr' >add/BDCA_dd;cc_dd;cc_dd;cc_dd;cc......'cr''lf'] <add/BDCA_'cr' >add/BDCA_dd;cc_dd;cc_dd;cc_dd;cc......'cr''lf']	Where: dd = 1 to N (over the satellite drop channel); where N = (modulator data rate) divided by (64 kbps). cc = 1 to 24 (terrestrial channel number for T1 data formats). cc = 1 to 31 (terrestrial time slot number for E1 data formats). Notes: 1. The status response returns programming information for 1 to N drop channels. 2. This command is not valid when the drop data format is specified as E1CAS and the modulator data rate is set to 1920.0 kbps.

Insert Channels Assignment	Command: Response: Status: Response:	<add/ICA_ii;cc'cr' >add/ICA_ii;cc'cr''lf'] <add/ICA_ii'cr' >add/ICA_ii;cc'cr''lf']	Where: ii = 1 to N (over the satellite insert channel); where N = (demodulator data rate) divided by (64 kbps). cc = 1 to 24 (terrestrial channel number for T1 data formats). cc = 1 to 31 (terrestrial time slot number for E1 data formats). cc = 0 if no insert is desired for the specified insert channel. Notes: 1. Time slot 16 (cc = 16) may not be specified when the insert data format is specified to be E1CAS. 2. This command is not valid when the insert data format is specified as E1CAS and the demodulator data rate is set to 1920.0 kbps.
Bulk Insert Channels Assignment	Command: Response: Status: Response:	<add/BICA_ii;cc_ii;cc_ii;cc_ii;cc......'cr' >add/BICA_ii;cc_ii;cc_ii;cc_ii;cc......'cr''lf'] <add/BICA_'cr' >add/BICA_ii;cc_ii;cc_ii;cc_ii;cc......'cr''lf']	Where: ii = 1 to N (over the satellite insert channel); where N = (modulator data rate) divided by (64 kbps). cc = 1 to 24 (terrestrial channel number for T1 data formats). cc = 1 to 31 (terrestrial time slot number for E1 data formats). cc = 0 if no insert is desired for the specified insert channel. Notes: 1. The status response returns programming information for 1 to N insert channels. 2. Time slot 16 (cc = 16) may not be specified when the insert data format is specified to be E1CAS. 3. This command is not valid when the insert data format is specified as E1CAS and the demodulator data rate is set to 1920.0 kbps.
ASYNC Transmit Overhead Baud Rate	Command: Response: Status: Response:	<add/TOBR_nnnnn'cr' >add/TOBR_nnnnn'cr''lf'] <add/TOBR_'cr' >add/TOBR_nnnnn'cr''lf']	Where: nnnnn = 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, or 38400. Note: TX ASYNC Overhead only.
ASYNC Receive Overhead Baud Rate	Command: Response: Status: Response:	<add/ROBR_nnnnn'cr' >add/ROBR_nnnnn'cr''lf'] <add/ROBR_'cr' >add/ROBR_nnnnn'cr''lf']	Where: nnnnn = 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, or 38400. Note: RX ASYNC Overhead only.
ASYNC Transmit Channel Character Length	Command: Response: Status: Response:	<add/TCCL_n'cr' >add/TCCL_n'cr''lf'] <add/TCCL_'cr' >add/TCCL_n'cr''lf']	Where: n = 5, 6, 7, or 8 (characters). Note: TX ASYNC Overhead only.
ASYNC Receive Channel Character Length	Command: Response: Status: Response:	<add/RCCL_n'cr' >add/RCCL_n'cr''lf'] <add/RCCL_'cr' >add/RCCL_n'cr''lf']	Where: n = 5, 6, 7, or 8 (characters). Note: RX ASYNC Overhead only.
ASYNC Transmit Channel Stop Bits	Command: Response: Status: Response:	<add/TCSB_n'cr' >add/TCSB_n'cr''lf'] <add/TCSB_'cr' >add/TCSB_n'cr''lf']	Where: n = 1 or 2 (stop bits). Note: TX ASYNC Overhead only.

ASYNC Receive Channel Stop Bits	Command: Response: Status: Response:	<add/RCSB_n'cr' >add/RCSB_n'cr''lf'] <add/RCSB_'cr' >add/RCSB_n'cr''lf']	Where: n = 1 or 2 (stop bits). Note: RX ASYNC Overhead only.
ASYNC Transmit Overhead Channel Parity	Command: Response: Status: Response:	<add/TOCP_xxxx'cr' >add/TOCP_xxxx'cr''lf'] <add/TOCP_'cr' >add/TOCP_xxxx'cr''lf']	Where: xxxx = ODD, EVEN, or NONE. Note: TX ASYNC Overhead only.
ASYNC Receive Overhead Channel Parity	Command: Response: Status: Response:	<add/ROCP_xxxx'cr' >add/ROCP_xxxx'cr''lf'] <add/ROCP_'cr' >add/ROCP_xxxx'cr''lf']	Where: xxxx = ODD, EVEN, or NONE. Note: RX ASYNC Overhead only.
ASYNC Transmit Communica tions Type	Command: Response: Status: Response:	<add/TCT_xxxxxxxx'cr' >add/TCT_xxxxxxxx'cr''lf'] <add/TCT_'cr' >add/TCT_xxxxxxxx'cr''lf']	Where: xxxxxxxx = RS232, RS485 (4- Wire), RS485_2W (2-Wire). Note: TX ASYNC Overhead only.
ASYNC Receive Communica tions Type	Command: Response: Status: Response:	<add/RCT_xxxxx'cr' >add/RCT_xxxxx'cr''lf'] <add/RCT_'cr' >add/RCT_xxxxx'cr''lf']	Where: xxxxx = RS232 or RS485. Note: RX ASYNC Overhead only.
Transmit Data Phase	Command: Response: Status: Response:	<add/TDP_xxxx'cr' >add/TDP_xxxx'cr''lf'] <add/TDP_'cr' >add/TDP_xxxx'cr''lf']	Where: xxxx = NRM (normal data phasing), INV (inverted data phasing).
Receive Data Phase	Command: Response: Status: Response:	<add/RDP_xxxx'cr' >add/RDP_xxxx'cr''lf'] <add/RDP_'cr' >add/RDP_xxxx'cr''lf']	Where: xxxx = NRM (normal data phasing), INV (inverted data phasing).
CTS Delay Time	Command: Response: Status: Response:	<add/CTSD_xx'cr' >add/CTSD_xx'cr''lf'] <add/CTSD_'cr' >add/CTSD_xx'cr''lf']	Where: xx = 0 to 60 (number of seconds).
IDR Transmit ESC Type	Command: Response: Status: Response:	<add/IDRT_xxxxx'cr' >add/IDRT_xxxxx'cr''lf'] <add/IDRT_'cr' >add/IDRT_xxxxx'cr''lf']	Where: xxxxx = DATA (64K DATA) or AUDIO (2x32K AUDIO). Note: TX IDR Overhead only.
IDR Receive ESC Type	Command: Response: Status: Response:	<add/IDRR_xxxxx'cr' >add/IDRR_xxxxx'cr''lf'] <add/IDRR_'cr' >add/IDRR_xxxxx'cr''lf']	Where: xxxxx = DATA (64K DATA) or AUDIO (2x32K AUDIO). Note: RX IDR Overhead only.
IBS Transmit ESC Type	Command: Response: Status: Response:	<add/IBST_xxxxx'cr' >add/IBST_xxxxx'cr''lf'] <add/IBST_'cr' >add/IBST_xxxxx'cr''lf']	Where: xxxxx = DATA (64K DATA) or AUDIO (2x32K AUDIO). Note: TX IBS Overhead only.
IBS Receive ESC Type	Command: Response: Status: Response:	<add/IBSR_xxxxx'cr' >add/IBSR_xxxxx'cr''lf'] <add/IBSR_'cr' >add/IBSR_xxxxx'cr''lf']	Where: xxxxx = DATA (64K DATA) or AUDIO (2x32K AUDIO). Note: RX IBS Overhead only.

A.3.4 System Configuration Commands

Time Of Day	Command: Response: Status: Response:	<add/TIME_hh:mmxx'cr' >add/TIME_hh:mmxx'cr''lf'] <add/TIME_'cr' >add/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:	<add/DATE_mm/dd/yyyy'cr' >add/DATE_mm/dd/yyyy'cr''lf'] <add/DATE_'cr' >add/DATE_mm/dd/yyyy'cr''lf']	Where: mm = 1 to 12 (month). dd = 1 to 31 (day). yyyy = 00 to 99 (year) in 2 - digit year mode, and 1975 to 1999 and 2000 to 2075 in 4 - digit mode.
Remote	Command: Response:	<add/REM_'cr' >add/REM_'cr''lf']	Configures the modem for remote operation. The SDM300L will respond to any status request at any time. However, the SDM300L must be in 'Remote Mode' to change configuration parameters.
Clear Stored Faults	Command: Response:	<add/CLSF_'cr' >add/CLSF_'cr''lf']	This command is used to clear all stored faults logged by the SDM300L.
Modem Operation Mode	Command: Response: Status: Response:	<add/MOM_xxxxxxx'cr' >add/MOM_xxxxxxx'cr''lf'] <add/MOM_'cr' >add/MOM_xxxxxxx'cr''lf']	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 and when receive only mode is selected, transmit faults are inhibited.
System Modem Type	Command: Response: Status: Response:	<add/SMT_xxxxxxx'cr' >add/SMT_xxxxxxx'cr''lf'] <add/SMT_'cr' >add/SMT_xxxxxxx'cr''lf']	Where: xxxxxx = IDR, IBS, DI, ASYNC, AUPC, EFD, VSAT, 309 or CUSTOM.
Save Modem Config.	Command: Response:	<add/SMC_n'cr' >add/SMC_n'cr''lf']	Where: n = 1, 2, 3, 4, or 5 (stored configuration number). This command saves the current modem configuration for recall at a later time using the 'RMC_' command. Up to five different modem configurations can be saved.
Recall Modem Config.	Command: Response:	<add/RMC_n'cr' >add/RMC_n'cr''lf']	Where: n = 1, 2, 3, 4, or 5 (stored configuration number). This command causes the modem to be reprogrammed with configuration parameters previously saved using the 'SMC_' command. One of five saved configurations can be specified.
Local Modem AUPC Mode	Command: Response: Status: Response:	<add/LMA_xxx'cr' >add/LMA_xxx'cr''lf'] <add/LMA_'cr' >add/LMA_xxx'cr''lf']	Where: xxx = ON or OFF. This command configures the modem for the LOCAL MODEM AUPC mode. When 'ON' is selected, the AUPC configuration can be entered.
RTS TX-IF Control Mode	Command: Response: Status: Response:	<add/RTSM_xxx'cr' >add/RTSM_xxx'cr''lf'] <add/RTSM_'cr' >add/RTSM_xxx'cr''lf']	Where: xxx = ON or OFF. 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 (also the TX-IF output has to be programmed ON and no major modulator faults are present). If 'OFF' is selected, the TX-IF output will operate normal ignoring the RTS signal.

RF Mode Control	Command: Response: Status: Response:	<add/RFMD_xxxx'cr' >add/RFMD_xxxx'cr''lf'] <add/RFMD_'cr' >add/RFMD_xxxx'cr''lf']	Where: xxxx = NRM (Normal Mode), PWR (Turn RF off on power up), COMM (Turn RF off on power up and loss of remote communications after 10 seconds), CD (Turn RF ON when carrier is detected, turn RF OFF when no carrier is detected. For the RF ON condition, the TX-IF must be programmed ON. Note: RTS TX-IF, when enabled over-rides CD). This command allows for the RF output to be enabled or disabled depending on the following described conditions. One application for this command will be in demand network systems.

