COMTECH EF DATA™

A SUBSIDIARY OF COMTECH TELECOMMUNICATIONS CORP.

DST

Digital Satellite Terminal System
Operator's Guide

Part Number MN/DST.IOM
Revision 2
October 19, 2005

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Errata A

Comtech EF Data Documentation Update

Subject:	Add Terrasat BUC Mounting Kit, KT/9930-1
Date:	April 11, 2006
Document:	DST, Digital Satellite Terminal System, Operator's Guide, Revision 2, October 19, 2005
Part Number:	MN/DST.EA2
Collating Instructions:	Attach this page to page 3-10

Comments:

Add Terrasat BUC Mounting Kit KT/9930-1 to read:

Table 3-1. Optional: BUC Mounting Kit, KT/9930-1

Item	Part No.	Nomenclature	QTY
1	FP/9026-1	Bracket, Lower Block Up	1
2	FP/BR9929-1	Bracket	1
3	HW5/16-18HEXNT	Nut, Hex	1
4	HW/5/16-FLT	Washer, Flat	1
5	HW/5/16-SPLIT	Washer, Split	1
6	HW/5/16-18X1.25	Bolt, Hex-Head	1
7	HW/M4X16PH	Screw, Pan-Head	2
8	HW/1/4-20HEXNUT	Nut, Hex	1
9	HW/1/4-SPLIT	Washer, Split	2
10	HW/1/4-FLT	Washer, Flat	3
11	03P1078	Bolt, Hex	1

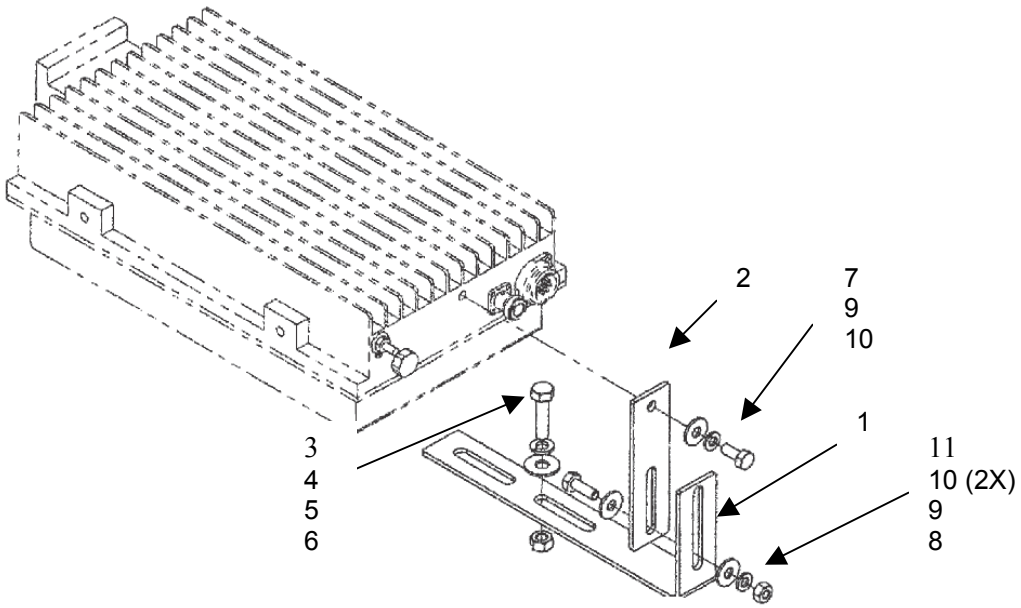


Figure 3-1. Mounting Kit , KT9930-1

Errata B for MN/DST.IOM Rev 2

Comtech EF Data Documentation Update

DST

Digital Satellite Terminal System
Operator's Guide

Part Number MN/DST.IOM Revision 2

Subject: Add 3W BUC to Table 3.2

Errata Part Number: ER-DST-EB2 (*Errata documents are not revised)*

CO Number: C-0036663

Comments: See attached page(s). The new information will be included in the next released revision of the manual.

Table 3-2. LO, MIX and Mod Spectrum Settings for Modulator And BUC

P1dB_min	Band	FSK	CEFD Part #	RF Start Frequency (GHz)	RF End Frequency (GHz)	LO (Offset) Freq. (MHz)	Mix (+/-)	Modem Spectrum (Utility Modulator Menu)	Supply Voltage	Spar Mount Kit	Feed Mount Kit
*2 Watt	Ku	Yes	RF/BUC02KU-A-F-T	14.00	14.50	13,050.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
*4 Watt	Ku	Yes	RF/BUC04KU-A-F-T	14.00	14.50	13,050.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
*8 Watt	Ku	Yes	RF/BUC08KU-A-F-T	14.00	14.50	13,050.00	+	Normal	48 VDC	KT/8924-1	KT/9928-1
**1 Watt	Ku	No	RF/BUC01KU-A-N-N	14.00	14.50	13,050.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
**4 Watt	Ku	No	RF/BUC04KU-A-N-N	14.00	14.50	13,050.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
*2 Watt	Ext Ku	Yes	RF/BUC02KU-B-F-T	13.75	14.25	12,800.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
*3 Watt	Ext Ku	No	RF/BUC02KU-A-N-N-0-1	13.75	14.50	12,800.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
*4 Watt	Ext Ku	Yes	RF/BUC04KU-B-F-T	13.75	14.25	12,800.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
* 8 Watt	Ext Ku	Yes	RF/BUC08KU-B-F-T	13.75	14.25	12,800.00	+	Normal	48 VDC	KT/8924-1	KT/9928-1

* Option A BUC Mounting
** Option B BUC Mounting

Customer Support

Contact the Comtech EF Data Customer Support Department for:

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

A Customer Support representative may be reached at:

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

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

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

service@comtechEF Data.com

Contact us via the web at www.comtechefdata.com.

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

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

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

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

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

For more information regarding the warranty policies, see Warranty Policy, p. xiii.

Table of Contents

Figures

Tables

About this Manual

This manual provides basic installation and operation information for the Comtech EF Data DST Digital Satellite Terminal System. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the DST System.

Related Documents

The following documents are referenced in this manual:

- *Comtech EF Data UB-530 Universal Breakdown Panel Installation and Operation Manual*
- *INTELSAT Earth Station Standards 308, 309, 310, and 314.*
- *International Telephone Telegraph Consultative Committee V.335 and G.721*

Conventions and References

Cautions and Warnings

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

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

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

Metric Conversion

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

Trademarks

Windows is a trademark of Microsoft Corporation.

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

Reporting Comments or Suggestions Concerning this Manual

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

Overview of Changes to Revision 1:

ELECTRICAL SAFETY

The DST Digital Satellite Terminal System has been shown to comply with the following safety standard:

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

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

FUSES

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

For continued operator safety, always replace the fuses with the correct type and rating. Refer to the SDM /CiM manual.

Environmental

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

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

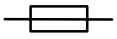
Installation

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

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

The DST is shipped with a line inlet cable suitable for use in the country of operation. If it is necessary to replace this cable, ensure the replacement has an equivalent specification. Examples of acceptable ratings for the cable include HAR, BASEC and HOXXX-X. Examples of acceptable connector ratings include VDE, NF-USE, UL, CSA, OVE, CEBEC, NEMKO, DEMKO, BS1636A, BSI, SETI, IMQ, KEMA-KEUR and SEV.

International Symbols:

Symbol	Definition
~	Alternating Current
	Fuse

Symbol	Definition
	Protective Earth
	Chassis Ground

Telecommunications Terminal Equipment Directive

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

EMC (Electromagnetic Compatibility)

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

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

(Also tested to FCC Part 15 Class B)

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

Additionally, the DST has been shown to comply with the following standards:

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

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

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

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

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

Warranty Policy

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

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

Limitations of Warranty

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

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

Exclusive Remedies

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

Disclaimer

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

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

Notes:

Chapter 1. INTRODUCTION

This equipment is designed for maximum reliability and performance in C- and/or Ku-Band applications.

1.1 DST Overview

The **D**igital **S**atellite **T**erminal (DST) (Figure 1-1) consists of three major components:

DST	*iProSat*
L-Band Satellite Modem – provides conversion of data to L-Band and delivers power and a 10 MHz reference signal to the outdoor equipment. For additional information. Refer to the *modem Installation and Operations Manual*	**Internet Enabled L-Band Satellite Modem** – provides an Ethernet data interface, L-Band IF interface and delivers power and a 10 MHz reference to the outdoor equipment. For additional information. Refer to the *modem Installation and Operations Manual.*
A Block Up Converter (BUC) Provides frequency conversion from L-Band to C- or Ku-Band and power amplification to a selectable transmit power level.	
A Low Noise Block (LNB) Down Converter Provides frequency conversion of the received signal from C- or Ku-Band to L-Band and power amplification of the signal with low levels of noise added.	

Figure 1-1. Modem with Typical LNB and a 2 Watt BUC

1.2 Description

The DST is an integrated, single thread, **S**ingle **C**hannel **P**er **C**arrier (SCPC), **V**ery **S**mall **A**perture **T**erminal (VSAT) system designed to meet the needs of a single and/or multiple site installations.

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

Note: The antenna and the **O**rtho **M**ode **T**ransducer (OMT) are not part of the DST system. The **T**ransmit **R**eject **F**ilter (TRF), **R**eceive **R**eject **F**ilter (RRF), and L-Band **I**nter-**F**acility **L**ink (IFL) cables are optional equipment as are mounts.

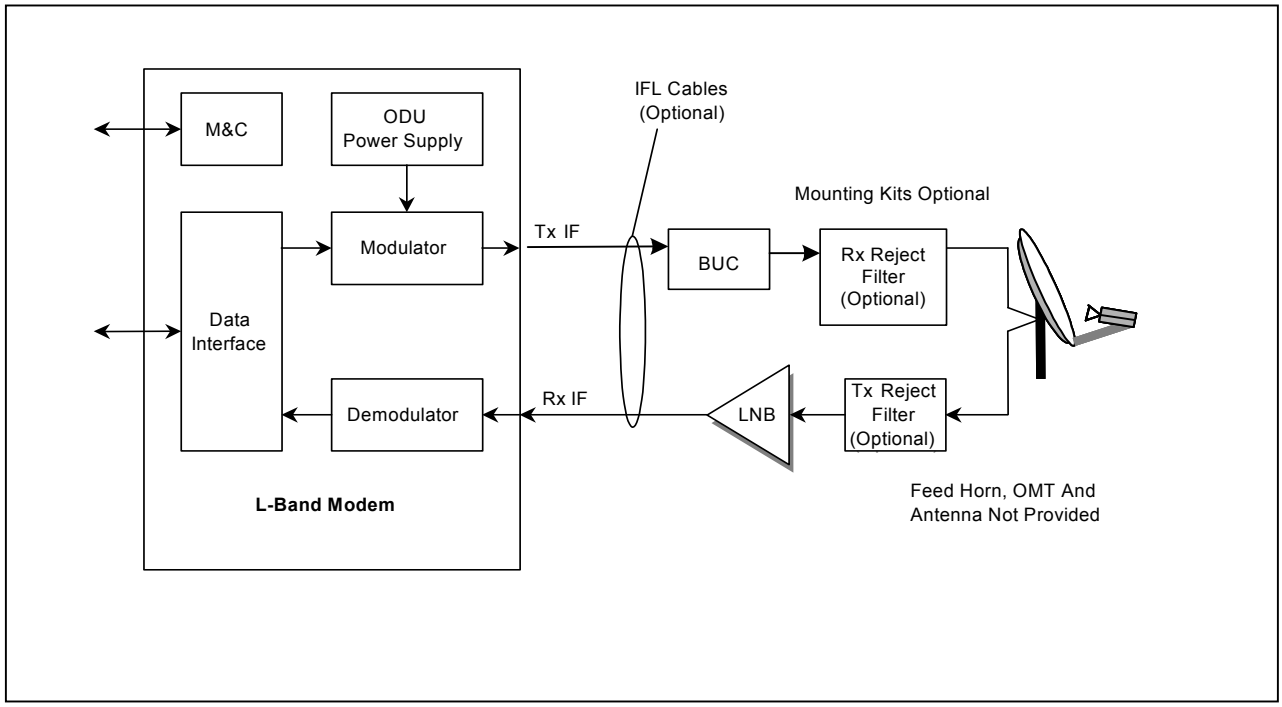


Figure 1-2. DST System Block Diagram

1.2.1 Description of Indoor Unit

The IDU for the DST is one of several L-Band Satellite Modes produced by Comtech EF Data. The modem provides the data interface and connects to the ODUs at L-Band frequencies. In addition, the modem provides the M&C interface for the DST system, a 10 MHz reference, and power for both the BUC and the LNB. The DST employs a user-friendly M&C interface that is accessible from either the front panel of the indoor unit (IDU) or its remote port.

