10 to 40W 1:1 Uplink Downlink Redundant System

Operation and Maintenance Manual

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TITLE:

10 to 40W 1:1 Uplink Downlink Redundant System

Designer: Marina Lissianskaia Date: 25 Nov 05		**REV 1**
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Table of Contents

List of Tables

List of Figures

Preface

Scope

This document covers the installation of the 10 to 40W 1:1 Uplink Downlink Redundant System. It contains information intended for engineers, technicians and operators working with the redundant system.

To make inquiries, or to report errors of fact or omission in this document, please contact **mitec telecom inc**. at (514) 694-9000.

IMPORTANT

Important information concerning the operation and care of this product, as well as safety of authorized operators is highlighted throughout this document by one of the following labels:

NOTE

Indicates a reminder, a special consideration, or additional information that is important to know.

CAUTION!

Identifies situations that have the potential to cause equipment damage.

WARNING!!

Identifies hazardous situations that have the potential to cause equipment damage as well as serious personal injury.

1 Introduction

1.1 General Description

The 1:1 uplink/downlink redundant system is comprised of an outdoor (ODU) Uplink Redundant Assembly, an outdoor Downlink Redundant Assembly and as indoor (IDU) system controller. It provides redundant control for both the uplink and downlink applications.

The outdoor component of the system consists of:

- A 1:1 Uplink Redundant Kit, WRK-596446-485-ES-02, containing two 40-Watt L-Band to C-Band Hub Mount Block-up converters (BUCs), mitec model WTX-596446-70-ES-35 with a WR137 waveguide switch assembly, assembled on a mounting plate;
- One junction box assembled on the WRK-596446-485-ES-02 mounting plate, that combines the two booster Monitoring and Control interfaces and links the outdoor unit (ODU) to the indoor controller (IDU).
- A section of WR137 flexible waveguide for uplink connection to the antenna;
- A 1:1 Downlink Redundant Kit, WRK-340420RX-ES-02, containing two C-band to L-Band Hub Mount Block-Down converters (LNBs) with a WR229 waveguide switch assembly.

The indoor component of the system is a 1:1 Up/Downlink Controller, 2RU rack-mount mitec model WRK-340145-485-IS-01. It is connected to the ODU through its junction box and cables and provides all monitoring and control functions.

For the component interconnections and module definitions, refer to the System Block Diagram, Figure 1.

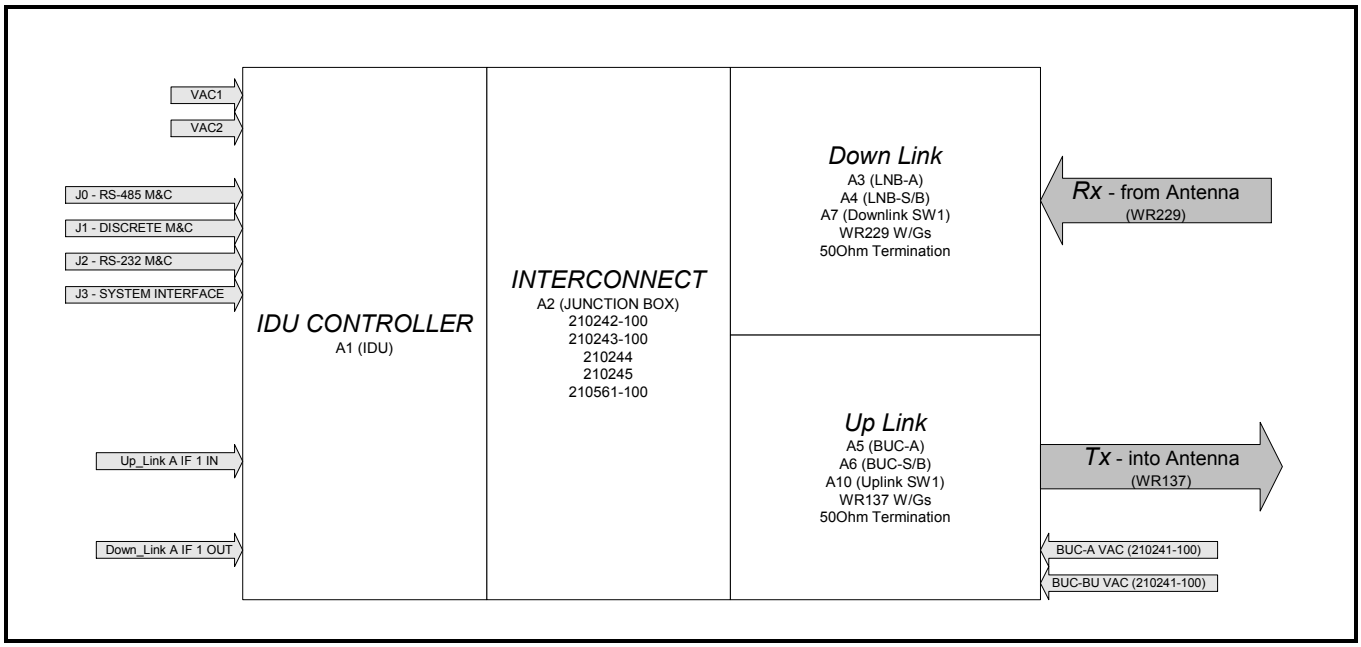

Figure 1 – System Block Diagram

1.1.1 Abbreviations

Table 1 lists the abbreviations that may appear within this manual.

Table 1 – Abbreviations and Definitions

Abbreviation	Description
A	Ampere
AC	Alternating Current
B/U	Back Up
BUC	Block Up Converter
ºC	Degrees Celsius
dB	Decibel
dBm	Decibel referenced to mW
DC	Direct Current
GHz	Gigahertz (10^6 cycles per second)
HPA	High Power Amplifier
IDU	In Door Unit
IF	Intermediate Frequency
IM-3	Third Order Intermodulation
LNB	Low Noise Block
LO	Local Oscillator
M&C	Monitor and Control
MHz	Megahertz (10^3 cycles per second)
N/A	Not Applicable
ODU	Out Door Unit
P_{1dB}	Power at one dB of gain compression
RF	Radio Frequency
SCL	Single Carrier Level
SSPA	Solid State Power Amplifier

Abbreviation	Description
UUT	Unit Under Test
V	Volt
VFD	Vacuum Florescent Display
W	Watt
W/G	Wave Guide

1.1.2 System Specifications

Table 2 and Table 3 summarize the electrical specifications of the 10 to 40W 1:1 Uplink Downlink Redundant System.

Table 2 – System RF Specifications

Parameter	Specification
Up-Link	
Input IF Frequency	950 to 1525 MHz
LO Frequency	4.9 GHz
Output RF Frequency	5.9 to 6.425 GHz
Output Power @ P1dB Compression point	46 dBm (40W) min
Output Power Saturation point	47 dBm (50W) typical
Conversion Gain	65 dB, nom
Gain Flatness (small signal)	±2.5 dB, nom over full band at 25^0C
Phase Noise	-60 dBc/Hz, max@ 300 Hz off the carrier; -70 dBc/Hz, max@ 1 kHz off the carrier; -80 dBc/Hz, max @ 10 kHz off the carrier; -90 dBc/Hz, max @ 100 kHz off the carrier; -100 dBc/Hz, max @ 1 MHz off the carrier
Spurious	-50 dBc max, @Pout = P_{1dB} rated
IM-3	-26 dBc max@ Pout = 43dBm SCL (Two equal signals total, 5 MHz separate)
Harmonics	-50 dBc @ P_{1dB} nom
Output RL (cold)	-18 dB, min, with built-in output isolator
Source VSWR	1.5 :1, max (operational)
Load VSWR	1.5 :1, max (operational) Infinite at any angle with no damage module with built-in output isolator
Power Consumption per BUC: RF Booster BUC	110 / 220VAC; 250 W, max 24VDC 1A max via IF cable; supplied by IDU
Down-Link	
Input RF Frequency	3.625-4.2 GHz
LO Frequency	5.76 GHz
Output IF Frequency	950 to 1525 MHz
Noise Temperature	45 K max
Conversion Gain	65 dB nom
Phase Noise	-63 dBc/Hz, max@ 100 Hz off the carrier; -73 dBc/Hz, max@ 1 kHz off the carrier; -83 dBc/Hz, max @ 10 kHz off the carrier; -90 dBc/Hz, max @ 100 kHz off the carrier;
Power Consumption per LNB	24VDC 0.35A max.

Table 3 – System Electrical Specifications

Parameter	Specification
Up-Link	
IF Input Port Impedance	50 Ohm
IF Input port	DC Block; 10MHz Block
10MHz Reference Source	0±5dBm; 10^{-8} stability; injected into each IF line
DC Supply	24VDC 2A max; injected into IF line
Down-Link	
IF Output Port Impedance	75 Ohm
IF Output Port	DC Block; 10MHz Block
DC Supply	24VDC 0.5A max; injected into IF line
Power Supply	
AC Input	Two 110/220 VAC Auto ranging; 160W max each
DC Output 1	Two 24VDC 4 A min
DC_OUT1 Efficiency	85% nom
DC Output 2	Two 12VDC 2.5 A min
DC_OUT1 Efficiency	80% nom

1.2 Receiving and Inspection

The redundant kit will arrive in a custom designed shipping container. Immediately upon receipt of the Redundant Kit, check the Bill of Lading against the actual equipment you have received. Inspect the shipping container exterior for visible damage incurred during shipping.

The customized wooden shipping crate is constructed to include individual interior boxes that hold the individual components of the system. Refer to Figure 2 and Table 1 for details.

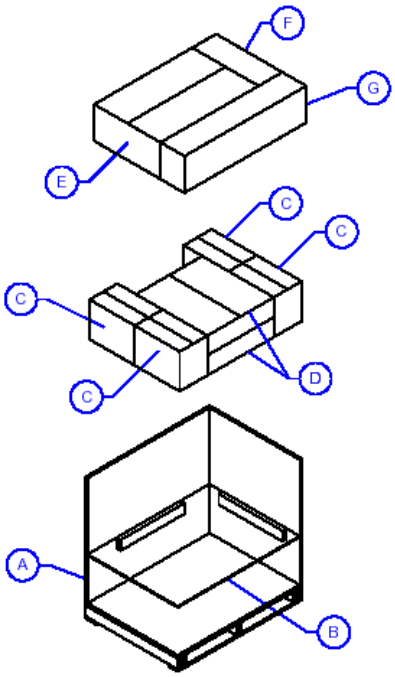

Figure 2 – Shipping Container Layout Diagram

Table 4 – Shipping Container Contents

Interior Box Designation	Contents
C x 4	Qty 2: WTX-596446-70-ES-35 - C-Band BUC (1 per box) Qty 1: WRK-340420RX-ES-02 - L-Band 1:1 Downlink Redundant Kit Qty 1: C-Band WG/Switch Sub-assembly
D x 2	Qty 1: 7507257-01 Base Mounting Plate Qty 1: WRK-340146-485-IS-01 IDU Controller
E	Spare space
F	Qty 1: 210251-000AD Junction Box Qty: 1 Hardware Kit Qty 1: Operating Manual
G	Qty 1: 210536-001 Flexible Waveguide Assembly

CAUTION!

Handle the redundancy kit with extreme care. Excessive shock may damage the redundancy kit's delicate internal components.

NOTE

Before unpacking the shipping container, move them near to the site where it will be mounted. Ensure that the containers are oriented correctly in accordance with the "This Side UP "labels. Carefully remove the SSPAs and accessories from the shipping containers.

Verify that all items have been received and undamaged during shipment. Verify that all items are complete. If there are any omissions or evidence of improper packaging, please notify **Mitec Telecom Inc.** immediately.

1.2.1 Equipment Damage or Loss

Mitec Telecom Inc. is not responsible for damage or loss of equipment during transit. For further information, contact the responsible transport carrier.

When declaring equipment as damaged during transit, preserve the original shipping cartons to facilitate inspection reporting.

1.2.2 Return of Equipment

When returning equipment to **Mitec** for repair or replacement:

1. Identify, in writing, the condition of the equipment,
2. Refer to the sales order, Purchase Order and the date the equipment was received,

Notify **Mitec** Sales Administration Department of the equipment condition and obtain a Return Material Authorization (RMA) number and shipping instructions. **Mitec** will pay for the cost of shipping the product to the customer after the repairs are completed.

NOTE

Do not return any equipment without an RMA number. *This is important for prompt, efficient handling of the returned equipment and of the associated complaint.*

1.3 Preparing for Installation

Before attempting to install or use the 10 to 40W 1:1 Uplink Downlink Redundant System, we recommend that you first familiarize yourself with the kit by reading through this manual. Understanding the operation of the redundant kit will reduce the possibility of incorrect installation, thereby causing damage or injury to yourself or others.

*The redundant kit **must** be installed in accordance with the conditions and recommendations contained in the following sections.*

When you are ready to begin your installation, use the information in Chapter 2 (Installation) as a guide for making all the required electrical connections.

1.3.1 Safety Precautions

Carelessness or mishandling of the redundant kit may damage the unit causing serious injury to yourself or others. Please adhere to the following:

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2 Installation

This section describes the installation and theory of operation of the redundant system.

2.1 Outdoor Unit (ODU)

2.1.1 WRK-596446-485-ES-02 Uplink Redundant Kit

NOTE

An O-ring shall be used to seal each waveguide connection.

2.1.1.1 Assembly of WRK-596446-485-ES-02 HPA Redundancy Kit

Use the information in this section as a guide to assemble and install the redundant kit. The system is designed to function outdoors with the specified humidity up to 100% during operation. However, installation should be carried out in dry conditions, free of salt spray or excessive humidity. This will eliminate the possibility of moisture and other foreign substances from entering the output waveguide flange.

CAUTION!

Only authorized technical personnel should perform the Installation and proper electrical hookups of the redundant system.

Table 5 lists the parts of the WRK-596446-485-ES-02 that are shipped separately. Mounting brackets, hardware and gaskets are included to complete the assembly. Refer to the assembly drawing in Appendix A for further details.

Table 5 – WRK-596446-485-ES-02 Components for Assembly

Description	Part Number	Qty
Mounting Frame	7507257-01	1
40 W C-Band HPA with BUC	WTX-596446-70-ES-35	2
Junction Box	210251-001	1
Redundancy Switch/HP Term/Flex WG Assy	-	1
Switch Assy Mounting Bracket	210497	1

2.1.1.2 Attach Sub-assemblies to Mounting Frame

With reference to the assembly drawing, WRK-596446-485-ES-02AD, in Appendix A, complete the following steps to assemble the WRK-596446-485-ES-02.

1. Attach the Redundancy Control Switch/Term/Flex WG Assembly (See Figure 3) with the mounting bracket PN 210497, using the appropriate hardware as specified on the assembly drawing.

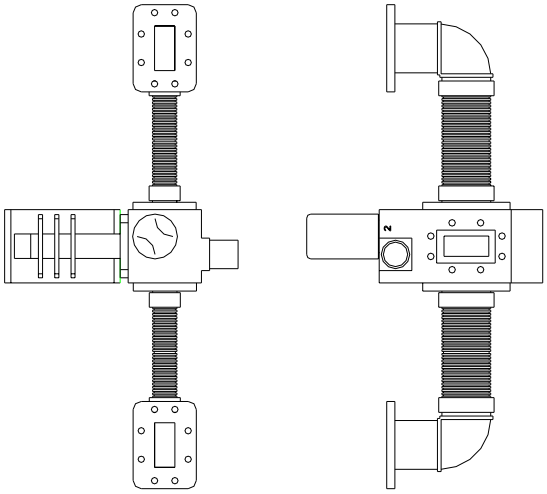

Figure 3 – C-Band Redundancy Control Switch/Term/Flex WG Sub-Assy

2. Secure this assembly to the mounting frame PN 7507257-01. Use hardware as specified as per the assembly drawing.

3. Assemble the cables to the junction box, as shown in drawing 21051-001AD in Appendix A. Fasten the junction box, PN 210251-001 to the mounting frame, using the specified hardware as per the assembly drawing.

4. Attach both HPA Systems to the mounting frame, as per the assembly drawing in Appendix A, using the specified hardware as per the assembly drawing. Do not torque the fasteners all the way until the waveguide interconnections are completed.

5. Complete the connections between the waveguide flanges (2) and the booster outputs. Use O-Rings and hardware as specified. Ensure the waveguide is not under tension, and then tighten the fastening hardware to fix the position of the SSPAs on the frame.

6. Install the cable assemblies between the junction box and the WRK-596446-485-ES-02 assemblies. Refer to the detailed block diagram and the cable drawings in Appendix A.

The WRK-596446-485-ES-02 is now ready for assembly the antenna feed support.

NOTE

Both SSPAs contain two high flow-rate fans (300 CFM) for cooling the RF Amplifier Module. These fans function continuously during the booster operation. To provide a sufficient airflow, the booster should be mounted with a minimum clearance of 3 inches on the bottom and all four sides. Adequate cooling for the boosters will provide years of top performance.

2.1.2 WRK-340420RX-ES-02 Downlink LNB Redundancy Kit Assembly

With reference to the WRK-340420RX-ES-02AD assembly drawing in Appendix A, assemble the waveguide bends, LNBs waveguide switch and waveguide termination, using the included specified hardware and gaskets.

2.1.3 Securing the ODU Components to the Antenna Feed

Complete the following steps to complete the installation of the ODU.

1. Install the components of the WRK-596446-485-ES-02 Redundant System onto the antenna feed support through the mounting holes on the frame, using the specified hardware. Refer to the system assembly drawing, 210590AD in Appendix A,

2. Carefully install the connecting flexible waveguide assembly between the WRK-596446-485-ES-02 output waveguide flange, using the specified gaskets and hardware, as illustrated in the system assembly drawing 210590AD in Appendix A.

3. Install the WRK-340420RX-ES-02AD Redundant System onto the antenna feed by completing the waveguide flange connection, using the specified gaskets and hardware, as illustrated in the system assembly drawing, 210590AD in Appendix A.

4. Install the interconnecting cables from the WRK-340420RX-ES-02 waveguide switch to the junction box. Refer to the detailed block diagram and the cable drawings in Appendix A.

5. Ensure all connections are secure and torqued.

WARNING!!

It is preferable that all coaxial cables are installed before the system is powered up. Once powered up, there is 24 VDC on all coaxial connections, which could be easily shorted when a cable is connected. Should such a short occur, the system will react appropriately and the shorted line will be turned off until the short is removed. No damage will occur.

2.2 Indoor unit (IDU)

The IDU controller is a standard 2 RU chassis, which can be mounted in an EIA-standard 19-inch equipment rack. If the controller is to be mounted in a rack, be sure to allow adequate clearance at the rear of the unit for attaching the cables.

NOTE

Recommended clearance above and below the unit is 3.5 inches. Allow a minimum clearance of 1.75 inches.

CAUTION!

Do not mount the unit using only the front panel mountings -the unit is too heavy. Failure to properly support the unit from front to back will deform the front panel and cause internal mechanical damage.

2.2.1 Environmental Conditions

Operate and store the IDU in a dry, well-ventilated area with a minimum of dust and vibration.

Operating temperature range: 0^0C to $+50^0$ C.

Operating relative humidity range: 5% to 90%

Install the unit in an area protected form excessive dust and humidity. Failure to do so will result in malfunction or damage, and will reduce the service life of the unit.

CAUTION!!

Keep liquids away from the unit. Liquids penetrating to the interior of the unit will cause malfunction or equipment damage.

2.2.2 Safety

2.2.2.1 Electrical

Carelessness, or mishandling of the controller may damage the unit causing injury. Please adhere to the following:

WARNING!!

