COMTECH
EF DATA ™

XSAT-7080
5 to 25, 50 & 100 Watts

X-Band Transceiver
Installation and Operation Manual

Errata A
Comtech EFData Documentation Update

Subject: Revised Pin lable for Connector J3
Date: February 12, 2007
Part Number: MN/XSAT7080.IOM
Related Document: XSAT-7080, X-Band Transceivers Installation and Operation
                          Manual, Rev. 0 dated October 21, 2005
Collating Instructions: Attach this errata sheet to the cover.

Comments:

The highlighted change revises the connector pinout label.

Change Specifics:

3.1.1   CONNECTOR J3: AC POWER, MAINS, 100 TO 125 VAC, OR 205 TO 240 VAC.

WARNING

To avoid a serious shock hazard, correctly determine the mating connector type in use and wire it according to the following table:

	EARLY UNITS	NEWER UNITS
Pin	Mating Connector Type KPT06J12-3S MS3116J12-3S	Mating Connector Type CA3106E18-22SB
A	Line	Ground
B	Ground	Neutral
Labeled C or G	Neutral	Line

XSAT-7080

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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

480 333 200 (Main Comtech EF Data Number)
480 333 4357 (Customer Support Desk)
480 333 2161 FAX

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

service@comtechefdata.com

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

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

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

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

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

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

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

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About this Manual

This manual provides installation and operation information for the Comtech EF Data XSAT-7080 X-Band Transceiver, 5 to 25, 50, and 100-WATT. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the XSAT-7080 X-Band Transceiver.

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 the 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 Technical Publication department: techpubs@comtechefdata.com

Safety Notice

This equipment has been designed to minimize exposure of personnel to hazards.

The operators and technicians must:

- Know how to work around, with and on high voltage equipment.
- Exercise every precaution to ensure personnel safety.
- Exercise extreme care when working near high voltages.
- Be familiar with the warnings presented in this manual.

> **⚠ CAUTION**
>
> *CAUTION - A Neutral Fusing - Double pole/ neutral fusing used on the prime power supply input.*

Installation Guidelines Regarding Power Line Quality

As a company with many years of experience selling and servicing equipment installed around the world, Comtech EF Data has become familiar with the varying quality of the AC power grid around the world. The following offers some installation guidelines that should help ensure a reliable installation.

- **Surge suppression:** High voltage surges can cause failure of the power supply. These surges are typically caused by circuit switching on the main AC power grid, erratic generator operation, and by lightning strikes. While the transceiver does have built in surge suppression, if the unit will be installed in a location with questionable power grid quality, Comtech EF Data recommends installation of additional power conditioning/surge suppression at the power junction box.

- **Grounding:** The transceiver provides a grounding terminal. This is provided to allow the user to ground the transceiver to the antenna's grounding network. All components installed at the antenna should be grounded to a common grounding point at the antenna.

- **Electrical welding:** If welding needs to take place at the antenna, disconnect all cables from the transceiver except for the ground wire. Cap all RF connections with terminations. This will prevent damage to the input/output circuitry of the transceiver.

- **Lightning:** Lightning strikes on or around the antenna will generate extremely high voltages on all cables connected to the transceiver. Depending on the severity of the strike, the transceivers internal surge protection combined with the recommended external suppression may protect the transceivers power supply. However, if the installation will be in an area with a high probability of lightning strikes, Comtech EF Data recommends the installation of surge suppression on the RF and IF cables. One source of these suppressors is PolyPhaser (www.polyphaser.com)

For further information, please contact Comtech EF Data, Customer Support Department.

Warranty Policy

This Comtech EF Data product is warranted against defects in material and workmanship for a period of 2 years from the date of shipment. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective.

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

Limitations of Warranty

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

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

Exclusive Remedies

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

Disclaimer

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

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

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Chapter 1. INTRODUCTION

1.1 INTRODUCTION

This manual provides instructions on the installation, operation and maintenance of the XSAT-7080, 5 to 25, 50, and 100 Watt Model X-Band Transceiver, manufactured by Comtech EF Data, Tempe, Arizona.

1.2 Functional Description

The XSAT70870 is designed for use in communication systems, or in satellite up-link data systems, for the reception of SCPC/MCPC, DAMA, and TDMA communication signals. It can also be used in communications system applications with full transponder HDTV and analog TV.

The converter is environmentally sealed and is designed to be hard mounted on or near the antenna structure. A covered cooling fan is mounted on the outside of the unit to maintain a reduced operating temperature for enhanced reliability.

> **⚠ WARNING**
>
> *The Downconverter RF input connector is wired to supply DC voltage to an LNA. This voltage is capable of damaging any test equipment connected to the connector. Do not connect test equipment to this connector without a coaxial DC block between the connector and the test equipment.*

**XSAT-7080
5 to 25 Watt
X-Band Transceiver**

**XSAT-7080
50 Watt
X-Band Transceiver**

**XSAT-7080
100 Watt
X-Band Transceiver**

Chapter 2. SPECIFICATIONS

2.1 SPECIFICATIONS

IMPORTANT

Comtech EF Data reserves the right to change specifications of productions described in this document at any time without notice and without obligation to notify any person of such changes. Information in this document may differ from that puiblished in other Comtech EF Data documents. Refer to the website or contact Customer Support for the latest released product information.

Transmit			Receive		
Frequency	7900 to 8400 MHz		RX Frequency	7250 to 7750 MHz	
TX-IF Frequency	70 ± 18 MHz 140 ± 36 MHz (Optional)		RX-IF Frequency	70 ± 18 MHz 140 ± 36 MHz (Optional)	
Output Power, P1dB	5W 10W 25W 50W 100W	+37 dBm +40 dBm +44 dBm +47 dBm +50 dBm	Gain without LNA	45 ± 1 dBm	
Gain	5W 10W 25W 50W 100W	+65 dB +68 dB +71 dB +74 dB +77 dB	Gain Flatness without LNA	± 0.75 dB Full RF Band ± 0.75 per 36 MHz	
Gain Flatness	± 0.75 dB Full RF Band ± 0.75 per 36 MHz		Gain Stability, without LNA	± 0.25 dB constant temp ± 1.00 dB –40 to +55°C (-40 to 131°F)	
Gain Stability	± 0.25 at Constant C ± 1.00 dB from –40 to +55°C (-40 to 131°F)		Output Power, P1dB	+13 dBm	
Carrier Mute	-70 dBc		Two Tone Inter-modulation	-50 dBc for two tones at 0 dBm each, 1 MHz apart	
Intermodulation	-33 dBc for two carriers at –6 dB OPBO from rated power		Image Rejection	-60 dBc	
2nd Harmonic	-55 dBc		RF Input VSWR	1.25:1	
Spurious	AC line harmonics Carrier Related, < 500 kHz All other in-band	-45 dBc -60 dBc -65 dBc	RF Input Connector	Type N (Female)	
AM to PM Conversion	3 degrees at 6 dB OPBO from related power		IF Output Impedance	50 Ω	
RF Output VSWR	1.25:1		IF Output VSWR	1.25:1	
RF Output Connector	5 – 25W 50W and 100W	Type N Female CPR-112	IF Output Connector	Type N (Female)	

Common	
Conversion	Dual, No Spectral Inversion
Frequency Step Size	1 and 2.5 MHz automatic
Frequency Stability	$\pm$ 1 x 10^{-9}/day 1 x 10^{-7}/day 40$\circ$ to 55$\circ$C 1 x 10^{-8}/ Temp

Attenuation Steps	TX RX	0 to 25 dB, in 0.25 dB steps 0 to 20 dB, in 0.25 dB steps
Phase Noise	100 Hz 1 kHz 10 kHz 100 kHz	-66 dBc/Hz -76 dBc/Hz -86 dBc/Hz -96 dBc/Hz
Group Delay	Linear Parabolic Ripple	0.1 ns/MHz 0.02 ns/MHz^2 1 ns/p-p

Monitor & Control	
Methods	Both RS-485 and RS-232 Serial Interface Handheld controller, optional
Commands	Set TX frequency Set RX frequency Set TX attenuation Set RX attenuation Report TX output power Mute TX Report internal temperature Report power supply voltages Set time Set date
Faults	Upconverter functions Downconverter functions Upconverter Synthesizers Downconverter Synthesizers Internal Reference Oscillator LNA current fault Overtemperature condition

Environmental		
Temperature: Operating Non-Operating		-40 to +55$\circ$C (-40 to 131$\circ$F) -50 to +75$\circ$C (-58 to 167$\circ$F)
Attitude		15,000 Feet, mean sea level
Humidity		0 to 100 %, Relative
Prime Power		90 to 260 VAC Standard 47 to 63 Hz Standard 48 VDC Optional
Dimensions: 5 to 25W 50W 100W		11H x 8W x 11D inches (28H x 20W x 28D cm) 9.75H x 10W x 23d inch (25H x 25W x 58D cm) 10.60H x 12.5W x 26D inches (27H x 32W x 66D cm)
Weight: 5 to 25W 50W 100W		36 lbs (16 kg) 65 lbs (29 kg) 80 lbs (40 kg)
Low Noise Amplifier		Customer defined

Model:					
RF Power AC Power	5W 165W	10W 220W	25W 275W	50W 450W	100W 825W

2.2 DIMENSION ENVELOPE
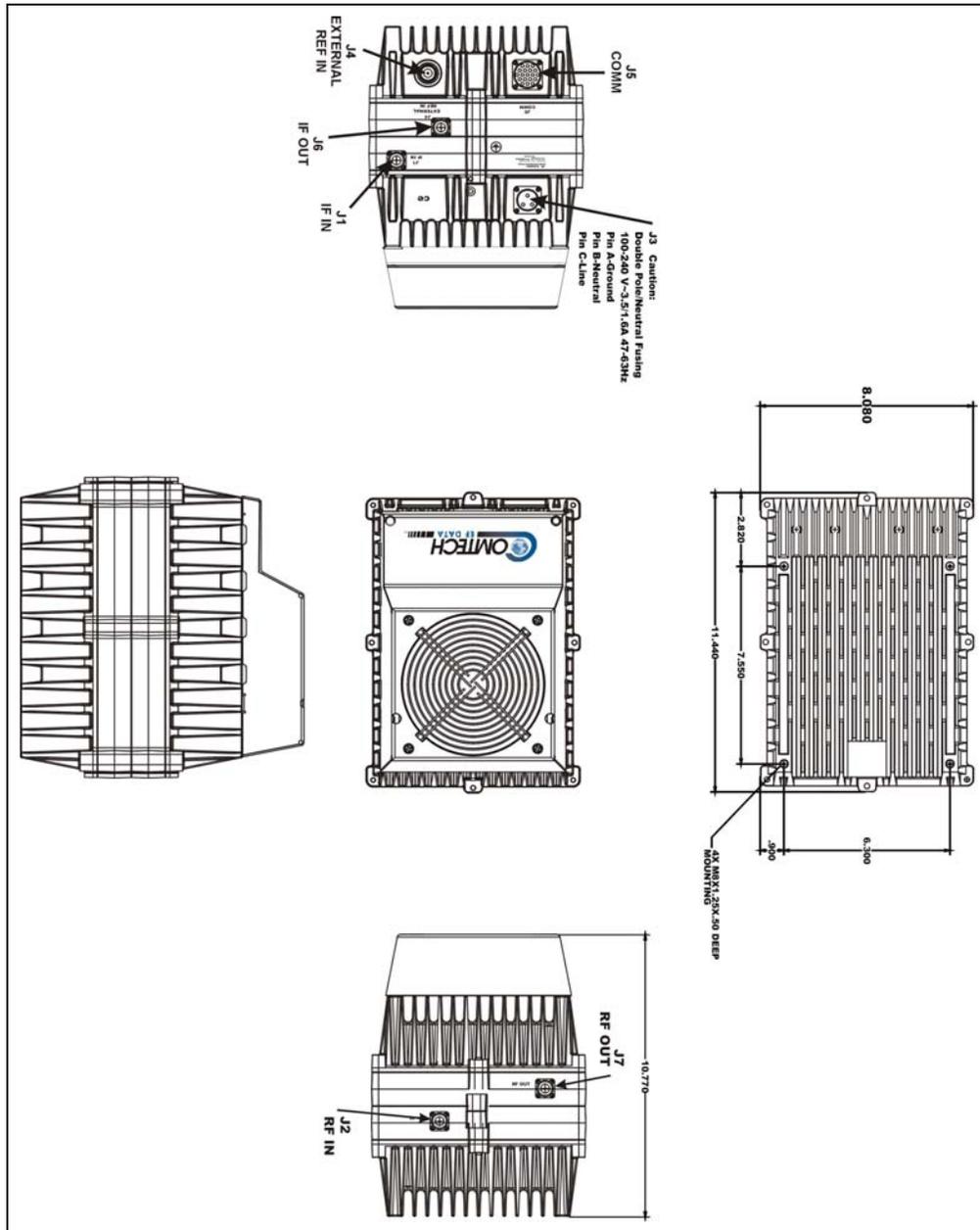
Figure 2-1. 5 to 25-WATT Dimensional Drawing
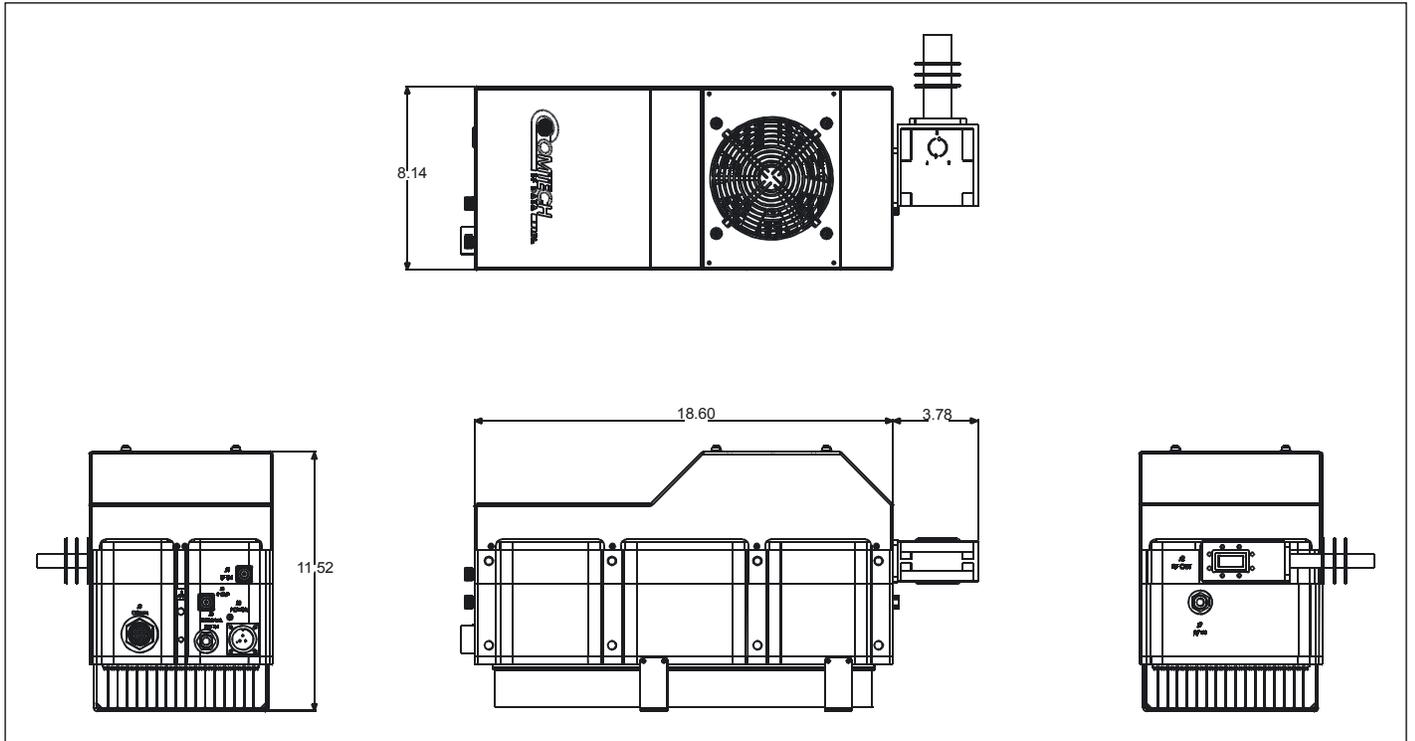
Figure 2-2. 50-WATT Dimensional Drawing
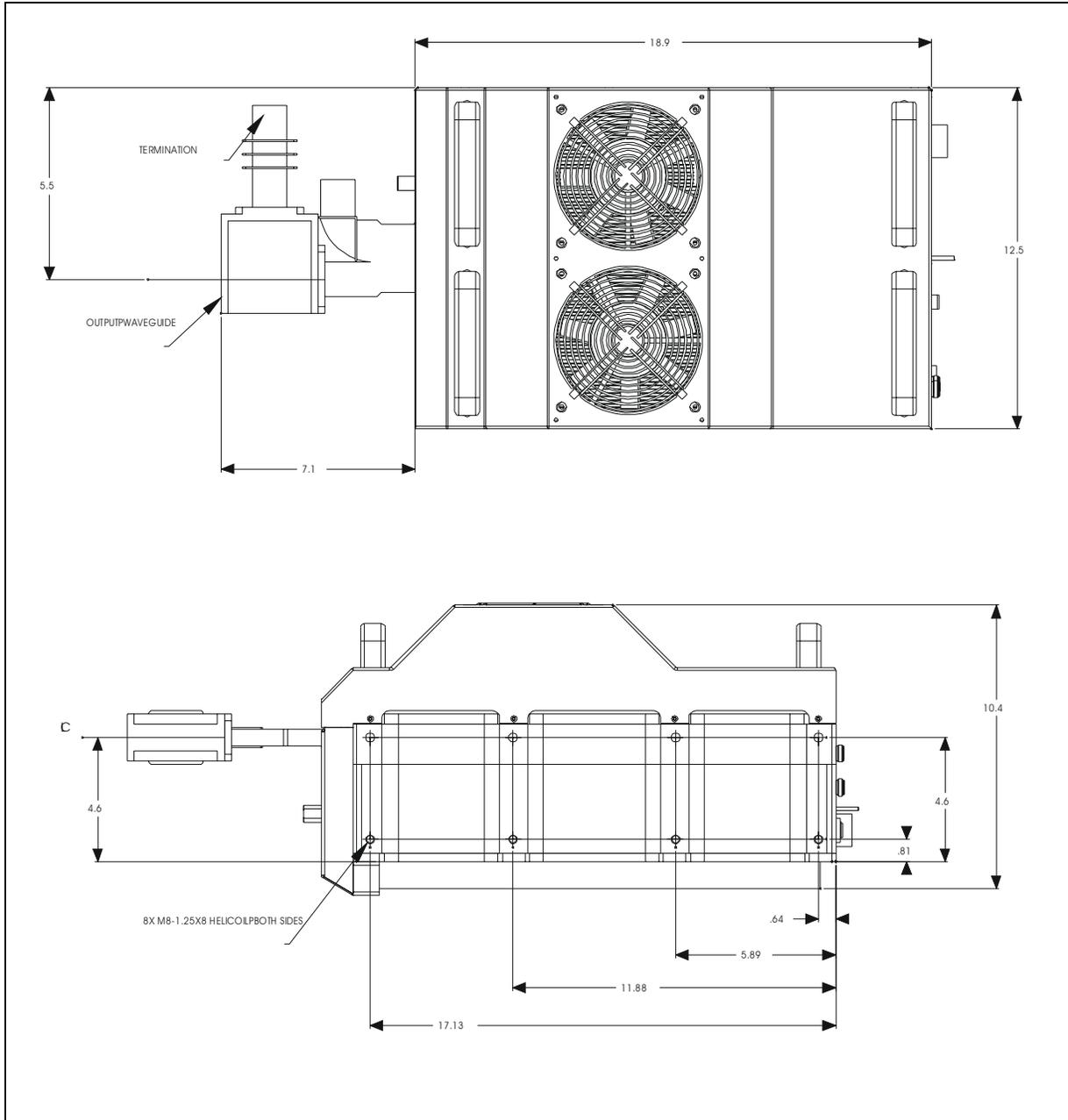
Figure 2-3. 100-WATT Dimensional Drawing
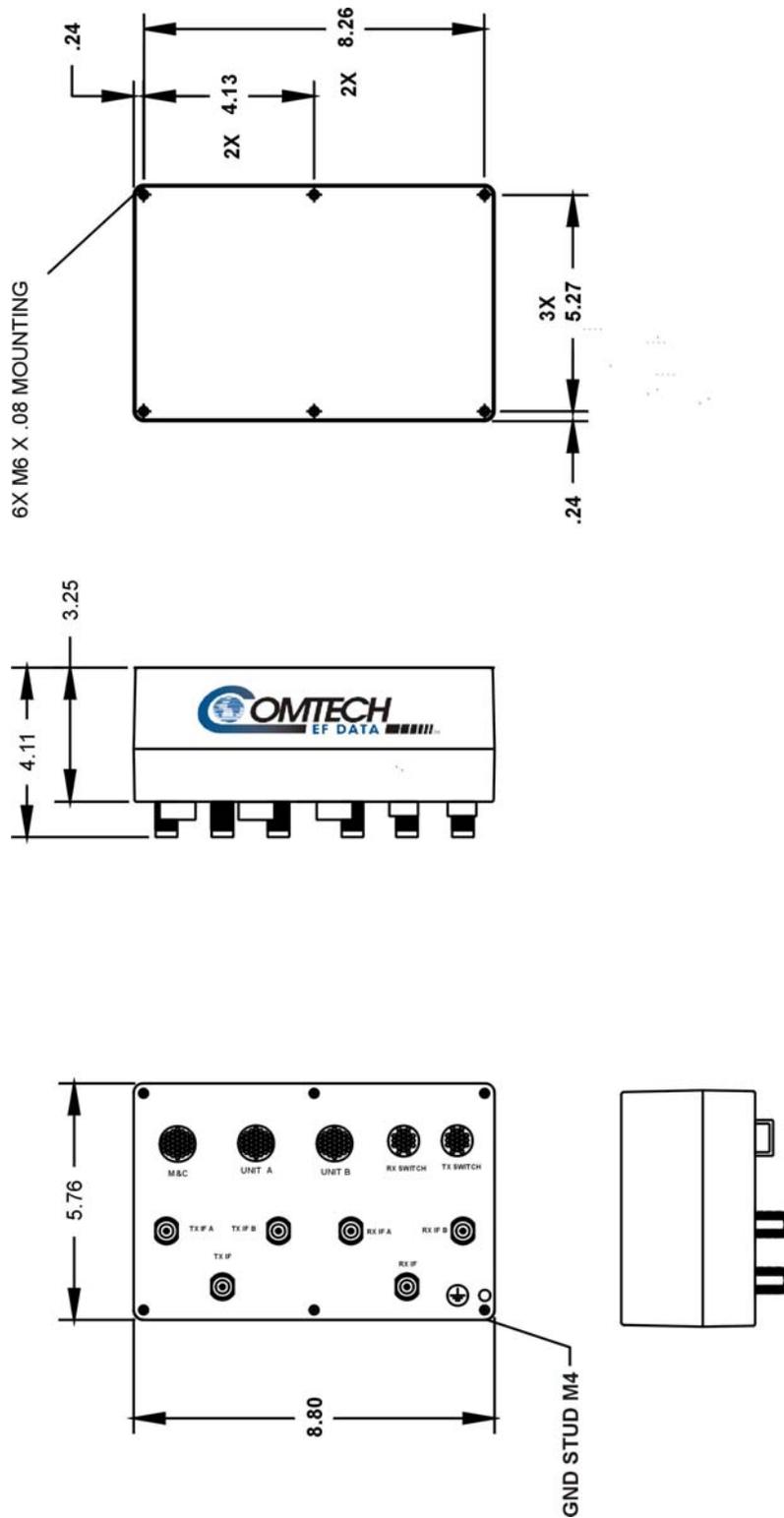
Figure 2-4. Remote Switch Dimensional Drawing

Chapter 3. SYSTEM OPERATION

This section contains instructions for operating the XSAT-7080, X-Band Transceiver. The Primary customer interface to the XSAT is via the Remote Communications port. Chapter 4 provides details regarding the protocol and command/response structure used on this interface. This chapter will define in detail the controllable parameters provided via the command/response structure.