For additional modem information, *refer to Installation and Operation Manual for the modem being used.*

1.2.2 Description of Monitor and Control (M&C)

The DST employs the user-friendly monitor and control (M&C), which is accessible from either the front panel or the remote port of the modem. The *DST* M&C is primarily LAN based using Telnet, SNMP or a web browser:

- Data rate and code rate
- ODU power supply On/Off for BUC and LNB
- Hi/Lo ODU current alarm for BUC and LNB current
- 10 MHz Reference On/Off for BUC and LNB
- TX Carrier On/Off
- TX Carrier outdoor power level using modem power offset
- C- or Ku-Band TX and RX frequency programming
- Link power control using the optional AUPC
- FSK monitor and control of FSK capable BUCs, including power leveling

1.3 Features and Options

1.3.1 Features

The DST is designed for maximum performance and reliability for VSAT applications, including:

- Point-to-point to multipoint links
- Symmetric and Asymmetric Networks
- Internet and router connectivity
- Automatic Uplink Power Control (AUPC) enhanced links

1.3.2 Options

The DST includes the following options:

How Enabled	IDU Options
Hardware + Fast	See modem manual for additional details
Hardware	24 VDC 100W AC ODU (BUC) Power Supply
Hardware	48 VDC 150W AC ODU (BUC) Power Supply
Hardware	BUC power 2 watts
Hardware	BUC power 5 watts
Hardware	BUC power 10 watts
Hardware	IFL Cables
Hardware	LNB 3.625 to 4.200 GHz
Hardware	TX Reject Filter
Hardware	Mounting Kits

1.4 Specifications

The following tables list the system and individual component specifications.

Table 1-1. Specifications

Parameter	Specification	
IDU Specifications	Refer to modem Installation and Operation Manual	
Block Up Converter (BUC)	Contact Comtech EF Data Customer Support department.	
Low Noise Block (LNB) Converter	Contact Comtech EF Data Customer Support department.	
Remote Control Specifications		
Serial Interface	EIA-232 or EIA-485 (2- or 4-wire)	
M&C Items	TX Frequency TX Power Data Rate Select Scrambler (On/Off) RX Carrier Detect Power Supply Voltages Plesiochronous Buffer FSK parameters	RX Frequency Transmitter On/Off Data Loopback IF Loopback (L-Band) RAW Corrected Eb/No RX Signal Level Fault Status Error Threshold Alarm
Configuration Retention	At least 1 year without power	
BUC FSK Communications		
FSK Serial Communications	Refer to modem Installation and Operation Manual	

Table 1-2. IFL Cable Specifications

Parameter	Specification
Construction	Double-Shielded Coaxial
TX Cable Connector	Type N Male Connectors
RX Cable Connector	Refer to Modem manual.
Insertion Loss	1.0 dB/10 feet max
VSWR	1.25:1
Adapter CN/F-N-ADP-MF	Type F Male to Type N Female - Adapts Type N Cable modems with Type F RX Connector.

Notes:

Chapter 2. INDOOR UNIT INSTALLATION

This chapter provides installation and IDU mounting instructions for the DST.

2.1 Unpacking

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

Do not use any cutting tool that will extend more than 1 inch (2.5 cm) into the container. This can cause damage to the modem.

Unpack the DST as follows:

1. Cut the tape at the top of the carton indicated by OPEN THIS END.
2. Remove the cardboard/foam space covering the unit.
3. Remove the unit, manual, and power cord from the carton.
4. Save the packing material for storage or reshipment purposes.
5. Inspect the equipment for any possible damage incurred during shipment.
6. Check the equipment against the packing list to ensure the shipment is correct.

2.2 Equipment Inspection

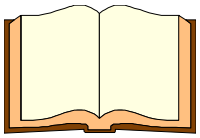
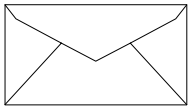
2.2.1 Included Parts

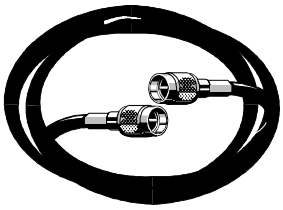
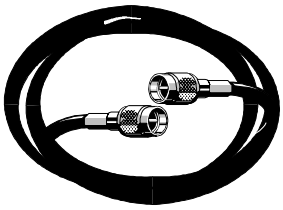
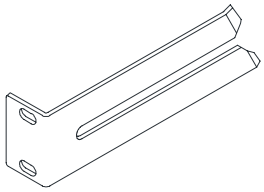
A typical Satellite Terminal System contains the following components:

Notes:

1. Parts are not drawn to scale.
2. Because each installation can be customized, this manual will provide instructions for installing the universal mounting kit.

Table 2-1. Mounting Components

Qty	Description
1	DST Components 
1	Installation and Operation Manual 
1	Envelope containing the test data 

Qty	Description
2	Cable Assembly – Transmit (Optional)  *Comtech EF Data Part No. CA/6357-50, -100, -150, -175, or -200*
2	Cable Assembly – Receive (Optional)  *Comtech EF Data Part No. CA/9645-50, -100, -150, -175, or -200*
1	IDU Mounting Bracket (Optional)  *FP/6138-1 From Comtech EF Data Kit KT/6228-1*

2.2.2 Mounting Kit

Table 2-2. Optional: Mounting Kit, KT/6228-1 (IDU to Rack)

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

2.3 Installation

2.3.1 IDU Installation

Tools Required:

Screw Driver	Phillips
5/32-inch	SAE Allen Wrench

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

1. Install the IDU rear support brackets as follows:

   a. Install provided rear support bracket onto the mounting rail of the rack. Fasten with provided bracket bolts.

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

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

   c. Refer to Chapter 3 prior to connecting.

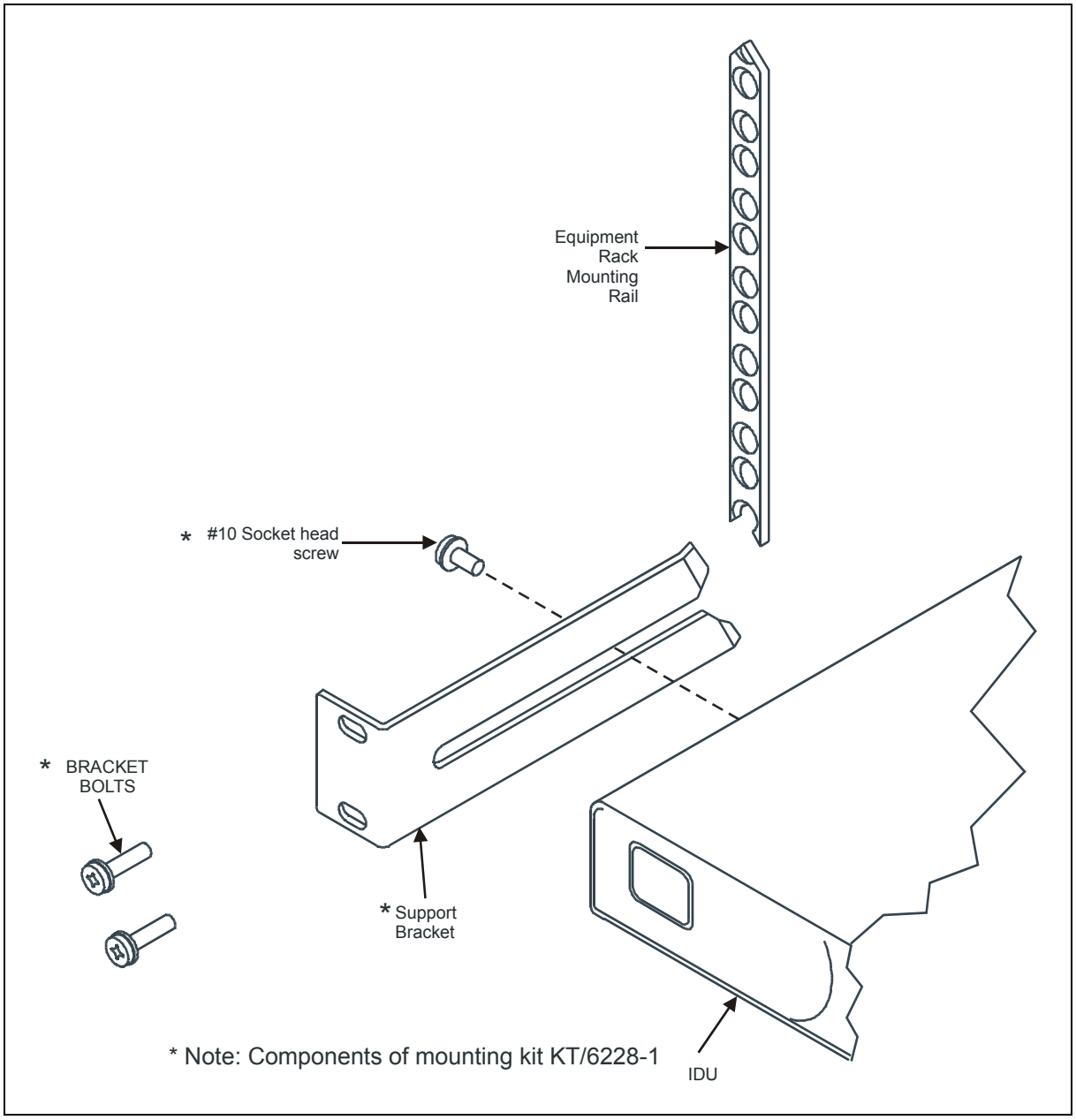


Figure 2-1. IDU Installation with Optional KT/6228-1 Rear Mounting Bracket.

2.3.2 IFL Cable Installation

Comtech EF Data recommends the use of a high-performance cable assembly for the DST. Manufacturer recommends the cable not exceed 300 feet in length. A non-high-performance cable assembly may result in damage to the IDU, BUC, or LNB.

Refer to Tables 2-5 and 2-6 and for IFL Cables that are available from the factory.

Prior to connecting the cables, ensure that the ODU and LNB voltages have been switched off.

Table 2-3. TX Cable Specification (Type N Male Connectors)

Part No.	Length		Frequency, GHz	VSWR	Insertion Loss, max
	feet	meters			
CA/6357-50	50 ± 2	15.2 ± 0.7	2	1.25:1	1.0 dB/10 feet
CA/6357-100	100 ± 3	30 ± 1	2	1.25:1	1.0 dB/10 feet
CA/6357-150	150 ± 3	46 ± 1	2	1.25:1	1.0 dB/10 feet
CA/6357-175	175 ± 3	53± 1	2	1.25:1	1.0 dB/10 feet
CA/6357-200	200 ± 3	61 ± 1	2	1.25:1	1.0 dB/10 feet

Table 2-4. RX Cable Specification (Type F Male Connectors)

Part No.	Length		Frequency, GHz	VSWR	Insertion Loss, max
	feet	meters			
CA/9645-50	50 ± 2	15.2 ± 0.7	2	1.25:1	1.0 dB/10 feet
CA/9645-100	100 ± 3	30 ± 1	2	1.25:1	1.0 dB/10 feet
CA/9645-150	150 ± 3	46 ± 1	2	1.25:1	1.0 dB/10 feet
CA/9645-175	175 ± 3	53± 1	2	1.25:1	1.0 dB/10 feet
CA/9645-200	200 ± 3	61 ± 1	2	1.25:1	1.0 dB/10 feet

Notes:

1. The TX cable above has Type N connectors and was used for both TX and RX with the SDM-300L2 and early revisions of the CiM-300L in conjunction with LNBs that have Type N Connectors.
2. The SDM-300L3 and later revisions of the CiM-300L modems use a Type N connector for TX and a Type F connector for RX and use the cables listed above.
3. Equivalent cables/supplies may be used.
4. The DST is manufactured to accommodate a TX attenuation of 20 dB maximum between the IDU and ODU, and a RX attenuation of 25 dB maximum between the IDU and RX LNB.

