PCB-4300A

1:2 Phase Combiner
Installation and Operation Manual

Part Number MN-PCB-4300A
Revision 2

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.

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Revision History

Rev	Date	Description
-	5-2017	Initial Release.
1	2-2018	Added remote commands STB, STA, STV, TPE, TPS, and RFD to Chapter 5. Updated Table 6.1, Management Information Base Files, in Chapter 6. Updated Appendix A to add Mounting Bracket Kit, part number KT-0021261 and update cable assembly in Tables A-2, A3, and A-6. Updated Preface Product Support and Comtech EF Data Headquarters information.
2	2-2018	Added default line for IPA, IPG, and SPA commands.

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Acronym List

Acronym	Description
AOF	Amplitude Offset
EIA	Electronic Industries Association
GND	Ground
HPOD	High Powered Outdoor Amplifier
LED	Light Emitting Diode
M&C	Monitor and Control
NMS	Network Management System
OID	Object Identifiers
PCB	Printed Circuit Board
PCCB	Phase Combiner Control Box
RMA	Return Marerial Authorization
RS	Recommended Standard
SNMP	Simple Network Management System
SSPA	Solid State Power Amplifier
VSWR	Voltage Standing Wave Ratio
WG	Waveguide

PREFACE

About this Manual

This manual provides installation and operation information for the Comtech EF Data PCB-4300A 1+1 Phase Combiner. This is an informational document intended for the persons responsible for the operation and maintenance of the PCB-4300A.

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

This is an informational document intended for the persons responsible for the operation and maintenance of the modem.

Conventions and References

Patents and Trademarks

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

Warnings, Cautions, and Notes

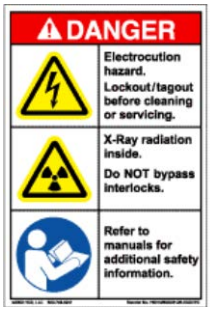
A <u>WARNING</u> gives information about a possible hazard that MAY CAUSE DEATH or SERIOUS INJURY.

A <u>CAUTION</u> gives information about a possible hazard that MAY CAUSE INJURY or PROPERTY DAMAGE.

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

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

Examples of Multi-Hazard Notices



Recommended Standard Designations

Electronic Industries Association (EIA) designations supersede Recommended Standard (RS) designations. Reference to the old RS designations (e.g., RS-232) may appear where it might concern actual text displayed on the unit's rear panel, Serial Interface, or Web Server Interface pages. All other references in the manual use the EIA designations.

Metric Conversion

Metric conversion information is provided on the inside back cover of this manual. Comtech EF Data provides this information to assist the user in cross-referencing non-Metric to Metric conversions.

Electrical Safety Notice

Double pole / neutral fusing is used on the prime power supply input.

This equipment is designed to minimize exposure of personnel to hazards. For further information, contact the Comtech EF Data Customer Support Department. The persons responsible for the operation and maintenance of the PCB-4300A 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.

Product Support

For all product support, please call:
+1.240.243.1880
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Warranty Policy

Comtech EF Data 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 EF Data 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 EF Data for the warranty period specific to the product purchased.

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

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 EF Data strongly recommends all equipment be returned in its original packaging.

Comtech EF Data Corporation'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.

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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 EF Data Corporation, 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 EF Data Corporation.

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 EF Data Corporation, 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 EF Data Corporation 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 EF Data Corporation cannot identify the cause of the reported failure.

Exclusive Remedies

Comtech EF Data Corporation'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 EF Data Corporation's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech EF Data Corporation 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 EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Chapter 1. INTRODUCTION

1.1 Overview

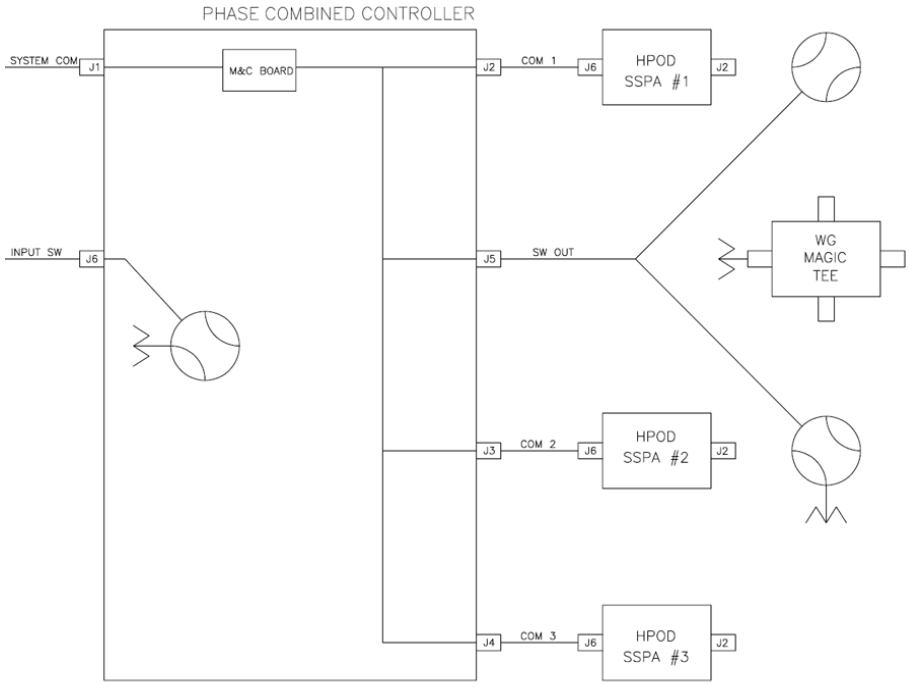
Phase combining is a traditional technique that cost effectively increases the available output power of an amplifier system. The PCB-4300A 1:2 Phase Combiner (Figure 1-1), together with three Solid State Power Amplifiers (SSPAs) and associated waveguide and cabling, form a complete 1:2 phase combined system.

Figure 1-1. Comtech EF Data PCB-4300 1:2 Phase Combiner Control Box (PCCB)

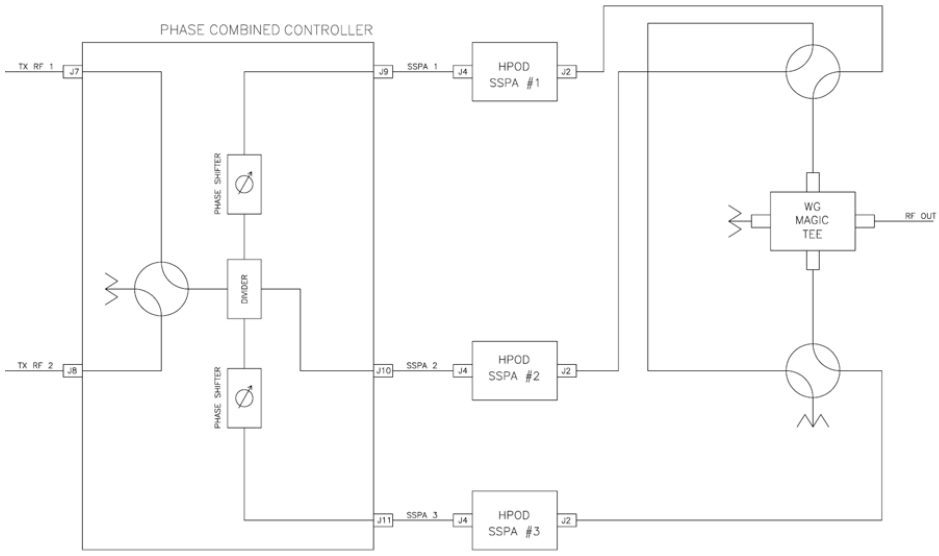
In a 1:2 phase combined system, two of the three SSPAs are normally online and their outputs are summed in the waveguide combiner, effectively doubling the system output power. The third SSPA remains offline and, in the event of a failure of either of the two online units, its “standby” output is automatically switched in place of the failed unit – thereby maintaining full system output power.

1.2 Functional Description

The PCB-4300A is available in a C-Band version. Contact Comtech EF Data for the Ku-band version. The box may be included in a top-level system assembly or as a subassembly kit. For application examples, see **Appendix A. ASSEMBLY KITS**.



Monitor & Control (M&C) System Interconnect



RF System Interconnect

Figure 1-2. Combined System Block Diagrams

The block diagrams shown in Figure 1-2 depict the major components of the 1:2 phase combined system. (These diagrams employ High Powered Outdoor Amplifiers (HPODs) as the designated SSPAs.)

The Phase Combiner Control Box (PCCB) contains a microprocessor-based Monitor and Control (M&C) circuit board to control the system. Interconnection is as follows:

- The PCCB communicates with each SSPA via control cables that are attached from the PCCB "**SSPA COM 1 | J2**", "**SSPA COM 1 | J3**", and "**SSPA COM 1 | J4**" connectors to each SSPA.
- Through this connection, the PCCB receives it prime power to operate. A +24V signal from each SSPA is diode OR'ed to provide redundant operating power for the PCCB.
- A "Y" cable connects to the "**SSPA SW OUT | J5**" connector for control of the waveguide switches. M&C communication with the PCCB is accomplished via the "**SYSTEM COM | J1**" connector.

In order to avoid ambiguities, all communication to each SSPA is also accomplished via the PCCB M&C.

The PCCB provides a weatherized housing for the necessary input RF components. System interconnection is as follows:

- An input RF redundancy switch, controlled via the "**RF INPUT SWITCH | J6**" connector, selects which RF path is directed to the output.
- The output RF signal is fed into an in-phase divider, which equally splits the signal in phase and amplitude to the "**SSPA OUT 1 | J9"**, "**SSPA OUT 2 | J10"**, and "**SSPA OUT 3 | J11"** output connectors.
    - The RF paths to the "**SSPA OUT 1 | J9"** and "**SSPA OUT 3 | J11"** output connectors each contain a manually adjustable phase shifter. These phase shifters are used to equalize the phase difference of each SSPA signal path to achieve maximum system output power. They are accessible via a small cover panel. These critical components are factory set and should only be adjusted, if needs arise, by carefully following an appropriate alignment procedure.

      See Chapter 3. OPERATION and ADJUSTMENT PROCEDURES for operational and alignment information.

      It is also important to install the individual SSPAs in the correct position (as aligned at the factory). For installation examples, see **Appendix A. ASSEMBLY KITS.**
    - The path to "**SSPA OUT 2 | J10"** output connector contains a length of coaxial cable that is factory manufactured to provide equal phase length paths from the RF input to each PCCB output when the adjustable phase shifter is set to its midpoint. This provides a maximum adjustable phase range.

There are also several isolators inside the PCCB that maintain good system Voltage Standing Wave Ratio (VSWR). Do not alter any RF cable inside (or outside) of the box that is part of the RF signal path.

- The RF signals from the PCCB are fed to the RF input of the respective SSPA via a set of phase matched cables. Again, the phase length (and matching) of these cables is essential to system operation and no substitutes should be used. The routing should not be such to cause extreme bends.

- The output waveguide combining system consists of balanced waveguide lengths, two waveguide transfer switches, a “Magic-Tee” combiner with termination, and couplers for test and alignment.

1.3 Theory of Operation

As mentioned previously, phase combining is a common technique to increase the available output power of an amplifier system. Referring back to **Figure 1-2,** when two signals of equal phase and amplitude are fed into the “Magic-Tee” combiner, the individual power of each SSPA is summed at the output port and cancelled in the termination port.

In real systems, the phase and amplitude of the two signals are never exactly equal, so there is a small amount of power that is absorbed by the load termination. This terminated port is sometimes referred to as the “wasted” power port. In practice, however, it is possible to keep phase and amplitude imbalances at low enough levels such that overall combining losses are only in the 0.2 to 0.5 dB range.

Figure 1-3 shows the effects of phase imbalance on the power combining efficiency.

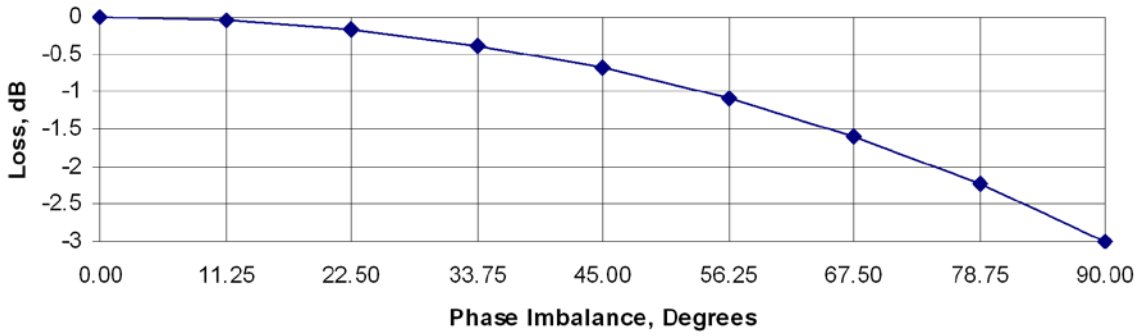


Figure 1-3. Combining Loss vs. Phase Imbalance Summary of Specifications

1.3.1 Phase and Gain Equalization

Phase and gain equalization are performed at the factory, and no user intervention is required unless an amplifier or other critical system component, such as the phase combiner box, needs to be replaced.

The following paragraphs are provided for informational purposes only.

See Chapter 3. OPERATION and ADJUSTMENT PROCEDURES for operational and alignment information.

Naturally, three separate amplifiers are likely to have different phase and gain characteristics. The PCB-4300A 1:2 system is designed such that the phase difference between the three amplifier paths is compensated by adjusting the phase shifter in the PCCB. This is done at the factory for the full amplifier bandwidth and should not normally require further adjustment in the field unless an amplifier has been replaced.

The gains of the three amplifiers are calibrated at the factory to provide optimum system performance. The PCB-4300A software has a command that reads the stored factory gain of each SSPA and adjusts "offsets" to equalize the gains between the three SSPAs. These Amplitude Offsets – AOF1, AOF2, and AOF3 – are often further fine-tuned at the factory to provide optimum system performance (see test datasheet for specific system offsets).

1.3.2 System Switching

The possible combinations of which two SSPAs are "online" and directed to the system waveguide combiner output, versus which SSPA is offline, are as follows:

- 1+2 online (SSPA #3 offline)
- 1+3 online (SSPA #2 offline)
- 2+3 online (SSPA #1 offline)

There are two software modes that control which two SSPAs are online versus which SSPA is offline: "automatic" and "manual". Either mode is invoked by the state of the FoRCe (FRC=) command (see **Chapter 5. REMOTE CONTROL**). Note the following:

- **FRC=00 –** This command is the factory default and executes *automatic* mode, whereby the two SSPAs that are online and combined will generally be the first two that "clear" their faults; i.e., the first two SSPAs that are powered on. (Refer also to the PRF setting description below.) Should a fault occur in an online unit while FRC=00, the offline unit will automatically switch in place of the faulted unit, maintaining full system output power.
- **FRC=*XX*** – Where FRC=00 is the *automatic* mode, when it is desired to force two *specific* SSPAs online, executing this command puts the system in *manual* mode and combines the output of the two selected SSPAs. This is accomplished by sending this command, where *XX* = **12** (1+2), **13** (1+3), or **23** (2+3).

  Manual mode also implies that, if one of the online units fail, a switchover to replace the faulted unit with the offline unit will NOT occur automatically.

  (Note that the FRC command is also useful, should system re-alignment be needed – i.e. the command indirectly directs one SSPA to the offline port for easy characterization and measurement.)

The recommended and default setting is FRC=00.

PRF=*XX* – The PReFerred command, where *XX* = **00**, **12**, **13**, or **23**, affects the possible online/offline states. Note the following:

- If the setting is PRF=00, there is no *preferred* condition, and the first two SSPAs without faults detected by the PCB-4300A will be directed online.
- If PRF is something other than 00 – e.g., PRF=13 – then, if at any time both units 1 and 3 have no faults, they will be switched online.

The recommended and default setting is PRF=00.

1.3.3 System Gain

Due to the power divider and cable losses, the overall gain of the system will be approximately 5-10 dB less than the individual gain of each amplifier. Refer to the system test data sheet for actual system gain.

1.3.4 System Attenuation

The PCB-4300A makes it easy to adjust the overall system gain. Upon input of the requested attenuation setting, the PCB-4300A automatically adjusts the gain of each SSPA accordingly, resulting in the desired attenuation value while maintaining optimum power combining conditions.

The SSPAs included in the system are calibrated over a range 10 dB beyond specification (30 dB *vs.* 20 dB). As explained above, a portion of the 30 dB range is required for gain equalization. Therefore, while the maximum allowable attenuation in a 1:2 system is software-limited to 24 dB, it still exceeds system specifications.

1.4 Dimensional Envelope

All dimensions are in English units; metric units are shown in parentheses. This figure is typical for the C-Band versions of the PCB-4300A.

