RCF6001

C- or Ku-Band Satellite Terminal

Installation and Operation Manual

TM082 Rev. 1.0

September, 1999

- NOTICE -

RADYNE COMSTREAM

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

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

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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 permission to open and disassemble the product as required for evaluation. In all cases, Radyne has sole responsibility for determining the cause and nature of failure, and Radyne's determination with regard thereto shall be final.

RCF6001 C- or Ku-Band Satellite Terminal
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TM082 - Record of Revisions

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Revision Level	Date	Reason for Change
1.0	9-10-99	Initial Release

Section One – RCF6001 Satellite Terminal Description

1.0 Introduction

The RCF6001 is a C- or Ku-Band Satellite Terminal that consists of a Radyne ComStream DMD2401LBST Satellite Modem, Block Upconverter (BUC) and Low Noise Block (LNB). The system is available in a variety of frequencies and power levels. Cabling and antennas can also be supplied for a single source solution.

Highlights

- Complete C- or Ku-Band Satellite Terminal System
- Optional Antennas and Cabling
- Modem with Power and High-Stability Reference (10 MHz) to Outdoor RF Units
- BPSK and QPSK Operation
- 9.6 to 4375 Kbps Operation

The frequency agile DMD2401 LBST is the heart of the RCF6001 system. The DMD2401LBST modem supplies an L-Band output frequency of 950-1525 MHz.
The modem also supplies power and a high stability 10 MHz reference signal through the center conductor of the transmit and receive cables. This design eliminates the use of an outdoor power supply and diplexer. The LBST controls all parameters of the outdoor units remotely or via the front panel of the modem. The modulator and demodulator operate independently using BPSK and QPSK modulation in either SCPC or VSAT modes.

The Block Upconverter (BUC) comes in a variety of frequencies and power levels. The BUC is based on a simple block conversion with an L-Band input and a C- or Ku-Band output. A single LO does the conversion from L-Band to the desired output frequency. The output power levels that are available for C-Band BUCs are 5, 10, 20 and 40 watts. The available power levels for the Ku-Band BUCs are 2, 4, 8, 16 and 25 watts.

The Low Noise Block (LNB) comes in a variety of frequencies and power levels. The Low Noise Block does a single LO conversion from C- or Ku-Band to an L-Band output. Typical gain of an LNB is 60 dB.

2.0 DMD2401 LB/ST Satellite Modem

The Radyne Corporation DMD2401 LB/ST L-Band Satellite Modem and Outdoor Unit (ODU) Driver is a microprocessor-controlled Binary Phase Shift Keyed (BPSK) or Quadrature Phase Shift Keyed (QPSK), 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 is referred to as the “modem” or DMD2401 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 or QPSK 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 RS485 or RS232 serial control channel.

Figure 1-1. DMD2401 LB/ST Satellite Modem Front Panel

Available options for the DMD2401 LB/ST include a low data rate asynchronous serial overhead channel for remote monitor and control. Additionally, a Reed-Solomon codec is available for applications requiring Bit Error Rates of 10^{-10}.

1.1 Applications

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

1.1.1 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.

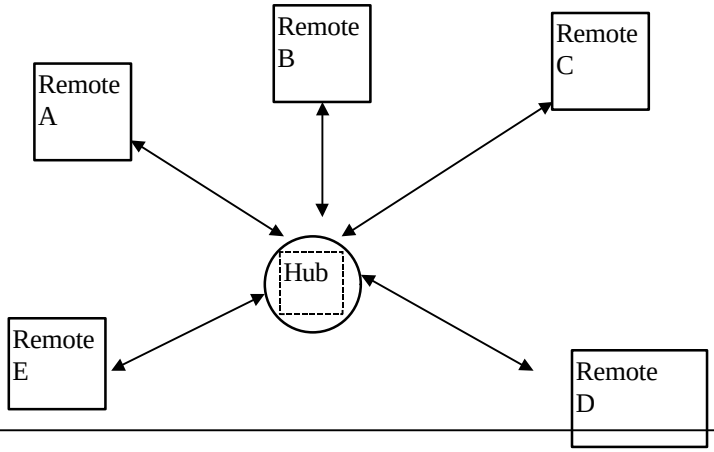
1.1.2 SCPC Point to Multi–Point Links in a Broadcast Application

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.

Star Network Configuration



1.1.3 DAMA (Demand Assigned Multiple Access)

Suppose that we wanted to simulate a telephone network with a virtual switch between modems carrying digitized voice information. 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

1.1.4 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 above.

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 2 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.

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 modem case.

Þ ***CAUTION:*** *Before initially applying power to the modem, it is a good idea to disconnect the transmit output from the operating satellite ground station equipment. This is especially true if the current modem configuration settings are unknown, where incorrect setting could disrupt existing communications traffic.*

2.1 Unpacking

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

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

2.1.1 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.

2.2 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.

Table 2-1. DMD2401 LB/ST Rear Panel Connectors

Connector ID	Description	Function
J1	SMA 50-Ohm Female	Rx IF 950-1525 MHz
J2	SMA 50-Ohm Female	Tx IF 950-1525 MHz
J3	9-pin D-Sub Female	RS-232 Terminal Port
J4	9-pin D-Sub Female	Remote Port Connector
J5	9-Pin D-Sub Male	Alarm Connector
J6	BNC Female	10 MHz External Reference
J7	BNC Female	Reference Monitor, 5 dBm ± 3
J8	BNC Female	External Clock
J9	37-Pin D-Sub Female	Sync. Data Interface, RS422/RS485/RS232/V.35

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 Connections / Interface Connectors

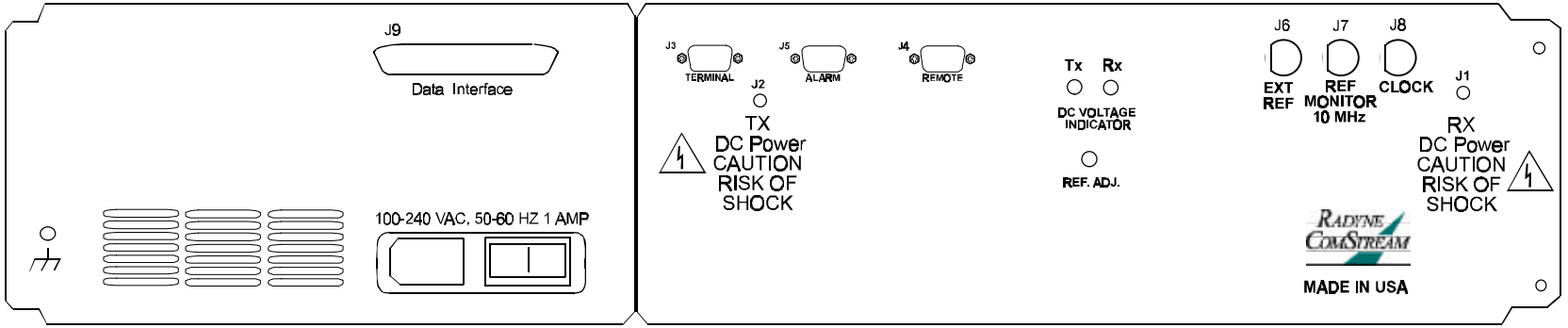
All modem connections are made to the labeled connectors located on the rear of the unit. The connector definitions and pinout tables are shown below, and are those on the modem unit. Any connection interfacing to the modem must be the appropriate mating connector.

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.

2.4.1 DMD2401 LB/ST Connector Pinout Tables

The following tables contain the pinout information for the various Data/IF connectors located on the rear panel of the DMD2401 LB/ST. See Figure 2-1 for the DMD2401 LB/ST Rear Panel.

DMD2401 LB/ST Rear Panel Connectors



J1 - SMA 50-Ohm Female.	RX IF 950-1525 MHz
J2 - SMA 50-Ohm Female.	TX IF 950-1525 MHz
J3 - 9-Pin D-Sub Female.	Terminal Port (RS-232)
J4 - 9-Pin D-Sub Female.	Remote Port Connector
J5 - 9-Pin D-Sub Male.	Alarm Connector
J6 - BNC Female.	10 MHz External Reference
J7 - BNC Female.	Reference Monitor, 5 dBm +/-3
J8 - BNC Female.	External Clock
J9 - 37-Pin D-Sub Female.	Sync. Data Interface RS422/RS485/RS232/V.35

Figure 2-1. DMD2401 LB/ST Rear Panel Connectors

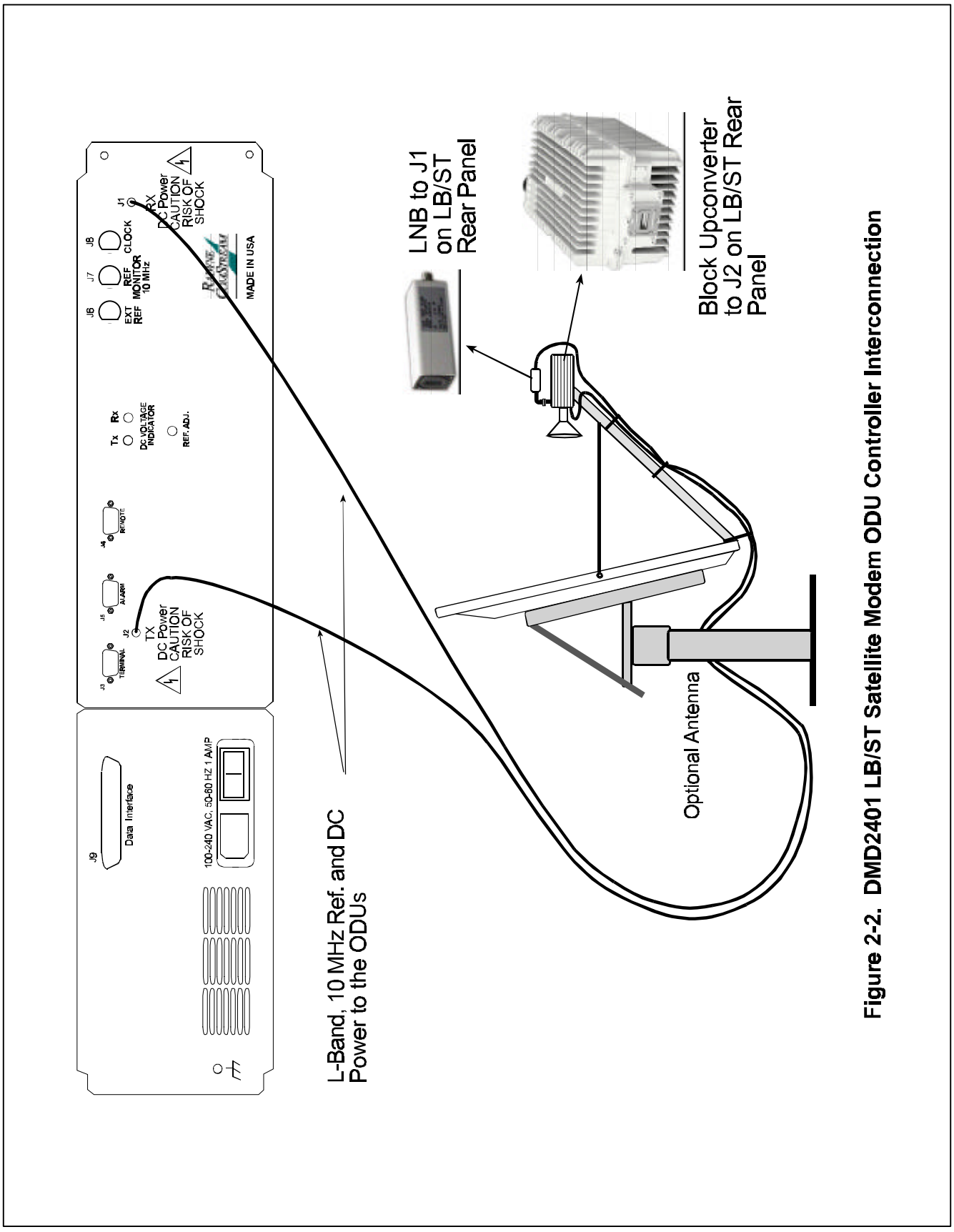


Figure 2-2. DMD2401 LB/ST Satellite Modem ODU Controller Interconnection

J3 – RS232 Terminal Port

Table 2-2. J3 - RS232 Terminal Port - 9-Pin Female 'D'			
Pin No.	**Signal**	**Description**	**Direction**
3	TxD	Transmit Data	Output
2	RxD	Receive Data	Input
5	Gnd	Ground	-----

J5 – Alarm Connection

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 J6.

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 follows:

	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 2-3 below. Note that the NC and NO (Normally Closed and Normally Open) nomenclature applies to non-energized relays.

Table 2–3. J5 - Alarm Connector – 9-Pin Male 'D' Sub Connector	
J6 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

J4 - Remote

The RS-485 connection is for remote monitor and control of the modem.
Refer to Table 2-4 below for the pinouts.

Table 2-4.

J4- RS485 Remote Port - 9-Pin Female 'D'

Pin No.	Signal	Description	Direction
1	RS485 TxD-B	Transmit Data B	Output
2	TxC-A	Transmit Clock A	Output
3	TxC-B	Transmit Clock B	Output
4	RxC-A	Receive Clock A	Input
5	Common	Signal Common	
6	RS485 TxD-A	Transmit Data A	Output
7	RxC-B	Receive Clock B	Input
8	RS485 RxD-B	Receive Data B	Input
9	RS485 RxD-A	Receive Data A	Input

J9 – Data Interface

Table 2–5.

J9 - Sync Data RS422/RS485/RS232/V.35 - 37-Pin Female

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 has the capability of constantly outputting the DM/DSR signal. (DSR and DM are actually the same signal). The modem is always in the condition of being able to pass data. DTR input to the modem is not necessary. The DM/DSR output of the modem is located on pins 11 and 29 as shown above.**

J6 – Ext. Ref. IN

This port is used for injecting an External Reference Frequency into the modem. The DMD2401 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: 256 KHz to 10 MHz in multiples of 8 KHz
Amplitude: 0.2 V p-p to 5 V p-p
Type: Sinewave or Squarewave

Section 3 – RCF6001 Satellite Terminal Operation

3.0 Operating Procedures

Operation of the DMD2401 LB/ST consists of controlling the unit operating parameters and monitoring status and responses via front panel or Terminal Mode control.

These methods may be used separately or together to monitor and control the DMD2401 LB/ST.

3.1 Front Panel Control

The front panel of the DMD2401 allows complete monitor and control of all modem parameters and functions via a keypad, LCD display and status LEDs.

