INSTALLATION AND OPERATING MANUAL

50W Extended Ku-Band Hub-mount
SOLID STATE POWER BLOCK UP-CONVERTER (SSPB)
SATELLITE TRANSMITTER
SSPBMg–KX50–CSE

PM GR0-3521A0-3N1, Rev. 4

WARRANTY

This Advantech Wireless product is warranted against defects in material and workmanship for a period of 2 years from date of shipment. During the warranty period, Advantech Wireless 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 Wireless at:

Phone: +1-514-694-8666 or Fax: +1-514-868-0371
Website: www.advantechwireless.com or e-mail: support@advantechwireless.com

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

Advantech Wireless Technologies Inc.
(A BAYLIN TECHNOLOGIES COMPANY)
16715 Hymus Blvd.
Kirkland, Quebec
H9H 5M8
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 Wireless 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 Wireless 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 Wireless uses the following symbols for safety related information. For your own safety, please read the information carefully BEFORE operating the equipment.

Symbols used in this manual:

WARNING! Indicates a hazardous procedure that may result in serious injury or death, if not performed properly.

CAUTION! Indicates a dangerous procedure that may result in light-to-severe injury or loss related to equipment malfunction, if proper precautions are not taken.

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

The operator cannot repair this unit. DO NOT attempt to remove the top cover or disassemble the internal components. Only qualified service technicians should service this unit. There is a risk of damaging the precision components.

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

ALWAYS TERMINATE THE OUTPUT WAVEGUIDE OF THE UNIT WITH AN RF LOAD CAPABLE OF DISSIPATING FULL CW RF POWER. SIMILARLY TERMINATE THE RF INPUT PORT 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 from and into the local environment. If an RF source is not connected to the RF input port, the unit may go into a self-induced mode and generate high levels of RF energy. Destruction caused by an excessive load voltage standing wave ratio (VSWR) will void the warranty.

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

DO NOT LOOK INTO THE RF OUTPUT PORT OF THE POWERED BLOCK UP-CONVERTER! Handle the powered SSPB with extreme care. Keep in mind that the levels of microwave radiation, which do not induce immediate physical discomfort in most individuals, can be sufficiently high to induce long term effects. The eyes are the most vulnerable parts of the body.

The maximum permissible levels of exposure are quite low in comparison to the power levels produced by the equipment built by Advantech Wireless (e.g. less than 10 mW versus 4 to 700 W delivered by the different units). The maximum 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.

2. GENERAL INFORMATION

2.1 INTRODUCTION

This manual contains information that describes the installation, operation and maintenance procedures for the 50-Watt Extended Ku-Band hub-mount (outdoor) Solid State Power Block Up-Converter model SSPBMg-KX50-CSE. Because specialized training is required for some phases of installation and operation, certain parts of this manual are directed only to properly trained personnel. Warnings appear at the appropriate points to caution all users of the potential RF hazards.

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

Advantech Wireless *has prepared this manual for use as a guide for the proper installation, operation and maintenance of Advantech Wireless equipment and computer programs. The drawings, specifications and information contained herein are the property of Advantech Wireless. Unauthorized use or disclosure of these drawings, specifications and information is strictly prohibited. They shall not be reproduced, copied or used in whole or in part as the basis for manufacturing or sale of the equipment or software programs without the prior written consent of Advantech Wireless.*

2.2 DESCRIPTION

The SSPBMg-KX50-CSE is a 50-Watt Extended Ku-Band hub-mount (outdoors) Solid State Power Block Up-Converter (SSPB). The entire SSPB is self-contained and is intended for mounting on to the antenna hub, see **Figure 1:** Product Outline at page 12. It incorporates an Interface Assembly, Up-Converter Assembly, High Power Amplifier (HPA) Assembly, Power Supply Assembly and a Main Controller Board. The block diagram of the SSPB is shown in **Figure 2:** Block Diagram (page 13) and the various connectors are shown in **Figure 3:** Connectors (page 16).

2.2.1 POWER SUPPLY

There is only one power supply assembly in this SSPB. The power supply provides +12 V DC high current for GaAs devices and +24 V DC high current for GaN devices. **The power supply is configured for 90 to 264 V AC.**

The overall power consumption, at saturated RF output power, is 450 W, typical (320 W, max. at linear power).

2.2.2 UP-CONVERTER ASSEMBLY

The RF signal arriving from a modem enters the Up-Converter Assembly through a 'N-type' connector, see **Figure 3:** Connectors (page 16). The L-Band (950 MHz to 1700 MHz) signal enters the high gain Low Noise Amplifier (LNA) and Medium Power Amplifier (MPA) stages that boost the RF power level sufficient for the transmission through the Up-Converter Assembly.

