AL-7103 MKII

1.15m (45”) Ku-Band & X-Band Maritime Stabilized VSAT System

Installation and Operation Manual

Document: MAN29-0669, Revision A

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Revision History & Control

Revision History

Revision #	Date	Description
Rev: -	June 2009	Initial version
Rev.: A	March 2012	Updated Version

List of Effective Pages

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 97 CONSISTING OF THE FOLLOWING:

Safety Precautions

The following general safety information is for installing, operating, and servicing the system.

Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary. Observe the following list of safety precautions when installing, operating and maintaining the system:

- Keep clear of the moving Antenna, at all times.
- The Antenna Pedestal is equipped with high torque motors that develop considerable forces. These forces can be harmful.
- This equipment contains potentially harmful voltages when connected to the designated power sources. Never remove equipment covers except for maintenance or internal adjustments.
- Before removing the covers of any unit, verify that the CCU POWER switch is in the OFF position.

- Metal parts accessible to the operator are connected to the chassis' ground to prevent shock, and similar hazards. The chassis' ground conductor must not be removed. Ensure the enclosure is at ground potential.
- Only qualified and trained personnel should perform installation, operation and maintenance of this equipment.
- Although the Radome is not heavy, care should be taken when lifting it since it acts as a sail during windy conditions. At least two people should handle the Radome during installation.
- To prevent shock or fire hazard, when sub-units are open or cables are disconnected, do not expose the equipment (with the exception of the Radome) to rain or moisture.
- Avoid making unauthorized modifications to the circuitry. Any such changes to the system will void the warranty.
- Do not disconnect cables from the equipment while the system is powered-on.

- Interfacing this equipment requires the use of high quality connectors and cables.
- Use only ORBIT authorized parts for repair.

About this Manual

This manual is designed to guide you through the operating and installation procedures for the OrSat (AL-7103-Ku & X) system.

Conventions Used in this Manual

This text style…	Identifies…	Example
Text	Normal descriptive text.	
Text	Emphasized text.	
Text/**Text**	Words or figures that appear on the screen or that should be typed, or a key to be pressed < >. The name of a file or directory.	400
TEXT	The name of a software or hardware component.	ANTENNA
	The description of a procedure.	➢ **To configure…**

Notations in this Manual

This information is important and should be noted.

Information given in this message warns of a hazard.

Information given in this warning refers to the safest method of installation or operation and *must be adhered to.*

Acronyms & Abbreviations

ADE	Above Deck Equipment
ADMx	Above Deck MUX
BDE	Below Deck Equipment
BDMx	Below Deck MUX
BUC	Block Up Converter
B/W	Band Width
CCU	Central Control Unit
IMU	Inertial Measurement Unit
KB	Keyboard
LNA	Low Noise Amplifier
LNB	Low Noise Block
M&C	Monitor & Control
Mk	Mark
MMI	Man-Machine Interface
MUX	Multiplexer
PSU	Power Supply Unit
RJ	Rotary Joint
SBC	Single Board Controller
SDM	Servo Drive Module
SR	Slip Ring

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List of Figures

1 Overview

1.1 Introduction

The Dual-Band AL-7103-Ku & X OrSat system is a Stabilized Marine Communication System, carrying a dual-offset, 1.15m (45”) Tx/Rx composite material antenna, housed inside a low-loss 1.28m (50”) Radome.

The system supports the following frequency bands:

- Ku Band :
  - Tx: 13.75-14.5GHz
  - Rx: 10.7 to 12.75 GHz
- X Band:
  - Tx: 7.9-8.4 GHz
  - Rx: 7.25-7.75 GHz

The system is designed to maintain, at all times, an accurate look angle of a high-efficiency linear-polarized satellite communication antenna towards a pre-selected geo-stationary communication satellite, while the platform on which it is mounted rocks and rolls on the ocean waves, in any relevant geographical location on the Globe: +75 to –75 deg Latitude.

The look angle is maintained in three angular dimensions with respect to the satellite: Azimuth, Elevation and Polarization Skew.

All the above is to allow a continuous two directional Tx/Rx satellite communication data link brought to life by one of the industry standard satellite digital communication modems, able to interface with the signals produced by the OrSat (AL-7103-Ku & X) antenna on L-Band frequency band from one hand, and the user data network from the other.

The satellite modem is not part of the OrSat (AL-7103-Ku & X) system and is normally provided by the customer or system integrator.

1.2 System Architecture

Refer to MAN26-1327-OrSat AL-7103-Ku System User Guide.

1.3 System Key Features

Refer to MAN26-1327-OrSat AL-7103-Ku System User Guide.

2 X-Band System Description

This Chapter describes the differences between the X-Band system and the Ku-Band system.

For a detailed description of the Ku System, refer to MAN26-1327-OrSat AL-7103-Ku System User Guide.

2.1 Main System Components

2.1.1 Above Deck Equipment (ADE)

Antenna and RF Front-end Assembly

The dual-offset, high efficiency, Gregorian 1.15m (45”) composite material antenna, is installed on the Y axis, and carries the Tx/Rx X-Band RF front end.

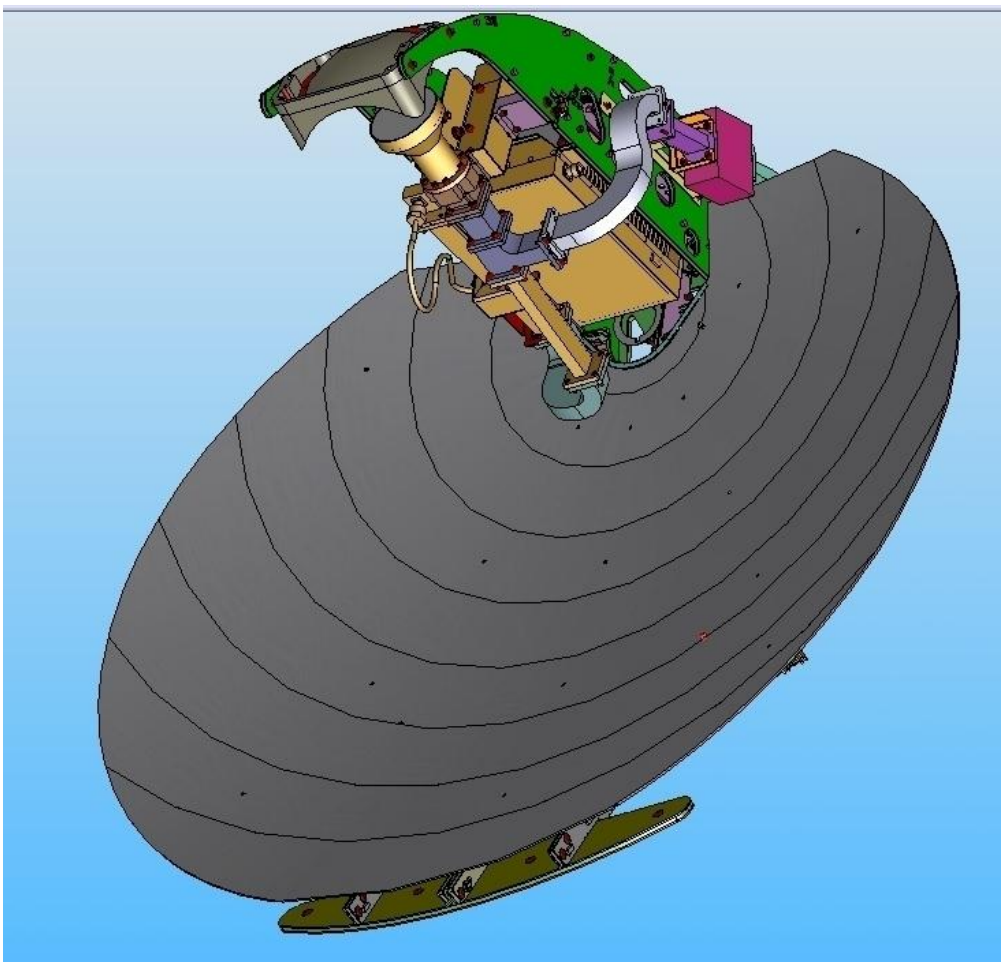

Figure 2-1: Antenna Reflector and RF Front-End

RF Package

The RF Package, mounted on the antenna reflector, includes the following major components:

- 10W BUC
- RF front end:
  - X-Band Feed
  - Septum Polarizer
  - 40 dB Rx Reject Filter
  - 60 dB Rx Reject Filter
  - Tx Reject Filter
  - LNB
  - X-Band Wave Guide
- DC Inserter

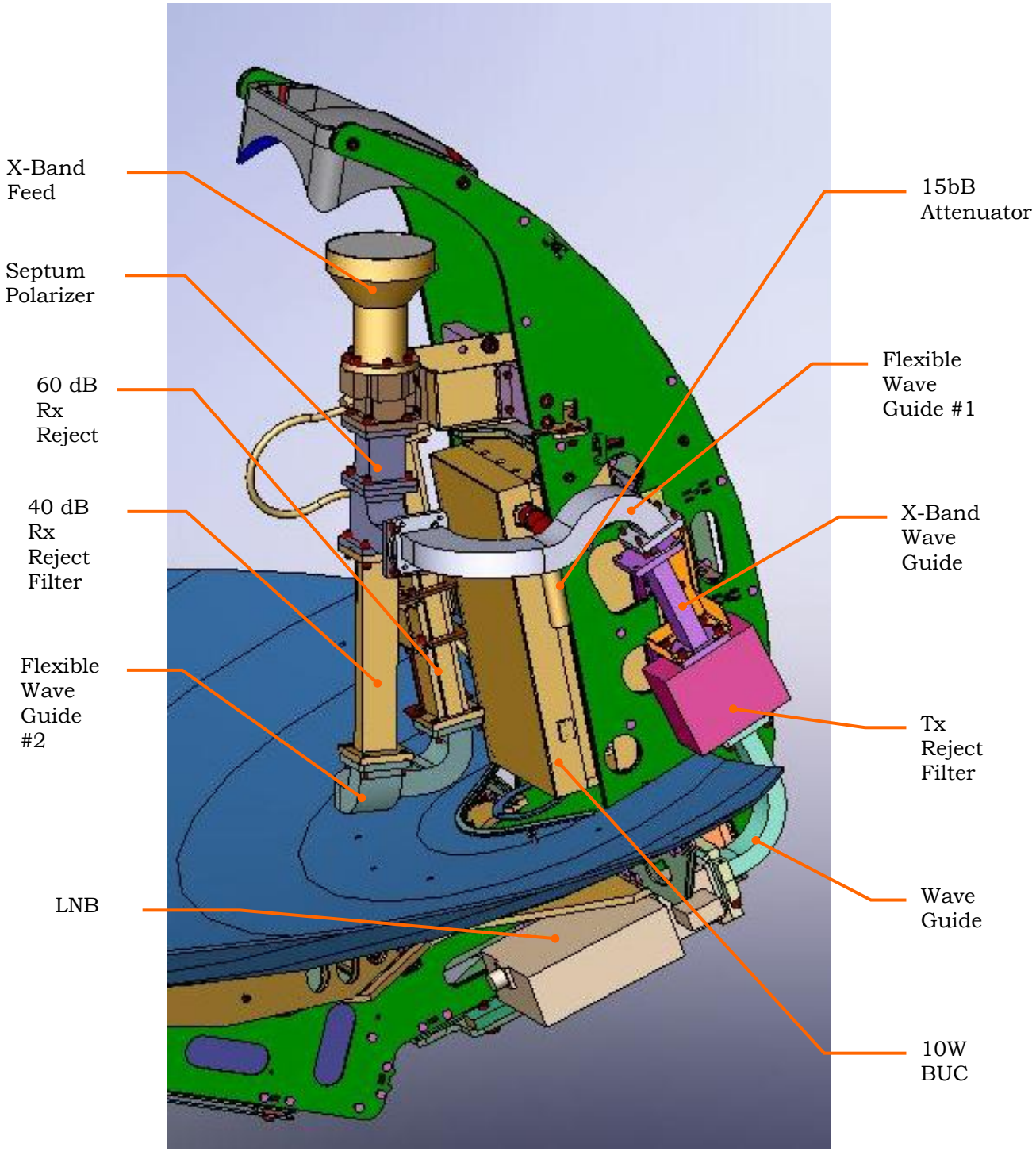

Figure 2-2: RF Package (sheet 1 of 2)

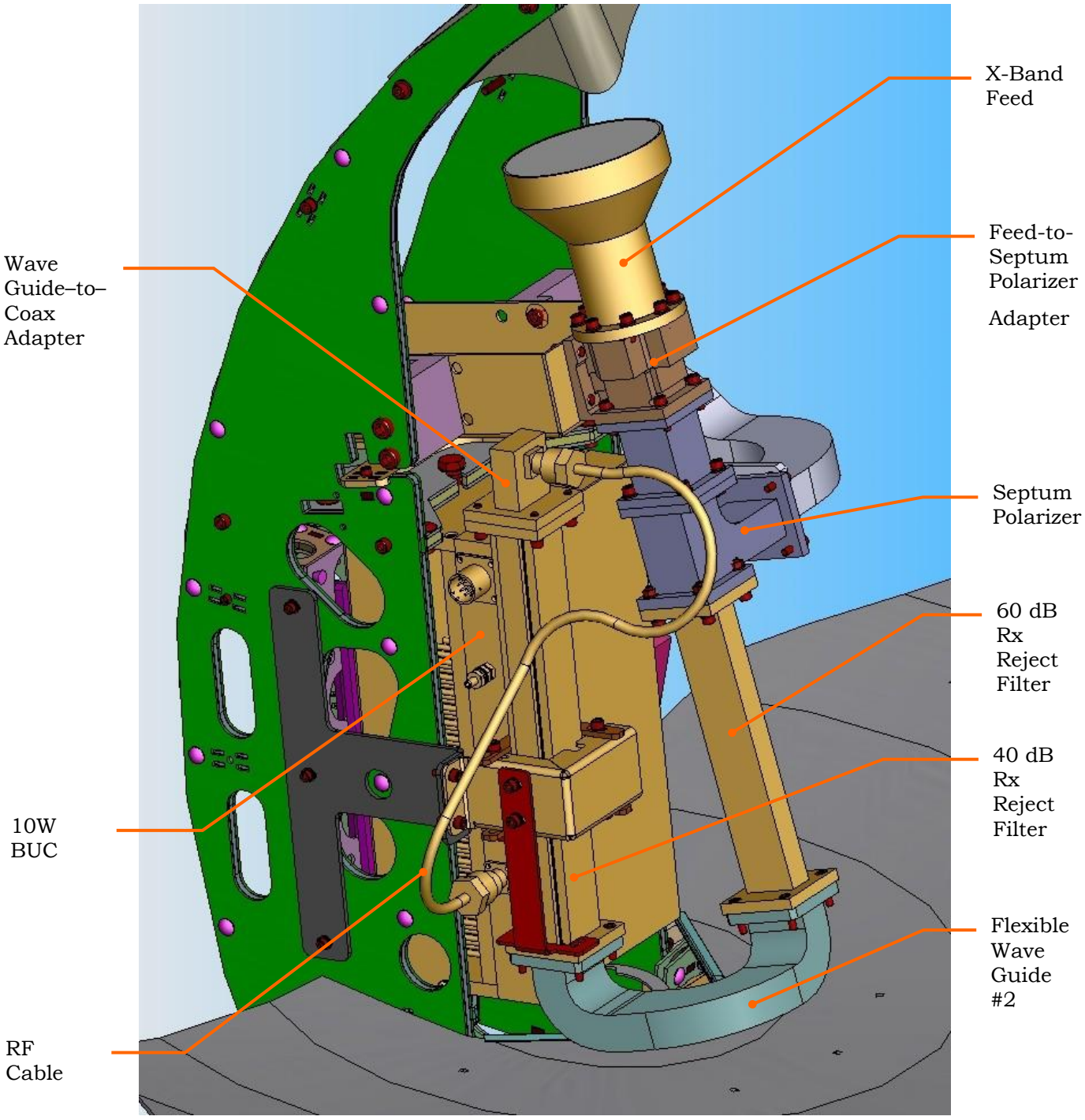

Figure 2-3: RF Package (sheet 2 of 2)

40 dB RX-Reject Filter

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X-Band RX-Reject Filter

P/N: AAF-0734/05

ELECTRICAL SPECIFICATION:

Passband Frequency range	7.90 ÷ 8.40 GHz
VSWR	1.15:1 max
Insertion loss	0.4 dB max
Reject Frequncy Band	7.25 ÷ 7.75 GHz
Rejection	40 dB min
Rejection @6.95 GHz	92 dB min

MECHANICAL SPECIFICATION:

Dimensions (LxWxH)	180mm x 47.8mm x 47.8mm
Flange type	UBR 84
Weight	0.4 Kg
Painting	according to fed std 595 N 17875 (white)

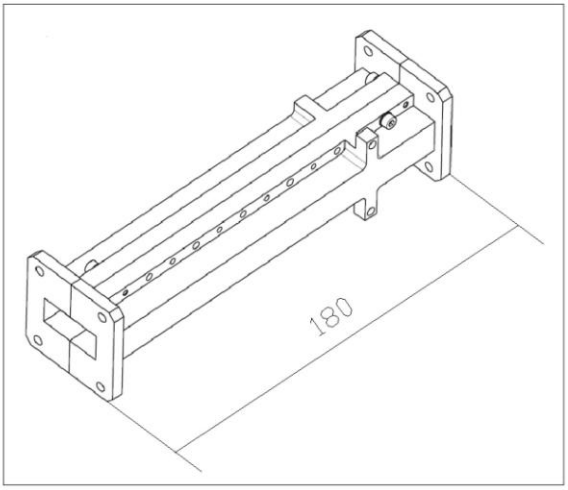

Fig. 1: Assembly dimension

60 dB RX-Reject Filter

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X-Band RX-Reject Filter

P/N : AAF-0674/06

ELECTRICAL SPECIFICATION:

Passband Frequency range	7.90 ÷ 8.40 GHz
VSWR	1.15:1 max
Insertion loss	0.45 dB max
Reject Frequncy Band	7.25 ÷ 7.75 GHz
Rejection	60 dB min
Rejection @6.95 GHz	110 dB min

MECHANICAL SPECIFICATION:

Dimensions (LxWxH)	258mm x 47.8mm x 47.8mm
Flange type	UBR 84
Weight	0.5 Kg
Painting	according to fed std 595 N 17875 (white)

