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HPOD

C, X, Ku-Band High Power Outdoor Amplifier
Installation and Operation Manual

Part Number MN/HPOD.IOM
Revision 9
December 19, 2022

IMPORTANT NOTE: The information contained in this document supersedes all previously published information regarding this product. Product specifications are subject to change without prior notice.

Revision History

Rev	Date	Description
1	---	Initial Release.
2-8	-	Various updates. Refer to PLM for details.
9	11/8/2022	• Updated logo • Editorial & formatting

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Units of Measurement

Unit / Symbol	Definition
Ω	Ohm
A	Ampere
AC	Alternating Current
bps	bits per second
˚C	Celsius (degrees)
DC	Direct Current
Hz	Hertz
kHz	kiloHertz
dB	decibel
dBc	Decibels relative t the carrier
dBm	Decibel-milliwatts
˚F	Fahrenheit (degrees)
Kbps	Kilobit per second
kg	kilogram
ksps	Kilosymbols per second
lbs.	pounds
mA	Milli-amp
Mbps	Megabit per second
MHz	Megahertz
mm	millimeter
ms	millisecond
Msps	Megasymbols per second
mW	milliwatt
in.	inch
Pps	Packets per second
ųF	100 micro-farads
W	Watt
V	Volt

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PREFACE

About this Manual

This manual provides installation and operation information for the Comtech Satellite Network Technologies, Inc. (Comtech) HPOD family of High-Power Outdoor Amplifiers. This document is intended for anyone who installs or operates the HPOD C-Band, X-Band, and Ku-Band units.

Disclaimer

Comtech has reviewed this manual thoroughly in order to provide an easy-to-use guide to this 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 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 there are any questions regarding this equipment, or the content and design of this manual, please contact the Comtech Product Support.

Conventions and References

Patents and Trademarks

See all of Comtech's Patents and Patents Pending at http://patents.comtechefdata.com.

Comtech acknowledges that all trademarks are the property of the trademark owners.

Warnings, Cautions, and Notes

A WARNING informs you about a possible hazard that MAY CAUSE DEATH or SERIOUS INJURY.

A CAUTION informs you about a possible hazard that MAY CAUSE INJURY or PROPERTY DAMAGE.

A <u>NOTE</u> gives you important information about a task or the equipment.

A <u>REFERENCE</u> directs you to additional information about a task or the equipment.

Examples of Multi-Hazard Notices
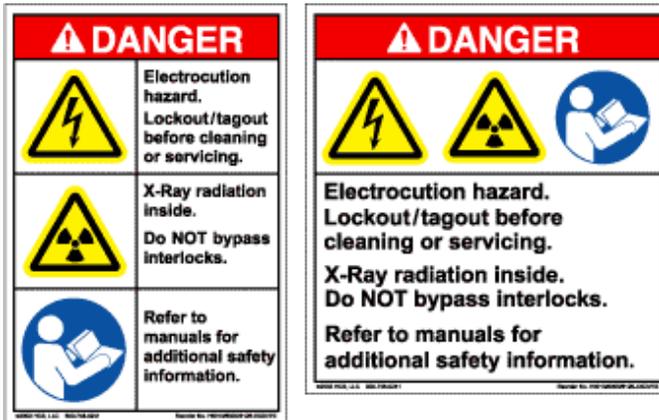
Recommended Standard Designations

The new designation of the Electronic Industries Association (EIA) supersedes the Recommended Standard (RS) designations. References to the old designations may be shown when depicting actual text (e.g., RS-232). All other references in the manual refer to EIA designations.

Electrical Safety Notice

⚠️ *CAUTION – Neutral Fusing – Double pole/neutral fusing is used on the prime power supply input.*

This equipment has been designed to minimize exposure of personnel to hazards. For further information, contact Comtech Customer Support Department. 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.

Installation Guidelines Regarding Power Line Quality

ⓘ *Comtech has become familiar with the varying quality of the AC power grid around the world. Observing the following installation guidelines should help ensure a reliable installation.*

- **Grounding:** The HPOD provides a grounding terminal to allow you to ground the HPOD to the antenna's grounding network. All components installed at the antenna should be grounded to a common grounding point at the antenna.

- **Surge suppression:** High voltage surges can cause failure of the power supply. The cause of such surges typically includes circuit switching on the main AC power grid, erratic generator operation, as well as lightning strikes.

  While the HPOD features built-in surge suppression, if installation is to be in a location with questionable power grid quality, Comtech recommends installation of additional power conditioning/surge suppression at the power junction box.

  Lightning strikes on or around the antenna will generate extremely high voltages on all cables connected to the HPOD. Depending on the severity of the strike, the HPOD's internal surge protection combined with the recommended external suppression may protect the HPOD's power supply. However, if installation is in an area with a high probability of lightning strikes, Comtech additionally recommends the installation of surge suppression on the RF and IF cables. One source of these suppressors is PolyPhaser (2Hwww.polyphaser.com).

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

Product Support

For all product support, please call:

+1.240.243.1880

+1.866.472.3963 (toll free USA)

Comtech Headquarters

http://www.Comtechefdata.com

Comtech Satellite Network Technologies, Inc.

2114 West 7th Street

Tempe, Arizona USA 85281

+1.480.333.2200

Warranty Policy

Comtech products are warranted against defects in material and workmanship for a specific period from the date of shipment, and this period varies by product. In most cases, the warranty period is two years. During the warranty period, Comtech will, at its option, repair or replace products that prove to be defective. Repairs are warranted for the remainder of the original warranty, or a 90-day extended warranty, whichever is longer. Contact Comtech for the warranty period specific to the product purchased.

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

All equipment returned for warranty repair must have a valid RMA number issued prior to return and be marked clearly on the return packaging. Comtech strongly recommends all equipment be returned in its original packaging.

Comtech's obligations under this warranty are limited to repair or replacement of failed parts, and the return shipment to the buyer of the repaired or replaced parts.

Limitations of Warranty

The warranty does not apply to any part of a product that has been installed, altered, repaired, or misused in any way that, in the opinion of Comtech, would affect the reliability or detracts from the performance of any part of the product, or is damaged as the result of use in a way or with equipment that had not been previously approved by Comtech.

The warranty does not apply to any product or parts thereof where the serial number or the serial number of any of its parts has been altered, defaced, or removed.

The warranty does not cover damage or loss incurred in transportation of the product. The warranty does not cover replacement or repair necessitated by loss or damage from any cause beyond the control of Comtech, such as lightning or other natural and weather-related events or wartime environments.

The warranty does not cover any labor involved in the removal and or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for repair or replacement.

The warranty excludes any responsibility by Comtech for incidental or consequential damages arising from the use of the equipment or products, or for any inability to use them either separate from or in combination with any other equipment or products.

A fixed charge established for each product will be imposed for all equipment returned for warranty repair where Comtech cannot identify the cause of the reported failure.

Exclusive Remedies

Comtech's warranty, as stated is in lieu of all other warranties, expressed, implied, or statutory, including those of merchantability and fitness for a particular purpose. The buyer shall pass on to any purchaser, lessee, or other user of Comtech's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech from any claims or liability of such purchaser, lessee, or user based upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

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

Notes:

Chapter 1. INTRODUCTION

1.1 Overview

Figure 1-1. Comtech HPOD SSPA

Comtech's High-Power Outdoor (HPOD) Solid-State Power Amplifier (SSPA) (**Figure 1-1**) delivers its rated power, guaranteed, at the 1 dB compression point, to the transmit waveguide flange. It provides a cost effective, more reliable replacement for **T**raveling **W**ave **T**ube **A**mplifiers (TWTA) in satellite communications.

1.2   Features

The HPOD SSPA base unit provides features that are typically offered as options elsewhere. Its features include temperature compensation, sample ports, power monitor, field-replaceable power factor-corrected power supply, and full remote monitor and control capabilities. Higher power is available through the use of Comtech 1:1 and 1:2 phase combining kits.

1.2.1 Solid-State Advantage

Each HPOD is constructed with highly reliable gallium arsenide (GaAs) FETs. With third order intermodulation products from 4 dB to 6 dB better than TWTA ratings, the HPOD replaces TWTAs with saturated power levels of up to twice the HPOD's rated output. The HPODs also provide a mean time between failures (MTBF) that is 4 to 5 times greater than the typical TWTA MTBF.

1.2.2 Field-Replaceable Power Supply

Recognizing that the MTBF limiting factor for almost all electronic equipment is the power supply, the HPOD provides for easy field replacement. Simply disconnect the AC mains, release the captive fasteners, and remove the supply from the SSPA module.

1.2.3 Built-in Redundancy Controller

Each HPOD has the ability to function as a 1+1 (one backup for one primary) and 1+2 (one backup for two primaries) redundancy controller in the backup mode. The optional redundancy configuration is implemented by attaching a ganged waveguide/coax transfer switch(es) to the input and output connectors of the amplifiers with a combination coaxial cable and waveguide kit. When the backup SSPA is commanded into the controller mode, it monitors the online SSPA(s) for faults. A faulted online unit may be disconnected and replaced without affecting the online power amplifier.

1.2.4 Phase Combining

Comtech's phase-combined systems allow the outputs of two amplifiers to be summed together. A "normal" 1:1 system using 300W amplifiers provides 300W of output power (the offline unit's capabilities are unusable). The same amplifiers in a 1:1 phase-combined system provide 600W of output power in normal operation, and a "soft failure" state of 300W. If no degradation on failure can be accommodated, a third amplifier can be added to form a 1:2 phase-combined system.

1.2.5 Optional "Smart BUC" Functionality

Comtech's unique approach to L-Band/RF frequency conversions eliminates DC and 10 MHz from the input coax. This simplifies redundancy and multi-carrier operation. It offers full 13.75 GHz to 14.5 GHz Ku-Band coverage and supports industry standard FSK modem/BUC communications. The optional BUC can lock to an external or internal reference oscillator.

1.2.6 Over Drive (Excessive RF Ouput Level) and OPS

The unit's specified linear rated output power level, Plinear, can be found in the unit datasheet. Although the unit may be capable, operating beyond its Plinear level is discouraged. As the input drive level is increased, excessive distortion of the output sets in which will result in degraded throughput and possible adjacent carrier interference.

Although the best protection against potentially degrading overdrive conditions is user attention and vigilance to the input and output levels as mentioned above, Comtech has implemented an overdrive protection software option[1] or "OPS", which will help protect the unit from damage and warn the user of gross overdrive conditions. However, it will be noted that the OPS feature is only an aid in preventing and notifying the operator of overdriven conditions, it does not guarantee protection of hardware or continuous unit operation in the "usable power" region in extreme or persistent overdriven conditions.

The overdrive protection setting is on the amplifier webpage and the information is displayed on the Status webpage. The settings are also available via serial commands (RS232/RS485).

With the overdrive protection mode activated, the operator can set a predetermined activation level (P1dB rated to P1dB – 10) which will trigger the OPS to set either an Alarm or Fault if the forward power is greater than the activation level. A Fault or Alarm will be determined by the overdrive protection mask setting. If the mask setting is Fault, then the OPS will mute the amplifier and set a summary fault. If the mask setting is Mask, then the OPS will set status to ALARM and will log the event.

The overdrive protection mode has 4 states: N/A, OK, ALARM, FAULT.

- When the overdrive protection mode is not selected (off), "N/A" is displayed in the status.
- When the overdrive protection mode is on and the forward power has not exceeded the activation level, "OK" is displayed in the status.
- When the overdrive protection mode is on and the forward power has exceeded the activation level, "FAULT" or "ALARM is displayed in the status.

It will also be noted when the overdrive protection mode is in "FAULT" state, that the OPS will not change the "FAULT" state if the mute is enabled, or the amplifier is off. The OPS is assuming the operator will correct the overdrive condition by lowering the input power level and then will disable the mute.

Notes:
1) Overdrive protection is only available in Firmware version 1.2.1 or newer.

1.3   Functional Description

Each HPOD consists of a Comtech SSPA module with a field replaceable power supply, a field replaceable fan assembly, and the Monitor/Control Processor (MCP). The amplifier features a Comtech low loss combining technique and MCP based temperature versus gain compensation.

1.3.1 Dimensional Envelope
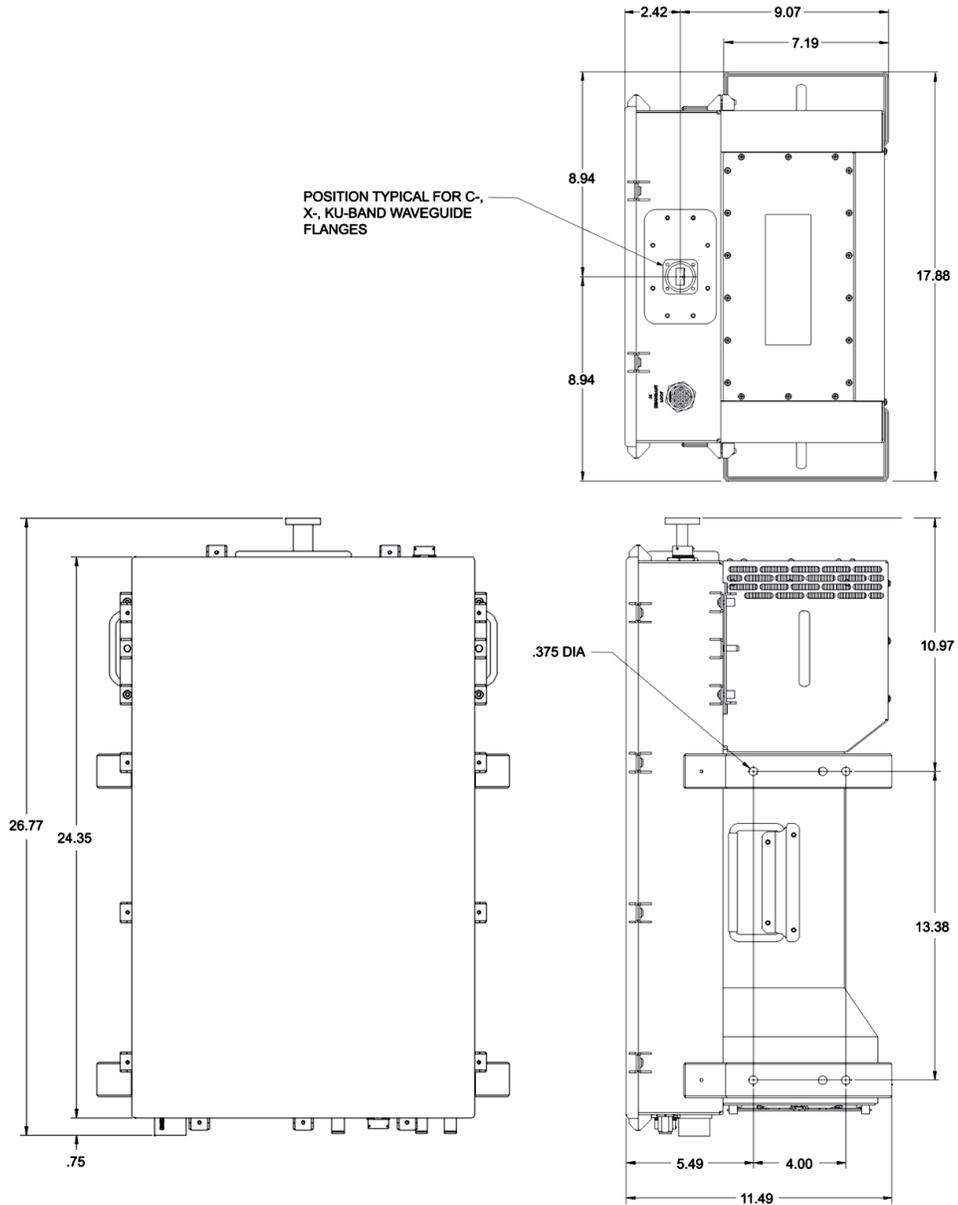
Figure 1-2. HPOD SSPA Dimensional Envelope

1.4   Theory of Operation

Figure 1-3 shows the block diagram for the HPOD SSPA. The major components of the unit are the:

- SSPA Module.

- Power Supply (Power Factor Corrected and Removable/Field Replaceable).

- Cooling System.

- Monitor and Control (M&C).
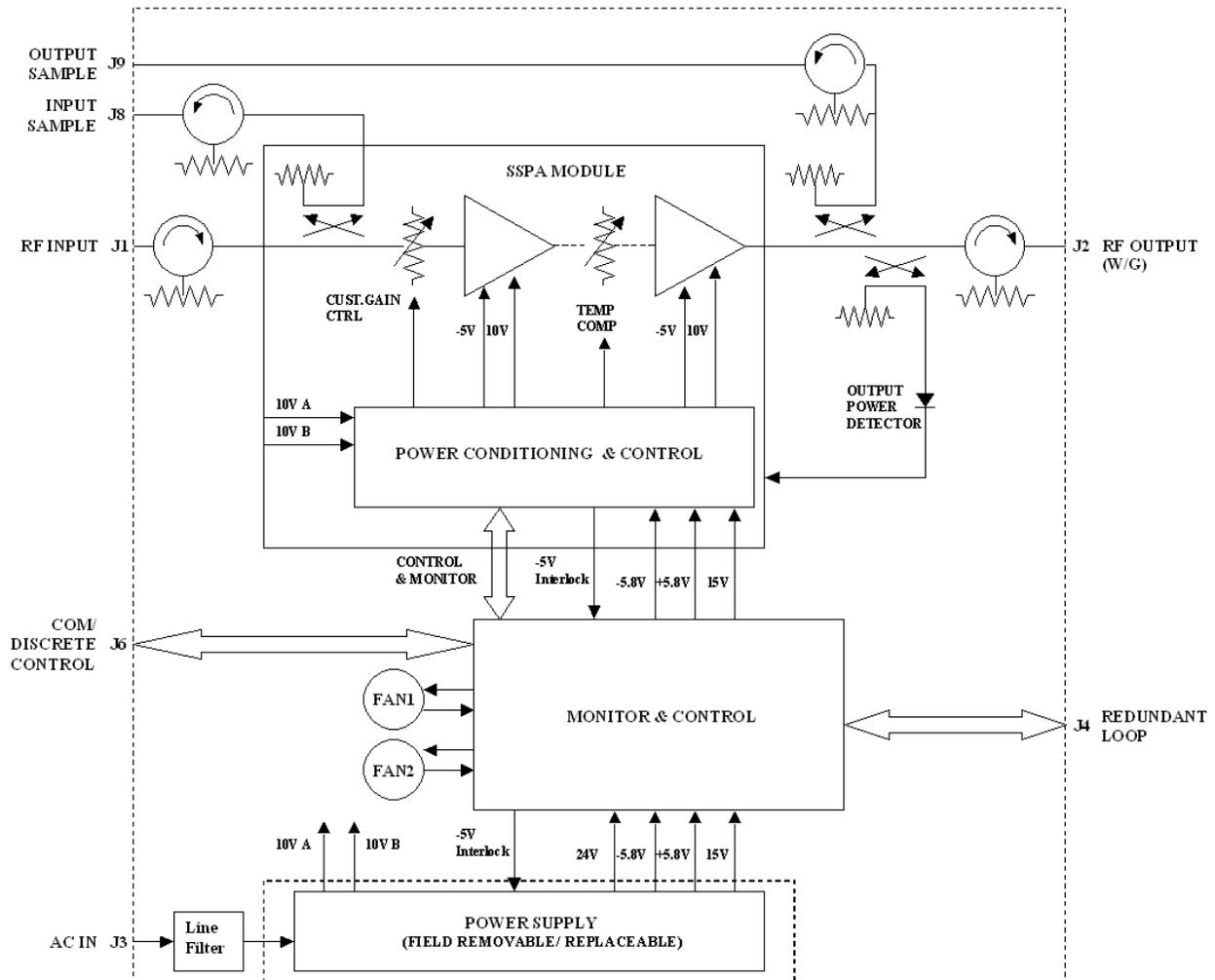
Figure 1-3. Comtech HPOD SSPA Block Diagram

1.4.1 SSPA Module

The amplifier module performs the core function of the unit. An isolator is at the RF input to ensure good VSWR. The RF signal then passes through an input sample port and on to an electronically controlled attenuator that adjusts the overall attenuation according to the user input. After some amplification, a second attenuator is automatically controlled via a look-up table to maintain the amplifier gain at a constant level over temperature variations.

The RF signal is then amplified by a multi-stage design that utilizes proprietary combining techniques to meet the rated power requirements. The output circuitry contains a coupler to provide a sampled signal for monitoring purposes. A power detector circuit also is included, and the reading is accessible via remote communication. A high-power circulator and load is located at the output to provide good VSWR and protection from external mismatch.

1.4.2 Power Supply

The SSPA features a removable power supply that is also power factor corrected. It connects to the main chassis via a specialized connector capable of the required high current. It supplies several voltages necessary for the unit to operate. The 10V output is capable of 2000W and supplies current to the power transistors in the RF amplifier module via two paths, or cables (10V A and 10V B). Circuitry within the RF module controls the output status of this power supply. If the RF module does not have the –5V supply for any reason, it does not allow the 10V power supply to turn on. This protects the power transistors within the RF module from failure due to improper power supply sequencing. The +24V output powers the cooling fans and is the source of power for waveguide switching when the SSPA is used in redundancy configurations. The +5V and +15V voltages are used to operate the M&C board and other overhead functions.

1.4.3 Cooling System

The SSPA unit contains a robust heat sink and thermal design to maintain a low operating temperature. Two temperature-controlled fans, which are monitored by the M&C board, draw cool outside air in across the power supply and specialized heat sink and exhaust the warmer air out the bottom of the unit. The amplifier module temperature is monitored, and if for any reason the amplifier temperature exceeds a safe preset limit, the amplifier module supply is shut down to protect the unit from thermal failure.

1.4.4 Monitor and Control (M&C)

The unit includes a microprocessor-based system that provides monitoring and control of the essential parameters of the unit. The user interfaces with the unit through the M&C system via the J6 | COM1 remote control/discrete communications port. The unit is capable of EIA-232, EIA-485 or Ethernet remote communication. A discrete mute control and relay status output is also available.

The M&C system monitors the fan speed, unit temperature, all power supply voltages, power transistor currents, output power, etc. Should a critical monitored parameter fail, the unit will mute the RF signal and report a fault. The details of the fault can be accessed via remote communication.

The M&C is also capable of acting as a controller in certain 1:1 or 1:2 redundancy systems. When configured as the back-up SSPA in such a system, it communicates with the other SSPA(s) and toggles the waveguide switches as necessary.

1.4.5 Block Up Converter Input Option

The HPOD amplifier, when delivered from the factory with an internal Block Up Converter (BUC), translates an L-Band input carrier to the desired output frequency (C-, X-, or Ku-). Local Oscillator (LO) frequencies are as follows:

BUC-4000 C, X, Ku, Ka			
Band	**Frequency**	**LO Frequency**	**Inverting**
C-Band	5850 MHz-to-6650 MHz	4900 MHz	No
X-Band	7900 MHz-to-8400 MHz	6950 MHz	No
Ku-Band-W	13.75 GHz-to-14.50 GHz	12.800 GHz	No

The same Ku-Band BUC is installed independent of amplifier bandwidth. Therefore, the "standard" 14.0 GHz-to-14.5 GHz HPOD has an L-Band frequency range of 1200 MHz-to-1700 MHz that translates up to 14.0 GHz-to-14.5 GHz, while the "Extended" 13.75 GHz-to-14.5 GHz HPOD translates L-Band frequencies from 950 MHz-to-1700 MHz up to 13.75 GHz-to-14.5 GHz.

Unlike most BUCs, no DC bias voltage should be provided on the center conductor of the L-Band coax.

In addition, the BUC version of the HPOD is available with an internal 10 MHz reference. As, such, no 10 MHz reference is required on the center conductor of the L-Band coax. If a reference is provided on the coax, the internal reference will detect and lock to it.

1.5   Specifications

Output	C-Band	X-Band	Ku-Band
Connector	CPR-137G Waveguide	CPR-112G Waveguide	WR75G Waveguide
Frequency	5.850 GHz -to-6.425 GHz	7.9 GHz-to-8.4 GHz	14.0 GHz -to-14.5 GHz (Standard)
			13.75 GHz -to-14.5 GHz (Optional)
Available Power: Outputs P1dB (Psat), Watts (See Note)	200(250) 250(300) 350(400) 400(500) 500(600	175(200) 200(250) 282(350)	80(100) 100(125) 175(200) 200(250)
Phase Combined Systems P1dB (Psat), Watts (See Note)	400(500) 500(600) 700(800) 800(1000) 1000(1200)	350(400) 400(500) 550(700)	160(200) 200(250) 350(400) 400(500)
	Note: P1dB over all temp/frequencies, Psat typ.		
Mute	-60 dBc		
Impedance	50Ω		
VSWR	1.25:1 Maximum		
Gain			
Linear	70 dB min, 75 dB typical		
Adjust	20 dB in 0,25 dB steps		
Full Band	± 1.0 dB		
with BUC option	± 1.5 dB		
Per 40 MHz	± 0.25 dB		
with BUC option	± 0.30 dB		
-40 to +55°C	± 1.0 dB		
with BUC option	± 1.5 dB		
Third Order Intermodulation			
Products	-30 dBc typical, -25 dBc max @ 3 dB total back-off from rated P1dB (two tones, ∆f = 1 MHz)		
AM to PM Conversion			
2° typical, 3.5° maximum at rated output			
Group Delay (per 40 MHz)			
Linear	± 0.03 ns/MHz		
Parabolic	± 0.003 ns/MHz2		
Ripple	± 1.0 ns peak to peak		

Spurious	
Second Harmonic	-60 dB dBc max @ 1 dB below rated output
Optional BUC LO Leakage	-20 dBm

Input	
Impedance	50Ω
Noise Figure	8 dB typical, 10 dB maximum @ maximum gain (15 dB for HPOD Ku-Band)
with BUC Option	25 dB
VSWR	1.25:1 Maximum
with BUC Option	1.50:1 Maximum
Connector	Type 'N'
Sample Ports	
Output Sample	Type N, 50Ω, -40 dBc nominal
Input Sample	Type N, 50Ω, -20 dBc nominal
Remote Control	
COM Port	EIA-485 or EIA-232
Alarms	
Summary Fault	Form C
Environmental	
Operating Temp.	-40° to +55°C (-40° to 131°F)
Non-operating Temp.	-50° to +75°C (-58° to 167°F)
Operating Humidity	0% to 100% condensing
Altitude	10,000 ft above sea level (derated 2°C/ 1000 ft AMSL)
Power Requirements	
	180 to 264 VAC, 47 Hz to 63 Hz (typical)
Physical	
Dimensions	26.77L x 17.88W x 11.49H inches (67.99L x 45.41W x 29.18H cm)
Weight	75 lbs. (34 kg) nominal
Available Options	
	Optional BUC

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Notes:

Chapter 2. EXTERNAL CONNECTORS AND PINOUTS

2.1   Cabling Connection Types

2.1.1   Coaxial Cable Connections

Coupling Type	Connector Type	
	Plug	**Jack**
Threaded (Type 'N' shown)		

Figure 2-1. Coaxial Connector Example

The HPOD SSPA uses Type 'N' coaxial cables. Type 'N' Coaxial cables (plugs) and their mating connectors (jacks/sockets) are available in a threaded coupling style (Figure 2-1). The jack for this coupling style features external threads. The plug shell features internal threads and has either a knurled outer surface (to permit hand tightening of the connection) or hex flats (to accommodate torqued installation).

Connection Instructions – Engage the plug onto the jack threads, and then turn the plug clockwise until it is fully threaded onto the jack. Do not over-tighten the connection.

2.1.2 Circular Cable Connections

The circular connectors provided on the HPOD SSPA accommodate weatherproof outdoor applications. The connector pairs (**Figure 2-2**) feature a sleeve lock configuration, with an array of pins (male side) coupled to mating sockets (female side).
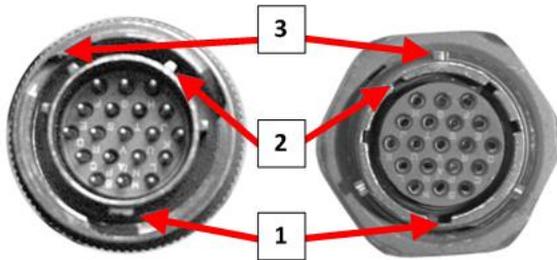
Feature	Description
1	Primary Alignment features
2	Secondary Alignment features
3	Sleeve Lock features

Figure 2-2. Circular Connector Example

Connection Instructions – Engage all of the alignment and lock features between the male connector (on the interconnection cable) and female socket.

To install the male connector into the female connector:

1) Engage the primary and secondary alignment tabs on the male connector with the mating cutouts on the female socket.

2) Push the male connector into the female socket.

3) Turn the male connector sleeve clockwise until the sleeve lock cutouts engage fully with the female socket tabs and you hear a "click" sound.
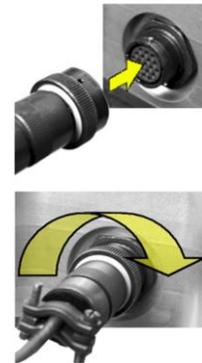
2.2 HPOD SSPA Cabling Connections

The HPOD SSPA external connectors (**Figure 2-3**) provide all necessary connections between the unit and other equipment. **Table 2-1** summarizes the connectors provided here, grouped according to service function.

Additionally:

- Detailed installation and operational information for using HPODs in 1:1 and 1:2 redundancy configurations is provided in **Appendix A. REDUNDANCY SYSTEM ASSEMBLY KITS** and **Appendix B. 1:1 AND 1:2 REDUNDANCY OPERATION**.

- Information on the HPOD's M&C operability via serial remote commands and queries is provided in **CHAPTER 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT.**
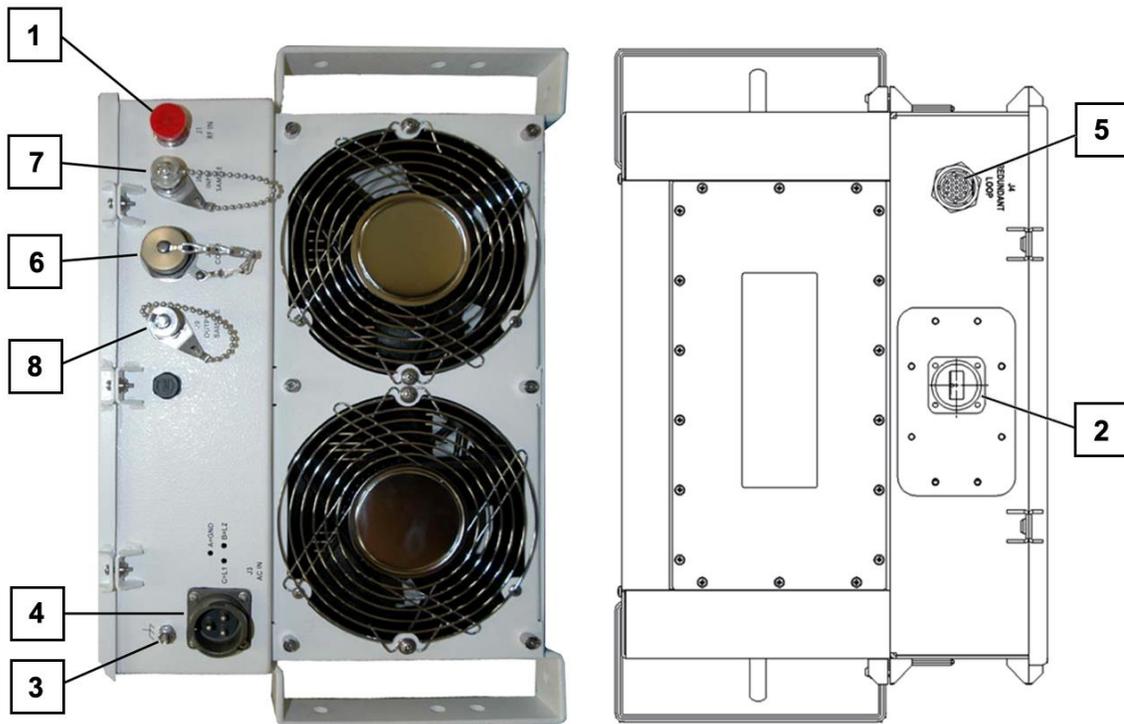
Figure 2-3. HPOD External Connectors

Table 2-1. HPOD SSPA External Connectors

Connector Group (Section)	Item	Ref Des	Connector Name	Connector Type	Connector Function
RF Signal (Sect. 2.3)	1	J1	RF IN	Type 'N' female	RF Input
	2	J2	RF OUT	Waveguide Flange	RF Output
Ground and Power (Sect. 2.4)	3	N/A	N/A	M4 Stud	Common Chassis Ground
	4	J3	AC IN	3-Pin Circular Conn.	Prime Input AC Power
	–	J10	N/A	4-Pin Circular Conn.	**Optional** -48VDC Power
Electrical Control Interface (Sect. 2.5)	5	J4	REDUNDANT LOOP	19-Pin Circular Conn.	Redundancy operation
	6	J6	COM1	19-Pin Circular Conn.	SSPA M&C
	7	J8	INPUT SAMPLE	Type 'N' female	-20 dB input signal sample
	8	J9	OUTPUT SAMPLE	Type 'N' female	-40 dB output signal sample

2.3   RF Signal Interface Connector Group

2.3.1   'J1 | RF IN' Connector

The **'J1 | RF IN'** (Input) connector is a Type 'N' female. Typical input levels (-30 dBm) depend on desired output power and unit attenuation. To prevent damage to the HPOD SSPA, RF input levels should not exceed +15 dBm.