3.1.1 Front Panel Layout and Features

The front panel layout is shown in Figure 3–1, 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.

3.1.2 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 three distinct areas showing current information. The upper left shows the current area of use, either Mod, Demod, Modem or Test. The upper right shows the current parameter being monitored, such as ‘Freq.’ (frequency) or ‘Bit 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.

The backlight brightness can be set for two states: Active and Idle. The active state is entered whenever a key on the front panel is depressed, while the idle state occurs after approximately 45 seconds of inactivity. Each state may be set to ‘Off’, 1/3 brightness, 2/3 brightness and full brightness. The default setting is full in the active state and 1/3 in the idle state. To change the settings for either state, go to the ‘Modem LCD Active’ or ‘Modem LCD Idle’ brightness parameter and adjust to the desired values.

3.1.3 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. During entry, the cursor keys allow moving a cursor to individual digits of a numerical entry or scrolling through the available options of a selection entry.

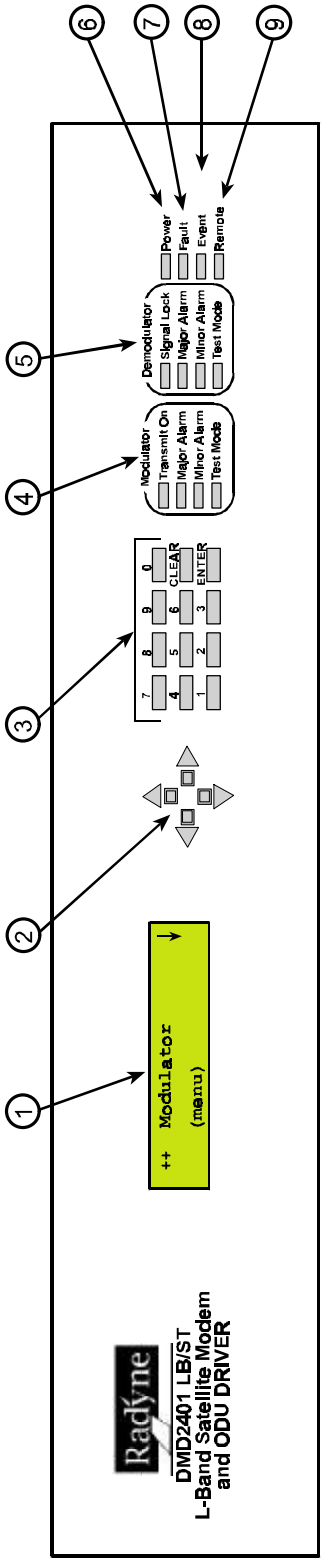


Figure 3-1. DMD2401 LB/ST Front Panel Controls and Indicators

Table 3-1. Front Panel Controls and Indicators

Figure 3-1 Item Number	Description	Function
1	LCD Front Panel Display	Displays Modem 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	Modulator LEDs	See Below for Itemized descriptions of these LEDs
5	Demodulator LEDs	See Below for Itemized descriptions of these LEDs
6	Power LED	Indicates Modem is powered-up
7	Fault LED	A fault has occurred; Common Fault
8	Event LED	See Paragraph 3.5 for details
9	Remote LED	Remote Control Operation in progress

3.1.4 Front Panel LED Indicators

There are 12 LEDs on the modem front panel to indicate status of the modem's operation. They are separated into three columns representing (from left to right) the Modulator status, the Demodulator status and the Modem (Unit) status. 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. Red indicates a fault condition that will result in lost communications.

Modem LED Indicators

1. Power: ***Green*** – Indicates the modem unit is currently under power.
2. Fault: ***Red*** – If summary fault condition exists from either Alarm A or B.
3. Stored 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.
4. Remote: ***Green*** – Indicates that the unit is set to respond to the remote control input.

Modulator LED Indicators

1. Transmit On: ***Green*** – Indicates that the transmit output is currently active.
2. Major Alarm: ***Red*** – Indicates that the transmit direction has failed, losing traffic.
3. Minor Alarm: ***Yellow*** – Indicates a transmit warning condition exists.
4. Test Mode: ***Yellow*** – Indicates the modulator is involved in a current test mode activity.

Demodulator LED Indicators

1. Signal Lock: ***Green*** – Indicates receiver lock to an incoming CXR and data including FEC sync.
2. Major Alarm: ***Red*** – Indicates that the receive direction has failed, losing traffic.
3. Minor Alarm: ***Yellow*** – Indicates a receive warning condition exists, either an incoming carrier with a low input level or a low E_b/N_o (programmable threshold).
4. Test Mode: ***Yellow*** – Indicates the receiver is involved in a current test mode activity.

3.1.4.1 Guide to Front Panel Monitor and Control

The front panel can be used to perform complete monitor and control of the modem setup and operating parameters. The operation of the front panel becomes very easy after a short period of use in which the user becomes familiar with the basic concepts and operations.

3.2 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 . Invalid input keys cause an error message to be displayed on the terminal.

The Terminal Control Mode supports serial baud rates of 2400, 9600 and 19200. 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. The emulation type can be changed either from the front panel or by pressing '$' (dollar sign) on the terminal keyboard. The terminal menus are shown in Appendix C at the end of this manual.

3.3 Modem Remote Port Control

The modem can be controlled by an external Monitor & Control (M&C) system through Remote Port mode (also referred to as Computer Mode). Communication between the DMD2401 and the external system control computer is via a binary protocol which is described in detail in Appendix B at the end of this manual. The remote port provides RS485 capability and thus can be used with a multi-drop control bus allowing a single external M&C computer to control several DMD2401 modems.

3.4 Parameter Setup

To set any parameter, the four arrow keys to the right of the LCD display are used to select the parameter to be set, followed by pressing the 'Enter' key to indicate that a new entry is desired, then setting the parameter via the numeric keypad and finalizing the data entry using the 'Enter' key. The current input can be canceled by depressing the 'Clear' key at any time before pressing 'Enter'. When the entry involves selection of 1 of several choices, this is accomplished by either: pressing an option number selection (0 to max. where max. may be 1 to 4) then pressing the 'Enter' key, or, using the up and down arrow keys to scroll though the available options, pressing 'Enter' when the desired option is displayed. When scrolling though the available options, the current setting is denoted by an arrow in the left column position.

Following a valid input, the modem will place the new setting into the nonvolatile EEPROM making it available immediately and also automatically the next time the unit is powered-up.

3.5 Modem Checkout

The following descriptions assume that the modem is installed in a suitable location with prime AC power applied and supporting equipment available.

3.5.1 Initial Power-Up

Þ ***CAUTION:*** *Before initial powerup of the DMD2401 LB/ST, it is a good idea to disconnect the transmit output from the operating satellite ground station equipment. This is especially true if the current modem configuration settings are unknown, where incorrect setting could disrupt existing communications traffic. New modems 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 (above the power entry connector) to the 'ON' position. At initial and every subsequent power-up, the modem processor 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, an Alarm 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. First set the 'Modem – Remote' parameter to 'Terminal' (option 3), then set the 'Modem – Remote Port' parameter to 'RS–232' (option 0). The 'Modem – Bit Rate, Format and Parity' also requires setting to match the terminal setting. The Modem Remote Address serves no function in the Terminal mode. Terminal Setup is as follows:

Terminal Setup:

Baud Rate:	19.2 K
Data Bits:	8
	No Parity
	1 stop bit

3.6 DMD2401 Automatic Uplink Power Control (AUPC) Operation

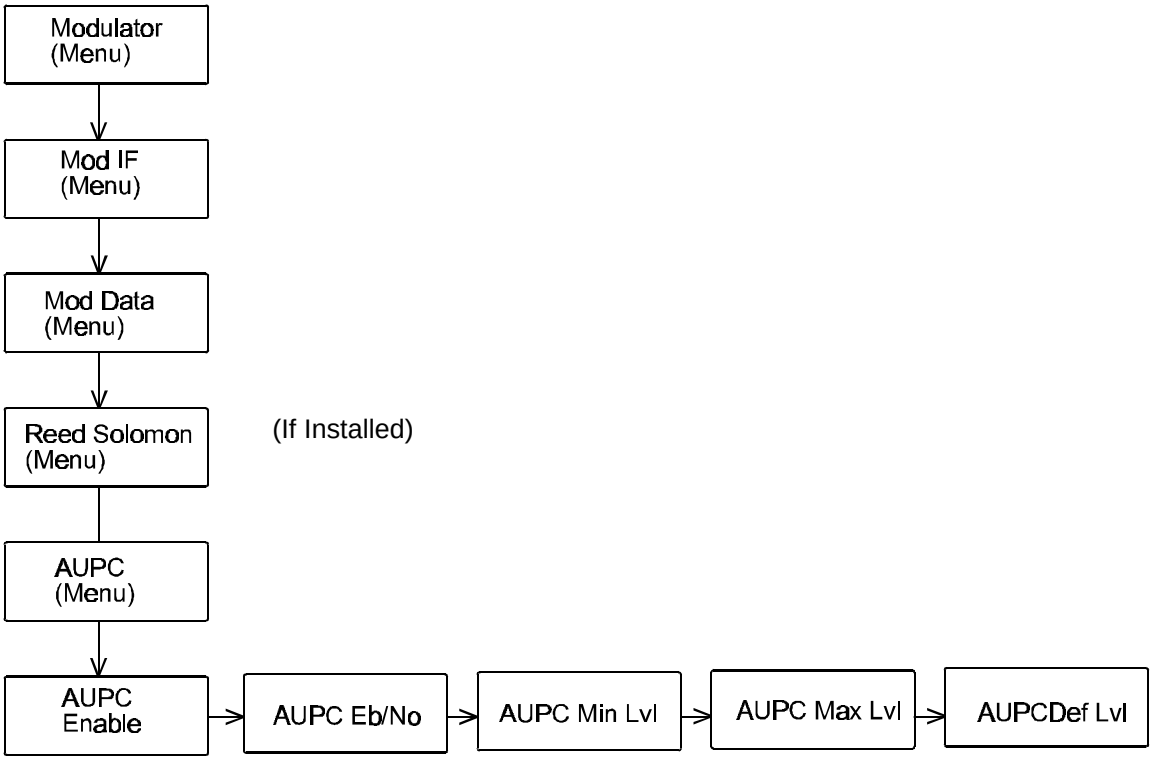
The DMD2401 modem has an optional built-in provision for Automatic Uplink Power Control (AUPC). AUPC attempts to maintain a constant E_b/N_o at the receive end of an SCPC link. This is especially useful when operating over a satellite at Ku-Band frequencies in locations with high rainfall periods.

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 E_b/N_o	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 schematically below:



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 also 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 that allow control of the maximum and minimum power output level. 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.

3.7 DMD2401 Asynchronous Overhead Operation

3.7.1 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, Page 60, Figure 10, resulting in a 16/15 aggregate to through data ratio.

KBPS	*BAUD*
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
. The characteristics of the channel interface is 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 1. 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.

3.8 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 (or 1/480th of the through terrestrial data rate), and is normally used to super-sample an asynchronous data channel.
Bit 2 -	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. Also, 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.

3.9 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 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.

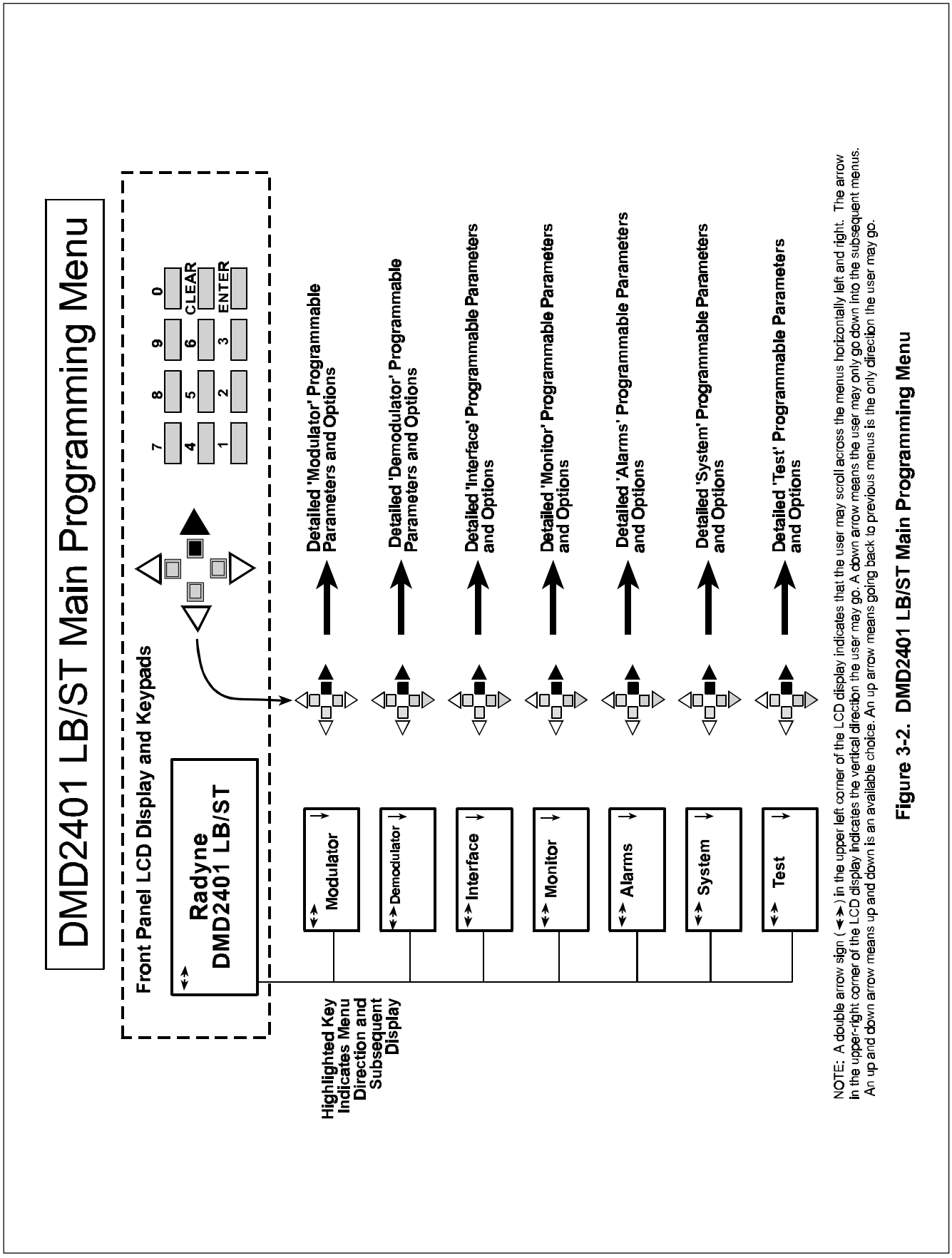
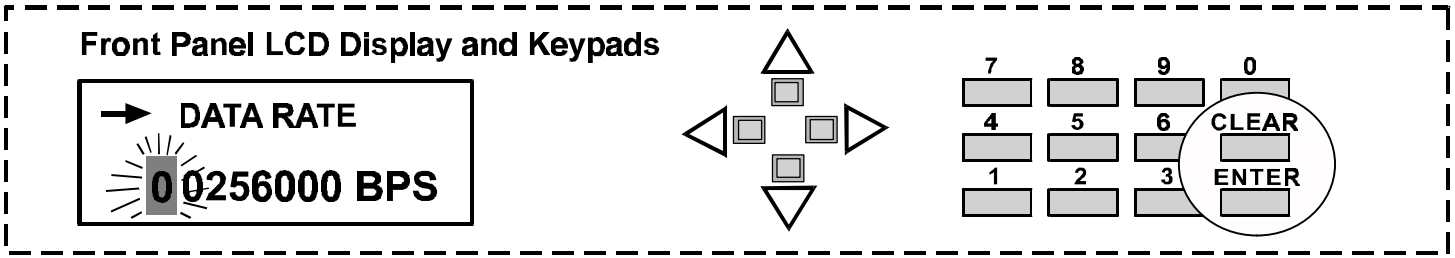


