WRK-340420RX-485-ES-00

C-Band 1:1 Downlink Redundant Kit with Bias Tee/Controller

Operation and Maintenance Manual

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Responsive
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mitec telecom inc.

Designers and manufacturers of telecom and wireless products

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H9R 5Z8

OPERATION AND MAINTENANCE MANUAL	Preliminary ☐	Released ☒

REVISION RECORD

Revision	ECN #	Description	Date	Approved
1		Preliminary Release.	01 Mar 07	

CM Approval

TITLE:

C-Band 1:1 Downlink Redundant System with Bias T/Controller

Designer: N. roy **Date: 01 Mar 07**		**REV 0**
Technical Writer: C. Strunga **Date: 01 Mar 07**	**DOCUMENT NO. 213265-001MA**	**PAGE 1 OF 15**

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Table of Contents

List of Tables

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Preface

Scope

This document covers the installation of the C-Band 1:1 Downlink Redundant System with Bias T/Controller. 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.

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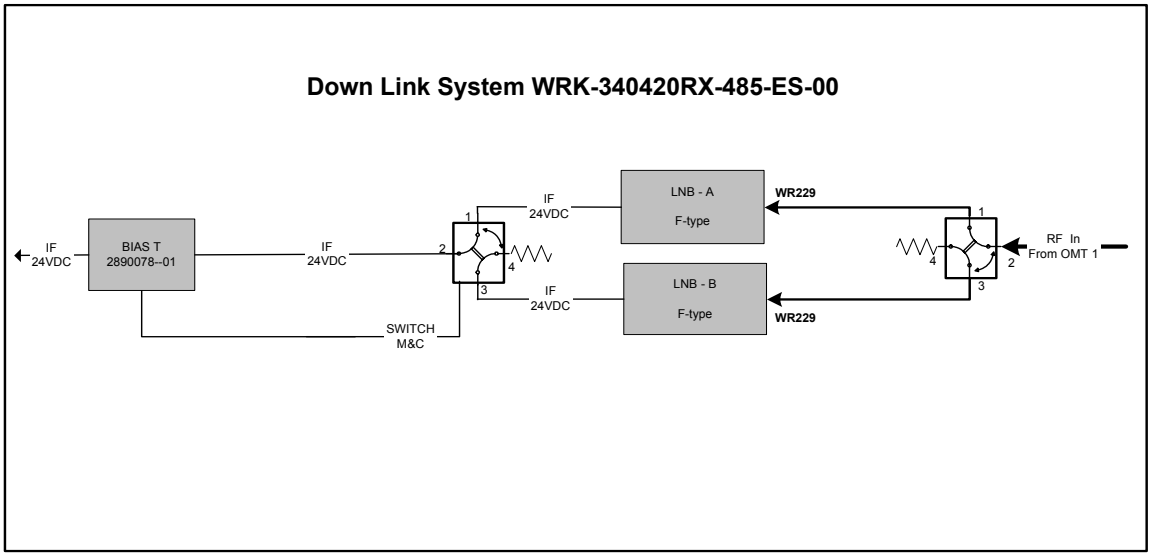
1 Introduction

1.1 General Description

The 1:1 Downlink Redundant Kit is an outdoor System. It includes two C-Band to L-Band Block-Downconverters (LNB), a Bias Tee, with integrated controller and a WR 229 waveguide switch assembly.



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
BUC	Block Up Converter
ºC	Degrees Celsius
dB	Decibel
dBm	Decibel referenced to mW
DC	Direct Current
GHz	Gigahertz (10^6 cycles per second)
IDU	In Door Unit
IF	Intermediate Frequency
LNB	Low Noise Block
M&C	Monitor and Control
MHz	Megahertz (10^3 cycles per second)

Abbreviation	Description
N/A	Not Applicable
ODU	Out Door Unit
RF	Radio Frequency
V	Volt
W	Watt
W/G	Wave Guide

1.2 Receiving and Inspection

The redundant kit will arrive in a standard 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.

Refer to the WRK-340420RX-485-ES-00 assembly drawing and parts list in Appendix A.

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.

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 WRK-340420RX-485-ES-00, 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:

WARNING!!

This unit is equipped with 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*
- *void the warranty*
- *cause damage to the units or related equipment*

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2 Installation

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.

NOTE

A gasket shall be used to seal each waveguide connection.

2.1 Assembly of WRK-340420RX-485-ES-00

CAUTION!

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

The parts list in Appendix A details the parts of the WRK-340420RX-485-ES-00. Hardware and gaskets are included to complete the assembly. Refer to the assembly drawing in Appendix A for further details.

With reference to the assembly drawing, WRK-340420RX-485-ES-00AD, in Appendix A, complete the following steps, if required.

1. If not already assembled and as per the assembly drawing, in Appendix A, assemble the waveguide switch sub-assembly, connecting the waveguide termination and waveguide bends to the switch. Use the hardware and gaskets specified on the assembly drawing.

2. With reference to the assembly drawing in Appendix A, assemble the LNBs, to the waveguide flanges. Use the hardware and gaskets specified in the assembly drawing.

3. Using the supplied hardware, assemble to the mounting plate, as per the assembly drawing.

4. Attach the controller assembly to the mounting plate, as per the assembly drawing, using the supplied hardware.

5. Assemble the U-bolt mounting kit to the mounting plate, as per the assembly drawing.

6. Complete the connections between the customer downlink waveguide port and the switch sub-assembly. Use gasket and hardware as specified.

2.2 Operation

The Downlink kit contains two C-Band to L-Band LNBs that are standard purchased components, and the input WR229 redundancy switch. For LNB technical information, refer to the LNB manufacturer user manual.

The monitoring and control for the WRK-340420RX-485-ES-00 is accomplished through the RS485 interface of the Bias T/controller assembly located on the mounting plate.

2.2.1 Downlink Redundant Kit Interface Connections

Table 2 details the connections for the downlink redundant kit.

Table 2: RF Ports and Control Interface

Connector Name	Type	Pin #	Signal Name	Description
Switch Port1	WR229	N/A	RF Output	RF Output (to LNB-A)
Switch Port2	WR229	N/A	RF Input	RF Input (from antenna)
Switch Port3	WR229	N/A	RF Output	RF Output (to LNB-B)
Switch Port4	WR229	N/A	N/A	Terminated (50Ω Load)
Switch Port1	N-type	N/A	IF Input	IF Input (from LNB-A)
Switch Port2	N-type	N/A	IF Output	IF Output (to Modem)
Switch Port3	N-type	N/A	IF Input	IF Input (from LNB-B)
Switch Port4	N-type	N/A	N/A	Terminated (50Ω Load)
Switch J1	MS3112E-14-15P	A	DRV_A	
		B	DRV_RTN	
		C	DRV_B	
		D	IND_A	
		E	IND_RTN	
		F	IND_B	
Control Module IF OUT J1	N Type Female			IF out +24Vdc in
Control Module IF IN J2	N Type Female			IF in +24Vdc OUT

Connector Name	Type	Pin #	Signal Name	Description
Control Module User Interface J3	MS3112E14-15P	A	TX^+	RS-485
		B	TX^-	
		C	GND	
		D	RX^+	
		E	RX^-	
SW Control Module J4	MS3112E-14-12S	A	DRV_A	
		B	DRV_RTN	
		C	DRV_B	
		D	IND_A	
		E	IND_RTN	
		F	IND_B	

2.3 Maintenance

WARNING!!

Shut down the LNBs before any maintenance is attempted. Failure to do so will result in personal injury. This includes removal of any RF power originating from other system components.

The WRK-340420RX-485-ES-00 requires very little preventive maintenance or repair.

2.3.1 LNB Maintenance

For preventive maintenance of the LNBs, refer to the ***LNB User Manual.***

2.3.2 Waveguide Switch Maintenance

Toggle the switching system at least once every three months to ensure proper switch operation.

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Appendix A

Drawings & Schematic Diagrams

MD-WRK-340420RX-485-ES-00 - Model Outline Drawing

AD-WRK-340420RX-485-ES-00 - Assembly Drawing

BM-WRK-340420RX-485-ES-00 - Parts List

211915-001 - Cable Assembly

211916-001 - Cable Assembly

211917-001 - Cable Assembly

19972-001AD - Cable Assembly

WRK-340420RX-485-00WD - Wiring Diagram

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REVISION			
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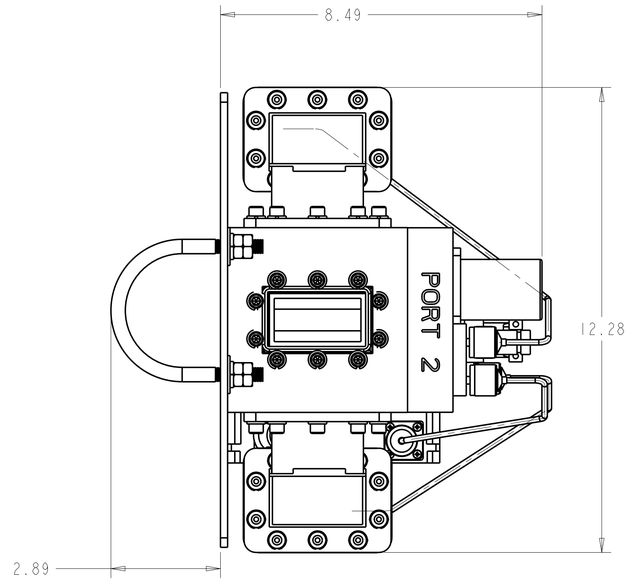