2.3.2   'J2 | RF OUT' Connector

> ⚠️   *WARNING! For safety reasons, never look directly into the waveguide output.*

The **'J2 | RF OUT'** (Output) connector is a waveguide interface. The flange that is used depends on the frequency range of the unit.

Table 2-2. 'J2 | RF OUT' Waveguide Output Flange

Unit Frequency Band	Waveguide Flange
C	CPR137G
X	CPR112G
Ku	WR75G

2.4   Ground and Power Connection Group

2.4.1   Ground Connection

An M4 stud is provided for connecting a common chassis ground among equipment.

2.4.2   'J3 | AC IN' Connector (AC Power Main)

> ⚠️ **WARNING!** *Before applying AC power to the unit, make sure the waveguide output of the amplifier is properly loaded or terminated. Failure to do so could lead to equipment damage and excessive RF radiation levels.*

The prime power input requirements are:

- 180 to 264 VAC

- 47 to 63 Hz

- The power supply is power factor corrected. The total power required from the prime power supply depends on the model used. Please refer to the respective data sheets.

The **'J3 | AC IN'** AC prime power input connector is a 3-pin circular connector, type CA3102E20- 19PB FMLB A. Ground Pin 'A' is of the first make/last break type. A mating connector (CA3106E20-19SB) is provided. The pinout specifications for J3 and its mate are provided in **Table 2-3**.

Table 2-3. 'J3 | AC IN' Connector Pinout

Pin	Description
A	Ground
B	L2
C	L1

2.4.3 'J10' Connector: Optional -48V DC Power Supply

> ⚠️ **WARNING! Before applying DC power to the unit, make sure the waveguide output of the amplifier is properly loaded or terminated. Failure to do so could lead to equipment damage and excessive RF radiation levels.**

The **'J10** | DC' prime power input connector is a 4-pin circular connector. A mating connector (CA3106E2222SB, Comtech PN CN/CA3106E2222SB) is provided. The pinout specifications for J10 and its mate are shown in **Table 2-4**.

Table 2-4. 'J10 | DC' Connector Pinout

Pin	Description
A	V+
B	No connect
C	No connect
D	V-

The power connection for the optional –48V DC supply is located on the power supply itself. A cap (Comtech PN HW/CAP-5015) is provided with the supply that must be installed on the **'J3** | AC' Power Connector located on the amplifier.

The prime power input requirements are:

- -36 to -72 VDC

- Careful consideration must be given to the choice of input wiring because of the current draw requirements of the HPOD. Wire that is 8 AWG or larger will be required for most installations.

- The total power required from the prime power supply depends on the model used. Please refer to the respective data sheets.

2.5   Electrical Control Interface Connection Group

2.5.1   'J4 | REDUNDANT LOOP' Connector

The **'J4 | REDUNDANT LOOP'** connector is located near the waveguide output and is used only in configurations where the SSPA controls waveguide switching.

In alternate configurations, such as "chain switching", another system block or external M&C controls the waveguide switching. In this case, the connector remains unused, and the protective cap should be left attached. The pinout specification is shown in **Table 2-5**.

Table 2-5. 'J4 | REDUNDANT LOOP' Connector Pinout

Pin	Name
A	SW_CMD_A1
B	SW_CMD_COM
C	SW_CMD_A2
D	SW_IND_A1
E	SW_IND_A2
F	SW_CMD_B1
G	SW_CMD_B2
H	SW_IND_B1
J	SW_IND_B2
K	ADDR_1
L	ADDR_2
M	COM
N	RED_1_1
P	RED_1_2
R	SMFLT_1_IN
S	SMFLT_2_IN
T	SMFLT_OUT
U	RED_TXD
V	RED_RXD

2.5.2 'J6 | COM1' Connector

The **'J6 | COM1'** Discrete Control connector is the primary input for controlling and monitoring the SSPA. It is a 19-pin circular connector, type MS3112E14-19S. The pinout specification is shown in **Table 2-6**.

Mating connector: ITT: KPT06J14-19P or MS3116J14-19P.

Table 2-6. 'J6 | COM1' Connector Pinout

Pin	Name	Description
A	RS485_+RX	
B	RS485_-RX	
C	RS485_+TX	
D	RS485_-TX	
E	RS232_RD	
F	Ethernet TX+	
G	RS232_TD	
H	Ethernet TX-	
J	Aux_Out	Not for customer use
K	SumFLT_COM	
L	SumFLT_NO	Open when faulted, else tied to Pin K.
M	SumFLT_NC	When faulted, tied to Pin K, else open.
N	GND	
P	ONLINE_Status	Not for customer use
R	+24V	Not for customer use
S	Mute Control	When **AUX=1**, system is muted until this pin is pulled to ground. At that time, the unit unmutes. See the AUX remote command.
T	Minor_FLT_COM	Reserved for future use
U	Ethernet RX-	
V	Ethernet RX+	

2.5.3 'J8 | INPUT SAMPLE' Connector

The **'J8 | INPUT SAMPLE'** port connector is a Type 'N' female. It provides a nominal –20 dB sample of the input signal. A calibration label is provided near the connector that shows the actual coupling values vs. frequency.

2.5.4 'J9 | OUTPUT SAMPLE' Connector

The **'J9 | OUTPUT SAMPLE'** port connector is a Type 'N' female. It provides a nominal -40 dB sample of the output signal. A calibration label is provided near the connector that shows the actual coupling values vs. frequency.

2.6 Energize the HPOD SSPA

> ⚠️ **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.**

The HPOD SSPA does not contain a 'Power On/Off' switch. Power **ON** the SSPA by connecting the **'J3 | AC IN'** Power connector to the appropriate prime power source. The Mute or Transmit status of the SSPA will automatically come up in the last stored state (factory default = Transmit on, not muted).
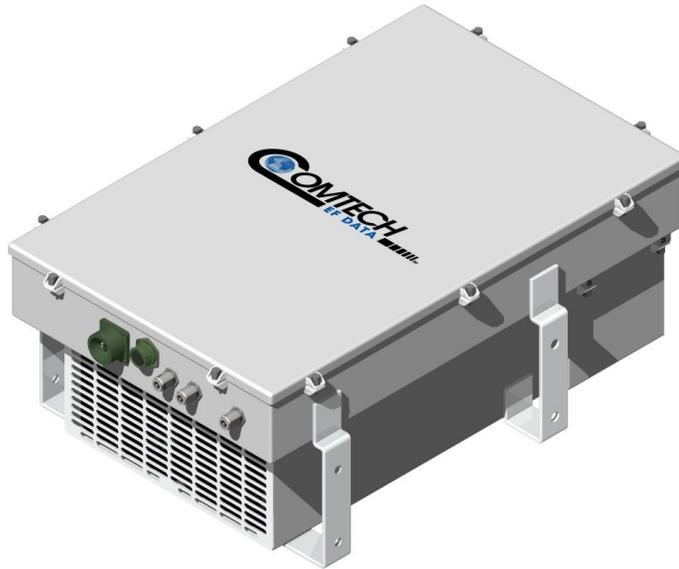
Figure 2-4. HPOD Unit

Notes:

Chapter 3. UPDATING FIRMWARE

3.1   Overview

> **To ensure optimal performance, it is important to operate the HPOD with its latest available firmware.**

Comtech's HPOD family of High-Power Outdoor Amplifiers are factory-shipped with the latest version of operating firmware. If you need to update the product firmware, you may download the update from the Comtech Web site (www.comtechefdata.com). You may also receive the firmware update archive file via e-mail from Comtech Product Support.

The HPOD Firmware Update process is as follows:

- Download the firmware update archive file via the Internet to a user-supplied Microsoft Windows®-compatible computer.

- Use the appropriate adapter cable to connect the HPOD **'J6 | COM1'** 19-pin port to a 9-pin serial port or Ethernet port of the user PC.

- Extract the firmware update files from the archive download file, and then transfer the files from the user PC to the HPOD via File Transfer Protocol (FTP):

  ▪ **For serial-based units,** you must use the user terminal emulator program, configured for serial operation, and the provided **FLSHCSAT.exe** utility program.

  ▪ **For Ethernet-based units,** you must use FTP protocol and the user terminal emulator program, configured for Telnet operation, and the HPOD Web Server Interface.

3.2 Getting Started: Prepare for the Firmware Download

1. **First, identify the firmware number and its version number.**

   User-supplied items needed:
   - A Microsoft Windows-based PC, equipped with available serial and Ethernet ports; a compatible Web browser (e.g., Internet Explorer); and a terminal emulator program (e.g., Tera Term or HyperTerminal).

   - An M&C adapter cable for connection between the HPOD **'J6 | COM1'** port and the user PC – either a 19-pin to 9-pin Serial Adapter Cable, or a 19-pin to RJ-45 Ethernet Adapter Cable.

   A. Connect the Adapter Cable from the HPOD **'J6 | COM1'** port to the pertinent port on the user PC.

   B. **On the PC – configure the terminal emulator program.**

   > *Refer to your terminal emulator program HELP feature or user guide for operating and configuration instructions.*

   Configure the utility program for either serial port or Telnet communication and terminal display operation:

• 19200 bps (Baud Rate)	• 8 Data Bits	• 1 Stop Bit
• Parity = NO	• Port Flow Control = NONE	• Display New line Rx/Tx: CR
• Local Echo = ON		

   C. **On the HPOD – energize the unit.**

   D. **Obtain the firmware information via one of the following methods:**
   - *Using Serial Remote Control or Telnet via the user PC terminal emulation program* – Log in to the HPOD, and then use '**FRW**' remote query to obtain, and make note of, the firmware information:

   Type (without the quotes) "<1/FRW?"<cr> at the command prompt to query the HPOD for its Firmware Number.

   > See Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT for information and instructions on using Remote Commands and Queries.

2. **Next, create a temporary folder (subdirectory) on the user PC for the firmware archive download.**

   > - *Drive letter 'c:' is used in these examples. Any valid, writable drive letter can be used.*
   > - *Typical for all tasks: Type the command <u>without quotes</u>, and then press Enter to execute.*

There are several ways the user may use create a temporary folder on a Windows-based PC:

A. Use the Windows Desktop to create and rename the temporary folder.
- Right-click anywhere on the desktop to open the popup submenu, and then select **New > Folder** to create the temporary folder. The new folder will be created on the desktop.

- Right-click on the new folder and then select '**Rename**' from the popup submenu. Rename this folder to "**temp**" or some other convenient, unused name.
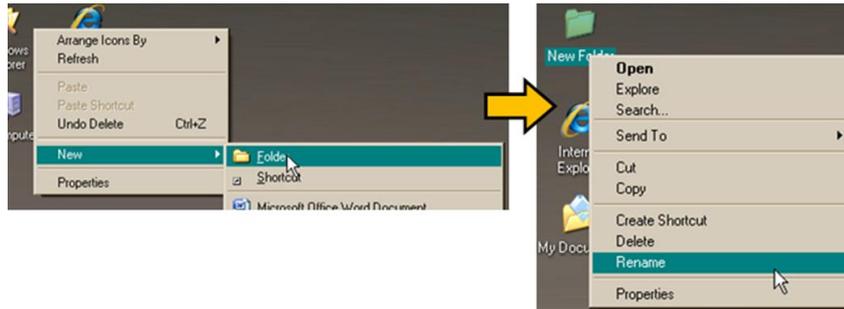
B. Use Windows Explorer to create and rename the temporary folder.
- Select **File > New > Folder** to create the temporary folder. The new folder will be created in the active folder.

- Right-click the '**New Folder**' folder name, and then rename this folder to "**temp**" or some other convenient, unused name.

C. Use the 'Run' and 'Browse' windows to create and rename the temporary folder.
- Select **[Start]** on the Windows taskbar and then click the **Run...** icon. The '**Run**' window will open.

- Click **[Browse]** in the '**Run**' window. The '**Browse**' window will open.

- Click the **Create New Folder** icon in the '**Browse**' window. The new folder will be created.

- Right-click the '**New Folder**' folder name, and then rename this folder to "**temp"** or some other convenient, unused name.

D. Use Windows Command-line to create the temporary folder.

- **First,** click **[Start]** on the Windows taskbar, and then click the '**Run...**' icon (or, depending on Windows OS versions *prior* to Windows 95, click the '**MS-DOS Prompt**' icon from the Main Menu).

- **Next,** open a **Command-line** window…

  o For Windows 95 or Windows 98 – Type "**command**".

  o For any Windows OS versions later than Windows 98 – Type "**cmd**" or "**command**".
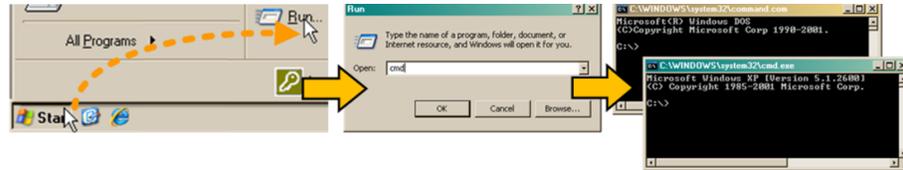
  o Alternately, from **[Start]**, select **All Programs > Accessories > Command Prompt**.

  o Finally, from the Command-line '**c:\>**' prompt, type "**mkdir temp**" or "**md temp**" (*mkdir* and *md* stand for *make directory*), and then click **[OK]**.
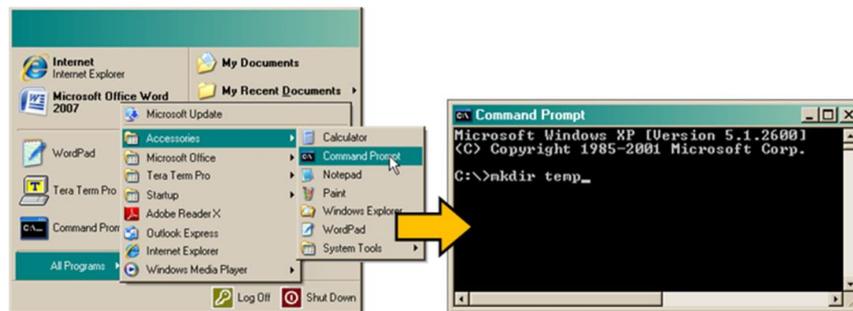
There should now be a 'temp' folder created and available for placement of the firmware file download.

3.3   Download and Extract the Firmware Update

1) **First, download the firmware update file from the Comtech Web site:**

   A. **Go online** to www.comtechefdata.com.

   B. **On the** *Main* **page** – Under **Support Information** or the **Support** tab, select the **Software Downloads** hyperlink.

   C. **On the** *Software Downloads* **page** – Click **Download Flash and Software Update Files**.

   D. **On the** *Flash Updates Index* **page** – Select the **(Select a Product Line) Amplifiers** hyperlink.

   E. **On the** *Amplifiers* **product page** – Select the **HPOD** product hyperlink.

   F. Select the appropriate firmware archive EXE or ZIP file download hyperlink.

   - *About Firmware Numbers, File Versions, and Formats: The Comtech Web site catalogues its firmware update files by product type (e.g., router, modem, etc.), the specific model, and optional hardware configurations.*

   - *You should download the HPOD serial (i.e., non-Ethernet) and/or Ethernet firmware as needed for your setup:*
     - The *non-Ethernet* HPOD firmware download hyperlink appears as **F12524X_V####**.
     - The *Ethernet* HPOD firmware download hyperlink appears as **F0020544X_V####**.

     When performing an Ethernet-based firmware update, both the non-Ethernet and Ethernet firmware downloads are required.

     For either download, '**X**' denotes the revision letter, and '**####**' represents the firmware version (e.g., V111 = Version 1.1.1).

   - **About File Archive Formats:** Comtech provides its downloadable files in two compressed archive formats: ***.exe** (self-extracting) and ***.zip** (compressed). The ***.exe** file does not require a file archiver and compression utility program such as *PKZIP for Windows, WinZip, ZipCentral,* etc. (*PKZIP for DOS* is not supported due to file naming conventions). **Comtech does not provide this utility program.**

   - Some firewalls do not allow the download of *.exe files. Download the *.zip file instead, and extract the firmware files from the archive download with a user-supplied utility program. For detailed information on handling archived files, refer to the utility program Help documentation.

G. Download the archive file to the temporary folder.

- Once the **EXE** or **ZIP** hyperlink is selected the '**File Download'** window opens and prompts selection of **[Open]** or **[Save]**:

  o Click **[Open]** to turn over file extraction to the user-supplied utility program. Be sure to extract the firmware files to the '**temp**' folder created earlier.

  o Click **[Save]** to open the '**Save As'** window. Be sure to select and **[Save]** the archive ***.exe** or ***.zip** file to the '**temp**' folder created earlier.

  Otherwise, click **[Cancel]** to quit and exit the file download process.

2) Next, extract the firmware files from the archive file.

- (If not already done with **File Download > [Open]**) Extract the firmware files from the downloaded ***.exe** or ***.zip** archive file with the user-supplied utility program:

  o Double-click on the archive file name, and then follow the prompts provided by the user-supplied utility program.

  Fo*r non-Ethernet* HPOD downloads – extract, at a minimum, four files:

  o ReleaseNotes_HPOD_vXXX.pdf – Where "XXX" denotes the firmware version number.

  o Fw12524x.CCC – Firmware file, where "x" denotes the firmware revision letter.

  o FLSHCSAT.EXE – The Comtech Flash Upload Utility Program.

  o CCCflash.hlp – FLSHCSAT Help File.

  For Ethernet HPOD downloads – extract, at a minimum, two files:

  o **ReleaseNotes_HPOD_Ethernet_vX-X-X.pdf** – Where "X-X-X" denotes the firmware version number.

  o **FW-0020544x.bin** – Firmware file, where "x" denotes the firmware revision letter.

3) Confirm availability of the firmware files in the temporary folder.

There are several ways the user may view the contents of the temporary folder on a Windows-based PC:

A. **From the Windows Desktop:**

- Double-left-click the '**temp'** folder saved to the Windows Desktop.

- Use **Windows Explorer** to locate, and then double-left-click the '**temp**' folder.

- Use the '**Browse'** window (**[Start] > ...Run > [Browse]**) to locate, and then double-click the '**c:\temp**' folder.

B. Using Command-line:

- Type "**cd c:\temp**" at the Command-line prompt to change to the temporary directory created earlier using Command-line.

- Type "**dir**" to list the files extracted to the temporary directory from the downloaded archive file.

The firmware files have been successfully downloaded and are now available for transfer to the HPOD.

3.4 Perform the FTP Upload Procedures

To proceed with the firmware update procedure, assumptions are made that:

- *The HPOD 'J6 | COM1' port is connected to the user-supplied, Windows-based PC serial port or Ethernet port, and*

- *The PC is running a terminal emulation program (for operation of the HPOD serial or Telnet interface) and/or a compatible Web Browser (for operation of the HPOD Web Server Interface).*

- *The latest firmware files have been downloaded or otherwise received from Comtech and are available on the user PC in an accessible temporary folder.*

3.4.1 Perform the Automated Serial-based FTP Upload Procedure

1) Double-click **FLSHCAT.EXE** (filename or icon) on the PC desktop to execute the FLASH UPLOAD utility program.

2) From the FLSHCAT dialogue box, select the pertinent serial port used for communication between the PC and the HPOD (this example selects COM1, as noted at 'A'.)

3) Do not select a Baud Rate ('B') other than the default selection of 19200, unless otherwise instructed by Comtech Technical Support.

4) Click '**Software Upload**' ('C').
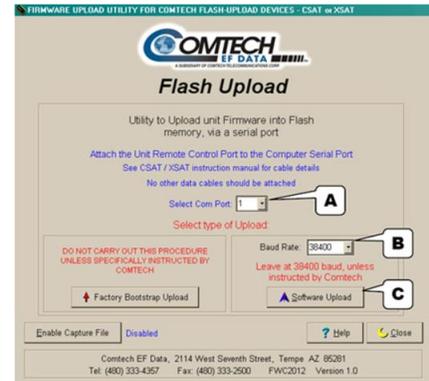
A. Select the firmware file for upload. Click '**Choose File'** then, once the *Select a File Name* dialogue box opens, use the window on the right to navigate to the desired folder. Finally, double-click on the firmware file from the window on the left.
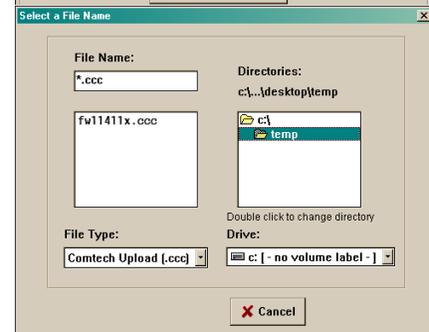
B. Once the file is selected, the upload will take place – *do not interrupt this upload process*.

If the upload is not successful for any reason (e.g., the comms cable is not physically connected, the wrong COM port is specified, the user inadvertently interrupted the upload, etc.), troubleshoot the setup as needed, and then click on 'Repeat Upload' or 'Go Back to Start' to resume or retry the upload process.
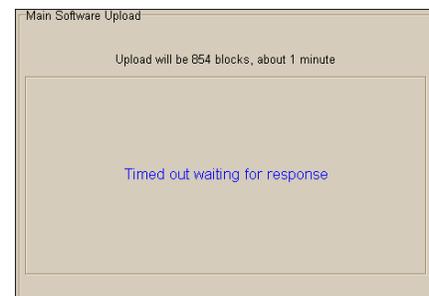
5) Upon successful completion of the upload, you may click on '**Go Back to Start**' (if, for example, more than one HPOD requires upgrade) or '**Close**' (to exit the FLSHCAT program).

6) Reboot the HPOD.

    A. Disconnect the power source from the HPOD.

    B. Re-energize the HPOD. The unit will reboot using the updated firmware image.

7) To update and load the other image, repeat steps 1 through 6.

The HPOD is now operating with its latest firmware. The serial-based firmware update process is now complete.

3.4.2　Perform the Ethernet-based FTP Upload Procedure

1) **Use Command-line to send a "PING" command to confirm proper connection and communication between the user PC and the HPOD:**

- If the IP Address of the HPOD is still not known:

  o **Via Telnet Remote Control –** Type the "**<1/IPA?**" remote query (without quotes) at the command prompt. The HPOD returns the configured IP Address:

  >0001/IPA=192.168.1.4/24 *(default)*

  o **Via the HPOD Web Server Interface –** View the *IP Address/Range* entry in the *Network Maintenance* section of the '**Admin | Access**' page:

- **Once the IP Address is known – use Command-line to PING:**

  Type "**ping xxx.xxx.xxx.xxx**" at the **Command-line** prompt (where 'xxx.xxx.xxx.xxx' denotes the HPOD IP Address).

  The response should confirm whether or not the HPOD is properly connected and communicating.

2) **Use Command-line to transfer (FTP) the files from the user PC to the HPOD:**

A. Type "**ftp xxx.xxx.xxx.xxx**" (where '**xxx.xxx.xxx.xxx**' is the HPOD IP Address).

B. Type "**bin**" to set the binary transfer mode.

C. Type "**prompt**" and then "**hash**" to facilitate the file transfer.

D. Type "**put FW-0020544x.bin bulk:**" (where '**x**' denotes the revision letter) at the **Command-line** prompt, without quotes, to begin the file transfer. The destination "bulk" must be all lower case.

The process sequences through several blocks – this may take several minutes for the transfer to occur.

> *In the event you receive the "Connection closed by remote host." message, wait another minute before continuing. The firmware update sometimes takes longer than the FTP client allows.*

E. Type "bye" to terminate the FTP session, and then close the Command-line window.

F. Repeat steps 2A through 2E for F12524X_V#### except, for Step 2D:

- Type "**put FW-0020544x.bin hpodbulk:**" (where '**x**' denotes the revision letter) at the **Command-line** prompt, without quotes, to begin the file transfer. The destination "hpodbulk" must be all lower case.

3) Use Telnet Remote Control or the HPOD Web Server Interface to verify that the PC-to-Unit FTP file transfer was successful.

- **Via Telnet Remote Control** – Type the "**<1/FRW?**" remote query (without quotes) at the command prompt. The unit will return the Bulk, MnC, and FPGA firmware load information.

- **Via the HPOD Web Server Interface** – Open the '**Config | Utility**' page and review the SC/13320 Board Firmware Version section to verify that the PC-to-Unit FTP file transfer was successful.

SC/13320 Board Firmware Version
Boot: FW-0000082.9.9.9 ,11/20/08
Bulk 1: FW-0000378,1.1.1b,08/30/11
Bulk 2: FW-0020544-;1.1.1 ;10/24/11

4) Use the HPOD Web Server Interface to select the boot image. To select the desired boot Image, open the HPOD Web Server Interface '**Config | Utility**' page. Use the **Next Reboot Image** drop-down list in the *Current SC/13320 Active Firmware Image #* section to select **1** or **2**, and then click **[Submit]**.

Current SC/13320 Active Firmware Image: 1   Next Reboot Image: 2 ▼ Submit

5) Reboot the HPOD.

A. Disconnect the power source from the HPOD.

B. Re-energize the HPOD. The unit will reboot using the updated firmware image.

6) To update the other firmware image, repeat steps **1** through **5**.

The HPOD is now operating with its latest firmware. The Ethernet-based firmware update process is now complete.

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Notes:

Chapter 4. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

4.1 Overview

This chapter describes the functionality of the HPOD Ethernet (HTTP) Interface. Ethernet-based Remote Product Management of the HPOD is available using the **'J6 | COM1''** port.

> *To proceed with Ethernet-based Remote Product Management, assumptions are made that:*
>
> - *The HPOD is operating with the latest version firmware files.*
>
> - *The HPOD is connected to a user-supplied Windows-based PC as follows:*
>
>   o *The PC's Ethernet port is connected to the HPOD 'J6 | COM1' port with a 190-pin to RJ-45 adapter cable.*
>
>   o *The PC is running a terminal emulation program (for operation of the HPOD remote control Telnet interface) and a compatible web browser (for operation of the HPOD Web Server Interface).*
>
> - *The HPOD IP Address has been noted using the HPOD remote serial or Telnet 'FRW' query or by using the HPOD Web Server Interface Admin | Access page.*

> *See the Remote Commands and Queries specifications tables found in Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT for detailed descriptions of the configuration parameters featured on the individual web pages depicted in this chapter.*

4.2   Ethernet Management Interface Protocols

The user PC facilitates access to Ethernet-based remote monitor and control (M&C) of the HPOD through three separately operated protocols:

- **Simple Network Management Protocol (SNMP).** This *non-secure* interface requires a user-supplied Network Management System (NMS) and a user-supplied Management Information Base (MIB) File Browser.

- **Telnet Interface.** This *non-secure* interface requires use of the user PC's Command-line interface, or a user-supplied terminal emulation program such as HyperTerminal.

- **HPOD Web Server (HTTP) Interface.** This *non-secure* interface requires a compatible user-supplied web browser such as Internet Explorer.

4.3   SNMP Interface

The *Simple Network Management Protocol* (SNMP) is an Internet-standard protocol for managing devices on IP networks. An SNMP-managed network consists of three key components:

- **The managed device.** This includes the HPOD.

- **The SNMP Agent.** This is the software that runs on the HPOD. The HPOD SNMP Agent supports both **SNMPv1** and **SNMPv2c**.

- **The user-supplied Network Management System (NMS).** This is the software that runs on the manager.

4.3.1   Management Information Base (MIB) Files

The following MIB files are associated with the HPOD:

MIB File/Name (where 'x' is revision letter)	Description
FW-0020546x.mib ComtechEFData Root MIB file	ComtechEFData MIB file gives the root tree for ALL Comtech HPOD products (PSx) and consists of only the following OID: Name: comtechEFData Type: MODULE-IDENTITY OID: 1.3.6.1.4.1.6247 Full path: iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).comtechEFData(6247) Module: ComtechEFData
FW-0020547x.mib HPOD MIB file	MIB file consists of all of the OIDs for management of the HPOD functions
FW-0020548x.mib HPOD Traps MIB file	Trap MIB file is provided for SNMPv1 traps common for HPOD.

An MIB file is used for SNMP remote management of a unique device and consist of a tree of nodes called Object Identifiers (OIDs). Each OID provides remote management of a particular function.

Compile these MIB files in a user supplied MIB Browser or SNMP Network Monitoring System server.

4.3.2 SNMP Community Strings

In SNMP v1/v2c, the SNMP Community String is sent unencrypted in the SNMP packets. Caution must be taken by the network administrator to ensure that SNMP packets travel only over a secure and private network if security is a concern.

The HPOD uses Community Strings as a password scheme that provides authentication before gaining access to the router agent's MIBs. They are used to authenticate users and determine access privileges to the SNMP agent.

Type the SNMP Community String into the user supplied MIB Browser or Network Node Management software.

Three Community Strings are defined for SNMP access:

- **Read Community**   default = public

- **Write Community**   **default = private**

- **Trap Community**   **default = comtech**

For proper SNMP operation, the HPOD MIB files must be used with the associated version of the HPOD M&C. Please refer to the HPOD FW Release Notes for information on the required FW/SW compatibility.

4.3.3 SNMP Traps

The HPOD sends out SNMP traps both when a fault occurs and when it is cleared.

1)   The SNMP agent supports SNMP v1 and v2c.

2)   If SNMP v1 traps are to be used, then make sure to compile the traps file.

Use the **hpodSNMPTrapVersion** OID to configure the type of traps that the HPOD will send.

The HPOD uses these MIB2 v1 traps and v2 notifications:

MIB2 SNMPv1 trap: Authentication Failure	5
MIB2 SNMPv2 notifications: Authentication Failure	1.3.6.1.6.3.1.1.5.5

The HPOD uses these Faults v1 traps and v2 notifications:

Faults SNMPv1 traps:		Faults SNMPv2 notifications:	
hpod24VPowerSupplyStatusV1	62476201	hpod24VPowerSupplyStatus	1.3.6.1.4.1.6247.62.1.3.1.1
hpod15VPowerSupplyStatusV1	62476202	hpod15VPowerSupplyStatus	1.3.6.1.4.1.6247.62.1.3.1.2
hpod10V1PowerSupplyStatusV1	62476203	hpod10V1PowerSupplyStatus	1.3.6.1.4.1.6247.62.1.3.1.3
hpod10V2PowerSupplyStatusV1	62476204	hpod10V2PowerSupplyStatus	1.3.6.1.4.1.6247.62.1.3.1.4
hpod7V5TPowerSupplyStatusV1	62476205	hpod7V5TPowerSupplyStatus	1.3.6.1.4.1.6247.62.1.3.1.5
hpod5VPowerSupplyStatusV1	62476206	hpod5VPowerSupplyStatus	1.3.6.1.4.1.6247.62.1.3.1.6
hpodN5VPowerSupplyStatusV1	62476207	hpodN5VPowerSupplyStatus	1.3.6.1.4.1.6247.62.1.3.1.7
hpodFan1StatusV1	62476208	hpodFan1Status	1.3.6.1.4.1.6247.62.1.3.1.8
hpodFan2StatusV1	62476209	hpodFan2Status	1.3.6.1.4.1.6247.62.1.3.1.9
hpodTemperatureStatusV1	62476210	hpodTemperatureStatus	1.3.6.1.4.1.6247.62.1.3.1.10
hpodShutdownStatusV1	62476211	hpodShutdownStatus	1.3.6.1.4.1.6247.62.1.3.1.11
hpodIICStatusV1	62476212	hpodIICStatus	1.3.6.1.4.1.6247.62.1.3.1.12
hpodFwdPwrStatusV1	62476213	hpodFwdPwrStatus	1.3.6.1.4.1.6247.62.1.3.1.13
hpodBUCStatusV1	62476214	hpodBUCStatus	1.3.6.1.4.1.6247.62.1.3.1.14
hpodRefStatusV1	62476215	hpodRefStatus	1.3.6.1.4.1.6247.62.1.3.1.15
hpodSummaryFaultV1	62476216	hpodSummaryFault	1.3.6.1.4.1.6247.62.1.3.2.1
hpodOverdriveStatusV1	62476217	hpodOverdriveStatus	1.3.6.1.4.1.6247.62.1.3.1.16

Note: Overdrive status traps are only available if main board firmware FW12524 is version 1.2.1 or newer and ethernet board firmware FW-0020544 is version 1.2.1 or newer.