3.1 PIN-OUTS

3.1.1 CONNECTOR J3:   AC POWER, MAINS, 100 TO 125 VAC, OR 205 TO 240 VAC.

> **WARNING**
> To avoid a serious shock hazard, correctly determine the mating connector type in use and wire it according to the following table:

	Early Units	Later Units
Pin	Mating Connector Type KPT06J12-3S MS3116J12-3S	Mating Connector Type CA3106E18-22SB
A	Line	Ground
B	Ground	Neutral
C	Neutral	Line

3.1.2 CONNECTOR J5:   COMM, REMOTE COMMUNICATIONS PORT.

Mating connector: ITT: KPT06J14-19P or MS3116J14-19P
Connections, see the following table:

Pin	Signal	I/O	Notes
A	EIA -485 +RX	Input	XSAT Receive Line
B	EIA -485 –RX	Input	XSAT Receive Line Compliment
C	EIA -485 TX+	Output	XSAT Transmit Line
D	EIA -485 TX-	Output	XSAT Transmit Line Compliment
E	EIA -232 Rd	Input	XSAT Receive Line
F	REDUNDANT FAULT	Input	Redundant Controller Status Input
G	EIA -232 Td	Output	XSAT Transmit Line
H	AUXCOM Rd	Input	Auxiliary RS232 Rd used with Redundant Controller
J	AUXCOM Td	Output	Auxiliary RS232 Td used with Redundant Controller
K	FAULT COMMON	Output	
L	FAULT NORM OPEN	Output	Open(OK) / Short(Fault)
M	FAULT NORM CLOSED	Output	Short(OK) / Open(Fault)
N	ADDRESS SELECT	Input	Redundant Addressing
P	ONLINE STATUS	Input	Input from Redundant Controller
R	+24V AUX	Output	24V output to power Redundant Controller
S	REDUNDANCY	Input	Open (stand-alone) / Gnd (Redundancy)
T	GROUND	Passive	
U	GROUND	Passive	
V	NO CONNECT		

3.2 TURNING ON THE XSAT

The XSAT does not contain a 'Power On/Off' switch. The XSAT is powered ON by connecting the J3 "AC Power" connector to the appropriate prime power source. See Section 1 for detailed requirements for the 'prime power source'.

> ⚠️ **WARNING**
> *Never turn the unit ON without proper termination on the J7 "RF OUTPUT" port. Individuals can be exposed to dangerously high electromagnetic levels.*

In addition, when directly connecting the XSAT to Laboratory Test Equipment, a DC block should be used between the J2 'RF IN' port and RF test source. The reason for this is that the XSAT can be configured to supply a 12Vdc, 400 milliamp, LNA Current Source output on this port. The DC block will protect any test equipment connected directly to J7.

3.3 CONFIGURING THE XSAT

The XSAT is a complete RF Down Converter Terminal, RF Up Converter Terminal, and RF High Power Amplifier (HPA) in a single weather safe package. The following paragraphs will define the meaning and use of all of the controllable parameter of the XSAT.

3.3.1 FREQUENCY

Both the Receiver frequency and the Transmitter frequency are user configurable. The receiver frequency can be selected to any frequency divisible by either 1.0 MHz or 2.5 MHz in the valid Rx frequency range. The transmitter frequency can be selected to any frequency divisible by either 1.0 MHz or 2.5 MHz in the valid Tx frequency range.

Associated Remote Command(s):   DFQ= , UFQ=

3.3.2 ATTENUATION

Both the Receiver attenuation and the Transmitter attenuation are user configurable. The receiver attenuation can be selected between 00.00 and 20.00 dB in 0.25 dB increments. The transmitter attenuation can be selected between 00.00 and 25.00 dB in 0.25 dB increments.

Associated Remote Command(s):   DAT= , UAT=

3.3.3 GAIN OFFSET

Both the Receiver and the Transmitter Gain Offsets are user configurable. The Gain Offset are only used in redundant configurations. The user can use these parameters to adjust for gain difference between two XSAT Transceivers used in a 1:1 redundant configuration. The offset can be selected between 0.00 and –4.00 dB in 0.25 dB increments.

Associated Remote Command(s):   DGO= , UGO=

3.3.4 MUTE MODE

The XSAT offers two operating modes with regards to frequency changes and unit muting. The two modes are; 'muted after frequency change' and 'unmuted after frequency change'.

- If the Mute Mode is set to '1', the firmware will leave the IF or RF muted following a change to either the Down Converter Frequency or Up Converter Frequency respectively. The operator can then 'unmute' the unit using the commands in the next section.

- If the Mute Mode is set to '0', the firmware will automatically 'unmute' the IF or RF following a change to the Down Converter Frequency or Up Converter Frequency respectively. This assumes that the unit was 'unmuted' prior to the frequency change and that there are no faults following the change. The factory default for this mode is '1'.

Associated Remote Command(s):   MUT=

3.3.5 MUTE

The output state of both the Receiver and the Transmitter are user controllable. The receiver output state (the 'IF IN' port, J1) will be ON only if the following two requirements are met:
(1) The receiver hardware must be fault free
(i.e. No Synthesiser or IFLO faults).
(2) The receiver must be unmuted (i.e. DMU=0).

The transmitter output state (the 'RF OUT' port, J7) will be ON only if the following three requirements are met:
(1) The transmitter hardware must be fault free
(i.e. No Synthesiser or IFLO faults).
(2) The transmitter must be unmuted (i.e. UMU=0).
(3) The transmitter Amplifier must be ON (i.e. AMP=1).

Associated Remote Command(s):   DMU= , UMU=

3.3.6 TX AMPLIFIER

The Tx amplifier ON/OFF state is user controllable. Turning the Tx amplifier OFF removes the 10Vdc supply to the RF Power FETs. The TX Amplifier must be ON in order for the XSAT to transmit a RF signal.

Associated Remote Command(s):   AMP=

3.3.7 CHANNEL SLOPE ADJUST MODE

Comtech EF Data's XSAT transcievers provide two operating modes for the Receiver IF and Transmitter RF output channel slopes; 'Calibrated' and 'Manual' modes.

- In Calibrated mode, the XSAT firmware uses a calibration 'lookup' table based on the selected frequency to determine the optimum channel slope setting.

- In Manual mode, the customer adjusts the channel slope using the DSA and USA commands defined in the next section.

Associated Remote Command(s):   DSM=, USM=

3.3.8 CHANNEL SLOPE ADJUST

Both the Rx IF output and the Tx RF output channel slopes are user controllable.

- The receiver channel slope can be varied for approximately 2dB of positive slope. The parameter for controlling this is the 'Down Slope Adjust' which can be varied from 0.0 to 1.0 in 0.1 steps. 0.0 is the default setting and also is the value used when the channel flatness is tuned and tested in the factory. 1.0 corresponds to approximately 2dB of positive slope.

- The transmit channel slope can be varied for approximately 2dB of positive slope. The parameter for controlling this is the 'Up Slope Adjust' which can be varied from 0.0 to 1.0 in 0.1 steps. 0.0 is the default setting and also is the value used when the channel flatness is tuned and tested in the factory. 1.0 corresponds to approximately 2dB of positive slope.

Associated Remote Command(s):   DSA= , USA=

3.3.9 REFERENCE FREQUENCY ADJUST

A manual, fine adjustment of the internal 10MHz reference frequency is provided as a user controllable parameter. This parameter can be varied within the range 000 to 255, with the factory default setting at 087. Varying this parameter from 000 to 255 will result in a change of approximately 6.5 kHz and 4.0 kHz at the RF and IF output ports respectively.

Associated Remote Command(s):   REF=

3.3.10 EXTERNAL REFERENCE FAULT LOGIC

The XSAT allows the user to select whether or not the summary fault relay is activated if the internal 10MHz reference loses lock with the external reference attached to 'EXTERNAL REF IN port' J4.

(The factory default is 0)

Associated Remote Command(s):   LFL=

3.3.11 COLD START FUNCTION

The XSAT provides an optional 'Cold Start' feature that will ensure that the internal 10MHz reference signal is at a stable temperature prior to allowing the RF and IF outputs to be turned ON. A fixed cold start interval of 15 minutes is used.

- If 'Cold Start' is ON when the XSAT is powered ON, the IF and RF outputs will remain muted for 15 minutes even if all the conditions defined in 3.2.5 are satisfied. At the end of the 15 minute interval, the RF and IF output will automatically be turned ON if the conditions of 3.2.5 are met.

- If a XSAT was powered ON with 'Cold Start ON', the operator can override this function by setting 'Cold Start OFF'.

Associated Remote Command(s):   CLD=

3.3.12 AUTO FAULT RECOVERY

This parameter defines how the XSAT responds to momentary fault conditions.

- If 'Auto Fault Recovery ' is OFF and a fault condition occurs that causes either the RF or IF output to be muted, then that fault condition clears, the XSAT will remain muted. In this mode, operator intervention is necessary to return the XSAT to normal operating mode.

- If 'Auto Fault Recovery' is ON and the same situation occurs, the XSAT will automatically be unmuted and return to normal operating mode. To protect against repetitive, momentary faults, if the XSAT experiences five occurrences of the same fault, the 'Auto Fault Recovery' parameter will automatically be set to OFF.

> **Example: If the Up Converter IFLO synthesizer goes unlocked and starts sweeping while Auto Fault Recovery is ON, the XSAT would see a unlocked / locked condition at the sweep rate of the IFLO synthesizer. After the 5th occurrence the firmware will set Auto Fault Recovery to OFF and keep the XSAT RF output muted.**

Associated Remote Command(s):   AFR=

3.3.13 LNA CURRENT SOURCE

The XSAT has the circuitry necessary to source current, at 12 Vdc, up the "RF IN" port J2, to power a LNA. This current source can be turned ON/OFF via the user. This source is capable of providing up to 400 mA.

> ⚠ **WARNING**
>
> *Never turn the unit ON without proper termination on the J7 "RF OUTPUT" port. Individuals can be exposed to dangerously high electromagnetic levels.*

> ❗ **IMPORTANT**
>
> *Exercise care when directly connecting the XSAT to Laboratory Test Equipment. A DC block should be used between the J2 "RF IN"' port and RF test source to protect the test equipment in case the source is accidentally turned ON. (The factory default is OFF).*

Associated Remote Command(s):   LCS=

3.3.14 LNA CURRENT CALIBRATION AND CURRENT WINDOW

The XSAT provides the capability to monitor the LNA current when configured to supply current to a LNA. In addition, an adjustable window detect for the LNA current is provided. After attaching the LNA and turning on the current source, the user can 'Calibrate' the current and set a window from ±20% to ±50% to trigger an alarm. The user can disable the 'window detect' feature by setting the window value to ±99%. (The factory default is 99)

Associated Remote Command(s):   CAL= , LCW=

3.3.15 LNA FAULT LOGIC

The XSAT allows the user to select whether or not the summary fault relay is activated if the LNA current moves out the prescribed window. This allows the user to control whether or not the redundancy controller will switch on a LNA current alarm in the redundant configuration. (The factory default is 0)

Associated Remote Command(s):   LFL=

3.3.16 REDUNDANCY CONTROLLER AUTO/MANUAL

The Operating mode of the Comtech EF Data Redundant Switch Unit (RSU-5060) can be set via a command to the ONLINE XSAT. The RSU-5060 initializes to the AUTO mode when power is first applied.

- In AUTO mode the RSU-5060 monitors the state of the two XSATs and will automatically switch the OFFLINE unit online if the ONLINE unit faults.

- In MANUAL mode, the RSU-5060 will only switch the position of the Tx and Rx transfer switches when commanded to do so via either the RTG= command or via Pin V on the 'M&C Control' connector (J5) on the RSU-5060. The user sets AUTO mode by sending a '1' in the data field and MANUAL mode with a '0' in the data field.

Associated Remote Command(s):   RAM=

3.3.17 REDUNDANCY CONTROLLER TOGGLE

The User can cause the RSU-5060 Redundant Switch Unit to switch the position of both the Tx and Rx transfer switches using this command.

- If the RSU-5060 is in AUTO mode, the command will only cause a switchover if the OFFLINE unit is currently UNFAULTED.

- If the RSU-5060 is in MANUAL mode, the command will cause a switchover independent of the state of the OFFLINE unit.

Associated Remote Command(s):   RTG=

3.3.18 SET PHYSICAL ADDRESS

The Remote (Physical) address to which the XSAT will respond can be set to any value between 0001 and 9999. (The factory default is 0001)

Associated Remote Command(s):   SPA=

3.3.19 SET BAUD RATE

The Baud Rate of the communication port, J5, can be set to any values shown below:

    1200, 2400, 4800, 9600, 19200, 38400 (The factory default is 9600)

Associated Remote Command(s):   SBR=

3.3.20 SET DATE

The XSAT contains a battery powered Real Time Clock (RTC) used to provide Date/Time stamping of events, alarms and faults. The date can be changed by the user.

Associated Remote Command(s):   DAY=

3.3.21 SET TIME

The XSAT contains a battery powered Real Time Clock (RTC) used to provide Date/Time stamping of events, alarms and faults. The time can be changed by the user.

Associated Remote Command(s):   TIM=

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Chapter 4. REMOTE CONTROL

4.1 INTRODUCTION

This document describes the protocol and message repertoire for remote monitor and control of the XSAT Outdoor terminal.

The electrical interface is either an RS-485 multi-drop bus (for the control of many devices) or an RS-232 connection (for the control of a single device), and data is transmitted in asynchronous serial form, using ASCII characters. Control and status information is transmitted in packets, of variable length, in accordance with the structure and protocol defined in later sections.

4.1.1 RS-485

The RS-485 interface is provided at the 19-pin circular J5 connector. The interface is a 4-wire RS-485 interface using the pin out shown in Table 4-1. Since a half-duplex communication protocol is used, the +Tx and +Rx as well as the –Tx and –Rx signals can be tied together at the user end to support a 2-wire interface. The RS-485 driver is only active during transmission and is tri-stated when not is use.

Table 4-1. RS-485 Interface

Pin	Signal Name	I/O	Notes
A	RS--485 +Rx	Input	XSAT Receive line
B	RS--485 –Rx	Input	XSAT Receive line complement
C	RS--485 +Tx	Output	XSAT Transmit line
D	RS--485 –Tx	Output	XSAT Transmit line complement
T	Ground	Passive	

4.1.2 RS-232

The RS-232 interface is provided at the 19-pin circular J5 connector. The interface provides the five signals shown in Table 4-2. The XSAT only requires three wires (TD, RD, and Ground), the other two signal are provided for terminal equipment that requires RTS/CTS handshaking. The XSAT simply ties these two signals together.

Table 4-2.   RS-232 interface

Pin	Signal Name	I/O	Notes
E	RS-232 RD	Input	XSAT Rx line
G	RS-232 TD	Output	XSAT Tx line
T	Ground	Passive	

4.2 BASIC PROTOCOL

Whether in RS-232 or RS-485 mode, all data is transmitted half-duplex as asynchronous serial characters suitable for transmission and reception by a UART. In this case, the asynchronous character format is fixed at; 8 data bits, 1 stop bit, no parity. The baud rate may vary between 1200 baud and 19,200 baud.

All data is transmitted in framed packets. The master is assumed to be a PC or ASCII dumb terminal, which is controlling the process of monitor and control. The master is the only device that is permitted to initiate the transmission of data. Slaves are only permitted to transmit when they have been specifically instructed to do so by the master.

All bytes within a packet are printable ASCII characters. In this context, the Carriage Return and Line Feed characters are considered printable.

All messages from master to slave require a response (with one exception). This will either be to return data that has been requested by the master, or to acknowledge reception of an instruction to change the configuration of the slave. The exception to this is when the master broadcasts a message (such as Set time/date) using Address 0.

4.2.1 PACKET STRUCTURE

Table 4-3. Master-to-Slave:

	Start of Packet	Device Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
Character	<		/		= or ?		Carriage Return
ASCII Code	60		47		61 or 63		13
# Characters	1	4	1	3	1	n	1

Example: <0135/UAT=12.25{CR}

Table 4-4. Slave-to-Master:

	Start of Packet	Device Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
Character	>		/		=, ?, !, or *		Carriage Return, Line Feed
ASCII Code	62		47		61, 63, 33 or 42		13, 10
# Characters	1	4	1	3	1	From 0 to n	2

Example: >0135/UAT=07.75{CR}{LF}

4.2.1.1 START OF PACKET

Master to Slave: This is the character: < = (ASCII code 61)

Master to Slave: This is the character: > = (ASCII code 62)

Because this is used to provide a reliable indication of the start of packet, these two characters may not appear anywhere else within the body of the message.

4.2.1.2 ADDRESS

Up to 9999 devices can be uniquely addressed. In RS-232 and RS-485 applications, the permissible range of values is 1 to 9999. It is programmed into a slave unit using the Set Physical Address (SPA) command.

> **IMPORTANT**
>
> The master sends a packet with the address of a slave - the destination of the packet. When the slave responds, the address used is the same address, to indicate to the master the source of the packet. The master does not have its own address.

4.2.1.3 INSTRUCTION CODE

This is a three-character alphabetic sequence that identifies the subject of the message. Wherever possible, the instruction codes have been chosen to have some significance.

> **For example UAT for Up Converter attenuation, UFQ for Up Converter Frequency, etc. This aids in the readability of the message, should it be displayed in its raw ASCII form. All command are case sensitive, only upper case alphabetic characters may be used (A-Z, ASCII codes 65 - 90).**

4.2.1.4 INSTRUCTION CODE QUALIFIER

This is a single character that further qualifies the preceding instruction code.

Code Qualifiers obey the following rules:

1) From Master to Slave, the only permitted values are:

   =   (ASCII code 61)

   ?   (ASCII code 63)

   They have these meanings:

   The = code (master to slave) is used as the assignment operator, and is used to indicate that the parameter defined by the preceding byte should be set to the value of the argument(s) which follow it.

   > **For example, in a message from master to slave, UAT=12.50 would mean set the transmit attenuation to 12.50 dB.**

   The ? code (master to slave) is used as the query operator, and is used to indicate that the slave should return the current value of the parameter defined by the preceding byte.

> **For example, in a message from master to slave, 'UAT?' would mean return the current value of the transmit attenuation.**

2) From Slave to Master, the only permitted values are:

= (ASCII code 61)

? (ASCII code 63)

! (ASCII code 33)

* (ASCII code 42)

(ASCII code 35)

They have these meanings:

The = code (slave to master) is used in two ways:

- First, if the master has sent a query code to a slave (for example UAT?, meaning what's the Transmit Attenuation?), the slave would respond with UAT=xx.xx, where xx.xx represents the attenuation in question.

- Second, if the master sends an instruction to set a parameter to a particular value, then, providing the value sent in the argument is valid, the slave will acknowledge the message by replying with UAT= (with no message arguments).

The ? code (slave to master) is only used as follows:

- If the master sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is not valid, the slave will acknowledge the message by replying with (for example) with UAT? (with no message arguments).

- This indicates that there was an error in the message sent by the master.

The * code (slave to master) is only used as follows:

- If the master sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is valid, but the XSAT will not permit that particular parameter to be changed at that time, the slave will acknowledge the message by replying with (for example) with UAT* (with no message arguments).

The ! code (slave to master) is only used as follows:

- If the master sends an instruction code which the slave does not recognise, the slave will acknowledge the message by echoing the invalid instruction, followed by the ! character. Example: XYZ!

The # code (slave to master) is only used as follows:

- If the master sends an instruction code which the slave cannot currently perform because of hardware resource issues, the slave will acknowledge the message by echoing the invalid instruction, followed by the # character.

- This response can only occur if the operator sends two or more 'hardware configuration' type commands without allowing adequate time between commands for the hardware to be configured.

> **Example; the operator issued commands to change both the Up Converter frequency and the down converter frequency with less than 100 milliseconds between commands**

- If this response is returned the command has not been excepted an the operator must resend the command.

4.2.1.5 MESSAGE ARGUMENTS

Arguments are not required for all messages. All arguments are ASCII codes for the characters 0 to 9 (ASCII 48 to ASCII 57), period (ASCII 46) and comma (ASCII 44).

4.2.1.6 END OF PACKET

Master to Slave: This is the Carriage Return character (ASCII code 13)

Slave to Master: This is the two-character sequence Carriage Return, Line Feed. (ASCII code 13, and code 10.)

Both indicate the valid termination of a packet.

4.3 COMMANDS OR RESPONSES

The commands and responses a reprovided to assist the technican in monitoring and controlling the unit.

