CSAT-5060

50 Watt

C-Band Transceiver
Installation and Operation Manual

Part Number MN/CSAT506050.IOM   Revision 0

Errata A
Comtech EF Data Documentation Update

Subject: Revised format for Redundant Kits descriptions

Date: September 17, 2002
Document: CSAT5060 50Watt, C-Band Transceiver, Installation and
                        Operation Manual, Rev. 0, dated April 23, 2002
Part Number: MN/C506050.EA0
Collating Instructions: Attach this page to page 2-12

Comments:

Revised format for Redundant Kits descriptions

Change Specifics:

2.6   REDUNDANCY CONFIGURATION

2.6.1   MOUNTING KIT

Table 2-1. Final 1:1, C-Band Assembly (Switching), AS/0458

Part No.	Description	QTY
AS/0438	Kit, LNA Switching	1
AS/0440	Kit, Cable 1:1	1
AS/0460	Kit, Waveguide CRP137G	1
AS/0461	Kit, Waveguide CRP229	1
AS/0462	Switch, Waveguide, TX 1:1	1
AS/0490	Assy, Remote Switch Box	1

Table 2-2. 1:1 Mounting Assembly, AS/0597

Part No.	Description	QTY
*AS/0414	Redundancy Kit, Pole Mount	2
*AS/0415	Single-Thread Mounting Kit	2
AS/0437	Switch, Mount Kit TX	1

IMPORTANT *Refer to Single-Thread Configuration*.

Errata B
Comtech EF Data Documentation Update

Subject: Delete C-Band Filter from Mounting Kit AS/0438
Date: September 17, 2002
Document: CSAT5060 50Watt, C-Band Transceiver, Installation and
                        Operation Manual, Rev. 0, dated April 23, 2002
Part Number: MN/C506050.EB0
Collating Instructions: Attach this page to page 2-14
Comments: Deleted C-Band Filter P/N RF/TRF-CBND-WG from Mounting Kit
                        AS/0438. Filter to be ordered separately.

Change Specifics:

| Item	Part No.	Nomenclature	QTY
1	15D1002	Cover	2
2	FP/BR0076	Bracket, Switch	1
3	28P1084	Adapter	1
4	**Not Used**		
5	SW/WG2AGSM	Switch, CPR229 +24V, Sealed	1
6	Not Used		
7	HW/M6X1X15MMHEX	Bolt, Hex head	36
8	HW/M6LOCK	Washer, Lock	36
9	HW/M6X1X15MMFLATSS	Screw, Flat	4
10	CN/CX50NMALE	CN – 5Ω, N Male Termination	1
11	GA/GSKTCPR229FULL	Gasket, CPR229	4
12	HW/M6FLAT	Washer, Flat	36
	AS-0502	TX/RX Filter Support Bracket	1
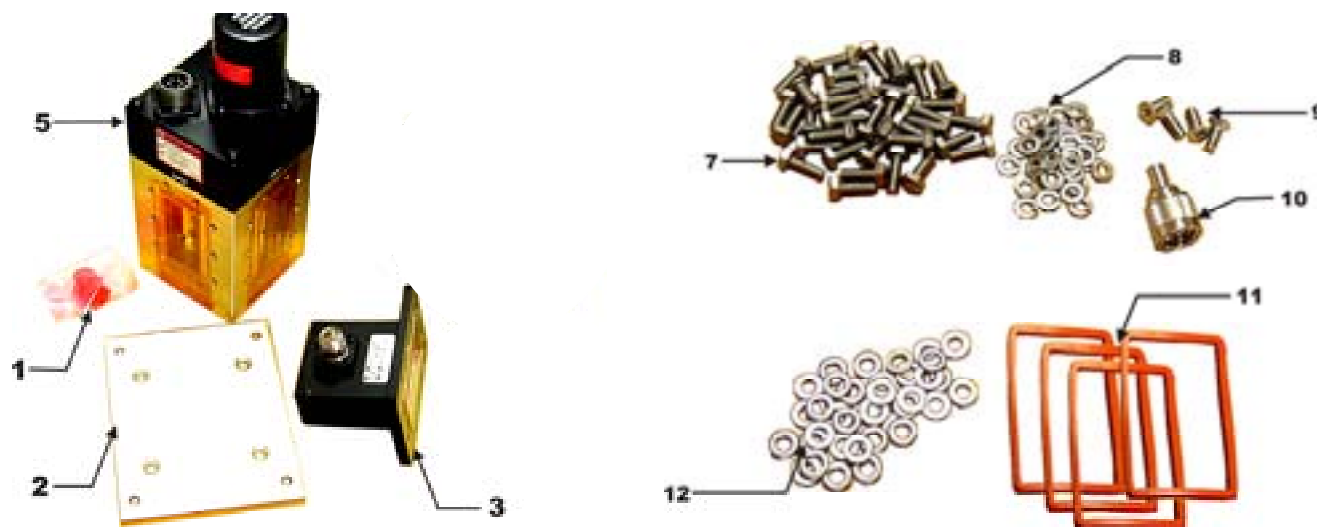
Figure 2-1. Mounting LNA Switch Kit, AS/0438

Errata C
Comtech EF Data Documentation Update

Subject: Revised Assembly Procedures for TRF Filter

Date: September 17, 2002
Document: CSAT5060 50Watt, C-Band Transceiver, Installation and Operation Manual, Rev. 0, dated April 23, 2002
Part Number: MN/C506050.EC0
Collating Instructions: Attach this page to page 2-23

Comments:

Revised Important Note and step 7 to read:

IMPORTANT	***Ensure that the OUTPUT flange of the filter is against switch (5). TRF Filter is Customer-Selectable at time of ordering.***

7. Position TRF Filter (customer-selectable), gasket (Table 2-7, Item 11), and Support Bracket (Table 2-8, Figure 2-12, AS/0502) on Port 4 of switch (Table 2-7, Item 5) and secure with 8 bolts (Table 2-8, Item 3), lockwashers (Table 2-8, Item 2), and flat washers (Table 2-8, Item 1) from AS/0502 kit, and use 2 bolts (Table 2-7, Item 7, Figure 2-11), lockwashers (Table 2-7, Item 8), and flat washers (Table 2-7, Item 12) from AS/438 kit.

Errata D
Comtech EF Data Documentation Update

Subject: Change Specification Temperatiures

Date: December 16, 2002
Document: CSAT5060 50Watt, C-Band Transceiver, Installation and
                         Operation Manual, Rev. 0, dated April 23, 2002
Part Number: MN/C506050.ED0
Collating Instructions: Attach this page following page 3

Comments:

Revised temperatures as specified in the Specification list. This information will be incorporatedf into the next revision.

Change Specifics:

Revise temperatures as follows:

-50°C = -58°F

75°C = 167°F

55°C = 131°F

CSAT-5060

50 Watt

C-Band Transceiver
Installation and Operation Manual

Customer Support

Contact the Comtech EF Data Customer Support Department for:

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

A Customer Support representative may be reached at:

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

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

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

service@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. x.

Table of Contents

Figures

Tables

About this Manual

This manual provides installation and operation information for the Comtech EF Data CSAT-5060, 50 Watt, C-Band Transceiver. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the 50 Watt C-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

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 Publications Department : techpub@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.

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

Warranty Policy

This Comtech EF Data product is warranted against defects in material and workmanship for a period of 24 months 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.

Chapter 1. INTRODUCTION

**CSAT-5060
50 Watt
C-Band Transceiver**

This manual provides instructions on the installation, operation and maintenance of the CSAT-5060, 50 Watt C-Band Transceiver manufactured by Comtech EF Data.

1.1 FUNCTIONAL DESCRIPTION

The Transceiver is designed for use in communication systems, or in satellite uplink data systems, for the reception of SCC/MCPC, DAMA, and TDMA communication signals. It also can 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.