The unit is equipped with AC power cords and plugs. Do not tamper with, or attempt to reconfigure the cords or plugs supplied with the unit, as this can result in personal injury and void the warranty.

Always disconnect the power cords before attempting to:

- *Unplug the connectors*
- *Replace parts*
- *Clean the unit*

2.2.3 Connecting the IDU to the ODU

Once the IDU has been installed, attach the cables from the components of the ODU to the appropriate rear panel connectors on the controller. Refer to the detailed block diagram in Appendix A for cable details.

The system should now be fully installed and connected.

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3 Operation

This section describes the operation of the 1:1 Uplink/downlink Redundant System.

3.1 General

The Uplink Outdoor unit consists of two 40W L-Band to C-Band BUCs, WTX-596446-70-ES-35 and the output WR137 Redundancy Switch.

The Downlink Outdoor unit consists of two C-Band to L-Band LNBs, manufacturer part ID NJS8477HN and the Input WR229 Redundancy Switch.

3.2 Outdoor Module

3.2.1 40W L-Band to C-Band BUC

This is a standard Mitec product, WTX-596446-70-ES-35. It contains a high gain low power Block-Up Converter (BUC) and a 40W High Power Amplifier (HPA). For additional details, please refer to its Operation and Maintenance Manual.

3.2.2 Low Noise Block (LNB)

This is a standard purchased item NJS8477SF, manufactured by NJRC.

3.2.2.1 Power Requirements

Table 6 – LNB Power Requirements

Parameter	Specification
Current per LNB	0.35A max. at 24 VDC
DC Supply voltage	15 to 24 VDC

3.2.2.2 Interface Definition

Table 7 – LNB Power Requirements

Connector	Connector Type	Signal parameter
J1 RF In	CPR229	RF In
J2 IF Out	N-type Female	24 VDC 0.34A max.

For further details please refer to the LNB user manual.

3.2.3 Junction Box

The junction box for the ODU is located on the mounting plate with the BUCs. If provides the M&C interface between the ODU and the IDU controller. Refer to Appendix B for the connector interface pinout information.

3.3 Indoor Module

3.3.1 Front Panel

The WRK-340145-485-IS-01 controller front panel is divided into 5 sections, which include the following features;

- System Status VFD Display – displays the uplink and downlink and alarm statuses, with push-button and menu controls.
- Mode indication and push-button controls;
- System Element Status LED display;
- Redundancy Status LED controls and alarm display;
- Sub-system toggle controls.

The front panel appears in Figure 4. Its controls and indicators are listed in Table 5.

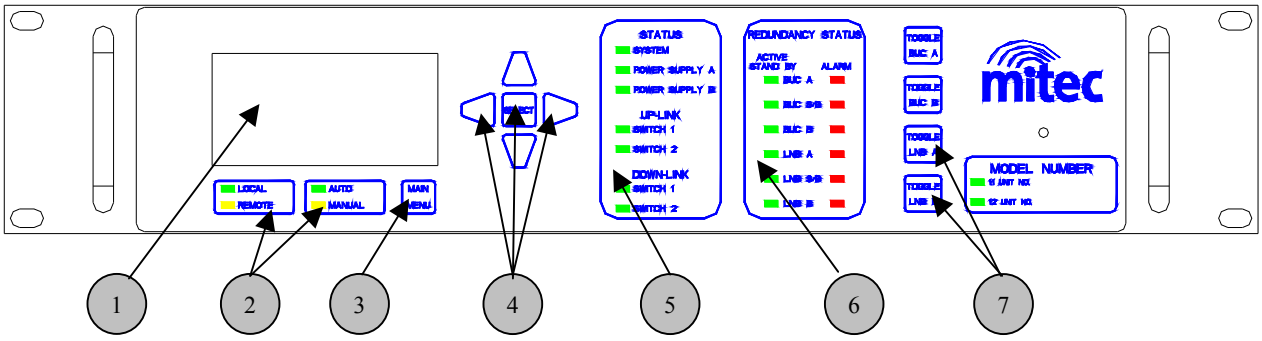


Figure 4 – WRK-340145-485-IS-01 Front Panel

Table 8 – WRK-340145-485-IS-01 Front Panel Features

Item	Description
1	VFD Display screen
2	Mode selection push buttons and LED display
3	MAIN MENU push button control
4	Direction arrows and select push buttons
5	System Element Status LED display
6	Redundancy Status LED display
7	Toggle Push button controls

3.3.2 LCD Menu Controls

On start up, the LCD display will first flash "Mitec", and then display the schematic of the uplink system, with the blinking cursor at the bottom of the screen on the DOWNLINK label. Pushing Select will display the downlink schematic.

Pushing the MAIN MENU button will display the top-level menu. From here, the user can toggle through the various lower-level screens to view the settings and statuses of the system and the elements that make up each chain. At any time, the user can push the MAIN MENU push button to return to the top-level menu.

NOTE

Chain B is an option for the 1:2 system configuration.

3.3.2.1 Main Menu

Uplink and Downlink - Allows user to select a specific chain. Once the chain has been selected, pushing select again will display the chain's status. At this level, the user can also choose to Mute a chain

View - Switches to view menu with schematic display.

3.3.2.2 Navigation

The UP/DOWN arrow buttons allow the user to browse through the menu.

- Right push button will display the lower-level menu selection options.
- LEFT push button will return the user to the previous menu.

There are two ways of navigating through the various screens.

3.3.2.3 Menu Mode

Pushing the SELECT button will display any lower level menu associated with the chosen menu option. By choosing an option and then pushing the select button the user will go further down in the menu ti the status of a single system element.

3.3.2.4 View Mode

In view mode, the appropriate system (uplink/downlink) schematic will appear, displaying:

- Switch positions indicated by icons
- Elements of the active chain, indicated by a dot inside their icons.
- BUC/Boosters/LNB/Switch alarms indicated by the appropriate icon blinking.

In view mode, pushing the Down arrow will move the cursor to an element in the chain. Pushing Select in this position will display the status of the chosen element.

Use the direction push buttons to move the cursor to another element.

3.4 Rear Panel

The rear panel houses the ac input sections and all the connectors for interfacing with other system equipment. The rear panel appears in Figure 5. Its various features are listed in Table 9.

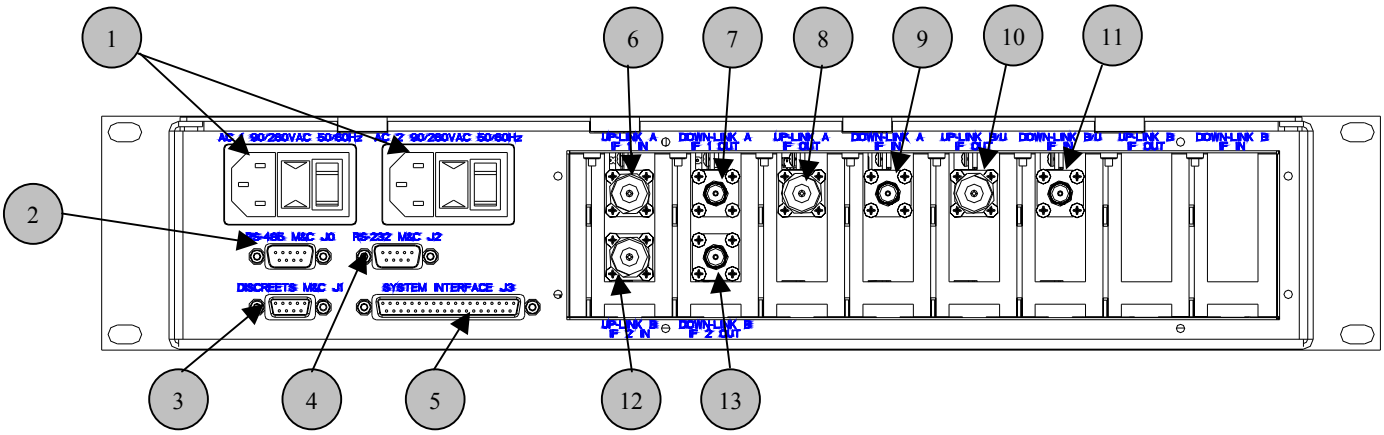


Figure 5 – WRK-340145-485-IS-01 Rear Panel

Table 9 – WRK-340145-485-IS-01 Rear Panel Features

Item	Description
1	Power Supply Modules
2	9-pin RS-485 Interface (J0)
3	9-pin Discrete M&C Interface (J1)
4	9-pin RS-232 M&C Interface (J2)
5	37-pin System Interface (J3)
6	N-Type Female Uplink A IF IN
7	F-Type Female Downlink A IF OUT
8	N-Type Female Uplink A IF OUT
9	F-type Female Downlink A IF IN
10	N-Type Female Uplink S/B IF OUT
11	F-type Female Downlink S/B IF IN
12	N-Type Female Uplink B IF IN
13	F-type Female Downlink B IF OUT

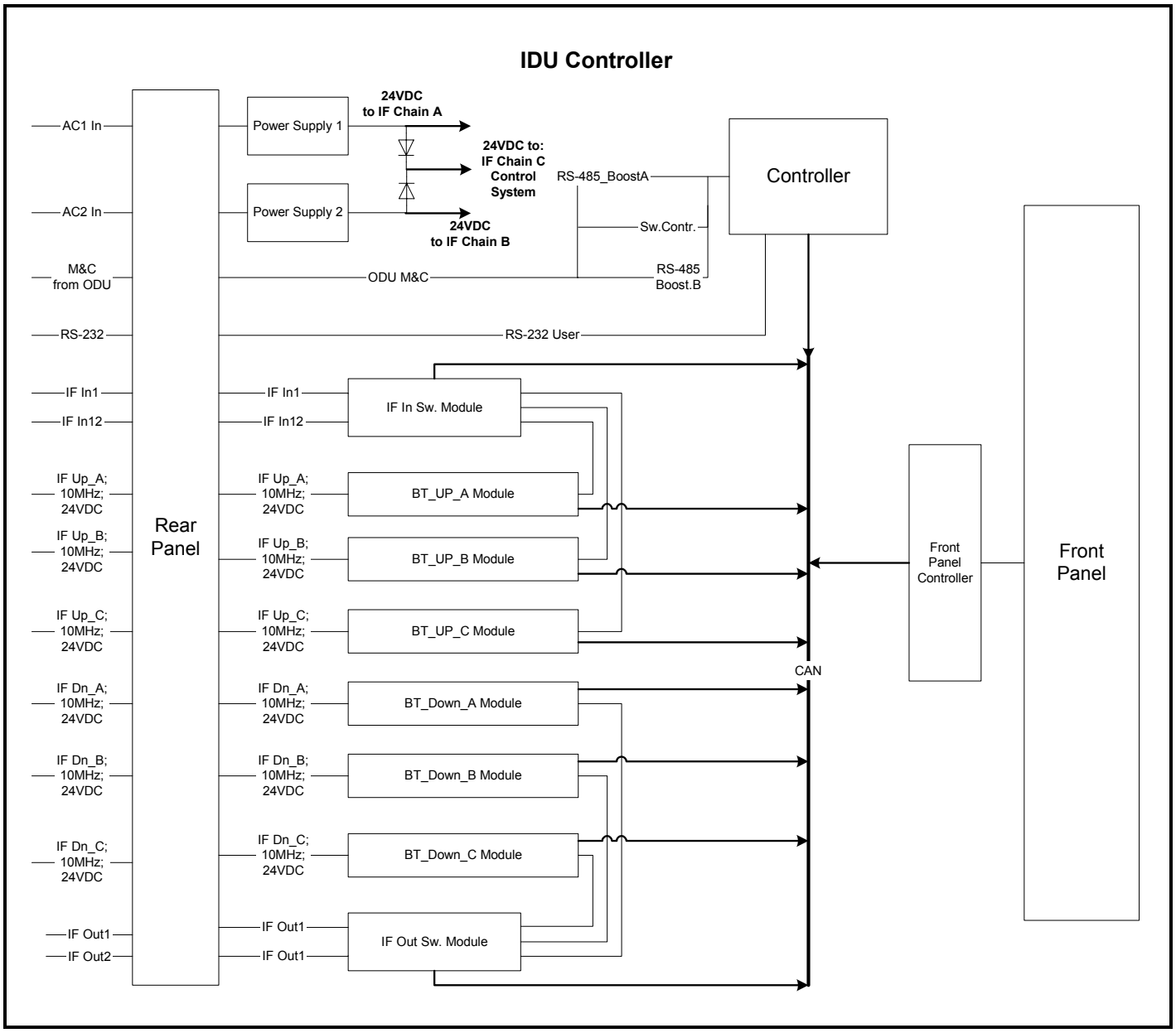
3.5 Functional Overview

The major components of the WRK-340145-485-IS-01 are:

- Power Supplies;
- Bias Tee Modules;
- Motherboard;
- Switching Modules

The IDU controller detailed block diagram, Figure 6, details its main components.

Figure 6 – IDU Detailed Block Diagram



Refer to Figure 7 for the location of the modules within the WRK-340145-485-IS-01 cabinet.

3.5.1 IF Input/Output Switching Module

The IF Input/Output Switching module is a plug-in PCB card providing configurable IF path switching for a 1:1 redundancy configuration.

The IF IN switching module provides switching from one IF In port (from the modem) to one output of two Bias Tee modules (IF_OUT-A or IF_OUT-B).

The IF OUT module provides switching from one IF OUT Port (going to the model) to one OUT of two Bias Tee Modules (IF_OUT_A or IF_OUT_B).

Table 10 - IF Switching Module Specifications

Parameter	Specification
Frequency	950MHz to 1525MHz
Impedance	50 Ohm
Return Loss at IF In/Out_1 and IF In/Out_2	-14dB max
Return Loss at IF In/Out_A,B,C	-14dB max
Insertion Loss	-3dB nom any IF path
Switch Control	CAN Interface
DC Supply Voltage	TBD
IF In/Out port DC characteristics	DC Block
IF In/Out port 10MHz Isolation	-40dBc max
Connectors: IF In / Out_1/2 IF_In/Out_A/B/S-B/C DC Supply CAN Interface	2 x 2 N-type female 3 x 2 SMA female TBD TBD

3.5.2 Power Supply Modules

The Power Supply Modules convert two redundant 90 to 260VAC 50-60Hz input AC voltages into 24VDC voltage supplying power to all IDU modules as well as to the BUCs and the LNBs within the ODUs .

Power is applied to the WRK-340145-485-IS-01 using the ON/OFF switches in the rear panel power input sections. If a failure occurs in one power supply, the second power supply module is capable of supplying ample power to continue operation. Each ac input has a 2A fuse in the line. To replace a fuse, remove the plastic cap in the rear panel AC module, replace the fuse and reinsert the plastic cap.

Table 11: Power Supply Technical Specifications

Parameter	Specification
Input	
Input Voltage	90 to 260VAC 50-60 Hz AC
Input Power	2 x 180W min
External Fuses	(?)

Parameter	Specification
Output	
DC Output Voltage	24 VDC
DC Current	3 x TBD A
Auxiliary DC Voltage	TBD
Short Circuit Protection	TBD
Connectors	
TBD	

3.5.3 *Bias Tee Module*

The Bias Tee Module with the IF path for Up/Down-Link provides the following functions:

- Generates high stability 10MHz reference signal;
- Injects 10 MHz reference signal into IF line;
- Injects 24 VDC into IF line;
- Monitors 10 MHz reference signal level, 24 VDC level, BUC/LNB current consumption
- Provides IF line Mute Control
- Provides all IF line telemetry via CAN Interface.

Table 12 - Bias-Tee Technical Specifications

Parameter	Specification
IF Parameters	
Input/Output IF Frequency	950 to 1525 MHz
Impedance	50 Ohm
Input/output Return Loss	-12 dB max
Output/Input Return Loss A/B/S-B/C (cold)	-12 dB max
Insertion Loss	5 dB nom
Reference Signal Frequency	10 MHz
Frequency Stability vs. Temperature	1x10e-8
Aging	5x10e-8/year
10MHz Source Warm Up Time within 10e-7	3 min max
10 MHz Output A/B/S-B	3 dBm min
10 MHz isolation to input	-50 dBc nom
10MHz level at IF Output/Input port	2dBm min
10MHz Source Phase Noise	-115 dBc/Hz, max@ 10 Hz off the carrier; -140 dBc/Hz, max@ 100 Hz off the carrier; -150 dBc/Hz, max @ 1 kHz off the carrier;

Parameter	Specification
M&C Functions (via CAN)	
Summary Alarm Status	*Broadcast in case of alarm*
10MHz Alarm (when polled)	If 10MHz level is below –10 dBm (?)
24VDC Alarm (when polled)	If DC supply voltage is below 15VDC
BUC/LNB Low Current Alarm (when polled)	If BUC/LNB current consumption is below Threshold
BUC/LNB High Current Alarm (when polled)	If BUC/LNB current consumption is below Threshold
Mute Status (when polled)	
Mute Control	
High Current Threshold Setting	Remembers setting at Power up
Low Current Threshold Setting	Remembers setting at Power up
Power Supply	
DC Supply Voltage	24VDC 2A min
Auxiliary Supply Voltage	(?) 5VDC 1A min
Short circuit protection	Overcurrent Shut Down (recoverable) at current consumption >4A (?)
Connectors	
IF Input/Output Connector	SMA female
IF Output/Input Connector	N-type female (rear panel)
10MHz Auxiliary	SMA female
CAN	TBD
DC Supply	TBD

3.5.4 *Master Controller*

The Master Controller communicates with the ODUs via RS-485 Serial Interface. It communicates with all IDU modules on the CAN BUS. It provides all System telemetry to the user via RS-232 or RS-485 User Interface. Master Controller makes decisions on System Redundancy Functions (?).

Table 13: Master Controller Technical Specifications

Parameter	Specification
Interfaces	
Booster (ODU) Serial Interfaces	3 x RS-485 half-full duplex compatible
Internal IDU Interface	CAN
Serial User Interface	RS-485 or RS-232 (both available)
Discrete User Interface	Contact Closure (?)
Discrete ODU interface	ODU Switches Control/Telemetry ODU Boosters Discrete Telemetry (contact closure)

Parameter	Specification
Control and Indicators via Booster Serial Interface	
Booster A/B/S-B/C Status	Active/Muted/Alarm
Booster A/B/S-B/C Output Power	20dB Dynamic Range
Booster A/B/S-B/C Case Temperature	Deg.C
Booster A/B/S-B/C Overtemperature Alarm	Case temperature >85deg.C +3/-5 deg.C
Booster A/B/S-B/C Com Status	Operational/Fault
Booster A/B/S-B/C Mute Control	
Control and Indicators via Booster Discrete Interface	
Booster Summary Alarm	Form C Relay (?)
Booster Mute Control	Contact Closure (?)
ODU Switch Control Interface	
TBD	
Control and Indicators via User Serial Interface	
See Tables in Paragraphs 2.2.1 and 2.2.2	
Control and Indicators via User Discrete Interface	
System Status	Operational / Fault – Contact Closure
BUC-Booster A / B / C Status	Operational / Fault – Contact Closure (?)
Redundancy Controls and Indicators	
Up/Down Link Chain A/B/S-B/C status	*Active/Stand by/Fault via*: User Serial Interface; CAN Interface (to the Front Panel Controller)
W/G Switches Up/Down - 1 / 2 Position	*via*: User Serial Interface; CAN Interface (to the Front Panel Controller)
Coax Switches Up/Down - 1 / 2 Position	*via*: User Serial Interface; CAN Interface (to the Front Panel Controller)
Switch Up/Down Link Control	*via*: Switch Control interface and CAN (to the Input Switching Module) User Serial Interface; CAN Interface (from the Front Panel Controller)
Power Supply	
Supply Voltage	5VDC 0.3A steady state; ?A peak **Redundant**

3.6 System Control Mechanism

3.6.1 Modes of Operation

The 1:1 Redundancy System Remote Controller WTX-340145-485-IS-01 can operate in:

- Auto Redundancy Control Mode
- Manual Redundancy Control Mode.