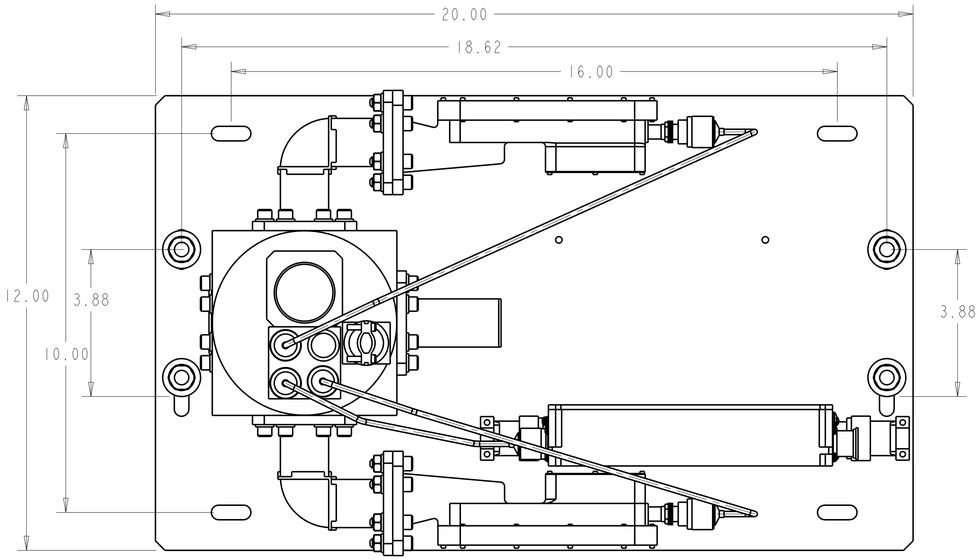

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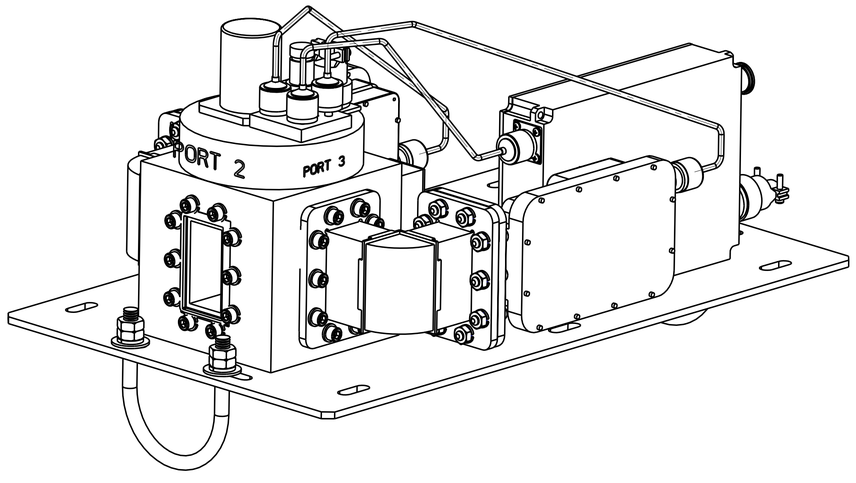

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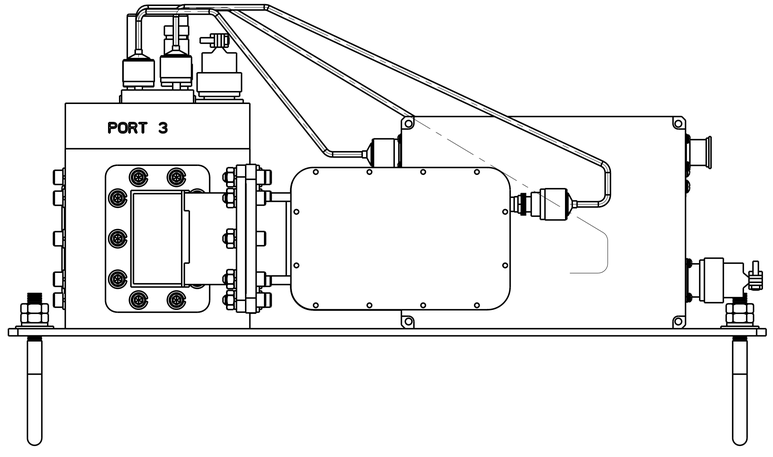

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ORIGINATOR: GUOQING FENG	DATE: 30-May-06	
DESIGNER: S. ZHOU/N.ROY	DATE: 30-May-06	

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	32	

DO NOT SCALE DRAWING

TITLE: C BAND DOWNLINK COLD REDUNDANT KIT
MATERIAL:
FINISH:

PROJECT NO: / JOB NO:
NEXT ASSEMBLY:
CAGE IDENT. NO: 38494
SIZE: D
DRAWING NO: MD-WRK-340420RX-485-ES-00
SCALE: 0.333
SHEET: 1 OF 1

(FORM 11477-008CF REV 3)

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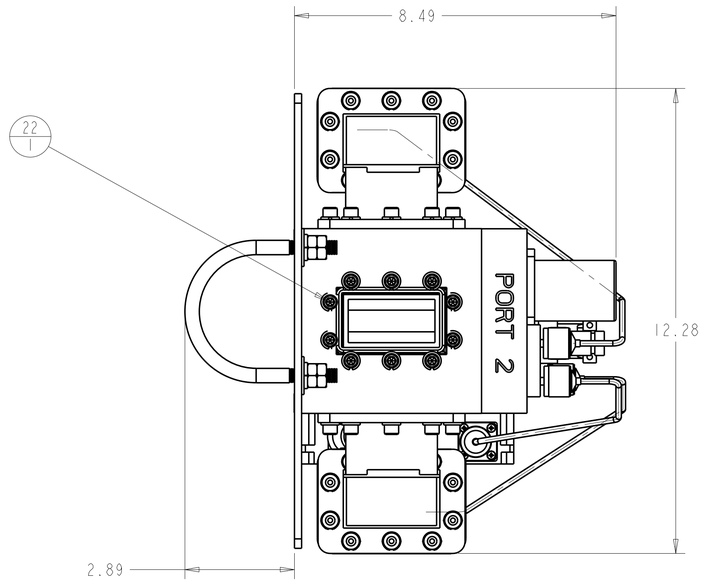