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)
Tx Frequency	UFQ=	6 bytes numerical	Command or Query. Tx Frequency in valid range. Frequency divisible by 1Mhz and 2.5 MHz are allowed. Example: UFQ= 7951.0	UFQ= (message ok) UFQ? (received ok, but invalid arguments found)	UFQ?	UFQ=*xxxx.x* (same format as command arguments)
Rx Frequency	DFQ=	6 bytes numerical	Command or Query. Rx Frequencyin valid range. Frequency divisible by 1Mhz and 2.5 MHz are allowed. Example: DFQ=7251.0	DFQ= (message ok) DFQ? (received ok, but invalid arguments found)	DFQ?	DFQ=*xxxx.x* (same format as command arguments)
Tx Attenuation	UAT=	5 bytes numerical	Command or Query. Tx Attenuation, in dB, between 00.00 and 25.00. Resolution = 00.25 dB. Example: UAT=12.75	UAT= (message ok) UAT? (received ok, but invalid arguments found)	UAT?	UAT=*xx.xx* (same format as command arguments)
Rx Attenuation	DAT=	5 bytes numerical	Command or Query. Rx Attenuation, in dB, between 00.00 and 20.00. Resolution = 00.25 dB. Example: DAT=12.75	DAT= (message ok) DAT? (received ok, but invalid arguments found)	DAT?	DAT=*xx.xx* (same format as command arguments)
Tx Gain Offset	UGO=	5 bytes numerical	Command or Query. Tx Gain Offset for 1:1 redundancy configurations. In dB, between -0.00 and -4.00. Resolution = 00.25 dB. Example: UGO=-1.25	UGO= (message ok) UGO? (received ok, but invalid arguments found)	UGO?	UGO=*xx.xx* (same format as command arguments)
Rx Gain Offset	DGO=	5 bytes numerical	Command or Query. Rx Gain Offset for 1:1 redundancy configurations. In dB, between -0.00 and -4.00. Resolution = 00.25 dB. Example: DGO=-1.25	DGO= (message ok) DGO? (received ok, but invalid arguments found)	DGO?	DGO=*xx.xx* (same format as command arguments)
Tx Amplifier	AMP=	1 byte, value of 0,1	Command or Query. Tx Amplifier, where: 0 = Amplifier OFF 1 = Amplifier ON Example: AMP=1	AMP= (message ok) AMP? (received ok, but invalid argument found)	AMP?	AMP=*x* (same format as command argument)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)
Mute Mode	MUT=	1 byte, value of 0,1	Command or Query. Mute Mode, where: 0 = Unmuted after Frequency change, 1 = Muted after Frequency change. Example: MUT=1	MUT=(message ok) MUT?(received ok, but invalid argument found)	MUT?	MUT=x (same format as command argument)
Tx Mute	UMU=	1 byte, value of 0,1	Command or Query. Tx Mute, where: 0 = Transmitter Unmuted, 1 = Transmitter Muted Example: UMU=1	UMU=(message ok) UMU?(received ok, but invalid argument found)	UMU?	UMU=x (same format as command argument)
Rx Mute	DMU=	1 byte, value of 0,1	Command or Query. Rx Mute, where: 0 = Receiver Unmuted, 1 = Receiver Muted Example: DMU=1	DMU=(message ok) DMU?(received ok, but invalid argument found)	DMU?	DMU=x (same format as command argument)
Tx Slope Mode	USM=	1 byte, value of 0,1	Command or Query. Tx Slope Mode, where: 0 =Manual Mode, 1 = Calibrated Mode. Example: USM=1	USM=(message ok) USM?(received ok, But invalid argument found)	USM?	USM=x (same format as command argument)
Tx Slope Adjust	USA=	3 bytes	Command or Query. Tx Slope Adjust, between 0.0 and 1.0. Resolution = 0.1. Example: USA=0.3	USA= (message ok) USA? (received ok, but invalid arg. found)	USA?	USA=x.x (same format as command argument)
Rx Slope Mode	DSM=	1 byte, value of 0,1	Command or Query. Rx Slope Mode, where: 0 =Manual Mode, 1 = Calibrated Mode. Example: DSM=1	DSM=(message ok) DSM?(received ok, But invalid argument found)	DSM?	DSM=x (same format as command argument)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)
Rx Slope Adjust	DSA=	3 bytes	Command or Query. Rx Slope Adjust, between 0.0 and 1.0. Resolution = 0.1. Example: DSA=0.3	DSA= (message ok) DSA? (received ok, but invalid arg. found)	DSA?	DSA=*x.x* (same format as command argument)
Reference Oscillator Adjust	REF=	3 bytes	Command or Query. Ref Osc Adjust, between 000 and 255. Resolution 001. Example: REF=087 Note: REF cannot be adjusted when the XSAT is locked to an external reference source.	REF= (message ok) REF? (received ok, but invalid argument found) REF* (message ok, but not permitted in current mode)	REF?	REF=*xxx* (same format as command argument)
Cold Start	CLD=	1 byte, value of 0,1	Command or Query. Cold Start, where: 0 = Disabled, 1 = Enabled Example: CLD=1	CLD= (message ok) CLD? (received ok, but invalid arguments found)	CLD?	CLD=*x* (same format as command arguments)
Auto Fault Recovery	AFR=	1 byte, value of 0,1	Command or Query. Auto Fault Recovery, where: 0 = Disabled, 1 = Enabled Example: AFR=1	AFR= (message ok) AFR? (received ok, but invalid arguments found)	AFR?	AFR=*x* (same format as command arguments)
Online Status	N/A	1 byte, value of 0,1	Query Only. Online status, where: 0 = OFFLINE, 1 = ONLINE Example: ONL=1	ONL= (message ok) ONL? (received ok, but invalid arguments found)	ONL?	ONL=*x* (same format as command arguments)
LNA Current Source	LCS=	1 byte, value of 0,1	Command or Query. LNA Current Source, where: 0 = Disabled, 1 = Enabled Example: LCS=1	LCS= (message ok) LCS? (received ok, but invalid arguments found)	LCS?	LCS=*x* (same format as command arguments)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)
LNA Fault Logic	LFL=	1 byte, value of 0,1	Command or Query. LFL controls whether or not the Summary Fault Relay (SFR) is affected by the LNA Current window monitor, where: 0 = A LNA Current fault does not effect the SFR, 1 = A LNA Current fault will effect the SFR. Example: LFL=1	LFL= (message ok) LFL? (received ok, But invalid arguments found)	LFL?	LFL=x (same format as command arguments)
Calibrate LNA Current	CAL=	None	Command only. This command is used to set the calibration point for the LNA current alarm feature. Example: CAL=	CAL= (message ok)	N/A	N/A
LNA Current Window	LCW=	2 bytes, numerical	Command or Query. LNA Current Monitor Window, this command allows the user to set the alarm window in $\pm$ % of the calibrated LNA current. Valid inputs are 20 to 50 in increments of 5. In addition, setting the value to 99 disables the alarm function. Example: LCW=30, set the alarm window at $\pm$ 30%.	LCW= (message ok) LCW? (received ok, but invalid arguments found)	LCW?	LCW=xx (same format as command arguments)
External Reference Fault Logic	XRF=	1 byte, value of 0,1	Command or Query. XRF controls whether or not the Software monitors the external refernece source. If enabled and no source is present a fault will be reported. 0 = A Ext Reference not monitored 1 = A Ext Reference is monitored and the lock state reported. Example: XRF=1	XRF= (message ok) XRF? (received ok, But invalid arguments found)	XRF?	XRF=x (same format as command arguments)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)
XSAT Global Configuration	CGC=	60 bytes, with numerical entries fixed value entries, and delimiters	Command or Query. Global configuration of Unit, in the form: FFFF.FAA.AAMSB.BGG.GGZffff.faa.aamsb.b gg.ggNRCXOOOLWWDeeeeeee, where: F = Tx Frequency – same as UFQ= (6 bytes) A = Tx Attenuation – same as UAT= (5 bytes) M = Tx Mute – same ad UMU= (1byte) S = Tx Slope Mode – same as USM= (1 byte) B = Tx Slope Value – same as USA= (3 bytes) G = Tx Gain Offset – same as UGO= (5 bytes) Z = Tx Amplifier State – same as AMP= (1 byte) f = Rx Frequency – same as UFQ= (6 bytes) a = Rx Attenuation – same as UAT= (5 bytes) m = Rx Mute – same ad UMU= (1byte) s = Rx Slope Mode – same as USM= (1 byte) b = Rx Slope Value – same as USA= (3 bytes) g = Rx Gain Offset – same as UGO= (5 bytes) N = Mute Mode – same as MUT= (1 byte) R = Auto Fault Recovery – same as AFR= (1 byte) C = Cold Start Mode – same as CLD= (1 byte) X = Ext Ref Fault Logic – same as XRF= (1 byte) O = Ref Oscillator Adjust – same as REF= (3 bytes) L = LNA Current Source – same as LCS= (1 byte) W = LNA Current Window – same as LCW= (3 bytes) D = LNA Fualt Logic – same as LFL= (1 byte) e = expansion (7 bytes), set to '0' Example: CGC=7951.012.75000.3-0.0017251.0 12.75000.3-0.00110108719900000000	CGC= (message ok) CGC? (received ok, But invalid arguments found)	CGC?	CGC= FFFF.FAA.AAMS B.BGG.GGZffff.faa.aams b.bgg.ggNRCXOOOLWWDeeeeeee e (same format as command arguments)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)
Redundancy Controller Box Auto/Manual Mode	RAM=	1 byte, value of 0,1	Command or Query. RAM controls whether or not the Redundancy Controller is in automatic or manual mode, where: 0 = Manual Mode, 1 = Auto Mode. Example: RAM=1	RAM= (message ok) RAM? (received ok, But invalid arguments found)	RAM?	RAM=x (same format as command arguments)
Redundancy Controller Box Toggle	RTG=	None	Command only. RTG= sent to the online XSAT will cause the Redundancy Box to toggle the Tx and Rx switches. Example: RTG=	RTG= (message ok) RTG? (received ok, But invalid arguments found)	N/A	N/A
Remote Address (Physical Address)	SPA=	4 bytes, numerical	Command or Query. Physical Address - between 0001 and 9999. Resolution 0001. Example: SPA=0890	SPA= (message ok) SPA? (received ok, but invalid arguments found)	SPA?	SPA=xxxx (same format as command arguments)
Remote Baud rate	SBR=	4 bytes	Command or Query. Baud Rate, as follows: 1200 = 1200 baud, 2400 = 2400 baud, 4800 = 4800 baud, 9600 = 9600 baud, 19K2 = 19200 baud. 38K4 = 38400 baud.	SBR= (message ok) SBR? (received ok, but invalid arguments found)	SBR?	SBR=xxxx (same format as command arguments)
Set RTC Date	DAY=	6 bytes, numerical	A command in the form mmddyy, where; dd = day of the month, between 01 and 31, mm = month of the year, between 01 and 12 and yy = year, between 97 and 96 (1997 to 2000, then 2000 to 2096) Example: DAY=042457 would be April 24, 2057	DAY= (message ok) DAY? (received ok, but invalid arguments found) DAY* (message ok, but not permitted in current mode	DAY?	DAY=xxxxxx (same format as command arguments

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)
Set RTC Time	TIM=	6 bytes, numerical	A command in the form hhmmss, indicating the time from midnight, where hh = hours, between 00 and 23; mm = minutes, between 00 and 59, and ss = seconds, between 00 and 59 Example: TIM=231259 would be 23 hours, 12 minutes and 59 seconds from midnight.	TIM= (message ok) TIM? (received ok, but invalid arguments found) TIM* (message ok, but not permitted in current mode)	TIM?	TIM=xxxxxx (same format as command arguments
Clear All Stored Alarms	CAA=	None	Command only Instructs the slave to clear all Stored Events This command takes no arguments.	CAA= (message ok)	N/A	N/A
Re-Initialize Retrieved Alarms Point	IAP=	None	Command only Instructs the unit to zero the retrieved alarms pointer to allow the user to retrieve the complete stored alarms log.	IAP=(message ok)	N/A	N/A

List New Alarms (Retrieve next 5 unread Stored Alarms)	N/A	145 bytes	Query only
			XSAT returns the oldest 5 Stored Events that have not yet been read over the remote control. Reply format: Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where Sub-body=
			YYYYYYYYYY ZZ mmddyy hhmmss,
			YYYYYYYYYY being the fault description.
			ZZ being the alarm typr.
			  FT = Fault
			  OK = Clear
			  IF = Information
			If there are no new events, the XSAT will reply with LNA*. Note: the XSAT incorporates a circular buffer capable of holding 100 events/alarms.
				N/A	LNA?	LNA=YY..ss
						(see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)
Total New Alarms (Retrieve Number of unread Stored Alarms)	N/A	2 bytes, numerical	Query only. XSAT returns the number of Stored Events which remain unread, in the form xx. Note: This means unread over the remote control – viewing the stored events from the front panel of the modem does not affect this value. Example reply: TNA=18'cr''lf'	N/A	TNA?	TNA=*xx* (see description for details of arguments)
Retrieve Serial Number	N/A	6 bytes, alpha numerical C00000 to C99999	Query only. Used to Query the units 6 digit serial number. Slave returns its S/N, in the form xxxxxx. Example: RSN=C00165'cr''lf'	N/A	RSN?	RSN=*xxxxxx* (see description for details of arguments)
Retrieve Equipment Type	N/A	20 bytes, alpha numerical	Query only. XSAT returns a string indicated the Model Number and the value of internal software revision installed Example: RET=XSAT-7080/025 V1.02'cr''lf'	N/A	RET?	RET=*x….x* (see description for details of arguments)
Circuit Identification Message	CID=	24 bytes, alpha numerical	Command or Query. Sets or queries the user-defined Circuit ID string, which is a fixed length of 24 characters. Valid characters include: Space ( ) * + _ , . / 0-9 A-Z	CID= (message ok) CID? (received ok, but invalid arguments found)	CID?	CID=*x….x* (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)
Retrieve Configuration Status	N/A	113 bytes, alpha numerical	Query only. Used to Query the configuration status of the XSAT Example: RCS='cr' 　　　UFQ=7905.0'cr' 　　　DFQ=7275.0'cr' 　　　UAT=12.50'cr' 　　　DAT=01.50'cr' 　　　ONL=YES'cr' 　　　XMT=ON'cr' 　　　AMP=ON'cr' 　　　UMU=OFF'cr' 　　　RCV=ON'cr' 　　　DMU=OFF'cr' 　　　CLD=OFF'cr' 　　　AFR=ON'cr' 　　　EXT=NO 'cr''lf'	N/A	RCS?	RCS=$x....x$ (see description for details of arguments)
Retrieve LNA Status	N/A	23 bytes, alpha numerical	Query only. Used to Query the LNA status of the XSAT Example: RLS='cr' 　　　LCS=ON'cr' 　　　LCW=40'cr' 　　　LFL=1'cr''lf'	N/A	RLS?	RLS=$x....x$ (see description for details of arguments)
Retrieve Utility Status	N/A	32 bytes, alpha numerical	Query only. Used to Query the utility status of the XSAT Example: RUS='cr' 　　　BDR=9600'cr' 　　　REF=087'cr' 　　　USA=0.3'cr' 　　　DSA=0.4'cr''lf'	N/A	RUS?	RUS=$x....x$ (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)

Retrieve Redundancy Status	N/A	37 bytes, alpha numerical	Query only.
			Used to Query the utility status of the XSAT
			Example: RRS='cr'
			    R 5V=5.0'cr'
			    R 12V=11.8'cr'
			    TX SW=OK'cr'
			    RX SW=OK'cr''lf'
				N/A	RRS?	RRS=*x….x* (see description for details of arguments)

Retrieve Maintenance Status	N/A	175 bytes, alpha numerical	Query only.
			Used to Query the maintenance status of the XSAT
			Example: RMS='cr'
			    24VT=023.9'cr'
			    20VT=020.3'cr'
			    12VT=012.0'cr'
			    10VT=010.2'cr'
			    P5VT=005.0'cr'
			    N5VT=-05.0'cr'
			    USYN=008.2'cr'
			    UIFL=003.9'cr'
			    DSYN=006.3'cr'
			    DIFL=003.8'cr'
			    REFV=002.9'cr'
			    LNAC=081.9'cr'
			    FANC=541.0'cr'
			    UTMP= 37.0'cr'
			    POWR=25.0-'cr'
			    DTMP= 34.0'cr''lf'
				N/A	RMS?	RMS=*x….x* (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)
Retrieve Alarm Status	N/A	171 bytes, text	Query only. Used to Query the Alarm status of the XSAT Example: RAS='cr' 　　　24VLT=OK'cr' 　　　20VLT=OK'cr' 　　　12VLT=OK'cr' 　　　10VLT=OK'cr' 　　　P5VLT=OK'cr' 　　　N5VLT=OK'cr' 　　　USYNH=OK'cr' 　　　UIFLO=OK'cr' 　　　DSYNH=OK'cr' 　　　DIFLO=OK'cr' 　　　REFLD=OK'cr' 　　　LNACR=OK'cr' 　　　FANMN=OK'cr' 　　　HSTMP=OK'cr' 　　　SHTDN=OK'cr' 　　　IICFT=OK'cr' 　　　CHKSM=OK'cr' 　　　BATLW=OK'cr' 　　　REDSW=OK'cr''lf'	N/A	RAS?	RAS=*x….x* (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)

Concise Configuration Status	N/A	31 bytes, alpha numerical	Query only.
			Used to Query the Configuration status of the XSAT
			Example: CCS=uuuu.udddd.daa.aabb.bbotamrncfx'cr''lf'
			where:
			    uuuu.u = Tx frequency
			    dddd.d = Rx frequency
			    aa.aa = Tx attenuation
			    bb.bb = Rx attenuation
			    o = online status, 0 = OFFLINE, 1 = ONLINE
			    t = transmitter status, 0 = OFF, 1 = ON
			    a = amplifier status, 0 = OFF, 1 = ON
			    m = Tx mute status, 0 = Unmuted, 1 = Muted
			    r = receiver status, 0 = OFF, 1 = ON
			    n = Rx mute status, 0 = Unmuted, 1 = Muted
			    c = cold start, 0 = Disabled, 1 = Enabled
			    f = auto fault recover, 0 = Disabled, 1 = Enabled
			    x = external reference present, 0 = NO, 1 = YES
				N/A	CCS?	CCS=$x….x$ (see description for details of arguments)

Concise LNA Status	N/A	4 bytes, alpha numerical	Query only.
			Used to Query the LNA status of the XSAT
			Example: CLS=abbc'cr''lf'
			where:
			    a = LNA Current 0=OFF, 1=ON
			    bb = Current window in %
			    c = LNA Fault Logic 0=OFF, 1=ON
				N/A	CLS?	CLS=$x….x$ (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)

Concise Utility Status	N/A	10 bytes, alpha numerical	Query only.
			Used to Query the Utility status of the XSAT
			Example: CUS=brrru.ud.d'cr''lf'
			where:
			   b = baud rate, 1 = 1200, 2 = 2400,
			      3 = 4800, 4 = 9600, and 5 = 19200
			   rrr = reference adjust
			   u.u = Up converter slope adjust
			   d.d = Down converter slope adjust
				N/A	CUS?	CUS=x….x (see description for details of arguments)

Concise Maintenance Status	N/A	80 bytes, numerical	Query only.
			Used to Query the Maintenance status of the XSAT
			Example: CMS=aaa.abbb.bccc.cddd.deee.e fff.fggg.ghhh.hiii.ijjj.jkkk.klll.lmmm.m nnn.nooo.oppp.p'cr''lf'
			where:
			   aaa.a = 24V Power Supply
			   bbb.b = 20V Power Supply
			   ccc.c = 12V Power Supply
			   ddd.d = 10V Power Supply
			   eee.e = +5V Power Supply
			   fff.f = -5V Power Supply
			   ggg.g = Tx Synthesizer Tuning Voltage
			   hhh.h = Tx IFLO Tuning Voltage
			   iii.i = Rx Synthesizer Tuning Voltage
			   jjj.j = Rx IFLO Tuning Voltage
			   kkk.k = Reference Tuning Voltage
			   lll.l = LNA Current in milliamps
			   mmm.m = Fan Current in milliamps
			   nnn.n = Up Conv Heat Sink Temperature
			   ooo.o = RF Output Power in Db
			   ppp.p = Down Converter Temperature
				N/A	CMS?	CMS=x….x (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Arguments for Command or Response to Query	Description of Arguments Note that all arguments are ASCII numeric codes between 48 and 57.	Response to Command (Slave to Master)	Query (Instruction code and qualifier)	Response to Query (Slave to Master)

Concise Alarm Status	N/A	18 bytes, numerical	Query only.
			Used to Query the Alarm status of the XSAT
			Example: CMS=abcdefghijklmnopqr'cr''lf'
			where: a thru n = 0 or 1, 0 = OK 1 = FT
			    a = 24V Power Supply Alarm
			    b = 20V Power Supply Alarm
			    c = 12V Power Supply Alarm
			    d = 10V Power Supply Alarm
			    e = +5V Power Supply Alarm
			    f = -5V Power Supply Alarm
			    g = Tx Synthesizer Lock Detect Alarm
			    h = Tx IFLO Lock Detect Alarm
			    I = Rx Synthesizer Lock Detect Alarm
			    j = Rx IFLO Lock Detect Alarm
			    k = Reference Lock Detect Alarm
			    l = LNA Current Alarm
			    m = Fan Current Alarm
			    n = Temperature Alarm
			    o = HPA Thermal Shutdown Alarm
			    p = Internal IIC-bus Alarm
			    q = EEPROM checksum Alarm
			    r = NVRAM/RTC Low Battery Alarm
				N/A	CAS?	CAS=x….x (see description for details of arguments)

Summary Fault Status	N/A	1 byte, alpha numerical	Query only. Used to Query the status of the XSAT Summary Fault Relay. Example: SFS=0'cr''lf' where: 0 = OK 1 = FT	N/A	SFS?	SFS=x (see description for details of arguments)

Chapter 5. REDUNDANT SYSTEM

Note: At this time, this section reflects the XSAT-70809 5 to 25 WATT and the XSAT-7080 100-WATT units only.

The XSAT-7080, is capable of operating in both stand-alone and redundant configurations. The XSAT fully redundant system provides automatic detection, switching, and status for both its configuration and health. The system is designed such that stand-alone operation is a functional sub-set of the fully redundant XSAT system. This provides the user with transparent functionality regardless of the mode or complexity the system has been setup to operate in.

IMPORTANT

Due to the parallel nature of the M&C interface, only RS-485 and RS-422 communications are supported through this device.

5.1 REDUNDANT SYSTEM

Figure 5-1 provides a block diagram for a typical XSAT redundant system.
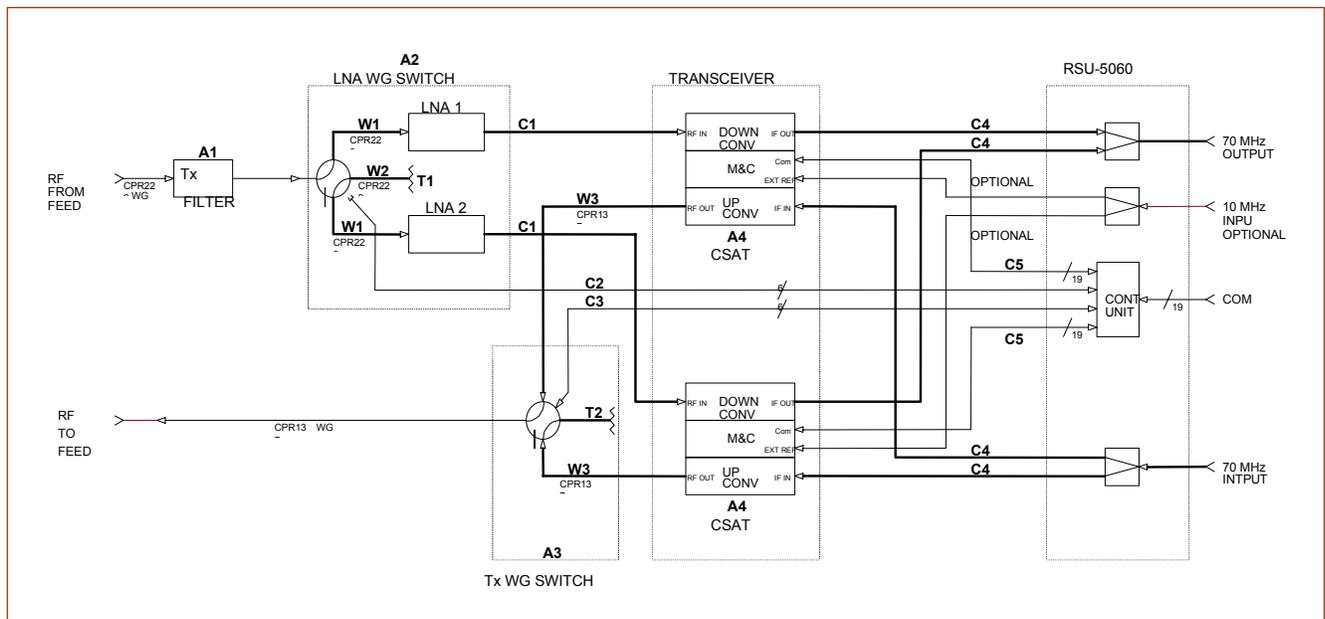
Figure 5-1. Typical XSAT Redundant System, without IF Transfer Switches
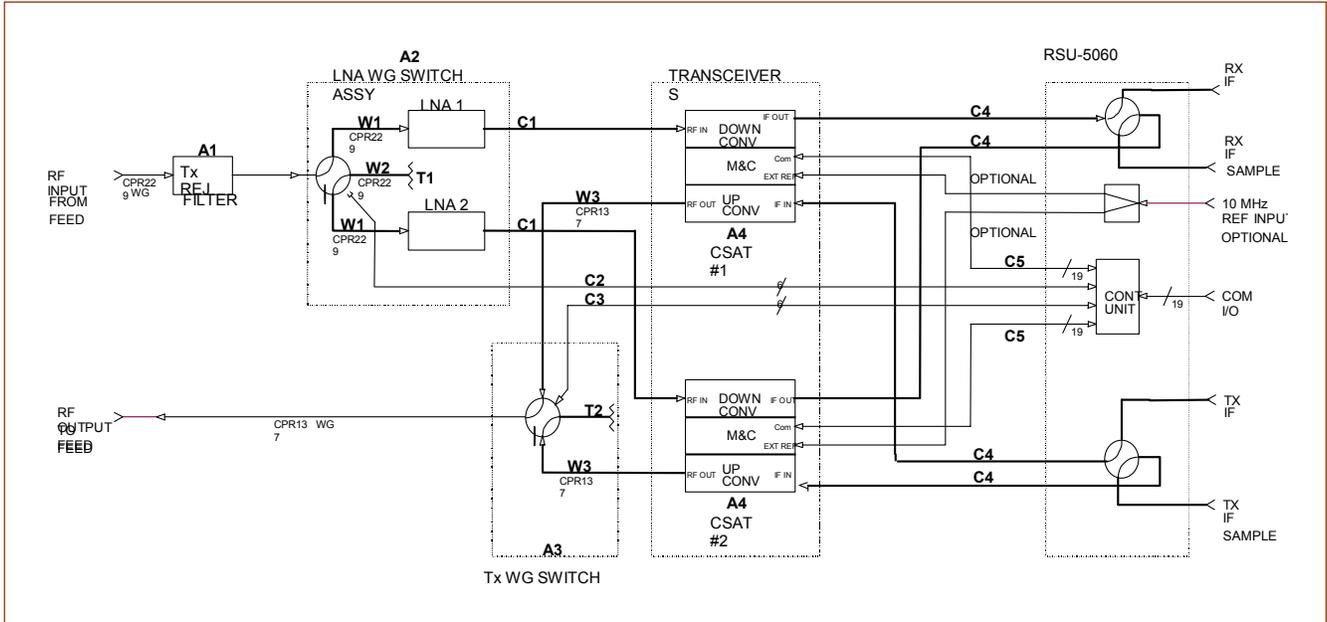
Figure 5-2. Typical XSAT Redundant System, with IF Transfer Switches

The standard RSU-5060 uses two 1:2 IF combiners/dividers to distribute the IF signals to the two transceivers. As an option, the RSU-5060 can be provided with IF transfer switches (Figure 5-2). This allows the user to access the offline transceiver from the TX/RX sample ports. These switches are internal to the RSU and their positions are set to mirror the external TX/RX switches.