2.3.3 Cable Installation

Note: Prior to connecting the cables, ensure that the ODU and LNB voltages have been switched off.

1. Connect RX L-Band cable from the LNB to the IDU CP3 connector.

2. Connect TX L-Band cable from the BUC to the IDU CP1 connector.

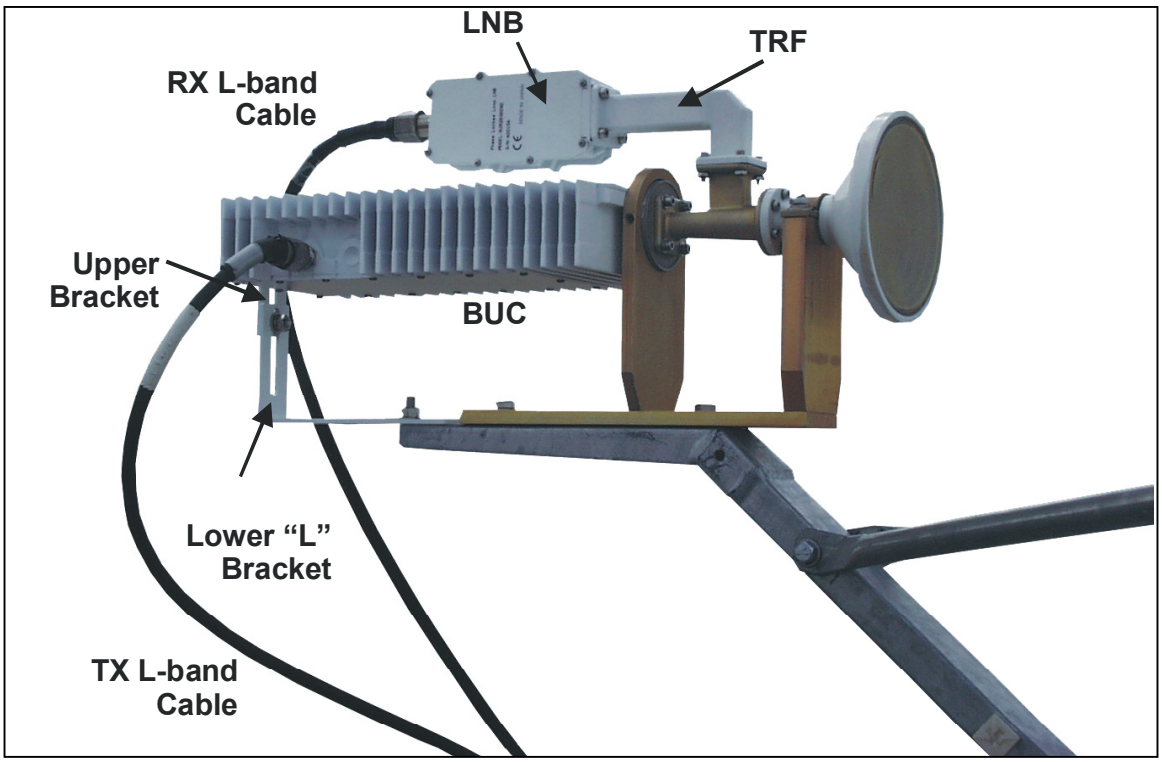


Figure 2-2. Typical ODU Unit Installation

Chapter 3. BLOCK UP CONVERTER

This chapter provides the description, operation, specification, and installation of a Block Up Converter (BUC)

3.1 Description of the Block Up Converter

The Block Up Converter (BUC) translates the L-Band carrier output from the IDU (in the 950 to 1750 MHz range) to C- or Ku-Band frequencies typically between:

- C-Band: 5.845 and 6.425 GHz and amplifies the carrier to the desired TX power level.
- Ku-Band: 14.0 and 14.5 GHz and amplifies the carrier to the desired TX power level.

The local oscillator of the BUC locks to the 10 MHz reference signal from the IDU in order to provide an accurate frequency translation. In the event the BUC cannot lock to the 10 MHz reference, the output carrier is muted to prevent interference with adjacent carriers.

Notes :

3.2 LO, Mix and Spectrum Settings

3.2.1 C-Band

Table 3-1. LO, MIX and Mod Spectrum Settings for Modulator And BUC

P1dB_min	Band	FSK	CEFD Part #	RF Start Frequency (GHz)	RF End Frequency (GHz)	LO (Offset) Freq. (MHz)	Mix (±)	Modem Spectrum (Utility Modulator Menu)	Supply Voltage	Spar Mount Kit	Feed Mount Kit
5 Watt	C	Yes	RF/BUC05C-A-F-T	5.850	6.425	7,375.00	-	Invert	24 VDC	KT/8924-1	KT/9027-1
10 Watt	C	Yes	RF/BUC10C-A-F-T	5.850	6.425	7,375.00	-	Invert	48 VDC	TBD	TBD
1 Watt	C	No	RF/BUC01C-A-N-N	5.850	6.425	4,900.00	+	Normal	24 VDC	KT/8924-1	KT/9027-1
2 Watt	C	No	RF/BUC02C-A-N-N	5.850	6.425	4,900.00	+	Normal	24 VDC	KT/8924-1	KT/9027-1
5 Watt	C	No	RF/BUC05C-A-N-N	5.850	6.425	4,900.00	+	Normal	24 VDC	KT/8924-1	KT/9027-1
2 Watt	Ext C	No	RF/BUC02C-B-N-N	6.725	7.025	5,760.00	+	Normal	24 VDC	KT/8924-1	KT/9027-1
5 Watt	Ext C	No	RF/BUC05C-B-N-N	6.725	7.025	5,760.00	+	Normal	24 VDC	KT/8924-1	KT/9027-1

3.2.2 Ku-Band

Table 3-2. LO, MIX and Mod Spectrum Settings for Modulator And BUC

P1dB_min	Band	FSK	CEFD Part #	RF Start Frequency (GHz)	RF End Frequency (GHz)	LO (Offset) Freq. (MHz)	Mix (+/-)	Modem Spectrum (Utility Modulator Menu)	Supply Voltage	Spar Mount Kit	Feed Mount Kit
*2 Watt	Ku	Yes	RF/BUC02KU-A-F-T	14.00	14.50	13,050.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
*4 Watt	Ku	Yes	RF/BUC04KU-A-F-T	14.00	14.50	13,050.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
*8 Watt	Ku	Yes	RF/BUC08KU-A-F-T	14.00	14.50	13,050.00	+	Normal	48 VDC	KT/8924-1	KT/9928-1
**1 Watt	Ku	No	RF/BUC01KU-A-N-N	14.00	14.50	13,050.00	+	Invert	24 VDC	KT/8924-1	KT/9928-1
**2 Watt	Ku	No	RF/BUC02KU-A-N-N	14.00	14.50	13,050.00	+	Invert	24 VDC	KT/8924-1	KT/9928-1
**4 Watt	Ku	No	RF/BUC04KU-A-N-N	14.00	14.50	13,050.00	+	Invert	24 VDC	KT/8924-1	KT/9928-1
*2 Watt	Ext Ku	Yes	RF/BUC02KU-B-F-T	13.75	14.25	12,800.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
*4 Watt	Ext Ku	Yes	RF/BUC04KU-B-F-T	13.75	14.25	12,800.00	+	Normal	24 VDC	KT/8924-1	KT/9928-1
* 8 Watt	Ext Ku	Yes	RF/BUC08KU-B-F-T	13.75	14.25	12,800.00	+	Normal	48 VDC	KT/8924-1	KT/9928-1
**1Watt (Typical) 28 dBm)	Ext Ku	No	RF/BUC01KU-B-N-N	13.75	14.25	15,200.00	-	Invert	24 VDC	KT/8924-1	KT/9928-1
**2 Watt	Ext Ku	No	RF/BUC02KU-B-N-N	13.75	14.25	15,200.00	-	Invert	24 VDC	KT/8924-1	KT/9928-1

* Option A BUC Mounting
** Option B BUC Mounting

3.3 BUC Envelope Dimensions and Mounting

Notes:

1. Dimensions are listed in inches and centimeters are in parentheses.
2. This figure is a typical configuration. For specific applications, contact Comtech EF Data, Customer Support department.

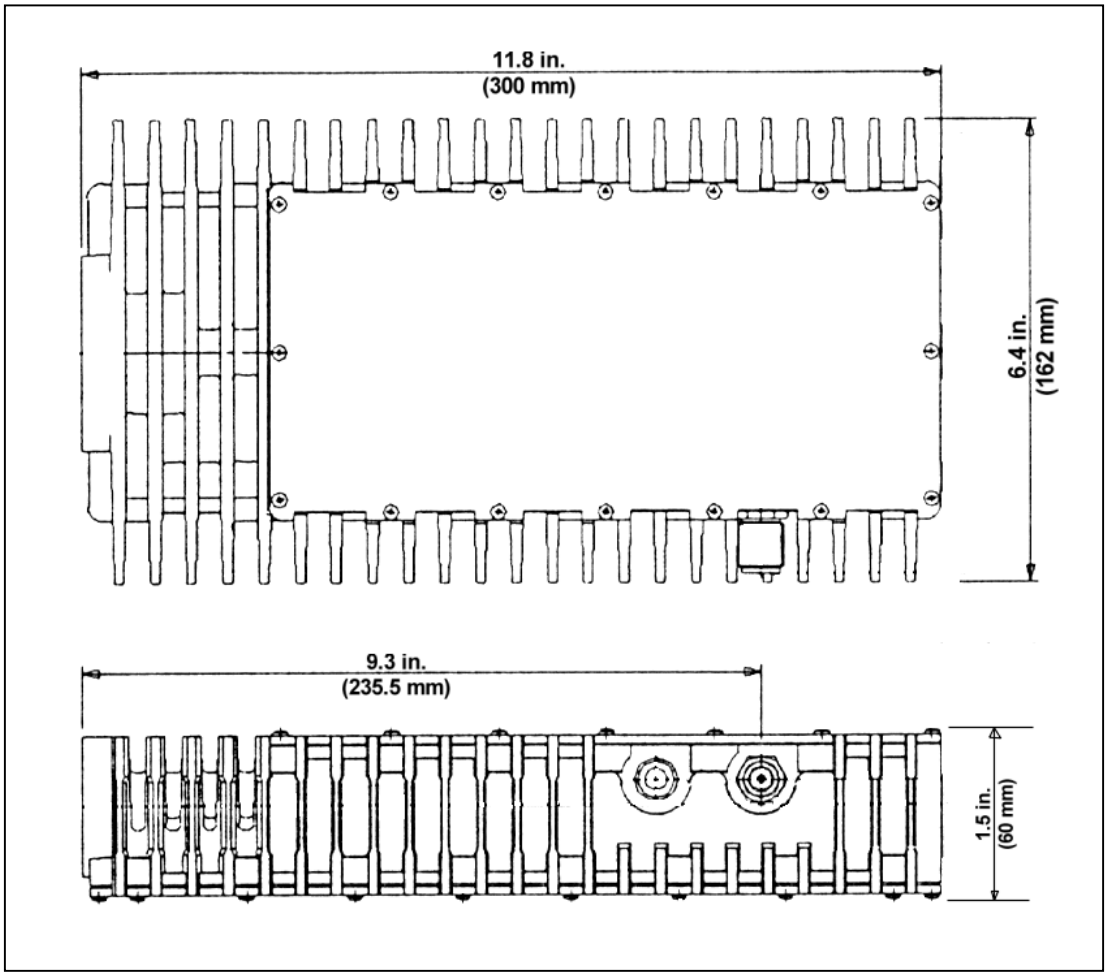


Figure 3-1. BUC Envelope

3.4 ODU Installation

Refer to Figure 3-2.