Figure 3-2. DMD2401 LB/ST Main Programming Menu

3.10 Front Panel Menu Selections

Entering New Parameters From The Front Panel Keypad



After arriving at a programmable parameter that needs to be modified, depress the 'Enter' key. 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 numeric keypad, depress the 'Enter' key to lock in the new parameter. If a change needs to be made, depress the 'Clear' key and the display defaults back to the original parameter. Depress 'Enter' again and re-enter the new parameters followed by 'Enter'. **NOTE:** *If at any time the user wishes to abort the changes being made, depress the 'Clear' key to begin again.*

Figure 3-3. Entering New DMD2401 Parameters

The front panel has seven top level menus as follows**: Modulator, Demodulator, Interface, Monitor, Alarms, System,** and **Test**. The menu items are shown in the tables below:

The following table is a listing of the Command and Status parameters available to the user from the front panel of the DMD2401 LB/ST. A brief description of each of the items follows. By using the following descriptions and the previous Figures, the user should become familiar rather quickly with the hierarchical structure of the DMD2401 LB/ST command and status parameters available at the front panel of the modem.

Modulator

Mod IF/RF

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
: 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
: Enter in 1 MHz steps from 950-1525 MHz.

Power
: Tx Power level is entered in dBm from -5 to -30 dBm.

Carrier
: Turns carrier On & Off

Spectrum Inv
: Inverts the direction of rotation for PSK modulation. Normal meets the IESS specification

Modulation
: Sets modulation type QPSK, BPSK, OQPSK

Mod Data

Data Rate
: Sets Data Rate in BPS Steps. Use arrows or Keypad.

Conv Enc
: Selects Tx code rate and type

Diff Encode
: Enables or disables differential encoder

Scrmbl Sel
: Selects scrambler type (V.35-IESS)

Scrmbl Ctrl
: Enables or disables scrambler operation

Data Invert
: Sets data polarity to Normal, Inverted, or Auto.

Reed-Solomon

Enable/Disable the Reed-Solomon Encoder

ModRS Codes
: Displays the currently used n, k Reed-Solomon Codes. Custom RS codes may be selected.

ModRS Depth
: Displays the currently used Reed-Solomon interleaver depth. In Closed Net Mode, Depth = 8 or 4 may be selected.

Demodulator

Demod IF/RF

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.

Tx 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.

Tx IF
: Enter in 1 MHz steps from 950-1525 MHz

Spectrum Inv
: Inverts the direction of rotation for PSK modulation in demod. Normal meets the IESS specification

Demodulation
: Sets Demodulation type QPSK, BPSK, OQPSK

Swp Bound
: Sets acquisition range for the demodulator

Input Limit

Demod Data

Data Rate
: Sets Data Rate in BPS Steps. Use arrows or Keypad

Conv Dec
: Selects Rx code rate and type

Diff Decode
: Enables or disables differential decoder

Dscrmbl Sel
: Selects descrambler type

Dscrmbl Ctrl
: Enables or disables descrambler operation

Data Invert
: Sets data polarity to Normal, Inverted, or Auto.

Reed-Solomon

Enable/Disable the Reed-Solomon Decoder

DMDRS Codes
: Displays the currently used n, k Reed-Solomon Codes. In Closed Net Mode, custom RS codes may be selected.

DMDRS Depth
: Displays the currently used Reed-Solomon deinterleaver depth. In Closed Net Mode, Depth = 8 or 4 may be selected.

Interface

General

EXT Clk Freq
: Selects Frequency of External Clock.

Freq Ref Src
: Selects Internal, External, or High Stability

Ext Ref Freq
: Sets the External Reference Frequency

Intf Type

Selects Interface type, V.35/422/232

Tx Setup

Tx Ckt ID
: Provides entry of Tx circuit Identifier
: Circuits can be given up to an 11 character alphanumeric identity

Tx Clock
: SCT (Int)

Clk Polarity
Normal

SCT Source
Internal
Tx Terr Intf
RS422

Rx Setup

Rx Ckt ID
Provides entry of Rx circuit Identifier
Circuits can be given up to an 11 character alphanumeric Identity such as DLINK1
Buff Size
Set the Doppler buffer size in Bytes
Buff Size
Sets Doppler buffer size in ms.
Buff Clk
Selects buffer clock source: SCTE (Ext)
Clk Polarity
Normal
Rx Terr Intf
RS422

Monitor

Level
Estimated receive signal level as seen by the Demodulator
Eb/No
Estimated Eb/No as seen by the Demodulator.
SER
Estimated channel error rate (before decoding) measured by the modem.
CBER
Estimated corrected bit error rate (after decoding).
Error Count
Current Error Count from the Viterbi Decoder.
Offset Freq
The received carrier frequency offset as measured by the modem.

Event Buff
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, and so on, maintaining the maximum 40 events.
Press Clear to Erase Events

Voltages (Menu)
+5 Volt
Measured voltage of the +5 volt power bus inside modem.
+12 Volt
Measured voltage of the +12 volt power bus inside modem.
-12 Volt
Measured voltage of the -12 volt power bus inside modem.
Buffer Stat
Doppler buffer % full status.
Press Clr to Center Buffer
Causes Doppler buffer to re-center
BER Exponent

Sets the time base for the channel error rate measurement, used to estimate Eb/No. This number is 'N' in the following equation: $B=10^N$; where: 'B' is the number of data bits in the averaging period.

Alarms

Modem Alarms

Active Alrms

Major Tx

TxuProc Mask

Tx Processor fault
Indicates a HW failure within the modem.

TxPower Mask
Indicates that the Modem Tx output power is within allowed tolerance. A solid indication indicates a HW or programming failure within the modem.

TxOSClk Mask
Indicates that the TX Oversample clock PLL is not locked. This alarm will flash on during certain modem parameter changes. A solid indication indicates a HW or programming failure within the modem.

CompClk Mask
Indicates that Tx composite clock PLL is not locked.
This alarm will flash on during certain modem parameter changes. A solid indication indicates a HW or programming failure within the modem.

TxSynth Mask
Indicates that Tx IF synthesizer is not locked.
This alarm will flash on during certain modem parameter changes.A solid indication indicates a HW or programming failure within the modem.

FPGACfg Mask

REF PLL MASK
Pass/No

TxForce
Pass/No

Major Rx

RxuProc Mask
Rx Processor fault
Indicates a hardware failure within the modem.

SigLoss Mask
Indicates that the demod is unable to lock to a signal.

IF Synth Mask
Indicates the Rx IF synthesizer is not locked.
This alarm will flash ON during certain modem parameter changes. A solid indication indicates a HW or programming failure within the modem.

BuffPll Mask

RxLevel Mask

RxForce Mask

Minor Tx

Tx Activity

TerrClk Mask

Indicates no terrestrial clock activity.

IntClk Mask

Indicates no SCT clock activity.

BNCClk Mask

Indicates no BNC clock activity

TxSatCk Mask

Indicates no Tx Sat clock activity

Tx Data Mask

Indicates no Tx data activity.

TerrAIS Mask

Indicates that AIS has been detected in the Tx data stream.

Minor Rx

BufUFLw Mask

Indicates that a Doppler buffer underflow has occurred.

BufOFLw Mask

Indicates that a Doppler buffer overflow has occurred.

Buf <10% Mask

Indicates that the Doppler buffer is about to underflow.

Buf >90% Mask

Indicates that the Doppler buffer is about to overflow.

VitLock Mask

Indicates that the Viterbi decoder is not locked.

SequLock

Indicates that the Sequential decoder is not locked.

Rx Activity

Buf Clk Mask

Indicates that the selected buffer clock source is not active.

Ext BNC Mask

Rx Sat Mask

Indicates that the Rx Sat buffer clock source is not active.

ExtRef Mask

SatAIS Mask

Indicates that AIS has been detected in the Rx data stream.

Rx RS Faults

Dec Lock

Indicates status of the Reed-Solomon Decoder Lock

Dintlvr

Indicates status of the Reed-Solomon de-interleaver word fault

UnCWord

Indicates status of the Reed-Solomon uncoded word fault

Common

-12 Power

Indicates power supply voltage out of range.

+12 Power

Indicates power supply voltage out of range.

+5 Power
Indicates power supply voltage out of range.
Battery
Indicates battery failure

RAM/ROM
Indicates M&C memory fault.
M&C uProc
Indicates M&C microprocessor HW failure.
Ref PLL Mask
Pass/No
Ext EXC Mask
Pass/No
Ext Ref Mask
Indicates no activity on the external reference.
HS Ref Mask
Pass/No
HSRFPLL Mask
Pass/No

Latched Alrm

The following alarms are latched in order to catch intermittent failures:

Major Tx
TxµProc
TxPower
TxOSClk
CompClk
TxSynth
FPGACfg
Major Rx
RxuProc
Sigloss
IFSynth
BuffPLL
RxLevel

Minor Tx
Tx Activity
RS FIFO
TxBUC
Minor Rx
BufUFlw
BufOFLw
Buf < 10%
Buf > 90%
Viterbi
Seq Lock
Rx Activity
Buf Clk Mask
Ext BNC Mask
Rx Sat Mask
ExtRef Mask
SatAIS Mask
Common
-12 Power

+12 Power
+5 Power
Battery
RAM/ROM
M&C uProc
Ref PLL
Ext Ref Lock
Ext EXC Act
HS Ref Mask
HSRFPLL

System

Control Mode

Selects active control source between Front Panel, Terminal and Computer

General

Date
Time
Backlight
Level
Sets backlight level for ON condition.
Timeout
Sets number of seconds (0..99) from keyboard inactivity to backlight turn off.
Key Click
Enable/Disable front panel audible key click.
Radyne DMD2401 LB/ST Version 2.0
Modem Version
Firmware Rev (Menu)
FPGA
Tx CPLD
Rx CPLD

NOTE: Enter LO frequencies in MHz before entering the Mod and Demod IF Frequencies.

BUC LO (MHz)
Enter frequency in MHz
BUC LO Loc.
Low Side
LNB LO (MHz)
Enter frequency ijn MHz
LNB LO Loc.
Low Side

M&C

Term Baud
M&C Remote Port Baud Rate
Emulation
Terminal Emulation mode: Selects Terminal Emulation Mode for Terminal Port, VT100, ADDS-VP, WYSE 50
Remote Mode
Remote Emulation mode: Selects Remote Port Protocols
Remote Address
Remote Baud

Test

2047 Test Tx/Rx
Enables the 2047 pattern test

Tx enables the TX pattern generator
Rx enables the receive pattern checker
Tx/Rx enables both

Tx Insert Errors

Selects the number of errors to insert
Once the number of errors to insert has been selected, pushing ‘enter’ twice causes the number of errors selected to be inserted in the data stream.

Rx 2047 Err

Shows the number of errors detected by the 2047 pattern checker.

Rx 2047 BER

Shows the number of errors detected by the 2047 pattern checker.

Clear 2047 (Ent=Y, Clr=N)

Loopbacks

Carrier

Normal

Tx Force Alarm

Rx Force Alarm

Remote Port

LED Test Normal

Section 4 - Maintenance

4.0 Periodic Maintenance

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

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

4.1 2401 LB/ST 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 -55 dBm absolute.

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 RF Loopback disconnects the Demodulator from the IF receive input connector.

4.2 DMD2401 LB/ST Fault Philosophy

The DMD2401LB/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. Also, a feature exists that allows the user to ‘Mask’ out certain Alarms as explained below.

4.2.1 Alarm Masks

The user has the capability to ‘Mask’ individual alarms on the DMD2401. 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.

4.2.2 Active Alarms

4.2.2.1 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.

4.2.2.2 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.

4.2.2.3 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.

4.3 DMD2401 Fault Tree Matrices

Tables 4-1 through 4-3 represent, in matrix form, the faults that may occur within the DMD2401. There are three matrices; Tx Faults, Rx Faults, and Common Equipment Faults.

4.3.1 Interpreting the Matrices

The first vertical column in the Tables represent 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.

4.4 DMD2401 Bit Error Rate (BER) Curves

Figures 4-1 through 4-4 represent the BER curves for the DMD2401. Included in these specifications are Viterbi, Concatenated Reed-Solomon and 56 Kbps Sequential.

