INSTALLATION AND OPERATING MANUAL

REDUNDANT 200 W C-BAND HUB-MOUNT

SOLID STATE BLOCK UP-CONVERTER

SSPBM - C200 - BRE

PM 1R1-31N1A0-2N0 REV. 7

WARRANTY

This ADVANTECH Advanced Microwave Technologies, Inc. product is warranted against defects in material and workmanship for a period of 2 years from the date of shipment. During the warranty period, ADVANTECH Advanced Microwave Technologies, Inc. will, at its option, either repair or replace products that will prove to be defective.

To return a product for warranty or repair service, you must first request a Return Material Authorization (RMA) number by contacting ADVANTECH at:

Phone: (514) 420-0045 or Fax: (514) 420-0073
Website: www.AdvantechAMT.com or e-mail: Support@AdvantechAMT.com

The unit should be shipped to the following address, in original shipping container (box), with shipping charges prepaid.

ADVANTECH Advanced Microwave Technologies, Inc.
657 Orly Avenue
Dorval, Quebec
H9P 1G1
CANADA

Please indicate the RMA number on all shipping documentation.

Units shipped without prior issued RMA, or shipped not in original packing, may be subject of rejection and returned at sender's own expense.

LIMITATIONS OF WARRANTY

ADVANTECH Advanced Microwave Technologies, Inc. warrants this product to be free of materials and workmanship defects.

The foregoing warranty shall not apply to defects resulting from improper handling or abuse by the Buyer, unauthorized modification, operation outside of the environmental specifications for the product, or improper installation or maintenance.

ADVANTECH Advanced Microwave Technologies, Inc. shall not be liable for any direct, indirect, special, incidental or consequential damages.

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1. SAFETY

In addition to this section, included by reference are the following pertinent sections of the International Standard IEC-215, 'Safety requirements for radio transmitting equipment':

Appendix D, 'GUIDANCE ON ASSESSING THE COMPETENCE OF PERSONNEL FOR DESIGNATION AS SKILLED' and also Sub-clause 3.1 of the Standard.

Appendix E, 'GUIDANCE ON SAFETY PRECAUTIONS TO BE OBSERVED BY PERSONNEL WORKING ON RADIO TRANSMITTING EQUIPMENT', also Sub-clauses 3.2, 3.7 and 22.1 of the Standard.

To prevent the risk of personal injury or loss related to equipment malfunction Advantech uses the following symbols for safety related information. For your own safety, please read the information carefully BEFORE operating the equipment.

Symbols used in manual:

WARNING: This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

CAUTION: This indicates a hazardous and dangerous procedure that could result in light-to-severe injury or loss related to equipment malfunction, if proper precautions are not taken.

---------- **WARNING** ----------

When supplying power to this equipment, use the 3-pin connector provided, to connect to a **grounded power outlet**. If power is supplied without grounding to the equipment, there is a risk of receiving a severe or fatal electric shock.

In the context of this document any voltage that is lethal is viewed as 'High Voltage'. Therefore, even prime power (90 to 265V AC) is dangerous because prime power potentials have been known to cause death or injury.

---------- **WARNING** ----------

This equipment can not be repaired by the operator. DO NOT attempt to remove the equipment cover or to disassemble internal components. Only qualified service technicians should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury to untrained personnel. In addition, there is a risk of damage to precision components.

---------- **WARNING** ----------

ALWAYS TERMINATE THE OUTPUT OF THE BLOCK UP-CONVERTER WITH A RF LOAD CAPABLE OF DISSIPATING FULL CW RF POWER. SIMILARLY TERMINATE THE INPUTS TO AVOID THE POSSIBILITY OF THE UNIT BEING DRIVEN BY STRAY LEAKAGE SIGNALS. Incorporate the terminations prior to applying prime power to the unit. This procedure prevents self-oscillation and irradiation of the local environment. Even if a source is not connected to the unit you are working with, there are situations where the block up-converter can go into a self-induced mode and generate high levels of RF energy. Destruction caused under excessive load voltage standing wave ratio (VSWR) will void the warranty. Although this equipment has internal protection for VSWR higher than 3:1 and will automatically go in shutdown (with a delay of 1 second), still it is a safe procedure to avoid unwanted effects.

---------- **WARNING** ----------

DO NOT LOOK INTO THE OUTPUT PORTS OF THE POWERED RF TBLOCK UP-CONVERTER. Treat the powered RF unit with extreme care. Keep in mind that levels of microwave radiation that do not induce immediate physical discomfort in most individuals can be sufficiently high to induce longer term effects. Your eyes are particularly vulnerable parts of your body.

The permissible levels of exposure are quite low compared to the power levels of the amplifiers built by Advantech (e.g. less than 10 mW versus 20 to 500 W delivered by various units). The permissible levels are currently being studied by a number of organizations. In the past the U.S. safety Code established a dosage rate of 10 mW/cm^2. Currently there is consideration being given to reducing the permissible level to 1 mW/cm^2 in the United States, as has been the case for several European countries.

---------- **CAUTION**----------

THIS IS A HEAVY EQUIPMENT. USE TWO OR MORE PEOPLE TO LIFT AND MOVE this equipment or use an equipment cart. There is a risk of back injury, if this equipment is lifted by one person.

2. PACKING LIST

2.1 PACKING LIST FOR ONE UNIT

PACKING LIST FOR SSPBM-C200-BRE UP-CONVERTER (one unit) (Shipping Kit P/N 195-31N1A0-0N1)			
Item	**Quantity**	**Description**	**Part #**
1.	1	Installation and Operating Manual	PM 1R1-31N1A0-2N0 Rev. 7
2.	1	200W C-Band Block Up-Converter, model SSPBM-C200-BRE	1R0-31N1A0-2N0
3.	1	Connector circular MIL C-5015, straight cable plug, 3 sockets, MS3106F16-10S (connector for J5)	631-310616-001
4.	2	Connector circular, MIL-C-26482, 6 contacts female, straight cable plug, shell 10, MS3116F10-6S (connectors for RS-232 and RS-485 Serial Interfaces)	631-311606-001
5.	1	Connector circular, MIL-C-26482, 10 contacts female, straight cable plug, shell 12 (connector for RELAY Interface)	631-311612-003
6.	1	WR-137 CPR half gasket silicone	705-137000-001
7.	1 roll	Moisture sealing/insulating tape (mastic tape)	709-224200-001
8.	8	#10-32 x 1/2" Mach screw hex head 18-8 Stainless Steel (SS)	802-103290-001
9.	8	#10 Split washer 18-8 SS	803-100100-001
10.	8	#10 Flat Washer 7/16 OD X.20 OD X.031 THK 18-8 SS	803-100200-001

2.2 PACKING LIST FOR 1:1 REDUNDANT SYSTEM

PACKING LIST FOR SSPBM-C200-BRE Redundant BLOCK UP-CONVERTER (P/N 1R1-31N1A0-2N0)			
Item	**Quantity**	**Description**	**Part #**
1.	1	Installation and Operating Manual	PM 1R1-31N1A0-2N0 Rev. 7
2.	2	200W C-Band Block Up-Converter, model SSPBM-C200-BRE	1R0-31N1A0-2N0
3.	1	WMR-C300L Redundancy Kit (see the following table)	190-500400-0C0

2.3 PACKING LIST FOR REDUNDANCY KIT

PACKING LIST FOR WMR-C300L Redundancy Kit (P/N 190-500400-0C0)			
Item	**Quantity**	**Description**	**Part #**
1.	1	WR137 Waveguide Switch Assembly	24T-310200-001
2.	2	Safety Ground Cable	260-100018-001
3.	1	SSPB Redundancy Cable Assembly	26R-31N000-001
4.	1	Flexible Cable Assembly	26T-210200-001
5.	1	Flexible Cable Assembly	26T-210200-101
6.	1	Splitter 50 Ω 70 to L-Band N-Type	290-500100-201
7.	1	Angle	330-155752-001
8.	1	“A” Decal	780-000220-001
9.	1	“B” Decal	780-000230-001
10.	1	“Tx” Label	780-101080-001
11.	2	¼-20x5/8” Bolt Hex Head 18-8 SS	800-142090-006
12.	2	4-40x1-1/4 Mach Screw Hex Socket Cap 18-8 SS	802-440030-004
13.	4	8-32 x 5/8” Mach Screw Hex Socket Cap 18-8 SS	802-832030-003
14.	2	¼ Split Washer High Collar 18-8 SS	803-140100-002
15.	2	#4 Split Washer 18-8 SS	803-400100-001
16.	4	#8 Split Washer 18-8 SS	803-800100-001

3. GENERAL INFORMATION

This manual contains information that describes installation, operation and maintenance procedures for the 200 W C-Band hub-mount (outdoor) Solid State Block Up-Converter, model SSPBM-C200-BRE. Because specialized training is required for some phases of installation and operation, certain parts of this manual are directed only to trained personnel. Warnings appear at the appropriate points to caution all users of potential RF and high-voltage hazards.

For a safe and versatile operation, please read the information carefully BEFORE using the equipment.

4. MAJOR SUBSYSTEMS AND THEIR FUNCTIONS

4.1 INTRODUCTION

This manual contains information required to install and operate the Redundant 200W C-Band Hub-mount (Outdoor) Solid State Block Up-Converter model SSPBM-C200-BRE.

4.2 DESCRIPTION

The SSPBM-C200-BRE includes two outdoor C-Band 200 W Solid State Power Block Up-Converters (SSPB), a Junction Box, and a waveguide switching unit for 1:1 redundant transmission operation. Each Solid State Power Block Up-Converter unit is self-contained and is intended for mounting near the hub of the antenna.. Each Up-Converter unit incorporates a DC main power supply and forced air cooling system, see **Figure 1:** Product Outline (single unit) at page 17. Each unit features a serial RS-485 interface that provides full remote monitor and control capabilities via a computer interface as well as serial RS-232 interface (that may be used in Terminal mode) and a discrete interface (Relay) for local or remote monitoring and control of selected functions. A product outline drawing of a redundant system is shown in **Figure 2** at page 18 . A functional block diagram of a single unit is shown in **Figure 3** at page 19 and one of the redundant system is shown in **Figure 4** at page 21.

4.3 SINGLE UNIT MAJOR COMPONENTS

The SSPB Up-Converter consists of the following major components:

- L-Band to C-Band Up-Converter Module,
- Power Amplifier Module,
- Waveguide Assembly,
- 10 MHz Reference Oscillator,
- Main Controller Board,
- Power Supply,
- Current Sensor, and
- Power Monitor Board.

These components are interconnected using dedicated wiring harnesses and coaxial cables.

To clarify the explanation of the components in the following paragraphs, refer to the block diagram in **Figure 3** at page 19.

4.3.1 L-BAND TO C-BAND UP-CONVERTER MODULE

The **L/C-Band Up-Converter Module** converts and amplifies the incoming L-Band carrier into the desired C-Band carrier.

The module has an internal synthesizer, which is fixed at 4900 MHz.

The up-converter module has RS-485 communication port that connects to the main controller board. It also provides a discrete ALARM signal to the Main Controller.

4.3.2 POWER AMPLIFIER MODULE

The **Power Amplifier Module** amplifies the RF signals from the L/C-Band up-converter module over the frequency range of 5850 MHz to 6425 MHz. The power amplifier has a fixed gain of 65 dB, typical.

The monitoring and control signals are the Alarm Output and the Relay Input for muting the power amplifier.

Temperature sensors are installed at the module's hot spots to prevent the RF devices from overheating and operating at temperatures exceeding 85ºC.

The power amplifier also has the following functions:

1. Provides and removes the DC voltages to the GaAs FET devices within the module.
2. Provides a temperature dependent DC voltage to the L-C up-converter for temperature compensation.
3. Sends a FAULT signal to the main controller board when detecting a fault.
4. Any Synthesizer is out of lock

The power amplifier will be in the Mute mode if:

1. The user sends a MUTE command through the Relay, RS-232, or RS-485 interfaces.
2. The hot spot temperature exceeds +85 °C.
3. Any of the GaAs FET devices failed (drain current out of range).

