DMD2401 LB/ST

L-Band Satellite Modem and ODU Driver

Installation and Operation Manual

TM075 - Rev. 1.3
March, 2002

Radyne ComStream Corporation • 3138 E. Elwood St. • Phoenix, AZ 85034 • (602) 437-9620 • Fax: (602) 437-4811

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Radyne ComStream Corporation Warranty Policy

Warranty and Service

Radyne ComStream Corporation (Seller) warrants the items manufactured and sold by Radyne ComStream Corporation to be free of defects in material and workmanship for a period of two (2) years from date of shipment Radyne ComStream Corporation's obligation under its warranty is limited in accordance with the periods of time and all other conditions stated in all provisions of this warranty. This warranty applies only to defects in material and workmanship in products manufactured by Radyne ComStream Corporation. Radyne ComStream Corporation makes no guarantee whatsoever concerning products or accessories not of its manufacture. Repair, or at Radyne ComStream Corporation's option, replacement of the Radyne ComStream Corporation products or defective parts therein shall be the sole and exclusive remedy for all valid warranty claims.

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The applicable warranty period shall commence on the date of shipment from Radyne ComStream Corporation's facility to the original purchaser and extend for the stated period following the date of shipment. Upon beginning of the applicable Radyne ComStream Corporation warranty period, all customers' remedies shall be governed by the terms stated or referenced in this warranty. In-warranty repaired or replacement products or parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced products or parts. Repair or replacement of products or parts under warranty does not extend the original warranty period.

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The following are expressly ***not covered*** under warranty:

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2. Products, items, parts, accessories, subassemblies, or components which are expendable in normal use or are of limited life, such as but not limited to, bulbs, fuses, lamps, glassware, etc. Radyne ComStream Corporation reserves the right to revise the foregoing list of what is covered under this warranty.

Warranty Replacement and Adjustment

Radyne ComStream Corporation will not make warranty adjustments for failures of products or parts which occur after the specified maximum adjustment period. Unless otherwise agreed, failure shall be deemed to have occurred no more than seven (7) working days before the first date on which a notice of failure is received by Radyne ComStream Corporation. Under no circumstances shall any warranty exceed the period stated above unless expressly agreed to in writing by Radyne ComStream Corporation.

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This warranty is expressly in lieu of and excludes all other express and implied warranties, Including but not limited to warranties of merchantability and of fitness for particular purpose, use, or applications, and all other obligations or liabilities on the part of Radyne ComStream Corporation, unless such other warranties, obligations, or liabilities are expressly agreed to in writing by Radyne ComStream Corporation. All obligations of Radyne ComStream Corporation under this warranty shall cease in the event its products or parts thereof have been subjected to accident, abuse, alteration, misuse or neglect, or which have not been operated and maintained in accordance with proper operating instructions.

In no event shall Radyne ComStream Corporation be liable for Incidental, consequential, special or resulting loss or damage of any kind howsoever caused. Radyne ComStream Corporation's liability for damages shall not exceed the payment, if any, received by Radyne ComStream Corporation for the unit or product or service furnished or to be furnished, as the case may be, which is the subject of claim or dispute.

Statements made by any person, including representatives of Radyne ComStream Corporation, which are inconsistent or in conflict with the terms of this warranty, shall not be binding upon Radyne ComStream Corporation unless reduced to writing and approved by an officer of Radyne ComStream Corporation.

Warranty Repair Return Procedure

Before a warranty repair can be accomplished, a Repair Authorization must be received. It is at this time that Radyne ComStream Corporation will authorize the product or part to be returned to the Radyne ComStream Corporation facility or if field repair will be accomplished. The Repair Authorization may be requested in writing or by calling:

Radyne ComStream Corporation
3138 E. Elwood St.
Phoenix, Arizona 85034 (USA)
ATTN: Customer Support
Phone: (602) 437-9620
Fax: (602) 437-4811

Any product returned to Radyne ComStream Corporation for examination must be sent prepaid via the means of transportation indicated as acceptable to Radyne ComStream Corporation. Return Authorization Number must be clearly marked on the shipping label. Returned products or parts should be carefully packaged in the original container, if possible, and unless otherwise indicated, shipped to the above address.

Non-Warranty Repair

When a product is returned for any reason, Customer and its shipping agency shall be responsible for all damage resulting from improper packing and handling, and for loss in transit, not withstanding any defect or nonconformity in the product. By returning a product, the owner grants Radyne ComStream Corporation permission to open and disassemble the product as required for evaluation. In all cases, Radyne ComStream Corporation has sole responsibility for determining the cause and nature of failure, and Radyne ComStream Corporation's determination with regard thereto shall be final.

DMD2401 LB/ST L-Band Satellite Modem and ODU Driver
Installation and Operation Manual
TM075 – Record of Revisions

Revision Level	Date	Reason for Change
1.0	11-13-98	Initial Release
1.1	6-15-99	Added AUPC Data, revised the Operation Section, updated the Remote Specification, added Appendix C, Terminal Screens.
1.2	1-25-02	Revised and reformatted Technical Manual.
1.3	3-11-02	Added new product features.

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Section 1 – Introduction

1.0 Description

The Radyne ComStream Corporation DMD2401 LB/ST L-Band Satellite Modem and Outdoor Unit (ODU) Driver is a microprocessor-controlled Binary Phase Shift Keyed (BPSK), Quadrature Phase Shift Keyed (QPSK), Offset Quadrature Phase Shift Keyed (OQPSK), 8PSK Trellis Coded 8-Phase Shift Keyed Modulator and Demodulator for use as part of the transmitting and receiving ground equipment in a satellite communications system. The DMD2401 LB/ST has the capability of delivering power and a 10 MHz Reference Signal to a Low Noise Block Downconverter (LNB) and also to a Block Upconverter (BUC) capable of an 8-Watt Output. The DMD2401 LB/ST Modem may be referred to as the “modem” throughout the remainder of this document.

This versatile equipment package combines unsurpassed performance with numerous user-friendly Front Panel programmable functions. All of the configuration, monitor and control functions are available at the Front Panel. Operating parameters such as variable data rates, FEC Code Rate and IF/RF Frequencies can be readily set and reconfigured from the Front Panel by earth station operations personnel. Additionally, all functions can be accessed with a terminal or personal computer via a serial link for complete remote monitor and control capability.

The DMD2401 LB/ST operates at data rates up to 4.375 Mbps. Selection of any data rate is provided over the range of 9.6 Kbps to 4.375 Mbps in 1 bps steps.

The DMD2401 LB/ST is designed to perform as both ends of a satellite Single Channel Per Carrier (SCPC) Link or as the VSAT remote site modem in a TDMA Hub System. The Modulator and Demodulator operate independently using BPSK, QPSK, OQPSK, or 8PSK Modulation in either SCPC or VSAT Modes.

The DMD2401 LB/ST is programmable from the Front Panel. The program menu was specifically designed for ease of use to quickly put the modem online and for any network changes. The modem also can be monitored and controlled through the RS-485 or RS-232 serial control channel.

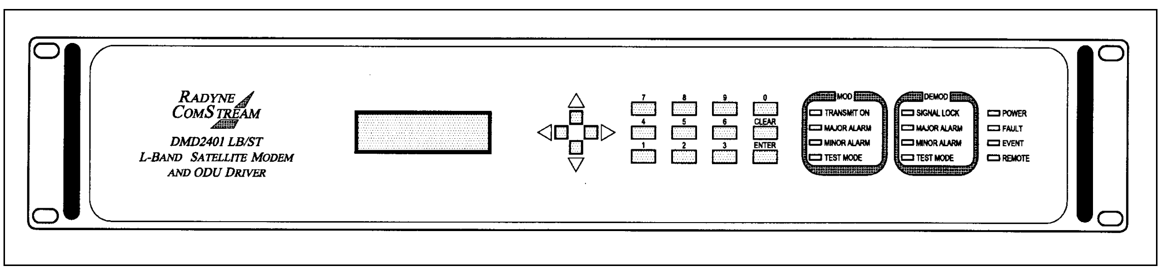

Figure 1-1. DMD2401 LB/ST L-Band Satellite Modem and ODU Driver

The DMD2401 is also the ideal VSAT modem for use in a Point-to-Point Frame Relay Hybrid Network. Other applications include FDMA, telephony, video conferencing, long-distance learning, paging and newsgathering.

Refer to Table 1-1 for selection of any data rate that is provided over the following ranges:

Table 1-1. Data Rates				
FEC	**1/2**	**2/3**	**3/4**	**7/8**
BPSK	4800 bps – 1250 Kbps	N/A	7200 bps – 1875 Kbps	8400 bps – 2187.5 Kbps
QPSK	9600 bps – 2500 Kbps	N/A	14400 bps – 3750 Kbps	16800 bps – 4375 Kbps
OQPSK	9600 bps – 2500 Kbps	N/A	14400 bps – 3750 Kbps	16800 bps – 4375 Kbps
8PSK	N/A	Optional	N/A	N/A

The DMD2401 can track and acquire a carrier over a programmable range of ±1 kHz to ±42 kHz. Acquisition times of less than 10 seconds are typical at data rates of 64 Kbps over a range of ± 25 kHz.

To facilitate link testing, the DMD2401 incorporates built-in '2047' test pattern generators with BER measurement capability. A user-selectable terrestrial and/or satellite loopback test capability is also provided.

For applications requiring systems redundancy, multiple DMD2401 modems may be used with the Radyne RCS11 1:1 Redundancy Switch or the RCS20 M:N (N $\leq$ 9) Redundancy Switch. A full range of industry-standard interfaces are available for the DMD2401, DMD2401L, and DMD2401 IBS/IDR. These include RS-232, V.35, RS-422/-449 and ITU G.703.

1.1 DMD2401 Available Options

A wide range of options are available for the DMD2401 LB/ST which include a low data rate asynchronous serial overhead channel for remote monitor and control. A brief description of each follows:

1.1.1 Reed-Solomon Codec

The DMD2401 can be equipped with a Reed-Solomon outer codec with an interleaver as an optional enhancement for applications requiring Bit Error Rates of 10^{-10}. The encoder and decoder are completely independent and meet IESS-308/-309 Specifications. Once prepped, this option can be installed in the field by installing four ICs into existing sockets.

Note: Custom Reed-Solomon codes are also available.

1.1.2 Sequential Decoding

The DMD2401 can also be equipped with an optionally installed sequential decoder. The DMD2401 must be prepped for this option in the factory. Once prepped, the option can be added by installing an IC into an existing socket. Sequential Encoding/Decoding can operate with 1/2, 3/4, and 7/8 Rates up to data rates of 4.375 Mbps.

1.1.3 Asynchronous Overhead Channel

The DMD2401 can be equipped with optional asynchronous overhead channel capability. The option can be added in the field by installing a single interface PC board. The overhead channel is proportional to the data rate (Baud Rate is approximately 1/2000 of the Data Rate for Standard IBS and up to a maximum of 19.2 Kbaud for IBS Async).

1.1.4 Customized Options

The DMD2401 may be customized for specific customer requirements. Most modifications/customization can be accomplished by means of firmware/software modifications. The following are examples of the types of customization available to the user:

1. Customized Data Rates.
2. Customized Scrambler/Descramblers.
3. Customized Overhead Framing Structures.
4. Customized Modulation Formats.
5. Customized Uses for Asynchronous Overhead Channel.

1.1.5 8PSK Modulation

The DMD2401 can be equipped with 8PSK Modulation capability as an add-on option. The 8PSK Option can be added by installing one IC into an existing socket.

1.1.6 Analog AGC Voltage

The DMD2401 can be equipped at the factory to produce an analog voltage equivalent to its AGC for use in antenna controllers.

1.1.7 Drop and Insert (D&I)

The DMD2401 can be equipped at the factory with D&I as an add-on enhancement. The D&I Functions are completely independent and can be programmed for n x 64 blocks of either T1 or E1 Data Streams.

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Section 2 – Installation

2.0 Installation Requirements

The DMD2401 LB/ST Modem is designed to be installed within any standard 19-inch wide equipment cabinet or rack, and requires two rack units of mounting space (3.5 inches) vertically and 21 inches of depth. Including cabling, a minimum of 23-inches of rack depth is required. The rear panel of the DMD2401LB/ST is designed to have power enter from the left and IF cabling enter from the center when viewed from the rear of the modem. Data and control cabling can enter from either side although they are closer to the right. The unit can be placed on a table or suitable surface if required.

WARNING!!

There are no user-serviceable parts or configuration settings located inside the DMD2401 LB/ST Chassis. There is a potential shock hazard internally at the Power Supply Module. DO NOT open the DMD2401 LB/ST chassis under any circumstances.

CAUTION!!

Before initially applying power to the unit, it is a good idea to disconnect the transmit output from the operating ground station equipment. This is especially true if the current DMD2401 LB/ST configuration settings are unknown, where incorrect settings could disrupt existing communications traffic.

WARNING!!

SHOCK HAZARD. Double-Pole/Neutral Fusing. Exercise extreme caution.

2.1 Unpacking

The DMD2401 LB/ST was carefully packaged to avoid damage and should arrive complete with the following items for proper installation:

- DMD2401 LB/ST Modem Unit.
- Power Cord, 6-foot with applicable AC Connector.
- Installation and Operation Manual.

2.2 Removal and Assembly

If using a knife or cutting blade to open the carton, exercise caution to ensure that the blade does not extend into the carton, but only cuts the tape holding the carton closed. Carefully unpack the unit and ensure that all of the above items are in the carton. If the Prime AC power available at the installation site requires a different power cord/AC connector, then arrangements to receive the proper device will be necessary before proceeding with the installation.

The DMD2401 LB/ST Unit is shipped fully assembled and does not require removal of the covers for any purpose in installation. Should the power cable AC connector be of the wrong type for the installation, either the cable or the power connector end should be replaced. The power supply itself is designed for universal application using from 100 to 240 VAC, 50-60 Hz, 1.0 A.

2.3 Mounting Considerations

When mounted in an equipment rack, adequate ventilation must be provided. The ambient temperature in the rack should preferably be between 10° and 35° C, and held constant for best equipment operation. The air available to the rack should be clean and relatively dry. Modem units should not be placed immediately above a high heat or EMF generator to ensure the output signal integrity and proper receive operation.

Do not mount the DMD2401 LB/ST in an unprotected outdoor location where there is direct contact with rain, snow, wind or sun. The modem is designed for indoor applications only. The only tools required for rack mounting the DMD2401 LB/ST is a set of four rack mounting screws and an appropriate screwdriver. Rack mounting brackets are an integral part of the cast front bezel of the unit and are not removable.

! WARNING!!

J1 and J2, Tx and Rx IF connectors have voltage on the ports. Exercise care when the DMD2401 LB/ST has power applied.

2.4 Modem Checkout

The following descriptions assume that the DMD2401 LB/ST is installed in a suitable location with prime AC power and supporting equipment available.

2.4.1 Initial Power-Up

! CAUTION!!

Before initial powerup of the DMD2401 LB/ST, it is a good idea to disconnect the transmit output from the operating ground station equipment. This is especially true if the current modulator configuration settings are unknown, where incorrect settings could disrupt the existing communications traffic. New units from the factory are normally shipped in a default configuration which includes setting the transmit carrier off.

Turn the unit 'ON' by placing the Rear Panel Switch (located above the power entry connector) to the 'ON' Position. Upon initial and subsequent power-ups, the DMD2401 LB/ST Microprocessor will test itself and several of its components before beginning its main Monitor/Control Program. These Power-Up Diagnostics show no results if successful. If a failure is detected, the Fault LED will illuminate.

The initial field checkout of the modem can be accomplished from the Front Panel or in the Terminal Mode. The Terminal Mode has the advantage of providing full screen access to all of the modem's parameters, but requires a separate terminal or computer running a terminal program. The unit is placed into Terminal Mode by setting two options via the Front Panel. The two options are the Term Baud and Emulation settings found under the System M&C Submenus.

Terminal Setup:

Baud Rate:	19.2 K (can be changed via Front Panel)
Data Bits:	8
Parity:	No Parity (Fixed)
Stop Bits:	1 Stop Bit

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Section 3 – Operation

3.0 Theory of Operation

A digital terrestrial interface supplies the modulator with a data stream. The data stream is synchronized if the incoming stream is framed. The data is scrambled, and FEC is added. The data is then convolutionally encoded, punctured, then constellation mapped. The resulting I&Q symbols are digitally filtered. The data is then converted into an analog waveform and is vector modulated onto an RF Carrier produced from the Transmit IF Synthesizer Circuitry.

3.1 DMD2401 LB/ST Operation

A block diagram of the signal flow is shown in Figure 3-1 below. The modem is shown in a typical application with customer data, Tx/Rx RF Equipment and an antenna.

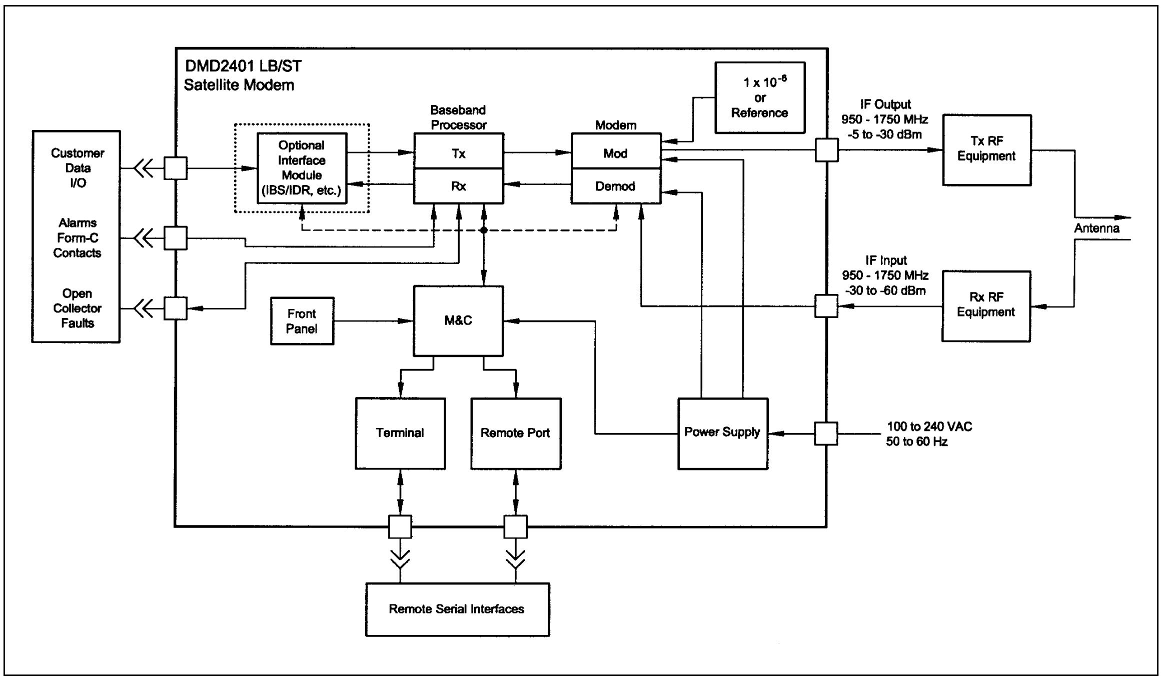

Figure 3-1. Functional Block Diagram

3.2 Applications

Following are just a few representative forms of satellite communications links and networks in which the DMD2401 LB/ST modem may be used.

3.2.1 SCPC Point-to-Point Links

The most straightforward application for a satellite modem is to serve as the Data Communications Equipment (DCE) for a point-to-point data link. When used in this mode, two modems located at two different sites are tuned to complementary transmit and receive frequencies. Each direction of the communications link may have the same or entirely different transmission parameters. In this application, it is typical that the link is established and maintained on a continuous basis, although a special "on demand" case is described later.

3.2.2 SCPC Point to Multi–Point Links in a Broadcast Application

A broadcast application might involve the necessity of sending continuous or intermittent data from one source and “broadcasting” the information to many remote locations. For instance, constant pricing information and updates may be sent by a central location to many store locations. There may be minor return information from the remotes acknowledging receipt.

Another broadcast application could be transmitting background music from a central location to many store sites. In this case, there would be no return path.

The topology of the network in both of these broadcast examples would typically be called a “Star” network. As shown in the Figure below, the shape of the configuration is drawn with the central “Hub” as the center of the star and the remotes as points of the star. In both cases the transmit frequency and other parameters are shared by the receiver of all the remotes.

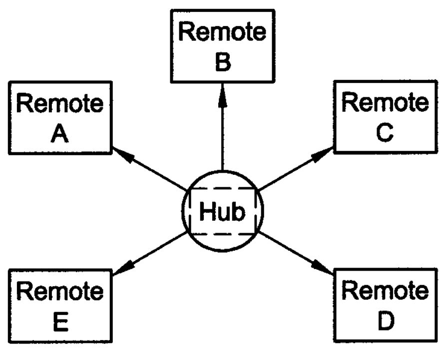

Figure 3-2. Star Network Configuration

3.2.3 DAMA (Demand Assigned Multiple Access)

Suppose that a telephone network with a virtual switch between modems carrying digitized voice information is to be simulated. We might use a central computer to assign a pair of frequencies for any conversation and send this connection information to the proper sites to set up the connection. In this application, a new network configuration is usable. That is a “Mesh” network where any of the voice modems at any site can be programmed to link with any other modem. The resulting link diagram looks like a mesh of interconnects.

Since the frequencies can be assigned on demand, the network is then called “Demand Assigned, Multiple Access,” or DAMA.

3.2.4 TDMA (Time Division Multiple Access) Remote Site Application

In a TDMA network, the central Hub continually transmits a stream of outbound data containing information for multiple remote sites, while the remote sites transmit back to the Hub on a timed basis. Each of these remotes is said to “burst” its information back on a specific frequency. This may be the same inbound frequency for all sites. Each of the remotes is responsible for accessing its own information from the outbound data stream by reading the address assigned to specific parts of the data. The TDMA network usually looks like the Star network shown in Figure 3-2.

The DMD2401 LB/ST is specifically designed to be usable as the remote site modem of a TDMA network when coupled with a proper “Burst” demodulator at the hub site.

Since the frequencies can be assigned on demand, the network is then called “Demand Assigned, Multiple Access,” or DAMA.

3.3 DMD2401 LB/ST Initial Configuration Check

The DMD2401 LB/ST is shipped from the factory with preset factory defaults. Upon initial power-up, a user check should be performed to verify the shipped modem configuration. Refer to Section 3, Operation for the Modulator and Demodulator Front Panel Menu Screens to locate and verify the following configuration settings are correct:

Note: Transmit (Tx) and Receive (Rx) Interface types are dependent upon the customer’s order.

Standard DMD2401 LB/ST Factory Configuration Settings

Modulator:

Data Rate:	2,048,000 Kbps
Forward Error Correction:	1/2 Rate Viterbi
Modulation:	QPSK
Frequency:	950.000000 MHz
Modulator Output Power:	-30 dBm
Carrier:	Off

Demodulator:

Data Rate:	2,048,000 Kbps
Forward Error Correction:	1/2 Rate Viterbi
Frequency:	950.000000 MHz

To lock up the modem, turn the carrier ON, enter ‘IF Loopback Enable,’ or connect a loopback cable from J1 to J2 on the rear panel of the modem.

3.4 DMD2401 LB/ST Automatic Uplink Power Control (AUPC Operation)

The DMD2401 LB/ST modem has an optional built-in provision for Automatic Uplink Power Control (AUPC). AUPC attempts to maintain a constant E_b/N_o at the receive end of an SCPC link. This is especially useful when operating over a satellite at Ku-Band frequencies in locations with high rainfall periods.

Note: An Asynchronous or IBS Interface is required for AUPC. Also, IBS (Async Framing Mode MUST be selected to provide a channel for AUPC operation.

The IBS (Async Framer Data Mode provides a service channel between the two sites of a link permitting the modem processors to send messages and get responses over this channel. AUPC can be set to operate on either or both directions of a link but always requires a bi-directional channel. Therefore, both the Modulator and Demodulator interface mode must be set to IBS (Async for the AUPC menus to be visible and for the AUPC function to operate properly. The AUPC functions and their descriptions are shown below:

Function	Description
AUPC ENABLE/DISABLE	Enables/Disables the AUPC to function locally
AUPC Eb/No	Desired E_b/N_0 of remote modem
AUPC MIN LVL	Sets minimum output power to be used
AUPC MAX LVL	Sets maximum output power to be used
AUPC DEF LVL	Sets default output power to be used

The AUPC menus are located under the Modulator Menu as shown in Section 4.

The basic AUPC operation is described as follows: Assume that the two modems, one at each end of the link, are set to AUPC operation. Only one direction is discussed, but the same functions could be occurring in both directions simultaneously. Modem "A" is transmitting to modem "B" under normal conditions and modem "B" has a receive Eb/No of 7.5 dB. Modem "A" has been set to an AUPC Eb/No on the Front Panel of 7.5 dB, and is currently outputting –15 dBm. Next, it begins raining at location "B", and the Eb/No drops to –7.0 then –6.8 dB. Modem "B" is constantly sending update messages to "A" and reports the current Eb/No. When "A" sees the drop in Eb/No, it slowly begins to raise the output power, and raises it again when it sees further drops. As the rain increases in intensity, and the Eb/No decreases again, "A" continues to increase its power level to compensate, and when the rain diminishes and quits, it lowers its power level to compensate. The operation is therefore a feedback control loop with the added complication of a significant time delay.

There are safeguards built into the AUPC system. First, the Modulator has two additional parameters, which allow control of the maximum and minimum power output levels. Second, a default power level is specified which takes precedence over the output power level during signal loss or loss of AUPC channel communication. The default power level should normally be set to a high enough level to reestablish communication regardless of rain fade. The other controls are built into the operating control software to limit response times and detect adverse operating conditions.

3.5 DMD2401 LB/ST Asynchronous Overhead Operation

3.5.1 Asynchronous Framing/Multiplexer Capability

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

For Regular Async. (Standard IBS), the Baud Rate is approximately 1/2000 of the Data Rate listed in the table below. For Enhanced Async. (IBS Async.), the Baud Rate is selectable, but Data Rate limited. The maximum Baud Rate is 19,200 bps for IBS Async.

Kbps	Baud Rate Example for Standard IBS
128	64
256	128
384	192
512	256
640	320
768	384
896	448
1024	512
1152	576
1280	640
1408	704
1536	768
1664	832
1792	896
1920	960
2048	1024

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

Two software-controlled modes are designed into the card to best utilize the available bits; "Standard IBS" and "IBS (Async)". The characteristics of the Channel Interface are also determined by the standard or Async Mode.

The Async Channel can be set under software-control to either RS-232 or RS-485 mode. The pin assignments for both modes are shown in Table 5-14 through 5-18. The "RS-485" setting controls the output into tri-state when the modem is not transmitting data, allowing multiple modem outputs to be connected together.

3.6 Standard IBS Mode

In the first or "Normal" mode, all bit assignments are per the IBS standard. The bits of Overhead Housekeeping byte 32 are implemented as shown below:

Bit 1	ES to ES Data Channel	This bit is routed directly to the ES to ES Data Channel. Its data rate is 1/512th of the aggregate rate (0r 1/480th of the through terrestrial data rate, and is normally used to super-sample an asynchronous data channel.
Bit 2	Frame Alignment	Part of the Frame Alignment word.
Bit 3	Backward Alarm	Transmit and Receive with main processor to activate main alarm/LED
Bit 4	Multiframe Message	As per IBS
Bits 5 and 6	Spare	Not currently utilized
Bits 7 and 8	Encryption Utilization	Not currently utilized

The ratio of the through terrestrial data channel rate to the aggregate rate is 15/16.
The standard transmit and receive channels of the ES to ES data channel in standard IBS mode are raw channels operating at the specific bit rate as controlled by the data channel rate, without buffering. In addition, no clocks are provided with this channel. Since it would be rare that the data rate provided was exactly that required for a standard rate device, the only method of communicating using this channel is to allow it to super-sample the user data.

3.7 Asynchronous Multiplexer Mode

Since many of the frame bits in the standard IBS mode are not used, an "Enhanced" multiplexer mode has been implemented that can be engaged under software control. Since this mode changes the use of many of the framed non-data bits, this mode is only usable when the DMD2401 LB/ST is at both ends of a link. In this mode, the overhead signaling bytes 16 and 48 can be used to implement a significantly higher speed ES to ES Data Channel under software control. When implemented, this rate is 16 times that of the normal IBS standard, or 1/30th of the terrestrial data rate (1/32nd of the aggregate rate).

Note: The IBS Async Mode MUST be selected for true asynchronous channel operation to be available.

3.8 ESC Backward Alarms

When running in IDR Mode and if the modem has the ESC Option, there will be four Backward Alarms available for use by the earth stations at each end of the link (both ends must have the ESC option). These alarms are accessed via the ESC ALARMS Port. The four alarms are controlled by four relays, each having a normally open, normally closed, and a common connection. The common connections of these relays (referred to as Backward Alarm Inputs) can be connected to whichever system on the earth station that the user wishes to trigger the backward alarm. When ground is applied to the common (input) connection of one of these relays, that relay and associated backward alarm will then be in a “no fault” state. When the ground is removed, the relay and the associated Tx Backward Alarm will toggle to the faulted state. When in the faulted state, the receive end of the link will receive that backward alarm that is initiated at the transmit end of the link.

The user can connect whichever systems on the earth stations that they desire to these Backward Alarms Relays as long as they will supply ground to the Backward Alarm Relay Input in the “no fault” condition and the ground will be removed in the “faulted” condition.

For example: the user could connect the Demod Summary Fault of the modem to the Backward Alarm 1 Input, so that if the demod went into Major Alarm (such as a Carrier Loss), Backward Alarm 1 would be transmitted to the receive end of the link. At the receive end, it would show up as Rx Backward 1 (Receive Backward Alarm 1).

3.8.1 To Disable the ESC Backward Alarms

If the ESC ALARMS Port will not be used and the Backward Alarm Indications are to be disabled, connect the following pins of the ESC ALARMS Port:

Connect Pins 1, 10, 11, 22 and 23 (connect all together). Pin 1 is ground and Pins 10, 11, 22, and 23 are the inputs of Backward Alarms 1 through 4. By connecting these four pins to ground (Pin 1) the Backward Alarms will be disabled and indicate “PASS” for BK1 through BK4.

3.9 IDR or IBS/D&I Configuration Instructions

Note: Newer Modems are Front Panel Configurable (disregard Sections 3.9.1 and 3.9.2). To check; from the Front Panel (Section 4.2.7), go to System Menu, Firmware Rev. Menu, ‘DaughterCPLD’, and check for by F04230 Revision C or above.

3.9.1 IDR Configuration (Older Modems)

1. In this configuration, J17 on the back panel will be used as the ESC Port.

2. Attach the 10 Pin Ribbon Cable from J17 on the Back Panel to J3 on the AS/3760 Interface Card.

3. Remove Jumpers R38 and R40 located on the AS/3771 Daughter Card.

4. Cycle power on the unit.

3.9.2 IBS/D&I Configuration (Older Modems)

1. In this configuration, J17 on the back panel will be used as the ES-ES Communications Port.

2. Attach the 10 Pin Ribbon Cable from J17 on the Back Panel to J11 on the AS/3771 Daughter Card.

3. Install Jumpers R38 and R40 located on the AS/3771 Daughter Card.

4. Cycle power on the unit.

3.10 Configuring the DMD2401 for Drop and Insert

Several dependencies exist when configuring the modem for Drop and Insert (D&I). The following paragraphs explain these dependencies and provide the user with the information required to ensure smooth transition into Drop & Insert and to minimize the potential impact of these dependencies.

The following steps should be followed when setting up Drop & Insert:

1. Select the appropriate interface type:

   Newer Modem:

B.T1.AMI	Balanced T1 (1.544 Mb) AMI Coding
B.T1.B8ZS	Balanced, T1 (1.544 Mb), B8ZS Coding,
U.E1	Unbalanced, E1 (2.048 Mb), HDB3 Coding
B.E1	Balanced, E1 (2.048 Mb), HDB3 Coding

   Older Modem:

B.T1.B8ZS	Balanced, T1 (1.544 Mb), B8ZS Coding,
U.E1	Unbalanced, E1 (2.048 Mb), HDB3 Coding
B.E1	Balanced, E1 (2.048 Mb), HDB3 Coding

2. Set the mode to Closed Net

3. Select the desired Data Rate.

4. Set the Mode to Drop & Insert.

5. Select the Terrestrial Framing.

6. Select the Terrestrial Frame Source (applicable to Insert only).

7. Use the SatCh TS edit capability to define the desired mapping of Satellite Channels to Terrestrial Slots.

8. Copy the appropriate Edit Map to the Active Map.

3.10.1 Interface Type

Interface Type affects the terrestrial framing and data rates used by the Drop & Insert function in the following ways:

1. When a T1 interface type is selected, the terrestrial framing options will only reflect the valid T1 framing selections of:

T1-D4	(D4 framing, no Robbed Bit Signaling)
T1-ESF	(ESF framing, no RBS)
T1-D4-S	(D4 framing with Robbed Bit Signaling)
T1-ESF-S	(ESF framing with RBS)

2. When an E1 interface type is selected, the terrestrial framing options will only reflect the valid E1 framing selections of:

PCM-30	(Channel Associated Signaling)
PCM-30C	(CAS with CRC checking)
PCM-31	(Common Channel Signaling)
PCM-31C	(CCS with CRC checking)

3. When a T1 interface type is selected, attempting to change the data rate to 1920000 will result in the error message ‘DATA RATE OUT OF BOUNDS’. If an E1 interface type is selected, a data rate entry of 1920000 is valid and will be allowed.

3.10.2 Mode

The operational mode of the modem often determines which additional menus and displays are available for use by the operator. The D&I mode-specific menus will not be displayed unless the operational mode of the modem is set to D&I. Therefore, the next step in configuring the modem should be to set the operational mode to D&I. At this point, the D&I specific menus in the Interface section will become available and will remain available until the operational mode of the modem is changed to something other than D&I. When the operational mode is changed to something other than D&I, the D&I specific menus will automatically disappear.

Mode affects the Drop & Insert function by affecting the Data Rate in the following manner:

1. In Closed Net mode, any valid IDR, IBS, or Drop & Insert data rate may be entered.

2. In Drop & Insert Mode, only valid D&I data rates may be entered.

The entry of an invalid rate will result in the error message ‘DATA RATE OUT OF BOUNDS.’

3.10.3 Data Rate

Data Rate also affects the Drop and Insert function in the following ways:

1. It determines the number of Satellite Channels that will be displayed in the Edit Maps.

2. It contributes to the operational mode selection process. Trying to change the operational mode to Drop & Insert when a data rate is not set to a valid D&I rate will result in the error message ‘DATA RATE OUT OF BOUNDS.’ The mode change will not be allowed.

3. Once Drop & Insert mode has been selected, trying to change the data rate to something other than another valid D&I data rate will result in the error message ‘DATA RATE OUT OF BOUNDS.’ The change will not be allowed.

The Mod Data Rate should be set according to the number of timeslots to be dropped, and the Demod Data Rate should be set according to the number of timeslots to be inserted. The following table gives the allowable D&I data rates based on the number of slots (n) to be dropped or inserted.

Number of Slots (n)	D&I Data Rates
1	64,000
2	128,000
3	192,000
4	256,000
5	320,000
6	384,000
8	512,000
10	640,000
12	768,000
15	960,000
16	1,024,000
20	1,280,000
24	1,536,000
30	1,920,000 (valid with E1 Interface only)

3.10.4 Terrestrial Framing - Drop Mode/Insert Mode

The Drop Mode selection and the Insert Mode selection identify the terrestrial data-framing format. As previously mentioned, their selection is influenced by the mod and demod interface types. In turn, the selection of the terrestrial framing formats influences the satellite channel to terrestrial timeslot mappings in the following manner:

1. The selection of T1-D4, T1-ESF, or T1-D4-S, or T1-ESF-S type terrestrial framing format limits the terrestrial timeslots to values from 1-24.

2. The selection of PCM-30 or PCM-30C type terrestrial framing limits the terrestrial timeslots to values from 1-15, 17-31. In these modes, terrestrial timeslot 16 is reserved for ABCD signaling and may not be dropped or inserted.

3. The selection of PCM-31 or PCM-31C type terrestrial framing limits the terrestrial timeslots to values from 1-31.

Therefore, the terrestrial framing format should be identified via the Drop Mode and Insert Mode entries prior to editing the Drop or Insert satellite channel to terrestrial timeslot maps.

3.10.4.1 Insert Terrestrial Frame Source

The insert terrestrial frame source selection tells the modem where the insert terrestrial frame is coming from. External means the terrestrial frame is to be input via the Insert Data In port. Internal means that the modem needs to generate the terrestrial frame and that all non-inserted timeslots need to be filled with the appropriate idle code based upon the terrestrial framing (T1 or E1). In addition, the selection of the insert terrestrial frame source also influences the Buffer Clock selection in the following manner:

When the insert terrestrial frame source selection is set to External, the received satellite data will be clocked out of the Doppler buffer based upon the clock recovered from the insert data input. Therefore, the Buffer Clock selection will automatically be set to External and cannot be modified.

When the insert terrestrial frame source selection is set to Internal, the operator needs to specify how data should be clocked out of the Doppler buffer. In this case, the operator will be able to select either SCTE, SCT, or RX SAT as the source for the Buffer Clock. Therefore, the insert terrestrial frame source selection should be made prior to attempting to change the Buffer Clock. In most instances, the insert terrestrial frame source selection will be set to External and the Buffer Clock will automatically be set to External.

3.10.5 Alarms

The following alarms are unique to Drop & Insert and vary based on the terrestrial framing:

- Alarms
  - Modem Alarms
    - Active Alarms
      - Minor Tx
        - Drop Alarms
          - FrmLock – Indicates Terrestrial Frame lock on the Send Data Port.
Valid in all framing modes
          - MFrmLck – Indicates Terrestrial Multiframe lock on the Send Data Port.
Valid in PCM-30, PCM-30C
          - CRCLock – Indicates valid CRC received via the Send Data Port.
Valid in PCM-31C, PCM-30C
          - SigData – Indicates valid signaling data received via the Send Data Port.
Valid in PCM-30, PCM-30C
      - Minor Rx
        - Insert Alarms
          - FrmLock – Indicates Terrestrial Frame lock on the Receive Data Port.
Valid in all framing modes
          - MFrmLck – Indicates Terrestrial Multiframe lock on the Receive Data Port.
Valid in PCM-30, PCM-30C

There are also additional Backward Alarms available in Drop & Insert Mode

- Alarms
  - Modem Alarms
    - Backward Alarms
      - Prompt – This is the prompt maintenance alarm output by the modem
      - Service – This is the deferred service alarm output by the modem
      - TerBack – Indicates whether or not a terrestrial backward alarm is being received
      - SatBack – Indicates whether or not a satellite backward alarm is being received which would be caused by the demod losing lock at the other end of the link

Force TerBck – Allows the operator to force the terrestrial backward alarm output to On, Off, or Normal for testing purposes.