A.3.5 Automatic Uplink Power Control (AUPC)

AUPC Local Enable	Command: Response: Status: Response:	<add/LPC_xxx'cr' >add/LPC_xxx'cr''lf'] <add/LPC_'cr' >add/LPC_xxx'cr''lf']	Where: xxx = ON or OFF. Notes: 1. When programmed ON, the MOP (Modulator Output Power) command is not allowed, only MOP status is allowed. 3. ASYNC or AUPC Overhead only.
AUPC Nominal Power Level	Command: Response: Status: Response:	<add/NOMP_snn.n'cr' >add/NOMP_snn.n'cr''lf'] <add/NOMP_'cr' >add/NOMP_snn.n'cr''lf']	Where: snn.n = -30.0 to -5.0, in 0.1 steps (nominal range in dBm). Notes: 1. The nominal power range is modified relative to the value specified by the modulator power offset (MPO_). 2. ASYNC or AUPC Overhead only.
AUPC Maximum Power Limit	Command: Response: Status: Response:	<add/MAXP_snn.n'cr' >add/MAXP_snn.n'cr''lf'] <add/MAXP_'cr' >add/MAXP_snn.n'cr''lf']	Where: snn.n = -30.0 to -5.0, in 0.1 steps (nominal range in dBm). Notes: 1. The nominal power range is modified relative to the value specified by the modulator power offset (MPO_). 2. ASYNC or AUPC Overhead only.
AUPC Minimum Power Limit	Command: Response: Status: Response:	<add/MINP_snn.n'cr' >add/MINP_snn.n'cr''lf'] <add/MINP_'cr' >add/MINP_snn.n'cr''lf']	Where: snn.n = -30.0 to -5.0, in 0.1 steps (nominal range in dBm). Notes: 1. The nominal power range is modified relative to the value specified by the modulator power offset (MPO_). 2. ASYNC or AUPC Overhead only.
AUPC Eb/N0 Target Set Point	Command: Response: Status: Response:	<add/ENSP_nn.n'cr' >add/ENSP_nn.n'cr''lf'] <add/ENSP_'cr' >add/ENSP_nn.n'cr''lf']	Where: nn.n = 3.2 to 16.0, in 0.1 increments (Eb/N0 in dB). Note: ASYNC or AUPC Overhead only.
AUPC Maximum Tracking Rate	Command: Response: Status: Response:	<add/MAXT_n.n'cr' >add/MAXT_n.n'cr''lf'] <add/MAXT_'cr' >add/MAXT_n.n'cr''lf']	Where: n.n = 0.5 to 6.0, in 0.5 increments (max tracking rate in dBm/minute). Note: ASYNC or AUPC Overhead only.

AUPC Local Carrier Loss Action	Command: Response: Status: Response:	<add/LCL_xxxx'cr' >add/LCL_xxxx'cr''lf'] <add/LCL_'cr' >add/LCL_xxxx'cr''lf']	Where: xxxx = HOLD, NOM, or MAX (power level setting when local carrier loss). Note: ASYNC or AUPC Overhead only.
AUPC Remote Carrier Loss Action	Command: Response: Status: Response:	<add/RCL_xxxx'cr' >add/RCL_xxxx'cr''lf'] <add/RCL_'cr' >add/RCL_xxxx'cr''lf']	Where: xxxx = HOLD, NOM, or MAX (power level setting when remote carrier loss). Note: ASYNC or AUPC Overhead only.
Remote Modem AUPC Commands	Notes: 1. Always wait 3 seconds between consecutive remote modem command/status polls. 2. If Local AUPC is not enabled, status commands will return last known condition. They will also request status from the remote modem. This allows a second request to return proper status.		
Remote AUPC Enable	Command: Response:	<add/RPC_xxx'cr' >add/RPC_xxx'cr''lf'	Where: xxx = ON or OFF (remote AUPC enable). Note: ASYNC or AUPC Overhead only.
Remote Interface Substitution Pattern	Command: Response: Status: Response:	<add/RISP_xxx'cr' >add/RISP_xxx'cr''lf'] <add/RISP_'cr' >add/RISP_xxx'cr''lf']	Where: xxx = ON or OFF (remote transmit 2047 pattern enable). Notes: 1. Transmit 2047 Pattern. 2. ASYNC or AUPC Overhead only.
Remote Interface Baseband Loopback	Command: Response: Status: Response:	<add/RBBL_xxx'cr' >add/RBBL_xxx'cr''lf'] <add/RBBL_'cr' >add/RBBL_xxx'cr''lf']	Where: xxx = ON or OFF (remote baseband loopback enable). Note: ASYNC or AUPC Overhead only.
Remote Interface Read Error Status	Command: Response: Example: Command: Response:	<add/RRES_'cr' >add/RRES_nE-e'cr''lf'] <add/RRES_'cr' >add/RRES_2E-6'cr''lf']	Where: n = 1 to 9 (error rate number). e = 2 to 6 (exponent). Notes: 1. Received 2047 Pattern. 2. AYNC or AUPC Overhead only. This command returns 2047 BER from the remote AUPC modem. If data is not valid, the message 'No_Data' is returned in lieu of BER data.

A.4 Status Commands/Responses

A.4.1 Modulator Configuration Status

Modulator Config. Status	Command: Response:	<add/MCS_'cr' >add/MCS_'cr' RF_xxx'cr' MF_nnn.nnnnnnn'cr' MF_nnnnn.nnnn'cr' MR_nnnn_mmmm.mmm'cr' AMRA_nnnn_mmmm.mmm'cr' AMRB_nnnn_mmmm.mmm'cr'AM RC_nnnn_mmmm.mmm'cr' AMRD_nnnn_mmmm.mmm'cr' AMRV_nnnn_mmmm.mmm'cr' MPO_snn.n'cr' MOP_snn.n'cr' SE_xxx'cr' DENC_xxx'cr' MT_xxxxx'cr' MET_xxx'cr' COM_xxxxxx'cr' MRC_xxx'cr' MSR_xxx'cr' RSEN_xxx'cr' TDA_xxx'cr' TRSI_xx'cr' T310_xxx'cr' ODU_xxx'cr' (Note 1) ODUR_xxx'cr' (Note 1) ODUL_xxxx'cr' (Note 1) ODUH_xxxx'cr''lf'] (Note 1)	 RF Output Modulator Frequency (Non L-Band modem) Modulator Frequency (Non L-Band modem) Modulator Rate Preset 'A' Assignment Preset 'B' Assignment Preset 'C' Assignment Preset 'D' Assignment Preset 'V' Assignment Modulator Power Offset Modulator Output Power Scrambler Enable Differential Encoder Modulator Type Modulator Encoder Type Carrier Only Mode Modulator Reference Clock Modulator Spectrum Rotation Reed-Solomon Encoder Transmit BPSK Data Ordering TX Reed-Solomon Interleave Value TX 8PSK 2/3 IESS-310 Operation ODU Power ODU Reference ODU Current Monitor Low Current Threshold ODU Current Monitor High Current Threshold 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. Additional configuration status of new options and features will always be appended to the end. Notes 1. Data is only returned for the TX/RF L-Band modem.

Modulator/	Command:	<add/MCP_'cr'	
Coder	Response:	>add/MCP_'cr'	System Modem Type
Config.		SMT_xxxxxxx'cr'	Interface Transmit Overhead Type
Program		ITOT_xxxxx'cr'	Modem Operation Mode
Status		MOM_xxxxxxx'cr'	Modulator Type
		MT_xxxxx'cr'	Modulator Encoder Type
		MET_xxx'cr'	Modulator Frequency (Non L-Band modem)
		MF_nnn.nnnnnnn'cr'	Modulator Frequency (Non L-Band modem)
		MF_nnnnn.nnnn'cr'	Modulator Rate
		MR_nnnn_mmmm.mmm'cr'	Modulator Power Offset
		MPO_snn.n'cr'	AUPC Local Power Enable
		LPC_xxx'cr' (Note 10)	Modulator Output Power
		MOP_snn.n'cr' (Note 4)	Scrambler Enable
		SE_xxx'cr'	Differential Encoder
		DENC_xxx'cr'	Interface Loop Timing
		ILT_xxx'cr'	External Reference Frequency
		ERF_nnnnn.n'cr'	Transmit Clock (Source)
		TC_xxxx'cr'	Transmit Clock Phase
		TCP_xxxx'cr'	Baseband Loopback
		BBL_xxx'cr'	Interface Loopback
		ILB_xxx'cr'	Interface Coding Format Transmit
		ICFT_xxxx'cr'	Interface Substitution Pattern (TX 2047)
		ISP_xxxxxx'cr'	Transmit Data Fault
		TDF_xxxx'cr'	Service Channel Level TX1
		ISCL_TX1_nnn'cr'	Service Channel Level TX2
		ISCL_TX2_nnn'cr'	Transmit Data Phase
		TDP_xxxx'cr'	Drop Data Format
		DDF_xxxxxx'cr' (Note 1)	Bulk Drop Channels Assignment
		BDCA_dd;cc_dd;cc...'cr' (Note 1)	Modulator Reference Clock
		MRC_xxx'cr'	Modulator Spectrum Rotation
		MSR_xxx'cr'	Reed-Solomon Encoder
		RSEN_xxx'cr'	Backward Alarm Enable TX1
		BW_TX1_nnn'cr' (Note 2)	Backward Alarm Enable TX2
		BW_TX2_nnn'cr' (Note 2)	Backward Alarm Enable TX3
		BW_TX3_nnn'cr' (Note 2)	Backward Alarm Enable TX4
		BW_TX4_nnn'cr' (Note 2)	TX Driver Type
		TXDR_xxxxxx'cr'	ASYNC Transmit Overhead Baud Rate
		TOBR_nnnnn'cr' (Note 3)	ASYNC Transmit Channel Character Length
		TCCL_n'cr' (Note 3)	ASYNC Transmit Channel Stop Bits
		TCSB_n'cr' (Note 3)	ASYNC Transmit Overhead Channel Parity
		TOCP_xxxx'cr' (Note 3)	ASYNC Transmit Communications Type
		TCT_xxxxx'cr' (Note 3)	AUPC Nominal Power Value
		NOMP_snn.n'cr' (Note 10)	AUPC Minimum Power Value
		MINP_snn.n'cr' (Note 10)	AUPC Maximum Power Value
		MAXP_snn.n'cr' (Note 10)	AUPC Local Carrier Loss
		LCL_xxxx'cr' (Note 10)	AUPC Remote Carrier Loss
		RCL_xxxx'cr' (Note 10)	CTS Delay Time
		CTSD_xx'cr'	RTS TX-IF Control Mode
		RTSM_xxx'cr'	Transmit BPSK Data Ordering
		TDA_xxx'cr'	Carrier Only Mode
		COM_xxxxxx'cr'	IDR Transmit ESC Type
		IDRT_xxxxx'cr' (Note 2)	IBS Transmit ESC Type
		TRSI_xx'cr'	TX Reed-Solomon Interleave Value
		T310_xxx'cr'	TX 8PSK 2/3 IESS-310 Operation
		ODU_xxx'cr' (Note 11)	ODU Power
		ODUR_xxx'cr' (Note 11)	ODU Reference
		ODUL_xxxx'cr' (Note 11)	ODU Current Monitor Low Current Threshold
		ODUH_xxxx'cr' (Note 11)	ODU Current Monitor High Current Threshold
		RF_xxx'cr''lf']	RF Output (ON/OFF)
			Note: This command is used by the EF Data M:N protection switch to collect information that is necessary to configure back-up modems. Because this command (content and/or order) can be changed at any time by EF Data, it is advisable that other commands ('MCS_' and 'ICS_', or 'BCS_') be used for M&C systems.

			Notes: 1. Data is only returned for TX D&I Overhead (or Flex Mux D&I). 2. Data is only returned for TX IDR Overhead. 2. Data is only returned for TX ASYNC Overhead 3. Data not returned if Local AUPC is enabled & TX ASYNC/AUPC overhead. 5. Not Used. 6. Not Used. 7. Not Used. 8. Not Used. 9. Not Used. 10 Data is only returned for TX ASYNC/AUPC Overhead. 11 Data is only returned for the TX/RF L-Band modem.
Current Transmit Reed Solomon N/ K and Interleaver value	Command: Response:	<add/TXRS_'cr' >add/TXRS_nnn/kkk_ii'cr''lf']	Where: nnn = N value, kkk = K value and ii = Interleaver value.
Scrambler Type	Command: Response:	<addSCR_'cr' >add/SCR_xxxxxxxxxxxx'cr''lf']	Where xxxxxxxxxxxx = IBS SYNC, EFD MOD V.35, INTELSAT V.35, FDC MOD V.35, ITU V.35 or OFF.