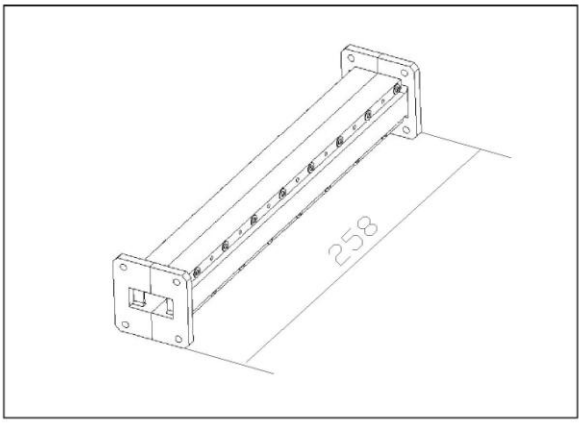

Fig. 1: Assembly dimension

X-Band TX-Reject Filter

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X-Band TX-Reject Filter

P/N : AAF-0764/01

ELECTRICAL SPECIFICATION:

Passband Frequency range	7.25 ÷ 7.75 GHz
VSWR	1.15:1 max
Insertion loss	0.35 dB max
Reject Frequency Band	7.90 ÷ 8.40 GHz
Rejection	62 dB min

MECHANICAL SPECIFICATION:

Flange type	PBR84
Dimensions (LxWxH)	74mm x 90mm x 48mm
Weight	0.7 Kg

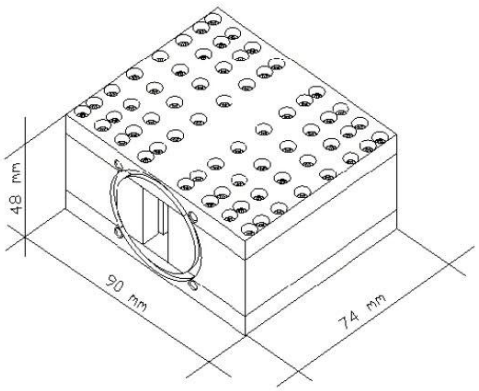

Fig. 1: Assembly dimensions

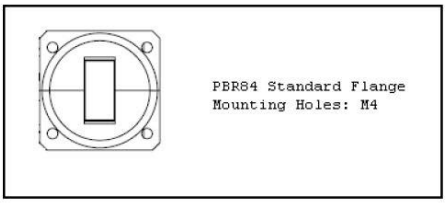

Fig. 2: Filter Flanges

X-Band Wave Guide

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WG15

P/N: AAF-0857/01

ELECTRICAL SPECIFICATION (Assy):

Frequency range

RX Band..... 7.25 ÷ 7.75 GHz

TX Band..... 7.90 ÷ 8.40 GHz

VSWR..... 1.1:1 max

Insertion loss.....0.05 dB max

MECHANICAL SPECIFICATION (Assy):

Flange type UBR84

Port Interfaces..... WR112

Dimensions (LxWxH)..... 99.1mm x 47.75mm x 47.6mm

Weight .....0.1 Kg

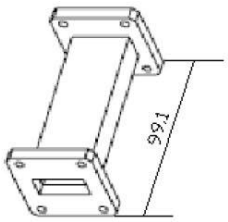

Fig. 1: Assembly dimensions

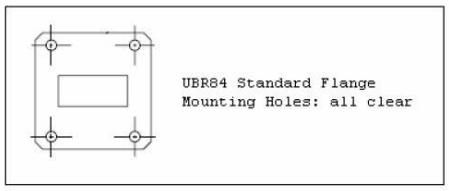

Fig. 2: WG15 Flanges

Septum Polarizer

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Septum Polarizer

P/N: AAF-0021/01 + AAF-0022/01

ELECTRICAL SPECIFICATION (Assy):

Frequency range

- RX Band ..... 7.25 ÷ 7.75 GHz
- TX Band ..... 7.90 ÷ 8.40 GHz

VSWR ..... 1.12:1 max

Insertion loss ..... 0.15 dB max

Axial Ratio ..... 0.5 dB max

Polarization Isolation ..... 23 dB min

Polarization Isolation @ 6.95 GHz ..... 18 dB min

MECHANICAL SPECIFICATION (Assy):

Flange type PBR84

TX-RX Port Interfaces WR112

Dimensions (LxWxH) ..... 107.5mm x 100.2mm x 47.6mm

Weight ..... 0.3 Kg

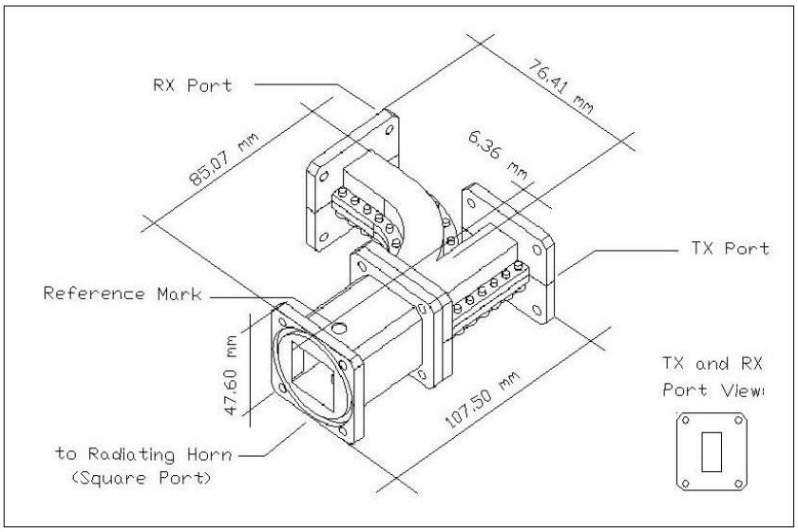

Fig. 1: Assembly dimensions

RX and TX Ports are referred to Reference Mark for a dual reflector optic.
A 180° rotation of Septum Divider is allowed without any port change.

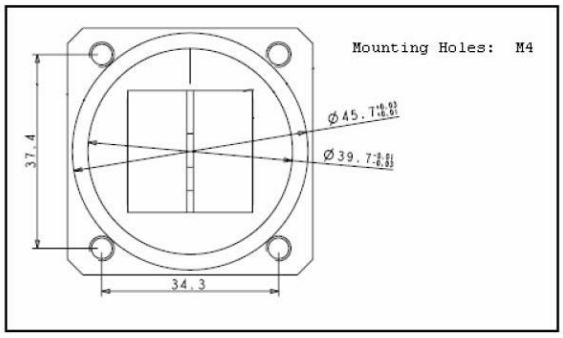

Fig. 2: Square Port (to radiating horn) Flange

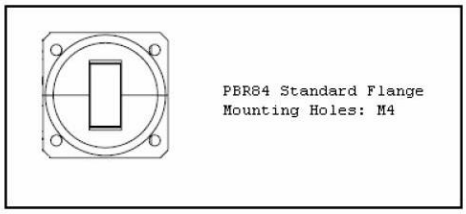

Fig. 3: RX Port Flange

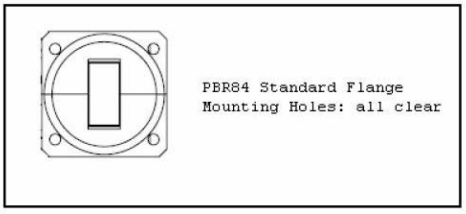

Fig. 4: TX Port Flange

Low Noise Block (LNB)

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LNB

P/N: AAC-0521/01

MECHANICAL SPECIFICATION:

Flange type	UBR84
Port Interfaces	WR112
Dimensions (LxWxH)	210mm x 100mm x 50mm
Weight	1 Kg

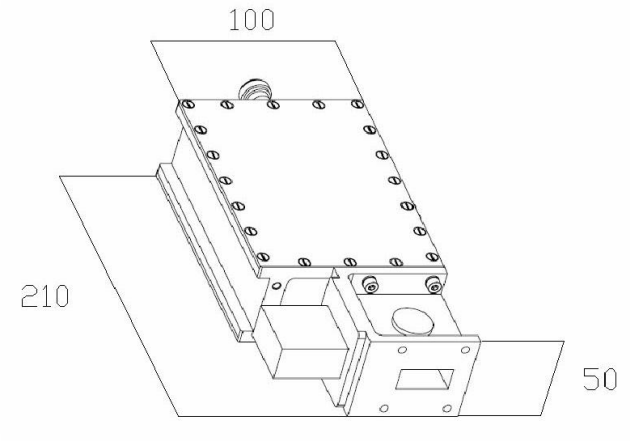

Fig. 1: Assembly dimensions

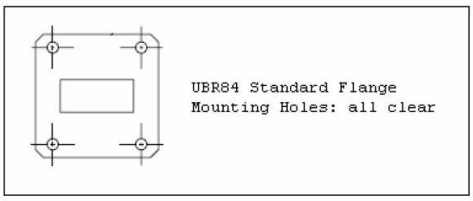

Fig. 2: LNB Flanges

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X-BAND LNB CONVERTER

GENERAL

The X-Band Low Noise Block (LNB) Converter is capable of converting the RF (7.25 ÷ 7.75 GHz) received signal into the L-Band (950 ÷ 1450 MHz) output signal, by means of a 6300 MHz Local Oscillator (LO). Moreover, it incorporates a proper low noise amplifier (LNA), in order to provide the required RF to L-Band gain with associated low noise figure at the input section (0.75 dB typical value).

COMPOSITION

The X-Band LNB Converter consists of the following main parts:

- Low Noise Amplifier (LNA)
- Tx Reject Filter
- X/L Down Converter
- Local Oscillator (LO)
- L-Band Amplifier
- Multiplexer Section
- DC Section
- WR112 Isolator.

Low Noise Amplifier (LNA)

The LNA operates on the 7.5 GHz band of frequency and features a multi-stage amplification architecture with Tx reject filter as embedded interstage.

Tx Reject Filter

The Tx Reject Filter is a pass band filter, embedded into the LNA. It features a bandwidth covering the whole input frequency range and allows significant rejection in the nominal Tx portion of the X-Band [7.9 ÷ 8.4 GHz], before the conversion process.

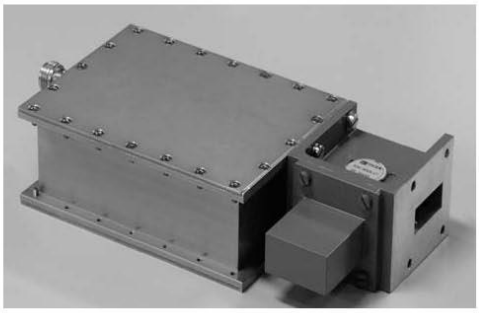
X/L Down Converter

The X/L Down Converter accomplishes the received signal conversion from the X-Band (7.25 ÷ 7.75 GHz) to the L-band (950 ÷ 1450 MHz), by means of a single conversion process, using a suitable high rejection mixer and a fixed Local Oscillator, without introducing frequency spectrum inversion.

Local Oscillator (LO)

The Local Oscillator performs the generation of a 6300 MHz fixed frequency reference signal. It is phase locked to a 10 MHz external reference, provided through the IFL coaxial cable interface.

The LO is integrated in an independent small-sized housing, located inside the LNB's overall mechanical enclosure, in order to protect the other equipment parts against EM interferences.



L-Band Amplifier

The L-Band amplifier is included in the RF/L-Band conversion chain to achieve the total required gain.

Multiplexer Section

The Multiplexer Section merges three signals into a single IFL coaxial cable: the L-Band output, the DC power supply input and the 10MHz external reference.

DC Section

The DC Section converts the DC input power, coming in through the IFL coaxial cable interface, into the DC voltage, required by the active devices. The overall power requirement is about 5 W.

A surge protection allows the X-Band LNB Converter to be protected against voltage and current surges, which may be induced into the IFL coaxial cable by nearby lightning strikes.

WR112 Isolator

The WR112 Isolator is a waveguide isolator, which provides the proper electric adaptation, for avoiding RF signal reflections to cause disturbances. It can be sized to fit the application's performance requirements.

INTEGRATION SCHEME

The X-Band LNB Converter's parts (LNA, Multiplexer, X/L-Band Converter, etc.) are integrated in three printed circuits boards (PCBs). Microstrip technology, based on "*soft substrates*" is employed.

Code: 6tm-cl000003-e Rev B

> X-BAND LNB CONVERTER

INTERFACES
The RF input interface is a WR112 waveguide transition, equipped with the WR112 Isolator.
The L-Band output connector is an N type female one. The same connector provides the DC power supply input and the 10 MHz external reference.

MECHANICAL CONFIGURATION
The X-Band LNB Converter is housed in an outdoor, waterproof (IP65) enclosure and is able to operate in a large temperature range (–32 ÷ +49 °C), at a relative humidity up to 100%, including condensing, and at an altitude of (up to) 3000 m above the sea level.

The small size and the light weight allow an easy mounting of the X-Band LNB Converter close to the antenna feed system.
Overall dimensions are: 195 x 48 x 100 mm (W x H x D) The weight is 1.2 Kg.
The paint colour is IR green.

EMC
The X-Band LNB Converter is compliant to MIL-STD-461.

MAIN FEATURES

- X-Band (7250 ÷ 7750 MHz) RF Input
- L-Band (950 ÷ 1450 MHz) IF Output
- No Spectral Inversion
- Low Intermodulation Distortion
- Low Phase Noise
- RF Isolation
- Embedded Rejection Scheme
- 60dB (typical) Gain
- 10 MHz External Reference
- External DC Power Supply
- Inter Facility Link on a single coaxial cable (IF Signal, 10MHz Reference and DC Power)
- Low Power Consumption (5 W)
- Light and Small Sized Package
- Easy-To-Install
- Reliable Outdoor Operation
- Weather Resistant (IP65 Protection)
- MIL-STD-461 Compliant

Code: 6tm-cl000003-e Rev B

> X-BAND LNB CONVERTER

TECHNICAL SPECIFICATIONS

RF INPUT CHARACTERISTICS

- Frequency: 7250 ÷ 7750 MHz
- Interface: WR 112 waveguide
- Noise Figure: Typical (55°K @ T = 23°C): 0.75 dB
  Max (75°K @ T = 23°C): 1.0 dB
- Tx Rejection (7.9 ÷ 8.4 GHz): 30 dB min
- VSWR: 1.25: 1 max
- Max Input level (no damage): + 10 dBm

L-BAND OUTPUT CHARACTERISTICS

- Frequency: 950 ÷ 1450 MHz
- Connector: Type-N Female
- Impedance: 50 Ohm unbalanced
- VSWR: 2.5 : 1 max
- Level (@ 1 dB compression point): 0 dBm min
- Intermodulation Products (with two tones 10 MHz apart, -10 dBm IF Output Power): -45 dBc min

TRANSFER CHARACTERISTICS

- Gain: 55 dB min, 60 dB typical
- Gain variation (over freq and temp): 6 dB p-p max
- Gain flatness in the whole band: 4 dB p-p max
- Gain flatness in any 36 MHz band: 1 dB p-p max
- Image rejection: 45 dB min
- Local oscillator frequency: 6300 MHz
- Phase Noise:
  - @ 100 Hz: -70 dBc/Hz max
  - @ 1 kHz: -75 dBc/Hz max
  - @ 10 kHz: -83 dBc/Hz max
  - @ 100 kHz: -93 dBc/Hz max
- Local oscillator leakage (@ waveguide input): -45 dBm max
- Local Oscillator Frequency Stability:
  as per external reference signal characteristics
- Spurious:
  - @ input level, signal independent: -140 dBm
  - @ IF output (-10 dBm output level): -50 dBc max

REFERENCE INPUT CHARACTERISTICS

- Frequency: 10 MHz
- Impedance: 50 Ohm unbalanced
- Connector: type-N Female (through IFL cable)
- VSWR: 1.5 : 1 max
- Level: -8 ÷ 0 dBm
- Frequency stability:
  - $\pm$ 3 x 10^{-8}, Temperature range 0 ÷ 50 °C
  - 1 x 10^{-11}/second (Allian variance)
  - 5 x 10^{-10}/day, T = cost, after 24 hours on time
  - 1 x 10^{-7}/year
- Phase Noise:
  - @ 10 Hz: -115 dBc/Hz max
  - @ 100 Hz: -140 dBc/Hz max
  - @ 1 kHz: -145 dBc/Hz max

ELECTRICAL INTERFACES

- RF input signal: WR-112 waveguide (UBR 84 flange / standard 4 clear holes)
- L band output signal: Type-N (50 Ohm) Female
- DC power: supplied through IFL cable
- External reference input signal: supplied through IFL cable

POWER SUPPLY CHARACTERISTICS

- DC power: +12 to +24 Vdc / 400 mA max supplied through IFL cable
- Power consumption: 5 W

MECHANICAL CHARACTERISTICS

- Sizes (W x H x D): 195 x 48 x 100 mm
- Weight: 1.2 Kg
- Protection: IP65

ENVIRONMENTAL CHARACTERISTICS

- Operating temperature: -32 ÷ +49 °C
- Storage temperature: -40 ÷ +71 °C
- Relative Humidity and frost: up to 100%, including condensing
- Operating altitude: 3000 m above the sea level
- Storage altitude: 10000 m above the sea level

RELIABILITY CHARACTERISTICS

- MTBF> 50000 h
- MTTR: $\leq$ 1 h
- Accordance to MIL-HDBK-217F, notice 2, "Ground Fixed" environment @ T= 25 °C

QUALIFICATIONS

- MIL-STD-461

Code: 6tm-cl000003-e Rev B

Block-Up-Converter (BUC)

General

- The 10W X-Band Block Up Converter, ITS Electronics model number UC-L7A98A4-4060, is a frequency translator with an integral power amplifier. It allows the translation of the input signals in the L band to the X band.
- In order to convert the frequency the Block Up Converter uses a integral RF local oscillator, mixing stage and the proper filtering.
- The local oscillator is able to phase-lock to an external signal, received @10MHz, in order to avoid frequency shifts. The 10MHz reference signal is frequency multiplexed with the input transmit signal, so to have a single interface cable.
- The Block Up Converter is remote-controllable by means a serial interface.
- The Block Up Converter operates outdoor, directly exposed to any environment agent, like rain, snow, sand, solar radiation etc.