4.4   Telnet Interface

The HPOD has a Telnet interface for the equipment M&C operations. Log in to the Telnet interface at the **Administrator** level or **Read/Write** level. An example of the login process is shown here:
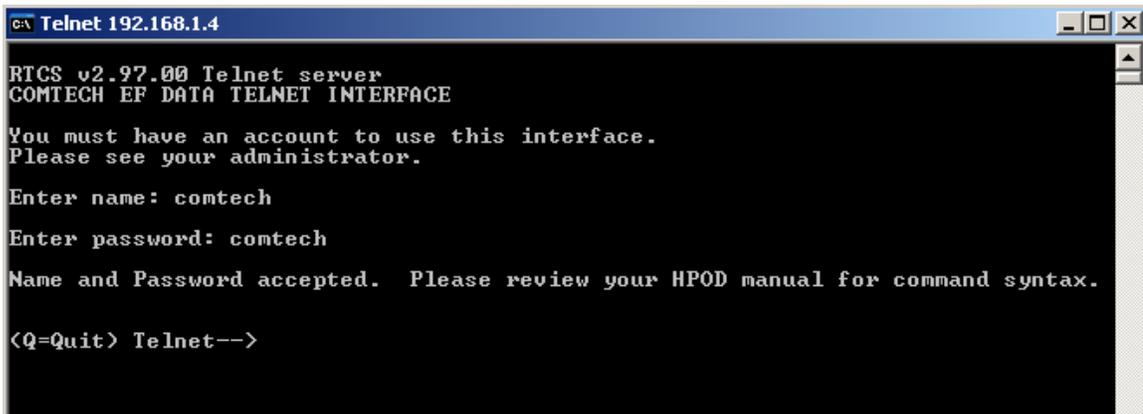
After you log into the Telnet interface as the Administrator, you can use the standard remote-control interface, defined in **Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT**, as shown here:
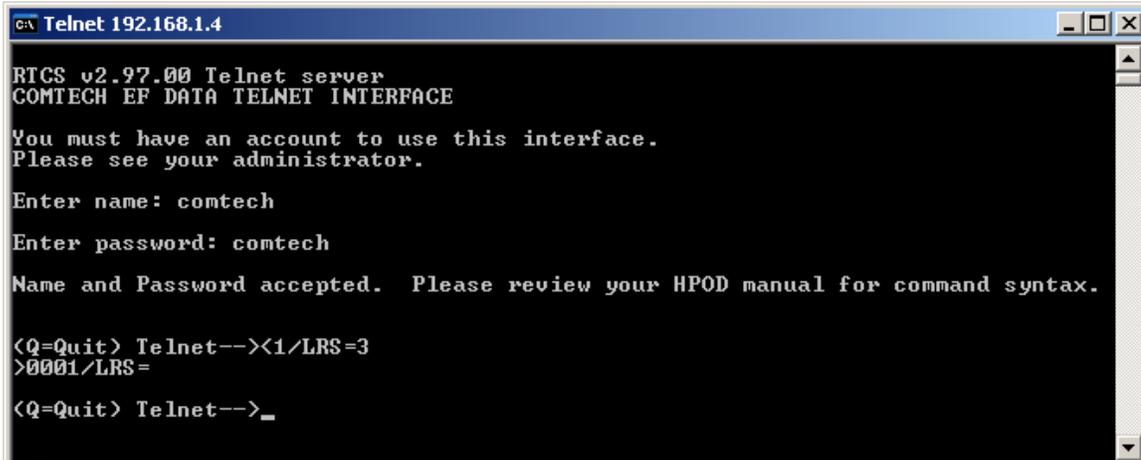
4.4.1 Telnet Operation via HyperTerminal

There is a disadvantage when using Windows Command-line as a Telnet client. Since Command-line cannot translate a '\r' (i.e., carriage return or "CR") to a '\r\n' (i.e., CR+line feed "LF") for the messages coming from Telnet Server, any multi-line Target-to-Controller response (e.g., the response to the FRW? query) will be displayed as one line, with the latter lines overwriting the previous lines.

In order to view the full response messages, Comtech recommends use of the HyperTerminal terminal emulation program, configured as a Telnet client.

Configure HyperTerminal as follows:

1) Ensure that the connection is made using **TCP/IP (Winsock)** instead of COM1 or COM2, as shown at the near right.

2) ASCII Setup (File → Properties → Settings → ASCII Setup): Check the "**Send line ends with line feeds**" option in the *ASCII Sending* section, and the "**Append line feeds to incoming line ends**" option in the *ASCII Receiving* section, as shown at the far right.
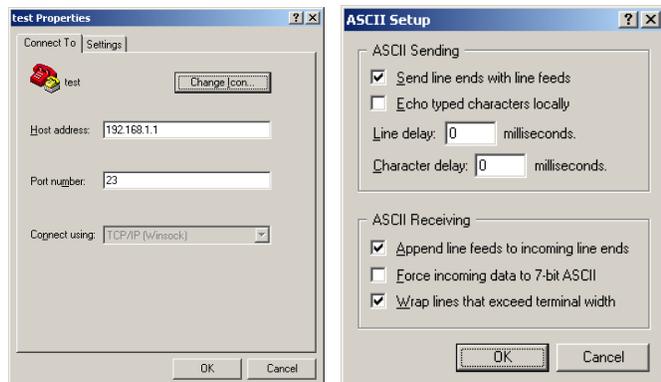
Examples of login and remote command/query execution, when using HyperTerminal as the Telnet interface, appear as follows:
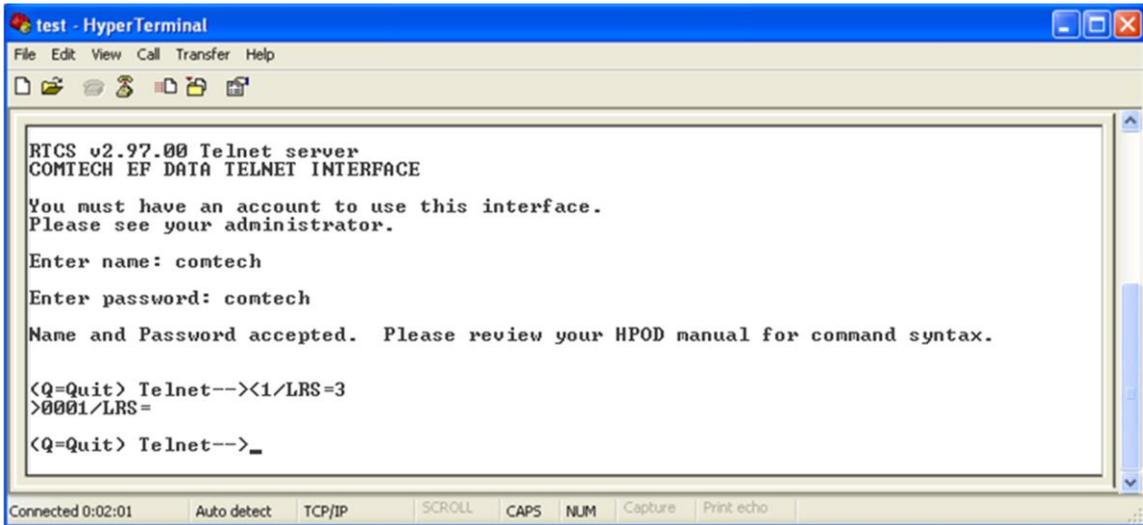
4.5 HPOD Web Server (HTTP) Interface

A user-supplied web browser allows the full monitor and control (M&C) of the HPOD from its embedded Web Server Interface. This application is designed for, and works best with, Microsoft's Internet Explorer Version 5.5 or higher.

4.5.1 Enable the Web Server Interface

Follow these steps to enable the HPOD Web Server Interface using only a 10/100BaseT remote interface and a Microsoft Windows operating system.

1) Select **Start**, then **Run**, then type "**cmd**" to open the command prompt window:

2) Start a Telnet session with the unit at the default IP address of **192.168.1.4**:
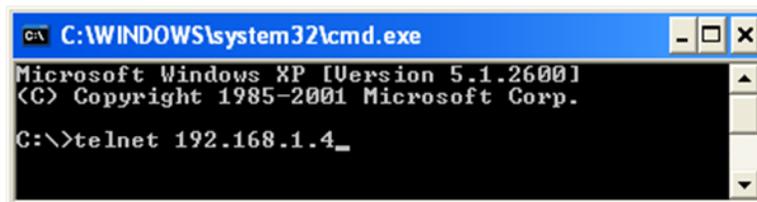
3) Enter the User name and password (the default for both is **comtech**):
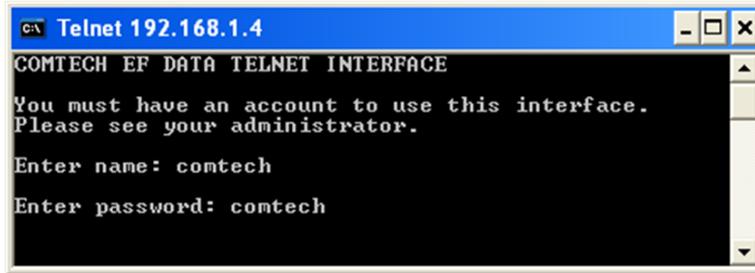
Use the **LRS** remote command to set the Ethernet remote control access parameter:

- Use *default* remote command **LRS=3** for **Serial + Ethernet control**

- Use remote command **LRS=2** for **Ethernet control only**.
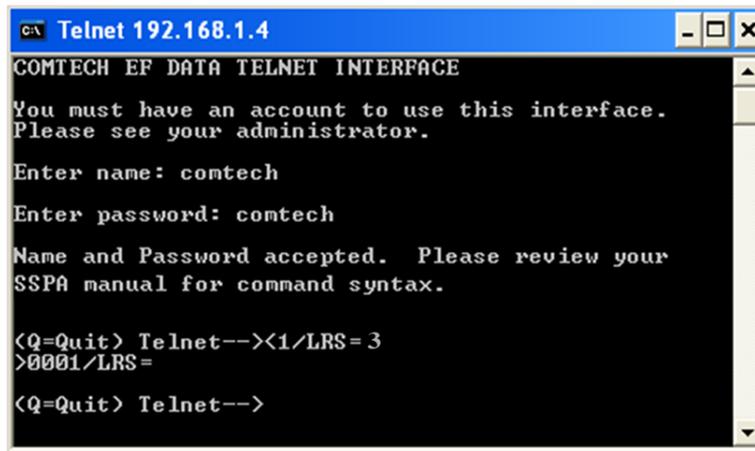
4) If necessary, use the **IPA** remote command to set a unique IP address.

> **1)** **Each HPOD must have a unique IP address assigned before connection to a network. If the IP address needs to be changed from the factory default setting, use the IPA=xxx.xxx.xxx.xxx.yy remote command, where 'xxx.xxx.xxx.xxx' is a valid IP address on the network where the unit will be installed, and 'yy' is the range (typically, yy=24).**
>
> **2)** **If you change the IPA value, make sure to shut off and restart the unit; then, start a new Telnet session using the new IP address.**

4.5.2 User Login

Follow these steps to log in to the HPOD Web Server Interface using a compatible web browser.

1) On the PC, type **http://192.168.1.4** (the default IP address for the HPOD) into the browser's **Address** area, and then press **[Enter]**.

2) The Login window will appear, similar to the example shown here. You are prompted to type a **User name** and **Password**. The default for both is **comtech**.

   Type the User Name and Password, and then click **[OK]**.

   After the valid User Name and Password are accepted, the HPOD Web Server Interface '**Home'** page appears:

The version shown in this example may vary.

4.5.3 Web Server Interface – Operational Features

4.5.3.1 Navigation

Navigation tabs are located at the top of each page. After you click a navigation tab, its nested page hyperlinks appear.

This manual shows page navigation and hyperlink selection in the format **'Top-Level Navigation Tab | Nested Page Hyperlink.' For example: 'Home | Home'** is interpreted to mean "*first* click the top-level '**Home**' navigation tab; *then*, click the nested '**Home**' page hyperlink."

4.5.3.2 Page Sections

Each page features one or more sections. The title at the upper-left corner of each page or page section indicates its operational features. Each section can feature editable fields, action buttons, and read-only displays that are specific to that section.

This manual explains the purpose and operation for each web page on a **per-page, per-section** basis.

4.5.3.3 Action Buttons

Action buttons are important in the Web Server Interface. Click an action button to do one of these tasks:

- Reset changed parameters to remove **unsaved** changes.

- Permanently save changes.

- Refresh the page with current data.
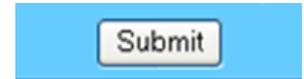
> *If you edit a field, make sure to click the action button before you leave the page. If you go to another page without first clicking the action button, your changes are <u>not</u> saved.*

4.5.3.4 Drop-down Lists

A drop-down list lets you choose from a list of selections. Left-click the drop-down button to open the list. Then, left-click on an item to select that choice.
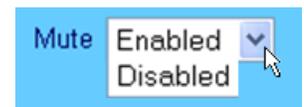
4.5.3.5   Text or Data Entry

Text boxes let you type data into a field. An action button may be associated with a single text box, or a group of text boxes.

For any text box, left-click anywhere inside the box, type the desired information into that field, and be sure to press **[ENTER]** when done.

Click the related action button to save the data.

If you edit any field, make sure to click the action button before you leave the page. If you go to another page without first clicking the action button, your changes are not saved.

4.5.4   Web Server Interface – Menu Tree

The HPOD Web Server Interface features four (4) navigation tabs at the top of each page. Nested hyperlinks (shown in gray) grant access to individual Web pages. The page names that are dimmed represent selectable links that are obsolete and should not be used.

Home	Admin	Config	Status
Home	Access	Amplifier	Monitor
Contact	SNMP	Utility	Alarms
Support		Redundancy	FETs

4.5.5   Web Server Page Descriptions

The following subsections the pages accessible via hyperlink from the navigation tabs shown in **Sect. 4.5.4**:

- **Sect. 4.5.5.1**   **Home Page**
- **Sect. 4.5.5.2**   **Admin (Administration) Pages**
- **Sect. 4.5.5.3**   **Config (Configure HPOD) Pages**
- **Sect. 4.5.5.4**   **Status Pages**

4.5.5.1 Home Page

Click the **Home** tab, and then select the **Home** hyperlink to continue.

4.5.5.1.1 Home | Home Page

Use this page to identify the product in use and its current firmware version.

Click the **Home** navigation tab and/or the nested hyperlink to return to this page from anywhere in the Web Server Interface.
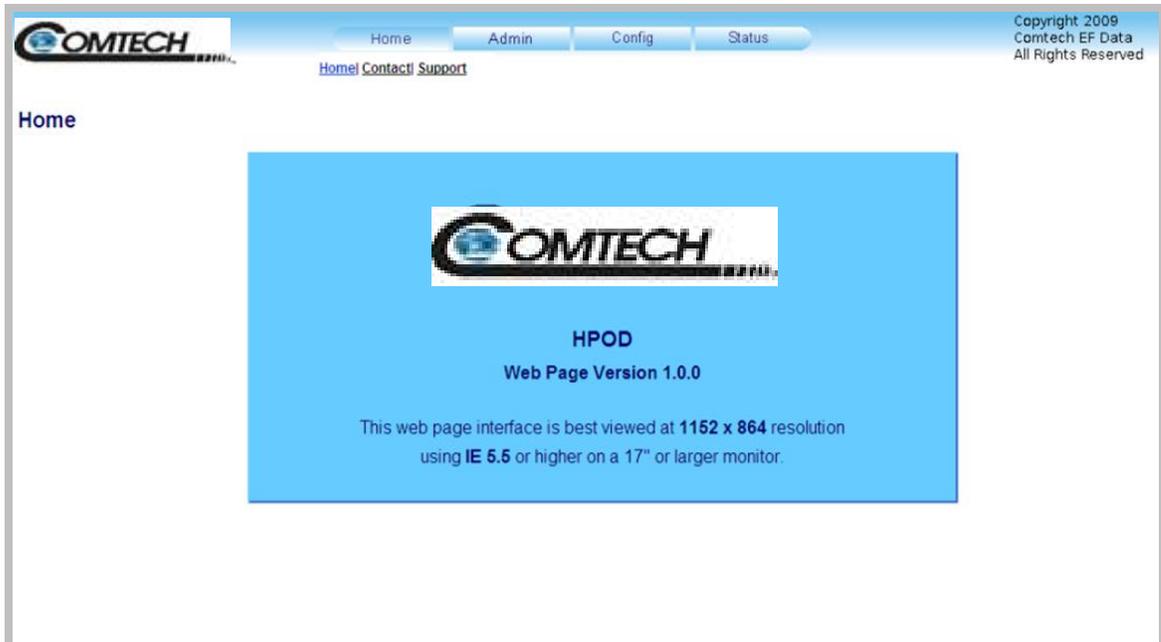
Figure 4-1. HPOD Home | Home page

4.5.5.1.2 Home | Contact and Home | Support Pages

Comtech Headquarters:
http://www.comtechefdata.com
Comtech Satellite Network Technologies, Inc.
2114 West 7th Street
Tempe, Arizona USA 85281
+1.480.333.2200

For all product support, please call:
+1.240.243.1880
+1.866.472.3963 (toll free USA)

4.5.5.2   Admin Pages

> ⊙ ***Only users logged in with the Administrator name and password have access to these pages.***

Click the **Admin** tab, and then select the **Access** or **SNMP** hyperlink to continue.

4.5.5.2.1   Admin | Access Page

The Administrator must use this page to manage the HPOD Web Server Interface access settings.

Figure 4-2. Admin | Access Page

> ⊙ ***At any time, click [Refresh] to update this page and see the most recent data.***

Network Maintenance

- **IP Gateway / IP Address/Range** – Enter the desired **IP Gateway** Address and **IP Address/ Range.**

Click **[Change IP Address]**, or click **[Reset]** to revert to the previously assigned **Network Maintenance** settings.

> ⊙ ***The MAC Address is read-only. It is set at the factory to a guaranteed unique address and cannot be modified.***

System Account Access Information

- **Read Only / Read/Write / Admin Names and Passwords** – These defaults, set at the factory, may be changed as needed:

Field	Factory Default Name / Password	Maximum Characters	Format
Read Only Name / **Password**	monitor / 1234		
Read/Write Name / **Password**	opcenter / 1234	10	alphanumeric
Admin Name / **Password**	comtech / comtech		

- **SMTP Server** – Set the mail server IP address from where you want to send e-mail, in the form **0.0.0.0**.

- **SMTP Domain Name / Destination** – The Administrator must assign the SMTP Domain Name and Destination.

Click **[Submit Access]** to save these settings or click **[Reset]** to revert to the previously assigned **System Account Access Information** settings.

Webpage Timeout

This is the maximum amount of time that the computer can remain idle before the session logs out. After the timeout occurs, you must log in to the Web Server Interface again.

Use the drop-down list to select **8 Hours** or **5 Minutes** (default), and then click **[Change]** to save.

4.5.5.2.2 Admin | SNMP Page

Sect. 4.3 SNMP INTERFACE

The Administrator must use this page to manage the HPOD SNMP (Simple Network Management Protocol) settings.

Figure 4-3. Admin | SNMP page

At any time, click [Refresh] to update this page and see the most recent data.

SNMP

- **Simple Network Management** – Use the drop-down list to set SNMP as **Enabled** or **Disabled**.

- **Read / Write / Trap Community Strings** – These defaults, set at the factory, may be changed as needed:

Field	Factory Default Name	Number of Characters	Format
Read Community String	public	0 to 20	alphanumeric
Write Community String	private	0 to 20	alphanumeric
Trap Community String	comtech	0 to 20	alphabetic

- **SNMP Contact / Name / Location** – Enter this contact information as needed, in alphanumeric format, up to a maximum of 20 characters.

- **Enabled Authentication Trap** – Use the drop-down list to set the Authentication Trap as **Enabled** or **Disabled**.

- **Trap IP 1 / Trap IP 2** – The Administrator can assign up to two SNMP Trap IP addresses in the form **000.000.000.000**.

- **Trap Version** – Use the drop-down list to select the SNMP Trap as version **SNMPv1** or **SNMPv2c**.

Click [**Submit SNMP**] to save these changes or click **[Reset]** to revert to the previously assigned SNMP settings.

4.5.5.3   Config Pages

Click the **Config** tab, and then select the **Amplifier**, **Utility**, or **Redundancy** hyperlink to
continue.

4.5.5.3.1   Config | Amplifier Page

Use this page to configure the communications, operations, and alarms/faults handling for the
amplifier.

Figure 4-4. Config | Amplifier page

At any time, click [Refresh] to update this page and see the most recent data.

Amplifier

- **Attenuation (dB)** – Enter an attenuation level, in 0.25 dB steps, from **00.00** to **20.00** dB.

- **Amplifier** – Use the drop-down list to set the amplifier as **On** or **Off**.

- **Mute** – Use the drop-down list to set the Mute function as **Enabled** or **Disabled**.

- **Overdrive Protection Mode**[1] **-** Use the drop-down list to set the function as **Enabled** or
  Disabled

- **Overdrive Activate Level**[1] **-** Enter a level from **P1dB rated** to **(P1dB rated - 10.00)**. Note:
  Maximum value can be 10.0. However, current customer attenautation (ATT) setting will
  factor into how large the activate level value can be used. For example: if ATT is 22.00 and
  ATT max range is 30.0, then maximum value the activate level can set to is 8.0.

- **Overdrive Mask**[1] **-** Use the drop-down list to set the overdrive mask to **Fault** or **Alarm**.
  Note: In falut mode, if an overdrive fault is triggered, the amplifier will be muted, and a
  summary fault activated. In Alarm mode, only a log is recorded.

Footnote:
[1]Overdrive protection settings are only available if main board firmware FW12524 is version 1.2.1 or newer and ethernet board firmware FW-0020544 is version 1.2.1 or newer.

Click **[Change Configuration]** to save these settings or click **[Reset]** to revert to the previously assigned **Amplifier** settings.

Fault Recovery

Use the drop-down list to set Fault Recovery as **Automatic** or **Manual**, and then click **[Change]**.

BUC Mute

Use the drop-down list to set BUC Mute as **Muted** or **Not Muted**, and then click **[Change]**.

Reference Adjust

Enter a numeric value from **0** to **255** to set the reference oscillator tuning voltage. The default voltage value is 87. Click **[Change]** when done.

Serial

- **Remote Address** – Enter a physical remote address from **0001** to **9999**.

- **Baud Rate** – Use the drop-down list to set the operating baud rate as **9600** or **19200** bps.

Click **[Change Serial Configuration]** to save these settings.

4.5.5.3.2 Config | Utility Page

Use this page to configure HPOD operating parameters.

Figure 4-5. Config | Utility page

At any time, click [Refresh] to update this page and see the most recent data.

Date and Time

Enter the Date and/or the Time:

Field	Format	Minimum Value	Maximum Value
Date (MM/DD/YY)	Month	01	12
	Day	01	31
	Year	00	99
Time (HH:MM:SS)	Hours	00	23
	Minutes	00	59
	Seconds	00	59

Click **[Change Date/Time]** to save the settings.

Circuit ID

Enter a Circuit ID string of up to 48 characters. Click **[Change CID]** to save the string.

Current SC/13320 Active Firmware Image # *(read-only)*

This example identifies **Image 1** as the Current Active Firmware Image.

Next Reboot Image – Use the drop-down list to select the Next Reboot Image as **1** or **2**, and then click **[Submit]** when done.

SC/13320 Board Firmware Version *(read-only)*

This *read-only* section identifies the current Boot, Bulk1, and Bulk2 firmware loads.

4.5.5.3.3 Config | Redundancy Page

See Appendix B. 1:1 AND 1:2 REDUNDANCY OPERATION for details on using this page to configure the HPOD for redundant operations.

Figure 4-6. Config | Redundancy page

At any time, click [Refresh] to update this page and see the most recent data.

4.5.5.4 Status Pages

Use the '**Status**' pages for updates on the HPOD's operational status, logged alarms, and Field Effect Transistor (FET) operating currents.

Click the **Status** tab, and then select the **Monitor**, **Alarms,** or **FETs** hyperlink to continue.

4.5.5.4.1 Status | Monitor Page

Use this page to monitor the operating status of the HPOD unit.

Figure 4-7. Status | Monitor page

At any time, click [Refresh] to update this page and see the most recent data.

4.5.5.4.2 Status | Alarms Page

Use this page to view and manage logged alarms data.
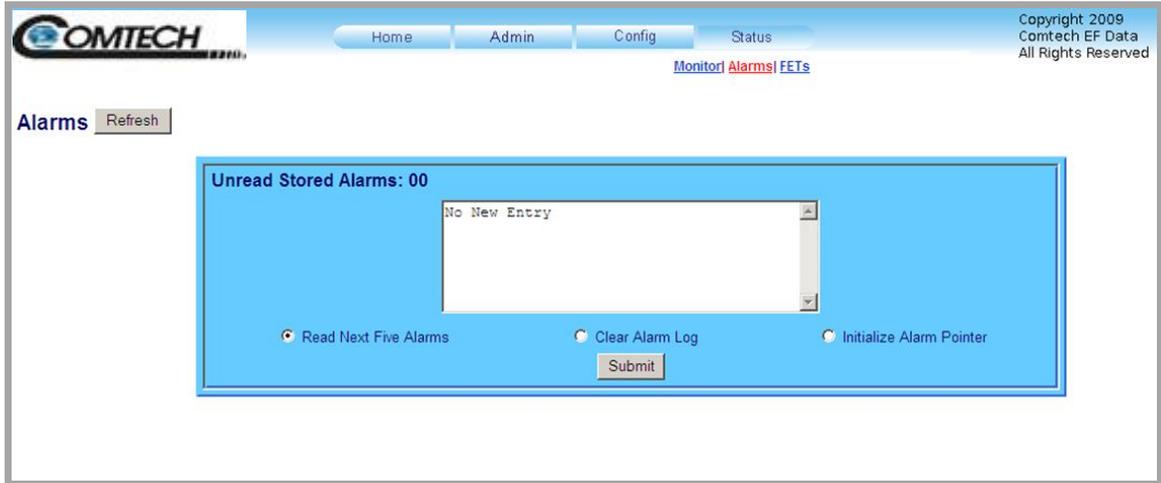
Figure 4-8. Status | Alarms page

> ⓘ *At any time, click [Refresh] to update this page and see the most recent data.*

Unread Stored Alarms:

This *read-only s*crollable display lists unread stored alarms in sequential, date-stamped format.

The unit returns and displays the five oldest stored alarms in the log. All alarms that are read from the log are also automatically removed from the log. The running tally of unread stored alarms (##) decrements accordingly to 00 once the log is cleared.

To manage the Unread Stored Alarms:

- Click the **Read Next Five Alarms** radio button, and then click **[Submit]** to display the next five unread alarms in the log.

- Click the **Clear Alarms Log** radio button, and then click **[Submit]** to clear all of the alarms stored in the log.

- Click the **Initialize Alarms Pointer** radio button, and then click **[Submit]** to reset the internal pointer to the beginning of the log.

4.5.5.4.3   Status | FETs Page

Use this *read-only* page to see the operating currents of all Field Effect Transistors (FETs) installed in the RF amplifier.

Figure 4-9. Status | FETs page

At any time, click [Refresh] to update this page and see the most recent data.

Notes:

Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT

5.1 Overview

This chapter describes the protocol and message command and query set for complete remote monitor and control of the HPOD SSPA. It also summarizes key operational parameters and some of their most commonly used remote commands and queries.

5.2 Key Operational Parameters

See Sect.5.5

Remote Commands and Queries *for detailed information about the remote commands and queries mentioned in this section.*

5.2.1 RF Input Level

The individual amplifier maximum gain and power rating determines the RF input level required to reach the full rated output power of the HPOD.

For example: If the test data of an SSPA rated for 250W (54 dBm) indicated a gain of 75 dB, then a signal of **54dBm – 75 dB = -21 dBm** would approximately give the rated output power.

Increasing input power beyond this level results in an output signal with increasingly higher levels of distortion. Of course, if the SSPA attenuation control is utilized, a higher-level input signal level can be accommodated.

⚠️ **CAUTION – Permanent damage may occur to the unit if the maximum input level exceeds 15 dBm.**

5.2.2 Attenuator Control

Execute the "ATT" command to attenuate HPOD gain over a 30 dB range.

5.2.3 Mute Control

The HPOD may be muted via software or discrete control:

- *Software* – Exercising the **MUT=1** command will "software" mute the unit.

- *Discrete Control* – When exercising the **AUX=1** command, the HPOD will be muted until Pin 'S' (on the '**J6 | COM1**' Discrete Control Connector) is pulled to ground (Pin 'K'). At that time, the unit unmutes.

The Mute command provides over 60 dB of RF on/off isolation. However, the Mute command only turns off the first few low power stages of the amplifier, the high-power stages remain on. By allowing the higher power transistors to stay on, the HPOD remains in a more thermally stable state should the mute condition be removed.

If the user desires to completely turn off the bias to the entire amplifier (perhaps to conserve energy in a redundant system), both the **MUT=1** and **AMP=0** commands should be executed. For normal transmit operation, **MUT=0** and **AMP=1** are required.

5.2.4 Faults

The M&C system monitors certain key functions of the SSPA for proper operation. Should any of these operating parameters exceed predetermined limits, the M&C system will declare a fault. Conditions that trigger a fault include:

- Any power supply more than ± 10% outside its nominal value.

- Either fan less than 25% of maximum speed.

- I2C internal bus communications fault.

- Thermal Shutdown. The system indicates a temperature fault if the unit is ≥ +95°C. This creates a summary fault and causes the unit to mute itself, and switch to the backup unit if in a redundancy system. However, the 10V supply to the Field Effect Transistors (FETs) will remain on until the unit reaches the thermal shutdown temperature of ≥ 100°C. For protection reasons, the unit will shut down the 10V supply to the power transistors at temperatures ≥ 100°C.

5.2.5   Power Detector

The HPOD features a power detector to monitor the output power. It has a useful range of over 20 dB, referenced to the unit's rated P1dB point. To read its value, execute the "RMS" query (e.g., <1/RMS?<cr>). The test data supplied with each unit gives an indication of the accuracy and flatness of the power monitor over the frequency band of operation.

5.2.6   Most Common Remote Queries

- **RMS** (Retrieve Maintenance Status): Displays voltages, fan speeds, Heatsink temperature, output power monitor reading, etc.

- **RCS** (Retrieve Configuration Status): Displays current attenuation, mute, amplifier, online, etc. status.

- **RAS** (Retrieve Alarm Status): Displays current alarm or fault status.

5.3   Serial Remote-Control Introduction

Serial-based Remote Product Management of the HPOD is available via its **J6 | COM1** port. This interface is either an EIA-485 multi-drop bus (for the control of multiple devices) or an EIA-232 connection (for the control of a single device). The interface transmits data in asynchronous serial form, using ASCII characters. This data consists of control and status information, transmitted in packets of variable length in accordance with the structure and protocol explained later in this chapter.

5.3.1   EIA-485

For applications where multiple devices are to be monitored and controlled, full-duplex (4-wire plus ground) EIA-485 is preferred. Half-duplex (2-wire plus ground) EIA-485 is possible but is not preferred. In full-duplex EIA-485 communication, there are two separate, isolated, independent, differential-mode twisted pairs, each handling serial data in different directions.

It is assumed that a 'Controller' device (a PC or ASCII dumb terminal) transmits data in a broadcast mode via one of the pairs. Multiple 'Target' devices are connected to this pair, and all simultaneously receive data from the Controller. The Controller is the only device with a line-driver connected to this pair – the Target devices have only line-receivers connected.

In the other direction, on the other pair each Target has a Tri-state line driver connected, and the Controller has a line-receiver connected. All the line drivers are held in high-impedance mode until one (and only one) Target transmits back to the Controller. Each Target has a unique address, and each time the Controller transmits, the address of the intended recipient Target is included in a framed 'packet' of data. All of the Targets receive the packet, but only one (the intended) will reply. The Target enables its output line driver and transmits its return data packet back to the Controller in the other direction, on the physically separate pair.

EIA-485 (full duplex) summary:

- Two differential pairs – one pair for Controller-to-Target, one pair for Target-to-Controller.

- Controller-to-Target pair has one line driver (Controller), and all Targets have line-receivers.

- Target-to-Controller pair has one line receiver (Controller), and all Targets have Tri-State drivers.

5.3.2 EIA-232

This is a much simpler configuration in which the Controller device is connected directly to the Target via a two-wire-plus-ground connection. Controller-to-Target data is carried via EIA-232 electrical levels on one conductor, and Target-to-Controller data is carried in the other direction on the other conductor.