1/2-inch	**Box Wrench (or adjustable)**
5/16-inch	**Box Wrench (or adjustable)**
7/16-inch	**Box Wrench (or adjustable)**
7/64-inch	**SAE Allen**
M3	**Metric Allen Wrench**
Screw Driver	**Phillips**

3.5 BUC Installation

After removing the protective covers, ensure that no foreign material or moisture enter

3.5.1 Mounting Kits

Table 3-3. Optional: C-Band Mounting Kit, KT/5738-1 (BUC to OMT)

QTY	Part No.	Nomenclature
8	03P1097	Bolt, Hex, 10-32x1, SS
1	FP/5195	Gasket, CPR137-FULL
8	HW/1-32HEXNUT	Nut, Hex, 10-32, SS
16	HW/10-FLT	Washer, Flat, No. 10, SS
8	HW/10-SPLIT	Washer, Split Lock, No. 10, SS
1	HW/GKT-CPR137G	Gasket, CPR137-Half

Table 3-4. Optional: Ku-Band Mounting Kit, KT/8924-1 (BUC to OMT)

QTY	Part No.	Nomenclature
3	32P1037	O-Ring
3	32P1039	O-Ring
4	HW/6-32 HEXNUT	#6 Nut
4	HW/6-32x7/8 SHCS	#6 Socket screw
8	HW/6-FLT	#6 Washer, Flat
4	HW/6-SPLIT	#6 Washer, Split
8	HW/8-FLT	#8 Washer, Flat
8	HW/8-SPLIT	#8 Washer, Split
4	HW/M4x12SHCS	M4 x 12 Socket Screw
4	HW/M4x25SHCS	M4 x 25 Socket Screw

Table 3-5. Optional: C- and Ku-Band Mounting Kit, KT/9928-1 (BUC to Feed Horn)

Item	Part No.	Nomenclature	QTY	Remarks **
1	FP/9026-1	Bracket, QP	1	
2	FP/BR9927-1	Bracket, Upper	1	Used with Option B BUC
3	HW/M4FLAT	Washer, Flat	2	Used with Option B BUC
4	HW/M4LOCK	Washer, Lock	4	Used with Option B BUC
5	HW/M4X16PH	Screw, Pan Head Phillips	2	Used with Option B BUC
6	HW/1/4-FLAT	Washer, Flat	2	
7	HW/1/4-SPLIT	Washer, Split	2	
8	03P1078	Bolt, Hex	1	
9	HW/1/4-20HEXNUT	Nut, Hex	1	
10	FP/BR9929-1	Bracket	1	Used with Option A BUC
11	HW/1/4-20X5/8HEX	Screw, Hex	1	Used with Option A BUC
*12 thru 19	Not Used			
20	HW/5/16-FLT	Washer, Flat	1	
21	HW/5/16-18X1.25	Bolt, HEX Head	1	
22	HW/5/16-SPLIT	Washer, Split	1	
23	HW/5/16-18HEXNT	Nut, Hex	1	

* Not Illustrated.
** Refer to Table 3-3

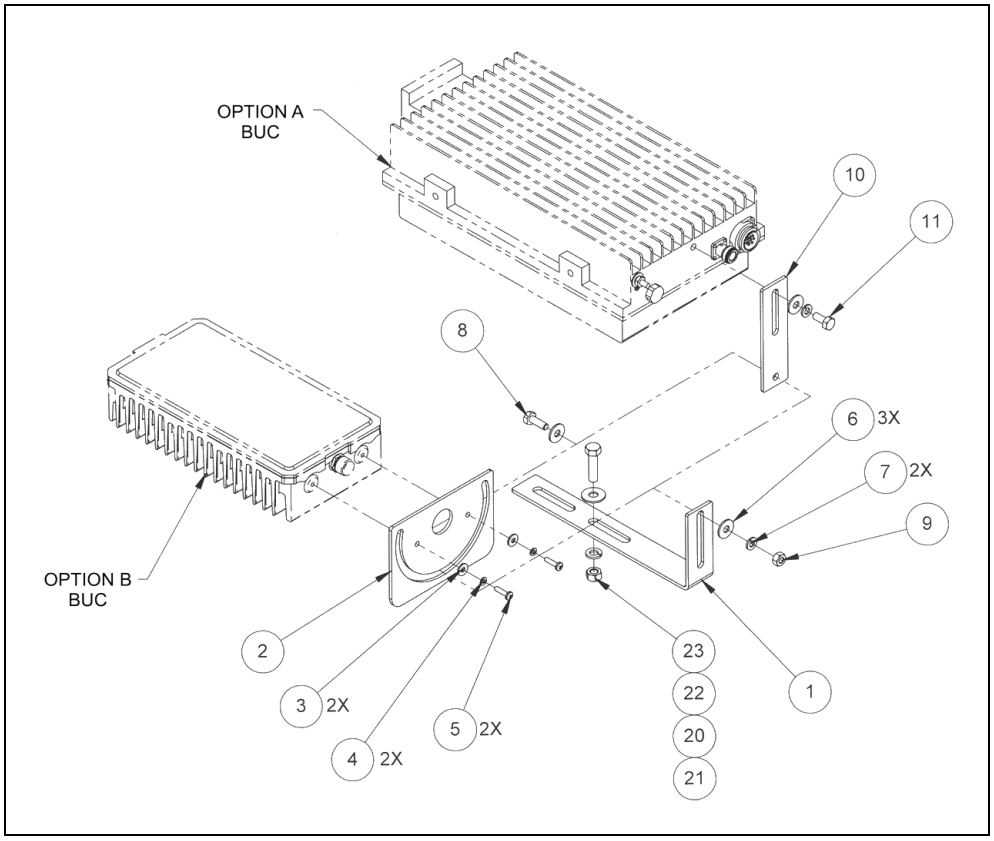


Figure 3-2. Mounting Kit, KT/9928-1

Table 3-6. Optional: BUC Mounting Kit, KT/10361-1

Item	Part No.	Nomenclature	QTY
1	FP/9026-1	Bracket, Lower Block Up	1
2	FP/BR9927-1	Bracket, Upper	1
3	HW5/16-18HEXNT	Nut, Hex	1
4	HW/5/16-FLT	Washer, Flat	1
5	HW/5/16-SPLIT	Washer, Split	1
6	HW/5/16-18X1.25	Bolt, Hex-Head	1
7	HW/M4X16PH	Screw, Pan-Head	2
8	HW/1/4-20HEXNUT	Nut, Hex	1
9	HW/1/4-SPLIT	Washer, Split	2
10	HW/1/4-FLT	Washer, Flat	3
11	03P1078	Bolt, Hex	1
12	HW/M4LOCK	Washer, Lock	2
13	HW/M$FLAT	Washer, Flat	2

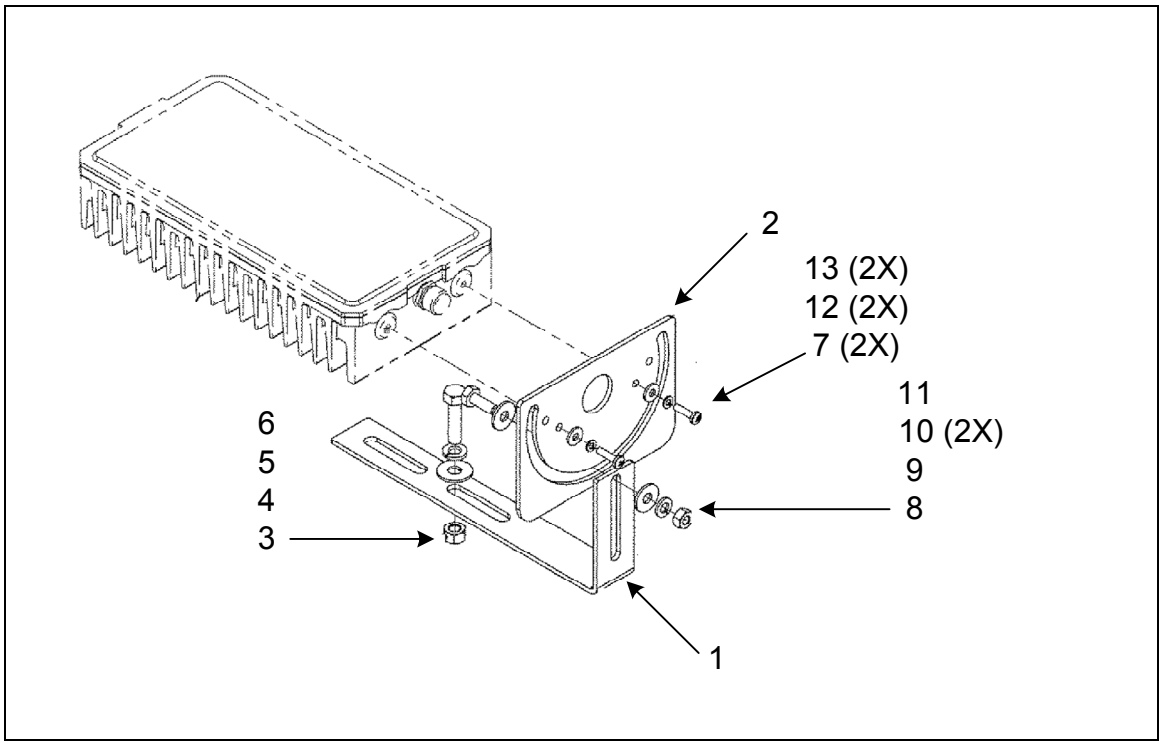


Figure 3-3. BUC Mounting Kit, KT/10361-1

3.5.2 Installation

To install the BUC to the antenna:

1. If installed: Remove protective covers from the antenna OMT and SSPA.

After removing the protective covers, ensure that no foreign material or moisture enters the antenna waveguide or BUC.

2. Install the appropriate gasket (from KT/8924-1 or KT/5738-1) on the antenna OMT, as follows:

    a. If only one of the mating flanges is grooved, the thin gasket should be installed.
    b. If both of the mating flanges are grooved, the thick gasket should be installed.

3. Position the SSPA (with gasket) in place on the antenna, and install with provided socket screws and washers (split and flat) from mounting kit.

4. Install ODU Mounting Kit KT/9928-1, as follows:

Option A BUC

a. Install bracket (10, Figure 3-2) to BUC and secure with flat washer (6), split washer (7), and screw (11).
b. Position universal lower 'L' bracket (1) to feed horn, loosely fasten with bolt (21), flat washer (20), lock washer (22), and nut (23).
c. Align bracket (1) with bracket (10) to adjust the position of the BUC.
d. Insert bolt (8) with flat washer (6) through bracket (1, 10) and secure with flat washer (6), split washer (7), and nut (9).
e. Tighten all hardware.

Option B BUC

a. Install bracket (2, Figure 3-2), to BUC and secure with two screws (5), two lock washer washers (4), two flat washers (3).
b. Position universal lower 'L' bracket (1) to feed horn, loosely fasten with bolt (21), flat washer (20), lock washer (22), and nut (23).
c. Align bracket (1) with bracket (2) to adjust for position of the BUC.
f. Insert bolt (8) with flat washer (6) through bracket (1, 10) and secure with flat washer (6), split washer (7), and nut (9).
d. Tighten all hardware.