Integral to the UP-Converter Assembly is a variable attenuation section that maintains the overall gain of this module constant against changes in temperature (global temperature compensation). A temperature dependent DC voltage is sent from a temperature sensor from within the HPA Assembly through the power conditioner board to the attenuator. The amount of attenuation is varied with the change in the DC voltage.

The Up-Converter Assembly converts and amplifies the incoming L-Band carrier signal into a Kx-Band carrier. To achieve this requirement, this assembly contains a synthesiser, a mixer, a multiplier, an LNA and several amplifier stages and two band-pass filters, see **Figure 2:** Block Diagram (page 13). For this application, the Up-Converter requires the L-Band signal, which is sent to the mixer and the 10 MHz reference signal, which is fed into the synthesiser.

The synthesiser contains a phase-locked loop local oscillator (PLL LO), which is normally phase-locked with the internal 10 MHz reference. When functioning correctly, the PLLLO generates a 3.200 GHz signal. The multiplier converts this signal into a 12.800 GHz LO signal. The 12.800 GHz signal and the L-Band signal are fed into a mixer to produce the required Kx-Band signal. The frequency-range provided by the Up-Converter Assembly is from 13.750 GHz to 14.500 GHz.

The synthesiser also contains an out of lock protection circuitry that prevents frequency shifts from occurring to the resulting Kx-Band signal. When the oscillator is not phase-locked, a signal is sent to the power conditioner board within the HPA Assembly to shutdown the RF devices.

The band-pass filter removes the unwanted harmonic frequencies, allowing the Kx-Band signal to pass through the HPA Assembly.

2.2.3 HPA ASSEMBLY

The HPA Assembly amplifies the RF signal from the Up-Converter Assembly to a power level sufficient for transmission. Integral to this module are several amplifier (PA) stages, one high power amplifier (HPA) stage and a power conditioner and monitor and control (M&C) board. The HPA Assembly includes also a band-pass (receive reject) filter. Other functionalities include internal power conditioning and overtemperature shutdown.

2.2.4 CONTROLLER BOARD

All of the controls, input/output communication and the decision-making, with the exception of the critical module-level decision are performed by the micro-controller within the Up-Converter. The Controller Board provides through the System Control interface:

- Fault detection and indication
- Forward RF power monitoring and indication
- Temperature monitoring and indication
- ON/OFF transmit switching
- Change in the unit's address

An ALARM will be triggered when the internal temperature of the SSPB exceeds 70°C. The SSPB will continue to operate in this condition.

A FAULT signal will be sent to the user if any one of the following occurs:

- Phase-locked loop oscillator within the synthesizer is out of lock.
- The baseplate temperature exceeds 85 °C
- Any of the RF devices fails

In case of over-temperature (>85 °C), the SSPB will automatically restart when its internal temperature decreases to 60 °C.

2.2.5 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 ±5 x 10^{-8} MHz/year typical), which is required by the converter module.

2.3 RECEIVE REJECT FILTER (INTERNAL)

The SSPB unit has an internal Receive Reject Filter. **TABLE 1** below lists the specifications of the internal Receive Reject Filter.

TABLE 1: FILTER SPECIFICATIONS

Parameter	Specification
Pass Band	13.750 - 14.500 GHz
Input Return Loss	- 23 dB, max
Output Return Loss	- 23 dB, max
Insertion Loss	0.15 dB, max
Stop Band	11.700 - 12.700 GHz
Rejection	35 dBc, min