4.3.3 WAVEGUIDE ASSEMBLY

The **Waveguide Assembly** contains a forward and reflected power detector, an RF output circulator and a waveguide receive reject filter.

The forward power detector and the reflected power detector monitor the RF output power level and the reflected power level respectively. The detected voltage signals are delivered to the Power Monitor Module that converts the analog signals in digital signals and delivers them to the Main Controller Board.

The circulator provides a VSWR protection at the SSPB RF output port. The VSWR at the circulator output is 1.25:1, minimum. The termination load of the isolator is capable of fully absorbing any reflected power. A CPR137 grooved type waveguide flange is the unit output.

4.3.4 10 MHz REFERENCE OSCILLATOR

This module is used to generate a highly stable and very low phase noise 10 MHz reference frequency with a high stability (of $\pm 5 \times 10^{-8}$ MHz/year typical), which is required by all converter modules. A 10 MHz reference is sent to each converter module via a coaxial cable.

4.3.5 MAIN CONTROLLER BOARD

The **Main Controller Board** contains a microprocessor controller that performs all of the monitoring and control, input/output communication and the decision-making. The main controller board provides:

1. Fault detection and indication from each module of the unit
2. Mute control and indication
3. Forward RF power indication
4. Reflected RF power indication
5. Redundancy control
6. Unit Gain control (attenuation setting)
7. Relay, RS-232 and RS-485 customer interface

4.3.5.1 FAULT Detection and Indication

The unit will automatically go into a shutdown mode (MUTE) and send a message to all of the external interfaces (including the Tx LED, which will turn red) when any one of the following occurs:

1. The local oscillator within an up-converter module is out of lock.
2. The hotspot temperature exceeds 85°C.
3. Any of the GaAs FET devices failed.
4. Reflected power is greater than 46 dBm (6 dB back-off from the rated P1dB).

The SSPB continually monitors the internal temperature and the current consumption. It also has an automatic shutdown feature to prevent operation at excessive temperatures. The unit will automatically restart when the hotspot temperature falls below to 65°C.

A thermal alarm may result from any one of the following conditions:

1. High ambient temperature (the SSPB Up-Converter is designed to operate between -30°C and +55°C ambient).
2. Blockage at the air intake or exhaust vents.

4.3.5.2 MUTE Control

The user can disable the RF output power remotely by:

1. Leaving unconnected pins G and H of the Relay interface connector the Transmit way will be MUTE (see **Section 5.1** at page 25).
2. Sending a mute command in terminal mode through the RS-232 interface for transmit.
3. Sending a mute command in packet mode through the RS-485 interface for transmit.

This feature is useful if the user wishes to perform a maintenance check or to check out the transmission system. Note that when the unit is in MUTE, the Tx LED is red flashing.

4.3.6 POWER SUPPLY

The **Power Supply Module** provides +12 VDC output to the following modules:

1. Power amplifier module (high current),
2. L/C-Band up-converter module,
3. 10 MHz oscillator,
4. Power monitor module,
5. Current sensor,
6. Main controller board, and
7. Redundancy waveguide switch (if working in the 1:1 redundancy mode).

The power supply also provides the following outputs:

- +5 VDC
- -9 VDC
- +48 VDC

The separate +48 VDC is necessary to operate the cooling fan. This will be a variable, temperature dependent, voltage that will ensure a variable rotation speed of the cooling fan related to the temperature (the fan will rotate slower when the temperature is low and faster when the temperature is high).

The power supply is configured to operate from an 180-264 VAC, 47-63 Hz, single phase supply. The overall typical power consumption, at the rated RF output power, is approximately 1500 W (for one unit).

4.3.7 COOLING SYSTEM

The thermal conduction from the modules to the heatsink and the cooling fan provide a sufficient cooling for the SSPB.

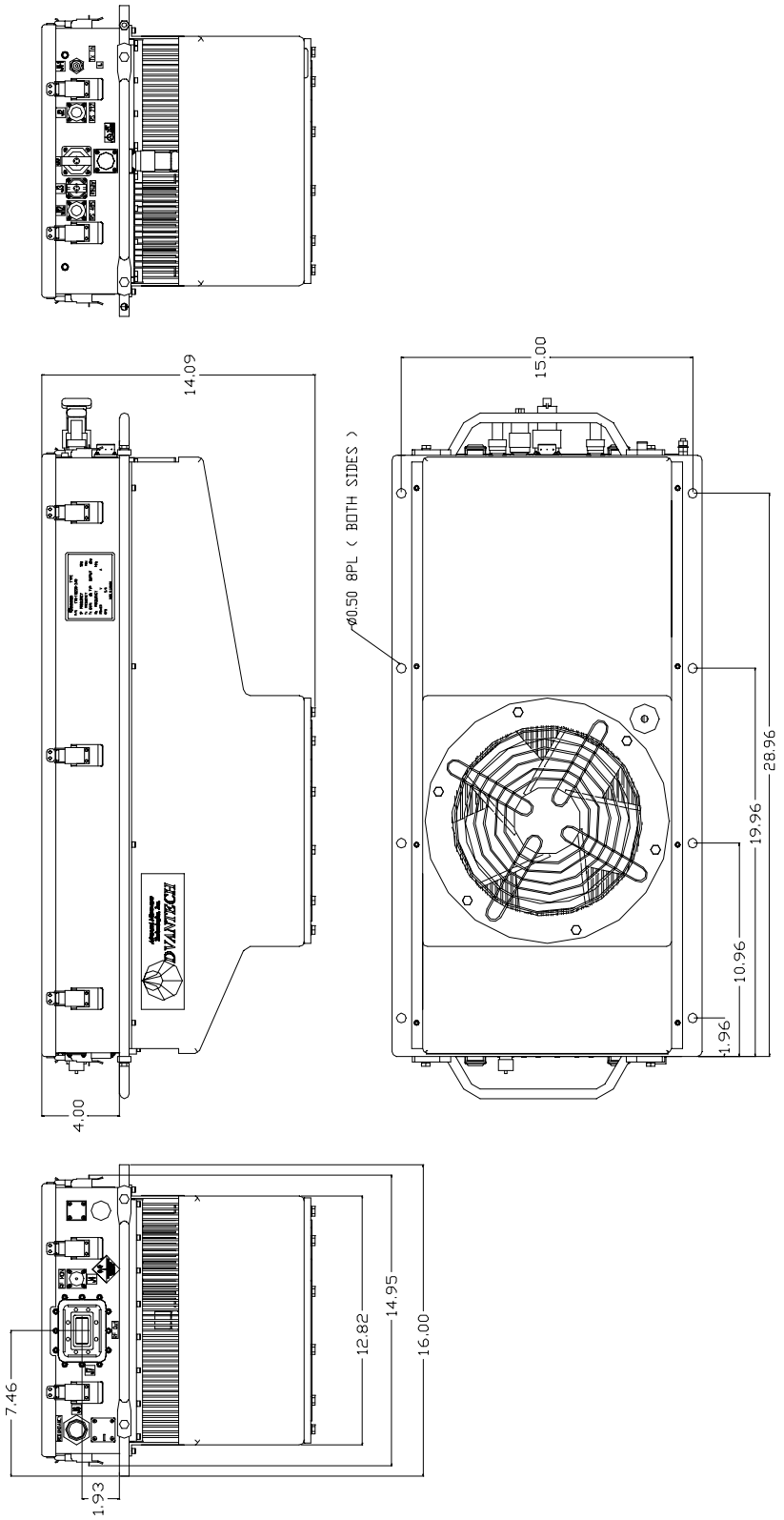


Figure 1: Product Outline (single unit)

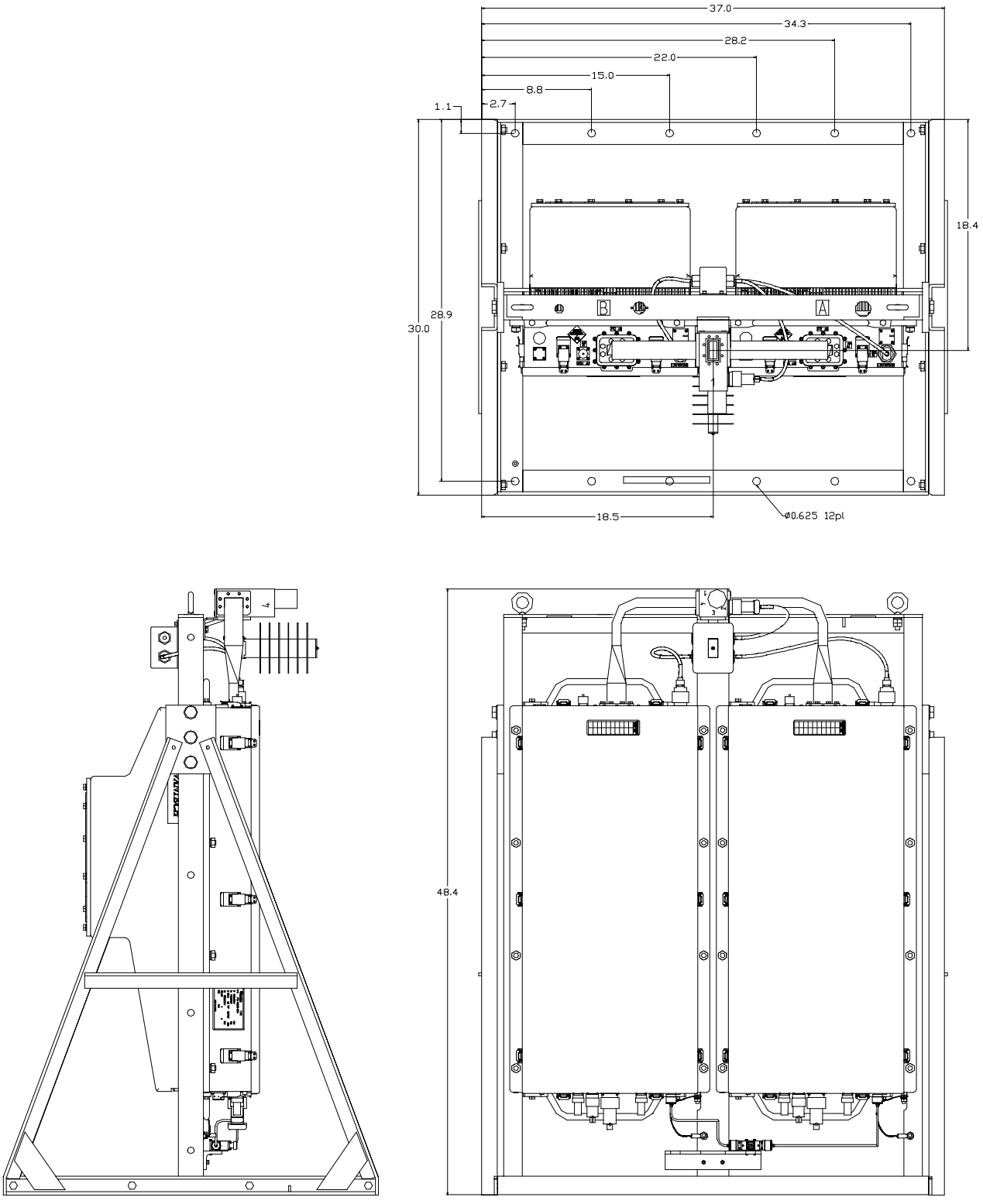


Figure 2: Product Outline (redundant system on frames)