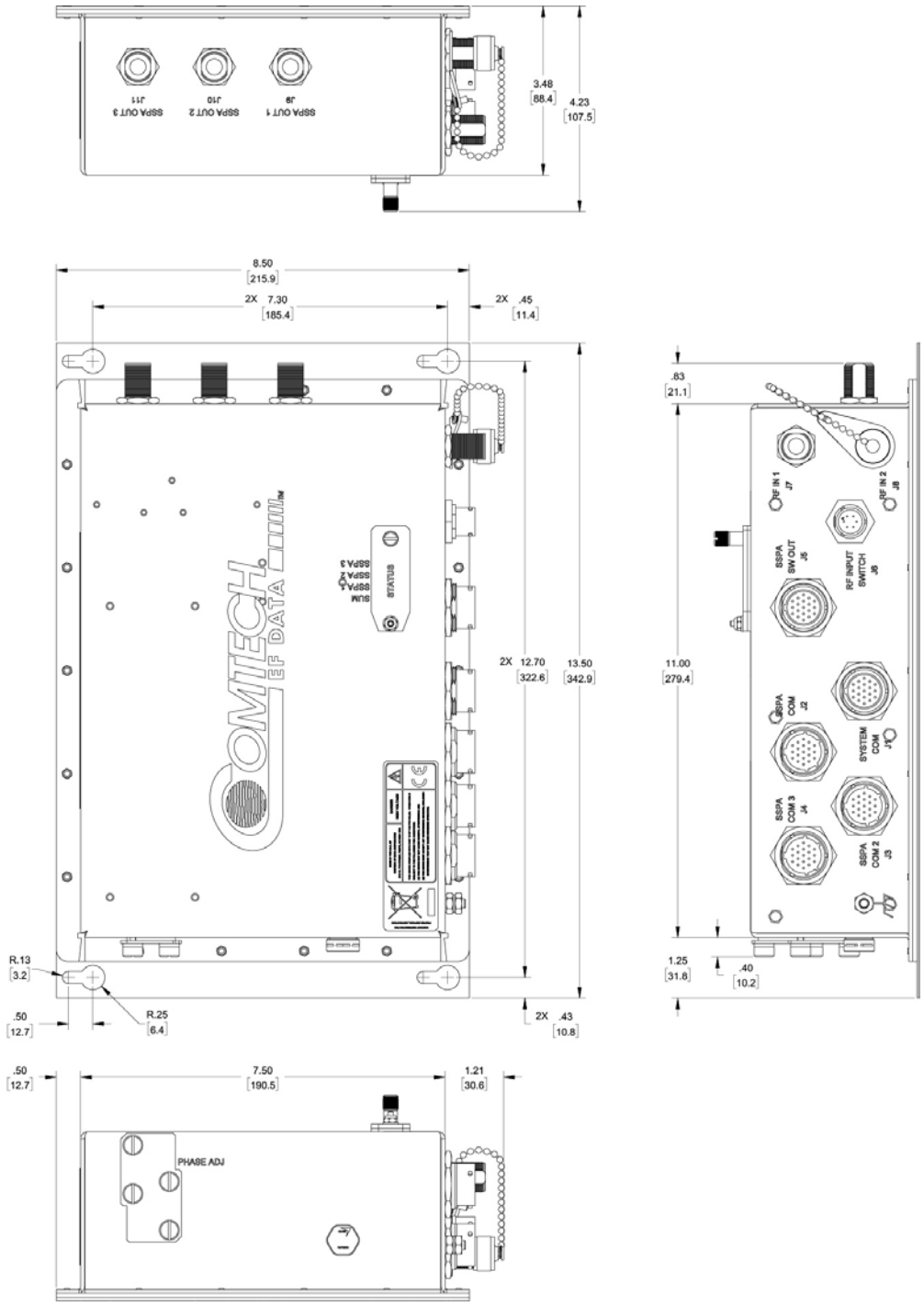


Figure 1-4. PCB-4300A Dimensional Envelope

Notes:

Chapter 2. EXTERNAL CONNECTORS

2.1 Overview

This chapter summarizes the connectors provided for all necessary external connections between the PCB-4300A and other equipment. Table 2-1 lists the external connectors grouped according to service function. Refer to Figure 3-2 for External Connectors illustration.

See Chapter 3. OPERATION AND ADJUSTMENT PROCEDURES and Appendix A. ASSEMBLY KITS for basic installation and operational examples. See Chapter 5. SERIAL REMOTE CONTROL for information about the remote M&C.

Table 2-1. External Connectors

Connector Group (Chapter Sect.)	Name / Ref Des	Connector Type	Function
M&C (Sect. 2.2)	SYSTEM COM | J1	19-pin Circular Connector	Customer EIA-232 and discrete interface
	SSPA COM 1 | J2	19-pin Circular Connector	Connects to SSPAs
	SSPA COM 2 | J3		
	SSPA COM 3 | J4		
	SSPA SW OUT | J5	19-pin Circular Connector	Connects to both waveguide switches
	RF INPUT SWITCH | J6	6-pin Circular Connector	Drive input, selects either RF IN 1 or RF IN 2
RF (Sect. 0)	RF IN 1 | J7	Type 'N'	RF Inputs to PCCB
	RF IN 2 | J8		
	SSPA OUT 1 | J9	Type 'N'	RF Outputs to SSPAs
	SSPA OUT 2 | J10		
	SSPA OUT 3 | J11		
Power/Ground (Sect 2.4)	AC	Pin 'R' on SSPA COM 1 J1, SSPA COM 2 J3, SSPA COM 3 J4	See Sect. 2.4.1 for AC power provision note
	Ground	#10-32 stud	Common Chassis Ground

To maintain compliance with the European EMC Directive (EN55022, EN50082-1) properly shielded cables are required for data I/O.

2.2 Monitor and Control (M&C) Interface Connectors

All M&C connectors are found on the front panel of the PCCB box.

2.2.1 SYSTEM COM | J1 Connector

The 19-pin circular **SYSTEM COM** | **J1** connector, type MS3112E14-19S, serves as the primary input between the user and the PCCB for controlling and monitoring all SSPAs. Its pinout specification is provided in Table 2-2.

Mating connector: ITT Cannon MS3116J14-19P (P/N CN/MS3116J14-19P).

Table 2-2. Connector J1 Pinouts

Pin #	Signal Function	Signal Name / Description
A	ETH_+TX	Customer communications interface
B	ETH_-TX	Customer communications interface
C	ETH_+RX	Customer communications interface
D	ETH_-RX	Customer communications interface
E	RS232_RD	Customer communications interface
F	Spare	Reserved for future use
G	RS232_TD	Customer communications interface
H	System Fault NO	When there is a summary fault in the PCB-4300A, this pin (NO) will be tied to the Fault Common pin.
J	System Fault NC	When there is not a summary fault in the PCB-4300A, this pin (NC) will be tied to the Fault Common pin.
K	Fault Common	
L	SSPA 1 Fault NO	When there is a fault with SSPA 1, this pin (NO) will be tied to the Fault Common pin.
M	SSPA 1 Fault NC	When there is not a fault with SSPA 1, this pin (NC) will be tied to the Fault Common pin.
N	Spare	Reserved for future use
P	SSPA 2 Fault NO	When there is a fault with SSPA 2, this pin (NO) will be tied to the Fault Common pin.
R	SSPA 2 Fault NC	When there is not a fault with SSPA 2, this pin (NC) will be tied to the Fault Common pin.
S	System Mute	SSPA will be muted if this pin is grounded
T	SSPA 3 Fault NO	(NOTE: This pin is reserved for use with 1:2 systems only.)
U	SSPA 3 Fault NC	(NOTE: This pin is reserved for use with 1:2 systems only.)
V	Ground	GND

2.2.2 SSPA COM 1 | J2, SSPA COM 2 | J3, SSPA COM 3 | J4 Connectors

The 19-pin circular **SSPA COM 1** | **J2, SSPA COM 2** | **J3**, and **SSPA COM 3** | **J4** connectors, type MS3112E14-19S, serve as the primary input/output interfaces between the PCCB and its specified SSPA. The typical pinout specification is provided in Table 2-3.

Typical mating connector: ITT Cannon MS3116J14-19P (P/N CN/MS3116J14-19P).

Table 2-3. Connectors J2, J3, and J4 Pinouts

Pin #	Signal Function	Signal Name / Description	Direction
A	NC		
B	NC		
C	NC		
D	NC		
E	RS232_RD	Provides for Comm between PCB and SSPA	Input
F	NC		
G	RS232_TD	Provides for Comm between PCB and SSPA	Output
H	Switch Inhibit Output	Provides a hardware mute input to SSPA with switch fault	Output
J	NC		
K	Ground	GND	
L	SUMFLT_NO	Monitors SSPA summary fault relay	Input
M	NC		
N	Ground	GND	
P	ONLINE_STATUS	Used by PCB for online status indication	Input
R	+24V	Bias voltage from SSPA	Input
S	Mute Control	Allow for customer inhibit. Tied to Pin S of System Comm (J1) connector	
T	NC		
U	NC		
V	NC		

2.2.3 SSPA SW OUT | J5 Connector

The 19-pin circular **SSPA SW OUT** | **J5** connector, type MS3112E14-19S, connects via a "Y" cable, to the SSPA #1 and SSPA #2 waveguide switches. The typical pinout specification is provided in Table 2-4.

Mating connector: ITT Cannon MS3116J14-19P (P/N CN/MS3116J14-19P)

Table 2-4. Connector J5 Pinouts

Pin #	Signal Function	Signal Name / Description	Direction
A	Pos1, SW1 Drive		Output
B	Ground	GND	
C	POS2, SW1, Drive		Output
D	POS1, SW1, Indicator		Input
E	Ground	GND	
F	POS2, SW1, Indicator		Input
G	NC		
H	POS1, SW2, Drive		Output
J	Ground	GND	
K	POS2, SW2, Drive		Output
L	POS1, SW2, Indicator		Input
M	Ground	GND	
N	POS2, SW2, Indicator		Input
P	NC		
R	NC		
S	NC		
T	NC		
U	NC		
V	NC		

2.2.4 RF INPUT SWITCH | J6 Connector

The PCCB contains a built-in selector switch – a latching 28 VDC coaxial unit. The switch position is selected by the 6-pin circular **RF INPUT SWITCH** | **J6** connector (P/N CN/MS-PT07M6PC). Its pinout specification is provided in Table 2-5.

Mating connector: ITT Cannon MS3116J10-6S (P/N CN/MS3116J10-6S).

Table 2-5. Connector J6 Pinouts

Pin #	Signal Function	Signal Name / Description	Direction
A	POS1, Drive		Input
B	Ground	GND	
C	POS2, Drive		Input
D	POS1, Indicator		Output
E	Ground	GND	
F	POS2, Indicator		Output

2.3 RF Interface Connectors

2.3.1 RF IN 1 | J7, RF IN 2 | J8 Connectors

The **RF IN 1** | **J7** and **RF IN 2** | **J8** connectors are Type 'N' female connectors, each serving as an RF signal input interface to the PCCB. Note the following:

- The **RF IN 1** | **J7** input is selected when the RF INPUT SWITCH J6's "**POS1**" Signal Function is activated.
- The **RF IN 2** | **J8** input is selected when the RF INPUT SWITCH J6's "**POS2**" Signal Function is activated.

2.3.2 SSPA OUT 1 | J9 Connector

The **SSPA OUT J10** connector, located on the left side panel of the PCCB, is a Type 'N' female connector. It provides the RF signal output from the PCCB to SSPA #1.

2.3.3 SSPA OUT 2 | J10, SSPA OUT 3 | J11 Connectors

The **SSPA OUT 2** | **J10** and **SSPA OUT 3 | J11** connectors, located on the right side panel of the PCCB, are Type 'N' female connectors. They provide the RF signal outputs from the PCCB to SSPA #2 and SSPA #3.

2.4 Power and Ground Interfaces

2.4.1 AC Power

The PCB-4300A derives its power from the SSPAs. Each SSPA provides a +24V signal line via cables interconnecting the SSPAs to the SSPA COM 1 J2, SSPA COM 2 J3, and SSPA COM 3 J4 connectors (Pin 'R' – see Table 2-3). These three signals are "diode OR'ed" to provide redundancy.

Although the PCCB will turn on and function with only one SSPA powered on, the system does not provide optimum output power unless at least two of the three SSPAs are powered on.

2.4.2 Ground Connector

A #10-32 stud is provided on the front panel of the PCCB for connecting a common chassis ground among equipment.

Notes:

Chapter 3. OPERATION AND ADJUSTMENT PROCEDURES

Comtech EF Data recommends that only qualified personnel familiar with high-power amplifiers, test equipment, and phase-combined systems attempt the procedures provided in this chapter. Furthermore, before attempting any of these procedures, it is strongly advised to:

- ***Read Chapter 1. INTRODUCTION to become familiar with system terminology and Theory of Operation.***
- ***Read Chapter 2. EXTERNAL CONNECTORS to become familiar with the external connectors and their functionality.***
- ***Read Chapter 5. SERIAL REMOTE CONTROL to become familiar with the serial remote control commands and queries.***

3.1 Overview

As indicated in **Chapter 1. INTRODUCTION**, the PCB-4300A 1:2 Phase Combiner system is aligned at the factory using a network analyzer. The in-factory adjustments are based on the specific arrangement of the SSPAs within the system. In order to ensure proper system operation and performance, it is mandatory that the components are installed in the same positions as was done in the factory. See Figure 3-1 for an assembly example.

Although the techniques featured in this chapter afford easy adjustment and setting of the phase shifter for optimum output power combining over the full amplifier bandwidth, ***alignment in the field is generally not required and it is strongly cautioned against making unneeded adjustments***.

However, if an amplifier or other critical system component is replaced (e.g., the PCB-4300A unit), the procedures provided in this chapter explain the steps necessary to restore proper system operation. Procedures for both single frequency and full bandwidth operation are provided in this chapter. This chapter also provides a verification procedure in the event that proper system operation confirmation is required.

It is recommended that only qualified personnel familiar with high-power amplifiers, test equipment, and phase combined systems attempt these procedures.

3.2 System Assembly, Cabling Connections, and Installation

3.2.1 1:2 Phase Combined System Assembly

Figure 3-1 shows an example of the PCB-4300A deployed in a typical 1:2 phase combined system (see **Appendix A. ASSEMBLY KITS** for details on band-specific system applications). Note the callouts in this figure, as they are referenced in the following procedures.

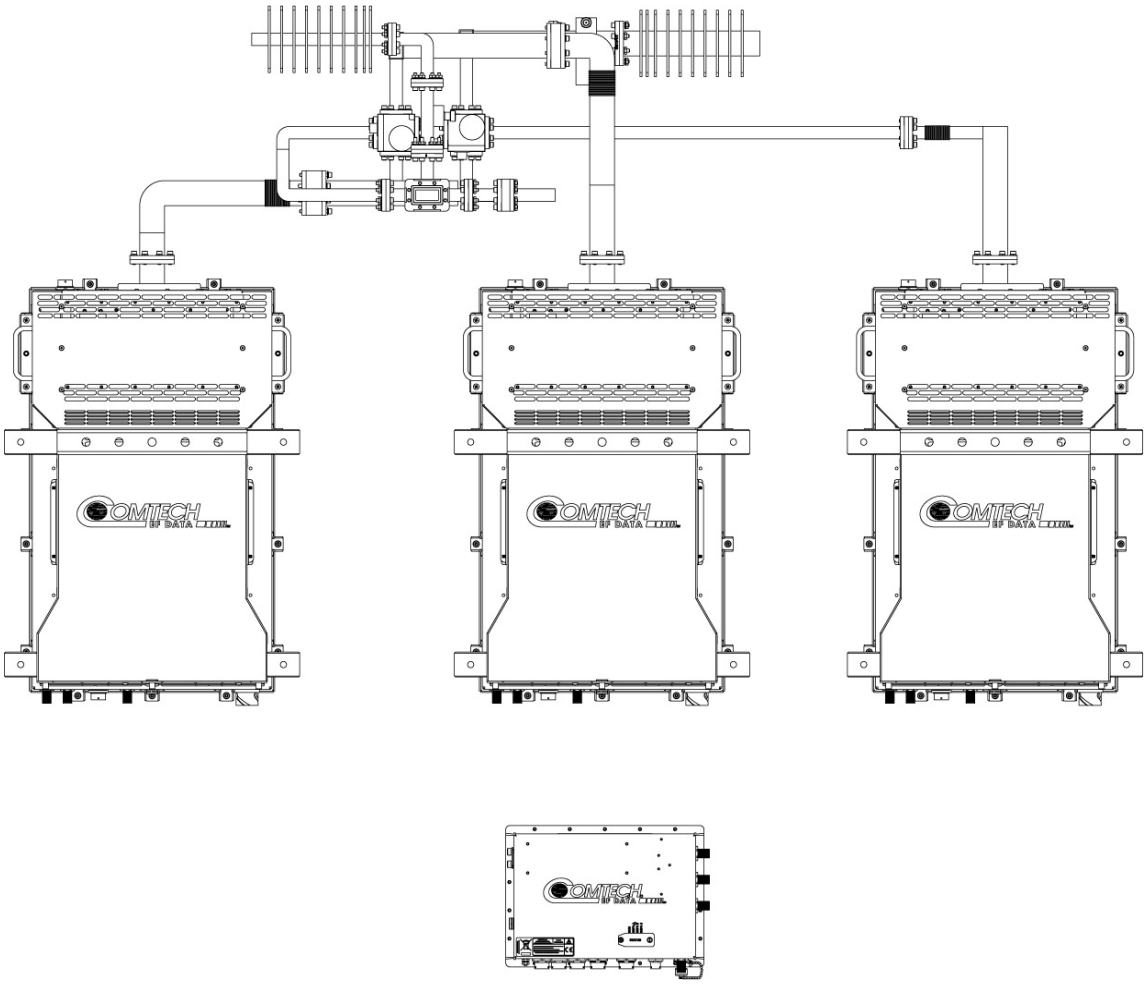


Figure 3-1. PCB-4300A 1:2 Phase Combiner System Assembly Example

3.2.2 PCCB Cabling Connections

Figure 3-2. PCB-4300A External Connectors – Front

Figure 3-3. PCB-4300A External Connectors – Right Side

Figure 3-4. PCB-4300A – Left Side

3.2.3 System Component Installation and Interconnection

Refer to Figure 3-1 through Figure 3-3, to perform the following steps:

Step	Procedure
1	Install the SSPAs in their respective positions as detailed in the factory data sheet and in accordance with Figure 3-1. This means that the specific serial numbered SSPA that was aligned in Position 1 at the factory must also now be installed in position 1; the same applies to the SSPAs in positions 2 and 3. Labels are provided to help ensure correct installation. It is suggested that any mounting hardware used in the installation process not be fully tightened until the entire system is installed.
2	Attach the Waveguide (WG) combining network to the mounting structure and to each SSPA. For assembly details, see Appendix A. ASSEMBLY KITS. Take care to install the provided waveguide gaskets at each SSPA output. It may be necessary to slightly adjust each SSPA to prevent undue stress on the waveguide structure. Tighten all hardware when proper alignment is achieved.
3	Assemble the PCB-4300A Phase Combiner Control Box (PCCB) to the mounting structure.
4	Install the Type 'N' RF Phase Matched Coaxial Cables (CEFD P/N CA/RF11872-1). Each cable is labeled according to its destination SSPA: • Connect the cable labeled 'SSPA1' from the PCCB Type 'N' port labeled 'SSPA OUT 1 | J9' to the RF Input port on SSPA #1. • Repeat this task for the cables labeled 'SSPA2' and 'SSPA3', connecting them between PCCB Type 'N' ports labeled 'SSPA OUT 1 | J10' and 'SSPA OUT 3 | J11' and their corresponding RF Input ports on SSPAs #2 and #3. *Make sure to correctly install all RF cabling, as any "cross" connections will cause system malfunction.*

Step	Procedure
5	Install the "COM" Cables (CEFD P/N CA/WR11966-2) between each of the following PCCB connectors and their corresponding SSPA "COM" ports: • (PCCB) SSPA COM 1 | J2 to SSPA #1 • (PCCB) SSPA COM 2 | J3 to SSPA #2 • (PCCB) SSPA COM 3 | J4 to SSPA #3
6	Install a WG Switch Control "Y" Cable (CEFD P/N CA/WR12013-1) between the PCCB connector labeled 'SSPA SW Out | J5', and the two waveguide switches as shown in Figure 3-1. Pay particular attention to ensure that the ends labeled 'SW1' and 'SW2' are respectively connected to WG Switch #1 and #2.
7	Install the user-provided RF Input Switch control cable (if applicable) to the PCCB 'RF INPUT SWITCH | J6'.
8	Properly terminate the WG system output port, review all cables for proper connections, and ensure that all mounting hardware is tightened.