Force SatBck – Allows the operator to force the satellite backward alarm output to On, Off, or Normal for testing purposes

3.11 Drop and Insert Mapping

The following displays under Interface D&I Setup (both Tx and Rx), are editing displays only:

SATCh TS
Enter to Edit

Any changes made in these displays are made on the screen, **but *are not* entered into the modem**. Once these menus are configured, the Mapping Menu must be used to actually enter the settings into the modem.

Example :

For a modem w/ Drop & Insert enabled at a data rate of 256 (with timeslots assigned 1-1, 2-2, etc.). At a data rate of 256, the modem will allow 4 channels to assign timeslots to. Under the Tx Menu, assign the timeslots that are to be used to the 4 channels. CH1 is assigned to TS1 (Timeslot #1), CH2 to TS 2, CH3 to TS3 and CH4 to TS4, <ENTER> must be depressed after assigning each individual TS. Once the timeslots are assigned to the channels, use the Left or Right Arrow Key to scroll to the Mapping Menu. This menu will appear in the following way:

Map Copy
********* *********

Note: The **** will be one of several words, just look for the "Map Copy" display).***

This is the menu where the channel assignments are actually entered into the modem. To do this, perform the following steps:

For the Transmit Side:

1. Push <ENTER> to get the flashing cursor.
2. Use the Up Arrow Key to make the left portion of the display read "TX EDIT".
3. Use the Right or Left Arrow Keys to switch the flashing cursor to the right portion of the display.
4. Use the Up or Down Arrow Key to make the right hand portion read "TX ACTIVE".
5. The mapping display should now look like this:

Map Copy
TX EDIT > TX ACTIVE

6. Push <ENTER> to enter this command. This tells the modem to configure to the settings that were assigned in the Channel/Timeslot display.

For the Receive Side:

1. With Rx Side Channels configured as follows: CH1 to TS1, CH2 to TS2, CH3 to TS3 and CH4 to TS4.

2. After the timeslots are assigned properly, scroll to the Mapping Menu and use the above procedure to enter the settings into the modem.

3. Set the display to read:

Map Copy
RX EDIT > RX ACTIVE

4. Press <ENTER> to enter the settings into the modem.

To View the current Timeslot Assignment:

1. If there is a question of the channels not being entered properly, the Mapping Menu may be used to see how the channels/timeslots are configured in the modem.

2. Use <ENTER> and the Arrow Keys to make the mapping menu read (for the Tx Side):

Map Copy
TX ACTIVE > TX EDIT

3. Press <ENTER>. The modem has now copied the current Tx Settings to the Tx Channel/Timeslot Display.

4. For the Rx Side:

Map Copy
RX ACTIVE > RX EDIT

5. Press <ENTER>. The modem has now copied the current Rx Settings to the Rx Channel/Timeslot display).

Note: It is not mandatory to assign timeslots in sequential order, although the lowest timeslot must be entered in the lowest channel. For example: timeslots may be assigned 1-2, 2-5, etc. but not 1-5, 2-2.

3.12 Loopbacks

3.12.1 Terrestrial Loopback

Terrestrial Loopbacks provides the following data loopback on the interface card:

Tx Loopback – Terrestrial TX data after passing through the line interface is looped back to the Rx data line drivers (refer to Figure 3-3).

Rx Loopback – The Rx data received by the satellite is looped back through the interface for retransmission to the satellite providing a far end loopback (refer to Figure 3-4).

Tx/Rx Loopback – Provides both of the above loopbacks simultaneously (refer to Figure 3-5).

3.12.2 Baseband Loopback

Baseband Loopback provides the following data loopback on the baseband (or framing card) and allows testing of the terrestrial interface of the modem:

Note: On the DMD2401, a framing card is required to properly use any of the baseband loopback functionality.

Tx BB Loopback – Terrestrial TX data after passing through the line interface and onto the baseband framing unit is looped back to the Rx data line drivers of the interface (refer to Figure 3-6).

Rx BB Loopback – The Rx Data received by the satellite is passed through the interface and looped back through baseband framing unit, then sent back through the interface for retransmission to the satellite providing a far end loopback (refer to Figure 3-7).

Tx/Rx BB Loopback – Provides both of the above loopbacks simultaneously (refer to Figure 3-8).

3.12.3 IF Loopback

IF Loopback loops back the modulated IF Signal from the modulator to the demodulator (refer to Figure 3-9).

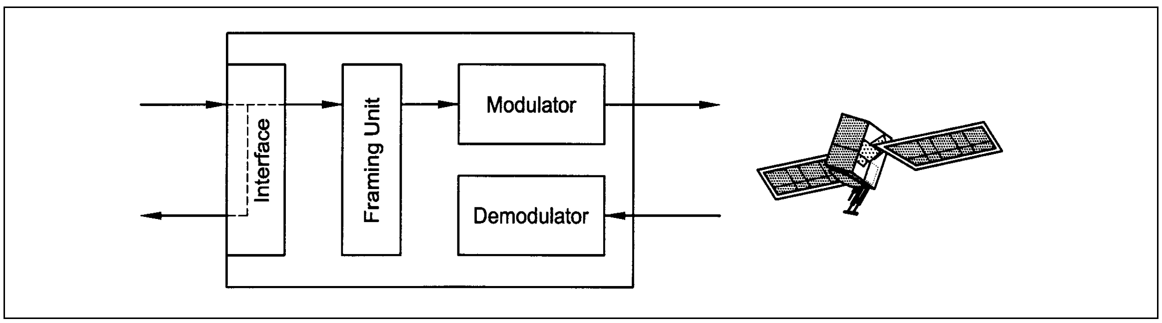

Figure 3-3. Tx Terrestrial Loopback

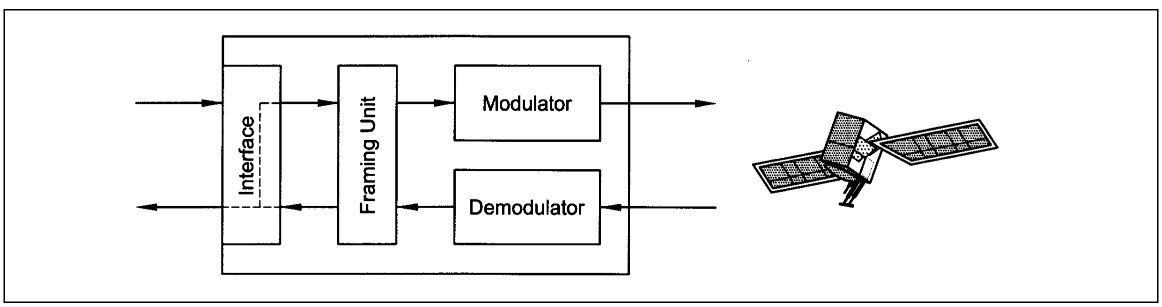

Figure 3-4. Rx Terrestrial Loopback

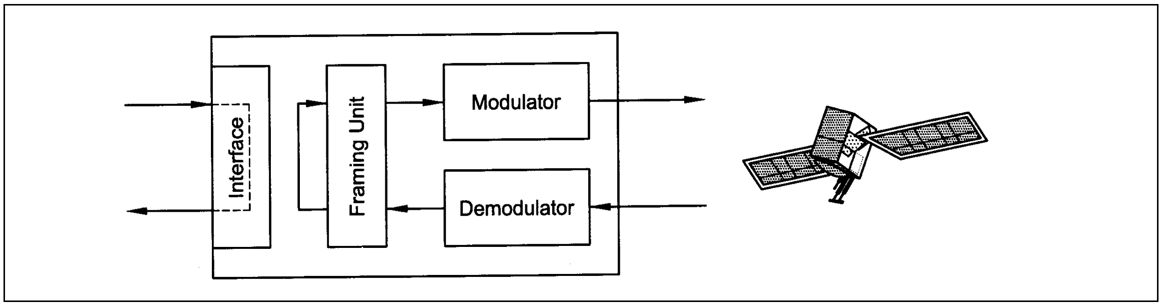

Figure 3-5. Tx/Rx Terrestrial Loopback

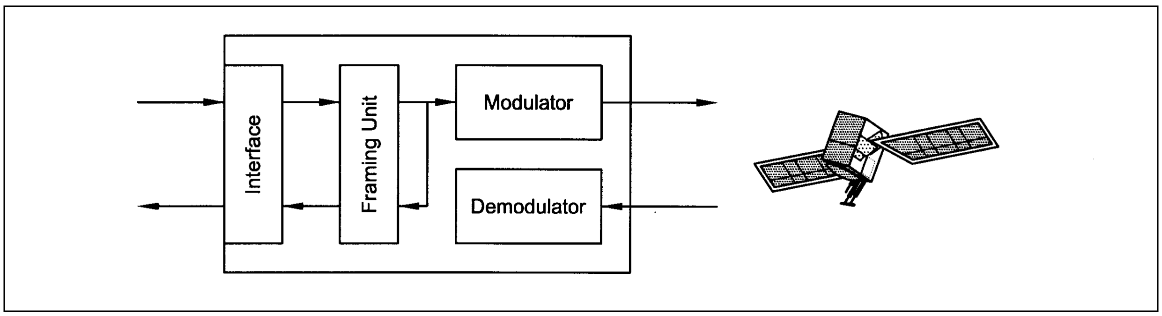

Figure 3-6. Tx Baseband Loopback

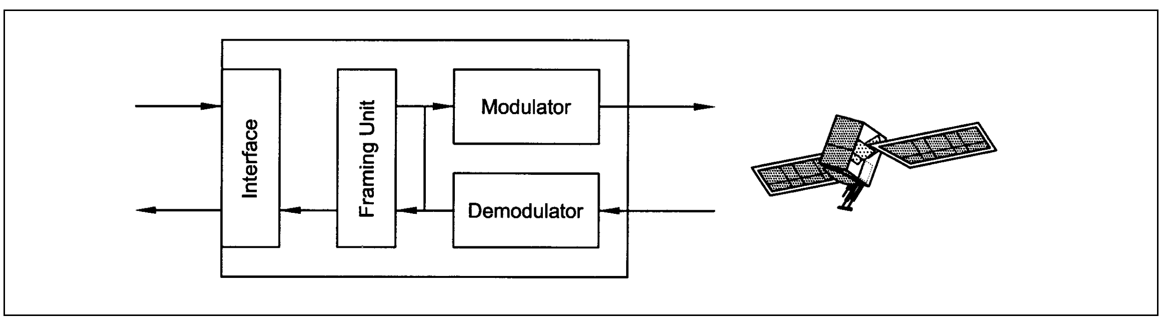

Figure 3-7. Rx Baseband Loopback

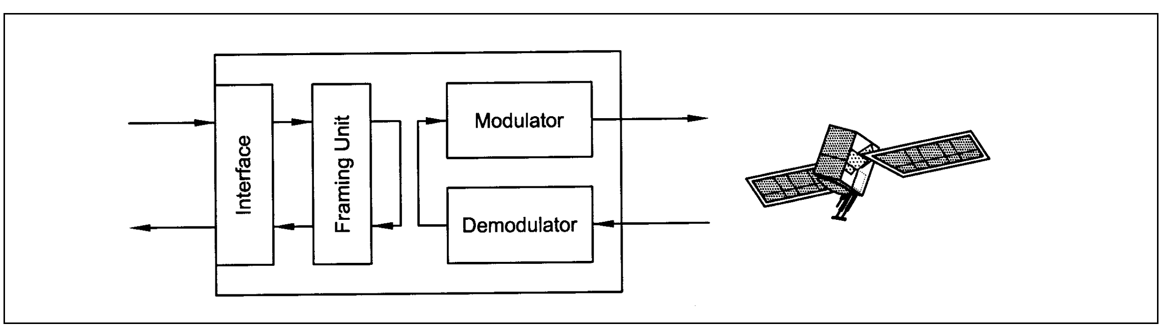

Figure 3-8. Tx/Rx Baseband Loopback

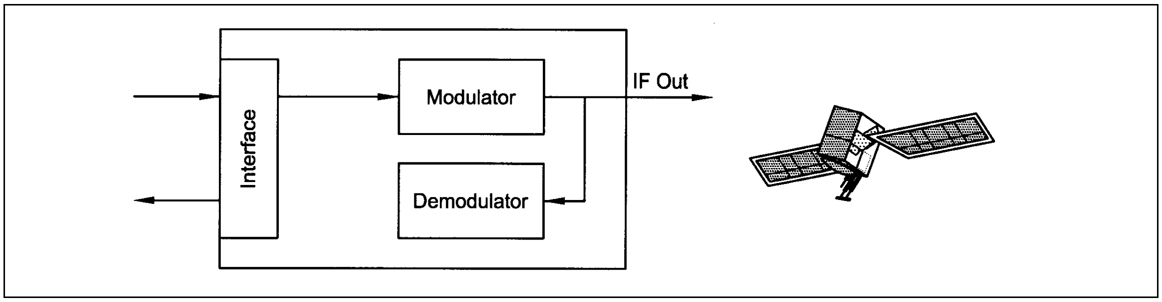

Figure 3-9. IF Loopback

Section 4 – User Interfaces

4.0 User Interfaces

There are two user interfaces available for the DMD2401 LB/ST. These are:

1. Front Panel
2. Terminal

4.1 Front Panel User Interface

The Front Panel of the DMD2401 LB/ST allows for complete control and monitor of all DMD2401 LB/ST parameters and functions via a keypad, LCD display and status LEDs.

The Front Panel layout is shown in Figure 4-1, showing the location and labeling of the Front Panel. The Front Panel is divided into three functional areas: the LCD Display, the Keypad, and the LED Indicators, each described below in Table 4-1.

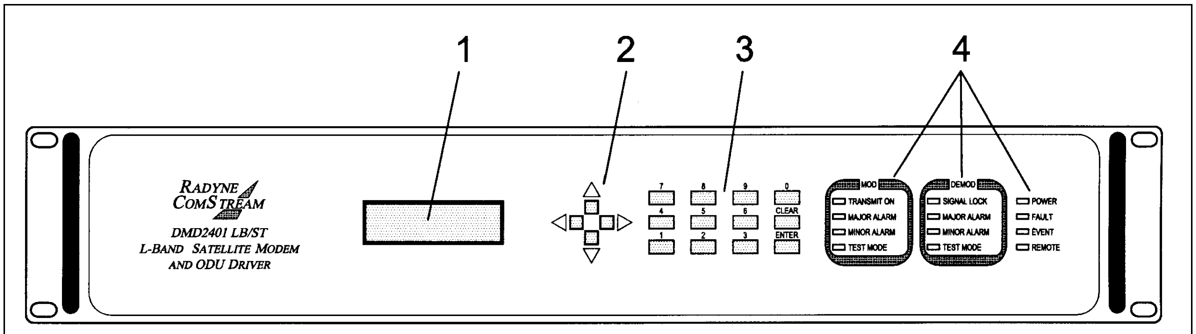

Figure 4-1. DMD2401 LB/ST Front Panel

Table 4-1.		
Item Number	**Description**	**Function**
1	LCD Front Panel Display	Displays DMD2401 LB/ST Operating parameters and Configuration data
2	Cursor Control Arrows	Controls the up, down, right and left motion of the cursor in the LCD Display window
3	Numeric Keypad	Allows entry of numeric data and Clear and Enter function keys
4	Front Panel LED Indicators	See Paragraph 4.1.2 below for an itemized description of these LEDs

4.1.1 Front Panel LCD Display

The Front Panel display is a 2 line by 16-character LCD display. The display is lighted and the brightness can be set to increase when the Front Panel is currently in use. The LCD display automatically dims after a period of inactivity. The display has two distinct areas showing current information. The upper area shows the current parameter being monitored, such as 'Frequency' or 'Data Rate'. The lower line shows the current value of that parameter. The LCD display is a single entry window into the large matrix of parameters that can be monitored and set from the Front Panel.

4.1.2 Front Panel LED Indicators

Eight LEDs on the DMD2401 LB/ST Front Panel (Refer to Table 4-2) indicate the status of DMD2401 LB/ST operation. The LED colors maintain a consistent meaning. Green signifies that the indication is appropriate for normal operation, Yellow means that there is a condition not proper for normal operation, and Red indicates a fault condition that will result in lost communications.

Table 4-2.

LED	Color	Function
Modem LED Indicators		
Power	Green	Indicates that the unit is turned on.
Fault	Red	Indicates a hardware fault for the unit.
Event	Yellow	Indicates that a condition or event has occurred that the modem has stored in memory. The events may be viewed from the Front Panel or in the Terminal Mode.
Remote	Green	Indicates that the unit is set to respond to the remote control input.
Modulator LED Indicators		
Transmit On	Green	Indicates that the Transmit Output is currently active.
Major Alarm	Red	Indicates that the Transmit Direction has failed, losing traffic.
Minor Alarm	Yellow	Indicates that a warning condition exists.
Test Mode	Yellow	Indicates that the modulator is involved in a current Test Mode activity.
Demodulator LED Indicators		
Signal Lock	Green	Indicates that the receiver locked to an incoming signal, including FEC Sync.
Major Alarm	Red	Indicates that the Receive Direction has failed, losing traffic.
Minor Alarm	Yellow	Indicates that a Receive Warning Condition exists.
Test Mode	Yellow	Indicates that the receiver is involved in a current Test Mode activity.

4.1.3 Front Panel Keypad

The Front Panel keypad consists of two areas: a 10-key numeric entry with 2 additional keys for the ‘Enter’ and ‘Clear’ function. The second area is a set of ‘Arrow’ or ‘Cursor’ keys (↑), (↓), (→), (←), used to navigate the parameter currently being monitored or controlled. Table 4-3 describes the key functions available at the Front Panel.

4.1.4 Parameter Setup

The four arrow keys (↑), (↓), (→), (←), to the right of the LCD display are used to navigate the menu tree and select the parameter to be set. After arriving at a parameter that needs to be modified, depress <Enter>. The first space of the modifiable parameter highlights (blinks) and is ready for a new parameter to be entered. After entering the new parameter using the keypad (Refer to Figure 4-2), depress <Enter> to lock in the new parameter. If a change needs to be made prior to pressing <Enter>, depress <Clear> and the display defaults back to the original parameter. Depress <Enter> again and re-enter the new parameters followed by <Enter>.

Following a valid input, the DMD2401 LB/ST will place the new setting into the nonvolatile EEPROM making it available immediately and available the next time the unit is powered-up.’

Table 4-3.

Edit Mode Key Functions (Front Panel Only)

Parameter Type	0 – 9	↑	↓	←	→	‘Clear’ & ←	‘Clear’ & →
Fixed Point Decimal	Changes Digit	Toggles ± (If Signed)	Toggles ± (If Signed)	Moves Cursor 1 Position Left	Moves Cursor 1 Position Right	N/A	N/A
Unsigned Hexadecimal	Changes Digit	Increments Digit Value	Decrements Digit Value	Moves Cursor 1 Position Left	Moves Cursor 1 Position Right	N/A	N/A
Enumerated	N/A	Previous Value in List	Next Value in List	N/A	N/A	N/A	N/A
Date/ Time	Changes Digit	N/A	N/A	Moves Cursor 1 Position Left	Moves Cursor 1 Position Right	N/A	N/A
IP Address	Changes Digit	Increments Digit Value	Decrements Digit Value	Moves Cursor 1 Position Left	Moves Cursor 1 Position Right	N/A	N/A
Text Strings	Changes Character	Increments Character Value	Decrements Character Value	Moves Cursor 1 Position Left	Moves Cursor 1 Position Right	Clears to Left of Cursor Inclusive	Clears to Right of Cursor Inclusive

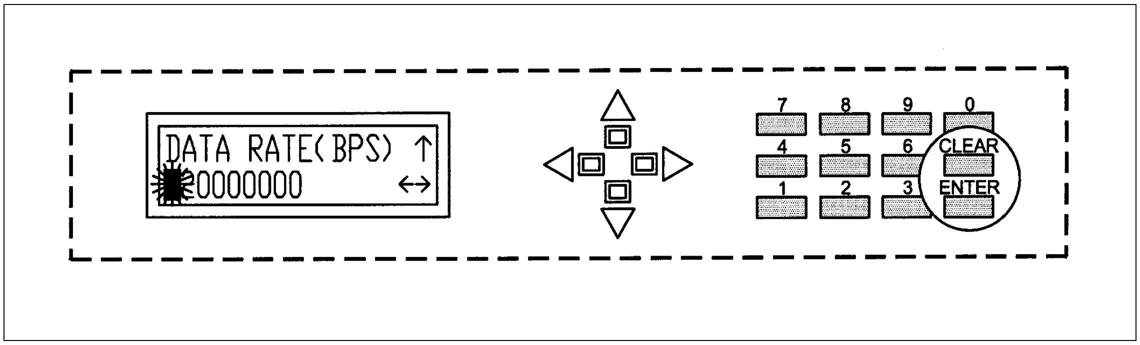

Figure 4-2. Entering New Parameters

4.2 Front Panel Control Menu Screens

The DMD2401 LB/ST Front Panel Control Screens are broken down into sections under several Main Menus.

4.2.1 Main Menus

Modulator

Demodulator

Interface

Monitor

Alarms

System

Test

4.2.2 Modulator

Mod IF/RF (menu):

Note: The LO frequencies of the Block Upconverter (BUC) and LNB must be entered first under the 'System/General/BUC LO/LNB LO' menus. The LB/ST will then calculate the Mod and Demod IF/RF frequencies.

Tx RF (MHz):	This Frequency is precalculated by the LB/ST after the operator has entered the LO frequencies of the BUC and LNB under the System/General menu.
Tx IF (MHz):	Enter in 1 MHz steps from 950-1750 MHz.
Power:	**{-5 to –30 dBm}** Allows the user to enter the Transmitter Power Level.
Carrier:	**{On, Off, Delay, RTS, VSat, Auto}** Allows the user to select the Carrier Type.

Spectrum Inv: **{Normal, Inverted}**
Allows the user to invert the direction of rotation for PSK Modulation. Normal meets the IESS Specification.

Modulation: **{BPSK, OQPSK, QPSK, 8PSK}**
Allows the user to select the modulation type.

<u>Mod Data (menu):</u>

Data Rate: **{Refer to Table 1-1 for Data Rates}**
Allows the user to set the Data Rate in Bps steps via the Front Panel Arrows or Keypad.

Conv Enc: **{VIT 1/2, VIT 3/4, VIT 7/8, Optional SEQ 1/2, Optional SEQ 3/4, Optional SEQ 7/8, Optional TRE 2/3}**
Allows the user to select the Tx Code Rate and Type.

Diff Encode: **{On, Off}**
Enables or disables the Differential Encoder.

Scrmbl Sel: **{None, V.35-IESS, V.35 CITT, V.35 EF, IBS Reed-Solomon Scrambler}**
Enables or disables scrambler operation.

Scrmbl Ctrl: **{Enable, Disable}**
Enables or disables scrambler operation.

Mod Framing: **{1/15 (IBS), 1/15 (Async), 96 Kbps (IDR), None}**
Used with IDR, IBS, or Asynchronous Interface Only.
Selects the Frame Type.

Data Invert: **{Normal, Inverted}**
Allows the user to invert the data.

IDR OH Type: **{Voice, 64Kbit}**
Available with 96 Kbps (IDR) Framing.

Symbol Pair: **{Normal, Swapped}**
Available in BPSK Modulation.

<u>ReedSolomon (menu):</u>

ModRS Enable: **{Enable Disable}**
Allows the user to enable or disable the Reed-Solomon Encoder.

ModRS Codes: **{Any valid n/k values can be entered (refer to Appendix A)}**
Displays the currently used n, and k Reed-Solomon Codes. In Closed Net Mode, custom RS Codes may be selected.

ModRS Depth: **{4, 8}**

Displays the currently used Reed-Solomon Interleaver Depth. In Closed Net Mode, a depth of 4 or 8 may be selected.

4.2.3 Demodulator

Demod IF/RF (menu):

Note: The frequencies of the Block Upconverter (BUC) and LNB must be entered first under the 'System/General' menu. The LB/ST will then calculate the Mod and Demod IF/RF frequencies.

Rx RF: This Frequency is precalculated by the LB/ST after the operator has entered the frequencies of the BUC and LNB under the System/General menu.

Rx IF: Enter in 1 MHz steps from 950-1750 MHz

Spectrum Inv: **{Normal, Inverted}**
Inverts the direction of rotation for PSK modulation. Normal meets the IESS Specification.

Demodulation: **{BPSK, OQPSK, QPSK, 8PSK}**
Allows the user to select the demodulation type.

Swp Bounds: **{1 – 42 kHz}**
Sets the acquisition range for the demodulator.

Input Limit: **{20 – 90 dBm}**

Demod Data (menu):

Data Rate: **{Refer to Table 1-1 for Data Rates}**
Allows the user to set the Data Rate in Bps steps via the Front Panel Arrows or Keypad.

Conv Dec: **{VIT 1/2, VIT 3/4, VIT 7/8, Optional SEQ 1/2, Optional SEQ 3/4, Optional SEQ 7/8, Optional TRE 2/3}**
Allows the user to select the Rx Code Rate and Type.

Diff Decode: **{On, Off}**
Enables or disables the differential decoder.

Descrmbl Sel: **{None, V.35-IESS, V.35 CITT, V.35 EF, IBS Reed-Solomon Scrambler}**
Selects the descrambler type.

Dscrmbl Ctrl: **{Enable, Disable}**
Enables or disables descrambler operation.

Dmd Framing: **{1/15 (Async), 1/15 (IBS), 96 Kbps (IDR), None}**
Used with IDR, IBS, or Asynchronous Interface Only.
Selects the Frame Type.

Data Invert: **{Normal, Inverted}**
Allows the user to invert the data.

IDR OH Type:	**{Voice, 64Kbit}** Available with 96 Kbps (IDR) Framing.

Symbol Pair: **{Normal, Swapped}**
Available in BPSK Modulation.

Reed-Solomon (menu):

DmdRS Enable: **{Enable Disable}**
Enables or disables the Reed-Solomon Decoder

DmdRS Codes: **{Any valid n/k values can be entered (refer to Appendix A)}**
Displays the currently used n, and k Reed-Solomon Codes. In Closed Net Mode, custom RS Codes may be selected.

DmdRS Depth: **{4, 8}**
Displays the currently used Reed-Solomon Interleaver Depth. In Closed Net Mode, a depth of 4 or 8 may be selected.

4.2.4 Interface Menu Options and Parameters

General (menu):

EXC Clk Freq: **{1.0, 1.544, 2.0, 2.048, 2.5, 5.0, 9.0, 10.0}**
Displays the external clock frequency in MHz.

Freq Ref Src: **{Internal, External}**
Allows the user to select between an internal and external frequency source.

Ext. Ref Freq: **{1 – 10 MHz, 1 MHz steps}**
Allows the user to enter the external reference frequency.

Intf Type: Displays the interface type installed.

Tx Setup (menu):

Tx Ckt ID: Allows the user entry of a Tx Circuit Identifier. Circuits can be given up to an 11 character alphanumeric identity such as LINK1.

Tx Clock: **{SCTE (Ext), SCT (Int)}**
Allows the user to select the clock source.

Clk Polarity: **{Normal, Auto, Inverted}**
Allows the user to select the Tx Clock Polarity.

SCT Source: **{Internal, Ext. BNC, SCR}**
Allows the user to select the Tx SCT Source.

Tx Terr Intf: **{RS-422, V.35, RS-232}**
Allows the user to select the Transmit Interface Type. Not available when G.703 Interface Type is installed.

TxAnsync Port: **{RS-485, RS-232}**
Allows the user to select the Transmit Async Port type.

Tx G703 Intf:	**{U.E1, B.E1, B.T1.B8ZS, B.T1.AMI}** Allows the user to select the Transmit G.703 Interface type. Only available when G.703 Interface is installed.

Tx D&I (menu):

Drop Mode:	**{Enable, Disable}** <u>E1 Mode:</u> PCM30, PCM30C, PCM31, PCM31C. <u>T1 Mode:</u> T1-D4, T1-ESF, T1-D4-S, T1-ESF-S

Rx Setup (menu):

Rx Ckt ID:	Allows the user entry of an Rx Circuit Identifier. Circuits can be given up to an 11 character alphanumeric identity such as LINK1.
Buff Size:	**{1 – 128}** Sets the Doppler Buffer Size in msec. Only available when no Optimal Interface is installed.
Buff Clk:	**{SCTE (Ext), SCT (Int), Rx Sat}** Selects the Buffer Clock source.
Clk Polarity:	**{Normal, Inverted}** Selects the Buffer Clock polarity.
Rx Terr Intf:	**{RS-422, V.35, RS-232}** Allows the user to select the Transmit Interface Type. Not available when the G.703 Interface is installed.
Asynchronous:	**{Off, On}**
Rx Async Port:	**{RS-485, RS-232}** Allows the user to select the Receive Async Port type.
Rx G703 Intf:	**{U.E1, B.E1, B.T1.B8ZS, B.T1.AMI}** Allows the user to select the Receive G.703 Interface type. Not available when Terr Interface is installed.

Rx D&I (menu):

Insert Mode:	**{Enable, Disable}** <u>E1 Mode:</u> PCM30, PCM30C, PCM31, PCM31C. <u>T1 Mode:</u> T1-D4, T1-ESF, T1-D4-S, T1-ESF-S

4.2.5 Monitor Menu Options and Parameters

Level:	Estimated receive signal (in dBm) as seen by the Demodulator.
AGC Voltage:	**(Optional Configuration)** Displays the voltage level of AGC present at Pin 5 of the Alarm Connector (J6).
Eb/No:	Estimated Eb/No as seen by the Demodulator.
SER:	Estimated channel error rate (before decoding) measured by the modem.
CBER:	**{0.00×10^{-12}}** Estimated corrected bit error rate (after decoding).
Error Count:	Displays the current error count from the Viterbi Decoder.
Offset Freq:	The received carrier frequency offset as measured by the modem.
Event Buff:	A history of events recorded in the event buffer. A maximum of 40 events may be stored in the buffer. Upon receipt of the 41st event, the first received event is automatically deleted, maintaining the last 40 events.
Press Clr to Erase Events:	Clears the contents of the Event Buffer.

Voltages (menu):

+5 Volt:	Displays the measured +5 VDC power bus inside the modem.
+12 Volt:	Displays the measured +12 VDC power bus inside the modem.
-12 Volt:	Displays the measured -12 VDC power bus inside the modem.
Buffer Stat:	**{0 – 100%}** Displays the buffer % full status.
Press Clr to Center Buffer:	Centers the buffer.
BER Exponent:	**{3 – 9}** Sets the time base for the channel error rate measurement, used to estimate Eb/No.

4.2.6 Alarms Menu Options and Parameters

Modem Alarms (menu):

Active Alrms (menu):

Major Tx (menu):

Status ***Edit Table***

TxuProc Mask: **{Pass/Fail, No/Yes}**
Tx Processor fault. Indicates a HARDWARE Transmit or DSP Failure within the modem.
Yes = Masked, No = Unmasked

TxPower Mask: **{Pass/Fail, No/Yes}**
Indicates that the Modem Tx Output Power is within allowed tolerances.

TxOSClk Mask: **{Pass/Fail, No/Yes}**
Indicates that the Tx Oversample Clock PLL is not locked. This alarm will flash 'On' during certain modem parameter changes.

CompCLK Mask: **{Pass/Fail, No/Yes}**
Indicates that the Tx Composite Clock PLL is not locked. This alarm will flash 'On' during certain modem parameter changes.

TxSynth Mask: **{Pass/Fail, No/Yes}**
Indicates that the Tx IF Synthesizer is not locked. This alarm will flash 'On' during certain modem parameter changes.

Tx FPGA Mask: **{Pass/Fail, No/Yes}**
This alarm indicates a Transmit Hardware FPGA failure within the modem.

Ref PLL Mask: **{Pass/Fail, No/Yes}**
This alarm indicates that the Modem Synthesizers are not locked to the external reference.

Tx Force: **{Pass/Fails}**
Allows a Major Tx Alarm to be forced (for testing purposes, etc.).

<u>Major Rx (menu):</u>

RxuProc Mask: **{Pass/Fail, No/Yes}**
Rx Processor fault. Indicates a Receive DSP Hardware failure within the modem.

SigLock Mask: **{Pass/Fail, No/Yes}**
Indicates that the Demodulator is unable to lock to a signal.

IFSynth Mask: **{Pass/Fail, No/Yes}**
Indicates the Rx IF Synthesizer is not locked. This alarm will flash 'On' during certain modem parameter changes.

BuffPLL Mask: **{Pass/Fail, No/Yes}**
Indicates that the Buffer Clock PLL is not locked. This alarm will flash 'On' during certain modem parameter changes.

RxLevel Mask: **{Pass/Fail, No/Yes}**
This alarm indicates that the Receive Automatic Gain Control is saturated (i.e., too much signal power is being supplied to the modem).

Rx FPGA Mask: **{Pass/Fail, No/Yes}**
This alarm indicates that a Receive FPGA Hardware Fault has occurred.

Rx Force: **{Pass/Fails}**
Allows a Major Rx Alarm to be forced (for testing purposes, etc.).

Minor Tx (menu):

Tx Activity (menu):

TerrClk Mask: **{Pass/Fail, No/Yes}**
Indicates no Terrestrial Clock activity.

Int Clk Mask: **{Pass/Fail, No/Yes}**
Indicates no SCT Clock activity.

BNC Clk Mask: **{Pass/Fail, No/Yes}**
Indicates no activity on the External BNC Clock.

TxSatCk Mask: **{Pass/Fail, No/Yes}**
Indicates on TX Sat Clock activity.

Tx Data Mask: **{Pass/Fail, No/Yes}**
Indicates no Tx Data activity.

TerrAIS Mask: **{Pass/Fail, No/Yes}**
Indicates that AIS has been detected in the Terrestrial Data Stream.

RS FIFO Mask: **{Pass/Fail, No/Yes}**
Indicates the status of the Tx Reed-Solomon FIFO.

Tx Cal Mask: **{Pass/Fail, No/Yes}**
Indicates that the modem has been calibrated for the output power level.

Minor Rx:

BufUFlw Mask: **{Pass/Fail, No/Yes}**
Indicates that a Doppler Buffer underflow has occurred.

BufOFlw Mask: **{Pass/Fail, No/Yes}**
Indicates that a Doppler Buffer overflow has occurred.

Buf<10% Mask: **{Pass/Fail, No/Yes}**
Indicates that the Doppler Buffer has gone below 10% full and may underflow.

Buf>90% Mask: **{Pass/Fail, No/Yes}**
Indicates that the Doppler Buffer has gone above 90% full and may overflow.

VitLock Mask: **{Pass/Fail, No/Yes}**
Indicates that the Viterbi Decoder is not locked.

SeqLock Mask: **{Pass/Fail, No/Yes}**
Indicates that the Sequential Decoder is not locked.

Rx Activity (menu):

Buf Clk Mask: **{Pass/Fail, No/Yes}**
Indicates that the selected buffer clock source is not active.

Ext BNC Mask: **{Pass/Fail, No/Yes}**
Indicates no activity on the External BNC Clock Port.

Rx Sat Mask: **{Pass/Fail, No/Yes}**
Indicates that the Rx Sat Buffer clock source is not active.

ExtRef Mask: **{Pass/Fail, No/Yes}**
Indicates no activity on the external reference.

SatAIS Mask: **{Pass/Fail, No/Yes}**
Fail indicates that there is a loss of satellite data.

Rx RS Faults (menu):

DecLock Mask: **{Pass/Fail, No/Yes}**
Indicates the status of the Reed-Solomon Decoder Lock.

Dintlvr Mask: **{Pass/Fail, No/Yes}**
Indicates the status of the Reed-Solomon De-interleaver word fault.

UnCWord Mask: **{Pass/Fail, No/Yes}**
Indicates the status of the Reed-Solomon uncoded word fault.

IBS Alarms:

Prompt Mask: **{Pass/Fail, No/Yes}**
Indicates that a Prompt Maintenance Alarm is generated as defined in Rec. ITU-T6.803.

Service Mask: **{Pass/Fail, No/Yes}**
Indicates that a Service Alarm is generated as defined in Rec. ITU-T6.803.

BER Mask: **{Pass/Fail, No/Yes}**
Fail indicates a BER of 1×10^{-3} or greater from satellite input.

Common (menu):

-12Volt Mask:	**{Pass/Fail, No/Yes}** Indicates the power supply voltage is out of range.
+12Volt Mask:	**{Pass/Fail, No/Yes}** Indicates the power supply voltage is out of range.
+5Volt Mask:	**{Pass/Fail, No/Yes}** Indicates the power supply voltage is out of range.
Temp Mask:	**{Pass/Fail, No/Yes}** Fail indicates that internal temperature of the modem is out of range.
IntFPGA Mask:	**{Pass/Fail, No/Yes}** Indicates a hardware failure on the Interface Card.
Battery Mask:	**{Pass/Fail, No/Yes}** Indicates that the Internal Clock Battery is low.
RAM/ROM Mask:	**{Pass/Fail, No/Yes}** Indicates an M&C Memory fault.
M&CProc Mask:	**{Pass/Fail, No/Yes}** Indicates an M&C Microprocessor hardware failure.
Ref PLL Mask:	**{Pass/Fail, No/Yes}** Indicates that the External Reference PLL is not locked.
Ext EXC Mask:	**{Pass/Fail, No/Yes}** Indicates that the External Clock is not active.
Ext Ref Mask:	**{Pass/Fail, No/Yes}** Indicates no activity on the External Reference.
HS Ref Mask:	**{Pass/Fail, No/Yes}** Indicates ???.
HSRf PLL Mask:	**{Pass/Fail, No/Yes}** Indicates ???.

Latched Alrm (menu):

Major Tx (menu):

TxuProc:	**{Pass/Fail}** Tx Processor fault. Indicates a Hardware Transmit DSP failure within the modem.
TxPower:	**{Pass/Fail}** Indicates that the Modem Tx Output Power is within the allowed tolerance.

TxOSClk: **{Pass/Fail}**
Indicates that the Tx Oversample Clock PLL is not locked. This alarm will flash 'On' during certain modem parameter changes.

CompCLK: **{Pass/Fail}**
Indicates that the Tx Composite Clock PLL is not locked. This alarm will flash 'On' during certain modem parameter changes.

TxSynth: **{Pass/Fail}**
Indicates that the Tx IF Synthesizer is not locked. This alarm will flash 'On' during certain modem parameter changes.

Tx FPGA: **{Pass/Fail}**
This alarm indicates a Transmit Hardware FPGA failure within the modem.

Ref PLL: **{Pass/Fail}**
This alarm indicates that the Modem Synthesizers are not locked to the external reference.

Tx Force: **{Pass/Fails}**
Allows a Major Tx Alarm to be forced (for testing purposes, etc.).