The current operating mode of the controller is reported on the front panel LED display.

NOTE

Auto Control Mode is a default mode of operation. The system is in Auto Control Mode when is powered up, even if it was in Manual Control Mode when was powered down. The reset Command also sets the system to Auto Control Mode.

3.6.1.1 Auto Control Mode

In Auto Control Mode, it provides all redundancy functions automatically. It constantly monitors and analyzes all subsystem statuses, decides on switching and executes switching from active to stand by unit when necessary. It allows the user to toggle from the active to the standby unit as long as the standby unit is not faulty.

All controls permitted in Auto Mode are available remotely via the RS-232/RS-485 User Interface or via the Remote Control panel. There is a Local/Remote Control Button on the Front Panel to switch from control via serial interface to local control using Front Panel. (Refer to Figure 4.)

3.6.1.2 Manual Control Mode

Manual Control Mode can be chosen for maintenance purposes, or in case if redundancy controller malfunctions. The system can be remotely switched to manual control mode via user serial interface or locally using front panel push button.

NOTE

In Manual Control Mode, the controller also provides all system monitoring, as in Auto Mode. However, in Manual Control Mode the controller only executes user commands and does not make any decisions on switching from a faulty unit.

3.6.2 Switching Criteria

The following events will trigger the up-link to automatically switch from active to stand by unit:

- The 10MHz signal level on the active chain is below threshold (Out of Lock Alarm). The affected chain BUC RED LED (A or S/B) will be illuminated;
- The active BUC current consumption is below low threshold or above high threshold (BUC Current Alarm). The affected chain BUC RED LED (A or S/B) will be illuminated;
- The active booster reports a Summary Alarm (Booster Alarm). The affected chain BUC RED LED (A or S/B) will be illuminated;
- The active Booster does not respond via the RS-485 interface (Booster Com Status Alarm). The affected chain BUC RED LED (A or S/B) will be illuminated.

The following events will trigger the downlink to automatically switch from active to stand by unit:

- The active LNB current consumption is below high threshold or above high threshold (LNB Current Alarm) The affected chain LNB RED LED (A or S/B) will be illuminated;

3.6.2.1 Waveguide Switch Manual Override

If the user changes the switch positions by manually turning the switch override directly on the waveguide switch, the system will follow by switching the corresponding IF switch to the same position.

3.6.3 System Alarm Relay Logic

Following is a summary of the system alarm relay logic.

Uplink Relay will declare an alarm if:

- The uplink waveguide switch is in alarm
- Any one of the BUCs is in alarm (not 10MHz alarm)
- Any Booster is in alarm

Downlink Relay will declare an alarm if:

- The downlink waveguide switch is in alarm
- Any one of the LNBs is in alarm

System Relay will declare an alarm if:

- Any power supply fails
- An IF switch fails
- Bias-Tee (10MHz) Alarm
- IF switch board communication alarm

The "**SYSTEM STATUS**" LED on the front panel will show an alarm if no uplink chain is operational or no downlink chain is operational. Conditions that can cause the system failure include;

- Both uplink chains are in alarm
- Both downlink chains are in alarm
- A waveguide switch is out of position
- One uplink chain AND the other power supply are in alarm, or one downlink chain AND the other power supply are in alarm.

3.6.4 Standby Failure and Alarms

In AUTO mode, a standby unit exhibits any of the alarms listed above, the redundancy controller will not switch. It will broadcast System Failure via the user serial interface and the front panel LEDs, and will turn ON the audible alarm on the remote control panel. Pushing any of the display control push buttons will switch the audible alarm OFF. The audible alarm can be switched OFF permanently in the System Settings Display Menu. It will be reset back on again after the system is powered down and then powered up.

The System Failure will be also be reported when any of the following conditions occur:

- Up-Link W/G Switch Failure (Uplink Switch1 Alarm RED LED will be illuminated);
- Up-Link Coax switch Failure (Uplink Switch1 Alarm RED LED will be illuminated);
- Downlink W/G Switch Failure (Downlink Switch1 Alarm RED LED will be illuminated);
- Downlink Coax Switch Failure (Downlink Switch1 Alarm RED LED will be illuminated);
- Redundancy Controller failure;
- Both Power Supplies fail.

3.6.4.1 Alarm LEDs

Following is a more detailed description of the conditions that will illuminate an alarm LED.

Switch Alarm (Uplink or Downlink)

When either an IF or RF switch is stuck between positions, cannot move to the other position or when the switches are out of synchronization, the affected switch alarm RED LED will illuminate. If the switch if stuck between positions, the redundancy switching controller will attempt to try to reposition the switch 5 times, in 0.5 second intervals. If it is still stuck, the controller will declare a system alarm and repeat these retries every 30 seconds. When the waveguide switch is stuck between positions, the controller will try to drive it by default to side A, then if side A is in alarm, normal logic takes place. If the switch is out of synchronization, the controller will attempt to return it to normal, as follows:

1. Treating the waveguide switch as the master, the controller will first try to synchronize the IF switch with the waveguide switch.

2. If this is unsuccessful, the controller will try to move the IF switch to the same position as the waveguide switch.

BUC Alarm (A or S/B)

The affected BUC RED alarm LED will illuminate if the following conditions occur:

- 10 MHz Alarm;
- BUC over current (or low current); this is latching. It will remain on even when the over current disappears. The controller reset via RS-232 is required to remove this alarm.
- Short circuit on an IF line; will recover once the short circuit condition is removed.
- Booster Summary alarm;
- Communication Alarm.

LNB Alarm (A or S/B)

The affect LNB RED alarm LED will illuminate if the following conditions occur:

- LNB over current (or low current); this is latching. It will remain on even when the over current disappears. The controller reset via RS-232 is required to remove this alarm.
- Short circuit; will recover once the short circuit condition is removed.

Power Supply Alarm

A Power Supply RED alarm LED will illuminate if the DC voltage from that power supply drops below 20V.

3.7 Serial Protocol

Refer to the serial protocol specification document for the 1:1 Up/Downlink Redundant system in Appendix C.

3.8 Controls and Indicators

3.8.1 Controls

Table 14 describes the controls available for the various modes of operation.

Table 14 - System Controls

#	Control	Description	
	Controls via RS-232/485 User Interface		**Default Setting**
1	System Mute Control	Mutes the System	Unmuted
2	Down-Link Mute Control	Mutes Both LNBs	Unmuted
3	Up-Link Mute Control	Mutes Both BUCs	Unmuted
4	BUC A/BU Mute Control	Mutes BUC A/BU	Unmuted
5	Toggle Down-Link	Switches Active/Stand by LNB	LNB A active
6	Toggle Up-Link	Switches Active/Stand by BUC	BUC A active
7	Manual Mode Control	User Controls Redundant System	Manual Mode off
8	Local/Remote Control	Switches Front panel vs. RS-232 Control	Remote Control
11	Reset	Resets Microcontroller	

	Internal Controls / Protections		Initial Settings
14	BUC A/BU Out of Lock Shut Down	Internally Set	
15	BUC A/BU Over Temperature Shut Down	Internally set	+85 ± 2deg.C
16	BUC A/BU Overcurrent Shut Down	Internally set for each BUC	
17	LNB A/BU Overcurrent Shut Down	Internally set for each LNB	± 1.5dB max
	Manual Controls (Front Panel)		
20	Up-Link Mute Control	Push Button via Display Menu	
21	Down-Link Mute Control	Push Button via Display Menu	
	BUC A/BU Mute Control	Push Button via Display Menu	
22	Up-Link Toggle	Push Button Front Panel	
23	Down-Link Toggle	Push Button Front Panel	
	LNB A/BU Mute Control	Push Button via Display Menu	
24	Local/Remote	Push Button Front Panel	
27	Manual Mode/Auto Mode	Push Button Front Panel	
28	System On/Off Control	2 x On/Off VAC Switches Rear panel	
30	Audible Alarm Reset	Switches off an Audible Alarm	

3.8.2 Indicators

Table 15 describes the interface and panel indicators available in each mode.

Table 15: System Indicators

#	Indicator	Description
	Indicators via RS232/RS485 User Interface	
1	Up-Link Status	Operating / Fault
2	Down -Link Status	Operating / Fault
3	Booster A/BU Status	Operational/Muted/Fault
4	10 MHz Reference A/BU status	Operational/Fault
5	LNB A/BU Status	Operational/Mute/Fault
6	BUC A/BU Status	Operational/Muted/Fault
7	Up-Link Switch Status	A / BU / Fault
8	Down -Link Switch Status	A / BU / Fault
9	Power Supply A Status	Operational/Fault
10	Power Supply B Status	Operational/Fault
11	Booster A Temperature	Degree C
12	Booster BU Temperature	Degree C
13	Booster A Output Power	20dB Dynamic range
14	Booster BU Output Power	20dB dynamic range
15	Up-Link Output Power	20dB dynamic range
16	Low Output Power Warning	20 dB below rated power
17	Booster A/BU Over Temperature Alarm	Operational/Fault
18	Booster A/BU Com Status	Operational/Fault
19	BUC A/BU Over Current Alarm	Operational/Fault
20	BUC A/BU low current Alarm	Operational/Fault
21	LNB A/BU Over Current Alarm	Operational/Fault
22	LNB A/BU low current Alarm	Operational/Fault
	Indicators via Discrete Interface	
23	System Status	Operational / Fault – Contact Closure
24	Up-Link Status	Operational / Fault – Contact Closure
25	Down-Link Status	Operational / Fault – Contact Closure

#	Indicator	Description
	Panel Indicators	
	Front Panel LED:	
26	System Status Bicolor LED	G-Operational / R-Fault
27	Power Supply A / B Status Bicolor LED	G-Operational / R-Fault
28	Up-Switch 1Status Bicolor LED	G-Operational / R-Fault
29	Down- Switch 1 Status Bicolor LED	G-Operational / R-Fault
30	Up-link Redundancy Status Bicolor LED	G - Active BUC / Y - Stand by BUC
31	Down-Link Redundancy Status Bicolor LED	G - Active LNB / Y - Stand by LNB
32	BUC A/B/S-B Status LED	R – Alarm; Operational - off
33	LNB A/B/S-B Status LED	R – Alarm; Operational - off
34	Redundancy Operation Mode LED	Auto Yellow LED / Manual Green LED
35	Control Mode	Local Green LED / Remote Green LED
36	Audible Alarm	Audible Alarm is on in case of System Fault
	Front Panel Display	
37	10 MHz 1 / 2 Status	Operational / Alarm
38	BUC A/B/S-B Status	Operational / Mute / Alarm
39	Booster A/B/S-B Summary Alarm Status	Operational / Mute / Alarm
40	Booster A/B/S-B Temperature	Deg.C
41	Booster A/B/S-B Output Power	Low Power Warning/ Pout [dBm] / Overpower Warning
42	Booster A/B/S-B Com Status	Operational / Alarm
43	LNB A/B/S-B Status	Operational / Mute / Alarm
44	Up-Switch ½ (output) Position	A / BU / Fault
45	Up-Switch ½ (input) Position	A / BU / Fault
46	Down-Switch ½ (output) Position	A / BU / Fault
47	Down-Switch ½ (input) Position	A / BU / Fault

3.9 System Interfaces

Refer to the tables in Appendix B for detailed connector definitions and pinout lists for all of the system interfaces.

3.10 General Considerations

The system shall meet all specifications over the full bandwidth and under all environmental conditions, when terminated in a load VSWR of 1.5:1, unless otherwise specified. All RF specifications shall be met within five minutes after the DC power application, except gain stability, which shall be met after a warm-up period of twenty minutes. During the warm-up period, the module shall not exhibit any alarm or require an RF mute input signal to reset any alarm/fault latches.

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4 Maintenance

This chapter contains information on how to maintain, troubleshoot and repair the system. It is extremely reliable, requiring very little preventive maintenance, or repair. Should there be a malfunction, this chapter also contains technical information to help diagnose basic failures.

4.1 Preventive Maintenance

WARNING!

Before any maintenance is attempted, make sure that the power to the system/unit in maintenance is turned OFF. Failure to observe this precaution may result in personal injury. This includes the removal of any RF power originating from other system components

4.1.1 WRK-596446-485-ES-02

This Uplink redundant system includes two mitec standard WTX-596446-70-ES-35 BUC/boosters. Refer to the WTX-596446-485-ES-01 Operation and Maintenance manual for maintenance instructions for these modules.

4.1.2 WRK-340420RX-ES-02

This Downlink redundant system includes two LNBs, which are manufactured by NJRC, item numbers NJS8477SF. Refer to the LNB manufacturer for maintenance requirements.

4.1.3 WRK-340145-485-IS-01

The WRK-340145-485-IS-01 indoor redundant system controller requires no preventive maintenance.

If internal modules require replacement, the following sequence of steps should be carried out.

WARNING!!

Make sure to disconnect the affected power cord before attempting to replace parts. Failure to do so may result in electrical shock.

1. Turn off power and disconnect power cords.
2. Slide the unit clear of the rack.
3. Remove hardware securing the enclosure top.
4. To replace a power supply module, disconnect all connections from the power supply, replace with new part, and reconnect.
5. To replace a bias-tee or switching module, disconnect connectors and remove screws at either end of the board supports. Replace board, refasten in place and reconnect.

Refer to the top-view in Figure 7 and Table 16 for main component placement. For clarity, wiring has been omitted from this drawing.

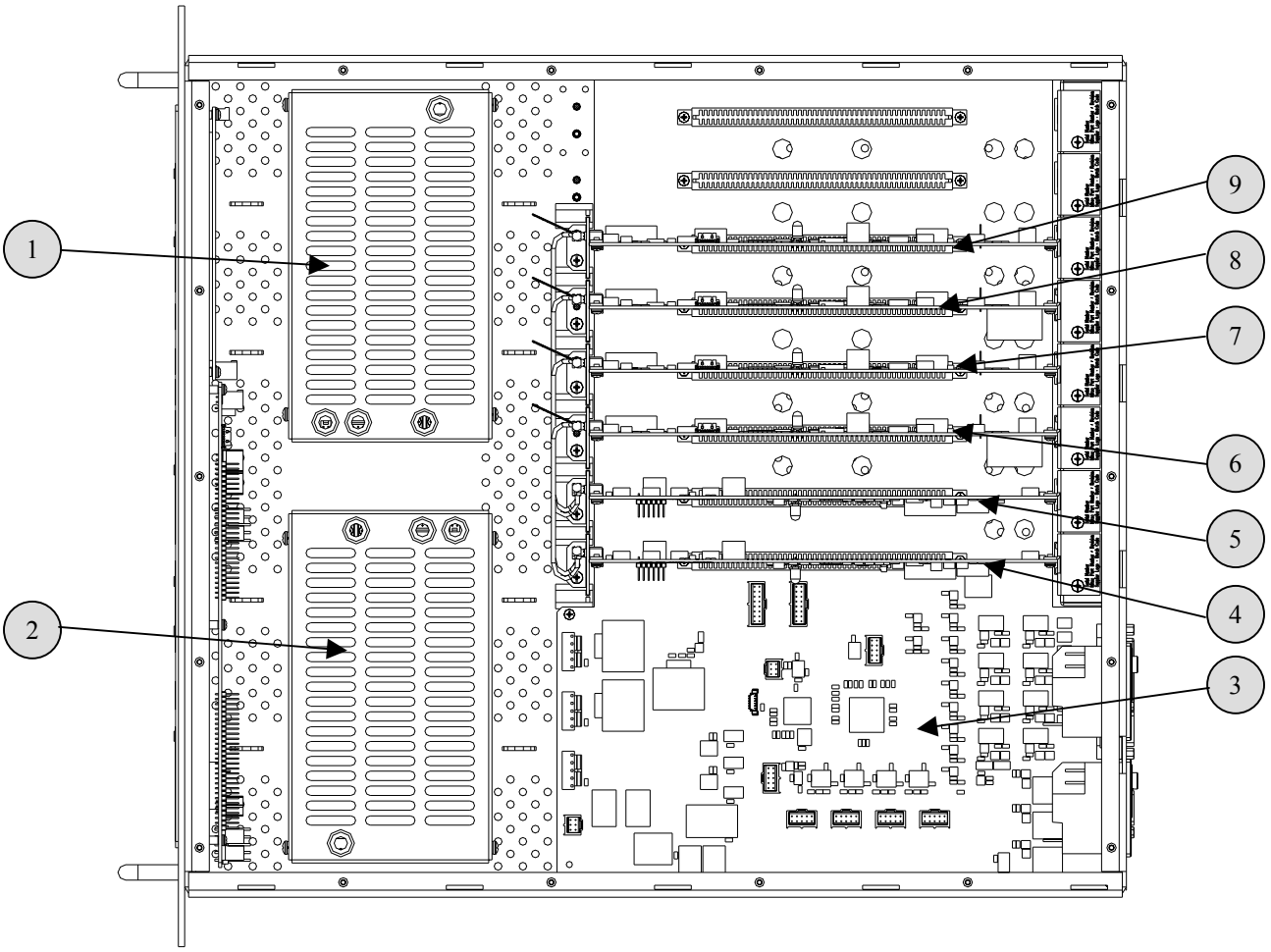

Figure 7 - Internal Top-view

Table 16 - Main Component Placement

Item	Description
1	Power Supply Module 2
2	Power Supply Module 1
3	Master Controller
4	Uplink Switching Module
5	Downlink Switching Module
6	BT-UP A Module
7	BT-DOWN A Module
8	BT-UP S/B Module
9	BT-DOWN S/B Module