Table 4-1. DMD2401 Interface/Common Equipment Fault Matrix

INTERFACE/COMMON EQUIPMENT FAULTS	TX IF OUTPUT OFF	TX MINOR ALARM LED	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		x				x													x			
+12V OUT OF RANGE		x				x													x			
-12V OUT OF RANGE		x				x													x			
TEMP. OUT OF RANGE		x				x													x			
NO EXT IF REF ACTIVITY		x																	x			

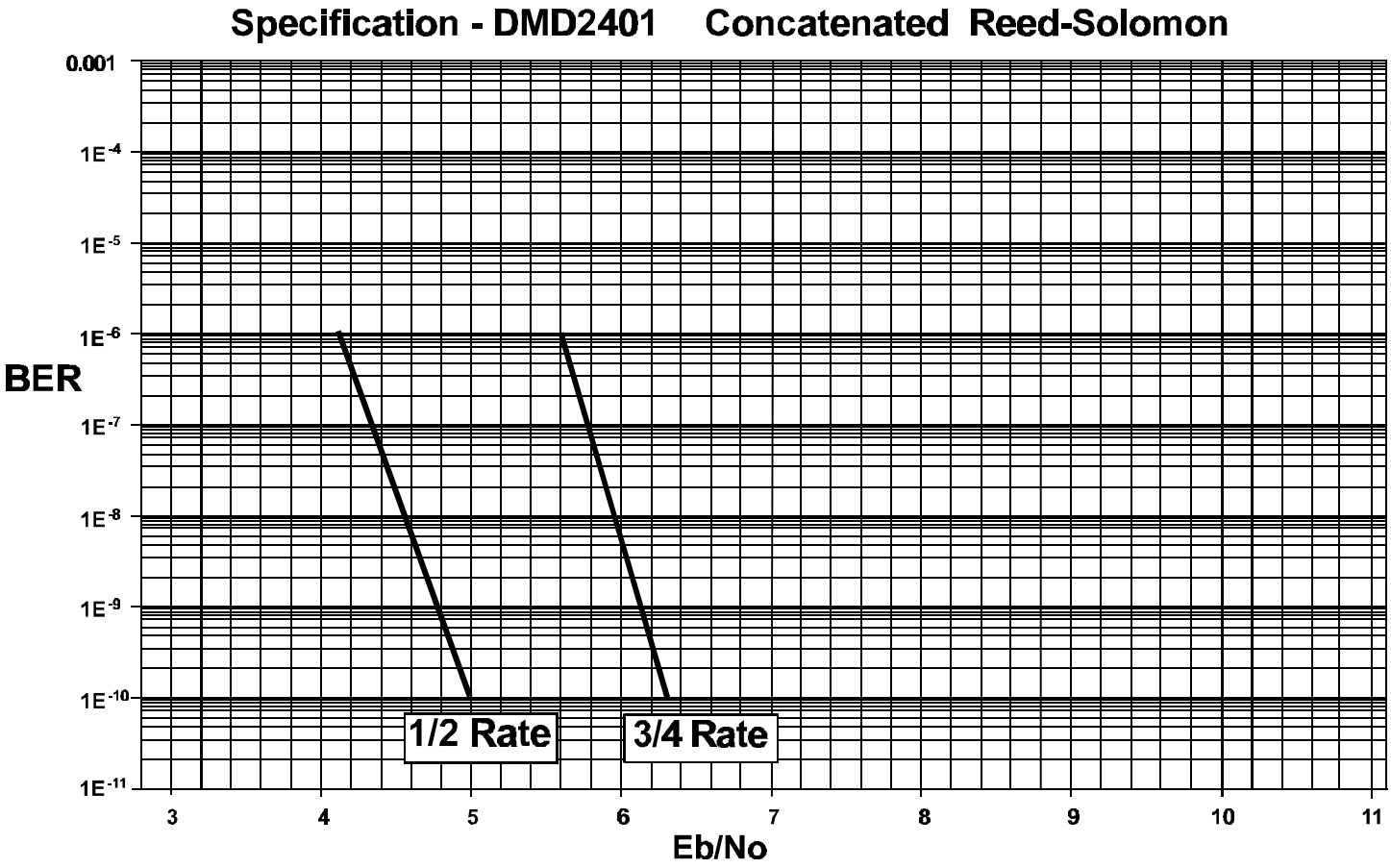
Table 4-3. DMD2401 TX Fault Matrix

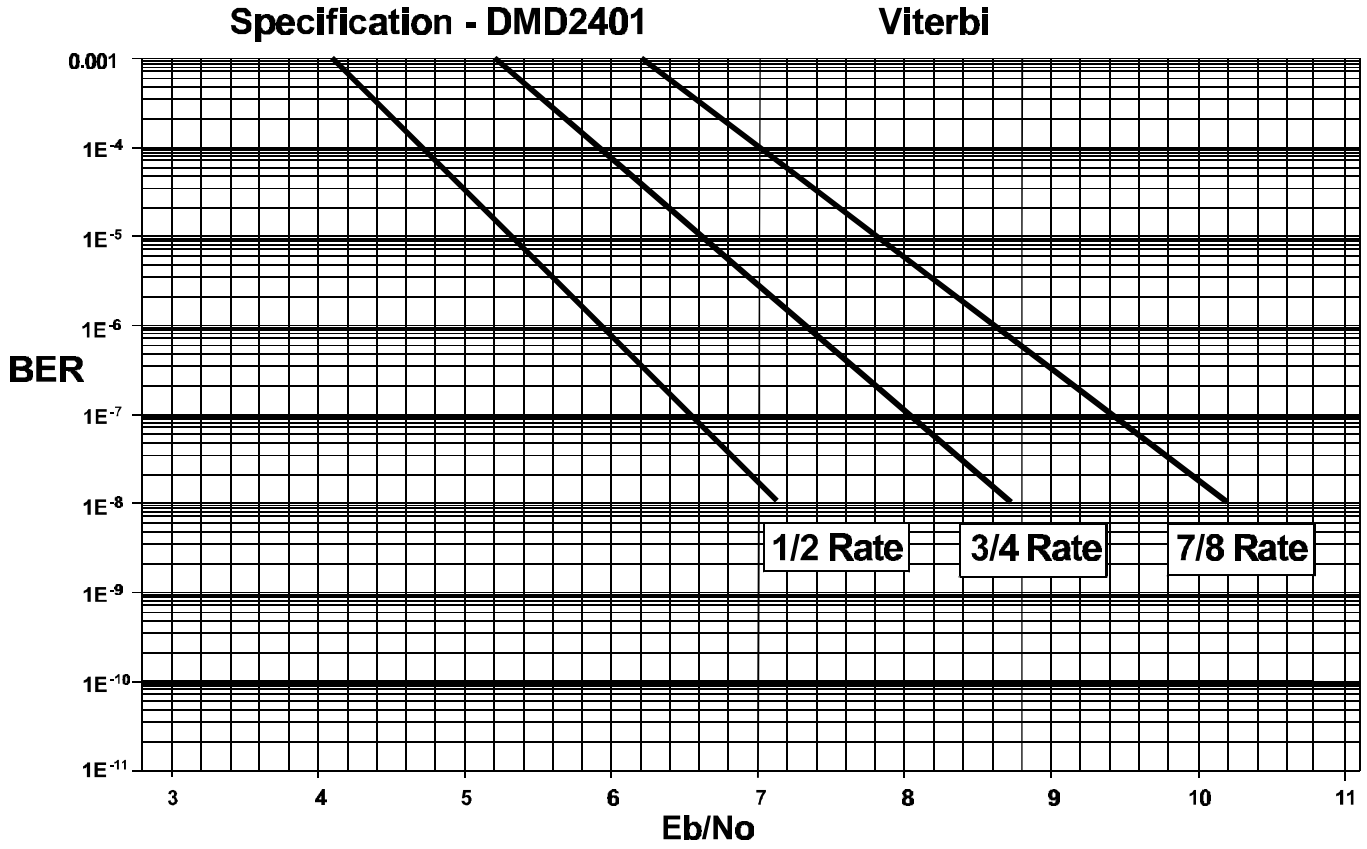
TX FAULTS	TX IF OUTPUT OFF	TX MINOR ALARM LED	TX MAJOR ALARM LED	TX AIS	RX FAULT LED	RX MINOR ALARM LED	RX MAJOR ALARM LED	RX AIS	MOD FAULT RELAY	DEMOD FAULT RELAY	MOD FAULT OPEN COLLECTOR	OVERRIDE TO INTERNAL REF
TX IF SYNTH UNLOCKED	x		x						x			
TX CLOCK ACT		x		x								
TX COMP CLK PLL UNLOCKED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

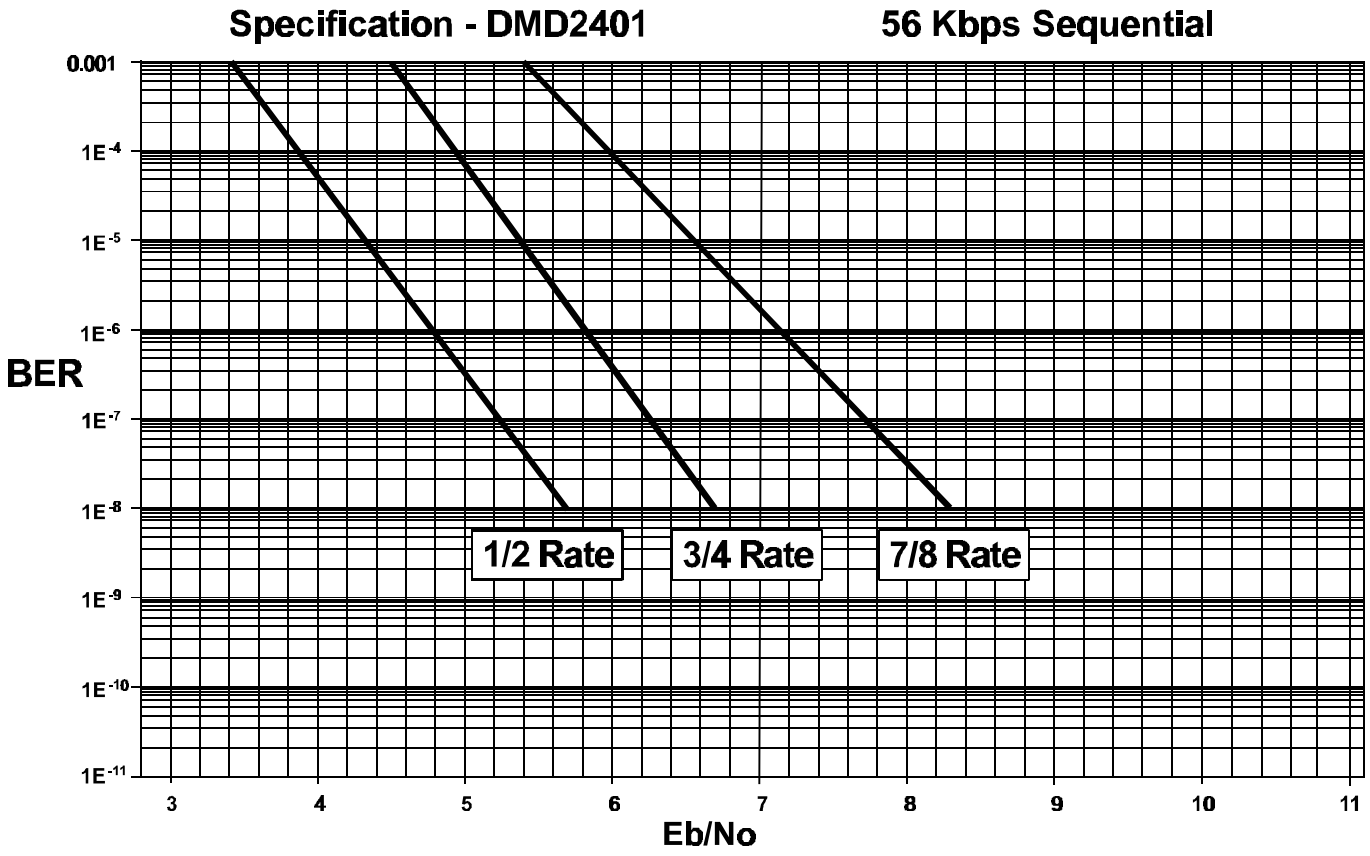
Applicable in Drop and Insert Only

Applicable In Drop and Insert Only

*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. When SCT is used as a reference, and activity is lost, the modem switches Tx reference to SCT


Specification - DMD2401 Concatenated Reed-Solomon
BER
0.001
1E-4
1E-5
1E-6
1E-7
1E-8
1E-9
1E-10
1E-11
1/2 Rate
3/4 Rate
3
4
5
6
7
8
9
10
11
Eb/No


Specification - DMD2401
Viterbi
BER
0.001
1E-4
1E-5
1E-6
1E-7
1E-8
1E-9
1E-10
1E-11
3
4
5
6
7
8
9
10
11
Eb/No
1/2 Rate
3/4 Rate
7/8 Rate


Specification - DMD2401
56 Kbps Sequential
0.001
1E-4
1E-5
1E-6
BER
1E-7
1E-8
1E-9
1E-10
1E-11
1/2 Rate
3/4 Rate
7/8 Rate
3
4
5
6
7
8
9
10
11
Eb/No

Section 5 – Ku-Band Outdoor Unit Installation Procedures

Introduction

This section provides instruction to integrate and install the 3100 Series Outdoor Unit (**ODU**) configured for 1-Watt, 2-Watt, 4-Watt, 8-Watt, 16-Watt or 25-Watts. Within this text **ODU** refers to any combination of the following elements: **BUC** (Block Upconverter), **SSPA** (Booster Amplifier) and **LNB** (Low Noise Block Downconverter). The combination of the noted elements is based upon the system configuration.

Adhere to the installation sequence listed in Table 5-1.

Table 5-1. Installation Sequence

Procedure	Section
Unpacking the System	5.1
Mechanical Inspection	5.1.1
Installation Tools	5.1.2
IFL Cable Installation Guidelines	5.2
General Cable Installation Considerations	5.2.1
Mounting the Typical 1, 2 or 4 Watt Outdoor Unit	5.3
Interface Connections for the 1, 2 or 4 Watt Outdoor Unit	5.4
Mounting the Typical 8 or 16 Watt Outdoor Unit	5.5
Interface Connections for the 8 or 16 Watt Outdoor Unit	5.6
Installation Verification	5.7

Unpacking the Outdoor Unit

Each product is completely assembled, tested and then shipped in its appropriate packaging. Care should be taken when removing equipment from the shipping container to prevent damage to the units. Ensure that all parts and accessories are removed from the shipping container and packing material.

Please DO NOT discard the container or any packing material until both a physical and mechanical inspection of the content has been performed. The container and packing material must be available if a damage claim is to be made with the carrier.

*Step 3. The **IDU** and **ODU** are shipped in separate cartons. Remove the **ODU** from its carton and verify the contents against the packing slip.*

Step 4. The cartons contain the necessary cable connectors, hardware, etc. required to interconnect the units.

Please adhere to the following procedure when unpacking the shipping container.

Step 3. Remove the tape from the cardboard box flap.

Step 4. Open the box and remove the top foam insert inside the carton.

Step 5. Carefully remove the equipment, manual and accessories.

Step 6. Check for loose components, bent or broken connectors and physical damage to the outside housing of the equipment.