<u>Major Rx (menu):</u>

RxuProc: **{Pass/Fail}**
Indicates a Receive DSP Hardware failure within the modem.

SigLoss: **{Pass/Fail}**
Indicates that the demod is unable to lock to a signal.

FrmSync: **{Pass/Fail}**
Indicates that the Framing Unit is unable to find the expected framing pattern.

IFSynth: **{Pass/Fail}**
Indicates the Rx IF Synthesizer is not locked. This alarm will flash 'On' during certain modem parameter changes.

BuffPLL: **{Pass/Fail}**
Indicates that the Buffer Clock PLL is not locked. This alarm will flash 'On' during certain modem parameter changes.

RxLevel: **{Pass/Fail}**
This alarm indicates that the Receive Automatic Gain Control is saturated (i.e., too much signal power is being supplied to the modem).

Rx FPGA: **{Pass/Fail}**
This alarm indicates that a Receive FPGA Hardware fault has occurred.

Minor Tx (menu):

Tx Activity (menu):

TerrClk: **{Pass/Fail}**
Indicates no Terrestrial Clock activity.

Int Clk: **{Pass/Fail}**
Indicates no SCT Clock activity.

BNC Clk: **{Pass/Fail}**
Indicates no activity on the External BNC Clock.

TxSatCk: **{Pass/Fail}**
Indicates no Tx Sat Clock activity.

Tx Data: **{Pass/Fail}**
Indicates no Tx Data activity.

TerrAIS: **{Pass/Fail}**
Indicates that AIS has been detected in the Terrestrial Data Stream.

RS FIFO: **{Pass/Fail}**
Indicates the status of the Tx Reed-Solomon FIFO.

Tx Cal: **{Pass/Fail}**
Indicates that the modem has been calibrated for the output power level.

Minor Rx (menu):

BufUFlw: **{Pass/Fail}**
Indicates that a Doppler Buffer underflow has occurred.

BufOFlw: **{Pass/Fail}**
Indicates that a Doppler Buffer overflow has occurred.

Buf<10%: **{Pass/Fail}**
Indicates that the Doppler Buffer has gone below 10% full and may underflow.

Buf>90%: **{Pass/Fail}**
Indicates that the Doppler Buffer has gone above 90% full and may overflow.

VitLock: **{Pass/Fail}**
Indicates that the Viterbi Decoder is not locked.

SeqLock: **{Pass/Fail}**
Indicates that the Sequential Decoder is not locked.

Rx Activity (menu):

Buf Clk Mask: **{Pass/Fail, No/Yes}**
Indicates that the selected buffer clock source is not active.

Ext BNC Mask: **{Pass/Fail, No/Yes}**
Indicates no activity on the External BNC Clock Port.

Rx Sat Mask: **{Pass/Fail, No/Yes}**
Indicates that the Rx Sat Buffer clock source is not active.

ExtRef Mask: **{Pass/Fail, No/Yes}**
Indicates no activity on the external reference.

SatAIS Mask: **{Pass/Fail, No/Yes}**
Fail indicates a loss of satellite data.

Rx RS Faults (menu):

DecLock Mask: **{Pass/Fail, No/Yes}**
Indicates the status of the Reed-Solomon Decoder Lock.

Dintlvr Mask: **{Pass/Fail, No/Yes}**
Indicates the status of the Reed-Solomon De-interleaver word fault.

UnCWord Mask: **{Pass/Fail, No/Yes}**
Indicates the status of the Reed-Solomon uncoded word fault.

IBS Alarms (menu):

Prompt Mask: **{Pass/Fail, No/Yes}**
Indicates that a Prompt Maintenance Alarm is generated as defined in Rec. ITU-T6.803.

Service Mask: **{Pass/Fail, No/Yes}**
Indicates that a Service Alarm is generated as defined in Rec. ITU-T6.803.

BER Mask: **{Pass/Fail, No/Yes}**
Fail indicates a BER of 1 x 10^{-3} or greater from satellite input.

Common (menu):

-12Volt Mask: **{Pass/Fail, No/Yes}**
Indicates the power supply voltage is out of range.

+12Volt Mask: **{Pass/Fail, No/Yes}**
Indicates the power supply voltage is out of range.

+5Volt Mask: **{Pass/Fail, No/Yes}**
Indicates the power supply voltage is out of range.

Temp Mask: **{Pass/Fail, No/Yes}**
Fail indicates that internal temperature of the modem is out of range.

IntFPGA Mask: **{Pass/Fail, No/Yes}**
Indicates a hardware failure on the Interface Card.

Battery Mask: **{Pass/Fail, No/Yes}**
Indicates that the Internal Clock Battery is low.

RAM/ROM Mask: **{Pass/Fail, No/Yes}**
Indicates an M&C Memory fault.

M&CProc Mask: **{Pass/Fail, No/Yes}**
Indicates an M&C Microprocessor hardware failure.

Ref PLL Mask: **{Pass/Fail, No/Yes}**
Indicates that the External Reference PLL is not locked.

Ext EXC Mask: **{Pass/Fail, No/Yes}**
Indicates that the External Clock is not active.

Ext Ref Mask: **{Pass/Fail, No/Yes}**
Indicates no activity on the External Reference.

HS Ref Mask: **{Pass/Fail, No/Yes}**
Indicates ???.

HSRf PLL Mask: **{Pass/Fail, No/Yes}**
Indicates ???.

Backward Alr:

RxBack Mask: **{Pass/Fail, No/Yes}**
Indicates that the modem is receiving an Rx Alarm from the modem that is receiving its data.

TxBack Mask: **{Pass/Fail, No/Yes}**
Indicates that the modem is receiving an Tx Alarm from the modem that is supplying its data.

Force Back: **{Normal, Alarm On, Alarm Off}**
Indicates the state of the Backward Alarm.

Clear Alarms **{Ent = Y, Clr = N}**
Clears all Latched Alarms.

4.2.7 System Menu Options and Parameters

Control Mode: **{Front Panel, Terminal, Computer}**
Allows the user to select the active control source.

General (menu):

Date: **{YY MMM DD}**
Displays, and allows the user to enter the current date.

Time: **{HH:MM:SS}**
Displays, and allows the user to enter the current time.

Backlight (menu):

Level: **{High, Low}**
Allows the user to enter the backlight intensity level.

Timeout: **{00 - 99}**
Allows the user to enter the length of time in seconds of keyboard inactivity before the backlight shuts off. 00 = no timeout.

Key Click: **{On, Off}**
Allows the user to enable/disable the audible beep heard each time a key is pressed.

F03657X-0: **Version 2.5**
Displays the current firmware revision.

Firmware Rev.:

FPGA #1: **{F0XXXXNN, Not Present}**
Indicates whether or not the firmware (where F0XXXX is the Radyne ComStream part number, and NN is the Radyne ComStream revision number) is present.

Tx CPLD: **{F0XXXXNN, Not Present}**
Indicates whether the firmware is present.

Rx CPLD: **{F0XXXXNN, Not Present}**
Indicates whether the firmware is present.

Intf CPLD: **{F0XXXXNN, Not Present}**
Indicates whether the firmware is present.

Intf TxDSP: **{F0XXXXNN, Not Present}**
Indicates whether the firmware is present.

Intf RxDSP: **{F0XXXXNN, Not Present}**
Indicates whether the firmware is present.

DaughterCPLD: **{F0XXXXNN, Not Present}**
Indicates whether the firmware is present.

M&C (menu):

Term Baud: **{300 - 115200}**
Indicates the Terminal Baud Rate.

Emulation: **{VT100, ADDS-VP, WYSE 50}**
Allows the user to select the Terminal Emulation Mode for the Terminal Port.

Remote Mode: **{RS-485, RS-232}**
Allows the user to select Remote Port Emulation Mode.

Remote Addr: **{32 - 255}**
Allows the user to select the Remote Port Multidrop Address.

Remote Baud: **{300, 600, 1200, 2400, 4800, 9600, 19200}**
Allows the user to select the Remote Port Baud Rate.

4.2.8 Test Menu Options and Parameters

2047 Test: **{None, Tx, Rx, Tx/Rx}**
Allows the user to enable/disable the 2047 Pattern Test.
Tx enables the Transmit Pattern Generator.
Rx enables the Receive Pattern Generator.
Tx/Rx enables both.

Tx Ins Error: **{0000 - 9999}**
Allows the user to select the number of errors to insert. Once the number of errors to insert has been selected, pushing 'Enter' causes the number of errors shown to be inserted in the data stream.

Rx 2047 BER: **{No Sync, nnnn x 10^{-9}}**
Shows the measured BER for the 2047 pattern.

Rx 2047 Err: **{No Sync, nnnnn}**
Shows the number of errors detected by the 2047 pattern checker.

Clear 2047: **(Ent = Y, Clr = N)**
Restarts the 2047 BER Test.

Loopbacks: **{Tx Terr, Rx Terr, Tx/Rx Terr, Tx BB, Rx BB, Tx/Rx BB, IF}**
Terrestrial Loopback is performed at the Terrestrial Interface.

Tx Terr – Sends Tx Terrestrial Data to Rx Data Out.
istant Loop) Sends received satellite data to the Modulator for transmission to the distant end.
Tx/Rx Terr – Enables both.

Baseband Loopback is performed at the interface between the Baseband Processor Card and the Modem Card. This ensures Framer/Deframer integrity.

Tx BB – Sends Tx Data to the Receive Input to the BB Card.
Rx BB – Sends Rx Data from the Modem Card to the Tx Data Input to the Modem Card.
Tx/Rx BB – Enables both.

IF Loopback loops the IF Output of the Modulator to the IF Input of the Demodulator.

Carrier:	**{CW, Dual, Offset, Normal}** CW - Causes the Modulator to output pure carrier. Dual – Causes a double sideband output. Offset – Causes a single sideband output. Normal – Causes the Modulator to output normal modulation.
TxForce Alrm:	**{No, Yes}** Allows a Major Tx Alarm to be forced (for testing purposes, etc.).
RxForce Alrm:	**{No, Yes}** Allows a Major Rx Alarm to be forced (for testing purposes, etc.).
Remote Port:	**{Normal, Test}** Test sends a constantly looping data packet through the Remote Port that displays “Testing…”.
LED Test:	**{Normal, Test}** Allows the user to test Front Panel LED function.

4.3 Terminal Mode Control

The DMD2401 LB/ST Terminal Mode Control allows the use of an external terminal or computer to monitor and control the modem from a full screen interactive presentation operated by the modem itself. No external software is required other than VT100 terminal emulation software (e.g. “Procomm” for a computer when used as a terminal. The control port is normally used as an RS–232 connection to the terminal device. The RS-232 operating parameters can be set using the modem Front Panel and stored in EEPROM for future use.

4.3.1 Modem Terminal Mode Control

The modem can be interactively monitored and controlled in the Terminal mode, with a full screen presentation of current settings and status. Programming is accomplished by selecting the item to be modified and pressing the terminal key of the option number. For example, to change the transmit data rate, enter ‘33’ at the terminal. The modem will respond by presenting the options available and requesting input. Two types of input may be requested. If the input is multiple choice, the desired choice is selected by pressing the ‘Space’ key. When the desired option is displayed, press the ‘Enter’ key to select that option. The other possible input type requires a numerical input (such as entering a frequency or data rate. This type of input is followed by pressing the ‘Enter’ or carriage return key. An input can be aborted at any time by pressing the ‘ESC’ key. Invalid input keys cause an error message to be displayed on the terminal.

The Terminal Control Mode supports serial baud rates of 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. The connection must be set for 8 data bits, 1 stop bit and no parity (8,N,1. Three terminal emulations are supported: VT100, WYSE 50, and ADDS-VP.

$ is used for setting the screen when the terminal is used is used for the first time or the non-volatile memory gets reset.

4.3.2 Modem Setup for Terminal Mode

Terminal mode communications and protocol is set from the Front Panel control by setting the “Control Mode” parameter to “Terminal”, and then setting the “Modem Port,” “Term Baud” and “Emulation” parameters as desired. Then a terminal is connected to Connector J5 on the Back

```
Enter Selection Number:
```

```
1.Main Menu                IF Input (dBm) :-31 [3.7 V]   SW:F04780-- Ver:1.3
2.Control Mode:Ft Panel    Eb/No          :>20.00        Intf Pres :IDR G.703
3.Remote Mode :RS-485      Uncorrected SER:0   E-5       +5  V Mon :+4.9
4.Remote Addr :101         Corrected   BER:0   E-12      +12 V Mon :+12.6
                           Offset Frq (Hz):+1            -12 V Mon :-11.9
6.Center Buffer            2047 Error Cnt :NO SYNC       Events    :9
  Buffer Fill%:50          2047 BER       :NO SYNC
-------------------------------MODULATOR CONTROLS------------------------------
30.Mod Mode   :Closed Net      40.Mod Framing:None
31.Frequency  :950.000000 MHz  41.Carrier Ctl:On         50.Data Invert:Normal
32.Insert Err :1               42.Carrier Sel:Normal     51.Output Pwr :-5.0
33.Data Rate  :2048000    BPS  43.Spectrum   :Normal     52.ReedSolomon:Disable
34.EXC Clock  :2048000     Hz  44.2047 Test  :2047 On    53.Reed Sol N :219
35.Modulation :QPSK            45.TxClock Sel:SCTE(Ext)  54.Reed Sol K :201
36.Conv Encodr:VIT 3/4         46.TxClock Pol:Inverted   55.RS Depth   :8
37.Scrmblr Ctl:Enable          47.SCT Source :Internal
38.Scrmblr Sel:V.35-IESS       48.Terr Loop  :Off
```

```
39.Diff Encodr:On              49.Base Loop  :Off
Enter Selection Number:
```

Figure 4-3. Modulator Control Terminal Screen

```
1.Main Menu                IF Input (dBm) :-31 [3.7 V]   SW:F04780-- Ver:1.3
2.Control Mode:Ft Panel    Eb/No          :>20.00        Intf Pres :IDR G.703
3.Remote Mode :RS-485      Uncorrected SER:0   E-5       +5  V Mon :+4.9
4.Remote Addr :101         Corrected   BER:0   E-12      +12 V Mon :+12.6
                           Offset Frq (Hz:+4            -12 V Mon :-11.9
6.Center Buffer            2047 Error Cnt :NO SYNC       Events    :9
  Buffer Fill%:50          2047 BER       :NO SYNC
------------------------------DEMODULATOR CONTROLS----------------------------
30.Demod Mode :Closed Net       40.Dmd Framing:None
31.Frequency  :950.000000 MHz  41.DscmblrCtl :Enable    51.Data Invert :Normal
32.Sweep Limit:25 kHz           42.DscmblrSel :V.35-IESS 52.BER Period  :10^5
33.Data Rate  :2048000    BPS  43.Spectrum   :Normal    53.Buffer/byte :8192
34.Ext Ref    :10.000000  MHz  44.2047 Test  :Normal    54.Buffer/msec :32
35.Ref Source :Internal        45.BufClk Sel :RX SAT    55.Reed Solomon:Disable
36.Inp Lvl Lmt:-90 dBm         46.BufClk Pol :Inverted  56.Reed Sol N  :219
37.Dmdulation :QPSK            47.IF Loop    :On        57.Reed Sol K  :201
38.Conv Decodr:VIT 3/4         48.Terr Loop  :Off       58.RS Depth    :8
39.Diff Decodr:On              49.Base Loop  :Off
Enter Selection Number:
```

Figure 4-4. Demodulator Control Terminal Screen

```
1.Main Menu                IF Input (dBm) :-31 [3.7 V]   SW:F04780-- Ver:1.3
2.Control Mode:Terminal    Eb/No          :>20.00        Intf Pres :IDR G.703
3.Remote Mode :RS-485      Uncorrected SER:0   E-5       +5  V Mon :+4.9
4.Remote Addr :101         Corrected   BER:0   E-12      +12 V Mon :+12.6
                           Offset Frq (Hz:+4            -12 V Mon :-11.9
6.Center Buffer            2047 Error Cnt :NO SYNC       Events    :10
  Buffer Fill%:50          2047 BER       :NO SYNC
(Page Down = ‘D’, Page Up = ‘U’)
------------------------------EVENT BUFFER------------------------------------
 LOG#   TIME      DATE     TYPE MESSAGE
 10     18:37:50  16JUL00  A    Demod Input Level Alarm
 11     18:37:50  16JUL00  A    Demod Viterbi Decoder Lock Alarm
 12     18:37:50  16JUL00  A    Demod Buffer Clock Lock Alarm
 13     18:37:50  16JUL00  A    Carrier Lock Alarm
 14     18:37:52  16JUL00  A    Demod Input Level Alarm Cleared
 15     18:37:52  16JUL00  A    Demod Viterbi Decoder Lock Alarm Cleared

31.Delete One Entry       41.Delete All Entries      51.Sort By :        Time

Enter Selection Number:
```

Figure 4-5. Event Buffer Terminal Screen

```
1.Main Menu                IF Input (dBm) :-31 [3.7 V]   SW:F04780-- Ver:1.3
2.Control Mode:Terminal    Eb/No          :>20.00        Intf Pres :IDR G.703
3.Remote Mode :RS-485      Uncorrected SER:0   E-5       +5  V Mon :+4.9
4.Remote Addr :101         Corrected   BER:0   E-12      +12 V Mon :+12.6
                           Offset Frq (Hz:+1            -12 V Mon :-11.9
6.Center Buffer            2047 Error Cnt :NO SYNC       Events    :10
  Buffer Fill%:50          2047 BER       :NO SYNC
-----------------------------------ALARM STATUS--------------------------------
MOD MAJOR    MASK  DEMOD MAJOR  MASK   DEMOD MINOR  MASK   COMMON        MASK
21.TxuProc:P  No   41.RxuProc:P  No    61.BufUFlo:P  No    81.+5Volts :P  No
22.TxPower:P  No   42.SigLock:P  No    62.BufOFlo:P  No    82.+12Volts:P  No
23.TxOSClk:P  No   43.IFSynth:P  No    63.Buf<10%:P  No    83.-12Volts:P  No
24.TxCmpCk:P  No   44.BuffPLL:P  No    64.Buf>90%:P  No    84.IntFPGA :P  No
25.TxSynth:P  No   45.RxLevel:P  No    65.VitLock:P  No    85.Battery :P  No
26.TxFPGA :P  No   46.RxFPGA :P  No    66.SeqLock:P  No    86.RAM/ROM :P  No
MOD MINOR    MASK  47.FrmSync:P  No    67.Buf Clk:P  No    87.MC uProc:P  No
28.TerrClk:P  No   48.MFrSync:P  No    68.RxBNCCk:P  No    88.ExRefLck:P  No
29.Int Clk:P  No                       69.RxSatCk:P  No    89.ExRefAct:P  No
30.TxSatCk:P  No                       70.Sat AIS:P  No    90.D Card  :P  No
31.TxBNCCk:P  No                       71.RS Lock:P  No
32.Tx Data:F  No                       72.RS Intr:P  No
33.TerrAIS:P  No                       73.RS U.W.:P  No    93.Force Tx:No
34.RS FIFO:P  No                                           94.Force Rx:No
Enter Selection Number:
```

Figure 4-6. Alarm Status Terminal Screen

```
1.Main Menu                IF Input (dBm) :-31 [3.7 V]   SW:F04780-- Ver:1.3
2.Control Mode:Terminal    Eb/No          :>20.00        Intf Pres :IDR G.703
3.Remote Mode :RS-485      Uncorrected SER:0   E-5       +5  V Mon :+4.9
4.Remote Addr :101         Corrected   BER:0   E-12      +12 V Mon :+12.6
                           Offset Frq (Hz:+8            -12 V Mon :-11.9
6.Center Buffer            2047 Error Cnt :NO SYNC       Events    :10
  Buffer Fill%:50          2047 BER       :NO SYNC
---------------------------------LATCHED ALARM STATUS--------------------------
MOD MAJOR          DEMOD MAJOR         DEMOD MINOR         COMMON
TxuProc:   Pass    RxuProc:   Pass     BufUFlo:   Pass     +5 Volts:   Pass
TxPower:   Pass    SigLock:   Pass     BufOFlo:   Pass     +12Volts:   Pass
TxOSClk:   Pass    IFSynth:   Pass     Buf<10%:   Pass     -12Volts:   Pass
TxCmpCk:   Pass    BuffPLL:   Pass     Buf>90%:   Pass     IntFPGA :   Pass
TxSynth:   Pass    RxLevel:   Pass     VitLock:   Pass     Battery :   Pass
TxFPGA :   Pass    RxFPGA :   Pass     SeqLock:   Pass     RAM/ROM :   Pass
MOD MINOR          FrmSync:   Pass     Buf Clk:   Pass     MC uProc:   Pass
TerrClk:   Pass    MFrSync:   Pass     RxBNCCk:   Pass     ExRefLck:   Pass
Int Clk:   Pass                        RxSatCk:   Pass     ExRefAct:   Pass
TxSatCk:   Pass                        Sat AIS:   Pass     D Card  :   Pass
TxBNCCk:   Pass                        RS Lock:   Pass
Tx Data:   Fail                        RS Intr:   Pass
TerrAIS:   Pass                        RS U.W.:   Pass
RS FIFO:   Pass                                            94.Clr Latched Alarms
Enter Selection Number:
```

Figure 4-7. Latched Alarm Status Terminal Screen

```
1.Main Menu                IF Input (dBm :-38           SW:F04780-- Ver:1.3
2.Control Mode:Terminal    Eb/No          :>20.00        Intf Pres :IDR G.703
3.Remote Mode :RS-485      Uncorrected SER:0   E-5       +5  V Mon :+4.9
4.Remote Addr :101         Corrected   BER:0   E-12      +12 V Mon :+12.6
                           Offset Frq (Hz:+12           -12 V Mon :-11.9
6.Center Buffer            2047 Error Cnt :NO SYNC       Events    :37
  Buffer Fill%:50          2047 BER       :NO SYNC
----------------------IDR / G.703 INTERFACE CONTROLS----------------------------
GENERAL                   TX SETUP                    RX SETUP
31.EXC Clock :2048000     51.Tx G703 Intf:B.E1        71.Rx G703 Intf:B.E1
32.Ref Source:Internal    52.IDR OH Type :64kBit      72.Buffer/msec :32
33.Ext Ref Fq:10.000000   53.ESC Ch #1   :-20         73.BufClk Sel  :RX SAT
                          54.ESC Ch #2   :+0          74.IDR OH Type :64kBit
                                                      75.ESC Ch #1   :+10
                                                      76.ESC Ch #2   :+0
38.ForceTxBack1:Normal
39.ForceTxBack2:Normal       ALARM      Mask             ALARM      Mask
40.ForceTxBack3:Normal    60.TxBack1:P   Yes          80.RxBack1:F   Yes
41.ForceTxBack4:Normal    61.TxBack2:P   Yes          81.RxBack2:F   Yes
42.Tx Ckt ID :            62.TxBack2:P   Yes          82.RxBack2:F   Yes
43.Rx Ckt ID :            63.TxBack2:P   Yes          83.RxBack2:F   Yes

Enter Selection Number:
```

Figure 4-8. IDR/G.703 Interface Control Terminal Screen

```
1.Main Menu                IF Input (dBm) :-31 [3.7 V]   SW:F04780-- Ver:1.3
2.Control Mode:Ft Panel    Eb/No          :NO SYNC       Intf Pres :RS-422/RS449
3.Remote Mode :RS-485      Uncorrected SER:0   E-5       +5  V Mon :+4.9
4.Remote Addr :101         Corrected   BER:0   E-12      +12 V Mon :+12.4
                           Offset Frq (Hz:+18           -12 V Mon :-11.9
6.Center Buffer            2047 Error Cnt :NO SYNC       Events    :14
  Buffer Fill%:50          2047 BER       :NO SYNC
-------------------------RS-422 INTERFACE CONTROLS------------------------------
GENERAL                   TX SETUP                    RX SETUP
31.EXC Clock :2048000     51.Tx Clock Sel:SCTE(Ext   71.Buffer/byte :8192
32.Ref Source:Internal    52.Tx Clock Pol:Inverted    72.Buffer/msec :32
33.Ext Ref Fq:10.000000   53.SCT Source  :Internal    73.Buff Clk Sel:RX SAT
                                                      74.Buff Clk Pol:Inverted
42.Tx Ckt ID :
43.Rx Ckt ID :
Enter Selection Number:
```

Figure 4-9. RS-422 Interface Control Terminal Screen

```
1.Main Menu              IF Input (dBm) :-31 [3.7 V]   SW:F04780-- Ver:1.3
2.Control Mode:Ft Panel   Eb/No          :>20.00        Intf Pres :V.35/422/232
3.Remote Mode :RS-485     Uncorrected SER:0   E-5       +5  V Mon :+4.9
4.Remote Addr :101        Corrected   BER:0   E-12      +12 V Mon :+12.5
                          Offset Frq (Hz:+9            -12 V Mon :-11.9
6.Center Buffer           2047 Error Cnt :NO SYNC       Events    :13
  Buffer Fill%:50         2047 BER       :NO SYNC
-------------------V.35/RS-422/RS-232 INTERFACE CONTROLS------------------------
GENERAL                  TX SETUP                     RX SETUP
31.EXC Clock :2048000    51.Tx Clock Sel:SCTE(Ext   71.Buffer/byte :8192
32.Ref Source:Internal   52.Tx Clock Pol:Inverted    72.Buffer/msec :32
33.Ext Ref Fq:10.000000  53.SCT Source  :Internal    73.Buff Clk Sel:RX SAT
                         54.Tx Terr Intf:V.35        74.Buff Clk Pol:Inverted
                                                     75.Rx Terr Intf:V.35
42.Tx Ckt ID :
43.Rx Ckt ID :
Enter Selection Number:
```

Figure 4-10. V.35/RS4-22RS-232 Interface Control Terminal Screen

```
1.Main Menu              IF Input (dBm :-68           SW:F04780-- Ver:1.3
2.Control Mode:Ft Panel   Eb/No          :NO SYNC       Intf Pres :V35/422 Async
3.Remote Mode :RS-485     Uncorrected SER:NO SYNC       +5  V Mon :+4.9
4.Remote Addr :101        Corrected   BER:NO SYNC       +12 V Mon :+12.6
                          Offset Frq (Hz:+0            -12 V Mon :-11.9
6.Center Buffer           2047 Error Cnt :NO SYNC       Events    :39
  Buffer Fill%:0          2047 BER       :NO SYNC
----------------ASYNCHRONOUS OVERHEAD CHANNEL INTERFACE CONTROLS----------------
GENERAL                  TX SETUP                     RX SETUP
31.EXC Clock :2048000    51.Tx Clock Sel:SCTE(Ext   71.Buffer/msec :32
32.Ref Source:Internal   52.Tx Clock Pol:Inverted    72.Buff Clk Sel:RX SAT
33.Ext Ref Fq:10.000000  53.SCT Source  :Internal    73.Buff Clk Pol:Inverted
                         54.Asynchronous:Off         74.Asynchronous:Off
                         55.TxAsync Baud:300         75.RxAsync Baud:300
                         56.TxAsync Port:RS-485      76.RxAsync Port:RS-485
                         57.Tx Terr Intf:RS-422      77.Rx Terr Intf:RS-422
42.Tx Ckt ID :
43.Rx Ckt ID :

Enter Selection Number:
```

Figure 4-11. Asynchronous Overhead Channel Interface Control Terminal Screen

```
1.Main Menu              IF Input (dBm :-38          SW:F04780-- Ver:1.3
2.Control Mode:Ft Panel  Eb/No          :>20.00       Intf Pres :G.703 T1/E1 S
3.Remote Mode :RS-485    Uncorrected SER:0   E-5      +5  V Mon :+4.9
4.Remote Addr :101       Corrected   BER:0   E-12     +12 V Mon :+12.5
                         Offset Frq (Hz:+0           -12 V Mon :-11.9
6.Center Buffer          2047 Error Cnt :NO SYNC      Events    :20
  Buffer Fill%:50        2047 BER       :NO SYNC
---------------------G.703 SYMMETRIC INTERFACE CONTROLS-------------------------
GENERAL                 TX SETUP                    RX SETUP
31.EXC Clock :2048000   51.Tx G703 Intf:G703BT1AMI  71.Buffer/byte :6176
32.Ref Source:Internal                              72.Buffer/msec :32
33.Ext Ref Fq:10.000000                             73.Buff Clk Sel:RX SAT
                                                    74.Rx G703 Intf:G703BT1AMI

42.Tx Ckt ID :
43.Rx Ckt ID :
Enter Selection Number:
```

Figure 4-12. G.703 Symmetric Control Terminal Screen

4.4 Remote Port User Interface

The Remote Port of the DMD2401 LB/ST allows for complete control and monitor functions via an RS-485 or RS-232 Front Panel Selectable Serial Interface.

Control and status messages are conveyed between the DMD2401 LB/ST and the subsidiary modems and the host computer using packetized message blocks in accordance with a proprietary communications specification. This communication is handled by the Radyne Link Level Protocol (RLLP), which serves as a protocol ‘wrapper’ for the M&C data.

Complete information on monitor and control software is contained in the following sections.

4.4.1 Protocol Structure

The Communications Specification (COMMSPEC) defines the interaction of computer resident Monitor and Control software used in satellite earth station equipment such as Modems, Redundancy Switches, Multiplexers, and other ancillary support gear. Communication is bi-directional, and is normally established on one or more full-duplex 9600-baud multi-drop control buses that conform to EIA Standard RS-485. If a single device is placed on a single control bus, then the control bus may conform to EIA Standard RS-232.

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

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4.4.2 Protocol Wrapper

The Radyne COMMSPEC is byte-oriented, with the Least Significant Bit (LSB) issued first. Each data byte is conveyed as mark/space information with one mark comprising the stop data. When the last byte of data is transmitted, a hold comprises one steady mark (the last stop bit). To begin or resume data transfer, a space (00h) substitutes this mark. This handling scheme is controlled by the hardware and is transparent to the user. A pictorial representation of the data and its surrounding overhead may be shown as follows:

S1	S2	B_0	B_1	B_2	B_3	B_4	B_5	B_6	B_7	S1	S2, etc.

The stop bit, S1 is a mark. Data flow remains in a hold mode until S1 is replaced by a space. If S1 is followed by a space, the space character is considered a start (ST) and not part of the actual data (B_0 - B_7).

The above byte-oriented protocol is standard for UART based serial communication ports such as Workstation or Personal Computer (PC) COM ports. COM ports should be configured for 8 data bits, no parity, and one stop bit. For example, for 9600-baud operation, COM ports should be configured as:

9600, 8, N, 1

The COMMSPEC developed for use with the Radyne Link Level Protocol (RLLP) organizes the actual monitor and control data within a shell, or 'protocol wrapper', that surrounds the data. The format and structure of the COMMSPEC message exchanges are described herein. Decimal numbers have no suffix; hexadecimal numbers end with a lower case h suffix and binary values have a lower case b suffix. Thus, 22 = 16h = 000010110b. The principal elements of a data frame, in order of occurrence, are summarized as follows:

<SYN> - the message format header character, or ASCII sync character, that defines the beginning of a message. The <SYN> character value is always 16h (1 Byte).

<BYTE COUNT> - the Byte Count is the number of bytes in the <DATA> field (two bytes).

<SOURCE ID> - the Source Identifier defines the multi-drop address origin. Note that all nodes on a given control bus have a unique address that must be defined (1 Byte).

<DESTINATION ID> - The Destination Identifier serves as a pointer to the multi-drop destination device that indicates where the message is to be sent (1 Byte).

<FRAME SEQUENCE NUMBER> -The FSN is a tag with a value from 0 through 255 that is sent with each message. It assures sequential information framing and correct equipment acknowledgment and data transfers (1 Byte).

<OPCODE> - The Operation Code field contains a number that identifies the message type associated with the data that follows it. Equipment under MCS control recognizes this code via firmware identification and subsequently steers the DATA accordingly to perform a specific function or series of functions. Acknowledgment and error codes are returned in this field (two bytes).

<...DATA...> - The Data field contains the binary data bytes associated with the <OPCODE>. The number of data bytes in this field is indicated by the <BYTE COUNT> value.

<CHECKSUM> - The checksum is the modulo 256 sum of all preceding message bytes, excluding the <SYN> character (1 Byte). The checksum determines the presence or absence of errors within the message. In a message block with the following parameters, the checksurn is computed as shown in Table 4-4 below.

Table 4-4. Checksum Calculation Example

Byte Field	Data Content	Running Checksum
<BYTE COUNT>	02h = 00000010b	00000010b
<SOURCEID>	F0h = 11110000b	11110010b
<DESTINATION ID>	2Ah = 00101010b	00011100b
<FSN>	09h = 00001001b	00100101b
<OPCODE>	03h = 00000011b	00101000b
<DATA> (Byte 1)	DFh = 11011111b	00000111b
<DATA> (Byte 2)	FEh = 11111110b	00000101b

Thus, the checksum is 00000101b; which is 05h or 5 decimal. Alternative methods of calculating the checksum for the same message frame are:

0002h + F0h + 2Ah + 09h + 0003h + DFh + FEh = 305h.

Since the only concern is the modulo 256 (modulo 1 00h) equivalent (values that can be represented by a single 8-bit byte), the checksum is 05h.

For a decimal checksum calculation, the equivalent values for each information field are:

2 + 240 + 42 + 9 + 3 + 223 + 254 = 773;
773/256 = 3 with a remainder of 5.

This remainder is the checksum for the frame.

5 (decimal) = 05h = 0101b = <CHECKSUM>

4.4.3 Frame Description and Bus Handshaking

In a Monitor and Control environment, every message frame on a control bus port executes as a packet in a loop beginning with a wait-for-SYN-character mode. The remaining message format header information is then loaded, either by the M&C computer or by a subordinate piece of equipment (such as the DMD2401 LB/ST) requesting access to the bus. Data is processed in accordance with the OPCODE, and the checksum for the frame is calculated. If the anticipated checksum does not match then a checksum error response is returned to the message frame originator. The entire message frame is discarded and the wait-for-SYN mode goes back into effect. If the OPCODE resides within a command message, it defines the class of action that denotes an instruction that is specific to the device type, and is a prefix to the DATA field if data is required. If the OPCODE resides within a query message packet, then it defines the query code, and can serve as a prefix to query code DATA.

The Frame Sequence Number (FSN) is included in every message packet, and increments sequentially. When the M&C computer or bus-linked equipment initiates a message, it assigns the FSN as a tag for error control and handshaking. A different FSN is produced for each new message from the FSN originator to a specific device on the control bus. If a command packet is sent and not received at its intended destination, then an appropriate response message is not received by the packet originator. The original command packet is then re-transmitted with the same FSN. If the repeated message is received correctly at this point, it is considered a new message and is executed and acknowledged as such.

If the command packet is received at its intended destination but the response message (acknowledgment) is lost, then the message originator (usually the M&C computer) re-transmits the original command packet with the same FSN. The destination device detects the same FSN and recognizes that the message is a duplicate, so the associated commands within the packet are not executed a second time. However, the response packet is again sent back to the source as an acknowledgment in order to preclude undesired multiple executions of the same command.

To reiterate, valid equipment responses to a message require the FSN tag in the command packet. This serves as part of the handshake/acknowledge routine. If a valid response message is absent, then the command is re-transmitted with the same FSN. For a repeat of the same command involving iterative processes (such as increasing or decreasing the transmit power level of a DMD2401 LB/ST modulator), the FSN is incremented after each message packet. When the FSN value reaches 255, it overflows and begins again at zero. The FSN tag is a powerful tool that assures sequential information framing, and is especially useful where commands require more than one message packet.

The full handshake/acknowledgment involves a reversal of source and destination ID codes in the next message frame, followed by a response code in the <OPCODE> field of the message packet from the equipment under control.

If a command packet is sent and not received at its intended destination, a timeout condition can occur because the packet originator does not receive a response message. On receiving devices slaved to an M&C computer, the timeout delay parameters may be programmed into the equipment in accordance with site requirements by Radyne ComStream, Inc. prior to shipment, or altered by qualified personnel. The FSN handshake routines must account for timeout delays and be able to introduce them as well.