A.4.2 Demodulator Configuration Status

Demodulator Config. Status	Command: Response:	<add/DCS_'cr' >add/DCS_'cr' DF_nnnnn.nnnn'cr' DR_nnnn_mmmm.mmm'cr' ADRA_nnnn_mmmm.mmm'cr' ADRB_nnnn_mmmm.mmm'cr' ADRC_nnnn_mmmm.mmm'cr' ADRD_nnnn_mmmm.mmm'cr' ADRV_nnnn_mmmm.mmm'cr' DE_xxx'cr' DDEC_xxx'cr' IFL_xxx'cr' (Note 1) SCF_snnnnn'cr' SWR_nnnnnn'cr' SR_xxx'cr' ERT_xxxx'cr' DT_xxxx'cr' DDT_xxx'cr' DSR_xxx'cr' RSDE_xxx'cr' RDA_xxx'cr' RRSI_xx'cr' R310_xxx'cr' LNB_xxx'cr' LNBV_xxx'cr' LNBR_xxx'cr' LNBL_xxx'cr' LNBH_xxx'cr''lf']	 Demodulator Frequency Demodulator Rate Preset 'A' Assignment Preset 'B' Assignment Preset 'C' Assignment Preset 'D' Assignment Preset 'V' Assignment Descrambler Enable Differential Decoder IF Loopback Sweep Center Frequency Sweep Width Range Sweep Reacquisition BER Threshold Demodulator Type Demodulator Decoder Type Demodulator Spectrum Rotation Reed-Solomon Decoder Receive BPSK Data Ordering RX Reed-Solomon Interleave Value RX 8PSK 2/3 IESS-310 Operation LNB Power LNB Voltage LNB Reference LNB Current Monitor Low Current Threshold LNB Current Monitor High Current Threshold 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 demod. Additional configuration status of new options and features will always be appended to the end. Notes: 1) Data is only returned for the TX/RF L-Band modem

Demod/	Command:	<add/DCP_'cr'	
Decoder	Response:	>add/DCP_'cr'	
Config.		SMT_xxxxxxx'cr'	System Modem Type
Program		IROT_xxxxx'cr'	Interface Receive Overhead Type
Status		MOM_xxxxxxx'cr'	Modem Operation Mode
		BERT_xxxx'cr'	BER Threshold
		DT_xxxx'cr'	Demodulator Type
		DDT_xxx'cr'	Demodulator Decoder Type
		DF_nnnnn.nnnn'cr'	Demodulator Frequency
		DR_nnnn_mmmm.mmm'cr'	Demodulator Rate
		DE_xxx'cr'	Descrambler Enable
		DEC_xxx'cr'IFL_xxx'cr' (Note 9)	Differential Decoder
		SCF_snnnnn'cr'	Sweep Center Frequency
		SWR_nnnnnn'cr'	Sweep Width Range
		SR_xxx'cr'	Sweep Reacquisition
		ILT_xxx'cr'	Interface Loop Timing
		ERF_nnnnn.n'cr'	External Reference Frequency
		BC_xxx'cr'	Buffer Clock
		RCP_xxxx'cr'	Receive Clock Phase
		BBL_xxx'cr'	Baseband Loopback
		ILB_xxx'cr'	Interface Loopback
		ICFR_xxxx'cr'	Interface Coding Format Receive
		IRFS_T1_ssss'cr'	Interface Receive T1 Frame Structure
		IRFS_E1_ssss'cr'	Interface Receive E1 Frame Structure
		IBP_xxx'cr'	Interface Buffer Programming
		IRE_xxxxxx'cr'	Interface Read Error (RX 2047)
		RDF_xxxx'cr'	Receive Data Fault
		ISCL_RX1_nnn'cr'	Service Channel Level RX1
		ISCL_RX2_nnn'cr'	Service Channel Level RX2
		RDP_xxxx'cr'	Receive Data Phase
		IDF_xxxxxx'cr' (Note 1)	Insert Data Format
		ICRC_xxx'cr' (Note 1)	Insert E1 CRC Enable
		IBS _nnnnnn'cr'	Interface Buffer Size
		BICA_dd;cc_dd;cc...'cr' (Note 1)	Bulk Insert Channels Assignment
		DSR_xxx'cr'	Demodulator Spectrum Rotation
		RSDE_xxx'cr'	Reed-Solomon Decoder
		BW_RX1_nnn'cr' (Note 2)	Backward Alarm Enable RX1
		BW_RX2_nnn'cr' (Note 2)	Backward Alarm Enable RX2
		BW_RX3_nnn'cr' (Note 2)	Backward Alarm Enable RX3
		BW_RX4_nnn'cr' (Note 2)	Backward Alarm Enable RX4
		RXDR_xxxxxx'cr'	RX Driver Type
		ROBR_nnnnn'cr' (Note 3)	ASYNC Receive Overhead Baud Rate
		RCCL_n'cr' (Note 3)	ASYNC Receive Channel Character Length
		RCSB_n'cr' (Note 3)	ASYNC Receive Channel Stop Bits
		ROCP_xxxx'cr' (Note 3)	ASYNC Receive Overhead Channel Parity
		RCT_xxxxx'cr' (Note 3)	ASYNC Receive Communications Type
		ENSP_nn.n'cr' (Note 8)	AUPC EBN0 Target Set Point
		MAXT_n.n'cr' (Note 8)	AUPC Max. Tracking Rate
		RDA_xxx'cr'	Receive BPSK Data Ordering
		IDRR_xxxxx'cr' (Note 2)	IDR Receive ESC Type
		IBSR_xxxxx'cr' (Note 2)	IBS Receive ESC Type
		RRSI_xx'cr'	RX Reed-Solomon Interleave Value
		R310_xxx'cr'	RX 8PSK 2/3 IESS-310 Operation
		LNB_xxx'cr'	LNB Power
		LNBV_xxx'cr'	LNB Voltage
		LNBR_xxx'cr'	LNB Reference
		LNBL_xxx'cr'	LNB Current Monitor Low Current Threshold
		LNBH_xxx'cr''lf']	LNB Current Monitor High Current Threshold
			This command is used by the EF Data M:N protection switch to collect information that is necessary to configure back-up modems. Because this command (content and/or order) can be changed at any time by EF Data, it is advisable that other commands ('DCS_' and 'ICS_', or 'BCS_') be used for M&C systems.

			Notes: 1. Data is only returned for RX D&I overhead (or Flex Mux D&I mode).is installed. 2. Data is only returned for RX IDR Overhead. 3. Data is only returned for RX ASYNC Overhead. 4. Not Used. 5. Not Used. 6. Not Used. 7. Not Used. 8. Data is only returned for RX ASYNC/AUPC Overhead. 9. Data is only returned for the TX/RF L-Band modem
Interface Config. Status	Command:	<add/ICS_'cr'	
	Response:	>add/ICS_'cr'	
		TC_xxxx'cr'	Transmit Clock (Source)
		ERF_nnnnn.n'cr'	External Reference Frequency
		TCP_xxxx'cr'	Transmit Clock Phase
		RCP_xxxx'cr'	Receive Clock Phase
		BBL_xxx'cr'	Baseband Loopback
		ILB_xxx'cr'	Interface Loopback
		ILT_xxx'cr'	Interface Loop Timing
		ICFT_xxxx'cr'	Interface Coding Format Transmit
		ICFR_xxxx'cr'	Interface Coding Format Receive
		BC_xxx'cr'	Buffer Clock (Source)
		IRFS_T1_ssss'cr'	Interface Receive Frame Structure (T1)
		IRFS_E1_ssss'cr'	Interface Receive Frame Structure (E1)
		IBP_xxx'cr'	Interface Buffer Programming
		IBS _nnnnnn'cr'	Interface Buffer Size
		ITOT_xxxxx'cr'	Interface Transmit Overhead Type
		IROT_xxxxx'cr'	Interface Receive Overhead Type
		ISP_xxxxxx'cr'	Interface Substitution Pattern (TX 2047)
		IRE_xxxxxx'cr'	Interface Read Error (RX 2047)
		TDF_xxxx'cr'	Transmit Data Fault
		RDF_xxxx'cr	Receive Data Fault
		ISCL_TX1_nnn'cr'	Service Channel Level TX1
		ISCL_TX2_nnn'cr'	Service Channel Level TX2
		ISCL_RX1_nnn'cr'	Service Channel Level RX1
		ISCL_RX2_nnn'cr'	Service Channel Level RX2
		TDP_xxxx'cr'	Transmit Data Phase
		RDP_xxxx'cr'	Receive Data Phase
		DDF_xxxxxx'cr' (Note 1)	Drop Data Format
		BDCA_dd;cc_dd;cc...'cr' (Note 1)	Bulk Drop Channels Assignment
		ICRC_xxx'cr' (Note 2)	Insert E1 CRC Enable
		IDF_xxxxxx'cr' (Note 2)	Insert Data Format
		BICA_dd;cc_dd;cc...'cr' (Note 2)	Bulk Insert Channels Assignment
		BW_TX1_nnn'cr' (Note 3)	Backward Alarm Enable TX1
		BW_TX2_nnn'cr' (Note 3)	Backward Alarm Enable TX2
		BW_TX3_nnn'cr' (Note 3)	Backward Alarm Enable TX3
		BW_TX4_nnn'cr' (Note 3)	Backward Alarm Enable TX4
		BW_RX1_nnn'cr' (Note 4)	Backward Alarm Enable RX1
		BW_RX2_nnn'cr' (Note 4)	Backward Alarm Enable RX2
		BW_RX3_nnn'cr' (Note 4)	Backward Alarm Enable RX3
		BW_RX4_nnn'cr' (Note 4)	Backward Alarm Enable RX4
		TXDR_xxxxxx'cr'	TX Driver Type
		RXDR_xxxxxx'cr'	RX Driver Type
		TOBR_nnnnn'cr' (Note 5)	ASYNC Transmit Overhead Baud Rate
		TCCL_n'cr' (Note 5)	ASYNC Transmit Channel Character Length
		TCSB_n'cr' (Note 5)	ASYNC Transmit Channel Stop Bits
		TOCP_xxxx'cr' (Note 5)	ASYNC Transmit Overhead Channel Parity
		TCT_xxxxx'cr' (Note 5)	ASYNC Transmit Communications Type
		ROBR_nnnnn'cr' (Note 6)	ASYNC Receive Overhead Baud Rate
		RCCL_n'cr' (Note 6)	ASYNC Receive Channel Character Length
		RCSB_n'cr' (Note 6)	ASYNC Receive Channel Stop Bits
		ROCP_xxxx'cr' (Note 6)	ASYNC Receive Overhead Channel Parity
		RCT_xxxxx'cr' (Note 6)	ASYNC Receive Communications Type
		LPC_xxx'cr' (Note 5)	AUPC Local Power Enable
		NOMP_snn.n'cr' (Note 5)	AUPC Nominal Power Value
		MINP_snn.n'cr' (Note 5)	AUPC Minimum Power Value

		MAXP_snn.n'cr' (Note 5) LCL_xxxx'cr' (Note 5) RCL_xxxx'cr' (Note 5) ENSP_nn.n'cr' (Note 6) MAXT_n.n'cr' (Note 6) RTSM_xxx'cr' TSD_xx'cr' IDRT_xxxxx'cr' (Note 3) IDRR_xxxxx'cr' (Note 4) IBST_xxxxx'cr' (Note 3) IBSR_xxxxx'cr' (Note 4)	AUPC Maximum Power Value AUPC Local Carrier Loss AUPC Remote Carrier Loss AUPC EBN0 Target Set Point AUPC Max. Tracking Rate RTS TX-IF Control Mode CTS Delay Time IDR Transmit ESC Type IDR Receive ESC Type IBS Transmit ESC Type IBS Receive ESC Type 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. Additional configuration status of new options and features will always be appended to the end. Notes: 1. Data is only returned for TX D&I Overhead. 2. Data is only returned for RX D&I Overhead. 3. Data is only returned for TX IDR Overhead. 4. Data is only returned for RX IDR Overhead. 5. Data is only returned for TX ASYNC Overhead. 6. Data is only returned for RX ASYNC Overhead. 7 thru 14. Not Used.
Current Receive Reed Solomon N/ K and Interleaver value	Command: Response:	<add/RXRS_'cr' >add/RXRS_nnn/kkk_ii'cr''lf']	Where: nn = N value, kkk = K value and ii = Interleaver value.
Descrambler Type	Command: Response:	<addDSCR_'cr' >add/DSCR_xxxxxxxxxxxx'cr''lf']	Where xxxxxxxxxxxx = IBS SYNC, EFD MOD V.35, INTELSAT V.35, FDC MOD V.35, ITU V.35 or OFF.