9 11/16

8.14

J7 RF IN

J2 RF OUT

M8X1.25 HELICOIL,PMOUNTING BOTH SIDES

5.38

6.47

5.47

22 3/16

22 13/16

18.60

3.75

.75

.64

9.75

1.00

J5 COMM

J6 IF OUT

J4 EXTERNAL REF IN

J3 AC POWER

J1 IF IN
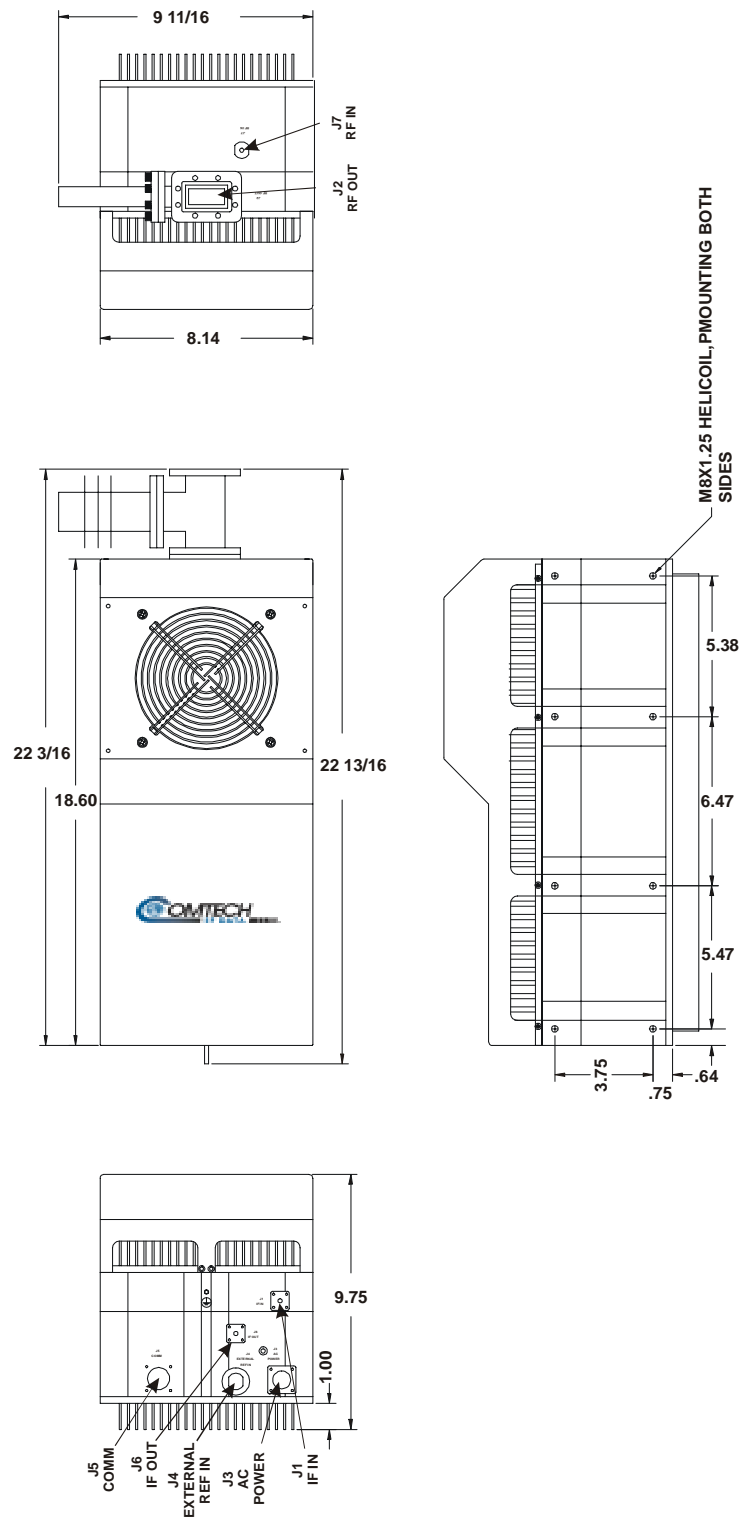
Figure 1-1 CSAT 50 dimensions

Figure 1-2 Remote Switch Dimensional Drawing

CSAT-5060

C-Band Transceiver 50 and 100 Watt
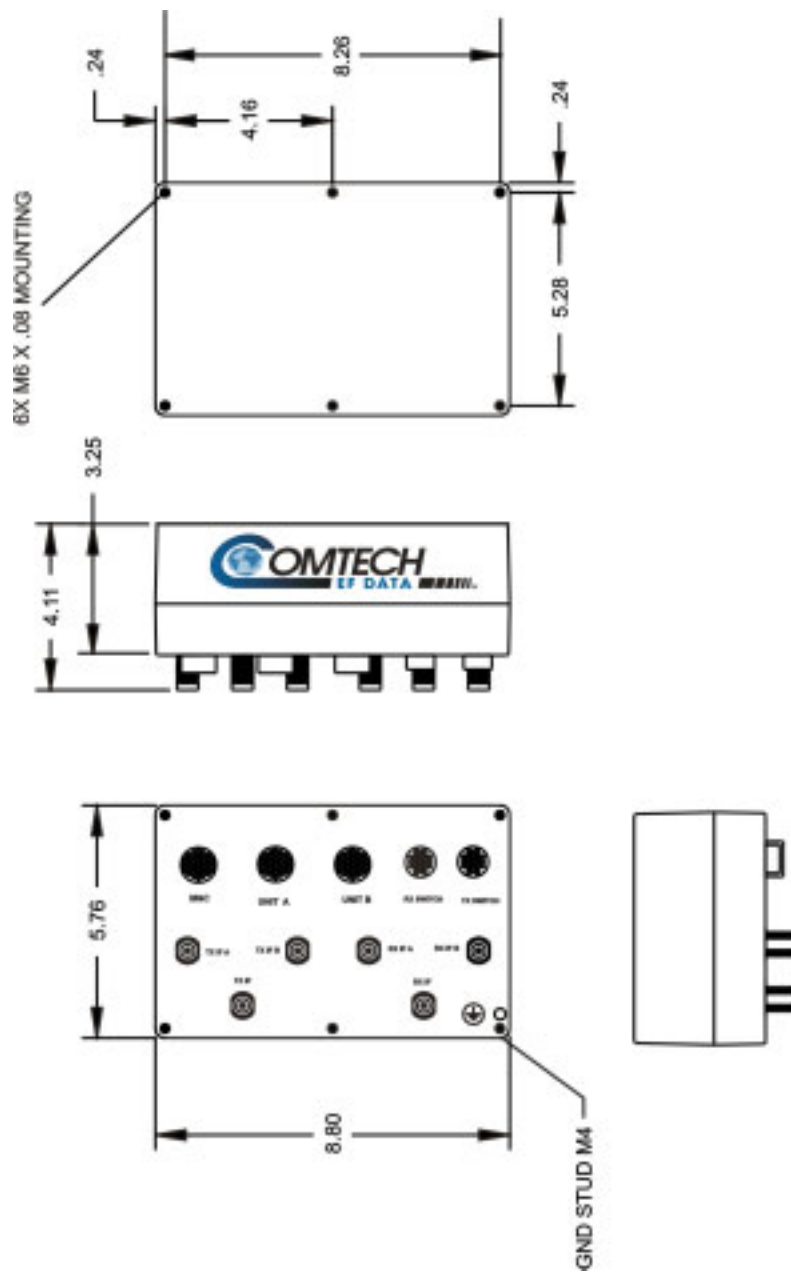
50 Watt

100 Watt

INTRODUCTION

The CSAT-5060 has been developed by a team of RF engineers with many years of experience in designing and manufacturing satellite transceivers and other RF products.

The CSAT-5060 is designed to provide the user with superior performance, long-term reliability and ease of installation with a very price competitive product.

The CSAT-5060 is the perfect choice for your VSAT application for TDMA, DAMA, and SCPC/MCPC sites requiring higher power.

FULL RATED POWER

The CSAT-5060 delivers the full rated power, or more, measured at the 1 dB compression point and at the output flange. The user realizes the useable output power that is available and receives full value for the investment.

PHASE NOISE

The dual synthesizers in the CSAT-5060 deliver superior phase noise performance, exceeding Intelsat specifications by a very comfortable margin. The user receives the benefits of spectral purity and the ability to go into multi-carrier environments with less concern.

THIRD ORDER INTERCEPT (TOI)

The design of the CSAT-5060 gives the user a high TOI that allows multi-carrier applications without the concerns normally associated with low power environments. The CSAT-5060 delivers performance usually found only in SSPA systems.

SMALL, COMPACT DESIGN

The CSAT-5060 offers a single unit chassis for the 50 and 100-Watt transceivers. This design allows quick, easy installation for these higher-powered transceivers. With the use of the EDMAC features of the companion CDM family of modems, even installation can be made without the requirement for expensive, heavy test equipment.

FULL MONITOR AND CONTROL

Designed into the CSAT-5060 are a variety of methods to monitor and control this device. The CSAT-5060 offers full Monitor and Control from a small, convenient Hand-Held Terminal or easy access via EIA-232 or EIA-485 connections. Full remote M&C can be achieved through the companion CDM Modem family or the PC Windows based EDMAC proprietary monitor and control software.

The CSAT-5060 is available in a 1:1 redundant configuration.

CSAT-5060

C-Band Transceiver
50 and 100 Watt

Transmit

Frequency, RF	5845 to 6425 MHz
	6425 to 6725 MHz (Optional Extended)
	5850 to 6650 MHz (Optional Wide)
	5845 to 6725 MHz (Optional Super Wide)
Frequency IF	70 MHz ± 18 MHz
	140 MHz ± 36 MHz (Optional)
Output Power, P_{1Db}	(50W) +47 dBm
	(100W) +50 dBm
Gain	(50W) 74 dB
	(100W) 77 dB
Attenuator Range	25 dB in 0.25 dB steps
Gain Flatness	± 0.75 dB full RF band
	± 0.75 dB per 36 MHz
Gain Stability	± 0.25 dB at constant C
	± 1.00dB from -40° to+55°C (-40 to 131° F)
Carrier Mute	-70 dBc
Intermodulation	-33 dBc for two carriers at 6 dB OPBO from rated power
Second Harmonic	-55 dBc
Spurious	AC line harmonics -45 dBc
	Carrier related, <500kHz -60 dBc
All other in-band	(50 W) -18 dBm -65 dBc
	(100 W) -15 dBm -65 dBc
AM to PM Conversion	3.0° at 6 dB OPBO from rated power
RF Output VSWR	1.25:1
RF Output Connector	CPR137G
IF Input Impedance	50 Ohms
IF Input VSWR	1.25:1
IF Input Connector	Type N Female

Receive

Frequency RF	3625 to 4200 MHz
	3400 to 4200 MHz (Optional)
Frequency IF	70 MHz ±18 MHz
	140 MHz ± 36 MHz (Optional)
Gain, without LNA	45 dB
Gain Flatness, without LNA	± 0.75 dB full RF band
	± 0.75 dB per 36 MHz
Gain Stability, w/o LNA	± 0.25 dB constant temp.
	± 1.00 dB -40° to +55°C
Output Power, P1dB	+13dBm
Two Tone Inter-modulation	-50 dBc for two tones at 0 dBm each, 1 MHz apart
Image Rejection	-60 dBc
RF Input VSWR	1.25:1
RF Input Connector	Type N Female
IF Output Impedance	50 Ohms
IF Output VSWR	1.25:1
IF Output Connector	Type N Female

Common

Conversion	Dual, no spectral inversion
Frequency Step Size	1.0 and 2.5 MHz automatic

Frequency Stability	1x10^{-9}/day	
	1x10^{-7}/year	
	-40° to +55°C	1x10^{-8}/Temp
Attenuation steps	Tx	0-25 dB in 0.25 dB steps
	Rx	0-20 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

Monitor and Control

Methods Interface	Both EIA-485 and EIA-232 Serial
	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
	Over temperature condition

Environmental

Temperature		-40° to +55° C (-40 to 122° F) Operating
		-50° to +75° C (-90 to 135° F) Storage
Altitude		15,000 ft, mean sea level
Humidity		0 to 100 Percent, Relative
Prime Power		90 to 260 VAC Standard
		47 to 63 Hz Standard
		48 VDC Optional
Dimensions:	50 W	9.75H x 10W x 23D inch
		(24.77H x 25.4W x 58.42D cm)
	100 W	10 H x 12.5W x 26D inch
		(25.4H x 31.75W x 66.04D cm)
Weight:	50 W	65 lbs (29 kg)
	100 W	80 lbs (40 kg)
Low Noise Amplifier		45° K, non-isolated

NOTES:

Chapter 2. INSTALLATION

2.1 UNPACKING AND INSPECTION

Inspect the shipping container for damage:

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. **If the shipment is incomplete**, or there is mechanical damage, or the converter does not operate properly, notify the Comtech EF Data Customer Service representative immediately.

5. **If there is damage to the shipping container**, notify the carrier, and retain all shipping materials for inspection by the carrier.

2.2 PERSONNEL

Comtech EF Data recommends that two technicians are required to perform any of the following installations.

2.3 TOOLS REQUIRED

The following tools are recommended for unit installation.

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

2.4 SINGLE-THREAD CONFIGURATION

2.4.1 MOUNTING KITS

The following mounting hardware is used to pole-mount the unit in a single-thread configuration.

Pole Mounting Hardware

AS/0600
UNIVERSAL POLE MOUNT

↓

AS/0414
UNIVERSAL POLE MOUNT

↓

AS/0415
CSAT MOUNT BRACKETS
(2 required)
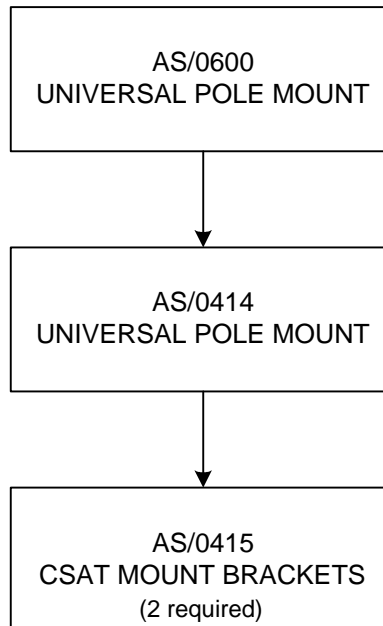
Table 2-1. Universal Pole Mount, 50 Watt, AS/0600

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

Table 2-2. Universal Pole Mount, AS/0414

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
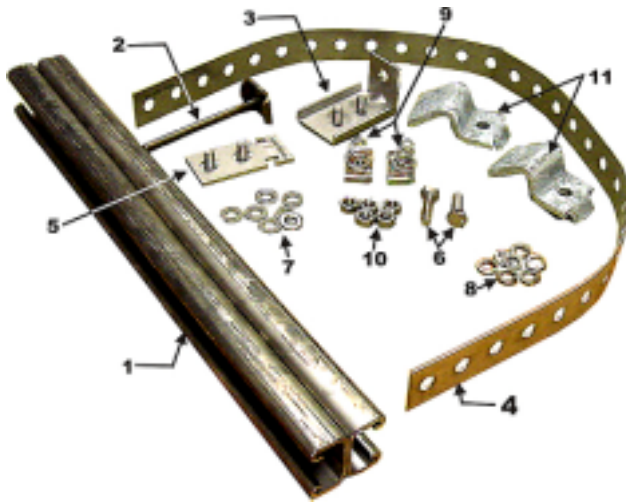
Figure 2-1 Universal Pole Mounting Kit, AS/0414