4.4.4 Global Response Operational Codes

In acknowledgment (response) packets, the operational code <OPCODE> field of the message packet is set to 0 by the receiving devices when the message intended for the device is evaluated as valid. The device that receives the valid message then exchanges the <SOURCE ID> with the <DESTINATION ID>, sets the <OPCODE> to zero in order to indicate that a good message was received, and returns the packet to the originator. This “GOOD MESSAGE” opcode is one of nine global responses. Global response opcodes are common responses, issued to the M&C computer or to another device, that can originate from and are interpreted by all Radyne equipment in the same manner. These are summarized as follows (all opcode values are expressed in decimal form):

Table 4-5. Response Opcodes

Response Opcode Description	Opcode
Good Message	00h
Bad Parameter	FFh
Bad Opcode	FEh
Bad Checksum	FDh
Command Not Allowed in LOCAL Mode	FCh
Command Not Allowed in AUTO Mode	FBh
Bad Destination	FAh
Unable to Process Command	F9h
Packet Too Long	F8h

The following response error codes are specific to the DMD2401 LB/ST:

Response Opcode Description	Opcode
MPARM_FREQUENCY_ERROR	0x0401
MPARM_DATARATE_ERROR	0x0404
MPARM_EXCCLOCK_ERROR	0x0405
MPARM_EXTREFERENCE_ERROR	0x0406
MPARM_FREQREFSOURCE_ERROR	0x0407
MPARM_MODULATIONTYPE_ERROR	0x0408
MPARM_CONVENCODER_ERROR	0x0409
MPARM_REEDSOLOMON_ERROR	0x040A
MPARM_SCRAMBLERCONTROL_ERROR	0x040B
MPARM_SCRAMBLERTYPE_ERROR	0x040C
MPARM_DIFFERENTIALENCODER_ERROR	0x040F
MPARM_XMITPOWERLEVEL_ERROR	0x0410
MPARM_CARRIERCONTROL_ERROR	0x0411
MPARM_CARRIERSELECTION_ERROR	0x0412
MPARM_SPECTRUM_ERROR	0x0413
MPARM_MODE_ERROR	0x0414
MPARM_TERRLOOPBACK_ERROR	0x0415
MPARM_BASELOOPBACK_ERROR	0x0416
MPARM_CLOCKCONTROL_ERROR	0x0417
MPARM_CLOCKPOLARITY_ERROR	0x0418
MPARM_FRAMING_ERROR	0x0419

MPARM_DROPMODE_ERROR	0x041A
MPARM_SCTSOURCE_ERROR	0x041B
MPARM_DROPMAP_ERROR	0x041D
MPARM_MODE_ERROR	0x0422
MPARM_CIRCUITID_ERROR	0x0423
MPARM_INTERFACETYPE_ERROR	0x0429
MPARM_NOTIMPLEMENTED_ERROR	0x042D
MPARM_SUMMARYFAULT_ERROR	0x0430
MPARM_DATAINVERT_ERROR	0x0431
MPARM_ASYNCTERRINTERFACETYPE_ERROR	0x0433
MPARM_CTSCONTROL_ERROR	0x0434
MPARM_CARRIERDELAY_ERROR	0x0443
DPARM_MODE_ERROR	0x0600
DPARM_FREQUENCY_ERROR	0x0601
DPARM_DATARATE_ERROR	0x0603
DPARM_SWEEPBOUNDARY_ERROR	0x0604
DPARM_LEVELLIMIT_ERROR	0x0605
DPARM_DEMODULATIONTYPE_ERROR	0x0608
DPARM_CONVDECODER_ERROR	0x0609
DPARM_REEDSOLOMON_ERROR	0x060A
DPARM_DIFFERENTIALDECODER_ERROR	0x060B
DPARM_DESCRAMBLERCONTROL_ERROR	0x060C
DPARM_DESCRAMBLERTYPE_ERROR	0x060D
DPARM_SPECTRUM_ERROR	0x060E
DPARM_BUFFERCLOCK_ERROR	0x0610
DPARM_BUFFERCLOCKPOL_ERROR	0x0611
DPARM_INSERTMODE_ERROR	0x0612
DPARM_FRAMING_ERROR	0x0615
DPARM_OPERATINGMODE_ERROR	0x0616
DPARM_BERMEASUREPERIOD_ERROR	0x0619
DPARM_CIRCUITID_ERROR	0x061A
DPARM_TERRLOOPBACK_ERROR	0x061B
DPARM_BASELOOPBACK_ERROR	0x061C
DPARM_IFLOOPBACK_ERROR	0x061D
DPARM_INTERFACETYPE_ERROR	0x061E

DPARM_NOTIMPLEMENTED_ERROR	0x0622
DPARM_DATAINVERT_ERROR	0x0623
DPARM_SUMMARYFAULT_ERROR	0x0624
DPARM_EXTERNALEXCSOURCE_ERROR	0x0625
DPARM_BUFFERSIZEMSEC_ERROR	0x0629
DPARM_BUFFERSIZEBYTES_ERROR	0x062A
DPARM_ASYNCINTERFACETYPE_ERROR	0x0630
DPARM_BUFFERSIZEMSECBYTES_ERROR	0x0631
MDPARM_TIME_ERROR	0x0A01
MDPARM_DATE_ERROR	0x0A02

4.4.5 Collision Avoidance

When properly implemented, the physical and logical devices and ID addressing scheme of the COMMSPEC normally precludes message packet contention on the control bus. The importance of designating unique IDs for each device during station configuration cannot be overemphasized. One pitfall, which is often overlooked, concerns multi-drop override IDs. All too often, multiple devices of the same type are assigned in a direct-linked (“single-thread”) configuration accessible to the M&C computer directly. For example, if two DMD2401 LB/ST Modems with different addresses (DESTINATION IDs) are linked to the same control bus at the same hierarchical level, both will attempt to respond to the M&C computer when the computer generates a multi-drop override ID of 22. If their actual setup parameters, status, or internal timing differs, they will both attempt to respond to the override simultaneously with different information or asynchronously in their respective message packets and response packets, causing a collision on the serial control bus.

To preclude control bus data contention, different IDs must always be assigned to the equipment. If two or more devices are configured for direct-linked operation, then the M&C computer and all other devices configured in the same manner must be programmed to inhibit broadcast of the corresponding multi-drop override ID.

The multi-drop override ID is always accepted by devices of the same type on a common control bus, independent of the actual DESTINATION ID. These override IDs with the exception of “BROADCAST” are responded to by all directly linked devices of the same type causing contention on the bus. The “BROADCAST” ID, on the other hand, is accepted by all equipment but none of them returns a response packet to the remote M&C.

The following multi-drop override IDs are device-type specific, with the exception of “BROADCAST”. These are summarized below with ID values expressed in decimal notation:

Directly-Addressed Equipment	Multi-Drop Override ID
Broadcast (all directly-linked devices)	00
DMD-3000/4000, 4500 or 5000 Mod Section, DMD15	01
DMD-3000/4000, 4500 or 5000 Demod Section, DMD15	02
RCU-340 1:1 Switch	03
RCS-780 1:N Switch	04
RMUX-340 Cross-Connect Multiplexer	05
CDS-780 Clock Distribution System	06
SOM-340 Second Order Multiplexer	07
DMD-4500/5000 Modulator Section	08
DMD-4500/5000 Demodulator Section	09
RCU-5000 M:N Switch	10
DMD15 Modulator	20
DMD15 Demodulator	21
DMD15 Modem	22
DVB3000 Video Demodulator	23
RCS20 M:N Switch	24
RCS10 M:N Switch	25
RCS11 1:1 Switch	26
DMD2401 LB/ST Modem	27
Unused	28-31

Note that multi-drop override IDs 01 or 02 can be used interchangeably to broadcast a message to a DMD3000/4000 modem, or to a DMD4500/5000, or to a DMD15 modem. Radyne ComStream Corporation recommends that the multi-drop override IDs be issued only during system configuration as a bus test tool by experienced programmers, and that they not be included in run-time software. It is also advantageous to consider the use of multiple bus systems where warranted by a moderate to large equipment complement. Therefore, if a DMD2401 LB/ST is queried for its equipment type identifier, it will return a “27”.

4.4.6 Software Compatibility

! CAUTION!!

The DMD2401 LB/ST RLLP is not software-compatible with the following previous Radyne products: RCU5000 and DMD4500. These products may not occupy the same bus while using this protocol as equipment malfunction and loss of data may occur.

When Radyne equipment is queried for information (Query Mod, Query Demod, etc.) it responds by sending back two blocks of data; a non-volatile section (parameters that can be modified by the user) and a volatile section (status information). It also returns a count value that indicates how large the non-volatile section is. This count is used by M&C developers to index into the start of the volatile section.

When new features are added to Radyne equipment, the control parameters are appended to the end of the non-volatile section, and status of the features, if any, are added at the end of the volatile section. If a remote M&C queries two pieces of Radyne equipment with different software revisions, they might respond with two different sized packets. The remote M&C MUST make use of the non-volatile count value to index to the start of the volatile section. If the remote M&C is not aware of the newly added features to the Radyne product, it should disregard the parameters at the end of the non-volatile section and index to the start of the volatile section.

If packets are handled in this fashion, there will also be backward-compatibility between Radyne equipment and M&C systems. Remote M&C systems need not be modified every time a feature is added unless the user needs access to that feature.

4.4.7 Flow Control and Task Processing

The original packet sender (the M&C computer) relies on accurate timeout information with regard to each piece of equipment under its control. This provides for efficient bus communication without unnecessary handshake overhead timing. One critical value is designated the Inter-Frame Space (FS). The Inter-Frame Space provides a period of time in which the packet receiver and medium (control bus and M&C computer interface) fully recover from the packet transmission/reception process and the receiver is ready to accept a new message. The programmed value of the Inter-Frame Space should be greater than the sum of the “turnaround time” and the round-trip (sender/receiver/bus) propagation time, including handshake overhead. The term “turnaround time” refers to the amount of time required for a receiver to be re-enabled and ready to receive a packet after having just received a packet. In flow control programming, the Inter-Frame Space may be determined empirically in accord with the system configuration, or calculated based on established maximum equipment task processing times.

Each piece of supported equipment on the control bus executes a Radyne Link Level Task (RLLT) in accordance with its internal hardware and fixed program structure. In a flow control example, the RLLT issues an internal “message in” system call to invoke an I/0 wait condition that persists until the task receives a command from the M&C computer. The RLLT has the option of setting a timeout on the incoming message. Thus, if the equipment does not receive an information/command packet within a given time period, the associated RLLT exits the I/0 wait state and takes appropriate action.

Radyne equipment is logically linked to the control bus via an Internal I/O Processing Task (IOPT) to handle frame sequencing, error checking, and handshaking. The IOPT is essentially a link between the equipment RLLT and the control bus. Each time the M&C computer sends a message packet, the IOPT receives the message and performs error checking. If errors are absent, the IOPT passes the message to the equipment’s RLLT. If the IOPT detects errors, it appends error messages to the packet. Whenever an error occurs, the IOPT notes it and discards the message; but it keeps track of the incoming packet. Once the packet is complete, the IOPT conveys the appropriate message to the RLLT and invokes an I/0 wait state (wait for next <SYN> character).

If the RLLT receives the packetized message from the sender before it times out, it checks for any error messages appended by the IOPT. In the absence of errors, the RLLT processes the received command sent via the transmitted packet and issues a “message out” system call to ultimately acknowledge the received packet. This call generates the response packet conveyed to the sender. If the IOPT sensed errors in the received packet and an RLLT timeout has not occurred, the RLLT causes the equipment to issue the appropriate error message(s) in the pending equipment response frame.

To maintain frame synchronization, the IOPT keeps track of error-laden packets and packets intended for other equipment for the duration of each received packet. Once the packet is complete, the IOPT invokes an I/0 wait state and searches for the next <SYN> character.

4.4.8 RLLP Summary

The RLLP is a simple send-and-wait protocol that automatically re-transmits a packet when an error is detected, or when an acknowledgment (response) packet is absent.

During transmission, the protocol wrapper surrounds the actual data to form information packets. Each transmitted packet is subject to time out and frame sequence control parameters, after which the packet sender waits for the receiver to convey its response. Once a receiver verifies that a packet sent to it is in the correct sequence relative to the previously received packet, it computes a local checksum on all information within the packet excluding the <SYN> character and the <CHECKSUM> fields. If this checksum matches the packet <CHECKSUM>, the receiver processes the packet and responds to the packet sender with a valid response (acknowledgment) packet. If the checksum values do not match, the receiver replies with a negative acknowledgment (NAK) in its response frame.

The response packet is therefore either an acknowledgment that the message was received correctly, or some form of a packetized NAK frame. If the sender receives a valid acknowledgment (response) packet from the receiver, the <FSN> increments and the next packet is transmitted as required by the sender. However, if a NAK response packet is returned, the sender re-transmits the original information packet with the same embedded <FSN>.

If an acknowledgment (response) packet or a NAK packet is lost, corrupted, or not issued due to an error and is thereby not returned to the sender, the sender re-transmits the original information packet; but with the same <FSN>. When the intended receiver detects a duplicate packet, the packet is acknowledged with a response packet and internally discarded to preclude undesired repetitive executions. If the M&C computer sends a command packet and the corresponding response packet is lost due to a system or internal error, the computer times out and re-transmits the same command packet with the same <FSN> to the same receiver and waits once again for an acknowledgment or a NAK packet.

To reiterate, the format of the message block is shown in Table B-4, Link Level Protocol Message Block.

Table 4-6. Link Level Protocol Message Block

SYNC	COUNT	SRC ADDR	DEST ADDR	FSN	OP CODE	DATA BYTES	CHECKSUM

The RLLP Remote Port Packet structure is as follows:

<SYNC>	Message format header character that defines the beginning of a message. The <SYNC> character value is always 0x16. (1 byte)
<COUNT>	Number of bytes in the <DATA> field. (two bytes)
<SOURCE ADDR>	Identifies the address of the equipment from where the message originated. (1 byte)

<DEST ADDR> Identifies the address of the equipment where the message is to be sent. (1 byte)

<FSN> Frame sequence number ensures correct packet acknowledgment and data transfers. (1 byte)

<OPCODE> This byte identifies the message type associated with the information data. The equipment processes the data according to the value in this field. Return error codes and acknowledgment are also included in this field. (two bytes)

<...DATA...> Information data. The number of data bytes in this field is indicated by the <BYTE COUNT> value.

<CHECKSUM> The modulo 256 sum of all preceding message bytes excluding the <SYNC> character. (1 byte)

4.4.9 DMD2401 LB/ST Opcode Command Set

The DMD2401 LB/ST Opcode Command Set is listed below, separated by commands that control the modulator only, the demodulator only, or the entire module.

4.4.10 Modulator Command Set

Command	Opcode
Query Mod All	2400h
Query Mod Latched Alarms	2405h
Query Mod Current Alarms	2408h
Query Mod Status	240Bh
Query Mod RTS Level	2433h
Command Mod All	2601h
Command Mod Frequency	2602h
Command Mod Data Rate	2604h
Command Mod Modulation Type	2606h
Command Mod Convolutional Encoder	2607h
Command Mod Differential Encoder	2608h
Command Mod Carrier Control	2609h
Command Mod Carrier Selection	260Ah
Command Mod Clock Control	260Bh
Command Mod Clock Polarity	260Ch
Command Mod Drop Mode	260Eh
Command Mod Output Level	260Fh
Command Mod Reed-Solomon Encoder	2610h
Command Mod Spectrum	2611h

Command Mod Operating Mode	2612h
Command Mod Scrambler Control	2613h
Command Mod Scrambler Type	2614h
Command Module Ext Ref Source	2616h
Command Mod Terrestrial Loopback	2617h
Command Mod Baseband Loopback	2618h
Command Mod Mode	2619h
Command Mod External EXC Clock	261Ah
Command Mod Ext Ref Frequency	261Bh
Command Mod Data Invert	2623h
Command Mod SCT Source	260Dh
Command Mod Async TERR Interface	2626h
Command Mod CTS Mode and Polarity	2631h
Command Mod CTS Level	2632h
Command Mod Carrier Delay	2637h

4.4.11 Demodulator Command Set

Command	Opcode
Query Demodulator All	2401h
Query Demod Latched Alarms	2406h
Query Demod Current Alarms	2409h
Query Demod Status	240Ch
Query Demod Eb/No, Input Level, Raw BER, Corrected BER, and Frequency Offset	240Dh
Query Demod Lock Status	2437h
Command Demod All	2A00h
Command Demod Frequency	2A01h
Command Demod Data Rate	2A02h
Command Demod Sweep Boundary	2A04h
Command Demod Demodulation Type	2A07h
Command Demod Convolutional Decoder	2A08h
Command Demod Differential Decoder	2A09h
Command Demod Reed-Solomon	2A0Ah
Command Demod Mode	2A0Bh
Command Demod Descrambler	2A0Dh

Command Demod Descrambler Type	2A0Eh
Command Demod Spectrum	2A0Fh
Command Demod Buffer Clock	2A11h
Command Demod Buffer Clock Polarity	2A12h
Command Demod Insert Mode	2A13h
Command Demod Operating Mode	2A17h
Command Demod BER Measure Period	2A1Ah
Command Demod Terrestrial Loopback	2A1Ch
Command Demod Baseband Loopback	2A1Dh
Command Demod IF Loopback	2A1Eh
Command Demod Center Buffer	2A20h
Command Demod Buffer Size Time/Bytes	2A31h
Command Demod Async TERR Int	2A2Eh

4.4.12 Module Command Set

RLLP Command	**Opcode**
Query Module Identification	2403h
Query Module Current Alarms	240Ah
Query Module Time	240Eh
Query Module Date	240Fh
Query Module Time and Date	2410h
Query Module Options	2431h
Command Module Control Mode	2600h
Command Drop & Insert Map Copy	2C00h
Command Drop & Insert Map	2C01h
Command Module Clear Latched Alarms	2C03h
Command Module Set Time	2C04h
Command Module Set Date	2C05h
Command Module Set Time and Date	2C06h
Command Module Soft Reset	2C07h
Command Module Default Configuration	2C30h

4.4.13 Detailed Command Descriptions

4.4.13.1 DMD2401 LB/ST Modulator

Opcode: <2400h> Query a Modulator's Configuration and Status

Query Response		
<1>	Number of Nonvol bytes	**CAUTION!!** ***See Paragraph B.6. This is the number of configuration bytes and is an offset to the start of the status block.***
Configuration Bytes		
<4>	Frequency	Unsigned Binary Value in Hz
<3>	Reserved	Ignore
<4>	Data Rate	Unsigned Binary Value in BPS
<4>	EXC Clock	Unsigned Binary Value in Hz
<1>	Modulation Type	0 = QPSK, 1 = BPSK, 2 = 8PSK, 4 = OQPSK
<1>	Convolutional Encoder	0 = None 1 = Viterbi 1/2 Rate 3 = Viterbi 3/4 Rate 5 = Viterbi 7/8 Rate 7 = Sequential 1/2 Rate 9 = Sequential 3/4 Rate 11 = Sequential 7/8 Rate 14 = Trellis 2/3
<1>	Reed-Solomon	0 = Disable, 1 = Enable
<1>	Reed-Solomon N	Unsigned Binary
<1>	Reed-Solomon K	Unsigned Binary
<1>	Reed-Solomon T	Unsigned Binary
<1>	RS Interleaver Depth	Unsigned Binary, 4 or 8
<1>	Scrambler Control	0 = Off, 1 = On

<1>	Scrambler Type	0 = None 1 = IBS Scrm. 2 = V35_IESS 3 = V35_CCITT 4 = V35_EFDATA 7 = Reed-Solomon Scrm. 8 = V35_EFRS
<2>	Transmit Power Level	Signed value. -50 to -300 (-5.0 to -30.0 dBm), Implied Decimal Point
<1>	Differential Encoder	0 = Off, 1 = On
<1>	Carrier Control	0 = Off, 1 = On, 2 = Auto, 3 = VSat, 4 = RTS, 5 = Delay
<1>	Carrier Selection	0 = Normal, 1 = CW, 2 = Dual, 3 = Offset
<1>	Spectrum	0 = Normal, 1 = Inverted
<1>	Operating Mode	0 = Normal, 1 = 2047 Test
<1>	Clock Control	0 = Internal (SCT), 1 = External (SCTE)
<1>	Clock Polarity	0 = Normal, 1 = Inverted, 2 = Auto
<1>	SCT Source	0 = Internal, 1 = SCR, 2 = Ext. BNC
<1>	Alarm 1 Mask Major Alarms	Bit 0 = Transmit Processor Fault Bit 1 = Transmit Output Power Level Fault Bit 2 = Transmit Oversample PLL Lock Fault Bit 3 = Transmit Composite Clock PLL Lock Fault Bit 4 = IF Synthesizer Lock Fault Bit 5 = Transmit FPGA Configuration Fault Bit 6 = Transmit Forced Alarm Bit 7 = External Reference PLL Lock Fault (0 = Mask, 1 = Allow)
<1>	Alarm 2 Mask Minor Alarms	Bit 0 = Terrestrial Clock Activity Detect Fault Bit 1 = Internal Clock Activity Detect Fault Bit 2 = Tx Sat Clock Activity Detect Fault Bit 3 = Tx Data Activity Detect Fault Bit 4 = Tx Data AIS Detect Fault Bit 5 = Transmit EXT BNC Clock Activity Detect Fault Bit 6 = Transmit Reed-Solomon Fault Bit 7 = Tx BUC Fault, LBST only (0 = Mask, 1 = Allow)
<1>	Common Alarm 1 Mask	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Interface FPGA Bit 4 = Temperature Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare

		(0 = Mask, 1 = Allow)
<24>	Tx Circuit ID	24 ASCII Characters
<1>	Tx Terrestrial Loopback	0 = Disabled, 1 = Enabled
<1>	Tx Baseband Loopback	0 = Disabled, 1 = Enabled
<1>	Reserved	Ignore
<1>	Reserved	Ignore
<1>	Data Invert	0 = Normal, 1 = Invert
		Note: The following byte applies only if an Asynchronous, IDR or IBS Interface is installed. If not, ignore.
<1>	Framing	0 = No Framing 1 = 1/16 IBS 2 = 1/16 Async 3 = 96 Kbit IDR
		Note: The following three bytes applies only if an Asynchronous, Interface Card is installed. If not, ignore.
<1>	Async Baud Rate	0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 50 6 = 110 7 = 300 8 = 600
<1>	Async Port Type	0 = RS-232, 1 = RS-485
<1>	Async Terrestrial Interface Type	0 = V.35, 1 = RS-422, 2 = RS-232
		Note: The following byte applies only if a Synchronous Multiprotocol Interface Card is installed. If not, ignore.
<1>	Multiprotocol Interface Card Interface Type	0 = RS-422, 1 = V.35, 2 = RS-232
		Note: The following byte applies only if a Symmetric G.703 Interface Card is installed. If not, ignore.
<1>	G.703 Interface Type	0 = G703T1AMI 1 = G703T1B8ZS

		2 = G703BE1 3 = G703UE1
		Note: The following byte applies to all DMD2401 modems, regardless of interface type.
<1>	BPSK Symbol Pairing	0 = Normal, 1 = Swapped
		Note: The following nine bytes apply only if an Asynchronous Interface Card or IBS Interface Card is installed, and the AUPC option is also installed. If not, set to zero.
		Note: AUPC minimum power level < AUPC default power level < AUPC max. power level.
<1>	AUPC Enable	0 = Disabled, 1 = Enabled
<2>	AUPC Eb/No	Unsigned Binary (1 Decimal Point Implied)
<2>	AUPC Minimum Power Limit	Signed Value, –50 to –300 (–5.0 to –30 dBm), Implied Decimal Point
<2>	AUPC Maximum Power Limit	Signed Value, –50 to –300 (–5.0 to –30 dBm), Implied Decimal Point
<2>	AUPC Default Power Level	Signed Value, –50 to –300 (–5.0 to –30 dBm), Implied Decimal Point
		Note: The following two bytes apply only if an IDR or IBS interface card is installed. If not, ignore.
<1>	Daughter Card Fault Mask	0 = Mask, 1 = Allow
<1>	Transmit Mode	0 = Closed Net Mode 1 = IDR Mode 2 = IBS Mode 3 = Drop & Insert Mode
		Note: The following 11 bytes apply only if an IDR or IBS interface card is installed, and the transmit mode parameter is set to IDR Mode. If an IDR or IBS interface card is not installed, ignore. If an IDR or IBS interface card is installed, but the transmit mode parameter is not set to IDR mode, these bytes can be set to any valid values, but will be ignored.
<1>	Transmit IDR Overhead Mode	0 = Voice, 1 = 64 Kbit Data
<1>	IDR Backward Alarm Mask	Bit 0 = IDR Backward Alarm 1 Bit 1 = IDR Backward Alarm 2 Bit 2 = IDR Backward Alarm 3

		Bit 3 = IDR Backward Alarm 4 Bits 4 - 7 = Spare (0 = Mask, 1 = Allow)
<1>	IDR Force Backward Alarm 1	0 = Force Alarm Always ON 1 = Force Alarm Always OFF 2 = Normal Operation
<1>	IDR Force Backward Alarm 2	0 = Force Alarm Always ON 1 = Force Alarm Always OFF 2 = Normal Operation
<1>	IDR Force Backward Alarm 3	0 = Force Alarm Always ON 1 = Force Alarm Always OFF 2 = Normal Operation
<1>	IDR Force Backward Alarm 4	0 = Force Alarm Always ON 1 = Force Alarm Always OFF 2 = Normal Operation
<1>	Interface Type	**If G.703 Daughter Card is Installed:** 0 = G.703 Unbalanced E1 1 = G.703 Balanced E1 2 = G.703 T1, B8ZS **If Synchronous Multiprotocol Daughter Card is installed:** 0 = V.35 1 = RS-422 2 = RS-232
<2>	Transmit ESC Audio #1 Volume	-20 to +10, Signed Binary Value (in dB)
<2>	Transmit ESC Audio #2 Volume	-20 to +10, Signed Binary Value (in dB)
<1>	Drop Mode	0 = Disable 1 = T1-D4 2 = T1-ESF 3 = PCM-30 4 = PCM-30C 5 = PCM-31 6 = PCM-31C 7 = T1-SLC96
<30>	DropMap	Mapping of Satellite Channels to dropped Terrestrial Timeslots
<1>	Drop Alarm Status Mask	Bit 0 = Terrestrial Frame Lock Fault (all modes) Bit 1 = Terrestrial Multiframe Lock Fault (PCM-30 and PCM-30C only) Bit 2 = Terrestrial CRC Lock Fault (PCM-30C and PCM-31C only) Bit 3 = Terrestrial Yellow Alarm Received (T1 only) Bit 4 = Terrestrial FAS Alarm Received (E1 only)

		Bit 5 = Terrestrial MFAS Alarm Received (PCM-30 and PCM-30C only) Bit 6 = Loss of T4errestrial Signaling (reported by DSP) Bit 7 = Spare
<1>	Drop Backward Alarm Mask	Bit 0 = Backward Alarm Received from Drop Terrestrial Bits 2 – 7 = Spares
<1>	ForceSatBack	Force D&I Satellite Backward Alarm to be transmitted
<30>	Drop Edit Map	Edit mapping of Satellite channels to dropped Terrestrial Time
	Status Bytes	
<1>	Revision Number	Decimal Point Implied
<1>	Alarm 1 Major Alarm	Bit 0 = Transmit Processor Fault Major Alarm Bit 1 = Transmit Output Power Level Fault Bit 2 = Transmit Oversample PLL Lock Fault Bit 3 = Transmit Composite Clock PLL Lock Fault Bit 4 = IF Synthesizer Lock Fault Bit 5 = Transmit FPGA Configuration Fault Bit 6 = Transmit Forced Alarm Bit 7 = External Reference PLL Lock Fault (0 = Pass, 1 = Fail)
<1>	Alarm 2 Minor Alarm	Bit 0 = Terrestrial Clock Activity Detect Fault Minor Alarm Bit 1 = Internal Clock Activity Detect Fault Bit 2 = Tx Sat Clock Activity Detect Fault Bit 3 = Tx Data Activity Detect Fault Bit 4 = Terrestrial AIS (Tx Data AIS Detect Fault) Bit 5 = Transmit Ext BNC Clock Activity Detect Fault Bit 6 = Transmit Reed-Solomon Fault Bit 7 = Tx BUC Fault, LBST Only (0 = Pass, 1 = Fail)
<1>	Common Alarm	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Latched Alarm 1 Major Alarm	Bit 0 = Transmit Processor Fault Major Alarm Bit 1 = Transmit Output Power Level Fault Bit 2 = Transmit Oversample PLL Lock Fault Bit 3 = Composite Clock PLL Lock Fault Bit 4 = IF Synthesizer Lock Fault Bit 5 = Transmit FPGA Configuration Fault Bit 6 = Transmit Forced Alarm Bit 7 = External Reference PLL Lock Fault (0 = Pass, 1 = Fail)

<1>	Latched Alarm 2 Minor Alarm	Bit 0 = Terrestrial Clock Activity Detect Fault Minor Alarm Bit 1 = Internal Clock Activity Detect Fault Bit 2 = Tx Sat Clock Activity Detect Fault Bit 3 = Tx Data Activity Detect Fault Bit 4 = Terrestrial AIS (Tx Data AIS Detect Fault) Bit 5 = Transmit Ext BNC Clock Activity Detect Fault Bit 6 = Transmit Reed-Solomon Fault Bit 7 = Tx BUC Fault, LBST Only (0 = Pass, 1 = Fail)
<1>	Latched Common Alarm	Bit 0 = -12 V alarm Bit 1 = +12 V alarm Bit 2 = +5 V alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM / ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Online Flag	0 = Offline, 1 = Online
<1>	+5V Voltage	+5 V, Implied Decimal Point (ex: 49 = +4.9 V)
<1>	+12V Voltage	+12 V, Implied Decimal Point (ex: 121 = +12.1 V)
<1>	-12V Voltage	-12 V, Implied Decimal Point and Minus Sign (ex: 118 = -11.8 V)
<2>	Temperature	Degrees C, Implied Decimal Point (ex: 490 = 49.0 C) (Temperature is measured at the output amplifier, and does not represent the overall internal temperature)
<4>	Reserved	Ignore These Bytes ***Note: The following three bytes apply only if an asynchronous interface card, IDR or IBS interface card is installed, and the AUPC option is installed and the AUPC is enabled. If not, ignore this byte.***
<1>	Remote AUPC Status	Bit 0 = AUPC Communication Error Bits 1-2 = Eb/No Status 0 = Eb/No is Invalid 1 = Eb/No is Valid 2 = Eb/No is Smaller Than Indicated Value 3 = Eb/No is Larger Than Indicated Value
<2>	Remote AUPC Eb/No	Unsigned Binary Value Decimal Point Implied

	Daughter Card Fault	***Note: The following byte applies only if an asynchronous interface card, IDR or IBS interface card is installed, and the AUPC option is installed and the AUPC is enabled. If not, ignore this byte.*** 0 = Daughter Card OK 1 = Daughter Card Faulted
<1>	Transmit IDR Backward Alarms	***The following byte applies only if an IDR or IBS interface card is installed and the modem is in IDR mode. If not, ignore this byte.*** Bit 0 = Backward Alarm 1 Bit 1 = Backward Alarm 2 Bit 2 = Backward Alarm 3 Bit 3 = Backward Alarm 4 Bits 4 – 7 = Spare (0 = Not Transmitted, 1 = Transmitted)
<1>	Control Mode	0 = Front Panel, 1 = Terminal, 2 = Computer
<1>	Drop Alarm Status	Bit 0 = Terrestrial Frame Lock Fault (all modes) Bit 1 = Terrestrial Multiframe Lock Fault (PCM-30 and PCM-30C only) Bit 2 = Terrestrial CRC Lock Fault (PCM-30C and PCM-31C only) Bit 3 = Terrestrial Yellow Alarm Received (T1 only) Bit 4 = Terrestrial FAS Alarm Received (E1 only) Bit 5 = Terrestrial MFAS Alarm Received (PCM-30 and PCM-30C only) Bit 6 = Loss of T4errestrial Signaling (reported by DSP) Bit 7 = Spare
<1>	Drop Backward Alarm Status	Bit 0 = Backward Alarm Received from Drop Terrestrial Bits 2 – 7 = Spares

Opcode: <240Bh> Query a Modulator's Status

Query Response		
<1>	Revision Number	Decimal Point Implied
<1>	Alarm 1 Major Alarm	Bit 0 = Transmit Processor Fault Bit 1 = Transmit Output Power Level Fault Bit 2 = Transmit Oversample PLL Lock Fault Bit 3 = Composite Clock PLL Lock Fault Bit 4 = IF Synthesizer Lock Fault Bit 5 = Transmit FPGA Configuration Alarm Fault Bit 6 = Transmit Forced Alarm Bit 7 = External Reference PLL Lock Fault (0 = Pass, 1 = Fail)
<1>	Alarm 2 Minor Alarm	Bit 0 = Terrestrial Clock Activity Detect Fault Bit 1 = Internal Clock Activity Detect Fault Bit 2 = Tx Sat Clock Activity Detect Fault Bit 3 = Tx Data Activity Detect Fault

		Bit 4 = Terrestrial AIS (Tx Data AIS Detect Fault) Bit 5 = Transmit Ext BNC Clock Activity Detect Fault Bit 6 = Transmit Reed-Solomon Fault Bit 7 = Tx BUC Fault, LBST Only (0 = Pass, 1 = Fail)
<1>	Common Alarm	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Latched Alarm 1 Major Alarm	Bit 0 = Transmit Processor Fault Bit 1 = Transmit Output Power Level Fault Bit 2 = Transmit Oversample PLL Lock Fault Bit 3 = Composite Clock PLL Lock Fault Bit 4 = IF Synthesizer Lock Fault Bit 5 = Transmit FPGA Configuration Alarm Fault Bit 6 = Transmit Forced Alarm Bit 7 = External Reference PLL Lock Fault (0 = Pass, 1 = Fail)
<1>	Latched Alarm 2 Minor Alarm	Bit 0 = Terrestrial Clock Activity Detect Fault Bit 1 = Internal Clock Activity Detect Fault Bit 2 = Tx Sat Clock Activity Detect Fault Bit 3 = Tx Data Activity Detect Fault Bit 4 = Terrestrial AIS (Tx Data AIS Detect Fault) Bit 5 = Transmit Ext BNC Clock Activity Detect Fault Bit 6 = Transmit Reed-Solomon Fault Bit 7 = Tx BUC Fault, LBST Only (0 = Pass, 1 = Fail)
<1>	Latched Common Alarm	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Fault Bit 4 = Spare Bit 5 = Battery fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Online Flag	0 = Offline, 1 = Online
<1>	+5 V Voltage	+5 V, Implied Decimal Point (ex: 49 = +4.9 V)
<1>	+12 V Voltage	+12 V, Implied Decimal Point (ex: 121 = +12.1 V)

<1>	-12 V Voltage	-12 V, Implied Decimal Point and Minus Sign (ex: 118 = -11.8 V)
<2>	Tx Temperature	Degrees C, Implied Decimal Point (ex: 490 = 49.0 °C) Temperature is measured at the output amplifier, and does not represent the overall internal temperature
<4>	Reserved	Ignore These Bytes
		Note: The following byte applies only if an asynchronous interface card or an IDR or IBS interface card is installed, and the AUPC option is installed and the AUPC is enabled. If not, ignore this byte.
<1>	Remote AUPC Status	Bit 0 = AUPC Communication Error Bits 1-2 = Eb/No Status (0 = Eb/No is Invalid) (1 = Eb/No is Valid) (2 = Eb/No is Smaller than Indicated Value) (3 = Eb/No is Larger than Indicated Value)
		Note: The following two bytes apply only if an asynchronous interface card or an IDR or IBS interface card is installed, and the AUPC option is installed and the AUPC is enabled. If not, ignore Note: The following two bytes.
<2>	Remote AUPC Eb/No	Unsigned Binary Value, Decimal Point Implied
		Note: The following byte applies only if an IDR or IBS interface card is installed. If not, ignore this byte.
<1>	Daughter Card Fault	0 = Daughter Card OK, 1 = Daughter Card Faulted
		Note: The following byte applies only if an IDR OR IBS interface card is installed and the modem is in IDR mode.
<1>	Transmit IDR Backward Alarms	Bit 0 = Backward Alarm 1 Bit 1 = Backward Alarm 2 Bit 2 = Backward Alarm 3 Bit 3 = Backward Alarm 4 Bits 4 - 7 Spare (0 = Not Transmitted, 1 = Transmitted)
<1>	Control Mode	0 = Front Panel, 1 = Terminal, 2 = Computer
<1>	Drop Alarm Status	Bit 0 = Terrestrial Frame Lock Fault (all modes) Bit 1 = Terrestrial Multiframe Lock Fault (PCM-30 and PCM-30C only) Bit 2 = Terrestrial CRC Lock Fault (PCM-30C and PCM-31C

		only) Bit 3 = Terrestrial Yellow Alarm Received (T1 only) Bit 4 = Terrestrial FAS Alarm Received (E1 only) Bit 5 = Terrestrial MFAS Alarm Received (PCM-30 and PCM-30C only) Bit 6 = Loss of T4errestrial Signaling (reported by DSP) Bit 7 = Spare
<1>	Drop Backward Alarm Status	Bit 0 = Backward Alarm Received from Drop Terrestrial Bits 2 – 7 = Spares

Opcode: <2405h> Query a Modulator's Latched Alarms

Query Response		
<1>	Latched Alarm 1 Major Alarm	Bit 0 = Transmit Processor Fault Bit 1 = Transmit Output Power Level Fault Bit 2 = Transmit Oversample PLL Lock Fault Bit 3 = Composite Clock PLL Lock Fault Bit 4 = IF Synthesizer Lock Fault Bit 5 = Transmit FPGA Configuration Alarm Fault Bit 6 = Transmit Forced Alarm Bit 7 = External Reference PLL Lock Fault (0 = Pass, 1 = Fail)
<1>	Latched Alarm 2 Minor Alarm	Bit 0 = Terrestrial Clock Activity Detect Fault Bit 1 = Internal Clock Activity Detect Fault Bit 2 = Tx Sat Clock Activity Detect Fault Bit 3 = Tx Data Activity Detect Fault Bit 4 = Terrestrial AIS (Tx Data AIS Detect Fault) Bit 5 = Transmit Ext BNC Clock Activity Detect Fault Bit 6 = Transmit Reed-Solomon Fault Bit 7 = Tx BUC Fault, LBST Only (0 = Pass, 1 = Fail)
<1>	Latched Common Alarm	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)

Opcode: <2408h> Query a Modulator's Current Alarms

Query Response		
<1>	Alarm 1 Major Alarm	Bit 0 = Transmit Processor Fault Bit 1 = Transmit Output Power Level Fault Bit 2 = Transmit Oversample PLL Lock Fault Bit 3 = Composite Clock PLL Lock Fault Bit 4 = IF Synthesizer Lock Fault Bit 5 = Transmit FPGA Configuration Alarm Fault Bit 6 = Transmit Forced Alarm Bit 7 = External Reference PLL Lock Fault (0 = Pass, 1 = Fail)
<1>	Alarm 2 Minor Alarm	Bit 0 = Terrestrial Clock Activity Detect Fault Bit 1 = Internal Clock Activity Detect Fault Bit 2 = Tx Sat Clock Activity Detect Fault Bit 3 = Tx Data Activity Detect Fault Bit 4 = Terrestrial AIS (Tx Data AIS Detect Fault Bit 5 = Transmit Ext BNC Clock Activity Detect Fault Bit 6 = Transmit Reed-Solomon Fault Bit 7 = Tx BUC Fault, LBST Only (0 = Pass, 1 = Fail)

<1>	Common Alarm	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)

Opcode: <2433h> Query a Modulator's RTS Level

Query Response		
<1>	RTS Level	Bit 0 = Level 0 = Off, 1 = On Bits 1 – 7 = Spares

Opcode: <2601h> Command a Modulator's Configuration

<4>	Frequency	Unsigned Binary Value in Hz
<3>	Reserved	Set to Zero
<4>	Data Rate	Unsigned Binary Value in BPS
<4>	EXC Clock	Unsigned Binary Value in Hz
<1>	Modulation Type	0 = QPSK, 1 = BPSK, 2 = 8PSK, 4 = OQPSK
		Note: The following command will also turn the carrier off to protect the satellite.
<1>	Convolutional Encoder	0 = None 1 = Viterbi 1/2 Rate 3 = Viterbi 3/4 Rate 5 = Viterbi 7/8 Rate 7 = Sequential 1/2 Rate 9 = Sequential 3/4 Rate 11 = Sequential 7/8 Rate 14 = Trellis 2/3
<1>	Reed-Solomon	0 = Disable, 1 = Enable
<1>	Reed-Solomon N	Unsigned Binary
<1>	Reed-Solomon K	Unsigned Binary
<1>	Reed-Solomon T	***Note: This byte is always set to zero; as the T value is calculated from N and K.***
<1>	RS Interleaver Depth	Unsigned Binary (4 or 8)
<1>	Scrambler Control	0 = Off, 1 = On