A.4.3 ODU Configuration Status

Outdoor Unit Status	Command: Response:	<add/OUS_'cr' >add/OUS_'cr' CURRENT_xxx'cr' VOLTAGE_xxx'cr' TEMP_xxx'cr' PLL_xxx'cr' CKSUM_xxx'cr' SFLT_xx'cr''lf']	 Current (FLT/OK) Voltage (FLT/OK) Temperature (FLT/OK) Phase Lock Loop (FLT/OK) Checksum (FLT/OK) Number of stored faults logged (0 to 10)
Outdoor Unit Temperature	Command: Response:	<add/ODUT_'cr' >add/ODUT_'cr' ODU_sxx_yyy'cr''lf']	Where s = + or – sign, xx = 0 to 99 degree in C and yyy = OK or OOR (Out of Range).
Outdoor Unit Phase Lock Loop	Command: Response:	<add/OPLL_'cr' >add/OPLL_xxxxxxxx'cr''lf']	Where xxxxxxxx = UNLOCKED or OK.
Outdoor Unit Software Version	Command: Response:	<add/OSV_'cr' >add/OSV_xxcr''lf']	Where xx = 0 to 15.
Outdoor Unit Power Class	Command: Response:	<add/OPC_'cr' >add/OPC_xxcr''lf']	Where xx = 2 to 60 Watts
Outdoor Unit Address	Command: Response:	<add/OADR_'cr' >add/OADR_xxcr''lf']	Where xx = 1 to 15.
Outdoor Unit TX Output	Command: Response:	<add/ODUO_'cr' >add/ODUO_xxcr''lf']	Where xxx = ON or OFF.
Outdoor Unit Power Leveling	Command: Response:	<add/ODUP_'cr' >add/ODUP_xxcr''lf']	Where xxx = ON or OFF.

A.4.4 Fault Status

MODEM Faults Status (Summary)	Command:	<add/MFS_'cr'	
	Response:	>add/MFS_'cr'	
		DMD_xxx'cr'	Demodulator (FLT/OK)
		MOD_xxx'cr'	Modulator (FLT/OK)
		ITX_xxx'cr'	Interface Transmit Side (FLT/OK)
		IRX_xxx'cr'	Interface Receive Side (FLT/OK)
		CEQ_xxx'cr'	Common Equipment (FLT/OK)
		BWAL_xxx'cr'	Backward Alarms (FLT/OK)
		ODU_'cr''lf']	Outdoor Unit (FLT/OK)
Modulator Status	Command:	<add/MS_'cr'	
	Response:	>add/MS_'cr'	
		RF_xxx'cr'	RF Output (ON/OFF) actual status not config
		MOD_xxx'cr'	Module (OK/FLT)
		SYN_xxx'cr'	IF Synthesizer (OK/FLT)
		DCS_xxx'cr'	Data Clock Synthesizer (OK/FLT)
		ICH_xxx'cr'	I Channel (OK/FLT)
		QCH_xxx'cr'	Q Channel (OK/FLT)
		AGC_xxx'cr'	AGC Level (OK/FLT)
		SCT_xxx'cr'	Modem Reference PLL Lock (OK/FLT)
		EXT_xxx'cr'	Modem Reference Activity (OK/FLT)
		CONF_xxx'cr'	Configuration (OK/FLT)
		SFLT_xx'cr''lf']	Number of stored faults logged (0 to 10)
Demodulator Status	Command:	<add/DS_'cr'	
	Response:	>add/DS_'cr'	
		MOD_xxx'cr'	Demod Module (OK/FLT)
		CD_xxx'cr'	Carrier Detect (OK/FLT)
		SYN_xxx'cr'	IF Synthesizer Lock (OK/FLT)
		ICH_xxx'cr'	I Channel (OK/FLT)
		QCH_xxx'cr'	Q Channel (OK/FLT)
		BERT_xxx'cr'	BER Threshold (OK/FLT)
		CONF_xxx'cr'	Configuration (OK/FLT)
		LNB_xxx'cr'	LNB (OK/FLT)
		SFLT_xx'cr''lf']	Number of stored faults logged (0 to 10)
Interface Transmit Side Status	Command:	<add/ITXS_'cr'	
	Response:	>add/ITXS_'cr'	
		DRP_xxx'cr'	D&I Drop (OK/FLT)
		TXD_xxx'cr'	Transmit Data/AIS (OK/FLT)
		PLL_xxx'cr'	Transmit Synthesizer PLL Lock (OK/FLT)
		CLK_xxx'cr'	Selected Transmit Clock Activity (OK/FLT)
		TAC1_xxx'cr'	Transmit Audio Clip Channel #1 (OK/FLT)
		TAC2_xxx'cr'	Transmit Audio Clip Channel #2 (OK/FLT)
		CONF_xxx'cr'	Configuration (OK/FLT)
		IPM_xxx'cr'	IP Module (OK/FLT)
		SFLT_xx'cr''lf']	Number of Stored Faults Logged (0 to 10)
Interface Receive Side Status	Command:	<add/IRXS_'cr'	
	Response:	>add/IRXS_'cr'	
		UNFL_xxx'cr'	Buffer Underflow (OK/FLT)
		OVFL_xxx'cr'	Buffer Overflow (OK/FLT)
		RXD_xxx'cr'	Receive Data Loss/AIS (OK/FLT)
		FBER_xxx'cr'	Frame BER (OK/FLT)
		BWA_xxx'cr'	Receive Backward Alarm (OK/FLT)
		CLK_xxx'cr'	Selected Buffer Clock Activity (OK/FLT)
		PLL_xxx'cr'	Buffer Clock PLL Lock (OK/FLT)
		DMUX_xxx'cr'	Demux Lock (OK/FLT)
		2047_xxx'cr'	2047 Pattern Lock Detect (OK/FLT)
		BUFF_xxx'cr'	Buffer Full (OK/FLT)
		INS_xxx'cr'	D&I Insert (OK/FLT)
		RAC1_xxx'cr'	Receive Audio Clip Channel #1 (OK/FLT)
		RAC2_xxx'cr'	Receive Audio Clip Channel #2 (OK/FLT)
		CONF_xxx'cr'	Configuration (OK/FLT)
		IPM_xxx'cr'	IP Module (OK/FLT)
		SFLT_xx'cr''lf']	Number of Stored Faults Logged (0 to 10)
Common	Command:	<add/CES_'cr'	

Equipment Status	Response:	>add/CES_'cr' M&C_xxx'cr' INT_xxx'cr' BAT_xxx'cr' +5_xxx'cr' +12_xxx'cr' -12_xxx'cr' ST_xxx'cr' MODE_xxxxxx'cr' SFLT_xx'cr''lf']	Monitor & Control Module (OK/FLT) Data Interface/Overhead Module (OK/FLT) Battery/Clock (OK/FLT) +5V Power Supply (OK/FLT) +12V Power Supply (OK/FLT) -12V Power Supply (OK/FLT) Self Test (OK/FLT) Mode (LOCAL or REMOTE) Number of stored faults logged (0 to 10) The common equipment status command causes a block of data to be returned which indicates the status of the common equipment.
Interface Alarms (Backward Alarm) Status	Command: Response:	<add/IAS_'cr' >add/IAS_'cr' TXBWA1_xxx'cr' TXBWA2_xxx'cr' TXBWA3_xxx'cr' TXBWA4_xxx'cr' RXBWA1_xxx'cr' RXBWA2_xxx'cr' RXBWA3_xxx'cr' RXBWA4_xxx'cr' SFLT_xx'cr''lf']	TX Backward Alarm 1 (FLT/OK) TX Backward Alarm 2 (FLT/OK) TX Backward Alarm 3 (FLT/OK) TX Backward Alarm 4 (FLT/OK) RX Backward Alarm 1 (FLT/OK) RX Backward Alarm 2 (FLT/OK) RX Backward Alarm 3 (FLT/OK) RX Backward Alarm 4 (FLT/OK) Number of stored faults logged (0 to 10)

A.4.5 Error Performance

Raw BER	Command: Response:	<add/RBER_'cr' >add/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. 4.
Corrected BER	Command: Response:	<add/CBER_'cr' >add/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.

Interface Read Error Status	Command: Response:	<add/IRES_'cr' >add/IRES_tttt_xn.nE-ee'cr''lf']	Where: tttt = FRM (FRAME) or 2047 (indicates type of error being read). 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). This command returns frame or 2047 error rate. The 'IRE_' configuration command is used to select reading of frame or 2047 errors. 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. 4. 'Sampling' is returned if not enough data is currently available to calculate the error rate.
Eb/N0 Status	Command: Response:	<add/EBN0_'cr' >add/EBN0_xnn.ndB'cr''lf']	Where: x = < or > (data modifier to indicate that the Eb/N0 is less than or greater than the returned value). nn.n = 1.0 to 99.9 (Eb/N0 value). Notes: 1. The 'x' (< or >) parameter is only returned if the Eb/N0 has exceeded the computational resolution of the system. 2. 'No Data' is returned if the Eb/N0 cannot be calculated. 3. 'Sampling' is returned if not enough data is currently available to calculate the Eb/N0.
Modulator Rate Status	Command: Response:	<add/MR_'cr' >add/MR_nnnn_mmmm.mmm'cr''lf']	Where:. nnnn = 1/2 (QPSK 1/2 Turbo and non-Turbo), [coder rate], 3/4 (QPSK 3/4Turbo and non-Turbo), 7/8 (QPSK 7/8), BP12 (BPSK 1/2), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2 Turbo and non-Turbo), OQ34 (OQPSK 3/4 Turbo and non-Turbo), OQ78 (OQPSK 7/8), BPSK (BPSK1/1 Turbo and non-Turbo), QPSK (QPSK 1/1 Turbo and non-Turbo), OQSK (OQPSK 1/1 Turbo, and non-Turbo), 2144 (BPSK 21/44 Turbo Only), B516 (BPSK 5/16 Turbo Only), and 8P34 (8PSK 3/4 Turbo Only). mmmm.mmm = Data rate in kHz
Demodulator Rate Status	Command: Response:	<add/DR_'cr' >add/DR_nnnn_mmmm.mmm'cr''lf']	Where: nnnn = 1/2 (QPSK 1/2 Turbo and non-Turbo), [coder rate], 3/4 (QPSK 3/4 Turbo and non-Turbo), 7/8 (QPSK 7/8), BP12 (BPSK 1/2), 8P23 (8PSK 2/3), OQ12 (OQPSK 1/2 Turbo and non-Turbo), OQ34 (OQPSK 3/4 Turbo and non-Turbo), OQ78 (OQPSK 7/8), BPSK (BPSK1/1 Turbo and non-Turbo), QPSK (QPSK 1/1 Turbo and non-Turbo), OQSK (OQPSK 1/1 Turbo, and non-Turbo), 2144 (BPSK 21/44 Turbo Only), B516 (BPSK 5/16 Turbo Only), and 8P34 (8PSK 3/4 Turbo Only). mmmm.mmm = Data rate in kHz.

Receive Signal Level Status	Command: Response:	<add/RSL_'cr' >add/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, plus or minus). 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.
Interface Buffer Fill Status	Command: Response:	<add/IBFS_'cr' >add/IBFS_nn%'cr''lf']	Where: nn = 1 to 99 (relative to buffer depth).
LNB Current Monitor Status	Command: Response:	<add/LNBC_'cr' >add/LNBC_nnn'cr''lf']	Where: nnn = 0 to 500 (in 1 mA steps) 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.
ODU Current Monitor Status	Command: Response:	<add/ODUC_'cr' >add/ODUC_nnnn'cr''lf']	Where: nnn = 0 to 4000 (in 1 mA steps) 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	Command: Response:	<add/CSV_'cr' >add/CSV_xsnnnnn'cr' CD_yyy'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 75000. yyy = OK or FLT (decoder lock status OK or FAULT). 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.

A.5 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 status information.
The following symbols are commonly used to define the stored faults status commands:

# = Fault number (0 to 9). “0” is the first fault stored.
hh = Hours in 24-hr. format.
mm = Minutes.
ss = Seconds.
MM = Month.
DD = Day
YYYY = Year.