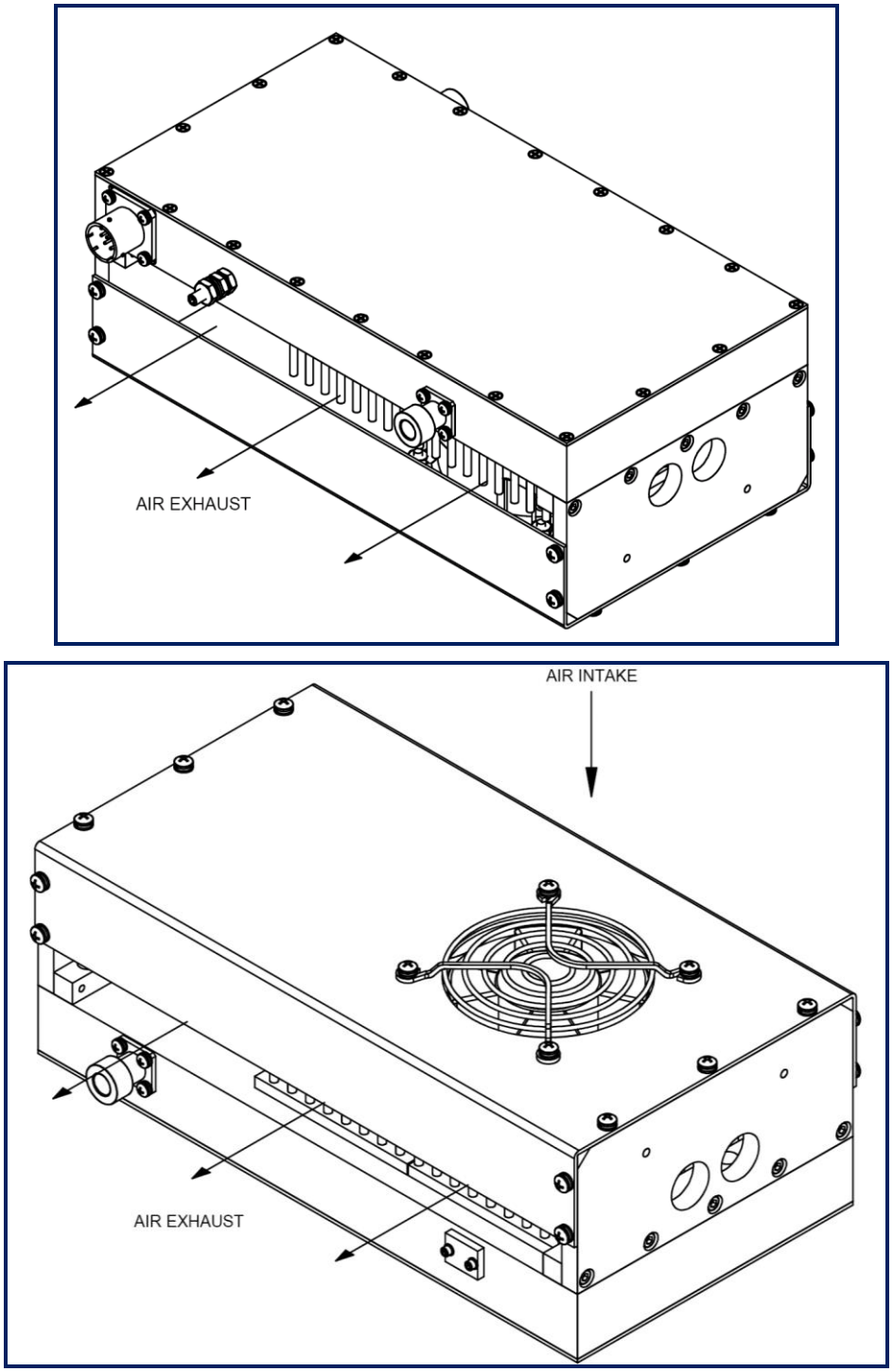


Figure 2-4: 10W BUC General View

M&C Interface

The following commands are available on the Remote Control:

- List available RS-232 commands
- Toggle periodic Diagnostic Data / Status Report
- Send single Diagnostic Data / Status Report
- Mutes / Unmutes the BUC
- Resets the unit
- Display Unit ID Information

The following signaling is provided on the Remote Control:

- RF Output Power Level (accuracy ±1.5 dB)
- Over Temperature Faults
- PA Temperature too high
- BUC Temperature too high
- Ambient Temperature too high
- PA Temperature too low
- BUC Temperature too low
- Ambient Temperature too low
- LO Lock Lost
- Fan spinning too fast
- Fan spinning too low.

PORT	FREQUENCY RANGE
IF INPUT	950 to 1450 MHz
RF OUTPUT	7.90 to 8.40 GHz

Pin designation for connector		
Connector	Pin	Function
J2	3	RS232 TX-D
	4	RS232 RX-D
	12	Reserved
	13	Reserved
	2, 7, 8, 11	GND
	5, 9, 10	20 to 28 Vdc, 50mVpp, 90W total
	1, 6	Not connected

Figure 2-5: BUC IF, RF and DC POWER/M&C Connectors

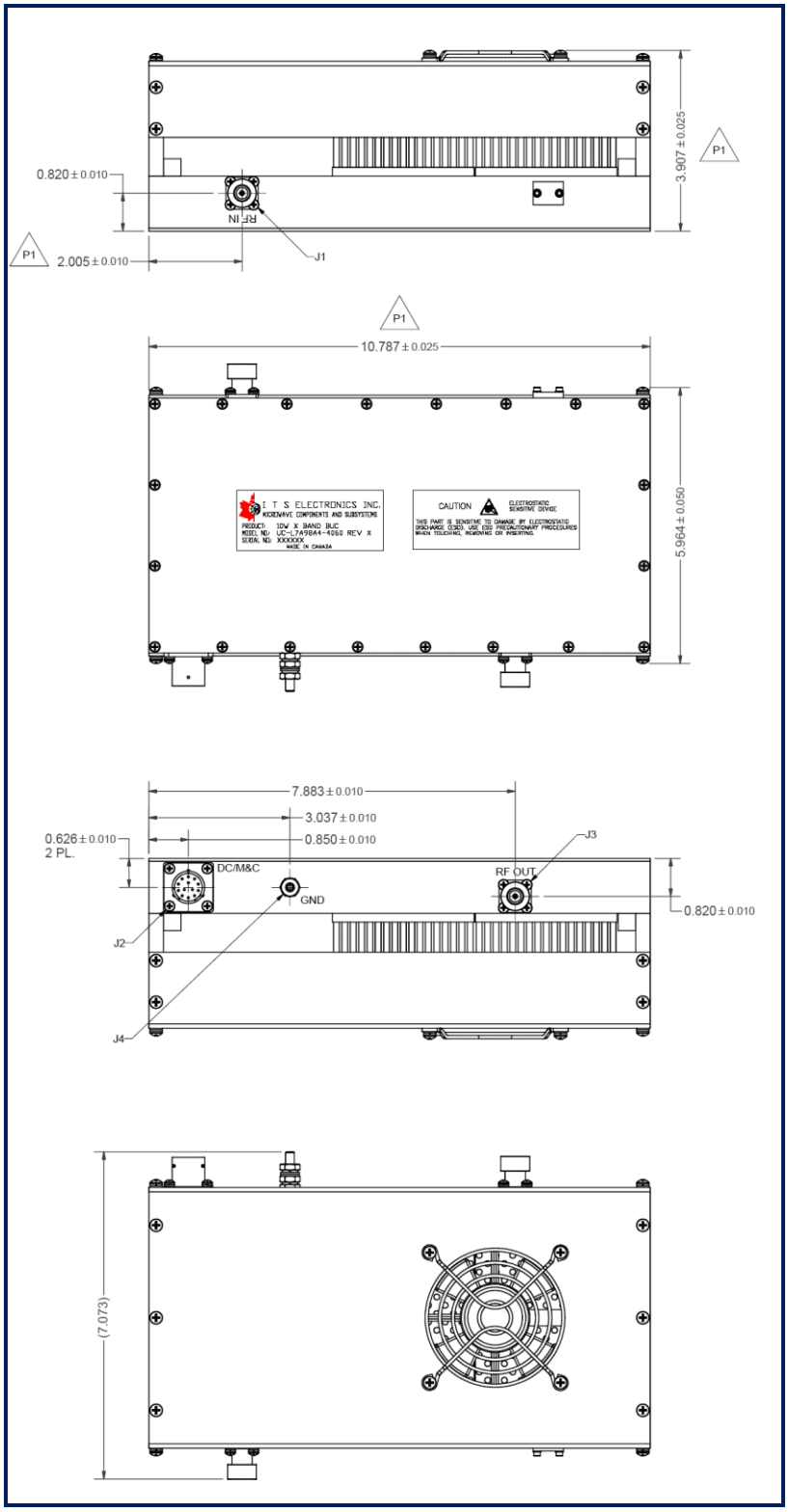
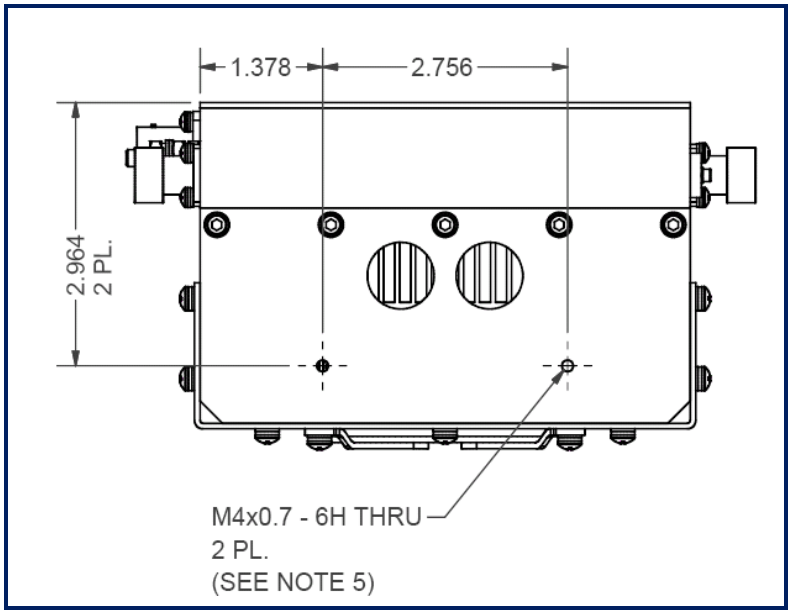
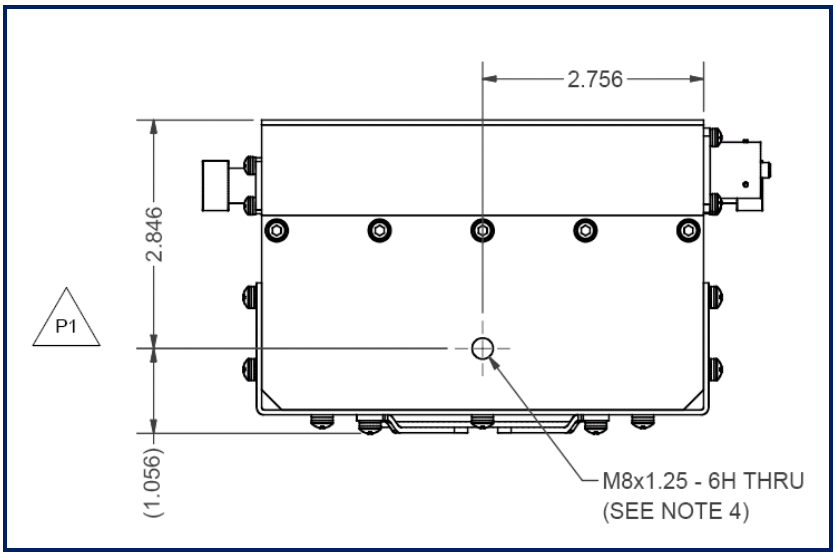


Figure 2-6: 10W BUC Layout Dimensions (sheet 1 of 2)





MECHANICAL SPECIFICATION

1. CONNECTORS:
   J1: RF INPUT, N-TYPE FEMALE, 50 Ohm.
   J2: DC INPUT / M&C, MIL-C-38999 SERIES I,
   13-PIN, PN# MS27466T-11B35P.
   J3: RF OUTPUT, N-TYPE FEMALE, 50 Ohm.
   J4: GROUND, #10-32 STUD.
2. MARKINGS: LABELS.
3. FINISH: NATO GREEN STANAG IR 2338.
4. M8 MOUNTING HOLE: 7.9mm OF AVAILABLE THREAD WITH 10mm OF MINIMUM CLEARANCE.
5. M4 MOUNTING HOLES: 7.9mm OF AVAILABLE THREAD WITH 8mm OF MINIMUM CLEARANCE.

Figure 2-7: 10W BUC Layout Dimensions (sheet 2 of 2)

Electrical characteristics

Input frequency range	MHz	950 ÷ 1450
Output frequency range	MHz	7900 ÷ 8400
Output power @1dBcp	dBm	+ 40.0 min
Output saturated power	dBm	+ 41.0 typ.
Max input level (no damage)	dBm	-10
Input VSWR	-	1.5:1 max
Output VSWR	-	1.5:1 max
Gain	dB	55 min
Gain flatness full band	dB	± 1 max
Gain flatness in 40 MHz	dB	± 0.25 max
Gain stability v/s temp.	dB	± 2.0 max
Gain Mute (ext command or unit fault)	dB	60 dB min
Two Tone Intermodulation @3dB back off from 1dBcp (total power)	dBc	- 26 max
Spurious, signal related	dBc	-50 max
Spurious, signal independent	dBm	-10 max in 7900÷8400 MHz
Spurious, out of TX RF band including IM products falling in RX band	dBm	-10 max
LO Leakage	dBm	-40 dBm @ 6950 MHz
Noise Power Density	dBm/KHz	-93 max in 7250÷7750 MHz
Phase Noise	dBc/Hz	-65 max @100Hz [ext. ref. –135 min]
		-75 max @1000Hz [ext. ref. –145 min]
		-85 max @10KHz [ext. ref. –145 min]
		-95 max @100KHz [ext. ref. –145 min]
Ext Reference Frequency	MHz	+10.00
Ext. Reference Level	dBm	-5 ÷ +5
2nd harmonic	dBc	-60 max
Noise Figure	dB	12 max @ max gain
Power requirements		20÷28 Vdc, 50mVpp, 90W
Serial interface		RS 232 9600 b/s, 8 bits ASCII, 1 start, 1 stop bit

Mechanical characteristics

Weight	Kg	6 max
Painting		NATO White Stanag IR 2338
Cooling		Forced air
Air inlet		Fan guards with integral filter; no additional filters are required in the specified environment conditions
RF input connector		N female 50 Ω
RF output flange		CPR 112 Grooved
DC Power / M&C connector		13-pin MIL -38999 Series MS27468T-11B35P

Environmental characteristics

Operating temperature	°C	-40 ÷ +65
Storage temperature	°C	-40 ÷ +80
Relative Humidity	100% MIL-STD810F Method 507.4 - Procedure I max. temp. 60ºC max R.H. 100%	
Rain	2”/hour max	
Altitude	10000 amsl min, derated by 6°C/1000m	
Sand and Dust	MIL-STD810F Method 510.4 - Procedure I	
Salt fog	MIL-STD810F Method 509.4 - Procedure I	
Solar Radiation	1120 W/m2 MIL-STD810F Method 505.4 - Procedure I 3 cycles 32-49ºC 0/1120 W/m2	
Shock	MIL-STD 810 F – Method 516.5 proc. 1 – Functional Shock	
Vibrations	MIL-STD 167 -1 Mast Mounted	
EMI/EMC	diated emissions according to MIL-STD-1E Method RE102 (army ground) diated Susceptibility according to MIL-STD-1E Method RS103 (army ground) nducted Susceptibility according to MIL-D-461E Method CS114 (army ground)	
Safety	according to IEC 60950	

DC Inserter

The DC inserter is used to feed 24VDC power supply voltage into the LNB.

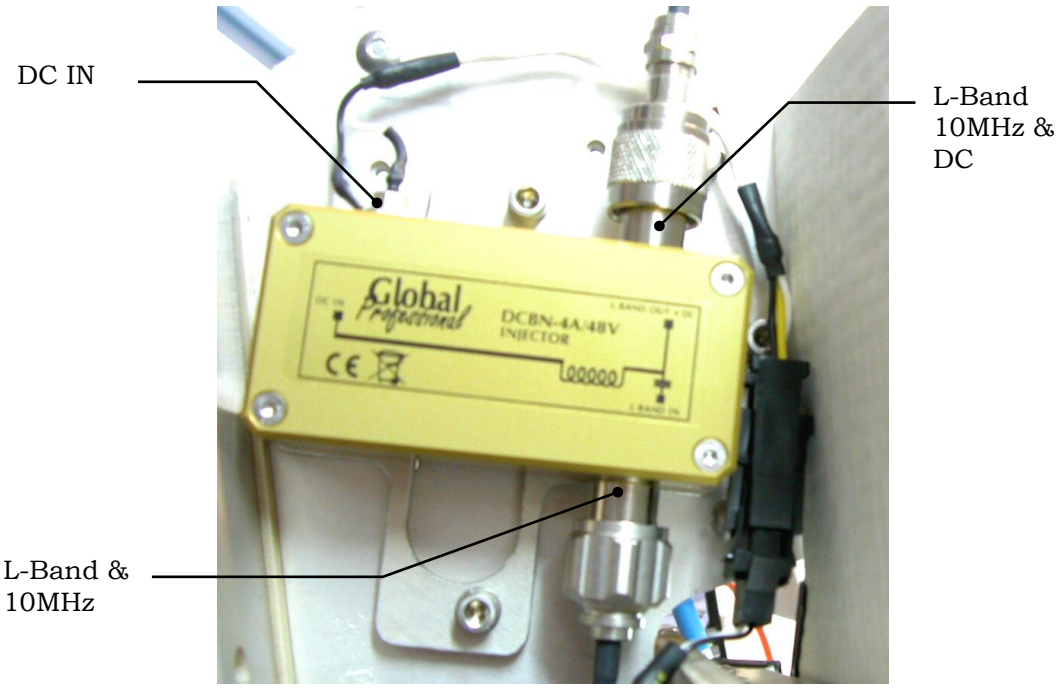


Figure 2-8: DC Inserter

2.2 Block Diagram Description

2.2.1 Overall System Description

The System is divided to the Above Deck Equipment (ADE) contained inside a Radome, and the Below Deck Equipment (BDE) that includes a Control computer (CCU) that provides a Man Machine Interface to the ADE. The CCU is connected to the compass and the satellite modem (provided by the customer).