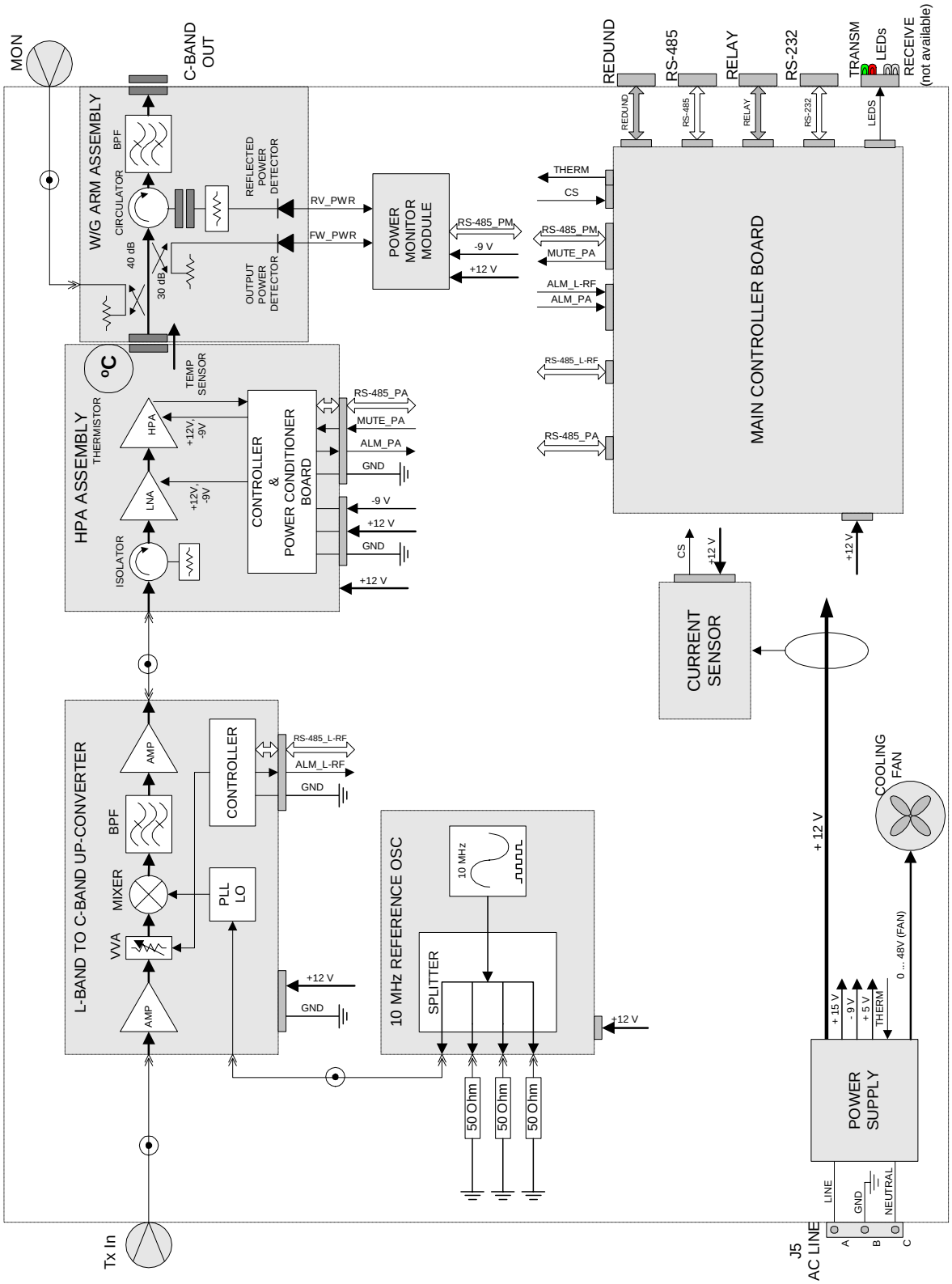


Figure 3: Block Diagram (one unit)

4.4 1:1 REDUNDANT SYSTEM

The major components of the 1:1 redundant system consist of:

- 2 Up-Converter units
- 1 Splitter (input splitter for transmission path)
- Waveguide arms & transmission switch
- Redundancy cable

Each unit drives the waveguide (W/G) switch to one position only (towards its own way). The main controller board recognizes the switch position and the condition of each unit. The standby unit (if not faulty) switches itself on line if the on-line unit failed.

The following table illustrates the state of LEDs for a unit working in a 1:1 Redundant System.

LED STATE		
PATH	PATH CONDITION	LED STATE
Tx	Operational ON- LINE	Green
	STAND-BY and NOT MUTE	Green blinking
	MUTE ON-LINE	Red blinking
	FAULT (Tx in shutdown)	Red
	STAND-BY and MUTE	Not lit
Rx (not available for these units)	Operational ON- LINE	Green
	STAND-BY and NOT MUTE	Green blinking
	MUTE ON-LINE	Red blinking
	FAULT (Rx in shutdown)	Red
	STAND-BY and MUTE	Not lit

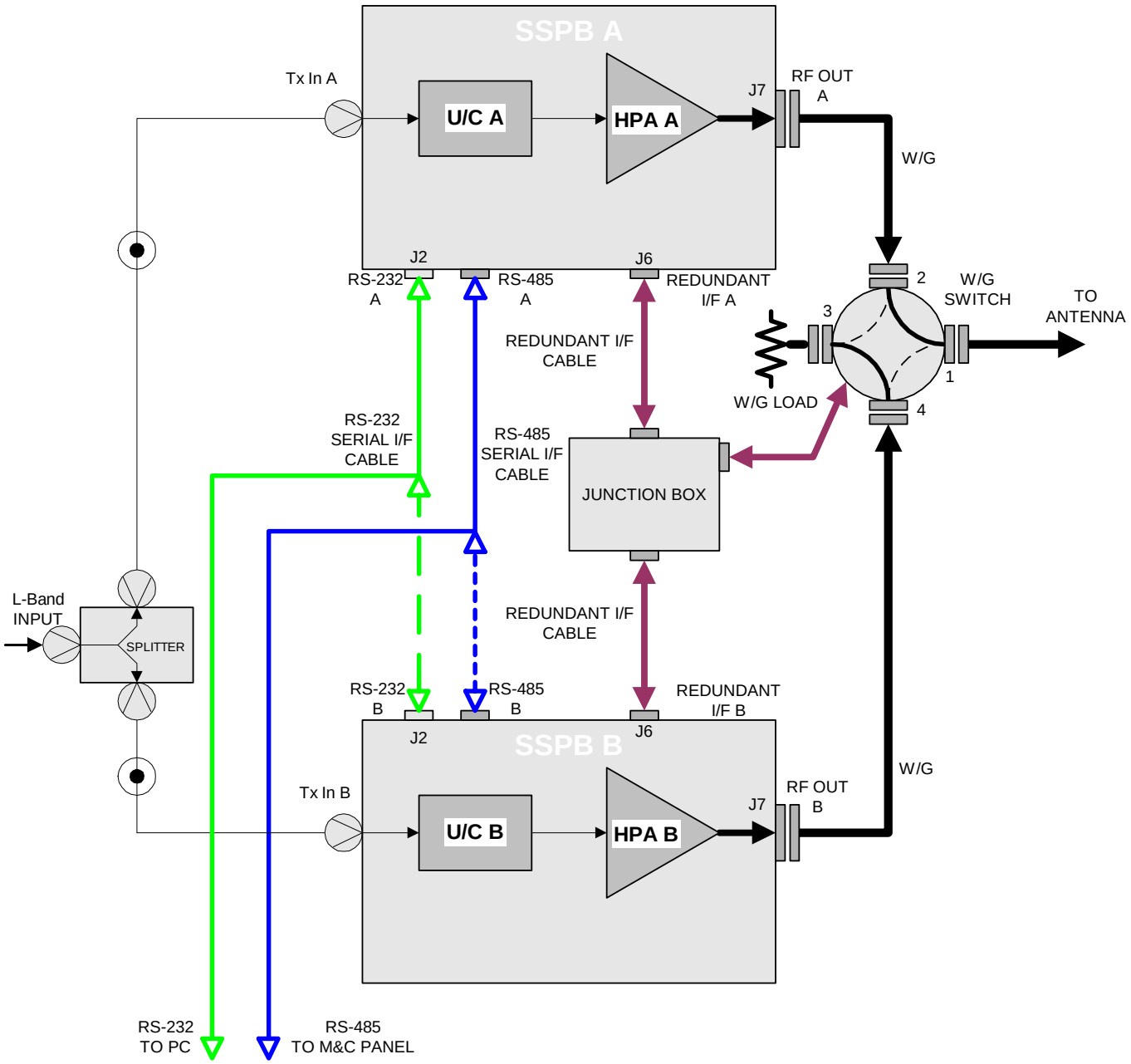


Figure 4: Redundant System Block Diagram

4.5 SPECIFICATIONS (SINGLE UNIT)

The Block Up-Converters specified herein are capable of meeting or exceeding the performance specifications listed in the following table over frequency range, operating temperature and line voltage variation, unless otherwise specified. The units will meet all RF performance specifications within thirty minutes of application of prime power.

TABLE 1: ELECTRICAL SPECIFICATIONS	
L-Band Input Frequency	950 – 1525 MHz
RF Output Frequency Range	5.850 – 6.425 GHz
Frequency Stability	Based upon 10 MHz Internal Reference
RF Output Power @ 1 dB Gain Compression (P1dB)	+ 52 dBm, min. (200 W saturated power)
Linear Gain	73 dB ± 1 dB, @ 6.150 MHz and +23 °C
Gain Adjustment Range	20 dB (between 53 dB and 73 dB)
Gain Flatness: over 500 MHz over 40 MHz	4 dB p–p, max 1.2 dB, max
Gain Variation Over Temperature	3 dB p-p, over the entire bandwidth
L-Band Input Impedance	50 Ω
L-Band Input Return Loss	18 dB, min
Output Return Loss	20 dB, min
Noise Figure	15 dB, max
Spurious at rated P1dB	- 60 dBc, max
Harmonics at rated P1dB	- 60 dBc, max
Third Order Intermodulation (two equal tones 5 MHz apart)	- 36 dBc, max @ 7 dB total back-off from rated P1dB - 26 dBc, max @ 3 dB total back-off from rated P1dB
Local Oscillator Frequency	4.900 GHz
Local Oscillator Leakage	-50 dBc, at 3 dB back-off from rated P1dB
Output Phase Noise Offset 100 Hz 1 kHz 10 kHz . ≥100 kHz	C-Band Single Side Band Phase Noise (max) - 60 dBc/Hz - 70 dBc/Hz - 80 dBc/Hz - 90 dBc/Hz

TABLE 2: MECHANICAL SPECIFICATIONS	
Physical Dimensions	See **Figure 1:** Product Outline (single unit) at page 17 & **Figure 2:** Product Outline (redundant system on frames) at page 18
Approximate Weight	124 lbs (56 kg) each unit
Mounting Requirements	See **Figure 1:** Product Outline (single unit) at page 17 & **Figure 2:** Product Outline (redundant system on frames) at page 18

TABLE 3: POWER REQUIREMENTS	
Power Requirements	180 –264 VAC, 47-63 Hz, single phase
Power Consumption	9 A typical @ 220 VAC (1250 W), each unit

TABLE 4: ENVIRONMENTAL CONDITIONS	
Temperature: Non-operating (continuous exposure) Operating (ambient)	 - 50° C to + 85° C - 30° C to + 55° C
Relative Humidity:	100% max., condensing, up to 2"/hr rain
Altitude:	10,000' AMSL, derated 2° C / 1,000' from AMSL