5.2 RSU-5060 INTERFACES

5.2.1 ELECTRICAL INTERFACE

The RSU-5060 contains five primary electrical control interface connectors, (J1 through J5) and six IF signal connectors (J6 through J11) .

Table 5-1. RSU-5060 Interface Connectors, without IF Transfer Switches

Connector	Function	Connector Type
J1	XSAT Unit A interface	MS3112E14-19S
J2	Rx Waveguide Switch interface	MS3112E10-6S
J3	XSAT Unit B interface	MS3112E14-19S
J4	Tx Waveguide Switch interface	MS3112E10-6S
J5	Customer M&C interface	MS3112E14-19S
J6	Tx IF Input from Customer Equipment	Type N, Female
J7	Tx IF Output to XSAT A	Type N, Female
J8	Tx IF Output to XSAT B	Type N, Female
J9	Rx IF Output to Customer Equipment	Type N, Female
J10	Rx IF Input from XSAT A	Type N, Female
J11	Rx IF Input from XSAT B	Type N, Female

Table 5-2. RSU-5060 Interface Connectors, with IF Transfer Switches

Connector	Function	Connector Type
J1	XSAT Unit A interface	MS3112E14-19S
J2	Rx Waveguide Switch interface	MS3112E10-6S
J3	XSAT Unit B interface	MS3112E14-19S
J4	Tx Waveguide Switch interface	MS3112E10-6S
J5	Customer M&C interface	MS3112E14-19S
J6	Tx IF Input from Customer Equipment	Type N, Female
J7	Tx IF Sample	Type N, Female
J7	Tx IF Output to XSAT A	Type N, Female
J8	Tx IF Output to XSAT B	Type N, Female
J9	Rx IF Output to Customer Equipment	Type N, Female
J9	Rx IF Sample	Type N, Female
J10	Rx IF Input from XSAT A	Type N, Female
J11	Rx IF Input from XSAT B	Type N, Female

5.2.1.1 XSAT UNIT A INTERFACE, J1

The J1 interface connector (19-pin) provides the communications and control signals as well as the +24 VDC power signal necessary between XSAT Unit A and the RSU-5060.

Table 5-3. XSAT A Signal Description (Connector J1)

Pin	Signal Name	Type	Description
A	RS485 RX+	Pass-thru	RS-485 Rx+, From M&C to XSAT Unit A
B	RS485 RX-	Pass-thru	RS-485 Rx-, From M&C to XSAT Unit A
C	RS485 TX+	Pass-thru	RS-485 Tx+, To M&C from XSAT Unit A
D	RS485 TX-	Pass-thru	RS-485 Tx-, To M&C from XSAT Unit A
E	n.c.		
F	REDUND_FLT*	Output	Fault Signal to XSAT A from RSU-5060
G	n.c.		
H	AUXCOM_RD	Output	RS2332 from RSU-5060 to XSAT A
J	AUXCOM_TD	Input	RS232 from XSAT A to RSU-5060
K	FAULT COMMON	Output	
L	XSAT A FLT – NO	Input	Shorted to pin K = O.K. , open = Faulted
M	n.c.		
N	n.c.		
P	POSITION A*	Output	Ground = A Online, Open = A Offline
R	A +24V	Input	+24VDC input power
S	REDUNDANCY A*	Output	Ground signal to XSAT A
T	GROUND	Passive	
U	GROUND	Passive	
V	n.c.		

5.2.1.2 RX WAVEGUIDE SWITCH INTERFACE, J2

The J2 interface connector (6-pin) provides the control and indicator signals between the Rx Waveguide Switch and the RSU-5060.

Table 5-4. Rx Waveguide Switch Signal Description (Connector J2)

Pin	Signal Name	Type	Description
A	POS A CMD	Output	24 VDC, 350 millisecond, Command Pulse
B	CMD RETURN	Passive	Grounded internal to RSU-5060
C	POS B CMD	Output	24 VDC, 350 millisecond, Command Pulse
D	POS A INDICATOR	Input	Shorted to Pin E = POSITION A
E	IND COMMOM	Passive	Grounded internal to RSU-5060
F	POS B INDICATOR	Input	Shorted to Pin E = POSITION B

5.2.1.3 XSAT UNIT B INTERFACE, J3

The J3 interface connector (19-pin) provides the communications and control signals as well as the +24 VDC power signal necessary between XSAT Unit B and the RSU-5060.

Table 5-5. XSAT B Signal Description (Connector J3)

Pin	Signal Name	Type	Description
A	RS485 RX+	Pass-thru	RS-485 Rx+, From M&C to XSAT Unit B
B	RS485 RX-	Pass-thru	RS-485 Rx-, From M&C to XSAT Unit B
C	RS485 TX+	Pass-thru	RS-485 Tx+, To M&C from XSAT Unit B
D	RS485 TX-	Pass-thru	RS-485 Tx-, To M&C from XSAT Unit B
E	n.c.		
F	REDUND_FLT*	Output	Fault Signal to XSAT B from RSU-5060
G	n.c.		
H	AUXCOM_RD	Output	RS2332 from RSU-5060 to XSAT B
J	AUXCOM_TD	Input	RS232 from XSAT B to RSU-5060
K	FAULT COMMON	Output	
L	XSAT B FLT – NO	Input	Shorted to pin K = O.K. , open = Faulted
M	n.c.		
N	B SELECT*	Output	Ground signal to XSAT B
P	POSITION B*	Output	Ground = B Online, Open = B Offline
R	B +24V	Input	+24VDC input power
S	REDUNDANCY B*	Output	Ground signal to XSAT B
T	GROUND	Passive	
U	GROUND	Passive	
V	n.c.		

5.2.1.4 TX WAVEGUIDE SWITCH INTERFACE, J4

The J4 interface connector (6-pin) provides the control and indicator signals between the Tx Waveguide Switch and the RSU-5060.

Table 5-6. Tx Waveguide Switch Signal Description (Connector J4)

Pin	Signal Name	Type	Description
A	POS A CMD	Output	24 VDC, 350 millisecond, Command Pulse
B	CMD RETURN	Passive	Grounded internal to RSU-5060
C	POS B CMD	Output	24 VDC, 350 millisecond, Command Pulse
D	POS A INDICATOR	Input	Shorted to Pin E = POSITION A
E	IND COMMOM	Passive	Grounded internal to RSU-5060
F	POS B INDICATOR	Input	Shorted to Pin E = POSITION B

5.2.1.5 M&C INTERFACE, J5

The J5 interface connector (19-pin) provides the communications and control signals between the RSU-5060 and the customer M&C system.

Table 5-7. M&C Signal Description (Connector J5)

Pin	Signal Name	Type	Description
A	RS485 RX+	Pass-thru	RS-485 Rx+, From M&C to XSAT A&B
B	RS485 RX-	Pass-thru	RS-485 Rx-, From M&C to XSAT A&B
C	RS485 TX+	Pass-thru	RS-485 Tx+, To M&C from XSAT A&B
D	RS485 TX-	Pass-thru	RS-485 Tx-, To M&C from XSAT A&B
E	B ONLINE CLOSED	Output	Shorted to pin K = XSAT B Online
F	n.c.		
G	n.c.		
H	n.c.		
J	n.c.		
K	IND/FLT COMMON	Input	
L	A FAULT OPEN	Output	Shorted to pin K = XSAT A Faulted
M	B FAULT OPEN	Output	Shorted to pin K = XSAT B Faulted
N	n.c.		
P	RED AUTO/MAN	Input	Ground = Manual, Open = Auto
R	n.c.		
S	A ONLINE CLOSED	Output	Shorted to pin K = XSAT A Online
T	GROUND	Passive	
U	GROUND	Passive	
V	SWITCH CMD	Input	Momentary short to GND, otherwise OPEN

5.2.1.6 TX IF INTERFACES, J6, J7, AND J8

The Tx IF input signal is fed from the customer's equipment to the RSU-5060 at connector J6. The RSU-5060 contains a power splitter which feeds the IF input signal to both XSAT A and XSAT B via the J7 and J8 connectors. The IF power at J7 and J8 will nominally be 3dBm less than the IF input power at J6.

If the RSU 5060 contains the IF transfer switch option, the power splitter is replaced with an IF transfer switch. This allows the customer to access the offline transceiver.

5.2.1.7 Rx IF Interfaces, J9 – J11

The Rx IF output signal is fed to the customer's equipment from the RSU-5060 at connector J9. The RSU-5060 contains a power combiner which takes the IF input signals from both XSAT A and XSAT B via the J10 and J11 connectors and provides a single output signal at J9. The IF output power at J9 will nominally be 3dBm less than the IF input power at either J10 or J11.

If the RSU 5060 contains the IF transfer switch option, the power splitter is replaced with an IF transfer switch. This allows the customer to access the offline transceiver.

5.2.2 Mechanical Interface

The RSU-5060 is housed in a weather resistant, sealed aluminum housing with five external circular connectors and six Female N-Type connectors. The mechanical dimensions and mounting interface are shown in Figure 5-3.
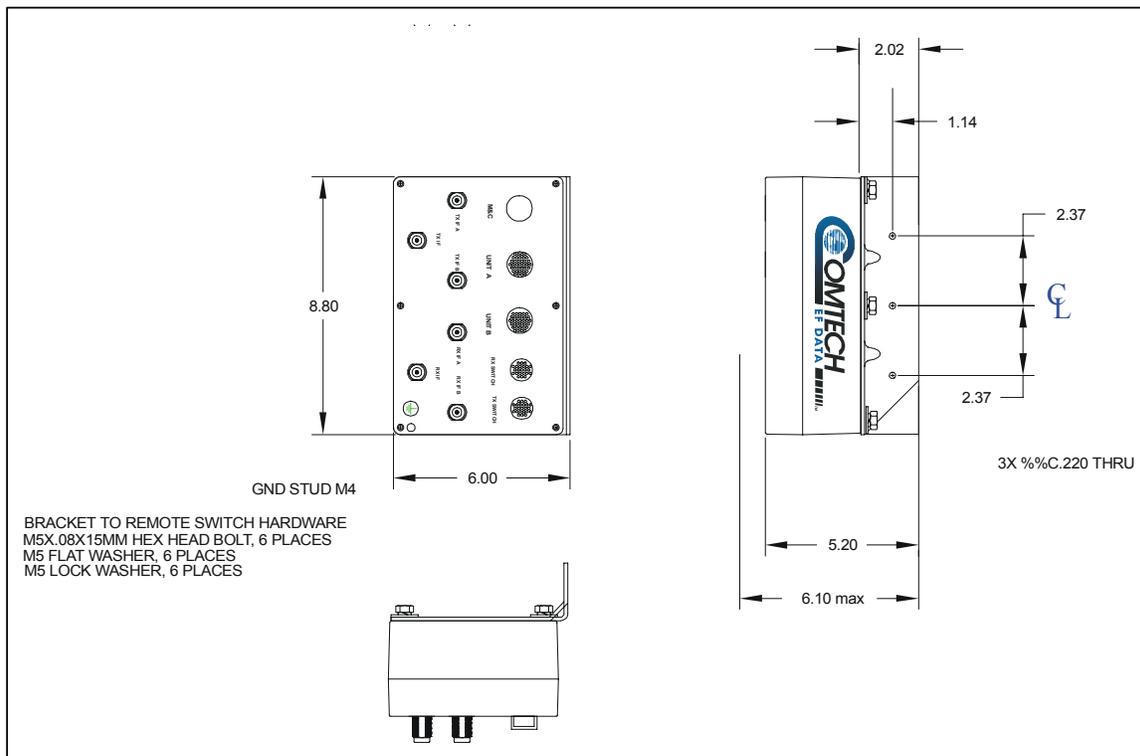
Figure 5-3. Mechanical Dimensions and Mounting Interface

5.3 RSU-5060 OPERATION

The RSU-5060 is designed to provide single-point control for both the Tx and Rx transfer switches (Waveguide Switches).   In addition, the RSU-5060 provides the customer with a single interface connection to his M&C system. Through this interface the customer can access and control all configuration, monitor and faults status parameters of both XSAT's. The RSU-5060 is a 'smart box,' the unit contains a micro controller running algorithms to process status and command information from the two XSAT's and control the Tx and Rx waveguide switches accordingly. A functional block diagram of the RSU-5060 is shown in Figure 5-4.
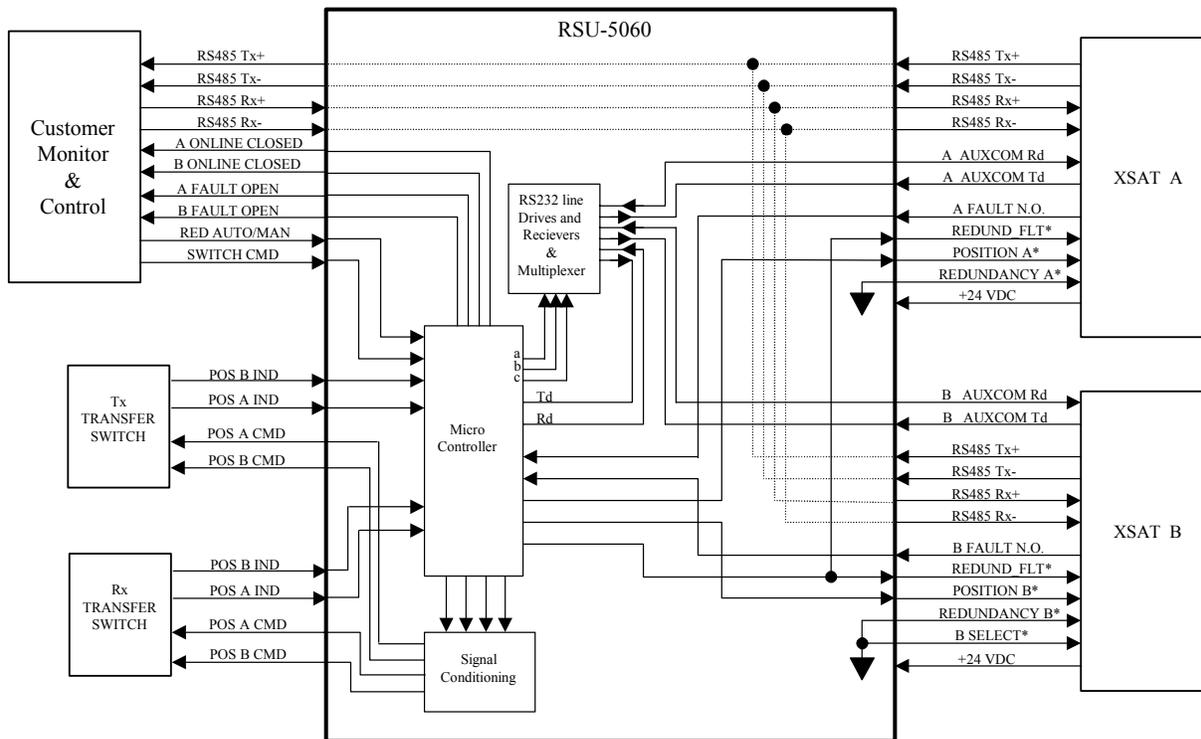
Figure 5-4. RSU-5060 Functional Block Diagram

5.3.1 RS-485 INTERFACE

The RSU-5060 provides a single point interface for the Customers M&C system by pig tailing the 4-wire RS-485 input to J5 and passing it out on both the J1 and J3 interface connectors. When using the RS-485, 4-wire interface to talk to the individual XSAT's are addressed at subsequent addresses through the use of the 'B SELECT *' signal going to XSAT B on the J3 interface connector. To set or change the address of both units, uses the SPA=XXXX command defined in sections 3 and 4 in conjunction with the global address 0000.

Example: To set the two XSAT's to addresses 0064 and 0065 send the following command:

<0000/SPA=0064'cr'

5.3.2 RED AUTO/MANUAL SIGNAL

Pin P on the J5 connector is the 'RED AUTO/MANUAL' input pin. The user can use this signal to control the operating mode of the RSU-5060. If this pin is left open, the RSU-5060 is operated in the AUTO mode. In AUTO mode, the RSU-5060 monitors the state of XSAT A and XSAT B via the 'A/B FAULT N.O.' signals on the J1/J3 connectors. If the ONLINE unit fails, the RSU-5060 will automatically command both the Tx and Rx transfer switches to change position.

Note: If the OFFLINE unit also is FAULTED, no switchover will occur.

The 'RED AUTO/MANUAL' signal has a corresponding REMOTE COMMAND, "RAM=X". This command, defined in section 4, can be used to control the operating mode of the RSU-5060 assuming that Pin P is left open. (Note: Grounding Pin P forces the RSU-5060 into MANUAL mode independent of the "RAM=X" remote command.

5.3.3 SWITCH CMD SIGNAL

Pin V on the J5 connector is the 'SWITCH CMD' input pin. The user can use this signal to command the RSU-5060 to change the position of both the Tx and Rx transfer switches. This pin should normally be left OPEN and momentarily shorted to ground to force a switch over (minimum pulse width for this signal is 100 mS). The RSU-5060 operating mode does effect how it will respond to the 'SWITCH CMD' command.

- If the operating mode is AUTO, a momentary short to ground on Pin V will cause the RSU-5060 to change the position of the Tx and Rx transfer switches **only if** the currently OFFLINE unit is not faulted.

- If the operating mode is MANUAL, a momentary short to ground on Pin V will **always** cause the RSU-5060 to change the position of the Tx and Rx transfer switches. Like the 'RED AUTO/MANUAL' signal above, the 'SWITCH CMD' also has a corresponding REMOTE COMMAND, "RTG=". This command, defined in Appendix A, has the same effect as a momentary short to ground on Pin V.

5.3.4 REDUNDANCY A/B SIGNALS

Pin S on both J1 and J3 connectors are used to tell the XSAT's that they are in a redundant configuration.

5.3.5 REDUND_FLT SIGNAL

Pin F on both J1 and J3 connectors are output signals from the RSU-5060 to the XSAT's to provide status indication to the XSAT's regarding the operating condition of both the RSU-5060 and the two transfer switches. This signal is normally a one-half hertz square wave. If this signal goes away, the ONLINE XSAT will use the AUXCOM (RS232) interface to the RSU-5060 to get more information regarding the problem at hand. This information is available to the user via the "RRS?" query described in Section 4.

5.3.6 AUXCOM SIGNALS

Pins H and J on both the J1 and J3 connectors are the RS-232 RD and RS-232 TD signals respectively. The AUXCOM interface is used solely in conjunction with the RSU-5060, and should not be confused with the 'Customers EIA232' interface available on the XSAT J5 connector (pin E and F). The AUXCOM interface is used by the ONLINE XSAT to ascertain information from the OFFLINE XSAT as well as the RSU-5060.

5.4 CONFIGURING A REDUNDANT SYSTEM

Comtech EF Data's Redundant XSAT system was designed to reduce the workload of a Customer M&C system in two manners.

- First, the RSU-5060 can be configured to automatically monitor the status of the two XSAT's and always keep the unfaulted XSAT ONLINE.

- Second, configuration commands sent to the ONLINE XSAT via the RS-485 interface are automatically passed along to the OFFLINE XSAT using the AUXCOM interface.

Therefore, if the user wants to change a configuration parameter such as Tx Frequency for the system, the user simply sends the command to the currently ONLINE XSAT and the OFFLINE XSAT will automatically receive the same command. This automatic update feature is true for the following configuration parameters:

- Transmit Frequency

- Receive Frequency

- Transmit Attenuation

- Receive Attenuation

- Auto Fault Recovery

- Cold Start

In addition to this automatic update feature, the XSAT is designed to sense whether it has gone from being the OFFLINE unit to the ONLINE unit and will automatically perform the following functions if necessary:

- Turn ON the Transmit Amplifier

- Turn OFF the Transmit Mute

- Turn OFF the Receive Mute

This feature allows the user to run the OFFLINE unit with the Power Transistors turned OFF to reduce power consumption if desired. However, it should be noted that approximately a 10 to 20°C (50 to 68°F) change in unit temperature can occur after turning ON the Tx Amplifier and that gain stability during this warm up period will be affected.

Notes:

Chapter 6. THEORY OF OPERATION

This chapter contains a general description of the theory of operation for the XSAT downconveter and upconverter sections. The XSAT can be used for SCPC, DAMA AND TDMA, as well as for full transponder HDTV and analog TV, applications.

The description in this section is for the standard 25Watt transceiver. For other models, refer to Chapter 2. Specification, for the correct frequency, gain, and output power levels associated with it. In all models, the downconverter and upconverter local oscillators are independently synthesized to allow simplex or duplex operation. In order to minimize complexity, they share a common power supply, an internal high stability 10 MHz reference oscillator, and the Maintenance and Control (M&C) unit.

The downconverter section operates in the frequency range of 7250 to 7750 MHz, with a temperature compensated gain of 45 dB. This high level of gain provides an IF output signal level of +13 dBm at 1 dB of gain compression. This provides the capability to handle longer modem cable runs, or fan out for splitting networks without requiring additional line amplifiers.

The upconverter section operates over a frequency range of 7900 to 8400 MHz with a temperature compensated gain of 71 dB.

For 25W Transceivers: The RF output level is +44 dBm minimum at 1 dB gain compression over the operating temperature range.

The phase noise performance of both the upconverter and downconverter sections exceeds the Intelsat phase noise mask for IBS and IDR services by 6 dB. This allows phase dependent demodulators to provide the best possible performance. The close-in phase noise is also very low making the converter ideal for low data rate applications such as DAMA hub earth stations.

An auto select RS-232 or RS-485 pin out is available in the circular COM connector on the exterior of the chassis. All configuration control, status retrieval and unit adjustments are available as ASCII commands through this interface.

6.1 RF SIGNAL CONVERSION

6.1.1 DOWNCONVERTER

The RF input to the downconverter is in the 7250 to 7750 MHz frequency range at a typical level of -45 dBm. The input signal is mixed down to the 1590 MHz IF in the first conversion mixer. High side LO injection is used for this mixing process. It is provided by the downconverter RFLO synthesizer in the 4510 to 5310 MHz frequency range in 1.000 or 2.500 MHz steps. Both step sizes are automatically selectable.