The following Figures provide several levels of the system's block diagram:

- ADE Overall Block Diagram
- ADE Power Distribution Block Diagram
- ADMx-BDMx Link

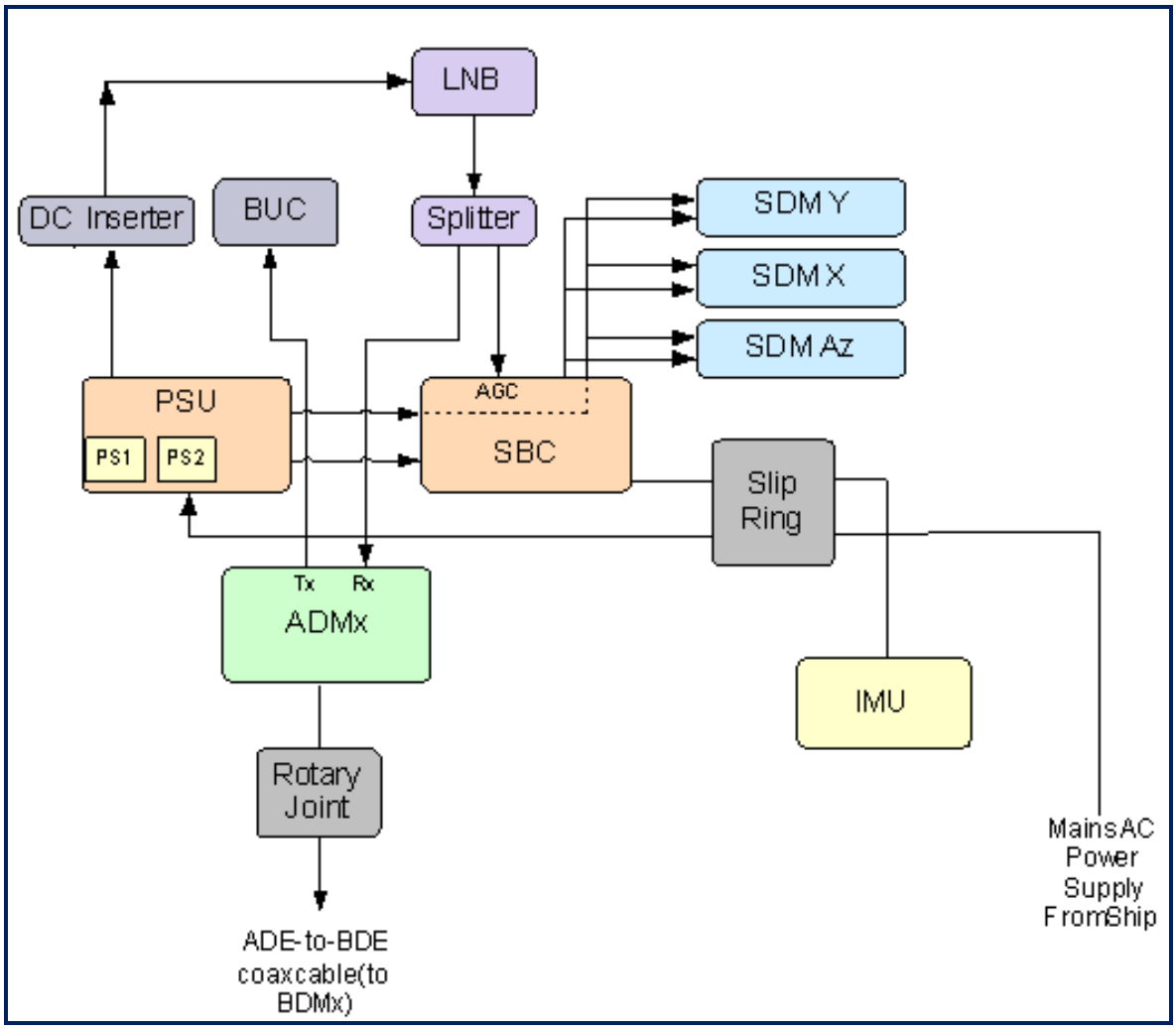


Figure 2-9: ADE Overall Block Diagram

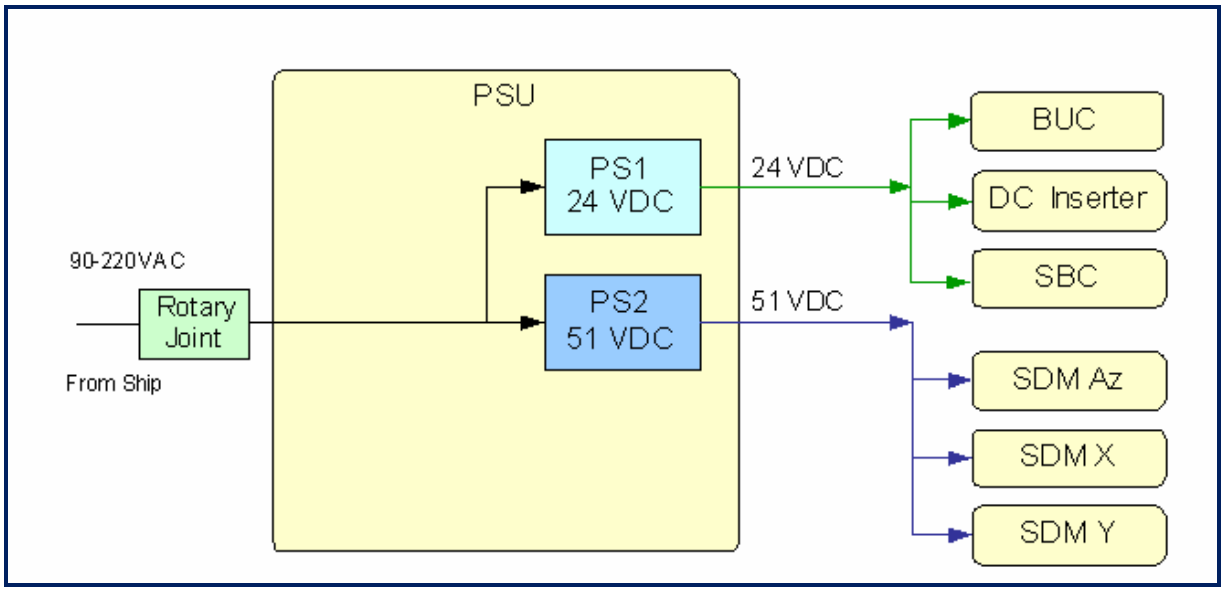


Figure 2-10: Power Distribution Block Diagram

2.3 ADE Interconnections and Cables

The AL-7103 ADE wiring is comprised of the following:

- Main Control harness connecting the SBC with all three SDMs
- Rx Coaxial path connecting the LNB to the ADMx and the SBC
- Tx Coaxial path connecting the BUC to the ADMx
- Single Channel Rotary Joint passing on the ADE-BDE connection to the ADMx
- Multiple Slip-ring assembly passing on the AC Mains power to the PSU as well as the IMU power and control signals to the SBC.

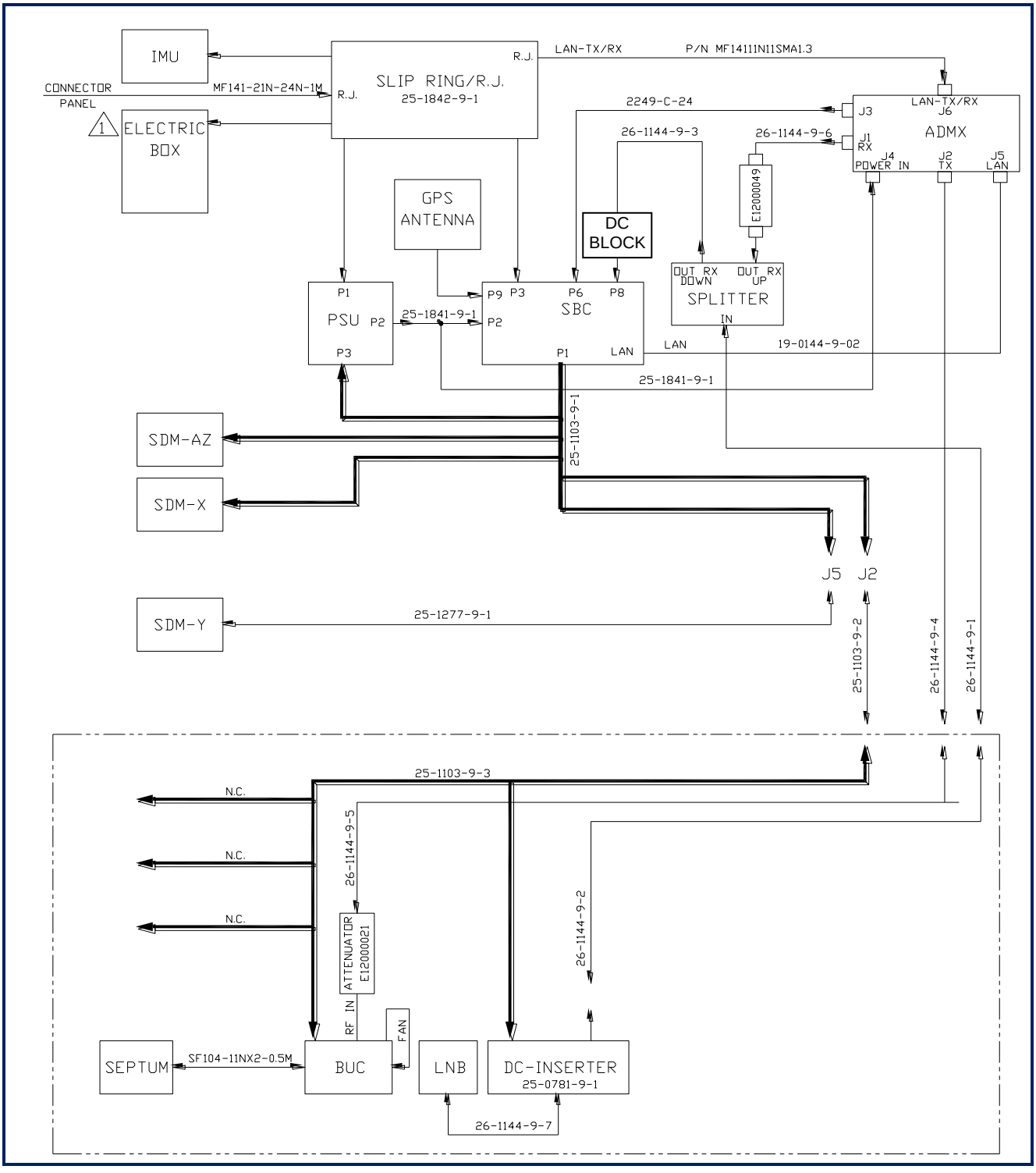


Figure 2-11:OrSat (AL-7103-Ku & X) System – X-Band Configuration Cabling Diagram

No.	CABLE P/N	CABLE DESCRIPTION
1	25-1841-9-1	PSU TO SBC POWER CABLE
2	25-1103-9-1	MAINE HARNESS AL-7103-SYSTEM
3	25-1103-9-2	SPIN THRU WEDGE CABLE
4	25-1103-9-3	POL-DISH CABLE
5	26-1144-9-1	RF CABLE 1.2M RX-WEDGE/RX SPLITTER
6	26-1144-9-2	RF CABLE 1.3M RX-WEDGE/RX-LNB
7	26-1144-9-3	RF CABLE 0.65M RX-SPLITTER/RX-SBC-J8
8	26-1144-9-4	RF CABLE 1.22M TX WEDGE/TX-ADMX
9	26-1144-9-5	RF CABLE 1.3M TX-DC INS./TX-WEDGE
10	26-1144-9-6	RF CABLE F-MALE 0.25M
13	25-1277-9-1	SDM-Y SPIN THRU X AXIS (J5-SDM)
15	25-1842-9-1	SLIP RING WIRING
16	MF14111N11SMA1.3	LAN-TX/RX INPUT CABLE R.J./ADMX
17	2249-C-24	ADMX TO SBC CABLE
19	MF141-21N-24N-1M	LAN-TX/RX INPUT WEDGE TO R.J.
20	19-0144-9-02	LAN CABLE SBC TO ADMX
21	E12000049	FILTER 22 KHz
22	25-0781-9-1	DC INSERTER ASSY
23	E12000021	ATTENUATOR 50R15DB N M/F LF
24	SF104-11NX2-0.5M	RF CABLE N TO N 0.5MTR

Figure 2-12: OrSat (AL-7103-Ku & X) System – X-Band ADE Cables

2.4 System Technical Specifications

2.4.1 Weight

- 270Kg (595 lb)

2.4.2 Packaging

- Weight: 400Kg [880 lb]
- Dimensions:
  - L= 1600 mm (63")
  - W= 1600mm (63")
  - H = 1825mm (71.8").

2.4.3 Radome

Dome Diameter:	1.28m (50”)
Base Diameter:	1.415m (55.7”)
Radome Height:	1.610m (63.4”)

2.4.4 CCU Interfaces

Modem Lock (IRD)	Yes
VGA Out:	Yes
LAN:	Yes
USB (for SW update):	Yes
Ship Gyro Interface	NEMA 0183 Synchro Step-by-Step

2.4.5 CCU Power Requirements

115VAC/220VAC 50Hz/60Hz (Switch), 150W

2.4.6 Antenna System

Antenna Type:	Gregorian Dual offset
Antenna diameter:	45” (1.15m)

2.4.7 Frequency Operation

Tx:	7.9-8.4 GHz
Rx:	7.25-7.75 GHz
Antenna Polarity:	Circular: Tx - RHCP, Rx - LHCP

2.4.8 Gain

Tx:	36.3dBi @8.15 GHz
Rx:	35.6dBi @7.50 GHz

- Cross-Pol. Discrimination: 35dB
- System G/T 12.9 [dB/K^{o}], @ 7.5 GHz, 20^{o} el.
- Sidelobe levels:

  $D/\lambda < 50$. The gain of the antenna shall be such that at least 90 percent of the sidelobe peaks do not exceed:

  $$G(\theta) = 32\text{-}25 \log_{10} \theta \text{ (dBi)}, \text{ for } 100\ \lambda/D \leq \theta \leq 48^{\circ}$$

  $$G(\theta) = -10 \text{ (dBi)}, \text{ for } 48^{\circ} < \theta \leq 180^{\circ}$$

- Radome Loss: 0.4dB Typical
- Terminal EIRP: 45.0dBw @ 8.15 GHz (10w BUC)

2.4.9 Range of Motion

- Full hemispherical coverage, down to satellite elevation view angle as low as 0° at all sea conditions.
- With no mechanical “points of singularity” (No “Keyholes” at Zenith & Horizon).
- Azimuth: Continuous
- Elevation: 0^{o} to 90^{o}

  (view angle including ship motion)
- Polarization: V/H
- Pointing Accuracy: 0.1° RMS.

2.4.10 Ship Motion

- Roll: 30° @ 8 sec.
- Pitch: 15°@ 6 sec.
- Yaw: 8° @ 15 sec.
- Turning Rate: 12°/sec

2.4.11 Electrical Interfaces

Power Requirements:

- AC (ADE) — AUTO RANGE, 90 to 250 VAC, 50/60 Hz, 350W, (with 4W BUC)

L-band:

- RX: — 950 – 1950 MHz
- TX: — 950 – 1450 MHz (STD)
  950 – 1700 MHz (EXT)

GPS out:

- Update rate: — 1 per second
- Availability: — Continuously

NBR Bandwidth:

- 0 – 70KHz (50KHz)
  Or
- 70 – 180KHz (150KHz)
  Or
- 180 –400KHz (300KHz)

- Beacon Signal (for the NBR): — Min. C/N 10Db
  (for a given bandwidth of 25 kHz [Min.])

2.4.12 Environmental Conditions for Above Deck Equipment (ADE)

- EMC: IEC-EN 60945 (Maritime Radio System Testing)
- Safety: EN 60204-1 & ISO 12100-2
- Shock: MIL-STD 810E Method 516.5 Pro. I
- Vibration: MIL-STD-167-1 (Mast Mounted)
- Temperature: -20°C to +45°C
- Solar Radiation 1,120W/sqm max.
- Humidity: up to 100% @ 40°C
- Wind Speed: 100 Knots
- Snow/Ice max loading: 20kg/sqm
- Salt atmosphere MIL-STD-810E Method 509.4 Proc. I
- Environmental Conditions for Above Deck Equipment (BDE):
  - EMC: IEC-EN 60945 (Maritime Radio System Testing)
  - Temperature: 0°C to +50°C
  - Humidity: 5 to 85% @ 40°C
  - Required Rack Unit: 5U including Keyboard

3 Principles of Operation

Refer to MAN26-1327- OrSat AL-7103 Installation and Operation Manual.

4 Getting Started - Basic System Operation

Refer to MAN26-1327- OrSat AL-7103 Installation and Operation Manual.

5 Error Messages & Troubleshooting

Refer to MAN26-1327 - OrSat AL-7103 Installation and Operation Manual.

6 Installation Guide

The Installation of the OrSat (AL-7103-Ku & X) consists of the following steps:

Step	Subject	Reference
1	Ship Survey & Installation Planning	Paragraph 6.1
2	Unpacking the system	Paragraph 6.2
3	Installation of the ADE	Paragraph 6.3
4	Installation of the BDE	Paragraph 6.4
5	Compass configuration procedure	Paragraph 6.5
6	Modem integration	Paragraph 6.6
7	Cease Transmission (Tx) Configuration	Paragraph 6.7
8	Polarization Skew Alignment Procedure	Paragraph 6.8
9	Setting the AGC Threshold Level	Paragraph 6.9

6.1 Ship Survey & Installation Planning

Refer to MAN26-1327- OrSat AL-7103 Installation and Operation Manual.

6.2 Unpacking the System

Refer to MAN26-1327- OrSat AL-7103 Installation and Operation Manual.

6.3 Installing the ADE

Refer to MAN26-1327- OrSat AL-7103 Installation and Operation Manual.

6.4 Installing the BDE

Refer to MAN26-1327- OrSat AL-7103 Installation and Operation Manual.

6.5 Compass Configuration Procedures

Refer to MAN26-1327- OrSat AL-7103 Installation and Operation Manual.

6.6 Modem Integration

6.6.1 Introduction (Rx & Tx Path Gain Calculation)

Following completion of the AL-7103 Mk II System installation, the Modem (which is not part or Orbit's deliverables) should be installed, connected and configured.

When installing the modem, verify the following:

- Rx signal, into the Modem, is within the modem dynamic range.
- Tx signal, from the modem, is set so that the BUC is not saturated, and on the other end strong enough for quality transmission (1dB Compression point).

The following paragraphs provide calculation examples, for a 50 m ADE-BDE cable, showing how to calculate the gain budget along the system's Rx and Tx paths.

For any other cable type or cable length, perform the pertaining calculations.

6.6.2 Rx Chain Gain Budget (from LNB to Rx Modem Input)

#	Parameter	Value
1	Total Rx chain Gain (ADMx & BDMx)	25dB, typical
2	Typical loss of LMR-400 cable	9dB @ L-BAND for 50m
3	Typical loss of cables, splitter & rotary joint within the pedestal	8dB
4	Total loss (# 2+3)	17dB
5	Total Rx system Gain (# 1–4)	8dB
6	Typical LNB output	– 55dBm
7	**Rx Input level to the modem (# 6+5)**	**-47dBm**

Conclusion: The calculated Rx Input level to the modem (-47dBm) is typically within the dynamic range of the modems, (depends on types of modem, modulation schemes & data rates).