Table 2-3. CSAT Mounting Brackets, AS/0415

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
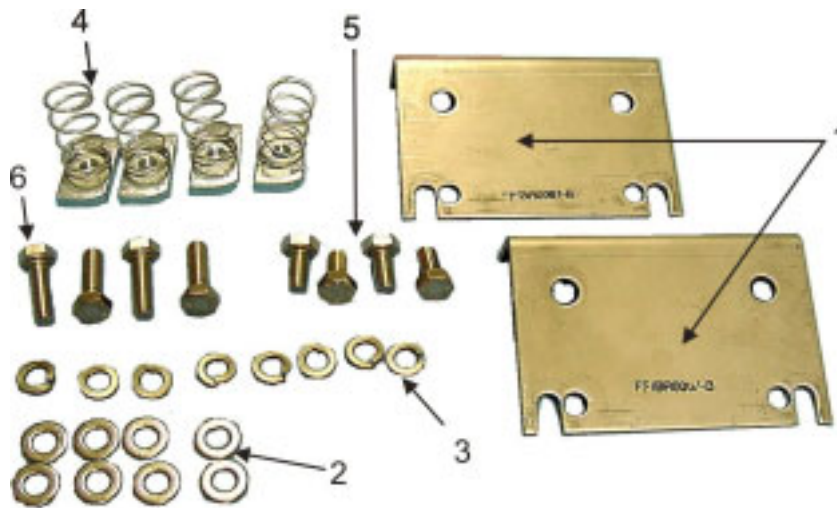
**Figure 2-2.
CSAT Mounting Brackets,
AS/0415**

2.4.2 SINGLE-THREAD INSTALLATION

Refer to Figure 2-3.
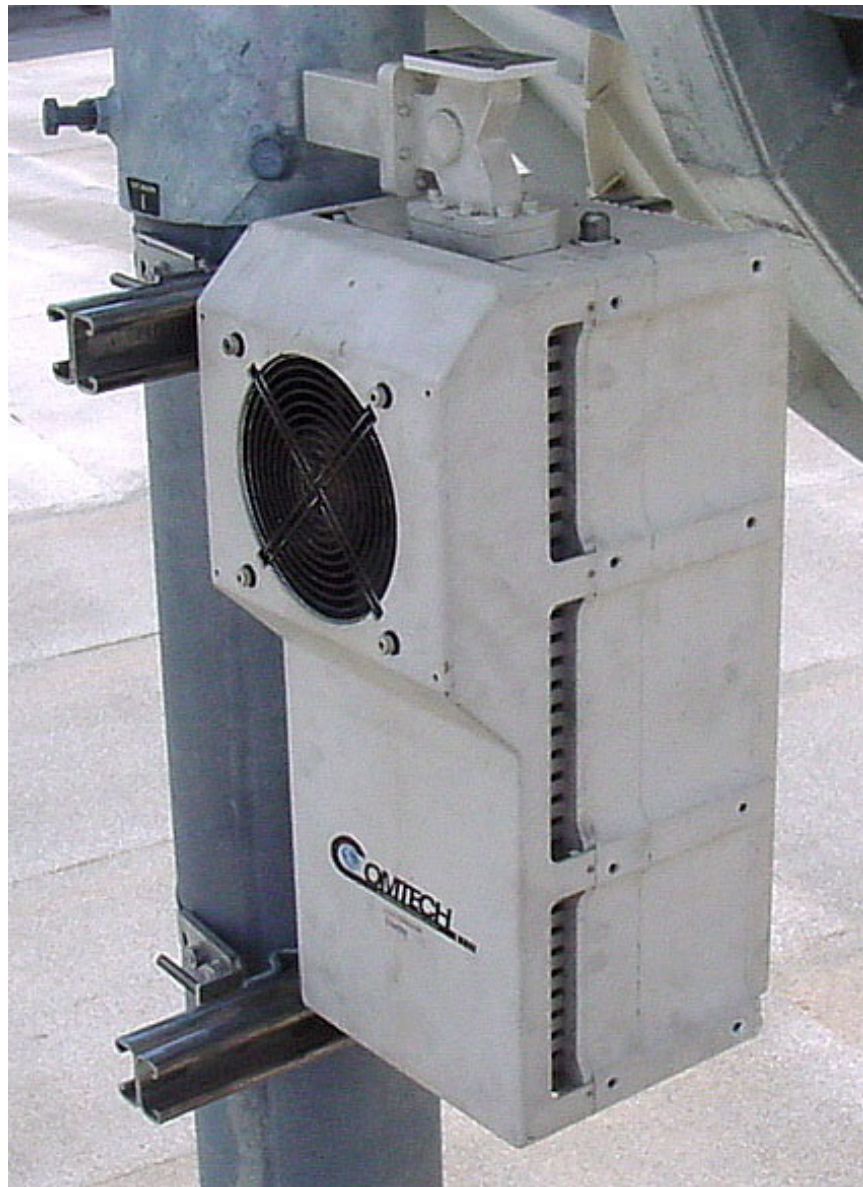
Figure 2-3. Single-Thread Configuration

1. Place Unistrut bracket (Table 2-2, Item 1) on a flat surface.

2. Refer to Figure 2-4. Slide two springnuts (Table 2-2, Item 9) into the each channel of the Unistrut bracket.

3. Fasten two pipe blocks (Table 2-2, Item 11) loosely to the springnuts using two bolts (Table 2-2, Item 6), two flat washers (Table 2-2, Item 7), and two splitlock washers (Table 2-2, Item 8).

4. Refer to Figure 2-5a. Position Unistrut bracket (Table 2-2, Item 1) with pipe blocks (Table 2-2, Item 11) against the mounting pole, slide the pipe blocks (Table 2-2, Item 11) until they contact the mounting pole.

5. Ensure the pipe blocks (Table 2-2, Item 11) are centered to the Unistrut bracket (Table 2-2, Item 1). Tighten the hardware.

Figure 2-4. Preparing the Pole Bracket

Figure 2-5a. Installing the Pole Bracket

Figure 2-5b Looking down

6. Attach bracket (Table 2-2, Item 5) to the strap (Table 2-2, Item 4) using two nuts (Table 2-2, Item 10), two flat washers, (Table 2-2, Item 7), and two splitlock washers (Table 2-2, Item 8).

7. Place the assembly against the pole with the strap around the pole and trim strap (Table 2-2, Item 4) to fit as shown in Figure 2-5a, using the tin snips.

8. Attach bracket (Table 2-2, Item 3) to the strap (Table 2-2, Item 4) using two nuts (Table 2-2, Item 10), two flat washers (Table 2-2, Item 7), and two splitlock washers (Table 2-2, Item 8).

9. Slide tensioner bracket (Table 2-2, Item 2) into channel of top Unistrut (Table 2-2, Item 1).

Figure 2-6. CSAT Single-Thread Bracket with Hardware

10. Place assembly on the pole. Slide bracket (Table 2-2, Item 3) over bracket (Table 2-2, Item 2).

11. Place flat washer (Table 2-2, Item 7) and splitlock washer (Table 2-2, Item 8), and nut (Table 2-2, Item 10) on bracket (Table 2-2, Item 2).

12. Tighten nut to secure the tension strap.

13. Slide two springnuts, (Table 2-3, Item 4, Figure 2-2) into channel of the Unistrut brackets (Table 2-2, Item 1, Figure 2-1).

14. Repeat procedure for second Unistrut bracket.

15. Install brackets (Table 2-3, Item 1, Figure 2-2) and secure to Unistrut bracket with bolts (Table 2-2, Item 6), flat washers (Table 2-3, Item 2) and split lock washers (Table 2-2, Item 4).

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 (Table 2-3, Item 5) at this time.

16. Install four bolts (Table 2-3, Item 6, figure 2-2), flat washers (Table 2-3, Item 2) and splitlock washers (Table 2-3, Item 3) on the CSAT unit.

17. Lift the CSAT unit and slide bolts (Table 2-3, Item 6) into the grooves of the brackets (Table 2-3, Item 1).

18. Ensure the washers are against the bracket.

19. Tighten the bolts.

Figure 2-7. Install CSAT 50 Watt Unit

2.4.3 LNA INSTALLATION

Refer to Figure 2-8.

The LNA is mounted to the OMT using the Waveguide Kit, CPR229, PN AS/0461.

To install a single LNA to an antenna, follow these steps:

Figure 2-8. Installation of LNA

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.

2.5 CABLE INSTALLATION

Take care during 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.

NOTE: All cables connecting to the CSAT unit connectors located on the bottom surface are customer-supplied.
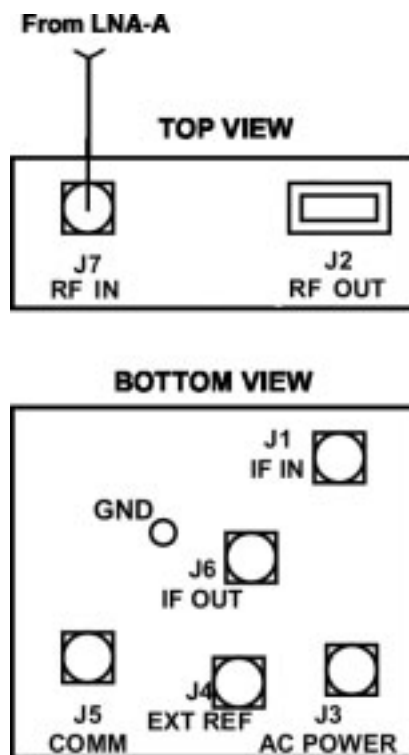
Figure 2-9. Cable Connections