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Appendix A

Drawings & Schematic Diagrams

1:1 Redundancy Control System Detailed Block Diagram

WRK-596446-485-ES-02AD Assembly Drawing

210244-003 Switch Control Cable

210245-002 BUC M&C Cable

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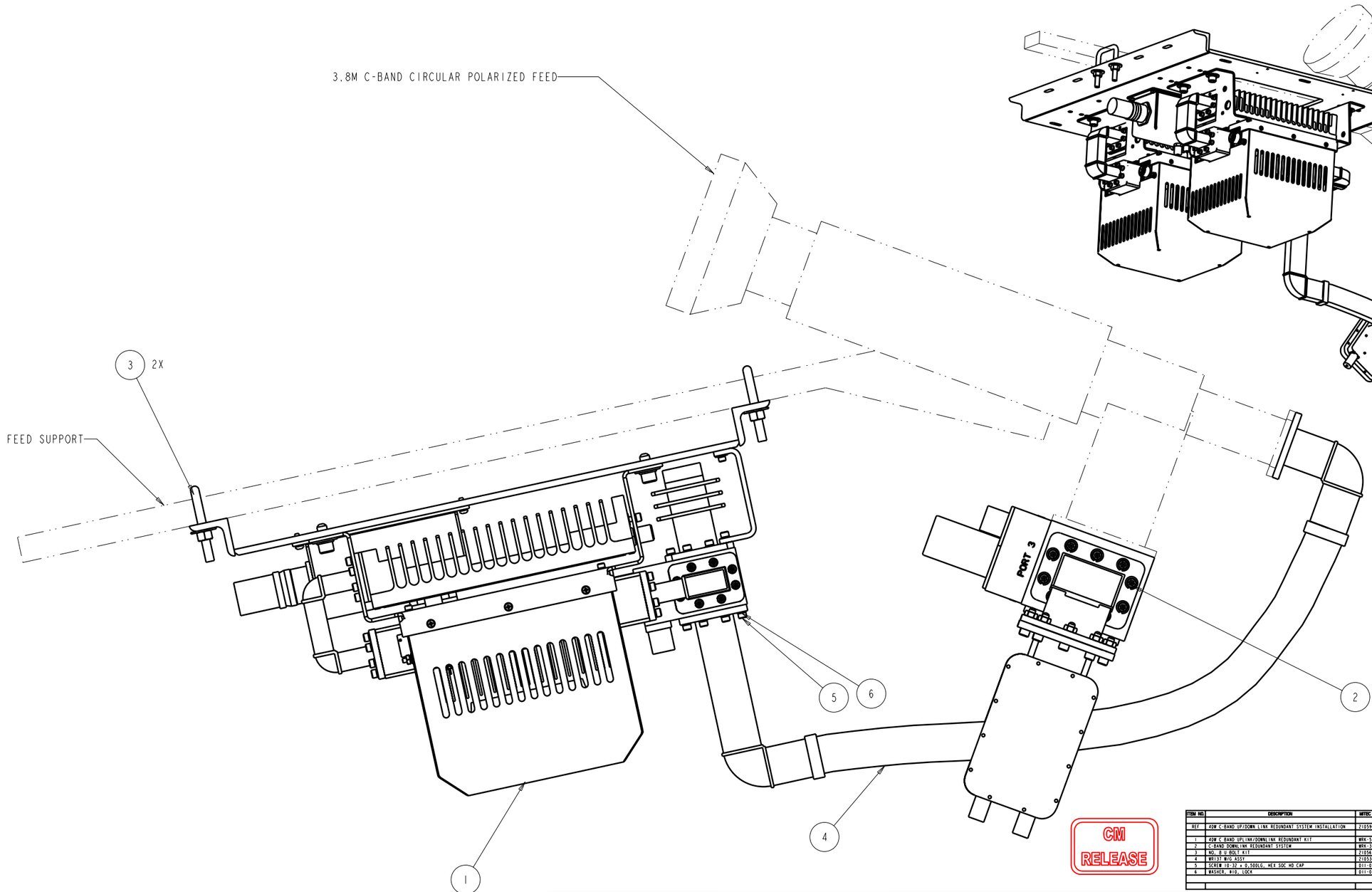

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REF ONLY

CM RELEASE

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REF	40W C-BAND UP/DOWN LINK REDUNDANT SYSTEM INSTALLATION	210590	1		
1	40W C BAND UPLINK/DOWNLINK REDUNDANT KIT	WRK-596446-485-ES-02	1		
2	C-BAND DOWNLINK REDUNDANT SYSTEM	WRK-340420RK-ES-02	1		
3	NO. 8 U BOLT KIT	210567SC	2		
4	WR137 B/G ASSY	210536-01	1		
5	SCREW 10-32 x 0.500LG, HEX SOC HD CAP	011-0191	8		
6	WASHER, #10, LOCK	011-0216	8	-	-

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DESIGNER:	J S DATE: Oct 21,05	

UNLESS OTHERWISE SPECIFIED		
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ABOVE 6.00 TO 24.00	±.03	±.010
ABOVE 24.00	±.06	±.015
ANGULAR DIMENSIONS	±1/2 DEG.	
FRACTIONAL DIMENSIONS	±1/64	
SURFACE FINISH	63	
DO NOT SCALE DRAWING		

TITLE: 40W C-BAND UP/DOWN LINK REDUNDANT SYSTEM INSTALLATION

MATERIAL: N/A

FINISH:

PROJECT NO: / JOB NO:

NEXT ASSEMBLY:

CAGE IDENT. NO: 38494

SIZE: D

DRAWING NO: 210590AD

SCALE: 0.500

SHEET: 1 OF 1

(FORM 11477-008CF REV 3)

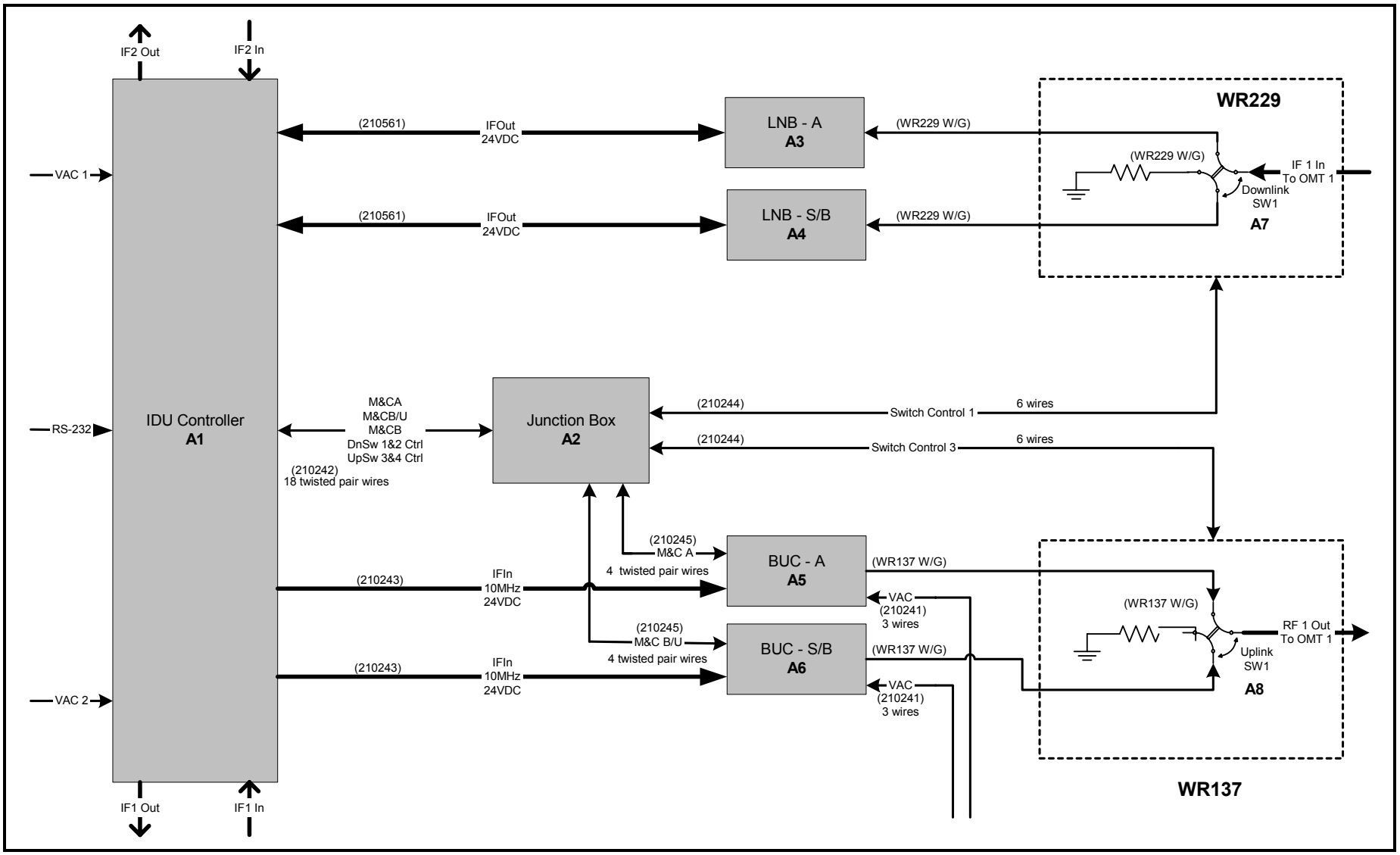

Figure 8 – Detailed System Block Drawing

REVISION			
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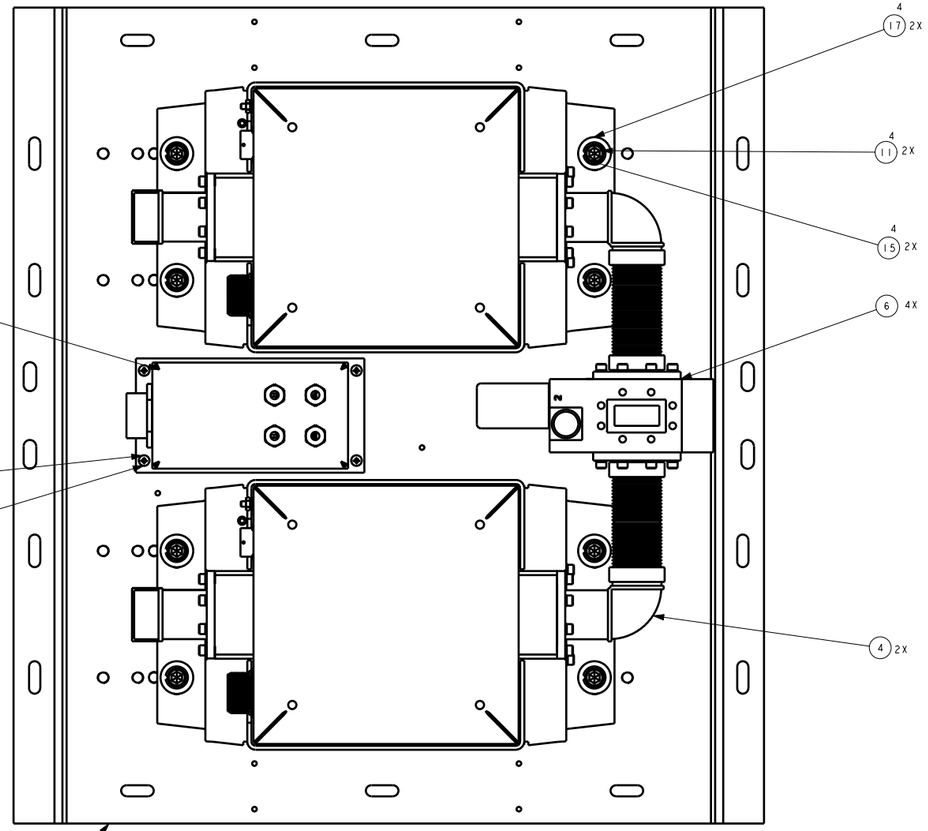
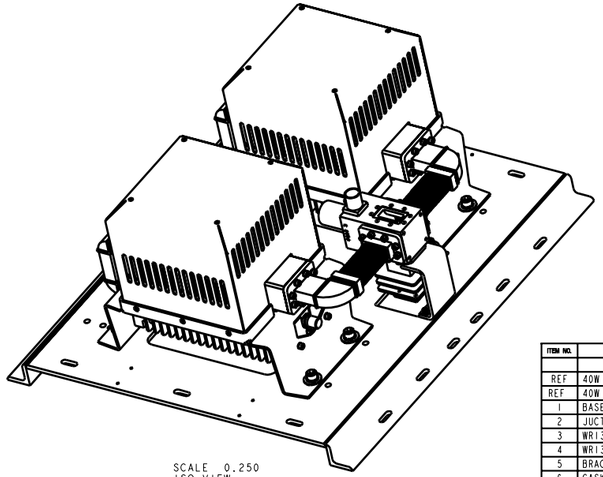
3	ECN 297-055	NOV 22.05	





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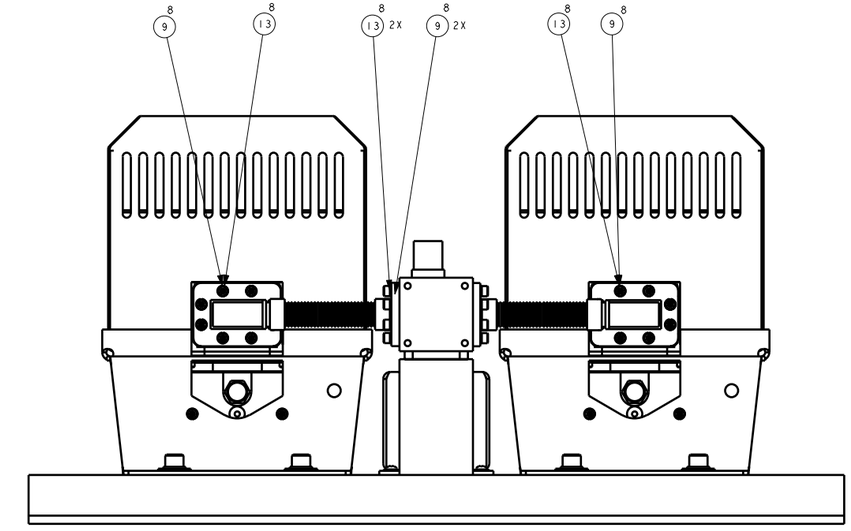
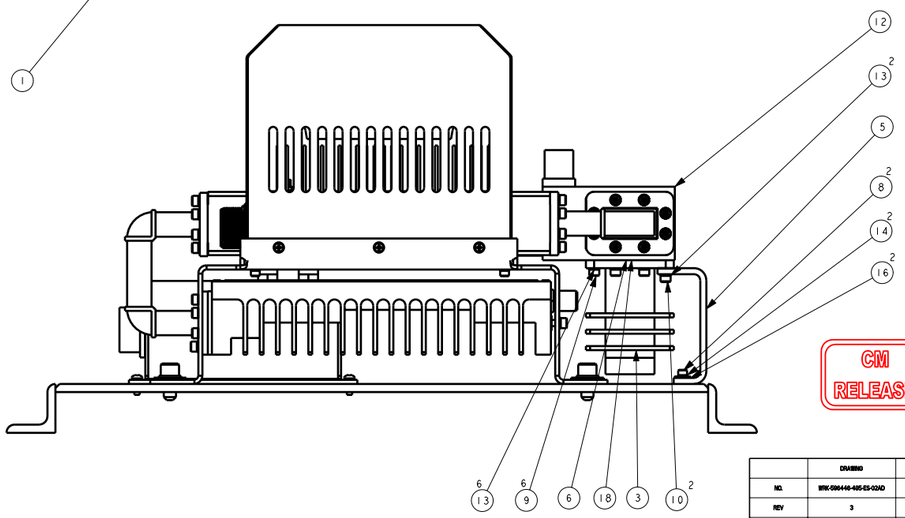
REF	40W C-BAND HPA WITH BUC ASSEMBLY	WTX-595446-70-ES-35	REF		
1	BASE BRACKET	7507257-01	1		
2	JUCTION BOX USED ON 1:1 UP LINK/DOWN LINK REDUNDANT SYSTEM	210251-001	1		
3	WR137 TERMINATION	13405-001AD	1		
4	WR137 W/G ASSY	2937545-01	2		
5	BRACKET, C-BAND UPLINK REDUNDANT SYSTEM	210497	1		
6	GASKET	002-0005	5		
7	No.8 PAN PHILLIPS 0.50 LENGTH	011-0145	4		
8	SCREW 8-32 x 0.500LG, HEX SOC HD CAP	011-0146	2		
9	SCREW 10-32 x 0.500LG, HEX SOC HD CAP	011-0191	38		
10	SCREW 10-32 x 0.625LG, HEX SOC HD CAP	011-0195	2		
11	SCREW 3/8-16 x 0.750LG, HEX SOC HD CAP	011-0262	8		
12	SWITCH, W/G, WR137, SMI	017-0193	1		
13	WASHER, #10, LOCK	011-0216	40	-	-
14	WASHER, #8, LOCK	011-0177	6	-	-
15	WASHER, 3/8, LOCK	011-0274	8	-	-
16	WASHER, FLAT, #8	011-0176	2		
17	WASHER, FLAT, 3/8	011-0273	8		
18	WR137 WG FLANGE CRP SHIM	2520983	1		
	WAVEGUIDE HARDWARE KIT	210718	2	SHIPPING LOOSE	
	3/8 U-BOLT KIT	011-1011	2	SHIPPING LOOSE	





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DESIGNER:	J.S M.L	DATE: Oct 13.05

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ABOVE 6.00 TO 24.00	±.03	±.010
ABOVE 24.00	±.06	±.015
ANGULAR DIMENSIONS	±1/2 DEG.	
FRACTIONAL DIMENSIONS	±1/64	
SURFACE FINISH	63	
DO NOT SCALE DRAWING		

TITLE: 40W C BAND UPLINK/DOWNLINK REDUNDANT KIT
MATERIAL: N/A
FINISH: N/A

PROJECT NO: / JOB NO:
NEXT ASSEMBLY:
CAGE IDENT. NO: 38494
SIZE: D
DRAWING NO: WRK-596446-485-ES-02AD
SCALE: 0.450
SHEET: 1 OF 1

(FORM 11477-008CF REV 3)

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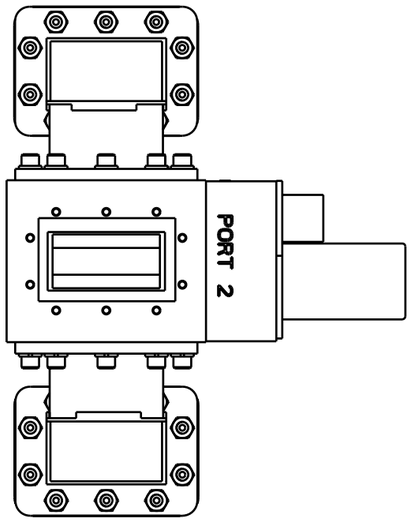