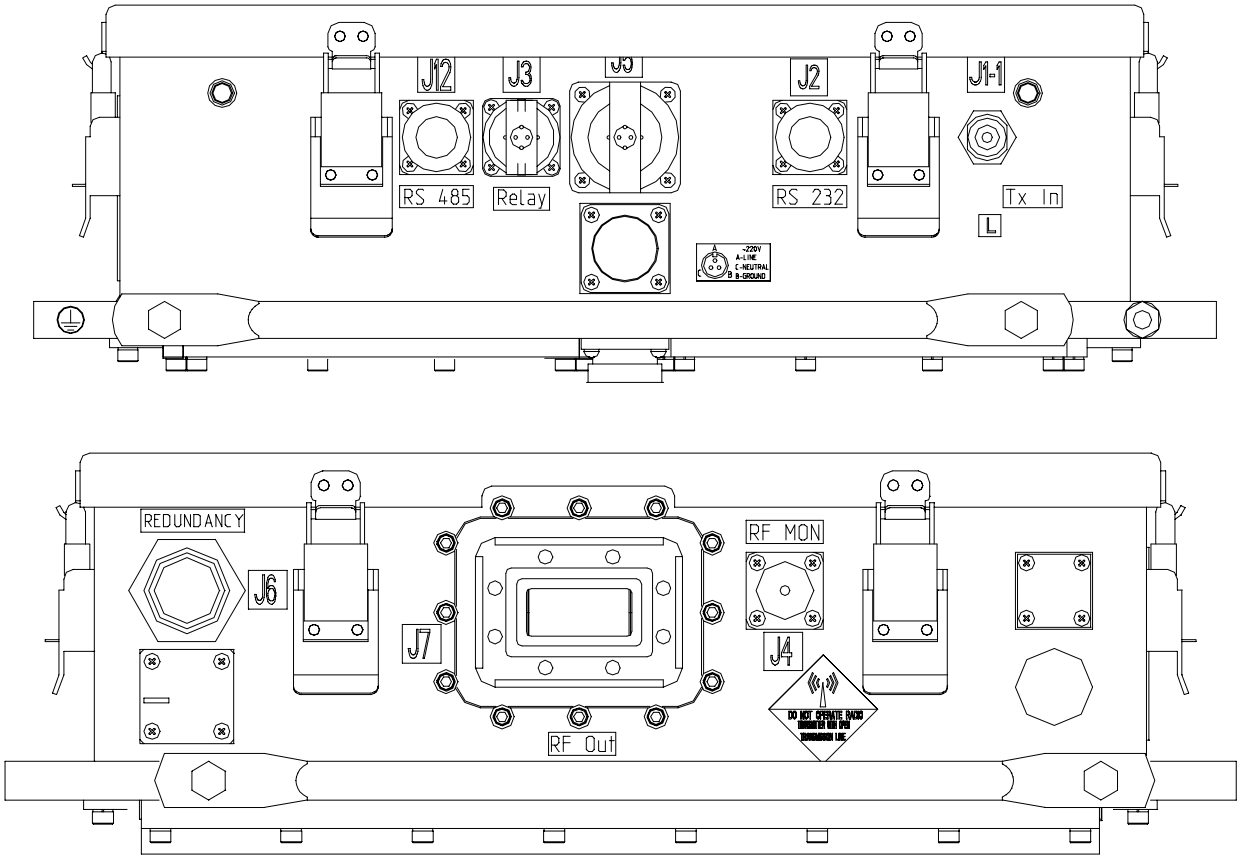


Figure 5: Connectors

TABLE 5: CONNECTORS			
Connector	**Function**	**Description**	**Mating Connector**
Tx In (J1)	L-Band Input	N - Type (F) 50 Ω	N - Type (M) 50 Ω
RS 232 (J2)	Serial Interface	MS3112E10-6P (M)	MS3116F10-6S (F)
Relay (J3)	Discrete Interface	MS3112E14-12P (M)	MS3116F14-12S (F)
10 MHz (J9)	Not used	-	Closed
RS 485 (J12)	Serial Interface	MS3112E10-6P (M)	MS3116F10-6S (F)
Rx Out (J11)	Not used	-	Closed
REDUNDANCY (J6)	Redundant Interface	MS3112J12-10P (M)	MS3116J12-10S (F)
RF MON (J4)	RF Output Monitor	N - Type (F) 50 Ω	N - Type (M) 50 Ω
LNX	Not used	-	Closed
RF Out (J7)	RF Output	CPR 137 (Grooved)	CPR 137 (Flat)
(J5)	AC Line	MS3102R16-10P (M)	MS3106F16-10S (F)

5. INTERFACES

Each unit provides four interfaces that can be used to connect the unit to several optional external devices. The interfaces for this model are listed below:

1. **Relay (Discrete) Interface:** This interface offers the essential monitoring and control of the Block Up-Converter by discrete signals.
2. **RS-232 Interface:** This interface offers the operator essential monitoring and control of the Block Up-Converter or of the 1:1 redundant system, using a PC with Term95 or HyperTerminal communications programs.
3. **RS-485 Interface:** This interface offers the complete monitoring and control of the SSPB Block Up-Converter or of the 1:1 redundant system and provides the communication and remote control through the RS-485 serial communication port in packet mode. The system may be connected to a Monitor & Control Panel or to a Network Manager System. The control system will discriminate between the two units of a redundant system by address.
4. **RF Output Monitor Interface:** This interface provides a sample of the output power of the unit through a 40dB coupler.

5.1 RELAY INTERFACE

The **Relay Interface** uses a 12-pin circular connector mounted on the Block Up-Converter enclosure. The connector type is listed in **TABLE 5** at page 24 and the location is shown in **Figure 5** at page 24. The pin assignment for this interface is shown in **TABLE 6** at page 26.

Pins A, B and C of the connector are of Form-C relay type outputs that provide for the user an indication informing the status of the transmission path of the SSPB unit.

Pins D, E and F are disabled (not used) for these units.

Pin G and H of the connector are inputs, allowing the user to mute or un-mute the RF path of the SSPB transmission.

Pin J and H are disabled (not used) for these units.

CAUTION: If pin G is not connected to pin H, the transmission path will remain disabled.

TABLE 6: RELAY INTERFACE – PIN ASSIGNMENT		
Pin	Signal Name	**Description**
A	Tx AL-NC	Normal closed contact of the Tx ALARM Form - C relay. Pin A closed to pin B indicates ALARM in the transmission path.
B	Tx AL-COM	Common contact of the Tx ALARM Form - C relay
C	Tx AL-NO	Normal open contact of the Tx ALARM Form – C relay. Pin C open relative to pin B indicates ALARM in the transmission path.
D	N/C	Not connected
E	N/C	Not connected
F	N/C	Not connected
G	Tx MUTE	Tx MUTE command: If pin G is NOT connected to pin H, the transmission path is MUTE. If pin G is connected to pin H, the transmission path is ON.
H	MUTE-COM	Common contact of the Tx MUTE and Rx MUTE Commands
J	N/C	Not connected
K	N/C	Not connected

5.2 RS-232 INTERFACE

This serial communication interface offers to the operator the essential monitoring and control of the SSPB or the redundant system using any PC terminal software. An IBM compatible personal computer can be connected to this port. The interface uses a 6-pin circular connector mounted on the SSPB enclosure. The type of mounting connector is listed in **TABLE 5** at page 24 and the location is shown in **Figure 5** at page 24. The pin assignment for this interface is shown in **TABLE 7**.

TABLE 7: RS-232 INTERFACE – PIN ASSIGNMENT

Pin	Type	Signal Name	Description
A	N/C	N/A	Not connected
B	N/C	N/A	Not connected
C	Input	RX	Serial receive RX
D	Output	TX	Serial transmit TX
E	DC supply	+5V	Power supply for hand held terminal
F	Common	GND	Serial common

5.3 RS-485 INTERFACE

This serial communication interface provides access to all monitor and control functions for the SSPB Block Up-Converter.

The RS-485 interface in a redundant system must be connected to the Network Management System (NMS). The NMS will have access to both units, discriminating them by address.

The interface uses a 6-pin circular connector mounted on the SSPB unit enclosure. The type of mounting connector is listed **TABLE 5** at page 24 and the location is shown in **Figure 5** at page 24. The pin assignment for this interface is shown in **TABLE 8**.

If this interface is being used, an interconnecting cable with the proper mating connector must be fabricated.

TABLE 8: RS-485 INTERFACE – PIN ASSIGNMENT

Pin	Type	Signal Name	Description
A	Output	TX+	Serial transmit TX+
B	Output	TX-	Serial transmit TX-
C	Input	RX+	Serial receive RX+
D	Input	RX-	Serial transmit RX-
E	N/C	N/A	Not connected
F	Common	GND	Safety ground / Shield

5.4 REDUNDANT INTERFACE

The **Redundant Interface** connections are made with a 26-pin circular connector mounted on the SSPB enclosure. The connector type is listed in **TABLE 5** at page 24 and the location is shown in **Figure 5** at page 24. A redundant system cable is provided with the redundancy kit that provides the interconnection between the two SSPB units and the waveguide switch.

5.5 RF OUTPUT MONITOR INTERFACE

This RF output sample port is located at the Mon connector, which is mounted on the SSPB enclosure. The type of mounting connector is listed in **TABLE 5** at page 24 and the location is shown in **Figure 5** at page 24. This interface is used for the independent monitoring of the SSPB output. A table of the coupling factor versus the frequency is provided with each unit. Note that because this port is located before the band-pass filter (BPF) the signal on this port may contain spurious signals and harmonics. This port should only be used for output power monitoring (via an external power meter) or should be kept capped if not used.

6. UNPACKING AND INSTALLATION

This Section contains instructions for the site preparation, unpacking and the installation of the SSPB Block Up-Converter.

6.1 INITIAL INSPECTION

Inspect the shipping container(s) for damage resulting from the shipment. If damaged, immediately contact the carrier that delivered the equipment and submit a damage report. Failure to do so may invalidate future claims.

6.2 UNPACKING

Carefully remove all of the items from the shipping container. Save all of the packing material until completing successfully the visual inspection. For a single unit, verify that all of the items listed on the packing list (see **Section 2** at page 9) have been received. For the redundant system, verify that all of the items listed in the redundancy kit are present. If any of the items are missing, contact ADVANTECH immediately. Inspect all of the items for evidence of damage resulting from the shipment. If damage seems evident, immediately contact the carrier that delivered the equipment and file a claim. Failure to do so may invalidate future claims. Check the SSPB units thoroughly for damaged or loose parts.

6.3 INSTALLATION

Installation of the SSPB Block Up-Converter requires the following phases:

Relay, Serial Interface and AC Power interconnecting cable construction

Environmental and adequate ventilation considerations

Mechanical, RF and electrical installation

TABLE 5 at page 24 lists all of the mounting connectors used by the SSPB unit and their corresponding mating connectors. **Figure 5** at page 24 shows the location of the mounting connectors.

6.3.1 RELAY, SERIAL INTERFACES AND AC POWER CABLES CONSTRUCTION

Prior to constructing the interconnecting cables, verify that the all of the cables are of sufficient length in order to connect the SSPB unit or the redundant system to the user's remote monitor and control system. Construct the Relay, RS-232, RS-485 Serial Interfaces and Power interconnecting cables as follows:

1. If using the Relay interface, construct the interconnecting cable(s) using the mating connector(s) provided in the shipping kit (see **Section 2** at page 9). Refer to **TABLE 6** at page 26 for the correct pin assignment. Verify that pins G and H of the Relay connector are connected together in order to un-mute the transmission path (Tx ON). If pins G and H are left disconnected, the transmission path will remain muted.
2. If using the RS-232 serial interface, construct the interconnecting cable(s) using the mating connector(s) provided in the shipping kit (see **Section 2** at page 9). Refer to **TABLE 7** at page 27 for the correct pin assignment.
3. If using the RS-485 serial interface, construct the interconnecting cable(s) using the mating connector(s) provided in the shipping kit (see **Section 2** at page 9). Refer to **TABLE 8** at page 28 for the correct pin assignment.
4. Construct the prime power cable(s) using the connector(s) provided in the shipping kit (see **Section 2** at page 9). For the correct pin assignment, refer to **TABLE 10** at page 33.

6.3.2 ENVIRONMENTAL AND ADEQUATE VENTILATION CONSIDERATIONS

Each SSPB unit contains a forced air cooling system, which prevents the internal components from overheating. The cooling subsystem consists of a single fan operating at a variable speed to effectively distribute and remove the air from within the SSPB unit.