6.6.3 Tx Chain Gain Budget (modem to BUC input)

Coarse Adjustment

#	Parameter	Value
1	Total Tx chain Gain (ADMx & BDMx)	21dB, typical
2	Typical loss of LMR-400 cable	15dBm @ 4.7GHz for 50m
3	Typical loss of cables & rotary joint within the pedestal	3dB
4	15 dB Attenuator	15dB
5	Total loss (# 2+3+4)	33 dB
6	Total Tx system Gain (# 1–5)	-12 dB
7	Typical BUC input level for 1dB Compression	10W(40dBm) BUC: – 20dBm @60db Gain
8	**Typical coarse value of modem output, for BUC 1dB Compression (# 6-7)**	**10W BUC:** **-20 – (-12)= -8 dBm**
9	Typical Modem dynamic output range	0 to – 30dB

Conclusion: The calculated coarse value of modem output, for BUC 1dB Compression is within the typical Modem dynamic output range (0 to – 30dB).

Fine adjustment model output level (using the HUB station)

Setting the Modem power for driving the BUC to 1dB Compression:

1. Activate “Tx on” in the Modem.

   Caution: use the coarse typical calculated values as a starting modem power level (in order to avoid BUC saturation).

2. Raise the Modem power 1 dB at a time while monitoring of the signal at the HUB Spectrum Analyzer (1dB of power giving increase of 1dB of signal).

3. 1dB Compression is reached when 1dB increase of Modem power causes less then 0.5dB of increase in signal level. Do not increase the Modem power beyond this point, as it will drive the BUC into compression.

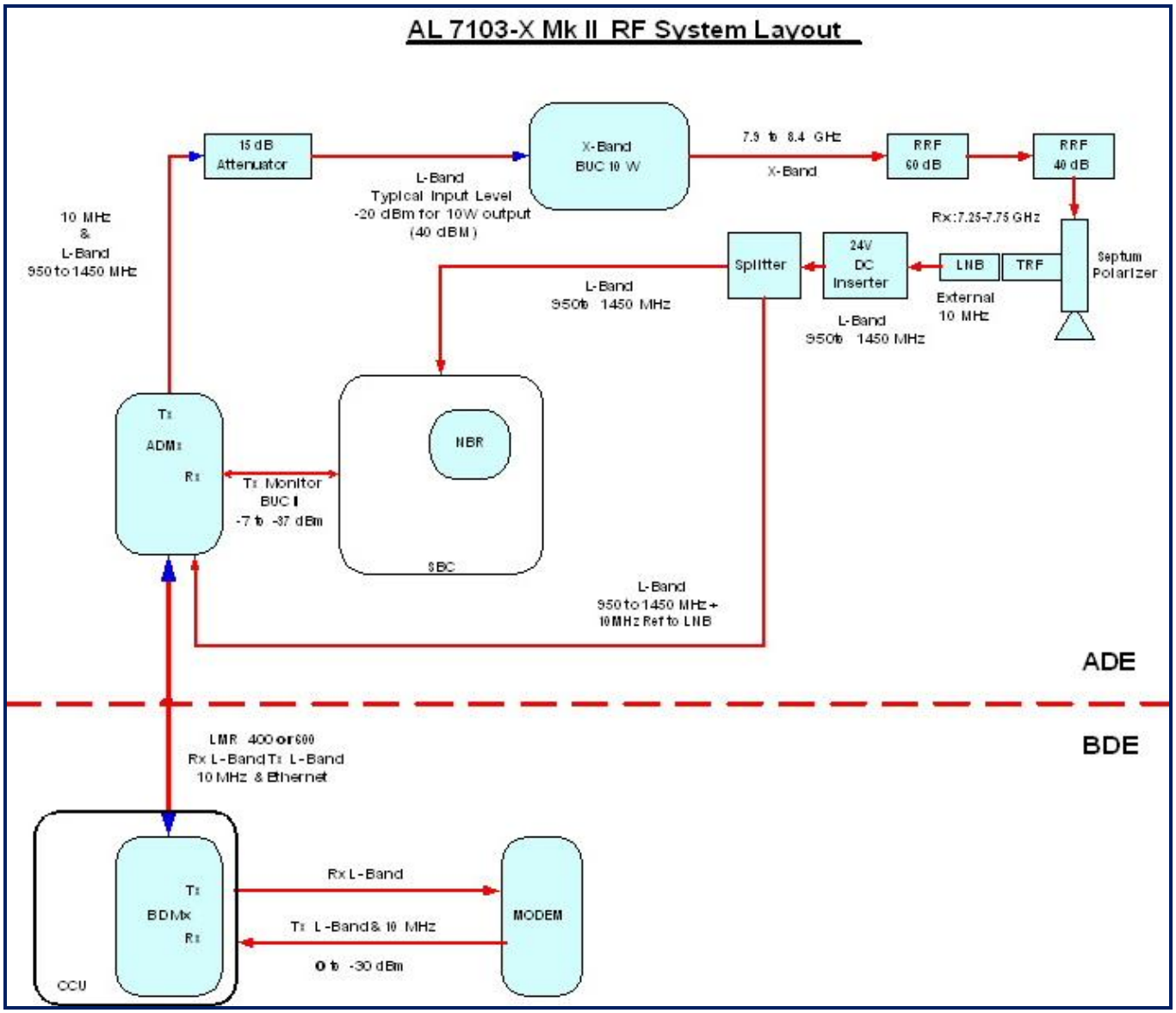


Figure 6-1: AL 7103-X Mk II System - RF Layout

6.6.4 Setting up the GPS output on CCU COM2

Refer to MAN26-1327- OrSat AL-7103 Installation and Operation Manual.

6.7 Cease Transmission (Tx) Configuration

To set and configure the Cease-Transmission (Tx) feature, perform the following procedures.

6.7.1 Setting up Cease-Tx Control

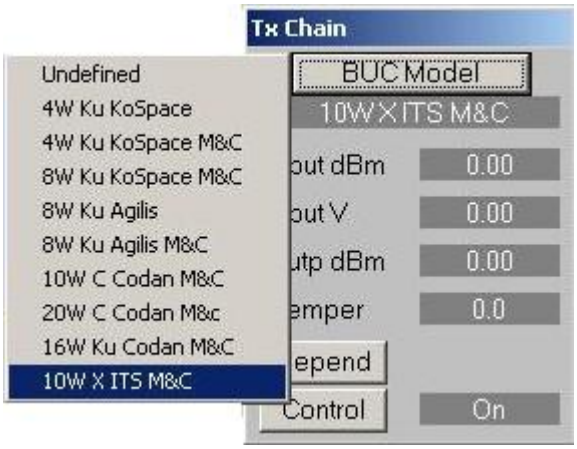
Purpose

The below explains the monitoring and control of the AL-7103 Tx Chain with all BUCs currently defined as valid options.

The Tx-Chain consists of BUC, ADMx, and the logic for automatic control over Tx-enable by the AL-7103 software (“Cease Transmit”).

“Tx Chain” Configuration Screen

“Tx Chain” screen contains the following:



BUC Model:

BUC Model selection list:

“Undefined”, “4W Ku KoSpace”, “4W Ku KoSpace M&C”, “8W Ku KoSpace”, “8W Ku Agilis”, “8W Ku Agilis M&C”, -, “10W C Codan”, “20W C Codan”, “16W Ku Codan”, “10W X ITS M&C”.

Input (dBm):

L-Band signal power measured on the output of the ADMx in dBm. If ADMx to BUC input losses are taken into consideration, this value has a good correlation of the L-band power injected into the BUC

Input (Volts):

L-Band signal power as measured by the ADMx monitor, in Volts, before the conversion to dBm.

Output (dBm):

BUC output power indication in dBm. This is only presented for BUC’s equipped with a output power monitor compatible with the SBC interface: 10w and 20w Codan, 8w KoSpace. If not active, this display will present a blank field.

~~~~~~

Disclaimer Note:

Neither Input (dBm) nor Output (dBm) are designed as precision measurement devices. The presented values have more of an indicative quality, their accuracy strongly dependent on the BUC brand as well as the current environmental conditions.

Regardless, those tools have been proven as extremely effective aids for the in-field integration process.

~~~~~~

Temperature (degC):

BUC temperature indication in degC. This is only presented for BUC's equipped with a temperature monitor compatible with the SBC interface: 10w and 20w Codan, 8w KoSpace. If not active, this display will present a blank field.

Control Button: Tx Control

The button presents a select list with the following options: None/On/Off/Auto.

Default: On (To prevent the need of Configuration change, after software upgrade on a system equipped with KoSpace 4w BUC)

Last selection is saved in non-volatile memory if "Save Maintenance" (or "Save All") is activated.

(Note that in the present version this control has only three states: On/Off/Auto)

Function:

When changed to "On" – The AL-7103 software should send a Tx-On command

When changed to "Off" – The AL-7103 software should send a Tx-Off command

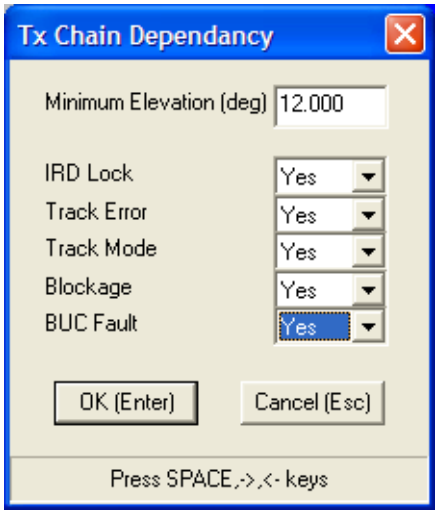
When set to "Auto" – The AL-7103 software will send a Tx-On command if all of the "Tx Dependency"-enabled conditions are true for the duration of minimal time of two consecutive seconds. The AL-7103 software will send a Tx-Off command if one, or more, of the "Tx Dependency"-enabled conditions are false.

When set to "None" – The AL-7103 software will not send any commands.

When "Tx Control" is set to either On, Off, or None the "Tx Dependency" parameters should be disabled (presented in light gray).

Control Button: Tx Dependency

The button opens a configuration sub-screen with the following parameters:



Function:

Min Elevation [deg]: Tx will be stopped if the antenna Elevation angle, relative to the Earth horizon, goes below the dialed value.

IRD Lock: If set to “Yes”, will stop Tx if satellite IRD Lock turns to “Unlock”

Track Error: If set to “Yes”, will stop Tx if the Tracking error produced by the ConScan Step-track, exceeds the Track Error Threshold value, as set in Step-track configuration sub-screen

Track Mode: If set to “Yes”, will stop Tx if the current mode is not Step-track

Blockage: If set to “Yes”, will stop Tx if Antenna view is blocked according to Antenna Blockage Zones settings

BUC Fault: If set to “Yes”, will stop Tx if BUC Fault is identified.

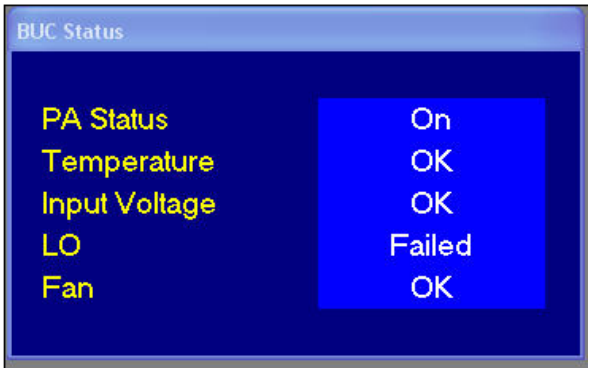
Note that when a Cease-Tx condition is identified, the BUC Tx is stopped immediately (less then 100msec), while when the Cease-Tx condition disappears, the BUC Tx is renewed only after a 2 second delay. This is in compliance with regulatory requirements.

All the above is relevant only if the Control is set to “Auto” and the particular selected BUC has the appropriate interface for Tx Control: “10W X ITS M&C”.

“BUC Status” Screen

BUC Status screen is sequentially accessible thru the “GpsTunerBUC” control label on the Maintenance screen. “BUC Status” screen will present the following status:

For “10W X ITS M&C” Model:



PA Status: On/Off

Temperature: OK/Failed

Input Voltage: OK/Failed

LO: OK/Failed

Fan: OK/Failed

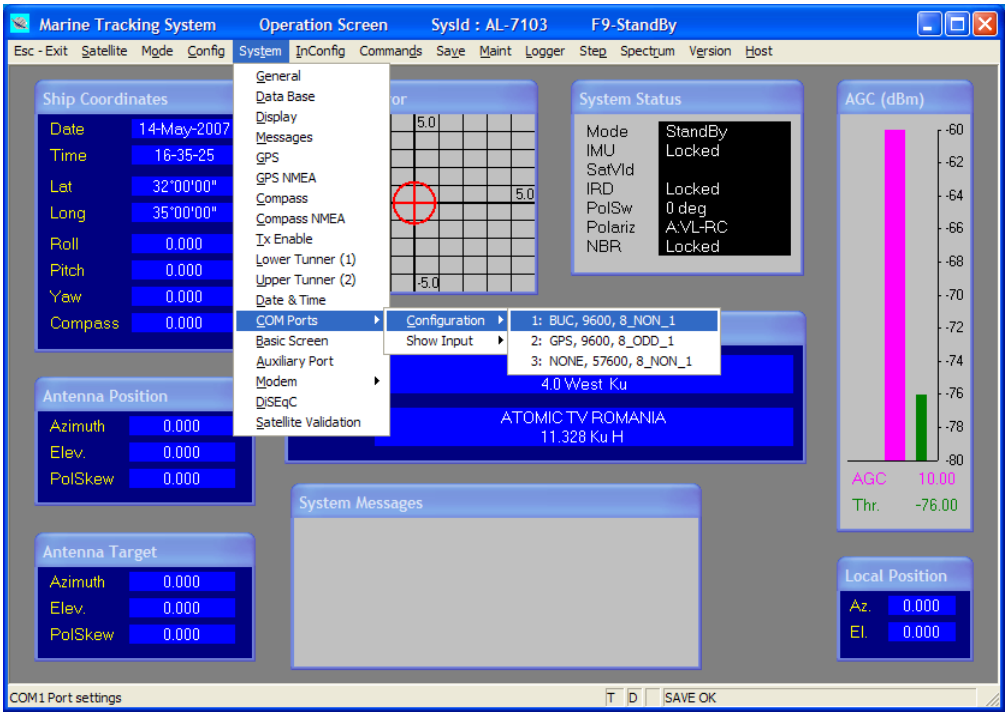
Note that “LO” will indicate “Failed” if there is no 10MHz sync on the BUC input.

BUC Serial number

Hardware ID screen presents BUC S/N for BUCs, which are able to provide this info.

COM-1 Set-up for BUCs using Comm-link

For selected BUC using a serial communication link to converse with the SBC, the COM-1 port must be set up accordingly:



6.7.2 Enter Blockage Zones Angles

Refer to MAN26-1327 - OrSat AL-7103 Installation and Operation Manual.

6.7.3 Set-up Local Position Antenna Angles Display

Refer to MAN26-1327 - OrSat AL-7103 Installation and Operation Manual.

6.8 Polarization Skew Alignment Procedure

Refer to MAN26-1327 - OrSat AL-7103 Installation and Operation Manual.

6.9 Setting the AGC Threshold Level

Refer to MAN26-1327 - OrSat AL-7103 Installation and Operation Manual.

7 Appendix A – Installation Addendum

Refer to MAN26-1327 - OrSat AL-7103 Installation and Operation Manual.

8 Appendix B – Installation and Removal of Ku-Band and X-Band RF Kits

8.1 Overview

8.1.1 Introduction

This appendix provides information and instructions required to change between Ku-Band and X-Band configurations of the OrSat AL-7103 System.

This document includes the following procedures:

Changing the system configuration from Ku-Band to X-Band

- Removal of Ku-Band RF Kit.
- Installation of X-Band RF Kit.

Changing the system configuration from X-Band to Ku-Band

- Removal of X-Band RF Kit.
- Installation of Ku-Band RF Kit.

CAUTION

Only authorized and qualified ORBIT technicians should perform the following procedure.

8.2 Changing the System Configuration from Ku-Band to X-Band

8.2.1 Removal of Ku-Band RF Kit

Table 8-1. Removal of Ku-Band RF Kit

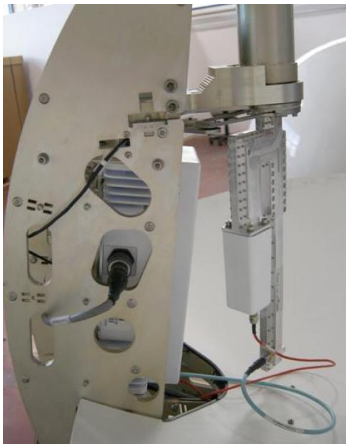
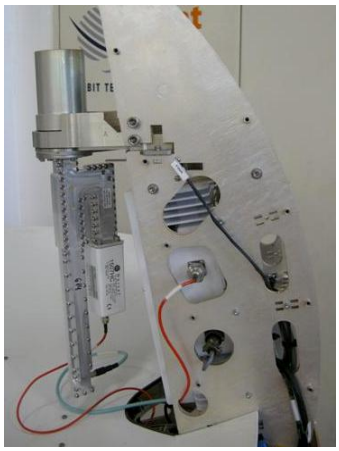
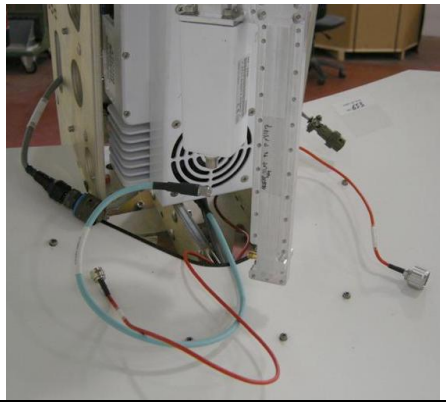
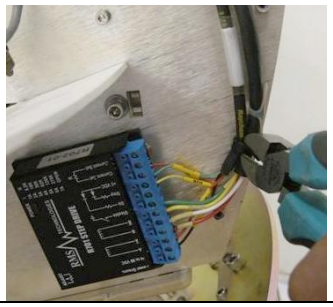
Step	Description	Details
1.	Disconnect cables from the BUC and LNB connectors.	  
2.	Cut the tie-wraps securing the cables to the dish structure.	 