3.2.4 LED Status Operation

The PCB-4300A features four Light-Emitting Diode (LED) indicators. Each LED provides the user with visual cues to the operational, online, and offline status of the system.

Figure 3-5 illustrates the location of the LED indicators. Located on the top of the PCB-4300A enclosure under a pivoting protective plate, the LEDs may be viewed by loosening the captive screw that keeps the plate in place; the user can then swing the plate away to reveal the LED display window.

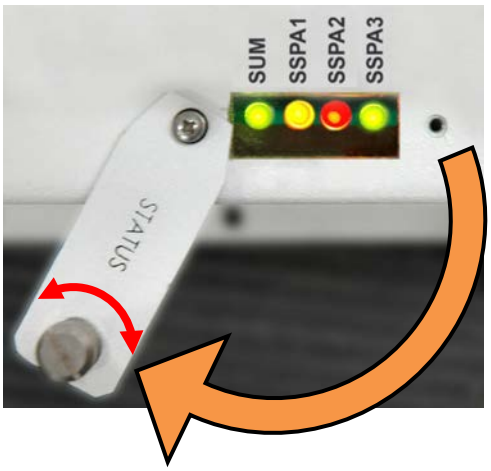


Figure 3-5. LED Indicators

The behavior of the LEDs, as they appear under varying operational conditions, is as follows:

Table 3-1. LED Descriptions

LED *	Color / Behavior	Description
SUM (LED 1)	Green	Phase Combiner has no summary fault.
	Red	A Summary Fault has occurred.
SSPA 1 (LED 2) -or- SSPA 2 (LED 3) -or- SSPA 3 (LED 4)	Green	SSPA is unfaulted, unmated.
	Orange	SSPA is unfaulted but muted.
	Red	SSPA is faulted.

* If LED light is blinking, this indicates either a switch fault or that a backup unit is being used.

3.3 Initial System Setup and Verification

Verify that the system has been assembled, that all cables have been connected, and that the output port is terminated in a broadband high power load as depicted in Figure 1-2 block diagram in **Chapter 1. INTRODUCTION**. If the system is "live" and you desire only to verify operation, see **Section 3.5**.

The following test equipment is required

- Dual Channel Power Meter, or two single channel Power Meters. (If only one power meter is available, attachment to the Combined Output Power Test Port Coupler is generally preferred.)
- CW Input Signal Source.
- Calibration data of system test couplers, i.e., the Combined Output Power Coupler and the "Wasted" Power Coupler.
- PC for serial control and communication.
- Test Datasheet (shipped from by factory).

Verify overall system performance by repeating the factory-performed tests, and then comparing these new results to the findings on the provided Test Datasheet. Take care to review and become familiar with this datasheet before attempting these tests.

Follow these steps:

Step	Procedure
1	Verify that the amplitude offsets reported by the PCB-4300A agree with those set at the factory (see provided Test Datasheet). The offsets for SSPAs #1, #2 and #3 can be queried by sending remote query <X/AOF=?Y via the serial port (where X=PCB-4300A address, and Y=1, 2, or 3 – the individual SSPA offset in question). Make sure the system attenuation is set to zero (ATT=0.00).

After the amplitude offsets have been verified in **Step 1**, the procedure is then basically continued in two parts – **System Gain Verification** and **System P1dB Verification**.

3.3.1 System Gain Verification

Step	Procedure
1	Set the CW Input Signal Source to the start, center, and end frequencies of the amplifier range and to a level that will give a system output power of approximately 10 dB below the combined P1dB. For example, for a 14-14.5 GHz system with a combined Prated of 53dBm (individual SSPA= 50dBm) and a system gain of 65 dB, the input source would be set to a level of 53 dBm – 65 – 10 = -22 dBm. Measure, verify, and record this level at the input to the phase combiner system for each of the three frequencies.
2	Attach one channel of the power meter to the Combined Output Power Test Coupler (refer to Figure 3-1); attach the second channel of the power meter to the "Wasted" Power Test Coupler. Make sure the power meter has been appropriately calibrated to include the respective correction factors of the test port couplers.
3	• Execute remote command FRC=13 to force SSPAs #1 and #3 *online*. If necessary, query the PCB-4300A via remote query FRC?. • Apply the CW signal from the source to the input of the phase combiner system. • Measure the output power by reading the power meter channel attached to the Combined Output Power Test Coupler; add the input signal level, and compute the gain. For example, if : A. The input frequency was 14.0 GHz; B. The corrected power meter reading at the Combined Output Power Test Coupler was 42.1 dBm; C. The measured input signal level for 14.0GHz was -22.2 dBm (as per Step 2); Then the computed gain at 14.0 GHz would be 42.1 + 22.2 = 64.3 dB for the two SSPAs currently online.
4	Repeat Step 4 for the other two frequencies with the current SSPAs online, e.g., FRC=13.
5	Repeat Steps 4 and 5 for the other possible SSPA combinations, e.g., FRC=12, and FRC=23.
6	Compare the data taken to that under the "Gain" section on the factory's Test Datasheet. Note that small errors or differences – probably within the range of ±1 dB – are to be expected due to different power meters, calibration issues, etc. The factory maintains a stringent Calibration and Test Procedure to ensure correct and accurate data is shipped with every system. Before contacting the factory to report any notable discrepancies, double check all connections and the calibration factors involved.

3.3.2 System P1dB Verification

Step	Procedure
1	The 1 dB compression point can also be measured for each of the possible online combinations and frequencies. Use the commands listed above to test the various SSPA online pairs. Again, small differences between customer data and factory data are expected due to the factors listed previously in Section 3.3.1, Step 6. The "wasted" power readings are given in the datasheet for reference purposes only. The user should not be concerned with discrepancies in the "Wasted" power readings if the corresponding P1dB level is satisfactory.

3.4 Single Frequency Alignment (as necessary)

This alignment procedure should be attempted only if there has been a replacement of one of the SSPAs or other critical component (such as the PCB-4300A) since the time that the system was aligned at the factory.

This particular procedure is for an application that requires operation only over a small fraction of the possible amplifier bandwidth. The alignment procedure for narrow band operation is less complex than alignment for full bandwidth – see **Section 3.5** for the Full Bandwidth Alignment procedure.

The equipment required for this procedure is identical to that as described in **Section 3.3**; the exception being that this procedure also requires use of the Phase Shifter Adjustment Tool Kit (screwdriver and socket) provided with the system.

The procedure is basically divided into two parts: **Gain Equalization** and **Phase Equalization**. It is recommended that the user first review **Section 3.3** for details of the test methods and remote control commands and queries that will be utilized in this procedure.

3.4.1 Gain Equalization

The gains of the individual SSPAs will be equalized by use of the “offline” or “standby” test coupler and AOF settings. The offline port is used because it will give a reading of the output of an individual amplifier.

Follow these Steps:

Step	Procedure
1	Select the frequency at which it is desired to align the system. Apply a CW signal to the input of the PCB-4300A at a level that will give a system output power of approximately 10 dB below the combined P1dB. For example, for a 14-14.5 GHz system with a combined Prated of 53dBm (individual SSPA=50 dBm) and a system gain of 65 dB, the input source would be set to a level of 53dBm – 65 – 10 = -22 dBm.
2	Attach one channel of the power meter to the Offline Power Test Coupler (refer to Figure 3-1). Make sure the power meter has been appropriately calibrated.
3	Execute remote serial command ATT=0.00 to the PCB-4300A. This ensures the system attenuation is set to 0 dB.
4	Execute serial remote command AGI= to the PCB-4300A. This command performs a coarse equalization of the gains according to a factory calibration value stored in each individual SSPA; reads this value from each of the three SSPAs; then adjusts the Amplitude Offset (AOF1, AOF2, and AOF3) levels of the two SSPAs with the higher gain to match the unit with the lowest gain. For example, if the factory calibrated gains were SSPA#1=75 dB, SSPA#2=73dB, and SSPA#3=76dB, the AGI= command would result in the following offsets: AOF1=2.00, AOF2=0.00, and AOF3=3.00.
5	Measure the gain (or output level) of each individual SSPA at the desired frequency by using serial remote command FRC= to alternately send the output of each SSPA to the Offline Test Port Coupler. The table that follows is intended as a worksheet to help equalize the gains. (Note that the AOF level can be queried via serial remote command <X/AOF=?Y (where X=PCB-4300A address, and Y=1, 2, or 3 – the individual SSPA offset in question.)

Step	Procedure			
5 (cont)	Offline SSPA	'FRC=' Setting	AOF Value	Measured Output Level (dBm) @Fre=_____
	1	23	AOF#1=_____	#1=_____
	2	13	AOF#2=_____	#2=_____
	3	12	AOF#3=_____	#3=_____
6	If necessary, fine-tune the offsets of one or more of the SSPAs to achieve equalization. Record the final offsets and output levels in the above table. (The offsets are adjusted by the serial remote command <X/AOF=Y,Z.ZZ (where X=PCB-4300A address; Y=1, 2, or 3 – individual SSPA offset in question; and Z.ZZ=desired offset level). For example, if it is desired to set the offset level of AOF#3 to 3.75 dB, and the PCB-4300A address is 1, then serial remote command <1/AOF=3,3.75 should be sent.			

3.4.2 Phase Equalization

Once the amplitudes have been equalized at the selected frequency, the phase paths can be aligned. This is accomplished by adjusting the two-phase shifters inside the PCB-4300A box (see Figure 3-6), using the Phase Shifter Adjustment Tool Kit, such that the Combined Output Power Level is maximized and the "Wasted" Output Power Level is minimized.

Referring to the block diagram in **Figure 1-2**, there are two phase shifters:

- The phase shifter in the path to SSPA#1 are used to equalize the phase between SSPAs #1 and #2;
- The phase shifter in the path to SSPA#3 is used to equalize the phase between SSPAs #3 and #2.

Since they were equalized to a "reference" (i.e., #2), by default SSPAs #1 and #3 will be equalized to each other.

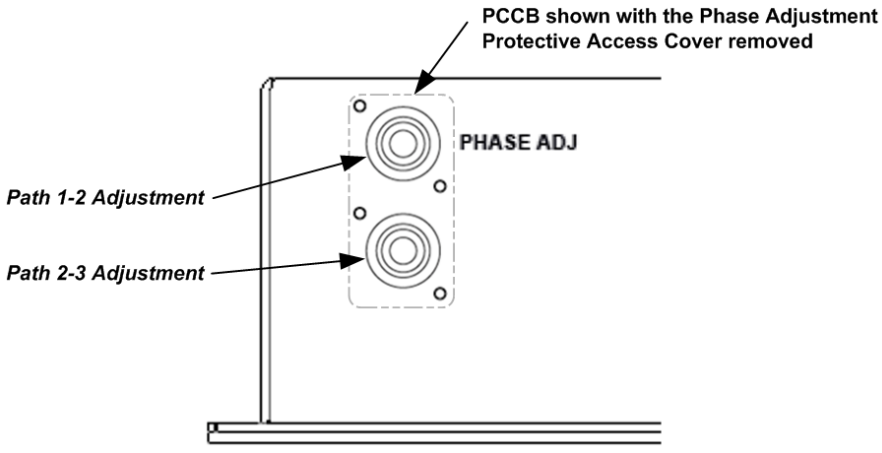


Figure 3-6. Phase Shifter Adjustment Locations

Observe the following:

Step	Procedure
1	Attach one channel of the power meter to the Combined Output Power Test Coupler (refer to Figure 3-1). Attach the second channel of the power meter to the "Wasted" Power Test Coupler. Make sure the power meter has been appropriately calibrated to include the respective correction factors of the test port couplers. Note: If only one power meter is available, it may be alternately switched between the Combined Output Test Coupler and the Wasted Test Coupler. It is suggested to start with it at the Wasted Test Port as the power level at this port will be more sensitive to adjustment.
2	Align the phase between SSPA#1 and #2: • First, execute serial remote command FRC=12. • Referring to Figure 3-6, use the provided tool to loosen the locknut on the phase shifter for path 1-2. Slowly turn the phase shifter with the screwdriver while viewing the Combined and Wasted Power readings. For single frequency alignment, the optimum setting is when the Combined level is maximized and the Wasted level is minimized. Note: For single frequency operation, (a) the difference between Combined and Wasted Power levels will be 15-25 dB or more, and (b) there may be two different positions of the phase shifter which give good results.
3	Align the phase between SSPA#3 and #2: • First, execute serial remote command FRC=23. • Referring to Figure 3-6, adjust the phase shifter for path 2-3 as was done for path 1-2 in Step 2.
4	After aligning paths 1-2 and 2-3 per Steps 2 and 3, execute serial remote command FRC=13 to combine SSPAs #1 and #3. The Combined and Wasted level ratios should be similar to those for the other paths mentioned above. Then: • Perform any necessary fine adjustments, toggling between all three paths until satisfactory performance is achieved. • Tighten all phase shifter adjustment nuts with the provided socket. • Replace the cover over the access hole. Note: The Wasted Power Level is more sensitive, but optimizing it beyond *reasonable* values has a diminishing effect on the desired Combined Output Power.

3.5 Full Bandwidth Alignment (as necessary)

This alignment procedure should be attempted only if there has been a replacement of one of the SSPAs or other critical component (such as the PCB-4300A) since the time that the system was aligned at the factory.

The alignment procedure for full bandwidth operation is obviously more complex than alignment for narrow band operation – see **Section 3.4** for the Single Frequency Alignment procedure. At the factory, a multi-channel network analyzer is utilized to accomplish the phase matching, which facilitates adjustments to be made while viewing system performance over the full amplifier bandwidth.

The test procedure provided here facilitates aligning the system with a CW input source and power meters. The equipment required for this procedure is identical to that as described in **Sections 3.3 and 3.4**. The system will have to be aligned by toggling back and forth between start, middle and stop frequencies. While very similar to the Single Frequency Alignment procedure described in the previous section, the alignments and adjustments must now be made and "balanced" over the full amplifier bandwidth.

The procedure is basically divided into two parts: **Gain Equalization** and **Phase Equalization**. It is recommended that the user first review **Section 3.4** for details of the test methods and remote control commands and queries that will be utilized in this procedure.

3.5.1 Gain Equalization

The gains of the individual SSPAs will be equalized by use of the "offline" or "standby" test coupler and AOF settings. The offline port is used because it will give a reading of the output of an individual amplifier.

Follow these steps:

Step	Procedure
1	Apply a CW signal to the input of the PCB-4300A at a level that will give a system output power of approximately 10 dB below the combined P1dB. For example, for a 14-14.5 GHz system with a combined Prated of 53dBm (individual SSPA=50 dBm) and a system gain of 65 dB, the input source would be set to a level of 53dBm – 65 – 10 = -22 dBm.
2	Attach one channel of the power meter to the Offline Power Test Coupler (refer to Figure 3-1). Make sure the power meter has been appropriately calibrated to include the respective correction factors of the Offline Test Port Coupler.
3	Execute remote serial command ATT=0.00 to the PCB-4300A. This ensures the system attenuation is set to 0 dB.
4	Execute serial remote command AGI= to the PCB-4300A. This command performs a coarse equalization of the gains according to a factory calibration value stored in each individual SSPA; reads this value from each of the three SSPAs; then adjusts the Amplitude Offset (AOF1, AOF2, and AOF3) levels of the two SSPAs with the higher gain to match the unit with the lowest gain. For example, if the factory calibrated gains were SSPA#1=75 dB, SSPA#2=73dB, and SSPA#3=76dB, the AGI= command would result in the following offsets: AOF1=2.00, AOF2=0.00, and AOF3=3.00.

<table>
<tr><th>Step</th><th colspan="6">Procedure</th></tr>
<tr><td>5</td><td colspan="6">Measure the gain (or output level) of each individual SSPA at the start, middle, and stop frequencies of the amplifier band by using serial remote command FRC= to alternately send the output of each SSPA to the Offline Test Port Coupler.
The table that follows is intended as a worksheet to help equalize the gains. (Note that the AOF level can be queried via serial remote command <X/AOF=?Y (where X=PCB-4300A address, and Y=1, 2, or 3 – the individual SSPA offset in question.)</td></tr>
<tr><td rowspan="5"></td><td rowspan="2">Offline SSPA</td><td rowspan="2">‘FRC=’ Setting</td><td rowspan="2">AOF Value</td><td colspan="3">Measured Output Level (dBm)</td></tr>
<tr><td>F_{strt}=</td><td>F_{mid}=</td><td>F_{end}=</td></tr>
<tr><td>1</td><td>23</td><td>AOF#1=_____</td><td>_____</td><td>_____</td><td>_____</td></tr>
<tr><td>2</td><td>13</td><td>AOF#2=_____</td><td>_____</td><td>_____</td><td>_____</td></tr>
<tr><td>3</td><td>12</td><td>AOF#3=_____</td><td>_____</td><td>_____</td><td>_____</td></tr>
<tr><td>6</td><td colspan="6">If necessary, fine-tune the offsets of one or more of the SSPAs to achieve equalization. Record the final offsets and output levels in the above table. (The offsets are adjusted by the serial remote command <X/AOF=Y,Z.ZZ (where X=PCB-4300A address; Y=1, 2, or 3 – individual SSPA offset in question; and Z.ZZ=desired offset level).
For example, if it is desired to set the offset level of AOF#3 to 3.75 dB, and the PCB-4300A address is 1, then serial remote command <1/AOF=3,3.75 should be sent.</td></tr>
</table>

3.5.2 Phase Equalization

Once the amplitudes have been equalized across the frequency band, the phase paths can be aligned. This is accomplished by adjusting the two-phase shifters inside the PCB-4300A box (see Figure 3-6), using the Phase Shifter Adjustment Tool Kit, such that the Combined Output Power Level is maximized and the “Wasted” Output Power Level is minimized.