Prior to installing the SSPB unit or the 1:1 redundant system, verify that:

1. Environmental conditions listed in **TABLE 4** at page 23 will be met.
2. A minimum clearance of 30-cm (12 inches) is necessary in front of the air intake and exhaust openings on the SSPB unit mounting-frame.
3. A minimum clearance of 30-cm (12 inches) is necessary below the 1:1 redundant system.
4. The grill of the fan intake and the exhaust openings of each installed SSPB unit are free of any obstructing debris.

CAUTION: Obstructing objects and/or debris may reduce the efficiency of the cooling system and significantly impact the transceiver longevity.

6.3.3 MECHANICAL, RF AND ELECTRICAL INSTALLATION

6.3.3.1 Single Unit

1. Bolt the SSPB unit at the antenna hub by using the six mounting holes provided by the enclosure, see **Figure 1** at page 17.
2. Position the interconnecting waveguide system flange so that it aligns precisely with the waveguide flange of the SSPB RF output port.
3. Install the supplied waterproof gasket (supplied in the packing list**)** on to the interconnecting waveguide flange.

CAUTION: If the waveguide is intended to be pressurized, do not exceed 2-3 psi pressure, in order to protect the inside pressure window installed by ADVANTECH.

4. After alignment verification, loosely attach the interconnecting waveguide on to the RF output port using the hardware provided in the shipping kit.
5. Carefully tighten all bolts (in opposite pairs rather than sequentially around the perimeter of the flange) so that the connection is firm.

CAUTION: Do not over-tighten the waveguide flange screws. Over-tightening the bolts may cause the stripping of the threads or distort the mating flange. Recommended torque is 30 in-lbs for #10-32 bolts.

6. Ground the SSPB unit by attaching a #6 gauge copper wire to the ground terminal provided by the unit enclosure to a properly grounded structure.
7. If it is desired to use the Relay interface, then attach the interconnecting cable fabricated per **Section 6.3.1** to the Relay connector of the SSPB unit. Connect the free end of the interconnecting cable to the operator's monitor and control system.

NOTE: Whether this interface is being used or not, it is necessary to connect pin G of the Relay connector to pin H (common) in order to enable (un-mute) the transmission path. If pin G of this interface is not connected to pin H, the transmission path of the unit will remain muted.

8. If it is desired to use the RS-485 interface, then connect the interconnecting cable fabricated per **Section 6.3.1** to the RS-485 port of the SSPB unit.

9. If it is desired to use the RS-232 terminal mode, then:

a. Connect the interconnecting cable fabricated per **Section 6.3.1** to the RS-232 port of the SSPB unit.
b. Attach to the free end of the interconnecting cable a 9-pin or 25-pin D-type connector with a pin assignment as listed in **TABLE 9**.
c. Attach the cable with the 9-pin or 25-pin D-type connector to RS-232 port of the personal computer.

TABLE 9: SERIAL INTERFACE RS-232 CONNECTION INFORMATION

Serial Interface RS-232 Pin	Active Condition	RS-232 at PC Pin	
		DB-9	DB-25
C	RX ←	3	2
D	TX →	2	3
E	+5 VDC power source	-	-
F	Common	5	7

10. Connect the L-Band input source to the N-type 50 Ω female connector Tx In input port of the SSPB unit.
11. Verify that AC power source is switched OFF.
12. Verify that the AC power source can satisfy the power requirements as given by **TABLE 3** at page 23.

WARNING: Proper grounding of the AC power outlet is necessary for personnel and equipment safety. Improper grounding may cause serious injury or death of the operator.

CAUTION: Ensure that the proper pin is selected for AC operation. Applying power on the wrong pin may permanently damage the AWMT unit necessitating factory repair. Refer to **TABLE 10** at page 35 for the correct pin assignment.

13. Using the AC power cable fabricated per **Section 6.3.1**, connect one end of the power cable to port (J5) of the SSPB Block Up-Converter.
14. Connect the remaining end of the cable to the AC power source.

TABLE 10: AC LINE (J5) CONNECTOR – PIN ASSIGNMENTS	
Description	**Pin**
Phase (live)	A
Ground	B
Neutral	C

15. If necessary, connect a power meter or a spectral analyzer to the RF output monitor port (Mon).

6.3.3.2 Redundant System Installation

While performing the redundant system installation refer to **Figure 2** at page 18 for the location of all major components.

1. Mount the two SSPB units on to the twelve studs provided by the mounting frame (see the packing list) using the six mounting holes provided on the sides of each unit and the hardware provided with the mounting frame kit.
2. Position the two units and the frame on a flat surface with the air intakes facing downward.
3. Install the waveguide assembly with the support bracket to the frame using the one spacer, two #1/4-20 x ¾ inch bolts, two #1/4 lock washers and #1/4 flat washers.

NOTE: The spacer is installed between the support bracket and the mounting frame. The high power load should be facing downward and towards the frame.

4. Align the waveguide arm labeled 'TO SSPB A' with unit 'A' and the waveguide arm labeled 'TO SSPB B' with unit 'B'.

NOTE: Each SSPB has assigned either an 'A' or 'B' designation as marked on the mounting frame for the 1:1 redundant system. The redundancy cable has labels on each part (A or B).

5. Attach the waveguide arm labeled 'TO SSPB A' on to the RF output port of SSPB 'A' using one WR137 gasket, eight #10-32 x ½ inch screws, eight #10 lock washers and eight #10 flat washers (see the packing list for a single unit). Finger-tight all screws.

CAUTION: Do not over-tighten the waveguide flange screws. Over-tightening the bolts may cause the stripping of the threads or distort the mating flange. Recommended torque is 30 in-lbs for #10-32 bolts.

6. Tighten all screws around the RF output port of SSPB 'A' using a 'star' pattern to achieve uniform contact across the entire surface of flange.
7. Repeat steps 5 and 6 for SSPB 'B'.
8. Tighten all screws around the RF output port of SSPB 'A' and SSPB 'B' a second time.
9. Attach the 1:2 splitter on to the frame using two #6-32 x 3/8 inch hex screws.
10. Connect the semi-rigid cable assembly to the port marked 'Tx In' for SSPB 'A' and the IF output port of the splitter.
11. Connect the second semi-rigid cable assembly to the port marked 'Tx In' for SSPB 'B' and the IF output port of the splitter.
12. Connect the cables of the redundancy wiring harness to the Junction Box and to the switches.

NOTE: The labels provided by the cables indicate the correct designation.

13. Attach the two ground harness assemblies to the studs provided by the SSPB 'A'.
14. Attach the two ground harness assemblies to the studs provided by the SSPB 'B'.
15. Attach the free ends of all four ground harness assemblies on to the mounting holes provided by the mounting frame using three #6-32 x 3/8 inch screws, three #6 lock washers and three #6 flat washers.
16. Orient the 1:1 redundant system in the upright position (RF output of the waveguide assembly faces the antenna).
17. Position and secure the assembled 1:1 redundant system on to the hub using the mounting holes provided by the frame and the correct hardware.
18. For grounding the 1:1 redundant system, attach a #6 gauge copper wire to the ground terminal provided by the mounting frame. Install the free end of the copper wire to a properly grounded structure.

CAUTION: If the waveguide is intended to be pressurized, do not exceed 2-3 psi pressure, in order to protect the inside pressure window installed by ADVANTECH.

19. Using one WR137 waterproof gasket, eight #10-32 x 1/2 inch screws eight #10 lock washers and eight #10 flat washers, connect the waveguide RF output port of the waveguide assembly to the flange of the interconnecting waveguide leading to an antenna. Finger-tight all screws.

20. Tighten all screws around the flange of the waveguide switch assembly RF output port using a 'star' pattern to achieve uniform contact across the entire surface of flange.

21. If it is desired to use the Relay interface(s), attach the interconnecting cable(s) fabricated per **Section 6.3.1** to the Relay port of the/each SSPB unit. Connect the free end of the interconnecting cable(s) to the operator's monitor and control system.

22. If it is desired to use the RS-485 interface, then connect the interconnecting cable fabricated per **Section 6.3.1** to the RS-485 port of any SSPB unit.

NOTE: If an IBM® compatible personal computer with an RS-232 port is used for the remote monitoring and control of the redundant system via the RS-485 serial interface, then it is necessary to use an RS-232/RS-485 adapter.

23. If it is desired to use the RS-232 interface, then:
    a. Connect the interconnecting cable(s) fabricated per **Section 6.3.1** to the RS-232 port of the/each SSPB unit.
    b. Attach to the free end of the interconnecting cable(s) a 9-pin or 25-pin D-type connector with a pin assignment as listed in **TABLE 9**.
    c. Attach the cable(s) with the 9-pin or 25-pin D-type connector to RS-232 port of the personal computer.

24. Connect the RF source to the N-type female connector at the IF input port of the RF splitter.

25. Verify that AC power source is switched OFF.

26. Verify that the AC power source can satisfy the power requirements as given by **TABLE 3**.

WARNING: Proper grounding of the AC power outlet is necessary for personnel and equipment safety. Improper grounding may cause serious injury or death of the operator.

CAUTION: Ensure that the proper pin is selected for AC operation. Applying power on the wrong pin may permanently damage the SSPB unit necessitating factory repair. Refer to **TABLE 10** at page 33 for the correct pin assignment.

27. Using the AC power cables fabricated per **Section 6.3.1**, connect one end of the power cables to each SSPB unit.

28. Connect the remaining end of the cables to the AC power source.

7. PRE-POWER AND SYSTEM CHECKOUT

This Section describes the pre-power procedure for the SSPB Block Up-Converter and an initial checkout of the system.

WARNING: The information presented in this section is addressed to technicians who have specific training in, and knowledge of Microwave Power Transceivers. Inappropriate use of the SSPB unit may cause serious injury to the operator or may result in damage of the unit. Do not attempt to operate the SSPB before becoming thoroughly familiar with the contents in this Section.

NOTE: When prime power is ON, the Monitor and Control Board will start operating!

7.1 PRE-POWER PROCEDURES

Before applying power to the SSPB Block Up-Converter, verify that the following conditions are met:

4. Verify that the voltage of the station's AC prime power matches with the value marked on the ID label. It is 85-264 VAC for the unit(s).
5. The prime power station is properly grounded.
3. All cable and waveguide connections are secure and there is no evidence of pinched wires and loose hardware.
4. The circuit breaker at the prime power station is switched OFF.
5. The IF input and RF output ports are connected to a matched source and a proper load capable of withstanding full CW RF power.
6. The cooling fan(s) is/are not obstructed.

7.2 OPERATIONAL SETTINGS VERIFICATION

The SSPB arrives with all of its factory-pre-set operational values that meet the requirements of a typical installation. Before starting the unit at the installation site, check the configurable settings and if necessary, reset to meet the customer's requirements.

8. OPERATION

8.1 INTRODUCTION

This Section describes the normal operation of the SSPB Block Up-Converter and the 1:1 redundant system. The design of this equipment allows for minimal operator intervention and maintenance.

The SSPB or the system may be monitored and controlled via the RS-232 or the RS-485 serial interfaces, or via the Relay interface. The Relay interface provides for the user an alarm indication and remote RF mute capability of the designated SSPB unit. The RS-232 and the RS-485 serial interfaces provide access to the SSPB or to the redundant system functions, including the monitoring of key operating parameters and shutdown (mute) command.

8.2 SAFETY CONSIDERATIONS

WARNING: Prolonged operation without a load at the output may cause severe bodily harm, loss of sight, even death. Do not operate any transceiver if the RF output connector is not connected to a load.

Please note that an SSPB Block Up-Converter failure due to the above condition will be attributed to abuse or neglect and will not be covered by the standard warranty.