IF filtering is provided by the 1590 MHz BPF. It is just wide enough to pass the 36 MHz bandwidth of the desired signal while maintaining more than adequate amplitude and group delay flatness. At the same time, it is narrow enough to provide the necessary rejection to the image, the RFLO, and other spurious signals. The second mixer operates at a fixed input frequency of 1590 MHz. It operates with high side LO injection at 1180 MHz provided by the downconverter IFLO and converts the IF signal down to the 70 ±18 MHz output frequency.
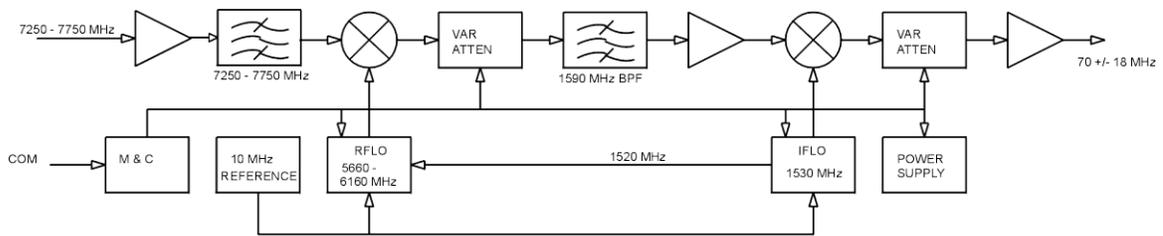
Figure 6-1. Functional Block Diagram of the Downconverter Section

6.1.2 UPCONVERTER

The RF input to the upconverter is at 70 ± 18 MHz at a typical level of -35 dBm which would provide an output power back-off of 8 dB. In operation, the input signal is mixed up to the 1350 MHz IF in the first conversion mixer operating at a fixed frequency with low side LO injection at 1280 MHz provided by the upconverter IFLO. IF filtering is provided by the 1350 MHz BPF. It is just wide enough to pass the 36 MHz bandwidth of the desired signal while maintaining more than adequate amplitude and group delay flatness. At the same time, it is narrow enough to provide the necessary rejection to any unwanted mixer products, the IFLO, and other spurious signals.

The second mixer up converts the 1350 MHz IF signal to the desired output frequency. It uses low side LO injection in the 6550 to 7050 MHz frequency range provided by the upconverter RFLO in 1.000 or 2.500 MHz steps. Both step sizes are automatically selectable. The upconverted signal is then filtered to reject the RFLO leakage, and any other unwanted mixer spurs at the mixer output. The output signal is then amplified by a series of internally matched power FET's to raise the power level of the output signal to the specified level. An isolator is provided at the output of the high power output stage to protect it from mismatches at the output connection to the antenna feed.
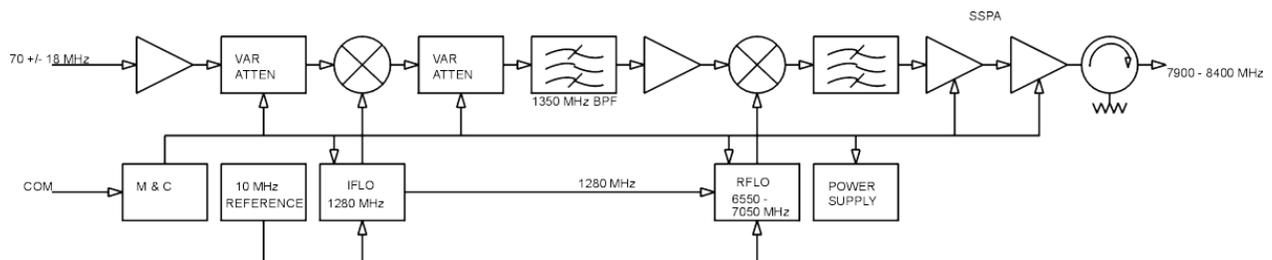
Figure 6-2. Functional Block Diagram of the Upconverter Section

6.2 MONITOR & CONTROL

The Monitor & Control (M & C) unit is designed to monitor the functions of the transceiver, and provide the control for remote command inputs to the up and down converter sections. It controls the attenuator settings, the frequency settings, and it monitors the alarm system and logs any alarms that might occur. Remote control inputs are provided through the RS-232 or RS-485 connections in the circular COM connector either by remote computer interface or by local operator inputs through the external hand held control unit.

Chapter 7. MAINTENANCE AND TROUBLESHOOTING

This chapter is intended to provide procedures to assist operator and maintenance personnel in the checkout, maintenance and troubleshooting of the transceiver. Comtech EF Data recommends that spare replacement transceivers be used to replace transceivers removed from the system for maintenance. The input and output signals, the interconnecting cables and the location of the modules are as shown in Figure 7-1.
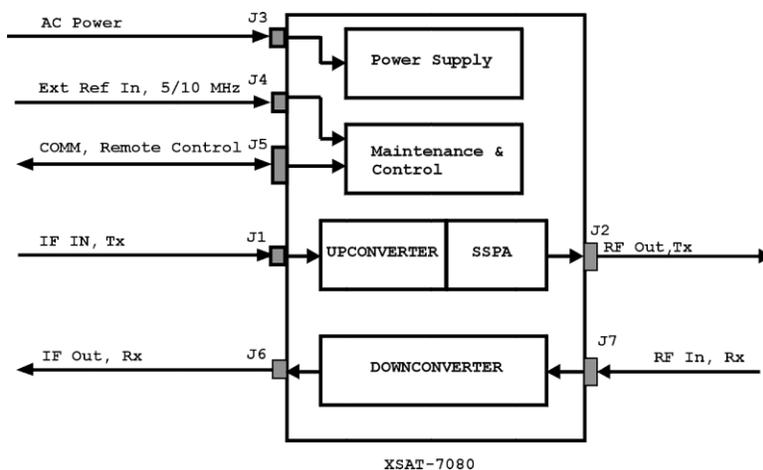
Figure 7-1. Converter Signal and Interconnecting Cable Diagram

7.1 MAINTENANCE TESTING

Use the instructions in the applicable appendix for installing the transceiver for checkout, and the procedures in Chapter 3, for operating the transceiver.

Step	Procedures
1	The transceiver contains an Upconverter, a Solid-State Power Amplifier (SSPA) and a Downconverter.
2	The Upconverter translates the IF input frequency of 52 to 88 MHz to an RF frequency of 7900 to 8400 MHz depending on the setting for the output frequency.
3	The IF input level is -20 to -30 dBm (typical). The signal is then amplified by the 25 Watt SSPA to the desired output level ($\geq$ +44 dBm at 1 dB compression).
4	The Downconverter translates the RF input signal down to the IF output frequency of 52 to 88 MHz.
5	The RF input level is -45 dBm (typical), and the IF output level is +13 dBm at 1 dB compression.

7.2 TROUBLESHOOTING

Transceiver operating problems can be identified by first observing the status indicators through the Communications port. When a fault condition is indicated, using the Retrieve Alarm Status (RAS) command can identify the specific fault, or faults. The status of all transceiver functions will be displayed as described in Chapter 5 (see the Retrieve Alarm Status commands).

7.3 CONVERTER FAULTS

Check the Alarm Status for possible faults, or an indication of a marginal performance tolerance condition.

7.3.1 DC POWER SUPPLY VOLTAGES

24 VDC	10 VDC
20 VDC	P5 VDC (+5 VDC)
12 VDC	N5 VDC (-5 VDC)

A fault ("FT") indicates a voltage level exceeding ±10% of the power supply voltage. If the voltage exceeds ± 10%, contact Comtech EF Data.

7.3.2 RF CONVERTER MODULE

Synthesizer and IFLO Lock Detect Fault:

During normal operation, neither the Upconverter nor the Downconverter synthesizer or IFLO should experience a Lock Detect fault.

- If one or more of these functions is faulted the transceiver will not function properly.

- If a fault condition exists and an EXT REF is being used, check the connection to the transceiver and make sure it is secure.

- It may be necessary to remove the EXT REF if it is faulty.

- If the fault still exists, contact Comtech EF Data Customer Support .

7.3.3 REFERENCE OSCILLATOR MODULE

Reference Lock Detect:

A fault ("FT") indicates that the reference oscillator is not locked. Check all connections to the converter module to make sure they are secure. If the fault still exists, contact Comtech EF Data Customer Support.

7.3.4 LNA CURRENT FAULT

LNA Current Fault:

This can indicate either a problem in the XSAT LNA current source circuitry or a problem with the LNA.

- First, insure that the LNA is connected and that no shorts exist. Use the RMS? Command to query the measured LNA current.

- If the LNA and cable are OK, proceed to disconnect the LNA and measure from the center conductor of the cable to the shield of the cable using a DVM. A voltage of 12Vdc shall be measured if the LNA Current Source is Enable (i.e. LCS=1).

- Contact Comtech EF Data Customer Support for further troubleshooting.

7.3.5 FAN FAULT

Fan Fault:

Contact Comtech EF Data Customer Support for troubleshooting help.

7.3.6 TEMPERATURE FAULT

Transceiver Over Temperature Fault:

A fault ("FT") indicates that the converter is over temperature. Turn the prime power switch off and return the transceiver to Comtech EF Data for repair.

7.4 EQUIPMENT RETURN AND REPAIR PROCEDURE

Refer to the Customer Support section in the Preface of this manual for additional information on returning equipment for repair.

> **IMPORTANT**
>
> *An item is considered "Out-of-Warranty" if the warranty period (as determined by the original purchase) has expired; or the equipment has been damaged or otherwise made unusable as a result of an accident or unreasonable use, neglect, improper or unauthorized service, repairs or modifications, or other causes not arising out of defects in design, material, or workmanship.*

7.5 PRODUCT APPLICATION, UPGRADING OR TRAINING INFORMATION

To obtain product application, upgrade or training information, contact Comtech EF Data Customer Support at: service@comtechefdata.com

Chapter 8.   XSAT-7080 +10 dBm Unit

This chapter describes items particular to the XSAT-7080 10-Watt unit.

8.1 Overview

This appendix provides instructions on the installation, operation and maintenance of the XSAT-7080 +10 dBm. Transceiver manufactured by Comtech EF Data.

**XSAT-7080 +10 dBm
X-Band Transceiver**

8.1.1   Function Description

The Transceiver is designed for use in communication systems, or in satellite uplink data systems, for the reception of SCPC, DAMA, and TDMA communication signals. It also can be used in communications system applications with full transponder HDTV and analog TV. The RF operating frequency range is as follows:

Upconverter section	7900 to 8400
Downconverter section	7250 to 7750

This transceiver provides an upconverted ouput used to drive an external SSPA or TWTA. The down conversion side of the transceiver operates the same as the higher power versions of the same XSAT. The converter is environmentally sealed and is designed to be hard mounted on or near the antenna structure.

> ⚠ **CAUTION**
>
> *The downconverter RF input connector is wired to supply DC voltage to an LNA. This voltage is capable of damaging any test equipment connected to the connector. Do not connect test equipment to the connector without a coaxial DC block between the connector and the test equipment.*

8.1.2 Prime Power Level

The power input requirements for the X-Band Downconverter is as follows:

Prime Power Level	100 to 125 Volts AC, or 205 to 240 Volts AC, 47 to 623 Hz.
Current Requirements	Typical current requirements is 1.2 amps at 100 to 125 VAC or 0.6 amps at 205 to 240 VAC.

8.1.3 Physical Dimensions

Parameter	Specification	
Length	11 inches	(28 cm)
Width	8 inches	(20 cm)
Height	8 inches	(20 cm)
Weight	36 pounds	(16 kg)

8.2　　Specifications

The following are the design, operating, and environmental specifications for the XSAT-7080 unit.

Transmit	
Frequency	7900 to 8400 MHz
Intermodulation 　Total OPBO = 6 dB 　SCL = 9 dB OPBO, 　Δ = 1 MHz	- 45 dBc
TX Output Power, P1dB	+10 dBm
TX Gain	34 ± 1.0 dB
TX Gain Flatness	± 0.75 per 36 MHz ± 1.0 dB per 40 MHz
TX Gain Stability	± 1.00 dB from –40 to +55°C (-40 to 131°F)
2nd Harmonic	-55 dBc
Carrier Mute	-70 dBc
Transmit Spurious: 　AC Line Harmonics 　Signal Related 　Signal Related, In-Band 　Signal Independent	-45 dBc < 500 kHz, –60 dbc -65 dBc -55 dBm
AM to PM Conversion	3 degrees at 6 dB OPBO from related power
IF Frequency Range	70 ± 20 MHz
IF Input VSWR	1.25:1
RF Output VSWR	1.25:1
RF Output Impedance	50 Ω
IF Input Impedance	50 Ω
TX Noise Figure	15 dB (Typical)
IF Output Connector	Type N (Female)
IF Input/Output Connectors	Type N (Female)

Receive	
RX Fequency	7250 to 7750 MHz
RX Gain	45 ± 1 dB
RX-IF Frequency	70 ± 18 MHz 70 ± 20 MHz (Optional) 140 ± 36 MHz (Optional)
Gain, without LNA	± 0.75 dB Full RF Band ± 0.25 dB constant temp
Gain Flatness	± 0.75 dB Full RF Band ± 0.75 per 36 MHz ± 1.0 dB per 40 MHz
Image Rejection	60 dB In-Band
RX Gain Stability, without LNA, at 0 dBm Output Level	± 0.25 dB Constant C ± 1.00 dB –40 to +55°C (-40 to 131°F)
Output Power, P1dB	+13 dBm
RX Noise Figure	11 dB (Typical
Intermodulation	-50 dBc for two tones at 0 dBm each, 1 MHz apart
IF Output VSWR	1.25:1
RF Input VSWR	1.25:1
IF Output Impedance	50 Ω
RF Input Impedance	50 Ω
RF Input/Output Connectors	Type N (Female)

Common		
Conversion	Dual, No Spectral Inversion	
Sense	Positive, No Inversion	
Frequency Step Size	1 and 2.5 MHz automatic	
Frequency Stability	$\pm 1 \times 10^{-9}$/day (maximum) 1×10^{-7}/day $\pm 1 \times 10^{-8}$/day (maximum) -40 to 55°C (-40 to 131°F)	
Attentuation Steps	TX	0 to 25 dB, in 0.25 dB steps
	TX (Optional)	0 to 30 dB, in 0.25 dB steps
	RX	0 to 20 dB, in 0.25 dB steps
	RX (Optional)	0 to 30 dB, in 0.25 dB steps
Phase Noise	100 Hz	-66 dBc/Hz
	1 kHz	-76 dBc/Hz
	10 kHz	-86 dBc/Hz
	100 kHz	-96 dBc/Hz
Group Delay	Linear	0.1 ns/MHz
	Parabolic	0.02 ns/MHz^2
	Ripple	1 ns/p-p
M&C Methods	Both EIA-485 and EIA-232 Serial Interface Handheld controller, optional	
External Reference Connector	5 or 10 MHz EXT REF port available in addition to internal frequency reference.	
Redundant Switch	Outdoor unit (ODU) with autoswitch on failure	
M&C Interface	M&C Interfaces between: Transceivers and Switch Switch and CMA compler	
MTBF: Transceiver Switch	$\geq$ 50,000 hours $\geq$ 90,000 hours	
CE Mark	Meets CE Mark spec	

Environmental		
Temperature: Operating Non-Operating	-40 to +55°C (-40 to 131°F) -50 to +75°C (-58 to 167°F)	
Attitude	15,000 Feet, mean sea level	
Humidity	0 to 100 %, Relative	
Rainfall	50 mm/hr	
Solar Radiation	350 BTU/foot2/hour	
Prime Power	90 to 260 VAC Standard 47 to 63 Hz Standard 48 VDC Optional	

Chapter 9. External Amplifier Communication (+10 dBm Transceiver Only)

This chapter describes items particular to the +10 dBm unit.

9.1 Overview

The +10 dBm XSAT Transceiver provides an additional connector (J8) to ease communications with an external amplifier. This connector passes the RS-485 serial communication signals to the external amplifier. It also connects the fault relay of the external HPA to the XSAT redundant controller system. This allows the system to recognize a fault of the external HPA and drive the redundant switching appropriately.

The downconversion side of the transceiver operates the same as the standard XSAT.

9.2 External Amplifier Communication

The J8 connector allows a single cable interface between the XSAT and the external HPA.

Refer to the following table for connector pinouts. The RS-485 connections are parallelled with the RS-485 connections on the XSAT's standard M and C connection. This allows the customers M&C to transmit and receive commands from the external HPA.

If the XSAT detects an open between pin F and pin G, it will generate a fault and the data will be acted upon by the redundant controller.

J8 Connector Pin Out for External Amplifier Communication	
+10 dBm XSAT Trasceiver	
Pin Number	Signal Description
A	RX+
B	RX-
C	TX+
D	TX-
E	No Connect
F	Fault (Normally Open)
G	Fault Common
H	Ground
Comtech EF Data Part No.	CN/MS3116J12-8P
ITT Cannon Part No.	MS3116J12-8P
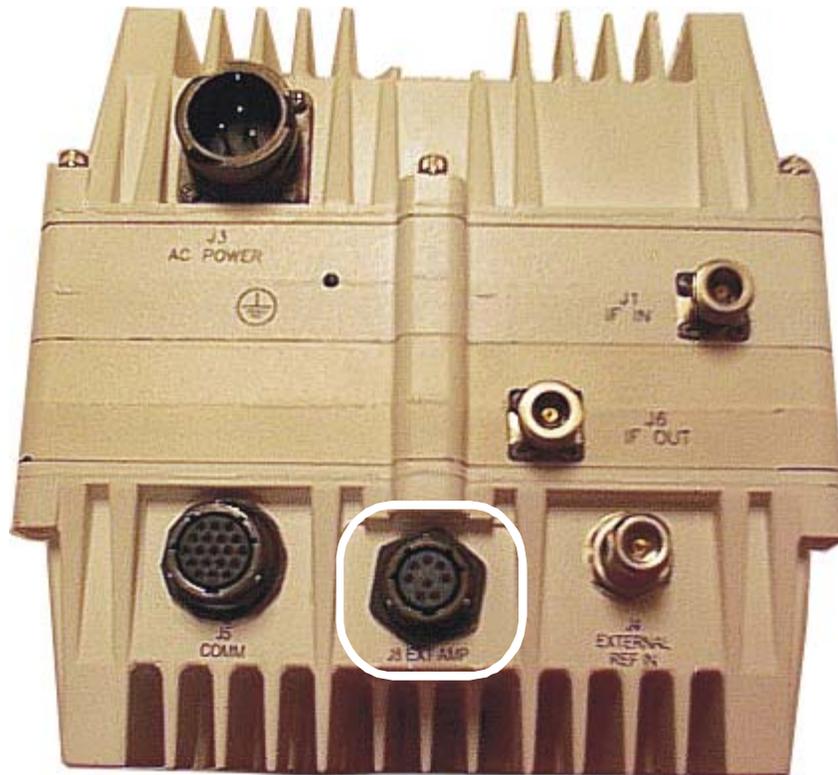
Figure 9-1. J8 Connector for External Amplifier Communication

Appendix A. 5 – 25 WATT INSTALLATION

A.1 UNPACKING AND INSPECTION

Inspect the shipping container for damage:

Step	Procedures
1	Retain shipping container and packing materials for possible re-shipment.
2	Checked to determine that all parts, materials and documentation has been shipped with the converter.
3	Inspect converter for possible damage, and then tested for proper operation.
4	Notify the Comtech EF Data Customer Service representative immediately; if the shipment is incomplete, or there is mechanical damage, or the converter does not operate properly:
5	Notify the carrier, and retain all shipping materials for inspection by the carrier; if there is damage to the shipping container:

A.2 PERSONNEL

Comtech EF Data recommends that two technicians be required to install any of the following installations.

A.3 TOOLS REQUIRED

The following tools are recommended for unit installation.

Qty.	Description
1	Adjustable Wrench Alternate: Set of various box wrenches
1	Phillips® - Head Screwdriver
1	Tin Snips

A.4 SINGLE-THREAD CONFIGURATION

WARNING

The Downconverter RF input connector is wired to supply DC voltage to an LNA. This voltage is capable of damaging any test equipment connected to the connector. Do not connect test equipment to this connector without a coaxial DC block between the connector and the test equipment.

A.4.1 MOUNTING KIT

The following tables reflect the contents of the mounting kits.

Table A-1. Universal Pole Mount, AS/0599

Part No.	Nomenclature	QTY
AS/0414	Kit, Universal Pole Mount	1
AS/0608	Bracket, Mount 25W Single Thread	1

Item No.	Part No.	Nomenclature	QTY
1	FP/BR0078	Bracket, Unistrut	1
2	FP/BR0072	Bracket, Strap Tensioner	1
3	FP/BR0070	Bracket, Strap-Termination Pole Mounting Kit	1
4	FP/BR0071	Bracket, 1 1/4 Strap	1
5	FP/BR0069	Bracket, Strap-Fixed, Pole Mounting Kit	1
6	HW/M8X1.25X25HEXSS	Bolt, Hexhead, M8X1.25X25, SS	2
7	HW/M8FLATSS	Washer, Flat, M8 SS, Metric	7
8	HW/M8LOCKSS	Washer, Splitlock, M8, SS, Metric	7
9	HW/M8SPRINGNUT	Springnut, M8 xX 1.25	2
10	HW/M8X1.25MMHEXNUTSS	Nut, Hex M8X1.25X16MM, SS	5
11	HW/PIPEBLOCK	Pipe, Block	2

Figure A-1. Universal Pole Mounting Kit, AS/0414

Item No.	Part No.	Nomenclature	QTY
1	FP/BR0095	Bracket, Single-Thread 25W XSAT	1
2	HW/M8X1.25MMHEX	Bolt, Hexhead	4
3	HW/M81.25X20MMFHSS	Screw, Flathead	4
4	HW/M8FLATSS	Washer, Flat SS	4
5	HW.M8SPRINGNUT	Springnut	4
6	HW/M8LOCKSS	Washer, Splitlock SS	4
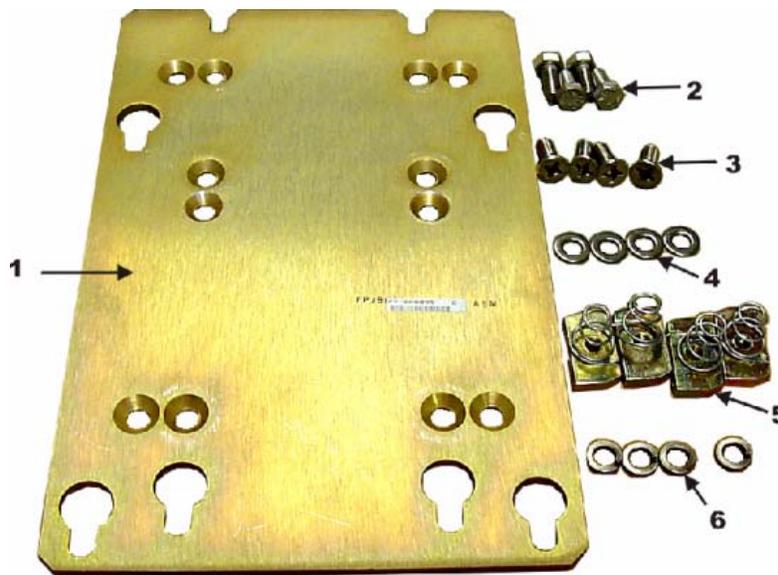
Figure A-2. Single-Thread Bracket, AS/0608

A.4.2 SINGLE-THREAD INSTALLATION
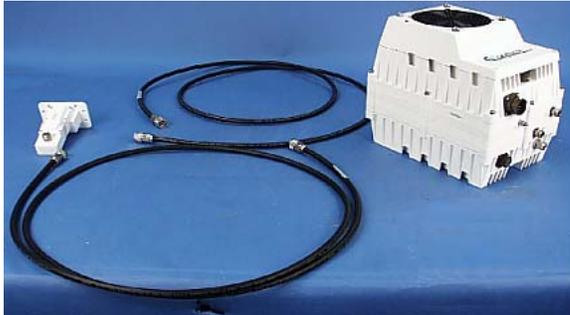
Figure A-3. Single-Thread Installation

IMPORTANT

Two RF Cables (TX/RX) and a LNA are required for installation.