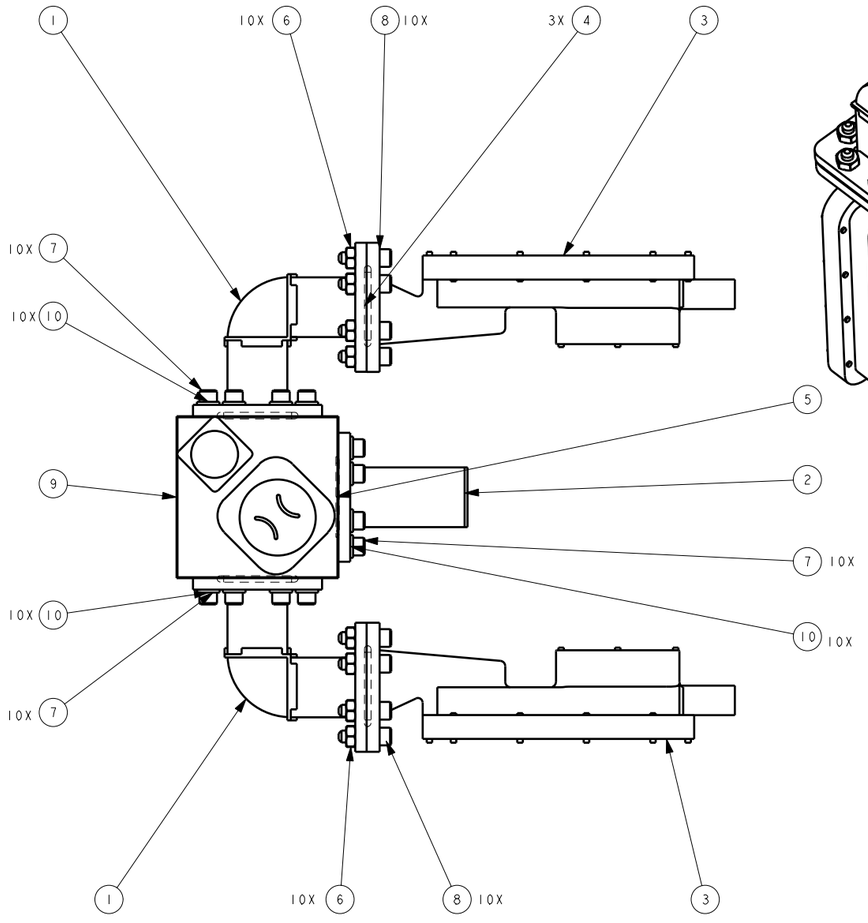

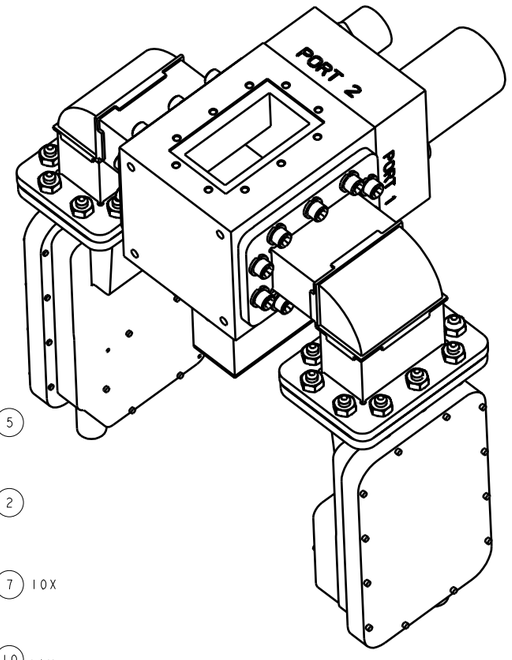

ISO VIEW
REF ONLY

CM RELEASE

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1	WR 229 W/G ASSEMBLY	210533-001	2		
2	WR229 LOW POWER TERMINATION	2523292-2-2	1		CPRF
3	C BAND PLL LNB F-FEMALE TYPE	067-0004	2	NJ8477S	
4	GSKT RECTANGULAR O-RING FOR CPR 229	1511308-2	4		
5	GSKT RECTANGULAR O-RING FOR CPR137	1511309-2	1		
6	NUT 1/4-20UNC, HEX	011-0254	20	-	-
7	SCREW 1/4-20 x 0.625LG, HEX SOC HD CAP	011-0231	30		
8	SCREW 1/4-20 x 0.875LG, HEX SOC HD CAP	011-0237	20		
9	SWITCH, WR112 DUAL, 7.9-8.4GHz, SMT	017-0194	1	HAF6	
10	WASHER, #1/4, LOCK	011-0260	30	-	-
	WAVEGUIDE HARDWARE KIT	210719	1	SHIPPING LOOSE	

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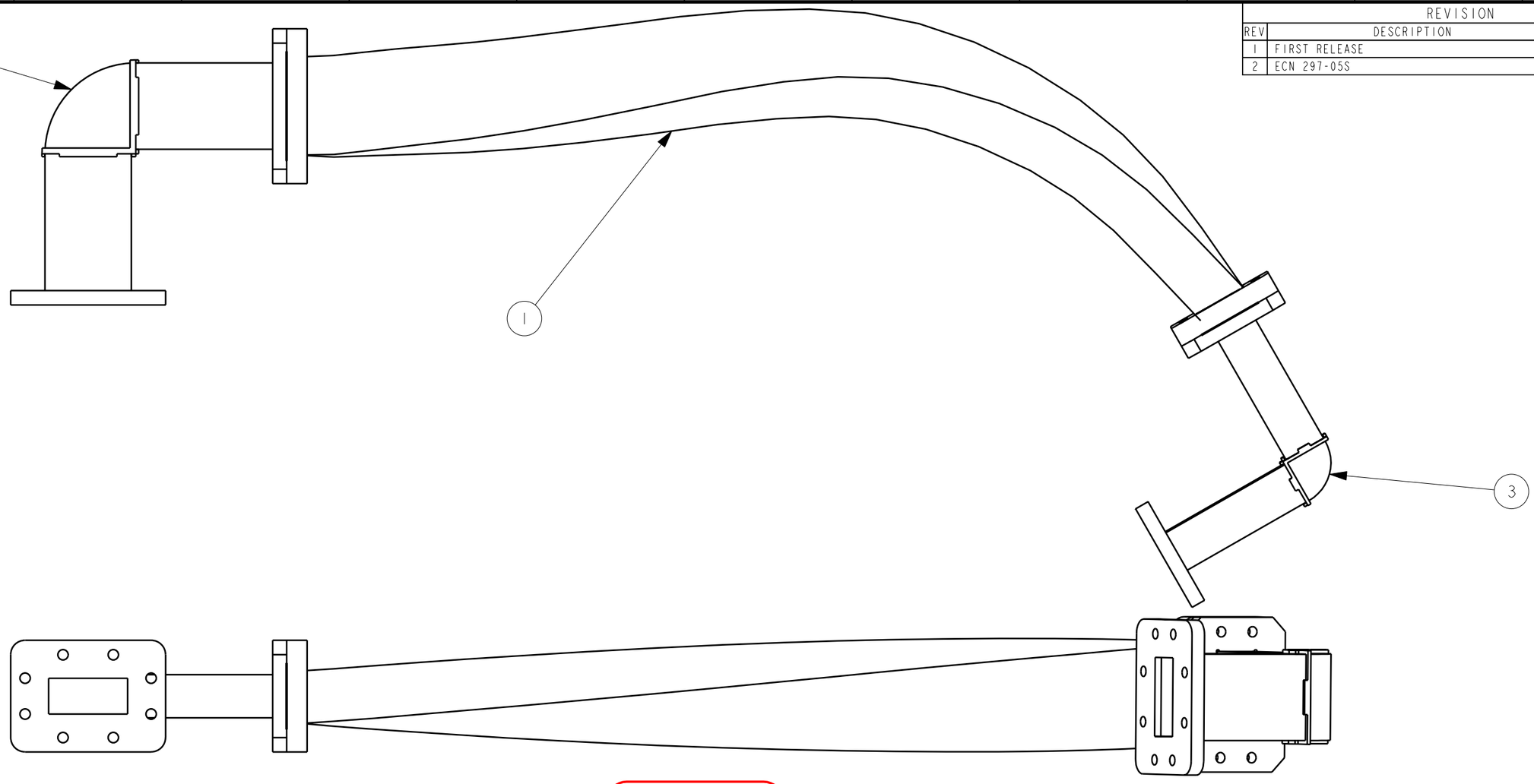
ABOVE 6.00 TO 24.00	± .03	± .010
ABOVE 24.00	± .06	± .015
ANGULAR DIMENSIONS	± 1/2 deg.	
FRACTIONAL DIMENSIONS	± 1/64	
SURFACE FINISH	63	
DO NOT SCALE DRAWING		

TITLE: C-BAND DOWNLINK REDUNDANT SYSTEM
MATERIAL: N/A
FINISH:

PROJECT NO: / JOB NO:
NEXT ASSEMBLY:
CAGE IDENT. NO: 38494
SIZE: C
DRAWING NO: WRK-340420RX-ES-02AD
SCALE: 0.500
SHEET: 1 or 1

(FORM 11477-007CF REV 3)

REVISION			
REV	DESCRIPTION	DATE	APP
1	FIRST RELEASE	Nov 28,05	.
2	ECN 297-05S	NOV 28,05	



CM RELEASE

ITEM NO.	DESCRIPTION	MITEC DRAWING/PART NO.	QTY	MFR. PART NO.	COMMENTS/MFR.
REF	WR137 W/G ASSY	210536-001	1		
1	WR 137 FLEX ASSY	210744-001	1		
2	WR 137 W/G ASSY	210743-001	1		
3	WR 137 W/G ASSY	210743-002	1		
	HWARE WR 137 CPR FULL GASK	P2520589-5	2		

	DRAWING	PART
NO.	210536-001AD	210536-001
REV	2	2
STATE		

ORIGINATOR: JS DATE: Nov 28,05

DESIGNER: JS DATE: Nov 28,05

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES

BASIC DIMENSIONS	2 DEC.	3 DEC.
UP TO 6.00	±.02	±.005
ABOVE 6.00 TO 24.00	±.03	±.010
ABOVE 24.00	±.06	±.015
ANGULAR DIMENSIONS	±1/2 DEG.	
FRACTIONAL DIMENSIONS	±1/64	
SURFACE FINISH	63	

DO NOT SCALE DRAWING

TITLE: WR137 W/G ASSY

MATERIAL:

FINISH:

CAGE IDENT. NO: 38494

SIZE: B

DRAWING NO: 210536-001AD

PROJECT NO: / JOB NO:

NEXT ASSEMBLY: 210590

SCALE: 0.500

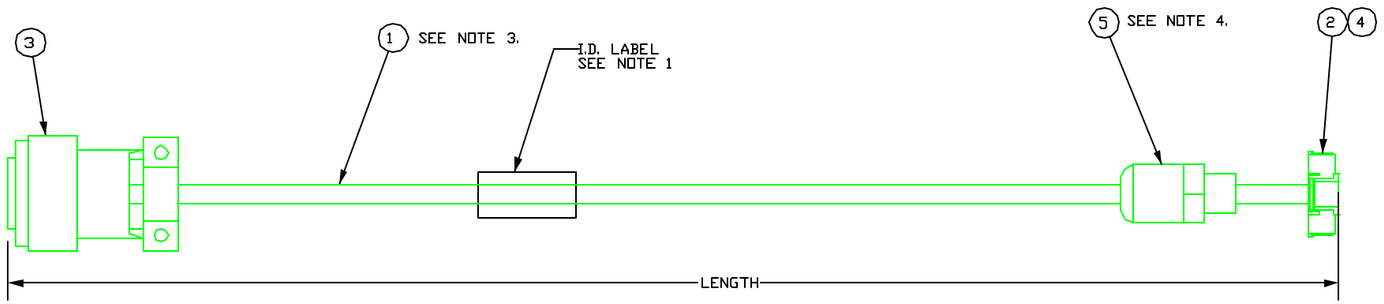
SHEET: 1 OF 1

(FORM 11477-006CF REV 3)

REVISION			
REV	DESCRIPTION	DATE	APP
1	FIRST RELEASE	NOV 24/05	.

ITEM NO	DESCRIPTION	MITEC DRAWING/PART NO.	QTY	MFR. PART NO.	COMMENTS/MFR.
REF		210244-000	1		
1	CABLE		1		SEE NOTE 3
2	2.00MM PITCH SHERLOCK WIRE TO BOARD RECEPTACLE	0DL-U88B	1		
3	CONN CYL PWR L4 F3 MS3116 S E 7.5	4845844	1		
4	CRIMP TERMINAL FEMALE 2MM	0DL-U89	6		
5	LIQUID TIGHT FITTING	045-0232	1		SEE NOTE 4

NOTE:
1 -MARK/IDENTIFY PARTS AS PER MITEC QPP-1050
2 -ALL SUPPLIERS SHALL COMPLY WITH QPP-1113 REQUIREMENTS AS CALLED OUT IN PURCHASE ORDER
3 -CABLE SHOULD BE 6 CONDUCTOR 24 AWG. OVERALL SHEILDED UV PROTECTED JACKET OPERATING TEMP. -20°C TO 60°C. REF. BELDEN # 9536
4 -ITEM 5 MUST BE INSERTED BEFORE ASSEMBLING ITEM 2 AND 4.



DASHES	LENGTH IN FOOT	DESCRIPTION
-001	1	SWITCH CTRL CABLE
-002	2	SWITCH CTRL CABLE
-003	3	SWITCH CTRL CABLE
-004	4	SWITCH CTRL CABLE
-005	5	SWITCH CTRL CABLE
-006	6	SWITCH CTRL CABLE
-007	7	SWITCH CTRL CABLE
-008	8	SWITCH CTRL CABLE
-009	9	SWITCH CTRL CABLE
-010	10	SWITCH CTRL CABLE

WIRING TABLE

FROM ITEM 2		ITEM 3	
PIN	WIRE COLOR	PIN	SIGNAL NAME
1	BLACK	A	SW DRV 1
2	WHITE	B	SW DRV RTN (GND)
3	RED	C	SW DRV 2
4	GREEN	D	SW IND 1
5	BROWN	E	SW IND RTN (GND)
6	BLUE	F	SW IND 2

CM RELEASE

	DRWG	PART
NO.	210244-000AD	210244-000
REV	L	J
STATE		
ORIGINATOR	DARCY CRAWLEY	DATE: Oct 31,05
DESIGNER	NORMAND ROY	DATE: Oct 31,05

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES

BASIC DIMENSIONS	2 DEC.	3 DEC.
UP TO 6.00	±.02	±.005
ABOVE 6.00 TO 24.00	±.03	±.010
ABOVE 24.00	±.06	±.015
ANGULAR DIMENSIONS	±1/2 deg.	
FRACTIONAL DIMENSIONS	±1/64	
SURFACE FINISH	√	

DO NOT SCALE DRAWING

TITLE: SWITCH CTRL CABLE
MATERIAL:
FINISH:

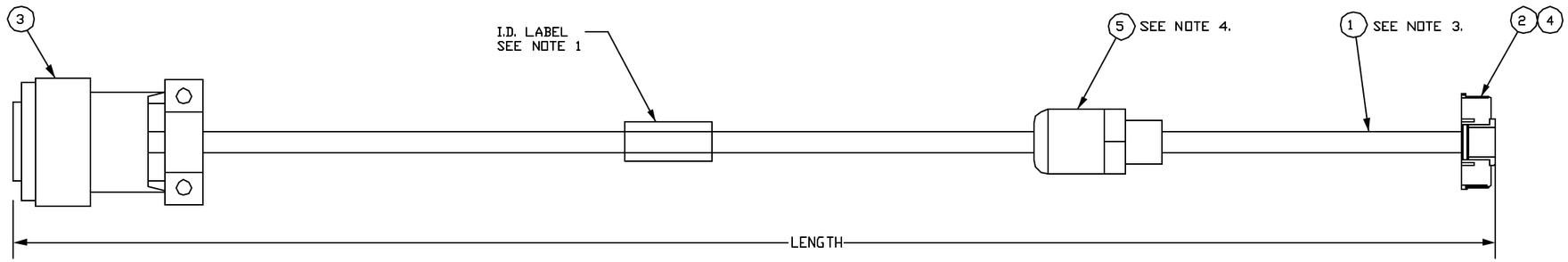
PROJECT NO: / JOB NO:
NEXT ASSEMBLY:
CAGE IDENT. NO: 38494
SIZE: C
DRAWING NO: 210244-000AD
SCALE: 1.000
SHEET: 1 OF 1

(FORM 11477-007CF REV 3)

REVISION			
REV	DESCRIPTION	DATE	APP
1	FIRST RELEASE	NOV 24/05	.
1.1	Roling ECN 297-05S	Dec 9	N.

ITEM NO.	DESCRIPTION	MITEC DRAWING/PART NO.	QTY	MFR. PART NO.	COMMENTS/MFR.
REF		210245-000	1		
1	CABLE	-	1		SEE NOTE 3
2	2.00MM PITCH SHERLOCK WIRE TO BOARD RECEPTACLE	001-1088	1		
3	CONN. CYL PWR 14 15 MS3116 S E 7.5	4849013	1		
4	CRIMP TERMINAL FEMALE 2MM	001-1089	6		
5	LIQUID TIGHT FITTING	046-0232	1		SEE NOTE 4

NOTE:
1 -MARK/IDENTIFY PARTS AS PER MITEC QPP-1050
2 -ALL SUPPLIERS SHALL COMPLY WITH QPP-1113
REQUIREMENTS AS CALLED OUT IN PURCHASE ORDER
3 -CABLE SHOULD BE 3 TWISTED PAIR 24 AWG, OVERALL SHEILD
UV PROTECTED JACKET, MAX. 15 PF/FOOT
OPERATING TEMP. -20°C TO 60°C.
REF. BELDEN #8103.
4 -ITEM 5 MUST BE INSERTED BEFORE ASSEMBLING
ITEM 2 AND 4.



DASHES	LENGTH IN FOOT	DESCRIPTION
-001	1	BUC M & C CABLE
-002	2	BUC M & C CABLE
-003	3	BUC M & C CABLE
-004	4	BUC M & C CABLE
-005	5	BUC M & C CABLE
-006	6	BUC M & C CABLE
-007	7	BUC M & C CABLE
-008	8	BUC M & C CABLE
-009	9	BUC M & C CABLE
-010	10	BUC M & C CABLE

WIRING LIST

FROM ITEM 2			ITEM 3	
PIN	SIGNAL NAME	WIRE COLOR	PIN	SIGNAL NAME
1	RX+ IN	PAIR1-WHITE/BLUE	A	TX+ OUT
2	RX- IN	PAIR1-BLUE/WHITE	B	TX- OUT
3	TX+ OUT	PAIR2-WHITE/ORANGE	C	RX+ IN
4	TX- OUT	PAIR2-ORANGE/WHITE	D	RX- IN
5	ALARM IN	PAIR3-WHITE/GREEN	E Change for E	ALARM IN
6	ALR RTN	PAIR3-GREEN/WHITE	G Change for H	ALR RTN

CM RELEASE

	DRWDG	PART
NO.	210245-000AD	210245
REV	L	1
STATE		
ORIGINATOR	DARCY CRAWLEY	DATE: Oct 31,05
DESIGNER	NORMAND ROY	DATE: Oct 31,05

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES

BASIC DIMENSIONS	2 DEC.	3 DEC.
UP TO 6.00	±.02	±.005
ABOVE 6.00 TO 24.00	±.03	±.010
ABOVE 24.00	±.06	±.015
ANGULAR DIMENSIONS	±1/2 deg.	
FRACTIONAL DIMENSIONS	±1/64	
SURFACE FINISH	√	

DO NOT SCALE DRAWING

TITLE: BUC M & C CABLE
MATERIAL:
FINISH:

mitec

CAGE IDENT. NO: 38494
SIZE: C
DRAWING NO: 210245-000AD
PROJECT NO: / JOB NO:
NEXT ASSEMBLY:
SCALE: 1.250
SHEET: 1 OF 1

(FORM 11477-007CF REV 3)

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Appendix B

System Interface Details

Appendix B contains the connector pinout lists and definitions for the various components of the 1:1 Redundant Up/Downlink system.