5.3.3 Basic Protocol

Whether in EIA-232 or EIA-485 mode, all data is transmitted as asynchronous serial characters, suitable for transmission and reception by a Universal Asynchronous Receiver/Transmitter (UART). The asynchronous character format is 8-N-1 (8 data bits, no parity, 1 stop bit). The baud rate may vary from 1200 to 19200 baud.

All data is transmitted in framed packets. The Controller (assumed to be a PC or ASCII dumb terminal) that is in charge of the process of monitor and control is the only device that is permitted to initiate, at will, the transmission of data. Targets are only permitted to transmit when they have been specifically instructed to do so by the Controller.

All bytes within a packet are printable ASCII characters, less than ASCII code 127. In this context, the Carriage Return and Line Feed characters are considered printable.

All messages from Controller-to-Target require a response, with one exception: This will be either to return data that has been requested by the Controller, or to acknowledge reception of an instruction to change the configuration of the Target. The exception to this is when the Controller broadcasts a message (such as Set Time/Date) using Address 0, when the Target is set to EIA-485 mode.

5.3.4 Packet Structure

Controller-to-Target (Issued Command or Query)						
Start of Packet	**Target Address**	**Address Delimiter**	**Instruction Code**	**Code Qualifier**	**Optional Arguments**	**End of Packet**
 ASCII code 60 (1 character)	0000 (default) (4 characters)	/ ASCII code 47 (1 character)	(3 characters)	= *or* ? ASCII codes 61 *or* 63 (1 character)	(n characters)	Carriage Return ASCII code 13 (1 character)

Packet Example: <0412/MUT=1[cr]

Target-to-Controller (Response to Command or Query)						
Start of Packet	**Target Address**	**Address Delimiter**	**Instruction Code**	**Code Qualifier**	**Optional Arguments**	**End of Packet**
> ASCII code 62 (1 character)	(4 characters)	/ ASCII code 47 (1 character)	(3 characters)	=, ?, !, or* ASCII codes 61, 63, 33, or 42 (1 character)	(0 to n characters)	Carriage Return ASCII code 13 or 10 (2 characters)

Packet Example: >0412/MUT=1[cr][lf]

Detailed description of the packet components follow.

5.3.4.1 Start of Packet

- **Controller-to-Target** – This is the character '<' (ASCII code 60).

- **Target-to-Controller** – This is the character '>' (ASCII code 62).

The '<' and '>' characters indicate the start of packet. They may not appear anywhere else within the body of the message.

5.3.4.2 Target Address

Up to 9,999 devices can be uniquely addressed; in both **EIA-485** and **EIA-23**2 applications, the permissible range of values is 1 to 9999. The address is programmed into a Target unit using the remote-control port.

> *The Controller sends a packet with the address of a Target – the destination of the packet. When the Target responds, the address used is the same address, to indicate to the Controller the source of the packet. The Controller does not have its own address.*

5.3.4.3 Address Delimiter

This is the "forward slash" character '/ ' (ASCII code 47).

5.3.4.4 Instruction Code

This is a three-character alphabetic sequence that identifies the message subject. Wherever possible, the instruction codes have been chosen to have some significance to aid in the readability of the message, should it be displayed in its raw ASCII form. Only upper case and lower-case alphabetic characters may be used (A-Z, ASCII codes 65-90).

5.3.4.5   Instruction Code Qualifier

This is a single character that further qualifies the preceding instruction code. Code Qualifiers obey the following rules:

1) **From Controller-to-Target**, the only permitted characters are:

Character	Definition
= **(ASCII code 61)**	This character is used as the **Assignment Operator** (AO). It establishes that the Instruction Code that precedes it is to be used as a *command* to assign or configure operation. The instruction set that follows serves to assign the Target's new parameter setting or operational value. **Example: From Controller-to-Target**, MUT=1 means "enable the mute function."
? **(ASCII code 63)**	This character is used as the **Query Operator** (QO). It establishes that the Instruction Code that precedes it is to be used as a *query* that returns the Target's current configured parameter setting or operational value. **Example: From Controller-to-Target**, MUT? means "what's the current state of the MUTE function?"

2) **From Target-to-Controller**, the only permitted characters are:

Character	Definition
= **(ASCII code 61)**	This character is used in two ways: a. If the Controller sends a query to the Target – for example: **MUT?** meaning "what's the current state of the MUTE function?", the Target would respond with **MUT=x**, where **x** represents the state in question: **1** being *enabled*, and **0** being *disabled*. b. If the Controller sends an instruction to set a parameter to a particular value, and the value sent is valid, the Target acknowledges the message and responds with **MUT=** (with no message arguments).
? **(ASCII code 63)**	If the Controller sends an instruction to set a parameter to a particular value, and the value sent is not valid, the Target then acknowledges the message and responds with, for example, **MUT?** (with no message arguments). This indicates that there was an error in the message sent by the Controller.
! **(ASCII code 33)**	If the Controller sends an instruction code that the Target does not recognize, the Target responds by echoing the invalid instruction, followed by **!** **Example:** XYZ!

Character	Definition
* (ASCII code 42)	If the Controller sends the command to set a parameter to a particular value, and the value sent is valid BUT the router will not permit that particular parameter to be changed at present, the Target acknowledges the message and responds with, for example, **MUT*** (with message arguments).
# (ASCII code 35)	If the Controller sends an instruction code which the Target cannot currently perform because of hardware resource issues, then the Target 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. **For example,** if the operator issued commands to change both the frequency and the attenuation with less than 100 milliseconds between commands, and if this response is returned, then the command has not been accepted and the operator must resend the command.

5.3.4.6   Optional Message Arguments

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

5.3.4.7   End of Packet

- **Controller-to-Target** – This is the 'Carriage Return' ([CR]) character (ASCII code 13).

- **Target-to-Controller** – This is the two-character sequence 'Carriage Return', 'Line Feed' ([cr][lf]) (ASCII codes 13 and 10). Both indicate the valid termination of a packet.

5.4   Remote Commands and Queries

Index Notes:

Column 'C' = Command; **Column 'Q'** = Query; columns marked '**X**' designate instruction code as *Command only*, *Query only*, or *Command/Query*.

Instr Code	C	Q
AFR	X	X
AMP	X	X
ATT	X	X
AUX	X	X
BCM	X	X
CAA	X	
CAS		X
CCS		X
CFS		X
CID	X	X
CMS		X
CRA	X	X
CUS		X
DAT	X	X
FPA	X	X
FPT	X	X
FRW		X

Instr Code	C	Q
GOF	X	X
IMG	X	X
IPA	X	X
IPG	X	X
LNA		X
MAC		X
MUT	X	X
ODF	X	X
ONL	X	X
OVR	X	X
OVU	X	X
PNM		X

Instr Code	C	Q
RAS		X
RCS		X
RED	X	X
REF	X	X
RET		X
RFS		X
RMS		X
RSN		X
RUS		X
SBO	X	X
SBR	X	X
SFS		X
SPA	X	X
TIM	X	X
TNA		X
TPE	X	X
TPS	X	X
TSC		X
XRF	X	X

NOTE – Instruction Code Qualifiers, as defined in **Sect. 5.4.2.5**, are used in the command/query tables '**Response to Command**' columns:

=	Message OK	*	Message OK, but not permitted in current mode
?	Received OK, but invalid arguments found	#	Message OK, but unit is not in **Remote** mode
!	Invalid instruction		

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Auto Fault Recovery	AFR=	1 byte, value of 0, 1	Command or Query. Automatically mutes SSPA output in the event of detected fault. If enabled, it causes the output to go active (un-mute) if all faults are cleared. If disabled, output remains muted even if all faults are cleared. Example: <1/AFR=1'cr' >0001/AFR='cr''lf'	AFR= AFR? AFR*	AFR?	AFR=x (See Description of Arguments)

RF Power Amplifier State	AMP=	1 byte, value of 0, 1	Command or Query.
			Turn ON or OFF the RF power amplifiers, in the form x, where:
			   0 = Off
			   1 = On
			Example: <1/AMP=1'cr'
				AMP=
				AMP?
				AMP*
					AMP?	AMP=x
						
						(See Description of Arguments)

Attenuation	ATT=	5 bytes, numerical	Command or Query. Set a valid attenuation level, in 0.25 dB increments, in the form xx.xx. **Example:** <1/ATT=12.25'cr'	ATT= ATT? ATT*	ATT?	ATT=xx.xx (See Description of Arguments)
Gain Offset	GOF=	5 bytes, numerical	Command or Query. Set or query the adjusted attenuation level, in 0.25 dB increments, in a 1:1 redundant system so power is equal between the online and offline units when a switchover occurs, in the form xx.xx. **Example:** <1/GOF=02.00'cr'	GOF= GOF? GOF*	GOF?	GOF =xx.xx (See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Overdrive Protection Mode	OVR=	1 byte, value of 0, 1	Command or Query. Sets or returns the overdrive mode in the form x, where: 0=Disabled **(DEFAULT)** 1=Enabled **Example:** <1/OVR=1'cr'	OVR= OVR? OVR*	OVR?	OVR=x (See Description of Arguments)
Overdrive Trigger Level	OVU=	4 bytes, numerical	Command or Query. Sets or returns the overdrive trigger level in the form xx.x, where: xx.x=P1dB rated to (P1dB rated - 10.00, in dB) **Default value:** P1dB rated value. **Example:** <0001/OVU=42.5{CR} NOTES: Maximum value can be 10.0. However, current customer attenautation (ATT) setting will factor into how large OVU value can be used. For example: if ATT is 12.00 and ATT max range is 20.0, then maximum value OVU can set to is 8.0.	OVU= OVU? OVU*	OVU?	OVU=xx.x (See Description of Arguments)
Overdrive Protection Mode Mask	ODF=	1 byte, value of 0, 1	Command or Query. Sets or returns the overdrive mode mask in the form x, where: 0= FAULT 1=ALARM **Example:** <1/ODF=1'cr' NOTES: In Fault mode, if an overdrive fault is triggered, the amplifier will be muted, and a summary fault activated. In Alarm mode, only a log is recorded.	ODF= ODF? ODF*	ODF?	ODF=x (See Description of Arguments)

Set Backup Offset	SBO=	7 bytes, numerical	Command or Query.
			Set or query the adjusted attenuation level, in 0.25 dB increments, in a 1:2 redundant system so power is equal between the online and offline units when a switchover occurs. In the form #,xx.xx where:
			    # = 1 or 2
			    xx.xx = level, in 0.25 dB increments
			Examples: SBO=1,02.00'cr' or SBO=2,02.50'cr'
				SBO=
				SBO?
				SBO*
					SBO?	SBO=#,xx.xx
						
						(See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query

Auxiliary Mute Enable	AUX=	1 byte value of 0,1	Command or Query.
			Enable or disable the auxiliary mute mode, in the form x, where:
			  0 = Disabled
			  1 = Enabled
			Example:(AUX Mute Enabled): AUX=1'cr'
			Note: When enabled, Pin H of the J6 COMM 1 connector must be grounded to UN-MUTE unit. Otherwise, unit will be muted, and if a mute query is given (MUT?) the response will be MUT=2 to indicate a hardware-controlled mute is present.
				AUX=
				AUX?
				AUX*
					AUX?	AUX=x
						
						(See Description of Arguments)

BUC Mute State	BCM=	1 byte value of 0,1	Command or Query.
			Mute the unit, in the form x, where:
			  0 = BUC Muted
			  1 = BUC Not Muted
			Example: BCM=1'cr' would allow the BUC to transmit
			Note: Only active if the optional BUC is installed.
				BCM=
				BCM?
				BCM*
					BCM?	BCM=x
						
						(See Description of Arguments)

Low Forward Power Threshold	FPT=	5 bytes, numerical	Command or Query. Sets or returns the threshold for the low forward power fault in the form xxx.x: NOTES: If the forward power drops below the specified value, a fault may be indicated based on FPA setting. **Example:** <0001/FPT=030.0'cr'	FPT= FPT? FPT*	FPT?	FPT=xxx.x
Low Forward Power Mask	FPA=	1 byte value of 0,1	Command or Query. Sets or returns the low forward power mask in the form x, where: 0= FAULT 1=MASK **Example:** <1/FPA=1'cr'	FPA= FPA? FPA*	FPA?	FPT=x (See Description of Arguments)
Clear All Stored Alarms	CAA=	None	Command only. Clears all Stored Events: Example: <1/CAA='cr' >0001/CAA='cr''lf' **Note:** This command takes no arguments.	CAA=	N/A	N/A

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query

Concise Alarm Status	N/A	25 bytes, alphanumeric	Query only.
			Reports the Alarm status of the unit. Response is comma delimited in the form a,b,c,d,e,f,g,h,I,j,k,I,m'cr''lf' where:
			a thru k = 0 or 1
			   0 = OK
			   1 = FT
			a = +24V Power Supply
			b = +15V Power Supply
			c = +10V-A Power Supply
			d = +10V-B Power Supply
			e = +7.5V Power Supply
			f = +5V Power Supply
			g = -5V Power Supply
			h = Fan#1 State
			i = Fan#2 State
			j = Heatsink Temp
			k = Shutdown
			l = IIC Status
			m=Forward Power Alarm
				N/A	CAS?	CAS=x….x
						
						(See Description of Arguments)

Concise Configuration Status	N/A	24 bytes, alphanumeric	Query only.
			Reports the summarized version of RCS. Response is comma delimited in the form aaaaa,b,c,d,e-e,fffff,g,'cr' where:
			aaaaa = attenuation in dB
			b = RF power amplifier state
			c = mute state
			   0 = unmuted
			   1 = muted
			d = online status
			e-e = redundancy state and mode
			fffff = gain offset in dB
			g = AFR
				N/A	CCS?	CCS=x….x
						
						(See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Concise RF Power FET Current Status	N/A	Variable length depending on the number of FETs installed in the amplifier	Query only. Reports concise version of RFS. response is comma delimited in the form xxx,xxx,x.x,x.x,……….,x.x	N/A	CFS?	CFS=x…..x (See RFS Description of Arguments)
Circuit Identification	CID=	24 bytes, alphanumeric	Command or Query. Set User-defined string to identify or name the unit or station. The CID is a 24-byte field of data that is entered as one line, but it will be read back from the unit as two 12-byte lines of data. Examples: <1/CID= Station #001--HPOD #01--'cr' >0001/CID= <1/CID?'cr' >0001/CID='cr' Station #001'cr' --HPOD #01--'cr''lf'	CID= CID?	CID?	CID=x…x (See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Concise Maintenance Status	N/A	84 bytes, alphanumeric	Query only. Reports the concise version of RMS. The response is comma delimited in the form aaa.a,bbb.b,ccc.c,ddd.d,eee.e, fff.f,ggg.g,hhh.h,iii.i,jjj.j,kkk.k,lll.l,mmm.m,nnn.n,'cr''lf' where: aaa.a = +24V Power Supply bbb.b = +15V Power Supply ccc.c = +10V-1 Power Supply ddd.d = +10V-2 Power Supply eee.e = +7.5V Power Supply fff.f = +5V Power Supply ggg.g = -5V Power Supply hhh.h = Fan #1 speed (in percent) iii.i = Fan #2 speed (in percent) jjj.j = Amplifier temperature in deg. C kkk.k = Amplifier 10V1 lll.l = Amplifier 10V2 mmm.m=Forward RF output power, in dBm **Note:** nnn.n will appear for Ref Voltage if Reference Oscillator Module is installed.	N/A	CMS?	CMS=x….x (See Description of Arguments)
Configure Redundancy Amp	CRA=	1 byte value of 0,1	Command or query. Permits configuration of the redundancy amplifier mode in 1:1 and 1:2 redundancy systems, in the form x, where: 0 = Disabled - the offline unit's amp state will follow the online unit's amp state (Default). 1 = Enabled - the offline unit's amp state will be Off, if it becomes the online unit, then its amp state will be On. This affects all units in the redundancy system. **Note:** The same CRA value should be sent to all units in the redundancy system.	CRA= CRA?	CRA?	CRA=x (See Description of Arguments)
Concise Utility Status	N/A	11 bytes, alphanumeric	Query only. Reports the Maintenance status of the unit. Response is comma delimited in the form aaaa,bbbb,ccc,'cr''lf' where: aaaa = Remote Unit Address bbbb = Remote Baud Rate	N/A	CUS?	CUS=x….x (See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Set RTC (Real-Time-Clock) Date	DAT=	6 bytes, numeric	Command or Query. Set clocks in the form **mmddyy**, where: mm = month of the year, between 01 and 12 dd = day of the month, between 01 and 31 yy = year, between 00 and 96 (2000 to 2096) **Example:**(date = April 24, 2003): <1/DAT=042403'cr' >0001/DAT='cr''lf'	DAT= DAT? DAT*	DAT?	DAT=xxxxxx (See Description of Arguments)
Retrieve Firmware Number	N/A	256 bytes	Query only. Returns the firmware type loaded into the unit. **Example:** <1/FRW?'cr' >0001/FRW='cr' BULK=FW12524'cr' MnC =FW12522'cr' FPGA=FW10788'cr''lf' **Note:** the RET? Query returns the MnC firmware revision.	N/A	FRW?	FRW=x…x (See Description of Arguments)
Mute State	MUT=	1 byte, value of 0,1	Command or Query. Mutes the unit, in the form x, where: 0 = Disabled 1 = Enabled 2 = Unit muted due to discrete control lines. Query response only. **Example:** <1/MUT=1'cr'	MUT= MUT? MUT*	MUT?	MUT=x (See Description of Arguments)
Online Status	ONL=	1 byte, value of 0, 1	Command or Query. Online status (applies only to redundancy), in the form x, where: 0 = Disabled 1 = Enabled **Example:** <1/ONL=1'cr' >0001/ONL='cr''lf'	ONL= ONL? ONL*	ONL?	ONL=x

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query

Retrieve next 5 unread Stored Alarms	N/A	145 bytes, alphanumeric	Query only.
			Reports the five oldest stored events in the alarm log, and if there are no events in the log the unit will reply with LNA*. All events that are read from the log are also automatically removed from the log.
			Reply format:
			YYYYYYYYYY ZZ mmddyy hhmmss'cr'
			YYYYYYYYYY ZZ mmddyy hhmmss'cr'
			YYYYYYYYYY ZZ mmddyy hhmmss'cr'
			YYYYYYYYYY ZZ mmddyy hhmmss'cr'
			YYYYYYYYYY ZZ mmddyy hhmmss'cr''lf'
			Where:
			YYYYYYYYYY is the fault description.
			ZZ is the event type:
			   FT = Fault
			   OK = Clear
			   IF = Information
			mmddyy hhmmss = date / time stamp.
			Example:
			<1/LNA?'cr'
			>0001/LNA='cr'
			LOG CLR IF 175503 052307'cr'
			FAN #1 FT 175504 052307'cr'
			OVR TMP FT 175504 052307'cr'
			FAN #1 OK 175504 052307'cr'
			IIC BUS FT 175504 052307'cr''lf'
				N/A	LNA?	LNA=YY..ss
						
						(See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Retrieve Alarm Status	N/A	117 bytes, alphanumeric	Query only. Reports the Alarm status of the unit. Example: <1/RAS?'cr' >0001/RAS='cr''lf' P24VT=OK'cr' P15VT=OK'cr' P10V1=OK'cr' P10V2=OK'cr' P7V5T=OK'cr' P5VLT=OK'cr' N5VLT=OK'cr' FAN#1=OK'cr' FAN#2=OK'cr' HSTMP=OK'cr' SHTDN=OK'cr' IICST=OK'cr' FPOUT=OK'cr''lf' **Note:** BUC=XX, and REF=XX will appear in the list if the BUC, and reference oscillator are installed.	N/A	RAS?	RAS=x….x (See Description of Arguments)
Retrieve Configuration Status	N/A	45 bytes, alphanumeric	Query only. Reports the configuration status of the unit. Example: <1/RCS?'cr' >0001/RCS='cr''lf' ATT=12.75'cr' (Attenuation in dB) AMP=1'cr' (RF power amplifier state, 0=OFF, 1=ON) MUT=1'cr' (RF mute state, 0=un-muted, 1=muted) ONL=1'cr' (Online status for redundancy) RED=1-1'cr' (Redundancy state and mode, states: 0=OFF, 1=ON, modes: 0=manual, 1=auto) GOF=00.00'cr' (Gain Offset in dB) AFR=1'cr''lf' (Auto Fault Recovery, 0=manual, 1=auto)	N/A	RCS?	RCS=x….x (See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Redundancy State	RED=	1 byte, value of 0, 1, 2	Command or Query. Set or report as ON or OFF the redundancy state, in the form x, where: 0 = Off 1 = 1:1 Redundancy 2 = 1:2 Redundancy Example: <1/RED=1'cr' >0001/RED='cr''lf'	RED= RED? RED*	RED?	RED =x
Reference Oscillator Tuning	REF=	3 bytes, numeric	Command or Query. Adjusts the reference oscillator tuning voltage by sending a DAC value in the form xxx, where: xxx = numeric value from 0 to 255, and the default value is set to 87. Example: <1/REF=87'cr' >0001/REF= **Note:** This command sets the DAC value, but the actual Reference Oscillator tuning voltage can be monitored using the RMS command.	REF= REF? REF*	REF?	REF=xxx (See Description of Arguments)
Retrieve Equipment Type	N/A	22 bytes, alphanumeric	Query only. Returns the Model Number and the version of the MnC firmware installed in the unit. Example: <1/RET?'cr' >0001/RET=CPA-300 VER: 1.0.3'cr''lf'	N/A	RET?	RET=x….x (See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
RF Power FET Current status	N/A	variable length depending on the number of FETs installed in the amplifier	Query only. Returns all the FET currents. Example: <1/RFS? 'cr' >0001/RFS='cr' Q01=xx'cr' Q02=xx'cr' Q03=xx.x'cr' Q04=xx.x'cr' Q05=xx.x'cr' Q06=xx.x'cr' Q07=xx.x'cr' Q08=xx.x'cr' Q09=xx.x'cr' Q10=xx.x'cr' Q11=xx.x'cr' Q12=xx.x'cr' Q13=xx.x'cr' Q14=xx.x'cr' Q15=xx.x'cr' Q16=xx.x'cr''lf'	N/A	RFS?	RFS=x….x (See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Retrieve Maintenance Status	N/A	168 bytes, alpha-numeric	Query only. Returns the maintenance status of the unit. Example: <1/RMS?'cr' >0001/RMS='cr' P24VT=024.1'cr' P15VT=015.2'cr' P10V1=010.4'cr' P10V2=010.4'cr' P7V5T=007.8'cr' P5VLT=005.8'cr' N5VLT=-05.7'cr' FANR1=100.0'cr' FANR2=100.0'cr' ATEMP=+40.0'cr' A10V1=010.2'cr' A10V2=010.2'cr' FWPWR=+37.6'cr' RVPWR=02.0'cr''lf' (optional) ***Note:** REFV will appear if REF OSC module is installed.	N/A	RMS?	RMS=x….x (See Description of Arguments)
Serial Number	N/A	9 bytes, numeric, 000000000 to 999999999	Query only. Returns the unit's 9 digit serial number in the form xxxxxxxxx. Example: <1/RSN?'cr' >0001/RSN=072282040'cr''lf'	N/A	RSN?	RSN=xxxxxxxxx (See Description of Arguments)
Retrieve Utility Status	N/A	27 bytes, alpha-numeric	Query only. Returns the utility status of the unit. Example: RUS='cr' ADR=0001'cr' BDR=9600'cr'	N/A	RUS?	RUS=x….x (See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Remote Baud Rate	SBR=	4 bytes, alphanumeric	Command or Query. Set remote baud rate in the form xxxx, where: 9600 = 9600 baud 19K2 = 19200 baud **Example:** SBR=9600'cr' **Note:** When changing baud rates remotely the response to the command will be returned using the same baud rate as that used to send the command.	SBR= SBR?	SBR?	SBR=xxxx (See Description of Arguments)
Summary Fault Status	N/A	1 byte, value of 0,1	Query only. Returns the condition of the summary fault relay where: 0 = Not Faulted (SumFLT_COM J6 pin K is connected to SumFLT_NO J6 pin L, and SumFLT_NC J6 pin M is open) 1 = Faulted (SumFLT_COM J6 pin K is connected to SumFLT_NC J6 pin M, and SumFLT_NO J6 pin L is open) Example: <1/SFS? >0001/SFS=0'cr''lf'	N/A	SFS?	SFS=x (See Description of Arguments)
Remote Address	SPA=	4 bytes, numeric	Command or Query. Set Physical Address in the form xxxx, where: xxxx = address between 0001 to 9999, resolution 0001 **Example:** SPA=0412'cr'	SPA= SPA?	SPA?	SPA=xxxx (See Description of Arguments)
Set RTC Time	TIM=	6 bytes, numeric	Command or Query. Sets or returns the RTC time in the form **hhmmss**, where: hh = hours, between 00 and 23; mm = minutes, between 00 and 59, ss = seconds, between 00 and 59 **Example:**(time = 23 hours, 12 minutes and 59 seconds since midnight.): <1/TIM=231259'cr' >0001/TIM='cr''lf'	TIM = TIM? TIM*	TIM?	TIM=xxxxxx (See Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Retrieve Number of unread Stored Alarms	N/A	2 bytes, numeric, 00 to 99	Query only. Returns the number of stored events that remain unread in the alarm log, in the form xx, where: Xx = A maximum of 99 events may be stored in the alarm log. Example: <1/TNA? 'cr' >0001/TNA=14'cr''lf'	N/A	TNA?	TNA=xx (See Description of Arguments)
Terminal Status change	N/A	1 byte, value of 0,1	Query only. Indicates if there has been a change in the terminal status since the last time the command was given. A value of 0 indicates no status change, and a value of 1 indicates there has been a terminal status change. Example: <1/TSC?'cr' >0001/TSC=0'cr''lf'	N/A	TSC?	TSC=x (See Description of Arguments)
Software Image	IMG=	1 byte	Command or Query. Current Active software image, in the form x, where: 1=Bulk Image # 1 currently active 2=Bulk Image # 2 currently active **Example:** IMG=1 (which is Image #1 active)	IMG= IMG? IMG* IMG#	IMG?	IMG=x (See Description of Arguments)
IP Address	IPA=	18 bytes	Command or Query. Set the IP address and network prefix for the 10/100 BaseT Ethernet management port, in the form aaa.bbb.ccc.ddd.yy where: aaa = 0-223 bbb = 0-255 ccc = 0-255 ddd = 001-255 yy = 08-30 **Default Value:** 192.168.001.004.24 **Example:** 192.168.001.004.24	IPA= IPA? IPA* IPA#	IPA?	IPA= aaa.bbb.ccc.ddd.yy (see Description of Arguments)

Parameter Type	Command (Instruction & Qualifier)	Number of Arguments	Description of Arguments	Response to Command	Query (Instruction & Qualifier)	Response to Query
Gateway Address	IPG=	15 bytes	Command or Query. Set the Gateway IP address for the 10/100 Base Tx Ethernet management port, in the form aaa.bbb.ccc.ddd, where: aaa = 0-223 bbb = 0-255 ccc = 0-255 ddd = 001-255 **Default Value:** 192.168.001.005 **Example:** IPG = 192.168.001.005	IPG= IPG? IPG*	IPG?	IPG = aaa.bbb.ccc.ddd (see Description of Arguments)
Unit MAC Address	N/A	17 bytes	Query only. Reports, in hexadecimal, the MAC address of the unit. **Example:** MAC=00-06-B0-00-D2-A7	MAC= MAC*	MAC?	MAC= xx-xx-xx-xx-xx-xx (See Description of Arguments)
Time Protocol Enable	TPE	1 byte, value of 0,1	Command or Query. Enables or Disables the Time Protocol, in the form x, where: 0 = Time protocol disabled 1 = Time protocol enabled **Example:** TPE=1 (Time protocol enabled)	TPE= TPE?	TPE?	TPE=x (See Description of Arguments)
Time Protocol Server	TPS	15 bytes	Command or Query. Sets or returns the Time Server IP address for the unit Tx Ethernet management port, in the form aaa.bbb.ccc.ddd, where: aaa = 0-223 bbb = 0-255 ccc = 0-255 ddd = 001-255 **Default Value:** 255.255.255.255 **Example:** IPG = 192.168.001.005	TPS= TPS?	TPS?	TPS= aaa.bbb.ccc.ddd (see Description of Arguments)

Notes:

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Appendix A. REDUNDANCY SYSTEM ASSEMBLY KITS

A.1   Overview

Several kits are available from Comtech to mount and install HPOD 1:1 or 1:2 Redundancy Systems. These kits are tailored to the operational frequency of the system. The figures and tables provided in the subsections that follow provide examples of these currently available kits.

> *The illustrations provided in this appendix are intended as reference examples only. The dimensions shown in these example figures are subject to change and may not reflect your installed configuration.*

Once all system kit components have been assembled and all interconnecting RF and M&C cables have been installed, see **Appendix B. 1:1 AND 1:2 REDUNDANCY OPERATION** for further information about configuring, operating, and troubleshooting your HPOD 1:1 or 1:2 Redundancy System.