Referring to the block diagram in **Figure 1-2**, there are two phase shifters:

- The phase shifter in the path to SSPA#1 are used to equalize the phase between SSPAs #1 and #2;
- The phase shifter in the path to SSPA#3 is used to equalize the phase between SSPAs #3 and #2.

Since they were equalized to a “reference” (i.e., #2), by default SSPAs #1 and #3 will be equalized to each other.

Observe the following:

Step	Procedure
1	Attach one channel of the power meter to the Combined Output Power Test Coupler (refer to Figure 3-1). Attach the second channel of the power meter to the "Wasted" Power Test Coupler. Make sure the power meter has been appropriately calibrated to include the respective correction factors of the test port couplers. Note: If only one power meter is available, it may be alternately switched between the Combined Output Test Coupler and the Wasted Test Coupler. It is suggested to start with it at the Wasted Test Port as the power level at this port will be more sensitive to adjustment.
2	Align the phase between SSPA#1 and #2: • First, execute serial remote command FRC=12. • Referring to Figure 3-4, use the provided tool to loosen the locknut on the phase shifter for path 1-2. Slowly turn the phase shifter with the screwdriver while viewing the Combined and Wasted Power readings. Toggle back and forth between the Start, Middle, and Stop frequencies to maximize the difference (ratio) between the Combined Power and the Wasted Power. The ratio generally needs to be balanced at the endpoints, and will usually be greater at the center frequency. Note: For broadband operation, (a) the difference between Combined and Wasted Power levels will be 10-20 dB or more, and (b) there may be two different positions of the phase shifter which give good results at the center frequency, but there is only one position which will give the broadest band operation – i.e., which gives the best difference between the combined and wasted power levels at all frequencies.
3	Align the phase between SSPA#3 and #2: • First, execute serial remote command FRC=23. • Referring to Figure 3-4, adjust the phase shifter for path 2-3 as was done for path 1-2 in Step 2.
4	After aligning paths 1-2 and 2-3 per Steps 2 and 3, execute serial remote command FRC=13 to combine SSPAs #1 and #3. The Combined and Wasted level ratios should be similar to those for the other paths mentioned above. Then: • Perform any necessary fine adjustments, toggling between all three paths until satisfactory performance is achieved. It may be necessary to slightly "skew" the combined/wasted power ratio over frequency to achieve best system performance at a band edge. • Tighten all phase shifter adjustment nuts with the provided socket. • Replace the cover over the access hole. Note: The Wasted Power Level is more sensitive, but optimizing it beyond *reasonable* values has a diminishing effect on the desired Combined Output Power.

Chapter 4. UPDATING FIRMWARE

4.1 Update Firmware via the Internet

To ensure optimal performance, it is important to operate the PCB-4300A with its latest available firmware.

The PCB-4300A 1:2 Phase Combiner is factory-shipped with the latest version of operating firmware. If a firmware update is needed, it can be acquired by download from the Comtech EF Data Web site (www.comtechefdata.com) or from Comtech EF Data Customer Support, during normal business hours, via e-mail or on CD by standard mail delivery.

The PCB-4300A Firmware Update process is as follows:

- Ethernet FTP Upload
- Download and Extract the Firmward Update
- Firmware Upgrade

4.2 Ethernet FTP Upload Procedure

4.2.1 Setup for the Firmware Download

Do these steps:

1. Locate and identify the exterior connectors on the Phase Combiner Control Box (PCCB).
2. Connect the PCB-4300A to a user-supplied PC.

User-supplied items needed:

- A Microsoft Windows-based PC, equipped with an available serial port, and running a terminal emulator program (e.g., Tera Term or HyperTerminal).
- A serial adapter cable for connecting the PC to the PCB-4300A. If needed, the CA/WR12243-1 System Programming Cable is available from Comtech EF Data. Contact CEFD Customer Support for ordering information.

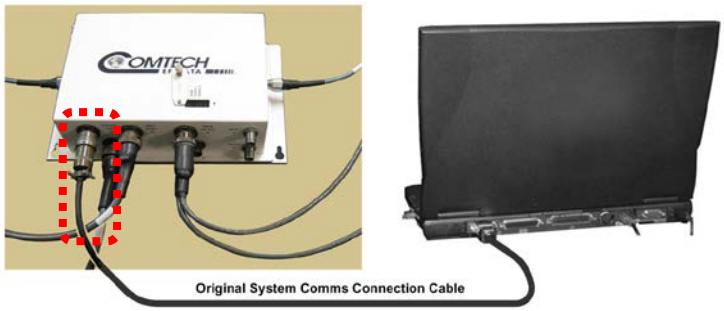


Figure 4-1. Typical Unit to PC Connection

a. Connect the user PC serial port to the PCB-4300A "**SYSTEM COM | J1**" port.

b. **On the PC:** Open the terminal emulator program.

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

Configure the utility program serial port communication and terminal display operation:

- **9600 or 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. Energize the PCB-4300A (the PCB-4300A derives its power from the SSPAs).

3. Obtain the firmware number for the PCB-4300A.
   - **On the PC:** Via serial remote control, obtain the firmware number by using the **<1/FRW?** query.

See* Chapter 5. SERIAL REMOTE CONTROL *for information and instructions on using remote commands and queries via the PCB-4300A Serial Interface.

4. 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 without quotes, and then press Enter to execute.***

There are several ways you 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.

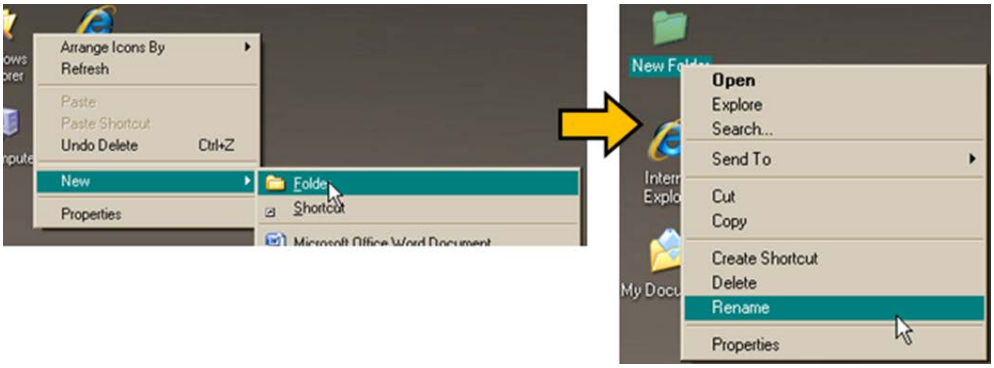


Figure 4-2. Temporary Folder Setup using Windows Desktop

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.

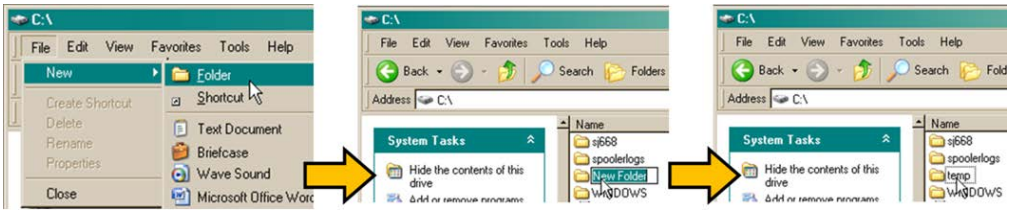


Figure 4-3. Temporary Folder Setup using Windows Explorer

c. Use the **'Run'** and **'Browse'** windows to create and rename the temporary folder.

- Select **[Start]** on the Windows task bar, 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.

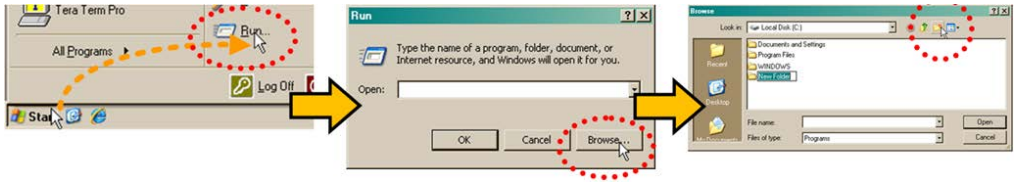


Figure 4-4. Temporary Folder Setup using 'Run' and 'Browse'

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]**.

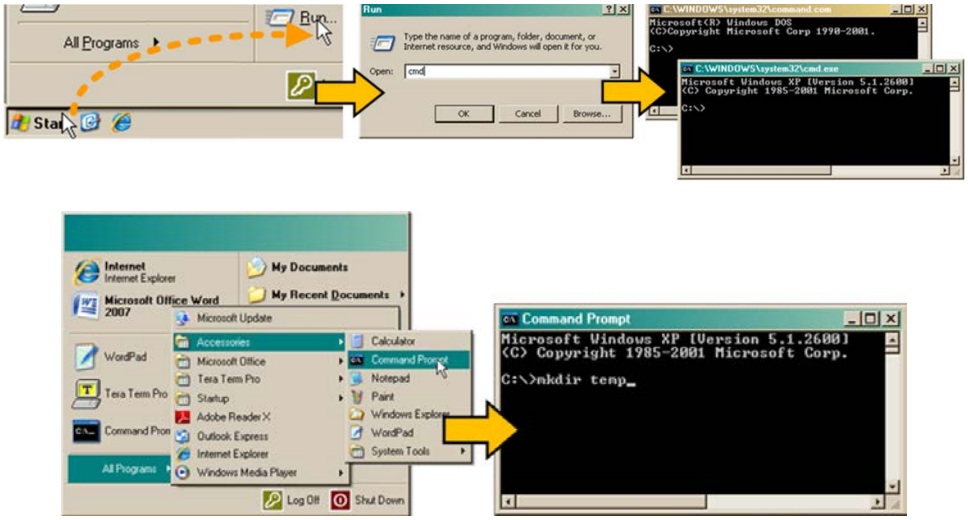


Figure 4-5. Temporary Folder Setup using Windows Command Line

There should now be a "temp" folder created and available for placement of the firmware file download.

4.3 Download and Extract the Firmware Update

1. First, download the firmware update file from the Comtech EF Data 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. Under the **PCB-4X00A** heading, select the **PCB-4300A (1:2 Phase Combiner)** product hyperlink.
   f. Select the appropriate firmware archive EXE or ZIP file download hyperlink.

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

  *The download hyperlink for the PCB-4300A base unit firmware appears as **FW-0021045x.zip**, where '**x**' denotes the revision letter.*
- ***About File Archive Formats:*** *Comtech EF Data 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 EF Data 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 firmware 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]**:
  - 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.
  - 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.

Figure 4-6. Download Firmware Archive File

2. Extract the firmware files from the archive file.

   a. (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:

   b. Double-click on the archive file name, and then follow the prompts provided by the user-supplied utility program. Extract, at a minimum, four files:
      - FW-0021045*_Bulk_v*_*_*.zip, where "*_*_*" is the version (bulk image file).
      - FW10874-2-.mib (Comtech EF Data MIB file)
      - FW-0021047*.mib (PCB-4X00A MIB file), where "*" is the revision.
      - PCB-4X00A_ReleaseNotes_v*_*_*.doc, where "*" is the version (release notes).

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

   There are several ways you 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 PCB-4300A.

4.4 Firmware Upgrade

1. With the System Programming cable (CEFD P/N CA/WR12243-1) connected, verify the communication and connection by issuing a **"ping"** command to the modem.

    a. Locate the IP address of the unit remotely by using **<1/IPA?**.

    b. Select the **"Start"** button on the Windows toolbar and select the **"Run…"** option.

    c. From WinXP or Windows7, type **"cmd"** or use the **"DOS Prompt"** or **"Command Prompt"** icons in the Start Menu.

    d. Change the temporary directory created earlier to **"cd C:\temp"**.

    e. Use **"dir"** to show the files previously downloaded.

2. Initiate an FTP session with the unit using a DOS window.

    a. Using the PC, type **"ftp xxx.xxx.xxx.xxx"** where **"xxx.xxx.xxx.xxx"** is the IP address of the unit, obtained previously in step 1.a.

    b. Type **"comtech"** for the user name and **"comtech"** for the password to complete the login.

    c. Verify the FTP transfer is binary by typing **"bin"**.

    d. Type **"prompt"**, then type "hash" to initiate the file transfers.

3. Type **"put FW-0021045*_Bulk_v*_*_*.zip"** to begin the file transfers.

4. Type **"bye"** and close the DOS window to terminate the FTP session.

5. Verify the FTP upgrade using **<1/SWR?** serial remote command.

6. Change the desired image to boot using the **<1/IMG=X** serial remote command, where X is 1 or 2, and then reboot the unit.

7. Verify the new software versions are booting by using **<1/RET?** The serial remote command response:

    PCB-4X00A Phase Combiner Ver: X.X.X.

8. Disconnect the System Programming cable (CEFD P/N CA/WR12243-1) and reconnect the original System Communications connection cable.

9. The LEDs on the top of the PCCB may illuminate GREEN (unmuted), ORANGE (muted), or RED (faulted) to indicate the current status of the PCCB, SSPA1, and SSPA2 operations.

See Chapter 3. OPERATION and ADJUSTMENT PROCEDURES, Section 3.2.4, for additional information on the LED operation states.

The PCB-4300A Firmware Update Process is now complete.

Chapter 5. SERIAL REMOTE CONTROL

5.1 Overview

5.1.1 Remote Commands

Remote monitor and control of the PCB4300A 1:2 Phase Combiner is available only through an an EIA-232 connection, and data is transmitted in asynchronous serial form using ASCII characters. Control and status information is transmitted in packets of variable length, in accordance with the structure and protocol defined in later sections.

5.1.2 EIA-232

The Controller device connects 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.

5.2 Remote Commands and Queries Overview

5.2.1 Basic Protocol

All data is transmitted as asynchronous serial characters, suitable for transmission and reception by a UART. The asynchronous character is fixed at 8-N-1 (8 data bits, no parity, one stop bit). Only two baud rates are supported: 9600 baud and 19200 baud.

All data is transmitted in framed packets. The host Controller is assumed to be a user PC running a terminal emulator program or an ASCII dumb terminal that is in charge of the process of monitor and control. The Controller 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.

5.2.2 Packet Structure

Controller-to-Target						
Start of Packet	Target Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
< ASCII code 60 (1 character)	 (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)

Example: <0412/MUT=1{CR}

Target-to-Controller						
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)	 (From 0 to n characters)	Carriage Return, Line Feed ASCII codes 13,10 (2 characters)

Example: >0412/MUT={CR}{LF}

5.2.2.1 Start Of Packet

- **Controller-to-Target:** This is the character '<' (ASCII code 60).
- **Target-to-Controller:** This is the character '>' (ASCII code 62).

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

5.2.2.2 Target (Base) Address

Up to 9,999 devices can be uniquely addressed. In the EIA-232 application, the permissible range of values is 1 to 9999. It is programmed into a Target unit using serial remote control. The factory default target address is 1.

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.

5.2.2.3 Virtual Address

Virtual Address is a method that allows the user to access the SSPA via the PCCB using any communications software. Virtual Address is aupported in the EIA-232 application.

The following example depicts use of the virtual addressing scheme:

<123V1/MUT? *where:*
Base address = 123;
'V' = virtual address delimiter;
1 = virtual address of SSPA automatically set by the PCCB.

Notes:

1. Only four virtual commands can be used to program the individual SSPAs when in Phase Combined mode (FRC=0):
   - CAA=
   - DAT=
   - TIM=
   - IAP=
2. All virtual queries can be directed to the individual SSPAs in any mode.
3. The following virtual commands can NEVER be used to program the individual SSPAs:
   - MUT=
   - ATT=

5.2.2.4 Address Delimiter

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

5.2.2.5 Instruction Code

This is a three-character alphabetic sequence that identifies the subject of the message. Wherever possible, the instruction codes have been chosen to have some significance. This aids in the readability of the message if seen in its raw ASCII form. Upper and lower case alphabetic characters (i.e., A-Z [ASCII codes 65-90], and a-z [ASCII codes 97-122]) may be used.

5.2.3 Instruction Code Qualifier

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

Code Qualifiers obey the following rules:

1. ***From Controller-to-Target***, the only permitted values are:

Symbol	Definition
= (ASCII code 61)	'=' is used as the assignment operator, and is used to indicate that the parameter defined by the preceding byte should be set to the value of the argument(s) that follow it. For example: MUT=1 would mean 'enable the Mute function.'
? (ASCII code 63)	'?' is used as the query operator, and is used to indicate that the Target should return the current value of the parameter defined by the preceding byte. For example: MUT? Would mean 'return the current state of the Mute function.'

2. ***From Target-to-Controller***, the only permitted values are:

Symbol	Definition
= (ASCII code 61)	The = code is used in two ways: First, if the Controller has sent a query code to a Target (for example: MUT? would mean 'return the current state of the Mute function'), the Target would then respond with MUT=x, where 'x' represents the state in question (1 being 'enabled', 2 being 'disabled). Second, if the Controller sends an instruction to set a parameter to a particular value, then, providing the value sent in the argument is valid, the Target will acknowledge the message by replying with MUT= (with no message arguments).
? (ASCII code 63)	The ? code is only used as follows: If the Controller sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is not valid, the Target will acknowledge the message by replying (for example) with MUT? (with no message arguments). This indicates that there was an error in the argument of the message sent by the Controller.
! (ASCII code 33)	The ! code is only used as follows: If the Controller sends an instruction code that the Target does not recognize, the Target will acknowledge the message by echoing the invalid instruction, followed by the ! character; for example, XYZ!