8.3 BASIC OPERATING PROCEDURE

Perform the following operating procedure:

1. Verify that the 'Pre-Power and System Checkout' procedure as described in **Section 7** was performed successfully.
2. Switch ON the main power source.
3. Wait for the software to boot into PC.
4. If using either the RS-232 or the RS-485 interface, set up the serial communication linkage between an SSPB Block Up-Converter and the user's computer terminal. See **Section 6.3**.
5. Ensure that the L-Band input signal is being applied to the SSPB unit/redundant system.
6. For the redundant system repeat steps 6 and 7 for the second SSPB unit.
7. Allow the SSPB/System to warm up for 30 minutes, ensuring that all electrical specifications are met (see **TABLE 1** at page 22).

8.4 USING THE SSPB SOFTWARE

The RS-232 and the RS-485 interfaces provide the serial communication between the user's monitoring and control system and the micro-controller within an SSPB Block Up-Converter. The user may employ any RS-232 terminal communications software (like Term95 or HyperTerminal) or the RS-485 serial communication protocol.

8.4.1 USING THE RS-232 INTERFACE

Before using the RS-232 Interface, become thoroughly familiar with the items listed in **TABLE 11** at page 40 and **TABLE 12** at page 42.

Operate the SSPB/system via the RS-232 Interface as follows:

1. Switch on the power station's circuit breaker to power up the SSPB/system.
2. Run any terminal program in the personal computer.
3. Use the following communication parameters:
   - Bits per second: 19200
   - Data Bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow Control: None
4. After running the program in the computer and pressing the **<Enter>** key a display similar to **Figure 6** at page 39 will be shown.

NOTE: The micro-controller within an SSPB Block Up-Converter determines automatically whether the unit is functioning alone or in a 1:1 redundant system.

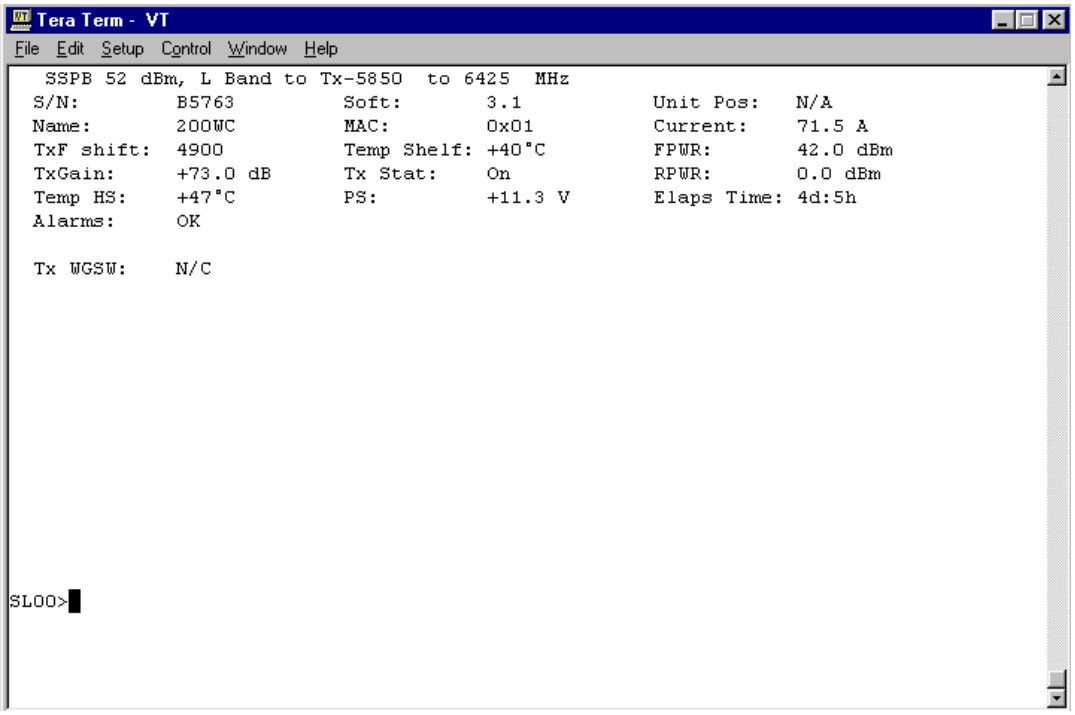
5. If necessary, to change the status of the SSPB/System, use the commands listed in **TABLE 12** at page 42.

NOTE: At start up the unit is in the hand-held Terminal Mode. To change to PC Mode, type '**t2**' and then press <**ENTER**>. For operation with the Hand Held Terminal type '**t1**'.

If the Hand Held Terminal model 8045 is used for the RS-232 communication with the unit, the adequate configuration should be set. In order to set the configuration:

- While simultaneously pressing the CTRL, SHIFT keys press the F1 key.
- In the menu displayed use F1 key to change parameters, F2 & F3 keys to navigate, F4 key to quit (without changing parameters) and F5 key to save the changed values for parameters. Type again F4, to exit the menu. The required values for parameters are:

  - BAUD RATE: 19200
  - DATA BITS: 8
  - PARITY: NONE
  - STOP BITS: 1



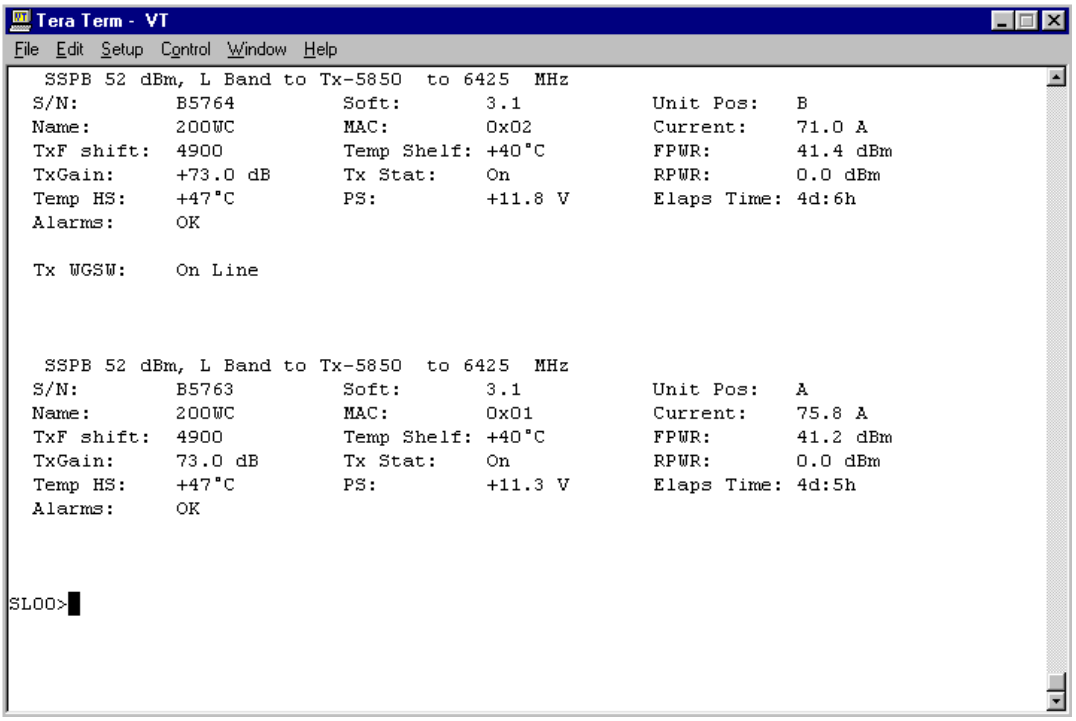


Figure 6: Terminal Mode Display for single unit and for redundant system (after pressing <ENTER>)

TABLE 11: RS-232 MENU ITEM DEFINITION	
Item	**Description**
S/N	Serial Number of the SSPB Block Up-Converter
Soft	Version number of the main controller board software within the SSPB that is connected to the RS-232 port of the PC
Unit Pos	Indicates the position of the unit (A or B) in the redundant system
Name	Indicates the name of the unit (SSPB A for Block Up-Converter A, or SSPB B for Block Up-Converter B)
MAC	Indicates the serial address of the Monitor and Control of the unit (in hex)
Current	Indicates the 12 VDC current consumption of the unit, in amperes
TxF Shift	Indicates the LO Frequency of the Block Up-Converter transmission path, in MHz
Temp Shelf	Shelf Temperature of the unit in degrees Celsius.
FPWR	Indicates the Forward Power of the Block Up-Converter (the transmission path output power) in dBm
TxGain	Indicates the transmission Gain in dB
Tx Stat	Indicates the transmission status (On or Mute)
RPWR	Indicates the Reverse (reflected) Power of the Block Up-Converter (the transmission path reflected power) in dBm
Temp HS	Hot Spot Temperature of the unit in degrees Celsius.
PS	Power Supply Voltage (12 V)
Elaps Time	Elapsed Time from the first start-up (days:hours)
Alarms	Provides the alarm and fault messages and the normal status message: 1. Alarm (excess +12 VDC current, faulty RF devices, power supply failure, L-RF up-converter module failure, low power alarm, high power alarm). 2. Temperature Pre-Alarm (hot spot temperature exceeds 75 ºC) 3. Out of Lock of the PLL in Up-Converter triggering a shutdown 4. High Reflected Power shutdown 5. Overdrive Alarm (output power exceeds by 1.5 dB the rated P1dB) 6. Temperature shutdown (hot spot temperature exceeds 85ºC) 7. OK (SSPB unit is functioning properly).
Tx WGSW	Transmission Waveguide position (on-line or stand by)