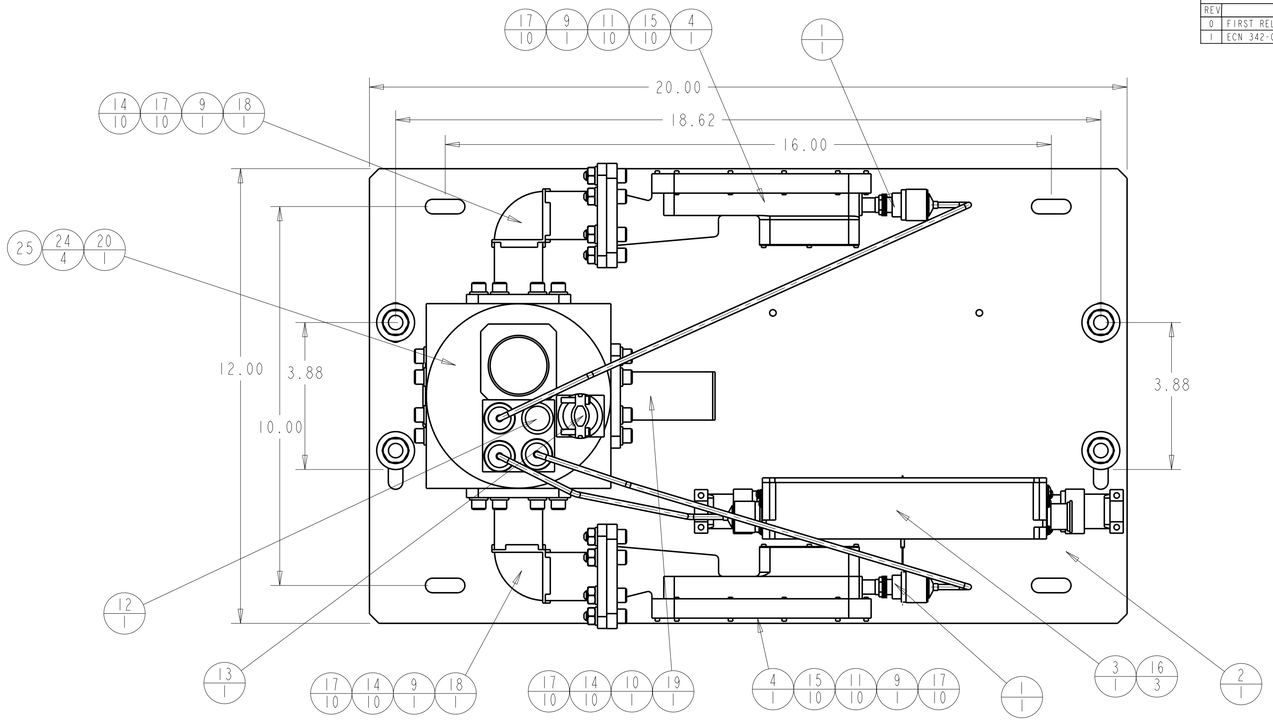

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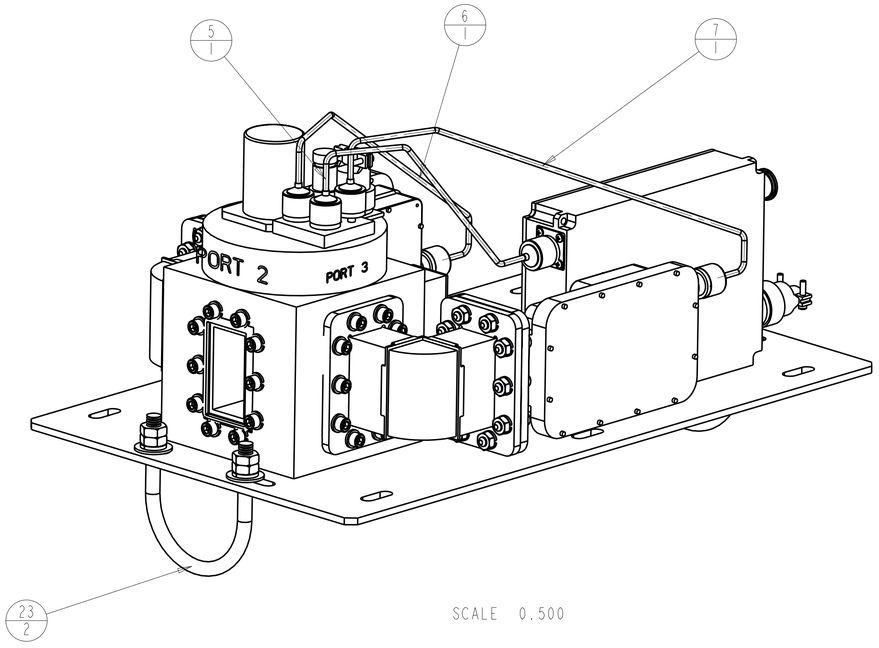

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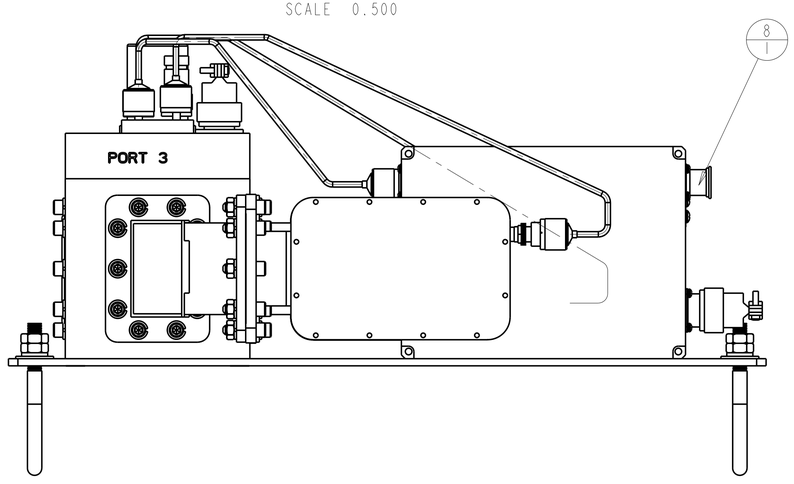

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DESIGNER:	S.ZHOU/N.ROY	DATE: 30-May-06

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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	
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MATERIAL:

FINISH:

PROJECT NO: / JOB NO:

NEXT ASSEMBLY:

CAGE IDENT. NO: 38494

SIZE: D

DRAWING NO: AD-WRK-340420RX-485-ES-00

SCALE: 0.333

SHEET: 1 OF 1

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CADM Release Date	Drawing/CADM Office No;	REV
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CM Approval;	**Title**	
	C BAND DOWNLINK COLD REDUNDANT SYSTEM	

ECN HISTORY

DATE	REV	DESCRIPTION	BY;
09-Jun-06	0	FIRST RELEASE	S.ZHOU
20-Jun-06	1	ECN295-06S	G.FENG
15-Jul-06	2	ECN342-06S	G.FENG

FIRST APPROVAL

SIGNATURES	DATE
ORIGINATOR: GUOQING FENG	09-Jun-06
ENG: S.ZHOU / N.ROY	09-Jun-06
APPROVAL: MARINA LISSIANSKAIA	09-Jun-06
APPROVAL: MARINA LISSIANSKAIA	15-Jul-06

ASSEMBLY

NEXT ASSY.	USED ON

ICI	Item no.	omponent Designatio	Value	Description	Mitec Part No.	QTY	REV	Comments and Alternate P/N
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				C BAND DOWNLK COLD REDUNDANT SYSTEM BENCH TEST RECORD	WRK-340420RX-485-ES-00TP	REF		
				C BAND DOWNLINK COLD REDUNDANT SYSTEM CABLING DIAGRAM	WRK-340420RX-485-ES-00WD	REF		
	1			ADAPTER COAX , F MALE TO N FEMALE	001-1221	2		
	2			BASE BRACKET(ROHS)	211951-001	1		
	3			BIAS TEE	2890078-01	1		
	4			C BAND PLL LNB F-FEMALE TYPE		2		OPTION, NOT SHOWN
	5			CABLE ASSY, SEMI-RIGID COAX CABLE (ROHS)	211915-001	1		
	6			CABLE ASSY, SEMI-RIGID COAX CABLE (ROHS)	211916-001	1		
	7			CABLE ASSY, SEMI-RIGID COAX CABLE (ROHS)	211917-001	1		
	8			COVER, CONNECTOR, ESD, SHELL #10	100598-003	1		
	9			FULL GSKT RECTANGULAR O-RING FOR CPR 229	1511308-2	4		
	10			HALF GSKT RECTANGULAR O-RING FOR CPR 229	1511309-2	1		
	11			NUT 1/4-20UNC, HEX	011-0254	20		
	12			RES TERMINATION	5079013	1		
	13			RF SWITCH CABLE ASSEMBLY	19972-001AD	1		
	14			SCREW 1/4-20 x 0.625LG, HEX SOC HD CAP	011-0231	30		
	15			SCREW 1/4-20 x 0.875LG, HEX SOC HD CAP	011-0237	20		
	16			SCREW FLAT 82 DEG PHILLIPS 8-32L3/8	6212015-06	3		
	17			WASHER, #1/4, LOCK	011-0260	50		
	18			WR 229 W/G ASSEMBLY	210533-001	2		
	19			WR229 LOW POWER TERMINATION	2523292-2-2	1		
	20			WR229 W/G, TYPE N SW, SEALED, +12VDC, CKT4	017-0203	1		
	21			CON CYL PWR 14 15 MS3116 S E 7.5	4849044	1		SHIPPING LOOSE
	22			HARDWARE KIT WR229 CPRG	211948-001PL	1		SHIPPING LOOSE
	23			U-BOLT MOUNTING KIT	2840006-01	2		SHIPPING LOOSE
	24			SCREW 1/4-20UNC x 1/2LG, CSINK FLAT PHILLIPS, SS	011-1018	4		
	25			LOCKTITE 24231, BLUE	020-0082	A/R		

REVISION			
REV	DESCRIPTION	DATE	APP
0	FIRST RELEASE	05-Jun-06	.

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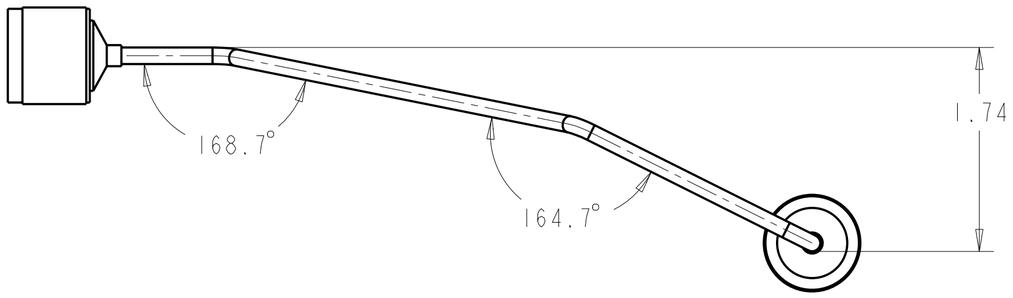