Table 8-1. Removal of Ku-Band RF Kit

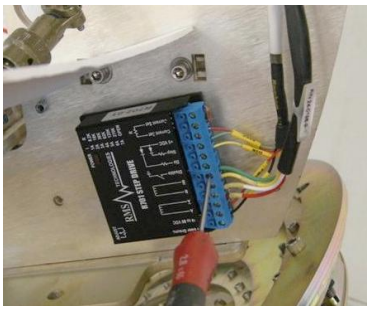
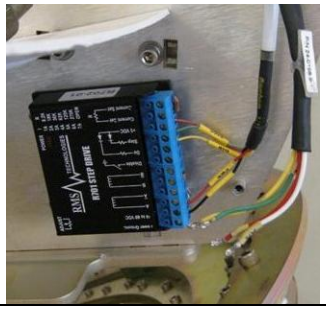
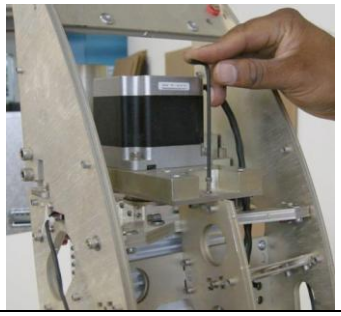
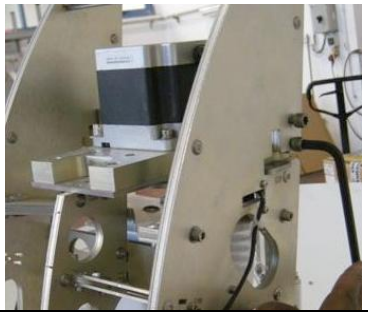
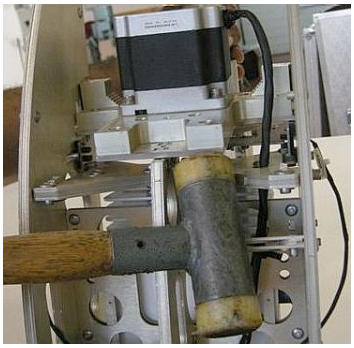
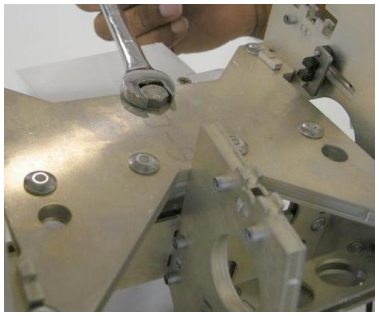
Step	Description	Details
3.	Disconnect cable wires from the Stepper Motor Driver. Do not disconnect the current-limit resistor from the terminal.	 
4.	Remove three 6/32” screws and four 5/16” screws securing the feed assembly to the dish structure.	 
5.	Using a plastic hammer, tap on the feed assembly to release it from the dish structure. Remove the feed assembly.	   

Table 8-1. Removal of Ku-Band RF Kit

Step	Description	Details
6.	Remove two M-4 screws securing the BUC to the dish structure. Loosen the M-8 screw securing the BUC to the dish structure. Remove the BUC. Install the two M-4 screws back on the BUC. Fasten the M-8 screw.	 

8.2.2 Installation of X-Band RF Kit

X-Band RF Kit

The X-Band RF Kit, ORBIT P/N KIT25-0097-10X-2, is contained and supplied within a dedicated packing box.

Figure 8-2: X-Band RF Kit – Packing Box

The following packing list and Figures list and depict the contents of the X-Band RF Kit.

Table 8-2. X-Band RF Kit – Packing List

ITEM	DESCRIPTION	ORBIT P/N	QTY
1.	TRF BRACKET	29-0676-4-1	1
2.	LNB BRACKET	29-0675-4-1	1
3.	RRF BRACKET	29-0642-4-1	1
4.	TRF+LNB SUB ASSY	29-0681-4-1	1
5.	FLEX WG #1	29-0644-4-1	1
6.	FEED SUB ASSY	29-0679-4-1	1
7.	RRF SUB ASSY	29-0678-4-1	1
8.	FLEX WG #2	29-0647-4-1	1
9.	BUC SUB ASSY	29-0648-4-1	1
10.	N TYPE TO N TYPE 90° ADAPTER	53N-50-0-4	1
11.	ATTENUATOR 15DB	E12000021	1
12.	RF CABLE	SF104-11NX2-0.5M	1
13.	DC INSERTER ASSEMBLY	25-0781-9-1	1
14.	RF CABLE 0.5m TX-BUC/DC.INS	26-1144-9-7	1
15.	DC BLOCK	CMH-F-M-DC BLOCK	1
16.	PHIL FH90 SCREW M3X8 ST.ST.	H00013040802	4
17.	N MALE TO F FEMALE ADAPTER	TC-666	2
18.	O- RING FOR FLEXIBLE WAVEGUIDES #1 & #2	K03000001	4
FASTENERS SET FOR X BAND FEED SUB ASSEMBLY			
19.	ALLEN SOCKET CAP SCREW, #6-32X3/4	H06063271204	3
20.	LOCK WASHER, #6	MS35338-136	3
FASTENERS SET FOR TRF+LNB SUB ASSEMBLY			
21.	ALLEN SOCKET CAP SCREW, #6-32X1"	H06063271604	5
22.	LOCK WASHER, #6	MS35338-136	5
23.	WASHER, #6	H20200691074	5

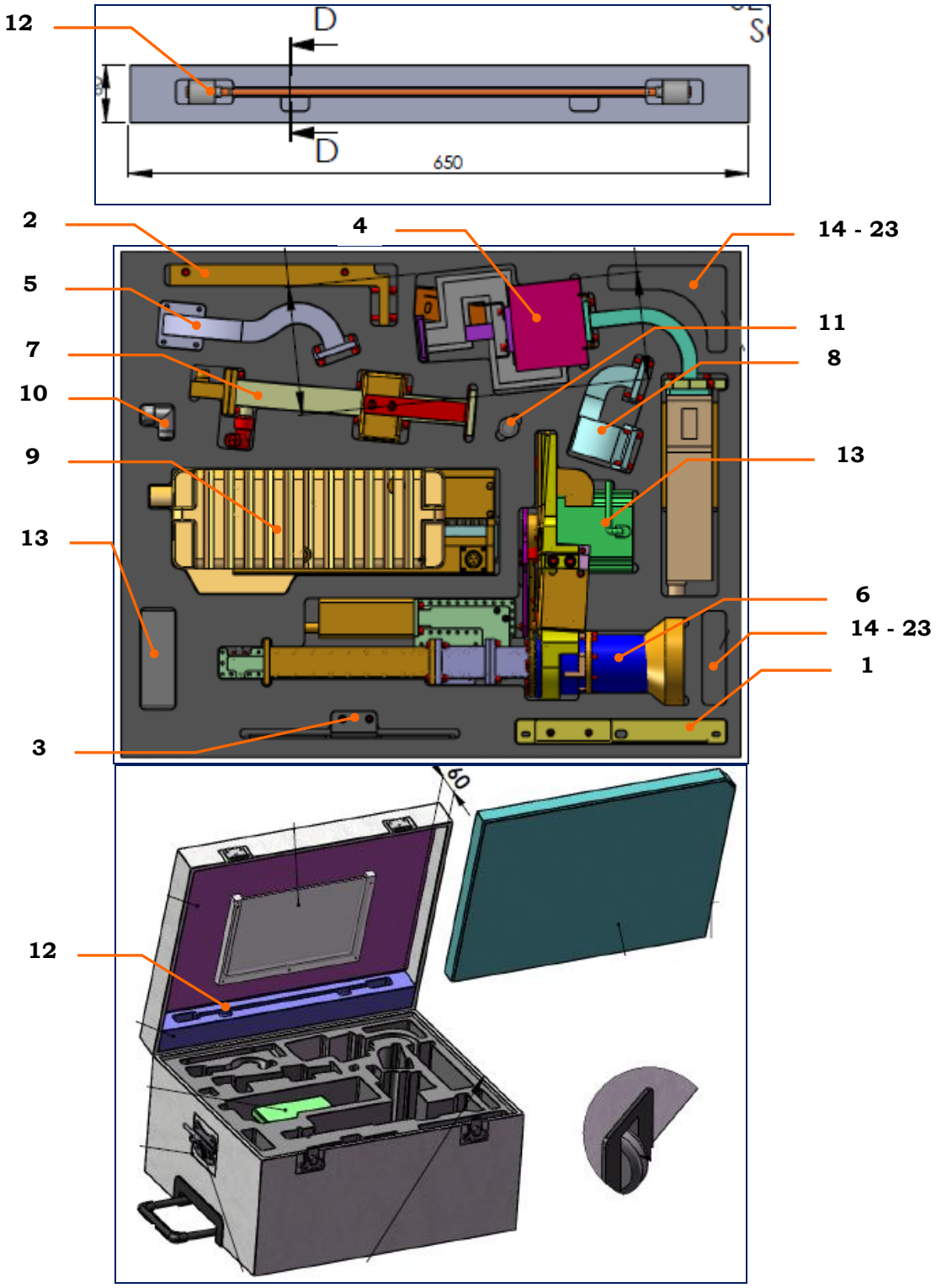


Figure 8-3: X-Band RF Kit – Packing Arrangement

Installation of X-Band RF Kit

Table 8-3. Installation of X-Band RF Kit

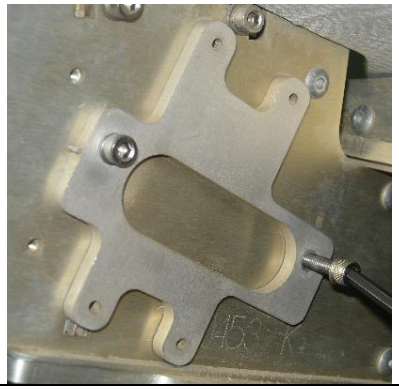
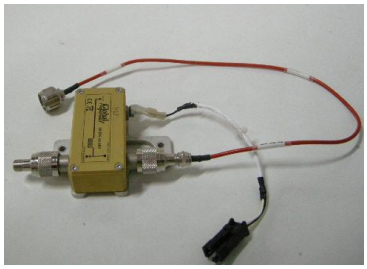
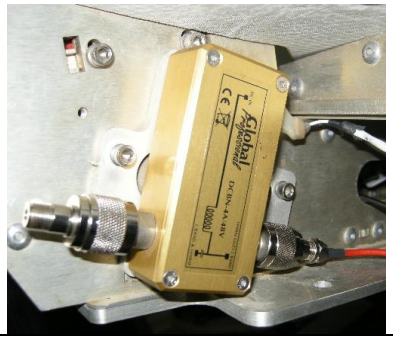
Step	Description	Details
1.	Remove two screws securing the DC inserter bracket to the dish assembly. Remove the DC inserter bracket.	
2.	Install two N MALE TO F FEMALE adapters on the DC inserter N Type connectors. Connect RF cable (14) to the L-Band 10MHz & DC connector. Fasten four screws (16) securing the DC inserter to its bracket. Mount the DC inserter and bracket on the dish structure. Fasten two screws securing the DC inserter bracket to the dish structure.	   

Table 8-3. Installation of X-Band RF Kit

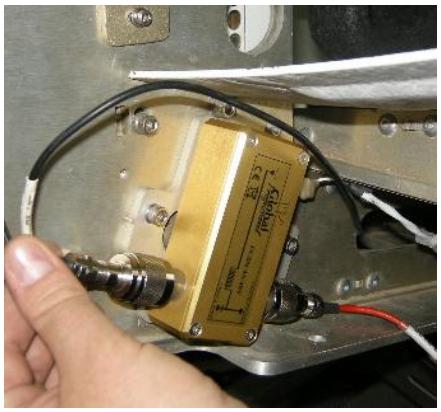
Step	Description	Details
3.	Connect the system's DC cable to the DC inserter Mollex cable (DC IN). Connect the system's Rx cable to the DC inserter L-Band & 10MHz connector.	 
4.	If the Tx Reject Filter (TRF) Bracket is already installed on the dish structure, proceed with the next step. If not, place the Tx Reject Filter (TRF) Bracket and fasten two screws, lock washers and washers (21, 22, 23) securing it to the dish structure.	 

Table 8-3. Installation of X-Band RF Kit

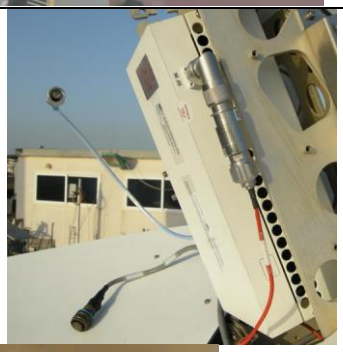
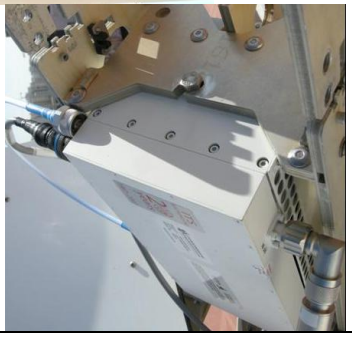
Step	Description	Details
5.	If the Rx Reject Filter (RRF) Bracket is already installed on the dish structure, proceed with the next step. If not, place the Rx Reject Filter (RRF) Bracket and fasten three screws, lock washers and washers (21, 22, 23) securing it to the dish structure.	 
6.	If the LNB Bracket is already installed on the dish structure, proceed with the next step. If not, place the LNB Bracket and fasten two 5/16” screws (supplied with the bracket) securing it to the dish structure.	 
7.	Place the BUC (9) and fasten the M-8 screw (supplied with the BUC) securing the BUC to the dish structure. Fasten two M-4 screws (supplied with the bracket) securing the BUC to the dish structure. Connect the RF cable (12) to the RF OUT connector on the BUC. Connect the Power cable to the DC/M&C connector on the BUC. Connect the N type to N type 90° adapter (10) to the RF INPUT connector on the BUC. Connect the 15 dB attenuator (11) to the N type to N type 90° adapter (10). Connect the system's Tx cable to the 15 dB attenuator (11).	    

Table 8-3. Installation of X-Band RF Kit

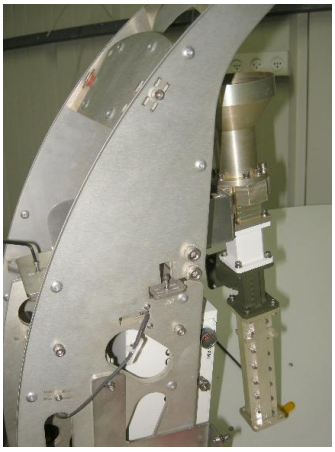
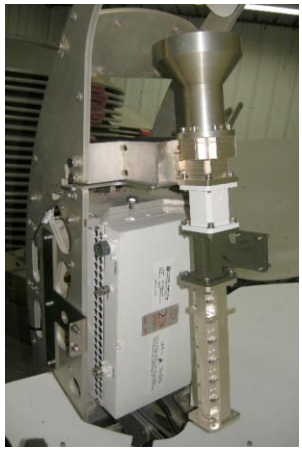
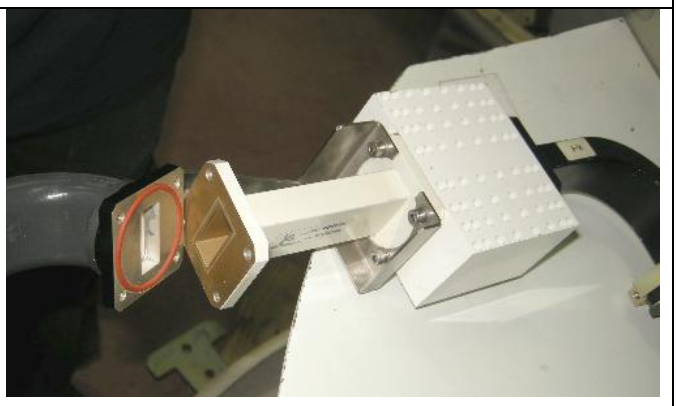
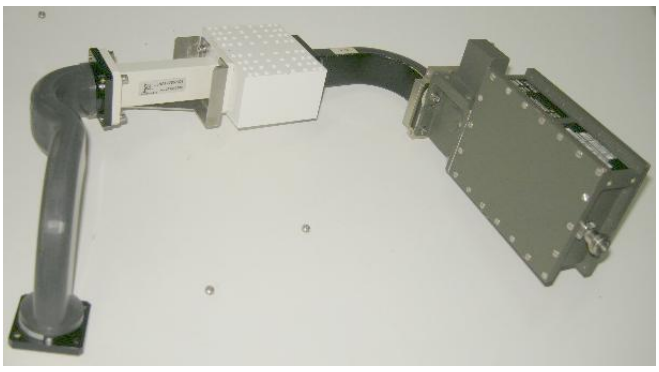
Step	Description	Details
8.	Remove four 5/16” screws mounted on the Feed Sub Assembly (6) bracket. Place the X-band Feed Sub Assembly (6) on the dish structure. Fasten three screws and lock washers (19, 20) securing the X-band Feed Sub Assembly (6) bracket to the dish structure. Fasten four 5/16” screws securing the Feed Sub Assembly (6) bracket.	   
9.	Place an O-ring (13) on the Flexible Waveguide #1 (5). Fasten four screws (supplied with Flexible Waveguide #1) securing the Flexible Waveguide #1 (5) to the TRF+LNB Sub Assembly (4).	 

Table 8-3. Installation of X-Band RF Kit

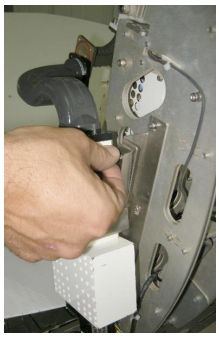
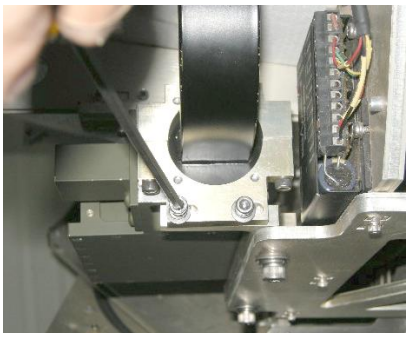
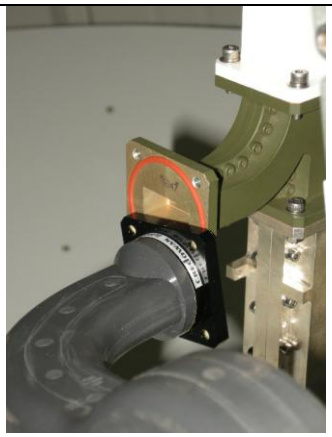
Step	Description	Details
10.	Loosen two screws, lock washers and washers (21, 22, 23) securing the Tx Reject Filter (TRF) Bracket (1) to the dish structure. Remove two screws from the Tx Reject Filter (TRF) Bracket. Place the combined Flexible Waveguide #1/TRF+LNB Sub Assembly on the Tx Reject Filter (TRF) Bracket. Install and loosely fasten the two screws securing the combined Flexible Waveguide #1/TRF+LNB Sub Assembly on the Tx Reject Filter (TRF) Bracket. Remove two screws from the LNB Bracket (2). Install and loosely fasten two screws securing the combined Flexible Waveguide #1/TRF+LNB Sub Assembly on the Tx Reject Filter (TRF) Bracket to the LNB Bracket.	   
11.	Place an O-ring (13) on the X-Band Feed Sub-Assembly (6). Fasten four screws (supplied with X-Band Feed Sub-Assembly) securing the Flexible Waveguide #1 (5) to the X-Band Feed Sub-Assembly (6). Rotate the 15 dB attenuator (11) with the N type to N type 90° adapter (10) approximately 30 degrees clockwise.	  