<1>	Scrambler Type	0 = None 1 = IBS Scrm. 2 = V35_IESS 3 = V35_CCITT 4 = V35_EFDATA 7 = Reed-Solomon Scrm. 8 = V35_EFRS
<2>	Transmit Power Level	Signed value. -50 to -300 (-5.0 to -30.0 dBm), Implied Decimal Point
<1>	Differential Encoder	0 = Off, 1 = On
<1>	Carrier Control	0 = Off, 1 = On, 2 = Auto, 3 = VSat, 4 = RTS, 5 = Delay
<1>	Carrier Selection	0 = Normal, 1 = CW, 2 = Dual, 3 = Offset
<1>	Spectrum	0 = Normal, 1 = Inverted
<1>	Operating Mode	0 = Normal, 1 = 2047 Test
<1>	Clock Control	0 = Internal (SCT), 1 = External (SCTE)
<1>	Clock Polarity	0 = Normal, 1 = Inverted, 2 = Auto
<1>	SCT Source	0 = Internal, 1 = SCR, 2 = Ext. BNC
<1>	Alarm 1 Mask Major Alarm	Bit 0 = Transmit Processor Fault Bit 1 = Transmit Output Power Level Fault Bit 2 = Transmit Oversample PLL Lock Fault Bit 3 = Composite Clock PLL Lock Fault Bit 4 = IF Synthesizer Lock Fault Bit 5 = Transmit FPGA Configuration Alarm Fault Bit 6 = Transmit Forced Alarm Bit 7 = External Reference PLL Lock Fault (0 = Mask, 1 = Allow)
<1>	Alarm 2 Mask Minor Alarm	Bit 0 = Terrestrial Clock Activity Detect Fault Bit 1 = Internal Clock Activity Detect Fault Bit 2 = Tx Sat Clock Activity Detect Fault Bit 3 = Tx Data Activity Detect Fault Bit 4 = Terrestrial AIS (Tx Data AIS Detect Fault) Bit 5 = Transmit Ext BNC Clock Activity Detect Fault Bit 6 = Transmit Reed-Solomon Fault Bit 7 = Tx BUC Fault, LBST Only (0 = Mask, 1 = Allow)
<1>	Common Alarm Mask	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault

		Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Mask, 1 = Allow)
<24>	Tx Circuit ID	ASCII Characters
<1>	Tx Terrestrial Loopback	0 = Disabled, 1 = Enabled
<1>	Tx Baseband Loopback	0 = Disabled, 1 = Enabled
<1>	Reserved	Set to Zero
<1>	Reserved	Set to Zero
<1>	Data Invert	0 = Normal, 1 = Invert
		Note: The following byte applies only if an Asynchronous, IDR or IBS Interface is installed. If not, set to zero.
<1>	Framing	0 = No Framing, 1 = 1/16 IBS, 2 = 1/16 Async, 3 = 96 Kbit IDR
		Note: The following byte applies only if an Asynchronous Interface Card is installed. If not, set to zero.
<1>	Async Baud Rate	0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 50 6 = 110 7 = 300 8 = 600
<1>	Async Port Type	***Note: The following byte applies only if an Asynchronous Interface Card is installed. If not, set to zero.*** 0 = RS-232, 1 = RS-485
<1>	Async Terrestrial Interface Type	***Note: The following byte applies only if an Asynchronous Interface Card is installed. If not, set to zero.*** 0 = V.35, 1 = RS-422, 2 = RS-232
<1>	Multiprotocol Interface Card	***Note: The following byte applies only if a Synchronous***

	Interface Type	***Multiprotocol interface card is installed. If not, set to zero.*** 0 = V.35,1 = RS-422, 2 = RS-232
<1>	G.703 Interface Type	***Note: The following byte applies only if a symmetric G.703 interface card is installed. If not, set to zero.*** 0 = G703T1AMI 1 = G703T1B8ZS 2 = G703BE1 3 = G703UE1
<1>	BPSK Symbol Pairing	***Note: The following byte applies to all DMD2401 modems, regardless of interface type.*** 0 = Normal, 1 = Swapped
<1>	AUPC Enable	***Note: The following byte applies only if an Asynchronous Interface Card, or an IDR OR IBS Interface Card is installed, AND the AUPC option is also installed. If not, set to zero.*** ***Note: AUPC minimum power level < AUPC default power level ≤ AUPC max. power level.*** 0 = Disabled, 1 = Enabled
<2>	AUPC Eb/No	***Note: The following two bytes apply only if an Asynchronous Interface Card, or an IDR OR IBS Interface Card is installed, AND the AUPC option is also installed. If not, set to zero.*** ***Note: AUPC minimum power level < AUPC default power level ≤ AUPC max. power level.*** Unsigned Binary, 1 Decimal Point Implied
<2>	AUPC Minimum Power Limit	***Note: The following two bytes apply only if an Asynchronous Interface Card, or an IDR OR IBS Interface Card is installed, AND the AUPC option is also installed. If not, set to zero.*** ***Note: AUPC minimum power level < AUPC default power level ≤ AUPC max. power level.*** Signed Value, –50 to –300 (–5.0 to –30 dBm), Implied Decimal Point
<2>	AUPC Maximum Power Limit	***Note: The following two bytes apply only if an Asynchronous Interface Card, or an IDR OR IBS Interface Card is installed, AND the AUPC option is also installed. If not, set to zero.***

		Note: AUPC minimum power level < AUPC default power level ≤ AUPC max. power level. Signed value, –50 to –300 (–5.0 to –30 dBm), Implied Decimal Point
<2>	AUPC Default Power Level	***Note: The following two bytes apply only if an Asynchronous Interface Card, or an IDR OR IBS Interface Card is installed, AND the AUPC option is also installed. If not, set to zero.*** ***Note: AUPC minimum power level < AUPC default power level ≤ AUPC max. power level.***
<1>	Daughter Card Fault Mask	Signed value, –50 dBm to –300 (–5.0 to –30 dBm), Implied Decimal Point ***Note: The following byte applies only if an IDR OR IBS interface card is installed. If not, set to zero.***
<1>	Transmit Mode	0 = Mask, 1 = Allow ***Note: The following byte applies only if an IDR OR IBS interface card is installed. If not, set to zero.*** 0 = Closed Net Mode 1 = IDR Mode 2 = IBS Mode 3 = Drop & Insert Mode
<1>	Transmit IDR Overhead Mode	***Note: The following byte applies only if an IDR OR IBS interface card is installed, and the transmit mode parameter is set to IDR Mode. If an IDR OR IBS interface card is not installed, set to zero. If an IDR OR IBS interface card is installed, but the transmit mode parameter is not set to IDR mode, these bytes can be set to any valid values, but will be ignored.*** 0 = Voice 1 = 64 Kbit Data
<1>	IDR Backward Alarm Mask	***Note: The following byte applies only if an IDR OR IBS interface card is installed, and the transmit mode parameter is set to IDR Mode. If an IDR OR IBS interface card is not installed, set to zero. If an IDR OR IBS interface card is installed, but the transmit mode parameter is not set to IDR mode, these bytes can be set to any valid values, but will be ignored.*** Bit 0 = IDR Backward Alarm 1 Bit 1 = IDR Backward Alarm 2 Bit 2 = IDR Backward Alarm 3 Bit 3 = IDR Backward Alarm 4 Bit 4 – 7 = Spare (0 = Mask, 1 = Allow)

<1>	IDR Force Backward Alarm 1	***Note: The following byte applies only if an IDR OR IBS interface card is installed, and the transmit mode parameter is set to IDR Mode. If an IDR OR IBS interface card is not installed, set to zero. If an IDR OR IBS interface card is installed, but the transmit mode parameter is not set to IDR mode, these bytes can be set to any valid values, but will be ignored.*** 0 = Force Alarm Always ON 1 = Force Alarm Always OFF 2 = Normal Operation
<1>	IDR Force Backward Alarm 2	***Note: The following byte applies only if an IDR OR IBS interface card is installed, and the transmit mode parameter is set to IDR Mode. If an IDR OR IBS interface card is not installed, set to zero. If an IDR OR IBS interface card is installed, but the transmit mode parameter is not set to IDR mode, these bytes can be set to any valid values, but will be ignored.*** 0 = Force Alarm Always ON 1 = Force Alarm Always OFF 2 = Normal Operation
<1>	IDR Force Backward Alarm 3	***Note: The following byte applies only if an IDR OR IBS interface card is installed, and the transmit mode parameter is set to IDR Mode. If an IDR OR IBS interface card is not installed, set to zero. If an IDR OR IBS interface card is installed, but the transmit mode parameter is not set to IDR mode, these bytes can be set to any valid values, but will be ignored.*** 0 = Force Alarm Always ON 1 = Force Alarm Always OFF 2 = Normal Operation
<1>	IDR Force Backward Alarm 4	***Note: The following byte applies only if an IDR OR IBS interface card is installed, and the transmit mode parameter is set to IDR Mode. If an IDR OR IBS interface card is not installed, set to zero. If an IDR OR IBS interface card is installed, but the transmit mode parameter is not set to IDR mode, these bytes can be set to any valid values, but will be ignored.*** 0 = Force Alarm Always ON 1 = Force Alarm Always OFF 2 = Normal Operation
<1>	Interface Type	***Note: The following byte applies only if an IDR OR IBS interface card is installed, and the transmit mode parameter is set to IDR Mode. If an IDR OR IBS interface card is not installed, set to zero. If an IDR OR IBS interface card is installed, but the transmit mode***

		parameter is not set to IDR mode, these bytes can be set to any valid values, but will be ignored. **If G.703 daughter card is installed:** 0 = G.703 Unbalanced E1 1 = G.703 Balanced E1 2 = G.703 T1, B8ZS **If Synchronous multiprotocol daughter card is installed:** 0 = V.35 1 = RS-422 2 = RS-232
<2>	Transmit ESC Audio #1 Volume	***Note: The following two bytes apply only if an IDR OR IBS interface card is installed, and the transmit mode parameter is set to IDR Mode. If an IDR OR IBS interface card is not installed, set to zero. If an IDR OR IBS interface card is installed, but the transmit mode parameter is not set to IDR mode, these bytes can be set to any valid values, but will be ignored.*** -20 to +10, signed binary value in dB
<2>	Transmit ESC Audio #2 Volume	***Note: The following two bytes apply only if an IDR OR IBS interface card is installed, and the transmit mode parameter is set to IDR Mode. If an IDR OR IBS interface card is not installed, set to zero. If an IDR OR IBS interface card is installed, but the transmit mode parameter is not set to IDR mode, these bytes can be set to any valid values, but will be ignored.*** -20 to +10, signed binary value in dB

Opcode: <2602h> Command a Modulator's Frequency

<4>	Frequency	***Note: The following command will also turn the carrier off to protect the satellite.*** Unsigned Binary Value in Hz

Opcode: <2604h> Command a Modulator's Data Rate

<4>	Data Rate	***Note: The following command will also turn the carrier off to protect the satellite.*** Unsigned Binary Value in BPS

Opcode: <2606h> Command a Modulator's Modulation Type

<1>	Modulation Type	***Note: The following command will also turn the carrier off to protect the satellite.*** 0 = QPSK, 1 = BPSK, 2 = 8PSK, 4 = OQPSK

Opcode: <2607h> Command a Modulator's Convolutional Encoder

<1>	Convolutional Encoder	***Note: The following command will also turn the carrier off to protect the satellite.*** 0 = None 1 = Viterbi 1/2 Rate 3 = Viterbi 3/4 Rate 5 = Viterbi 7/8 Rate 7 = Sequential 1/2 Rate 9 = Sequential 3/4 Rate 11 = Sequential 7/8 Rate 14 = Trellis

Opcode: <2608h> Command a Modulator's Differential Encoder

<1>	Differential Encoder	0 = Off, 1 = On

Opcode: <2609h> Command a Modulator's Carrier Control

<1>	Carrier Control	0 = Off, 1 = On, 2 = Auto, 3 = VSat, 4 = RTS, 5 = Delay

Opcode: <260Ah> Command a Modulator's Carrier Selection

<1>	Carrier Selection	0 = Normal, 1 = CW, 2 = Dual, 3 = Offset

Opcode: <260Bh> Command a Modulator's Clock Control

<1>	Clock Control	0 = Internal (SCT), 1 = External (SCTE)

Opcode: <260Ch> Command a Modulator's Clock Polarity

<1>	Clock Polarity	0 = Normal, 1 = Inverted, 2 = Auto

Opcode: <260Dh> Command a Modulator's SCT Source

<1>	SCT Source	0 = Internal, 1 = SCR, 2 = Ext. BNC

Opcode: <260Eh> Command a Modulator's Drop Mode

<1>	Mode	0 = Disable 1 = T1-D4 2 = T1-ESF 3 = PCM-30 4 = PCM-30C 5 = PCM-31 6 = PCM-31C 7 = T1-SLC96

Opcode: <260Fh> Command a Modulator's Output Level

<2>	Transmit Power Level	Signed Binary Value. -50 to -300 (-5.0 to -30.0 dBm), Implied Decimal Point

Opcode: <2610h> Command a Modulator's Reed-Solomon Encoder Characteristics

<1>	Reed-Solomon	0 = Disable, 1 = Enable
<1>	Reed-Solomon N	Unsigned Binary
<1>	Reed-Solomon K	Unsigned Binary
<1>	Reed-Solomon T	***Note: Always set to Zero; as the T value is calculated from N and K.***
<1>	RS Interleaver Depth	Unsigned Binary, 4 or 8

Opcode: <2611h> Command a Modulator's Spectrum

<1>	Spectrum	0 = Normal, 1 = Inverted

Opcode: <2612h> Command a Modulator's Operating Mode

<1>	Operating Mode	0 = Normal, 1 = 2047 Test

Opcode: <2613h> Command a Modulator's Scrambler Control

<1>	Scrambler Control	0 = Off, 1 = On

Opcode: <2614h> Command a Modulator's Scrambler Type

<1>	Scrambler Type	0 = None 1 = IBS Scrambler 2 = V.35_IESS 3 = V.35_CCITT 4 = V.35_EFDATA 7 = Reed-Solomon Scrambler 8 = V35_EFRS

Opcode: <2617h> Command a Modulator's Terrestrial Loopback

<1>	Terrestrial Loopback	0 = Disable, 1 = Enable

Opcode: <2618h> Command a Modulator's Baseband Loopback

<1>	Baseband Loopback	0 = Disable, 1 = Enable

Opcode: <2623h> Command a Modulator's Data Invert

<1>	Data Invert	0 = Normal, 1 = Inverted

Opcode: <2626h> Command a Modulator's Async Terrestrial Interface Type
Note: Command <2626h> is only valid if an asynchronous interface card is installed. If not, this command is ignored. Note: The following command will also turn the carrier off to protect the satellite.

Mod Async Terr Interface Type		
<1>	Async Framing	0 = No Framing, Async Off 1 = IBS Framing, Async On 2 = IBS Framing, Async Off
<1>	Async Baud Rate	0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 50 6 = 110 7 = 300 8 = 600
<1>	Async Port Type	0 = RS-232, 1 = RS-485
<1>	Async Terr Intf Type	0 = V.35, 1 = RS-422, 2 = RS-232

Opcode: <2631h> Command a Modulator's CTS Mode and Polarity

<1>	CTS Control	Bit 0 = Polarity 0 = Normal, 1 = Inverted Bits 1 and 2 = Mode 0 = Always On (factory default) 1 = CTS reflects the state of the RTS Input 2 = CTS reflects CTS Level Remote Command Bit 3 - 7 = Spares

Opcode: <2632h> Command a Modulator's CTS Level

Query Response		
<1>	CTS Level	Bit 0 = Level 0 = Off, 1 = On – only valid if CTS Control Mode bits Bits 1 - 7 = Spares

Opcode: <2637h> Command a Module's External Carrier Delay

<1>	Carrier Delay	Unsigned Binary Value in seconds (0 - 255)

4.4.13.2 DMD2401 LB/ST Demodulator

Opcode: <2401h> Query a Modulator's Configuration and Status

Query Response		
<1>	Number of Nonvol bytes	**CAUTION!!** ***See Paragraph B.6. This is the number of configuration bytes and is an offset to the start of the status block.***
Configuration Bytes		
<4>	Frequency	Binary Value, 1Hz Steps
<4>	Data Rate	Binary Value, 1 BPS Steps
<1>	Sweep Boundary	Sweep Limits (Max of ± 42 kHz)
<4>	External Reference	Unsigned Binary Value in Hz
<1>	Freq. Reference Source	0 = Internal, 1 = External
<1>	Input Level Limit	Lower Level Limit, Binary Value, 1 dB Steps, Negative Sign Implied
<1>	Demodulation Type	0 = QPSK, 1 = BPSK, 2 = 8PSK, 4 = OQPSK

<1>	Convolutional Decoder	0 = None 1 = Viterbi 1/2 Rate 3 = Viterbi 3/4 Rate 5 = Viterbi 7/8 Rate 7 = Sequential 1/2 Rate 9 = Sequential 3/4 Rate 11 = Sequential 7/8 Rate 14 = Trellis 2/3
<1>	Reed-Solomon	0 = Disable, 1 = Enable
<1>	Reed-Solomon N	Unsigned Binary
<1>	Reed-Solomon K	Unsigned Binary
<1>	Reed-Solomon T	Unsigned Binary
<1>	RS Interleaver Depth	Unsigned Binary, 4 or 8
<1>	Differential Decoder	0 = Off, 1 = On
<1>	Descrambler Control	0 = Disable, 1 = Enable
<1>	Descrambler Type	0 = None 1 = IBS Scrm. 2 = V35_IESS 3 = V35_CCITT 4 = V35_EFDATA 7 = Reed-Solomon Scrm. 8 = V.35_EFRS
<1>	Spectrum	0 = Normal, 1 = Inverted
<4>	Buffer Size	Byte 1 - 2 = Buffer Size in ms Byte 3 - 4 = Buffer Size in Bytes
<1>	Buffer Clock	0 = External, 1 = Internal, 2 = EXC, 3 = RX SAT
<1>	Buffer Clock Polarity	0 = Normal, 1 = Inverted
<1>	Operating Mode	0 = Normal, 1 = 2047 Test
<1>	Alarm 1 Mask	Bit 0 = Receive Processor Fault Bit 1 = Signal Lock Fault Bit 2 = Receive Satellite AIS Fault Bit 3 = Rx AGC/Input Level Fault Bit 4 = Reed-Solomon Sync Fault Bit 5 = Reed-Solomon Excessive Errors Fault Bit 6 = Reed-Solomon Uncorrectable Word Fault) Bit 7 = Receive Forced Alarm (0 = Mask, 1 = Allow)

<1>	Alarm 2 Mask	Bit 0 = Buffer Underflow Bit 1 = Buffer Overflow Bit 2 = Buffer Under 10% Bit 3 = Buffer Over 90% Bit 4 = Receive FPGA Configuration Alarm Fault Bit 5 = Rx LNB Fault, LBST Only Bits 6 - 7 = Spares (0 = Mask, 1 = Allow)
<1>	Alarm 3 Mask	Bit 0 = IF Synthesizer Lock Detect Fault Bit 1 = Rx Oversample PLL Lock Detect Fault Bit 2 = Buffer Clock PLL Lock Detect Fault Bit 3 = Viterbi Decoder Lock Fault Bit 4 = Sequential Decoder Lock Fault Bit 5 = Rx 2047 Test Pattern Lock Fault Bit 6 = External Reference PLL Lock Fault Bit 7 = Frame Sync/Multiframe Sync Loss (0 = Mask, 1 = Allow)
<1>	Alarm 4 Mask	Bit 0 = Buffer Clock Activity Detect Fault Bit 1 = External BNC Activity Detect Fault Bit 2 = Rx Satellite Clock Activity Detect Fault Bit 3 = External Reference PLL Activity Fault Bits 4 - 7 = Spares (0 = Mask, 1 = Allow)
<1>	Common Alarm 1 Mask	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Mask, 1 = Allow)
<1>	Reserved	Set to Zero
<1>	BER Measure Period	Unsigned Binary Number of Bits in Measurement Period, in Powers of Ten (ex: 6 = 10^6 Bits)
<24>	Rx Circuit ID	24 ASCII Characters
<1>	Rx Terrestrial Loopback	0 = Disabled, 1 = Enabled
<1>	Rx Baseband Loopback	0 = Disabled, 1 = Enabled
<1>	Rx IF Loopback	0 = Disabled, 1 = Enabled

<1>	Reserved	Ignore
<1>	Data Invert	0 = Normal, 1 = Invert
<1>	Async Framing	***Note: The following byte applies only if an Asynchronous, IDR or IBS Interface is installed. If not, ignore.*** 0 = No Framing, 1 = 1/16 IBS, 2 = 1/16 Async, 3 = 96 Kbit IDR
<1>	Async Baud Rate	***Note: The following byte applies only if an asynchronous interface card is installed. If not, ignore.*** 0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 50 6 = 110 7 = 300 8 = 600
<1>	Async Port Type	***Note: The following byte applies only if an asynchronous interface card is installed. If not, ignore.*** 0 = RS-232, 1 = RS-485
<1>	Async Terrestrial Interface Type	***Note: The following byte applies only if an asynchronous interface card is installed. If not, ignore.*** 0 = RS-422, 1 = V.35, 2 = RS-232
<1>	Multiprotocol Interface Card Interface Type	***Note: The following byte applies only if a synchronous multiprotocol interface card is installed. If not, ignore.*** 0 = V.35, 1 = RS-422, 2 = RS-232
<1>	G.703 Interface Type	***Note: The following byte applies only if a symmetric G.703 interface card is installed. If not, ignore.*** 0 = G703T1AMI 1 = G703T1B8ZS 2 = G703BE1 3 = G703UE1
<1>	BPSK Symbol Pairing	***Note: The following byte applies to all DMD2401 modems, regardless of interface type.*** 0 = Normal, 1 = Swapped

<1>	Receive Mode	***Note: The following byte applies only if an IDR OR IBS interface card is installed. If not, ignore.*** 0 = Closed Net Mode 1 = IDR Mode 2 = IBS Mode
<1>	T1/E1 Frame Source	***Note: The following byte applies only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, ignore*** 0 = Internal, 1 = External
<1>	Receive IDR Overhead Mode	***Note: The following byte applies only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, ignore*** 0 = Voice, 1 = 64 K Data
<1>	Receive IDR Backward Alarms Mask	***Note: The following byte applies only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, ignore*** Bit 0 = IDR Backward Alarm 1 Bit 1 = IDR Backward Alarm 2 Bit 2 = IDR Backward Alarm 3 Bit 3 = IDR Backward Alarm 4 Bits 4 - 7 = Spares (0 = Mask, 1 = Allow)
<1>	Interface Type (*If G.703 Daughter Card Installed)*	***Note: The following byte applies only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, ignore*** 0 = G.703 Unbalanced E1 1 = G.703 Balanced E1 2 = G.703 T1, B8ZS **If synchronous multiprotocol daughter card is installed:** 0 = V.35, 1 = RS-422, 2 = RS-232
<2>	Receive ESC Audio #1 Volume	***Note: The following two bytes apply only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, ignore*** -20 to +10, Signed Binary Value in dB
<2>	Receive ESC Audio #2 Volume	***Note: The following two bytes apply only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, ignore*** -20 to +10, Signed Binary Value in dB
<1>	Reserved	

<1>	Alarm 5 Mask	Bit 0 = IBS Satellite Multiframe Fault Bit 1 = IBS Satellite Frame Fault Bit 2 = Spare Bit 3 = IBS Alarm if BER < 10^{-03} Bit 4 = IBS Prompt Alarm Bit 5 = IBS Service Alarm Bits 6 - 7 = Spares
<1>	Insert Mode	0 = Disable 1 = T1-D4 2 = T1-ESF 3 = PCM-30 4 = PCM-30C 5 = PCM-31 6 = PCM-31C 7 = T1-SLC96
<30>	Insert Map	Mapping of Satellite Channels to insert Terrestrial Timeslots
<1>	Insert Alarm Mask	0 = Frame Lock Fault 1 = MultiFrame Lock Fault 2 = CRC Lock Fault. Valid only in T1-ESF and E1 – CRC enabled 3 = T1 Yellow Alarm Received 4 = E1 FAS Alarm Received 5 = E1 MFAS Alarm Received 6 = E1 CRC Alarm Received 7 = CRC Calculation Fault
<1>	Insert Back Alarm Mask	Bit 0 = Backward Alarm Received from Satellite Bits 2 – 7 = Spares
<1>	Force Terrestrial Back Alarm	Force D&I Terrestrial Backward Alarm to be Trans
<30>	Insert Edit Map	
Status Bytes		
<1>	Revision Number	Decimal Point Implied
<1>	Alarm 1	Bit 0 = Receive Processor Fault Bit 1 = Signal Lock Fault Bit 2 = Receive Satellite AIS Fault Bit 3 = Rx AGC Input Level Fault Bit 4 = Reed-Solomon Sync Fault Bit 5 = Reed-Solomon Excessive Errors Fault Bit 6 = Reed-Solomon Uncorrectable Word Fault Bit 7 = Receive Forced Alarm (0 = Pass, 1 = Fail)

<1>	Alarm 2	Bit 0 = Buffer Underflow Bit 1 = Buffer Overflow Bit 2 = Buffer Under 10% Bit 3 = Buffer Over 90% Bit 4 = Receive FPGA Fault Bit 5 = Rx LNB Fault, LBST Only Bits 6 - 7 Spares (0 = Pass, 1 = Fail)
<1>	Alarm 3	Bit 0 = IF Synthesizer Lock Detect Fault Bit 1 = Rx Oversample PLL Lock Detect Fault Bit 2 = Buffer Clock PLL Lock Detect Fault Bit 3 = Viterbi Decoder Lock Fault Bit 4 = Sequential Decoder Lock Fault Bit 5 = Rx 2047 Test Pattern Lock Fault Bit 6 = External Reference PLL Lock Fault Bit 7 = Frame Sync/Multiframe Sync Fault (0 = Pass, 1 = Fail)
<1>	Alarm 4	Bit 0 = Buffer Clock Activity Detect Fault Bit 1 = External BNC Activity Detect Fault Bit 2 = Rx Satellite Clock Activity Detect Fault Bit 3 = External Reference PLL Activity Fault Bits 4 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Common Alarm	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Reserved	Ignore
<1>	Latched Alarm 1	Bit 0 = Receive Processor Fault Bit 1 = Signal Lock Fault Bit 2 = Receive Satellite AIS Fault Bit 3 = Rx AGC Input Level Fault Bit 4 = Reed-Solomon Sync Fault Bit 5 = Reed-Solomon Excessive Errors Fault Bit 6 = Reed-Solomon Uncorrectable Word Fault Bit 7 = Receive Forced Alarm (0 = Pass, 1 = Fail)
<1>	Latched Alarm 2	Bit 0 = Buffer Underflow Bit 1 = Buffer Overflow Bit 2 = Buffer Under 10%

		Bit 3 = Buffer Over 90% Bit 4 = Receive FPGA Fault Bit 5 = Rx LNB Fault, LBST Only Bits 6 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Latched Alarm 3	Bit 0 = IF Synthesizer Lock Detect Fault Bit 1 = Rx Oversample PLL Lock Detect Fault Bit 2 = Buffer Clock PLL Lock Detect Fault Bit 3 = Viterbi Decoder Lock Fault Bit 4 = Sequential Decoder Lock Fault Bit 5 = Rx 2047 Test Pattern Lock Fault Bit 6 = External Reference PLL Lock Fault Bit 7 = Frame Sync Fault (0 = Pass, 1 = Fail)
<1>	Latched Alarm 4	Bit 0 = Buffer Clock Activity Detect Fault Bit 1 = External BNC Activity Detect Fault Bit 2 = Rx Satellite Clock Activity Detect Fault Bit 3 = External Reference PLL Activity Fault Bits 4 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Latched Comm. Alarm	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare
<1>	Reserved	Ignore
<4>	Error Counter	Unsigned Binary Value
<4>	Test 2047 Error Counter	Unsigned Binary Value
<2>	Raw BER Mantissa	Bytes 1 - 2 = Unsigned Binary Value Raw BER
<2>	Corrected BER Mantissa	Bytes 1 - 2 = Unsigned Binary Value Corrected BER
<2>	Eb/No	Unsigned Binary Value, 2 Decimal Places Implied
<4>	Offset Frequency	Unsigned Binary Value in Hz, Pos/Neg Indicated Below
<2>	Test 2047 Mantissa	Bytes 1 - 2 = Unsigned Binary Value Test 2047 BER
<1>	Raw BER Exponent	Byte 3 = Unsigned Binary Value Exponent
<1>	Corrected BER	Byte 3 = Unsigned Binary Value Exponent

	Exponent	
<1>	Test 2047 BER Exponent	Byte 3 = Unsigned Binary Value Exponent
<1>	Offset Frequency Sign	0 = Offset Frequency Pos, 1 = Offset Frequency Neg
<1>	BER/EbNo Status	Bit 0 = Raw BER and Corrected BER Status (1 = Valid) Bit 1 = Test 2047 BER Status (1 = Valid) Bits 2 - 3 = EbNo Status (0 = EbNo is Invalid, 1 = EbNo is Valid, 2 = EbNo is Smaller Than Indicated Value, 3 = EbNo is Greater Than Indicated Value Bits 4 - 7 = Reserved
<1>	Buffer Percent Full	Unsigned Binary Value Representing % Buffer Full (0 - 100 in 1% Steps)
<1>	Input Level	Unsigned Binary Value in -1 dB Steps, Negative Sign Implied
<1>	Input Level State	Signed Binary (0 = Equal to, 1 = Greater Than, -1 = Less Than Value in -1 dB Steps, Negative Sign Implied
<1>	Alarm 5	Bit 0 = IBS Satellite Multiframe Loss Bit 1 = IBS Satellite Frame Loss Bit 2 = Spare Bit 3 = IBS Alarm if BER < 10^{-03} Bit 4 = IBS Prompt Alarm Bit 5 = IBS Service Alarm Bits 6 - 7 = Spares
<1>	Insert Alarms	Bit 0 = Frame Lock Fault Bit 1 = Multiframe Lock Fault Bit 2 = CRC Lock Fault. Valid only in T1-ESF and E1 – CRC enabled Bit 3 = T1 Yellow Alarm Received Bit 4 = E1 FAS Alarm Received Bit 5 = E1 MFAS Alarm Received Bit 6 = E1 CRC Alarm Received Bit 7 = CRC Calculation Fault
<1>	Insert Back Alarm	Bit 0 = Backward Alarm Received from Satellite Bits 2 – 7 = Spares
<1>	AGC Voltage	In Hex, decimal point implied.

Opcode: <240Ch> Query a Demodulator's Status

Query response		
<1>	Revision Number	Decimal Point Implied
<1>	Alarm 1	Bit 0 = Receive Processor Fault Bit 1 = Signal Lock Fault Bit 2 = Receive Satellite AIS Fault Bit 3 = Rx AGC/Input Level Fault Bit 4 = Reed-Solomon Sync Fault Bit 5 = Reed-Solomon Excessive Errors Fault

		Bit 6 = Reed-Solomon Uncorrectable Word Fault Bit 7 = Receive Forced Alarm (0 = Pass, 1 = Fail)
<1>	Alarm 2	Bit 0 = Buffer Underflow Bit 1 = Buffer Overflow Bit 2 = Buffer Under 10% Bit 3 = Buffer Over 90% Bit 4 = Receive FPGA Configuration Fault Bit 5 = Rx LNB Fault, LBST Only Bits 6 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Alarm 3	Bit 0 = IF Synthesizer Lock Detect Fault Bit 1 = Rx Oversample PLL Lock Detect Fault Bit 2 = Buffer Clock PLL Lock Detect Fault Bit 3 = Viterbi Decoder Lock Fault Bit 4 = Sequential Decoder Lock Fault Bit 5 = Rx 2047 Test Pattern Lock Fault Bit 6 = External Reference PLL Lock Fault Bit 7 = Frame Sync/Multiframe Sync Fault (0 = Pass, 1 = Fail)
<1>	Alarm 4	Bit 0 = Buffer Clock Activity Detect Fault Bit 1 = External BNC Activity Detect Fault Bit 2 = Rx Satellite Clock Activity Detect Fault Bit 3 = External Reference PLL Activity Fault Bits 4 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Common Alarm	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Reserved	Ignore
<1>	Latched Alarm 1	Bit 0 = Receive Processor Fault Bit 1 = Signal Lock Fault Bit 2 = Receive Satellite AIS Fault Bit 3 = Rx AGC Input Level Fault Bit 4 = Reed-Solomon Sync Fault Bit 5 = Reed-Solomon Excessive Errors Fault Bit 6 = Reed-Solomon Uncorrectable Word Fault Bit 7 = Receive Forced Alarms (0 = Pass, 1 = Fail)

<1>	Latched Alarm 2	Bit 0 = Buffer Underflow Bit 1 = Buffer Overflow Bit 2 = Buffer Under 10% Bit 3 = Buffer Over 90% Bit 4 = Rx FPGA Configuration Fault Bit 5 = Rx LNB Fault, LBST Only Bits 6 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Latched Alarm 3	Bit 0 = IF Synthesizer Lock Detect Fault Bit 1 = Rx Oversample PLL Lock Detect Fault Bit 2 = Buffer Clock PLL Lock Detect Fault Bit 3 = Viterbi Decoder Lock Fault Bit 4 = Sequential Decoder Lock Fault Bit 5 = Rx 2047 Test Pattern Lock Fault Bit 6 = External Reference PLL Lock Fault Bit 7 = Frame Sync/Multiframe Sync Fault (0 = Pass, 1 = Fail)
<1>	Latched Alarm 4	Bit 0 = Buffer Clock Activity Detect Fault Bit 1 = External BNC Activity Detect Fault Bit 2 = Rx Satellite Clock Activity Detect Fault Bit 3 = External Reference PLL Activity Fault Bits 4 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Latched Common Alarm	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Reserved	Ignore
<4>	Error Counter	Unsigned Binary Value
<4>	Test 2047 Error Counter	Unsigned Binary Value
<2>	Raw BER Mantissa	Bytes 1 - 2 = Unsigned Binary Value Raw BER
<2>	Corrected BER Mantissa	Bytes 1 - 2 = Unsigned Binary Value Corrected BER
<2>	EbNo	Unsigned Binary Value, 2 Decimal Places Implied
<4>	Offset Frequency	Unsigned Binary Value in Hz, Pos/Neg Indicated Below
<2>	Test 2047 BER Mantissa	Bytes 1 - 2 = Unsigned Binary Value Test 2047 BER

<1>	Raw BER Exponent	Byte 3 = Unsigned Binary Value Exponent
<1>	Corrected BER Exponent	Byte 3 = Unsigned Binary Value Exponent
<1>	Test 2047 BER Exponent	Byte 3 = Unsigned Binary Value Exponent
<1>	Offset Frequency Sign	0 = Offset Frequency Pos, 1 = Offset Frequency Neg
<1>	BER/EbNo Status	Bit 0 = Raw BER and Corrected BER Status (1 = Valid) Bit 1 = Test 2047 BER Status (1 = Valid) Bits 2 - 3 = EbNo Status (0 = EbNo is Invalid, 1 = EbNo is Valid, 2 = EbNo is Smaller Than Indicated Value, 3 = EbNo is Greater Than Indicated Value) Bits 4 - 7 = Reserved
<1>	Buffer Percent Full	Unsigned Binary Value Representing % Buffer Full (0 - 100 in 1% steps)
<1>	Input Level	Unsigned Binary Value in -1 dB Steps, Negative Sign Implied
<1>	Input Level State	Signed Binary (0 = Equal to, 1 = Greater Than, -1 = Less Than Value in -1 dB Steps, Negative Sign Implied)
<1>	Alarm 5	Bit 0 = IBS/IDR Satellite Multiframe Sync Loss Bit 1 = IBS/IDR Satellite Frame Sync Loss Bit 2 = Spare Bit 3 = IBS BER Alarm Bit 3 = IBS Prompt Alarm Bit 5 = IBS Service Alarm Bits 6 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Backward Alarms	Bit 0 = IBS Backward Alarm or IDR Backward Alarm 1 Bit 1 = IDR Backward Alarm 2 Bit 2 = IDR Backward Alarm 3 Bit 3 = IDR Backward Alarm 4 Bits 4 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Latched Alarm 5	Bit 0 = IBS/IDR Satellite Multiframe Sync Loss Bit 1 = IBS/IDR Satellite Frame Sync Loss Bit 2 = Spare Bit 3 = IBS BER Alarm Bit 4 = IBS Prompt Alarm Bit 5 = IBS Service Alarm Bit 6 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Control Mode	0 = Front Panel, 1 = Terminal, 2 = Computer RLLP
<1>	Alarm 5	Bit 0 = IBS Satellite Multiframe Loss Bit 1 = IBS Satellite Frame Loss Bit 2 = Spare

		Bit 3 = IBS Alarm if BER < 10^{-03} Bit 4 = IBS Prompt Alarm Bit 5 = IBS Service Alarm Bits 6 - 7 = Spares
<1>	Insert Alarms	Bit 0 = Frame Lock Fault Bit 1 = Multiframe Lock Fault Bit 2 = CRC Lock Fault. Valid only in T1-ESF and E1 - CRC enabled Bit 3 = T1 Yellow Alarm Received Bit 4 = E1 FAS Alarm Received Bit 5 = E1 MFAS Alarm Received Bit 6 = E1 CRC Alarm Received Bit 7 = CRC Calculation Fault
<1>	Insert Back Alarm	Bit 0 = Backward Alarm Received from Satellite Bits 2 – 7 = Spares
<1>	AGC Voltage	In Hex, decimal point implied.