Modulator Stored Faults	Command: Response:	<add/MSF_#'cr' >add/MSF_# hh:mm:ss MM/DD/YYYYY'cr' MOD_xxx'cr' SYN_xxx'cr' DCS_xxx'cr' ICH_xxx'cr' QCH_xxx'cr' AGC_xxx'cr' SCT_xxx'cr' EXT_xxx'cr' CONF_xxx'cr''lf']	 Module (OK/FLT) IF Synthesizer (OK/FLT) Data Clock Synthesizer (OK/FLT) I Channel (OK/FLT) Q Channel (OK/FLT) AGC Level (OK/FLT) Modem Reference PLL Lock (OK/FLT) Modem Reference Activity (OK/FLT) Configuration (OK/FLT)
Demodulator Stored Faults	Command: Response:	<add/DSF_#'cr' >add/DSF_# hh:mm:ss MM/DD/YYYY'cr' MOD_xxx'cr' CD_xxx'cr' SYN_xxx'cr' ICH_xxx'cr' QCH_xxx'cr' BERT_xxx'cr' CONF_xxx'cr'' LNB_xxx'cr''lf']	 Demod Module (OK/FLT) Carrier Detect (OK/FLT) IF Synthesizer Lock (OK/FLT) I Channel (OK/FLT) Q Channel (OK/FLT) BER Threshold (OK/FLT) Configuration (OK/FLT) LNB (OK/FLT)
Interface Transmit Side Stored Faults	Command: Response:	<add/ITSF_#'cr' >add/ITSF_# hh:mm:ss MM/DD/YYYY'cr' DRP_xxx'cr' TXD_xxx'cr' PLL_xxx'cr' CLK_xxx'cr' TAC1_xxx'cr' TAC2_xxx'cr' CONF_xxx'cr''lf']	 D&I Drop (OK/FLT) Transmit Data/AIS (OK/FLT) Transmit Synthesizer PLL Lock (OK/FLT) Selected Transmit Clock Activity (OK/FLT) Transmit Audio Clip Channel #1 (OK/FLT) Transmit Audio Clip Channel #2 (OK/FLT) Configuration (OK/FLT)

Interface Receive Side Stored Faults	Command: Response:	<add/IRSF_#'cr' >add/IRSF_# hh:mm:ss MM/DD/YYYY'cr' UNFL_xxx'cr' OVFL_xxx'cr' RXD_xxx'cr' FBER_xxx'cr' BWA_xxx'cr' CLK_xxx'cr' PLL_xxx'cr' DMUX_xxx'cr' 2047_xxx'cr' BUFF_xxx'cr' INS_xxx'cr' RAC1_xxx'cr' RAC2_xxx'cr' CONF_xxx'cr''lf']	 Buffer Underflow (OK/FLT) Buffer Overflow (OK/FLT) Receive Data Loss/AIS (OK/FLT) Frame BER (OK/FLT) Receive Backward Alarm (OK/FLT) Selected Buffer Clock Activity (OK/FLT) Buffer Clock PLL Lock (OK/FLT) Demux Lock (OK/FLT) 2047 Pattern Lock Detect (OK/FLT) Buffer Full (OK/FLT) D&I Insert (OK/FLT) Receive Audio Clip Channel #1 (OK/FLT) Receive Audio Clip Channel #2 (OK/FLT) Configuration (OK/FLT)
Common Equipment Stored Faults	Command: Response:	<add/CSF_#'cr' >add/CSF_# hh:mm:ss MM/DD/YYYY'cr' M&C_xxx'cr' INT_xxx'cr' BAT_xxx'cr' +5_xxx'cr' +12_xxx'cr' -12_xxx'cr' ST_xxx'cr''lf']	 Monitor & Control Module (OK/FLT) Data Interface/Overhead Module (OK/FLT) Battery/Clock (OK/FLT) +5V Power Supply (OK/FLT) +12V Power Supply (OK/FLT) -12V Power Supply (OK/FLT) Self Test (OK/FLT)
Interface Alarms Stored Faults	Command: Response:	<add/IASF_#'cr' >add/IASF_# hh:mm:ss MM/DD/YYYY'cr' TXBWA1_xxx'cr' TXBWA2_xxx'cr' TXBWA3_xxx'cr' TXBWA4_xxx'cr' RXBWA1_xxx'cr' RXBWA2_xxx'cr' RXBWA3_xxx'cr' RXBWA4_xxx'cr''lf']	 TX Backward Alarm 1 (FLT/OK) TX Backward Alarm 2 (FLT/OK) TX Backward Alarm 3 (FLT/OK) TX Backward Alarm 4 (FLT/OK) RX Backward Alarm 1 (FLT/OK) RX Backward Alarm 2 (FLT/OK) RX Backward Alarm 3 (FLT/OK) RX Backward Alarm 4 (FLT/OK)
Reed-Solomon Unavailable Seconds	Command: Response:	<add/RSSF_#'cr' >add/RSSF_# hh:mm:ss MM/DD/YYYY'cr' UNA_xxx'cr''lf']	 Unavailable Seconds (FLT/OK)
Outdoor Unit Status TX L-Band modem	Command: Response:	<add/OUSF_#'cr' >add/OUSF_# hh:mm:ss MM/DD/YYYY'cr' CURRENT_xxx'cr' VOLTAGE_xxx'cr''lf']	 Current (FLT/OK) Voltage (FLT/OK)

Bulk Consol. Analog Status	Command: Response:	<add/BCAS_'cr' >add/BCAS_p1,p2,p3, . . . pn'cr''lf']	This command is similar to the 'BCS_' command, but returns modem analog parameters. Additional status of new options and features will always be appended to the end.

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.
4	**Interface Read Error Status** (ref. 'IRES_' command).	p4 = tttt_xm.mE-ee.
5	**EB/N0** (ref. 'EBN0_' command).	p5 = xnn.n, EB/N0 in dB.
6	**Buffer Fill Status** (ref. 'IBFS_' command).	p6 = nn%, buffer fill status.
7	**LNB Current** (ref. LNBC_' command).	P7 = nnn, LNB Current
8	**ODU Current** (ref. ODUC_' command).	P8 = nnnn, ODU Current

Note: Parameters 2 through 6 are dependent on carrier acquisition, if the decoder is not locked empty data blocks are returned (,,,,,).

Bulk Consol. Status	Command: Response:	<add/BCS_'cr' >add/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 is terminated with a ',' (comma) except for the last parameter which has the standard message termination sequence ('cr''lf']). Most of the data returned is formatted the same way as the single command status request (refer to the appropriate portions of this document in preceding sections). Additional configuration status of new options and features will always be appended to the end.

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 = nnnnn.nnnn, IF frequency in MHz (TX L-Band).
3	**Modulator rate** (ref. 'MR_' command).	p3 = nnnn_mmmm.mmm, code rate/data rate in kbps.
4	**Modulator preset 'A' assignment** (ref. 'ARMA_' command).	p4 = nnnn_mmmm.mmm, code rate/data rate in kbps.
5	**Modulator preset 'B' assignment** (ref. 'ARMB_' command).	p5 = nnnn_mmmm.mmm, code rate/data rate in kbps.
6	**Modulator preset 'C' assignment** (ref. 'ARMC_' command).	p6 = nnnn_mmmm.mmm, code rate/data rate in kbps.
7	**Modulator preset 'D'** (ref. 'ARMD_' command).	p7 = nnnn_mmmm.mmm, code rate/data rate in kbps.
8	**Modulator preset 'V' assignment** (ref. 'ARMV_' command).	p8 = nnnn_mmmm.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), '3' (FDC), '4' (CSC), or '6' (SDM51).
14	**Modulator encoder type** (ref. 'MET_' command).	p14 = n, where 'n' is '0' (SEQ), '1' (VIT).
15	**Carrier only mode ON/OFF.**	p15 = n, where 'n' is '0' (off) or '1' (on).
16	**Demodulator IF** (ref. 'DF_' command).	p16 = nnnnn.nnnn, demodulator IF frequency in MHz.

Bulk Consol. Status (continued)

	Parameter Number	Parameter Name (Command Reference)	Description
	17	**Demodulator rate** (ref. 'DR_' command).	p17 = nnnn_mmmm.mmm, code rate/data rate in kbps.
	18	**Demodulator preset A** (ref. 'ADRA_' command).	p18 = nnnn_mmmm.mmm, code rate/data rate in kbps.
	19	**Demodulator preset B assignment** (ref. 'ADRB_' command).	p19 = nnnn_mmmm.mmm, code rate/data rate in kbps.
	20	**Demodulator preset C assignment** (ref. 'ADRC_' command).	p20 = nnnn_mmmm.mmm, code rate/data rate in kbps.
	21	**Demodulator preset D assignment** (ref. 'ADRD_' command).	p21 = nnnn_mmmm.mmm, code rate/data rate in kbps.
	22	**Demodulator preset V assignment** (ref. 'ADRV_' command).	p22 = nnnn_mmmm.mmm, code rate/data rate in kbps.
	23	**Descrambler enable** (ref. 'DE_' command).	p23 = n, where 'n' is '0' (off) or '1' (on).
	24	**Differential decoder** (ref. 'DDEC_' command).	p24 = n, where 'n' is '0' (off) or '1' (on).
	25	**Reserved null field**	
	26	**IF Loopback** (ref. 'IFL_' command).	P26 = n, where 'n' is '0' (off) or '1' (on).
	27	**Sweep center frequency** (ref. 'SCF_' command).	p27 = snnnnn, sweep center frequency in Hertz.
	28	**Sweep width range** (ref. 'SWR_' command).	p28 = nnnnnn, sweep range in Hertz.
(Note 16)	29	**Sweep reacquisition** (ref. 'SR_' command).	p29 = nnn, reacquisition time in seconds.
	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), '3' (FDC), or '4' (CSC).
	32	**Demodulator decoder type** (ref. 'DDT_' command).	p32 = n, where 'n' is '0' (SEQ), '1' (VIT).
	33	**Transmit clock source** (ref. 'TC_' command).	p33 = n, where 'n' is '0' (INT), '1' (REF), '2' (EXT), or 6 (DATA).
	34	**External reference frequency** (ref. 'ERF_' command).	p34 = nnnnn.n, external reference frequency in kHz.

Bulk Consol.
Status
(continued)

Parameter Number	Parameter Name (Command Reference)	Description
35	**Transmit clock phase** (ref. 'TCP_' command).	p35 = n, where 'n' is '0' (NRM), '1' (INV), '2' (AUTO).
36	**Receive clock phase** (ref. 'RCP_' command).	p36 = n, where 'n' is '0' (NRM), '1' (INV).
37	**Baseband loopback** ref. 'BBL_' command).	p37 = n, where 'n' is '0' (off) or '1' (on).
38	**Interface loopback** (ref. 'ILB_' command).	p38 = n, where 'n' is '0' (off) or '1' (on).
39	**Interface loop timing** (ref. 'ILT_' command).	p39 = n, where 'n' is '0' (off) or '1' (on).
40	**TX Interface coding format** (ref. 'ICFT_' command).	p40 = n, where 'n' is '0' (AMI), '2' (B8ZS), or '3' (HDB3).
41	**RX Interface coding format** (ref. 'ICFR_' command).	p41 = n, where 'n' is '0' (AMI), '2' (B8ZS), or '3' (HDB3).
42	**Buffer clock source** (ref. 'BC_' command).	p42 = n, where 'n' is '0' (INT), '1' (REF), '2' (EXT), '3' (SAT), '5' (INS).
43	**Interface RX-T1 frame structure** (ref. 'IRFS_' command).	p43 = n, where n is '0' (NONE) or '1' (G704).
44	**reserved null field.**	
45	**Interface RX-E1 frame structure** (ref. 'IRFS_' command).	p45 = n, where n is '0' (NONE) or '1' (G704).
46	**reserved null field.**	
47	**Interface Buffer Programming** (ref. 'IBP_' command).	p47 = n, where 'n' is '0' (BITS) or '1' (MS).
48	**Interface buffer size** (ref. 'IBS _' command).	p48 = nnnnnn, buffer size in bits or milli seconds.
49	**Interface transmit overhead type** (ref. 'ITOT_' command).	p49 = n, where 'n' is '0' (NONE), '1' (IDR), '2' (IBS), '3' (DI), '4' (ASYNC), ‘6’ (AUPC)
50	**Interface receive overhead type** (ref. 'IROT_' command).	p50 = n, where 'n' is '0' (NONE), '1' (IDR), '2' (IBS), '3' (DI), '4' (ASYNC), ‘6’ (AUPC)
51	**Interface substitution pattern** (ref. 'ISP_' command).	p51 = n, where 'n' is '0' (OFF) or '1' (ON).
52	**Interface read error** (ref. 'IRE_' command).	p52 = n, where 'n' is '0' (OFF) or '1' (ON).