Symbol	Definition
* (ASCII code 42)	The * code is only used as follows: If the Controller sends an instruction to set a parameter to a particular value, but then the value sent in the argument is valid but the target is in the wrong mode (e.g., Standby mode in Redundancy configuration or the Remote state is Ethernet Remote (LRS=3)), such that it will not permit that particular parameter to be changed at that time, the Target will acknowledge the message by replying (for example) with MUT* (with no message arguments).
# ASCI code 35)	The # code is only used as follows: If the controller sends an instruction code that 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; for example, MUT# (with no message arguments).

5.2.4 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).

5.2.5 End Of Packet

- **Controller-to-Target:** This is the ‘Carriage Return’ character (ASCII code 13).
- **Target-to-Controller:** This is the two-character sequence ‘Carriage Return’, ‘Line Feed’ (ASCII codes 13 and 10).

Both indicate the valid termination of a packet.

5.3 Remote Commands / Queries

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

CODE	C	Q	PAGE
AGI	X	–	5–8
AMP	X	X	5–8
AOF	X	X	5–8
ATT	X	X	5–8
CAS	–	X	5–8
CCS	–	X	5–9
CID	X	X	5–9
CMS	–	X	5–9
CUS	–	X	5–9
DAT	X	X	5–9

CODE	C	Q	PAGE
FRC	X	X	5–10
FRW	–	X	5–10
IAP	X	–	5–13
IMG	X	X	5–15
IPA	X	X	5–14
IPG	X	X	5–14
LNA	–	X	5–10
LRS	X	X	5–13
MAC	–	X	5–14
MUT	X	X	5–10

CODE	C	Q	PAGE
PNG	X	X	5–14
PRF	X	X	5–11
RAS	–	X	5–11
RCM	X	X	5–13
RCS	–	X	5–11
RET	–	X	5–12
RFD	X	–	5–16
RMS	–	X	5–12
RSN	–	X	5–12
RUS	–	X	5–12

CODE	C	Q	PAGE
SBR	X	X	5–12
SFS	–	X	5–12
SPA	X	X	5–13
STA	X	X	5–15
STB	X	X	5–15
STV	X	X	5–15
SWR	–	X	5–14
TIM	X	X	5–13
TNA	–	X	5–13
TPE	X	X	5–16

CODE	C	Q	PAGE
TPS	X	X	5–16
TSC	–	X	5–15
WCM	X	X	5–13

Unless otherwise noted – In the tables that follow, these codes are used in the 'Response to Command' column

= Message ok

? Received ok, but invalid arguments were found

* Message ok, but not permitted in current mode

Parameter Type	Command (Instruction Code and qualifier)	Command Valid for PCB or SSPA	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)	Query Valid for PCB or SSPA	Response to Query (Target to Controller)
Automatic Gain Initialize	AGI=	PCB	0 bytes, alphanumeric	Command only. Initializes all gains for the attenuation offset. This command takes no arguments.	AGI= AGI? AGI*	N/A	N/A	N/A
RF Power Amplifier State	AMP=	PCB	1 byte, value of 0, 1	Command or Query. Turns ON or OFF the SSPAs in the form AMP=x, where: 0 = Off 1 = On	AMP= AMP? AMP* AMP#	AMP?	ALL	AMP=x (see Description of Arguments for details)
Attenuation Offset	AOF=	PCB	7 bytes, alphanumeric	Command or Query Sets attenuation offset for specified SSPA *Command:* AOF=x,yy.yy *Query:* AOF?x where: x=1, 2, or 3 (SSPA number) yy.yy=Attenuation offset Example: AOF=1,01.50 Note: AOF command will not take values greater than 6 dB)	AOF= AOF? AOF* AOF#	AOF?x where x=1,2, or 3	PCB	AOF=x,yy.yy (see Description of Arguments for details)
Attenuation	ATT=	PCB	5 bytes, numerical	Command or Query. Valid attenuation level, in dB, at 0.25-dB step size as factory default. Example: ATT=12.25 Note: The attenuation range is limited to a maximum of 24 dB.	ATT= ATT? ATT* ATT#	ATT?	ALL	ATT=xx.xx (see Description of Arguments for details)
Concise Alarm Status	N/A	N/A	11 bytes numerical with commas	Query only. Used to Query the Alarm status of the unit, response is comma delimited. Example: CMS=a,b,c,d,e,f,g'cr''lf' *where:* a thru k = 0 or 1, 0 = OK 1 = FT a = +24V Power Supply b = +5V Power Supply c = SSPA1 d = SSPA2 e = SSPA3 f = SW1 Absent FLT g = SW2 Absent FLT	N/A	CAS?	ALL	CAS=x….x (see Description of Arguments for details)

Parameter Type	Command (Instruction Code and qualifier)	Command Valid for PCB or SSPA	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)	Query Valid for PCB or SSPA	Response to Query (Target to Controller)
Concise Configuration Status	N/A	N/A	24 bytes numerical	Query only. Used to query the summarized version of RCS. Example: CCS=aa.aa,b,c,d,e,f,g,x'cr''lf' *where:* aa.aa = attenuation in dB b = RF power amplifier state c = mute state d = reserved e,f,g,x = SSPAs fault status	N/A	CCS?	ALL	CCS=x….x (see Description of Arguments for details)
Circuit Identification	CID=	PCB	24 bytes, alphanumeric	Command or Query Used to identify or name the unit or station.	CID= CID?	CID?	ALL	CID=x…x (see Description of Arguments for details)
Concise Maintenance Status	N/A	N/A	23 bytes numerical	Query only. Used to Query the Maintenance status of the unit in concise format. Response is comma delimited. Example: CMS=aaa.a,bbb.b,ccc.c,ddd.d'cr''lf' where: aaa.a = +24V Power Supply bbb.b = +5V Power Supply ccc.c = +3.3V Power Supply ddd.d = +1.5V Power Supply	N/A	CMS?	ALL	CMS=x….x (see Description of Arguments for details)
Concise Utility Status	N/A	N/A	11 bytes alphanumeric	Query only. Used to Query the Maintenance status of the unit, response is comma delimited. Example: CUS=aaaa,bbbb'cr''lf' *where:* aaaa = Remote Unit Address bbbb = Remote Baud Rate	N/A	CUS?	ALL	CUS=x….x (see Description of Arguments for details)
Set RTC(Real-Time-Clock) Date	DAT=	ALL	6 bytes, numerical	Command or Query. A command in the form **mmddyy**, where; dd = day of the month, between 01 and 31, mm = month of the year, between 01 and 12 and yy = year, between 00 and 99 (2000 to 2099) Example: DAT=042503 would be April 24, 2003	DAT= DAT? DAT*	DAT?	ALL	DAT=xx (see Description of Arguments for details)

Parameter Type	Command (Instruction Code and qualifier)	Command Valid for PCB or SSPA	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)	Query Valid for PCB or SSPA	Response to Query (Target to Controller)
Force Unit Online	FRC=	PCB	2 bytes	Command or Query. Force two SSPA's to be online, in the form FRC=xy where: xy = 12 (SSPAs 1 and 2) 23 (SSPAs 2 and 3) 13 (SSPAs 1 and 3) 00 (Automatic mode)	FRC= FRC?	FRC?	PCB	FRC=xy (see Description of Arguments for details)
Retrieve Firmware Number	N/A	N/A		Query only Gets the Firmware Number of the unit. Bulk = FW/XXXXX M&C = FW/XXXXX FPGA = FW/XXXXX Example: FRW=FW12001'cr''lf'	N/A	FRW?	ALL	FRW=FWxxxxx
Retrieve next 5 unread Stored Alarms	N/A	N/A	145 bytes	Query only. The unit returns the oldest 5 Stored Events which have not yet been read over the remote control. Reply format: Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where Sub-body= YYYYYYYYYY ZZ mmddyy hhmmss, *where:* YYYYYYYYYY being the fault description. ZZ being the alarm type. FT = Fault OK = Clear IF = Information If there are no new events, the unit will reply with LNA*	N/A	LNA?	ALL	LNA=YY..ss (see Description of Arguments for details)
Mute State	MUT=	PCB	1 byte, value of 0,1	Command or Query. Mute the SSPAs, *where:* 0 = Disabled, 1 = Enabled 2 = Inhibit asserted (Query only) Example: MUT=1	MUT= MUT? MUT*	MUT?	ALL	MUT=x (see Description of Arguments for details)

Parameter Type	Command (Instruction Code and qualifier)	Command Valid for PCB or SSPA	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)	Query Valid for PCB or SSPA	Response to Query (Target to Controller)
Preferred	PRF=	PCB	2 bytes	Command or Query. Allows the user to choose two prefered SSPAs that will be switched to, if available, in the form PRF=xy, where: xy = 12 (SSPAs 1 and 2) 23 (SSPAs 2 and 3) 13 (SSPAs 1 and 3) 00 (Automatic mode)	PRF= PRF?	PRF?	PCB	PRF=xy (see Description of Arguments for details)
Retrieve Alarm Status	N/A	N/A	53 bytes alphanumeric	Query only. Used to Query the Alarm status of the unit. Example: RAS='cr' P24VT=OK'cr' P5VLT=OK'cr' SSPA1=OK'cr' SSPA2=OK'cr' SSPA3=OK'cr' SW1FT=OK'cr' SW2FT=OK''cr''lf' Note: XXXXX = reserved	N/A	RAS?	ALL	RAS=x….x (see Description of Arguments for details)
Retrieve Configuration Status	N/A	N/A	33 bytes alphanumeric	Query only. Used to Query the configuration status. Example: RCS='cr' ATT=12.75'cr' AMP=1'cr' MUT=1'cr' PCM=1,0'cr' FLT=0,0,0'cr''lf' *where:* ATT= attenuation in dB AMP= RF power amplifier state, 0=OFF, 1=ON MUT=RF mute state, 0=unmuted, 1=muted PCM=reserved FLT=X,Y,Z (SSPA fault states) X = SSPA#1 (1=faulted, 0=unfaulted) Y = SSPA#2 (1=faulted, 0=unfaulted) Z = SSPA#3 (1=faulted, 0=unfaulted)	N/A	RCS?	ALL	RCS=x….x (see Description of Arguments for details)

Parameter Type	Command (Instruction Code and qualifier)	Command Valid for PCB or SSPA	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)	Query Valid for PCB or SSPA	Response to Query (Target to Controller)
Retrieve Equipment Type	N/A	N/A	20 bytes, alphanumeric	Query only. The unit returns a string indicating the Model Number and the value of internal software revision installed. Example: Phase –Combine Ver. 1.1.16I or KPA-100-1415 VER:1.1.3	N/A	RET?	ALL	RET=x….x (see Description of Arguments for details)
Retrieve Maintenance Status	N/A	N/A	47 bytes, alphanumeric	Query only. Used to Query the maintenance status of the unit. P24VT=024.1'cr' P05VT=015.2'cr' P03VT=03.3'cr' P01VT=01.5'cr'	N/A	RMS?	ALL	RMS=*x….x* (see Description of Arguments for details)
Serial Number	N/A	PCB	9 bytes, numerical 000000000 to 999999999	Query only. Used to Query the units 9 digit serial number. Slave returns its S/N, in the form xxxxxxxxx. Example: RSN=000000165	N/A	RSN?	ALL	RSN=xxxxxxxxx (see Description of Arguments for details)
Retrieve Utility Status	N/A	N/A	17 bytes alphanumeric	Query only. Used to Query the utility status of the unit Example: RUS='cr' ADR=0001'cr' BDR=9600'cr''lf'	N/A	RUS?	ALL	RUS=x….x (see Description of Arguments for details)
Remote Baud Rate	SBR=	PCB	4 bytes	Command or Query. Set remote baud rate as follows: 9600 = 9600 baud 19K2 = 19200 baud	SBR= SBR? SBR#	SBR?	PCB	SBR=xx (see Description of Arguments for details)
Summary Fault Status	N/A	N/A	1 byte, value of 0,1	Query only. Used to Query the status of the Summary Fault Relay. Example: SFS=0 *where:* 0 = OK 1 = FT	N/A	SFS?	ALL	SFS=x (see Description of Arguments for details)

Parameter Type	Command (Instruction Code and qualifier)	Command Valid for PCB or SSPA	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)	Query Valid for PCB or SSPA	Response to Query (Target to Controller)
Remote Address	SPA=	PCB	4 byte, numerical	Command or Query. Set Physical Address-between 0001 to 9999. Resolution 0001 Example: SPA=0412 Default: 1	SPA= SPA?	SPA?	ALL	SPA=x (see Description of Arguments for details)
Set RTC Time	TIM=	ALL	6 bytes, numerical	Command or Query. A command in the form hhmmss, indicating the time from midnight, where hh = hours, between 00 and 23; mm = minutes, between 00 and 59, and ss = seconds, between 00 and 59. Example: TIM=231259 would be 23 hours, 12 minutes and 59 seconds past midnight.	TIM = TIM? TIM *	TIM?	ALL	TIM=xx (see Description of Arguments for details)
Retrieve Number of unread Stored Alarms	N/A	N/A	2 bytes, numerical	Query only. Returns the number of Stored Events which remain unread, in the form xx. Example reply: TNA=18	N/A	TNA?	ALL	TNA=xx (see Description of Arguments for details)
Initialize Stored Alarms Pointer	IAP=	ALL	None	Command only. Resets internal pointer to allow LNA? Query to start at the beginning of the stored alarms log.	IAP= IAP? IAP*	N/A	N/A	N/A
Remote State	LRS=	PCB	1 byte, value of 1 or 3	Command or Query. Used set the user's Remote state in the form x, where: 1=Serial Remote (RS-232) 3=Ethernet Remote Example: LRS=1 (selects Serial Remote)	LRS LRS? LRS* LRS#	LRS?	PCB	LRS=x (see Description of Arguments)
SNMP Read Community String	RCM=	PCB	20 bytes	xxxxxxxxxxxxxxxxxx = SNMP Read Community	RCM=	RCM?	PCB	RCM= xxxxxx…xxxxxx (see Description of Arguments)
SNMP Write Community String	WCM=	PCB	20 bytes	xxxxxxxxxxxxxxxxxx = SNMP Write Community	WCM=	WCM?	PCB	WCM= xxxxxx…xxxxxx (see Description of Arguments)

Parameter Type	Command (Instruction Code and qualifier)	Command Valid for PCB or SSPA	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)	Query Valid for PCB or SSPA	Response to Query (Target to Controller)
IP Address	IPA=	PCB	18 bytes numerical	Command or Query. Used to set the IP Address and network prefix for the 10/100 Base T Ethernet management port, in the form aaa.bbb.ccc.ddd.yy, where permitted ranges are: aaa = 0-223 bbb = 0-255 ccc = 0-255 ddd = 001-255 yy=08-30 **Example:** IPA=010.006.030.001.24 **Default**: 192.168.1.4.24	IPA= IPA? IPA*	IPA?	PCB	IPA= aaa.bbb.ccc.ddd.yy (see Description of Arguments)
IP Gateway	IPG=	PCB	15 bytes numerical	Command or Query. Used to set the IP Gateway Address for the Ethernet management port, in the form aaa.bbb.ccc.ddd, where permitted ranges are: aaa = 0-223 bbb = 0-255 ccc = 0-255 ddd = 001-255 **Example:** IPG=010.006.030.001 **Default:** 192.168.1.5	IPG= IPG? IPG* IPG#	IPG?	PCB	IPG= aaa.bbb.ccc.ddd (see Description of Arguments)
MAC Address	N/A	N/A	12 bytes, alpha-numerical	Query only. Used to query the unique MAC Address for the modem. **Example:** MAC=0006B00001C2	N/A	MAC?	PCB	MAC=aabbccddeeff (see Description of Arguments)
Ping Reply Enable	PNG=	PCB	1 byte, value of 0 or 1	Command or Query. Used to Enable or Disable Ping reply in the form x, where: 0=Disable Ping Reply 1=Enable Ping Reply	PNG= PNG? PNG*	PNG?	PCB	PNG=x (see Description of Arguments)
Software Revision	N/A	N/A	5 bytes	Query only. Unit returns the value of the internal software revision installed in the unit, in the form of x.x.x **Example:** SWR=2.0.2	N/A	SWR?	PCB	SWR=x.x.x (see description of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Command Valid for PCB or SSPA	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)	Query Valid for PCB or SSPA	Response to Query (Target to Controller)
Software Image	IMG=	N/A	1 byte, value of 1 or 2	Command or Query. Active software image in the form x, where: 1=Bulk Image #1 currently active 2=Bulk Image #2 currently active	IMG= IMG? IMG* IMG#	IMG?	PCB	IMG=x (see Description of Arguments)
Force Reboot	FRB=	PCB	None	Command only. Force a hard reset of the unit in 5 seconds.	FRB= FRB? FRB* FRB#	N/A	N/A	N/A
Terminal Status Change	N/A	N/A	1 byte, value of 0 or 1	Query only. Unit returns the configuration change state since last time it's queried in the form x, where: 0=Unit configuration has not been changed since last query. 1=Unit configuration has been changed since last query.	N/A	TSC?	PCB	TSC=x (see Description of Arguments)
SNMP Trap Destination IP Address 1	STA=	PCB	15 bytes, Numerical	Command or Query. Used to set the IP address of the first SNMP Trap destination IP Address 1 Where traps will be sent in the form: xxx.xxx.xxx.xxx is the IP addresss Example: <1/STA=010.006.030.001 When not configured, returns >0001/STA=0.0.0.0	STA= STA!	STA=xxx.xxx.xxx.xxx (See description of arguments)	PCB	STA=xxx.xxx.xxx.xxx (See description of arguments)
SNMP Trap Destination IP Address 2	STB=	PCB	15 bytes, Numerical	Command or Query. Used to set the IP address of the first SNMP Trap destination IP Address 2 Where traps will be sent, in the form: xxx.xxx.xxx.xxx is the IP addresss Example: <1/STB=010.006.030.001 When not configured, returns >0001/STB=0.0.0.0	STB = STB!	STB?	PCB	STB=xxx.xxx.xxx.xxx (See description of arguments)
SNMP Trap Version	STV=	PCB	1 byte	Command or Query. SNMP Trap Version that will be used to send traps. 1=SNMP Trap Version 1 2=SNMP Trap Version 2 Example: <1/STV=0	STV = STV!	STV?	PCB	STV =x (See description of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Command Valid for PCB or SSPA	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)	Query Valid for PCB or SSPA	Response to Query (Target to Controller)
Time Protocol Enable	TPE=	PCB	1 byte, numerical	Command or Query. 0 = Time protocol disabled 1 = Time protocol enabled **Example:** TPE=1 (Time protocol enabled) **Default Value:** 255 or 0	TPE= TPE?	TPE?	PCB	TPE=x (see description of arguments)
Time Protocol Server	TPS=	PCB	15 bytes, alpha-numeric	Command or Query. Used to set the Time Server IP address for the Unit. Tx Ethernet management port, in the format: xxx.xxx.xxx.xxx, where: xxx.xxx.xxx.xxx is the Time server IP address **Example:** TPS=192.168.001.005 **Default Value:** 255.255.255.255 or 0.0.0.0	TPS= TPS?	TPS?	PCB	TPS= xx.xxx.xxx.xxx.yy (see description of arguments)
Restore Factory Defaults	RFD=	PCB	None	Command only. Restores factory defaults in the NVRAM **Example:** RFD='cr'	RFD= RFD? RFD*	N/A	PCB	N/A

Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

6.1 Overview

Ethernet-based Remote Product Management is available using the **SYSTEM COM | J1** connector.