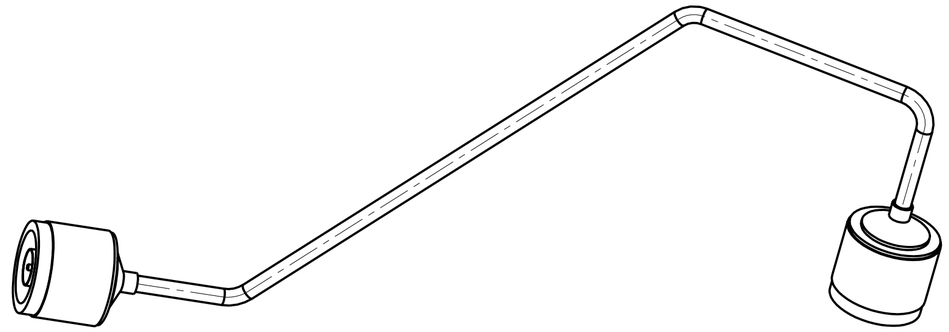

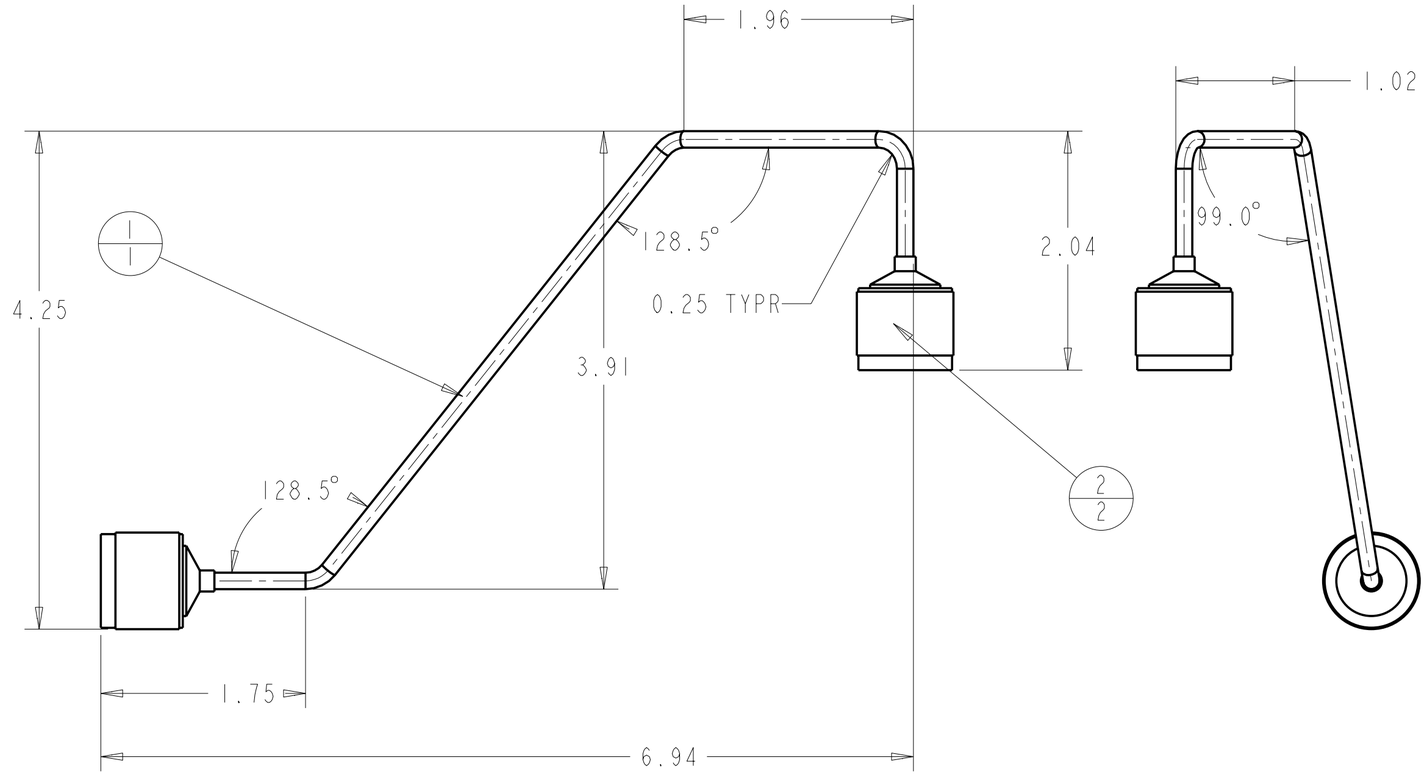

1. RoHS COMPLIANT AS PER EU DIRECTIVE 2002/95/EC.
2. MARK/IDENTIFY PARTS AS PER QPP-1050.
3. ALL SUPPLIERS SHALL COMPLY WITH QPP-1113 REQUIREMENTS AS CALLED OUT IN PURCHASE ORDER.

Preliminary

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DESIGNER: GUOQING FENG	DATE: 05-Jun-06	

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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 √	
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TITLE: CABLE ASSY, SEMI-RIGID COAX CABLE (ROHS)

MATERIAL:

FINISH:

PROJECT NO: / JOB NO:

NEXT ASSEMBLY:

CAGE IDENT. NO: 38494

SIZE: C

DRAWING NO: 211915-001AD

SCALE: 1.000

SHEET: 1 OF 1

(FORM 11477-007CF REV 3)

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2	STRAIGHT CABLE PLUG TYPE N	4899039	2		

REVISION			
REV	DESCRIPTION	DATE	APP
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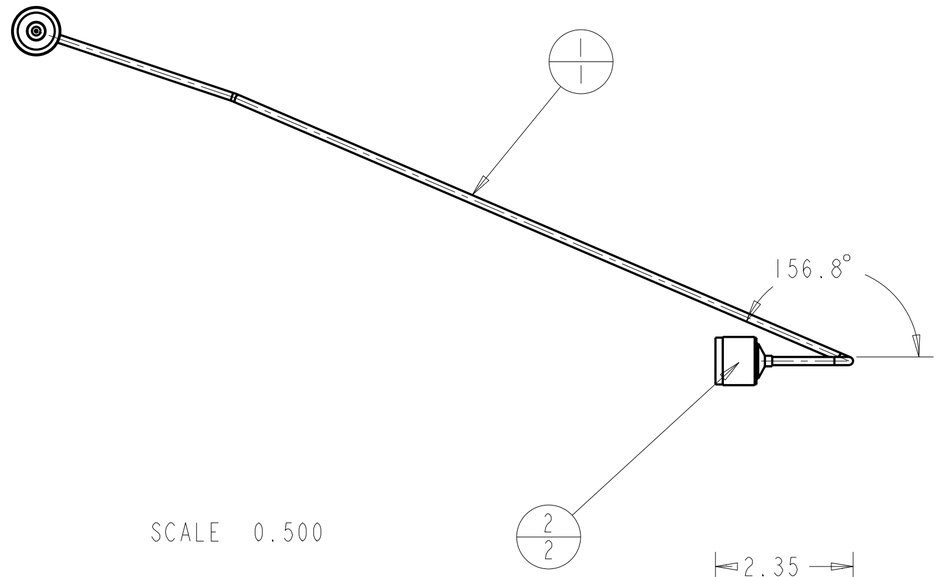

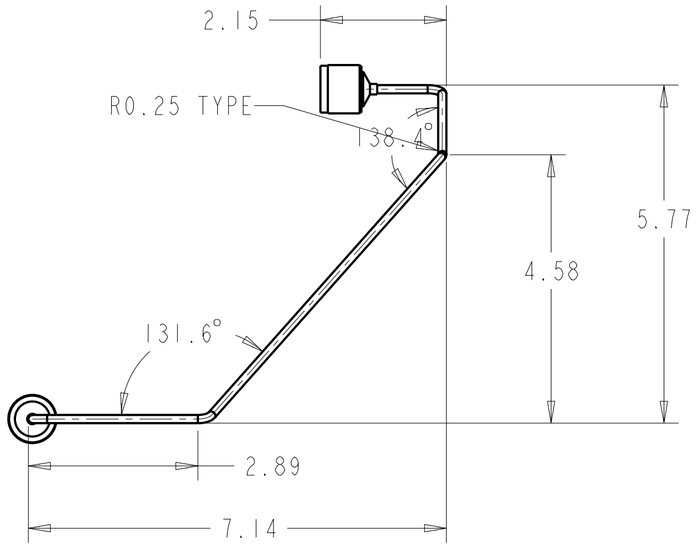

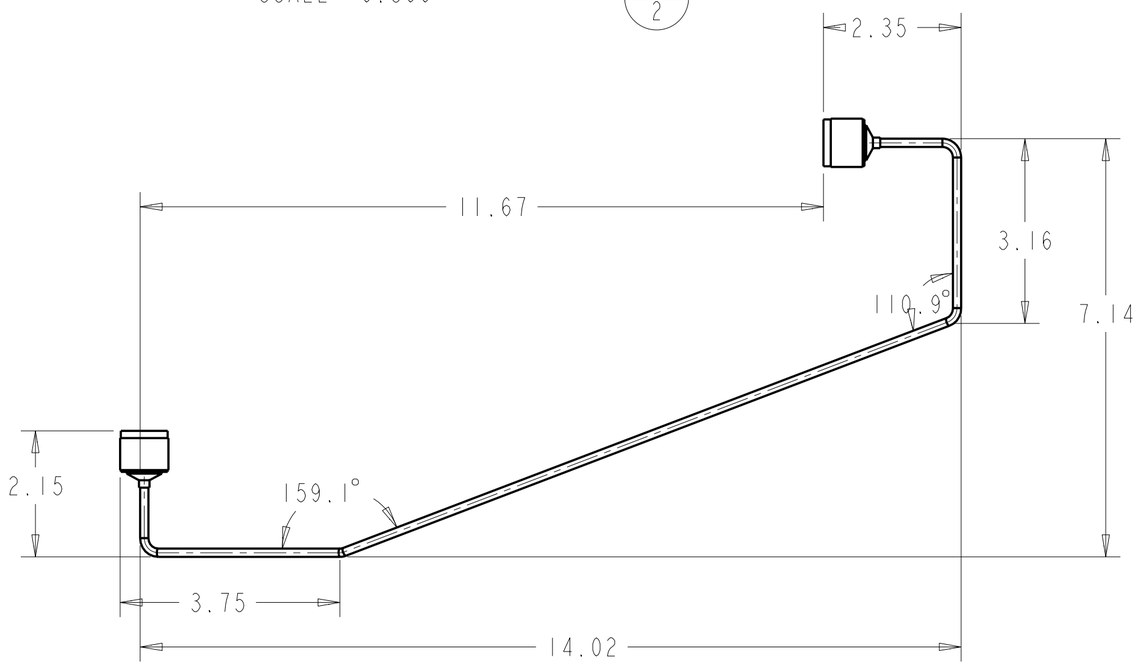

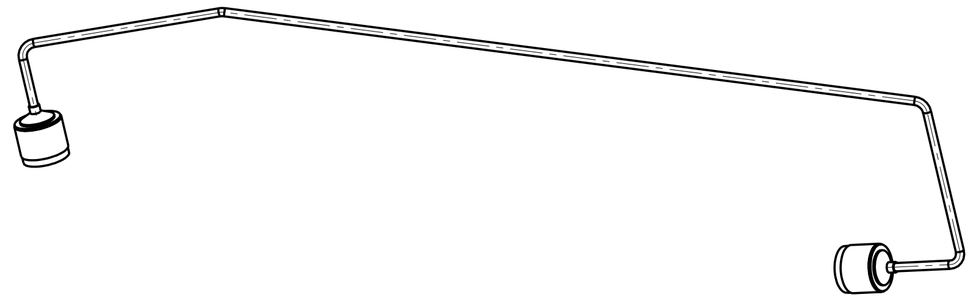

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1. RoHS COMPLIANT AS PER EU DIRECTIVE 2002/95/EC.
2. MARK/IDENTIFY PARTS AS PER QPP-1050.
3. ALL SUPPLIERS SHALL COMPLY WITH QPP-1113 REQUIREMENTS AS CALLED OUT IN PURCHASE ORDER.