Bulk Consol.
Status
(continued)

	Parameter Number	Parameter Name (Command Reference)	Description
	53	**Transmit data fault** (ref. 'TDF_' command).	p53 = n, where 'n' is '0' (NONE), '1' (DATA), or '2' (AIS).
	54	**Receive data fault** (ref. 'RDF_' command).	p54 = n, where 'n' is '0' (NONE), '1' (DATA), or '2' (AIS).
	55	**Interface service channel TX1** (ref. 'ISCL_' command).	p55 = nnn, service channel level in dBm.
	56	**Interface service channel TX2** (ref. 'ISCL_' command).	p56 = nnn, service channel level in dBm.
	57	**Interface service channel RX1** (ref. 'ISCL_' command).	p57 = nnn, service channel level in dBm.
	58	**Interface service channel RX2** (ref. 'ISCL_' command).	p58 = nnn, service channel level in dBm.
	59	**System modem type** (ref. 'SMT_' command).	p59 = n, where 'n' is '0' (IDR), '1' (IBS), "2' (EFD), 3' (CUSTOM), '4' (DI), '5' (ASYNC), or ‘8’ (AUPC)
	60	**Modem operation mode** (ref. 'MOM_' command).	p60 = n, where 'n' is '1' (TX_ONLY), '2' (RX_ONLY), '3' (DUPLEX).
	61	**MODEM REMOTE/LOCAL mode.**	p61 = n, where 'n' is '0' (LOCAL), '1' (REMOTE).
	62	**Transmit data phase** (ref. 'TDP_' command).	p62 = n, where 'n' is '0' (NRM), '1' (INV).
	63	**Receive data phase** (ref. 'RDP_' command).	p63 = n, where 'n' is '0' (NRM), '1' (INV).
	64	**Drop Data Format** (ref. 'DDF_' command).	p64 = n, where 'n' is '0' (T1), '1' (T1ESF), '2' (E1CCS), '3' (E1CAS), '6' (E131TS), '7' (T1S), and '8' (T1ESFS).
	65	**Insert Data Format** (ref. 'IDF_' command).	p65 = n, where 'n' is '0' (T1), '1' (T1ESF), '2' (E1CCS), '3' (E1CAS), '6' (E131TS), '7' (T1S), and '8' (T1ESFS).
	66	**Bulk Drop Channels Assignment.**	p66 = dd;cc_dd;cc_dd;cc_dd;cc......, as defined by the BDCA_ command.
(Note 1)	67	**Bulk Insert Channels Assignment.**	p67 = ii;cc_ii;cc_ii;cc_ii;cc......, as defined by the BICA_ command.
(Note 2)	68	**Insert E1 CRC Enable** (ref. 'ICRC_' command).	p68 = n, where 'n' is '0' (off) or '1' (on).
(Note 1)	69	**Modem Reference Clock** (ref. 'MRC_' command).	p69 = n, where 'n' is '0' (INT), '1' (EXT1), '2' (EXT5), '3' (EXT10), or '4' (EXT20), respectively.
	70	**Modulator Spectrum Rotation** (ref. 'MSR_' command).	p70 = n, where 'n' is '0' (NRM), '1' (INV).

Bulk Consol.
Status
(continued)

	Parameter Number	Parameter Name (Command Reference)	Description
(Note 2)	71	**Demodulator Spectrum Rotation** (ref. 'DSR_' command).	p71 = n, where 'n' is '0' (NRM), '1' (INV).
(Note 2)	72	**Reed-Solomon Encoder Enable** (ref. 'RSEN_' command).	p72 = n, where 'n' is '0' (off) or '1' (on).
	73	**Reed-Solomon Decoder Enable** (ref. 'RSDE_' command).	p73 = n, where 'n' is '0'(OFF), '1' (ON), '2' (CORR_OFF).
	74	**Backward Alarm enable TX1** (ref. 'BW_TX1_' command).	p74 = n, where 'n' is '0' (off) or '1' (on).
(Note 3)	75	**Backward Alarm enable TX2** (ref. 'BW_TX2_' command).	p75 = n, where 'n' is '0' (off) or '1' (on).
(Note 3)	76	**Backward Alarm enable** (ref. 'BW_TX3_' command).	p76 = n, where 'n' is '0' (off) or '1' (on).
(Note 3)	77	**Backward Alarm enable TX4** (ref. 'BW_TX4_' command).	p77 = n, where 'n' is '0' (off) or '1' (on).
(Note 3)	78	**Backward Alarm enable RX1** (ref. 'BW_RX1_' command).	p78 = n, where 'n' is '0' (off) or '1' (on).
(Note 4)	79	**Backward Alarm enable RX2** (ref. 'BW_RX2_' command).	p79 = n, where 'n' is '0' (off) or '1' (on).
(Note 4)	80	**Backward Alarm enable RX3** (ref. 'BW_RX3_' command).	p80 = n, where 'n' is '0' (off) or '1' (on).
(Note 4)	81	**Backward Alarm enable RX4** (ref. 'BW_RX4_' command).	p81 = n, where 'n' is '0' (off) or '1' (on).
(Note 4)	82	**TX Driver Type** (ref. 'TXDR_' command).	p82 = n, where 'n' is '0' (G.703), '1' (V.35), '2' (RS422), or '3' (RS232).
	83	**RX Driver Type** (ref. 'RXDR_' command).	p83 = n, where 'n' is '0' (G.703), '1' (V.35), '2' (RS422), or '3' (RS232).
	84	**reserved null field.**	
	85	**ASYNC TX Overhead Baud Rate** (ref. 'TOBR_' command).	p85 = nnnnn, where 'nnnnn' is the currently programmed baud rate.
(Note 5)	86	**ASYNC RX Overhead Baud Rate** (ref. 'ROBR_' command).	p86 = nnnnn, where 'nnnnn' is the currently programmed baud rate.
	87	**ASYNC TX Channel Char. Length** (ref. 'TCCL_' command).	p87 = n, where 'n' is the currently programmed character length.
	88	**ASYNC RX Channel Char. Length** (ref. 'RCCL_' command).	p88 = n, where 'n' is the currently programmed character length.

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Status
(continued)

	Parameter Number	Parameter Name (Command Reference)	Description
(Note 5)	89	**ASYNC TX Channel Stop** (ref. 'TCSB_' command).	p89 = n, where 'n' is the current number of stop bits programmed.
(Note 6)	90	**ASYNC RX Channel Stop Bits** (ref. 'RCSB_' command).	p90 = n, where 'n' is the current number of stop bits programmed.
(Note 5)	91	**ASYNC TX Channel Parity** (ref. 'TOCP_' command).	p91 = xxxx, where 'xxxx' is the currently programmed parity.
(Note 6)	92	**ASYNC RX Channel Parity** (ref. 'ROCP_' command).	p92 = xxxx, where 'xxxx' is the currently programmed parity.
(Note 5)	93	**ASYNC TX Communications Type** (ref. 'TCT_' command).	p93 = n, where 'n' is '0' (RS232), '1' (RS485_4WIRE), '2' (RS485_2WIRE).
(Note 6)	94	**ASYNC RX Communications Type** (ref. 'RCT_' command).	p94 = n, where 'n' is '0' (RS232), '1' (RS485).
(Note 14)	95	**AUPC Local Power enable ON/OFF** (ref. 'LPC_' command).	p95 = n, where 'n' is '0' (off) or '1' (on).
(Note 14)	96	**AUPC Nominal Power Value** (ref. 'NOMP_' command).	p96 = snn.n, where 'snn.n' Nominal Power Value in dBm.
(Note 14)	97	**AUPC Minimum Power Value** (ref. 'MINP_' command).	p97 = snn.n, where 'snn.n' Minimum Power Value in dBm.
(Note 14)	98	**AUPC Maximum Power Value** (ref. 'MAXP_' command).	p98 = snn.n, where 'snn.n' Maximum Power Value in dBm.
(Note 15)	99	**AUPC EBN0 Target Set Point** (ref. 'ENSP_' command).	p99 = nn.n, where 'nn.n' EBN0 Target Set Point in dB.
(Note 15)	100	**AUPC Max. Tracking Rate** (ref. 'MAXT_' command).	p100 = n.n, where 'n.n' is the Max. Tracking Rate in dB/Min.
(Note 14)	101	**AUPC Local Carrier Loss** (ref. 'LCL_' command).	p101 = n, where 'n' is '0' (HOLD), '1' (NOMINAL), or '2' (MAXIMUM).
(Note 14	102	**AUPC Remote Carrier Loss** (ref. 'RCL_' command).	p102 = n, where 'n' is '0' (HOLD), '1' (NOMINAL), or '2' (MAXIMUM).
	103	**reserved null field.**	
	104	**reserved null field.**	
	105	**Transmit BPSK Data Ordering** (ref. 'TDA_' command).	p105 = n, where 'n' is '0' (NRM), '1' (INV).
	106	**Receive BPSK Data Ordering** (ref. 'RDA_' command).	p106 = n, where 'n' is '0' (NRM), '1' (INV).

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Status
(continued)

	Parameter Number	Parameter Name (Command Reference)	Description
	107	**RTS TX-IF Control Mode** (ref. 'RTSM_' command).	p107 = n, where 'n' is '0' (off) or '1' (on).
	108	**CTS Delay Time** (ref. 'CTSD_' command).	p108 = nn, CTS delay time in seconds.
	109	**Carrier Only Mode** (ref. 'COM_' command).	p109 = n, where 'n' is '0' (OFF),'1' (CENTER-CW), '2' (DUAL-CW), '3' (OFFSET-CW).
	110	**IDR TX ESC Type** (ref. 'IDRT_' command).	p110 = n, where 'n' is '0' (AUDIO), '1' (DATA).
(Note 3)	111	**IDR RX ESC Type** (ref. 'IDRR_' command).	p111 = n, where 'n' is '0' (AUDIO), '1' (DATA).
(Note 4)	112	**IBS TX ESC Type** (ref. 'IBST_' command).	p112 = n, where 'n' is '0' (AUDIO), '1' (DATA).
(Note 3)	113	**IBS RX ESC Type** (ref. 'IBSR_' command).	p113 = n, where 'n' is '0' (AUDIO), '1' (DATA).
(Note 4)	114	**TX Reed-Solomon Interleave Value** (ref. 'TRSI_' command).	p114 = nn, Interleave value.
	115	**RX Reed-Solomon Interleave Value** (ref. 'RRSI_' command).	p115 = nn, Interleave value.
	116	**reserved null field.**	
	117	**reserved null field.**	
	118	**reserved null field.**	
	119	**TX 8PSK 2/3 IESS-310 Operation** (ref. 'T310_' command).	p119 = n, where 'n' is '0' (off) or '1' (on).
(Note 8)	120	**RX 8PSK 2/3 IESS-310 Operation** (ref. 'R310_' command).	p120 = n, where 'n' is '0' (off) or '1' (on).
	121 thru 124	Not Used.	

Notes:

1. Data will only be returned if TX Overhead is programmed for Drop & Insert. Comma is always returned.
2. Data will only be returned if RX Overhead is programmed for Drop & Insert. Comma is always returned.
3. Data will only be returned if TX Overhead is programmed for IDR/IBS. Comma is always returned.
4. Data will only be returned if RX Overhead is programmed for IDR/IBS. Comma is always returned.
5. Data will only be returned if TX Overhead is programmed for ASYNC. Comma is always returned.
6. Data will only be returned if RX Overhead is programmed for ASYNC. Comma is always returned.
7. Not Used.
8. Not Used.
9. Not Used.
10. Not Used.
11. Not Used
12. Not Used
13. Not Used.
14. Data will only be returned if TX Overhead is programmed for ASYNC/AUPC. Comma is always returned.
15. Data will only be returned if RX Overhead is programmed for ASYNC/AUPC. Comma is always returned.
16. Data will only be returned for TX L-Band modem. Comma is always returned.