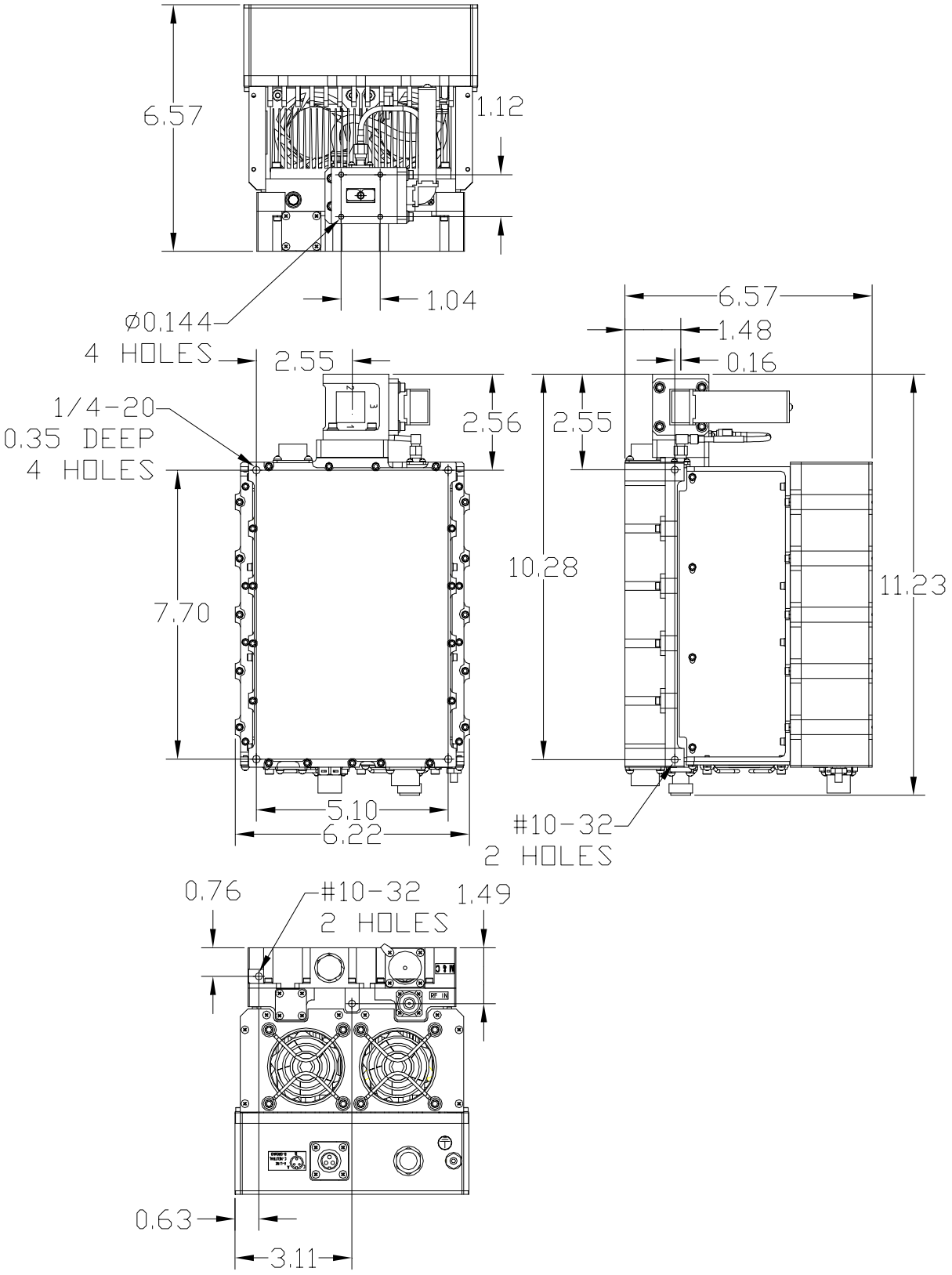

Figure 1: Product Outline (with external circulator)