Table 3-7. Optional: BUC Mounting Kit, KT/9930-1

Item	Part No.	Nomenclature	QTY
1	FP/9026-1	Bracket, Lower Block Up	1
2	FP/BR9929-1	Bracket	1
3	HW5/16-18HEXNT	Nut, Hex	1
4	HW/5/16-FLT	Washer, Flat	1
5	HW/5/16-SPLIT	Washer, Split	1
6	HW/5/16-18X1.25	Bolt, Hex-Head	1
7	HW/M4X16PH	Screw, Pan-Head	2
8	HW/1/4-20HEXNUT	Nut, Hex	1
9	HW/1/4-SPLIT	Washer, Split	2
10	HW/1/4-FLT	Washer, Flat	3
11	03P1078	Bolt, Hex	1

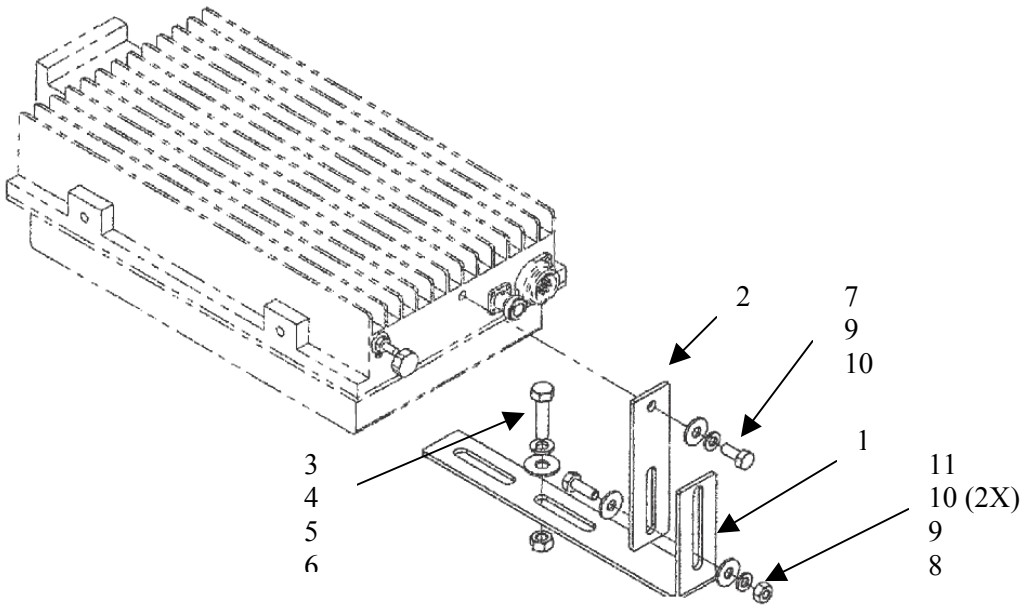
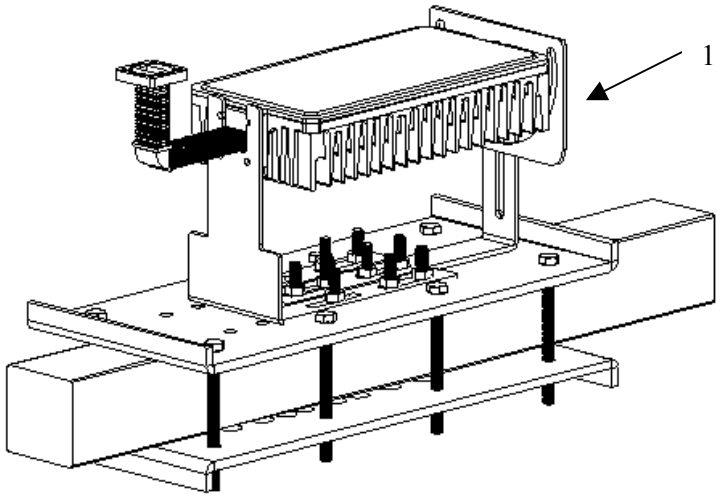


Figure 3-4. Mounting Kit , KT9930-1

3.6 Spar Mount

3.6.1 Ku-BUC Spar Mount, Typical NJRC

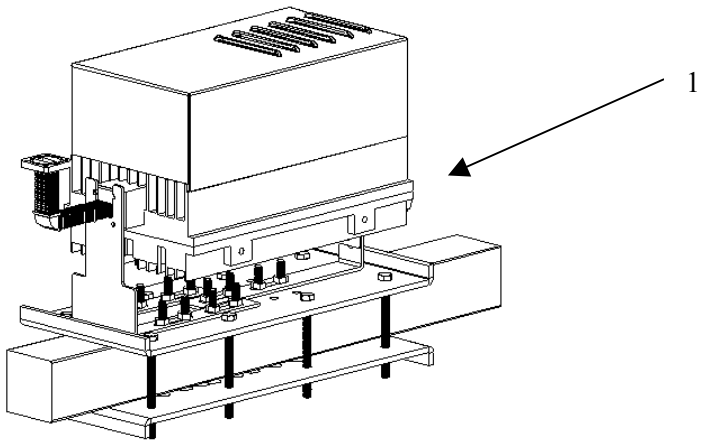


1.	KT/11125	KIT, BUC SPAR Mount, Ku-Band	RF
-2.	KT/9928-1	. Kit, BUC, Mount	1
-3.	FP/BR11119-1	. Bracket, BUC Mount	1
-4.	FP/BR11120-1	. Bracket, Mounting Plate	2
-5.	HW/5/16-18HEXNUT	. Nut, Hex	20
-6.	HW/5/16/18x1.25	. Bolt, Hex	12
-7.	HW/5/16-FLT	. Washer, Flat	20
-8.	HW/5/16-SPLIT	. Washer, Split	20
-9.	HW/5/16-18x2.25	. Bolt, Hex	8

- Item Not Illustrated.

Figure 3-5. Ku-BUC Spar Mount, Typical NJRC

3.6.2 Ku-Band Spar Mount Typical Terrasant

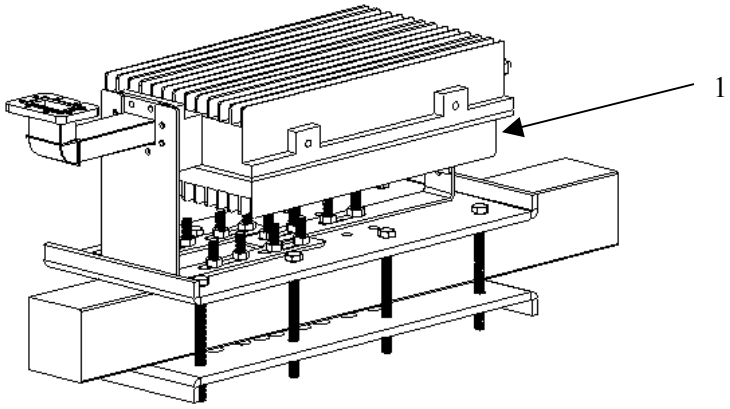


1.	KT/11125	KIT, BUC SPAR Mount, Ku-Band	RF
-2.	KT/9928-1	. Kit, BUC, Mount	1
-3.	FP/BR11119-1	. Bracket, BUC Mount	1
-4.	FP/BR11120-1	. Bracket, Mounting Plate	2
-5.	HW/5/16-18HEXNUT	Nut, Hex	20
-6.	HW/5/16/18x1.25	. Bolt, Hex	12
-7.	HW/5/16-FLT	. Washer, Flat	20
-8.	HW/5/16-SPLIT	. Washer, Split	20
-9.	HW/5/16-18x2.25	. Bolt, Hex	8

- Item Not Illustrated.

Figure 3-6. Ku-BUC Spar Mount, Typical Terrasat

3.6.3 C-Band Spar Mount, Typical



1.	KT/11124	KIT, BUC SPAR Mount, C-Band	RF
-2.	KT/9928-1	. Kit, BUC, Mount	1
-3.	FP/BR11118-1	. Bracket, BUC Mount	1
-4.	FP/BR11120-1	. Bracket, Mounting Plate	2
-5.	HW/5/16-18HEXNUT	. Nut, Hex	20
-6.	HW/5/16/18x1.25	. Bolt, Hex	12
-7.	HW/5/16-FLT	. Washer, Flat	20
-8.	HW/5/16-SPLIT	. Washer, Split	20
-9.	HW/5/16-18x2.25	. Bolt, Hex	8

- Item Not Illustrated.

Figure 3-7. C-Band Spar Mount, Typical

Chapter 4. LOW NOISE BLOCK DOWN CONVERTER

This chapter provides the description and operation for a LNB.

4.1 Description

The LNB amplifies the input Ku-Band signal and down converts it to L-Band in the range of 950 to 1750 MHz (there may be instances that the L-Band range = 950 to 1450 MHz). The choice of which downlink frequency band is determined by the selection of a frequency range, usually from one of LNBs in the following bands:

For C-Band	For Ku-Band
3.625 to 4.2 GHz	10.95 to 11.70 GHz
4.50 to 4.80 GHz	11.70 to 12.20 GHz
	12.25 to 12.75 GHz

LNBs are available that are either externally referenced (EXT REF) or internally referenced (INT REF).

- The EXT REF LNB accepts an external 10 MHz reference from the IDU. These units have the best phase noise performance and the lowest frequency drift.
- The INT REF LNB includes its own internal oscillator. DC power is supplied to the LNB through the IFL cable from the IDU.

The standard LNB noise temperature is: For C-Band < 35°K.
For Ku- Band < 65°K.

Optional: A TX Reject Filter (TRF) may be obtained with the system or supplied by the customer.

4.1.1 Options

Hardware	IFL Cables
Hardware	Externally Referenced from IDU or Internally Referenced
Hardware	TX Reject Filter
Hardware	Mounting Kits

4.2 LO, Mix and Spectrum Settings (LNB)

4.2.1 C-Band

Table 4-1. For C-Band: LO and MIX Information for Demodulator and LNB

LNB Part No.	Description	LO (Offset) Frequency (MHz)	MIX (+/-)	Min LNB Satellite Frequency (MHz)	Max LNB Satellite Frequency (MHz)	L-Band Frequency At LNB Min (MHz)	L-Band Frequency At LNB Max (MHz)	Demod Spectrum (Utility Demod Menu)	Operating Voltage, V	RF Connector
RF/LNB-C-55-35N	3.625 – 4.200 GHz Ext Ref	5,150.00	-	3,625.00	4,200.00	1,525.00	950.00	Invert	18	Type N
RF/LNB3.6-4.2FE	3.625 – 4.200 GHz Ext Ref	5,150.00	-	3,625.00	4,200.00	1,525.00	950.00	Invert	18	Type F
RF/LNB3.6-4.2F03	3.625 – 4.200 GHz Ext Ref	5,150.00	-	3,625.00	4,200.00	1,525.00	950.00	Invert	18	Type F
XXXXXXXXXXXX	3.400 – 4.200 GHz	5,150.00	-	3,400.00	4,200.00	1,525.00	950.00	Invert	18	Type F
XXXXXXXXXXXX	4.500 – 4.800 GHz	5,760.00	-	4,500.00	4,500.00	1,525.00	950.00	Invert	18	Type F

4.2.2 Ku-Band

Table 4-2. For Ku-Band: LO and MIX Information for Demodulator and LNB, Ku-Band

LNB Part No.	Description	LO (Offset) Frequency (MHz)	MIX (+/-)	Min LNB Satellite Frequency (MHz)	Max LNB Satellite Frequency (MHz)	L-Band Frequency At LNB Min (MHz)	L-Band Frequency At LNB Max (MHz)	Demod Spectrum (Utility Demod Menu)	Operating Voltage, V	RF Connector
RF/LNB-10.9-11.7FE	10.95 – 11.7 GHz Ext Ref	10,000.00	+	10,950.00	11,700.00	950.00	1700.00	Normal	18	Type F
RF/LNB-11.7-12.2FE	11.7 – 12.2 GHz Ext Ref	10,750.00	+	11,700.00	12,200.00	950.00	1450.00	Normal	18	Type F
RF/LNB-12.2-12.7FE	12.25 - 12.75 GHz Ext Ref	11,300.00	+	12,250.00	12,750.00	950.00	1450.00	Normal	18	Type F
RF/LNB-10.9-11.7F03	10.95 – 11.7 GHz ± 3 ppm	10,000.00	+	11,200.00	11,700.00	950.00	1450.00	Normal	18	Type F
RF/LNB-11.7-12.2F03	11.7 – 12.2 GHz ± 3 ppm	10,750.00	+	10,950.00	11,700.00	950.00	1700.00	Normal	18	Type F
RF/LNB-12.2-12.7F03	12.25 - 12.75 GHz ± 3 ppm	11,300.00	+	12,250.00	12,750.00	950.00	1450.00	Normal	18	Type F

4.3 Low Noise Block (LNB) Converter

Refer to Figure 4-1 for the LNB dimensional envelope drawing.

Notes:

1. Dimensions are listed in inches and centimeters are in parentheses.
2. This figure is typical of the LNB configurations. For specific applications, contact Comtech EF Data, Customer Support department.