Step 7. Store the cartons and wrapping material in an appropriate area for future use.

Step 5. If the shipping container is to be discarded, do not discard the cartons until the contents has been inspected and all material as been accounted for.

Step 6.

Mechanical Inspection

Inspect the equipment for mechanical shipping damage. Make sure that the equipment frame is free of damage and that no connectors, controls or indicators are broken, damaged or loose. Should any damage be discovered after unpacking the system, immediately file a claim with the carrier. A full report of the damage should be made and a copy forwarded to **Radyne ComStream**. **Radyne ComStream** will then advise on disposition of the equipment.

Inventory the Equipment

The equipment and accessories should be inspected for damage that may have occurred during shipment. If the containers are damaged notify **Radyne ComStream** and the freight carrier immediately. Inventory the equipment as follows:

Check the contents of the cartons against the packing slip provided or the list below, to ensure that the shipment is complete. The standard VSAT package should include:

Qty 1	Qty (1) 3130-0000 (3100 series) VSAT Indoor Unit (**IDU**)
Qty 1	Qty (1) 2-Watt 3110-000, 4-Watt 3111-000, 8-Watt 3112-0030 or 16-Watt 3113-0030 Outdoor Unit (**ODU**).
Qty 1	Qty (1) 2660-300X Low Noise Block (**LNB**)
Qty 1	Qty (1) 31XX Ancillary hardware / connector kit

Installation Tools

A list of basic tools required to complete installation of the VSAT Satellite System is provided for reference:

- ☞ Box end wrenches and/or crescent wrenches
- ☞ Phillips screwdriver
- ☞ Sealing tape (butyl rubber type) and plastic tape to protect / waterproof
- ☞ Antenna mounting hardware

IFL Cable Installation Guidelines

The lengths of the inter-connecting (IFL) cables will vary, the actual length will be determined by the site layout. Therefore, the user must supply the cables. The transmit inter-connection requires one double shielded 50Ω coaxial cable with a Type “N” Male Connector at each end. The receiver cable requires one 75Ω coaxial cable with a Type “N” Male Connector at the **IDU** end and a Type “F” Male at the **LNB** end.

For lengths up to 200 ft, RG-214 cable or equivalent is recommended for the TX side. Alternate cable types may be used so long as the attenuation at 1 GHz and the center conductor DC resistance is similar to RG-214 specifications. For lengths between 200 and 300 feet, a low loss foam dielectric cable such as Belden 9914 is required.

Such cable must have an insertion loss of less than 6 dB per 100 feet at 1 GHz and a center conductor DC resistance of less than 0.12 ohms per 100 feet.

Step 7. Refer to Table 5-2, IDU to ODU Interface Cable Requirements.

*Step 8. Failure to use the lower loss cable for extended lengths will result in significant reduction in **ODU** output power and excessive signal distortion.*

Table 5-2 IDU to ODU Interface Cable Requirements

Cable Type	Impedance	Loss per 100 Meters
RG-214	50 Ohms	36.6 dB
Belden 8214	50 Ohms	23.0 dB
Belden 9914	50 Ohms	19.7 dB

General Cable Installation Considerations

General guidelines to ensure that the **IDU** to **ODU** Coaxial Cables are properly prepared and installed are listed below:

1) Plan the route that the IFL cables will follow. Plan the route to minimize the cable length between the **IDU** and **ODU**. Keep in mind that approximately five feet at both ends should be added for drip loops and service loops.

2) Ensure that a strain relief is added to both cable connections.

3) Ensure that the external connector is sealed and waterproofed.

4) When running the cable between the **IDU** and **ODU**, follow standard installation practices. Avoid sharp corners. Secure the cable to the tower members, cable runways or other using hangers or manufacturer's approved tie-wraps at one meter (three-foot) intervals.

5) Ensure that the center pin of the type "N" male connector does not protrude beyond the inner metal ground shield. An improper terminated cable will damage the mating connectors of the **IDU** and **ODU**.

Mounting the Typical 1, 2 or 4 Watt Outdoor Unit

The following diagram and instructions pertain to mounting a 3100 Series **ODU** and **LNB** to an antenna using a **Radyne ComStream** supplied mounting plate. The mounting plate along with the miscellaneous hardware kits are not provided with the system unless specified or requested per the USER purchase order.

ODU Mounting Kits

BUC Mounting Kit Description (3110-0003)

The **BUC** mounting kit provides the mechanical support hardware for mounting the **BUC** to a Prodelin offset feed dish with aperture size of 1.8m, 2.4m and 3.8m.

Step 9. Refer to Figure 5-1 and Table 5-3.

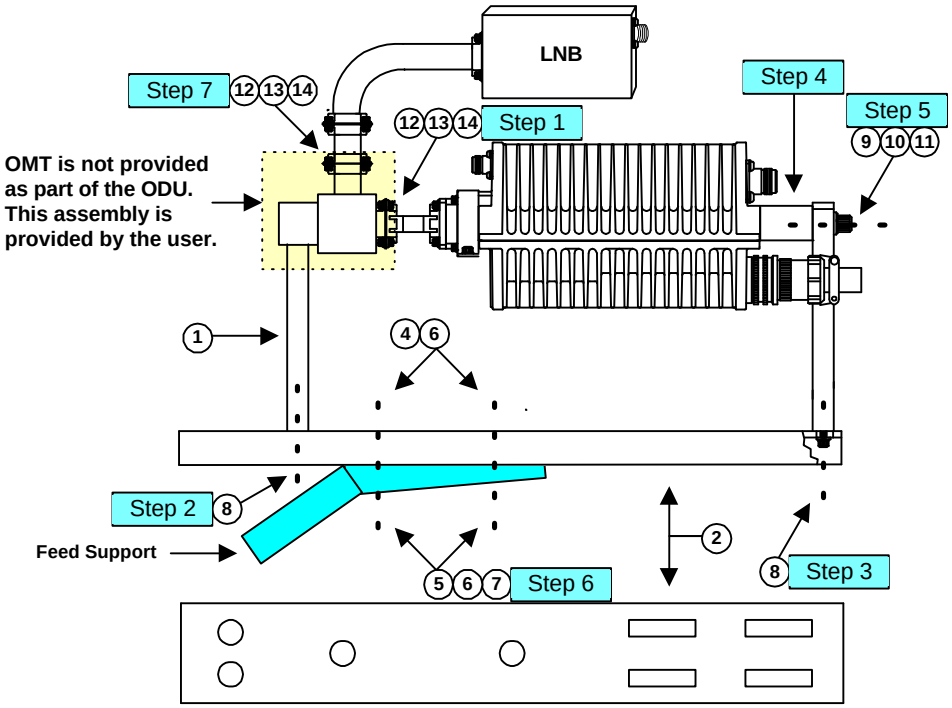
BUC Miscellaneous Hardware Kit Description (3110-0001)

The **BUC** miscellaneous hardware kit contains the hardware and "O" ring for connecting a **BUC** to a feed system. This hardware is separate from the mounting kit described above since this hardware is required for all types of antenna systems.

Attaching the ODU (BUC) / Feed Assembly

This document describes the steps required to assemble and integrate the **Radyne ComStream** Ku-Band **BUC** to a Prodelin antenna system. This document does not describe the installation instructions for the antenna system. Please refer to antenna manufacturer's manual. The following steps outline the procedure to attach the **Radyne ComStream BUC** and **LNB** to the antenna feed support.

Figure 5-1. ODU (BUC) Mounting Configuration



Step 1. Insert one “O” Ring (item 12) into the grooved flange of the ODU output flange. Attach feed assembly (horn and OMT) to the output flange of the **BUC** as shown in Figure 4-1, using four each #6 lock washers (item 14) and 6-32x5/8 screws (item 13). Loosely insert all four screws then tighten securely.

Step 8. Attach the horn support mount (item 1) to the mounting plate using two 1/4-20 flat head screws (item 8). Tighten screws securely.

Step 9. Attach the **BUC** rear support plate (item 2) to the mounting plate using two 1/4-20 flat head screws (item 8). Tighten screws securely.

Step 10. Place feed assembly and **BUC** on the mounting plate. The “neck” of the horn should sit in the cradle of the horn support. Secure horn with top strap and 1/4-20 bolts and lock washers (**provided with antenna system**). Finger tighten bolts.

Step 11. Attach the **BUC** to the rear support plate using one each 3/8 flat washer (item 11), 3/8 lock washer (item 10) and 3/8-16 bolt (item 9).

*Step 10.**Radyne ComStream** does not provide the OMT assembly. **Radyne ComStream** can provide the transmit reject filter as an option.*

Table 5-3 ODU (BUC) / Feed Parts List

Item #	Part #	Description	Qty
1	3110-1032	MTG PLATE, HORN SUPPORT	1
2	3110-1033	MTG PLATE, **BUC** REAR SUPPORT	1
3	3110-1034	MOUNTING PLATE	1
4	2400-3043-5608	SCRHEXHD 5/16-18 X 1.0”	2
5	2400-3044-140	WASHER, LOCK 5/16	2
6	2400-3045-813	WASHER, FLAT 5/16 OD .88	4
7	2400-3047-009	HEX NUT 5/16-18	2
8	2400-3040-1407	SCR82FL ¼-20 X ¾	4
9	2400-3043-3808	SCRHEXHD 3/8-16 X 1.25”	1
10	2400-3044-141	WASHER, LOCK 3/8	1
11	2400-3045-814	WASHER, FLAT 3/8 OD .81	1
12	MS9068-025	“O” -RING	2
13	2400-3038-610	SCRPNHD 6-32X5/8	4
14	2400-3044-136	WASHER. LOCK #6	4
15	DIN912-M4X14MM	SCREW SOC HD	4
16	DIN127-M4	WASHER, LOCK M4	4

*Step 11.Items 1-8, 12, 15-16 are part of the **BUC** Mounting Kit Part Number 3110-0003.*

*Step 12.Items 9-11 and 13-14 are part of the **BUC** Miscellaneous Hardware Kit Part Number 3110-0001.*

Step 12. Place the feed / **BUC** assembly onto the antenna feed support and secure using two 5/16-18x1 hex screws (item 4), four 5/16 flat washers (item 6), two 5/16 lock washers (item 5) and two 5/16-18 hex nuts (item 7). Tighten securely.

Step 13. Insert one “O” Ring (item 12) into the grooved flange of the transmit reject filter. Attach transmit reject filter and **LNB** to the receive port of the OMT using four each lock washers (item 16) and socket screws (item 15).

Step 14. Adjust the feed / **BUC** / **LNB** assembly to set the desired polarization. Tighten the horn strap and **BUC** rear mount bolt securely.

Step 15. The RF head assembly is complete. Refer to antenna system and VSAT system operation manuals for antenna alignment and system operation.

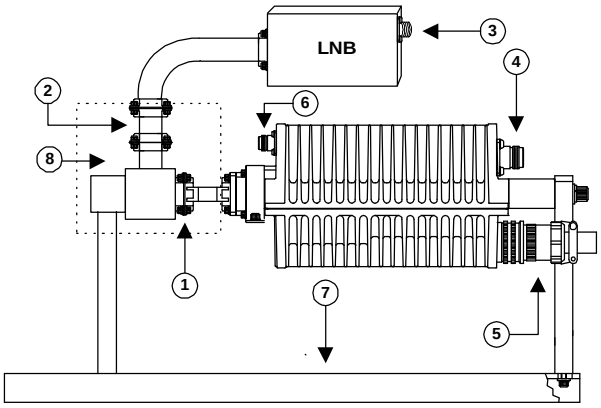
Interface Connections for the 1, 2, or 4 Watt ODU (BUC)

The following describes the various "USER" connections located on the 1-Watt, 2-Watt, or 4-Watt **ODU** (**BUC**).

1. WR75 Waveguide Flange, Grooved
Function: **ODU (BUC)** RF Output port

2. WR75 Transmit Reject Filter (Optional)
Function: Ku-Band RF Connection to Reject Filter

3. Male Type "F" Female Connector
Function: **LNB** Interface for L-Band Output connection to **IDU**



BUC3.VSD

*Step 13.Provides +15 Vdc source for **LNB** from **IDU**.*

Step 14.Refer to Section 5.2, IFL Cable Installation Guidelines.

Step 15.Refer to Section 5.2.1, General Cable Installation Considerations prior to installing the cable.

Step 16.Refer to Table 5-2, IDU to ODU Interface Cable Requirements.

4. Female Type "N" Connector

Function: ODU (**BUC**) Interface for L-Band Input connection from **IDU**

*Receives the modulated L-Band (950 - 1450 MHz) signal from **IDU**.*

Interface for a 10 MHz reference, 48 Vdc power, and an FSK monitor and control (M&C) link.

Refer to Section 5.2, IFL Cable Installation Guidelines.

Step 17.Refer to Section 5.2.1, General Cable Installation Considerations prior to installing the cable.

Step 18.Refer to Table 5-2, IDU to ODU Interface Cable Requirements.

5. SSPA I/F / RS-485 / 48Vdc

Function: Input for 48 Vdc Source and RS-485 communications

Used to route 48 Vdc and the RS-485 communication channel between the **ODU (BUC)** and **SSPA**.

Pins A, C, D, E, H, N, P, and T: Not Used

Pin B MISO

Pin F PIC_CLK

Pin G SS

Pin J GND (Ground) *See Note 1*.

Pin K +48 Vdc, *See Note 1*.

Pin L +48 Vdc, *See Note 1*.

Pin M GND (Ground) *See Note 1*.

Pin R MOSI

Pin S PIC_SEL

Step 19.Note 1: Pins J, K, L and M are not used (Not Connected) when DC power is applied to the unit via the IFL coaxial cable center conductor. It is important to note that when DC power is applied via the IFL coaxial cable center conductor that pins K & L have +48 vdc present.

6. Female type "TNC" Connector

Function: Optional **LNB** Interface 10 MHz reference and 15 Vdc or 12 Vdc Source

7. ODU (BUC) Mounting Kit

Function: Attaching **ODU** and **LNB** to antenna mounting structure

8. OMT / Reject Filter Assembly

Radyne ComStream does not provide this assembly. **Radyne ComStream** can provide the transmit reject filter as an option.

Mounting the Typical 8-Watt / 16-Watt Outdoor Unit (BUC)

The following diagram and instructions pertain to mounting an 8-Watt or 16-Watt **ODU** (**BUC**) to an antenna using a **Radyne ComStream** supplied mounting plate and hardware kits.