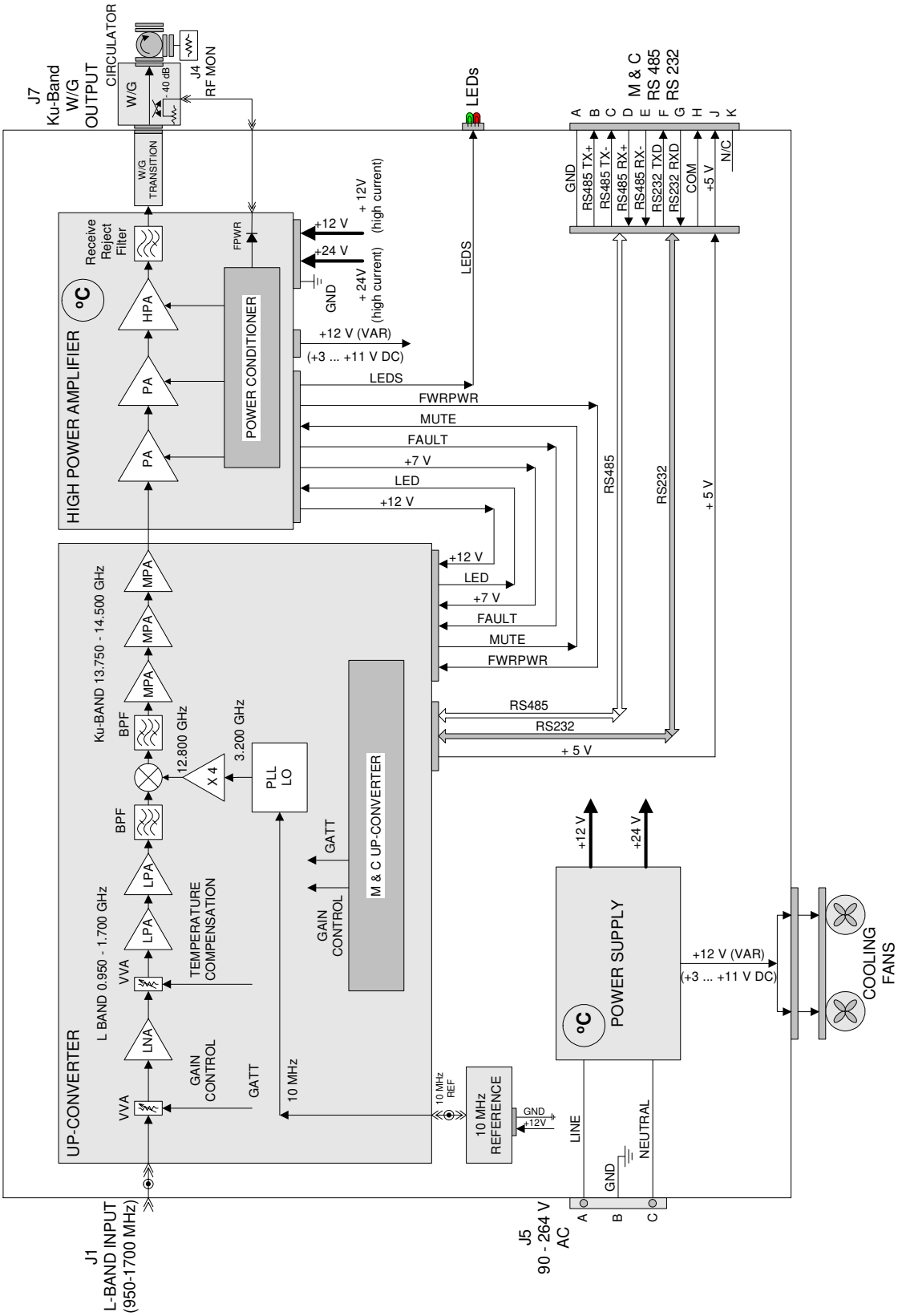

Figure 2: Block Diagram

2.4 SSPB SPECIFICATIONS

TABLE 2: ELECTRICAL SPECIFICATIONS	
L-Band Input Frequency	950 – 1700 MHz
RF Output Frequency Range	13.750 – 14.500 GHz
Frequency Stability	Based upon 10 MHz Internal Reference
RF Saturated Output Power (P_{SAT})	+ 47 dBm, typical
Linear Output Power (P_{LIN})*	+ 43.0 dBm, min
Linear Gain	68 dB, min, @ 23 °C and central frequency
Gain Flatness: over any 500 MHz over 40 MHz	3.0 dB, p-p, max 1.0 dB, max
Gain Variation Over Temperature	3 dB, p-p, over the entire bandwidth
L-Band Input Impedance	50 Ω
L-Band Input VSWR	1.29:1, max (-18 dB, max Return Loss)
Ku-Band Output VSWR	1.50:1, typ (-14 dB, typ Return Loss)
Noise Power Density	- 75 dBm/Hz, max (in transmit band) - 145 dBm/Hz, max (in receive band @ 12.75 GHz)
Spurious at saturated power (46.5 dBm) (in-band and out of band)	- 55 dBc, max
Third Order Intermodulation (two equal tones 5 MHz apart)	- 25 dBc, max @ 43.0 dBm (P_{LIN}) total output power
Local Oscillator Frequency	12.800 GHz
Local Oscillator Leakage	- 20 dBm, max
Output Phase Noise @ Offset 100 Hz 1 kHz 10 kHz . ≥100 kHz	Ku-Band Single Side Band Phase Noise (max) - 63 dBc/Hz - 73 dBc/Hz - 83 dBc/Hz - 93 dBc/Hz

***NOTE:** To establish P_{LIN} measure third order intermodulation with two equal tones 5 MHz apart to be – 25 dBc and note the total output power for this value of IMD3.