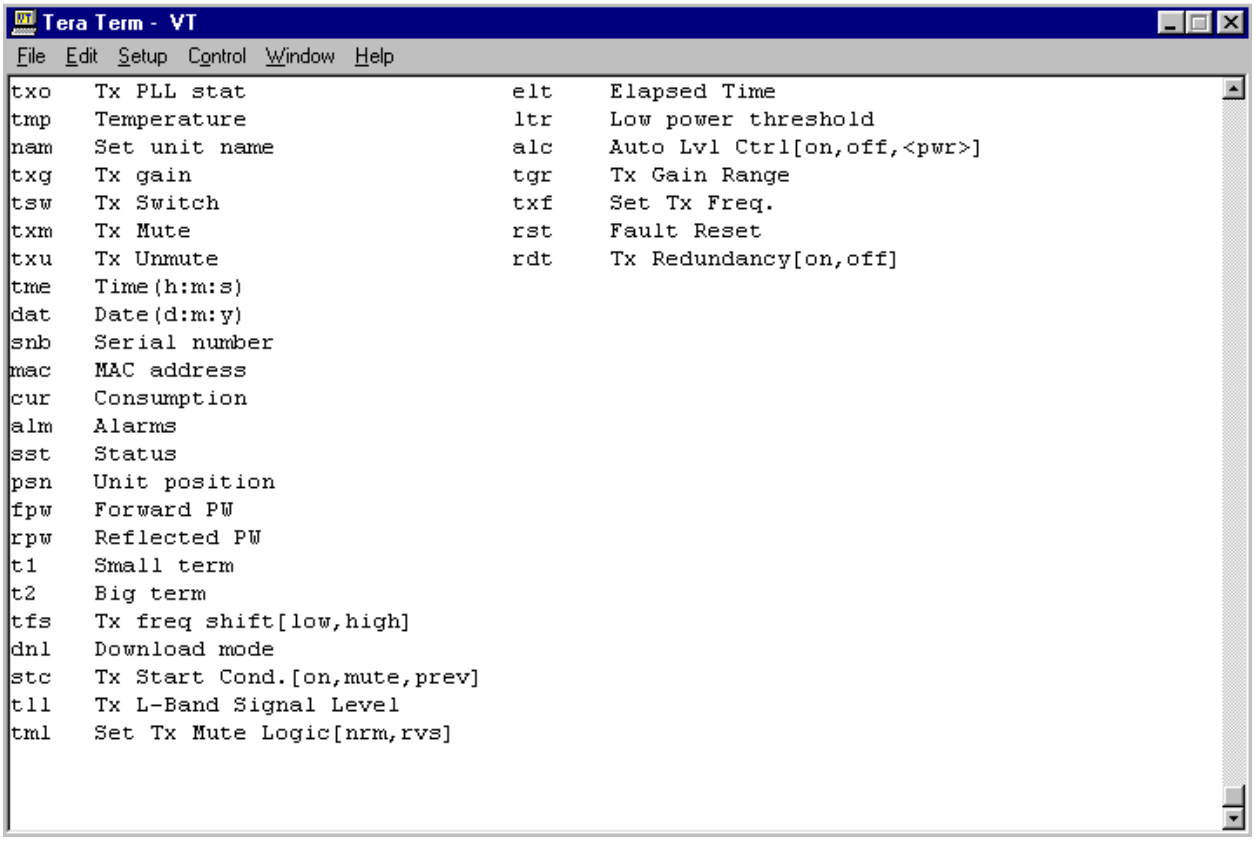


Figure 7: List of commands (after pressing h - Help) in Terminal Mode Display

TABLE 12: COMPUTER TERMINAL COMMANDS FOR RS-232 INTERFACE		
Command	**Description**	**Response**
h	**Help function**	Provides the list of commands that can be used to modify the status of an SSPB Block Up-Converter.
<ENTER>	**ENTER key of keyboard**	Provides and refreshes the main menu display on the computer monitor screen.
txo	**Tx PLL stat**	The status of the transmission PLL will be displayed
tmp	**Temperature**	The temperature of the L/C Up-Converter will be displayed
nam	**Set unit name**	Allows for a name to be attributed to the unit
txg	**Set Tx gain**	Allows for the adjustment of the transmission gain of the SSPB, in dB. Format of command is **txg 62.5 <ENTER>**, for setting 62.5 dB gain, e.g.
tsw	**Tx Switch**	Allows for the switching of the transmission to this unit
txm	**Tx Mute**	Transmission Mute command. The transmission path of the SSPB unit is muted (no RF output power)
txu	**Tx Unmute**	Transmission un-mute command. The transmission path of the SSPB unit is enabled
tme	**Time(h:m:s)**	Current time will be displayed (in format hour : minutes : seconds)
dat	**Date(d:m:y)**	Current date will be displayed (in format day : month : year)
snb	**Serial number**	Displays the serial number of the unit
mac	**MAC address**	Displays the Monitor and Control address
cur	**Consumption**	Displays the DC current consumption of the unit
alm	**Alarms**	Displays the ALARMS of the unit (OK if no alarm)
sst	**Status**	Displays the system status
psn	**Unit position**	Displays the position of the unit in the system (A or B) – for redundant systems only

TABLE 12: COMPUTER TERMINAL COMMANDS FOR RS-232 INTERFACE (continued)		
Command	**Description**	**Response**
fpw	**Forward PW**	Displays the forward transmission output power (in dBm)
rpw	**Reflected PW**	Displays the reflected transmission power (in dBm)
t1	**Small term**	Command to switch to Hand Held Terminal (this is the default mode; the unit will start in this mode)
t2	**Big term**	Command to switch to PC Terminal. If connected to a PC, always type **t2** to achieve connection to PC, because the default mode is **t1**
tfs	**Tx freq shift**	Displays the frequency shift in L-C Up-Converter
dnl	**Download**	Command for software downloading
stc	**Startup Condition**	Command for reading the startup condition
tll	**Tx L-Band signal level**	Allows for the display of the Tx L-Band signal level (in dBm)
tml	**Set Tx mute logic**	Allows for the setting of the logic of mute command for Tx (normal, or reversed)
elt	**Elapsed Time**	Elapsed functioning time
ltr	**Low output power threshold**	Allows for the reading and the setting of the low output power alarm threshold
alc	**Automatic level control**	Allows for ALC set (on, off) and the ALC level set
tgr	**Transmission gain range**	Displays the transmission gain range (in dB)
txf	**Transmission frequency**	Allows for the set of transmission frequency, so as to improve the gain accuracy and the temperature compensation. For wide band, use **txf 0**; for a certain frequency, use **txf freq**, where freq is L-Band input frequency in MHz.
rst	**Reset**	Reset command after FAULT signaling
rdt	**Redundant (on/off)**	Sets the redundancy on/off (automatic or manual switching) – only for redundant systems

8.4.1.1 Downloading the Customer Supplied Software

If it is required to change the internal software features, then download the supplied software as follows:

1. Create a new folder in the hard drive of a PC.
2. From the supplied source, copy the file “dlapp2000.exe” and the file with extension “.hex” into this folder.
3. Make R2-232 connection between PC and the unit.
4. Disconnect redundancy cable from unit (in case of a redundancy system).
5. Run the terminal mode program provided by the PC.
6. Run the “big terminal” mode (command “t2”).
7. From the terminal mode type “dnl” command and press [**Enter**].
8. Follow the screen instructions to set download mode.
9. After several seconds, the LED on the unit will flash red-green and the message “Ready for download from RS232” after pressing [**Enter**]

From this moment, the memory of the unit is clean! It is necessary to download application!

10. Close the terminal mode program.
11. Open the new folder and start the dlapp2000.exe program.

The DLAPP2 display with instructions appears on the screen.
12. At the prompt type “s[space]comX” and then press [**Enter**].
NOTE: **X is the number of the communication port connected to the unit.**

13. At the prompt type “pl[space] 19200 and then press [**Enter**].
14. At the prompt type “l[space] filename.hex” and then press [**Enter**].
15. After 20–30 seconds the download process should start. You will see progress on the screen.
16. When loading is complete, press ”q” and [**Enter**] to close “dlapp2000”.
17. Go to the terminal and check unit’s settings.

If download process was interrupted, it is need to restart power of the unit and start download process again without items from 6 to 9.

8.4.2 USING THE RS-485 INTERFACE

In order to use this interface, refer to **Section 10 APPENDIX A: RS-485 SERIAL COMMUNICATION PROTOCOL.**

9. MAINTENANCE

This Section describes scheduled maintenance procedure for the SSPB/system.

CAUTION: Improper maintenance of the SSPB Up-Converter unit may void the warranty.

9.1 PREVENTIVE MAINTENANCE

This product requires minimum maintenance, which consists of visual inspection and cleaning.

WARNING: The person performing maintenance of this equipment must have training and knowledge of both the product and safety requirements and safety issues related to the equipment. Read and practice the safety guidelines at the beginning of this manual (**Section 1** SAFETY at page 6).

9.2 MECHANICAL PREVENTIVE MAINTENANCE

Mechanical preventive maintenance consists of verifying the condition of all mechanical parts, with the AC power switched off. Perform the following inspection:

1. Check all connectors and plugs for evidence of damage and improper seating. Replace defective connector plugs and reset any that are dislodged.
2. Inspect the electrical wiring for signs of discolored, broken or poor insulation. Repair or replace if necessary.
3. Inspect all waveguides for discoloration, cracks, loose connectors and improper sealing. Tighten or replace waveguides as required.
4. Check for other defects such as, wear, breakage, deterioration, fungus, excess moisture and mounting integrity.

9.3 COOLING FAN CHECK

The SSPB Block Up-Converter unit is forced-air cooled, using a single fan. The cooling fan is located at the bottom shroud of the SSPA. Verify that the fan is operating smoothly. Any suspect noise may indicate wear and fan will have to be replaced. Check for debris or dust in the fan intake and in all openings on the unit. This may reduce the efficiency of the cooling system. The fan should be replaced every two years, in order to ensure the proper cooling of the unit.

WARNING: Do not come in contact with any electrical assembly while power is applied.

10. APPENDIX A: RS-485 SERIAL COMMUNICATION PROTOCOL

The protocol described in this Section is used for the interconnection between the SSPB Up-Converter unit and the user's monitoring and control system. The protocol supports the 4-wire RS-485 interface using the communication set-up 9600.N.8.1.

10.1 FRAME STRUCTURE

Each frame begins with the same starting byte: 0x55.

After the starting byte, 7 bytes are following.

The first byte in the master-to-slave direction is the address of the correspondent unit (0x01 to 0x07; the address 0x00 is the broadcast address - it must be used only for commands).

The first byte in the slave-to-master direction contains the address of the unit, shifted to the left by 4 (e.g. the unit with the address 0x05 will return address 0x50).

The second byte in the master-to-slave direction is a command or a data request.

The third, forth and fifth bytes in the master-to-slave direction carry the value of parameter or an expansion of the command. The third byte is the most significant (MS) byte, the fourth is the less significant (LS) byte, and the fifth byte is the value after the decimal point.

The second to the sixth bytes in the slave-to-master direction carry data or status from the slave unit.

The seventh byte in both the master-to-slave and the slave-to-master directions carry the check-sum, calculated as algebraic sum of bytes 1-6.

All not used (N/U) bytes are always set to 0xAA.

The format for gain, level, current consumption and temperature is a 2-bytes hexadecimal value in 0.1 dB, 0.1 dBm, 0.1 Amp or 0.1 degree (signed integer).

If the unit does not recognize the command, or if the checksum is not correct, the response will be always "condition status".

The commands marked N/A are not available for these units.

TABLE 13: COMMAND FRAME STRUCTURE				
No	**Description**	**2nd byte**	**3rd, 4th, 5th & 6th bytes**	**Response: 2nd, 3rd, 4th, 5th & 6th bytes**
1	Mute/Un-Mute Command	0x02	0x5A– mute Tx, 0xA5 – un-mute Tx	See **TABLE 14**
2	Set Gain	0x05	0x5A XX XX XX for A 0xA5 XX XX XX for B	See **TABLE 14**
3	Read Identification	0x07	0xAA AA AA AA	See **TABLE 15**
4	Read Serial Number	0x08	0xAA AA AA AA	5 ASCII characters
5	Read Frequency Range	0x09	0x5A for Tx	See **TABLE 16**
6	Read Gain Set	0x0A	0x5A for A 0xA5 for B	2 &3 bytes – real gain
7	Read Real Gain Range	0x0D	0x5A for Tx	See **TABLE 17**
8	Read output level	0x0E	0x5A for Tx	See **TABLE 18**
9	Read Hot Spot temperature and DC voltage	0x12	0xAA AA AA AA	2, 3 bytes –temperature 5, 6 bytes – DC voltage
10	Read available current consumption	0x13	0xAA AA AA AA	5,6 bytes - current
11	Read unit and switches status and positions	0x23	0xAA AA AA AA	See **TABLE 20**
12	Switch WG switches	0x24	0x5A – SW1 0xA5 – SW2	See **TABLE 14**
13	Read forward and reflected power levels	0x25	0xAA AA AA AA	2-3 bytes : FWD 5-6 bytes : REFL
14	Read frequency shift	0x27	0x5A for A 0xA5 for B	See **TABLE 19**
15	Request condition status	0x2A	0xAA AA AA AA	See **TABLE 14**
16	Set Power Alarms thresholds	0x2D	0x5A XX XX AA - High 0xA5 XX XX AA - Low	See **TABLE 14**
17	Read Power Alarms thresholds	0x2E	0xAAAAAAAA	2&3 bytes – high 5&6 bytes - low
18	Fault reset	0x66	0xA5	See **TABLE 14**

10.2 RESPONSES TO COMMANDS FROM SLAVE TO MASTER

For command 15 (0x2A - request condition status) the response is given in the following table.