The 8-Watt or 16-Watt Outdoor Unit is pre-assembled as shown in **Figure 5-2**. The User antenna type and design determine the mounting location of this assembly. The flexible waveguide is not provided with the mounting kit.

Figure 5-2. 8-Watt / 16-Watt Mounting

Insert Figure 5-2.

Table 5-4 Offset Mounting Kit (3110-0002)

Item	Part #	Description	Qty
1	MS9068-022	“O” Ring Parker	1
2	2400-3038-610	SCRPNHD 6-32x5/5 LG	8
3	2400-3044-136	Washer, Medlock NO. 6	8
4	36015	U-Bolt	2
5	2400-3044-141	Washer, Medlock 3/8	4
6	2400-3045-814	Washer, FL 3/8 OD. 81	4
7	2400-3047-010	Nut, Plain Hex 3/8-16	4

Step 20. Important: Make sure that the “O” Ring is installed and that the waveguide flange is properly sealed to prevent moisture from entering the waveguide.

Step 2. First secure the bottom section of the **ODU** mounting assembly by placing the **ODU** (**BUC**) mounting assembly onto the diagonal support member and secure using (1) U-Bolt and noted hardware.

Step 3. Secure the top section of the **ODU** (**BUC**) mounting assembly onto the cross member (support pole/pipe) and secure using (1) U-Bolt and noted hardware.

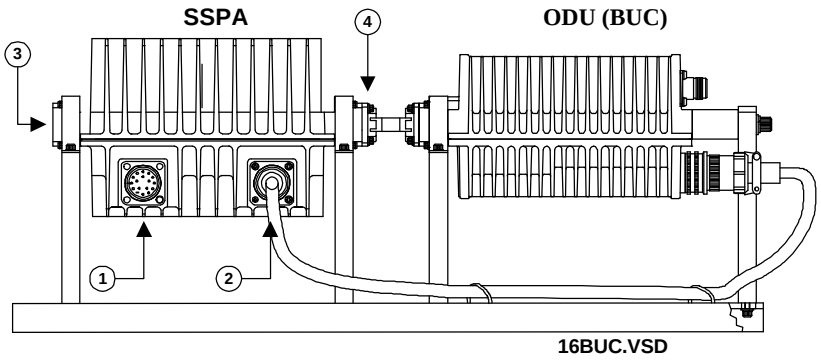
Step 4. If applicable, attach flexible waveguide between the **ODU** (**BUC**) and feed assembly using the hardware noted.

Interface Connections for the 8-Watt / 16-Watt ODU (BUC)

The following describes the various “USER” connections located on the 8-Watt and 16-Watt **ODU** (**BUC**).

*Step 21. This section provides information pertaining to the **SSPA** interface connections. Refer to **Section 5.4 for ODU (BUC) Interface Connections**.*

Figure 5-3 8-Watt / 16-Watt ODU BUC Connector Details.



1. 48Vdc / RS-485 Port

Function: 48 Vdc Interface from **AMP Controller**

Step 22.16-Watt Configuration ONLY.

*Step 23.**Radyne ComStream** does not provide the **AMP Controller** to **SSPA** 48 Vdc Cable assembly as part of these systems, only cable connectors are provided. Refer to **Table 4-5** for cable wiring information.*

Table 5-5 Wiring for 48 Vdc Connector to SSPA

Pin Assignment		
Amp Controller	**SSPA**	**Description**
Pin 1	Pin K	+48 Vdc
Pin 2	Pin L	+48 Vdc
Pin 3	Pin J	GND
Pin 4	Pin M	GND
* Remaining pins are not used.		

Step 24.Recommendation: Use AWG 18 or lower shielded multi-conductor cable.

Step 25.Recommendation: Connect the shields to the ground pins on either end of the cable to minimize radiated susceptibility and emissions.

2. BUC / SSPA Interface Port

Function: Provides the serial interface for communications between the **BUC** and **SSPA**. When configured as an 8-Watt system the 48 Vdc source voltage for the **SSPA** is routed through this port. When configured as a 16-Watt system the **AMP Controller** provides the 48 Vdc source voltage.

3. WR75 Waveguide Flange, Grooved

Function: **SSPA** RF Output port to antenna feed

4. Female Type "N" Connector

Function: **ODU** (**BUC**) Interface for L-Band Input connection from **IDU**

*Step 26. Receives the modulated L-Band (950 - 1450 MHz) signal from **IDU**.*

Step 27. Interface for a 10 MHz reference, 48 VDC power, and an FSK monitor and control (M&C) link.

Step 28. Refer to Section 5.2, IFL Cable Installation Guidelines.

Step 29. Refer to Section 5.2.1, General Cable Installation Considerations prior to installing the cable.

Step 30. Refer to Table 5-2, IDU to ODU Interface Cable Requirements.

Installation Verification

Verify that the following parameters have been adhered to while installing the unit.

6) All equipment located around or mounted directly on the antenna are bonded together and grounded to a proper earth ground.

7) The unit is located in a manner that allows ease of service.

8) The unit is properly secured in place.

9) All outdoor cable connections are properly seated, secured and waterproofed. A connector strain relief has been added to each cable end.

C-Band Outdoor Unit Installation Procedures

About this section

This section provides instruction to integrate and install the 3100 Series C-band Outdoor Unit (**ODU**) configured for any power level. Within this text **ODU** refers to any combination of the following elements: **BUC** (Block Upconverter), **SSPA** (Booster Amplifier) and **LNB** (Low Noise Block Downconverter). The combination of the noted elements is based on the system configuration.

Step 31.Adhere to the installation sequence listed in Table 4-1.

Table 4-6Installation Sequence

Procedure	Section
Unpacking the System	***4.1***
Mechanical Inspection	***4.1.1***
Installation Tools	***4.1.2***
IFL Cable Installation Guidelines	***4.2***
General Cable Installation Considerations	***4.2.1***
Mounting the Typical 5 Watt C-band Outdoor Unit	***4.3***
Interface Connections 5 Watt C-band Outdoor Unit	***4.4***
Mounting the Typical 10 Watt or higher C-band Outdoor Unit	***4.5***
Interface Connections for the 10 Watt or higher C-band Outdoor Unit	***4.6***
Installation Verification	***4.7***

Unpacking the Outdoor Unit

Ensure that all parts and accessories are removed from the shipping container and packing material. Please DO NOT discard the container or any packing material until both a physical and mechanical inspection of the content has been performed. The container and packing material must be available if a damage claim is to be made with the carrier.

*Step 32.The **IDU** and **ODU** are shipped in separate cartons. For higher power applications, the BUC/Booster are usually mounted and shipped together in a single carton. The cartons contain the specified cable connectors, hardware, etc. depending on the system configuration as ordered.*

Step 33.

Mechanical Inspection

Inspect the equipment for mechanical shipping damage. Make sure that the equipment frame is free of damage and that no connectors, controls or indicators are broken, damaged or loose. Should any damage be discovered after unpacking the system, immediately file a claim with the

carrier. A full report of the damage should be made and a copy forwarded to **Radyne ComStream**. **Radyne ComStream** will then advise on disposition of the equipment.

Step 34. *Subject to terms of the Service Policy, **Radyne ComStream** will repair all defective equipment. A Return Material Authorization number must accompany material forwarded to **Radyne ComStream**. To obtain an RMA number, call Customer Service at (602) 437-9620.*

Inventory the Equipment

The equipment and accessories should be inspected for damage that may have occurred during shipment. If the containers are damaged notify **Radyne ComStream** and the freight carrier immediately. Inventory the equipment as follows:

Check the contents of the cartons against the packing slip provided or the list below, to ensure that the shipment is complete. The standard VSAT package should include:

Qty (1) 3130-0000 (3100 series) VSAT Indoor Unit (**IDU**)
Qty (1) 3100 Series Outdoor Unit (**ODU**)
Qty (1) Low Noise Block (**LNB**)
Qty (1) Ancillary hardware kit
(Optional Booster and Amp Controller and connector kit as required)

Installation Tools

A list of basic tools required to complete installation of the VSAT Satellite System is provided for reference:

1) Box end wrenches and/or crescent wrenches
2) Phillips blade screwdriver
3) Sealing tape (butyl rubber type) and plastic tape to protect / waterproof
4) Antenna mounting hardware

IFL Cable Installation Guidelines

The interface between the Indoor Unit and Outdoor Unit is accomplished using two coaxial cables. The length of the (IFL) cables will depend on the site layout.

Step 35. *It is important to note that **Radyne ComStream** does not provide the IFL interface cables between the **IDU** and **ODU**. The User must supply these cables.*

The TX IFL inter-connection requires one double shielded 50Ω coaxial cable with a Type “N” Male Connector at each end. The RX IFL inter-connection requires one 50Ω or 75Ω-coaxial cable with a Type “N” Male Connector at the **IDU** end and a Type “F” Male at the **LNB** end.

For lengths up to 200 ft, RG-214 cable or equivalent is recommended for the IFL cables. Alternate cable types may be used as long as the attenuation at 1 GHz and the center conductor DC resistance is similar to RG-214 specifications. For lengths between 200 and 300 feet, a low

loss foam dielectric cable such as Belden 9914 is required. Such cable must have an insertion loss of less than 6 dB per 100 feet at 1 GHz and a center conductor DC resistance of less than 0.12 ohms per 100 feet.

Step 36. Refer to Table 4-2, IDU to ODU Interface Cable Requirements.

*Failure to use the lower loss cable for extended lengths will result in significant reduction in **ODU** output power and excessive signal distortion.*

Table 4-7 IDU to ODU Interface Cable Requirements

Cable Type	Impedance	Loss per 100 Meters
RG-214	50 Ohms	36.6 dB
Belden 8214	50 Ohms	23.0 dB
Belden 9914	50 Ohms	19.7 dB

General Cable Installation Considerations

General guidelines to ensure that the **IDU** to **ODU** Coaxial Cables are properly prepared and installed are listed below:

1) Plan the route that the IFL cables will follow. Plan the route to minimize the cable length between the **IDU** and **ODU**. Keep in mind that approximately five feet at both ends should be added for drip loops and service loops.

2) Ensure that a strain relief is added to both cable connections.

3) Ensure that the external connector is sealed and waterproofed.

4) When running the cable between the **IDU** and **ODU**, follow standard installation practices. Avoid sharp corners. Secure the cable to the tower members, cable runways or other using hangers or manufacturer's approved tie-wraps at one meter (three-foot) intervals.

5) Ensure that the center pin of the type "N" male connector does not protrude beyond the inner metal ground shield. An improper terminated cable will damage the mating connectors of the **IDU** and **ODU**.

Mounting the Typical 5-Watt C-Band Outdoor Unit

The following diagram and instructions pertain to mounting a 3100 Series C-band **ODU** and **LNB** to an antenna using a **Radyne ComStream** supplied mounting plate. The mounting plate along with the miscellaneous hardware kits are not provided with the system unless specified or requested per the USER purchase order.

Prodelin Antenna BUC Mounting Kit (C-band 3120-0004)

The **BUC** mounting kit provides the mechanical support hardware for mounting the C-band **BUC** to a Prodelin offset feed dish with aperture size of 1.8m, 2.4m and 3.8m. This top assembly kit contains the 3120-0001 **BUC** Misc. Hardware Kit and the 0200-935 Antenna Support Kit.

Step 37.Refer to Figure 4-1 and Table 4-3.

BUC Misc. Hardware Kit Description (C-band 3120-0001)

The **BUC** miscellaneous hardware kit contains the hardware and gasket for connecting a **BUC** to a feed system.

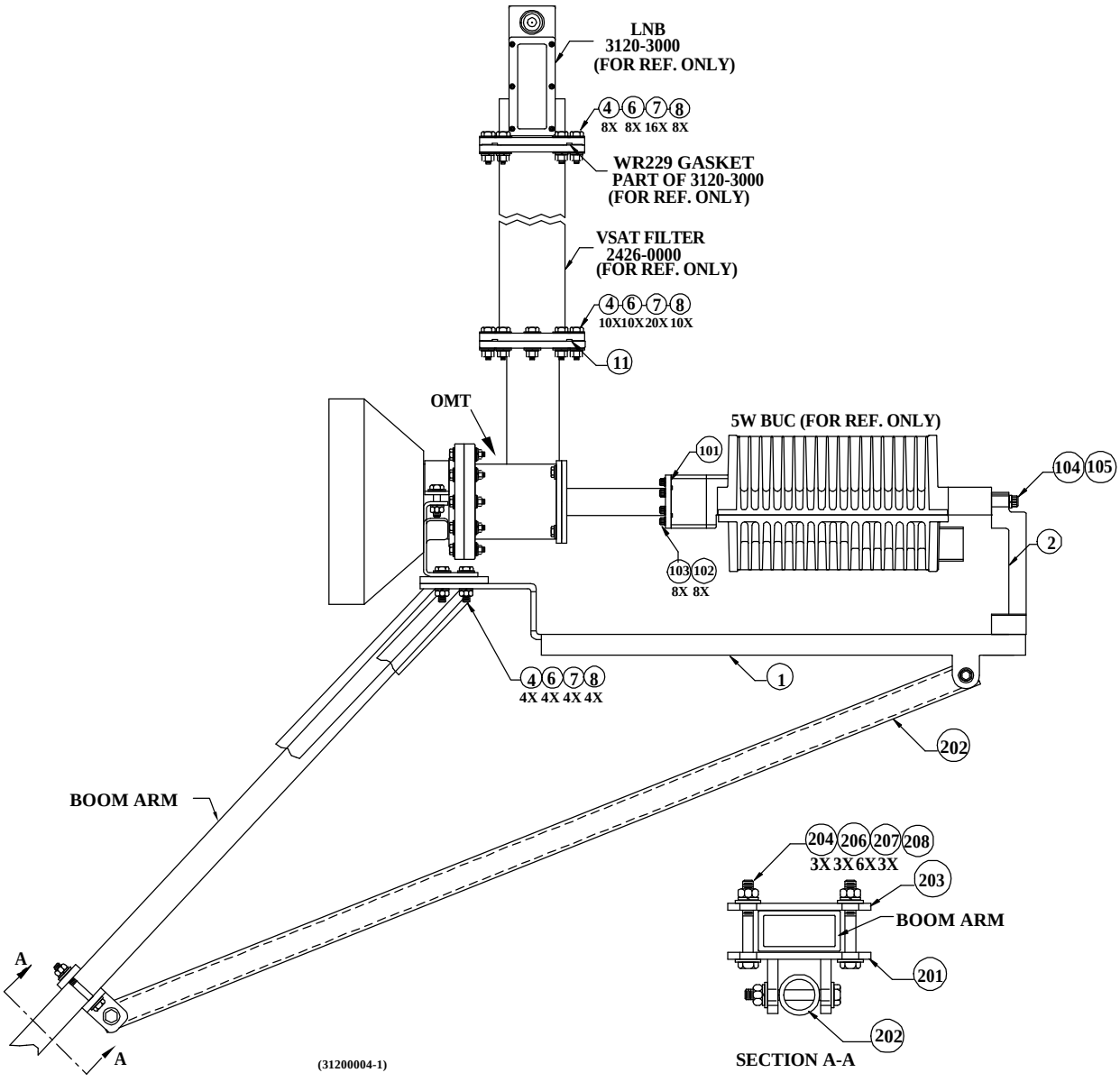
Antenna Support Kit Description (0200-935)

The antenna support hardware kit contains the hardware and bracket assemblies required to properly support the weight of the BUC and feed assembly.