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ORIGINATOR: GUOQING FENG DATE: 05-Jun-06

DESIGNER: GUOQING FENG DATE: 05-Jun-06

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: CABLE ASSY, SEMI-RIGID COAX CABLE (ROHS)

MATERIAL:

FINISH:

PROJECT NO: / JOB NO:

NEXT ASSEMBLY:

CAGE IDENT. NO: 38494

SIZE: C

DRAWING NO: 211916-001AD

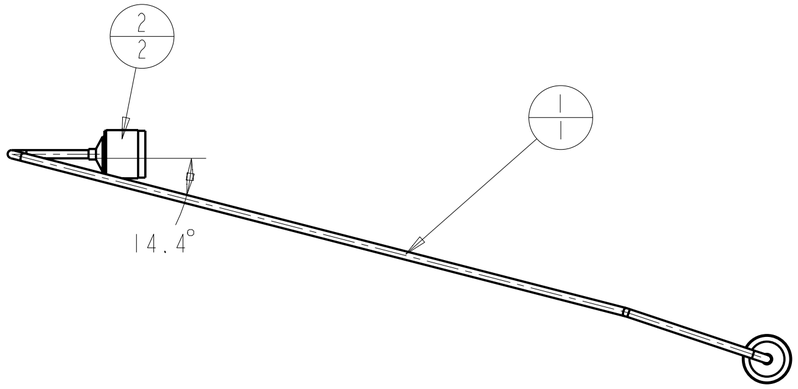
SCALE: 0.333

SHEET: 1 OF 1

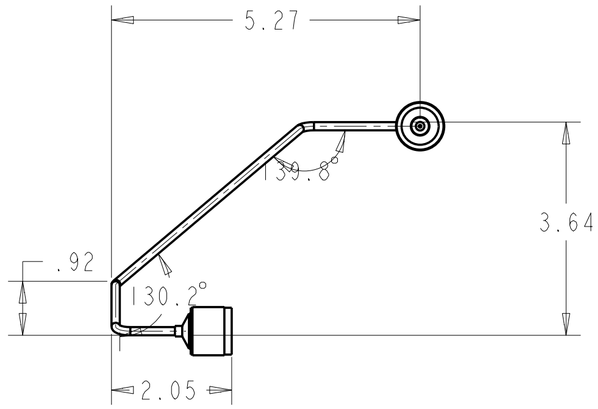
(FORM 11477-007CF REV 3)

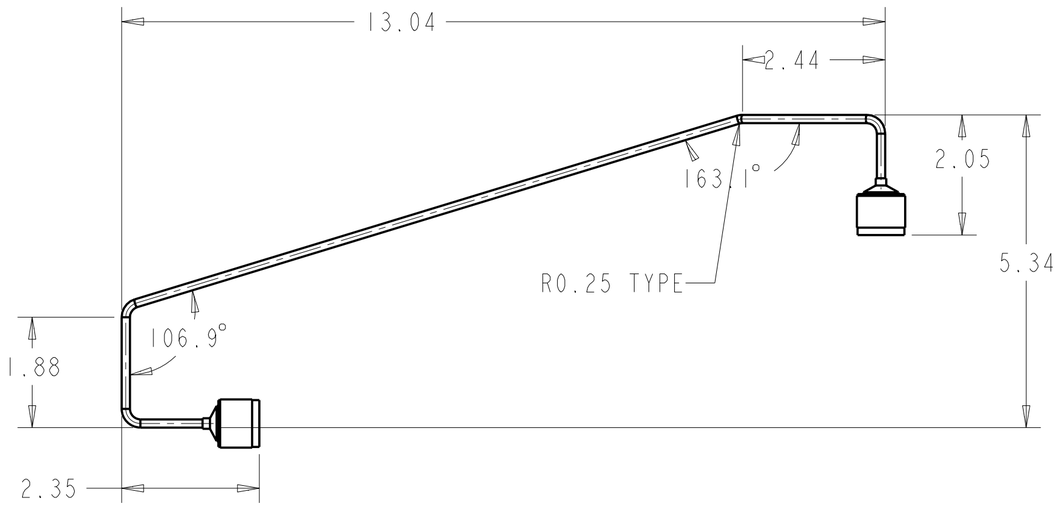
REVISION			
REV	DESCRIPTION	DATE	APP
0	FIRST RELEASE	05-Jun-06	.
1	ECN342-06S, INCREASE THE LENGTH FOR EASIER ASSEMBLY	15-JUL-06	GF

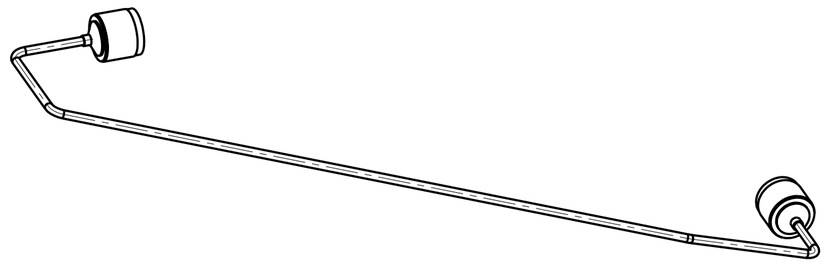
ITEM NO.	DESCRIPTION	MITEC DRAWING/PART NO.	QTY	MFR. PART NO.	COMMENTS/MFR.
REF	CABLE ASSY, SEMI-RIGID COAX CABLE (ROHS)	211917-001	1		
1	RF CAB SEMR 141 50 PTFE 120.0W 1.40/0.10	4609008	1		
2	STRAIGHT CABLE PLUG TYPE N	4899039	2		



SCALE 0.500







SCALE 0.500

1. RoHS COMPLIANT AS PER EU DIRECTIVE 2002/95/EC.
2. MARK/IDENTIFY PARTS AS PER QPP-1050.
3. ALL SUPPLIERS SHALL COMPLY WITH QPP-1113 REQUIREMENTS AS CALLED OUT IN PURCHASE ORDER.

	DRAWING	PART
NO.	211917-001AD	211917-001
REV	1	1
STATE	RELEASE	RELEASE
ORIGINATOR: GUOQING FENG	DATE: 05-Jun-06	
DESIGNER: GUOQING FENG	DATE: 05-Jun-06	

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: CABLE ASSY, SEMI-RIGID COAX CABLE (ROHS)

MATERIAL:

FINISH:

PROJECT NO: / JOB NO:

NEXT ASSEMBLY:

CAGE IDENT. NO: 38494

SIZE: C

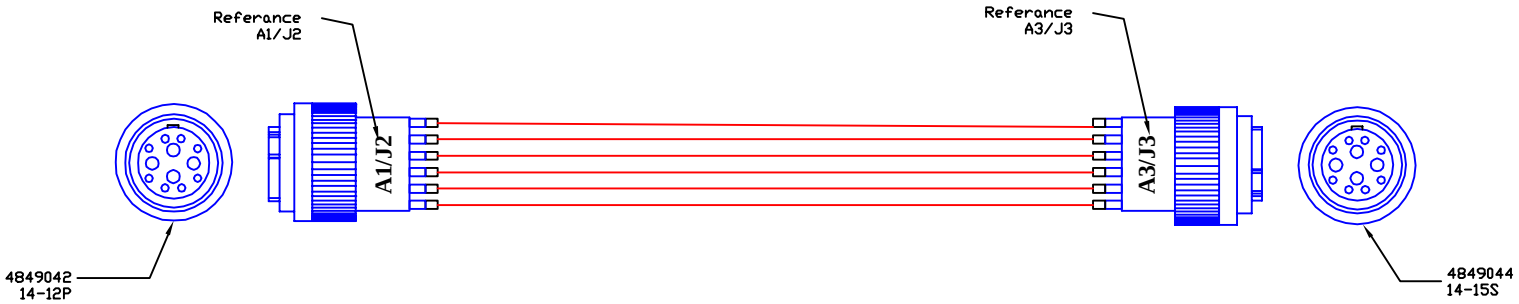
DRAWING NO: 211917-001AD

SCALE: 0.333

SHEET: 1 OF 1

(FORM 11477-007CF REV 3)

REVISION			
REV	DESCRIPTION	DATE	APP
0	FIRST RELEASE	11/04/2005	.



Description	Item	Item #	Qty
Connector A1/J2	Con cyl pwr 14 12 ms3116 pe7	4849042	1
Connector A3/J3	Con cyl pwr 14 15 ms3116 pe7	4849044	1
Cable	Cable sheilded 10 lead 22 awg	045-0005	20"

Note 1: Connector drawings are for representation purpose only.
Note 2: 4849042 & 4849044 are ordered in the top level
Note 3: Install labels marked with the references on connectors as shown.
Note 4: Use shrink tubing to cover the end of the PVC at the point the strength relieve of each connector is grabbing the cable. Shrink tubing should not be sticking out of the connector for less than ½ inch or more than 1 inch.
Note 5: DO NOT over tight the strength relieves on the connector. Excessive pressure will damage the wire isolation.
Note 6: Identify the cable as per Mitec QPP-1050.