Table A-1. Summary of Available Redundancy System Assembly Kits

SECTION / PRODUCT	SUBSECTION	TABLE (Parts List)	FIGURE(S)	Comtech P/N	DESCRIPTION
A.2 Common Kits	A.2.1	A-2	A-1	PL/12319-1	Universal Pole Mounting Kit
	A.2.2	A-3	A-2	PL/12300-1	Unit Mounting Kit
	A.2.3	A-4	A-3	KT/12200-1	1:1 Unistrut Kit
	A.2.4	A-5	A-4	KT-0000017	1:2 Unistrut Kit
	A.2.5	A-6	A-5	KT-0020827	1:1 or 1:2 Free Standing Unistrut Kit
A.3 1:1 Kits	A.3.1	N/A	A-6 thru A-8	N/A	HPOD 1:1 Redundancy System Mounting and Switch Kit Example
	A.3.2	N/A	A-9, A-10	3X KT-0020827	Ku-Band 1:1 Redundancy System Free Standing Mounting and Switch Kit Example
	A.3.3	A-7	A-11	KT/11799	ODPA C-Band 1:1 Redundancy Switch/Waveguide Kit
	A.3.4	A-8	A-12	KT/11387	ODPA X-Band 1:1 Redundancy Switch/Waveguide Kit
	A.3.5	N/A	A-13	KT/12240-1	C-Band 1:1 Redundancy System – Switch and Unistrut Assembly
	A.3.6	A-9	A-14	KT/12201-1	C-Band 1:1 Redundancy Switch/Waveguide Kit
	A.3.7	A-10	A-15	KT-0020523	C-Band Offline Unit Termination Bypass Waveguide Kit
	A3.8	A-11	A-16	KT/11936-1	Ku-Band 1:1 Redundancy Assembly Kit
	A3.9	A-12	A-17	KT/12337-1	Ku-Band 1:1 Redundancy Switch/Waveguide Kit
A.4 1:2 Kits	A.4.1	N/A	A-18, A-19	N/A	C-Band 1:2 Redundancy System Mounting and Switch Kit Example
	A.4.2	N/A	A-20, A-21	3X KT-0020827	C-Band 1:2 Redundancy System Free Standing Mounting and Switch Kit Example
	A.4.3	N/A	A-22 thru A-24	KT-0020685	Ku-Band 1:2 Redundancy System Mounting and Switch Kit Example

A.2 Common Mounting Kits

A.2.1 Universal Pole Mounting Kit (Comtech P/N PL/12319-1)

Table A-2. Universal Pole Mounting Kit (Comtech P/N PL/12319-1) Parts List

ITEM	QTY	Comtech P/N	DESCRIPTION
1	1	N/A	DUAL CHANNEL UNISTRUT (P/O MOUNTING KIT, SHOWN FOR REFERENCE ONLY)
2	2	HW/M8SPRING NUT	SPRING NUT, M8
3	2	HW/PIPEBLOCK	PIPE BLOCK
4	2	HW/M8X1.25X25HEXSS	HEX HEAD BOLT, M8, 25MM LG
5	7	HW/M8FLATSS	FLAT WASHER, M8
6	7	HW/M8LOCKSS	LOCK WASHER, M8
7	1	FP/BR0069	FLOATING STRAP BRACKET
8	1	FP/BR0071	PIPE STRAP (TRIM TO REQUIRED LENGTH)
9	5	HW/M8X1.25MMHEXNUTSS	HEX NUT, M8 X 16MM LG
10	1	FP/BR0070	FIXED STRAP BRACKET, STRAP
11	1	FP/BR0072	STRAP TENSIONER BOLT
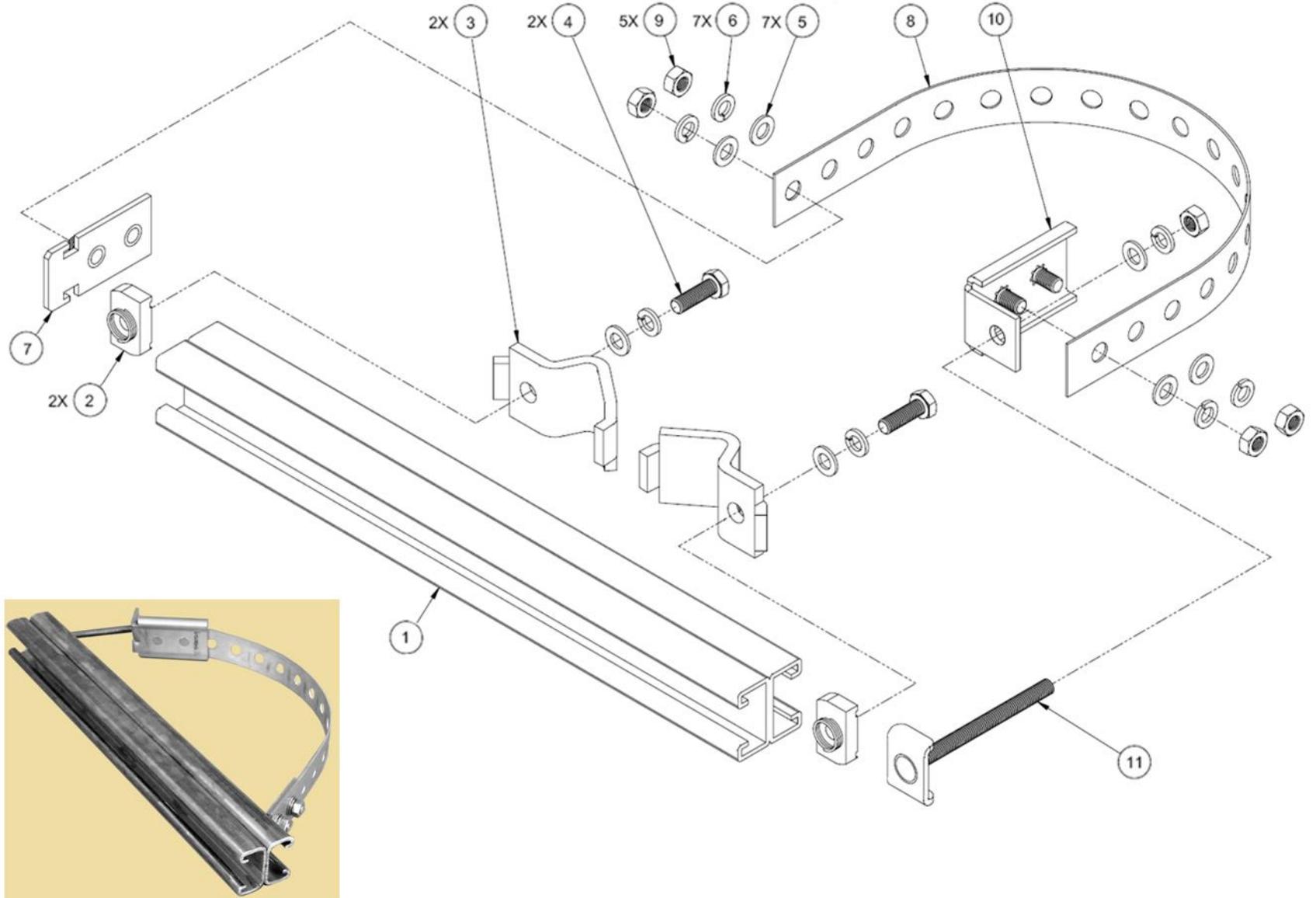
Figure A-1. Universal Pole Mounting Kit (CE Comtech FD P/N PL/12319-1)

A.2.2 Unit Mounting Kit (Comtech P/N PL/12300-1)

Table A-3. Unit Mounting Kit (Comtech P/N PL/12300-1) Parts List

ITEM	QTY	Comtech P/N	DESCRIPTION
1	2	FP/BR12239-1	Bracket, Mounting (ROHS)
2	4	HW/3/8SPRINGNUT	Springnut
3	4	HW/3/8-FLT	Washer, Flat
4	4	HW/3/8-SPLIT	Washer, Split
5	4	HW/3/8-16X1BLT	Bolt, Hex-Head
6	4	HW/5/16-18HEXNT	Nut, Hex
7	8	HW/5/16-FLAT	Washer, Flat
8	4	HW/5/16-SPLIT	Washer, Split
9	4	HW/5/16-18X1BLT	Bolt, Hex-Head
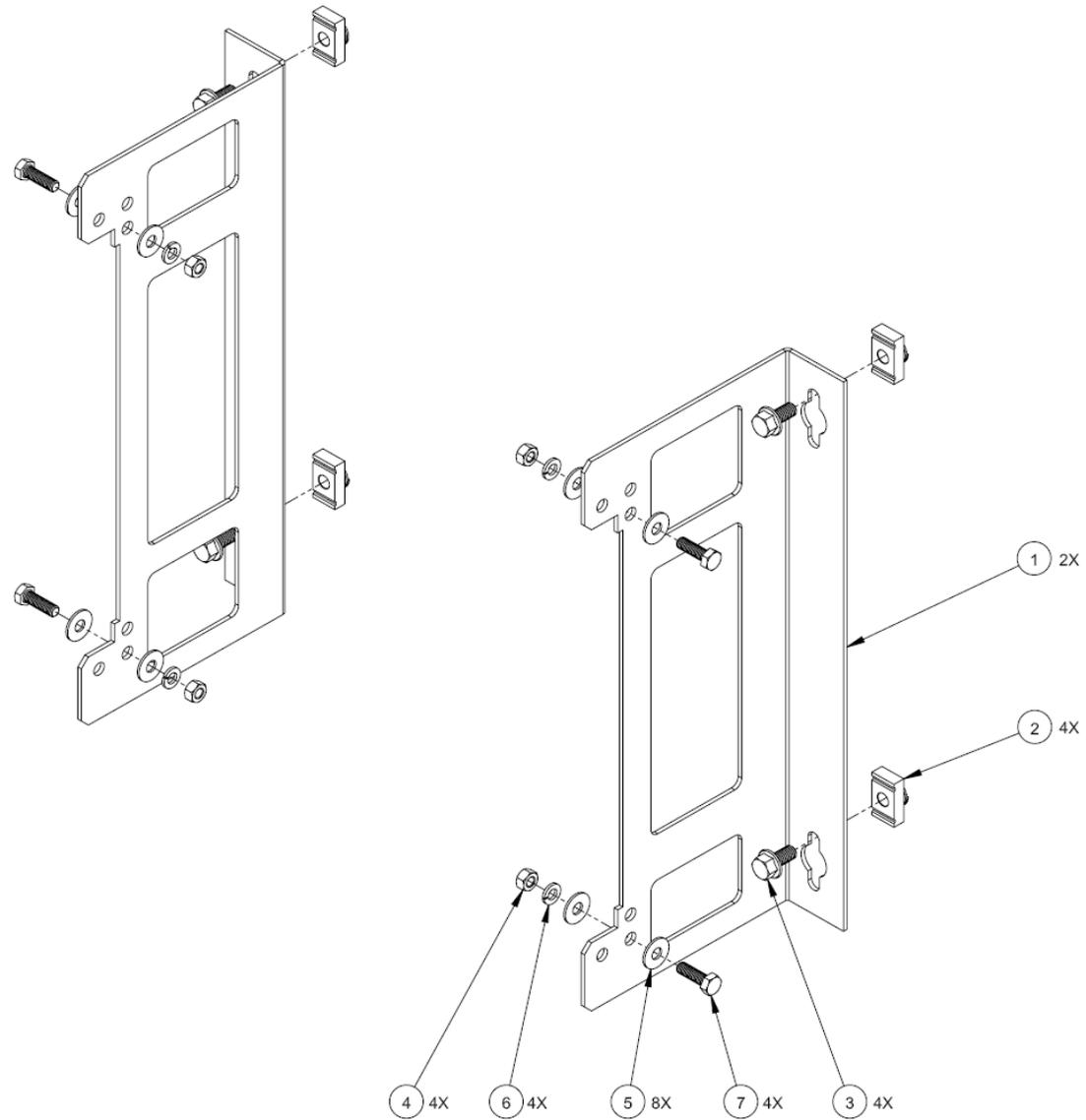
Figure A-2. Unit Mounting Kit (Comtech P/N PL/12300-1)

A.2.3   1:1 Unistrut Kit (Comtech P/N KT/12200-1)

Table A-4. 1:1 Redundancy System – Unistrut Kit (Comtech P/N KT/12200-1) Parts List

ITEM	QTY	Comtech P/N	DESCRIPTION
1	3	FP/BR11931-1	Dual Channel Unistrut
2	2	FP/BR11932-1	Bracket, Channel
3		Not Used	
4	6	HW/3/8SPRINGNUT	Springnut
5	6	HW/3/8-FLT	Washer, Flat
6	6	HW/3/8-SPLIT	Washer, Split
7	6	HW/3/8-16X1BLT	Bolt, Hex-Head, 3/8-16 x 1" LG
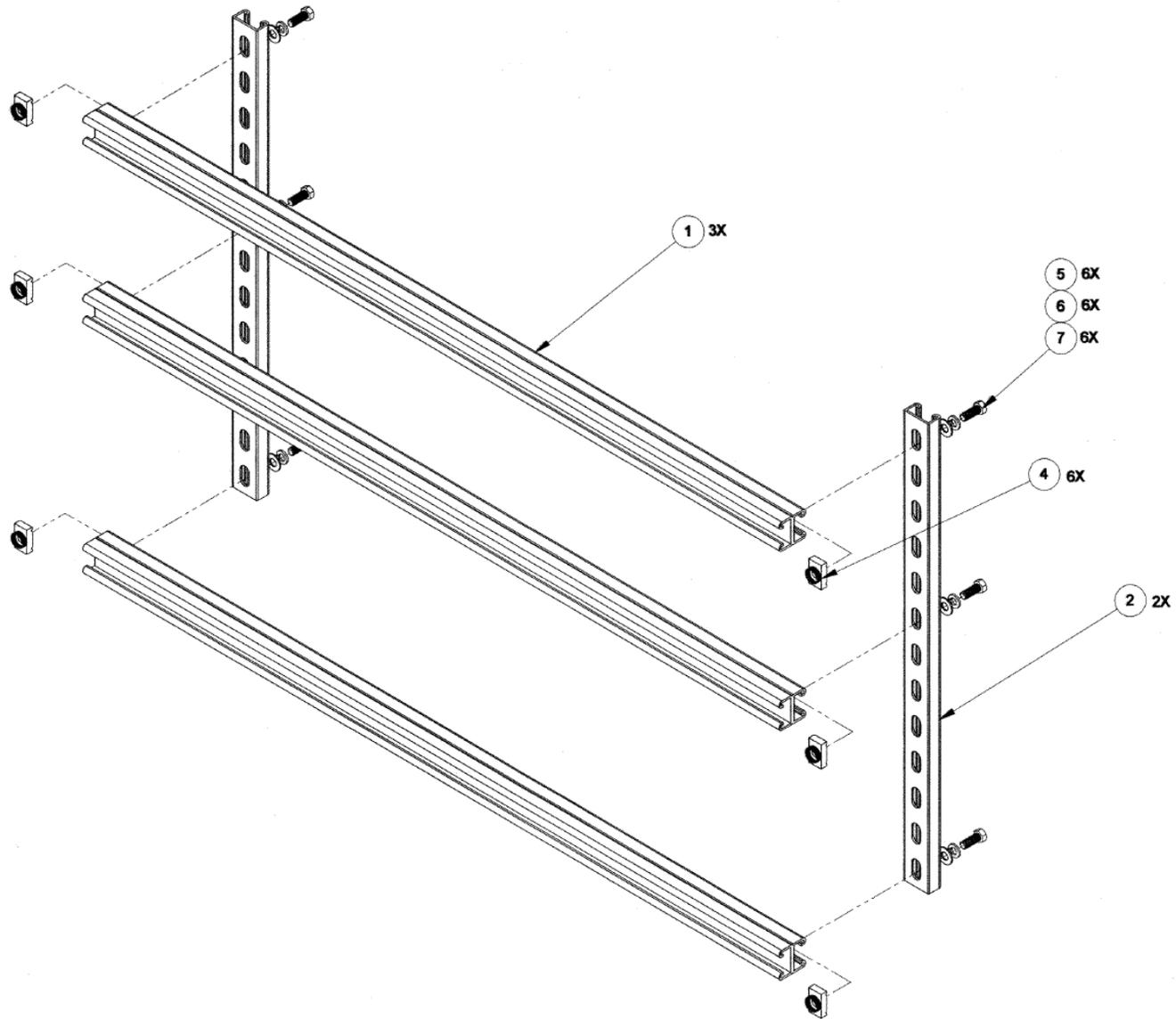
Figure A-3. 1:1 Redundancy System – Unistrut Kit (Comtech P/N KT/12200-1)

A.2.4   1:2 Unistrut Kit (Comtech P/N KT-0000017)

Table A-5. 1:2 Redundancy System – Unistrut Kit (Comtech P/N KT-0000017) Parts List

ITEM	QTY	Comtech P/N	DESCRIPTION
1	3	FP-0000134	Unistrut, Dual Channel
2	2	FP/BR11932-1	Bracket, Unistrut
3		Not Used	
4	6	HW/3/8SPRINGNUT	Springnut
5	6	HW-0000069	Washer, Flat, Thick
6	6	HW/3/8-SPLIT	Lock washer, Split
7	6	HW/3/8-16X1BLT	Bolt, Hex-Head 3/8-16 x 1" LG
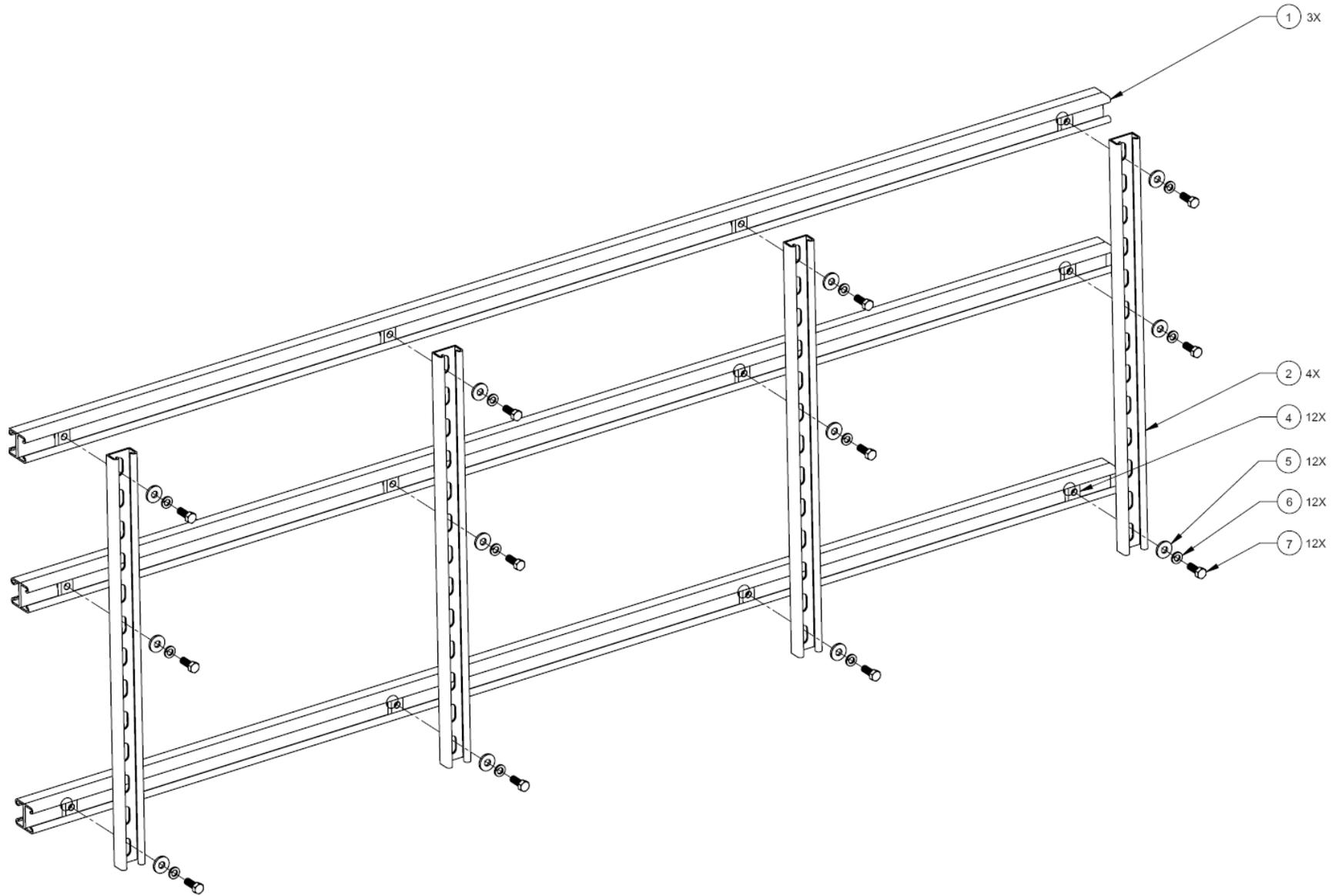
Figure A-4. 1:2 Redundancy System – Unistrut Kit (Comtech P/N KT-0000017)

A.2.5   1:1 or 1:2 Free Standing Unistrut Kit (Comtech P/N KT-0020827)

Table A-6. 1:1 or 1:2 Redundancy System – Free Standing Unistrut Kit (Comtech P/N KT-0020827) Parts List

ITEM	QTY	Comtech P/N	DESCRIPTION
1	2	FP/BR11931-1	Bracket, Unistrut
2	20	HW-0000070	Screw, Hex, Flanged Head 0.3
3	6	HW-0020764	Bracket, Unistrut, 90°
4	2	HW-0020765	Bracket, Flat, Unistrut
5	20	HW/3/8SPRINGNUT	Springnut
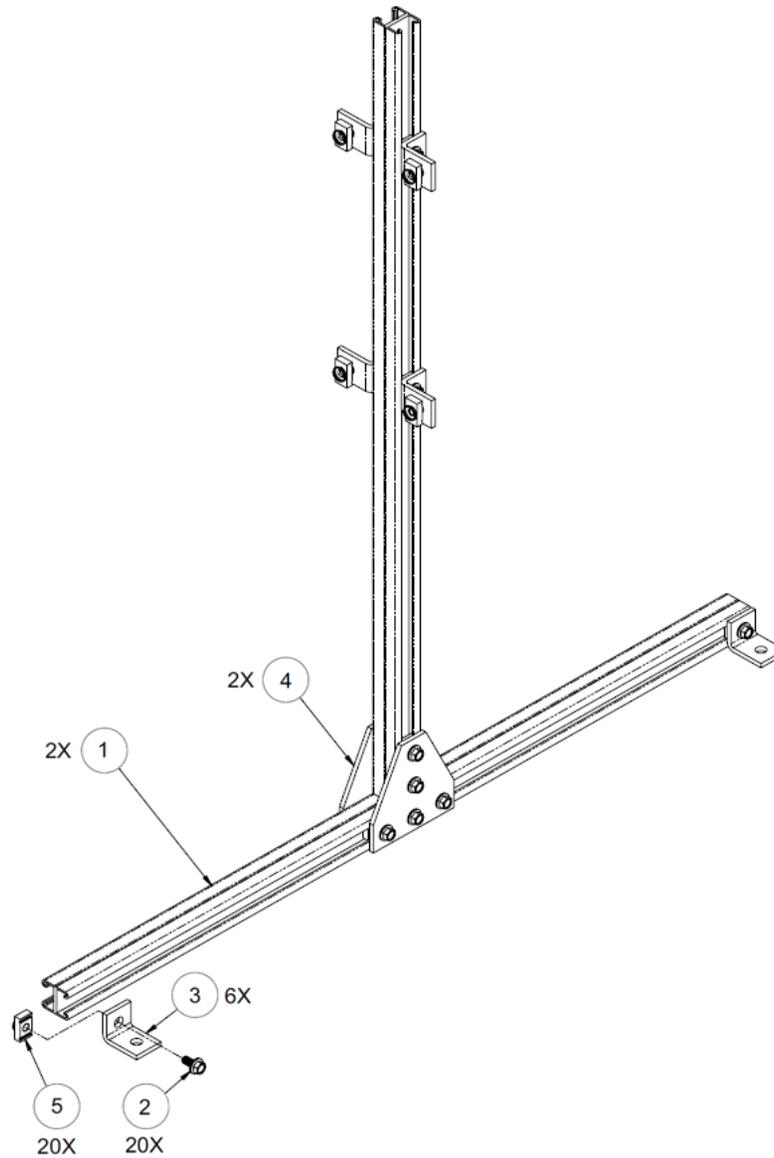
Figure A-5. 1:1 or 1:2 Redundancy System – Free Standing Unistrut Kit (Comtech P/N KT-0020827)

A.3   HPOD 1:1 Redundancy System Mounting and Switch Kit Examples

A.3.1   1:1 Redundancy System Mounting and Switch Kit Examples
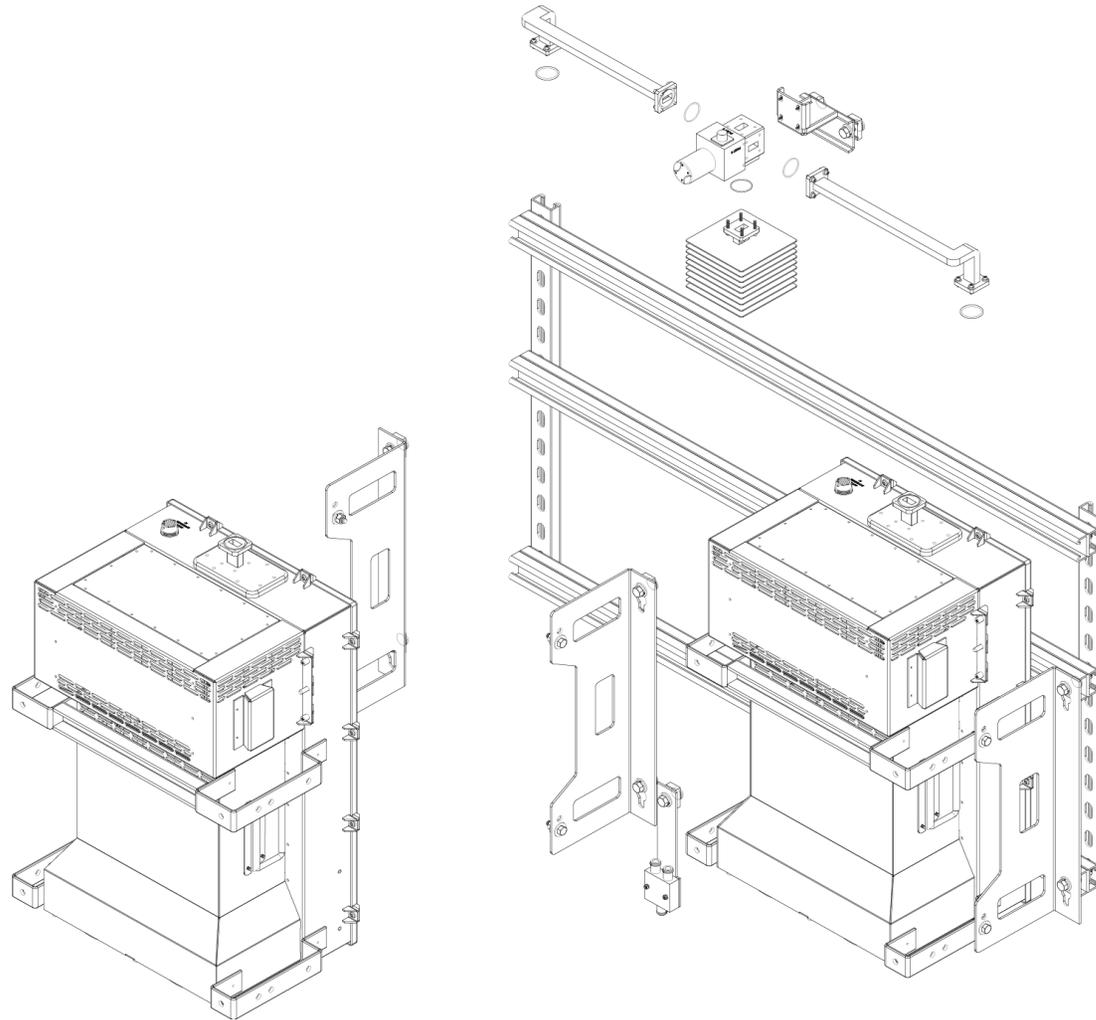
Figure A-6. 1:1 Mounting and Switch Kit Example – Exploded Isometric View
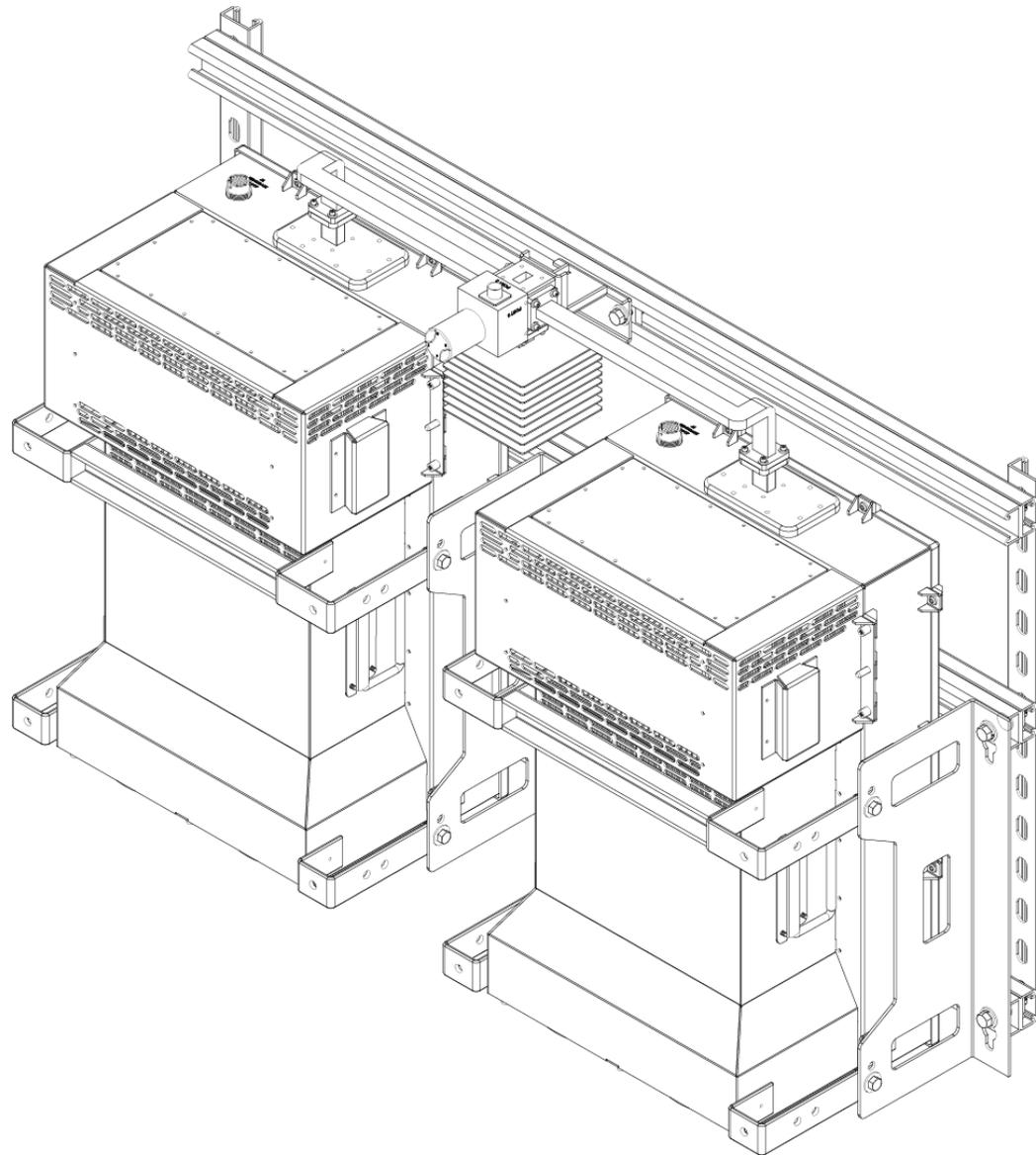
Figure A-7. 1:1 Mounting and Switch Kit Example – Assembled Isometric View
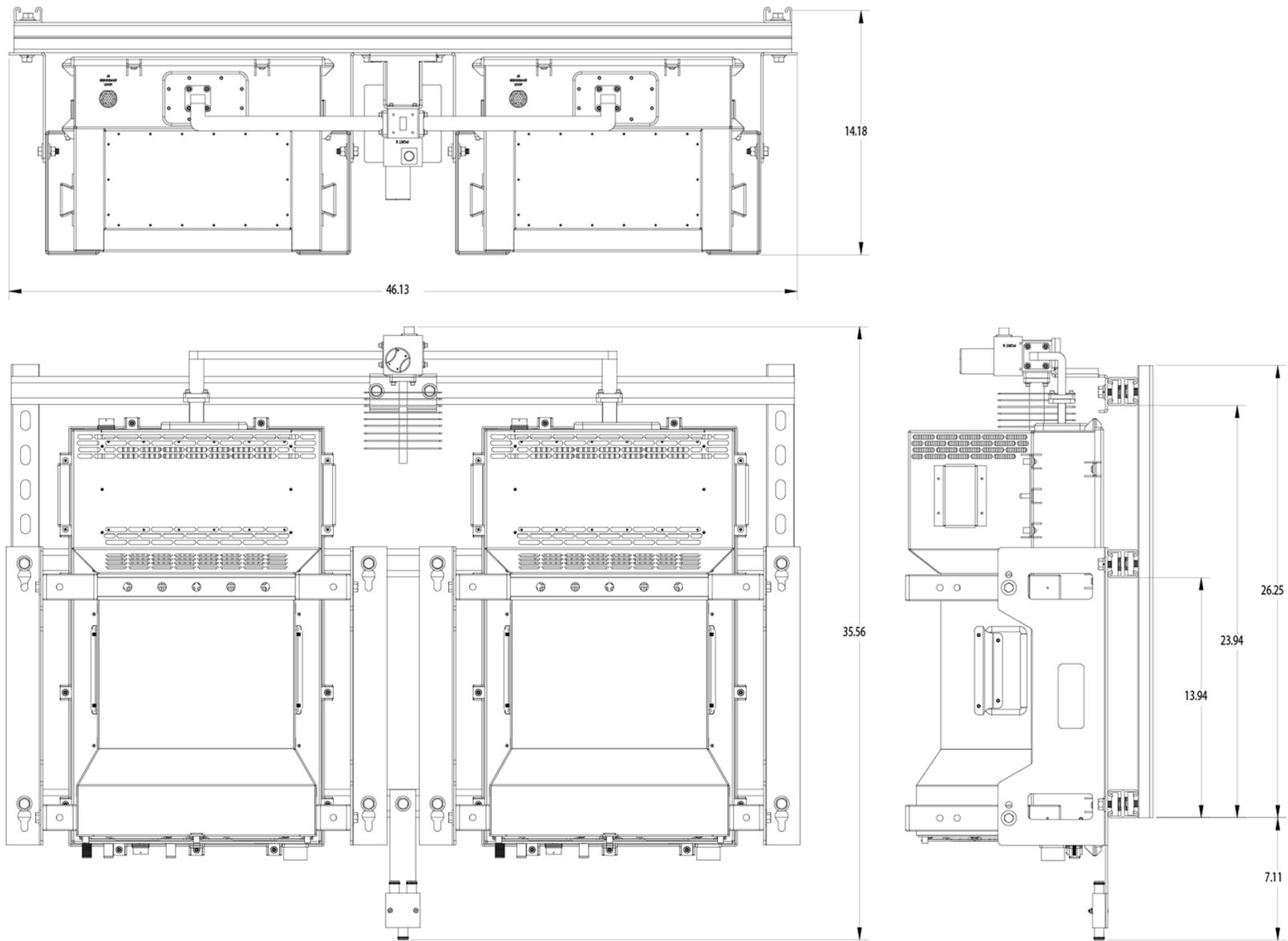
Figure A-8. 1:1 Mounting and Switch Kit Example – Assembled Views

A.3.2 Ku-Band 1:1 Free Standing Redundancy System Mounting and Switch Kit Example