Bulk Consoli-dated Status Faults	Command: Response:	<add/BCSF_'cr' >add/BCSF_abcdefghijklmnopqr'cr''lf']	This command causes all modem fault status 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. 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 = reserved. Bit 5 = Data Clock Synthesizer. Bit 2 = I Channel. Bit 1 = Q Channel. Bit 0 = AGC Level. Character 'c': Modulator fault status character 3. Bit 6 = 1 always. Bit 5 = Modem Reference PLL Lock. Bit 4 = reserved. Bit 3 = Configuration. Bit 2 = Modem Reference Activity. 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. Character 'e': Demodulator fault status character 2. Bit 6 = 1 always. Bit 5 = IF Synthesizer Lock. Bit 4 = reserved. Bit 3 = I Channel. Bit 2 = Q Channel. Bit 1 = reserved. Bit 0 = BER threshold. Character 'f': Demodulator fault status character 3. Bit 6 = 1 always. Bit 5 = LNB. Bit 4 = Configuration. 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 = Transmit Data/AIS. Bit 4 = Transmit Synthesizer PLL Lock. Bit 3 = Selected Transmit Clock Activity. Bit 2 = reserved. Bit 1 = Configuration. Bit 0 = Drop fault.

			Character 'i': Interface transmit side faults character 3. Bit 6 = 1 always. Bit 5 = TX Audio Channel 1 Clip. Bit 4 = TX Audio Channel 2 Clip. Bit 3 = reserved. Bit 2 = reserved. Bit 1 = reserved. Bit 0 = reserved. Character 'j': Interface receive side faults character 1. Bit 6 = 1 always. Bit 5 = Insert fault. Bit 4 = reserved. Bit 3 through Bit 0 = Binary representation (0 to 10) of the number of interface receive side stored faults. Character 'k': Interface receive side faults character 2. Bit 6 = 1 always. Bit 5 = Buffer Underflow. Bit 4 = Buffer Overflow. Bit 3 = Receive Data Loss/AIS. Bit 2 = Frame BER. Bit 1 = Receive Backward Alarm. Bit 0 = Selected Buffer Clock Activity. Character 'l': Interface receive side faults character 3. Bit 6 = 1 always. Bit 5 = Buffer Clock PLL Lock. Bit 4 = Demux Lock. Bit 3 = 2047 Pattern Lock Detect. Bit 2 = Buffer Full. Bit 1 = reserved. Bit 0 = Configuration. Character 'm': Interface receive side faults character 4. Bit 6 = 1 always. Bit 5 = RX Audio Channel 1 Clip. Bit 4 = RX Audio Channel 2 Clip. Bit 3 = reserved. Bit 2 = reserved. Bit 1 = reserved. Bit 0 = reserved. Character 'n': Common equipment fault status character 1. Bit 6 = 1 always. Bit 5 = Monitor & 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 'o': Common equipment fault status character 2. Bit 6 = 1 always. Bit 5 = Battery/Clock. Bit 4 = +5V power supply. Bit 3 = reserved. Bit 2 = +12V power supply. Bit 1 = -12V power supply. Bit 0 = reserved. Character 'p': Interface backward alarm status character 1. Bit 6 = 1 always. Bit 5 = TX Backward Alarm 1. Bit 4 = TX Backward Alarm 2. Bit 3 through Bit 0 = Binary representation (0 to 10) of the number of backward alarm stored faults. Character 'q': Interface backward alarm status character 2. Bit 6 = 1 always. Bit 5 = TX Backward Alarm 3. Bit 4 = TX Backward Alarm 4. Bit 3 = RX Backward Alarm 1. Bit 2 = RX Backward Alarm 2. Bit 1 = RX Backward Alarm 3. Bit 0 = RX Backward Alarm 4.

			Character 'r': Interface Reed-Solomon Unavailable Seconds Bit 6 = 1 always. Bit 5 = not used. Bit 4 = not used. Bit 3 through Bit 0 = Binary representation (0 to 10) of the number of Reed-Solomon Unavailable Seconds stored faults. Character 's': Outdoor Unit Status Character 1. Bit 6 = 1 always. Bit 5 = Current. Bit 4 = Voltage. Bit 3 through Bit 0 = Binary representation (0 to 10) of the number of Outdoor Unit stored faults. Character 't': Outdoor Unit Status Character 2. Bit 6 = 1 always. Bit 5 = reserved. Bit 4 = reserved. Bit 3 = reserved. Bit 2 = reserved. Bit 1 = reserved. Bit 0 = reserved.
Change Status	Command: Response:	<add/CS_'cr' >add/CS_x'cr''lf']	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. This command indicates that a change has or has not occurred on either the BCS_ or the BCSF_ response since the last BCS_ or BCSF_ poll.
Equipment Type	Command: Response:	<add/ET_'cr' >add/ET_tttttttt_xxx.yyy.zzz'cr''lf']	Where: tttttttt = Equipment type. xxx.yyy.zzz = Software version.
Monitor & Control Firmware Information	Command: Response:	<add/MCFI_'cr' >add/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).
DATA ROM Firmware Information	Command: Response:	<add/DFI_'cr' >add/DFI_'cr' FW/nnnnnn-ddr'cr' mm/dd/yy'cr' Turbo: FW/nnnnnn-r'cr''lf']	Where: nnnnnn = Firmware number (0 to 999999). dd = Firmware dash number (0 to 99). r = Firmware revision (-, or A to Z). Note: If Dash number is not used, '-dd' will be reported. Turbo FW number only reports if Turbo Codec is installed.

Boot M&C Firmware Information	Command: Response:	<add/BFI_'cr' >add/BFI_'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 Options/ Misc. Information	Command: Response:	<add/MOI_'cr' >add/MOI_'cr' s,HGH_PWR'cr' s,HGH_STAB'cr' s,ASLT'cr' s,VIT'cr' s,SEQ'cr' s,SR'cr' s,LRV'cr' s,FRV'cr' s,CARD_1_PCB'cr' s,CARD_2_PCB'cr' s,CARD_3_PCB'cr' s,8PSK_2/3'cr' s,TX_ONLY'cr' s,RX_ONLY'cr' s,OQPSK'cr' s,TX_L-BAND'cr''lf']	 (0 or +) High Power (0 or +) High Stability (- or +) Asymmetrical Loop Timing (- or +) Viterbi Encoder/Decoder (- or +) Sequential Encoder/Decoder (- or +) Single Code/Data Rate (- or +) Low Rate Variable (- or +) Full Rate Variable (x or +) Card #1 Installed (x or +) Card #2 Installed (x or +) Card #3 Installed (- or +) 8PSK 2/3 Code Rate (0 or +) TX Only Operation (0 or +) RX Only Operation (- or +) OQPSK 1/2, 3/4, 7/8 (0 or +) TX L-Band modem Notes: 1. s = 0 (Not Installed, Not Upgradable). 2. - (Not Installed, FAST Upgradable). 3. + (Installed). 4. X (Not Installed, Field Upgradable).
Card #1 Type Information	Command: Response:	<add/C1TI_'cr' >add/C1TI_'cr' ttttt'cr''lf']	Where: ttttt = type (OH_01, MUX_01, FMUX_01, IP 01, or NOT_INSTALLED).
Card #2 Type Information	Command: Response:	<add/C2TI_'cr' >add/C2TI_'cr' tttt'cr''lf']	Where: tttt = type (RS_02, RS_03, Turbo or NOT_INSTALLED).
Card #3 Type Information	Command: Response:	<add/C3TI_'cr' >add/C3TI_'cr' tttt'cr''lf']	Where: tttt = type (RS_02, RS_03, Turbo or NOT_INSTALLED).

Card #1 Options/ Misc. Information	Command: Response:	<add/C1OI_'cr' >add/C1OI_'cr' OH_01 list: s,G.703 'cr' s,IBS 'cr' s,ASYNC_AUPC'cr' s,D&I 'cr' s,IDR 'cr''lf'] MUX_01 list: s,4_CHAN_SYNC'cr' s,8_CHAN_SYNC'cr' s,4_CHAN_ASYNC'cr' s,8_CHAN_ASYNC'cr''lf'] IP_01 list: (CiM modem only) s, TCP accelerationC'cr' s, Data encryption'cr' s, Data compression'cr' s, QOS'cr' s, NAT'cr' s, Bridging'cr' s, IGMP'cr' s, Header compress'cr''lf']	 (- or +) (- or +) (- or +) (- or +) (- or +) (- or +) (- or +) (- or +) (- or +) Notes: 1. Card #1 Installed Only. 2. s = - (Not Installed, FAST Upgradable). 3. + (Installed).
Card #2 Options/ Misc. Information	Command: Response:	<add/C2OI_'cr' >add/C2OI_'cr' RS_02 list: s,INTELSAT'cr' s,AUPC'cr''lf'] RS_03 list: s,INTELSAT'cr' s,AUPC'cr''lf'] TURBOlist: s,AUPC'cr''lf'	 (- or +) (- or +) (- or +) (- or +) (- or +) Notes: 1. Card #2 Installed Only. 2. s = - (Not Installed, FAST Upgradable). 3. + (Installed).
Card #3 Options/ Misc. Information	Command: Response:	<add/C3OI_'cr' >add/C3OI_'cr' RS_02 list: s,INTELSAT'cr' s,AUPC'cr''lf'] RS_03 list: s,INTELSAT'cr' s,AUPC'cr''lf'] TURBOlist: s,AUPC'cr''lf'	 (- or +) (- or +) (- or +) (- or +) (- or +) Notes: 1. Card #3 Installed Only. 2. s = - (Not Installed, FAST Upgradable). 3. + (Installed).

Serial Number	Command: Response:	<add/SNUM_'cr' >add/SNUM_'cr' MODEM_xxxxxxxxx'cr' CARD_1_xxxxxxxxx'cr' (Note 1) CARD_2_xxxxxxxxx'cr' (Note 2) CARD_3_xxxxxxxxx'cr''lf'] (Note 3)	Where: xxxxxxxxx = Serial number 000000000 to 999999999. Notes: 1. Data is only returned if Card #1 is installed. 2. Data is only returned if Card #2 is installed. 3. Data is only returned if Card #3 is installed.
State Of Product	Command: Response:	<add/SOP_'cr' >add/SOP_'cr' add'cr' abc'cr' rrrrr bps'cr' <var-string1>'cr' <var-string2>'cr''lf']	 Product Address Data Format Baud Rate Comm Type Where: abc = Explained below. a = Number of data bits (7). b = Parity type (O, E, N). c = Number of stop bits (2). rrrrr = baud rate ("150", "300", "600", "1200", "2400", "4800", "9600", "14.4K", "19.2K"). <var-string1> = Variable length strings explaining communication hardware type "RS-485, 2 wire", "RS-485, 4 wire", "RS-232". <var_string2> = Variable length strings explaining the intention of the product. "Under normal system operation", "REFLASH of BULK firmware required", "REFLASH of M&C firmware required".

Glossary

The following is a list of acronyms and abbreviations that may be found in this manual.