Wire List

Wire #	From	Termination	To	Termination	Colour	AWG	Length (inches) +/- 1 inch	Signal
1	A1/J2 Pin A	Strip	A3/J3 Pin A	Strip	Black	22	20"	(A-B Port 1 - 2)
2	A1/J2 Pin B	Strip	A3/J3 Pin B	Strip	Brown	22	20"	GND
3	A1/J2 Pin C	Strip	A3/J3 Pin C	Strip	Red	22	20"	(C-B Port 1 - 4)
4	A1/J2 Pin D	Strip	A3/J3 Pin D	Strip	Orange	22	20"	(A-B Port 1 - 2)
5	A1/J2 Pin E	Strip	A3/J3 Pin E	Strip	Yellow	22	20"	GND
6	A1/J2 Pin F	Strip	A3/J3 Pin F	Strip	Green	22	20"	(C-B Port 1 - 4)

CM APPROVAL: CCB Approved

ORIGINATOR: N.R. DATE: 11/04/2005
DESIGNER: N.R. DATE: 11/04/2005

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 °	
Fractional Dimensions	±1/64	
Surface Finish	63	

DO NOT SCALE DRAWING

TITLE: RF switch cable harness
MATERIAL: .
FINISH: .

PROJECT NO: / JOB NO: .
NEXT ASSEMBLY: .
SCALE: .
CAGE IDENT. NO: 38494
SIZE: A
DRAWING NO: 19972-001AD
REV: 0
SHEET: 1 OF 1

mitec telecom

(FORM 11477-001CF REV 1)

REVISION			
Rev	DESCRIPTION	Date:	APP:
.	.	.	
.	.	.	
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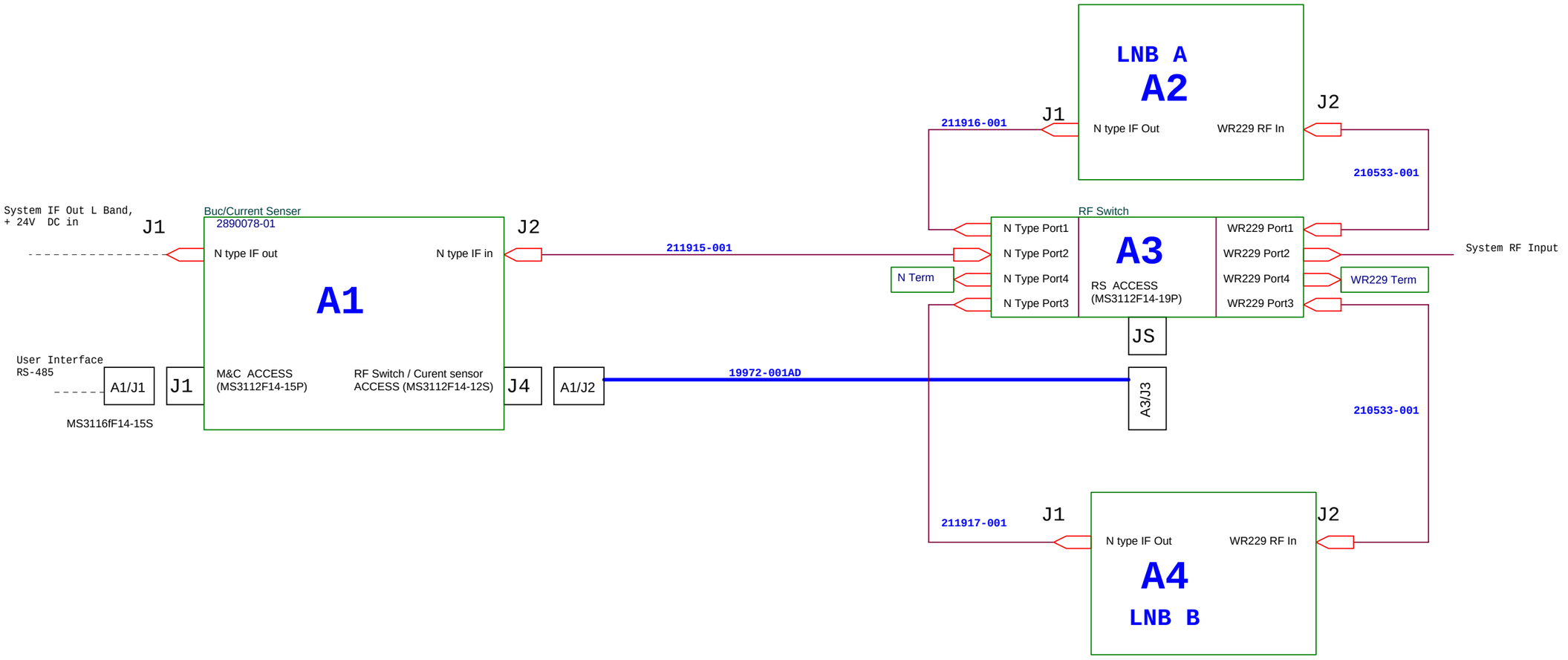

CM approval

Title

C to L-BAND, DownLink REDUNDANT SYSTEM

Originator: N Roy	Date: 03-07-07		Cage ident. no. 38494	Size B	Document Number WRK-340420RX-485-ES-00WD
Designer: N Roy	Date: 03-07-07	Project no. / Job no. --	Next assy. --	(FORM 11477-010CF REV 0)	Rev 0 / Sheet 1 of 1

Appendix B

LNB Documentation

Appendix B contains the manufacturer documentation relevant to the LNBs if they are been purchased with this redundant kit.

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Appendix C

Serial Protocol Documentation

Appendix C contains the serial protocol documentation relevant to this redundant kit.

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Revision	Date	Change Summary	Approval
0A	07-Oct-2003	Protocol specifications for down-link redundant kit WRK-109128RX-485-ES-00.	C. Villeneuve
0B	02-Feb-2004	Completely revamped the document format. No functional changes made to the software itself	C. Villeneuve
0C	1-Apr-2004	Examples redone with control module -= 0x1. (ECN88-04S)	C. Villeneuve

Serial Communication Protocol Specification
For
Down-Link Redundant Kit

Software Version 3900047-00

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 down-link redundant kit configured with control software 3900047-00.

The system as a whole consists of 1 main unit which the user may communicate with: The redundant control module. Refer to Figure 1) System Block Diagram.

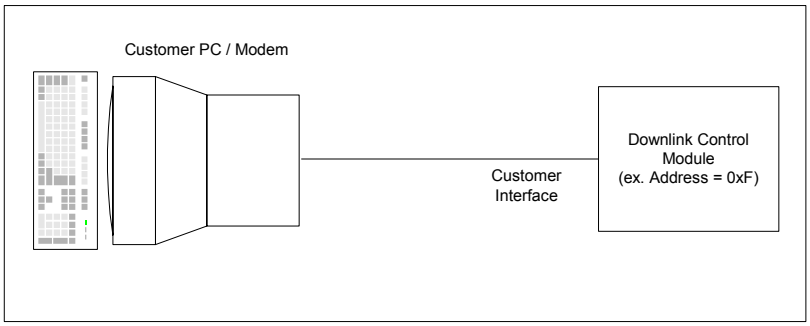


Figure 1) System Block Diagram

3 Definitions and acronyms

The following terms appear throughout this document:

BUC:	Block Up Converter
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 Transceiver (ie. typically a modem or PC).
Customer Interface Device:	The interface device used by the customer to interact with the Transceiver (ie. typically a modem or PC).
LNB:	Low Noise Block
PC:	Personal Computer.
RF:	Radio Frequency.
SCI:	Serial Communications Interface.
WBT:	Wavesat Bias Tee Unit
WTX:	Wavesat Transmitter. Also referred to as ODU or Booster.

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, RS485 half duplex and RS485 full duplex during production of the system. As a result, the customer must refer to the product user manual to confirm the interface of the product purchased.

5.3 Customer Interface Cable Connections

This software protocol remains the same regardless of the transport medium used (ie RS232, RS485 half duplex or RS485 full duplex). This section defines the wiring required to communicate with the Mitec product.