1:1 PHASE COMBINED Ku-BAND
HPOD MOUNTING KIT
SHOWN FOR REFERENCE

3X KT-0020827
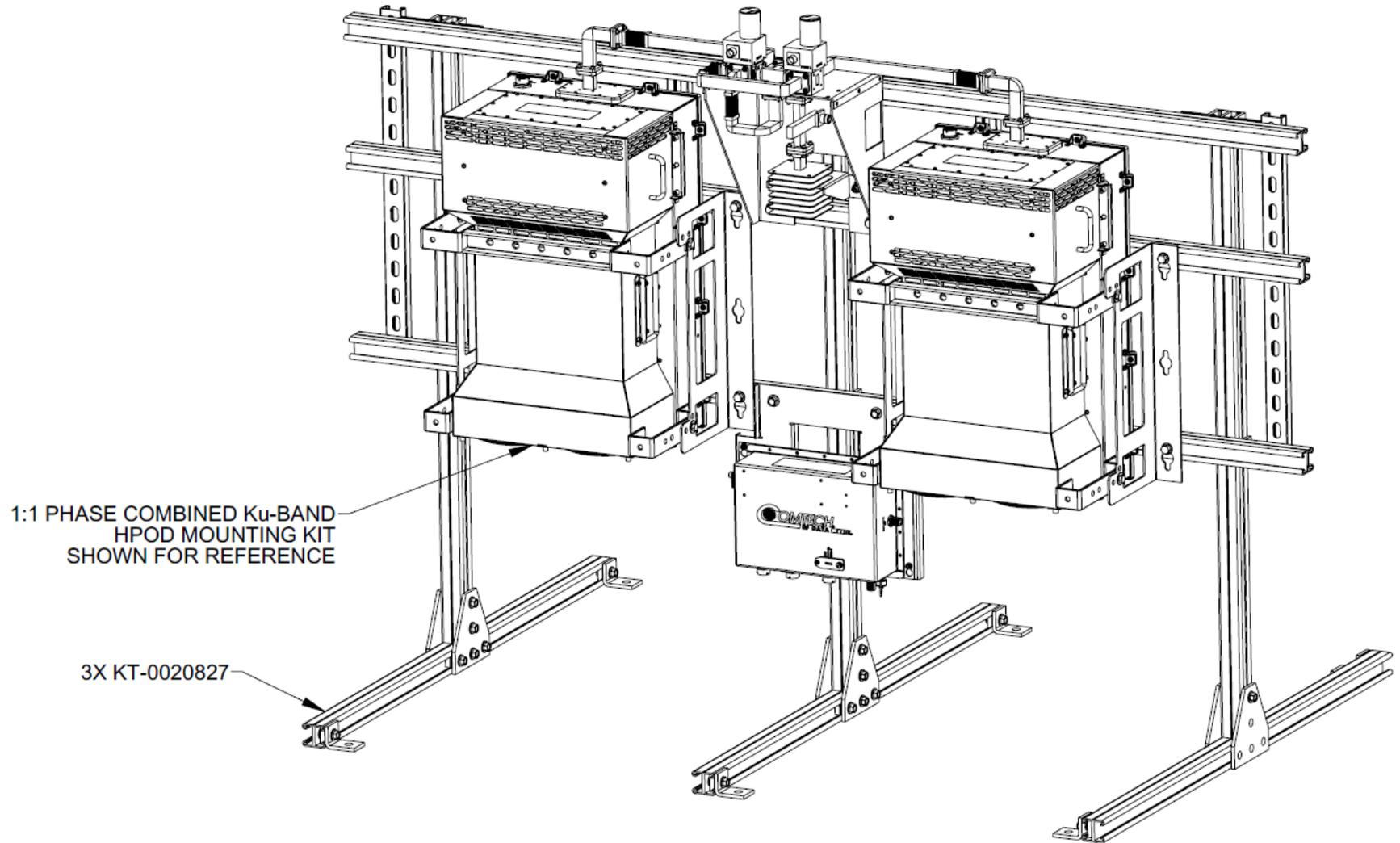
Figure A-9. Ku-Band 1:1 Free Standing Mounting and Switch Kit Example – Assembled Isometric View
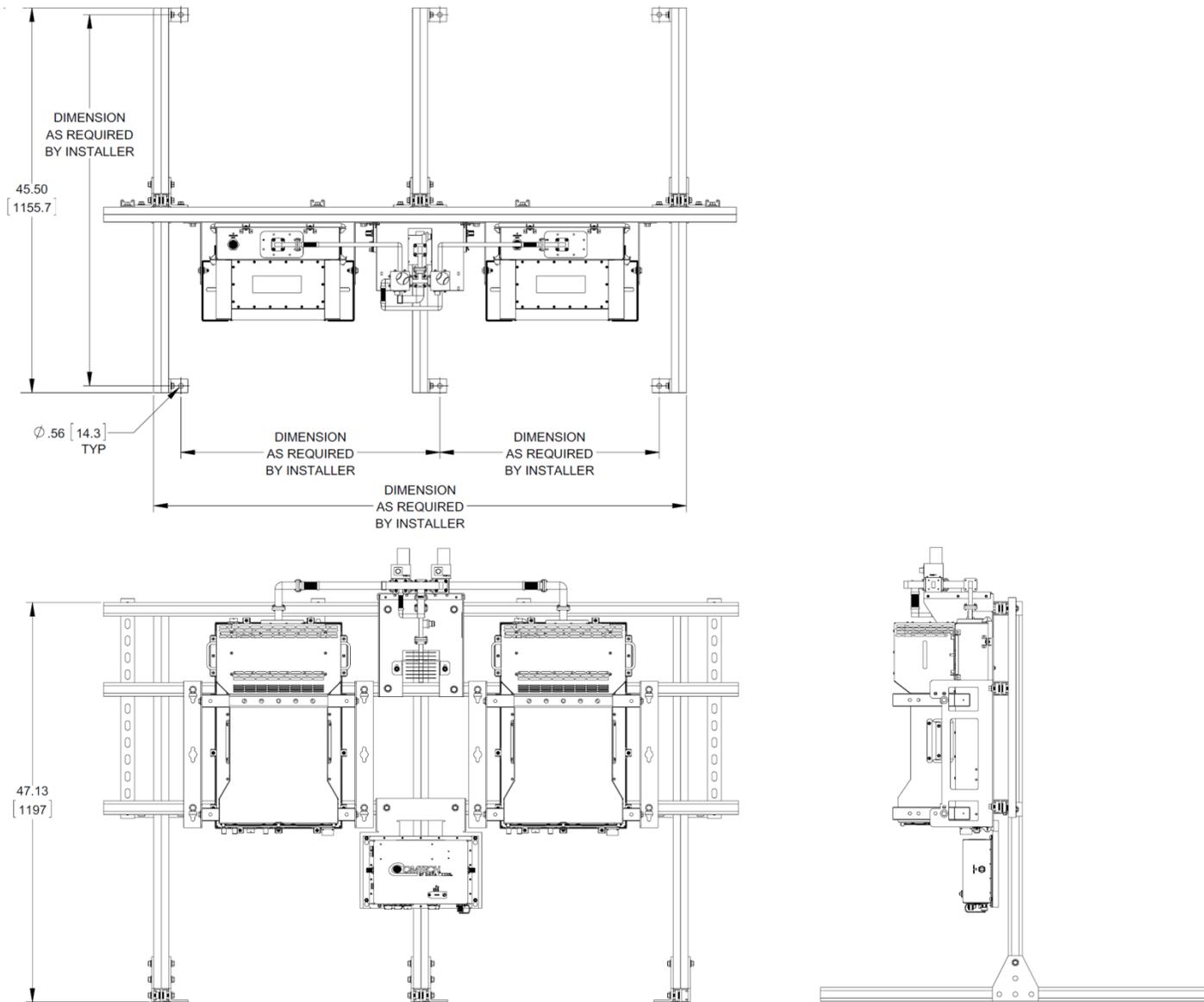
Figure A-10. Ku-Band 1:1 Free Standing Mounting and Switch Kit Example – Assembled Views

A.3.3   ODPA C-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/11799)

Table A-7. ODPA C-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/11799) Parts List

ITEM	QTY	Comtech P/N	DESCRIPTION
1	1	SW/WGS+28V137SC	Waveguide, CPR137, 28V, Sealed 3 Form C Relay
2	1	FP/BR11798-1	Bracket, Switch and Load Mounting
3	1	FP/WG11796-1	Waveguide, Left, CPRG-137, SSPA, C-Band
4	1	FP/WG11797-1	Waveguide, Right, CPRG-137, SSPA, C-Band
-5		Not Used	
6	2	FP/WG11801-1	Waveguide, Straight, CPRG-137
7	1	RF/C-TERM1000W	Termination, Load, 1000 Watt, CPRG-137
8	1	RF/CG-137-40-N	Crossguide, WR137, 40 dB, Type N Female
9		Not Used	
10	4	GA/CPR-137-R-H-C	Gasket, D Shape, CPR-137, Half Thickness,
11	4	GA/CPR137-R-F-C	Gasket, Round, CPR137, Full Thickness,
12 thru 19		Not Used	
20	40	HW/1/4-20X5/8SHCS	Screw, SS
21	40	HW/1/4-FLT	Washer, Flat
22	40	HW/1/4-SPLIT	Washer, Split
23	32	HW/10-32X1/2SH	Screw, Cap
24	16	HW/10-32X7/8SHCS	Screw, SS
25	48	HW/10-FLT	Washer, Flat
26	48	HW-10-SPLIT	Washer, Split
27 thru 29		Not Used	
30	1	SW/WG2AGS	Switch, CPR229
31	1	RF/CG-229-40-NRV	Crossguide, WR137
32	1	RF/ADP-CPR229-N	Adapter, Waveguide
33	2	FP/WG11800-1	Waveguide, E Bend
34 thru 99		Not Used	
100	2	RF/N-TERM50M1	RF, 50Ω N Male
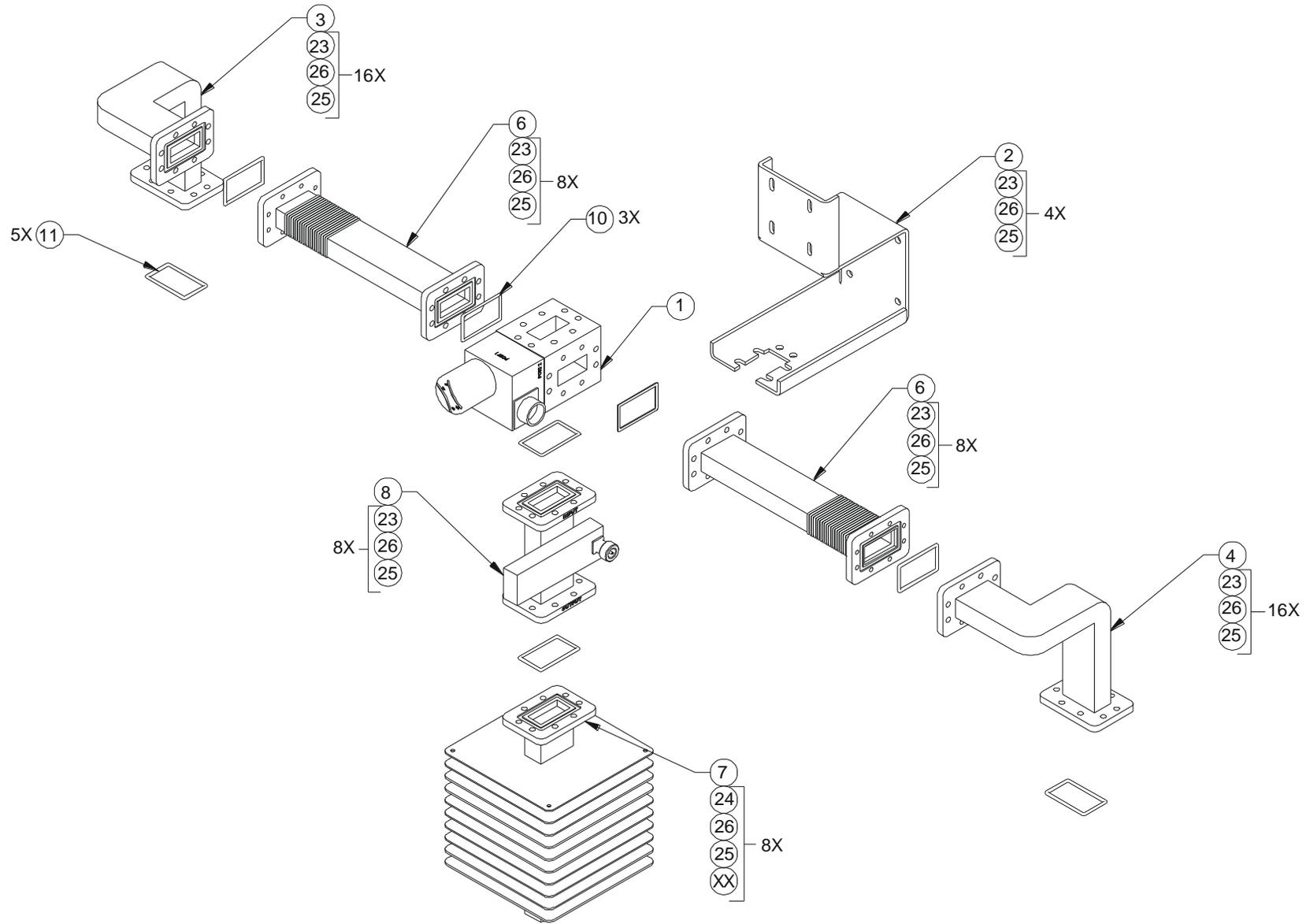
Figure A-11. ODPA C-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/11799)

A.3.4   ODPA X-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/11387-1)

Table A-8. ODPA X-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/11387-1) Parts List

ITEM	QTY	Comtech P/N	DESCRIPTION
1		Not Used	
2		Not Used	
3	1	RF/CG-112/137INN	Crossguide Coupler, 40 dB, Type N Connector,137-112
4	1	FP/WG11671-1	Waveguide, 1:1 Filter to TX
5	2	SW/WG-HAGS	Switch, WR112G, +24V, Sealed, Standard Thread, Cold Temperature Rating
6		Not Used	
7	2	FP/WG11305-1	Waveguide, 90 Degree H-Bend Transition
8	2	FP/WG11301-1	Waveguide, 90 Degree, CPRG-112
9	3	FP/WG11308-1	Waveguide, 90 Degree, H-Bend, CPRG-112
10		Not Used	
11	1	RF/X-TERM850W	Termination, Load, 850 Watt, CPRG112, with Crossguide Coupler, 40 dB
12		Not Used	
13	14	GA/CPR112-R-F-C	Gasket, Round, Full Thickness, CPR112
14 thru 19		Not Used	
20	A/R	HW/8-32HEXNUT	Nut, Hex 8-32
21	A/R	HW/8-FLT	Washer, Flat S.S.
22	A/R	HW/8-SPLIT	Washer, Split S.S.
23	A/R	HW/8-32X1/2SHCS	Screw, Socket Cap
24	A/R	HW/8-32X7/8SHCS	Screw, Socket Head Cap, S.S.
25	A/R	HW/SEM632X3/8PH	Screw, Square Cone Pan Head Phillips S.S.
26 thru 30		Not Used	
31	1	RF/ADAP-112-N	Adapter, CPRG112 to "N"
32	1	RF/CG-112/137INN	Coupler, Crossguide 40 dB N Type Connector
33 thru 54		Not Used	
55	4	RF/N-TERM50M1	RF, 50Ω 1Watt. DC-8 GHz, Type N Male

A/R = Use As Required
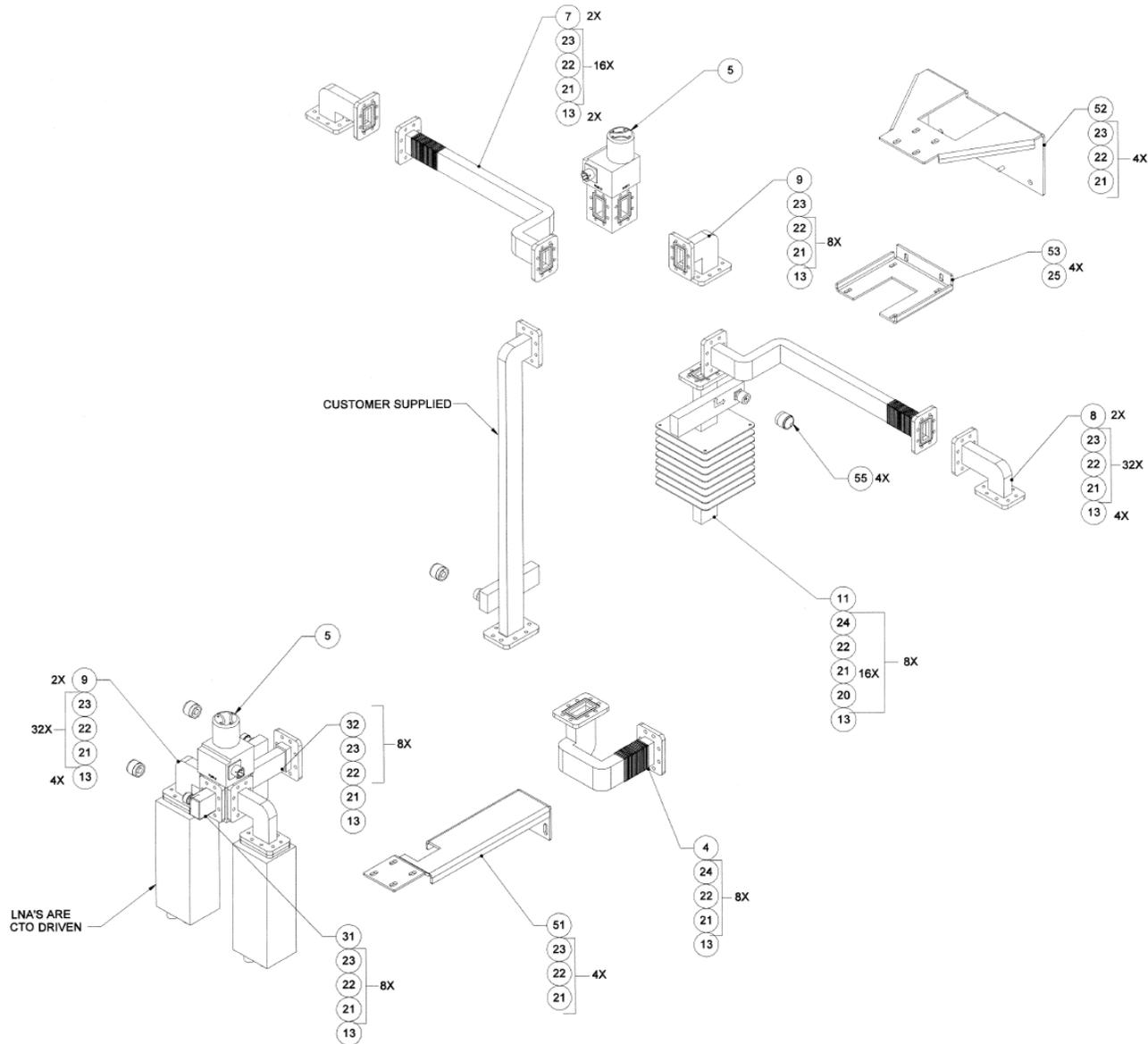
Figure A-12. ODPA X-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/11387-1)

A.3.5   C-Band 1:1 Redundancy System – Switch and Unistrut Assembly (Comtech P/N KT/12240-1)
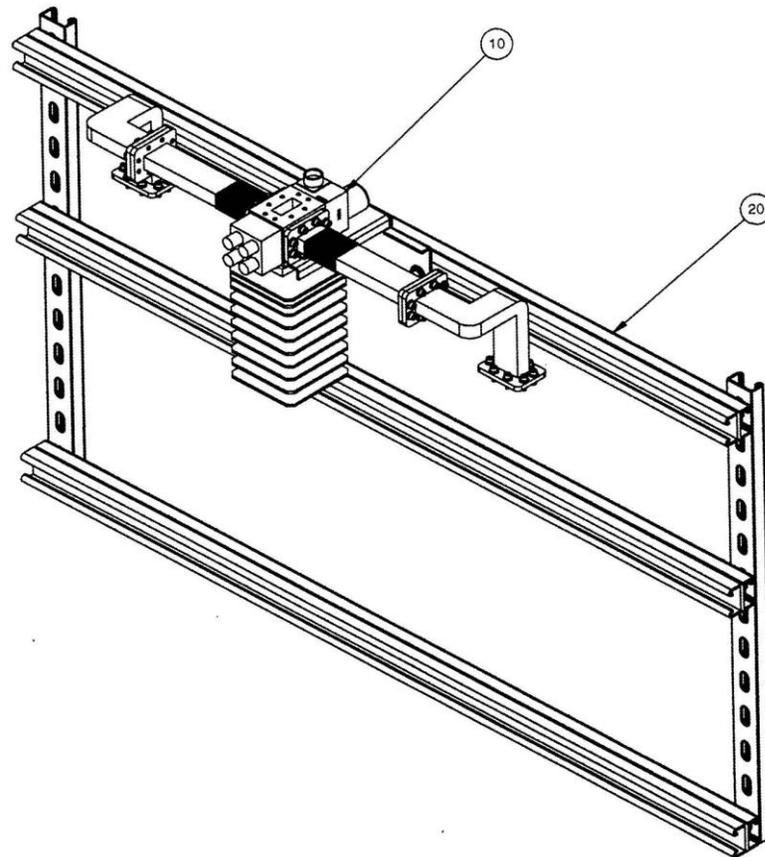
ITEM	QTY	Comtech P/N	DESCRIPTION	REF TABLE	REF FIGURE
10	1	KT/12201-1	HPOD C-Band 1:1 Redundancy Switch/Waveguide Kit (ROHS)	A-8	A-13
20	1	KT/12200-1	HPOD 1:1 Redundancy System – Common Unistrut Kit	A-3	A-4

Figure A-13. C-Band 1:1 Redundancy System – Switch and Unistrut Assembly (Comtech P/N KT/12240-1)

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A.3.6 C-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/12201-1)

Table A-9. C-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/12201-1) Parts List

ITEM	QTY	Comtech P/N	DESCRIPTION
1	1	FP/BR12242-1	Bracket, Mounting (ROHS)
2	4	GA/CPA-137-R-H-C	Gasket, Half-Thickness
3	4	GA/CPR-137-R-F-C	Gasket, Full-Thickness
4	1	RF/C-TERM1000W	Termination, Load
5	2	FP/WG12241-1	Waveguide, Straight (ROHS)
6	1	SW/WG-3NAFS-COLD	Switch, CPR137
7	1	FP/WG11796-1	Waveguide, Left
8	1	FP/WG11797-1	Waveguide, Right
9	2	HW/3/8SPRINGNUT	Springnut
10	64	HW/10-FLT	Washer, Flat
11	64	HW/10-SPLIT	Washer, Split
12	64	HW/10-32X5/8SHC	Screw, Cap
13	2	HW/3/8-FLT	Washer, Flat
14	2	HW/3/8-SPLIT	Washer, Split
15	2	HW/3/8-16X1BLT	Bolt, Hex-Head
16	1	FP/WG12419-1	Spacer, Waveguide
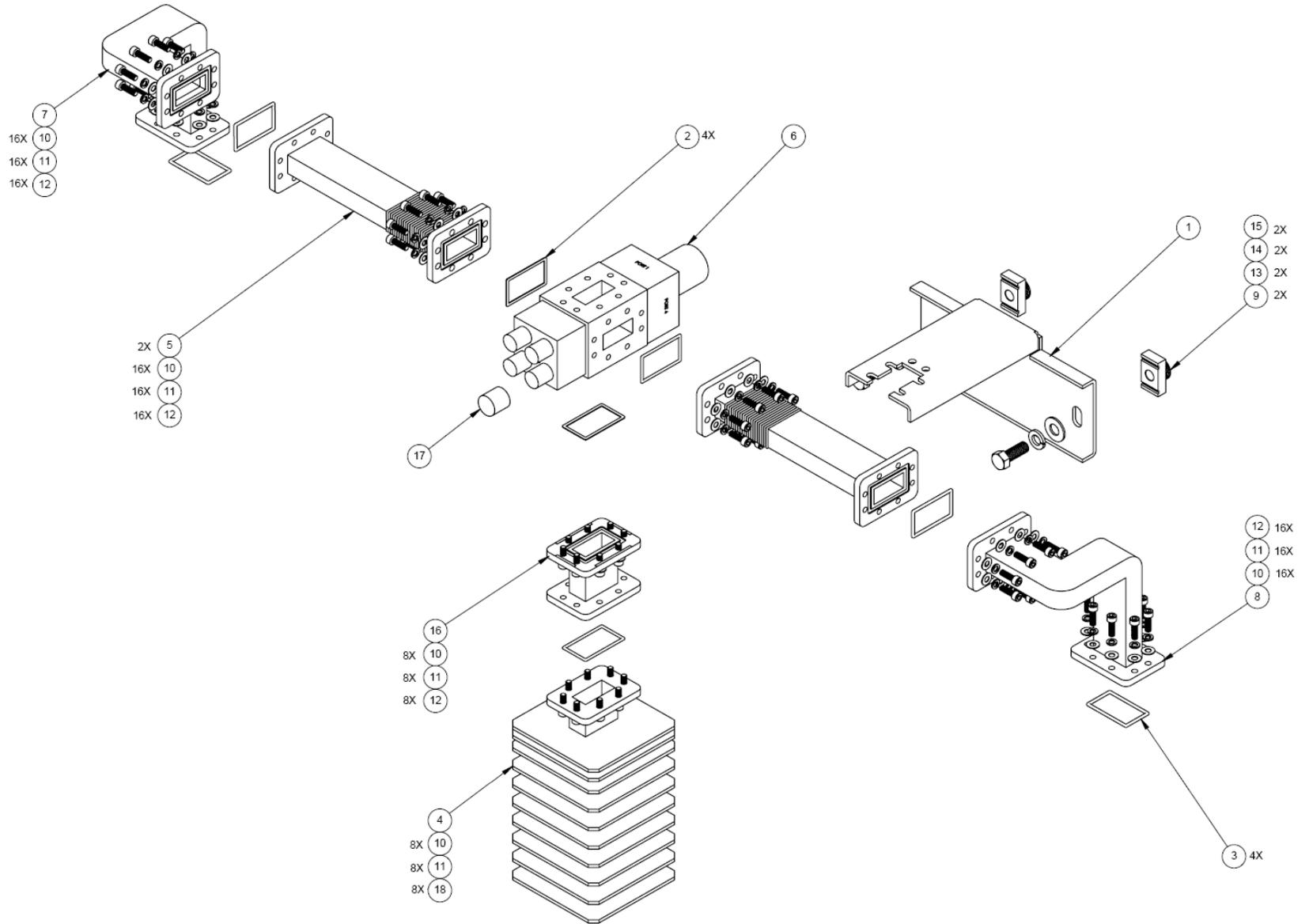
Figure A-14. C-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/12201-1)

A.3.7   C-Band Offline Unit Termination Bypass Waveguide Kit (Comtech P/N KT-0020523)

Table A-10. C-Band Offline Unit Termination Bypass Waveguide Kit (Comtech P/N KT-0020523) Parts List

ITEM	QTY	Comtech P/N	DESCRIPTION
1	1	FP/BR12242-1	Bracket, Mount (ROHS)
2	1	SW/WG-3NFAS-COLD	Switch, CPR 137
3	1	FP/WG10359-1	Waveguide
4	1	RF/CG-137-40-N	Crossguide, WR 137
5	1	FP/5683	Waveguide Adapter
6	1	FP-0020546	Waveguide, CPRG 137
7	6	CB/CX50NMALE	Connector, CN-50-OHM, Type 'N', Male
8	56	HW/10-FLT	Washer, #10 Flat
9	48	HW/10-SPLIT	Lock Washer, #10 Split
10	2	GA/CPR137-R-F-C	Gasket, CPR 137, Full Height
11	5	GA/CPR137-R-H-C	Gasket, CPR 137, Half Height
12	40	HW/10-32X5/8SHC	Screw, Socket Head #10-32 x 5/8 LG
13	8	HW/10-32HEXNUT	Hex Nut,3/8
14	8	HW/10-32X3/4SH	Screw, Socket Head #10-32 x 3/4 LG
15	2	HW/3/8SPRINGNUT	Spring Nut, 3/8
16	2	HW/3/8-FLT	Washer, Flat, 3/8
17	2	HW/3/8-SPLIT	Lock Washer, Split, 3/8
18	2	HW/3/8-16X1BLT	Bolt, Hex Head, 3/8-16 x 1" LG

Figure A-15. C-Band Offline Unit Termination Bypass Waveguide Kit (Comtech P/N KT-0020523)
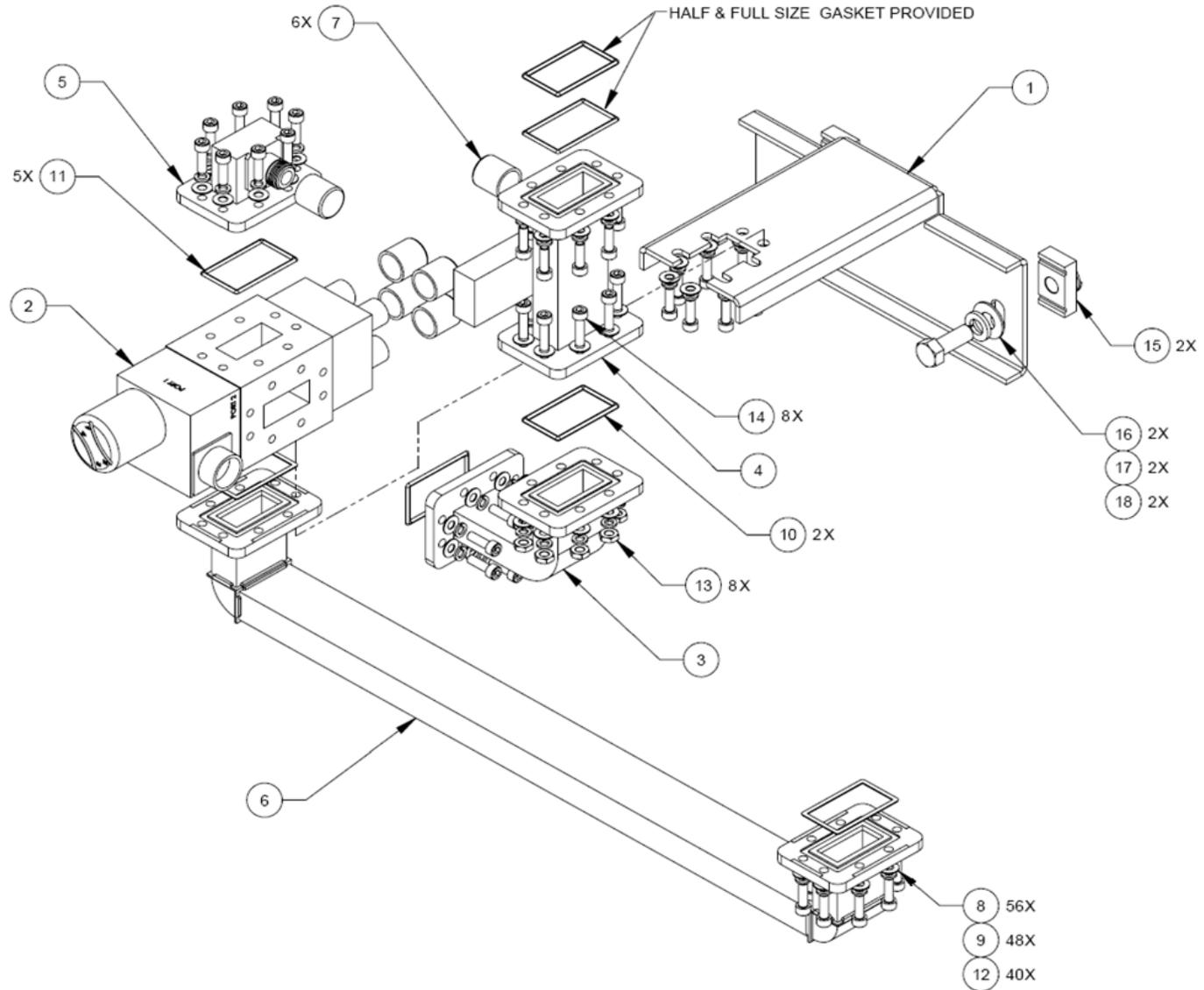
A.3.8 Ku-Band 1:1 Redundancy Assembly Kit (Comtech P/N KT/11936-1)

Table A-11. Ku-Band 1:1 Redundancy Assembly Kit (Comtech P/N KT/11936-1) Parts List