Opcode: <2406h> Query a Demodulator’s Latched Alarms

Query response		
<1>	Latched Alarm 1	Bit 0 = Receive Processor Fault Bit 1 = Signal Lock Fault Bit 2 = Receive Satellite AIS Fault Bit 3 = Rx AGC Input Level Fault Bit 4 = Reed-Solomon Sync Fault Bit 5 = Reed-Solomon Excessive Errors Fault Bit 5 = Reed-Solomon Uncorrectable Word Fault Bit 7 = Receive Forced Alarm (0 = Pass, 1 = Fail)
<1>	Latched Alarm 2	Bit 0 = Buffer Underflow Bit 1 = Buffer Overflow Bit 2 = Buffer Under 10% Bit 3 = Buffer Over 90% Bit 4 = Receive FPGA fault Bit 5 = Rx LNB Fault, LBST Only Bits 6 -7 = Spares (0 = Pass, 1 = Fail)
<1>	Latched Alarm 3	Bit 0 = IF Synthesizer Lock Detect Fault Bit 1 = Rx Oversample PLL Lock Detect Fault Bit 2 = Buffer Clock PLL Lock Detect Fault Bit 3 = Viterbi Decoder Lock Fault Bit 4 = Sequential Decoder Lock Fault Bit 5 = Rx 2047 Test Pattern Lock Fault

		Bit 5 = External Reference PLL Lock Fault Bit 7 = Frame Sync/Multiframe Sync Fault (0 = Pass, 1 = Fail)
<1>	Latched Alarm 4	Bit 0 = Buffer Clock Activity Detect Fault Bit 1 = External BNC Activity Detect Fault Bit 2 = Rx Satellite Clock Activity Detect Fault Bit 3 = External Reference PLL Activity Fault Bits 4 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Latched Comm. Alarm 1	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Latched Alarm 5	Bit 0 = IBS/IDR Satellite Multiframe Sync Loss Bit 0 = IBS/IDR Satellite Frame Sync Loss Bit 2 = Spare Bit 3 = IBS BER Alarm Bit 3 = IBS Prompt Alarm Bit 5 = IBS Service Alarm Bits 6 -7 = Spares (0 = Pass, 1 = Fail)

Opcode: <2409h> Query a Demodulator’s Current Alarms

Query response		
<1>	Alarm 1	Bit 0 = Receive Processor Fault Bit 1 = Signal Lock Fault Bit 2 = Receive Satellite AIS Fault Bit 3 = Rx AGC/Input Level Fault Bit 4 = Reed-Solomon Sync Fault Bit 5 = Reed-Solomon Excessive Errors Fault Bit 5 = Reed-Solomon Uncorrectable Word Fault Bit 7 = Receive Forced Alarm (0 = Pass, 1 = Fail)
<1>	Alarm 2	Bit 0 = Buffer Underflow Bit 1 = Buffer Overflow Bit 2 = Buffer Under 10% Bit 3 = Buffer Over 90% Bit 4 = Receive FPGA Fault Bit 5 = Rx LNB Fault, LBST Only Bits 6 - 7 Spares (0 = Pass, 1 = Fail)
<1>	Alarm 3	Bit 0 = IF Synthesizer Lock Detect Fault Bit 1 = Rx Oversample PLL Lock Detect Fault Bit 2 = Buffer Clock PLL Lock Detect Fault

		Bit 3 = Viterbi Decoder Lock Fault Bit 4 = Sequential Decoder Lock Fault Bit 5 = Rx 2047 Test Pattern Lock Fault Bit 5 = External Reference PLL Lock Fault Bit 7 = Frame Sync Fault (0 = Pass, 1 = Fail)
<1>	Alarm 4	Bit 0 = Buffer Clock Activity Detect Fault Bit 1 = External BNC Activity Detect Fault Bit 2 = Rx Satellite Clock Activity Detect Fault Bit 3 = External Reference PLL Activity Fault Bits 4 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Common Alarm 1	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Alarm 5	Bit 0 = IBS/IDR Satellite Multiframe Sync Loss Bit 0 = IBS/IDR Satellite Frame Sync Loss Bit 2 = Spare Bit 3 = IBS BER Alarm Bit 3 = IBS Prompt Alarm Bit 5 = IBS Service Alarm Bits 6 -7 = Spares (0 = Pass, 1 = Fail)

Opcode: <240Dh> Query a Demodulator's Eb/No, BER, Level, and AGC Voltage

Query response

<2>	Raw BER Mantissa	Bytes 1 - 2 = Unsigned Binary Value Raw BER
<2>	Corrected BER Mantissa	Bytes 1 - 2 = Unsigned Binary Value Corrected BER
<2>	EbNo	Unsigned Binary Value, 2 Decimal Places Implied
<1>	Raw BER Exponent	Byte 3 = Unsigned Binary Value Exponent
<1>	Corrected BER Exponent	Byte 3 = Unsigned Binary Value Exponent
<1>	BER/EbNo Status	Bit 0 = Raw BER and Corrected BER Status (1 = Valid) Bit 1 = Test 2047 BER Status (1 = Valid) Bits 2 - 3 = EbNo Status (0 = EbNo is Invalid, 1 = EbNo is Valid, 2 = EbNo is Smaller Than Indicated Value, 3 = EbNo is Greater Than Indicated Value) Bits 4 - 7 = Reserved
<1>	Input Level	Binary Value in -1 dB Steps, Negative Sign Implied
<1>	Input Level State	Signed Binary (0 = Equal to, 1 = Greater Than, -1 = Less Than Value in -1 dB Steps, Negative Sign Implied
<1>	AGC Voltage	In Hex, decimal point implied.

Opcode: <2437h> Query a Demodulator's Lock Status

<1>	Lock Status	Bit 0 = Demod Chipset Lock (0 = Unlocked, 1 = Locked) Bit 1 = Viterbi Lock (0 = Unlocked, 1 = Locked) Bit 2 = Reed-Solomon Lock (0 = Unlocked, 1 = Locked) Bit 3 = Sequential Lock (0 = Unlocked, 1 = Locked) Bits 4 – 7 = Spares (Decoders not in use default to locked state)

Opcode: <2A00h> Command a Demodulator's Configuration

<4>	Frequency	Binary Value, 1Hz Steps
<4>	Data Rate	Binary Value, 1 BPS Steps
<1>	Sweep Boundary	Sweep Limits, Max of ± 255 kHz
<4>	External Reference	Unsigned Binary Value in Hz
<1>	Freq. Reference Source	0 = Internal, 1 = External
<1>	Input Level Limit	Lower Level Limit, Binary Value, 1 dB Steps, Negative Sign Implied
<1>	Demodulation Type	0 = QPSK, 1 = BPSK, 2 = 8PSK, 4 = OQPSK
<1>	Convolutional	0 = None

	Decoder	1 = Viterbi 1/2 Rate 3 = Viterbi 3/4 Rate 5 = Viterbi 7/8 Rate 7 = Sequential 1/2 Rate 9 = Sequential 3/4 Rate 11 = Sequential 7/8 Rate 14 = Trellis 2/3
<1>	Reed-Solomon	0 = Disable, 1 = Enable
<1>	Reed-Solomon N	Unsigned Binary
<1>	Reed-Solomon K	Unsigned Binary
<1>	Reed-Solomon T	***Note: Always set to Zero; as the T value is calculated from N and K.***
<1>	RS Interleaver Depth	Unsigned Binary, 4 or 8
<1>	Differential Decoder	0 = Off, 1 = On
<1>	Descrambler Control	0 = Disable, 1 = Enable
<1>	Descrambler Type	0 = None 1 = IBS Scrm. 2 = V35_IESS 3 = V35_CCITT 4 = V35_EFDATA 7 = ReedSolomon Scrm. 8 = V35_EFRS
<1>	Spectrum	0 = Normal, 1 = Inverted
<4>	Buffer Size	Byte 1 – 2 = Buffer Size in ms Byte 3 - 4 = Buffer Size in Bytes
<1>	Buffer Clock	0 = External, 1 = Internal, 2 = EXC, 3 = RX SAT
<1>	Buffer Clock Polarity	0 = Normal, 1 = Inverted
<1>	Operating Mode	0 = Normal, 1 = 2047 Test
<1>	Alarm 1 Mask	Bit 0 = Receive Processor Fault Bit 1 = Signal Lock Fault Bit 2 = Receive Satellite AIS Fault Bit 3 = Rx AGC Level Fault Bit 4 = Reed-Solomon Sync Fault Bit 5 = Reed-Solomon Excessive Errors Fault Bit 5 = Reed-Solomon Uncorrectable Word Fault Bit 7 = Receive Forced Alarm (0 = Mask, 1 = Allow)

<1>	Alarm 2 Mask	Bit 0 = Buffer Underflow Bit 1 = Buffer Overflow Bit 2 = Buffer Under 10% Bit 3 = Buffer Over 90% Bit 4 = Receive FPGA Configuration Fault Bit 5 = Rx LNB Fault, LBST Only Bit 6 - 7 = Spares (0 = Mask, 1 = Allow)
<1>	Alarm 3 Mask	Bit 0 = IF Synthesizer Lock Detect Fault Bit 1 = Rx Oversample PLL Lock Detect Fault Bit 2 = Buffer Clock PLL Lock Detect Fault Bit 3 = Viterbi Decoder Lock Fault Bit 4 = Sequential Decoder Lock Fault Bit 5 = Rx 2047 Test Pattern Lock Fault Bit 6 = External Reference PLL Lock Fault Bit 7 = Frame Sync Fault (0 = Mask, 1 = Allow)
<1>	Alarm 4 Mask	Bit 0 = Buffer Clock Activity Detect Fault Bit 1 = External BNC Activity Detect Fault Bit 2 = Rx Satellite Clock Activity Detect Fault Bit 3 = External Reference PLL Activity Fault Bits 4 - 7 = Spares (0 = Mask, 1 = Allow)
<1>	Common Alarm 1 Mask	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V alarm Bit 3 = Temperature Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Mask, 1 = Allow)
<1>	Reserved	Set to Zero
<1>	BER Measure Period	Unsigned Binary Number of Bits in Measurement Period in Powers of Ten (ex: 6 = 10^6 Bits)
<24>	Rx Circuit ID	24 ASCII Characters
<1>	Rx Terrestrial Loopback	0 = Disabled, 1 = Enabled
<1>	Rx Baseband Loopback	0 = Disabled, 1 = Enabled
<1>	Rx IF Loopback	0 = Disabled, 1 = Enabled
<1>	Reserved	Set to Zero
<1>	Data Invert	0 = Normal, 1 = Invert
		Note: The following byte applies only if an

		Asynchronous, IDR or IBS Interface is installed. If not, set to zero.
<1>	Framing	0 = No Framing, 1 = 1/16 IBS, 2 = 1/16 Async, 3 = 96 Kbit IDR
<1>	Async Baud Rate	***Note: The following byte applies only if an asynchronous interface card is installed. If not, set to zero.*** 0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 50 6 = 110 7 = 300 8 = 600
<1>	Async Port Type	***Note: The following byte applies only if an asynchronous interface card is installed. If not, set to zero.*** 0 = RS-232, 1 = RS-485
<1>	Async Terrestrial Interface Type	***Note: The following byte applies only if an asynchronous interface card is installed. If not, set to zero.*** 0 = V.35, 1 = RS-422, 2 = RS-232
<1>	Multiprotocol Interface Card Interface Type	***Note: The following byte applies only if a synchronous multiprotocol interface card is installed. If not, set to zero.*** 0 = V.35, 1 = RS-422, 2 = RS-232
<1>	G.703 Interface Type	***Note: The following byte applies only if a symmetric G.703 interface card is installed. If not, set to zero.*** 0 = G703T1AMI 1 = G703T1B8ZS 2 = G703BE1 3 = G703UE1
<1>	BPSK Symbol Pairing	***Note: The following byte applies to all DMD2401 modems, regardless of interface type*** 0 = Normal, 1 = Swapped
<1>	Receive Mode	***Note: The following byte applies only if an IDR OR IBS interface card is installed. If not, set to zero.*** 0 = Closed Net Mode

		1 = IDR Mode 2 = IBS Mode 3 = Drop & Insert Mode
		Note: The following byte applies only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, set to zero.
<1>	T1/E1 Frame Source	0 = Internal, 1 = External
		Note: The following byte applies only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, set to zero.
<1>	Receive IDR Overhead Mode	0 = Voice, 1 = 64 K data
<1>	Receive IDR Backward Alarms Mask	Bit 0 = IDR Backward Alarm 1 Bit 1 = IDR Backward Alarm 2 Bit 2 = IDR Backward Alarm 3 Bit 3 = IDR Backward Alarm 4 Bits 4 - 7 = Spares (0 = Mask, 1 = Allow)
		Note: The following byte applies only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, set to zero.
<1>	Interface Type	**If G.703 daughter card installed:** 0 = G.703 Unbalanced E1 1 = G.703 Balanced E1 2 = G.703 T1, B8ZS **If synchronous multiprotocol daughter card is installed:** 0 = V.35, 1 = RS-422, 2 = RS-232
		Note: The following two bytes apply only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, set to zero.
<2>	Receive ESC Audio #1 Volume	-20 to +10, Signed Binary Value in dB
		Note: The following two bytes apply only if an IDR OR IBS interface card is installed and the Receive Mode is set to IDR Mode. If not, set to zero.
<2>	Receive ESC Audio #2 Volume	-20 to +10, Signed Binary Value in dB
<1>	Alarm 5 Mask	Bit 0 = IBS Satellite Multiframe Fault Bit 1 = IBS Satellite Frame Fault

		Bit 2 = Spare Bit 3 = IBS Alarm if BER < 10^{-03} Bit 4 = IBS Prompt Alarm Bit 5 = IBS Service Alarm Bits 6 - 7 = Spares
<1>	Insert Mode	(0 = Mask, 1 = Allow)
		Bit 0 = Disable Bit 1 = T1-D4 Bit 2 = T1-ESF Bit 3 = PCM-30 Bit 4 = PCM-30C Bit 5 = PCM-31 Bit 6 = PCM-31C
<30>	Insert Map	Bit 7 = T1-SLC96
<1>	Insert Alarm Mask	Mapping of Satellite Channels to Insert Terrestrial Timeslots
		0 = Frame Lock Fault 1 = MultiFrame Lock Fault 2 = CRC Lock Fault. Valid only in T1-ESF and E1 – CRC enabled 3 = T1 Yellow Alarm Received 4 = E1 FAS Alarm Received 5 = E1 MFAS Alarm Received 6 = E1 CRC Alarm Received
<1>	Insert Back Alarm Mask	7 = CRC Calculation Fault
		Bit 0 = Backward Alarm Received from Satellite
<1>	Force Terrestrial Back Alarm	Bits 2 – 7 = Spares
		Force D&I Terrestrial Backward Alarm to be Trans
<30>	Insert Edit Map	

Opcode: <2A01h> Command a Demodulator’s Frequency

<4>	Frequency	Unsigned Binary Value in Hz

Opcode: <2A02h> Command a Demodulator’s Data Rate

<4>	Data Rate	Unsigned Binary Value in BPS

Opcode: <2A04h> Command a Demodulator’s Sweep Boundary

<1>	Sweep Boundary	Set in 1 kHz Steps (Max of 255 kHz)

Opcode: <2A07h> Command a Demodulator’s Demodulation Type

<1>	Demodulation Type	0 = QPSK, 1 = BPSK, 2 = 8PSK, 4 = OQPSK

Opcode: <2A08h> Command a Demodulator’s Convolutional Decoder

<1>	Convolutional Decoder	0 = None 1 = Viterbi 1/2 Rate 3 = Viterbi 3/4 Rate 5 = Viterbi 7/8 Rate 7 = Sequential 1/2 Rate 9 = Sequential 3/4 Rate 11 = Sequential 7/8 Rate

		14 = Trellis 2/3

Opcode: <2A09h> Command a Demodulator's Differential Decoder

<1>	Differential Decoder	0 = Off, 1 = On

Opcode: <2A0Ah> Command a Demodulator's Reed-Solomon

<1>	Reed-Solomon	0 = Disable, 1 = Enable
<1>	Reed-Solomon N	Unsigned Binary
<1>	Reed-Solomon K	Unsigned Binary
<1>	Reed-Solomon T	***Note: Always set to Zero; as the T value is calculated from N and K.***
<1>	RS Interleaver Depth	Unsigned Binary, 4 or 8

Opcode: <2A0Dh> Command a Demodulator's Descrambler Control

<1>	Descrambler Control	0 = Disable, 1 = Enable

Opcode: <2A0Eh> Command a Demodulator's Descrambler Type

<1>	Descrambler Type	0 = None 1 = IBS Scrm. 2 = V35_IESS 3 = V35_CCITT 4 = V35_EFDATA 7 = Reed-Solomon Scrm. 8 = V35_EFRS

Opcode: <2A0Fh> Command a Demodulator's Spectrum

<1>	Spectrum	0 = Normal, 1 = Inverted

Opcode: <2A11h> Command a Demodulator's Buffer Clock

<1>	Buffer Clock	0 = External, 1 = Internal, 2 = EXC, 3 = RX SAT

Opcode: <2A12h> Command a Demodulator's Buffer Clock Polarity

<1>	Buffer Clock Polarity	0 = Normal, 1 = Inverted

Opcode: <2A13h> Command a Demodulator's Insert Mode

<1>	Insert Mode	0 = Disable 1 = T1-D4 2 = T1-ESF 3 = PCM-30 4 = PCM-30C 5 = PCM-31 6 = PCM-31C 7 = T1-SLC96

Opcode: <2A17h> Command a Demodulator's Operating Mode

<1>	Operating Mode	0 = Stop, 1 = 2047 Test

Opcode: <2A1Ah> Command a Demodulator's BER Exponent

<1>	BER Measure Period	Number of Bits in Measurement Period in Powers of Ten (ex: 6 = 10^6 Bits)

Opcode: <2A1Ch> Command a Demodulator's Terrestrial Loopback

<1>	Rx Terrestrial Loopback	0 = Disabled, 1 = Enabled

Opcode: <2A1Dh> Command a Demodulator's Baseband Loopback

<1>	Rx Baseband Loopback	0 = Disabled, 1 = Enabled

Opcode: <2A1Eh> Command a Demodulator's IF Loopback

<1>	Rx IF Loopback	0 = Disabled, 1 = Enabled

Opcode: <2A2E> Command a Demodulator's Async Terrestrial Interface Type

<1>	Demod Async Terr Interface Type	Async Framing (0 = No Framing, Async Off, 1 = IBS Framing, Async On, 2 = IBS Framing, Async Off)
<1>	Demod Async Terr Interface Type	Async Baud Rate (0 = 1200, 1 = 2400, 2 = 4800, 3 = 9600, 4 = 19200, 5 = 50, 6 = 110, 7 = 300, 8 = 600)
<1>	Demod Async Terr Interface Type	Async Port Type (0 = V.35, 1 = RS-422)
<1>	Demod Async Terr Interface Type	Async Terr Intf Type (0 = RS-422, 1 = V.35, 2 = RS-232)

Opcode: <2A20h> Command Center Buffer (No Parameters)

Opcode: <2A31h> Command a Demodulator's Buffer Size

<4>	Buffer Size	Byte 1 - 2 = buffer size in ms OR Byte 3 - 4 = buffer size in bytes (Either ms or bytes must be specified - the other field should be 0XfFFF)

4.4.13.3 Module Queries & Commands

Opcode: <2403h> Query a Module's Identification

Query response		
<1>	Modem ID	DMD2401 Modem = 27

Opcode: <240Eh> Query Time

Query response		
<1>	Hour	0 – 23
<1>	Minute	0 – 59
<1>	Second	0 – 59

Opcode: <240Fh> Query Date

Query response		
<1>	Year	0 – 99
<1>	Month	0 – 11
<1>	Day	0 – 30

Opcode: <2410h> Query Time and Date

Query response		
<1>	Year	0 – 99
<1>	Month	0 – 11
<1>	Day	0 – 30
<1>	Hour	0 – 23
<1>	Minute	0 – 59
<1>	Second	0 – 59

Opcode: <240Ah> Query Time and Date

Query Response		
<1>	Modulator Alarm 1 Major Alarm	Bit 0 = Transmit Processor Fault Bit 1 = Transmit Output Power Level Fault Bit 2 = Transmit Oversample PLL Lock Fault Bit 3 = Composite Clock PLL Lock Fault Bit 4 = IF Synthesizer Lock Fault Bit 5 = Transmit FPGA Configuration Alarm Fault Bit 6 = Transmit Forced Alarm Bit 7 = External Reference PLL Lock Fault (0 = Pass, 1 = Fail)
<1>	Modulator Alarm 2 Minor Alarm	Bit 0 = Terrestrial Clock Activity Detect Fault Bit 1 = Internal Clock Activity Detect Fault Bit 2 = Tx Sat Clock Activity Detect Fault Bit 3 = Tx Data Activity Detect Fault Bit 4 = Terrestrial AIS (Tx Data AIS Detect Fault) Bit 5 = Transmit Ext BNC Clock Activity Detect Fault Bit 6 = Transmit Reed-Solomon Fault Bit 7 = Tx BUC Fault, LBST Only (0 = Pass, 1 = Fail)
<1>	Modulator Common Alarm	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Demodulator Alarm 1	Bit 0 = Receive Processor Fault Bit 1 = Signal Lock Fault Bit 2 = Receive Satellite AIS Fault Bit 3 = Rx AGC/Input Level Fault Bit 4 = Reed-Solomon Sync Fault Bit 5 = Reed-Solomon Excessive Errors Fault Bit 6 = Reed-Solomon Uncorrectable Word Fault Bit 7 = External Reference PLL Lock Fault (0 = Pass, 1 = Fail)
<1>	Demodulator Alarm 2	Bit 0 = Buffer Underflow Bit 1 = Buffer Overflow Bit 2 = Buffer Under 10% Bit 3 = Buffer Over 90% Bit 4 = Receive FPGA Fault Bit 5 = Rx LNB Fault, LBST Only Bits 6 - 7 = Spares (0 = Pass, 1 = Fail)

<1>	Demodulator Alarm 3	Bit 0 = IF Synthesizer Lock Detect Fault Bit 1 = Rx Oversample PLL Lock Detect Fault Bit 2 = Buffer Clock PLL Lock Detect Fault Bit 3 = Viterbi Decoder Lock Fault Bit 4 = Sequential Decoder Lock Fault Bit 5 = Rx 2047 Test Pattern Lock Fault Bit 6 = External Reference PLL Lock Fault Bit 7 = Frame Sync Fault (0 = Pass, 1 = Fail)
<1>	Demodulator Alarm 4	Bit 0 = Buffer Clock Activity Detect Fault Bit 1 = External BNC Activity Detect Fault Bit 2 = Rx Satellite Clock Activity Detect Fault Bit 3 = External Reference PLL Activity Fault Bits 4 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Demodulator Common Alarm 1	Bit 0 = -12 V Alarm Bit 1 = +12 V Alarm Bit 2 = +5 V Alarm Bit 3 = Temperature Fault Bit 4 = Interface FPGA Fault Bit 5 = Battery Fault Bit 6 = RAM/ROM Fault Bit 7 = Spare (0 = Pass, 1 = Fail)
<1>	Demodulator Alarm 5	Bit 0 = IBS/IDR Satellite Multiframe Sync Loss Bit 1 = IBS/IDR Satellite Frame Sync Loss Bit 2 = Spare Bit 3 = IBS BER Alarm Bit 4 = IBS Prompt Alarm Bit 5 = IBS Service Alarm Bits 6 - 7 = Spares (0 = Pass, 1 = Fail)
<1>	Control Mode	0 = Front Panel, 1 = Terminal, 2 = Computer

Opcode: <2431h> Query a Module's Installed Options

Query response		
<1>	Frequency Band	Bits 0 - 3 = Tx Band Bits 4 - 7 = Rx Band (0 = 70 MHz, 1 = 140 MHz, 2 = L-band, 3 = Extended L-Band, 4 = 70 MHz High Output) (+5 to -20 dBm Tx)
<1>	Duplex	0 = No Mod, Demod Only 1 = No Demod, Mod Only 2 = Mod and Demod
<1>	Tx FEC Present	Bit 0 = Tx Viterbi Encoder Present Bit 1 = Tx Sequential Encoder Present Bit 2 = Tx RS Encoder Present Bit 3 = Tx Turbo Product Encoder Present

		Bit 4 = Tx 8PSK Encoder Present Bits 5 - 7 = Spare
<1>	Rx FEC Present	Bit 0 = Rx Viterbi Decoder Present Bit 1 = Rx Sequential Decoder Present Bit 2 = Rx RS Decoder Present Bit 3 = Rx Turbo Product Decoder Present Bit 4 = Rx 8PSK Decoder Present Bits 5 - 7 = Spare
<1>	Interface Card Type	0 = RS-422/RS-449 1 = V35/422 Async 2 = Univ. Async (This Interface is Obsolete) 3 = V.35/422/232 4 = G.703 T1/E1 S 5 = IDR V.35/422 6 = IBS V.35/422) 7= IDR G.703 8 = IBS G.703 9 - 255 = Undefined
<1>	Other Options	Bit 0 = AUPC Bit 1 = D&I Bits 2 - 7 = Spares

Opcode: <2600h> Command a Modem's Control Mode

<1>	Modem Control Mode	0 = Front Panel, 1 = Terminal, 2 = Computer

Opcode: <2616h> Command a Module's External Reference Source

<1>	External Ref. Source	0 = Internal, 1 = External

Opcode: <261Ah> Command a Module's External Clock

<4>	EXC Clock	Unsigned Binary Value in Hz

Opcode: <261Bh> Command a Module's External Reference Frequency

<4>	External Ref. Freq.	Unsigned Binary Value in Hz

Opcode: <2C00h> Command Drop and Insert Map Copy

<1>	From Map	0 = Drop Active Map 1 = Insert Active Map 2 = Drop Edit Map 3 = Insert Edit Map 4 –11 = User Map #1 through #8 12 – 19 = ROM Maps #1 through #8
<1>	To Map	0 = Drop Active Map 1 = Insert Active Map 2 = Drop Edit Map 3 = Insert Edit Map 4 –11 = User Map #1 through #8

Opcode: <2C01Bh> Command a Module's External Reference Frequency

<1>	Map to Change	0 = Drop Active Map 1 = Insert Active Map 2 = Drop Edit Map 3 = Insert Edit Map
<1>	New Map	4 –11 = User Map #1 through #8

Opcode: <2C03h> Command Clear all Latched Alarms (No Parameters)

Opcode: <2C04h> Command Set Time

<1>	Hour	0 - 23
<1>	Minute	0 – 59
<1>	Second	0 – 59

Opcode: <2C05h> Command Set Date

<1>	Year	0 – 99
<1>	Month	0 – 11
<1>	Day	0 - 30

Opcode: <2C06h> Command Set Time and Date

<1>	Year	0 – 99
<1>	Month	0 – 11
<1>	Day	0 – 30
<1>	Hour	0 – 23
<1>	Minute	0 – 59
<1>	Second	0 – 59

Opcode: <2C07h> Command soft reset the modem to the power-up state (no parameters).

Opcode: <2C30h> Command Module Set Default Configuration (No Parameters)

4.4.13.4 Default Values Modulator

Opcode: <2601h> Command a Modulator's Configuration

<4>	Frequency	70,000,000 Hz	<04> <2C> <1D> <80>
<3>	Reserved		<00> <00> <00>
<4>	Data Rate	2,048,000 BPS	<00> <1F> <40> <00>
<4>	EXC Clock	2,048,000 Hz	<00> <1F> <40> <00>
<1>	Freq. Reference Source	0 = Internal	<00>
<1>	Modulation Type	0 = QPSK	<00>
<1>	Convolutional Encoder	1 = Viterbi 1/2 Rate	<01>
<1>	Reed-Solomon	0 = Disable	<00>
<1>	Reed-Solomon N	126	<7E>
<1>	Reed-Solomon K	112	<70>
<1>	Reed-Solomon T	7	<07>

<1>	RS Interleaver Depth	4	<04>
<1>	Scrambler Control	1 = On	<01>
<1>	Scrambler Type	2 = V35_IESS	<02>
<2>	Transmit Power Level	-30.0 dBm	<FE> <D4>
<1>	Differential Encoder	1 = On	<01>
<1>	Carrier Control	0 = Off	<00>
<1>	Carrier Selection	0 = Normal	<00>
<1>	Spectrum	0 = Normal	<00>
<1>	Operating Mode	0 = Normal	<00>
<1>	Clock Control	0 = Internal	<00>
<1>	Clock Polarity	0 = Normal	<00>
<1>	SCT Source	0 = Internal	<00>
<1>	Alarm 1 Mask	No Alarms Masked	<FF>
<1>	Alarm 2 Mask	No Alarms Masked	<FF>
<1>	Common Alarm 1	No Alarms Masked	<FF>
<24>	Tx Circuit ID	24 ASCII Spaces	<20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20>
<1>	Tx Terrestrial Loopback	0 = Disabled	<00>
<1>	Tx Baseband Loopback	0 = Disabled	<00>
<1>	Reserved		<00>
<1>	Reserved		<00>
<1>	Data Invert	0 = Normal	<00>
<1>	Async Mode	0 = Async Off	<00>
<1>	Async Baud Rate	3 = 9600	<03>
<1>	Async Port Type	0 = RS-232	<00>
<1>	Async Terrestrial Interface Type	0 = RS-422	<00>
<1>	Multiprotocol Interface Type	0 = RS-422	<00>
<1>	G.703 Interface Type	0 = G703T1AMI	<00>

<1>	BPSK Symbol Pairing	0 = Normal	<00>
<1>	IDR or IBS Daughter Card Fault Mask	1 = Not Masked	<01>
<1>	Transmit Mode	0 = Closed Net	<00>
<1>	IDR Backward Alarm Mask	No Alarms Masked	<FF>
<1>	IDR Force Backward Alarm 1	Normal	<02>
<1>	IDR Force Backward Alarm 2	Normal	<02>
<1>	IDR Force Backward Alarm 3	Normal	<02>
<1>	IDR Force Backward Alarm 4	Normal	<02>
<1>	Interface Type		<02>
<2>	Transmit ESC #1 Volume	-20 dB	<FFDF>
<2>	Transmit ESC #2 Volume	-20 dB	<FFDF>

4.4.13.5 Default Values Demodulator

Opcode: <2A00h> Command a Demodulator's Configuration

<4>	Frequency	70,000,000 Hz	<04> <2C> <1D> <80>
<4>	Data Rate	2,048,000 BPS	<00> <1F> <40> <00>
<1>	Sweep Boundary	25 kHz	<19>
<4>	External Reference	30,000,000 Hz	<01> <C9> <C3> <80>
<1>	Ext Reference Source	0 = Internal	<00>
<1>	Input Level Limit	-60 dBm	<60>
<1>	Demodulation Type	0 = QPSK	<00>
<1>	Convolutional Decoder	1 = Viterbi ½Rate	<01>
<1>	Reed-Solomon	0 = Disable	<00>

<1>	Reed-Solomon N	126	<7E>
<1>	Reed-Solomon K	112	<70>
<1>	Reed-Solomon T	0	<00>
<1>	RS Interleaver Depth	4	<04>
<1>	Differential Decoder	1 = On	<01>
<1>	Descrambler Control	1 = Enable	<01>
<1>	Descrambler Type	2 = V35_IESS	<02>
<1>	Spectrum	0 = Normal	<00>
<4>	Buffer Size	32 msec 256 Bytes	<00> <01> <00> <04>
<1>	Buffer Clock	0 = External	<00>
<1>	Buffer Clock Polarity	0 = Normal	<00>
<1>	Operating Mode	0 = Normal	<00>
<1>	Alarm 1 Mask	No Alarms Masked	<FF>
<1>	Alarm 2 Mask	No Alarms Masked	<FF>
<1>	Alarm 3 Mask	No Alarms Masked	<FF>
<1>	Alarm 4 Mask	No Alarms Masked	<FF>
<1>	Common Alarm 1	No Alarms Masked	<FF>
<1>	Reserved		<00>
<1>	BER Measure Period	10^5 Bits	<05>
<24>	Rx Circuit ID	24 ASCII Spaces	<20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20> <20>
<1>	Rx Terrestrial Loopback	0 = Disabled	<00>
<1>	Rx Baseband Loopback	0 = Disabled	<00>
<1>	Rx IF Loopback	0 = Disabled	<00>
<1>	CD/Clock Control	0 = Receiver Allows Output Clock When CD False	<00>
<1>	Data Invert	0 = Normal	<00>
<1>	Async Mode	0 = Async Off	<00>

<1>	Async Baud Rate	3 = 9600	<03>
<1>	Async Port Type	0 = RS-232	<00>

<1>	Async Terrestrial Interface Type	RS-422	<00>
<1>	Multiprotocol Interface Type	0 = RS-422	<00>
<1>	G.703 Interface Type	0 = G703T1AMI	<00>
<1>	BPSK Symbol Pairing	0 = Normal	<00>
<1>	Receive Mode	0 = Closed Net	<00>
<1>	T1/E1 Frame Source	0 = Internal	<00>
<1>	Receive IDR Overhead Mode	0 = Voice	<00>
<1>	Receive IDR Backward Alarm Mask	No Alarms Masked	<FF>
<1>	Interface Type		<00>
<2>	Receive ESC #1 Volume	-20 dB	<FF><DF>
<2>	Receive ESC #2 Volume	-20 dB	<FF><DF>
<1>	Alarm 5 Mask	No Alarms Masked	<FF>

4.5 Terminal Port User Interface

The Terminal Port of the DMD2401 LB/ST allows for complete control and monitoring of all DMD2401 LB/ST parameters and functions via an RS-232 Serial Interface.

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Section 5 – Electrical Interfaces

5.0 DMD2401 LB/ST Connections

All modem connections are made to the labeled connectors located on the rear of the unit. The connector definitions and pinout tables are shown below, and are those on the modem unit. Any connection interfacing to the modem must be the appropriate mating connector.

Note: Shielded cables with the shield terminated to conductive backshells are required in order to meet EMC directives. Cables with insulation flammability ratings of 94 VO or better are required for Low Voltage Directives.

5.1 AC Power Input/Switch

The AC Power Entry Module is located at the left side of the modem (as viewed from the rear). Primary power applied to the port with the supplied power cable is 100 – 240 VAC, 50 – 60 Hz. Integrated into the power entry module is the Power On/Off Rocker Switch. Power consumption for the unit is 1A. The power cord/connector assembly is a supplied item.

A chassis ground connection (size 10-32 thread) stud, is located to the lower left of the AC Power Cord.

5.2 DC Power Input/Switch

The Optional DC Power Input and Switch (Figure 5-1) is available for all DMD2401 LB/ST products. The unit may be powered from a 36 – 72 VDC source with a maximum unit power consumption of 2A. Refer to Table 5-1 for pinouts.

Table 5-1. DC Power	
A	–
B	+
C	Ground

5.2 DMD2401 LB/ST with RS-422 Data Interface

The DMD2401 LB/ST Satellite Modem w/ RS-422 Data Interface is shown in Figure 5-1.

5.2.1 RX DC POWER (J1)

The Receive DC Power Port (J1) is the 950 – 1750 MHz Demodulator IF Input. It may be a Mini UHF (shown) or SMA Connector depending upon customer request.

5.2.2 TX DC POWER (J2)

The Transmit DC Power Port (J2) is the 950 – 1750 MHz Modulator IF Output. It may be a Mini UHF (shown) or SMA Connector depending upon customer request.

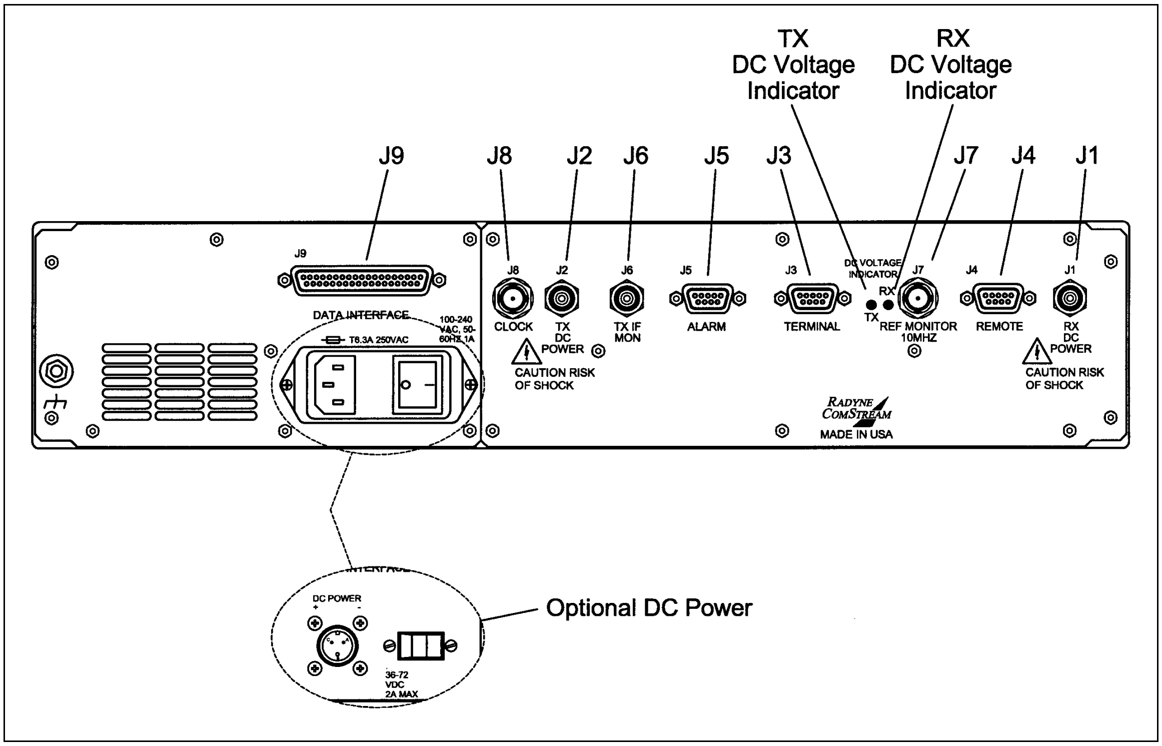

Figure 5-1. DMD2401 LB/ST Satellite Modem w/ RS-422 Data Interface

5.2.3 TERMINAL (J3)

The Terminal Port (J3) pinouts are listed below in Table 5-2.

Table 5-2. RS-232 Terminal Port – 9-Pin Female "D" Connector (J3)

Pin Number	Signal	Description	Direction
2	TxD	Transmit Data	Input
3	RxD	Receive Data	Output
5	GND	Ground	–

5.2.4 REMOTE (J4)

The Remote Port (J4) is the RS-485 connection for remote monitor and control of the modem. It is a 9-Pin Female "D" Connector. Refer to Table 5-3 below for the connector pinouts.

Table 5-3. RS-485 Remote Port – 9-Pin Female “D” Connector (J4)			
Pin Number	Signal	Description	Direction
1	RS-485 TxD-B	Transmit Data B	Output
5	GND	Ground	–
6	RS-485 TxD-A	Transmit Data A	Output
8	RS-485 RxD-B	Receive Data B	Input
9	RS-485 RxD-A	Receive Data A	Input

5.2.5 ALARM (J5)

The modem has two Form-C Dry Contact Alarm Relays onboard and an Alarm Connector located on the rear panel, the 9-pin male “D” sub connector (J5).

The two relays are designated Modulator Alarm and Demodulator Alarm. Non-Alarm is defined as the powered state of the relay. Thus, if there is a Modulator Alarm and/or Demodulator Alarm, the pins will be connected as shown in Table 5-4:

	Table 5-4. Alarm Relays	
	Alarm	No Alarm
Modulator	Pins 2 and 3 Shorted	Pins 1 and 2 Shorted
Demodulator	Pins 8 and 9 Shorted	Pin 7 and 8 Shorted

The pin definitions for J5 are shown in Table 5-5 below.

Note: The NC and NO (Normally Closed and Normally Open) nomenclature applies to non-energized relays.