Step	Procedures
1	Place unistrut bracket (1, Figure A-1) on a flat surface. (see Figure A-4)
2	Slide springnuts (9) into the channel of the unistrut bracket.
3	Fasten two pipe blocks (11) loosely to the springnuts using two bolts (6), two flat washers (7), and two split washer (8).
4	Position the unistrut bracket (1) with pipe blocks (11) against the mounting pole, slide the pipe blocks (11) until they contact the mounting pole. Ensure the pipe blocks (11) are centered to the unistrut bracket (1). Tighten the hardware.
5	Attach bracket (5, figure A-1) to the strap (4) using two nuts (10), two flat washers, (7), and two split washers (8).
6	Place the assembly against the pole with the strap around the pole and trim the strap to fit as shown in Figure A-5, using the tin snips. Attach bracket (3, figure A-1) to the strap (4) using two nuts (10), two flat washers (7), and two split washers (8).
7	Slide tensioner bracket (2) into channel of the unistrut bracket (1). Place assembly on the pole. Slide bracket (3) over bracket (2).
8	Place flat washer (7) and split washer (8), and nut (10) on bracket (2). Tighten nut to secure the tension strap.
9	Slide two springnuts, (5, figure A-2) into channel of the unistrut bracket (1, figure A-1).

Figure A-4. Installing Pole Bracket with XSAT Mounting Plate

Figure A-5b. On the Pole

Figure A-5c. Looking Down

Figure A-5. XSAT Single-Thread Bracket with Hardware
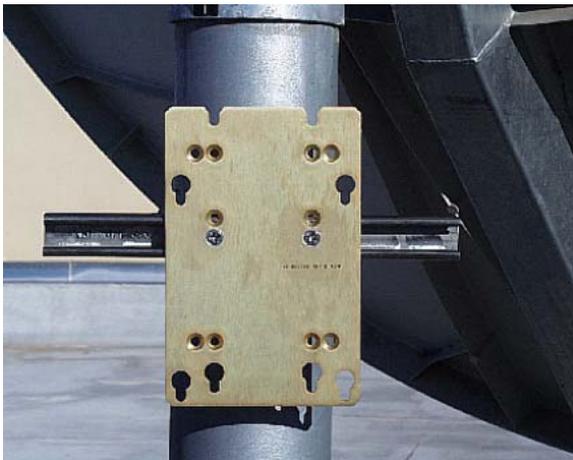
Figure A-6. Installing XSAT Single-Thread Bracket

Step	Procedure
10	Place bracket (1, Figure A-2) over springnuts and secure using screws (3).

IMPORTANT

Observe the orientation of the "Key" slots used for mounting the XSAT Transceiver.

11	Mount the unit as follows:

    a.   Loosely install four bolts (4 Figure A-2), four flat washers (4), and four split washers (6) into bolts hole located on the rear side of the unit.

    b.   Position unit against the bracket and hook the bolts into the key slots. Tighten bolts to secure.

Figure A-7. Mounting XSAT Unit

A.4.3 LNA INSTALLATION

The LNA can be mounted at three different options (Customer Select):

- Spar Mount, 1 X 2 Antenna, Mounting Kit P/N, AS/0422

- Spar Mount, 1.75 X 4 Antenna, Mounting Kit, P/N AS/0501

- Feed Horn Mounting Kit (Contact Comtech EF Data Customer Support department)

To install a single LNA to an antenna:

Step	Procedures
1	Remove the protective cover from the antenna OMT and LNA.
2	Install the appropriate gasket on the antenna end of the LNA. a. If only one of the mounting surfaces has a groove, use the half-thick gasket. b. If both mounting surfaces have grooves, use the full thick gasket.
3	Position the LNA (with gasket) in place on the antenna and fasten using the supplied hardware.

A.4.4 CABLE INSTALLATION

Refer to Figure A-9.

Care shall be exercised in cable installation. Install the cables using the most direct route and secure with clamps and ties. Avoid all sharp bends.

Cable connectors used in outdoors application shall be sealed to avoid leakage, particularly, N-type connectors. 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 shall be sealed with a self-amalgamating tape, such as 3M, Type 23 Scotch Self-Amalgamating tape, or equivalent, including military style (MS) connectors.

WARNING

The Downconverter RF input connector is wired to supply DC voltage to an LNA. This voltage is capable of damaging any test equipment connected to the connector. Do not connect test equipment to this connector without a coaxial DC block between the connector and the test equipment.

TOP VIEW

LNA

J7
TX OUT

J2
RX IN

Figure A-8. Cable Connections

BOTTOM VIEW

C/S

J3
AC POWER

J1
IF IN

C/S

GND

J6
IF OUT

J5
COMM

J4
EXT REF

C/S

C/S

C/S - CUSTOMER SUPPLIED

A.5 REDUNDANCY CONFIGURATION

Figure A-9. Redundancy Configuration

A.5.1 MOUNTING KIT

The following tables reflect the contents of the mounting kits.

Table A-2. 1:1 Mounting Kit Assembly, AS/0596

Part No.	Nomenclature	QTY
*AS/0414	Kit, Redundancy, Pole Mount	2
AS/0489	Assy, 1:1 25W XSAT	1
*AS/0608	Assy, Bracket Mount 25W XSAT	2

* - Refer to single-thread configuration

Table A-3. Assembly, 1:1 25W XSAT, AS/0510

Part No.	Nomenclature	QTY
AS/9751-1	Kit, Mounting LNA Switch	1
AS/0440	Kit, Cable, 1:1 X-Band	1
PL/9512	Kit, Waveguide	1
AS/0490	Assy, Remote Switch Cast Box	1
AS/0503	Assembly, TX/Remote Switch	1

Item No.	Part No.	Nomenclature	QTY
1	FP/BR0080	Bracket, Remote Coax Switch	1
2	HW/M4Flat	Washer, Flat	2
3	HW/M4LOCK	Washer, Lock	2
4	HW/M4X10PHP	Screw, Phillips Head 7X10	2
5	HW/M8FLATSS	Washer, Flat SS	4
6	HW/M8LOCKSS	Washer, Split-Lock SS	4
7	HW/M8SPRINGNUT	Springnut	4
8	HW/M8X1.25X25HEXSS	Bolt, Hex-Head SS	4
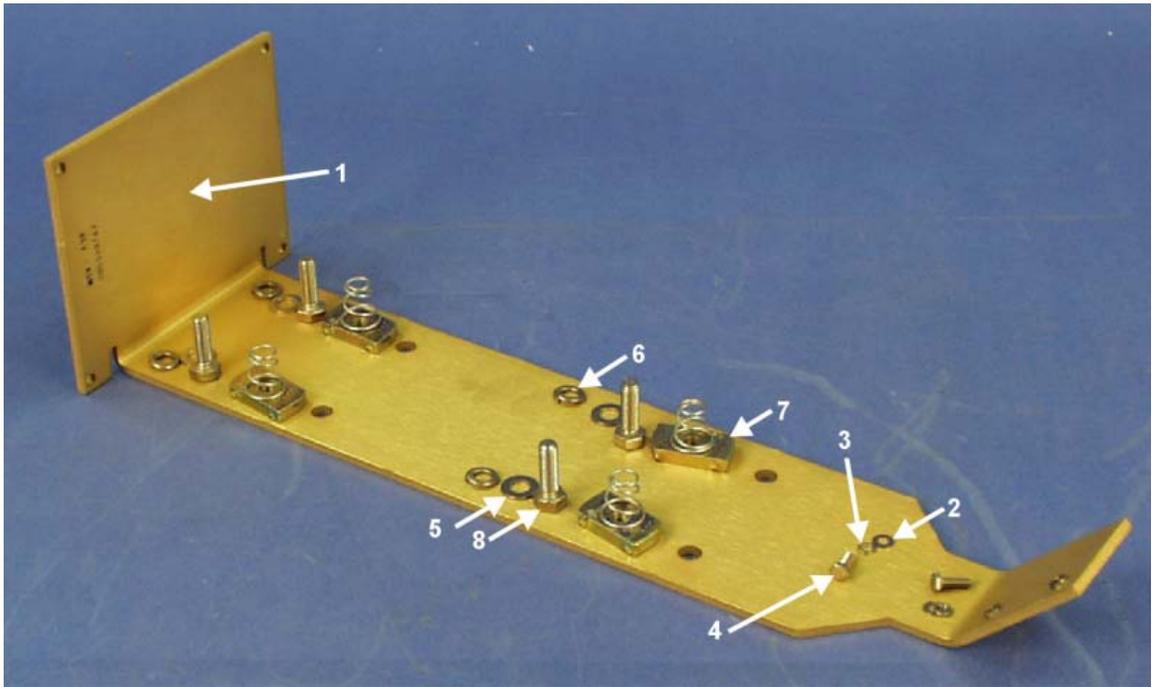
Figure A-10. 1:1 25W XSAT TX Switch Bracket, AS/0489

Item	Part No.	Nomenclature	QTY
1	FP/BR9748-1	Plate, Mtg 1:1 X-Band Redundant	1
2	FP/BR9752-1	Bracket, Mtg, X-Band TRF	1
3	FP/WG0039	CNTRC, Waveguide, Termination	1
4	GA/GSKTCPR112HLF	Gasket, CPR112 Half-Thick	4
5	HW/M4FLAT	Washer, Flat M4, SS	34
6	HW/M4LOCK	Washer, Lock, M4 SS	34
7	HW/M4X.07X10FHP	Screw, M4X10 Flat Head SS	4
8	HW/M4X.07X12MMHEX	Bolt, Hexhead, M4X.07X12MM SS	32
9	HW/M4X.07X8MMPHMS	Screw, Panhead, M4X.07X8MM SS	2
10	RF/TRF-13747-2	Filter, TRF, CPR-112F	1
11	SW/WG-HAGSM	Switch, WR112G, +24V, Sealed	1

Figure A-11. Mounting LNA Switch Kit, AS/9751-1

Item	Part No.	Nomenclature	QTY
1	CA/RF0097	Cable, Output RF	4
2	CA/WR0051	Cable, Control-LNA Switch	1
3	CA/WR0052	Cable, Control-TX Switch	1
4	CA/WR0053	Cable, Communication	1
5	CA/WR0053	Cable, Communication	1

Figure A-12. Cable Kit, AS/0440

Item	Part No.	Nomenclature	QTY
1	HW/M6X1X30MMHEX	Bolt, Hexhead	12
2	GA/GSKTCPR112HLT	Gasket, CPR112, Half-Thick	1
3	HW/M6X1HEXNUT	Nut, Hex	12
4	HW/M6LOCK	Washer, Lock	12
5	GA/GSKTCPR112FUL	Gasket, CPR112, Full-Thick	1
6	HW/M6FLAT	Washer, Flat	12
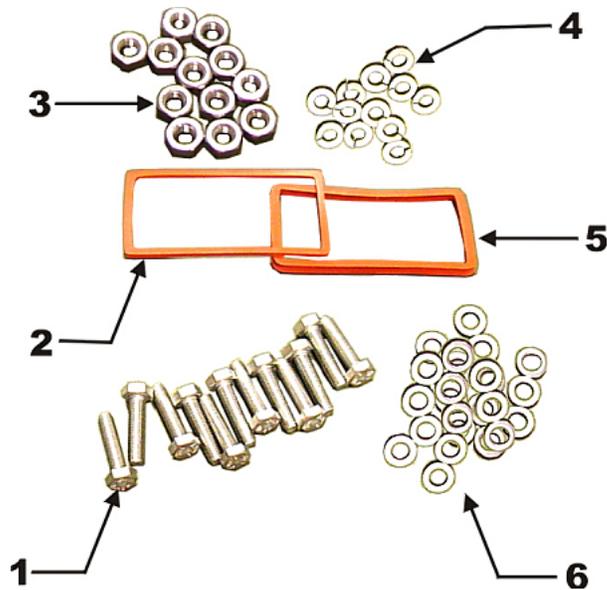
Figure A-13. Kit, Waveguide, AS/9512

Note: Contact Comtech EF Data Customer Support department for information concerning the Waveguide Mounting Kit.

Item	Part No.	Nomenclature	QTY
1	AS/0490	Assembly, Remote Switch Box	1

Figure A-14. Assembly, TX/Remote Switch, AS/0490

Item	Part No.	Nomenclature	QTY
1	SW/COAX-N-F-Sealed	Switch COAX N-FE	1
2	RF/A8430N	RF-ATTEN, DC, 30 dB	1
3	HW/M4X.07X8MMPHMS	Screw, Panhead	4
4	HW/M4LOCK	Washer, Lock	4
5	CA/RF0097	Cable, Output RF	2
6	CN/CXNPLUGCAP	Plug Cap, Non-shorting	1
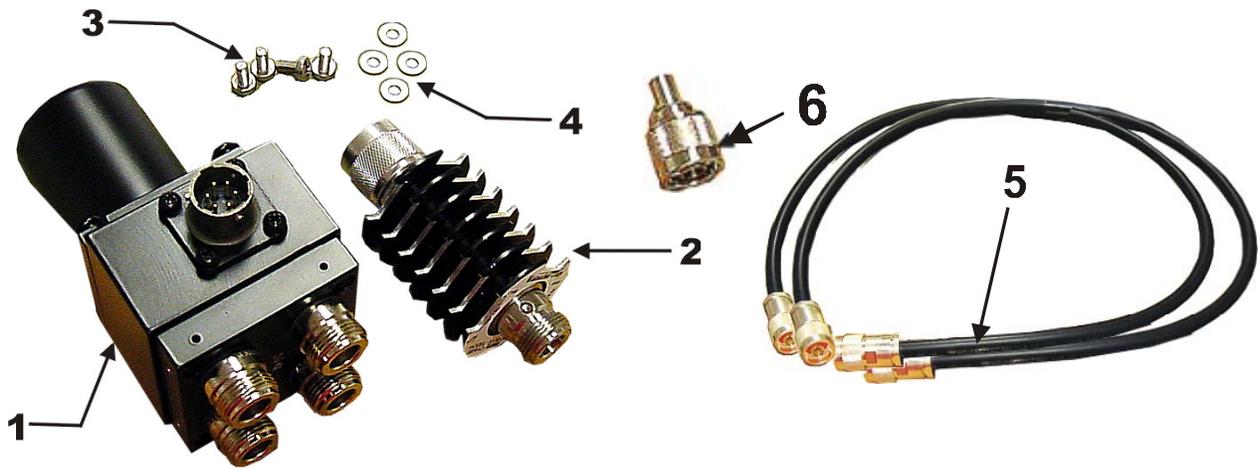
Figure A-15. TX/Remote Switch Assembly, AS/0503

A.5.2 ASSEMBLE TX/REMOTE SWITCH, AS/0503
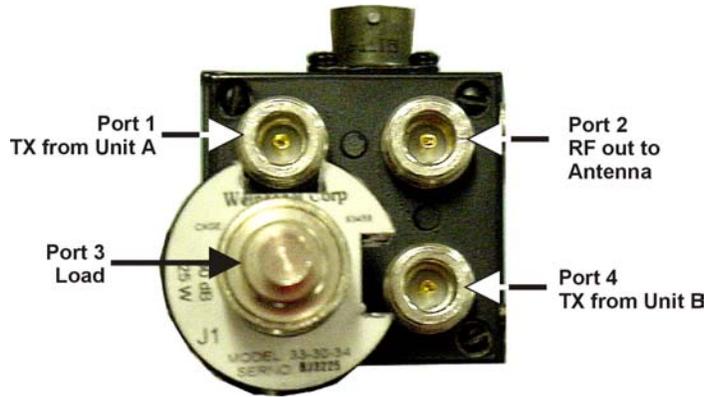
Step	Procedures
1	Connect attenuator (2, figure A-15) to switch (1) Port 3.
2	Ensure that machined grooves of attenuator allows for the future connection of the RF cables.
3	Connect the 50Ω termination (6) to the attenuator (2).

Figure A-16. Connections for the TX/Remote Switch Ports
(50Ω Termination and Attenuator Installed)

A.5.3 CONNECT CABLING TO THE REMOTE SWITCH BOX, AS/0490 USING AS/0440 CABLE KIT

Note: Refer to Figure A-18a for assembled view, refer to Figure A-21 for LNA port locations, and refer to Figure A-12 for Cable kit.

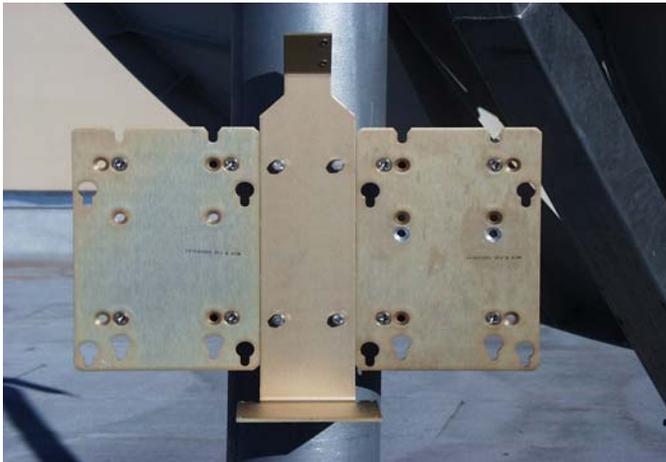| Step	Procedure
1	Connect one end of the Control cable, (4, Figure A-12) to UNIT A (1, Figure A-17) connector.
2	Connect one end of the Control cable, (5) to UNIT B (2, Figure A-17) connector.
3	Connect one end of Cable (2) to RX SWITCH (3 , Figure A-17) connector.
4	Connect one end of Cable (3, figure A-13) to TX SWITCH connector (4 , Figure A-17). Set box aside for later installation.
5	The four RF cables, (1, Figure A-12) are used to connect the IF ports on the switch controller to the units.
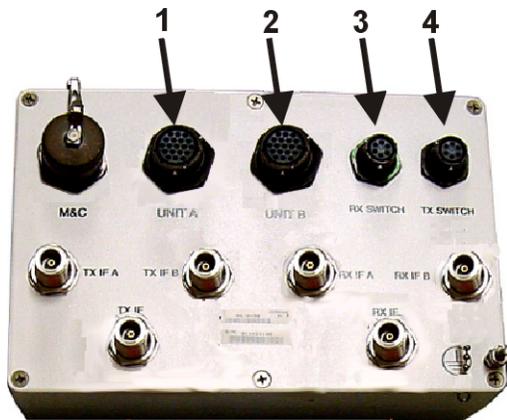
Figure A-17. Remote Switch Cast Box
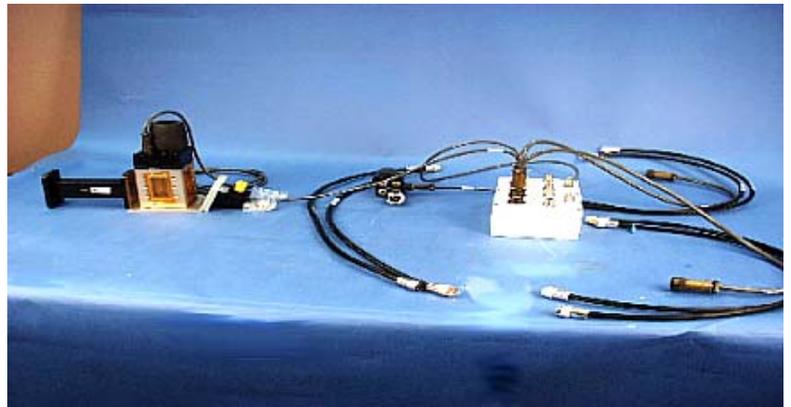
Figure A-18a. Switch Box with Cables

A.5.4 REDUNDANCY INSTALLATION

Notes:

1. Redundant XSAT's require two AS/0414 pole mount kits.

2. After the two pole brackets have been attached to the pole, they need to be properly spaced in relation to each other. This spacing is established with the switch-mounting bracket (1, figure A-11).

Figure A-18. Installation of Redundant Brackets

Step	Procedures
1	Place two springnuts (7, figure A-11) in each unistrut bracket (1, Figure A-1).
2	Center the bracket (1, figure A-11) horizontally on the top unistrut bracket (1, figure A-1) and fasten with two bolts (8, figure A-11) flat washers (5), and split washers (6).
3	Loosen lower unistrut bracket and position so the lower holes in the bracket are aligned vertically with the center of the lower unistrut bracket .
4	Position the springnuts as required. Secure bracket (1, figure A-11) to the unistrut bracket (1, figure A-1) using two bolts (8, figure A-11), flat washers (5), and split washers (6). Tighten the tension bracket (2, figure A-1).
5	Slide two springnuts (5, figure A-1) into the right-side of each of the two channels of the unistrut brackets (1, figure A-1).
6	Place one bracket (1, figure A-2) against the right side of the switch bracket (1, figure A-11). Position the springnuts to line up with four holes in bracket (1, figure A-2). Secure using screws (3, figure A-2).
7	Repeat steps (5) and (6) for the left bracket (1, figure A-2).

Step	Procedures
8	Place a unit on each bracket (1, figure A-2) and secure with four bolts (2), flat washers (4) and lock washers (6)
9	Position assembled TX switch (1,figure A-15) on bracket (1, figure A-11) and secure with two screws (4), flat washers (2), and lock washers (3).

Figure A-19. Installation of XSAT Transceivers

Figure A-20. Redundant Configuration with Cables Installed

A.5.5 LNA INSTALLATION
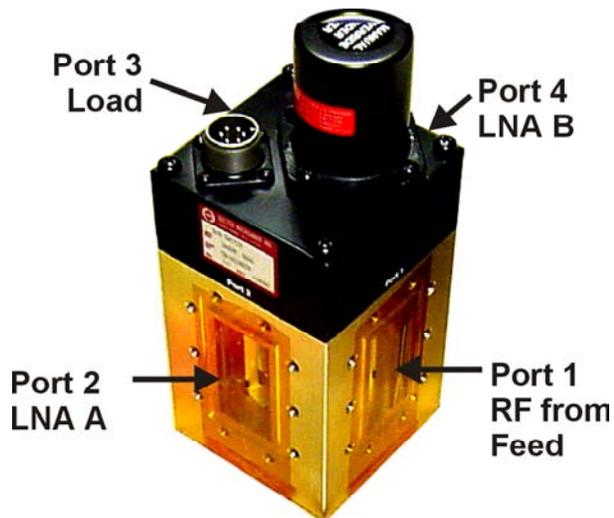
Figure A-21. Switch Port Locations

Step	Procedures
1	Remove all protective tape from switch and keep it clean.
2	Position Low Noise Amplifiers (LNAs) and gasket (4, Figure A-22) on Port 2 and Port 4 of switch (11).
3	Secure each LNA with eight bolts (8), lock washers (6) and flat washers (5).
4	Position waveguide termination (3) and gasket (4) on Port 3 and secure with eight bolts (8), lock washers (6), and flat washers (5).
5	Position filter (10), gasket (4) and use eight bolts (8), lockwashers (6), and flat washers (5) on remaining port.

Figure A-22. LNA Switch Kit, AS/9751-1 (Shown with Typical LNAs)

Step	Procedures
IMPORTANT	*Ensure that the OUTPUT flange of the filter is against switch (11).*
6	Loosely bolt bracket (2) to plate (1) as shown with screws (9), washers (5), and lockwashers (6).
7	Secure assembled switch to plate (1) using screws (7) installed through the bottom of the plate.
8	After Customer-Supplied Input waveguide has been secured to the RF Input, tighten bracket screws (9). Ensure all hardware is secured.

A.5.6 CABLE INSTALLATION

Refer to Figure A-24.

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.