Table 8-3. Installation of X-Band RF Kit

Step	Description	Details
12.	Carefully fasten the following screws, in a cross-wise manner: • Two screws, lock washers and washers (21, 22, 23) securing the Tx Reject Filter (TRF) Bracket (1) to the dish structure. • Two screws securing the combined Flexible Waveguide #1/TRF+LNB Sub Assembly on the Tx Reject Filter (TRF) Bracket. • Two screws securing the combined Flexible Waveguide #1/TRF+LNB Sub Assembly on the Tx Reject Filter (TRF) Bracket to the LNB Bracket.	
13.	Place two O-rings (13) on the Flexible Waveguide #2 (8). Fasten four screws (supplied with Flexible Waveguide #2) securing the Flexible Waveguide #2 to the RRF Sub Assembly.	 

Table 8-3. Installation of X-Band RF Kit

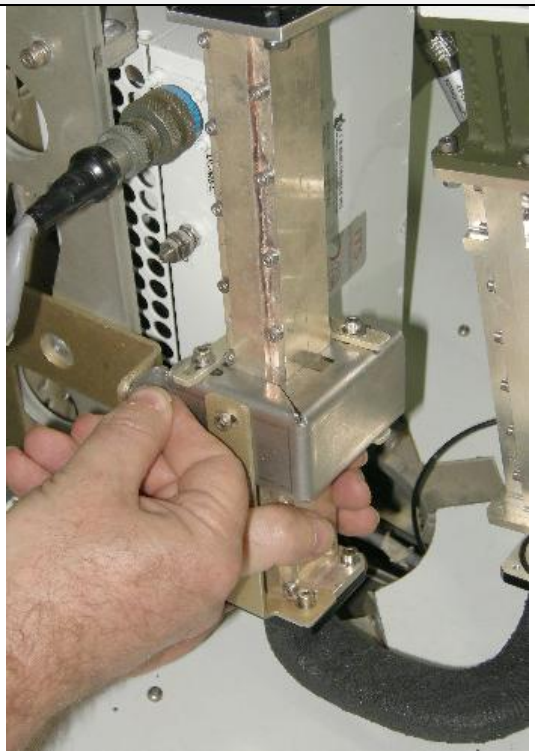
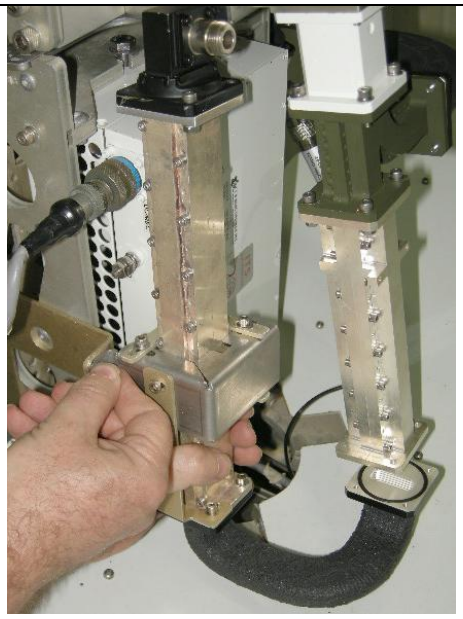
Step	Description	Details
14.	Place the combined Flexible Waveguide #2/RRF Sub Assembly on the Rx Reject Filter (RRF) Bracket. Loosely fasten two screws (supplied with Rx Reject Filter (RRF) Bracket) securing the combined Flexible Waveguide #2/RRF Sub Assembly to the Rx Reject Filter (RRF) Bracket.	
15.	Fasten four screws (supplied with Flexible Waveguide #2) securing Flexible Waveguide #2 to the feed assembly. Fasten two screws (supplied with Rx Reject Filter (RRF) Bracket) securing the combined Flexible Waveguide #2/RRF Sub Assembly to the Rx Reject Filter (RRF) Bracket.	

Table 8-3. Installation of X-Band RF Kit

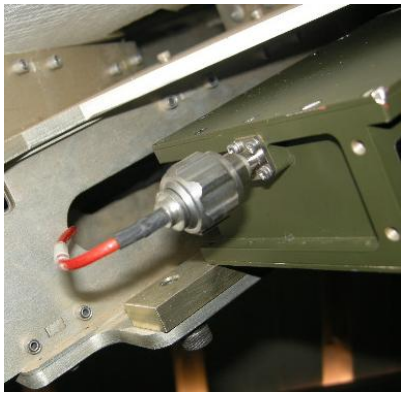
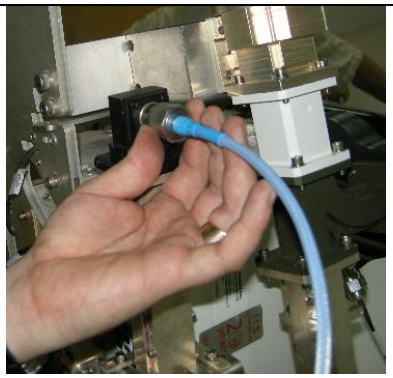
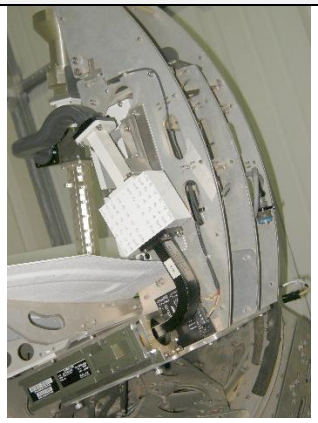
Step	Description	Details
16.	Pass the RF cable (14) through the dish structure, and connect it to the LNB connector.	 
17.	Connect the RF cable (12) to the waveguide-to-coax connector on the RRF assembly.	

Table 8-3. Installation of X-Band RF Kit

Step	Description	Details
18.	Disconnect cable from the SBC AGC connector P8. Install the DC Block (15) on SBC AGC connector P8. Re-connect the cable to the DC Block.	 

Table 8-3. Installation of X-Band RF Kit

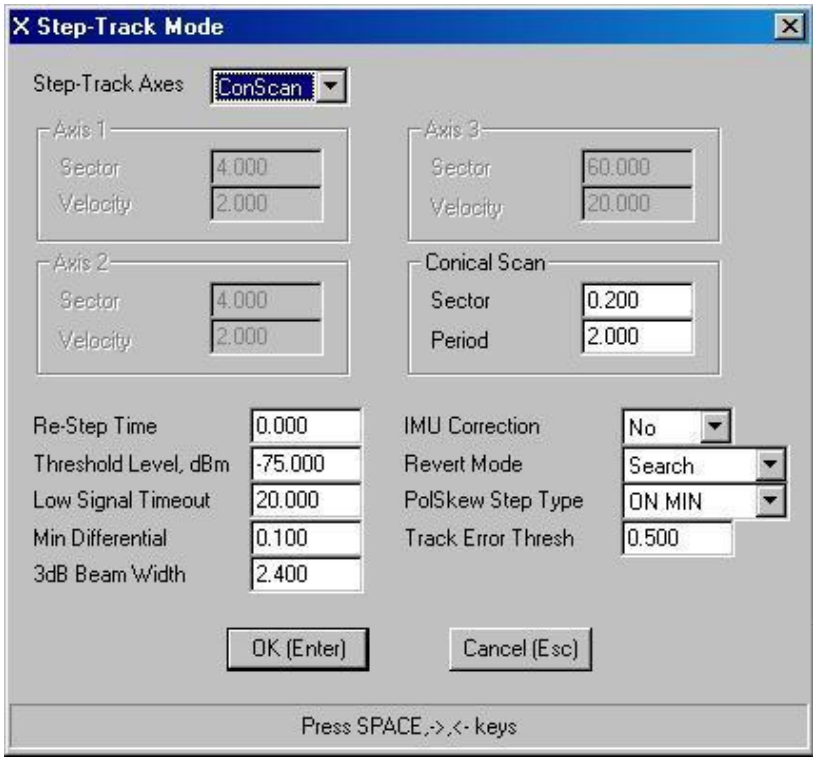
Step	Description	Details
19.	The X-Band RF Kit is installed. Visually inspect that all screws are tightened and all cables connected and secured.	  

Software Configuration Changes for Changing from Ku-Band to X-Band

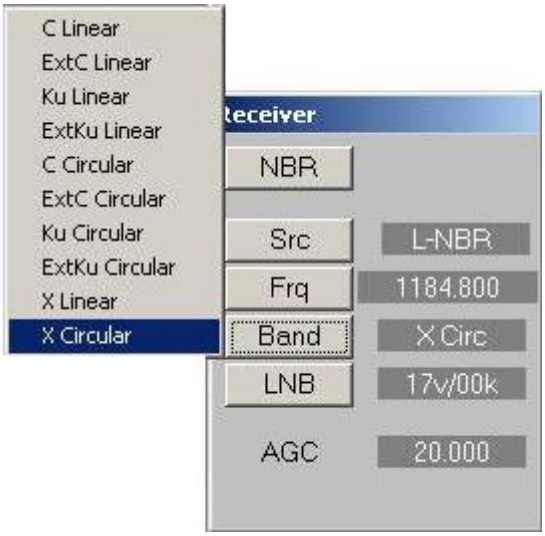
Following the installation of the X-Band RF Kit, perform the following procedure to change the software configuration from Ku-Band to X-Band configuration:

i. Apply power to the system.

ii. Access **Operation Screen** -> **InConfig** -> **Step-Track** -> **X-Band** and verify settings according to the following X-Band Step-Track Setup screen.

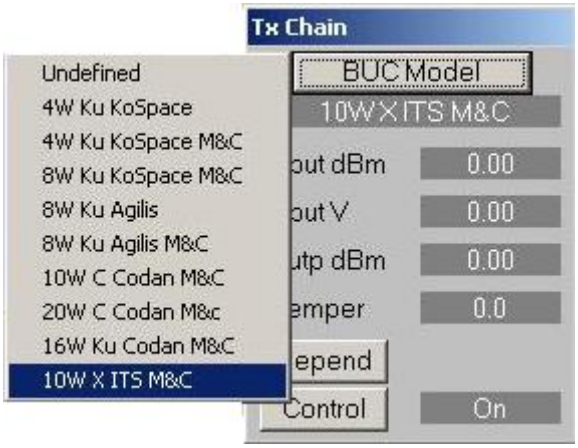


iii. Access **Maintenance Screen** -> **Receiver** window and set **Band** to **X Circular**. Attached X-Band Band Setup picture. Refer to the following X-Band Band Setup screen.



iv. Access **Maintenance Screen** -> **Tx Chain** window and set BUC Model to **10W X ITS M&C**. Refer to the following X-Band Tx Chain Setup screen.

v. Save the changes in controller non-volatile memory.


Tx Chain
BUC Model
10W X ITS M&C
Undefined
4W Ku KoSpace
4W Ku KoSpace M&C
8W Ku KoSpace M&C
8W Ku Agilis
8W Ku Agilis M&C
10W C Codan M&C
20W C Codan M&c
16W Ku Codan M&C
10W X ITS M&C
ut dBm
0.00
ut V
0.00
tp dBm
0.00
mper
0.0
epend
Control
On

8.3 Changing the System Configuration from X-Band to Ku-Band

8.3.1 Removal of X-Band RF Kit

Removal Procedure

Table 8-4. Removal of X-Band RF Kit

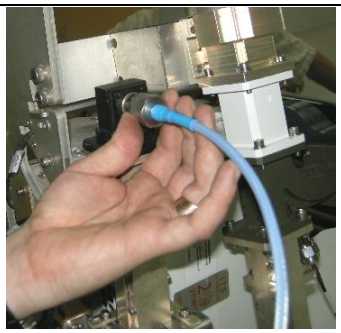
Step	Description	Details
1.	Disconnect cable from the DC Block on the SBC AGC connector P8. Remove the DC Block. Re-connect the cable to SBC AGC connector P8.	 
2.	Disconnect the RF cable (12) from the waveguide-to-coax connector on the RRF assembly. Disconnect the RF cable (12) from the RF OUT connector on the BUC.	 

Table 8-4. Removal of X-Band RF Kit

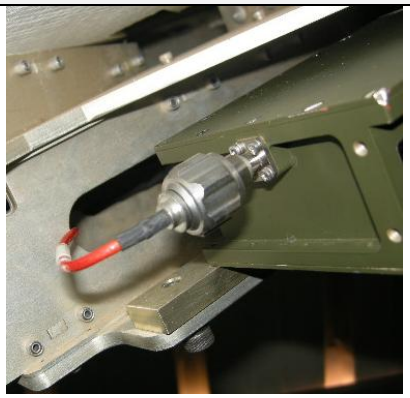
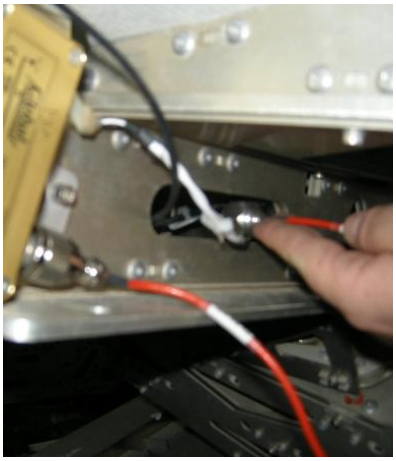
Step	Description	Details
3.	Disconnect the RF cable (14) from the LNB connector, and pass it through the dish structure.	 

Table 8-4. Removal of X-Band RF Kit

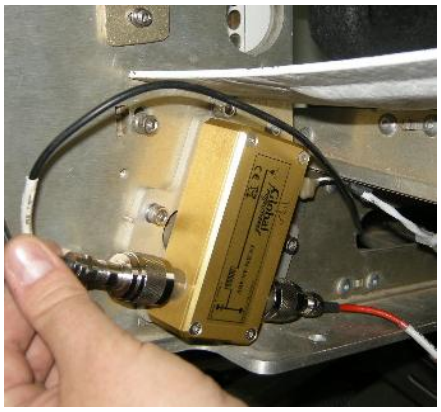
Step	Description	Details
4.	Disconnect the system's DC cable from the DC inserter Mollex cable (DC IN). Disconnect the system's Rx cable from the DC inserter L-Band & 10MHz connector.	 

Table 8-4. Removal of X-Band RF Kit

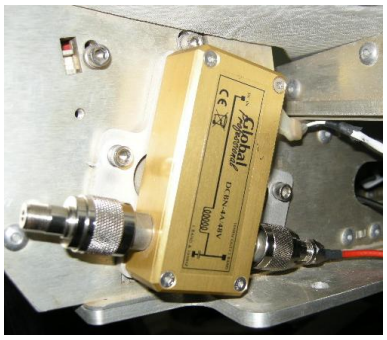
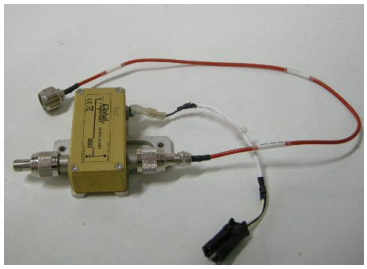
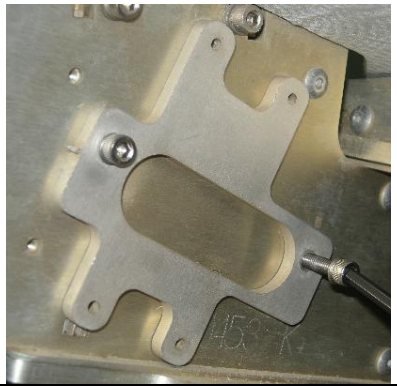
Step	Description	Details
5.	Remove the DC inserter and bracket from the dish structure. Remove four screws (16) securing the DC inserter to its bracket. Disconnect RF cable (14) from the L-Band 10MHz & DC connector. Remove two N MALE TO F FEMALE adapters from the DC inserter N Type connectors. Place the DC inserter bracket on the dish structure. Fasten two screws securing the DC inserter bracket to the dish structure.	    

Table 8-4. Removal of X-Band RF Kit

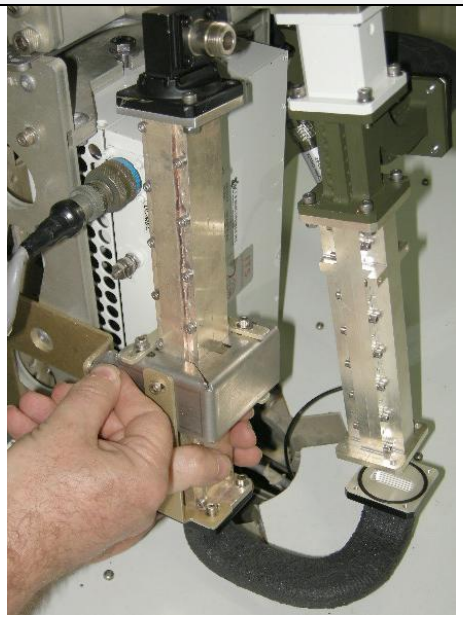
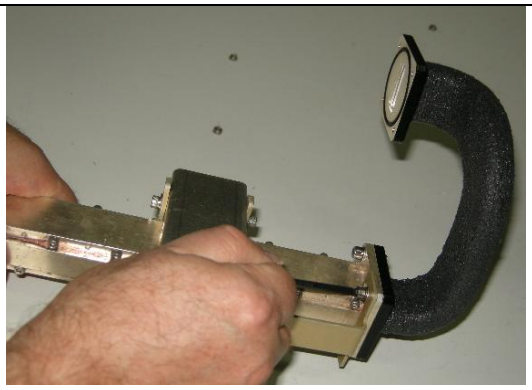
Step	Description	Details
6.	Remove two screws securing the combined Flexible Waveguide #2/RRF Sub Assembly to the Rx Reject Filter (RRF) Bracket. Remove four screws securing Flexible Waveguide #2 to the feed assembly.	
7.	Remove four screws securing the Flexible Waveguide #2 to the RRF Sub Assembly. Install the removed eight screws on both sides of the Flexible Waveguide #2. Remove the two O-rings and put them into their plastic bag.	 