Acronym	Definition
Ω	Ohms
8PSK	8 Phase Shift Keying
A	Ampere
AC	Alternating Current
ADJ	Adjust
AGC	Automatic Gain Control
AIS	Alarm Indication Signal
AM	Amplitude Modulation
ASCII	American Standard Code for Information Interchange
ASYNC	Asynchronous
AUPC	Automatic Uplink Power Control
BB	Baseband
bps	bits per second
BPSK	Binary Phase Shift Keying
C	Celsius
CLK	Clock
COM	Common
CS	Clear to Send
CTS	Clear to Send
CW	Continuous Wave
dB	Decibels
dBc	Decibels referred to carrier
dBm	Decibels referred to 1.0 milliwatt
DC	Direct Current
DCE	Data Circuit Terminating Equipment
Demod	Demodulator
DM	Data Mode
DSR	Data Signal Rate

EIA	Electronic Industries Association
EMC	Electro-Magnetic Compatibility
ESC	Engineering Service Circuit or Engineering Service Channel
ESD	Electrostatic Discharge
EXT REF CLK	External Reference Clock
FAST	Fully Accessible System Topology
FIFO	First in/First Out
FW	Firmware
GND	Ground
Hz	Hertz (cycle per second)
I/O	Input/Output
IF	Intermediate Frequency
INV	Invert
kbps	Kilobits per second
kHz	Kilohertz (10^3 Hertz)
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
lf	Line Feed
m	mille (10^{-3})
M&C	Monitor and Control
Max	Maximum
Mbps	Megabits per second
MC	Monitor and Control
MFS	Multiframe Sync
MHz	Megahertz (10^6 Hertz)
Mod	Modulator
MOP	Modulated Output Power
MSB	Most Significant Bit
MUX	Multiplexer
n	nano (10^{-9})
N/A	Not Applicable
NC	No Connection or Normally Closed
NO	Normally Open
NRM	Normal
OQPSK	Offset Quadrature Phase Shift Keying
p	pico (10^{-12})
PCB	Printed Circuit Board
PLL	Phase-Locked Loop
PPM	Parts Per Million
PSK	Phase Shift Keying
QPSK	Quadrature Phase Shift Keying
RAM	Random Access Memory
RD	Receive Data
RF	Radio Frequency
RR	Receiver Ready
RS	Ready to Send
RT	Receive Timing
RTS	Request to Send
RX	Receive (Receiver)
RXD	Receive Data
s	Second
SCT	Serial Clock Transmit
SD	Send Data
ST	Send Timing

SYNC	Synchronize
TT	Terminal Timing
TTL	Transistor-Transistor Logic
TX	Transmit (Transmitter)
TXCLK	Transmit Clock
TXD	Transmit Data
UB	Universal Brreakout box
US	United States
V	Volts
VAC	Volts, Alternating Current
VCO	Voltage-Controlled Oscillator
VDC	Volts, Direct Current
VIT	Viterbi
W	Watt

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SDM-300L3

Satellite Modem

Installation and Operation Manual

Addendum A

Subject: Add Appendic B. Burst Mode Modulator Operation
Part Number: MN/SDM300L3.AA0
Revision 0 Addendum A
October 13, 2003

Special Instructions:

This document contains new information for the SDM-300L3 Satellite Modem installation and operation manual, part number MN/SDM-300L3.IOM Rev. 0 dated August 1, 2003.

Collating Instructions

To update the manual, remove and insert the pages as follows:

Remove	Insert
	Appendix B (pages C-1 through C-18)

Appendix B. Burst Mode Modulator Operation

B.1 Burst Mode Modulator: 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.

B.1.1 Burst Mode

From the front panel, TX Terrestrial or SCT can be selected for the modulator clock input. An activity detector monitors the selected clock, to automatically switch the clock to SCT if there is a fault.

When a transmission is to be initiated, the RTS input must be activated. When detected, the modulator will put out a pure carrier for 96 clock cycles at 19.2 kbps or 288 clock symbols at 57.6 kbps, followed by a clock training sequence for 352 clock cycles. A 31-bit unique word is then transmitted.

At this time, the CTS line will go false. The next bit of data into the modem will be the first bit transmitted.

When the last bit of the data packet has been sent to the modem, the user deactivates the RTS line.

When the modulator detects RTS going false, the modulator will flush the convolutional encoder (6 bits), then put out the unique word prime twice (62 bits). At this point, the packet is complete, and the modulator will return the CTS to true. The modulator is now ready for the next packet.

Data to be transmitted will come from the interface card via the demodulator. The format is RS-422, and includes a clock that is synchronous with the data. The data signal at this point 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 (D/A) 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 will be identical to that of the input data streams, but 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 to 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 x 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 steps. Power leveling is provided at ± 1.0 dB to maintain the stability of the output level over time and temperature.

Note: The data packet must not be less than 48 bits of data. There is no maximum length for the data packet.

B.2 Burst Mode Modulator: Specifications

B.2.1 Digital Data Rate

The digital data rate is selectable at 19.2 or 57.6 kbps. The modem automatically calculates and sets the symbol rate.

Modulation Type	Encoding Type	Data Rate
QPSK 1/2	Viterbi	19.2 kbps
QPSK 1/2	Viterbi	57.6 kbps

B.2.2 Modulation and Encoding Types

QPSK modulation and 1/2 rate Viterbi forward error correction encoding is standard.

Encoder	Code Rate	Modulation
Viterbi, K7	1/2	QPSK

B.2.3 Scrambling Types

One of the following scrambling types can be selected by the operator.

- A programmable seed 2^15 -1 Synchronous Scrambler.
- None

B.2.4 Differential Encoder

The differential encoder is not needed as the data inversion ambiguity is resolved during acquisition.

B.2.5 Transmit Frequency (IF)

The range of the output IF spectrum can be selected by the operator from 50 to 180 MHz, in 1 Hz steps.

B.2.6 Frequency Reference

SCT, RX Bit Clock, and IF output are locked to the Frequency Reference.

Internal (Standard	Stability over the operating temperature range = ± 10 PPM.
Internal High Stability (Optional)	Stability over the operating temperature range = ± 0.2 PPM.
External Reference Input (Standard)	The External frequency reference connector is located on the back panel. This allows Frequency Reference to be locked to an external reference frequency standard. Impedance: 75Ω Frequency: 1, 5, 10 or 20 MHz Amplitude: ≥ +0 dBm < +20 dBm DC offset: Capacitively coupled Connector: BNC
Reference Frequency Output (Optional)	The External frequency reference connector can be used as an output when the High Stability option is installed. When selected from the front panel, this output can be used to lock other equipment to the Internal High Stability Reference of the selected modem. The output is 10 MHz, the level is +10 dBm ± 5 dBm.

B.2.7 Transmit Frequency Change Time

The time between the end of a remote command and the end of the modem reply for frequency change and synthesizer lock will be < 200 mS.

B.2.8 Phase Noise

1. The phase noise of the transmit IF output carrier is no worse than:

dBc/Hz	Distance from Carrier
-66.0	100 Hz
-76.0	1 kHz
-86.0	10 kHz
-96.0	100 kHz
-96.0	1 MHz

2. Fundamental AC line spurious is -42 dBc or lower.

3. The sum of all the single sideband spurious, from 0 to 0.75 x symbol rate, is -42 dBc or lower.

B.2.9 Transmit IF Output Switch

When set to off, no signal present at the output is greater than -60 dBm, measured in a 3 kHz bandwidth from 0 to 500 MHz.

B.2.10 Transmit IF Power

The TX-IF power is operator selectable from -5 to -30 dBm, in 0.1 dB steps, with an accuracy of ± 0.5 dB. The maximum drift due to temperature change over the specified range is ± 0.5 dB.

As an option the output can be selectable from +5 to -20 dBm, in 0.1 dB steps, with an accuracy of ± 0.5 dB. The maximum drift due to temperature change over the specified range is ± 0.5 dB.

B.2.11 Modulator Power Offset

An offset to the displayed IF output power may be entered from -99.0 to +99.0 dB, in 0.1 dB steps.

B.2.12 Modulated IF Output Shape

The modem meets the following transmit output spectral mask specifications. The desired mask is selectable from the front panel or remotely.

- INTELSAT/EUTELSAT
- Closed net (Comtech EF Data)

B.2.13 Spurious Emissions

Spurious emissions are measured relative to the power of the modulated carrier. The measurement is done with the carrier on in continuous mode and modulated by the correct data/clock signal. Spurious emissions measured in a 3 kHz bandwidth at the transmit IF output are:

0 to 500 MHz (-5 to -30 dBm)	-55 dBc
0 to 500 MHz (+5 to -20 dBm > 64 kbps)	-50 dBc
0 to 500 MHz (+5 to -20 dBm < 64 kbps)	-45 dBc

B.2.14 Modulator Phase Error

The modulator will have less than 2° of phase error

B.2.15 Transmit IF Test Modes

The following transmit IF test modes are available to the operator. Spurious emissions in the following test modes will be ≤ -30 dBc.

TX IF Test Modes	Remarks
CW:	Outputs a single carrier at the defined frequency
Offset:	Dual sideband signal with lower sideband and carrier suppressed ≤ -35 dBc
Dual sideband:	Suppressed carrier ≤ -35 dBc

B.2.16 Modulator Spectrum Rotation

The operator can select Normal or Inverted spectrum of the Modulator Output.

B.2.17 Transmit Preamble

In burst mode, when RTS transitions from false to true, the modem shall turn on the RF carrier and generate a burst preamble with the following characteristics:

96 symbols at 19.2 kbps 288 symbols at 57.6 kbps CW	352 symbols BIT TIMING	31 symbols UNIQUE WORD

Channel contents:

CW:	I and Q channels contain all 1's	
Bit Timing:	I:	1010...
	Q:	1010...
Unique Word:	I:	000 0010 0011 1010 1001 0111 1001 1011
	Q:	000 0010 0011 1010 1001 0111 1001 1011

***Note:** Bit Timing and the Unique Word is BPSK and uncoded.

At the end of the preamble, the modulator shall cause CTS to transition from false to true. This signals the baseband equipment to begin sending data. The RF carrier shall remain on until RTS transitions back to false.

B.2.18 Transmit Packet

The minimum length is 48 bps. The maximum length can be infinite. Packet length is determined by the user.

B.2.19 Transmit Postamble

When RTS transitions back to false, the modulator flushes the Encoder and sends the End of Message pattern, turns off the RF carrier and resets CTS back to false. The EOM pattern is shown below.

6 symbols Flush	31 symbols Unique Word’	31 symbols Unique Word’

Unique Word Prime	I:	110 1100 1111 0100 1010 1110 0010 0000
	Q:	110 1100 1111 0100 1010 1110 0010 0000

***Note:** The Unique Word Prime is BPSK and uncoded.

B.3 Burst Mode Specifications

General Specifications	
Operating Frequency Range	950 to 1750 MHz, synthesized in 100 Hz steps
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
Bit Error Rate	See Table 1-3
Phase Noise	In accordance with IESS-308
Digital Interface (Field Changeable Plug-in Modules) One Interface per Module)	RS-422/449 on 37-pin D MIL-STD-188 on 37-pin D V.35 on 25-pin D or 34-pin block RS-232 on 25 pin-D
Digital Data Rate: QPSK, 1/2 Rate QPSK, 1/2 Rate	 19.2 kbps 57.6 kbps
Doppler Buffer	N/A
Forward Error Correction	Convolutional encoding with soft decision, K=7 Viterbi decoding or Sequential
Data Scrambling	Selectable or none, 2^{15}-1, synchronous
Prime Power	90 to 264 VAC auto select, 47 to 63 Hz, 50W maximum, fused at 2A, 38 to 64 VDC
Operating Temperature	0° to 50°C (32 to 122°F)
Humidity	0 to 95% noncondensing
Diagnostic Features	IF Loopback RF Loopback Baseband Loopback (bi-directional, electrical) Fault Monitoring Bit Error Rate Monitoring Remote Control via Serial Port

Additional Modulator Specifications	
Output Power	-5 to -30 dBm, adjustable in 0.1 dB steps
Output Spurious and Harmonics	-55 dBc in 4 kHz BW in-band (50 to 180 MHz) -55 dBc in 4 kHz BW out-of-band (0 to 500 MHz)
Output Impedance	75Ω standard (50Ω optional)
Output Return Loss	20 dB
Output Frequency Stability	± 10 PPM
Data Clock Source	Internal or external External clock ± 100 PPM and < 5% jitter
Internal Data Clock Stability	± 10 PPM
Additional 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
Input Impedance	75Ω standard (50Ω optional)
Input Return Loss	20 dB
Carrier Acquisition Range	± 4 kHz minimum
Clock Acquisition Range	± 100 PPM
Acquisition Time	< 30 ms
Directed Sweep	N/A
Remote Control Specifications	
Serial Interface	RS-485/449, baud rate 110 to 19,200 bit/s Protocol not necessarily compatible with SDM-650 and SDM-308
Signals Controlled/Monitored	Transmit Frequency Receive Frequency Transmit Power Transmitter ON/OFF IF Loopback RF Loopback Baseband Loopback Scrambler ON/OFF Descrambler ON/OFF Sweep Center Filter Mask Raw Error Rate Corrected Bit Error Rate Receive E_b/N_0 TX Clock Internal/External RX Clock Normal/Invert Receive Signal Level Receive Carrier Detect Power Supply Voltages Fault Status Stored Fault Status
Configuration Retention	Will maintain current configuration for at least one year without power
Addressing	Programmable to 1 of 255 possibilities Address 0 reserved for global addressing
Local control of all remote functions included via push-button entry	

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	—

COMTECH EF DATA

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