PROCEED WITH ETHERNET-BASED REMOTE PRODUCT MANAGEMENT ASSUMING THAT:

- ***The PCB-4300A is operating with the latest version firmware files.***
- ***The PCB-4300A is connected to a user-supplied, Windows-based PC, and:***
  - ***The PC Ethernet port is connected to the PCB-4300A SYSTEM COM | J1 connector.***

6.2 Ethernet Management Interface Protocols

The user PC facilitates access to Ethernet-based remote monitor and control (M&C) of the PCB-4300A through the **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.

SNMP user interface is only available when the unit's Local/Remote state is set to Ethernet Remote through LRS serial remote command (LRS=3).

6.3 SNMP Interface

The 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 PCB-4300A.
- **The SNMP Agent.** The software that runs on the PCB-4300A. The SNMP Agent supports both **SNMPv1** and **SNMPv2c**.
- **The user-supplied NMS.** The software that runs on the manager.

6.3.1 Management Information Base (MIB) Files

MIB files are used for SNMP remote management of a unique device. A MIB file consists of a tree of nodes called Object Identifiers (OIDs). Each OID provides remote management of a particular function. These MIB files should be compiled in a user-supplied MIB Browser or SNMP Network Monitoring System server. The following MIB files are associated with the PCB-4300A:

Table 6-1. Management Information Base Files

MIB File/Name (where 'x' is revision letter)	Description
FW-0021074*.mib ComtechEFData MIB file	ComtechEFData MIB file gives the root tree for ALL Comtech EF Data products 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-0021047*.mib PCB-4X00A MIB file	MIB file consists of all of the OIDs for management of the unit functions.
FW-0021048*.mib PCB-4X00A MIB file	MIB file consists of all of the OIDs for traps of the unit functions.

6.3.2 SNMP Community Strings

CAUTION – 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 PCB-4300A uses Community Strings as a password scheme that provides authentication before gaining access to the Agent 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.

Two Community Strings are defined for SNMP access:

- **Read Community default = public**
- **Write Community default = private**

The Read and Write Community Strings can be configured using serial remote command RCM and WCM when remote state is at Serial Remote.

For proper SNMP operation, the PCB-4300A MIB files must be used with the associated version of the unit. Refer to the PCB-4300A FW Release Notes for information on the required FW/SW compatibility.

Appendix A. ASSEMBLY KITS

A.1 Overview

This appendix provides a reference to the Comtech EF Data accessory and assembly kits that satisfy installation requirements for a PCB-4300A 1:2 Phase Combined System – an example is shown as Figure A-1.

The PCB-4300A 1:2 Phase Combiner stand alone unit is available in a C-Band version only. Contact Comtech EF Data for the Ku-Band version. The PCCB may be available as a top assembly line item or as a kit subassembly item.

Figure A-1. PCB-4300A 1:2 Phase Combined System

A.1.1 Summary of Available Assemblies

Table A-1outlines availability of assembly kits for the PCB-4300A. This includes common subassemblies that may be shared amongst the available configurations. Note that since the model of the SSPA pair deployed within a 1:2 Phase Combined System may vary, the illustrations provided herein either show installed SSPAs for reference purposes only, or otherwise intentionally omit the depiction of any installed SSPA.

Table A-1. Appendix Figure Quick Reference

Assembly Type	Sect.	CEFD Part No.	Description
C-Band	A.2.1	KT-0000109	C-Band 1:2 Phase Combined Top Assembly Kit – 350W HPOD (Vertical Load)
	A.2.2	KT-0021054	C-Band 1:2 Phase Combined Top Assembly Kit – 350W HPOD (Horizontal Load)
	A.2.3	KT-0000107	1:2 Phase Combined C-Band Waveguide Kit – HPOD (Item No. 3 of KT-0000109 Top Assembly Kit)
	A.2.4	KT-0021154	C-Band 1:2 Phase Combiner Box and Bracket Kit (Item No. 4 of KT-0000109 Top Assembly Kit) (Item No. 4 of KT-0021054 Top Assembly Kit) (Item No. 4 of KT-0021177 Vertical Mounting Frame Kit)
	Not Shown	PL-0022637	C-Band 1:2 Combiner Box (Item No. 9 of KT-0021154)
	A.2.5	KT-0021177	Vertical Mounting Frame Kit
Common	A.3.1	PL/12319-1	HPOD 1:1 Redundancy Pole Mount Kit. (Use with KT-0000109 Top Assembly Kit)
	A.3.2	KT-0000017	1:2 Redundant HPOD Mounting Kit. (Item No. 1 of KT-0000109 Top Assembly Kit)
	A.3.3	KT/12300-1	Uni-Strut Mount HPOD Mounting Bracket Kit. (Item No. 2 of KT-0000109 and KT-0021054 Top Assembly Kit)
	A.3.4	KT-0021261	Vertical Uni-Strut Mount HPOD Mounting Bracket Kit (Item No. 2 of KT-0021177 Top Assembly Kit)

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A.2 C-Band Unit Assemblies

A.2.1 C-Band 1:2 Phase Combined Top Assembly Kit – 350W HPOD (KT-0000109) (Vertical Load)

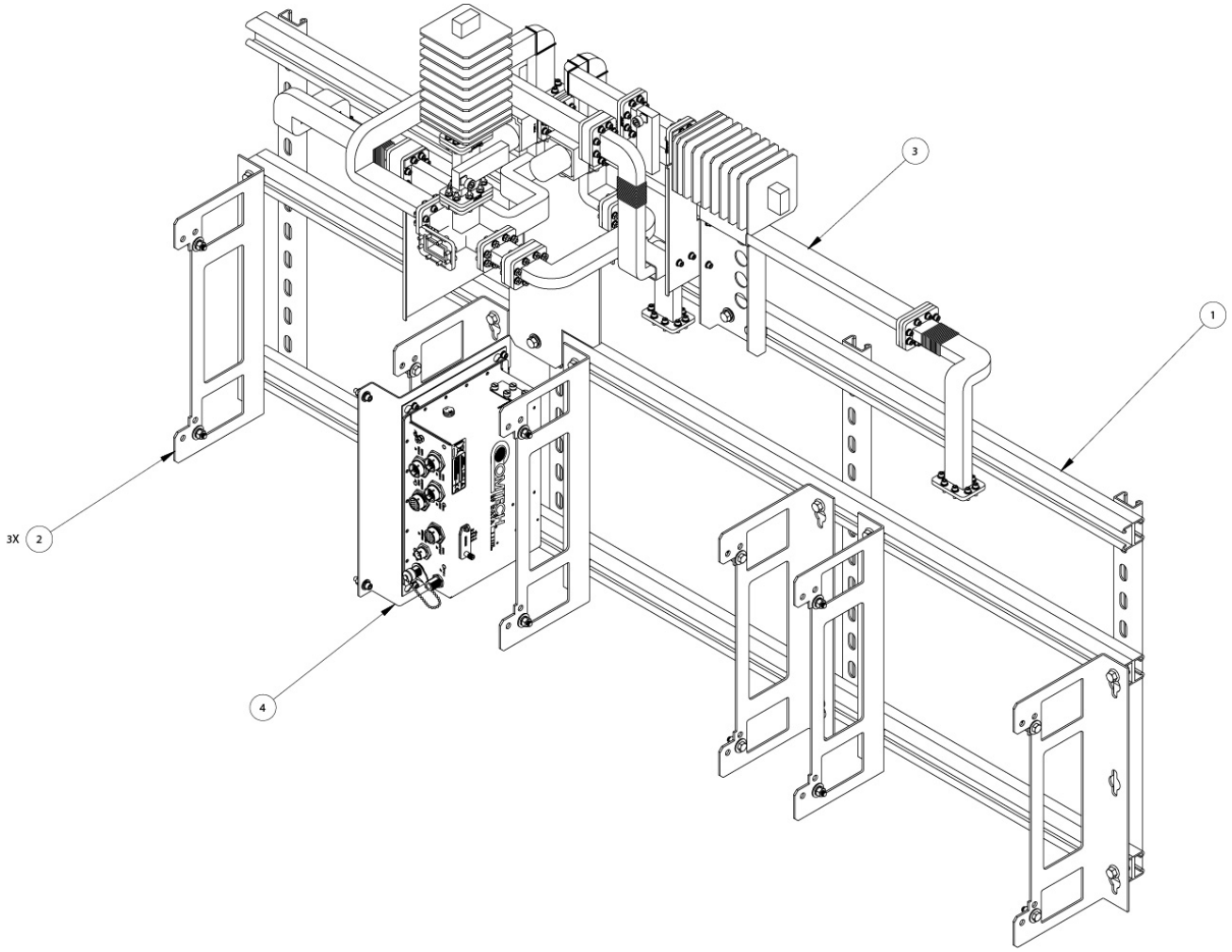

Figure A-2. C-Band 1:2 Phase Combined Top Assembly Kit – 350W HPOD (KT-0000109) (Vertical Load)

Table A-2. C-Band 1:2 Phase Combined Top Assembly Kit – 350W HPOD BOM (KT-0000109) (Vertical Load)

See Figure A-2			
Item No.	Qty	Item Number	Item Description
1	1	KT-0000017	MOUNTING KIT, 1:2 REDUNDANT HPOD
2	3	KT/12300-1	MOUNTING BRACKET KIT, UNI STRUT MOUNT HPOD
3	1	KT-0000107	WAVEGUIDE KIT, 1:2 PHASE COMBINED C-BAND HPOD
4	1	KT-0021154	PHASE COMBINER BOX AND BRACKET KIT, 1:2 C-BAND
N/A	3	CA-0021588	RF IN, MATCHED SET, 1:2 KU-BAND
N/A	3	CA-0021592	SSPA TO COMBINER BOX
N/A	1	CA/WR12013-1	CABLE ASSY, SWITCHES, COMBINED SYSTEM
N/A	A/R	LB/CABLE-1RFIN	LABEL, CABLE, RF INPUT, SSPA #1 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/CABLE-2RFIN	LABEL, CABLE, RF INPUT, SSPA #2 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/CABLE-3RFIN	LABEL, CABLE, RF INPUT, SSPA #3 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/HPODSSPA-1	LABEL, HPOD, SSPA #1 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/HPODSSPA-2	LABEL, HPOD, SSPA #2 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/HPODSSPA-3	LABEL, HPOD, SSPA #3 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/WG-SW1	LABEL, SWITCH, WAVEGUIDE, #1 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/WG-SW2	LABEL, SWITCH, WAVEGUIDE, #2 ID LABEL PRINT IN HOUSE
N/A	1	MS/11-314	DEEP SOCKET, 7/16", 12-POINT, 2.4" OAL, .065 DIA., 3/8" DRIVE
N/A	1	MS/S3161	SCREWDRIVER, STUBBY FLAT BIT, 3/16 BLADE, 1 1/4 BLADE LENGTH

Notes:

1. Items in ‘Item No.’ column marked ‘0’ indicate an item not shown.
2. In ‘Qty’ column, A/R = As Required

A.2.2 C-Band 1:2 Phase Combined Top Assembly Kit – 350W HPOD (KT-0021054) (Horizontal Load)

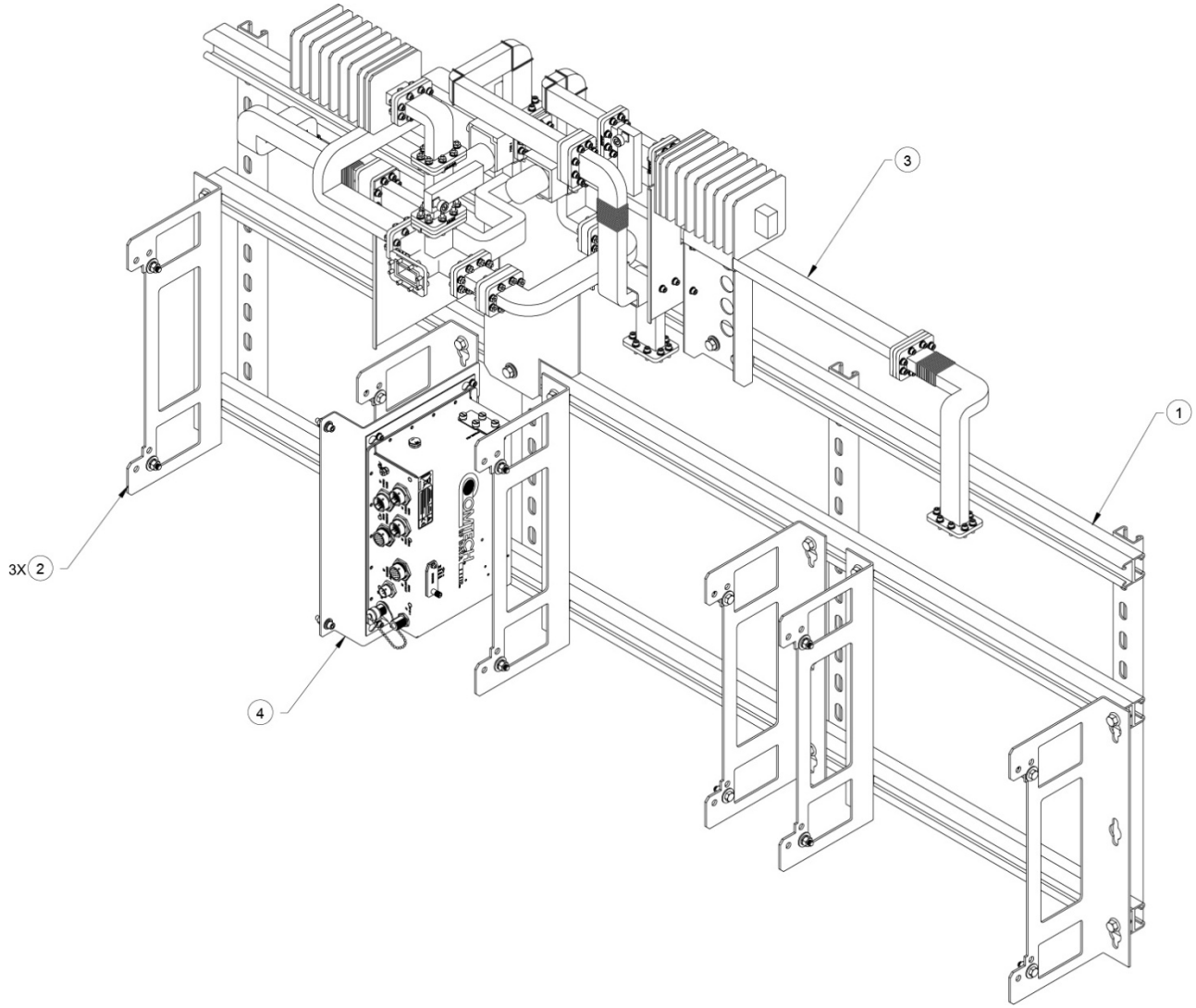

Figure A-3. C-Band 1:2 Phase Combined Top Assembly Kit – 350W HPOD (KT-0021054) (Horizontal Load)

Table A-3. C-Band 1:2 Phase Combined Top Assembly Kit – 350W HPOD BOM (KT-0021054) (Horizontal Load)

See Figure A-3			
Item No.	Qty	Item Number	Item Description
1	1	KT-0000017	MOUNTING KIT, 1:2 REDUNDANT HPOD
2	3	KT/12300-1	MOUNTING BRACKET KIT, UNI STRUT MOUNT HPOD
3	1	KT-0021056	WAVEGUIDE KIT, 1:2 PHASE COMBINED C-BAND HPOD, ROTATED LOAD
4	1	KT-0021154	PHASE COMBINER BOX AND BRACKET KIT, 1:2 C-BAND
N/A	1	D-0020802	1:2 PHASE COMBINED C-BAND HPOD, ROTATED LOAD, ASSY ENVELOPE DRAWING
N/A	3	CA-0021588	RF IN, MATCHED SET, 1:2 KU-BAND
N/A	3	CA-0021592	SSPA TO COMBINER BOX
N/A	1	CA/WR12013-1	CABLE ASSY, SWITCHES, COMBINED SYSTEM
N/A	A/R	LB/CABLE-1RFIN	LABEL, CABLE, RF INPUT, SSPA #1 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/CABLE-2RFIN	LABEL, CABLE, RF INPUT, SSPA #2 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/CABLE-3RFIN	LABEL, CABLE, RF INPUT, SSPA #3 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/HPODSSPA-1	LABEL, HPOD, SSPA #1 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/HPODSSPA-2	LABEL, HPOD, SSPA #2 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/HPODSSPA-3	LABEL, HPOD, SSPA #3 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/WG-SW1	LABEL, SWITCH, WAVEGUIDE, #1 ID LABEL PRINT IN HOUSE
N/A	A/R	LB/WG-SW2	LABEL, SWITCH, WAVEGUIDE, #2 ID LABEL PRINT IN HOUSE
N/A	1	MS/11-314	DEEP SOCKET, 7/16", 12-POINT, 2.4" OAL, .065 DIA., 3/8" DRIVE
N/A	1	MS/S3161	SCREWDRIVER, STUBBY FLAT BIT, 3/16 BLADE, 1 1/4 BLADE LENGTH