TABLE 14: CONDITION STATUS RESPONSE

Bit No	2nd byte	3rd byte	4th byte	5th byte	6th byte
0	Output level MS byte	Output level LS byte	Communication Status (see NOTES)	Tx status 1-on, 0-off	0
1				1- Tx Summary Alarm	0
2				1- Check sum error in command	1 – Unknown command
3				Power Class for P1dB (power in dBW) 5 bits From 30dBm – step 1dB 0 dBW = 30 dBm 1 dBW = 31 dBm . . . 22 dBW = 52 dBm	N/U
4					N/U
5					N/U
6					N/U
7					N/U

NOTES:
4th byte – Internal Communication Status is:
1 – for no communication, 0 – for communication O/K.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
N/U	HPA (Power Module)	N/U	N/U	PA (Driver) Module	IF-L Module (N/A)	L-RF Module	Digital Power Monitor

For command 3 (0x07 – read identification) the response is given in the following table:

TABLE 15: READ IDENTIFICATION RESPONSE					
Bit No	**2nd byte**	**3rd byte**	**4th byte**	**5th byte**	**6th byte**
0	1 – Up	N/U	0x07 – L to C	0	Software version number 0xXX
1	0	1 – ALC On 0 – ALC Off		0	
2	1 – PA (Driver)	0		0	
3	0	0		0	
4	1 – HPA (Power Module)	0		0	
5	0	0		0	
6	0	0		0	
7	0	0		0	

For command 5 (0x09 – read frequency range) the response is given in the following table:

TABLE 16: READ FREQUENCY RANGE RESPONSE					
Bit No	**2nd byte**	**3rd byte**	**4th byte**	**5th byte**	**6th byte**
0	MS byte Lowest Frequency	LS byte Lowest Frequency	0x5A for Tx	MS byte Highest Frequency	LS byte Highest Frequency
1					
2					
3					
4					
5					
6					
7					

For command 7 (0x0D – read gain range) the response is given in the following table:

TABLE 17: READ GAIN RANGE RESPONSE					
Bit No	**2nd byte**	**3rd byte**	**4th byte**	**5th byte**	**6th byte**
0	MS byte Minimum Value	LS byte Minimum Value	0x5A for Tx	MS byte Maximum Value	LS byte Maximum Value
1					
2					
3					
4					
5					
6					
7					

For command 8 (0x0E – read output level) the response is given in the following table:

TABLE 18: READ OUTPUT LEVEL RESPONSE					
Bit No	**2nd byte**	**3rd byte**	**4th byte**	**5th byte**	**6th byte**
0	0xAA	0xAA	0x5A for Tx	MS byte Output Level	LS byte Output Level
1					
2					
3					
4					
5					
6					
7					

For command 14 (0x27 – read frequency shift) the response is given in the following table:

TABLE 19: READ FREQUENCY SHIFT RESPONSE					
Bit No	**2nd byte**	**3rd byte**	**4th byte**	**5th byte**	**6th byte**
0	MS byte Frequency	LS byte Frequency	0x5A for A 0xA5 for B	0xAA	0xAA
1					
2					
3					
4					
5					
6					
7					

TABLE 20: UNIT AND SWITCHES STATUS AND POSITIONS RESPONSE					
Bit No	**2nd byte**	**3rd byte**	**4th byte**	**5th byte**	**6th byte**
0	1–B; 0-A	0	0	1 - Consumption Current Alarm	1 – SW1 Alarm
1	Tx 1-unmute; 0-mute	0	0	1 - Reflected power Alarm	1 – SW2 Alarm
2	0	1-L-RF alarm	0	1 - Overdrive Alarm	1 – SW1 not connected
3	Tx 1 - on line; 0 - stand by	1 - Temperature Alarm	0	1 – Low Power Alarm	1 – SW2 not connected
4	0	1 - PA Alarm	1 – Path A 0 – Path B	1 – ALC Low (N/U)	1 – SW3 Alarm
5	1 – standalone; 0 - redundant	1 - HPA Alarm	0	1 – ALC High (N/U)	1 – SW3 not connected
6	1 – S; 0 – A or B	1 – HPA R Alarm (N/U)	1 – High Power Alarm	0	0
7	0	1 - Temperature PreAlarm	0	1 – Power Supply Alarm	0

11. APPENDIX B: SAFETY AND EMC COMPLIANCE

ADVANTECH Products are compliant with following standards:

SAFETY: IEC 60950-1 second edition 2005

EMC: EN301489-1 2004 (EMC for radio equipment and services, common technical requirements):

EN 55022: 1998 / A1: 2000 - Class A
EN61000-4-4 Transient/burst 0.5kV Signal Lines, 1 kV Power Lines
EN61000-4-2 Electrostatic discharge 4kV CD, 8 kV AD
EN61000-4-5 Surge 1kV, 0.5 kV
EN61000-4-11 AC port dips 70%, 40%, 0%
EN 61000-4-3 Radiated Immunity 80-1000 MHz @ 3 V/m

SUPPLEMENTARY INFORMATION:

The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and of the EMC Directive 89/336/EEC and may carry the CE-marking accordingly.

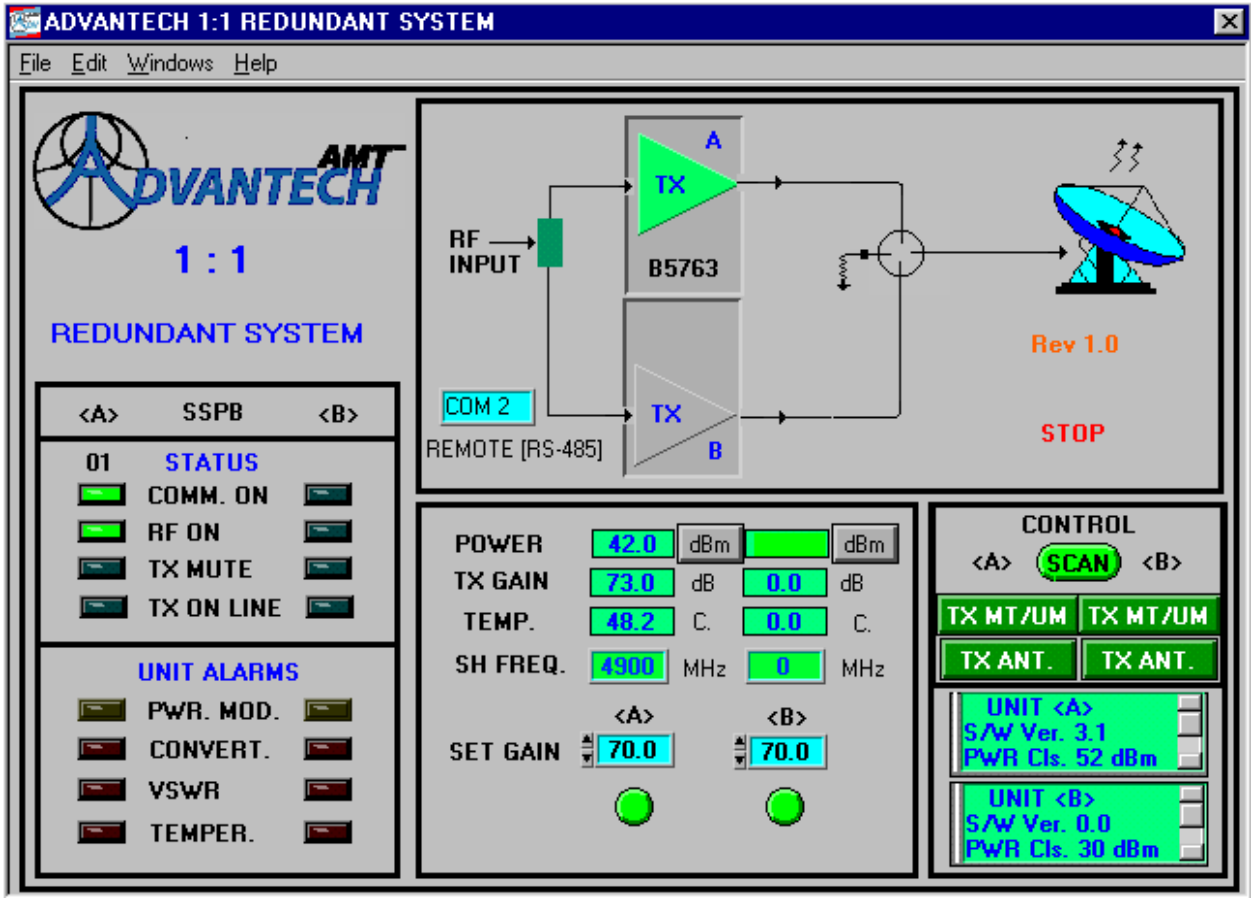


Figure 8: Proposed Graphic User Interface (GUI) using RS-485 Protocol (single unit)

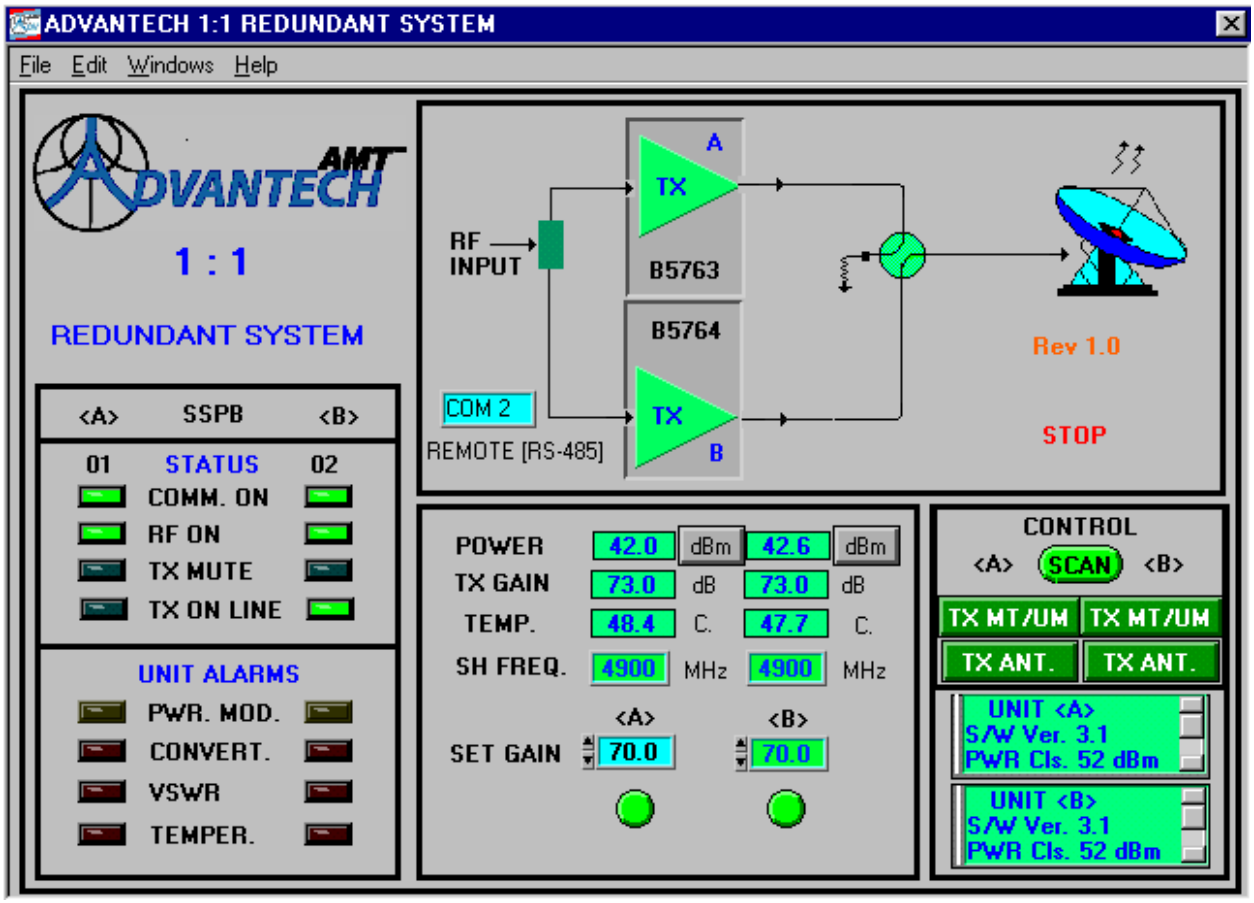


Figure 9: Proposed Graphic User Interface (GUI) using RS-485 Protocol (redundant system)