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Table 17 - List of System Modules vs. Module ID Reference

Module	Module Reference Identification
Indoor Unit (IDU)	A1
Junction Box (JBox)	A2
LNB – A	A3
LNB – B/U	A4
BUC – A	A5
BUC – B/U	A6
DnLk RF Switch 1 (SW1)	A7
UpLk RF Switch 1 (SW1)	A8

Table 18 - Interface Summary

From Unit.Connector *(Connector Type)*	Via Cable / Harness (Part Number)	To Unit Connector *(Connector Type)*	Description
A1.J0 *(DB-9 male)*	-	-	User interface *(RS 485 M&C)*
A1.J1 *(DB-9 female)*	-	-	User interface *(Discreet M&C)*
A1.J2 *(DB-9 male)*	-	-	User interface *(RS 232 M&C)*
A1.J3 *(DB-37 male)*	M&C / SW CTRL Cable *(210242)*	**A2**.J1 *(PT07C-22-55P)*	Switching System Interface
A1."UP-LINK A IF IN" *(N-Type female)*	-	-	User Interface *(IF output to MODEM A)*
A1."DOWN-LINK B/U IF IN" *(N-Type female)*	-	-	User Interface *(IF output to MODEM A)*
A1."DOWN-LINK A IF OUT" *(F-Type female)*	75 Ohm IF Cable *(210561)*	**A3**.J1 *(F-Type female)*	IF input from LNB A
A1."DOWN-LINK B/U IF OUT" *(F-Type female)*	75 Ohm IF Cable *(210561)*	**A4**.J1 *(F-Type female)*	IF input from LNB B/U
A1."UP-LINK A IF OUT" *(N-Type female)*	50 Ohm IF Cable *(210243)*	**A5**.J1 *(N-Type female)*	IF output to BUC A
A1." UP -LINK B/U IF OUT" *(N-Type female)*	50 Ohm IF Cable *(210243)*	**A6**.J1 *(N-Type female)*	IF output to BUC B/U
A1."AC_entry_A_3" *(EIC320)*	-	-	User Interface *(AC Power Interface)*
A1."AC_entry_B_3" *(EIC320)*	-	-	User Interface *(AC Power Interface)*
A2.J2	Switch CTRL Cable *(210244)*	**A7**.J1 *(MS3112E-14-15P)*	Switch CTRL 1
A2.J4	Switch CTRL Cable *(210244)*	**A8**.J1 *(MS3112E-14-15P)*	Switch CTRL 3
A2.J6	BUC M&C Cable *(210245)*	**A5**.J4 *(MS3112E14-12P)*	M&C A
A2.J8	BUC M&C Cable *(210245)*	**A6**.J4 *(MS3112E14-12P)*	M&C B/U
A3.J2 *(WR229)*	WR229 Waveguide	**A7**.PORT1 *(WR229)*	RF from Downlink SW1 to LNB A
A4.J2 *(WR229)*	WR229 Waveguide *(210533)*	**A7**.PORT3 *(WR229)*	RF from Downlink SW1 to LNB B/U
A5.J2 *((WR137))*	WR137 Waveguide *(2947545-01)*	**A8**.PORT1 *(WR137)*	RF from BUC A to Uplink SW1

From Unit.Connector *(Connector Type)*	**Via Cable / Harness (Part Number)**	**To Unit Connector** *(Connector Type)*	**Description**
A5.J3 *(MS3102R20-15P)*	AC Power Cable *(210241)*	-	User Interface *(AC Power Interface)*
A6.J2 *(WR137)*	WR137 Waveguide	**A8**.PORT3 *(WR137)*	RF from BUC B/U to Uplink SW1
A6.J3 *(MS3102R20-15P)*	AC Power Cable *(210241)*	-	User Interface *(AC Power Interface)*
A7.PORT2 *(WR229)*	-	-	User Interface (*RF input from Antenna)*
A7.PORT4 *(WR229)*	-	50Ω Termination	Terminated Port
A8.PORT2 *(WR137)*	WR137 Waveguide	-	User Interface (*RF output to Antenna)*
A8.PORT4 *(WR137)*	-	50Ω Termination	Terminated Port

WRK-340145-485-IS-01 Indoor Unit Interfaces

Table 19: In Door Unit RS-485_ M&C Interface

Connector Pin Numbe (Type: DB-9 male)	Signal Name
A1.J0 Interface "RS-485_ M&C"	
1	N/A
2	N/A
3	M&C_Tx+_OUT
4	M&C_Rx+_IN
5	N/A
6	M&C_Rx-_IN
7	N/A
8	N/A
9	M&C_Tx-_OUT

Table 20: In Door Unit Discreet_ M&C Interface

Connector Pin Numbe (Type: DB-9 female)	Signal Name
A1.J1 Interface "Discreet_ M&C"	
1	M&C_SUM_ALARM_NC_OUT
2	M&C_SUM_ALARM_NO_OUT
3	Dn_Lk_SUM_ALR_COM
4	Up_Lk_SUM_ALARM_NC_OUT
5	Up_Lk_SUM_ALARM_NO_OUT
6	M&C_SUM_ALR_COM
7	Dn_Lk_SUM_ALARM_NC_OUT
8	Dn_Lk_SUM_ALARM_NO_OUT
9	Up_Lk_SUM_ALR_RTN

Table 21: In Door Unit RS-232_ M&C Interface

Connector Pin Numbe (Type: DB-9 male)	Signal Name
A1.J2 Interface "RS-232_ M&C"	
1	N/A
2	RS232_Tx
3	RS232_Rx
4	N/A
5	GND
6	N/A
7	N/A
8	N/A
9	N/A

Table 22: In Door Unit Switching_System_Interface

Connector Pin Numbe (Type: 37 pin D-Sub male)	Signal Name
A1.J3 Interface "Switching System Interface"	
1	DnLk_SW1_DRV_A
2	DnLk_SW1_DRV_B/U
3	RESERVED
4	RESERVED
5	SW_DRV_RTN (GND)
6	UpLk_SW1_DRV_A
7	UpLk_SW1_DRV_ B/U
8	RESERVED
9	RESERVED
10	SSPA_A_ALARM_IN
11	SSPA_A_Rx+_IN
12	SSPA_A_Tx+_OUT
13	RESERVED
14	RESERVED
15	RESERVED
16	SSPA_B/U_ALARM_IN
17	SSPA_B/U_Rx+_IN
18	SSPA_B/U_Tx+_OUT
19	SW_IND_RTN (GND)
20	DnLk_SW1_IND_A
21	DnLk_SW1_IND_ B/U
22	RESERVED
23	RESERVED
24	SW_DRV_RTN (GND)
25	UpLk_SW1_IND_A
26	UpLk_SW1_IND_ B/U
27	RESERVED
28	RESERVED
29	SSPA_A_ALR_RTN
30	SSPA_A_Rx-_IN
31	SSPA_A_Tx-_OUT
32	RESERVED
33	RESERVED
34	RESERVED
35	SSPA_B/U_ALR_RTN
36	SSPA_B/U_Rx-_IN
37	SSPA_B/U_Tx-_OUT

Table 23: In Door Unit IF Interfaces

A1 IF Interfaces				
Connector Name	**Type**	**Signal Name**	**Signal Description**	**Signal Parameter**
UP-LINK A IF IN	N-Type Female	IF_OUT_A	IF output to MODEM A	f_{IF} = 950MHz to 1525MHz; -40dBm to 0dBm, typ.
DOWN -LINK S/B IF IN	N-Type Female	IF_IN_A	IF input from MODEM A	f_{IF} = 950MHz to 1525MHz; -40dBm to 0dBm, typ.
DOWN-LINK A IF OUT	F-Type Female	LNB_IN	IF input from LNB A 24V_{DC} supply to LNB A	f_{IF} = 950MHz to 1525MHz; -40dBm to 0dBm, typ. 24V_{DC} (22V_{min} – 25V_{max}) / 0.5A max
DOWN -LINK B/U IF OUT	F-Type Female	LNB_IN	IF input from LNB B/U 24V_{DC} supply to LNB B/U	
UP-LINK A IF OUT	N-Type Female	BUC_OUT	IF output to BUC A 10MHz output to BUC A 24V_{DC} supply to BUC A	f_{IF} = 950MHz to 1525MHz -40dBm to 0dBm, typ. 10MHz; ±5 x 10^{-8} stability; 0 ± 5dBm 24V_{DC} (22V_{min} – 25V_{max}) / 0.5A max
UP-LINK S/B IF OUT	N-Type Female	BUC_OUT	IF output to BUC B/U 10MHz output to BUC B/U 24V_{DC} supply to BUC B/U	

Table 24: In Door Unit AC Power Interface

Connector Name (Type; Description)	Connector Pin Numbe	Signal Name
A1 AC Power Interface		
AC_entry_A_3 (EIC320; AC filter and shield; 90-264V_{AC})	A	Line
	B	Ground
	C	Neutral
AC_entry_B_3 (EIC320; AC filter and shield; 90-264V_{AC})	A	Line
	B	Ground
	C	Neutral

Junction Box Interfaces

Table 25: Junction Box M&C / SW CTRL Interface

#	Connector Pin Number (Type 55 pin D-Sub)	Signal Name
	A2.J1 Interface	
1	A	DnLk_SW1_DRV_A
2	B	SW_DRV_RTN (GND)
3	C	DnLk_SW1_DRV_B/U
4	D	DnLk_SW1_IND_A
5	E	SW_IND_RTN (GND)
6	F	DnLk_SW1_IND_ B/U
7	G	RESERVED
8	H	N/A
9	J	RESERVED
10	K	RESERVED
11	L	N/A
12	M	RESERVED
13	N	UpLk_SW1_DRV_A
14	P	SW_DRV_RTN (GND)
15	R	UpLk_SW1_DRV_ B/U
16	S	UpLk_SW1_IND_A
17	T	N/A
18	U	UpLk_SW1_IND_ B/U
19	V	RESERVED
20	W	N/A
21	X	RESERVED
22	Y	RESERVED
23	Z	N/A
24	AA	RESERVED
25	BB	SSPA_A_ALARM_IN
26	CC	SSPA_A_ALR_RTN
27	DD	SSPA_A_Rx+_IN
28	EE	SSPA_A_Rx-_IN
29	FF	SSPA_A_Tx+_OUT
30	GG	SSPA_A_Tx-_OUT
31	HH	RESERVED
32	a	RESERVED
33	b	RESERVED
34	c	RESERVED
35	d	RESERVED
36	e	RESERVED
37	f	SSPA_B/U_ALARM_IN
38	g	SSPA_B/U_ALR_RTN
39	h	SSPA_B/U_Rx+_IN
40	i	SSPA_B/U_Rx-_IN
41	j	SSPA_B/U_Tx+_OUT
42	k	SSPA_B/U_Tx-_OUT
43-55	m, n, p, q, r, s, t, u, v, w, x, y, z	N/C

Table 26: Junction Box Switch_CTRL_1 Interface

Connector Pin Number	Signal Name
A2.J2 Interface "Switch_CTRL_1"	
1	DnLk_SW1_DRV_A
2	SW_DRV_RTN (GND)
3	DnLk_SW1_DRV_B/U
4	DnLk_SW1_IND_A
5	SW_IND_RTN (GND)
6	DnLk_SW1_IND_B/U

Table 27: Junction Box Switch_CTRL_3 Interface

Connector Pin Number	Signal Name
A2.J4 Interface "Switch CTRL 3"	
1	UpLk_SW1_DRV_A
2	SW_DRV_RTN (GND)
3	UpLk_SW1_DRV_B/U
4	UpLk_SW1_IND_A
5	SW_IND_RTN (GND)
6	UpLk_SW1_IND_B/U

Table 28: Junction Box M&C_A Interface

Connector Pin Number	Signal Name
A2.J6 Interface "M&C_A"	
1	SSPA_A_Rx+_IN
2	SSPA_A_Rx-_IN
3	SSPA_A_Tx+_OUT
4	SSPA_A_Tx-_OUT
5	SSPA_A_ALARM_IN
6	SSPA_A_ALR_RTN

Table 29: Junction Box M&C_B/U Interface

Connector Pin Number	Signal Name
A2.J8 Interface "M&C_B/U"	
1	SSPA_B/U_Rx+_IN
2	SSPA_B/U_Rx-_IN
3	SSPA_B/U_Tx+_OUT
4	SSPA_B/U_Tx-_OUT
5	SSPA_B/U_ALARM_IN
6	SSPA_B/U_ALR_RTN

LNB Interfaces

Table 30: LNB Interfaces

A3 (LNB - A), A4 (LNB – B/U) Interfaces				
Connector Name	**Type**	**Signal Name**	**Description**	**Parameter**
J1 "IF OUT"	N-type female	IF Out	IF Output +24V_{DC}	950MHz – 1525MHz -40dBm to 0dBm, typ. 24V_{DC} (22V_{min} – 25V_{max}) / 0.5A max
J2 "RF IN"	WR229	RF In	RF Input	-65dBm, max

BUC Interfaces

Table 31: BUC/Booster Interfaces

A5 (BUC A), A6 (BUC B/U) Interfaces					
Connector Name	**Type**	**Pin #**	**Signal Name**	**Description**	**Parameter**
J1 "IF IN"	N-type female	N/A	IF In	IF Input 10 MHz Ref. In	-19 dBm, max 0 to ±5 dBm
J2 "RF OUT"	WR137	N/A	RF Out	RF Output	47 dBm, max
J3 "AC Input"	MS3102R20-15P	A	L	Line	110/220VAC 50 - 60 Hz
		B	GND	Ground	
		C	N	Neutral	
J4 "RS-485"	MS3112E14-12P	A	TX+(output to)	RS-485	RS-485 Interface Half Duplex/ Full Duplex (Configurable)
		B	TX-		
		C	RX+(input from)		
		D	RX-		
		E	AL_Sum_NO	Summary Alarm Normally Open	Pin E Opens From Pin H on Alarm
		F	AL_Sum	System_Alarm	Alarm TTL Low
		G	GND	Ground	Signal GND
		H	AL_Sum_Comm	Alarm Common	Floating
		J	GND	Ground	DC GND
		K	M_I	Mute In	To Mute short Pin K to Pin M
		L	+12V	+12 VDC Out	+12 VDC
		M	M_I_Com	Mute In Common	

WR229 Switch Interfaces

Table 32: RF Ports and Control Interface for Downlink Switch 1

A7(SW1) Switch Interfaces					
Connector Name	**Type**	**Pin #**	**Signal Name**	**Description**	**Parameter**
A7.Port1	WR229	N/A	RF Output	RF Output (to LNB-A)	3.625GHz – 4.2GHz -xxdBm ±x dBm
A7.Port2	WR229	N/A	RF Input	RF Input (from antenna)	3.625GHz – 4.2GHz -xxdBm ±x dBm
A7.Port3	WR229	N/A	RF Output	RF Output (to LNB-B/U)	3.625GHz – 4.2GHz -xxdBm ±x dBm
A7.Port4	WR229	N/A	RF Output	Terminated (to 50Ω Load)	
A7.J1	MS3112E-14-15P	A	SW1_DRV_1		
		B	SW_DRV_RTN (GND)		
		C	SW1_DRV_2		
		D	SW1_IND_1		
		E	SW_IND_RTN (GND)		
		F	SW1_IND_2		

WR137 Switch Interfaces

Table 33: RF Ports and Control Interface for Uplink Switch 1

A8 (UPLINK SW1) Switch Interfaces					
Connector Name	**Type**	**Pin #**	**Signal Name**	**Description**	**Parameter**
A8.Port1	WR137	N/A	RF Input	RF Input (from BUC-A)	5.9GHz – 6.4GHz xxdBm ±x dBm
A8.Port2	WR137	N/A	RF Output	RF Output (to antenna)	5.9GHz – 6.4GHz xxdBm ±x dBm
A8.Port3	WR137	N/A	RF Input	RF Input (from BUC-B/U)	5.9GHz – 6.4GHz xxdBm ±x dBm
A8.Port4	WR137	N/A	RF Output	Terminated (50Ω Load)	
A8.J1	2E-14-15P	A	SW1_DRV_1		
		B	SW_DRV_RTN (GND)		
		C	SW1_DRV_2		
		D	SW1_IND_1		
		E	SW_IND_RTN (GND)		
		F	SW1_IND_2		

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Appendix C

Serial Protocol Documentation

Appendix C contains the serial protocol documentation, document number PS-3900062.

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Revision	Date	Change Summary	Approval
0A	05-Dec-2005	Protocol specification for 1:1 / 1:2 up-link and down-link redundant system with remote control panel.	C. Villeneuve
0A.1	20-Dec-2005	Added “Switch Drive” command. Adjusted “Switch Position” indicators.	C. Villeneuve

Serial Communication Protocol Specification
For
Redundant System with Remote Control Panel

Software Version 3900062-00

Table of Contents

1 Document legend

Text in this document highlighted in grey identifies features which are planned but not implemented yet.

2 Project Overview

This document describes the communications protocol used to communicate with up-link/down-link redundant system with remote control panel configured with control software 3900062-00.

The system as a whole consists of 3 or 4 main units (in 1:1 or 1:2 configuration) which the user may communicate with: The main control unit and two (or 3) boosters. Physically, the user only has to connect to the customer interface port on the main control unit to communicate with all modules. The distinction between which of the modules the command is destined for is made in the destination address of the command packet. Refer to Figure 1) System Block Diagram.

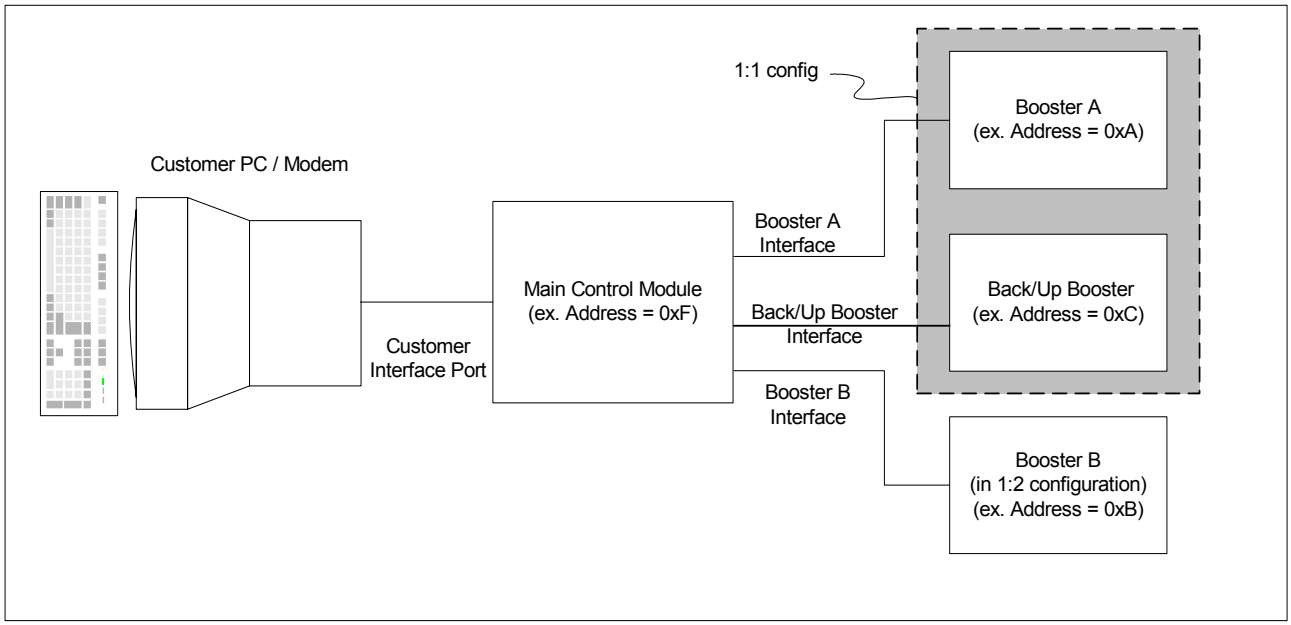


Figure 1) System Block Diagram

3 Definitions and acronyms

The following terms appear throughout this document:

CM:	Control Module.
Controller:	The microprocessor-based card and associated embedded software which handles all communications between the customer interface and the amplifier.
CRC:	Cyclic Redundancy Check
Customer Interface Port:	The interface port through which the device used by the customer will interact with the Control Module.
Customer Interface Device:	The interface device used by the customer to interact with the Control Module (i.e. typically a modem or PC).
PC:	Personal Computer.
RF:	Radio Frequency.
SCI:	Serial Communications Interface.
BUC:	Block-Up Converter.
B/U:	Back-up or Stand-by unit.

4 Scope

This document covers all aspects of the communication protocol which are required for the customer to develop a controlling device (typically a PC application program or modem) to interface with the Mitec product.