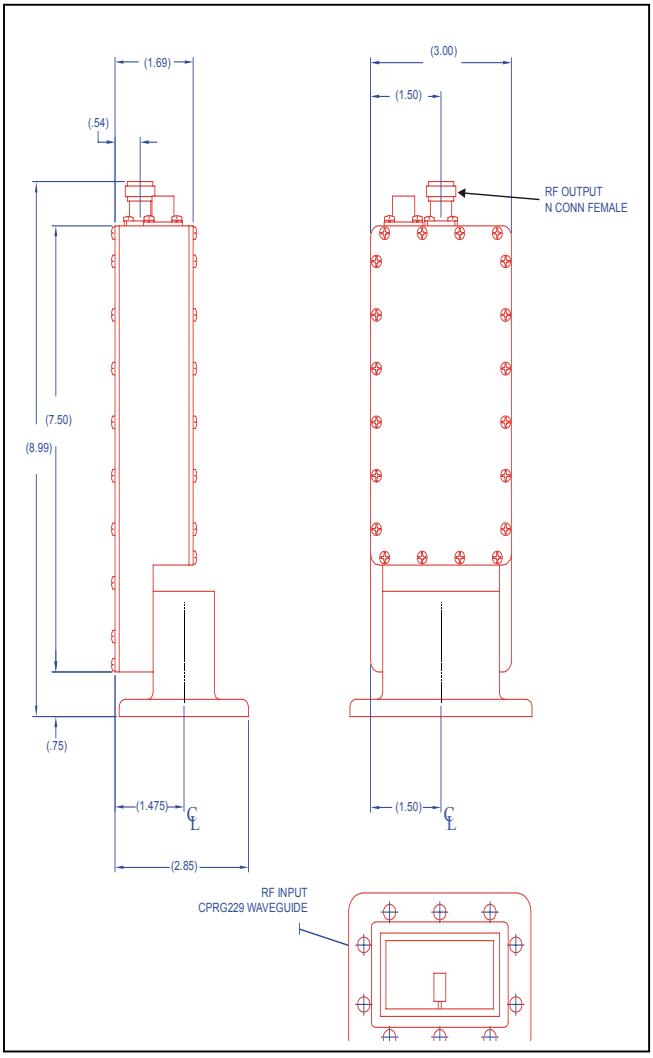


Figure 4-1. For C-Band: LNB Dimensional Envelope

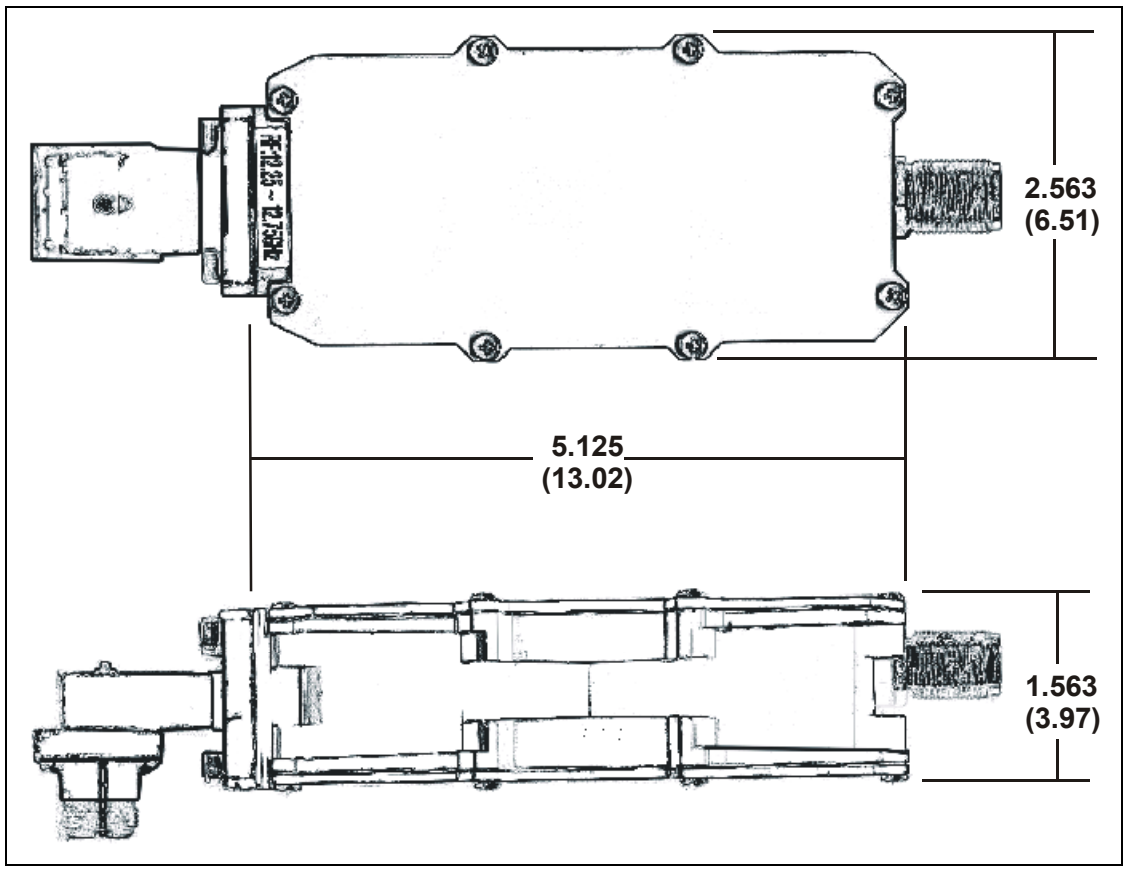


Figure 4-2. For Ku-Band : LNB Dimensional Envelope

4.4 LNB Installation

4.4.1 LNB Tooling

Refer to Figure 4-1.

1/2-inch	**Box Wrench (or adjustable)**
5/16-inch	**Box Wrench (or adjustable)**
7/16-inch	**Box Wrench (or adjustable)**
7/64-inch	**SAE Allen**
M3	**Metric Allen Wrench**
Screw Driver	**Phillips**

4.4.2 C-Band

Table 4-3. Selection of LNB to OMT

LNB Part No.	LNB Description	Comment
RF/LNB3.6-4.2FE	LNB, EXT REF	Type F Connector.
RF/LNB3.6-4.2F03	LNB, 3 ppm INT REF	Type F Connector.

4.4.3 Ku-Band

Table 4-4. Selection of LNB to OMT

LNB Part No.	LNB Description	Comment
RF/LNB-10.9-11.7 RF/LNB-11.7-12.2 RF/LNB-12.2-12.7	LNB, EXT REF	Type N Connector. For Spares or use with SDM-300L2 and other modems with Type N RF receive connector.
RF/LNB10.9-11.7FE RF/LNB11.7-12.2FE RF/LNB12.2-12.7FE	LNB, EXT REF	Type F Connector. Use with SDM-300L3 / CiM-300L and other modems with Type F RF receove connector.
RF/LNB10.9-11.7F03 RF/LNB11.7-12.2F03 RF/LNB12.2-12.7F03	LNB, 3 ppm INT REF	Type F Connector. Use with SDM-300L3 / CiM-300L and other modems with Type F RF receive connectors.

4.4.4 Mounting Kits

Table 4-5. Optional: C-Band Waveguide ASB Kit, KT/2721-1

QTY	Part Number	Description
10	03P1079	Bolt, Hex, 1/4-20X1, SS
1	32D1002	Gasket, Half, Waveguide CPR229
1	32P1040	Gasket, Full, Waveguide CPR229
20	HW/1/4-FLT	Washer, Flat, 1/4
10	HW/1/4-SPLIT	Washer, Split 1/4
10	HW/1/4HEXNUT	Nut, Hex 1/4

Table 4-6. Optional: Ku-Band Mounting Kit, KT/8924-1 (LNB to OMT)

QTY	Part Number	Description
3	32P1037	O-Ring
3	32P1039	O-Ring
4	HW/6-32 HEXNUT	#6 Nut
4	HW/6-32x7/8 SHCS	#6 Socket screw
8	HW/6-FLT	#6 Washer, Flat
4	HW/6-SPLIT	#6 Washer, Split
8	HW/8-FLT	#8 Washer, Flat
8	HW/8-SPLIT	#8 Washer, Split
4	HW/M4x12SHCS	M4 x 12 Socket Screw
4	HW/M4x25SHCS	M4 x 25 Socket Screw

4.4.5 LNB Installation

To install a single LNB:

1. If installed: Remove the protective covers from the LNB and TRF.

After removing the protective covers, ensure that no foreign material or moisture enters the antenna waveguide or TRF.

2. Install the appropriate o-ring on the LNB or TRF, as follows:

   a. If only one of the mating flanges is grooved, the thin o-ring should be installed.

   b. If both of the mating flanges are grooved, the thick o-ring should be installed.

3. Position the LNB (with o-ring) in place on the antenna OMT and install with provided M4x12 socket screws and No. 8 SAE washers (split and flat).

Note: Flat washers maybe omitted if there is interference with assembly.

4.4.6 TRF Installation

To install the TX Reject Filter to the antenna OMT:

1. If installed; remove protection covers from the OMT and TRF.

   CAUTION

   After removing the protective covers, ensure that no foreign material or moisture enters the antenna waveguide or TRF.

2. Install the appropriate gasket (from KT/8924-1 or KT/2721-1)on the antenna OMT or TRF, as follows:

   a. If only one of the mating flanges is grooved, the thin gasket should be installed.

   b. If both of the mating flanges are grooved, the thick gasket should be installed.

3. Position the TRF (with ogasket) in place on the antenna OMT and install with provided No. 6 SAE hardware, from Mounting Kit Part No. KT/8924-1 or KT/2721-1

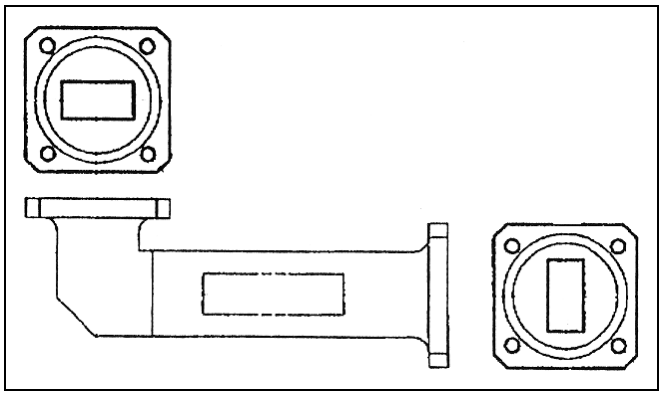


Figure 4-3. TRF Installation (Ku-Band Shown)

4.5 Cable Installation

Care should be exercised in cable installation. Install the cables using the most direct route and secure with clamps and ties. Avoid all sharp bends. Replacement of the cables can be the result.

Cable connectors used in outdoor applications must be sealed to avoid leakage. Moisture can seep into junctions at the plug end of the connector, between the fixed and movable parts, and where the cable connects to the connector. Signal attenuation and possible loss of signal can occur in the presence of moisture. All cable junctions must be sealed with a self-amalgamating tape, such as 3-M, Type 23 Scotch, or equivalent once installation and commissioning is complete (user supplied).

Chapter 5. OPERATION

This chapter describes the general operation of the RF terminal using the front panel keys. Detail operation is the same as specified in the SDM-300L3 / CiM-300L Installation and Operation Manual. For other Comtech EF Data Modems, refer to the appropriate modem Installation and Operation Manual.

5.1 Initial Operation

Careful setup is necessary to prevent damage to electronic components. Replacement of a component(s) may be the result.

5.1.1 Prior to Turning On Power

Note: Ensure DST system is installed properly and all connections all secure, except the L-Band TX and RX IF connectors which are initially disconnected.

Observe the following steps:

Step No.	Selection / Programming	Menu Location
1.	Make sure prime power to the Modem is removed.	
2.	Verify the IFL L-Band cables are not connected to the modem.	

5.1.2 Initial Power Up – Modem Only

Initially, the modem is set up and checked out and not connected to the IFL cables:

Note: Refer to the specific modem manual for programming information.

Set the modem for a known operating configuration. This includes some of the steps that follow.