Table 8-4. Removal of X-Band RF Kit

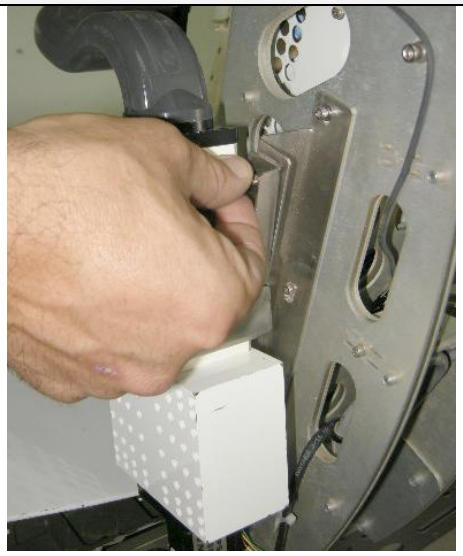
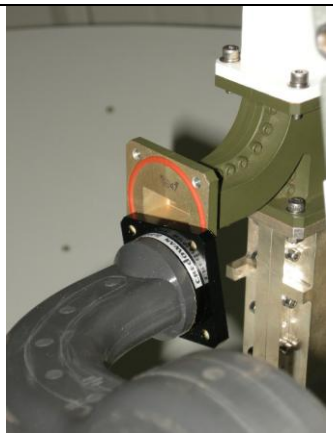
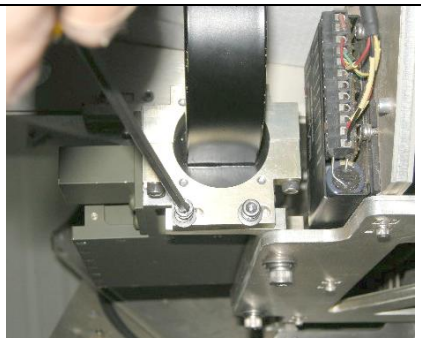
Step	Description	Details
8.	Loosen two screws securing the combined Flexible Waveguide #1/TRF+LNB Sub Assembly on the Tx Reject Filter (TRF) Bracket.	
9.	Remove four screws securing the Flexible Waveguide #1 (5) to the X-Band Feed Sub-Assembly (6). Remove the O-ring (13) from the X-Band Feed Sub-Assembly (6).	 
10.	Remove two screws securing the combined Flexible Waveguide #1/TRF+LNB Sub Assembly to the LNB Bracket.	

Table 8-4. Removal of X-Band RF Kit

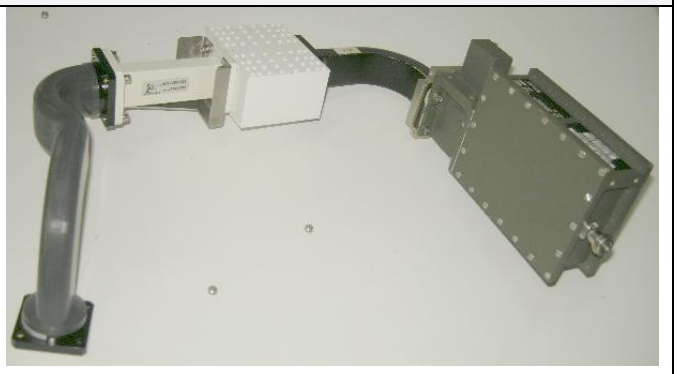
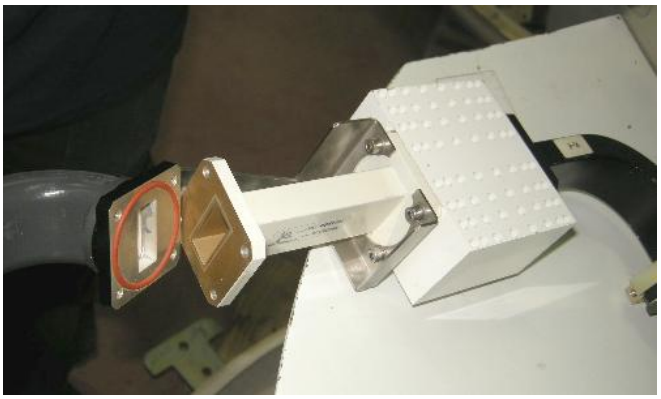
Step	Description	Details
11.	Remove four screws (securing the Flexible Waveguide #1 (5) to the TRF+LNB Sub Assembly (4). Remove the O-ring (13) from the Flexible Waveguide #1 (5). Install the removed four screws on both sides of the Flexible Waveguide #1. Remove the two O-rings and put them into their plastic bag.	 
12.	Install the removed screws on the LNB bracket and on the TRF bracket	 

Table 8-4. Removal of X-Band RF Kit

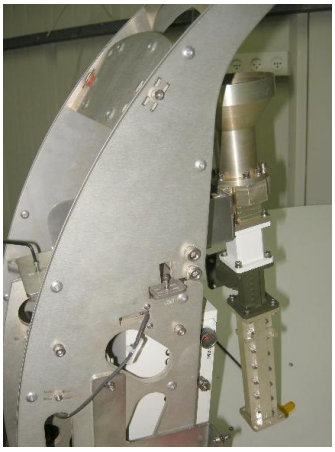
Step	Description	Details
13.	Remove four 5/16” screws securing the Feed Sub Assembly (6) bracket to the dish structure. Remove three screws and lock washers (19, 20) securing the X-band Feed Sub Assembly (6) bracket to the dish structure. Remove the X-band Feed Sub Assembly (6) from the dish structure. Install four 5/16” screws mounted on the Feed Sub Assembly (6) bracket.	   

Table 8-4. Removal of X-Band RF Kit

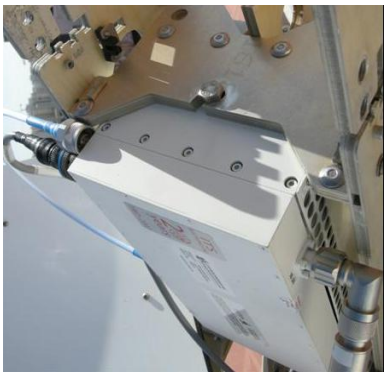
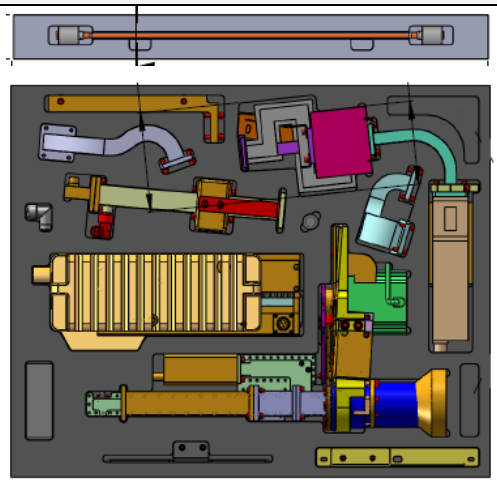
Step	Description	Details
14.	Disconnect the system's Tx cable from the 15 dB attenuator (11). Disconnect the 15 dB attenuator (11) from the N type to N type 90° adapter (10). Disconnect the N type to N type 90° adapter (10) from the RF INPUT connector on the BUC. Disconnect the Power cable from the DC/M&C connector on the BUC. Remove two M-4 screws securing the BUC to the dish structure. Remove the M-8 screw securing the BUC to the dish structure. Remove the BUC (9).	    

Table 8-4. Removal of X-Band RF Kit

Step	Description	Details
15.	Verify that all of the X-Band RF Kit are inserted into their designated location in the shipping crate.	

8.3.2 Installation of Ku-Band RF Kit

Ku-Band RF Kit

The Ku-Band RF Kit, ORBIT P/N KIT25-0097-8W-KU, is contained and supplied within a dedicated packing box.

Figure 8-4: Ku-Band RF Kit – Packing Box

The following packing list and Figures list and depict the contents of the Ku-Band RF Kit.

Table 8-5. Ku-Band RF Kit – Packing List

ITEM	DESCRIPTION	ORBIT P/N	QTY
1.	Feed Assembly	29-0683-4-1	1
2.	BUC Sub Assembly	29-0684-4-1	1
3.	RF cable	CF-210-51CM-SMSM	1
Fasteners set for KU band Feed Sub Assembly			
4.	#6-32X3/4, Allen socket cap screw	H06063271204	3
5.	#6, lock washer	MS35338-136	3
6.	#5/16-18x5/8 Allen socket cap screw	H06051671004	4

Figure 8-5: Ku-Band RF Kit – Packing Arrangement

Installation of Ku-Band RF Kit

Table 8-6. Installation of Ku-Band RF Kit

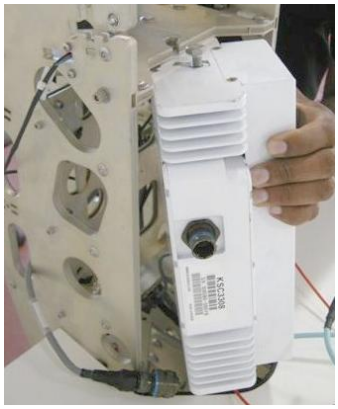
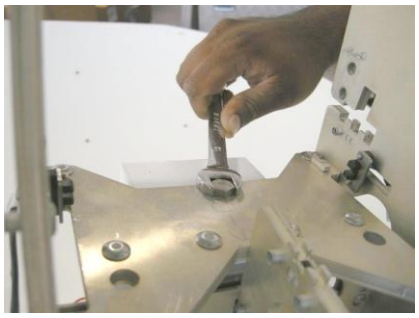
Step	Description	Details
1.	Loosen the M-8 screw on the BUC. Remove the two M-4 screws from the BUC. Place the BUC into the dish structure.	  
2.	Fasten two M-4 screws securing the BUC to the dish structure. Fasten the M-8 screw securing the BUC to the dish structure.	 

Table 8-6. Installation of Ku-Band RF Kit

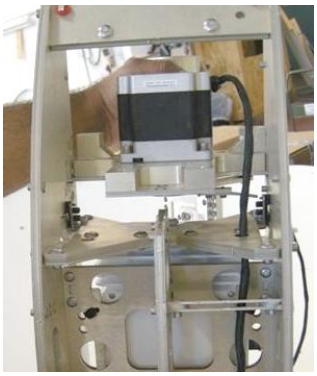
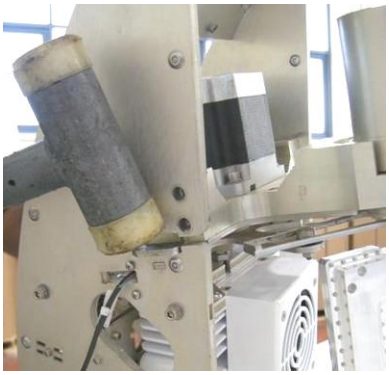
Step	Description	Details
3.	Place the feed assembly into the dish structure. Using a plastic hammer, tap on the feed assembly to secure it to the dish structure. Fasten three 6/32" screws securing the Feed Assembly to the dish structure. Fasten four 5/16" screws securing the Feed Assembly to the dish structure.	  

Table 8-6. Installation of Ku-Band RF Kit

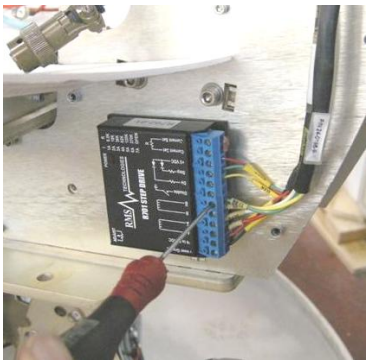
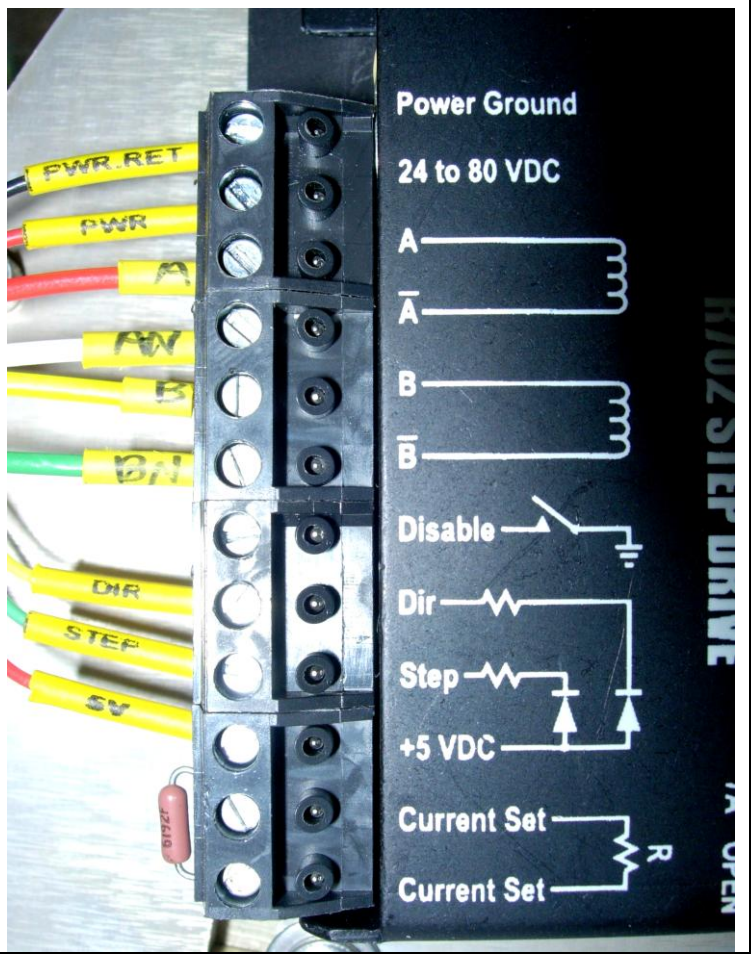
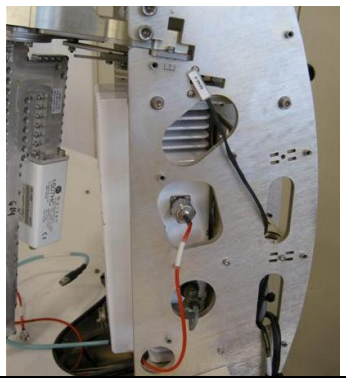
Step	Description	Details
4.	Connect the motor cable wires to the Stepper Motor Driver, as shown.	  

Table 8-6. Installation of Ku-Band RF Kit

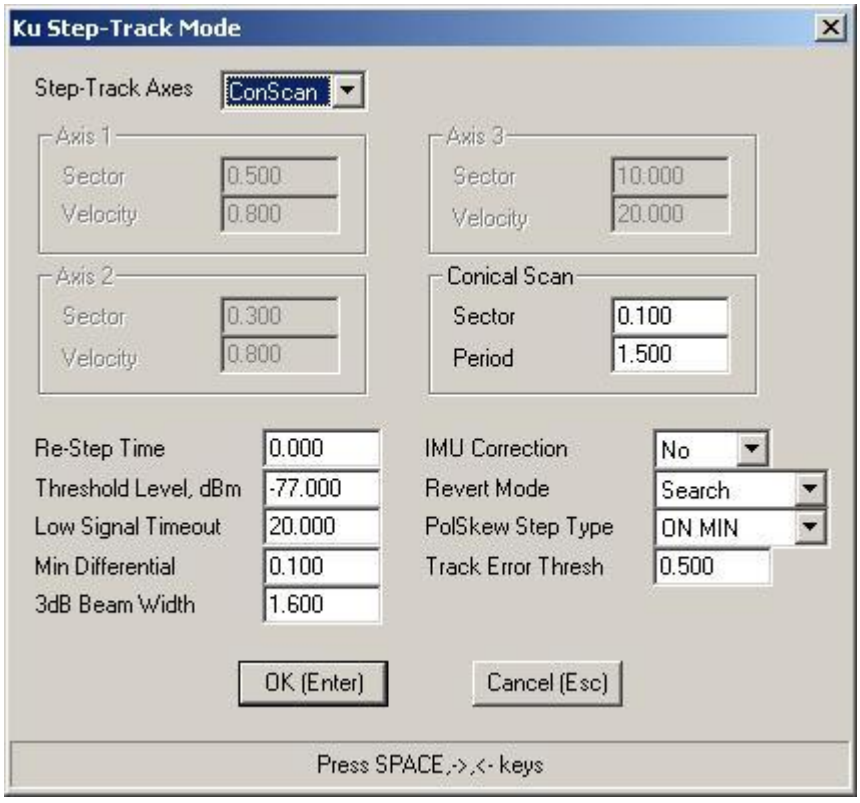
Step	Description	Details
5.	Install tie-wraps on the cables, securing them to the dish structure.	
6.	Connect cables to the BUC and LNB connectors.	 

Software Configuration Changes for Changing from X-Band to Ku-Band

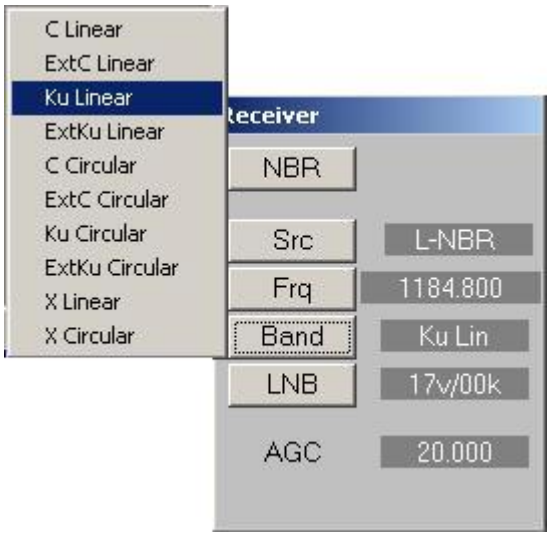
Following the installation of the Ku-Band RF Kit, perform the following procedure to change the software configuration from X-Band to Ku-Band configuration:

i. Apply power to the system.

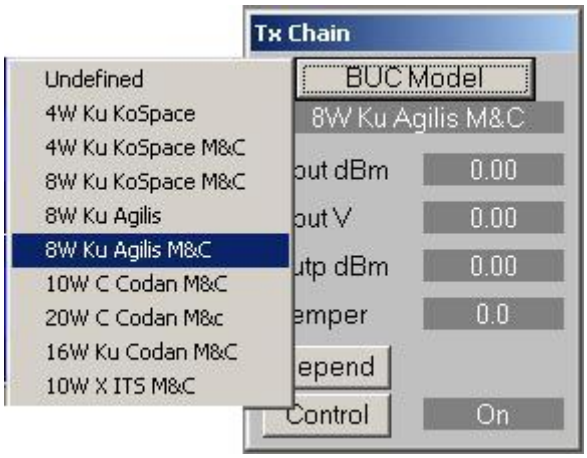
ii. Access **Operation Screen** -> **InConfig** -> **Step-Track** -> **Ku-Band** and verify settings according to the following Ku-Band Step-Track Setup screen.



iii. Access **Maintenance Screen** -> **Receiver** window and set **Band** to **Ku Linear**. Refer to the following Ku-Band Band Setup screen.



iv. Access **Maintenance Screen** -> **Tx Chain** window and set BUC Model to **8W Ku Agilis M&C**. Refer to the following Ku-Band Tx Chain Setup screen.



v. Save the changes in controller non-volatile memory.