Table 5-5. Alarm Connector Pin Assignment (J5)	
Pin Number	Connection
1	Mod Alarm Relay A NO on Alarm
2	Mod Alarm Relay A Common
3	Mod Alarm Relay A NC on Alarm
4	
5	AGC Voltage Output
6	GND
7	Demod Alarm Relay B NO on Alarm
8	Demod Alarm Relay B Common
9	Demod Alarm Relay B NC on Alarm

5.2.6 TX IF MON (J6)

The Transimit IF Monitor Port (J6) is used for injecting an external reference frequency into the modem. The DMD2401 LB/ST Master Oscillator is locked to this source. All internally generated frequencies within the modem will attain the stability of the applied external reference. The external reference must meet the following parameters:

Frequency:	10 MHz, 9 MHz, 5 MHz, 2.048 MHz or 1.024 MHz.
Amplitude:	0.2 Vp-p to 5 Vp-p
Type:	Sinewave or Squarewave
Stability:	1×10^{-7} or Better

5.2.7 REF MONITOR 10 MHz (J7)

The Reference Monitor Port (J7) is used for injecting an external reference frequency into the modem. The DMD2401 LB/ST Master Oscillator is locked to this source. All internally generated frequencies within the modem will attain the stability of the applied external reference. The external reference must meet the following parameters:

Frequency:	10 MHz, 9 MHz, 5 MHz, 2.048 MHz or 1.024 MHz.
Amplitude:	0.2 Vp-p to 5 Vp-p
Type:	Sinewave or Squarewave

5.2.8 CLOCK (J8)

The External Clock Port (J8) is used for injecting an external data clock into the modem. The data symbol clocks may then be selected to be locked to this source. The external clock must meet the following requirements:

Frequency:	9600 Hz to 2.048 MHz
Amplitude:	0.2 Vp-p to 5 Vp-p
Type:	Sinewave or Squarewave

5.2.9 DATA INTERFACE (J9)

The Data Interface Port (J9) is used for Synchronous Data Interface and allows the use of RS-422, RS-232, and V.35 Interfaces. It is a 37-Pin Female Connector. Refer to Table 5-6 for RS-422 connector pinouts, and Tables 5-7 and 5-8 for RS-232 and V.35 adapters.

Table 5-6. Sync Data - 37-Pin Female Connector (J9)

Pin Number	Signal	Description	Direction
4	SD-A	Send Data A (-)	Input
22	SD-B	Send Data B (+)	Input
5	ST-A	Send Timing A (-)	Output
23	ST-B	Send Timing B (+)	Output
6	RD-A	Receive Data A (-)	Output
24	RD-B	Receive Data B (+)	Output
7	RS-A	Request to Send A (-)	Input
25	RS-B	Request to Send B (+)	Input
8	RT-A	Receive Timing A (-)	Output
26	RT-B	Receive Timing B (+)	Output
9	CS-A	Clear to Send A (-)	Output
14	MF	Mod Fault - Open Collector	Output
33	DF	Demod Fault - Open Collector	Output
27	CS-B	Clear to Send B (+)	Output
11*	DM-A	Data Mode A (-)	Output
29*	DM-B	Data Mode B (+)	Output
13	RR-A	Receiver Ready A (-)	Output
31	RR-B	Receiver Ready B (+)	Output
3	BAL EXC-A	External Clock A (-)	Input
21	BAL EXC-B	External Clock B (+)	Input
16	RX-0-A	Receive Octet A (-)	Output
34	RX-0 B	Receive Octet B (+)	Output
17	TT-A	Terminal Timing A (-)	Input
35	TT-B	Terminal Timing B (+)	Input
1, 19, 20, 37	GND	Signal Ground	–

* ***Note: The DMD2401 Satellite Modem constantly asserts the DM/DSR Signal (DM and DSR are actually the same signal). The modem is always in the condition of being able to accept data. DTR Input to the modem is not necessary and is ignored. The DM/DSR Output of the modem is located on Pins 11 and 29 as shown above.***

5.2.9.1 RS-232 Adapter to J9

Table 5-7 provides the pinouts if the user wishes to fabricate an adapter from a 25-Pin, RS-232 to J9.

Table 5-7. 25-Pin RS-232 Adapter to J9

25-Pin Connector	Signal	37-Pin Connector (J9)	Signal	Description	Direction
7	GND	1	GND	Signal Ground	---
4	RTS	7	RS-A	Request to Send A (-)	Input
5	CTS	9	CS-A	Clear to Send A (-)	Output
6	DM	11	DM-A (DSR)	Data Mode A (-)	Output
8	RR	13	RR-A (RLSD)	Receive Ready A (-)	Output
2	SD	4	SD-A	Send Data A (-)	Input
3	RD	6	RD-A	Receive Data A (-)	Output
24	TT	17	TT-B	Transmit Timing A (-)	Input
17	RT	8	RT-A	Receive Timing A (-)	Output
15	ST	5	ST-A	Send Timing A (-)	Output

5.2.9.2 V.35 Adapter to J9

Table 5-8 provides the pinouts if the user wishes to fabricate an adapter from a 37-Pin, V.35 to J9.

Table 5-8. 25-Pin RS-232 Adapter to J9					
V.35 37-Pin Connector	**Signal**	**37-Pin Connector (J9)**	**Signal**	**Description**	**Direction**
B	GND	1	GND	Signal Ground	---
C	RTS	7	RS-A	Request to Send A (-)	Input
D	CTS	9	CS-A	Clear to Send A (-)	Output
E	DSR	11	DM-A (DSR)	Data Mode A (-)	Output
F	RR	13	RR-A (RLSD)	Receive Ready A (-)	Output
P	SD-A	4	SD-A	Send Data A (-)	Input
S	SD-B	22	SD-B	Send Data B (+)	Output
R	RD-A	6	RD-A	Recieve Data A (-)	Input
T	RD-B	24	RD-B	Receive Data B (+)	Output
U	TT-A	17	TT-A	Terminal Timing A (-)	Output
W	TT-B	35	TT-B	Terminal Timing B (+)	Input
V	RT-A	8	RT-A	Receive Timing A (-)	Output
X	RT-B	26	RT-B	Receive Timing B (+)	Input
Y	ST-A	5	ST-A	Send Timing A (-)	Output
AA	ST-B	23	ST-B	Send Timing B (+)	Output

5.2.10 TX DC VOLTAGE INDICATOR

The Transmit DC Voltage Indicator shows if there is DC Voltage present at J2.

5.2.11 RX DC VOLTAGE INDICATOR

The Receive DC Voltage Indicator shows if there is DC Voltage present at J1.

5.3 DMD2401 LB/ST with RS-422/V.35/RS-232/Asynchronous Data Interface

The DMD2401 LB/ST with RS-422/V.35/RS-232/Asynchronous Data Interface is shown in Figure 5-2.

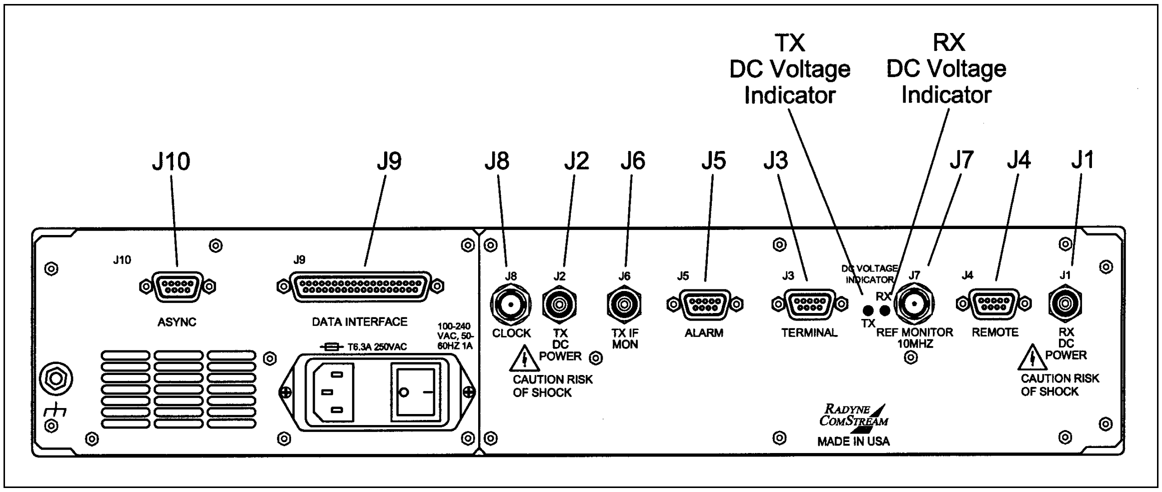

Figure 5-2. DMD2401 LB/ST with RS-422/V.35/RS-232/Asynchronous Data Interface

5.3.1 RX DC POWER (J1)

The Receive DC Power Port (J1) is the 950 – 1750 MHz Demodulator IF Input. It may be a Mini UHF (shown) or SMA Connector depending upon customer request.

5.3.2 TX DC POWER (J2)

The Transmit DC Power Port (J2) is the 950 – 1750 MHz Modulator IF Output. It may be a Mini UHF (shown) or SMA Connector depending upon customer request.

5.3.3 TERMINAL (J3)

The Terminal Port (J3) pinouts are listed in Table 5-2.

5.3.4 REMOTE (J4)

The Remote Port (J4) is the RS-485 connection for remote monitor and control of the modem. It is a 9-Pin Female “D” Connector. Refer to Table 5-3 for the connector pinouts.

5.3.5 ALARM (J5)

The modem has two Form-C Dry Contact Alarm Relays onboard and an Alarm Connector located on the rear panel, the 9-pin male “D” sub connector (J5).

The two relays are designated Modulator Alarm and Demodulator Alarm. Non-Alarm is defined as the powered state of the relay. Thus, if there is a Modulator Alarm and/or Demodulator Alarm, the pins will be connected as shown in Table 5-4:

The pin definitions for J5 are shown in Table 5-5.

Note: The NC and NO (Normally Closed and Normally Open) nomenclature applies to non-energized relays.

5.3.6 TX IF MON (J6)

The Transmit IF Monitor Port (J6) is used for injecting an external reference frequency into the modem. The DMD2401 LB/ST Master Oscillator is locked to this source. All internally generated frequencies within the modem will attain the stability of the applied external reference. The external reference must meet the following parameters:

Frequency:	10 MHz, 9 MHz, 5 MHz, 2.048 MHz or 1.024 MHz.
Amplitude:	0.2 Vp-p to 5 Vp-p
Type:	Sinewave or Squarewave
Stability:	1 x 10^{-7} or Better

5.3.7 REF MONITOR 10 MHz (J7)

The Reference Monitor Port (J7) is used for injecting an external reference frequency into the modem. The DMD2401 LB/ST Master Oscillator is locked to this source. All internally generated frequencies within the modem will attain the stability of the applied external reference. The external reference must meet the following parameters:

Frequency:	10 MHz, 9 MHz, 5 MHz, 2.048 MHz or 1.024 MHz.
Amplitude:	0.2 Vp-p to 5 Vp-p
Type: Sinewave or Squarewave	

5.3.8 CLOCK (J8)

The External Clock Port (J8) is used for injecting an external data clock into the modem. The data symbol clocks may then be selected to be locked to this source. The external clock must meet the following requirements:

Frequency:	9600 Hz to 2.048 MHz
Amplitude:	0.2 Vp-p to 5 Vp-p
Type:	Sinewave or Squarewave

5.3.9 DATA INTERFACE (J9)

The Data Interface Port (J9) is used for Synchronous Data Interface and uses RS-422, RS-232, and V.35 Interfaces. It is a 37-Pin Female Connector. Refer to Table 5-6 for the connector pinouts.

5.3.10 ASYNC (J10)

The Asynchronous Data (J10) is the data interface for asynchronous data. It uses RS-232, and RS-485 Interfaces and is a 9-Pin Female "D" Connector. Refer to Table 5-9 for the connector pinouts.

Table 5-9. Async Data Port – 9-Pin Female "D" Connector (J10)			
Pin Number	**Signal**	**Description**	**Direction**
1	TX-485-B	Transmit Data RS-485 (+)	Input
2	TXD-232	Transmit Data RS-232	Input
3	RXD-232	Receive Data RS-232	Output
5	GND	Ground	–
4	NC	NC	–
9	RX-485-A	Receive Data RS-485 (–)	Output
8	RX-485-B/CTS	Receive Data RS-485 (+)	Output
6	TX-485-A	Transmit Data RS-485 (–)	Input
7	RTS	Request to Send	Input

5.3.11 TX DC VOLTAGE INDICATOR

The Transmit DC Voltage Indicator shows if there is DC Voltage present at J2.

5.3.12 RX DC VOLTAGE INDICATOR

The Receive DC Voltage Indicator shows if there is DC Voltage present at J1.

5.4 DMD2401 LB/ST with G.703 Data Interface

The DMD2401 LB/ST Satellite Modem w/ G.703 Data Interface is shown in Figure 5-3.

5.4.1 RX DC POWER (J1)

The Receive DC Power Port (J1) is the 950 – 1750 MHz Demodulator IF Input. It may be a Mini UHF (shown) or SMA Connector depending upon customer request.

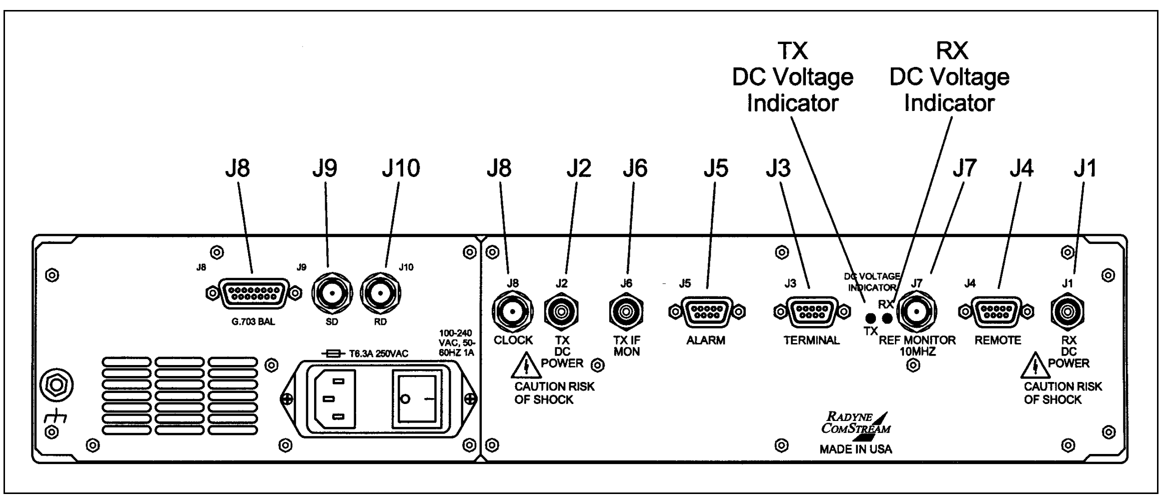

Figure 5-3. DMD2401 LB/ST with G.703 Data Interface

5.4.2 TX DC POWER (J2)

The Transmit DC Power Port (J2) is the 950 – 1750 MHz Modulator IF Output. It may be a Mini UHF (shown) or SMA Connector depending upon customer request.

5.4.3 TERMINAL (J3)

The Terminal Port (J3) pinouts are listed in Table 5-2.

5.4.4 REMOTE (J4)

The Remote Port (J4) is the RS-485 connection for remote monitor and control of the modem. It is a 9-Pin Female “D” Connector. Refer to Table 5-3 for the connector pinouts.

5.4.5 ALARM (J5)

The modem has two Form-C Dry Contact Alarm Relays onboard and an Alarm Connector located on the rear panel, the 9-pin male “D” sub connector (J5).

The two relays are designated Modulator Alarm and Demodulator Alarm. Non-Alarm is defined as the powered state of the relay. Thus, if there is a Modulator Alarm and/or Demodulator Alarm, the pins will be connected as shown in Table 5-4.

The pin definitions for J5 are shown in Table 5-5.

Note: The NC and NO (Normally Closed and Normally Open) nomenclature applies to non-energized relays.

5.4.6 TX IF MON (J6)

The Transmit IF Monitor Port (J6) is used for injecting an external reference frequency into the modem. The DMD2401 LB/ST Master Oscillator is locked to this source. All internally generated frequencies within the modem will attain the stability of the applied external reference. The external reference must meet the following parameters:

Frequency:	10 MHz, 9 MHz, 5 MHz, 2.048 MHz or 1.024 MHz.
Amplitude:	0.2 Vp-p to 5 Vp-p
Type:	Sinewave or Squarewave
Stability:	1 x 10^{-7} or Better

5.4.7 REF MONITOR 10 MHz (J7)

The Reference Monitor Port (J7) is used for injecting an external reference frequency into the modem. The DMD2401 LB/ST Master Oscillator is locked to this source. All internally generated frequencies within the modem will attain the stability of the applied external reference. The external reference must meet the following parameters:

Frequency:	10 MHz, 9 MHz, 5 MHz, 2.048 MHz or 1.024 MHz.
Amplitude:	0.2 Vp-p to 5 Vp-p
Type:	Sinewave or Squarewave

5.4.8 CLOCK (J8)

The External Clock Port (J8) is used for injecting an external data clock into the modem. The data symbol clocks may then be selected to be locked to this source. The external clock must meet the following requirements:

Frequency:	9600 Hz to 2.048 MHz
Amplitude:	0.2 Vp-p to 5 Vp-p
Type:	Sinewave or Squarewave

5.4.9 G.703 BAL (J8)

The G.703 Balanced Port (J8) are the G.703 balanced data connectors. It is a 15-Pin Female "D" Connector. Refer to Table 5-10 for connector pinouts.

Table 5-10. G.703 BAL - 15-Pin Connector (J10)

Pin Number	Signal	Description	Direction
1	SD-A	Send Data A (-)	Input
2	GND	Ground	–
9	SD-B	Send Data B (+)	Input
7	BAL EXC-A	External Clock A (-)	Input
8	BAL EXC-B	External Clock B (+)	Input
3	RD-A	Receive Data A (-)	Output
4	GND	Ground	–
11	RD-B	Receive Data B (+)	Output
12	DDO-A	Drop Data Out A (-)	Output
5	DDO-B	Drop Data Out B (+)	Output
13	IDI-A	Insert Data In A (-)	Input
6	IDI-B	Insert Data In B (+)	Input
14	MOD FLT	Mod Fault – Open Collector	Output
15	DMD FLT	Demod Fault – Open Collector	Output

5.4.10 SD (J9)

The Send Data Port (J9) is the unbalanced Send Data BNC Connector.

5.4.11 RD (J10)

The Receive Data Port (J10) is the unbalanced Receive Data BNC Connector.

5.4.12 TX DC VOLTAGE INDICATOR

The Transmit DC Voltage Indicator shows if there is DC Voltage present at J2.

5.4.13 RX DC VOLTAGE INDICATOR

The Receive DC Voltage Indicator shows if there is DC Voltage present at J1.

5.5 DMD2401 LB/ST with G.703 Data Interface with Drop and Insert

The DMD2401 LB/ST Satellite Modem w/ G.703 Data Interface with Drop and Insert is shown in Figure 5-4.

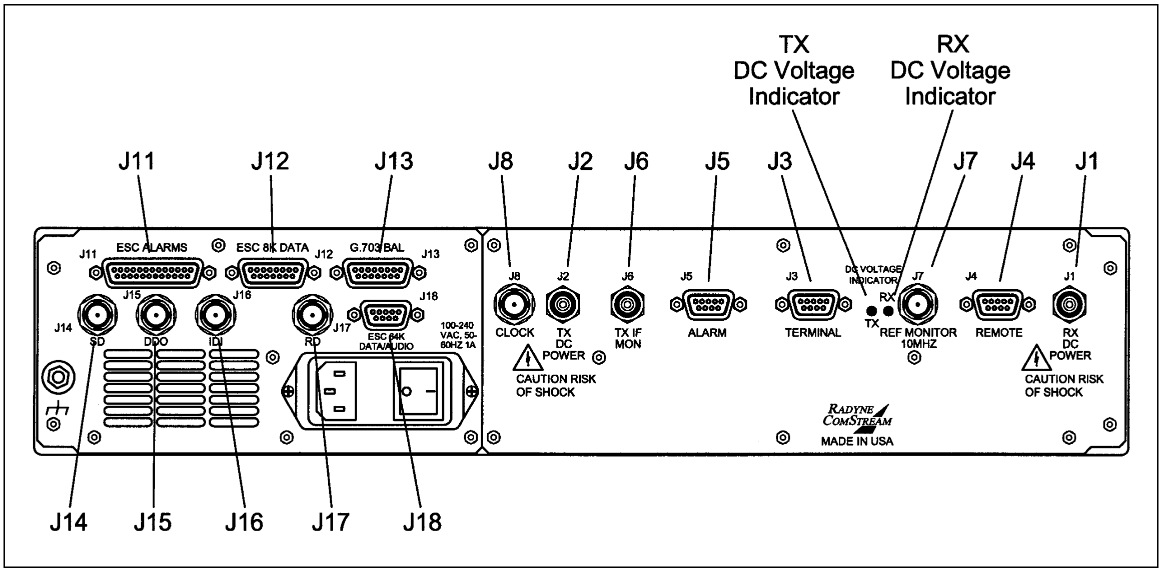

Figure 5-4. DMD2401 LB/ST with G.703 Data Interface with Drop and Insert

5.5.1 RX DC POWER (J1)

The Receive DC Power Port (J1) is the 950 – 1750 MHz Demodulator IF Input. It may be a Mini UHF (shown) or SMA Connector depending upon customer request.

5.4.2 TX DC POWER (J2)

The Transmit DC Power Port (J2) is the 950 – 1750 MHz Modulator IF Output. It may be a Mini UHF (shown) or SMA Connector depending upon customer request.

5.4.3 TERMINAL (J3)

The Terminal Port (J3) pinouts are listed in Table 5-2.

5.4.4 REMOTE (J4)

The Remote Port (J4) is the RS-485 connection for remote monitor and control of the modem. It is a 9-Pin Female “D” Connector. Refer to Table 5-3 for the connector pinouts.

5.4.5 ALARM (J5)

The modem has two Form-C Dry Contact Alarm Relays onboard and an Alarm Connector located on the rear panel, the 9-pin male “D” sub connector (J5).

The two relays are designated Modulator Alarm and Demodulator Alarm. Non-Alarm is defined as the powered state of the relay. Thus, if there is a Modulator Alarm and/or Demodulator Alarm, the pins will be connected as shown in Table 5-4.

The pin definitions for J5 are shown in Table 5-5.

Note: The NC and NO (Normally Closed and Normally Open) nomenclature applies to non-energized relays.

5.4.6 TX IF MON (J6)

The Transmit IF Monitor Port (J6) is used for injecting an external reference frequency into the modem. The DMD2401 LB/ST Master Oscillator is locked to this source. All internally generated frequencies within the modem will attain the stability of the applied external reference. The external reference must meet the following parameters:

Frequency:	10 MHz, 9 MHz, 5 MHz, 2.048 MHz or 1.024 MHz.
Amplitude:	0.2 Vp-p to 5 Vp-p
Type:	Sinewave or Squarewave
Stability:	1 x 10^{-7} or Better

5.4.7 REF MONITOR 10 MHz (J7)

The Reference Monitor Port (J7) is used for injecting an external reference frequency into the modem. The DMD2401 LB/ST Master Oscillator is locked to this source. All internally generated frequencies within the modem will attain the stability of the applied external reference. The external reference must meet the following parameters:

Frequency:	10 MHz, 9 MHz, 5 MHz, 2.048 MHz or 1.024 MHz.
Amplitude:	0.2 Vp-p to 5 Vp-p
Type: Sinewave or Squarewave	

5.4.8 CLOCK (J8)

The External Clock Port (J8) is used for injecting an external data clock into the modem. The data symbol clocks may then be selected to be locked to this source. The external clock must meet the following requirements:

Frequency:	9600 Hz to 2.048 MHz
Amplitude:	0.2 Vp-p to 5 Vp-p
Type:	Sinewave or Squarewave

5.4.9 ESC ALARMS (J11)

The ESC Alarm Interface Port (J11) is the ESC Alarm Connector. It is a 25-Pin Female “D” Connector. Refer to Table 5-11 for connector pinouts.

Table 5-11. ESC Alarm Interface - 25-Pin Female “D” (J11)			
Pin Number	**Signal**	**Description**	**Direction**
1	GND	Ground	–
2	ESCBWO 1NO	Backward Alarm Out-1NO	Output
3	NC	No Connection	–
4	ESCBWO 2NO	Backward Alarm Out-2 NO	Output
5	NC	No Connection	–
6	ESCBWO 3NO	Backward Alarm Out-3 NO	Output
7	GND	Ground–	–
8	ESCBWO 4NO	Backward Alarm Out-4 NO	Output
9	NC	No Connection	–
10	ESCBWI 2	Backward Alarm In 2	Input
11	ESCBWI 4	Backward Alarm In 4	Input
12	NC	No Connection	–
13	NC	No Connection	–
14	ESCBWO 1C	Backward Alarm Out-1 C	Output
15	ESCBWO 1NC	Backward Alarm Out-1 NC	Output
16	ESCBWO 2C	Backward Alarm Out- 2 C	Output
17	ESCBWO 2NC	Backward Alarm Out- 2 NC	Output
18	ESCBWO 3C	Backward Alarm Out- 3 C	Output
19	ESCBWO 3NC	Backward Alarm Out- 3 NC	Output
20	ESCBWO 4C	Backward Alarm Out- 4 C	Output
21	ESCBWO 4NC	Backward Alarm Out- 4 NC	Output
22	ESCBWI 1	Backward Alarm In- 1	Input
23	ESCBWI 3	Backward Alarm In- 3	Input
24	NC	No Connection	–
25	NC	No Connection	–

5.4.10 ESC 8K DATA (J12)

The ESC 8K Data Port (J12) is the ESC 8K Data Connector. It is a 15-Pin Female “D” Connector. Refer to Table 5-12 for connector pinouts.

Table 5-12. ESC 8K Data Interface - 15-Pin Female “D” Connector (J12)			
Pin Number	**Signal**	**Description**	**Direction**
1	ESCRXO-B	Rx Octet-B	Output
2	ESCRXC-B	Rx Clock-B	Output
3	ESCRXD-B	Rx Data-B	Output
4	NC	No Connection	–
5	NC	No Connection	–
6	ESCTXD-A	Tx Data-A	Input
7	ESCTXC-A	Tx Clock-A	Output
8	ESCTXO-A	Tx Octet-A	Output
9	ESCRXO-A	Rx Octet-A	Output
10	ESCRXC-A	Rx Clock-A	Output
11	ESCRXD-A	Rx Data-A	Output
12	GND	Ground	–
13	ESCTXD-B	Tx Data-B	Input
14	ESCTXC-B	Tx Clock-B	Output
15	ESCTXO-B	Tx Octet-B	Output

5.4.11 G.703 BAL (J13)

The G.703 Balanced Port (J13) are the G.703 balanced data connectors. It is a 15-Pin Female “D” Connector. Refer to Table 5-8 for connector pinouts.

5.4.12 SD (J14)

The Send Data Port (J14) is the unbalanced Send Data BNC Connector.

5.4.13 DDO (J15)

The Data Drop Out Port (J15) is the unbalanced Data Drop Out BNC Connector.

5.4.14 IDI (J16)

The Insert Data In Port (J16) is the unbalanced Insert Data In BNC Connector.

5.4.15 RD (J17)

The Receive Data Port (J17) is the unbalanced Receive Data BNC Connector.

5.4.16 ESC 64K DATA/AUDIO (J18)

J18 serves different purposes depending upon configuration

IDR Mode – 64 K Data or Voice depending upon Front Panel selection.
IBS or D&I Mode – Async Port

It is a 9-Pin Female "D" Connector. Refer to Tables 5-13 through 5-15 for connector pinouts.

Table 5-13. ESC AUDIO - 9-Pin Female "D" Connector (J18)

Pin Number	Signal	Description	Direction
1	ESCAUDTX 1A	Tx Audio 1A	Input
2	ESCAUDRX 1A	Rx Audio 1A	Output
3	GND	Ground	–
4	ESCAUDTX 2B	Tx Audio 2B	Input
5	ESCAUDRX 2B	Rx Audio 2B	Output
6	ESCAUDTX 1B	Tx Audio 1B	Input
7	ESCAUDRX 1B	Rx Audio 1B	Output
8	ESCAUDTX 2A	Tx Audio 2A	Input
9	ESCAUDRX 2A	Rx Audio 2A	Output

Table 5-14. ESC 64 K DATA - 9-Pin Female "D" Connector (J18)

Pin Number	Signal	Description	Direction
1	ESCAUDTX 1A	Tx Data 64K A	Input
2	ESCAUDRX 1A	Rx Data 64K A	Output
3	GND	Ground	Ground
4	ESCAUDTX 2B	Tx Clock 64K B	Output
5	ESCAUDRX 2B	Rx Clock 64K B	Output
6	ESCAUDTX 1B	Tx Data 64K B	Input
7	ESCAUDRX 1B	Rx Data 64K B	Output
8	ESCAUDTX 2A	Tx Clock 64K A	Output
9	ESCAUDRX 2A	Rx Clock 64K A	Output

Table 5-15. Asynchronous Interface - 9-Pin Female "D" Connector (J18)			
Pin Number	**Signal**	**Description**	**Direction**
1	TX-485-B	Transmit Data RS485 (+)	Input
2	TXD-232	Transmit Data RS232	Input
3	RXD-232	Receive Data RS232	Output
5	GND	Ground	–
4	NC	Not Connected	–
9	RX-485-A	Receive Data 485 (-)	Output
8	RX-485-B/CTS	Receive Data 485 (+)	Output
6	TX-485-A	Transmit Data 485 (-)	Input
7	RTS	Request to Send	Input

5.4.17 TX DC VOLTAGE INDICATOR

The Transmit DC Voltage Indicator shows if there is DC Voltage present at J2.

5.4.18 RX DC VOLTAGE INDICATOR

The Receive DC Voltage Indicator shows if there is DC Voltage present at J1.

5.5 Async Port Configuration Switches

The switch settings listed below in Tables 5-16 through 5-19 are used to configure the Async Port for the following applications. The DIP Switches are located on the inside of the unit on the Async Card with the exception of the AS/3771 Daughter Card (discussed below). The user must remove the top cover of the unit to access these switches.

Table 5-16. Async Port DIP Switch Settings – RS-485 Only	
1	OFF
2	OFF
3	OFF
4	OFF
5	OFF
6	ON

Table 5-17. Async Port DIP Switch Settings – RS-232 or RS-485	
1	ON
2	ON
3	OFF
4	OFF
5	OFF
6	ON

Table 5-18. Async Port DIP Switch Settings – RS-232 Only with CTS & RTS	
1	ON
2	ON
3	OFF
4	OFF
5	ON
6	OFF

Table 5-19. Async Port DIP Switch Settings – RS-232 Null or RS-485	
1	OFF
2	OFF
3	ON
4	ON
5	OFF
6	ON

Table 5-20. Async Port DIP Switch Settings – RS-232 Null Only with CTS & RTS	
1	OFF
2	OFF
3	ON
4	ON
5	ON
6	OFF

5.6 AS/3771 Daughter Card

Table 5-21 is used to configure AS/3771 Daughter Card. This card comes without switches. To configure it, find the resistor location that corresponds to the equivalent switch on the other interfaces and install the appropriate resistor. To place a switch in the OFF position corresponds to a *TBD* Ù resistor. To place a switch in the ON position corresponds to a 0Ù resistor. For example: to place Switch 3 in the ON position, install a 0Ù resistor for location R71.

Table 5-21. AS/3771 Daughter Card

Resistor Location	Corresponds to Switch #
R69	1
R70	2
R71	3
R72	4
R73	5
R87	6
OFF = TBD ON = 0Ù Resistor	

Section 6 – Maintenance

6.0 Periodic Maintenance

The DMD2401 LB/ST Modulator requires no periodic field maintenance procedures. The unit contains very few adjustments and most calibration is held in EEPROM. Should a unit be suspected of a defect in field operations after all interface signals are verified, the correct procedure is to replace the unit with another known working DMD2401 LB/ST. If this does not cure the problem, wiring or power should be suspect.

There is no external fuse on the DMD2401 LB/ST. The fuse is located on the power supply assembly inside the case, and replacement is not intended in the field.

6.1 Troubleshooting

The following is a brief list of possible problems that could be caused by failures of the modem or by improper setup and configuration for the type of service. The list is arranged by possible symptoms exhibited by the modem.

Symptom: The Modem will not acquire the incoming carrier:
Possible Cause: Improper receive input to modem.

Action: Check that the receive cabling is correct.
Possible Cause: Receive carrier level too low.

***Action*:** Check that the receive cabling is correct, that the downconverter is properly set and that the LNA is turned on. If a spectrum analyzer is available, locate and measure the receive level, which should not be below -65 dBm absolute, -50 dBm is nominal.
Possible Cause: Receive carrier frequency outside of acquisition range.

***Action*:** Check that the receive acquisition range is adequate for the possible system offsets. Setting the value to 30 kHz is a standard value encompassing all normal offsets. After acquisition, the actual receive frequency can be read from the Front Panel.
Possible Cause: Transmit carrier incompatible.

Action: Check the receive parameter settings and ensure that they match those on the modulator.
Possible Cause: Modem is in test mode.

Action: Check the modem Front Panel for yellow warning LEDs indicating a test mode is enabled. Self-Test or IF Loopback disconnects the Demodulator from the IF receive input connector.

Symptom: The Async Port is not configured correctly.

Action: Refer to Section 5.14 to correctly set switches for correct configuration.

6.2 DMD2401 LB/ST Fault Philosophy

The DMD2401 LB/ST performs a high degree of self-monitoring and fault isolation. The alarms are separated into three categories; Active Alarms, Common Equipment Alarms, and Latched Alarms. In addition, a feature exists that allows the user to ‘Mask’ out certain Alarms as explained below. Alarms that are recorded in the event buffer are the same as the alarm buffer.

6.2.1 Alarm Masks

The user has the capability to 'Mask' individual alarms on the DMD2401 LB/ST. When an Alarm is masked, the Front Panel LEDs and the Fault Relays do not get asserted, but the Alarm will still be displayed. This feature is very helpful during debugging or to lock out a failure that the user is already aware of.

6.2.2 Active Alarms

6.2.2.1 Major Alarms

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

6.2.2.2 Minor Alarms

Minor alarms indicate that a problem may persist outside the modem such as loss of terrestrial clock, loss of terrestrial data activity, or a detected transmit or receive AIS condition.
Alarms are grouped into Transmit Alarms and Receive Alarms - Transmit and Receive are completely independent.

6.2.2.3 Latched Alarms

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

6.3 DMD2401 LB/ST Fault Tree Matrices

Tables 6-1 through 6-3 represent, in matrix form, the faults that may occur within the DMD2401 LB/ST. There are three matrices: Interface/Common Equipment Faults, Tx Faults and Rx Faults.

INTERFACE/COMMON EQUIPMENT FAULTS	TX IF OUTPUT OFF	TX MAJOR ALARM LED	TX AIS	RX FAULT LED	RX MINOR ALARM LED	RX MAJOR ALARM LED	RX AIS	MOD FAULT RELAY	DEMOD FAULT RELAY	COM EQUIP FAULT RELAY	SW COM EQUIP FAULT RELAY	MINOR ALARM RELAY	IBS BACKWARD ALARM	SWITCH BACK TO INTERNAL	SIGNAL LOCK LED	TX BACKWARD ALARM	TX ON LED	FAULT LED	BOTH MOD AND DEMOD FAULT OPEN COLLECTOR	SW BUFF CLK TO BACKUP	SW TX CLK TO BACKUP
+5V OUT OF RANGE																		■			
+12V OUT OF RANGE																		■			
-12V OUT OF RANGE																		■			
TEMP. OUT OF RANGE																		■			
NO EXT IF REF ACTIVITY					■																

Table 6-1. DMD2401 LB/ST Interface/Common Equipment Fault Matrix

RX FAULTS	RX MINOR ALARM LED	RX MAJOR ALARM LED	RX AIS	MOD FAULT RELAY	DEMOD FAULT RELAY	COM EQUIP FAULT RELAY	SW COM EQUIP FAULT RELAY	IBS BACKWARD ALARM	RESERVED	RESERVED	SIGNAL LOCK LED OFF	DEMOD FAULT OPEN COLLECTOR	
SIGNAL LOSS		■			■			■			■	■	
RX IF SYNTH UNLOCKED		■	■		■			■			■	■	
RX DATA AIS RCVD.	■		■					■					
RX SIG LEVEL LOW		■			■			■			■	■	
VITERBI UNLOCKED		■	■		■			■			■		
SEQ UNLOCKED		■	■		■			■			■	■	Conditional When Sequential is Used
BER THRESHOLD REACHED	■							■					
BUFFER OVERFLOWS	■												
BUFFER UNDERFLOWS	■												
BUFFER PLL UNLOCKS		■			■								

Table 6-2. DMD2401 LB/ST RX Fault Matrix

TX FAULTS	TX IF OUTPUT OFF	TX MINOR ALARM LED	TX MAJOR ALARM LED	TX AIS	MOD FAULT RELAY	DEMOD FAULT RELAY	MOD FAULT OPEN COLLECTOR	OVERRIDE TO INTERNAL REF
TX IF SYNTH UNLOCKED	■		■		■			
TX CLOCK ACT		■		■				
TX COMP CLK PLL UNLOCKED	■		■	■	■			
TX OUTPUT LEVEL	■		■		■			
NO TX DATA ACTIVITY		■		■				
TX AIS RCVD		■		■				
TX OVERSMPL PLL UNLOCKED	■			■	■			
TX FIR COEFF ERROR	■		■	■	■			
TX FPGA CONFIG ERROR	■		■					
TX LOSS OF EXTERNAL REF		■		■				■
LOSS EXT REF								■

Note: When EXT EXC is used as a reference for the Mod Clock, and activity on the EXT EXC is lost, the modem switches Tx clock reference to SCTE if it exists, otherwise it switches to SCT.

Table 6-3. DMD2401 LB/ST TX Fault Matrix

6.3.1 Interpreting the Matrices

The first vertical column in the Tables represents the various Faults that the modem may identify. The top horizontal column indicates the various actions that the modem will undertake. These actions may be in the form of a relay, a switch or an LED.

6.3.2 IBS Fault Conditions and Actions

Figure 6-7 and Table 6-4 illustrate the IBS Fault Conditions and Actions to be taken at the Earth Station, at the Terrestrial Data Stream, and the Satellite. These faults include those detected on the Terrestrial link and those detected from the satellite.