2.6 REDUDANCY CONFIGURATION

2.6.1 MOUNTING KIT

```
┌─────────────────────┐
│      AS/0458        │
│  ASSY, 1:1 C-Band   │
│      50WATT         │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│      AS/0597        │
│ ASSY, 1:1 MOUNTING KIT │
└─────────────────────┘
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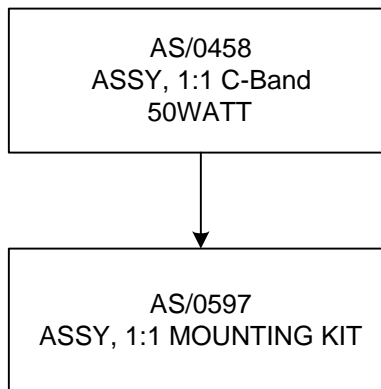
Table 2-4. Final 1:1, C-Band Assembly, AS/0458

Part No.	Description	QTY
AS/0438	Kit, LNA Mounting	1
AS/0440	Kit, Cable 1:1	1
AS/0460	Kit, Waveguide CRP137G	1
AS/0461	Kit, Waveguide CRP229	1
AS/0462	Switch, Waveguide, TX 1:1	1
AS/0490	Assy, Remote Switch Box	1

Table 2-5. 1:1 Mounting Assembly, AS/0597

Part No.	Description	QTY
*AS/0414	Redundancy Kit, Pole Mount	2
*AS/0415	Single-Thread Mounting Kit	2
AS/0437	Switch, Mount Kit TX	1

IMPORTANT *Refer to Single-Thread Configuration*.

Table 2-6. TX Switch Mounting Kit, AS/0437

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
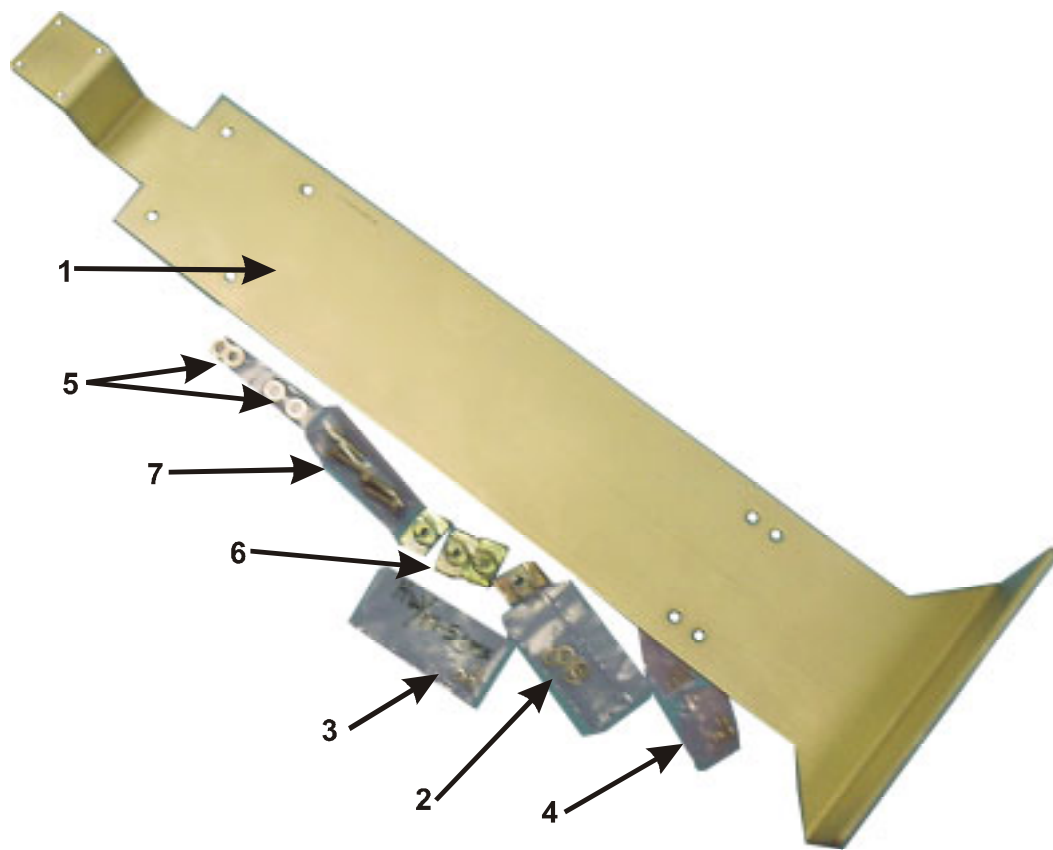
Figure 2-10. TX Switch Mounting Kit, AS/0437

Table 2-7. LNA Mounting Kit, AS/0438

Item	Part No.	Nomenclature	QTY
1	15D1002	Cover	2
2	FP/BR0076	Bracket, Switch	1
3	28P1084	Adapter	1
4	RF/TRF-CBND-WG	Filter, C-BAND	1
5	SW/WG2AGSM	Switch, CPR229 +24V, Sealed	1
6	Not Used		
7	HW/M6X1X15MMHEX	Bolt, Hexhead	36
8	HW/M6LOCK	Washer, Lock	36
9	HW/M6X1X15MMFLATSS	Screw, Flat	4
10	CN/CX50NMALE	CN – 5Ω, N Male Termination	1
11	GA/GSKTCPR229FULL	Gasket, CPR229	4
12	HW/M6FLAT	Washer, Flat	36
	AS-0502	TX/RX Filter Support Bracket	1

Figure 2-11. Mounting LNA Switch Kit, AS/0438

Table 2-8 TX/RX Filter Support Bracket AS/0502

Item	Part No.	Nomenclature	QTY
1	FP/BR0085	Bracket, Support, TX/RX Filter	1
2	M6 Lockwasher	M6 Lockwasher	12*
3	HW/M6X1X25MM	Bolt, Hexhead	12*
4	M6 Flatwasher	M6 Flatwasher	12*

* Note: Quantity may vary
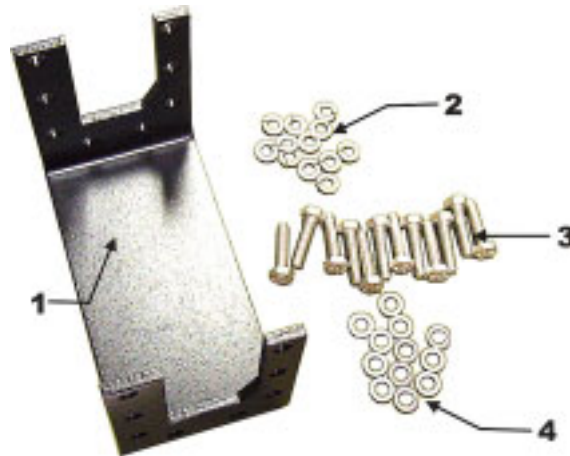
Figure 2-12 TX/RX Filter Support Bracket AS/0502

Table 2-9. Cable Kit, AS/0440

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-2-13. Cable Kit, AS/0440

Table 2-10.   Waveguide Kit, CPR137G, AS/0460

Item No.	Part No.	Nomenclature	QTY
1	HW/M5X.08X30MMHEX	Bolt, M5X.08X30MM Hexhead SS	12
2	GA/GSKTCP137HLF	Gasket, CP137, Half Thick	1
3	HW/M5X.08HEXNUT	Nut, Hex M5 x .08 SS	12
4	HW/M5LOCK	Lockwasher, M5 SS, Metric	12
5	GA/GSKTCP137FUL	Gasket, CP137, Full Thick	1
6	HW/M5FLAT	Washer, M5 Flat	24
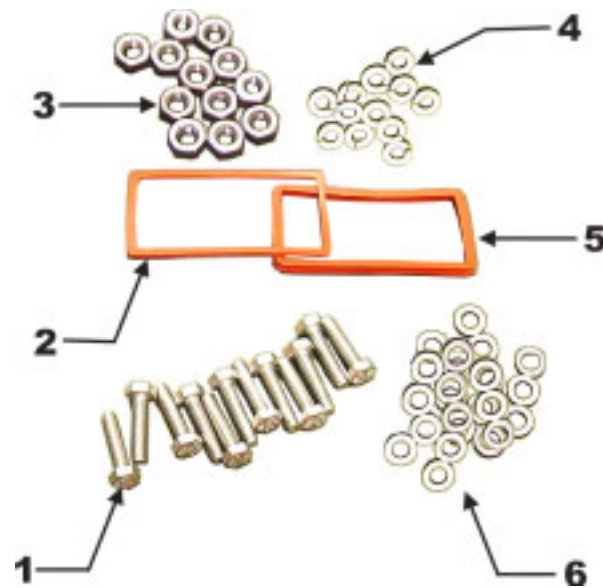
Figure 2-14. Waveguide Kit, CPR137G, AS/0460
(for mounting customer supplied unit to Transmit Switch Assembly)

Table 2-11. Waveguide Kit, CPR229, AS/0461

Item	Part No.	Nomenclature	QTY
1	HW/M6X1X30MMHEX	Bolt, Hexhead M6	12
2	GA/GSKTCPR229HALF	Gasket, CPR229, Half-Thick	1
3	HW/M6X1HEXNUT	Nut, Hex M6	12
4	HW/M6LOCK	Washer, Lock M6	12
5	GA/GSKTCPR229FULL	Gasket, CPR229, Full-Thick	1
6	HW/M6FLAT	Washer, M6 Flat	24
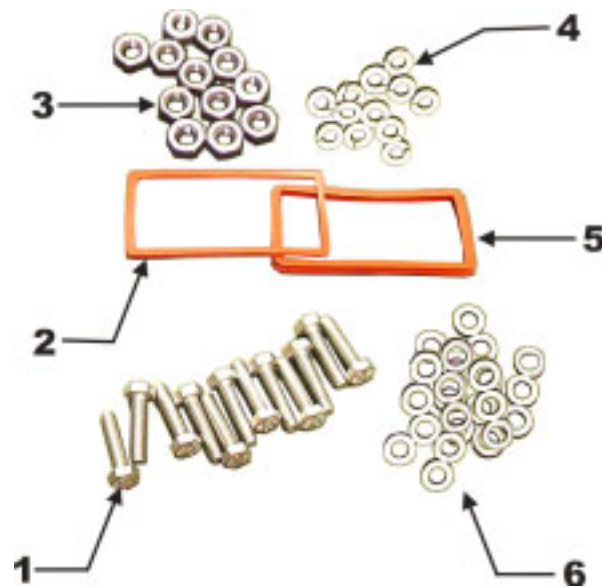
Figure 2-15. Waveguide Kit, CPR229, AS/0461
(for mounting customer supplied unit to LNA assembly)

Table 2-12. Waveguide Switch, TX 1:1, AS/0462

Item No.	Part No.	Nomenclature	QTY
1	FP/WG0034	Waveguide Termination, Small Fins	1
2	FP/WG0043	Waveguide CPRG137, 90° "E" 5.50 Flex x 2.00	2
3	GA/GSKTCP137FUL	Gasket, CP137, Full Thick	3
4	HW/M5FLAT	Washer, M5 Flat	28
5	HW/M5LOCK	Lockwasher, M5 SS, Metric	28
6	HW/M5X.08X12MMHEX	Bolt, M5X.08X12MM Hexhead SS	28
7	SW/WG3AGSM	Switch, CPR137G, +24V, Sealed Metric	1
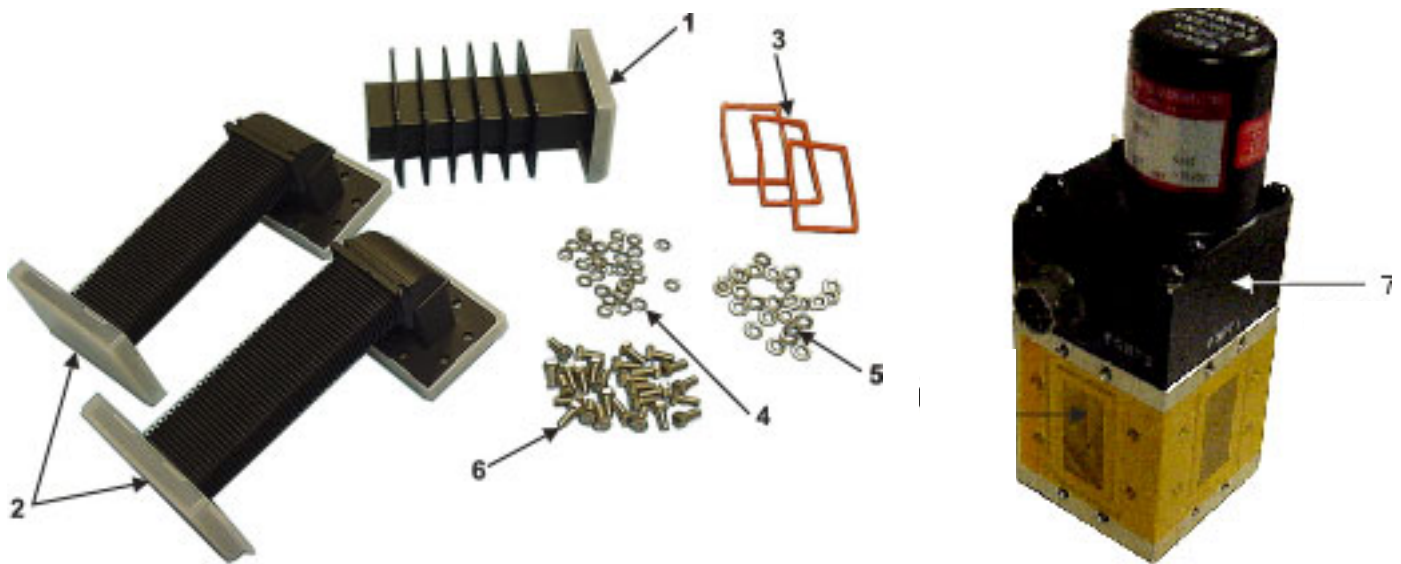
Figure 2-16. Waveguide Switch, TX 1:1, AS/0462

Table 2-13. Remote Switch Box Assembly, AS/0490

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

Figure-2-17. Remote Switch Box Assembly, AS/0490

2.6.2 REDUNDANCY INSTALLATION
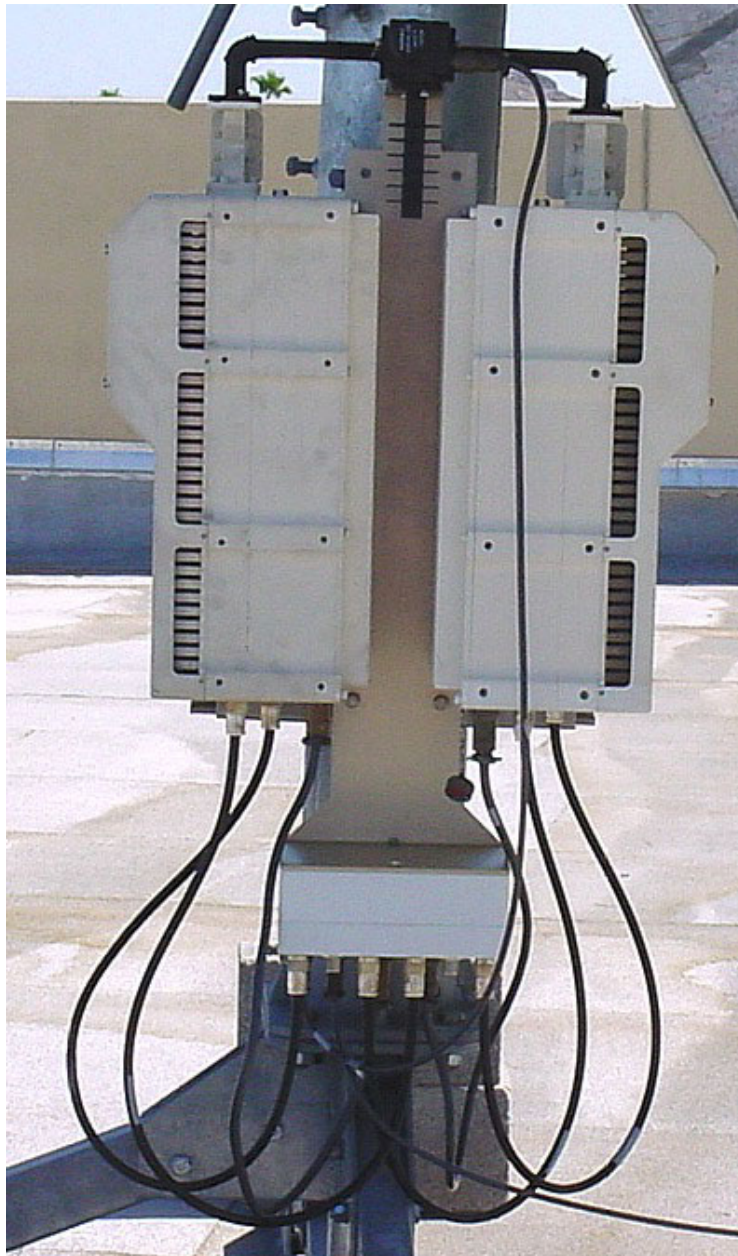
Figure 2-18. Redundant Configuration

ASSEMBLE WAVEGUIDE SWITCH, AS/0462

1. Refer to Table 2-12, Figure 2-16 and Figure 2-19.

2. Remove all protective tape from switch and keep it clean.

3. Install waveguide termination (Table 2-12, Item 1) and gasket (Table 2-12, Item 3) to Port 3 of switch (Table 2-12, Item 7) and secure with bolts (Table 2-12, Item 6), lockwashers (Table 2-12, Item 5), and flat washer (Table 2-12, Item 4).
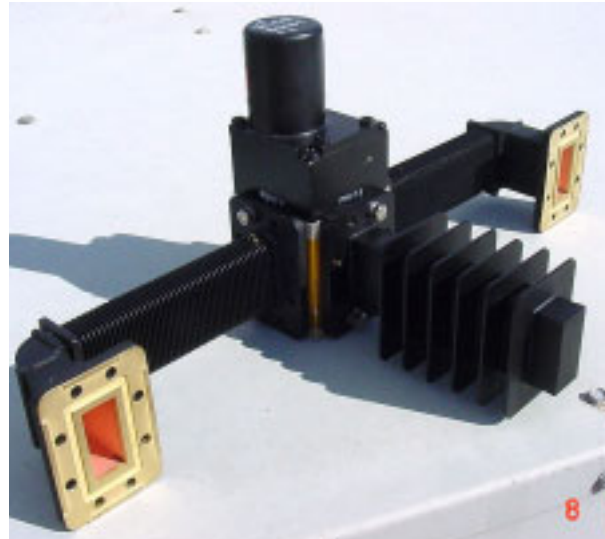
Figure 2-19. Assemble Waveguide Switch, AS/0462

4. Install waveguides (Table 2-12, Item 2) and gaskets (Table 2-12, Item 3) to Ports 2 and 4 of switch (Table 2-12, Item 7) and secure with bolts (Table 2-12, Item 6), lockwashers (Table 2-12, Item 5), and flat washers (Table 2-12, Item 4).

5. Finished assembly should look identical to Fig 2-19

6. Set waveguide switch assembly aside for later installation.

2.6.2.2 ASSEMBLE LNA SWITCH KIT, AS/0438

1. Refer to Table 2-7,
   Figures 2-11, 2-12, 2-20 and
   2-21.

2. Remove all protective tape
   from switch and keep it clean.
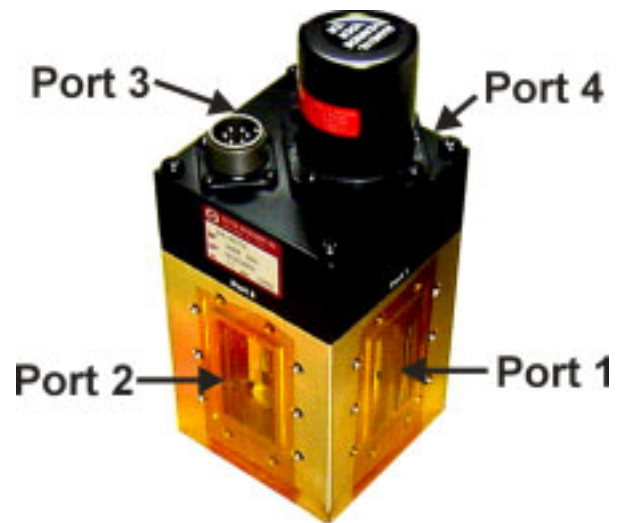
Figure 2-20. Switch Port Locations

3. Position Low Noise Amplifiers (LNAs) and gasket (Table 2-7, Item 11) on
   Port 2 and Port 4 of switch (Table 2-7, Item 5).
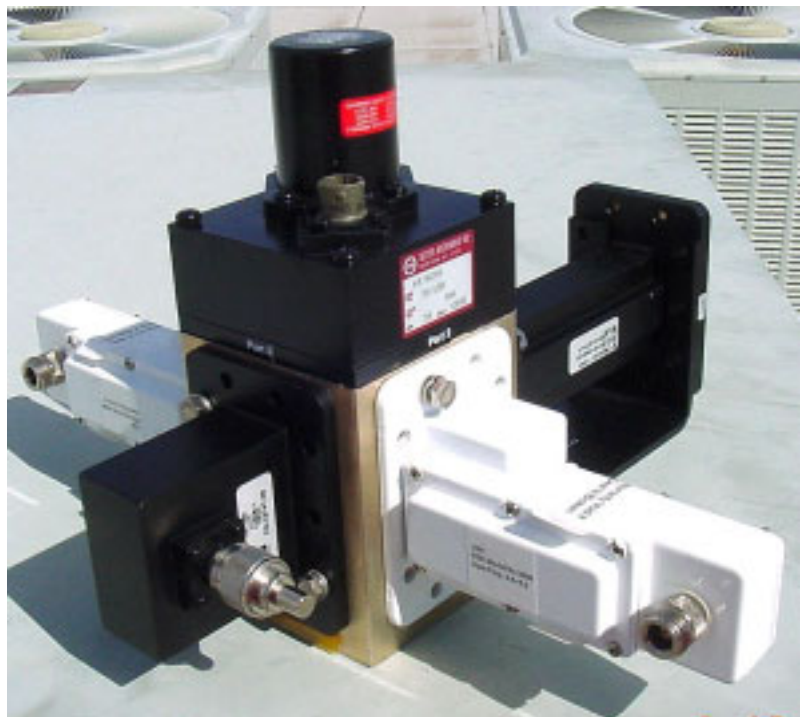
Figure 2-21. LNA Switch Kit, AS/0438

4. Secure each LNA with 8 bolts (Table 2-7, Item 7), lock washers (Table 2-7, Item 8) and flat washers (Table 2-7, Item 12). (See Figure 2-21.)

5. Position adapter (Table 2-7, Item 3) and gasket (Table 2-7, Item 11) on Port 3 and secure with 10 bolts (Table 2-7, Item 7), lock washers (Table 2-7, Item 8), and flat washers (Table 2-7, Item 12).

6. Place termination (Table 2-7, Item 10) on threaded part of Adapter (Table 2-7, Item 3)

IMPORTANT *Ensure that the OUTPUT flange of the filter is against switch (5).*

7. Position filter (Table 2-7, Item 4), gasket (Table 2-7, Item 11), and Support Bracket (Table 2-8, Figure 2-12, AS/0502) on Port 4 of switch (Table 2-7, Item 5) and secure with 8 bolts (Table 2-8, Item 3), lockwashers (Table 2-8, Item 2), and flat washers (Table 2-8, Item 1) from AS/0502 kit, and use 2 bolts (Table 2-7, Item 7, Figure 2-11), lockwashers (Table 2-7, Item 8), and flat washers (Table 2-7, Item 12) from AS/438 kit.

8. Set assembly aside for later installation.

2.6.2.3 ASSEMBLE REDUNDANT CONFIGURATION

1. Place Unistrut bracket
   (Table 2-2, Item 1,
   Figure 2-1) on a flat
   surface.

2. Slide two springnuts
   (Table 2-2, Item 9) into
   the channel of the
   Unistrut bracket.

Figure 2-22. Preparing the Pole Bracket