Attaching the ODU (BUC) / Feed Assembly

This installation procedure describes the steps required to install the **Radyne ComStream** C-Band **BUC** to a Prodelin antenna system. This manual does not describe the installation instructions for the antenna system. Please refer to antenna manufacturers manual. The steps outlined below are used to attach the **Radyne ComStream BUC** and **LNB** to the feed assembly and secure to the antenna feed support.

Figure 4-4. C-Band BUC to Prodelin Antenna Mounting Configuration



Step 38.Refer to Table 4-1 for parts list and Figures 4-1, 4-2 and 4-3 for assembly drawing.

Step 5. Insert one Gasket (item 101) into the grooved flange of the ODU output flange. Attach feed assembly (horn and OMT) to the output flange of the **BUC** as shown in **Figure 4-1**, using quantity eight each 10-32x5/8 screws (item 102) #10 lock washers (item 103). Loosely assemble all screws and washers then tighten securely.

Step 6. Attach the Transmit Reject Filter and LNB to the receive port of the OMT as shown in **Figure 4-1**.

Step 16. Attach the **BUC** Tail Mount Bracket (item 2) to the mounting plate (item 1) using hardware (items 6, 7 & 14) as shown in **Figure 4-2**. Tighten screws securely.

Step 17. Assemble Mounting Plate (item 1) to the Boom Arm with the Feed Support Bracket (both supplied with antenna) using hardware (items 4, 6, 7 & 8) as shown in **Figure 4-1**.

Step 18. Install Bracket Assembly (item 201) and Mounting Plate (item 203) to the Boom Arm using Hardware (items 204, 206, 207, 208) as shown in **Section A-A, Figure 4-1**. *Do not tighten hardware at this stage*.

Step 19. Attach the support brace (item 202) to the mounting plate (item 1) as shown in **Figure 4-2**. Please note, some kits may require additional support brackets, (item 15), to attach the support brace to the mounting plate, see **Figure 4-3**.

Step 20. Attach the bottom of the Support Brace (item 202) to the Boom Arm using the mounting assembly installed in Step 5 as shown in **Section A-A, Figure 4-1.** Loosely assemble all screws, nuts and washers then tighten securely.

Step 21. Place feed assembly and **BUC** on the mounting plate. The "neck" of the horn should sit in the cradle of the horn support. Attach the **BUC** to the rear support plate using one each 3/8-16 bolt (item 104), 3/8 lock washer (item 105) and 3/8 flat washer (item 106). Do not tighten completely.

Step 22. Secure horn with top strap and 1/4-20 bolts and lock washers (**provided with antenna system**). Finger-tighten bolts.

Step 23. Adjust the feed / **BUC** / **LNB** assembly to set the desired polarization. Tighten the horn strap and **BUC** rear mount bolt securely. The RF head assembly is complete. Refer to antenna system and VSAT system operation manuals for antenna alignment and system operation.

*Step 39.**Radyne ComStream** does not provide the OMT assembly. **Radyne ComStream** can provide the transmit reject filter as an option.*

Table 4-8C-Band ODU (BUC) / Feed Parts List

(3120-0004)

Item #	Part #	Description	Qty
1	3120-1032	MTG PLATE, HORN SUPPORT	1
2	3110-1042	BRACKET-OFFSET, BUC TAIL MOUNT	1
3	0200-935	PRODELIN SUPPORT KIT (See Below)	1
4	2400-3034-1409	SCRHEXHD 1/4-20X1.0”	22
6	2400-3044-139	WASHER, MEDLOCK, 1/4	24
7	2400-3045-810	WASHER, FLAT 1/4 OD.62	42
8	2400-3047-008	NUT,PLAIN HEX 1/4-20	22
11	22117P2	GASKET, WR229	1
13	3120-0001	MISC. KIT (See Below)	1
14*	2400-3039-1408	SCRSKTHD, 1/4-20X7/8LG	2
15*	3120-5610	BRACE, SUPPORT	2

(3120-0001)

101	16267P2	GASKET	1
102	2400-3039-1008	SCRSKTHD 10-32X5/8LG	8
103	2400-3044-138	WASHER, MEDLOCK #10	8
104	2400-3043-3808	SCRHXHD 3/8-16X1LG	1
105	2400-3044-141	WASHER, MEDLOCK 3/8	1
106	2400-3045-814	WASHER, FLAT 3/8 OD.81	1

(0200-935)

201	0490-588	BRACKET ASSY, MTG	1
202	0490-667	SUPPORT BRACE	1
203	0156-058	PLATE, MTG	1
204	2400-3043-1416	SCRHEXHD 1/4-20X2LG	3
205	2400-3043-1418	SCRHEXHD 1/4-20X2.5LG	1
206	2400-3044-139	WASHER, MEDLOCK, 1/4	6
207	2400-3045-811	WASHER, FLAT 1/4 OD .73	12
208	2400-3047-008	NUT,PLAIN HEX 1/4-20	6
209	2400-3043-1408	SCRHXHD, 1/4-20X7/8LG	2

* May not be supplied with all kits.

Figure 4-2 C-Band ODU (BUC) Mounting Configuration End View

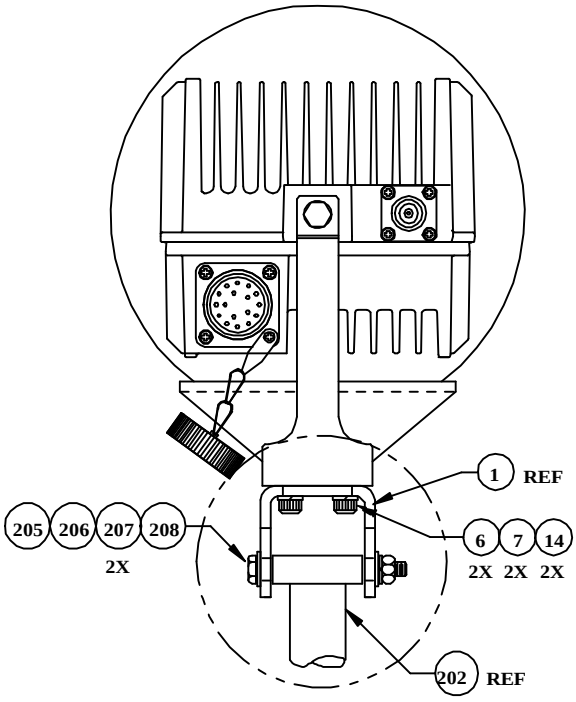
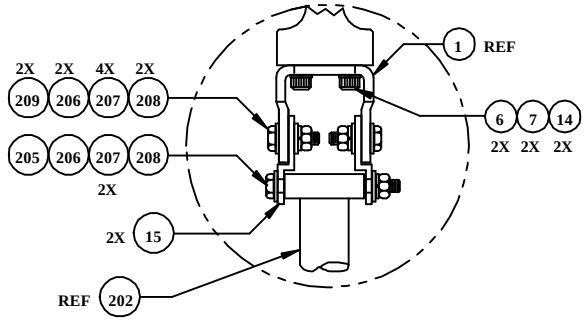


Figure 4-3 Alternate Mounting for Narrow Bracket



DETAIL B
(FOR NARROW ITEM 1 MOD. ONLY)

Interface Connections for the 5-Watt Ku-band ODU (BUC)

The following describes the various "USER" connections located on the 5-Watt C-band **ODU** (**BUC**).

1

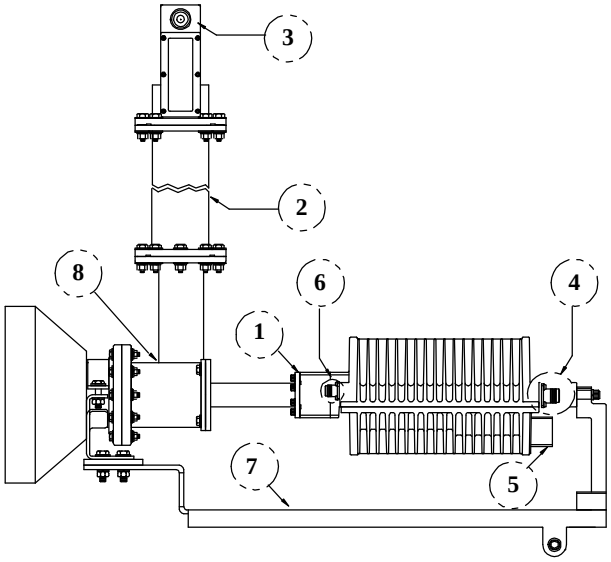
WR137 Waveguide Flange, Grooved
Function: **ODU (BUC)** RF Output port

2

CPR229Transmit Reject Filter (Optional)
Function: C-Band RF Connection to Reject Filter

3

Male Type "F" Female Connector
Function: **LNB** Interface for L-Band Output connection to **IDU**



*Step 40.Provides +15 VDC source for **LNB** from **IDU**.*

Step 41.Refer to Section 4.2, IFL Cable Installation Guidelines.

Step 42.Refer to Section 4.2.1, General Cable Installation Considerations prior to installing the cable.

***Step 43.**Refer to Table 4-2, IDU to ODU Interface Cable Requirements.*

4

Female Type "N" Connector

Function: **ODU** (**BUC**) Interface for L-Band Input connection from **IDU**

*Step 44.Receives the modulated L-Band (950 - 1525 MHz) signal from **IDU**.*

Step 45.Interface for a 10 MHz reference, 48 VDC power, and an FSK monitor and control (M&C) link.

Step 46.Refer to Section 4.2, IFL Cable Installation Guidelines.

Step 47.Refer to Section 4.2.1, General Cable Installation Considerations prior to installing the cable.

Step 48.Refer to Table 4-2, IDU to ODU Interface Cable Requirements.

5

SSPA - RS-485 / 48 Vdc

Function: Input for 48 Vdc Source and RS-485 communications.

Used to route 48 Vdc and the RS-485 communication channel between the **ODU (BUC)** and **SSPA**.

Pins A, C, D, E, H, N, P, and T: Not Used

Pin B MISO

Pin F PIC_CLK

Pin G SS

Pin J GND (Ground) *See Note 1*.

Pin K +48 Vdc, *See Note 1*.

Pin L +48 Vdc, *See Note 1*.

Pin M GND (Ground) *See Note 1*.

Pin R MOSI

Pin S PIC_SEL

Step 49.Note 1: Pins J, K, L and M are not used (Not Connected) when DC power is applied to the unit via the IFL coaxial cable center conductor. It is important to note that when DC power is applied via the IFL coaxial cable center conductor that pins K & L have +48 Vdc present.

6

Female type "TNC" Connector

Function: Optional **LNB** Interface 10 MHz reference and 15 Vdc or 12 Vdc Source for externally phase locked LNBs.

7

ODU (BUC) Mounting Kit

Function: Attaching **ODU** and **LNB** to antenna mounting structure

8

OMT / Reject Filter Assembly

Radyne ComStream does not provide this assembly. **Radyne ComStream** can provide the transmit reject filter as an option.

Mounting the Typical C-Band High Power Outdoor Unit Assembly

The following diagram and instructions pertain to mounting a 10-Watt, 20-Watt, 40-Watt or 60-Watt **ODU** (**BUC**) to an antenna using a **Radyne ComStream** supplied mounting plate and hardware kits.

The Outdoor Unit is pre-assembled as shown in **Figure 4-3**. The User antenna type and design determine the mounting location of this assembly. Refer to **Table 4-4** for the mounting kit parts list. The flexible waveguide is not provided with the mounting kit.

Table 4-9Offset Mounting Kit (3120-0002)

Item	Part #	Description	Qty
1	16267P2	Gasket	2
2	2400-3038-1008	SCRPNHD 10-32x5/8 LG	16
3	2400-3044-138	Washer, Medlock NO. 10	16
4	36015	U-Bolt	2
5	2400-3044-141	Washer, Medlock 3/8	4
6	2400-3045-814	Washer, FL 3/8 OD. 81	4
7	2400-3047-010	Nut, Plain Hex 3/8-16	4