5 Serial Communications Link Interface

5.1 Customer Interface Port Configuration

The customer interface port of the controller is configured as follows:

Baud Rate:	19200bps
Data bits:	8
Stop bits:	1
Parity:	None
HW Control	None

5.2 Customer Interface Transport Medium

The customer interface transport medium for this product may be configured for RS232 or RS485 half duplex.

5.3 Customer Interface Cable Connections

This software protocol remains the same regardless of the transport medium used (i.e. RS232 or RS485). This section defines the wiring required to communicate with the Mitec product.

Note that the pin numbers on both sides of the cable are deliberately omitted since these will vary depending on the Mitec product as well as the PC / Modem interface. Please refer to the specific user manuals for pin allocations.

For RS232:

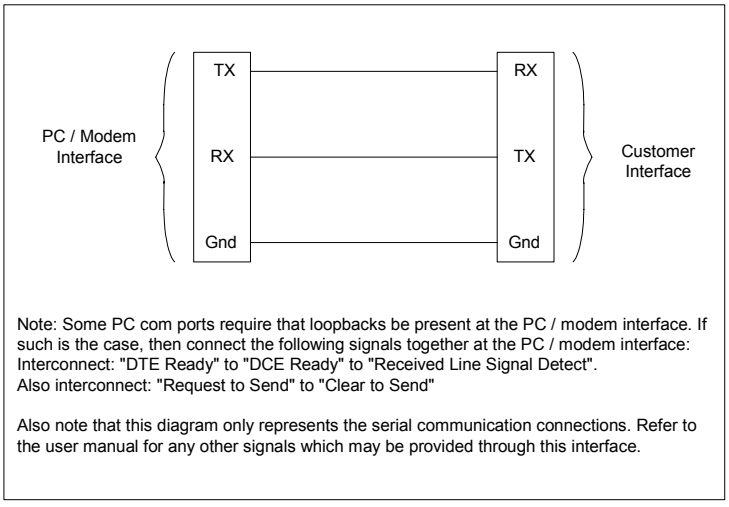


Figure 2) RS232 Customer Interface Wiring

For RS485 Half Duplex:

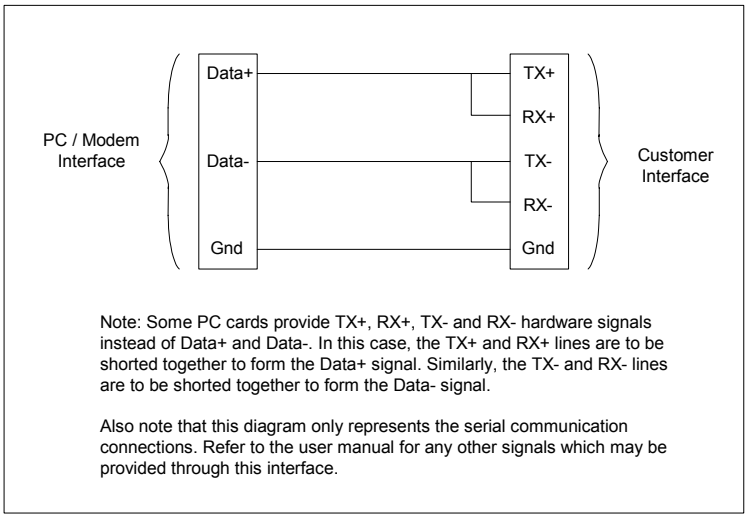


Figure 3) RS485 Half Duplex Customer Interface Wiring

For RS485 Full Duplex (ie RS422):

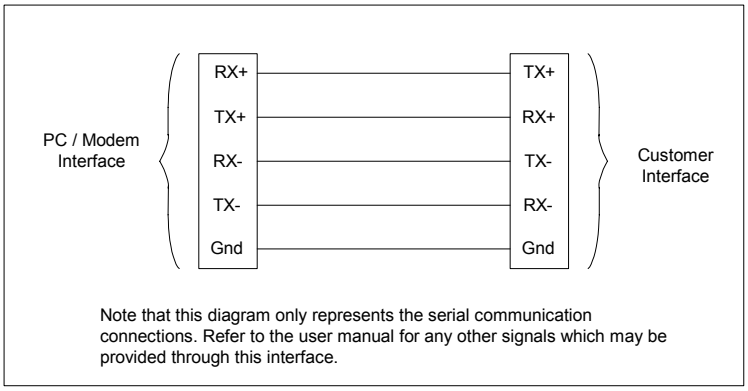


Figure 4) RS485 Full Duplex (ie RS422) Customer Interface Wiring

6 Communication Protocol Framing

6.1 SCI Packet Frame Format

The packets exchanged with the master controller will have the following format (regardless of direction):

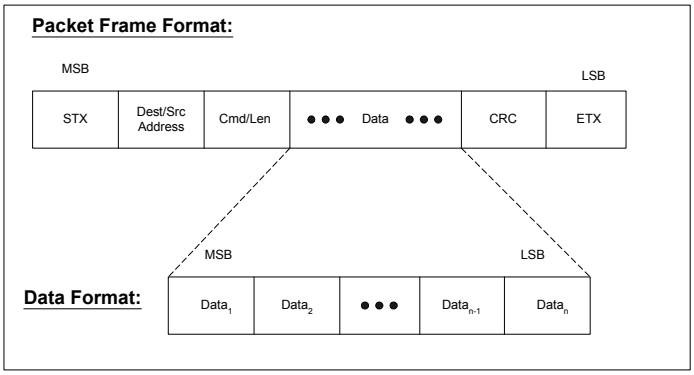


Figure 5) SCI Packet Frame Format

6.1.1 SCI Packet Byte Description

- **STX** is the start transmission byte (defined as 0x7E). This byte is used to determine the start of a packet.

- **Dest/Src Address** contains the destination address in the high nibble and the source address in the low nibble. The destination address is the address of the device which is to process the packet. The source address is the address of the device which sent the packet. Note that the device address of the customer interface device is always = 0x0F.

- **CMD/Len** contains the packet command in the high nibble and the number of bytes in the data portion of the packet in the lower nibble.

  The following commands may be sent by the customer interface device:

GET (command high nibble = 0x0)	Request the current value of a database element.
SET (command high nibble = 0x1)	Set the database element to the specified value.

  The following commands may be returned to the customer interface device:

UPD (command high nibble = 0x8)	Return the current value of a database element.
ACK (command high nibble = 0xE)	Acknowledge a received packet.
NACK (command high nibble = 0xF)	Reject a received packet (Not ACKnowledge).

- **$Data_1$ - $Data_n$** contains the packet payload. The value of the data bytes is specific to the command and will be covered in following sections.

- **CRC** is the cyclic redundancy check and is calculated by performing a byte-wise exclusive OR of the Dest/Src address byte, Cmd/Len byte and all data bytes. A bit-wise inversion is then applied to the CRC before being inserted into the packet. Refer to 6.1.3 CRC Calculation Example.

- **ETX** is the end transmission byte (defined as 0x7F). This byte is used to determine the end of a packet.

6.1.2 Default Address Values

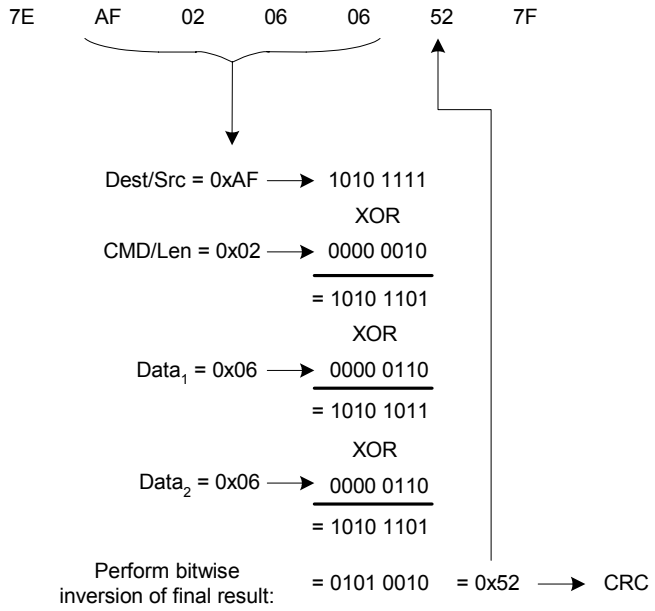
The customer interface device must always be assigned address 0xF.

The main control module device address is left at 0xF. It may be set by the customer using the SET Master Controller Device Address command (refer to SET Control Command List).

The booster device addresses can be left at the default value (0xF). Any commands destined to the boosters should, by default, be sent to address 0xA for booster A, 0xC for the back-up (B/U) booster and 0xB for booster B (in 1:2 configuration). It is then up to the main controller to interpret the messages and forward them to the corresponding booster.

6.1.3 CRC Calculation Example

To send a command to read the temperature (database element = 0x0606) from unit A (device address 0x0A), the command is:



6.1.4 Command / Reply Packet Sequencing

Under normal operation, the main control module will only send a packet to the customer interface device in response to a packet received from the customer.

However, the following exceptions apply:

- When there is any attempt to drive an RF switch, such as manually or upon a major alarm occurrence. In this case, the main controller will send a “Switch Position” update packet to the customer interface to make the user aware of the new state. Note that this packet will also be sent out if the switch is driven by a Toggle command (in addition to the ACK packet).

- When there is any change in system status, such as a change from auto to manual mode, the main controller will send a “System Status” update packet to the customer interface.

- When the alarm or warning status changes, i.e. upon a new alarm/warning declaration or clearance, the main controller will send the corresponding “Alarm Status” update packet (up-link alarm, down-link alarm or system/switch alarm) to the customer interface.

7 Command List

7.1 Default Reply Packet Format

This section identifies the packet format of the ACK (Acknowledge) and NACK (Not acknowledge) replies which may be sent to the customer interface device in response to a received command.

NOTE: The packets shown in the list below are based on the assumption that the master controller device address is set to 0xF and the boosters' device addresses are set to 0xA (unit A), 0xC (B/U unit) and 0xB (unit B). To modify the commands for different addresses, the Dest/Src byte and the CRC byte will have to change in all packets.

Reply	Packet Format	Explanation	Interpretation	Examples
ACK (Acknowledge)	7E FX E0 ZZ 7F	Acknowledge that the received packet was properly processed.	X = Device address of the packet source device. ZZ = CRC.	1) reply: 7E FF E0 E0 7F (ACK reply sent from the main control module) 2) reply: 7E FA E0 E5 7F (ACK reply sent from unit A)
NACK (Not Acknowledge)	7E FX F1 YY ZZ 7F	Indicate that a problem was encountered with the received packet.	X = Device address of the packet source device. YY = Error code: 03 = Incorrect CRC. 18 = Unrecognized command. 30 = Set command attempted on a restricted database element. 31 = Set command attempted while system is in Local mode, only commands sent from front panel will be accepted until system is set to Remote mode. ZZ = CRC.	1) reply: 7E FF F1 03 F2 7F (NACK reply sent from the main control module for an invalid CRC) 2) reply: 7E FA F1 18 EC 7F (NACK reply sent from unit A for an unrecognized command).

7.2 GET Status Command List

This section identifies the list of commands available to query the unit for status information.

NOTE: The packets shown in the list below are based on the assumption that the master controller device address is set to 0xF and the boosters' device addresses are set to 0xA (unit A), 0xC (B/U unit) and 0xB (unit B). To modify the commands for different addresses, the Dest/Src byte and the CRC byte will have to change in all packets.

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Get System Status	7E XF 02 FF 08 ZZ 7F	Query main control module for system status X = main controller serial address. ZZ = CRC.	**Update System Status:** 7E FX 8A FF 08 RR SS TT UU VV WW XX YY ZZ 7F X = main controller serial address. ZZ = CRC.	RR SS = Up-link status. RR = Bitmap as follows: **Bit 0:** Booster A mute status **Bit 1:** Booster B mute status **Bit 2:** Booster B/U mute status **Bits 3-7:** Not used SS = Bitmap as follows: **Bit 0:** BUC A mute status **Bit 1:** BUC B mute status **Bit 2:** BUC B/U mute status **Bits 3-7:** Not used Where mute status bit is defined as: 0=enabled; 1=muted. TT UU = Down-link status. TT = Bitmap as follows: **Bits 0-7:** Not used. UU = Bitmap as follows: **Bit 0:** LNB A mute status **Bit 1:** LNB B mute status **Bit 2:** LNB B/U mute status **Bits 3-7:** Not used Where mute status bit is defined as: 0=enabled; 1=muted.	1) cmd: 7E FF 02 FF 08 F5 7F reply: 7E FF 8A FF 08 01 05 00 05 00 02 22 22 7E 7F Booster A muted BUCs A and B/U muted LNBs A and B/U muted System in manual mode IF & RF switches in position A

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
				VV WW = System status. VV = Bitmap as follows: **Bits 0-7:** Not used. WW = Bitmap as follows: **Bit 0:** System configuration: 0 = 1:1 config; 1 = 1:2 config. **Bit 1:** Operation mode: 0 = auto; 1 = manual. **Bit 2:** Control mode: 0 = remote; 1 = local. **Bit 3:** Serial communication mode: 0 = RS232; 1 = RS485. **Bits 4-7:** Not used.	
				XX YY = Switch status. XX = Bitmap as follows: **Bits 1,0:** Down-link IF switch 1 position. **Bits 3,2:** Down-link IF switch 2 position (in 1:2 config). **Bits 5,4:** Up-link IF switch 1 position. **Bits 7,6:** Up-link IF switch 2 position (in 1:2 config). YY = Bitmap as follows: **Bits 1,0:** Down-link RF switch 1 position. **Bits 3,2:** Down-link RF switch 2 position (in 1:2 config). **Bits 5,4:** Up-link RF switch 1 position. **Bits 7,6:** Up-link RF switch 2 position (in 1:2 config). Where *switch 1 position* is defined as follows: 00: switch is stuck between 2 positions or disconnected. 01: switch in position A. 10: switch in position B/U. 11: undetermined, and *switch 2 position* is defined as follows (in 1:2 config): 00: switch is stuck between 2 positions or disconnected. 01: switch in position B. 10: switch in position B/U. 11: undetermined.	
			NACK	Refer to 7.1.	

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Get Up-Link Alarm Status	7E XF 02 FF 0A ZZ 7F	Query the control module for the current up-link alarm status. X = main controller serial address. ZZ = CRC.	**Update Up-Link Alarm Status:** 7E FX 88 FF 0A TT UU VV WW XX YY ZZ 7F X = main controller serial address. ZZ = CRC.	TT UU = Up-link A alarm status: TT = Bitmap as follows: **Bit 0:** Booster A summary alarm (over temperature or power supply alarm) **Bit 1:** Booster A power supply alarm **Bit 2:** Booster A over temperature alarm **Bit 3:** Booster A communication alarm **Bit 4:** Reserved **Bit 5:** Booster A low power warning (if applicable) **Bit 6:** Not used **Bit 7:** Up-link A summary alarm: 0 = up-link chain A operational; 1 = booster or BUC A major alarm. UU = Bitmap as follows: **Bit 0:** BUC A communication alarm **Bit 1:** BUC A 10MHz reference alarm **Bit 2:** BUC A 10MHz reference warning **Bit 3:** BUC A short circuit alarm **Bit 4:** BUC A low current alarm **Bit 5:** BUC A over current alarm **Bits 6-7:** Not used VV WW = Up-link B alarm status (in 1:2 config), XX YY = Up-link B/U alarm status, where: Up-link B and up-link B/U alarm status bitmaps are the same as for up-link A. **All alarm and warning bits**: 0 = no alarm or warning; 1 = alarm or warning.	1) cmd: 7E FF 02 FF 0A F7 7F reply: 7E FF 88 FF 0A 80 10 00 00 00 00 ED 7F Up-link A major alarm BUC A low current alarm Up-link B & B/U: no alarms
			NACK	Refer to 7.1.	

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Get Down-Link Alarm Status	7E XF 02 FF 0B ZZ 7F	Query the control module for the current down-link alarm status. X = main controller serial address. ZZ = CRC.	**Update Down-Link Alarm Status:** 7E FX 88 FF 0B TT UU VV WW XX YY ZZ 7F X = main controller serial address. ZZ = CRC.	TT UU = Down-link A alarm status: TT = Bitmap as follows: **Bits 0-6:** Not used **Bit 7:** Down-link A summary alarm: 0 = down-link chain A operational; 1 = LNB A major alarm. UU = Bitmap as follows: **Bit 0:** LNB A communication alarm **Bit 1:** LNB A 10MHz reference alarm (if applicable) **Bit 2:** LNB A 10MHz reference warning (if applicable) **Bit 3:** LNB A short circuit alarm **Bit 4:** LNB A low current alarm **Bit 5:** LNB A over current alarm **Bits 6-7:** Not used VV WW = Down-link B alarm status (in 1:2 config), XX YY = Down-link B/U alarm status, where: Down-link B and down-link B/U alarm status bitmaps are the same as for down-link A. **All alarm and warning bits**: 0 = no alarm or warning; 1 = alarm or warning.	1) cmd: 7E FF 02 FF 0B F6 7F reply: 7E FF 88 FF 0B 00 00 00 00 00 04 78 7F Down-link A & B: no alarms Down-link B/U 10MHz reference warning
			NACK	Refer to 7.1.	

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Get System and Switches Alarm Status	7E XF 02 FF 0C ZZ 7F	Query the control module for the current system and switches alarm status. X = main controller serial address. ZZ = CRC.	**Update System and Switches Alarm Status:** 7E FX 88 FF 0C TT UU VV WW XX YY ZZ 7F X = main controller serial address. ZZ = CRC.	TT UU = System alarm status: TT = Bitmap as follows: **Bit 0:** IF up-link input board communication alarm **Bit 1:** IF down-link output board communication alarm **Bits 2-3:** Reserved **Bit 4:** Manual mode warning **Bits 5-6:** Not used **Bit 7:** System critical alarm UU = Bitmap as follows: **Bit 0:** Power supply 1 alarm **Bit 1:** Power supply 2 alarm **Bits 2-7:** Not used VV WW = Up-link switches alarm status: VV = Bitmap as follows: **Bit 0:** IF switch 1 out of position **Bit 1:** IF switch 1 out of sync **Bit 2:** IF switch 1 unable to move **Bit 3:** IF switch 2 out of position **Bit 4:** IF switch 2 out of sync **Bit 5:** IF switch 2 unable to move **Bits 6-7:** Not used WW = Bitmap as follows: **Bit 0:** RF switch 1 out of position **Bit 1:** RF switch 1 out of sync **Bit 2:** RF switch 1 unable to move **Bit 3:** RF switch 2 out of position **Bit 4:** RF switch 2 out of sync **Bit 5:** RF switch 2 unable to move **Bits 6-7:** Not used XX YY = Down-link switches alarm status, where: Bitmaps for XX and YY are the same as those for VV and WW, respectively. **All alarm and warning bits**: 0 = no alarm or warning; 1 = alarm or warning.	1) cmd: 7E FF 02 FF 0C F1 7F reply: 7E FF 88 FF 0C 10 00 00 00 00 00 6B 7F Manual mode warning No switch alarms
			NACK	Refer to 7.1.	