Note that the pin numbers on both side 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:

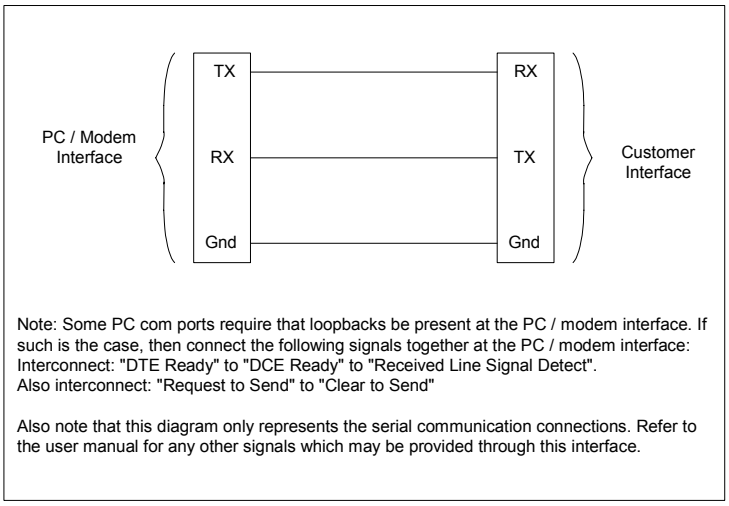


Figure 2) RS232 Customer Interface Wiring

For RS485 Half Duplex:

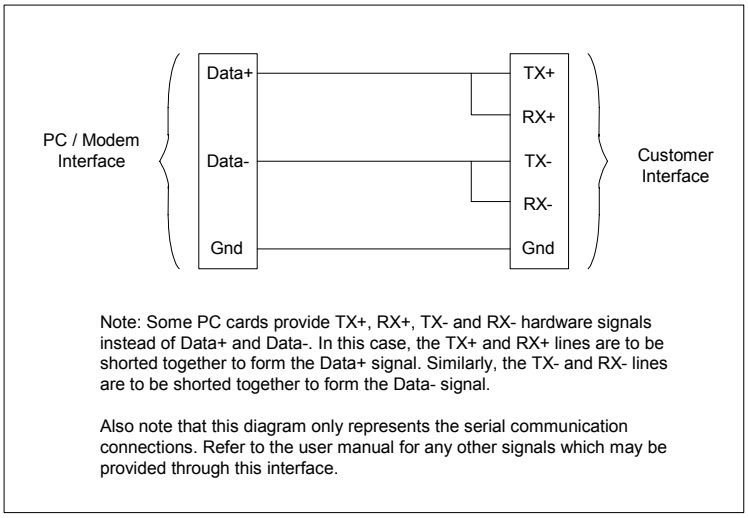


Figure 3) RS485 Half Duplex Customer Interface Wiring

For RS485 Full Duplex (ie RS422):

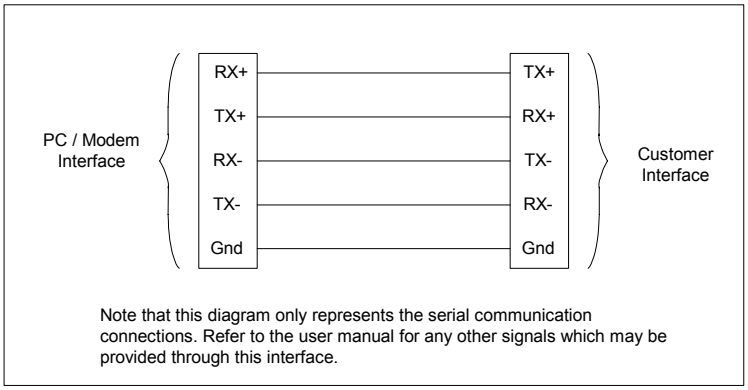


Figure 4) RS485 Full Duplex (ie RS422) Customer Interface Wiring

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):

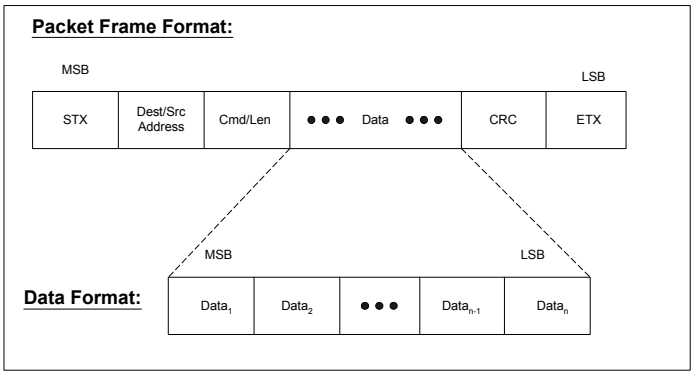


Figure 5) SCI Packet Frame Format

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 0**Error! Not a valid bookmark self-reference.**

- **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 redundant control module device address is factory defaulted to 0xF. It may be set by the customer using the SET Master Controller Device Address command (refer to SET Control Command List).

6.1.3 Address Setup Procedure

This section provides instructions to confirm the preset redundant control module address of 0xF.

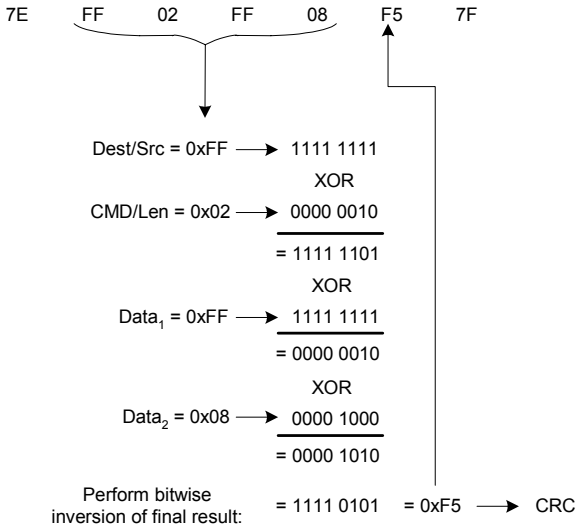
1) Ensure the customer interface cable is wired as shown in Customer Interface Cable Connections.

2) Use a PC program or modem to issue a "GET MASTER CONTROLLER DEVICE ADDRESS" command using destination address 0xF. A reply from the controller indicates that the link has been established. Note that the control module will always respond to packets with a destination address 0xF, regardless of it's current internal device address setting.

3) The customer may choose to leave the address at address 0xF provided it is the only module connected to the PC com port. If there is at least a second module connected (for example, the up link control module), then the down link address will have to be changed to a unique address other than 0xF. This is accomplished by removing all other modules from the com port and sending a "SET CONTROL MODULE DEVICE ADDRESS" command to the redundant control module to set the device address to the desired value (say 0x02). If an ACK reply was received, then the command was accepted

6.1.4 CRC Calculation Example

To send a command to read the redundant status (database element = 0xFF08) from the control module (device address 0x0F), the command is:



6.1.5 Command / Reply Packet Sequencing

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

7 Command List

7.1 Default Reply Packet Format

This section identifies the packet format 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 0x1. 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 F1 E0 EE 7F (ACK reply sent from the redundant control module)
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) ZZ = CRC.	1) reply: 7E F1 F1 03 FC 7F (NACK reply sent from the redundant control module for an invalid CRC)

7.2 GET Status Command List

This section identifies the list of commands available to query any 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 0x1. 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 Redundant Status	7E 1F 02 FF 08 15 7F	Query control module for redundancy status	**Update Redundant Status:** 7E F0 84 FF 08 XX YY ZZ 7F	XX = Bitmap as follows: **Bit 0:** Protection fault alarm status (0 = no alarm; 1 = alarm) **Bits 2,1:** RF switch position (00 = undetermined; 01 = side A active; 10 = side B active; 11 = switch in between 2 positions) **Bits 4,3:** RF switch force setting (00 = no force applied; 01 = forced to side A; 10 = forced to side B; 11 = not applicable) **Bit 5:** Not Used **Bit 6:** 10MHz alarm setting (0 = no alarm; 1 = alarm) **Bit 7:** Not used YY = Bitmap as follows: **Bit 0:** Not used **Bit 1:** Not used **Bits 3,2:** LNB A alarm status (00 = not applicable; 01 = undetermined; 10 = applicable / no alarm (LNB A OK); 11 = applicable / alarm (LNB A in alarm)) **Bit 4:** Not used **Bit 5:** Not used **Bits 7,6:** LNB B alarm status (00 = not applicable; 01 = undetermined; 10 = applicable / no alarm (LNB B OK); 11 = applicable / alarm (LNB B in alarm)) ZZ = CRC.	1) cmd: 7E 1F 02 FF 08 15 7F reply: 7E F1 84 FF 08 04 00 79 7F (No protection fault alarm; RF switch on position B; No force applied; No alarms) 2) cmd: 7E 1F 02 FF 08 15 7F reply: 7E F1 84 FF 08 0A 0C 7B 7F (No protection fault alarm; RF switch on position A; Forced applied to side A; LNB A alarm)
			NACK	Refer to 7.1.	

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Get Alarm Log	7E 1F 02 20 FF 3D 7F	Query the control module for the alarm log status. The alarm log identifies if an alarm condition has occurred since the last time the log was reset. Note that the Get Redundant Status command provides the current state of the alarms (other than the BUC alarms which are latched), whereas this command retains the history of the alarms.	**Update Alarm Log:** 7E F1 84 20 FF XX YY ZZ 7F	XX = Bitmap as follows: **Bit 0:** protection fault alarm status (0 = no alarm; 1 = alarm) **Bit 1:** 10MHz reference alarm status – if applicable (0 = no alarm; 1 = alarm) **Bit 2:** 24Vdc alarm status (0 = no alarm; 1 = alarm) **Bit 3-6:** Not Used **Bit 7:** Summary alarm status (0 = no alarm; 1 = alarm) YY = Bitmap as follows: **Bit 0:** Not Used **Bit 1:** BUC A alarm status (0 = no alarm; 1 = alarm) **Bit s2 - 4:** Not Used **Bit 5:** BUC B alarm status (0 = no alarm; 1 = alarm) **Bits 6 - 7:** Not Used ZZ = CRC.	1) cmd: 7E 1F 02 20 FF 3D 7F reply: 7E F1 84 20 FF 84 00 D1 7F (24Vdc alarm; Summary alarm) 2) cmd: 7E 1F 02 20 FF 3D 7F reply: 7E F1 84 20 FF 80 02 D7 7F (BUC A alarm; Summary alarm)
			NACK	Refer to 7.1.	
Get Control Module SW Version Base number (MSB)	7E 1F 02 05 FC 1B 7F	Query Control Module for SW version base MSB	**Update SW Version Base MSB:** 7E F1 84 05 FC 39 00 4A 7F	SW version base number MSB is always 0x3900.	1) cmd: 7E 1F 02 05 FC 1B 7F reply: 7E F1 84 05 FC 39 00 4A 7F cmd: 7E 1F 02 05 FD 1A 7F reply: 7E F1 84 05 FD 00 47 35 7F cmd: 7E 1F 02 05 FE 19 7F reply: 7E F1 84 05 FE 00 00 71 7F cmd: 7E 1F 02 05 FF 18 7F reply: 7E F1 84 05 FF 30 41 01 7F The resulting software version is: 3900047-00-R0A
			NACK	Refer to 7.1.	
Get Control Module SW Version Base number (LSB)	7E 1F 02 05 FD 1A 7F	Query Control Module for SW version base LSB	**Update SW Version Base LSB:** 7E F1 84 05 FD XX XX ZZ 7F	XX XX = SW version base number (LSB). ZZ = CRC.	
			NACK	Refer to 7.1.	
Get Control Module SW Version Configuration	7E 1F 02 05 FE 19 7F	Query Control Module for SW version configuration	**Update SW Version Config:** 7E F1 84 05 FE 00 XX ZZ 7F	XX = SW version configuration. ZZ = CRC.	
			NACK	Refer to 7.1.	