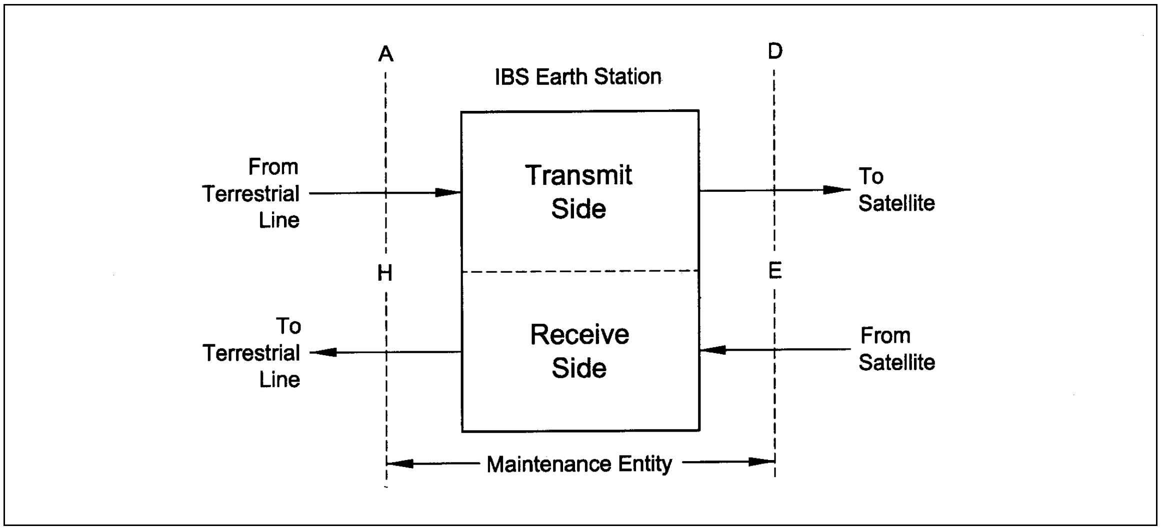

Figure 6-7. IBS Alarm Concept

Table 6-4. IBS Fault Conditions and Actions (includes Drop and Insert)			
Fault Detected on Terrestrial Link (Across Interface A)	**Action In Earth Station**	**Action to Terrestrial (Across Interface H)**	**Action to Satellite (Across Interface D)**
FA1 - Loss of Terrestrial Input	AS1, 2 - IBS Prompt, Service Alarm	AH2 - ‘1’ in Bit 3 of NFAS TSO, Yellow Alarm	AD1 - AIS in Relevant TS’s
FA2 - Loss of Terrestrial Signaling	AS1 - - IBS Prompt Alarm	AH2 - ‘1’ in Bit 3 of NFAS TSO, Yellow Alarm	AD3 - ‘1111’ in RelevantTS16’s
FA3 - Loss of Terrestrial Frame	AS1 - - IBS Prompt Alarm	AH2 - ‘1’ in Bit 3 of NFAS TSO, Yellow Alarm	AD1 - AIS in Relevant TS’s
FA4 - Loss of Terrestrial Multiframe	AS1 - IBS Prompt Alarm	AH2 - ‘1’ in Bit 3 of NFAS TSO, Yellow Alarm	AD3 - ‘1111’ in Relevant TS16’s
FA5 - BER of $1x\ 10^{-3}$	AS1 - IBS Prompt	AH2 - ‘1’ in Bit 3 of	AD1 - AIS in

or Greater on Terrestrial Input	Alarm	NFAS TSO, Yellow Alarm	Relevant TS's
FA6 - Alarm Indication Received on Terrestrial Input	---	---	AD2 - '1' in Bit 3 of Byte 32
Fault Detected From Satellite (Across Interface E)			
FA1 - Loss of Satellite Signal Input	AS1,2 - IBS Prompt, Service Alarm	AH1, 3 - AIS in TS's, '1111' in TS16	AD2 - '1' in Bit 3 of Byte 32
FA2 - Loss of Satellite Frame	AS1,2 - IBS Prompt, Service Alarm	AH1, 3 - AIS in TS's, '1111' in TS16	AD2 - '1' in Bit 3 of Byte 32
FA3 - Loss of Satellite Multiframe	AS1,2 - IBS Prompt, Service Alarm	AH1, 3 - AIS in TS's, '1111' in TS16	AD2 - '1' in Bit 3 of Byte 32
FA4 - BER of 1E-3 or Greater From Satellite Input	AS1,2 - IBS Prompt, Service Alarm	AH1, 3 - AIS in TS's, '1111' in TS16	AD2 - '1' in Bit 3 of Byte 32
FA5 - Alarm Indication Received From Satellite Input	AS2 - IBS Service Alarm	AH2 - '1' in Bit 3 of NFAS TS0, Yellow Alarm	---

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Section 7 – Technical Specifications

7.0 Introduction

This section defines the technical performance parameters and specifications for the DMD2401 LB/ST Satellite Modem.

7.1 Transmit and Receive Data Rates

BPSK, 1/2 Rate:	4800 bps – 1250 Kbps
BPSK, 3/4 Rate:	7200 bps – 1875 Kbps
BPSK, 7/8 Rate:	8400 bps – 2187.5 Kbps
QPSK, 1/2 Rate:	9600 bps – 2500 Kbps
QPSK, 3/4 Rate:	14400 bps – 3750 Kbps
QPSK, 7/8 Rate:	16800 bps – 4375 Kbps
OQPSK, 1/2 Rate:	9600 bps – 2500 Kbps
OQPSK, 3/4 Rate:	14400 bps – 3750 Kbps
OQPSK, 7/8 Rate:	16800 bps – 4375 Kbps
(Optional) 8PSK, 2/3 Rate	
Data Rate Setting:	Selectable in 1 bps steps

7.2 Modulator Specifications

Frequency:	950 – 1750 MHz
Reference Frequency Signal:	10 MHz
Reference Stability:	$1x10^{-7}$
(Optional)	$1x10^{-8}$, $1x10^{-9}$
Frequency Resolution:	100 Hz
Output Level:	-5 to 30 dBm, 0.1 dB steps
Phase Noise:	
100 Hz	-60 dBc
1 kHz	-70 dBc
10 kHz	-75 dBc
100 kHz	-85 dBc
Spurious and Harmonics:	-50 dBc
Impedance:	50Ù
Return Loss:	14 dB
Output Voltage:	24 V
Output Current:	5 A
10 MHz Reference levels:	-10 dBm, ± 5 dB
Connector:	SMA

7.3 Demodulator/Receive Specifications

Frequency:	950 – 1750 MHz
Frequency Resolution:	100 Hz
Carrier Acquisition:	± 30 kHz
Input Carrier Range:	-65 to -40 dBm (Symbol Rate < 64 kHz) -50 to -30 dBm (Symbol Rate > 640 kHz)
Aggregate Power:	Minimum of -10 dBm or 35 dBc
Impedance:	50Ù
Return Loss:	8 dB Minimum
Output Voltage:	24 V
Output Current:	5 A
10 MHz Reference Levels:	-10 dBm, ± 5 dB
Connector:	Type-F

Typical Eb/No (Viterbi)	**Rate 1/2**	**Rate 3/4**	**Rate 7/8**
@ BER=10^{-5}	5.1	6.2	7.5
@ BER=10^{-7}	6.2	7.7	8.6

Typical Eb/No (Trellis 8PSK)	**Rate 2/3**
@ BER=10^{-5}	7.2
@ BER=10^{-7}	8.9

Typical Eb/No, @ 64 Kbps Sequential	**Rate 1/2**	**Rate 3/4**	**Rate 7/8**
@ BER=10^{-5}	4.0	5.0	6.1
@ BER=10^{-7}	4.9	5.9	7.4

Note: Eb/No typical values include effect of using differential encoding and V.35 scrambler.

Descrambler:	Intelsat V.35, mode selectable
Data Buffering:	8 bits to 262,144 bits, in 8-bit steps
Terrestrial Interfaces:	RS-449/-422, RS-232, V.35, V.E1, B.E1, B.T1.B825, B.T1.AMI

7.4 Alarms

Summary Alarms:	Two separate Form-C Contacts available at the rear panel. Each provides a summary alarm of fault conditions.

7.5 Front Panel LED Indicators

Unit:	Power Alarm Event Remote
Demodulator:	Signal Lock Major Alarm Minor Alarm Test Mode
Modulator:	Transmit On Major Alarm Minor Alarm Test Mode

7.6 Monitor and Control

All operating parameters can be monitored and controlled via the Front Panel display/keypad, or the RS-485 or RS-232 Serial Control Channel in either Terminal or Command Modes. The following Modem Parameters may be controlled and/or monitored:

Modem Mode (Closed Net, IDR, IBS, D&I)
Transmit and Receive Frequencies
Transmit and Receive Offsets
Modulator Power Level
Modulator On/Off
Modulator/Demodulator Modulation (BPSK, QPSK, OQPSK, or 8PSK)
Modulator/Demodulator Data Rates (1 Bps steps)
Modulator/Demodulator Code Rates (1/2, 3/4, 7/8, 2/3)
Modulator/Demodulator Differential Decoders (On/Off)
Modulator/Demodulator Scrambler (On/Off)
Modulator/Demodulator Data (inverted or non-inverted)
Modulator/Demodulator Clock Source and Phase
Demodulator FIFO Size, Delay and Status
Demodulator Eb/No
Demodulator Low Eb/No
Demodulator Measure BER and Estimated BER
Modulator/Demodulator Alarms
Modem Remote Port Address, Data Rate, Enable/Disable Modem Test Modes
Mod/Demod Framing (None, 96K, 1/15 (IBS), 1/15 (Async))

7.7 Options

Concatenated Codec:	A Reed-Solomon codec is available.
Asynchronous Channel:	Asynchronous overhead channel for remote control and order-wire applications.

7.8 Environmental

Input Power:	100 - 240 VAC, 50 - 60 Hz, 6.0 A (IEC 3-pin Power Connector with Switch)
Outdoor Unit Power:	6 A maximum combined is available from Rx and Tx outputs.
Operating Temperature:	0 – 50°C, 95% humidity, non-condensing
Storage Temperature:	-20 to 70°C, 99% humidity, non-condensing

7.9 Physical

Chassis size:	19 x 17 x 3.5 inches (48.26 x 43.2 x 4.45 cm)
Weight:	16 pounds (7.2 Kg)
Shipping Weight:	20 pounds (9.0 Kg)

7.10 Bit Error Rate (BER) Curves

Figures 7-1 through 7-5 represent the BER curves for the DMD2401 LB/ST.

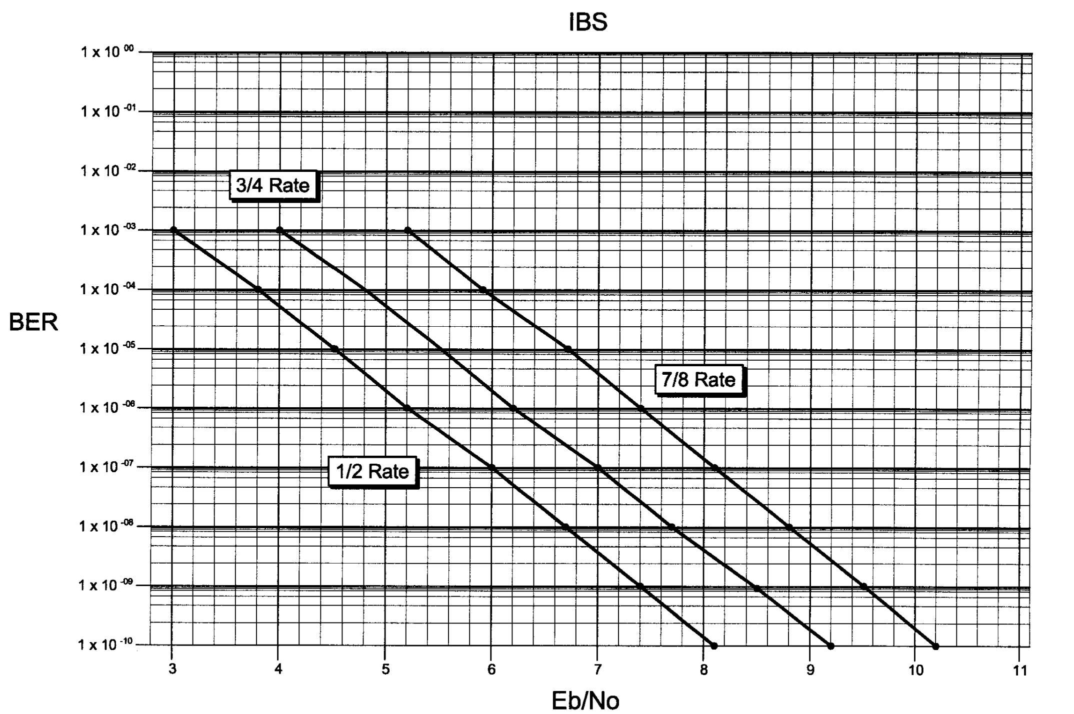

Figure 7-1. IBS BER Curve

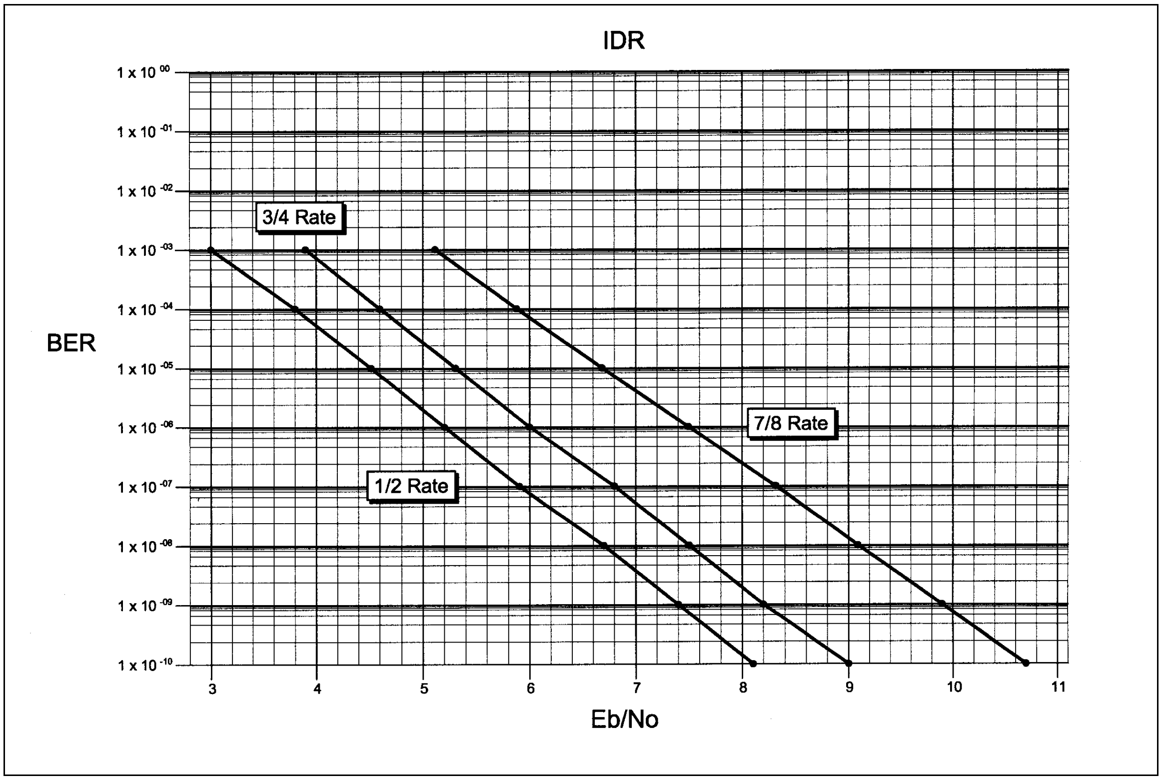

Figure 7-2. IDR BER Curve

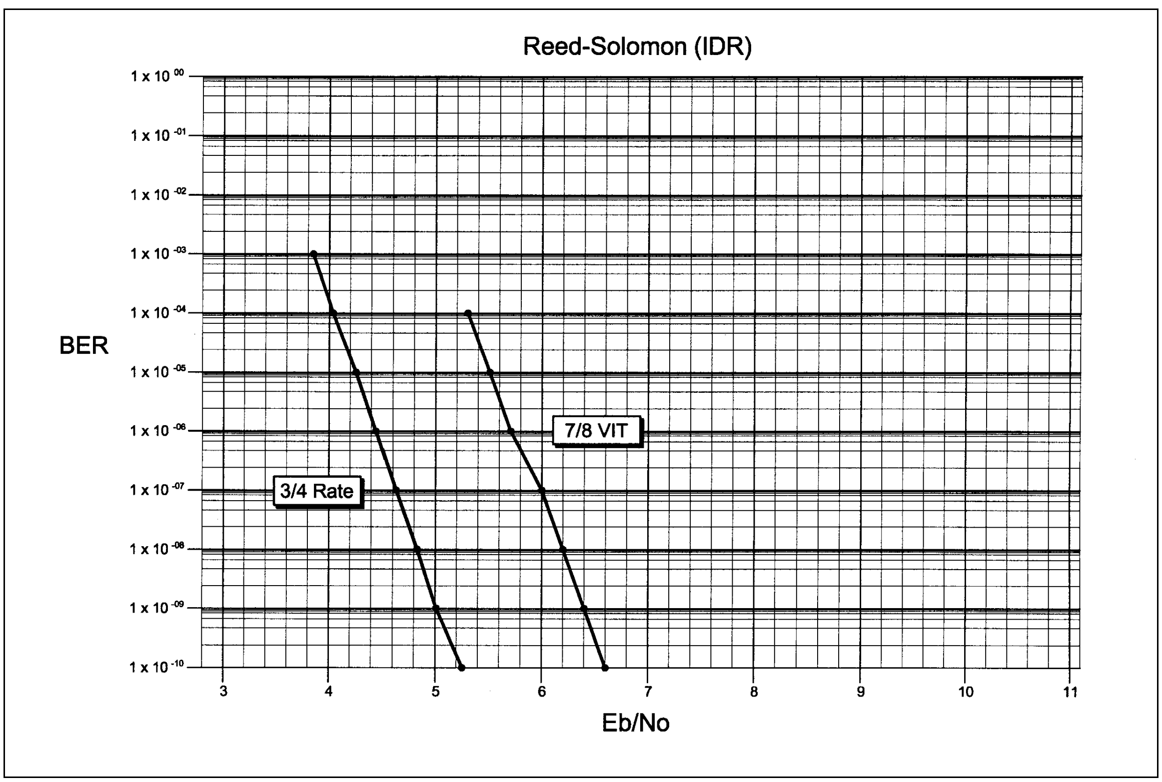

Figure 7-3. Reed-Solomon (IDR) BER Curve

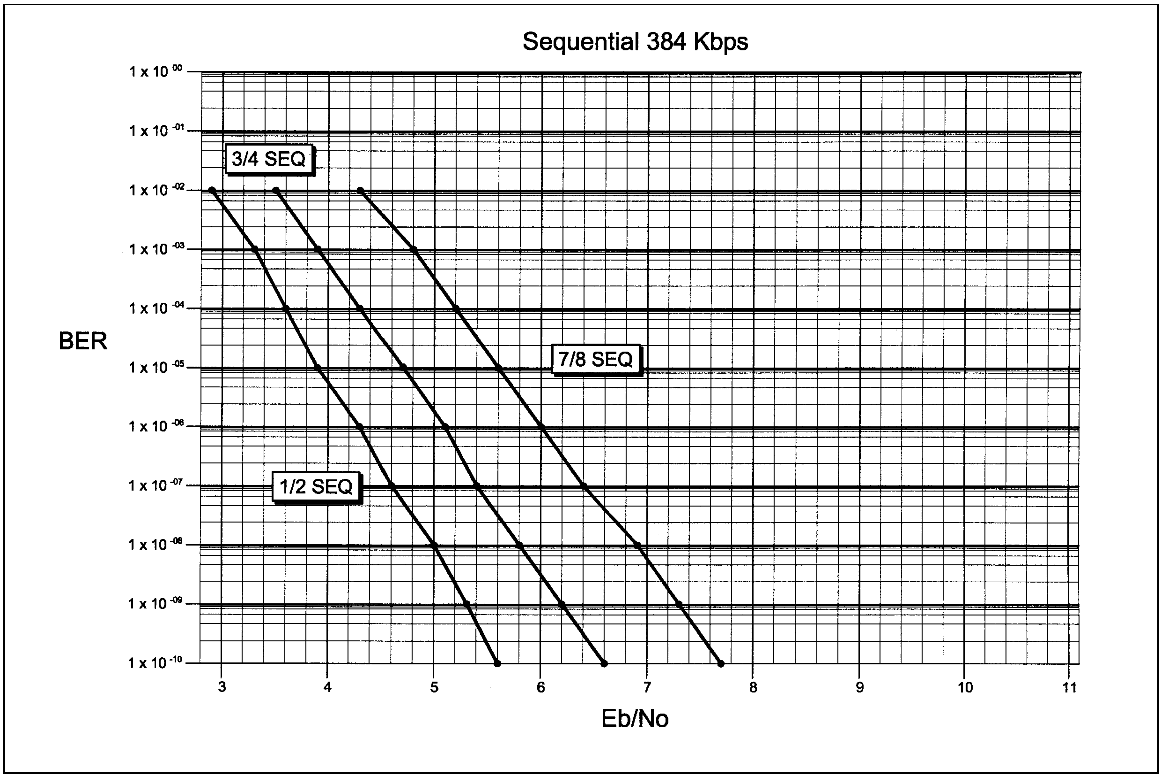

Figure 4-4. Sequential 384 Kbps BER Curve

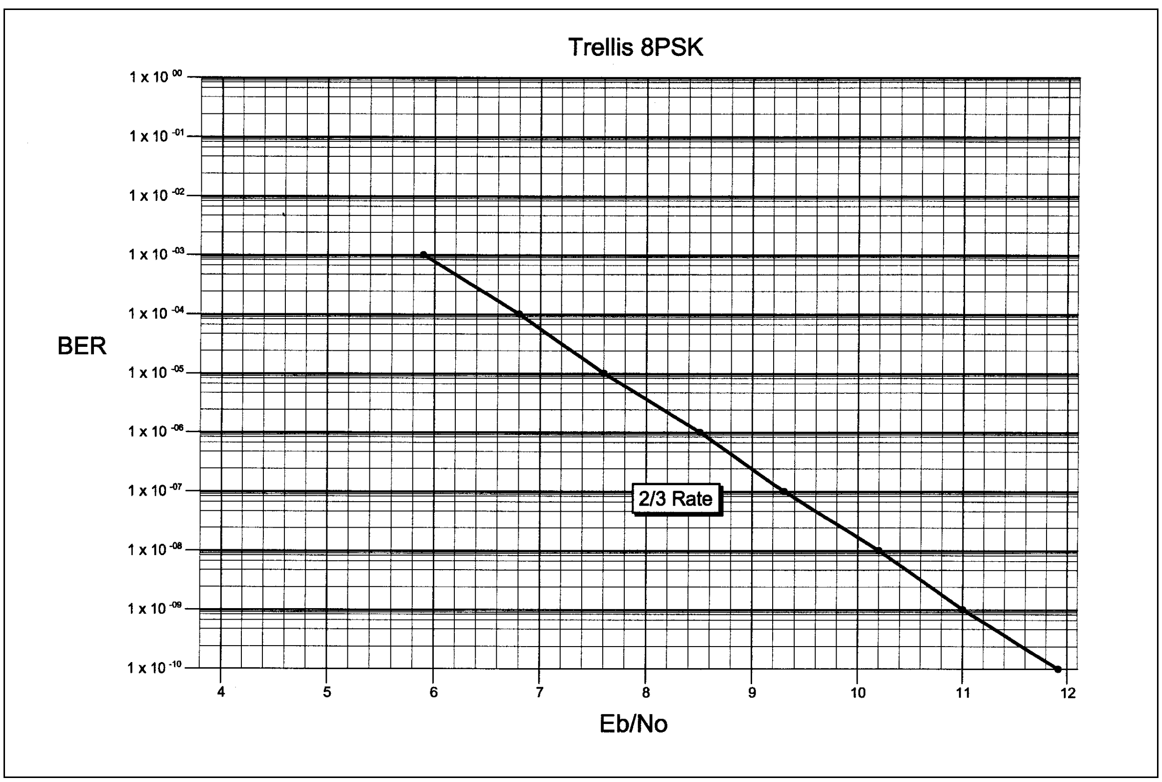

Figure 7-5. Trellis 8PSK BER Curve

7.11 AGC Curve

Figure 6-6 represents the AGC Curve for the DMD2401 LB/ST.

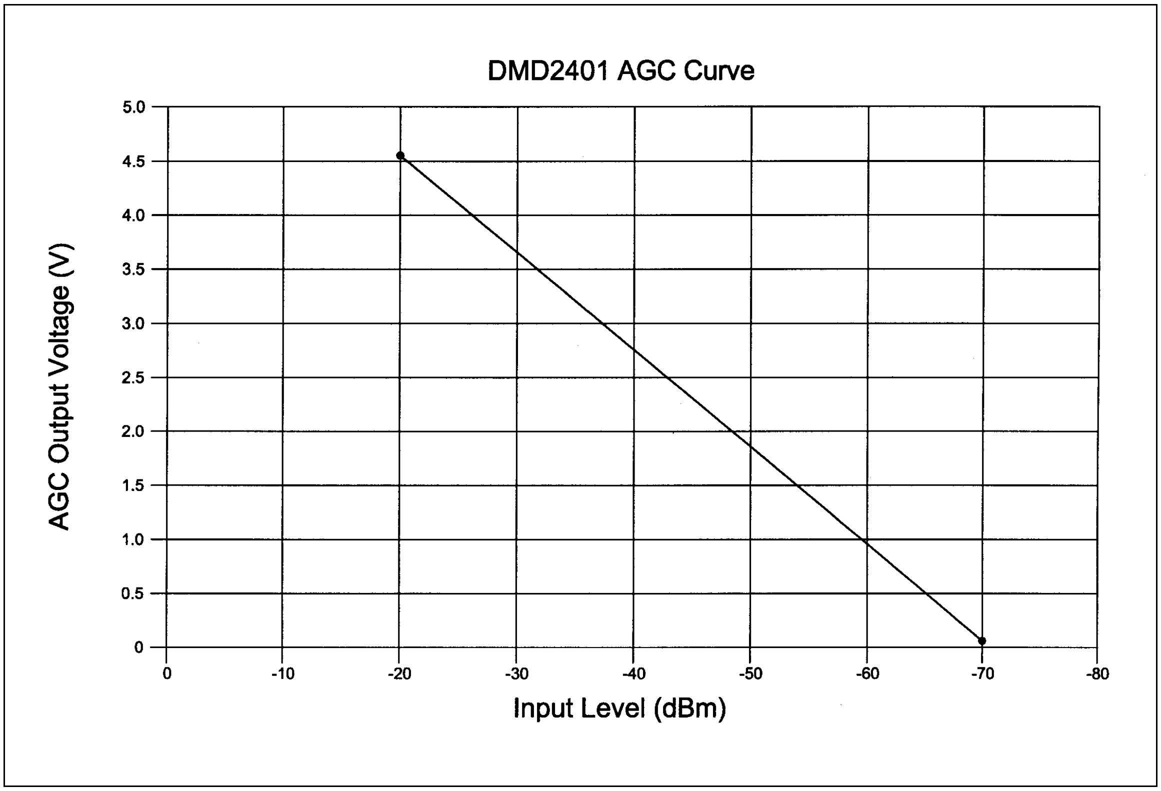

Figure 7-6. DMD2401 LB/ST AGC Curve

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Section 8 – Appendices

Appendix A – Reed-Solomon Codes

<u>**n**</u>	<u>**Valid Values for k**</u>
2	1
3	2
4	2, 3
5	3, 4
6	3, 4, 5
7	4, 5, 6
8	4, 6, 7
9	5, 6, 7, 8
10	5, 7, 8, 9
11	6, 8, 9, 10
12	6, 8, 9, 10, 11
13	7, 9, 10, 11, 12
14	7, 10, 11, 12, 13
15	8, 10, 12, 13, 14
16	8, 11, 12, 13, 14, 15
17	9, 12, 13, 14, 15, 16
18	9, 12, 14, 15, 16, 17
19	10, 13, 15, 16, 17, 18
20	10, 14, 15, 16, 17, 18, 19
21	11, 14, 16, 17, 18, 19, 20
22	11, 15, 17, 18, 19, 20, 21
23	12, 16, 18, 19, 20, 21, 22
24	12, 16, 18, 20, 21, 22, 23
25	13, 17, 19, 20, 21, 22, 23, 24
26	13, 18, 20, 21, 22, 23, 24, 25

27	14, 18, 21, 22, 23, 24, 25, 26
28	14, 19, 21, 23, 24, 25, 26, 27
29	15, 20, 22, 24, 25, 26, 27, 28
30	15, 20, 23, 24, 25, 26, 27, 28, 29
31	16, 21, 24, 25, 26, 27, 28, 29, 30
32	16, 22, 24, 26, 27, 28, 29, 30, 31
33	17, 22, 25, 27, 28, 29, 30, 31, 32
34	17, 23, 26, 28, 29, 30, 31, 32, 33
35	18, 24, 27, 28, 30, 31, 32, 33, 34
36	18, 24, 27, 29, 30, 31, 32, 33, 34, 35
37	19, 25, 28, 30, 31, 32, 33, 34, 35, 36
38	19, 26, 29, 31, 32, 33, 34, 35, 36, 37
39	20, 26, 30, 32, 33, 34, 35, 36, 37, 38
40	20, 27, 30, 32, 34, 35, 36, 37, 38, 39
41	21, 28, 31, 33, 35, 36, 37, 38, 39, 40
42	28, 32, 34, 35, 36, 37, 38, 39, 40, 41
43	29, 33, 35, 36, 37, 38, 39, 40, 41, 42
44	30, 33, 36, 37, 38, 39, 40, 41, 42, 43
45	30, 34, 36, 38, 39, 40, 41, 42, 43, 44
46	31, 35, 37, 39, 40, 41, 42, 43, 44, 45
47	32, 36, 38, 40, 41, 42, 43, 44, 45, 46
48	32, 36, 39, 40, 42, 43, 44, 45, 46, 47
49	33, 37, 40, 41, 42, 43, 44, 45, 46, 47, 48
50	34, 38, 40, 42, 43, 44, 45, 46, 47, 48, 49
51	34, 39, 41, 43, 44, 45, 46, 47, 48, 49, 50
52	35, 39, 42, 44, 45, 46, 47, 48, 49, 50, 51
53	36, 40, 43, 45, 46, 47, 48, 49, 50, 51, 52
54	36, 41, 44, 45, 47, 48, 49, 50, 51, 52, 53
55	37, 42, 44, 46, 48, 49, 50, 51, 52, 53, 54

56	38, 42, 45, 47, 48, 49, 50, 51, 52, 53, 54, 55
57	38, 43, 46, 48, 49, 50, 51, 52, 53, 54, 55, 56
58	39, 44, 47, 49, 50, 51, 52, 53, 54, 55, 56, 57
59	40, 45, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58
60	40, 45, 48, 50, 52, 53, 54, 55, 56, 57, 58, 59
61	41, 46, 49, 51, 53, 54, 55, 56, 57, 58, 59, 60
62	42, 47, 50, 52, 54, 55, 56, 57, 58, 59, 60, 61
63	48, 51, 53, 54, 56, 57, 58, 59, 60, 61, 62
64	48, 52, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63
65	49, 52, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64
66	50, 53, 55, 57, 58, 59, 60, 61, 62, 63, 64, 65
67	51, 54, 56, 58, 59, 60, 61, 62, 63, 64, 65, 66
68	51, 55, 57, 59, 60, 61, 62, 63, 64, 65, 66, 67
69	52, 56, 58, 60, 61, 62, 63, 64, 65, 66, 67, 68
70	53, 56, 59, 60, 62, 63, 64, 65, 66, 67, 68, 69
71	54, 57, 60, 61, 63, 64, 65, 66, 67, 68, 69, 70
72	54, 58, 60, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71
73	55, 59, 61, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72
74	56, 60, 62, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73
75	57, 60, 63, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74
76	57, 61, 64, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75
77	58, 62, 65, 66, 68, 69, 70, 71, 72, 73, 74, 75, 76
78	59, 63, 65, 67, 69, 70, 71, 72, 73, 74, 75, 76, 77
79	60, 64, 66, 68, 70, 71, 72, 73, 74, 75, 76, 77, 78
80	60, 64, 67, 69, 70, 72, 73, 74, 75, 76, 77, 78, 79
81	61, 65, 68, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80
82	62, 66, 69, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81
83	63, 67, 70, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82

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85	68, 71, 73, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84
86	69, 72, 74, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85
87	70, 73, 75, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86
88	71, 74, 76, 77, 79, 80, 81, 82, 83, 84, 85, 86, 87
89	72, 75, 77, 78, 80, 81, 82, 83, 84, 85, 86, 87, 88
90	72, 75, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89
91	73, 76, 78, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90
92	74, 77, 79, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91
93	75, 78, 80, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92
94	76, 79, 81, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93
95	76, 80, 82, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94
96	77, 80, 83, 84, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95
97	78, 81, 84, 85, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96
98	79, 82, 84, 86, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97
99	80, 83, 85, 87, 88, 90, 91, 92, 93, 94, 95, 96, 97, 98
100	80, 84, 86, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99
101	81, 85, 87, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
102	82, 85, 88, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101
103	83, 86, 89, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102
104	84, 87, 90, 91, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103
105	88, 90, 92, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104
106	89, 91, 93, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105
107	90, 92, 94, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106
108	90, 93, 95, 96, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107
109	91, 94, 96, 97, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108
110	92, 95, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109
111	93, 96, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110
112	94, 96, 98, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111

113	95, 97, 99, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112
114	95, 98, 100, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113
115	96, 99, 101, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114
116	97, 100, 102, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115
117	98, 101, 103, 104, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116
118	99, 102, 104, 105, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117
119	100, 102, 105, 106, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118
120	100, 103, 105, 107, 108, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119
121	101, 104, 106, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120
122	102, 105, 107, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121
123	103, 106, 108, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122
124	104, 107, 109, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123
125	105, 108, 110, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124
126	108, 111, 112, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125
127	109, 112, 113, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126
128	110, 112, 114, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127
129	111, 113, 115, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128
130	112, 114, 116, 117, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129
131	113, 115, 117, 118, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130
132	114, 116, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131
133	114, 117, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132
134	115, 118, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133
135	116, 119, 120, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134
136	117, 119, 121, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135
137	118, 120, 122, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136
138	119, 121, 123, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137
139	120, 122, 124, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138
140	120, 123, 125, 126, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139

141	121, 124, 126, 127, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140
142	122, 125, 127, 128, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141
143	123, 126, 128, 129, 130, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142
144	124, 126, 128, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143
145	125, 127, 129, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144
146	126, 128, 130, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145
147	129, 131, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146
148	130, 132, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147
149	131, 133, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148
150	132, 134, 135, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149
151	133, 135, 136, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150
152	133, 136, 137, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151
153	134, 136, 138, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152
154	135, 137, 139, 140, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153
155	136, 138, 140, 141, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154
156	137, 139, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155
157	138, 140, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156
158	139, 141, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157
159	140, 142, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158
160	140, 143, 144, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159
161	141, 144, 145, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160
162	142, 144, 146, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161
163	143, 145, 147, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162
164	144, 146, 148, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163
165	145, 147, 149, 150, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164
166	146, 148, 150, 151, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165
167	147, 149, 151, 152, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166
168	150, 152, 153, 154, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167
169	151, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168

170	152, 153, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169
171	152, 154, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170
172	153, 155, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171
173	154, 156, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172
174	155, 157, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173
175	156, 158, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174
176	157, 159, 160, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175
177	158, 160, 161, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176
178	159, 161, 162, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177
179	160, 162, 163, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178
180	160, 162, 164, 165, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179
181	161, 163, 165, 166, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180
182	162, 164, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181
183	163, 165, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182
184	164, 166, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183
185	165, 167, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184
186	166, 168, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185
187	167, 169, 170, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186
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208	188, 190, 191, 192, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207
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213	194, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
214	195, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213
215	196, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214
216	197, 198, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215
217	198, 199, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216
218	199, 200, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217
219	200, 201, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218
220	200, 202, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219
221	201, 203, 204, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220
222	202, 204, 205, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221
223	203, 205, 206, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222
224	204, 206, 207, 208, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223
225	205, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224

226	206, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225
227	207, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226
228	208, 209, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227
229	209, 210, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228
230	210, 211, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229
231	212, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230
232	213, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231
233	214, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232
234	215, 216, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233
235	216, 217, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234
236	217, 218, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235
237	218, 219, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236
238	219, 220, 221, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237
239	220, 221, 222, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238
240	220, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239
241	221, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240
242	222, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241
243	223, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242
244	224, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243
245	225, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244
246	226, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245
247	227, 228, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246

248	228, 229, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247
249	229, 230, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248
250	230, 231, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249
251	231, 232, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250
252	233, 234, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251
253	234, 235, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252
254	235, 236, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253
255	236, 237, 238, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254

Appendix B - Carrier Control

B.0 States

Carrier **Off**:	Modulator Output Disabled
Carrier **On**:	Modulator Output Enabled (refer to Section B.1, Item 1)
Carrier **Auto**:	Modulator Output Enabled (refer to Section B.1, Item 2)
Carrier **VSat**:	Modulator Output Enabled (refer to Section B.1, Item 3)
Carrier **RTS**:	Modulator Output Enabled (refer to Section B.1, Item 4)
Carrier **Delay**:	Modulator Output Enabled (refer to Section B.1, Item 5)

B.1 Description

1. Modulator output is turned off before reprogramming modulator functions that may alter the output spectrum through the front panel, and the user is required to enter “Yes” to re-enable output after the change. When using the terminal, the modulator is turned off while re-programming modulator functions that may alter the output spectrum, and the user is required to manually turn on the output after the reprogramming.

2. Modulator output is turned off before reprogramming modulator functions that may alter the output spectrum through the front panel, but the output is automatically turned on after the change. When using the terminal, the modulator is turned off while re-programming modulator functions that may alter the output spectrum, and but the output is automatically turned on after the change.

3. Modulator output is turned off before reprogramming modulator functions that may alter the output spectrum through the front panel, and the user is required to enter “Yes” to re-enable output after the change. When using the terminal, the modulator is turned off while re-programming modulator functions that may alter the output spectrum, and the user is required to manually turn on the output after the reprogramming (same as “Carrier On”). Additionally “VSat” mode disables the modulators output is the modems demodulator does not have signal lock. When signal lock returns to the demodulator, the modems modulator turns the carrier back on.

4. Modulator output is turned off before reprogramming modulator functions that may alter the output spectrum through the front panel, and the user is required to enter “Yes” to re-enable output after the change. When using the terminal, the modulator is turned off while re-programming modulator functions that may alter the output spectrum, and the user is required to manually turn on the output after the reprogramming (same as “Carrier On”). Additionally “RTS” (Request To Send) mode enables the modulator’s output based on the RTS lead of the data interface. When RTS is enabled on the data interface, the modulator turns on the carrier, when the RTS is disabled the modulator turns off the carrier.

5. Modulator output is turned off before reprogramming modulator functions that may alter the output spectrum through the front panel, and the user is required to enter “Yes” to re-enable output after the change. When using the terminal, the modulator is turned off while re-programming modulator functions that may alter the output spectrum, and the user is required to manually turn on the output after the reprogramming (same as “Carrier On”). Additionally at power-up the carrier delay time in seconds, specified in the <System> <Carrier Dly> (front panel) or Modulation options (terminal) will suspend carrier output for the stored amount of seconds.

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