3. Fasten two pipe blocks (Table 2-2, Item 11) loosely to the springnuts using
   two bolts (Table 2-2, Item 6), two flat washers (Table 2-2, Item 7), and two
   splitlock washer (Table 2-2, Item 8).

4. Repeat procedure for second Unistrut bracket (Table 2-2, Item 1)

5. Refer to Figure 2-
   24. Position
   Unistrut bracket
   (Table 2-2, Item 1)
   with pipe blocks
   (Table 2-2, Item 11)
   against the
   mounting pole, slide
   the pipe blocks
   (Table 2-2, Item 11)
   until they contact
   the mounting pole.

Figure 2-23. Pipe Blocks

6. Ensure the pipe blocks (Table
   2-2, Item 11) are centered to
   the Unistrut brackets (Table 2-
   2, Item 1).

7. Tighten the hardware.

8. Attach bracket (Table 2-2,
   Item 5, Figure 2-1) to the strap
   (Table 2-2, Item 4) using two
   nuts (Table 2-2, Item 10), two
   flat washers, (Table 2-2, Item
   7), and two splitlock washers
   (Table 2-2, Item 8).

Figure 2-24. Looking down at Pipe Blocks

9. Place the assembly against the pole with the strap around the pole and trim the
   strap (Table 2-2, Item 4) to fit as shown in Figure 2-23, using the tin snips.

10. Attach bracket (Table 2-2, Item 3, Figure 2-1) to the strap (Table 2-2, Item 4)
    using two nuts (Table 2-2, Item 10), two flat washers (Table 2-2, Item 7), and
    two splitlock washers (Table 2-2, Item 8).

11. Slide tensioner bracket (Table 2-2, Item 2) into channel of the top Unistrut
    bracket (Table 2-2, Item 1).

12. Place assembly on the pole.

13. Slide bracket (Table 2-2, Item 3) over bracket (Table 2-2, Item 2).

14. Place flat washer (Table 2-2, Item 7) and splitlock washer (Table 2-2, Item 8), and nut (Table 2-2, Item 10) on bracket (Table 2-2, Item 2).

15. Tighten nut to secure the tension strap.

16. Slide eight springnuts into channel of the Unistrut bracket (Table 2-2, Item 1, Figure 2-1).

17. Repeat procedure for second Unistrut bracket (Table 2-2, Item 1).

18. Install bracket (Table 2-3, Item 1, Figure 2-10) and secure to Unistruts with four bolts (Table 2-3, Item 7) and flat washers (Table 2-3, Item 2).

19. Ensure that the bracket is centered on the Unistruts.

20. Tighten hardware.

IMPORTANT *When installed, ensure the CSAT 50 Watt unit fan is facing outward*

21. Install brackets (Table 2-3, Item 1, Figure 2-2) and secure to Unistrut brackets with four bolts (Table 2-3, Item 6), flat washers (Table 2-3, Item 2) and split lock washers (Table 2-3, Item 3). Refer to Figure 2-6 for proper orientation.

22. See photo to the right. Position brackets (Table 2-3, Item 1) against center bracket. Do not tighten hardware at this time.

23. Install four bolts (Table 2-3, Item 5 , Figure 2-2) with split washers (Table 2-3, Item 3) , and flat washers (Table 2-3, Item 2) into provided mounting holes in the CSAT 50 Watt casting.

24. Carefully lift the unit, and slide the bolt head into the groove of bracket (Figure 2-6).

25. Ensure the washers are between the unit and the bracket.

26. Do not tighten hardware at this time.

27. Temporarily install the assembled waveguide switch (See Figures 2-19 and 2-25 for location and orientation).

28. Ensure that the ports line-up and can be secured. If a gap is present, adjust by sliding the unit and brackets (Table 2-3, Item 1, Figure 2-2) on the Unistrut (In or Out).

29. Tighten hardware.

30. Install the assembled waveguide switch (Figure 2-19) and waveguide gaskets.

31. Secure assembly with bolts, lock washers and flat washers from hardware kits supplied with each CSAT unit (not shown, PN AS/0402-2).

Figure 2-25. Installation of the Waveguide Switch.

2.7 LNA ASSEMBLY

Figure 2-26. Installation of the Redundant LNA Assembly.

1. Refer to Table 2-11, Figures 2-15 and 2-26.

2. Remove the protective cover from the antenna OMT.

3. Install the appropriate gasket (Kit AS/0461, Figure 2-15) on the antenna end of the TRF.

4. If only one of the mounting surfaces has a groove, use the half-thick gasket (Table 2-11, Item 2).

5. If both mounting surfaces have grooves, use the full thick gasket (Table 2-11, Item 5).

6. Position the LNA switch assembly (with gasket) in place on the antenna and fasten using the supplied hardware (Table 2-11)

2.8 CABLE INSTALLATION

Refer to Figure 2-27.

Take care during 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.
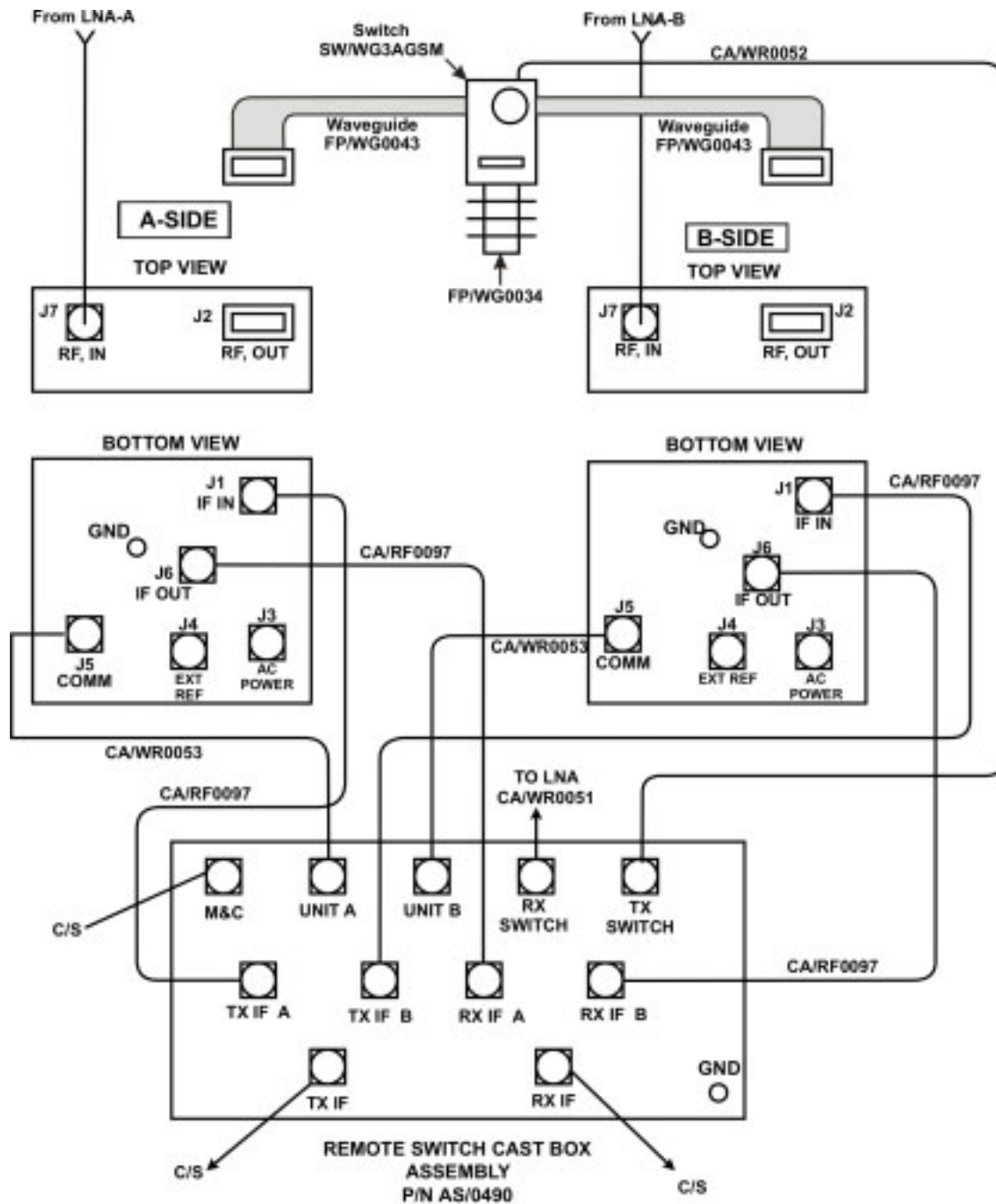
Figure 2-27. Cable Installation

Chapter 3. SYSTEM OPERATION

This section contains instructions for operating the CSAT-5060, 50 Watt C-Band Transceiver. The Primary customer interface to the CSAT is via the Remote Communications port. Appendix A provides details regarding the protocol and command/response structure used on this interface. This section 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	NEWER 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	CSAT Receive Line
B	EIA -485 –RX	Input	CSAT Receive Line Compliment
C	EIA -485 TX+	Output	CSAT Transmit Line
D	EIA -485 TX-	Output	CSAT Transmit Line Compliment
E	EIA -232 Rd	Input	CSAT Receive Line
F	REDUNDANT FAULT	Input	Redundant Controller Status Input
G	EIA -232 Td	Output	CSAT 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 CSAT

The CSAT does not contain a 'Power On/Off' switch. The CSAT 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 waveguide termination on the J2 "RF OUTPUT" port. Individuals can be exposed to dangerously high electromagnetic levels.***

In addition, when directly connecting the CSAT to Laboratory Test Equipment, a DC block should be used between the J7 'RF IN' port and RF test source. The reason for this is that the CSAT can be configured to supply a 11Vdc, 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 CSAT

The CSAT 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 CSAT.

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=
Example(s):	DFQ=3720.0 , UFQ=6137.0

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 25.00 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=
Example(s):	DAT=04.25 , UAT=11.50

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 CSAT 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=
Example(s):   DGO= -1.75, UGO=1.00

3.3.4 MUTE MODE

The CSAT 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=
Example(s):   MUT=0

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, J2) 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=