Command	Packet Format	Explanation	Possible Replies	Interpretation	Examples
Get Control Module SW Version Revision	7E 1F 02 05 FF 18 7F	Query Control Module for SW version revision	**Update SW Version revision:** 7E F1 84 05 FF RR RR ZZ 7F	RR RR = SW version revision represented as two ASCII characters. ZZ = CRC.	
			NACK	Refer to 7.1.	
Get Control Module Device Address	7E FF 02 03 06 07 7F	Query Control Module for device address	**Update control module device address:** 7E FF 84 03 06 00 XX ZZ 7F	XX = Control module device address. ZZ = CRC.	1) cmd: 7E FF 02 03 06 E7 7F reply: 7E FF84 03 06 00 0F 8E 7F (Control module device address = 0xF) 2) cmd: 7E FF 02 03 06 E7 7F reply: 7E FF 84 03 06 00 00 81 7F (Control module device address = 0x0)
			NACK	Refer to 7.1.	

7.3 GET Alarms Command List

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

All alarms are available as bits in the Get Redundant Status command.

7.4 SET Control Command List

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

NOTE: The packets shown in the list below are based on the assumption that the master controller device address is set to 0x1. 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
Toggle RF Switch	7E 1F 14 06 0A 00 00 F8 7F	Alternate the position of the RF switch. Note that the packet will not be processed if the standby unit is in alarm or if the RF switch is forced.	**ACK**	Refer to 7.1.	1) cmd: 7E 1F 14 06 0A 00 00 F8 7F reply: ACK
			NACK	Refer to 7.1.	
Force RF switch	7E 1F 14 19 FF 00 XX ZZ 7F	Force the RF switch to the specified side, regardless of system conditions on that side. XX = 0x00: Remove all forces XX = 0x01: Force to side A XX = 0x02: Force to side B ZZ = CRC	**ACK**	Refer to 7.1.	1) cmd: 7E 1F 14 19 FF 00 01 13 7F reply: ACK (Force to side A) 2) cmd: 7E 1F 14 19 FF 00 02 10 7F reply: ACK (Force to side B) 3) cmd: 7E 1F 14 19 FF 00 00 12 7F reply: ACK (Remove all forces)
			NACK	Refer to 7.1.	
Alarm Reset	7E 1F 14 06 0B 00 XX ZZ 7F	Reset the latched alarms on side A and/or B. Note: This command does not clear the alarm log values. XX = 0x01: Reset side A alarms only XX = 0x10: Reset side B alarms only XX = 0x11: Reset side A and side B alarms ZZ = CRC	**ACK**	Refer to 7.1.	1) cmd: 7E 1F 14 06 0B 00 10 E9 7F reply: ACK (Clear all latched alarms on side B only) 2) cmd: 7E 1F 14 06 0B 00 11 E8 7F reply: ACK (Clear all latched alarms on both sides)
			NACK	Refer to 7.1.	
Clear Alarm Log	7E 1F 14 20 FF 00 00 2B 7F	Reset the logged alarms.	**ACK**	Refer to 7.1.	1) cmd: 7E 1F 14 20 FF 00 00 2B 7F reply: ACK (Clear the alarm log)
			NACK	Refer to 7.1.	
Set Control Module Device Address	7E FF 14 03 06 00 XX ZZ 7F	Set control module device address ((0 ≤ address ≤ 0xD) OR (address = 0xF))	**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) 2) cmd: 7E FF 14 03 06 00 00 11 7F reply: ACK (Set control module device address to 0x0)
			NACK	Refer to 7.1.	

8 Appendix I: Troubleshooting Guide

Problem	Possible Remedies
No response at all from the redundant control module.	1) Ensure the cable assembly is wired properly (refer to 5.3Customer 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 5.1Customer 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.
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 relevant to this redundant kit.

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ECN Pending

ECN 059-07V PENDING

9000 Trans-Canada, Pointe Claire, PQ, T: 514-694-9000, F: 514-694-7652

CM RELEASE

Document:	**BR-WTX-14014546-70-ES-37-R0A**	**Date:**	**Sep/29/04**
Number:	**WTX-14014546-70-ES-37**	**Page:**	**1 of 3**
Rev:	**0A**	**Originator:**	**Simon Zhou**
Title:	**L-Ku-Band 40W 70 dB Gain ODU**	**Approval**	**Marina Lissianskaia**

Revision	Date	Change Summary	Approval
0A	**Sep/29/04**	Engineering Release	ML

Serial Number: _____ Tested by: _____ Date: _____

Spec	Parameters	F1	F2	F3	F4	F5	F6
1	**Input Frequency**, MHz 950-1450 **Output Frequency**, GHz 13.75-14.25	950	1050	1150	1250	1350	1450
2.	**Gain**, dB - 69dB typ @ -40°C ambient						
	@ +25°C ambient						
	@ +55°C ambient						
3	**Gain flatness** - +/-2.5dB nom @-40°C ambient @+25°c ambient @+55°c ambient						
4	**Output Power @ P_{1dB},** dBm 46.0 dBm, min @-40°c ambient						
	46.0 dBm, min @ +25°C ambient						
	46.0dBm, typ. @ +55°C ambient						
5	**IMD,** dBc – 30dBc typ separated 5Mhz, 2 tones @ 37dBm/tone @ +25°C ambient	F out=13.75GHz		Fout=14.00GHz		Fout=14.25GHz	
6	**Spurious in Band**, dBc -50dBc max @P1dB @-40°C ambient;						

7	**Spurious out of Band**, dBc -50dBc max @P1dB @-40°C ambient;	
Spec	Parameters	Fc=14.25GHz
8	**Phase Noise**, @ offset from Fc -60dBc/Hz @ 300Hz -70dBc/Hz @ 1KHz -80dBc/Hz @ 10KHz -90dBc/Hz @ 100KHz -100dBc/Hz @ 1MHz 2.2 degrees max from 300Hz up to 1MHz	 dBc/Hz @ 300Hz dBc/Hz @ 1KHz dBc/Hz @ 10KHz dBc/Hz @ 100KHz dBc/Hz @ 1MHz degrees max from 300Hz up to 1MHz
9	**Temperature Shut Down** T ambient, °C +60°C min T hot spot, °C +87°C max	

Monitor and Control Interface Test.

1. Mute Control via RS-485 Passed/Failed
2. Temperature monitor

Ambient T,°C	-40°C	+25°C	+55°C
Vtem.senc, V			

3. Output Power Detector

3.1. Fout=13.75GHz

Pout, dBm	24	27	30	33	35	37	39	41	42	43	44	45	45.5	46	46.5	47
Vdet, V																

3.2. Fout=14.00 GHz

Pout, dBm	24	27	30	33	35	37	39	41	42	43	44	45	45.5	46	46.5	47
Vdet, V																

3.3 Fout=14.25 GHz

Pout, dBm	24	27	30	33	35	37	39	41	42	43	44	45	45.5	46	46.5	47

Vdet, V																

4. System Alarm via RS-485 passed/failed

5. System Alarm (Hardware line)
   TTL high operational; passed/failed
   TTL low alarm condition passed/failed

Plots and Graphs to be attached:

- Test Item 2 - Gain vs Frequency @-40°C, +25°C, +55°C ___p.
- Test Item 4 – Pin vs Pout at F1, F3, F6 @-40°C, +25°C, +55°C ___p.
- Test Item 5 – IMD @+25°C ___p.

Interface

Connector Name	Type	Pin #	Signal Name	Description	Parameter
J1 “IF IN”	N-type female	N/A	IF In	IF Input 24 VDC IN 10 MHz Ref. In	-20 dBm, max 24 VDC, 1.0 A -5dBm to 5dBm
J2 “RF OUT”	WR75G	N/A	RF Out	RF Output	47.0 dBm, max
3 “AC POWER IN”	17pin Bulkhead Connector (male) MS3102R20-29P	A	L (AC)	Line	110/220 VAC
		B	GND	Ground	
		C	N (AC)	Neutral	
		D-T	-	Not Connected	
J4 “M&C” Interface	17pin Bulkhead Connector (female) MS3102R20-29S	A	Rx+	Rx+	RS-485
		B	Rx-	Rx-	
		C	Tx+	Tx+	
		D	Tx-	Tx-	
		E	Det	Detector	analog
		F	Alarm	Summary Alarm	TTL
		G	GND	GND	
		H-T	-	Not Connected	