Step No.	Selection / Programming	Menu Location
3.	Disconnect the L-Band TX and RX cables from the modem.	Not Applicable (NA)
4.	Connect prime power to the modem.	NA
5.	Allow modem to complete initialization.	NA
6.	ODU Power = OFF	**Configuration: Modulator**
7.	Modem Transmitter = ON (Transmitter ON (Green LED) at front panel LED is On)	**Configuration: Modulator**
8.	LNB Power = OFF	**Configuration: Demodulator**
9.	IF Loopback = ON (Test Mode LED turns ON). This matches the L-Band demodulator frequency to the L-Band modulator frequency. Ensure the Mod Spectrum (Inversion) matches the Demod Spectrum (Inversion). This is required for the demodulator to lock. See comments in the paragraph on LO, Mix and Spectrum for loopback over satellite (RF Loopback).	**Configuration: Demodulator** **Utility: Modulator** **Utility: Demodulator**
10.	Verify the carrier is locked. (Carrier Detect LED is Green at front panel)	Front Panel
11.	Make sure all faults are resolved before going forward.	Front Panel LEDs and LCD Faults/ Alarms
12.	IF Loopback = Off (Test Mode LED turns Off).	**Configuration: Demodulator**

5.2 LO, Mix and Spectrum (Inversion) Settings

The SDM-300L3 / CiM-300L Satellite Modem permits programming of terminal (satellite) frequencies instead of the L-Band frequencies. This is useful because it allows direct entry of the assigned TX and RX frequencies. Three parameters are adjusted to setup the modem with the BUC/LNB. These are the:

- LO: Local Oscillator Frequency.
- Mix Sign: + or -, determines whether the L-Band carrier is added or subtracted from the LO to translate to the satellite frequency.
- Mod Spectrum and Demod Spectrum (Inversion); needed to correct for any inversion caused by the frequency translation.

    - For BUC only. Refer to Chapter 3, for the LO frequencies for BUCs provided by Comtech EF Data, along with the MIX(+ or -) and Spectrum (Inversion) for several common frequency bands.

    - For LNB only. Refer to Chapter 4, for the LO frequencies for LNBs provided by Comtech EF Data, along with the MIX(+ or -) and Spectrum (Inversion) for several common frequency bands

The LO and MIX are entered into the modem to program the satellite frequency for the terminal. Frequencies other than those shown are possible as long as the LO and MIX are known.

- MIX = "+" when LO < Satellite Operating Frequency
- MIX = "-" when LO > Satellite Operating Frequency

Whenever MIX = - the spectrum of the carrier is inverted. The SDM-300L3 / CiM-300L easily corrects for this with the Normal and Inverted selections located under the **Utility: Modulator** and **Utility: Demodulator** menus.

Match the modulator inversion to the MIX in the BUC and the demodulator inversion to the MIX in the LNB using the following:

- Spectrum = Normal when MIX = +
- Spectrum = Invert when MIX = –

As a general rule it is best to radiate the spectrum toward the satellite in the Normal spectral sense. Then transmission links with any other corresponding sites are always consistent at the satellite interface.

When doing RF loopback testing over the satellite or end-to-end the settings are correct with this setup. However, if there is a single inversion in the modem for operation over

the satellite, it will be necessary to temporarily match the spectral inversion of modulator and demodulator when performing IF loopback testing.

Note: The modem will only allow programming of terminal frequencies that are within its valid L-Band frequency limits.

5.3 Applying Power To The BUC

1. ***Care should be exercised in cable installation. Install the cables using the most direct route and secure with clamps and ties. Avoid all sharp bends. Replacement of the cables can be the result.***
2. ***If the ODU voltage is not correct, DO NOT connect the TX-IF Cable to the modem or damage may result. Contact Comtech EF Data Customer Service department.***
3. ***Ensure TX and RX L-Band cables are not connected. After the modem is checked out, then configure to operate with the ODU.***
4. ***Initially, set LNB and BUC current wide enough to avoid false reports during installation. Readjust the limit at a later time.***
5. ***For FSK operation with an FSK capable BUC see the modem manual. Complete steps 13 through 29 prior to continuing.***

Note: Refer to Section 2, for proper installation of the IFL cables.

The conditions for the BUC to TX and the LNB to function are:

- Proper TX L-Band power to the BUC from modem.
- Sufficient and correct DC power at the BUC and LNB
- 10 MHz reference supplied to the BUC
- 10 MHz reference supplied to the LNB for EXT REF units

Note: Manufacturer recommends a 5-minute warm-up period at initial turn on for the ODU to ensure proper performance. This can be accomplished by performing steps 15 through 18, prior to initiating the power start-up.

TX Side Setup:

Step No.	Selection / Programming	Menu Location
13.	Disconnect BUC.	
14.	Determine the ODU voltage required by the BUC and record for reference	
15.	Turn the ODU Power = ON and Verify the BUC/ODU Voltage is correct. The ODU voltage sent to the BUC is verified two ways per the next step.	**Configuration: Modulator**
16.	The ODU voltage is reported under the Monitor Menu. To avoid damage to the BUC, confirm voltage matches the BUC voltage requirement. (Typical Voltage is +24 or +48 VDC ± 5%)	**Function Select: Monitor** For CEFD BUCs, refer to Chapter 3, Table 3-1
17.	To protect the equipment, select the ODU Power = OFF. This is necessary before connecting the L-Band coaxial cables to the unit	**Configuration: Modulator**
18.	Set the TX Terminal LO (MHz) and MIX (+ or -). The LO frequency is the BUC local oscillator frequency and the MIX is. Mix = "-" if the BUC LO > Satellite Frequency Mix = "+" if the BUC LO < Satellite Frequency	**Utility: Modulator** For CEFD BUCs, refer to Chapter 3, Table 3-1
19.	Set Mod Spectrum to Normal or Invert.	**Utility: Modulator**
20.	Program the satellite frequency under the TX Terminal Frequency menu	**Configuration: Modulator**
21.	Set the TX Power Level to a safe (low) value	**Configuration: Modulator**
22.	Turn TX carrier to Off.	**Configuration: Modulator**
23.	Connect BUC.	
24.	Turn TX reference to On.	**Configuration: Modulator**
25.	Turn TX ODU power to On.	**Configuration: Modulator**
26.	To automate warm up and delay carrier turn ON for a programmed delay after prime power is applied see the ODU Output Delay menu.	**Configuration: Modulator**
27.	Record the nominal BUC current after the unit is warmed up and functioning normally.	**Function Select: Monitor**
28.	Set the High alarm about 20% higher than nominal	**Utility: Modulator**
29.	Set the Low alarm about 20% to 40% lower for the ODU (BUC).	**Utility: Modulator**

IMPORTANT

At this point, the unit will start transmitting when the TX-IF output is tuned On (under Configuration: Modulator menu).

5.4 Initial Operation of the Modem with the ODU and LNB

RX Side Setup:

Step No.	Selection / Programming	Menu Location
30.	Disconnect LNB.	
31.	Set the RX Terminal LO (MHz) and MIX (+ or -). The LO frequency is the BUC local oscillator frequency and the MIX is. Mix = "-" if the LNB LO > Satellite Frequency Mix = "+" if the LNB LO < Satellite Frequency	**Utility: Demodulator** For CEFD LNBs, refer to Chapter 4, Table 4-1
32.	Set Demod Spectrum to Normal or Invert.	**Utility: Demodulator**
33.	Program the satellite frequency under the Rx Terminal Frequency menu	**Configuration: Demodulator**
34.	Select 10 MHz Ref = ON	**Configuration: Demodulator**
35.	Program LNB Voltage to the correct value (13, 18, or 24 VDC)	**Configuration: Demodulator**
36.	LNB Voltage OFF.	
37.	Connect LNB.	
38.	Program LNB Power = ON	**Configuration: Demodulator**
39.	Record the nominal ODU and LNB current after the units are warmed up and functioning normally.	**Function Select: Monitor**
40.	Set the High alarm about 20% higher than nominal	**Utility: Demodulator**
41.	Set the Low alarm about 20% to 40% lower than nominal.	**Utility: Demodulator**

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Appendix A. Selecting LNBs For Use With L-Band Modems

This chapter provides guidelines for choosing LNBs for use the DST Terminals.

A.1 Introduction

An option added to the DST Digital Satellite Terminals is the selection of either INT or EXT REF LNBs. The 10 MHz reference for an EXT REF LNB is delivered up the coaxial cable, while the reference for an internally referenced unit is contained within the unit.

A.1.1 Comparing LNBs

For adequate system performance, an INT REF LNB is the type phase locked to crystal reference. While these have a larger frequency uncertainty than an EXT REF LNB they are usable in many cases. The tradeoffs for INT and EXT REF LNBs include:

Item	EXT REF LNB	INT REF LNB
Frequency Stability	±0.02 ppm (from modem)	±3.0 ppm (inside LNB)
Phase Noise	Best	OK
Sensitivity To Thermal Gradients	Least	OK
Minimum Data / Symbol Rates	Lowest	Higher
Cost	Higher	Lower

Because the reference for an EXT REF LNB is indoors and exposed to a smaller temperature range and more benign environment, it provides the highest available frequency stability. The INT REF LNB experiences the full range of environmental exposure, but these units are capable good levels of performance. To decide, a frequency uncertainty budget is evaluated to take into account all of the contributors and decide whether an INT REF LNB is suitable.

A.1.2 Carrier Spacing And Frequency Uncertainty

When there is no carrier uncertainty, the carrier spacing is usually 1.3 * SR, where SR is the symbol rate of the modem. More generally, the carrier uncertainty is:

$$fv \leq SR * 2 * k, \quad \text{or}$$
$$SR \geq fv / (2 * k)$$

where,

fv = Total One Sided Frequency Variation or Uncertainty
SR = Symbol Rate
k = Carrier Spacing Factor, usually 1.3

The factor of 2 appears because the uncertainty is ±fv. The maximum carrier uncertainty is illustrated in Figure A-1 where the ideal position of the carrier is shown in the center, and its location due to uncertainty is displaced to extreme positions of +fv and -fv relative to the ideal. Because the goal is to establish the minimum symbol rate for a given frequency uncertainty fv is expressed in terms of symbol rate (SR) and Carrier Spacing Factor (k).

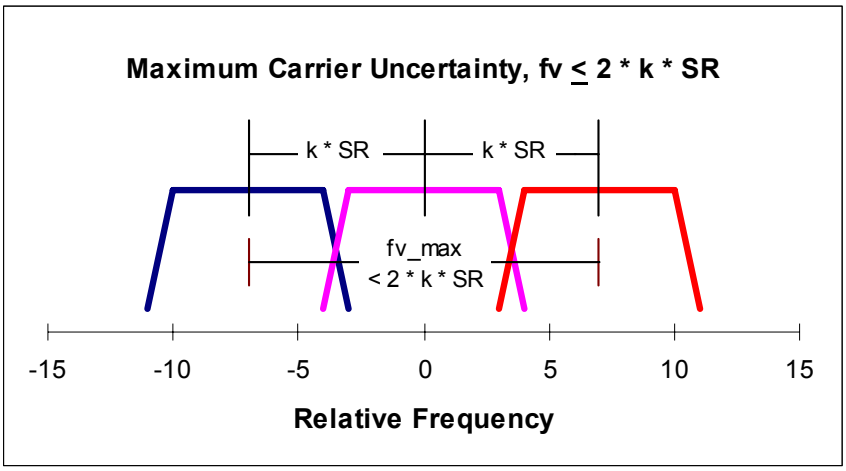

Figure A-1. Maximum Carrier Uncertainty, fv, expressed in terms of Symbol Rate, SR

The most efficient spectral utilization is obtained when the symbol rate is high enough that a k * SR spacing factor is usable. This requires that fv is smaller than the carrier spacing to prevent locking to the wrong carrier. Alternatively, if the carrier spacing is too small compared to fv it is necessary to increase the spacing. For a typical link carrier spacing is 1.3 * SR, when k = 1.3, and this is still acceptable as long as SR ≥ fv /(2 * 1.3). When the uncertainty, fv, is higher, then k ≥ 1.3 is needed resulting in a wider spacing between the carriers.

A.1.3 Frequency Uncertainty Budget

An example of a typical frequency uncertainty budget for a Ku-Band link with a 3 ppm LNB is expressed by:

± 309 Hz	BUC with LO = 15,450 MHz, ±0.02 ppm
± 32,250 Hz	LNB with LO = 10,750 MHz, ±3 ppm
± 58 Hz	Modulator + Demodulator at 1,450 MHz, ±0.02 ppm
± 10,000 Hz	Satellite Uncertainty
± 42,617 Hz	± Uncertainty
x 2	Convert ± to total End to End
85,234 Hz	End to End Uncertainty, fv
÷ 2.6	2 * k, where k = 1.3
32,782 sps	SR ≥ fv /(2 * 1.3), minimum symbol rate for 1.3 carrier spacing

Data rate and symbol rate are related by:

$$DR = SR * m * CRv * CRrs$$

where,

DR = Data Rate
m = Modulation Index (m = 1 BPSK, 2 QPSK, 3 8PSK, 4 16QAM)
CRv = Viterbi or Turbo Code Rate, 1/2, 3/4 etc.
CRrs = Reed Solomon Code Rate, 201/219 etc. or 1/1 when there is no RS

For the example above, with a total frequency uncertainty of 85.2 kHz and minimum symbol rate of 32.8 ksps, the minimum data rate for QPSK 3/4 Turbo is 49.2 kbps.