Example(s):   DMU=0 , UMU=0

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 CSAT to transmit a RF signal.

Associated Remote Command(s):   AMP=
Example(s):   AMP=1

3.3.7 CHANNEL SLOPE ADJUST MODE

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

- In Calibrated mode, the CSAT 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=
Example(s):   DSM=1, USM=1

3.3.8 CHANNEL SLOPE ADJUST

Both the Receiver IF output and the Transmitter 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=
Example(s):   DSA=0.0 , USA=0.8

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 6.5kHz and 4.0kHz at the RF and IF output ports respectively.

Associated Remote Command(s):   REF=
Example(s):   REF=087

3.3.10 EXTERNAL REFERENCE FAULT LOGIC

The CSAT 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):   XRF=
Example(s):   XRF=0

3.3.11 COLD START FUNCTION

The CSAT 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 CSAT 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 CSAT was powered ON with 'Cold Start ON', the operator can override this function by setting 'Cold Start OFF'.

Associated Remote Command(s):   CLD=
Example(s):   CLD=1

3.3.12 AUTO FAULT RECOVERY

This parameter defines how the CSAT 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 CSAT will remain muted. In this mode, operator intervention is necessary to return the CSAT to normal operating mode.

- If 'Auto Fault Recovery' is ON and the same situation occurs, the CSAT will automatically be unmuted and return to normal operating mode. To protect against repetitive, momentary faults, if the CSAT 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 CSAT 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 CSAT RF output muted.

Associated Remote Command(s):   AFR=
Example(s):   AFR=1

3.3.13 LNA CURRENT SOURCE

The CSAT has the circuitry necessary to source current, at 11 Vdc, up the 'RF IN port' J7, 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 waveguide termination on the J2 "RF OUTPUT" port. Individuals can be exposed to dangerously high electromagnetic levels.

IMPORTANT

Exercise care when directly connecting the CSAT to Laboratory Test Equipment. A DC block should be used between the J7 "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=
Example(s):   LCS=1

3.3.14 LNA CURRENT CALIBRATION AND CURRENT WINDOW

The CSAT 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=
Example(s):   CAL= , LCW=40

3.3.15 LNA FAULT LOGIC

The CSAT 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=
Example(s):   LFL=0

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 CSAT. 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 CSATs 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=
Example(s):   RAM=1

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=
Example(s):   RTG=

3.3.18 SET PHYSICAL ADDRESS

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

Associated Remote Command(s):   SPA=
Example(s):   SPA=0001

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=
Example(s):   SBR=9600

3.3.20 SET DATE

The CSAT 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=
Example(s):   DAY=042900

3.3.21 SET TIME

The CSAT 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=
Example(s):   TIM=231259

Appendix A. REMOTE CONTROL

A.1 INTRODUCTION

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

The electrical interface is either an EIA-485 multi-drop bus (for the control of many devices) or an EIA-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.

A.1.1 EIA-485

The EIA-485 interface is provided at the 19-pin circular J5 connector. The interface is a 4-wire EIA-485 interface using the pin out shown in the table below. 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 EIA-485 driver is only active during transmission and is tri-stated when not is use.

Table A-1.   EIA-485 Interface

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

A.1.2 EIA-232

The EIA-232 interface is provided at the 19-pin circular J5 connector. The interface provides the five signals shown in the table below. The CSAT only requires three wires (TD, RD and Ground), the other two signal are provided for

terminal equipment that requires RTS/CTS handshaking. The CSAT simply ties
these two signals together.

Table A-2.   EIA-232 interface

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

A.2 BASIC PROTOCOL

Whether in EIA-232 or EIA-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.

A.2.1 PACKET STRUCTURE

Table A-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 A-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}

A.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.

A.2.1.2 ADDRESS

Up to 9999 devices can be uniquely addressed. In EIA-232 and EIA-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 is own address.

A.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).

A.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 CSAT 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.

A.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).

A.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.

A.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= 5901.0	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=3652.5	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)
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)

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 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)
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 CSAT 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)

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)
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)
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 ± % 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 ± 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)
CSAT 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=5901.012.75000.3-0.0013652.5 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.ggNRCXOOOLWWDeeeeee e (same format as command arguments)
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 CSAT 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

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)
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
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