Cable connectors used in outdoors application must be sealed to avoid leakage, particularly, N-type connectors. 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 3M, Type 23 Scotch Self-Amalgamating tape, or equivalent, including military style (MS) connectors.
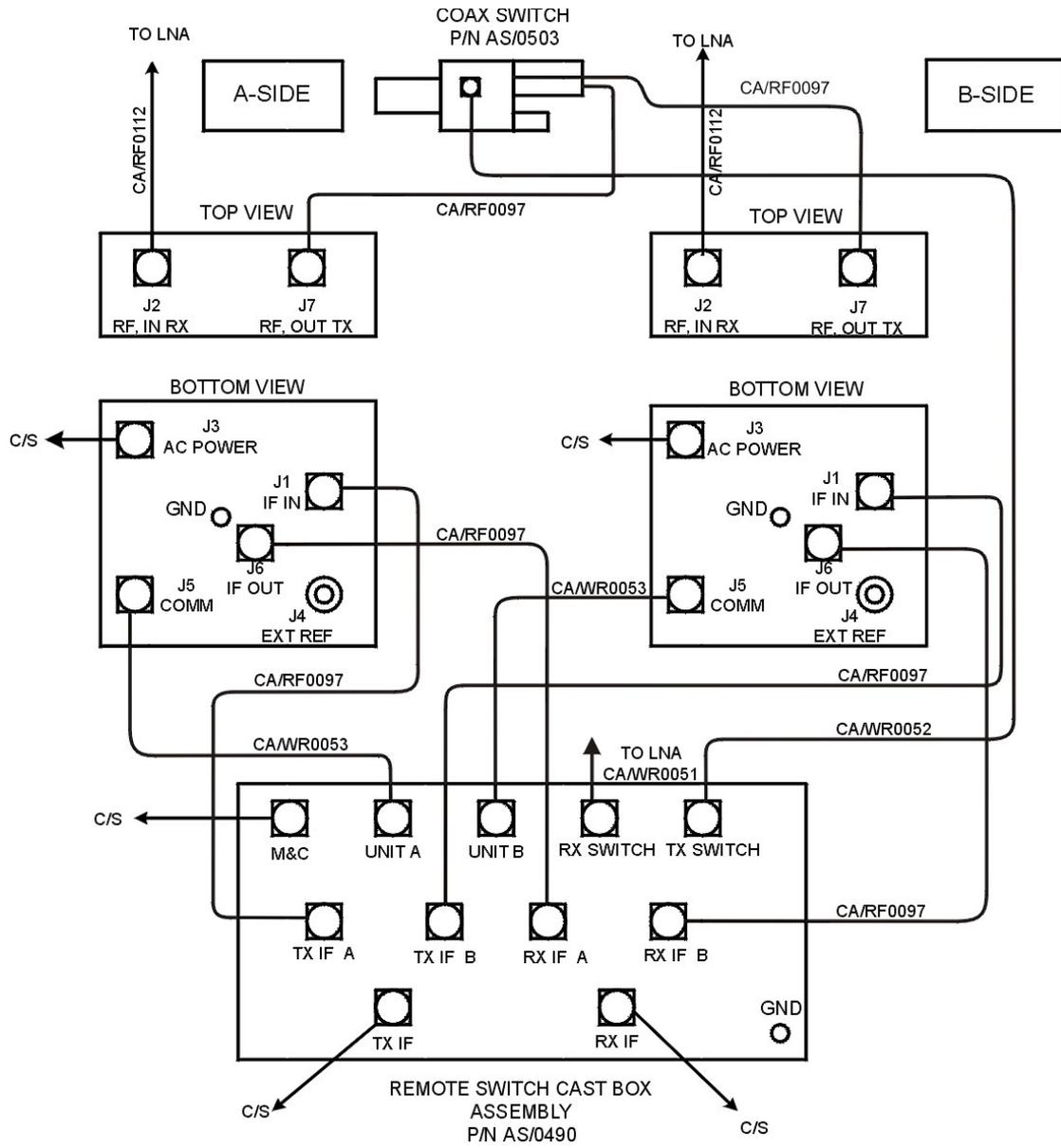
**Figure A-23. Cabling the Redundant Configuration
(Block Diagram)**

A.6 SPAR MOUNTING INSTRUCTION

A.6.1 SPAR MOUNTING KIT

The following mounting is providing to Spar-mount the unit in a single thread configuration.

Item No.	Part No.	Nomenclature	QTY
1	HW/M8FLATSS	Washer, Flat SS	8
2	HW/M8X1.25X15MMHEX	Bolt, Hex	4
3	HW/M8LOCKSS	Washer, Splitlock	4
4	FP/BR0073	Bracket, Mounting Spar 1x2	2
5	HW/M8X1.25X25HEXSS	Bolt, Hex	4
6	HW/M8X1.25HEXNUTSS	Nut, Hex	4
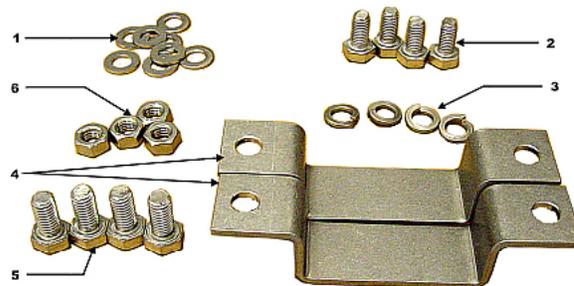
Figure A-24. Spar Mount, 1 x 2, AS/0422

A.6.2 MOUNTING KITS

Refer to the following kits:

‣ Spar Mounting Kit, 1 x 2, AS/0422
‣ Spar Mounting Kit, 1.75 x 4, AS/0501

Customer-Select

A.6.3 MOUNTING INSTRUCTIONS

Step	Procedures
1	Position the XSAT Transceiver against the spar arm of the satellite dish and bolt the two spar mounting brackets (4, figure A-24) to the unit.
2	Secure using bolts (2), flat washers (1), and split washers (3).

Appendix B. 50 and 100-WATT INSTALLATION

B.1 UNPACKING AND INSPECTION

Inspect the shipping container for damage:

Step	Procedures
1	Retain shipping container and packing materials for possible re-shipment.
2	Check to determine that all parts, materials and documentation has been shipped with the converter.
3	Inspect converter for possible damage, and then test for proper operation.
4	Notify the Comtech EF Data Customer Service representative immediately; if the shipment is incomplete, or there is mechanical damage, or the converter does not operate properly.
5	Notify the carrier, and retain all shipping materials for inspection by the carrier, if there is damage to the shipping container.

B.2 PERSONNEL

Comtech EF Data recommends that two technicians be required to install any of the following installations.

B.3 TOOLS REQUIRED

The following tools are recommended for unit installation.

Qty.	Description
1	Adjustable wrench
	Alternate: Set of various box wrenches
1	Tin Snips

B.4 SINGLE -THREAD CONFIGURATION

B.4.1 MOUNTING KITS

The following mounting procedures are to provide pole-mount instructions for the unit in a single-thread configuration.

Table C-1. Universal Pole Mount, 100 Watt, AS/0600

Part No.	Nomenclature	QTY
AS/0414	Kit, Redundancy, Pole Mount	2
AS/0415	Kit, XSAT Single-Thread Mounting Kit	1

Item No.	Part No.	Nomenclature	QTY
1	FP/BR0078	Bracket, Unistrut	1
2	FP/BR0072	Bracket, Strap Tensioner	1
3	FP/BR0070	Bracket, Strap-Termination Pole Mounting Kit	1
4	FP/BR0071	Bracket, 1 1/4 Strap	1
5	FP/BR0069	Bracket, Strap-Fixed, Pole Mounting Kit	1
6	HW/M8X1.25X25HEXSS	Bolt, Hexhead, M8X1.25X25, SS	2
7	HW/M8FLATSS	Washer, Flat, M8 SS, Metric	7
8	HW/M8LOCKSS	Washer, Splitlock, M8, SS, Metric	7
9	HW/M8SPRINGNUT	Springnut, M8 xX 1.25	2
10	HW/M8X1.25MMHEXNUTSS	Nut, Hex M8X1.25X16MM, SS	5
11	HW/PIPEBLOCK	Pipe, Block	2

Figure B-1 Universal Pole Mounting Kit, AS/0414

Item No.	Part No.	Nomenclature	QTY
1	FP/BR0067	Bracket, Pole Mount Kit	2
2	HW/M8FLATSS	Washer, Flat, M8 SS, Metric	8
3	HW/M8LOCKSS	Washer, Splitlock, M8, SS, Metric	8
4	HW/M8SPRINGNUT	Springnut, M8 xX 1.25	4
5	HW/M8X1.25MMHEXSS	Bolt, Hex M8X1.25X16MM, SS	4
6	HW/M8X1.25X25HEXSS	Bolt, Hexhead, M8X1.25X25, SS	4
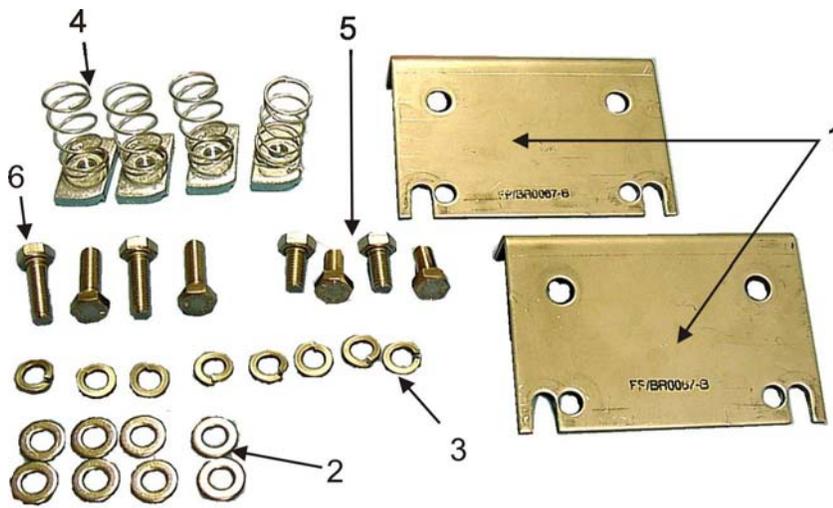
Figure B-2. Mounting Brackets, AS/0415

B.4.2 SINGLE-THREAD INSTALLATION

Step	Procedures
1	Place Unistrut brackets (1, Figure B-1) on a flat surface.
2	Slide two springnuts (9) into the each channel of the Unistrut brackets.
3	Fasten two pipe blocks (11) loosely to the springnuts using two bolts (6), two flat washers (7), and two splitlock washer (8).
4	Position Unistrut brackets (1) with pipe blocks (11) against the mounting pole, slide the pipe blocks (11) until they contact the mounting pole.
5	Ensure the pipe blocks (11) are centered to the Unistrut brackets (1). Tighten the hardware.

Figure B-3. Preparing the Pole Bracket

Figure B-4 Looking down

B-5. Installing the Pole Bracket
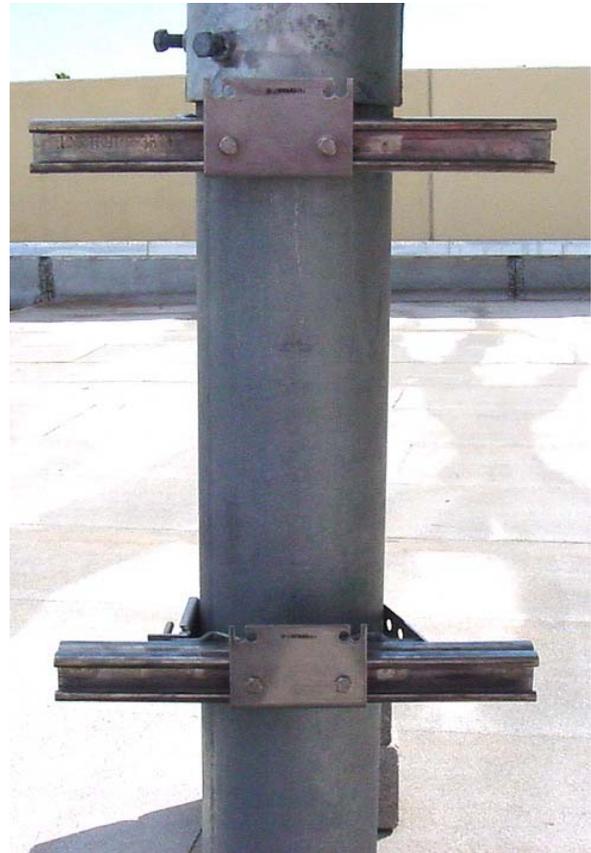
Figure B-6.   Single-Thread with Hardware

Step	Procedure
6	Each bracket (5, figure B-1) to the strap (4) using two nuts (10), two flat washers, (7), and two splitlock washers (8).
7	Place the assembly against the pole with the strap around the pole and trim strap (4) to fit as shown in Figure B-4, using the tin snips.
8	Attach bracket (3, figure B-1) to the strap (4) using two nuts (10), two flat washers (7), and two splitlock washers (8).
9	Slide tensioner bracket (2) into channel of the top Unistrut bracket (1).
10	Place assembly on the pole. Slide bracket (3) over bracket (2).
11	Place flat washer (7) and splitlock washer (8), and nut (10) on bracket (2).
12	Tighten nut to secure the tension strap.

Step	Procedures
13	Slide two springnuts, (4, figure B-2) into channel of the Unistrut brackets (1, figure B-1).
14	Repeat procedure for second Unistrut bracket.
15	Install brackets (1, figure B-2) and secure to Unistrut bracket with bolts (6), flat washers (2) and split lock washers (4).
16	Install four bolts (6, figure 2-2), flat washers (2) and splitlock washers (3) on the XSAT unit.
17	Lift the XSAT unit and slide bolts (6) into the grooves of the brackets (1).
18	Ensure the washers are against the bracket.
19	Tighten the bolts.

Figure B-7. Install XSAT 100 Watt Unit

IMPORTANT

Ensure the brackets are centered in each Unistrut. Ensure the unit is positioned with the fan facing outward and free of any obstructions. Do not tighten bolt (5) at this time.

B.4.3 LNA INSTALLATION

Figure B-8. Installation of LNA

The LNA is mounted to the OMT using Waveguide Kit, CPR112, PN AS/9751-1

To install a single LNA to an antenna, proceed as follows:

Step	Procedures
1	Remove the protective cover from the antenna OMT and LNA.
2	Install the appropriate gasket on the antenna end of the LNA.
3	If only one of the mounting surfaces has a groove, use the half-thick gasket.

  a. If both mounting surfaces have grooves, use the full thick gasket.

  b. Position the LNA (with gasket) in place on the antenna and fasten using the supplied hardware.
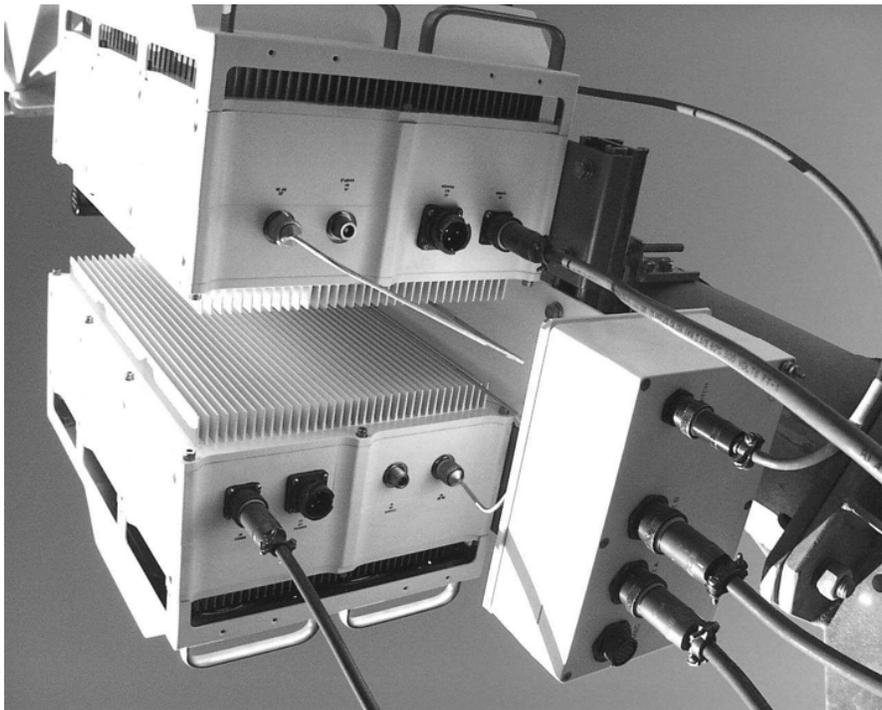
B.5 CABLE INSTALLATION

Care shall be exercised in cable installation. Install the cables using the most direct route and secure with clamps and ties. Avoid all sharp bends.

Cable connectors used in outdoors application shall be sealed to avoid leakage, particularly, N-type connectors. 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 shall be sealed with a self-amalgamating tape, such as 3M, Type 23 Scotch Self-Amalgamating tape, or equivalent, including military style (MS) connectors.

WARNING

The Downconverter RF input connector is wired to supply DC voltage to an LNA. This voltage is capable of damaging any test equipment connected to the connector. Do not connect test equipment to this connector without a coaxial DC block between the connector and the test equipment.

From LNA-A

TOP VIEW

J7
RF IN

J2
RF OUT

Figure B-9. Cable Connections

BOTTOM VIEW

J1
IF IN

GND

J6
IF OUT

J5
COMM

J4
EXT REF
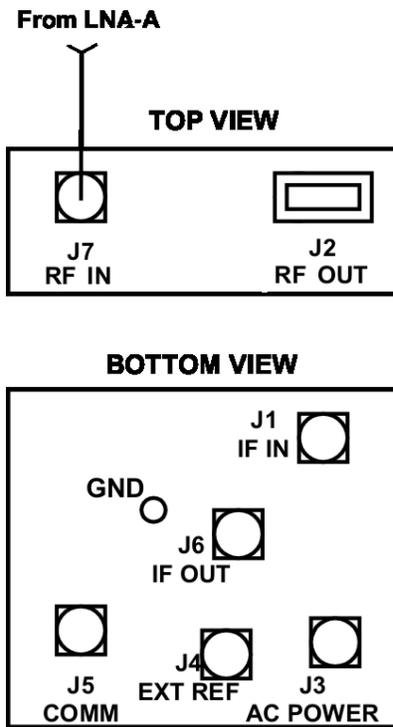
J3
AC POWER

NOTE: All cables connecting to the XSAT unit connectors located on the bottom surface are customer-supplied.

B.6 REDUDANCY CONFIGURATION

Note: Redundancy applies to the 100-WATT only.

B.6.1 MOUNTING KIT

Part No.	Nomenclature	QTY
KT/9850	Kit, 1:1 XSAT 100W	1
KT/9849	Kit, 1:1 Mounting	1

Table B-2. Final 1:1, X-Band LNA Assembly, KT/9850

Part No.	Description	QTY
AS/9751-1	Kit, LNA Mounting	1
AS/0440	Kit, Cable 1:1	1
AS/9512-2	Kit, Waveguide CRP112G, Metric	1
AS/9759-1	Switch, Waveguide, TX 1:1	1
AS/0490	Assy, Remote Switch Box	1

Table B-3. 1:1 Mounting Assembly, KT/9849

Part No.	Description	QTY
*AS/0414	Redundancy Kit, Pole Mount	2
*AS/0415	Single-Thread Mounting Kit	2
AS/0479	Switch, Mount Kit TX	1

IMPORTANT

*Refer to Single Thread Configuration.

Item No.	Part No.	Nomenclature	QTY
1	FP/BR0066	Bracket, Switch Mounting	1
2	HW/M58FLATSS	Washer, Flat M8, SS, Metric	4
3	HW/M5FLAT	Washer, Flat SS Metric	3
4	HW/M5LOCK	Washer, Lock SS, Metric	3
5	HW/M5X.08HEXNUT	Nut, Hex, M5X.08 SS	3
6	HW/M8SPRINGNUT	Springnut, M8 X 1.25	4
7	HW/M8X1.25X25HEXSS	Bolt, Hex Head, M8 X 1.25 X 25 SS	4
8	FP/BR9756-1	Bracket, Switch Mounting	1
9	HW/M5X.O8HEXNUT	Nut, Hex	4
10	HW/M5LOCK	Washer, Lock SS, Metric	4
11	HW/M5X.08X15MMHEX	Bolt, Hex Head	4
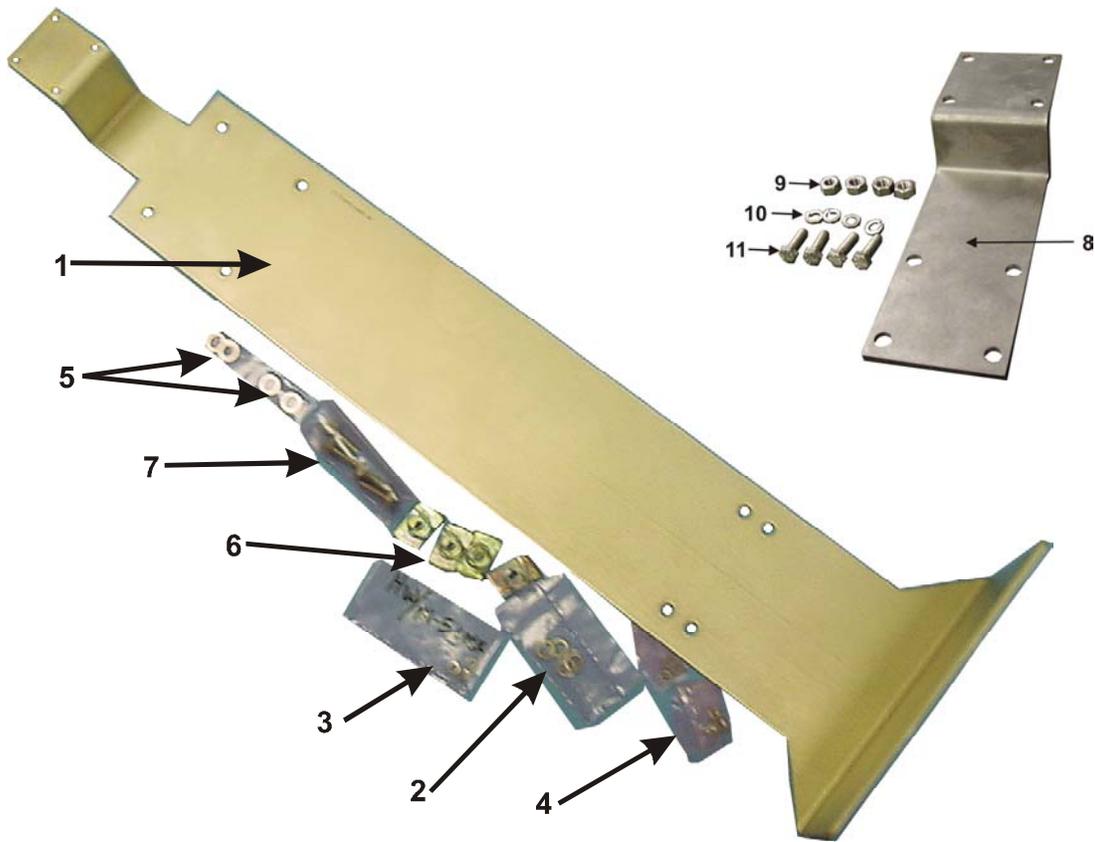
Figure B-10. TX Switch Mounting Kit, AS/0479

Item	Part No.	Nomenclature	QTY
1	FP/BR9748-1	Plate, Mtg 1:1 X-Band Redundant	1
2	FP/BR9752-1	Bracket, Mtg, X-Band TRF	1
3	FP/WG0039	CNTRC, Waveguide, Termination	1
4	GA/GSKTCPR112HLF	Gasket, CPR112 Half-Thick	4
5	HW/M4FLAT	Washer, Flat M4, SS	34
6	HW/M4LOCK	Washer, Lock, M4 SS	34
7	HW/M4X.07X10FHP	Screw, M4X10 Flat Head SS	4
8	HW/M4X.07X12MMHEX	Bolt, Hexhead, M4X.07X12MM SS	32
9	HW/M4X.07X8MMPHMS	Screw, Panhead, M4X.07X8MM SS	2
10	RF/TRF-13747-2	Filter, TRF, CPR-112F	1
11	SW/WG-HAGSM	Switch, WR112G, +24V, Sealed	1

Figure B-11. LNA Mounting Plate Assembly, AS/9751-1

Item	Part No.	Nomenclature	QTY
1	CA/RF0097	Cable, Output RF	4
2	CA/WR0051	Cable, Control-LNA Switch	1
3	CA/WR0052	Cable, Control-TX Switch	1
4	CA/WR0053	Cable, Communication	1
5	CA/WR0053	Cable, Communication	1