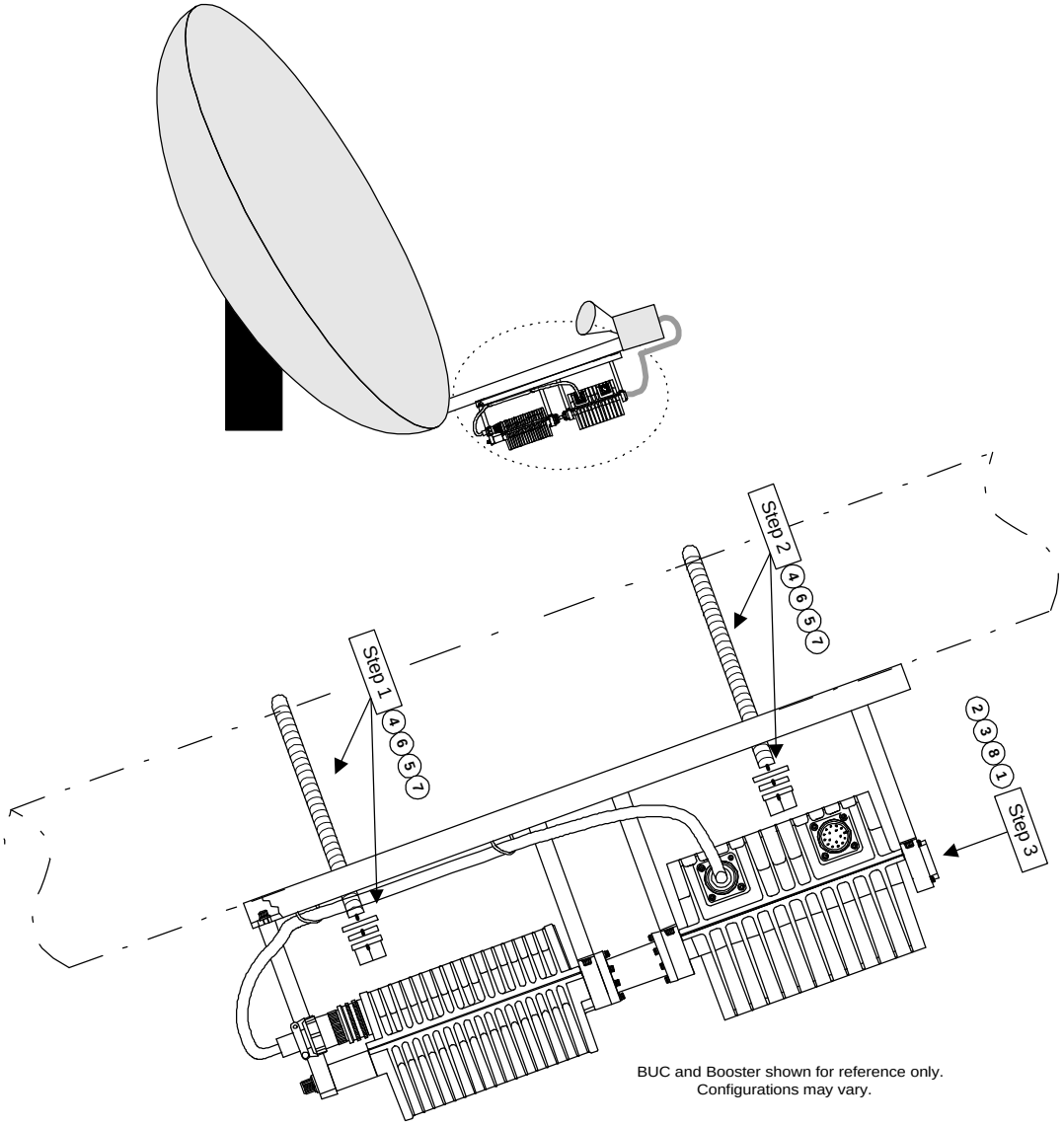
Step 50.Important: Make sure that the Gasket is installed and that the waveguide flange is properly sealed to prevent moisture from entering the waveguide.

Step 7. First secure the bottom section of the **ODU** mounting assembly by placing the **ODU** (**BUC**) mounting assembly onto the diagonal support member and secure using (1) U-Bolt and noted hardware.

Step 8. Secure the top section of the **ODU** (**BUC**) mounting assembly onto the cross member (support pole/pipe) and secure using (1) U-Bolt and noted hardware.

Step 9. If applicable, attach flexible waveguide between the **ODU** (**BUC**) and feed assembly using the hardware noted.

Figure 4-4 Typical 10-Watt / 20-Watt Mounting

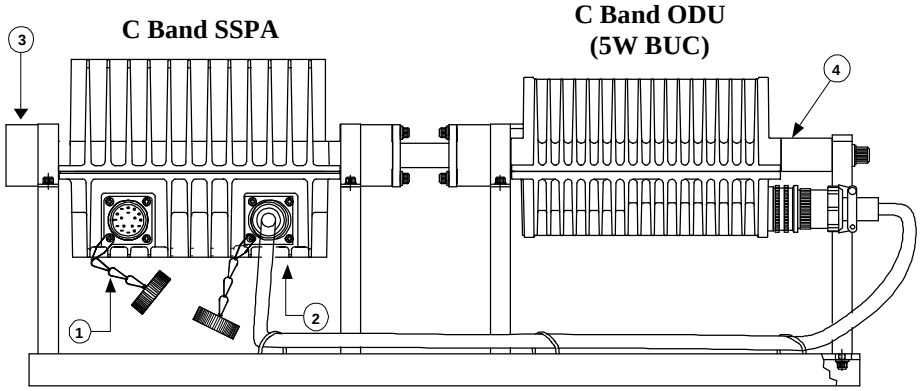


Interface Connections for the High Power C-Band ODU Assemblies

The following describes the various "USER" connections located on the 10-Watt, 20-Watt, 40-Watt and 60-Watt **ODU** Assemblies.

*Step 51.This section provides information pertaining to the **SSPA** interface connections. Refer to **Section 4.4 for ODU (BUC) Interface Connections**.*

Figure 4-5 10-Watt thru 60-Watt ODU SSPA Connector Details



10-Watt system is shown for reference.

1

48VDC / RS-485 Port

Function: 48 VDC Interface from **AMP Controller**

Step 52.20 Watt, 40 Watt and 60 Watt Configurations ONLY.

*Step 53.**Radyne ComStream** does not provide the **AMP Controller** to **SSPA** 48 VDC Cable assembly as part of these systems, only cable connectors are provided. Refer to **Table 4-5** for cable wiring information.*

Table 4-10 Wiring for 48 Vdc Connector to SSPA

Pin Assignment		
Amp Controller	**SSPA**	**Description**
Pin 1	Pin K	+48 VDC
Pin 2	Pin L	+48 VDC
Pin 3	Pin J	GND
Pin 4	Pin M	GND
* Remaining pins are not used.		

Step 54.Recommendation: Use AWG 18 or lower shielded multi-conductor cable.

Step 55.Recommendation: Connect the shields to the ground pins on either end of the cable to minimize radiated susceptibility and emissions.

2. BUC / SSPA Interface Port

Function: Provides the serial interface for communications between the **BUC** and **SSPA**. When configured as a 10-Watt system the 48VDC source voltage for the **SSPA** is routed through this port. When configured as a 20-Watt system the **AMP Controller** provides the 48VDC source voltage. This cable is provided with the system.

3. WR137 Waveguide Flange, Grooved

Function: **SSPA** RF Output port to antenna feed

4. Female Type "N" Connector

Function: **ODU** (**BUC**) Interface for L-Band Input connection from **IDU**

*Step 56. Receives the modulated L-Band (950 - 1525 MHz) signal from **IDU**.*

Step 57. Interface for a 10 MHz reference, 48 VDC power, and an FSK monitor and control (M&C) link.

Step 58. Refer to Section 4.2, IFL Cable Installation Guidelines.

Step 59. Refer to Section 4.2.1, General Cable Installation Considerations prior to installing the cable.

Step 60. Refer to Table 4-2, IDU to ODU Interface Cable Requirements.

Installation Verification

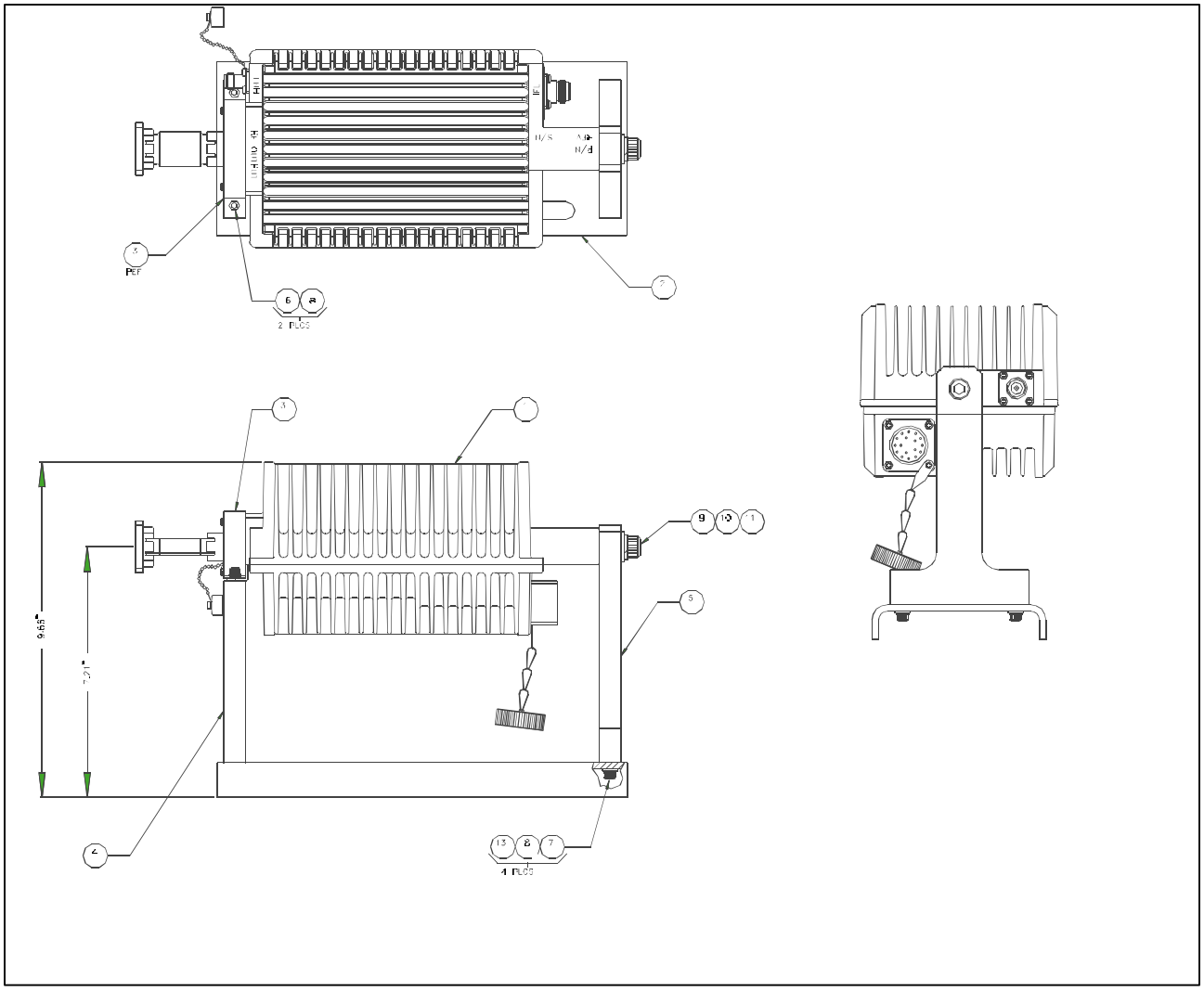
Verify that the following parameters have been adhered to while installing the unit.

10) All equipment located around or mounted directly on the antenna are bonded together and grounded to a proper earth ground.

11) The unit is located within or in a manner that allows ease of service.

12) The unit is properly secured in place.

13) All outdoor cable connections are properly seated, secured and waterproofed. A connector strain relief has been added to each cable end.


9.65"
7.21"

Appendix A

DMD2401 LB/ST Satellite Modem Technical Specifications

A.1 Introduction

This section defines the technical performance parameters and requirements for the DMD2401 Satellite Modem.

DMD2401 LB/ST Technical Specifications

Transmit and Receive Data Rates

DMD2401LB BPSK - 9.6 to 1024 Kbps, Rate 1/2 (Standard)
QPSK - 19.2 to 2048 Kbps, Rate 1/2 (Optional)
QPSK - 28.8 to 2048 Kbps, Rate 3/4 (Optional)
QPSK - 33.6 to 2048 Kbps, Rate 7/8 (Optional)

Data Rate Setting: Selectable in 1 bps steps

Modulator/Tx Specifications

Frequency	950-1525 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
Phase Noise	
100 Hz	-60 dBc
1000Hz	-70 dBc
10 KHz	-75 dBc
100 KHz	-85 dBc
Spurious and Harmonics	-50 dBc
Impedance	50 ohms
Return Loss	14 dB
Output Voltage	
Output Current	
10 MHz Reference levels	-10 dBm, ± 5 dB
Connector	SMA

Demodulator/Rx Specifications

Frequency	950-1525 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	Min. of -10 dBm or 35 dBc
Impedance	50-ohm
Return Loss	8 dB Min.
Output Voltage	
Output Current	
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, @ 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

Descrambler: Intelsat V.35, mode selectable
Data Buffering: 8 bits to 262,144 bits, in 8-bit steps
Terrestrial Interfaces: RS-449/422, RS232 or V.35

Alarms

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

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

Monitor and Control

All operating parameters can be monitored and controlled via the front panel display/keypad or the RS485 or RS232 serial control channel in either terminal or command modes. The following modem parameters may be controlled and/or monitored:

- Transmit and Receive Frequencies
- Transmit and Receive Offsets
- Modulator Power Level
- Modulator On/Off
- Modulator/Demodulator Modulation (BPSK, QPSK or OQPSK)
- Modulator/Demodulator Data Rates (1 bps steps)
- Modulator/Demodulator Code Rates (1/2, 3/4, 7/8)
- 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

Options

Concatenated Codec: A Reed-Solomon codec is available.

Asynchronous Channel: Asynchronous overhead channel for remote control and order-wire applications.

Viterbi and Sequential Coding

Environmental

Prime Power:	100-240 Vac, 50-60 Hz, 1.0 A (IEC 3-pin Power Connector with Switch)
Outdoor Unit Power:	150 Watts, 100 - 240 Vac, Autoranging
Operating Temp.:	0 to 50° C, 95% humidity, non- condensing
Storage Temp.:	-20 to 70° C, 99% humidity, non-condensing

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)

C-Band Block Upconverter Specifications
Electrical Performance Parameters

Output frequency range	5.85 – 6.425 GHz
Input frequency range	950 – 1525 MHz
Input level range	-5 to –55 dBm (-20 for P1dB)
Reference signal frequency	10 MHz
Reference signal level	-3 to +10 dBm
Power levels	Available up to 40 watts

Ku-Band Block Upconverter Specifications

Electrical Performance Parameters

Output frequency range	14.0 – 14.4 GHz 13.75 – 14.25 GHz (option)
Input frequency range	950 – 1525 MHz
Input level range	-5 to –55 dBm (-20 for P1dB)
Reference signal frequency	10 MHz
Reference signal level	-3 to +10 dBm
Power levels	Available up to 25 watts

(The following specifications apply to both C- and Ku-Band Bucs)

Intermodulation IM_3	> -30 dBc
(Two tone signal with 5 MHz distance and a summary output power of 6 dB below rated power, 6 dB back off)	
Gain stability	± 0.5 dB/day at constant temperature
Gain variation (flatness)	± 2 dB over 500 MHz
(over freq. and temp.)	± 1 dB over any 80 MHz band
Group delay	< 10 ns over any 80 MHz band
Carriers transmit interrupt	> 50 dB
Local oscillator phase noise	< 2.8^{o} RMS double sideband
Spurious	< -20 dBm (in-band)
Noise figure	< 20 dB
DC input	42 to 60 Vdc (nominal 48V) (24 Vdc optional)