Notes:

1. Items in ‘Item No.’ column marked ‘0’ indicate an item not shown.
2. In ‘Qty’ column, A/R = As Required

A.2.3 C-Band 1:2 Phase Combined System Waveguide Kit – HPOD (KT-0000107)

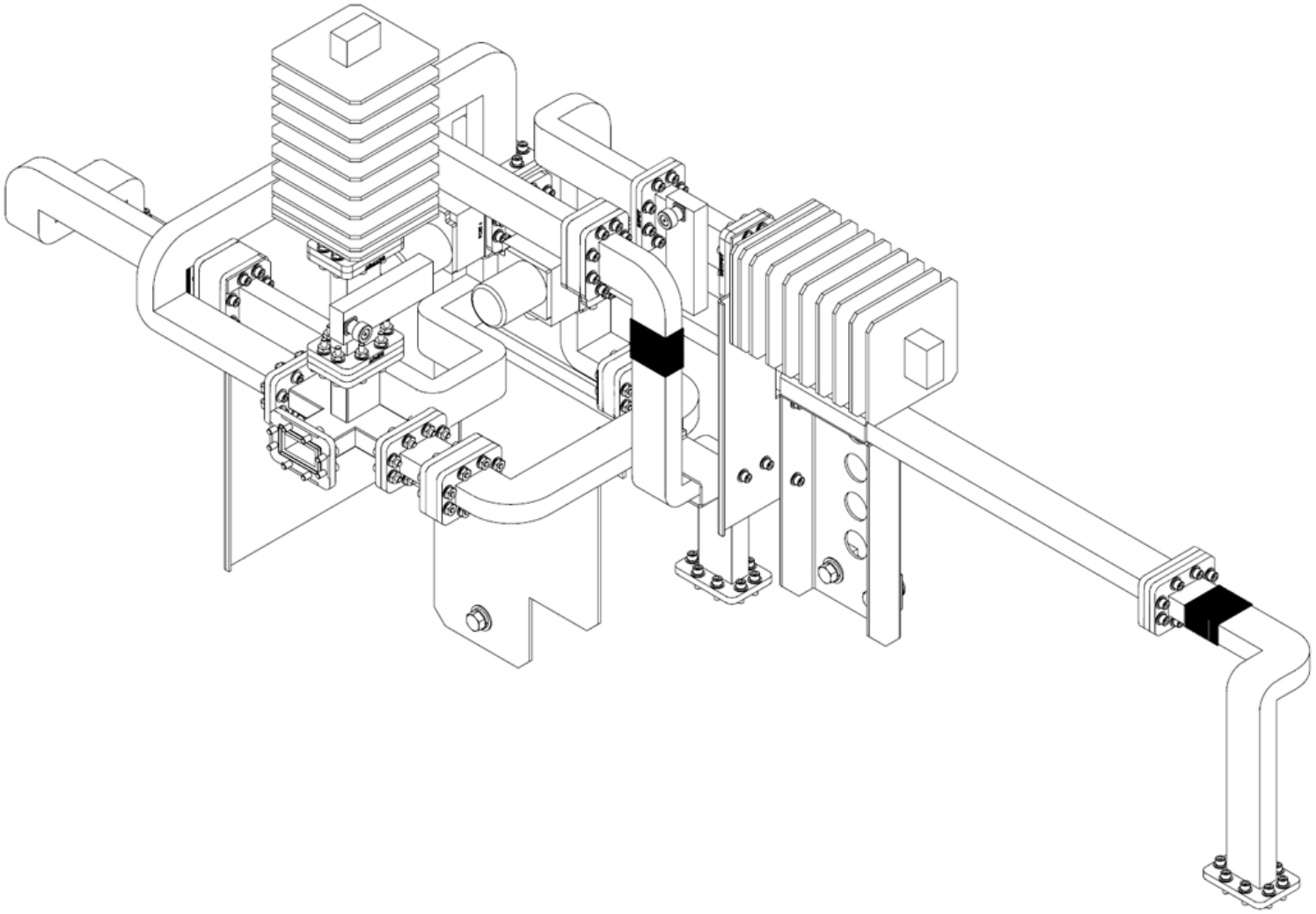

Figure A-4. C-Band 1:2 Phase Combined System Waveguide Kit (Assembled) – HPOD (KT-0000107)

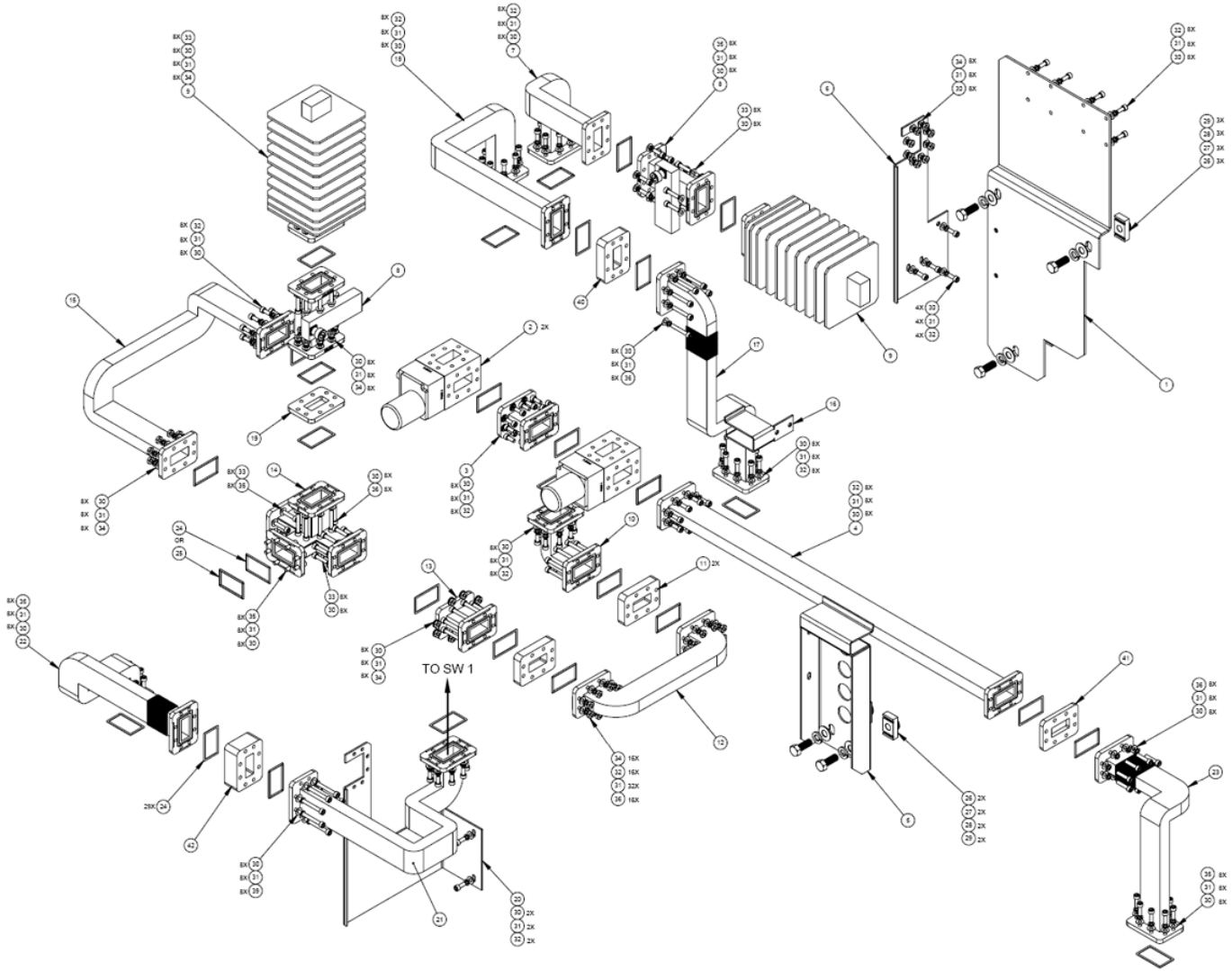

Figure A-5. C-Band 1:2 Phase Combined System Waveguide Kit (Exploded) – HPOD (KT-0000107)

Table A-4. C-Band 1:2 Phase Combined System Waveguide Kit (Exploded) – HPOD BOM (KT-0000107)

See Figure A-5			
Item No.	QTY	CEFD Part No.	Description
1	1	FP-0000589	MOUNTING BRACKET, DUAL SWITCH, C-BAND
2	2	SW/WGS28V-137S	SW WAVEGUIDE, CPR137, +28V SEALED
3	1	FP-0000586	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, SW1_P4 TO SW2_P3
4	1	FP-0000587	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, A3
5	1	FP-0000597	MOUNTING BRACKET, WAVEGUIDE SUPPORT, A3
6	1	FP-0000606	BRACKET, WAVEGUIDE SUPPORT
7	1	FP-0000600	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, SW2 TERMINATION
8	2	RF/CG-137-40-N	RF CROSSGUIDE, WR137, 40DB, N FEMALE, GROOVED
9	2	RF/C-TERM1000W	RF TERMINATION, LOAD, 1000 WATT, CPRG-137
10	1	FP-0000593	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, SW2_P3_TB TO TB-1
11	5	FP-0000594	WAVEGUIDE SPACER, CPR-137 X .500
12	1	FP-0000595	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, TB-1 TO TB-2
13	1	FP-0000608	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, TB-TEE_D TO TB-2
14	1	HW-0000131	RF MAGIC TEE, COUPLER, 5.85-6.425 GHz, WR-137G, C-BAND, 4-WAY
15	1	FP-0000592	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, L3-TEE_C TO L3-SW1_P2
16	1	FP-0000605	BRACKET, WAVEGUIDE SUPPORT, 1:2 PHASE COMBINED C-BAND HPOD, AMP2
17	1	FP-0000598	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, A2-1 TO IN-AMP2
18	1	FP-0000599	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, A2
19	1	FP-0000596	WAVEGUIDE ADAPTER, 1:2 PHASE COMBINED C-BAND HPOD
20	1	FP-0000607	BRACKET, WAVEGUIDE SUPPORT
21	1	FP-0000590	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, A1
22	1	FP-0000591	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, IN-AMP1 TO A1-1
23	1	FP-0000588	WAVEGUIDE, 1:2 PHASE COMBINED C-BAND HPOD, IN-AMP3 TO A3-1
24	29	GA/CPR-137-R-H-C	GASKET, D SHAPE, CPR-137, HALF THICKNESS, CONDUCTIVE
25	1	GA/CPR137-R-F-C	GASKET, ROUND, CPR137, FULL THICKNESS, CONDUCTIVE
26	5	HW/3/8SPRINGNUT	SPRINGNUT, 3/8-16, SHORT SPRING, SST (P3300)
27	5	HW/3/8-FLT	3/8 FLAT WASHER, S.S.
28	5	HW/3/8-SPLIT	3/8 SPLIT LOCK WASHER S.S.

See Figure A-5			
Item No.	QTY	CEFD Part No.	Description
29	5	HW/3/8-16X1BLT	3/8 - 16 HEX HEAD BOLT, 1.0 LONG, S.S.
30	254	HW/10-FLT	#10 FLAT WASHER S.S.
31	198	HW/10-SPLIT	#10 SPLIT LOCK WASHER S.S.
32	78	HW/10-32X1/2SH	10-32X1/2 SOCKET HEAD CAP SCREW S.S.
33	8	HW/10-32X7/8SHCS	SCREW, 10-32 X 7/8 SOCKET HEAD CAP SCREW S.S.
34	56	HW/10-32HEXNUT	HW 10-32 HEX NUT S.S.
35	40	HW/10-32X5/8SHC	HW 10-32 X 5/8 SOCKET HEAD CAP SCREW S.S.
36	32	HW/1032X1-1/4SHCS	SCREW, 10-32 X 1 1/4 SOCKET HEAD CAP SCREW S.S.
37	24	HW/10-32X3/4SH	10-32X3/4 SOCKET HEAD CAP SCREW S.S.
38	8	HW/10-32X1SHCS	10-32X1.0 SOCKET HEAD CAP SCREW S.S.
39	8	HW/10-32X1.75SH	10-32 X 1.75 SOCKET HEAD CAP SCREW S.S.

A.2.4 C-Band 1:2 Phase Combiner Box and Bracket Kit (KT-0021154)

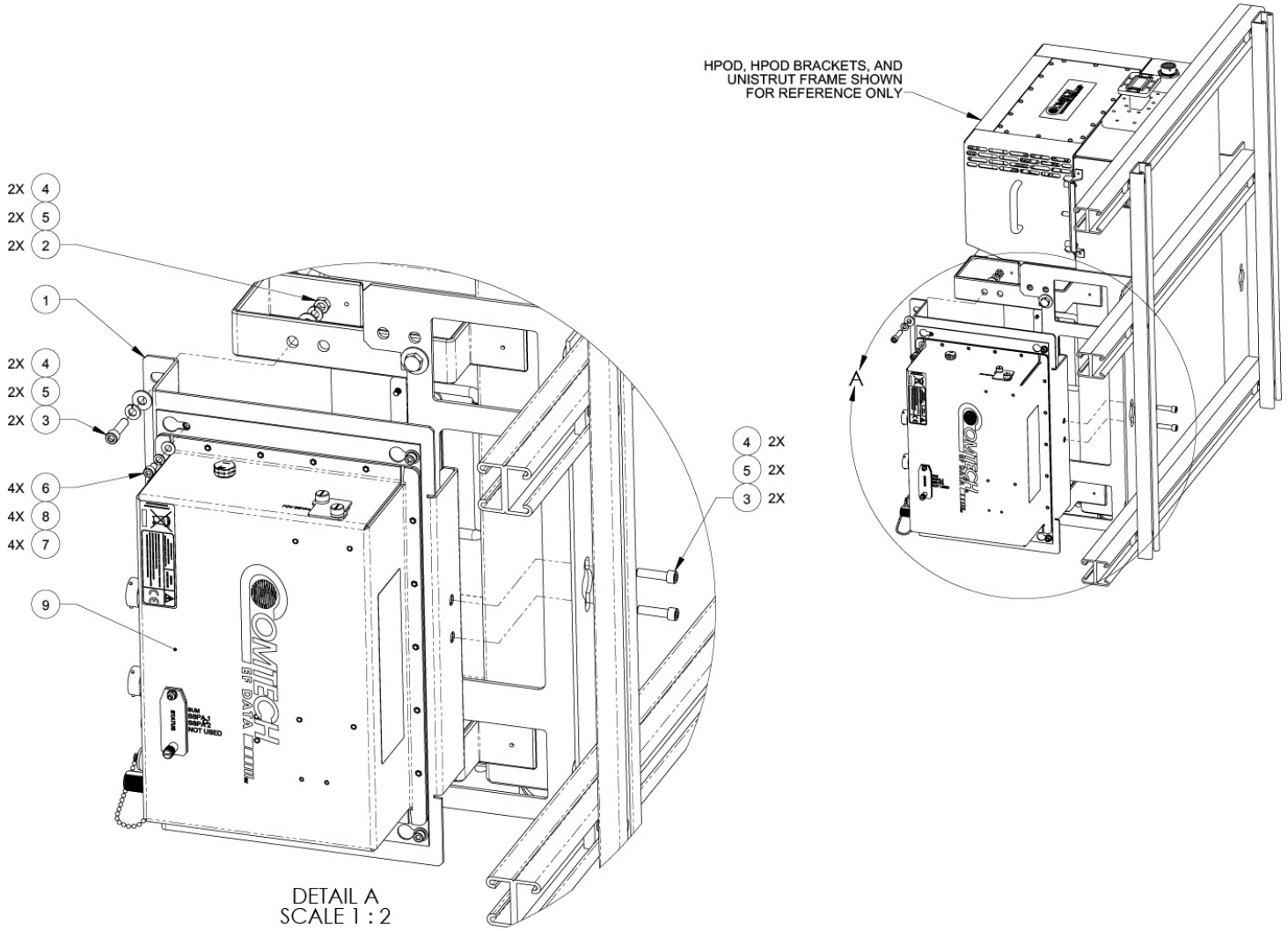

Figure A-6. C-Band 1:2 Phase Combiner Box and Bracket Kit (KT-0021154)

Table A-5. C-Band 1:2 Phase Combiner Box and Bracket Kit BOM (KT-0021154)

See Figure A-6			
Item No.	QTY	CEFD Part No.	Description
1	1	FP-0022138	BRACKET, HPOD PHASE COMBINER
2	2	HW/1/4-20HEXNUT	1/4-20 HEXNUT, SS
3	4	HW/1/4-20X1SHCS	1/4X20X1 SOCKET HD CAP SCREW SS
4	6	HW/1/4-FLT	1/4 FLAT WASHER
5	6	HW/1/4-SPLIT	1/4 SPLIT WASHER
6	4	HW/10-32X3/8SH	10-32 X 3/8 SOCKET HEAD CAP, S.S.
7	4	HW/10-FLT	#10 FLAT WASHER S.S.
8	4	HW/10-SPLIT	#10 SPLIT LOCK WASHER S.S.
9	1	PL-00226637	COMBINER BOX, 1:2 C-BAND

A.2.5 Vertical Mounting Fram Kit (KT-0021177)