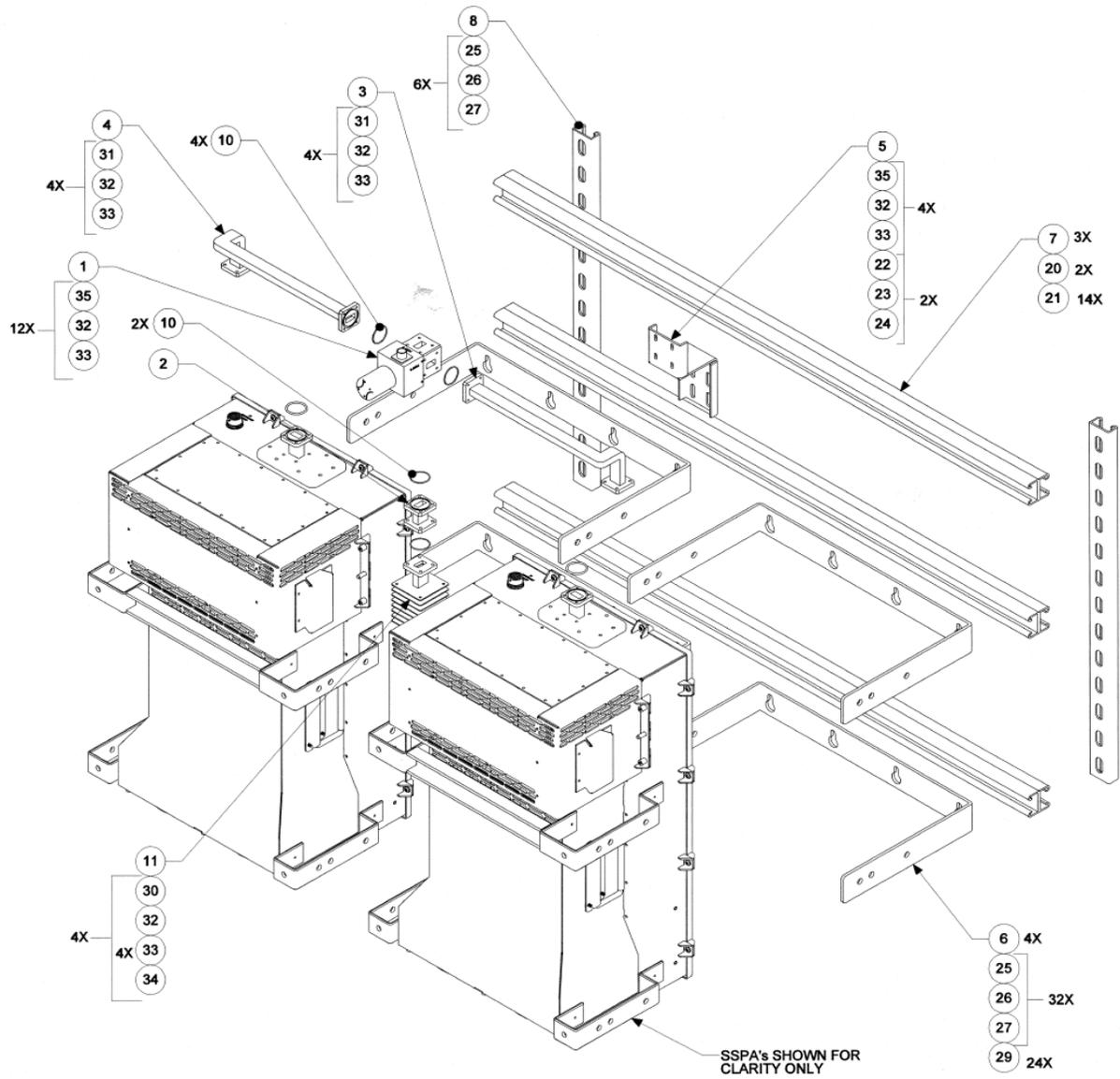| ITEM	QTY	Comtech P/N	DESCRIPTION
1	1	SW/WGS+28V-75SB	Switch, +28VDC
2	1	FP/WG11825-1	Waveguide, Straight
3	1	FP/WG11935-1	Waveguide, Right
4	1	FP/WG11934-1	Waveguide, Left
5	1	FP/BR11933-1	Bracket, Switch
6	4	FP/BR11424-1	Bracket, Mounting
7	3	FP/BR11931-1	Bracket, Unistrut
8	2	FP/BR11932-1	Bracket, Unistrut
-9	2	GA/WR75-R-F-C	Gasket, Full Thickness
10	6	GA/WR75-R-H-C	Gasket, Half Thickness
11	1	RF/TERM75/350W	Waveguide, Termination
12 thru 19		Not Used	
20	2	HW/1/4SPRINGNUT	Nut, Channel
21	14	HW/3/8SPRINGNUT	Nut, Spring
22	2	HW1/4-20X5/8SHCS	Screw 1/4-20 x 5/8 SHCS, SS
23	2	HW/1/4-SPLIT	Washer, Lock
24	2	HW/1/4-FLT	Washer, Flat
25	38	HW/38-16X1BLT	Bolt, Hex Head
26	38	HW/3/8-SPLIT	Washer, Lock
27	38	HW/3/8-FLT	Washer, Flat
-28		Not Used	
29	24	HW/3/8-16HEXNUT	Nut, Hex
30	4	HW/6-32X3/4SHCS	Screw, Socket Head
31	8	HW/6-32X5/8SHCS	Screw, Socket, Head
32	28	HW/6-SPLIT	Washer, Lock
33	32	HW/6-FLT	Washer, Flat
34	4	HW/6-32HEXNUT	Nut, Hex
35	16	HW/6-32X1/2SHCS	Screw, Socket Head

Figure A-16. Ku-Band 1:1 Redundancy Assembly Kit (Comtech P/N KT/11936-1)

A.3.9 Ku-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/12337-1)

Table A-12. Ku-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/12337-1) Parts List

ITEM	QTY	Comtech P/N	DESCRIPTION
1	1	SW/WGS+28V-75SB	Switch, Waveguide
2	1	RF/TERM75/350W	Waveguide, Termination
3	1	FP/BR12338-1	Bracket, Mounting (ROHS)
4	1	FP/WG11934-1	Waveguide, Left
5	1	FP/WG11935-1	Waveguide, Right
6	2	HW/3/8SPRINGNUT	Springnut
7	2	HW/3/8-FLT	Washer, Flat
8	2	HW/3/8-SPLIT	Washer, Split
9	2	HW/3/8-16X1BLT	Bolt, Hex-Head
10	20	HW/6-FLT	Washer, Flat
11	20	HW/6-SPLIT	Washer, Split
12	4	HW/6-32X7/8SHCS	Screw, Cap
13	16	HW/6-32X1/2SHCS	Screw, Cap
14	2	GA/WR75-R-F-C	Gasket, Full-Thickness
15	4	GA/WR75-R-H-C	Gasket, Half-Thickness
16	1	FP/SP12360-1	Spacer (ROHS)
17	4	HW/4-FLT	Washer, Flat
18	4	HW/4-SPLIT	Washer, Split
19	4	HW/440X3/8SHCS	Screw
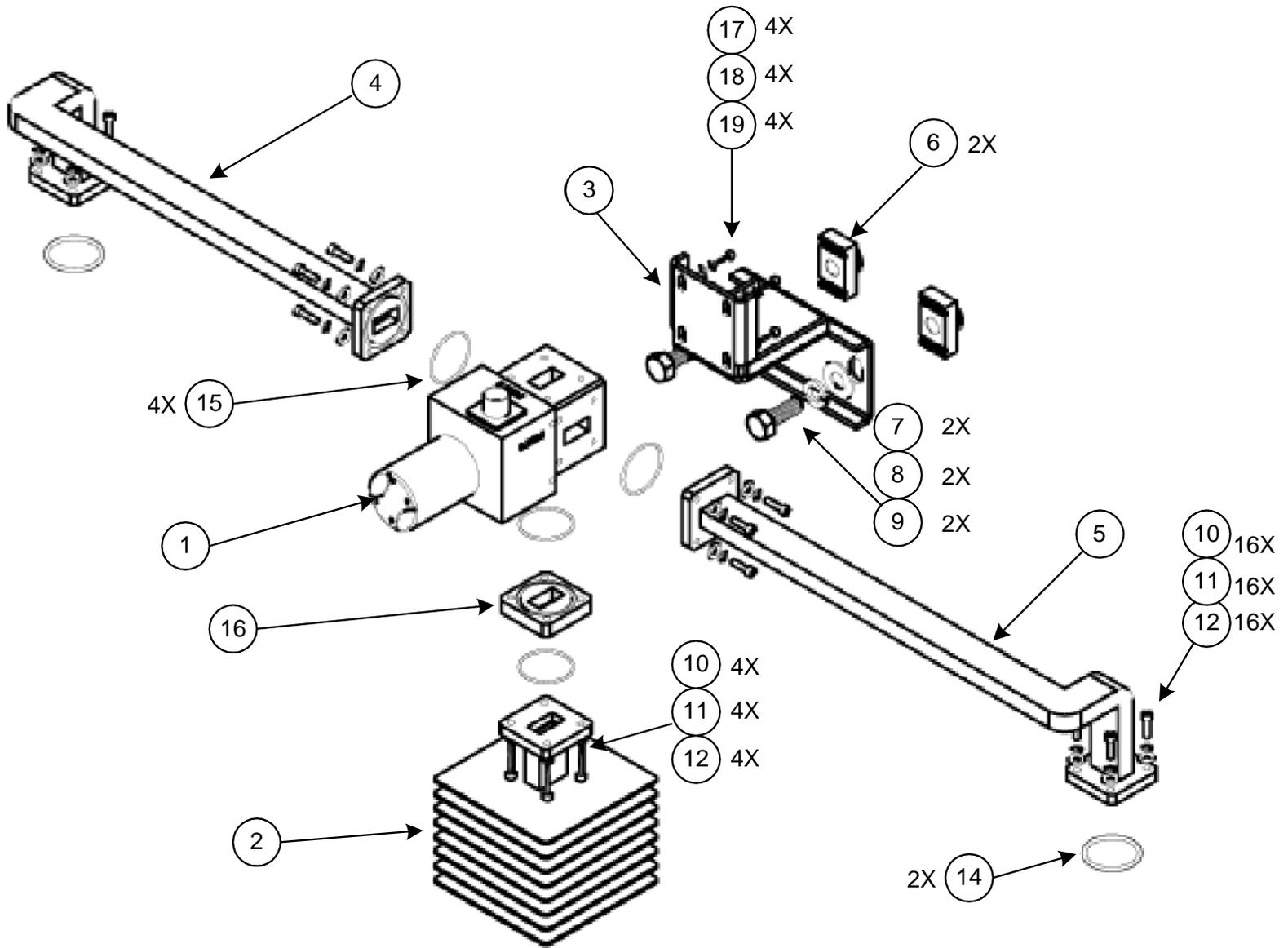
Figure A-17. Ku-Band 1:1 Redundancy Switch/Waveguide Kit (Comtech P/N KT/12337-1)

A.4   HPOD 1:2 Redundancy System Mounting and Switch Kit Examples

A.4.1   C-Band 1:2 Redundancy System Example
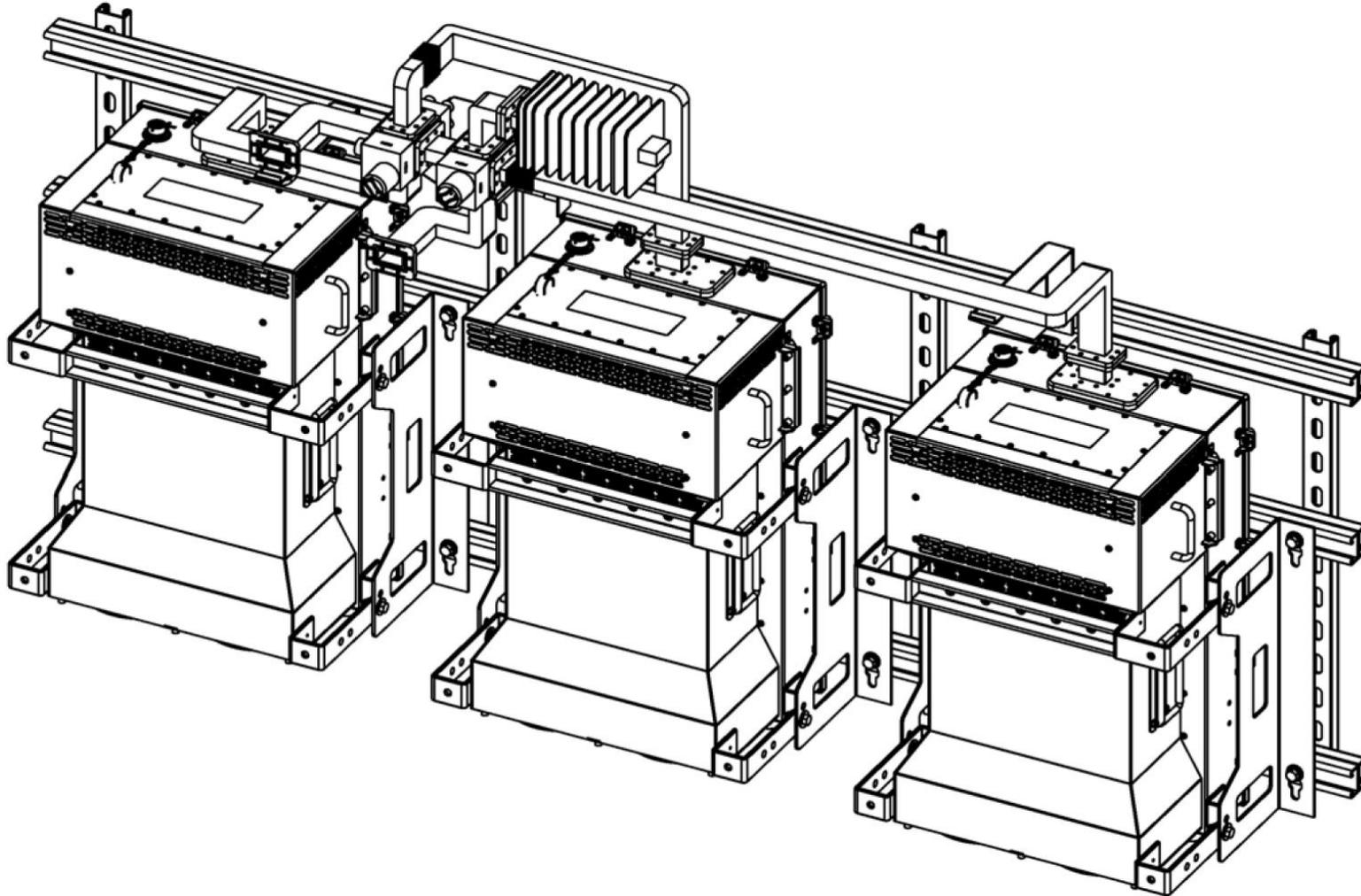
Figure A-18. C-Band 1:2 Redundancy System – Isometric View

74.1

SWITCH DETAIL 'A'

SWITCH 2 OUTPUT
(CPRG-137)

SWITCH 1 OUTPUT
(CPRG-137)

A

26.3

37.0

14.4
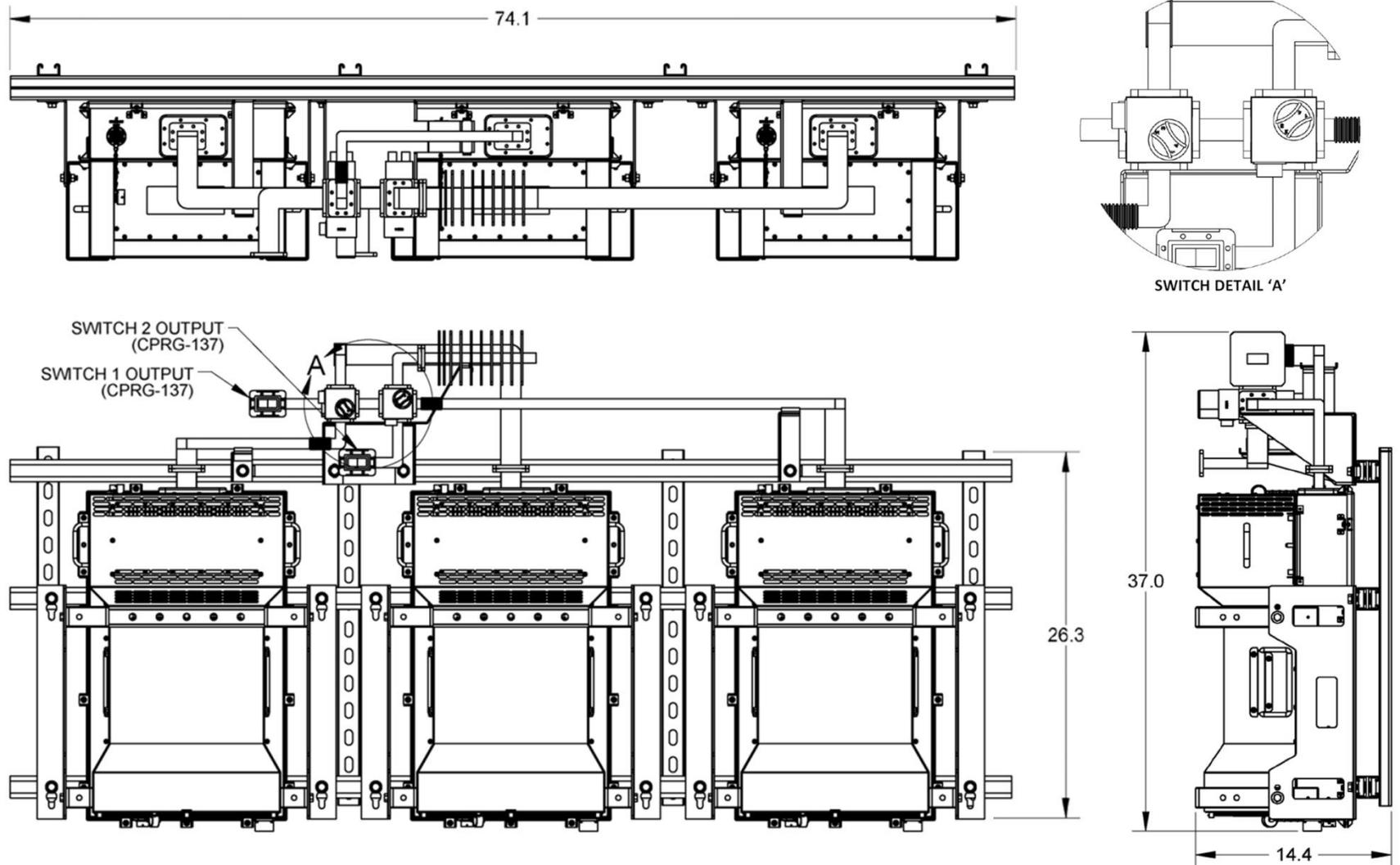
Figure A-19. C-Band 1:2 Redundancy System – Assembled Views

A.4.2 C-Band 1:2 Redundancy System Free Standing Example Using Kit KT-0020827

1:2 PHASE COMBINED C-BAND
HPOD MOUNTING KIT
SHOWN FOR REFERENCE

3X KT-0020827
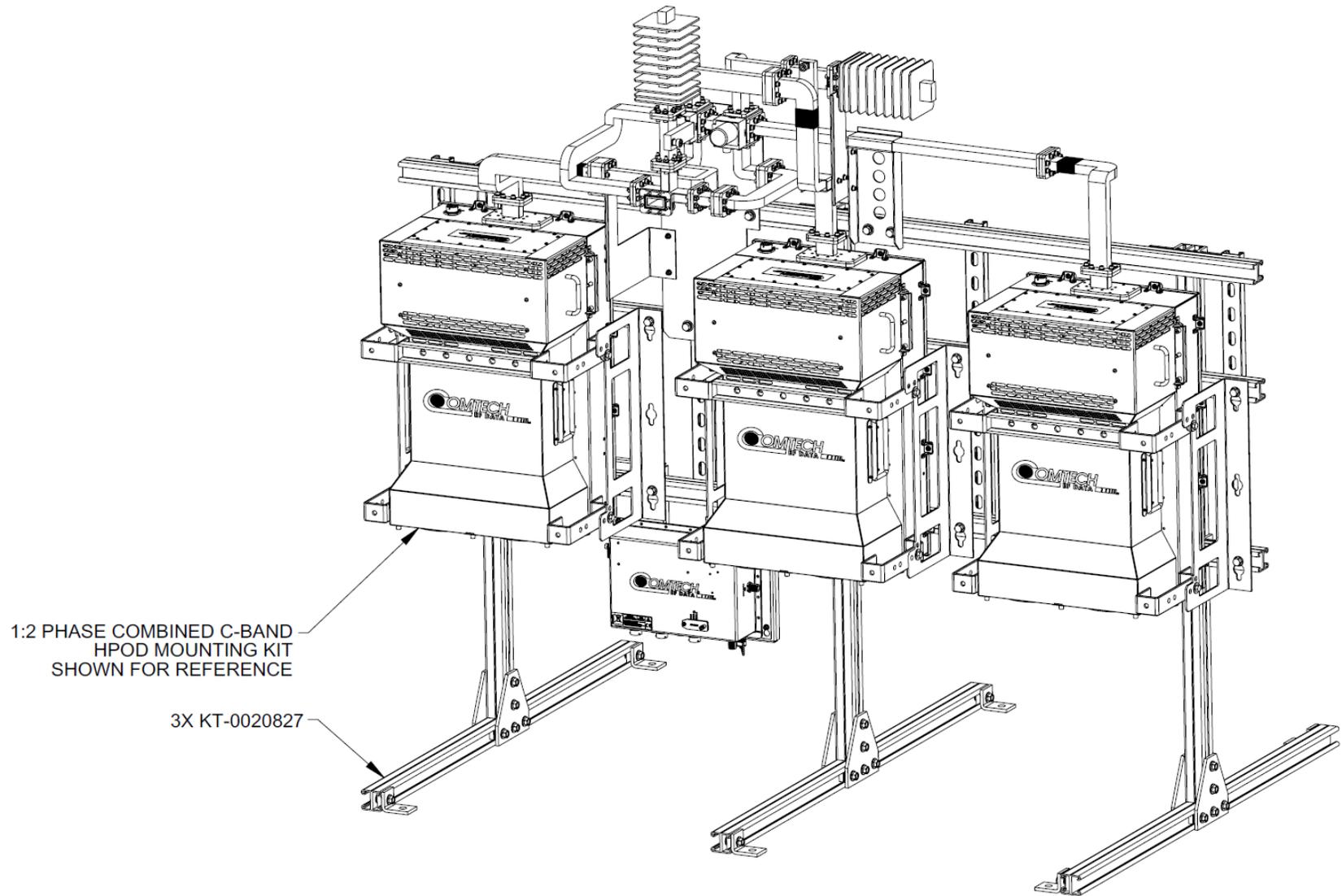
Figure A-20. C-Band 1:2 Free Standing Mounting and Switch Kit Example – Assembled Isometric View
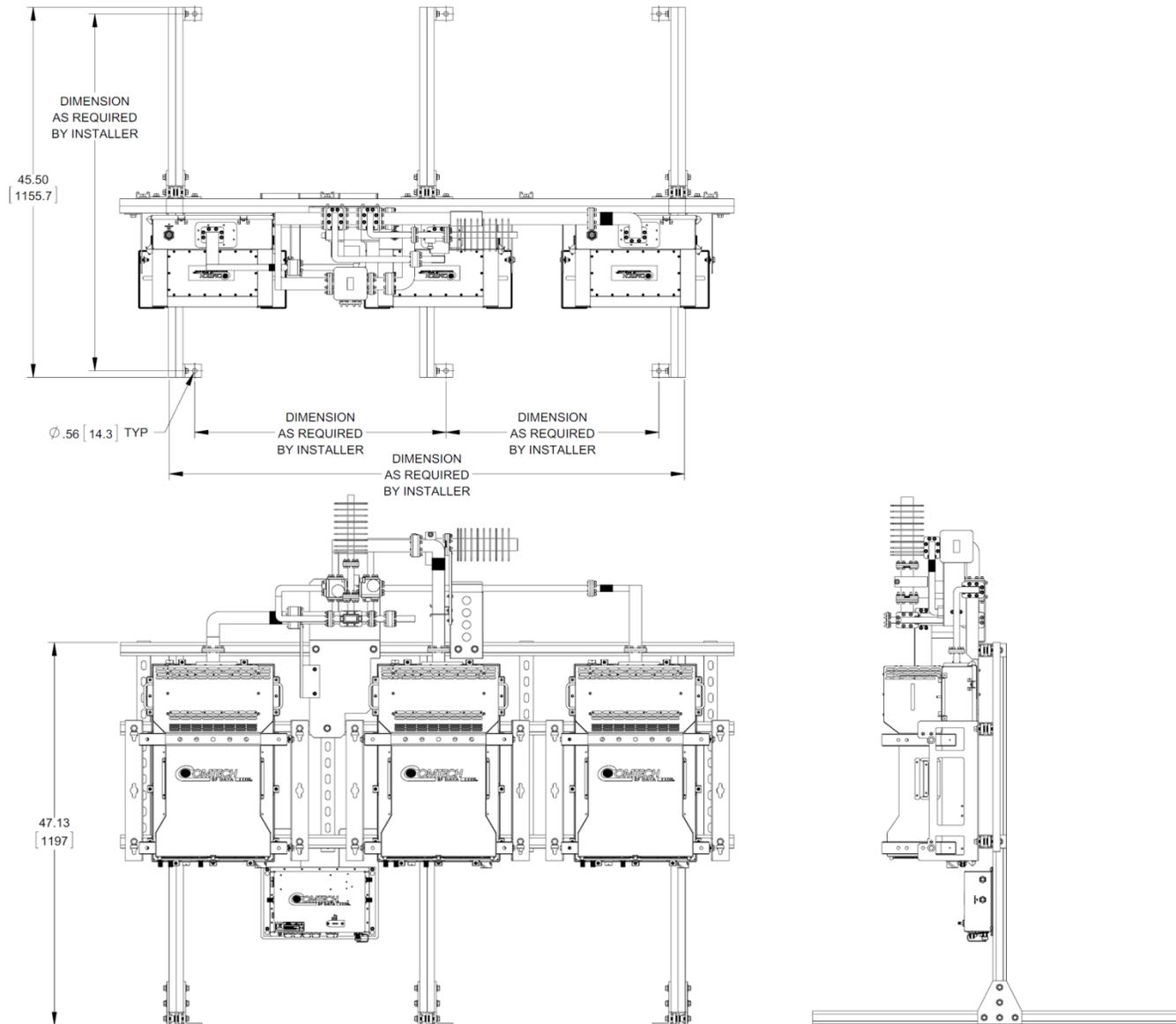
Figure A-21. C-Band 1:2 Free Standing Mounting and Switch Kit Example – Assembled Views

A.4.3 Ku-Band 1:2 Redundancy System Example (Comtech P/N KT-0020685)
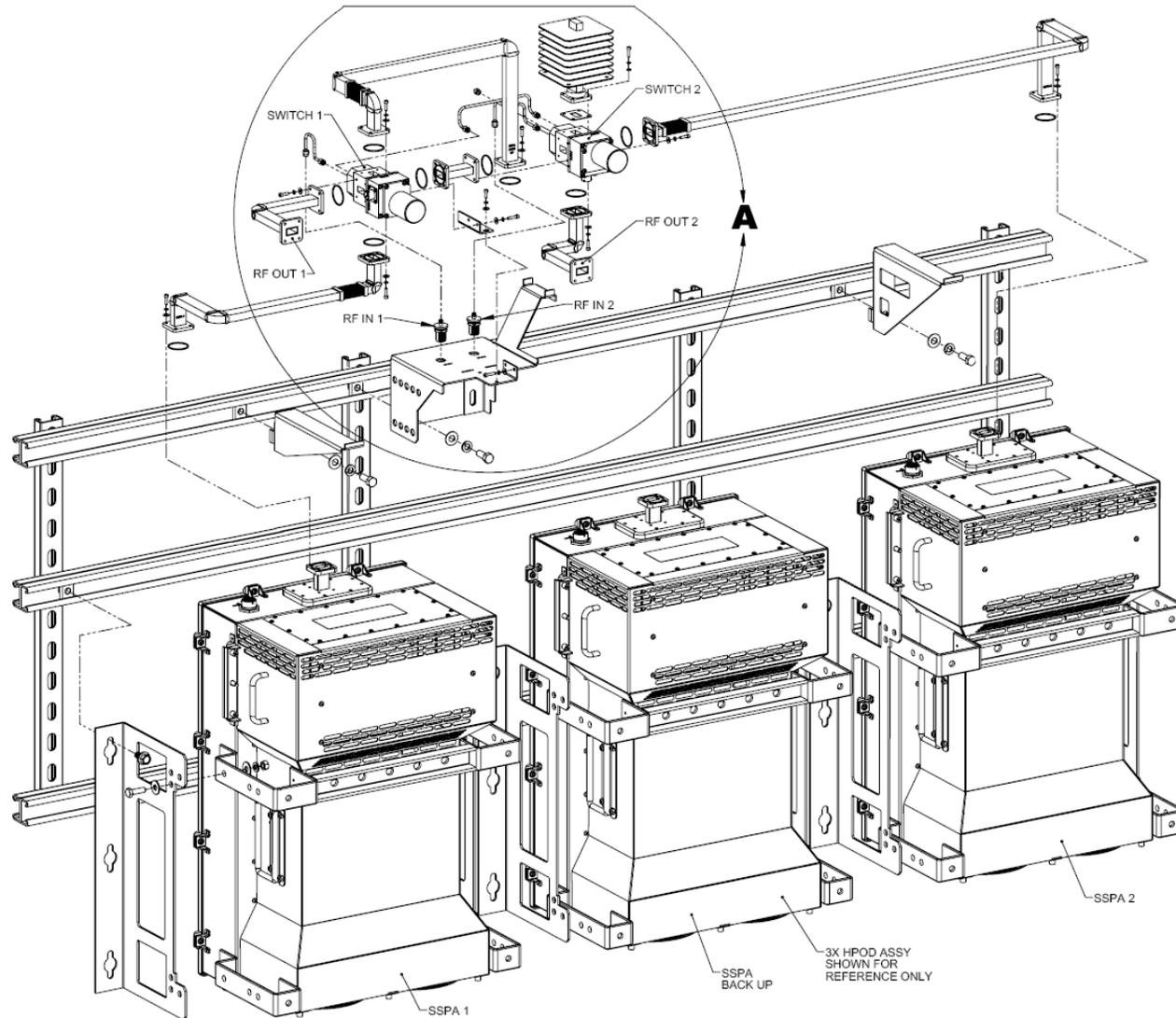
Figure A-22. Ku-Band 1:2 Redundancy System – Exploded Isometric View (Front)
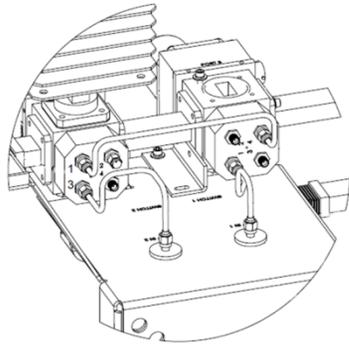
SWITCH DETAIL 'A'
AS ASSEMBLED, VIEWED FROM BACK
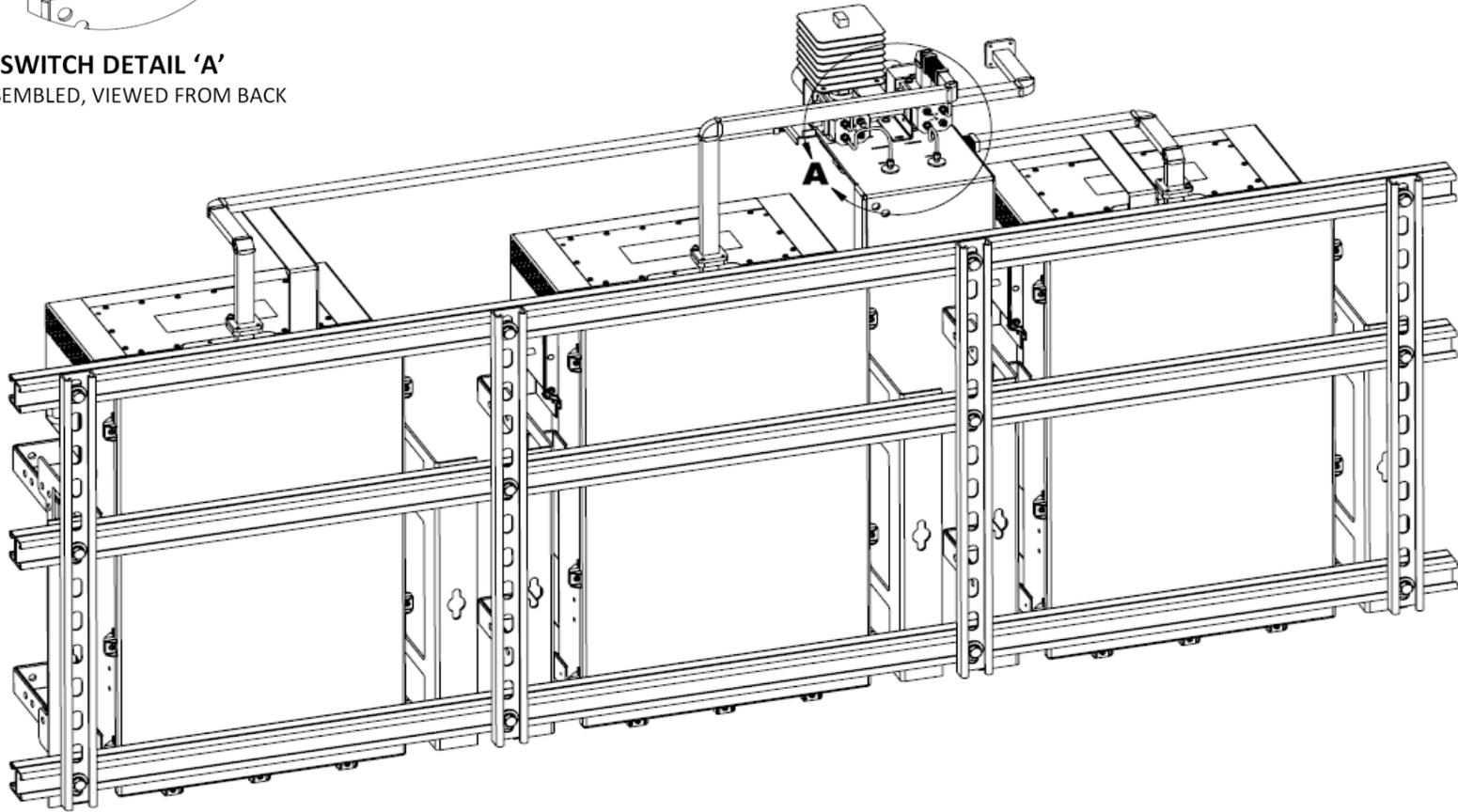
Figure A-23. Ku-Band 1:2 Redundancy System – Assembled Isometric Views (Back)
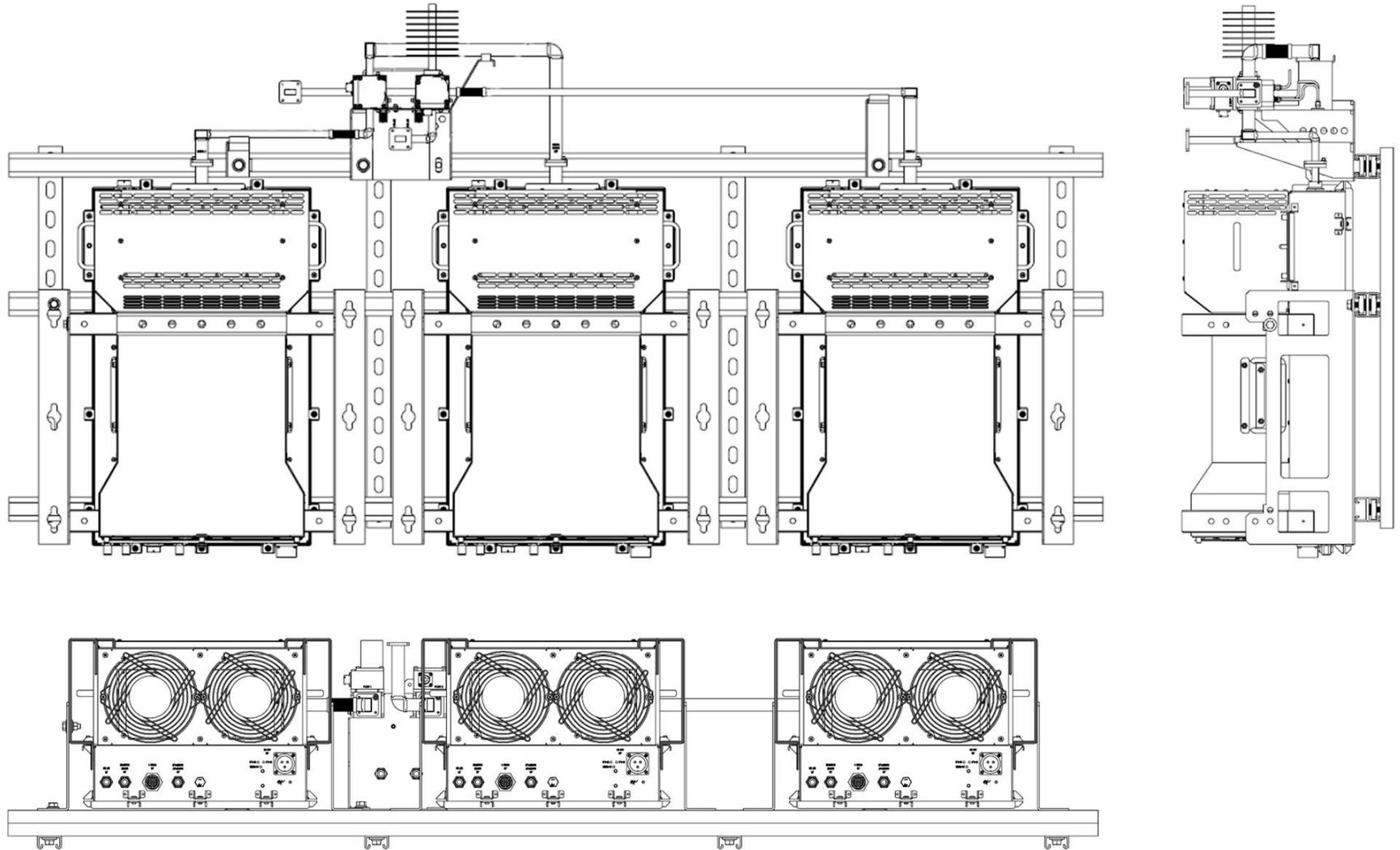
Figure A-24. Ku-Band 1:2 Redundancy System – Assembled Views