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)

List New Alarms (Retrieve next 5 unread Stored Alarms)	N/A	145 bytes	Query only
			CSAT 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 CSAT will reply with LNA*. Note: the CSAT incorporates a circular buffer capable of holding 100 events/alarms.
				N/A	LNA?	LNA=YY..ss
						(see description for details of arguments)

Total New Alarms (Retrieve Number of unread Stored Alarms)	N/A	2 bytes, numerical	Query only. CSAT 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. CSAT returns a string indicated the Model Number and the value of internal software revision installed Example: RET=CSAT-5060/050 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 CSAT
			Example: RCS='cr'
			    UFQ=5845.0'cr'
			    DFQ=3625.0'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 CSAT
			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 CSAT
			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)

Retrieve Redundancy Status	N/A	37 bytes, alpha numerical	Query only.
			Used to Query the utility status of the CSAT
			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)

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 Maintenance Status	N/A	175 bytes, alpha numerical	Query only.
			Used to Query the maintenance status of the CSAT
			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)

Retrieve Alarm Status	N/A	171 bytes, text	Query only.
			Used to Query the Alarm status of the CSAT
			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 CSAT 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 CSAT 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)
Concise Utility Status	N/A	10 bytes, alpha numerical	Query only. Used to Query the Utility status of the CSAT 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)

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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 Maintenance Status	N/A	80 bytes, numerical	Query only. Used to Query the Maintenance status of the CSAT 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 CSAT
			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 CSAT Summary Fault Relay. Example: SFS=0'cr''lf' where: 0 = OK 1 = FT	N/A	SFS?	SFS=*x* (see description for details of arguments)

NOTES:

Appendix B. REDUNDANT SYSTEMS

The CSAT-5060, 50 Watt C-Band Transceiver is capable of operating in both stand-alone and redundant configurations. The CSAT 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 CSAT system. This provides the user with transparent functionality regardless of the mode or complexity the system has been setup to operate in.

B.1 REDUNDANT SYSTEM

Figure B-1 provides a block diagram for a typical CSAT redundant system.
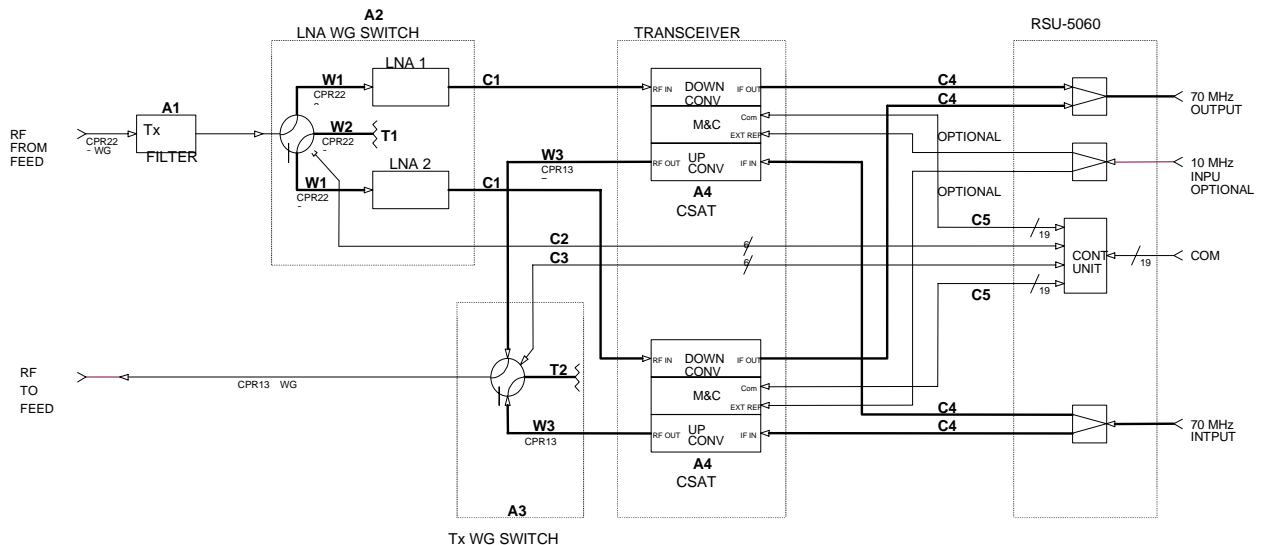
Figure B-1. Typical CSAT Redundant System

B.1.1 RSU-5060 INTERFACES

B.1.1.1 ELECTRICAL INTERFACE

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

Table B-1.   RSU-5060 Interface Connectors

Connector	Function	Connector Type
J1	CSAT Unit A interface	MS3112E14-19S
J2	Rx Waveguide Switch interface	MS3112E10-6S
J3	CSAT 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 CSAT A	Type N, Female
J8	Tx IF Output to CSAT B	Type N, Female
J9	Rx IF Output to Customer Equipment	Type N, Female
J10	Rx IF Input from CSAT A	Type N, Female
J11	Rx IF Input from CSAT B	Type N, Female

B.1.1.2 CSAT 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 CSAT Unit A and the RSU-5060.

Table B-2 . CSAT A Signal Description (Connector J1)

Pin	Signal Name	Type	Description
A	RS485 RX+	Pass-thru	RS-485 Rx+, From M&C to CSAT Unit A
B	RS485 RX-	Pass-thru	RS-485 Rx-, From M&C to CSAT Unit A
C	RS485 TX+	Pass-thru	RS-485 Tx+, To M&C from CSAT Unit A
D	RS485 TX-	Pass-thru	RS-485 Tx-, To M&C from CSAT Unit A
E	n.c.		
F	REDUND_FLT*	Output	Fault Signal to CSAT A from RSU-5060
G	n.c.		
H	AUXCOM_RD	Output	RS2332 from RSU-5060 to CSAT A
J	AUXCOM_TD	Input	RS232 from CSAT A to RSU-5060
K	FAULT COMMON	Output	
L	CSAT 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 CSAT A
T	GROUND	Passive	
U	GROUND	Passive	
V	n.c.		

B.1.1.3 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 B-3 . 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

B.1.1.4 CSAT 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 CSAT Unit B and the RSU-5060.

Table B-4.   CSAT B Signal Description (Connector J3)

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

B.1.1.5 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 B-5. 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

B.1.1.6 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 B-6. M&C Signal Description (Connector J5)

Pin	Signal Name	Type	Description
A	RS485 RX+	Pass-thru	RS-485 Rx+, From M&C to CSAT A&B
B	RS485 RX-	Pass-thru	RS-485 Rx-, From M&C to CSAT A&B
C	RS485 TX+	Pass-thru	RS-485 Tx+, To M&C from CSAT A&B
D	RS485 TX-	Pass-thru	RS-485 Tx-, To M&C from CSAT A&B
E	B ONLINE CLOSED	Output	Shorted to pin K = CSAT 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 = CSAT A Faulted
M	B FAULT OPEN	Output	Shorted to pin K = CSAT 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 = CSAT A Online
T	GROUND	Passive	
U	GROUND	Passive	
V	SWITCH CMD	Input	Momentary short to GND, otherwise OPEN

B.1.1.7 Tx IF Interfaces, J6, J7, and J8

The Tx IF input signal is fed from the customers equipment to the RSU-5060 at connector J6. The RSU-5060 contains a power splitter which feeds the IF input signal to both CSAT A and CSAT 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.

B.1.1.8 Rx IF Interfaces, J9 – J11

The Rx IF output signal is fed to the customers equipment from the RSU-5060 at connector J9. The RSU-5060 contains a power combiner which takes the IF input signals from both CSAT A and CSAT 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.

B.1.2 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 Chapter 1

B.2 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 CSAT's. The RSU-5060 is a 'smart box,' the unit contains a microcontroller running algorithms to process status and command information from the two CSAT's and control the Tx and Rx waveguide switches accordingly. A functional block diagram of the RSU-5060 is shown in Figure B-2.
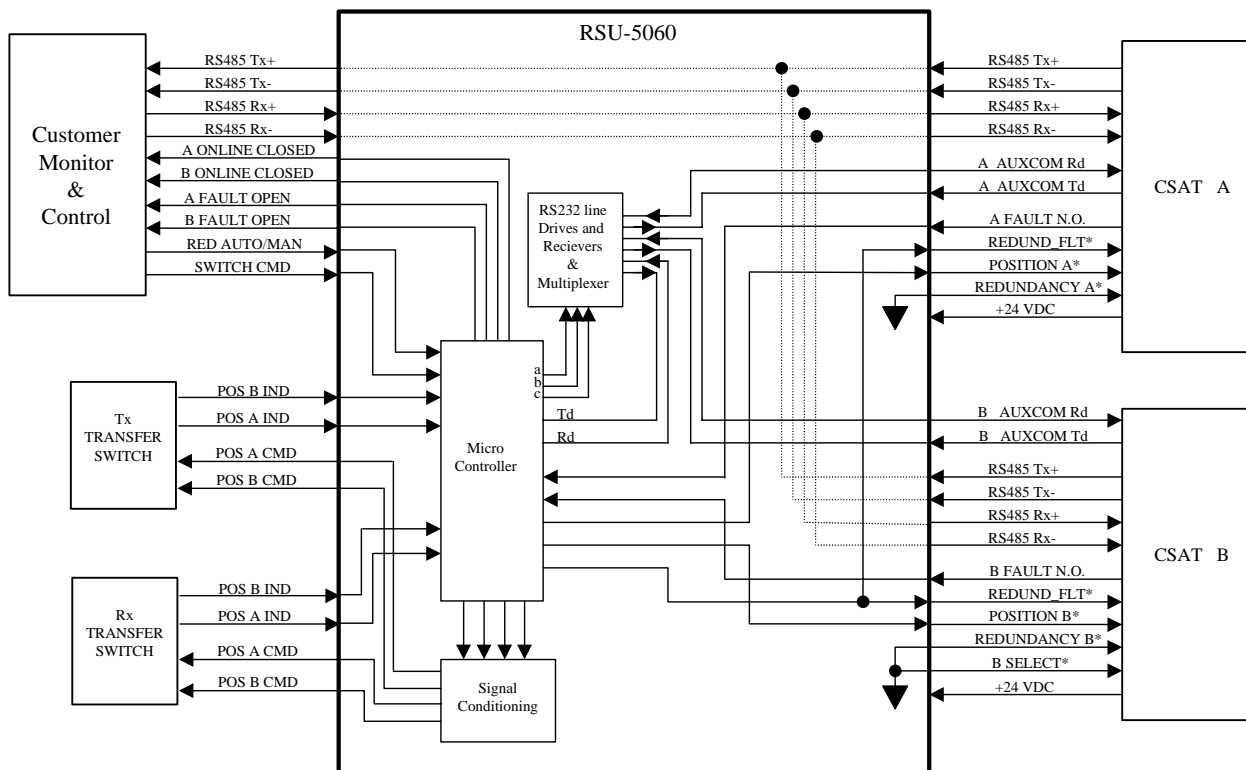
Figure B-2 RSU-5060 Functional Block Diagram

B.2.1 EIA-485 INTERFACE