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Get RF Switch Positions	7E XF 02 36 FF ZZ 7F	Query for current RF switch positions X = main controller device address ZZ = CRC	**Update RF switch positions:** 7E FX 84 36 FF 00 SS ZZ 7F	SS = Switch positions Bitmap as follows: **Bits 1,0:** Down-link RF switch 1 position. **Bits 3,2:** Down-link RF switch 2 position (in 1:2 config). **Bits 5,4:** Up-link RF switch 1 position. **Bits 7,6:** Up-link RF switch 2 position (in 1:2 config). Where *switch 1 position* is defined as follows: 00: switch is stuck between 2 positions or disconnected. 01: switch in position A. 10: switch in position B/U. 11: undetermined, and *switch 2 position* is defined as follows (in 1:2 config): 00: switch is stuck between 2 positions or disconnected. 01: switch in position B. 10: switch in position B/U. 11: undetermined. Note: IF switch positions follow the RF switch positions, or an alarm is declared. ZZ = CRC	1) cmd: 7E FF 02 36 FF CB 7F reply: 7E FF 84 36 FF 00 22 6F 7F Up-link switch 1 in position A Down-link switch 1 in position A
			NACK	Refer to 7.1.	
Get up-link protection mode	7E XF 02 06 01 ZZ 7F	Query for up-link protection mode X = main controller device address ZZ = CRC	**Update up-link protection mode:** 7E FX 84 06 01 00 SS ZZ 7F	SS = Protection mode: 00 : MHSB (monitored hot stand-by) Stand-by unit will be enabled (default). 01 : MCSB (monitored cold stand-by) Stand-by unit will be muted. ZZ = CRC	1) cmd: 7E FF 02 06 01 05 7F reply: 7E FF 84 06 01 00 00 83 7F Up-link MHSB
			NACK	Refer to 7.1.	

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Get down-link protection mode	7E XF 02 06 02 ZZ 7F	Query for down-link protection mode X = main controller device address ZZ = CRC	**Update down-link protection mode:** 7E FX 84 06 02 00 SS ZZ 7F	SS = Protection mode: 00 : MHSB (monitored hot stand-by) Stand-by unit will be enabled (default). 01 : MCSB (monitored cold stand-by) Stand-by unit will be muted. ZZ = CRC	1) cmd: 7E FF 02 06 02 06 7F reply: 7E FF 84 06 02 00 01 81 7F Down-link MCSB
			NACK	Refer to 7.1.	

7.3 GET Boosters Information

This section identifies the list of commands available to query any booster for information.

NOTE: The packets shown in the list below are based on the assumption that the master controller device address is set to 0xF and the boosters' device addresses are set to 0xA (unit A), 0xC (B/U unit) and 0xB (unit B). To modify the commands for different addresses, the Dest/Src byte and the CRC byte will have to change in all packets.

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Get Booster Temperature	7E XF 02 06 06 ZZ 7F	Query booster for current temperature X = Booster device address ZZ = CRC	**Update Booster Temp:** 7E FX 84 06 06 TT TT ZZ 7F	X = Booster device address TT TT = Booster temp in ^{o}C + 273 ZZ = CRC	1) cmd: 7E AF 02 06 06 52 7F reply: 7E FA 84 06 06 01 02 82 7F (Booster A temp = 0x0102 = 0d258, 258-273 = -15^{o}C) 2) cmd: 7E CF 02 06 06 32 7F reply: 7E FC 84 06 06 01 34 B2 7F (Booster B/U temp = 0x0134 = 0d308, 308 – 273 = +35^{o}C)
			NACK	Refer to 7.1.	
Get Booster Temperature Voltage	7E XF 02 2F FF ZZ 7F	Query booster for temperature voltage X = Booster device address ZZ = CRC	**Update Booster Temp Voltage:** 7E FX 84 2F FF TT TT ZZ 7F	X = Booster device address TT TT = Temperature sensor voltage reading from 0V (0x0000) to 5V (0x03FF). This may be used for a more accurate temperature reading. i.e. Temperature = (Sensor reading * 0.4883) – 273. ZZ = CRC	1) cmd: 7E CF 02 2F FF E2 7F reply: 7E FC 84 2F FF 02 62 37 7F (Booster B/U temp = 0x0262 = 0d610, 610*0.4883 - 273 = 24.9^{o}C)
			NACK	Refer to 7.1.	
Get Booster Output Power	7E XF 02 17 FF ZZ 7F	Query booster for output power X = Booster device address ZZ = CRC	**Update Booster Output Power:** 7E FX 84 17 FF PP PP ZZ 7F	X = Booster device address PP PP = 10 * Output power in dBm. ZZ = CRC.	1) cmd: 7E AF 02 17 FF BA 7F reply: 7E FA 84 17 FF 01 2C 44 7F (Booster A power = 0x012C = 0d300, 300/10 = 30.0 dBm) 2) cmd: 7E CF 02 17 FF DA 7F reply: 7E FC 84 17 FF 01 F9 97 7F (Booster B/U power = 0x01F9 = 0d505, 505/10 = 50.5 dBm)
			NACK	Refer to 7.1.	

7.4 GET Settings Command List

This section identifies the list of commands available to query the unit for settings information.

NOTE: The packets shown in the list below are based on the assumption that the master controller device address is set to 0xF and the boosters' device addresses are set to 0xA (unit A), 0xC (B/U unit) and 0xB (unit B). To modify the commands for different addresses, the Dest/Src byte and the CRC byte will have to change in all packets.

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Get Booster A Device Address	7E FF 02 03 04 ZZ 7F	Query booster A device address	**Update booster A device address:** 7E FF 84 03 04 00 YY ZZ 7F	YY = Booster A device address. ZZ = CRC.	1) cmd: 7E FF 02 03 04 05 7F reply: 7E FF 84 03 04 00 0A 89 7F (Booster A device address = 0xA)
			NACK	Refer to 7.1.	
Get Booster B Device Address	7E FF 02 03 07 ZZ 7F	Query booster B device address	**Update booster B device address:** 7E FF 84 03 07 00 YY ZZ 7F	YY = Booster B device address. ZZ = CRC.	1) cmd: 7E FF 02 03 07 06 7F reply: 7E FF 84 03 07 00 0B 8B 7F (Booster B device address = 0xB)
			NACK	Refer to 7.1.	
Get Booster B/U Device Address	7E FF 02 03 05 ZZ 7F	Query booster B/U device address	**Update booster B/U device address:** 7E FF 84 03 05 00 YY ZZ 7F	YY = Booster B/U device address. ZZ = CRC.	1) cmd: 7E FF 02 03 05 04 7F reply: 7E FF 84 03 05 00 0C 8E 7F (Booster B/U device address = 0xC)
			NACK	Refer to 7.1.	
Get Main Control Module Device Address	7E FF 02 03 06 ZZ 7F	Query Main Control Module device address	**Update main control module device address:** 7E FF 84 03 06 00 YY ZZ 7F	YY = Main control module device address. ZZ = CRC.	1) cmd: 7E FF 02 03 06 07 7F reply: 7E FF 84 03 06 00 0F 8E 7F (Main control module device address = 0xF) 2) cmd: 7E FF 02 03 06 07 7F reply: 7E FF 84 03 06 00 00 81 7F (Main control module device address = 0x0)
			NACK	Refer to 7.1.	
Get Main Controller SW Version	7E XF 02 FF 00 ZZ 7F	Query Main Control Module for SW version X = Main controller device address ZZ = CRC	**Update SW Version** 7E FX 8A FF 00 03 90 YY YY 00 GG RR RR CRC 7F	Global software version. YY YY = SW version base number (LSB). GG = SW version configuration. RR RR = SW version revision.	1) cmd: 7E FF 02 FF 00 FD 7F reply: 7E FF 8A FF 00 03 90 00 62 00 00 30 41 F5 7F The resulting software version is: 3900062-00-R0A
			NACK	Refer to 7.1.	

7.5 SET Control Command List

This section identifies the list of commands available to set control parameters of any unit.

NOTE: The packets shown in the list below are based on the assumption that the master controller device address is set to 0xF and the boosters' device addresses are set to 0xA (unit A), 0xC (B/U unit) and 0xB (unit B). To modify the commands for different addresses, the Dest/Src byte and the CRC byte will have to change in all packets.

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Set Auto/Manual operation mode	7E XF 14 06 03 00 YY ZZ 7F	Select system operation mode (automatic or manual): X = main controller serial address YY: 00 = auto mode (default); 01 = manual mode ZZ = CRC	**ACK** **NACK**	Refer to 7.1. Refer to 7.1.	1) cmd: 7E FF 14 06 03 00 01 10 7F reply: ACK (set system in manual mode) 2) cmd: 7E FF 14 06 03 00 00 11 7F reply: ACK (set system in auto mode)
Set Remote control mode	7E XF 14 06 04 00 YY ZZ 7F	Change control mode from front panel (Local) to PC (Remote): X = main controller serial address YY: 00 = remote mode (default); 01 = local mode ZZ = CRC	**ACK** **NACK**	Refer to 7.1. Refer to 7.1.	1) cmd: 7E FF 14 06 04 00 00 16 7F reply: ACK (set system in remote control mode from PC)
Set up-link protection mode	7E XF 14 06 01 00 YY ZZ 7F X = main controller device address ZZ = CRC	Selects the up-link protection mode: X = main controller serial address YY = 0x00: Set to MHSB (Standby unit will remain enabled) YY = 0x01: Set to MCSB (Standby unit will be automatically muted) ZZ = CRC	**ACK** **NACK**	Refer to 7.1. Refer to 7.1.	1) cmd: 7E FF 14 06 01 00 00 13 7F reply: ACK (Set to MHSB) 2) cmd: 7E FF 14 06 01 00 01 12 7F reply: ACK (Set to MCSB)
Set down-link protection mode	7E XF 14 06 02 00 YY ZZ 7F	Selects the down-link protection mode: X = main controller serial address YY = 0x00: Set to MHSB (Standby unit will remain enabled) YY = 0x01: Set to MCSB (Standby unit will be automatically muted) ZZ = CRC	**ACK** **NACK**	Refer to 7.1. Refer to 7.1.	1) cmd: 7E FF 14 06 02 00 00 10 7F reply: ACK (Set to MHSB) 2) cmd: 7E FF 14 06 02 00 01 11 7F reply: ACK (Set to MCSB)
Drive switches	7E XF 14 06 09 WW YY ZZ 7F	Drive a switch to the required position. X = main controller serial address	**ACK + Switch update**	Refer to 7.1.	1) cmd: 7E FF 14 06 09 01 01 1B 7F Drive down-link switch 1 to side A. reply: ACK

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
		WW = switch to drive: 0x00: up-link switch 1. 0x01: down-link switch 1. 0x02: up-link switch 2 (in 1:2 config). 0x03: down-link switch 2 (in 1:2 config). YY = switch new position: 01: drive to side A (or side B in 1:2 config). 02: drive to B/U side. ZZ = CRC	**NACK**	Refer to 7.1.	reply: Update Switch positions
Toggle switches	7E XF 14 06 0A 00 YY ZZ 7F	Alternate the position of a switch. X = main controller serial address YY = 0x00: Toggle up-link switch 1 between A and B/U units. YY = 0x01: Toggle down-link switch 1 between A and B/U units. YY = 0x02: Toggle up-link switch 2 between B and B/U units (in 1:2 config). YY = 0x03: Toggle down-link switch 2 between B and B/U units (in 1:2 config). ZZ = CRC	**ACK + Switch update**	Refer to 7.1.	1) cmd: 7E FF 14 06 0A 00 01 19 7F Toggle down-link switch 1. reply: ACK reply: Update Switch positions
			NACK	Refer to 7.1.	
Up-Link Mute Control	7E XF 14 06 0C MM SS ZZ 7F Note: In auto mode, mute control will follow the system protection mode setting (MHSB or MCSB) upon switching. In manual mode, mute status can be controlled by the present command.	Mute / Unmute up-link unit A, B and / or B/U X = main controller serial address MM = 0x00: to enable MM = 0x01: to mute SS: bit0 = 1: Apply to side A bit1 = 1: Apply to side B bit2 = 1: Apply to side B/U ZZ = CRC	**ACK**	Refer to 7.1.	1) cmd: 7E FF 14 06 0C 00 01 1F 7F reply: ACK (Enable up-link chain A) 2) cmd: 7E FF 14 06 0C 01 02 1D 7F reply: ACK (Mute up-link chain B) 3) cmd: 7E FF 14 06 0C 01 05 1A 7F reply: ACK (Mute up-link chains A and B/U)
			NACK	Refer to 7.1.	4) cmd: 7E FF 14 06 0C 00 05 1B 7F reply: ACK (Enable up-link chains A and B/U)

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Down-Link Mute Control	7E XF 14 06 0D MM SS ZZ 7F Note: In auto mode, mute control will follow the system protection mode setting (MHSB or MCSB) upon switching. In manual mode, mute status can be controlled by the present command.	Mute / Unmute down-link unit A, B and / or B/U X = main controller serial address MM = 0x00: to enable MM = 0x01: to mute SS: bit0 = 1: Apply to side A bit1 = 1: Apply to side B bit2 = 1: Apply to side B/U ZZ = CRC	**ACK**	Refer to 7.1.	1) cmd: 7E FF 14 06 0D 00 01 1E 7F reply: ACK (Enable down-link chain A) 2) cmd: 7E FF 14 06 0D 01 02 1C 7F reply: ACK (Mute down-link chain B) 3) cmd: 7E FF 14 06 0D 01 05 1B 7F reply: ACK (Mute down-link chains A and B/U)
			NACK	Refer to 7.1.	4) cmd: 7E FF 14 06 0D 00 05 1A 7F reply: ACK (Enable down-link chains A and B/U)
Booster Mute Control	7E XF 14 06 0E MM SS ZZ 7F Note: In auto mode, mute control will follow the system protection mode setting (MHSB or MCSB) upon switching. In manual mode, mute status can be controlled by the present command.	Mute / Unmute booster A, B and / or B/U (boosters only, not the BUCs) X = main controller serial address MM = 0x00: to enable MM = 0x01: to mute SS: bit0 = 1: Apply to side A bit1 = 1: Apply to side B bit2 = 1: Apply to side B/U ZZ = CRC	**ACK**	Refer to 7.1.	1) cmd: 7E FF 14 06 0E 00 01 1D 7F reply: ACK (Enable booster A) 2) cmd: 7E FF 14 06 0E 01 02 1F 7F reply: ACK (Mute booster B) 3) cmd: 7E FF 14 06 0E 01 05 18 7F reply: ACK (Mute boosters A and B/U)
			NACK	Refer to 7.1.	4) cmd: 7E FF 14 06 0E 00 05 19 7F reply: ACK (Enable boosters A and B/U)
BUC Mute Control	7E XF 14 06 0F MM SS ZZ 7F Note: In auto mode, mute control will follow the system protection mode setting (MHSB or MCSB) upon switching. In manual mode, mute status can be controlled by the present command.	Mute / Unmute BUC A, B and / or B/U (BUCs only, not the boosters) X = main controller serial address MM = 0x00: to enable MM = 0x01: to mute SS: bit0 = 1: Apply to side A bit1 = 1: Apply to side B bit2 = 1: Apply to side B/U ZZ = CRC	**ACK**	Refer to 7.1.	1) cmd: 7E FF 14 06 0F 00 01 1C 7F reply: ACK (Enable BUC A) 2) cmd: 7E FF 14 06 0F 01 02 1E 7F reply: ACK (Mute BUC B) 3) cmd: 7E FF 14 06 0F 01 05 19 7F reply: ACK (Mute BUCs A and B/U)
			NACK	Refer to 7.1.	4) cmd: 7E FF 14 06 0F 00 05 18 7F reply: ACK (Enable BUCs A and B/U)
Alarm Reset System	7E XF 14 06 0B 00 01 ZZ 7F	Reset all latched alarms. X = main controller device address	**ACK**	Refer to 7.1.	1) cmd: 7E 0F 14 06 0B 00 01 E8 7F reply: ACK (Clear all system latched alarms)

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
		ZZ = CRC	**NACK**	Refer to 7.1.	
Set Control Module Device Address	7E FF 14 03 06 00 YY ZZ 7F	Set control module device address (0 ≤ address ≤ 0x9, or 0xF, default to 0xF) YY = Device address ZZ = CRC	**ACK**	Refer to 7.1.	1) cmd: 7E FF 14 03 06 00 0F 1E 7F reply: ACK (Set control module device address to 0xF)
			NACK	Refer to 7.1.	2) cmd: 7E FF 14 03 06 00 00 11 7F reply: ACK (Set control module device address to 0x0)
Set RS232 or RS485 mode	7E FF 14 03 03 00 YY ZZ 7F	Set serial communication to use RS232 or RS485 (default to RS232). System has to be reset for this command to take effect. YY: Bit 0: 0 = RS485; 1 = RS232 Bits 1-7: Not used ZZ = CRC	**ACK**	Refer to 7.1.	1) cmd: 7E FF 14 03 03 00 00 14 7F reply: ACK (Set serial communication mode to RS485)
			NACK	Refer to 7.1.	2) cmd: 7E FF 14 03 03 00 01 15 7F reply: ACK (Set serial communication mode to RS232)

8 Appendix I: Troubleshooting Guide

Problem	Possible Remedies
No response at all from the control module.	1) Ensure the cable assembly is wired properly (refer to 5.3 Customer Interface Cable Connections) and that it is properly connected between the control module customer interface port and the customer device. 2) Verify that the com port parameters are as specified in 5.1 Customer Interface Port Configuration. 3) Confirm that the customer interface cable is connected to the correct PC com port. 4) Ensure that there are no other applications executing on the same com port. 5) If the transport medium is RS232, then connect the loopbacks identified in the note in Figure 2) RS232 Customer Interface Wiring. 6) If using a control module address other than 0xF, then send a "GET Control Module Device Address" command to destination address 0xF. The reply will contain the current control module address. Note that the control module will respond to all commands received with destination address 0xF. 7) If the transport medium is RS485 half duplex, note that some PC cards require software control of the RS485 transmit and receive buffer enable lines. The software in the customer device may need to coordinate the enabling /disabling of these buffers. 8) Ensure the control module is powered on.
Unable to communicate with a booster (communication with control module is OK)	1) Ensure the cable assembly between the control module and the booster is properly connected.
Packet response is not as expected (for example, RF traffic is valid, but the booster currently routed to the antenna is reporting a major alarm)	1) Confirm that the Destination / Source address byte is not inverted (i.e. Destination address is in the upper nibble, source address is in the lower nibble). 2) Ensure that the cables connecting the boosters to the control module are as indicated in the product user manual.
Reply packet is incomplete.	1) If software control of the transmit and receive buffer enable lines is required (RS485 half duplex), then it is possible that the timing between the transition needs to be adjusted.

Appendix D

Bench Test Record

Appendix D contains the Bench Test Record applicable to the system that this manual accompanies.

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Appendix E

Spare Parts

Appendix E contains a table of recommended spare parts for on-hand replacement. The following sheet can be copied and used as a fax form to order the required spare parts. Please make sure to include all identifying information to facilitate the processing of your order. The order may also be sent via email or regular mail delivery, at the following address.

mitec telecom inc.
9000 Trans Canada Blvd.
Pointe Claire, Quebec, Canada
H9R 5Z8

Fax: (514)694-3814
Email: egregoire@mitectelecom.com

For additional information, please contact our customer service department at:
(514)694-9000 or 1-800-724-3911

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mitec telecom inc.

designers and manufacturers of telecom & wireless products
ISO 9001 Certified

Spare Parts Order Form

From:			
Place By:		**Signature:**	
Telephone:			
Fax		**Email:**	

Part Description	Part Number	Qty	Unit Price*	Line Total*

* To be completed by **mitec** Sales Department

Fax to: Customer Service (514)694-3814