A.1.3.1 Uncertainty For 0.02 ppm Modem and 0.02 ppm BUC

Depending upon the satellite, the uncertainty will vary so a plot of the minimum symbol rate versus satellite frequency uncertainty is convenient as shown in Figure A-2. Cases are presented for both Ku-Band and C-Band where the modem supplies a 0.02 ppm reference to the BUC and the LNB is either uses the 0.2 ppm from the modem or is a 3 ppm internally referenced unit. The LO frequency for the Ku-Band LNB is 10,750 MHz and 5,150 MHz for the C-Band LNB.

The first and second curves at the top of Figure A-2 show a 3 ppm LNB at Ku-Band and C-Band, respectively. The bottom line in the figure is actually two lines plotted for Ku-Band and C-Band for an externally referenced LNB and 0.02 ppm. However, the curves are virtually on top of each other because the modem / BUC / LNB combination has negligible contribution to the frequency uncertainty, only 582 Hz for Ku-Band frequencies and 309 Hz for C-Band. In this configuration, the satellite stability dominates the frequency uncertainty budget.

The Ku-Band error budget with the 3 ppm LNB was presented earlier, and the budget for an externally referenced LNB at 0.02 ppm follows:

± 309 Hz	BUC with LO = 15,450 MHz, ±0.02 ppm
± 215 Hz	LNB with LO = 10,750 MHz, ±0.02 ppm
± 58 Hz	Modulator + Demodulator at 1,450 MHz, ±0.02 ppm
± 10,000 Hz	Satellite Uncertainty
± 10,582 Hz	± Uncertainty
x 2	Convert ± to total End to End
21,164 Hz	End to End Uncertainty fv
÷ 2.6	2 * k, where k = 1.3
8,140 sps	SR ≥ fv /(2 * 1.3), minimum symbol rate for 1.3 carrier spacing

The highest stability and least amount of frequency uncertainty is provided when an externally referenced LNB (and BUC) is connected to a modem with a ±0.02 ppm reference.

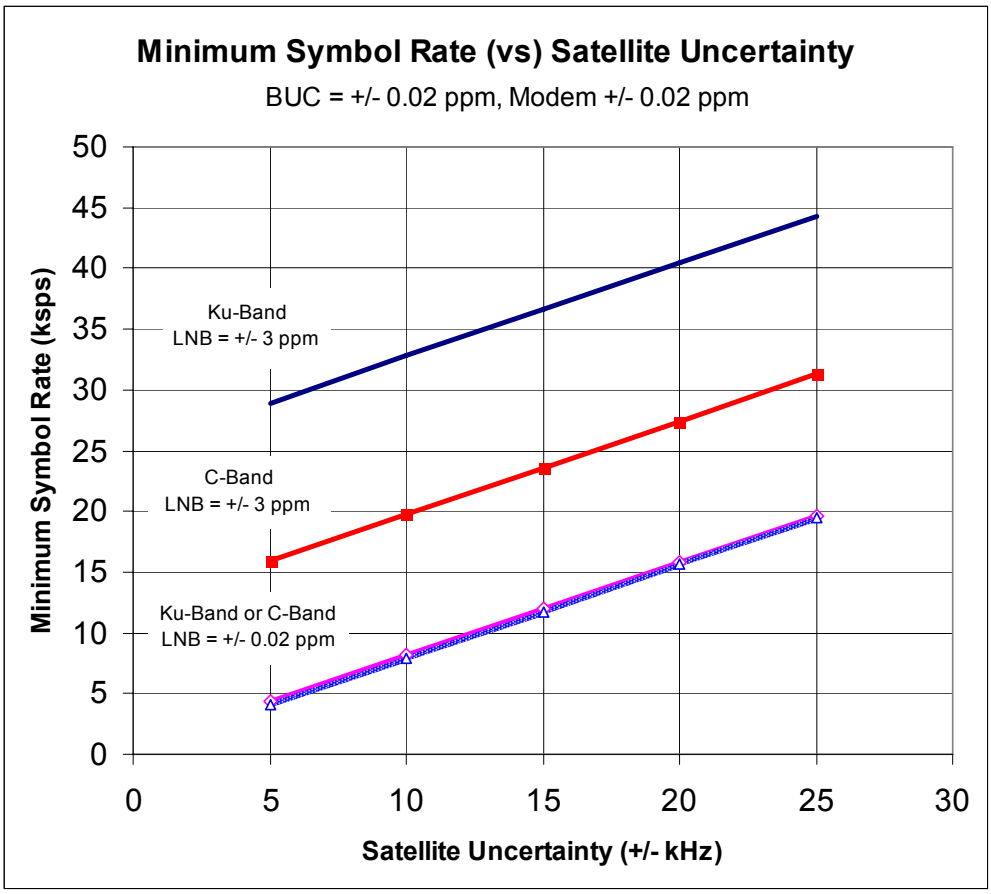

Figure A-2. Minimum Symbol Rate versus Satellite Uncertainty for Ku-Band and C-Band

A.1.3.2 Uncertainty for 1 ppm Modem and 0.02 ppm BUC

In multi-carrier applications, the carriers from several L-Band modems operate through an LNB and BUC. In these situations the modem does not supply the high stability 0.02 ppm frequency reference or the ODU (BUC) power supply. They are provided by a separate piece of equipment that also combines the Tx carriers and divides the RX signals as illustrated in Figure A-3.

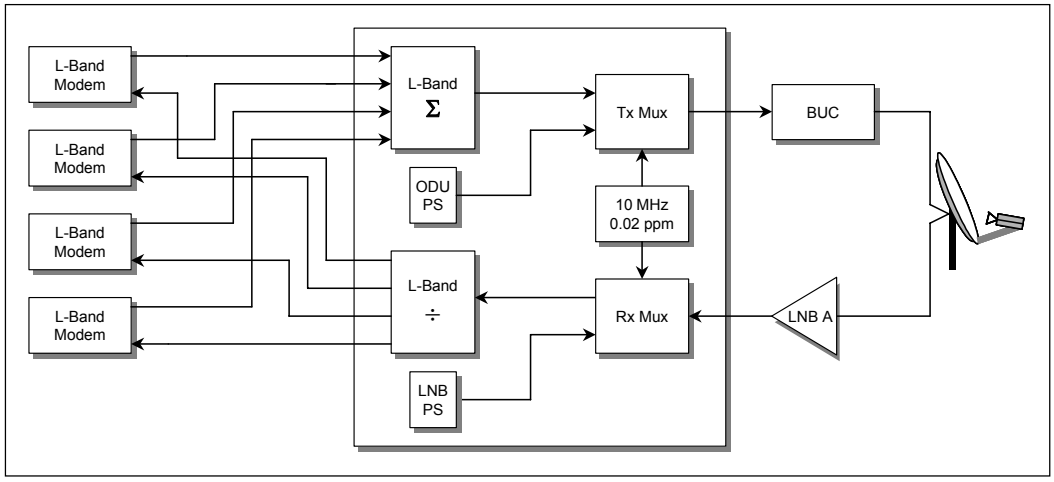

Figure A-3. Multi-Carrier Application With 1 ppm Modem

This topology relaxes the frequency stability requirements for the modem because the ODU no longer depends upon it for the 0.02 ppm reference. A 1.0 ppm stability for the modem is adequate for operation at L-Band. The symbol rate versus satellite frequency uncertainty for this application is plotted in Figure A-4 for cases with both internally and externally referenced LNBs. This figure is similar to the previous one but the curves are all displaced several kilohertz higher reflecting the relaxed 1.0 ppm frequency uncertainty for the modem.

The combination of a 1.0 ppm modem with the L-Band summer and splitter, ODU / BUC and LNB power supplies and 10 MHz reference simplify the implementation of a multi-carrier solution. By tasking the modem only with transferring L-Band signals the messy details of also handling DC and 10 MHz reference are avoided. The external unit injects the DC and 10 MHz reference on the satellite side of the splitter / summer minimizing the losses incurred if these signals were routed from the modem.

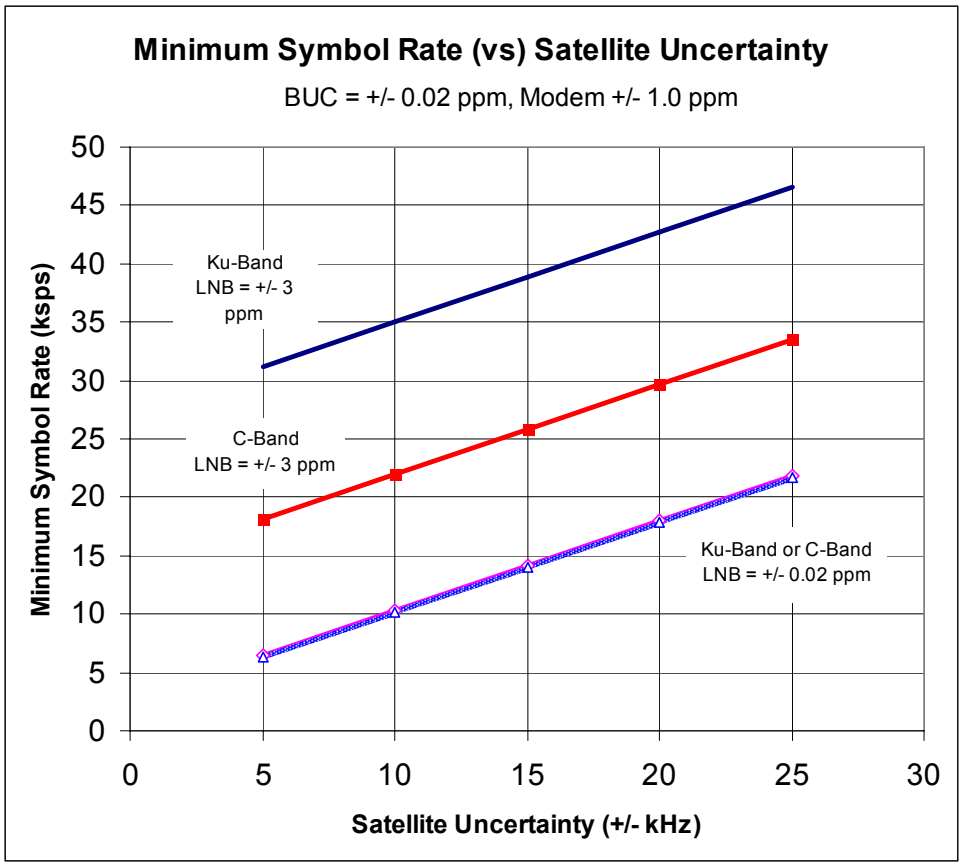

Figure A-4. Minimum Symbol Rte versus Satellite Uncertainty For Multi-Carrier Applications With a 1.0 ppm Modem

Index

METRIC CONVERSIONS

Units of Length

Unit	Centimeter	Inch	Foot	Yard	Mile	Meter	Kilometer	Millimeter
1 centimeter	—	0.3937	0.03281	0.01094	6.214×10^{-6}	0.01	—	—
1 inch	2.540	—	0.08333	0.2778	1.578×10^{-5}	0.254	—	25.4
1 foot	30.480	12.0	—	0.3333	1.893×10^{-4}	0.3048	—	—
1 yard	91.44	36.0	3.0	—	5.679×10^{-4}	0.9144	—	—
1 meter	100.0	39.37	3.281	1.094	6.214×10^{-4}	—	—	—
1 mile	1.609×10^{5}	6.336×10^{4}	5.280×10^{3}	1.760×10^{3}	—	1.609×10^{3}	1.609	—
1 mm	—	0.03937	—	—	—	—	—	—
1 kilometer	—	—	—	—	0.621	—	—	—

Temperature Conversions

Unit	° Fahrenheit	° Centigrade
32° Fahrenheit	—	0 (water freezes)
212° Fahrenheit	—	100 (water boils)
-459.6° Fahrenheit	—	273.1 (absolute 0)

Formulas
C = (F - 32) * 0.555
F = (C * 1.8) + 32

Units of Weight

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

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