Figure B-12. Cable Kit, AS/0440

Item No.	Part No.	Nomenclature	QTY
1	HW/M4X.07X30MMSHCS	Bolt, M4X.07X30MM Socket Head SS	12
2	GA/GSKTCPR112FUL	Gasket, CP112, Full	1
3	HW/M4HEXNUT	Nut, M4, Hexnut, SS	12
4	HW/M4LOCK	Lockwasher, M4, Lockwasher, SS	12
5	GA/GSKTCPR112HLF	Gasket, CP112, Half 112	1
6	HW/M4FLAT	Washer, M4, Flat, SS	24
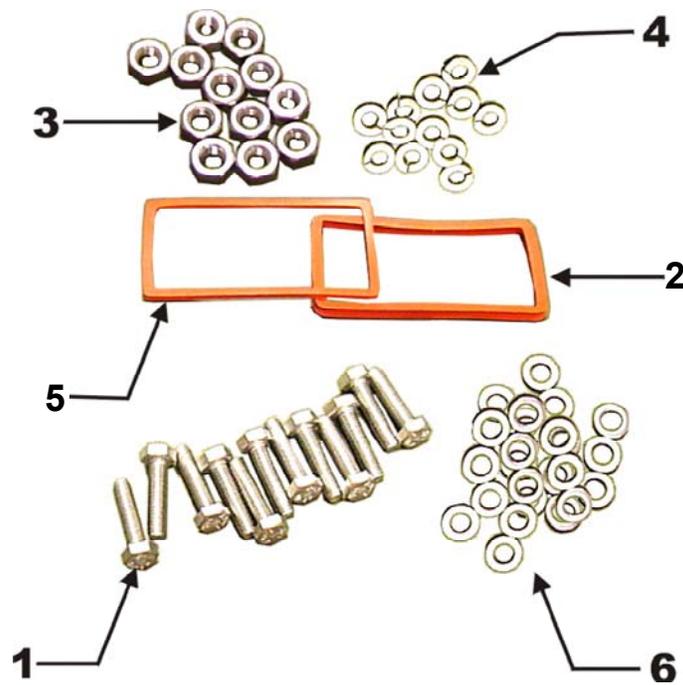
Note: For mounting customer-supplied unit to Transmit Switch Assembly

Figure B-13. Waveguide Kit, CPR112, AS/9512-2

tem No.	Part No.	Nomenclature	QTY
1	FP/WG0039	Waveguide Termination, Small Fins	1
2	FP/WG9756-1	Waveguide CPRG112, 90° "E" 5.50 Flex x 2.00	1
3	FP/WG9757-1	Waveguide, CPRG112, "Jogged"	1
4	GA/GSKTCPR112HLF	Gasket, CP112, Half-Thick	3
5	HW/M4FLAT	Washer, M4 Flat	28
6	HW/M4LOCK	Lockwasher, M4 SS, Metric	28
7	SW/WG-HAGSM	Switch, CPR112G, +24V, Sealed Metric	1
8	HW/M48.07X12MMHEX	Bolt, M4X.07X12MM Hexhead SS	28
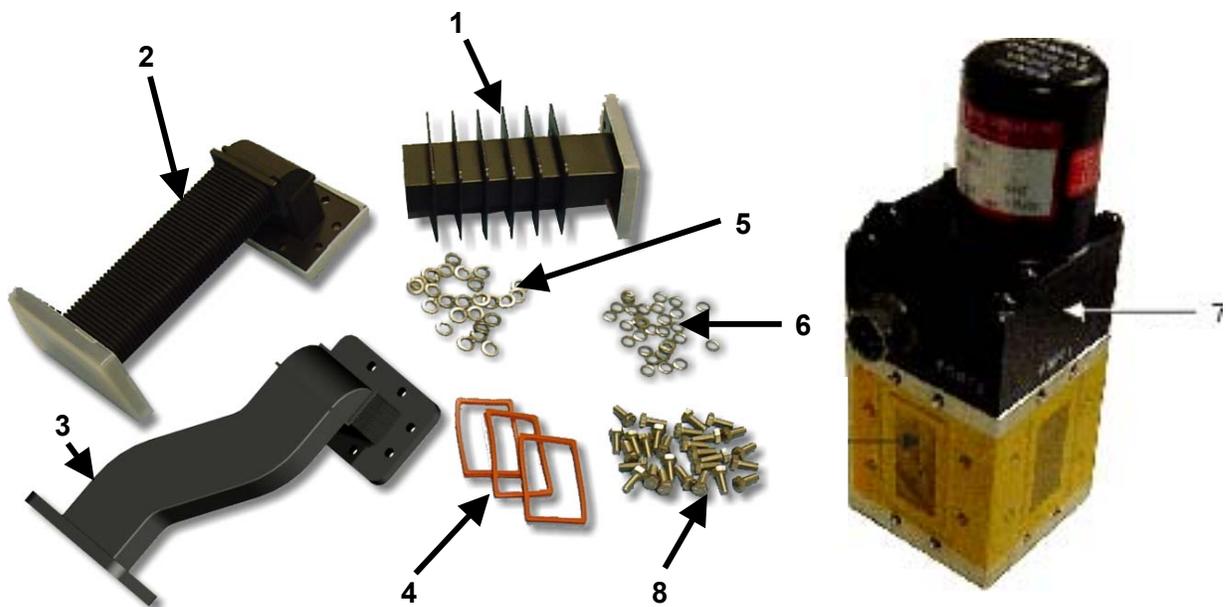
Figure B-14. Waveguide Switch, TX 1:1, AS/9759-1 (Partial Kit)

Item	Part No.	Nomenclature	QTY
1	AS/0490	Assembly, Remote Switch Box	1

Figure B-15.   Remote Switch Box Assembly, AS/0490

B.6.2 REDUNDANCY INSTALLATION
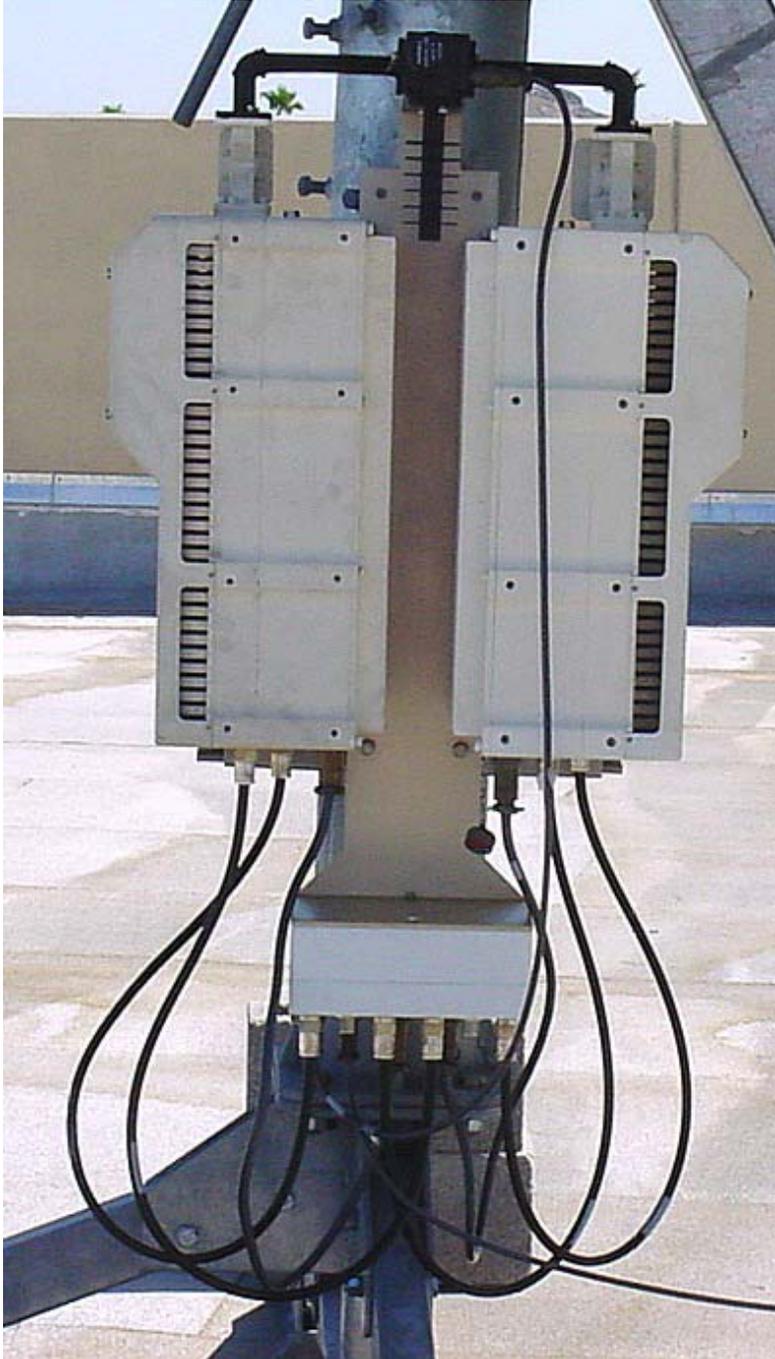
Figure B-16. Redundant Configuration

B.6.2.1 ASSEMBLE WAVEGUIDE SWITCH, AS/9759-1

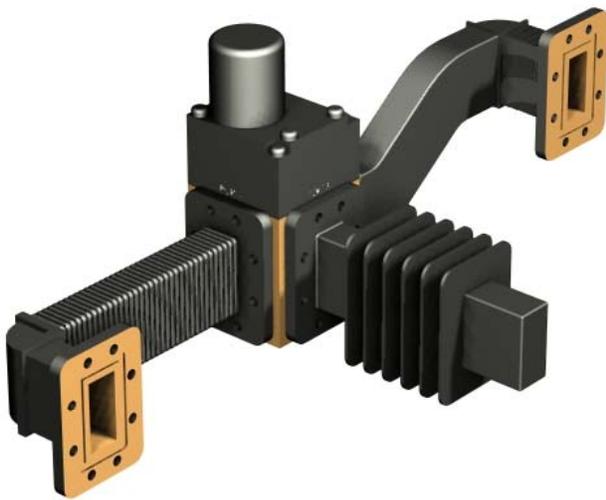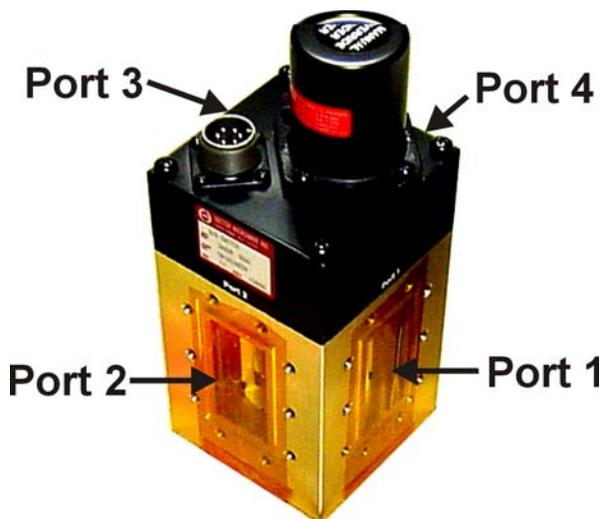| Step	Procedures
1	Remove all protective tape from switch and keep it clean
2	Install waveguide termination (1, Figure B-15) and gasket (4) to Port 3 (Fig. 2-19) of switch (7, Figure B-15) and secure with bolts (8), lockwashers (6), and flat washer (7).
3	Install waveguides (2) and gaskets (4) to Ports 2 and 4 of switch (7) and secure with bolts (8), lockwashers (6), and flat washers (7).
4	Final assembly should look identical to Figure B-18. Set waveguide switch assembly aside for later installation.

Figure 2-17. Assemble Waveguide Switch, AS/9759-1

(Partial Kit)

Figure B-18. Switch Port Locations

B.6.2.2 ASSEMBLE REDUNDANT CONFIGURATION

Step	Procedures
1	Place Unistrut bracket (1, Figure B-1) on a flat surface. (see Figure B-19.)
2	Slide two springnuts (9) into the channel of the Unistrut bracket.
3	Fasten two pipe blocks (11) loosely to the springnuts using two bolts (6), two flat washers (7), and two splitlock washers (8).
4	Repeat procedure for second Unistrut bracket (1)
5	Position Unistrut bracket (1) with pipe blocks (11) against the mounting pole, slide the pipe blocks (11) until they contact the mounting pole. (see Figure B-20.)
6	Ensure the pipe blocks (11) are centered to the Unistrut brackets (1). (see Figure B-21.)
7	Tighten the hardware.

Figure B-19. Preparing the Pole Bracket

Figure B-20. Pipe Blocks

Figure B-21. Looking down at Pipe Blocks

Step	Procedures
8	Attach bracket (5, figure B-1) to the strap (4) using two nuts (10), two flat washers, (7), and two splitlock washers (8).
9	Place the assembly against the pole with the strap around the pole and trim the strap (4) to fit as shown in Figure B-21, using the tin snips.
10	Attach bracket (3, figure B-1) to the strap (4) using two nuts (10), two flat washers (7), and two splitlock washers (8).
11	Slide tensioner bracket (2) into channel of the top Unistrut bracket (1).
12	Place assembly on the pole.

Step	Procedures
13	Slide bracket (3) over bracket (2).
14	Place flat washer (7) and splitlock washer (8), and nut (10) on bracket (2).
15	Tighten nut to secure the tension strap.
16	Slide two springnuts, (5, figure B-2) into channel of the Unistrut bracket (1, figure B1).
17	Repeat procedure for second Unistrut bracket (1).
18	Install bracket (1, figure B-10) and secure to the Unistruts with four bolts (11), and lock washers (10).
19	Install switch mount bracket (8, figure B-10), to main bracket (1). Secure with four bolts (11), lock washer (10), and nuts (9).
20	Ensure that the bracket is centered on the Unistruts. Tighten hardware.

IMPORTANT

When installed, ensure the XSAT 100 Watt unit fan is facing outward.

Step	Procedures
21	Install brackets (1, figure B-2) and secure to Unistrut brackets with four bolts (6), flat washers (2) and split lock washers (3).
22	Position brackets (1) against center bracket. Do not tighten hardware at this time
23	Install four bolts (7, figure B-10) with split washers (10) , and flat washers (2) into provided mounting holes in the XSAT 100 Watt casting
24	Carefully lift the unit, and slide the bolt head into the groove of bracket (1, figure B-10).
25	Ensure the washers are between the unit and the bracket. Do not tighten hardware at this time.
26	Temporary install the assembled waveguide switch (Figure B-18).
27	Ensure that the ports line-up and can be secured. If a gap is present, adjust by sliding the unit and bracket (1, figure B-2) on the Unistrut (In or Out).

Step	Procedures
28	Tighten hardware.
29	Install the assembled waveguide switch (Figure B-18) and waveguide gaskets.
30	Secure assembly with bolts, lock washers and flat washers from hardware kits supplied with each XSAT unit (not shown, PN AS/0402-2).

Figure B-22. Installation of the Waveguide Switch.

WAVEGUIDE, CPR137G, "E" BEND WITH OFFSET
PART # FP/WG0043

WAVEGUIDE, CPRG137, "E" BEND
PART # FP/WG0051
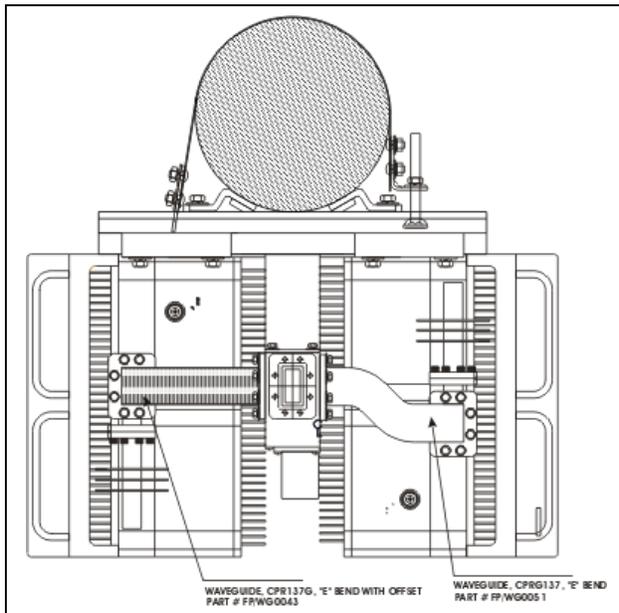
gure 2-23   Waveguide layout

B.6.2.3 ASSEMBLE LNA SWITCH KIT, AS/9751-1
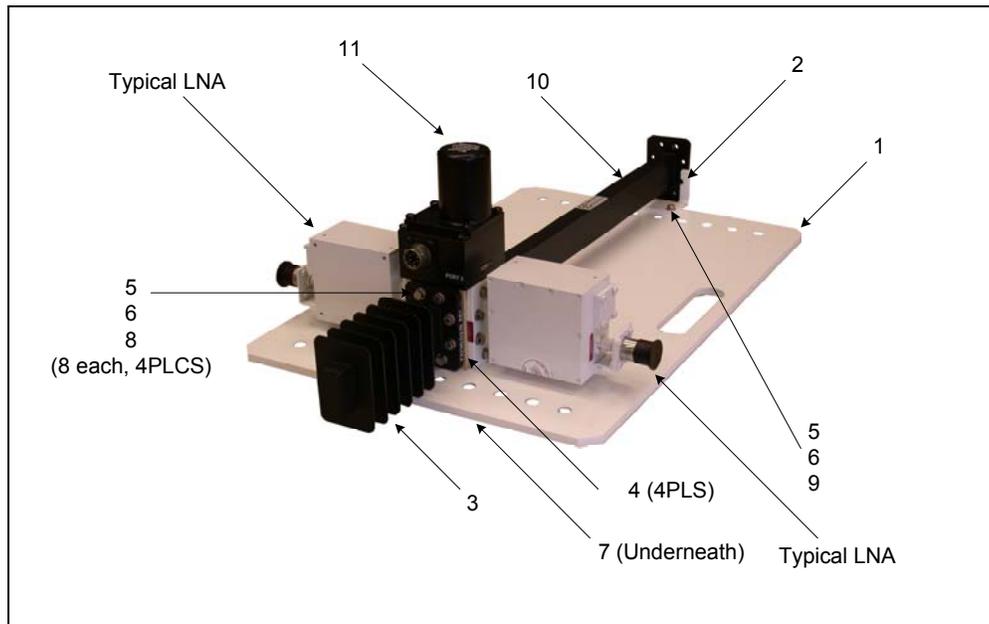
Figure 2-24. LNA Switch Kit, AS/9751-1 (Shown with Typical LNAs)

Step	Procedures
1	Remove all protective tape from switch and keep it clean.
2	Position Low Noise Amplifiers (LNAs) and gasket (4, Figure B-24) on Port 2 and Port 4 of switch (11).
3	Secure each LNA with eight bolts (8), lock washers (6) and flat washers (5).
4	Position waveguide termination (3) and gasket (4) on Port 3 and secure with eight bolts (8), lock washers (6), and flat washers (5).
5	Position filter (10), gasket (4) and use eight bolts (8), lockwashers (6), and flat washers (5) on remaining port.

IMPORTANT

Ensure that the OUTPUT flange of the filter is against switch (11).

6	Loosely bolt bracket (2) to plate (1) as shown with screws (9), washers (5), and Lockwashers (6).
7	Secure assembled switch to plate (1) using screws (7) installed through the bottom of the plate.
8	After Customer-Supplied Input waveguide has been secured to the RF Input, tighten bracket screws (9). Ensure all hardware is secured.

B.7 LNA ASSEMBLY

Install assembled Redundant LNA assembly as follows:

Step	Procedures
1	Remove the protective cover from the antenna OMT.
2	Install the appropriate gasket (2, Figure B-13 or Figure B-14) on the antenna end of the TRF.
3	Install the appropriate gasket (2, Figure B-13 or Figure B-14) on the antenna end of the TRF. a. If only one of the mounting surfaces has a groove, use the half-thick gasket.(2). b. If both mounting surfaces have grooves, use the full thick gasket (5).
4	Position the LNA switch assembly (with gasket) in place on the antenna and fasten using the supplied hardware.

B.8 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.

Cable connectors used in outdoors application must be sealed to avoid leakage, particularly N-type connectors. 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 3M, Type 23 Scotch Self-Amalgamating tape, or equivalent, including military style (MS) connectors.
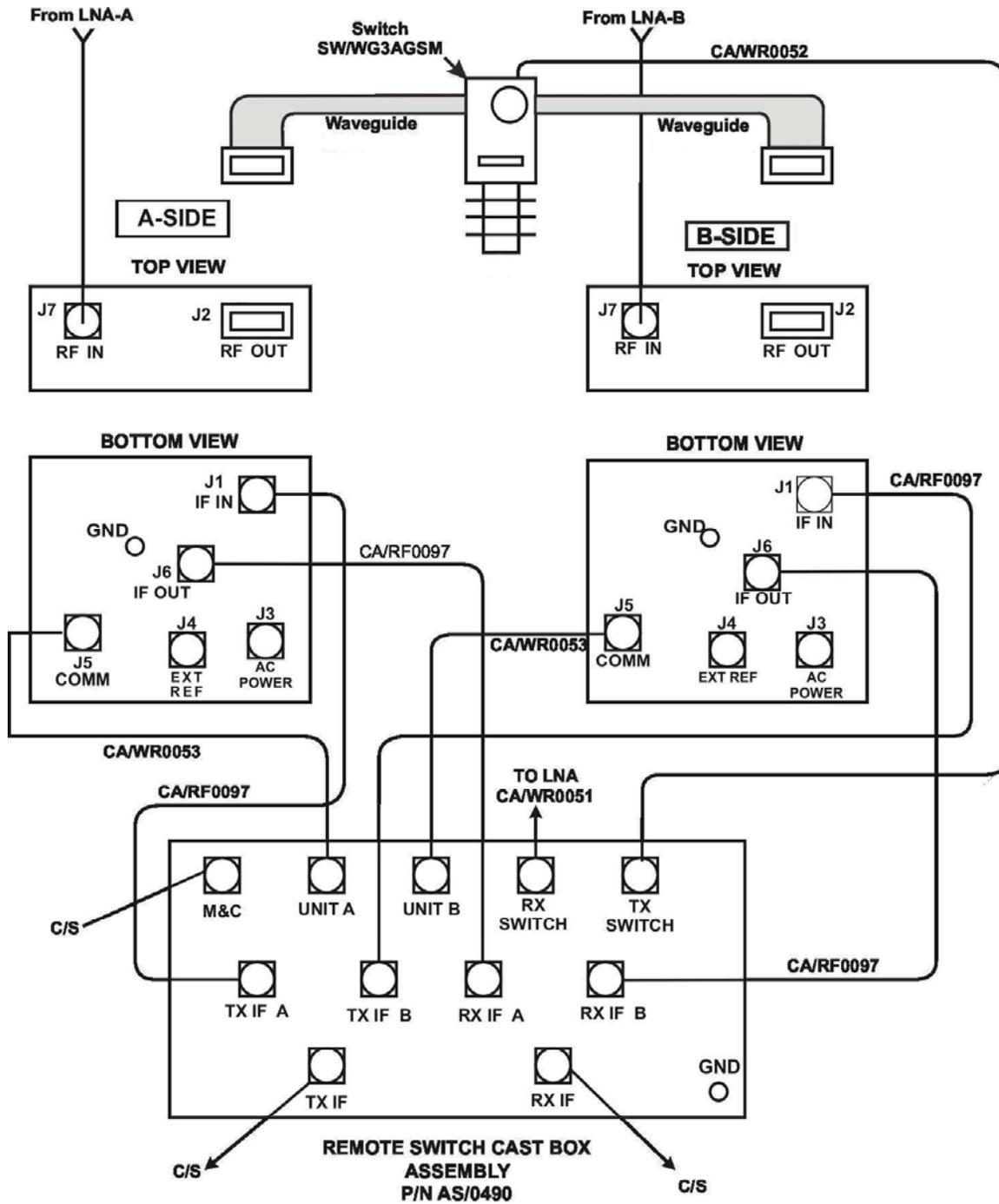
C/S = CUSTOMER - SUPPLIED

Figure B-25. Cable Installation

Notes:

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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	—