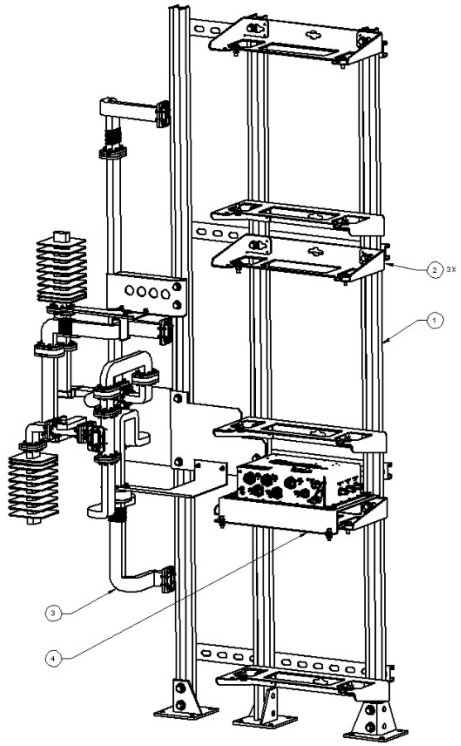

Figure A-7. Vertical Mounting Frame Kit (KT-0021177)

Table A-6. Vertical Mounting Frame Kit (KT-0021177)

See Figure A-7			
Item No.	QTY	CEFD Part No.	Description
1	1	KT-0021175	MOUNTING KIT, 1:2 REDUNDANT HPOD, INDOOR MTG FRAME, VERTICAL WITH POST BASES
2	3	KT-0021261	MOUNTING BRACKET KIT, UNI STRUT MOUNT HPOD
3	1	KT-0021056	WAVEGUIDE KIT, 1:2 PHASE COMBINED C-BAND HPOD, ROTATED LOAD
4	1	KT-0021154	KIT, 1:2 PHASE COMBINER BOX AND BRACKET, C-BAND
N/A	3	CA-0021588	RF IN, MATCHED SET, 1:2 KU-BAND
N/A	3	CA-0021592	SSPA TO COMBINER BOX
N/A	1	CA/WR12013-1	CABLE ASSY, SWITCHES, COMBINED SYSTEM

A.3 Common Kit Subassemblies

A.3.1 HPOD 1:1 Redundancy Pole Mount Kit (PL/12319-1)

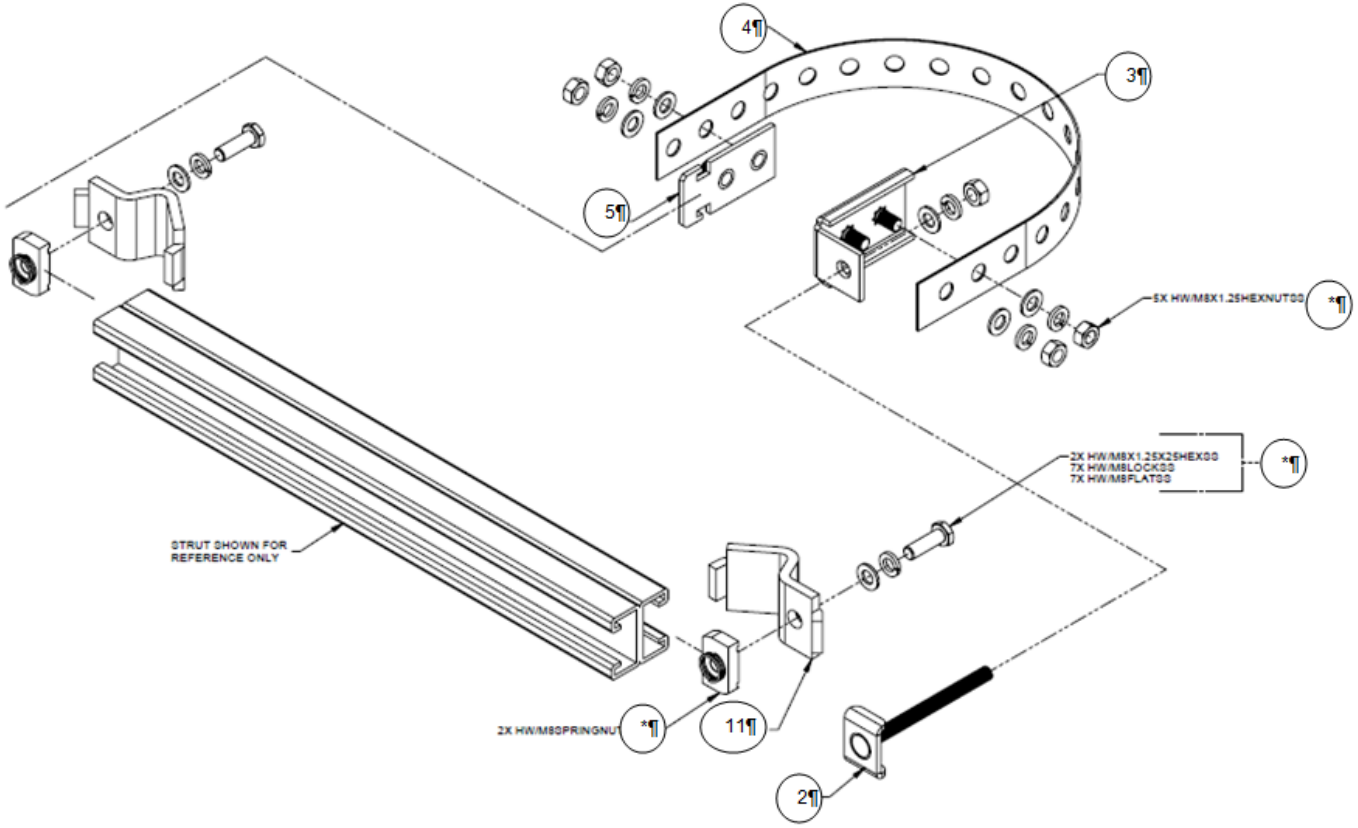

Figure A-8. HPOD 1:1 Redundancy Pole Mount Kit (PL/12319-1)

Table A-7. HPOD 1:1 Redundancy Pole Mount Kit - BOM (PL/12319-1)

See Figure A-8			
Item No.	QTY	CEFD Part No.	Description
-	N/A	N/A	Strut (Shown for reference only)
2	1	FP/BR0072	Bracket, Strap Tensioner
3	1	FP/BR0070	Strap, Termination, Pole Mounting Kit
4	1	FP/BR0071	Bracket, Modification, 1-1/4 Strap (TRIM TO REQUIRED LENGTH)
5	1	FP/BR0069	Strap, Fixed, Pole Mounting Kit
11	2	HW/PIPEBLOCK	Pipe Block, 2/8 inch, 1 and 5/8 unistrut channel
*	1	KT-0020905	Kit, Commn Purchase Hardware Kit for CSAT PL/12319-1 and AS/0414. See Table A-8.

Table A-8. Hardware Kit (KT-0020905)

* This is part of the HPOD 1:1 Redundancy Pole Mount Kit, Part No. PL/12319-1.

See Figure A-8			
Item No.	QTY	CEFD Part No.	Description
6	2	HW/M8X1.25X25HEXSS	Bolt, Hex head, M8X1.25X25, SS
7	7	HW/M8FLATSS	Washer, Flat, M8, SS, METRIC
8	7	HW/M8LOCKSS	Washer, Split Lock, M8, SS, METRIC
9	2	HW/M8SPRINGNUT	Spring Nut, M8X1.25
10	5	HW/M8X1.25MMHEXNUTSS	Nut, Hex M8X1.25X16MM, SS

A.3.2 1:2 Redundant HPOD Mounting Kit (KT-0000017)

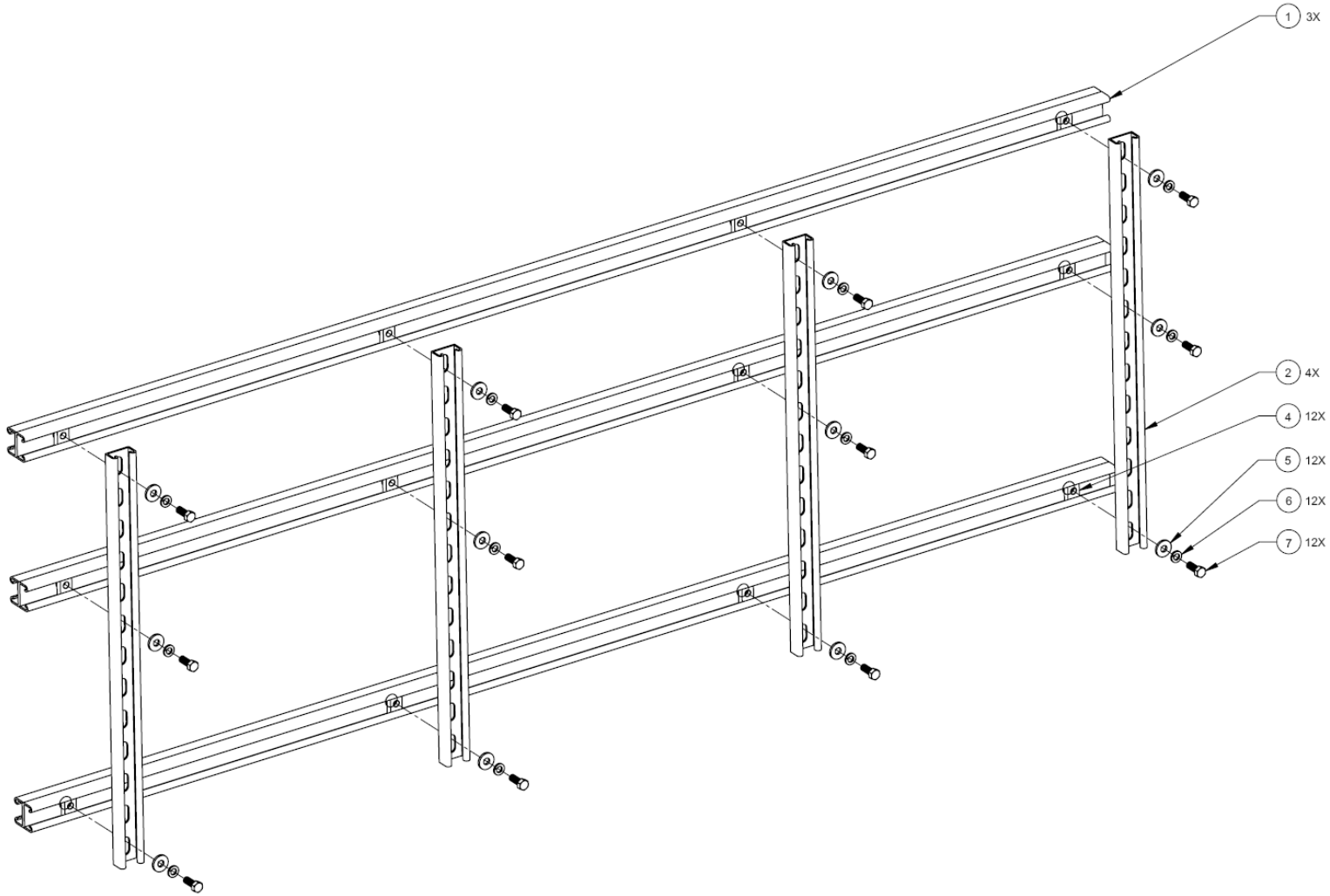

Figure A-9. 1:2 Redundant HPOD Mounting Kit (KT-0000017)

Table A-9. 1:2 Redundant HPOD Mounting Kit - BOM (KT-0000017)

See Figure A-9			
Item No.	QTY	CEFD Part No.	Description
1	3	FP-0000134	Unistrut, Dual Channel, 74.13” LG
2	4	FP/BR11932-1	Bracket, Unistrut, SS, 26.25” LG
4	12	HW/3/8SPRINGNUT	Spring Nut, 3/8-16, Short Spring, SS (P3300)
5	12	HW-0000069	Washer, Flat, Thick, 3/8, SS
6	12	HW/3/8-SPLIT	Washer, Lock, Split, 3/8, SS
7	12	HW/3/8-16X1BLT	Bolt, Hex Head, 3/8 x 1” LG, SS

A.3.3 Uni-Strut Mount HPOD Mounting Bracket Kit (KT/12300-1)

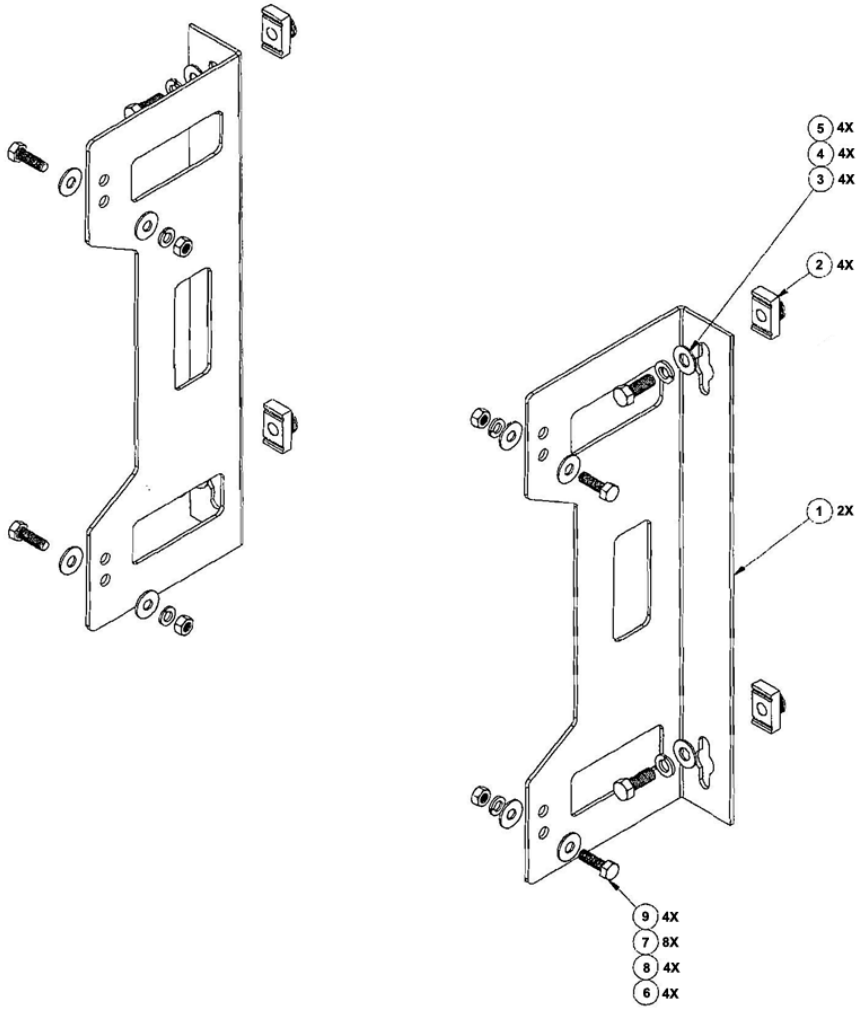

Figure A-10. Uni-Strut Mount HPOD Mounting Bracket Kit (KT/12300-1)

Table A-10. Uni-Strut Mount HPOD Mounting Bracket Kit - BOM (KT/12300-1)

See Figure A-10			
Item No.	QTY	CEFD Part No.	Description
1	2	FP/BR12239-1	Bracket, Unistrut
2	4	HW/3/8SPRINGNUT	Spring Nut, 3/8-16, Short Spring, SS (P3300)
3	4	HW/3/8-FLT	Washer, Flat, 3/8
4	4	HW/3/8-SPLIT	Washer, Lock, Split, 3/8, SS
5	4	HW/3/8-16X1BLT	Bolt, Hex Head, 3/8-16 x 1” LG, SS
6	4	HW/5/16-18HEXNT	Nut, Hex, 5/16-18, SS
7	8	HW/5/16-Flat	Washer, Flat, 5/16, SS
8	4	HW/5/16-SPLIT	Washer, Lock, Split, 5/16, SS
9	4	HW/5/16-18X1BLT	Bolt, Hex Head, 5/16-18 x 1” LG, SS

A.3.4 Vertical Uni-Strut Mount HPOD Mounting Bracket Kit (KT-0021261)

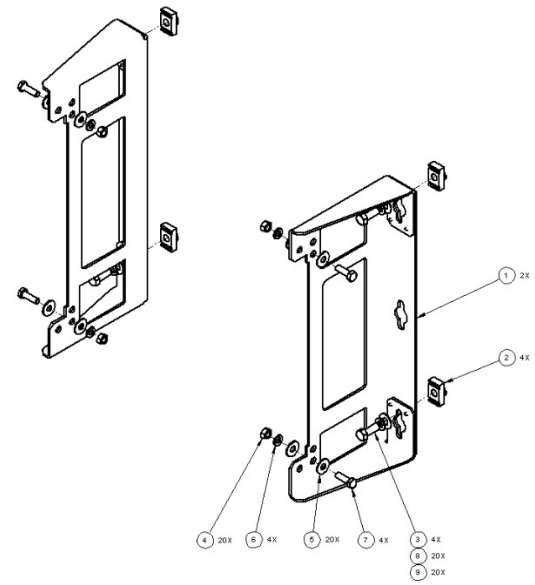

Figure A-11. Vertical Uni-Strut Mount HPOD Mounting Bracket Kit (KT-0021261)

Table A-11. Vertical Uni-Strut Mount HPOD Mounting Bracket Kit – BOM (KT-0021261)

See Figure A-11			
Item No.	QTY	CEFD Part No.	Description
1	2	FP-0022325	Mounting Bracket, HPOD & LPOD PS-2, with Gussets
2	4	HW/3/8SPRINGNUT	Spring Nut, 3/8-16, Short Spring, SS (P3300 Channel)
3	4	HW/3/8-16X1BLT	Bolt, Hex Head, 3/8-16 x 1" LG, SS
4	4	HW/5/16-18HEXNT	Nut, Hex, 5/16-18, SS
5	8	HW/5/16-Flat	Washer, Flat, 5/16, SS
6	4	HW/5/16-SPLIT	Washer, Lock, Split, 5/16, SS
7	4	HW/5/16-18X1BLT	Bolt, Hex Head, 5/16-18 x 1" LG, SS
8	4	HW/3/8-FLT	Washer, Flat, 3/8 Replaced Hw/3/8Flat on 10-25-00
9	4	HW/3/8-SPLIT	Washer, Lock, Split, 3/8, SS

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