The RSU-5060 provides a single point interface for the Customers M&C system by pig tailing the 4-wire EIA-485 input to J5 and passing it out on both the J1 and J3 interface connectors. When using the EIA-485, 4-wire interface to talk to the individual CSAT's are addressed at subsequent addresses through the use of the 'B SELECT *' signal going to CSAT 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 CSAT's to addresses 0064 and 0065 send the following command:
>   <0000/SPA=0064'cr'

B.2.2 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 CSAT A and CSAT 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.

B.2.3 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.

B.2.4 REDUNDANCY A/B SIGNALS

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

B.2.5 REDUND_FLT SIGNAL

Pin F on both J1 and J3 connectors are output signals from the RSU-5060 to the CSAT's to provide status indication to the CSAT'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 CSAT 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.

B.2.6 AUXCOM SIGNALS

Pins H and J on both the J1 and J3 connectors are the EIA-232 RD and EIA-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 CSAT J5 connector (pin E and F). The AUXCOM interface is used by the ONLINE CSAT to ascertain information from the OFFLINE CSAT as well as the RSU-5060.

B.3 CONFIGURING A REDUNDANT SYSTEM

Comtech EF Data's Redundant CSAT 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 CSAT's and always keep the unfaulted CSAT ONLINE.

- Second, configuration commands sent to the ONLINE CSAT via the EIA-485 interface are automatically passed along to the OFFLINE CSAT 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 CSAT and the OFFLINE CSAT 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 CSAT 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:

Appendix C.   MAINTENANCE AND TROUBLESHOOTING

This appendix 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 C-1.

CSAT–5060/050
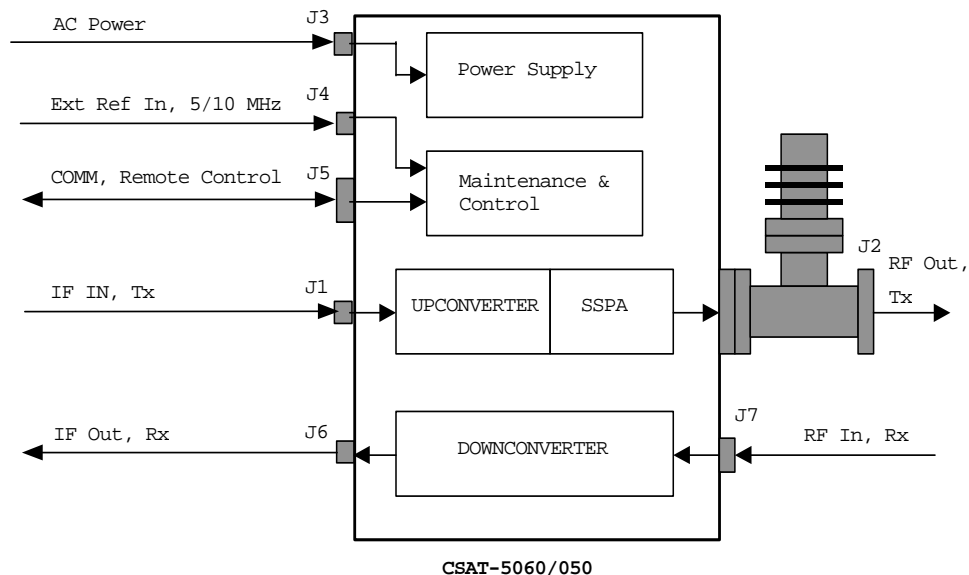
Figure C-1. Converter Signal and Interconnecting Cable Diagram

C.1 MAINTENANCE TESTING

Use the instructions in Chapter 2 for installing the transceiver for checkout, and the procedures in Chapter 3, for operating the transceiver.

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 5845 to 6425 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 50 Watt SSPA to the desired output.

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). The signal is then amplified to the desired output level.

C.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 Appendix A (see the Retrieve Alarm Status commands).

C.3 CONVERTER FAULTS

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

C.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.

C.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 .

C.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.

C.3.4 LNA CURRENT FAULT

LNA Current Fault:

This can indicate either a problem in the CSAT 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 11Vdc shall be measured if the LNA Current Source is Enable (i.e. LCS=1).
- Contact Comtech EF Data Customer Support for further troubleshooting.

C.3.5 FAN FAULT

Fan Fault:

Contact Comtech EF Data Customer Support for troubleshooting help.

C.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.

C.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.

C.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

Appendix D. THEORY OF OPERATION

This appendix contains a general description of the theory of operation for the CSAT downconveter and upconverter sections. The CSAT can be used for SCPS/MCPC, DAMA, and TDMA, as well as for full transponder HDTV and analog TV, applications.

The description is for the standard 50W transceiver. 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 3400 to 4200 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 5845 to 6425 MHz with a temperature compensated gain of 74 dB. The RF output level is +47 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 EIA-232 or EIA-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.

D.1 RF SIGNAL CONVERSION

D.1.1 DOWNCONVERTER

The RF input to the downconverter is in the 3400 to 4200 MHz frequency range at a typical level of -45 dBm. The input signal is mixed down to the 1110 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 1110 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 1110 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.
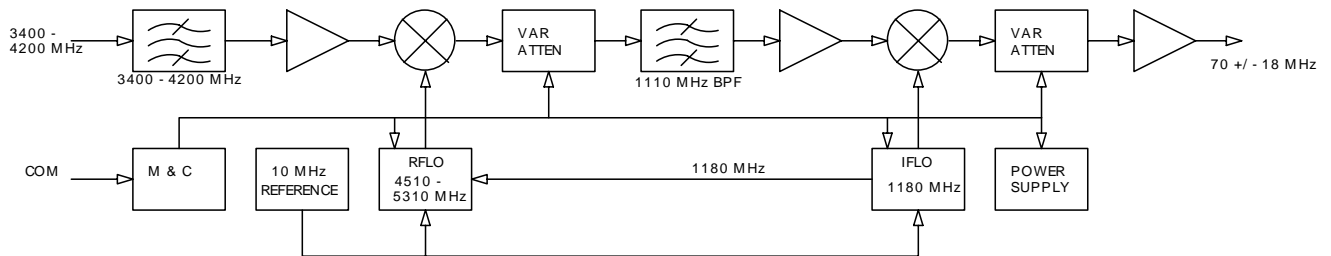
Figure D-1 Functional block diagram of the downconverter section

D.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 1250 MHz IF in the first conversion mixer operating at a fixed frequency with low side LO injection at 1180 MHz provided by the upconverter IFLO. IF filtering is provided by the 1250 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 1250 MHz IF signal to the desired output frequency. It uses low side LO injection in the 4595 to 5175 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.
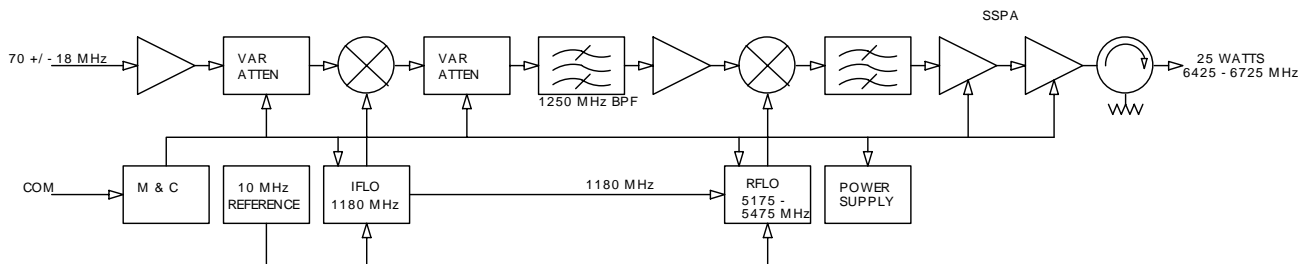
Figure D-2 Functional block diagram of the upconverter section

D.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 EIA-232 or EIA-485 connections in the circular COM connector either by remote computer interface or by local operator inputs through the external hand held control unit.

Appendix E. External Amplifier Communication (+10 dBm Transceiver Only)

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

E.1 Overview

The +10 dBm CSAT 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 CSAT 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 CSAT.

E.2 External Amplifier Communication

The J8 connector allows a single cable interface between the CSAT 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 CSAT's standard M and C connection. This allows the customers M&C to transmit and receive commands from the external HPA.

If the CSAT 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 CSAT 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
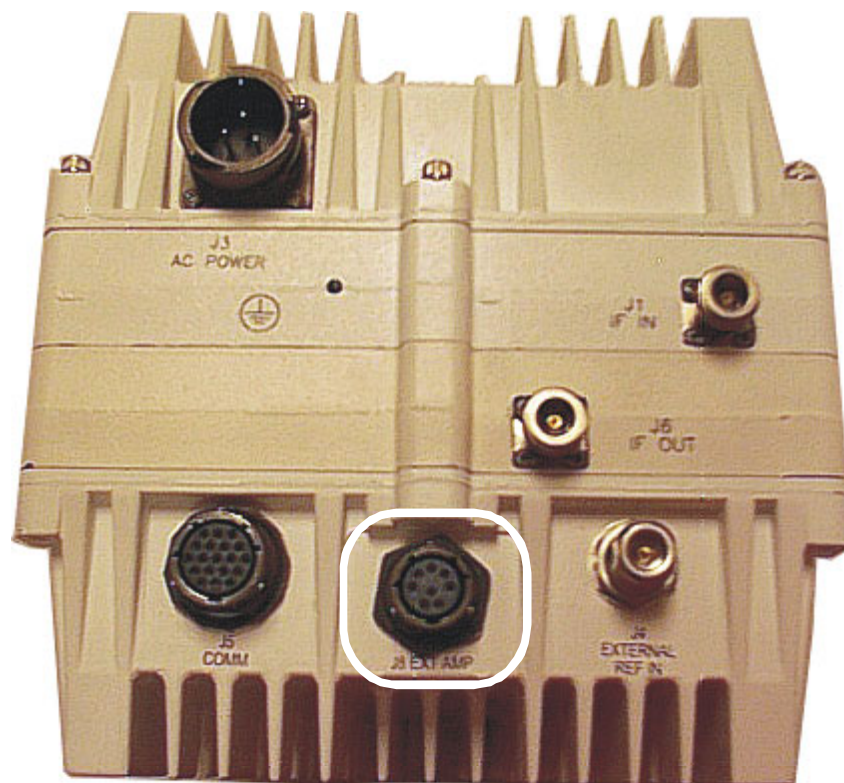
Figure B-1. J8 Connector for External Amplifier Communication

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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	—

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