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Appendix B. 1:1 AND 1:2 REDUNDANCY OPERATION

B.1   Overview

Comtech's C-, X-, and KU-Band High-Power Outdoor Power Amplifiers (HPODs) can be used in redundant configuration by connecting the appropriate redundancy loop cable between the user M&C location and each HPOD '**J4 | REDUNDANT LOOP**' port. This 1:1 or 1:2 cable has connector pinouts that allow the HPODs to both automatically detect the type of cable in use and, when properly connected between the user and the redundancy setup, automatically configure itself for operations in accordance with the labeling for each cable connector (SSPA 1 or SSPA 2 for a 1:1 system, or SSPA 1, SSPA 2, or SSPA BU for a 1:2 system).

### B.1.1   1:1 Redundancy Mode

In 1:1 redundancy mode, the unit that is currently not the active unit (determined by the switch position) will be the controlling Backup Unit (BU).

The redundancy system's operating mode is determined by using the "RAM" serial remote command:

- If **RAM=1** i set in both units, the system will be in "AUTO" redundancy mode. In this mode, if a fault is detected with the active unit – either by loss of communications between the offline and online unit or via the summary fault – the backup (offline) unit will switch the waveguide switch and become the active(online) unit (assuming the backup unit is not faulted).

- If **RAM=0** is set in both units, the system is set to "MANUAL" redundancy mode, and no switchovers will occur upon fault detection.

Switch position is determined by using the "SSW" serial remote command:

- **SSW=1** sets the switch to put SSPA 1 online;

- **SSW=2** sets the switch to put SSPA 2 online.

In 1:1 applications, the BU also stores an offset value, to be used when the BU replaces the active unit. This offset may be set with the GOF= command. When the online unit is being "backed up" the BU's attenuator will be set to this value. This value may be different than the attenuation value of the online unit to compensate for any gain mismatch between the BU and online units.

To calibrate, do these steps:

Step	Task
1	Identify the unit with the most gain.
2	Calculate the actual error.
3	To compensate for the error, set the GOF= command in the unit having the highest error. **For example –** If SSPA 1 has 70 dB of gain, and BU SSPA 2 has 72 dB, send the GOF=2.00 command to the BU SSPA 2 to store these values.

B.1.2   1:2 Redundancy Mode

Figure B-1 shows the block diagram for an HPOD 1:2 Redundancy System. For the purpose of example, this figure shows a C-Band system.
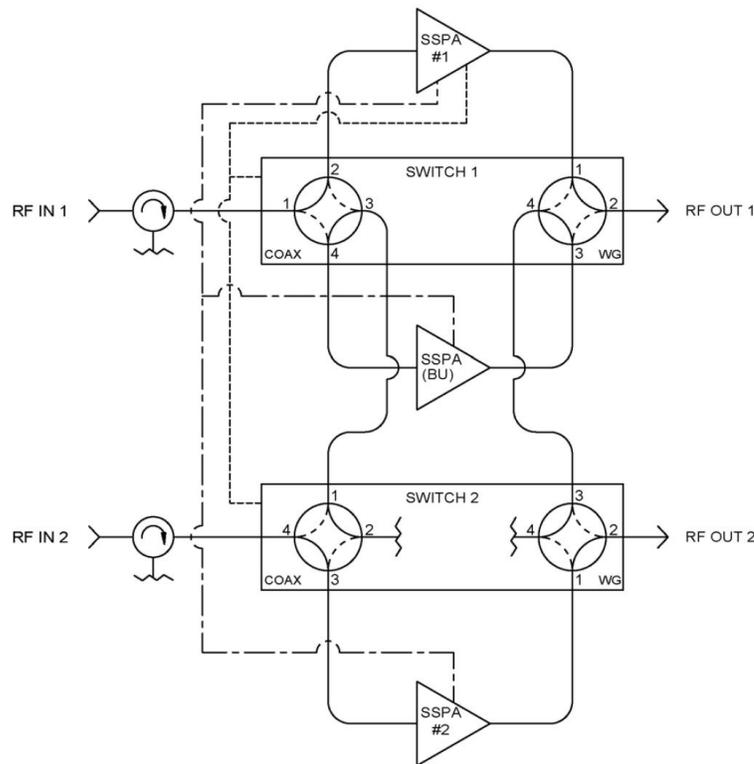
Figure B-1. HPOD C-Band 1:2 Redundancy System Block Diagram

In 1:2 redundancy mode there is a dedicated **B**ackup**U**nit (designated as **BU**) as determined by the cable position. In this configuration, the BU is responsible for monitoring the two online units for communications and summary faults.

While the BU is constantly monitoring both units for their status, if either has a fault, use the last (good) status as the configuration for the BU before the BU goes online. Once the BU goes online, the redundancy auto/manual status reverts to manual mode, and the BU stays online until reset by the user.

The user may reset the system by issuing a FBU=0 command to place the units back into auto mode. When issuing this command, the BU then switches back to the "normal" configuration of SSPAs 1 and 2 online.

The system can be operated manually by sending an FBU=1 command (which forces SSPA 1 to be backed up), or a FBU=2 command (which forces SSPA 2 to be backed up) to the BU.

In 1:2 applications, the BU also stores an offset value, to be used when the BU replaces an active unit, for each of the two online units. This offset may be set with the SBO= command. When an online unit is being "backed up" the BU's attenuator will be set to this value. This value may be different than the attenuation value of the online unit to compensate for any gain mismatch between the BU and online units.

To calibrate, do these steps:

Step	Task
1	After proper operating levels have been established in online SSPA 1 and 2, store their attenuation settings using the SBO= command in the backup unit. **For example –** SSPA 1, the active SSPA, requires 15.00 dB of attenuation. SSPA 2, the BU unit, requires 10.00 dB: Enter the remote commands SBO=1,15.00 and SBO=2,10.00 to store these values.
2	Send the FBU=1 command to the BU unit. This will force the BU unit to replace SSPA 1. The BU unit will read the setting stored by the SBO=1 command (in this example, 15.00) and apply this value to its own attenuation setting. This value can now be tuned to compensate for any gain mismatch. **For example –** If the output power is 1 dB too high in this state, send ATT=16.00 to the BU unit. If the Tx level is now correct, send SBO=1,16.00 to the BU unit.
3	Repeat the above process to achieve desired level matching and for SSPA 2.

B.2 Redundancy Operation Using the SSPA (HPOD) Web Server Interface

See Chapter 4. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT for detailed information about using the Web Server interface.

To proceed with Ethernet-based Remote Product Management, assumptions are made that:

- *The HPOD is operating with the latest version firmware files.*

- *The HPOD is connected to a user-supplied Windows-based PC as follows:*

   o *The User PC Ethernet port is connected to the HPOD 'J6 | COM1' port with a 190-pin to RJ-45 adapter cable.*

   o *The User PC is running a terminal emulation program (for operation of the HPOD Telnet remote control interface) and a compatible web browser (for operation of the Web Server Interface).*

- *The HPOD's IP Address has been noted using the HPOD serial or Telnet remote 'FRW' query or using the Web Server Interface 'Admin | Access' page.*

B.2.1 Web Server Interface Overview

To use the SSOPA (HPOD) Web Server Interface:

- Open a compatible Web browser.

- Enter the *HPOD IP Address* into the browser **Address** field (default is http://192.168.1.4)

- Enter a valid *user name* / *password* (default is comtech / comtech). The SSPA Web Server Interface '**Home**' page appears upon successful login:
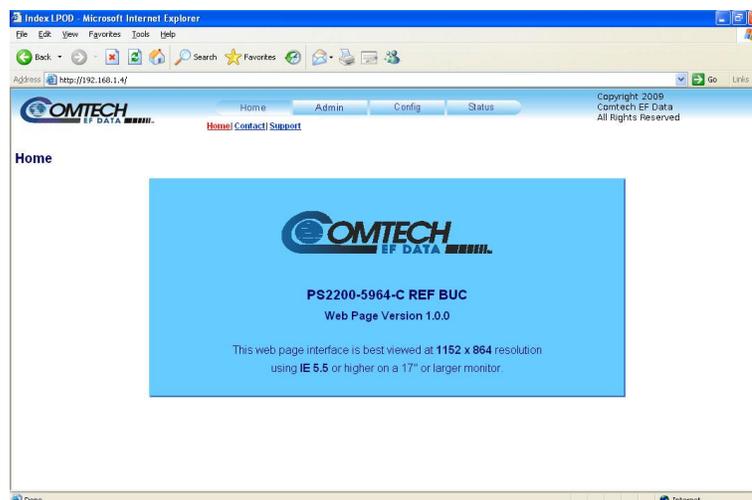
The Web Server Interface features four (4) navigation tabs at the top of each page. Nested hyperlinks (shown in gray) grant access to individual Web pages. The hyperlink for the Redundancy page is available under the **Config** tab.

Home	Admin	Config	Status
Home	Access	Amplifier	Monitor
Contact	SNMP	Utility	Alarms
Support		Redundancy	FETs

Click the **Config** tab, and then select the **Redundancy** hyperlink to continue.

B.2.2 Config | Redundancy Page

Use this page to configure the HPOD 1:1 or 1:2 redundancy operations settings.

Figure B-2. SSPA Web Server Interface – 'Config | Redundancy' Page

At any time, click [Refresh] to update this page and see the most recent data.

Redundancy State and Mode

- Use the drop-down list to set the Redundancy State as **Off**, **1:1**, or **1:2**.

- Use the drop-down list to set the Redundancy Mode as **Manual** or **Automatic**.

Click **[Change]** to save these settings.

Set Switch Position (1:1 only)

In Manual Mode only – To force a unit into the active online state, use the drop-down list to select a unit number, and then click [Send the Command].

Gain Offset (1:1 only)

Enter the gain offset, in 0.25 dB steps, and then click [Change].

Force Back-up State (1:2 only)

Use the drop-down list to set the back-up state as follows:

- Select **Unit 01** or **Unit 02** to put that HPOD into an offline state and set the Redundancy Mode to *Manual*.

- Select **None** to put the backup unit offline and set the Redundancy Mode to Automatic.

Click **[Change]** to save this setting.

Backup Offset for Unit 01 (1:2 only)

Enter the Backup Offset for Unit 01, in 0.25 dB steps, and then click **[Change]**.

Backup Offset for Unit 02 (1:2 only)

Enter the Backup Offset for Unit 02, in 0.25 dB steps, and then click **[Change]**.

Online Status

The active status for the unit is identified here as **Online** or **Offline**.

.

B.3 Redundancy Operation using Serial-based Remote Commands and Queries

See Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT for detailed information about using the HPOD EIA-485/232 serial interface.

Index Notes: Columns marked '**X**' designate instruction code or system compatibility as follows:

- Instruction **Code** – Column '**C**' = Command; Column '**Q**' = Query; '**X**' indicates *Command only*, *Query only*, or *Command/Query*;

- **Redundancy System Compatibility** – 'X' indicates *1:1 systems only*, *1:2 systems only*, or *both 1:1 and 1:2 system compatibility*

CODE	C	Q	DESCRIPTION	1:1	1:2
FBU	X	X	Forces one of the online units to be a backed up for maintenance and test purposes		X
ONL	X	X	Sets or returns the online status (i.e., online, offline)	X	
CRA	X	X	Permits configuration of the redundancy amplifier mode in 1:1 and 1:2 redundancy systems	X	X
RAM	X	X	Sets or returns the redundancy mode (i.e., MANUAL or AUTO)	X	
RED	X	X	Sets or returns the redundancy state (i.e., 1:1 or 1:2)	X	X
SSW	X	X	Forces switch position (i.e., SSPA 1 or SSPA 2 online)	X	
GOF	X	X	Sets or returns the gain offset in a 1:1 system to equalize attenuation levels	X	
SBO	X	X	Sets or returns the gain offset in a 1:2 system to equalize attenuation levels		X

NOTE – Instruction Code Qualifiers, as defined in **Sect. 5.4.2.5**, are used in the command/query table '**Response to Command**' column:

=	Message OK	*	Message OK, but not permitted in current mode
?	Received OK, but invalid arguments found	#	Message OK, but unit is not in **Remote** mode
!	Invalid instruction		

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 – i.e., ASCII codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to query (Target to Controller)
Force Back-Up State	FBU=	1 byte, value of 0, 1, 2	Command or Query. For 1:2 systems only (sent only to the BU unit). Force one of the online units to be a backed up for maintenance and test purposes, in the form x, where: 0 = Force BU *OFFLINE* and place system in AUTO mode. 1 = Force SSPA 1 *OFFLINE* and place system in MANUAL mode. 2 = Force SSPA 2 *OFFLINE* and place system in MANUAL mode.	FBU= FBU?	N/A	N/A
Online Status	N/A	1 byte, value of 0,1	Query only. For 1:1 systems only (sent to both units). Returns the online status in the form x, where: 0 = OFFLINE 1 = ONLINE	ONL= ONL?	ONL?	ONL=x (see Description of Arguments for details)
Configure Redundancy Amp	CRA=	1 byte value of 0,1	Command or query. Permits configuration of the redundancy amplifier mode in 1:1 and 1:2 redundancy systems, in the form x, where: 0 = Disabled - the offline unit's amp state will follow the online unit's amp state (Default). 1 = Enabled - the offline unit's amp state will be Off, if it becomes the online unit, then its amp state will be On. This affects all units in the redundancy system. **Note:** The same CRA value should be sent to all units in the redundancy system.	CRA= CRA?	CRA?	CRA=x (See Description of Arguments)
Redundancy Mode	RAM=	1 byte, value of 0,1	Command or Query. For 1:1 systems only (sent to both units). Sets or returns redundancy mode in the form x, where: 0 = MANUAL 1 = AUTO	RAM= RAM?	RAM?	RAM=x (see Description of Arguments for details)

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 – i.e., ASCII codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to query (Target to Controller)
Redundancy State	N/A	1 byte, value of 0, 1, 2	Query only. Returns the current redundancy state in the form x, where: 0 = OFF 1 = 1:1 Redundancy 2 = 1:2 Redundancy	N/A	RED?	RED=x (see Description of Arguments for details)
Set switch position	SSW=	1 byte, value of 0,1	Command only. For 1:1 systems only(sent to either unit): Only used when system is in MANUAL redundancy mode (RAM=0, both units). Forces switch position in the form x, where: 1 = Forces switch to put SSPA 1 online 2 = Forces switch to put SSPA 2 online	SSW= SSW?	N/A	N/A
Gain Offset	GOF=	5 bytes, numerical	Command or Query. Set or query the adjusted attenuation level, in 0.25 dB increments, in a 1:1 redundancy system so power is equal between the online and offline units when a switchover occurs, in the form xx.xx. **Example:** GOF=02.00'cr'	GOF= GOF? GOF*	GOF?	GOF =xx.xx (See Description of Arguments for details)

Set Backup Offset	SBO=	7 bytes, numerical	Command or Query.
			Set or query the adjusted attenuation level, in 0.25 dB increments, in a 1:2 redundancy system so power is equal between the online and offline units when a switchover occurs.
			In the form #,xx.xx where:
			  # = 1 or 2
			  xx.xx = level, in 0.25 dB increments
			Examples: SBO=1,02.00'cr' or SBO=2,02.50'cr'
				SBO=
				SBO?
				SBO*
					SBO?	SBO=#,xx.xx
						(See Description of Arguments for details)

B.4 HPOD Series 1:1 Redundancy Test

B.4.1 Connection

Step	Task
1	Connect HPOD redundancy loop connectors together using a CA/WR12190-1 redundancy loop cable.
2	Connect a 28V waveguide switch to the switch connector on the redundancy loop cable.
3	Since both units will be connected to a single EIA-485 bus, they will need independent serial COMM addresses. To simplify the setup: a. Power up the unit connected to the "SSPA 2" end of the CA/WR11124-1 cable. Using a EIA-485 connection and a terminal program, set the serial COMM address to "2" (SPA=0002). b. Disconnect SSPA 2 from the EIA-485 cable. Connect the EIA-485 cable to and power up the unit connected to the "SSPA 1" end of the redundancy loop cable. Confirm this unit's serial COMM address is "1". If required set it to "1" (SPA=0001). c. When complete, the SSPA connected to the "SSPA 1" end of the redundancy interlink cable should have EIA-485 COMM address 1 and SSPA 2 will be COMM address 2.
4	Connect both units to the EIA-485 COMM cable and power both units on. Confirm correct serial comms by sending them both an RET? query and noting the response.
5	The units auto detect the presence of the redundancy loop cable. Send an RED? query to both units. Both should report RED=1, indicating proper detection of the redundancy loop cable.

B.4.2 Operation

Task	Procedure
1	Set both units to "Auto" redundancy mode by sending them RAM=1 command.
2	Establish the current online status by sending each unit an ONL? query. Note one unit should return ONL=1 (online), and one unit should return ONL=0 (offline)
3	Fail the unit that reported ONL=1. The switch should throw. Restore the unit
4	Repeat the ONL? query to both units. The unit that was failed in step 2 should now report ONL=0 and the other should report ONL=1. Fail this unit and confirm the switch transitions.
5	Put the system in "Manual" mode by sending RAM=0 commands to both units.
6	The "SSW" command will force the switch to point to the selected unit. For example, an "SSW=1" command will force the switch to point to SSPA 1 no matter which SSPA the command was issued to. Ensure either unit can throw the switch in both directions by sending the following commands: • <1/SSW=1 (the switch may or may not transition) • <1/SSW=2 (the switch should transition) • <1/SSW=1 (the switch should transition) • <2/SSW=2 (the switch should transition) • <2/SSW=1 (the switch should transition)

Notes:

Appendix C. MAINTENANCE

C.1   Overview

This appendix provides the procedures for assisting operations and maintenance personnel in the maintenance and troubleshooting of the Comtech C-, X-, and Ku-Band High-Power Outdoor Amplifier (HPOD). Comtech recommends the use of spare replacement HPODs in place of any HPODs removed from the system for maintenance.

C.2   Replace the Power Supply

C.2.1   Remove the Old Power Supply

⚠️ *The SSPA/power supply interconnection is waterproof <u>only</u> when the power supply and SSPA are mated. When exposed, the connection is only water-resistant. Do <u>not</u> leave the SSPA or power supply exposed to the elements unless properly mated and assembled.*
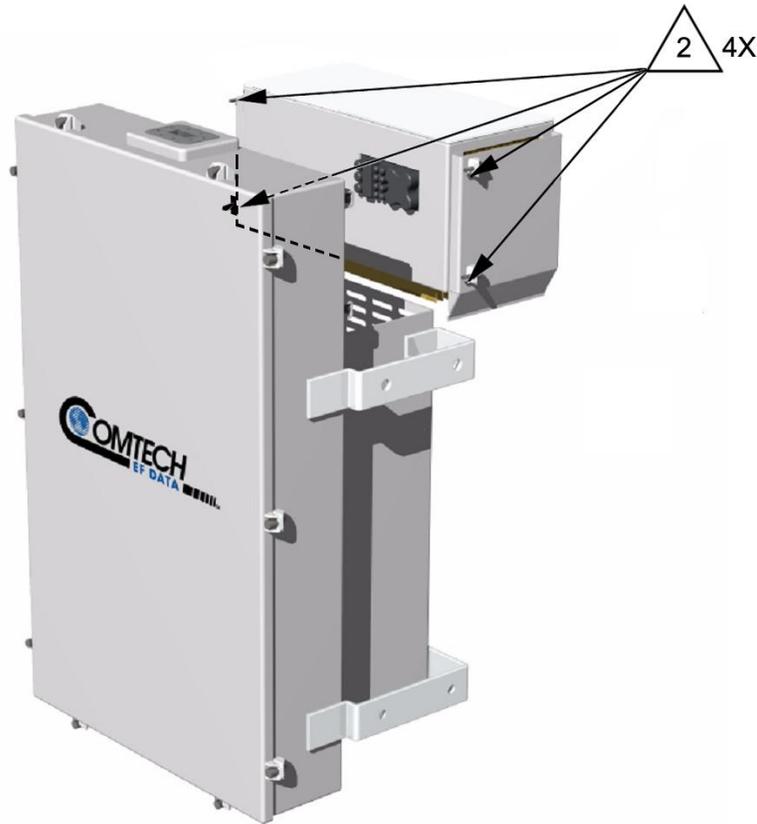

Figure C-1. Remove/Replace the HPOD Power Supply

To remove the old power supply, do these steps:

Step	Task
1	Disconnect the HPOD SSPA from its power source.
2	Loosen the four captive fasteners as shown in **Figure C-1**. 🛈 *Be sure to use an appropriate screwdriver, such as the one provided with the SSPA, to avoid damaging the fasteners.*
3	Remove the power supply from the SSPA.

C.2.2 Install the New Power Supply

To install the new power supply, do these steps:

Step	Task
1	Visually inspect the exposed SSPA heat sink for any debris or blockage. Use compressed air to clean and clear as needed.
2	Visually inspect both the SSPA and power supply connector for cleanliness or damage. Clean and correct as required.
3	Inspect the gasket for damage. Replace as required.
4	Install the power supply onto the SSPA. Make sure that the guide pins and connection are properly aligned. Gently press to engage the connector.
5	Tighten the four captive fasteners where shown previously in **Figure C-1**. ***Be sure to use an appropriate screwdriver, such as the one provided with the SSPA, to avoid damaging the fasteners.***
6	Reconnect the HPOD SSPA to its power source.

C.3   Replace the Fan Assembly

The fans used by the HPOD are designed for long life even in harsh environments. Still, they are mechanical devices subject to wear and may need replacement after several years. In dusty environments, their removal facilitates clearing the heat sink of accumulated dust.
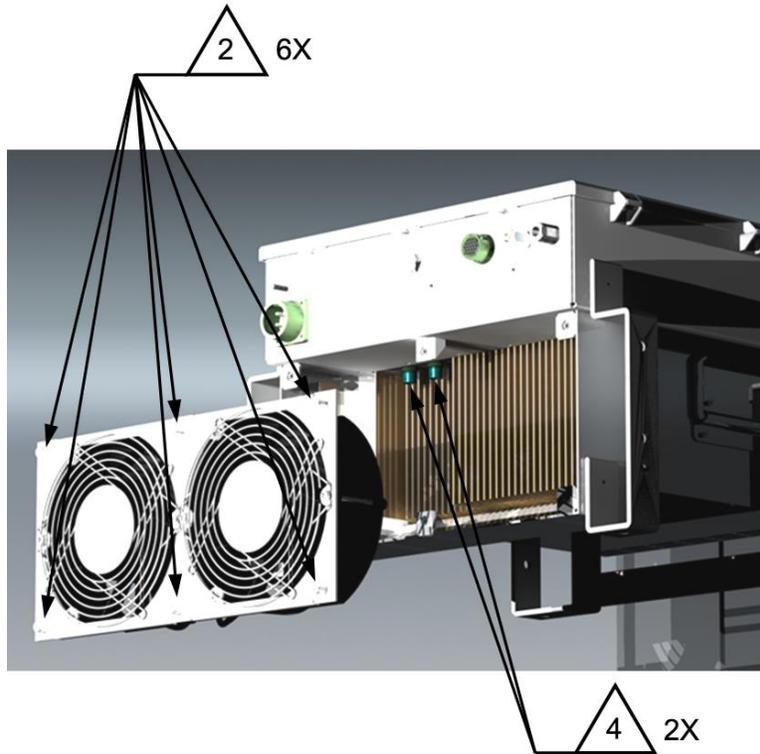
C.3.1   Remove the Old Fan Assembly

Figure C-2. Remove the Old HPOD Fan Assembly

To remove the old fan assembly, do these steps:

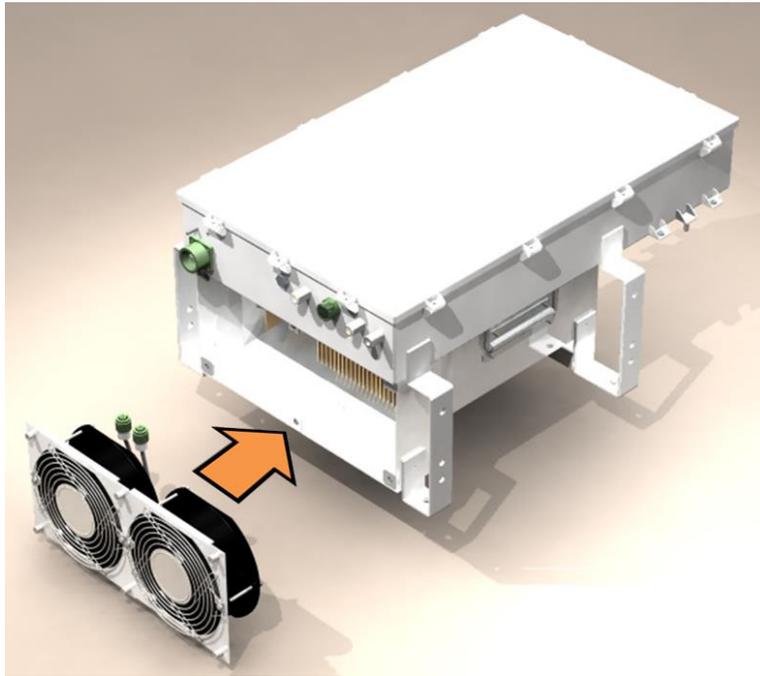| Step	Task
1	Disconnect the HPOD SSPA from its power source.
2	Loosen the six captive fasteners where shown in **Figure C-2**.
	Be sure to use an appropriate screwdriver, such as the one provided with the SSPA, to avoid damaging the fasteners.
3	Remove the fan assembly far enough so that you can gain access to the fan's two circular connectors.
4	Disconnect the fan's circular connectors, and then remove the fan assembly.

C.3.2 Install the New Fan Assembly

Figure C-3. Install the New HPOD Fan Assembly

To install the new fan assembly, do these steps:

Step	Task
1	Visually inspect the exposed SSPA heat sink for any debris or blockage. Use compressed air to clear and clean the heat sink as needed.
2	Connect the fan assembly's circular connectors to the SSPA.
3	Position the fan assembly onto the SSPA. Make sure that you align the assembly properly, so that you can bolt down the fasteners without any cable or fan interference.
4	Tighten the four captive fasteners where shown previously in **Figure C-2**. ⓘ *Be sure to use an appropriate screwdriver, such as the one provided with the SSPA, to avoid damaging the fasteners.*
5	Reconnect the HPOD SSPA to its power source.

C.4   Scheduled Maintenance

> ⓘ ***The SSPA heat sink should be cleaned once a year or sooner, depending on environmental conditions***.

To perform this maintenance, do these steps:

Step	Task
1	Disconnect the HPOD SSPA from its power source.
2	Remove the power supply as instructed in **Sect. C.2.1**.
3	Remove the fan assembly as instructed in **Sect. C.3.1**.
4	Use compressed air to clear the heat sink portions of the power supply.
5	Use compressed air to blow *through* the SSPA heat sink to remove any foreign object accumulation that may be obstructing airflow.
6	Re-install the power supply as instructed in **Sect. C.2.2**.
7	Re-install the fan assembly as instructed in **Sect. C.3.2**.
8	Reconnect the HPOD SSPA to its power source.

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