TABLE 3: MECHANICAL SPECIFICATIONS	
Physical Dimensions	See **Figure 1:** Product Outline (page 12) – white paint
Approximate Weight	18 lbs (8.2 kg)
Mounting holes (4)	#8-32, 0.25" deep (2 on each side), see **Figure 1:** Product Outline (page 12)

TABLE 4: POWER REQUIREMENTS	
Power Requirements	90 to 264 V AC (110 / 220 V AC. autoranging)
Power Consumption	1.7 A typical @ 220 V AC (320 W) @ P_{LIN}; 2.2 A @ 220 V AC (450 W) @ P_{SAT}

TABLE 5: ENVIRONMENTAL CONDITIONS	
Temperature: Non-operating (continuous exposure) Operating (ambient)	 - 50 °C to + 85 °C - 30 °C to + 55 °C (with start-up at – 30 °C)
Relative Humidity:	Up to 100% relative humidity, condensing
Altitude:	10,000 feet AMSL, derated 2 °C/1,000 feet from AMSL

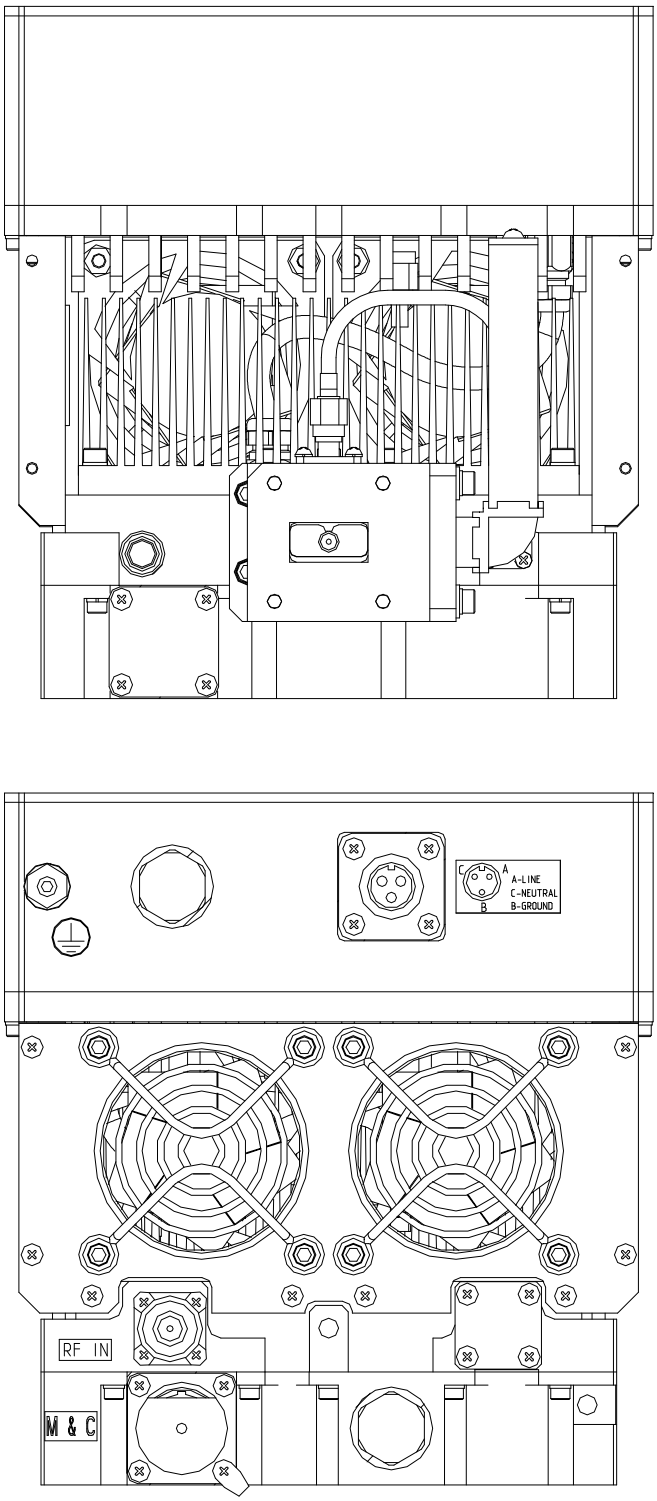

Figure 3: Connectors

TABLE 6: CONNECTORS			
Connector	**Function**	**Description**	**Mating Connector**
RF IN (J1)	INP Up-converter Input	N - Type (F)	N - Type (M)
M & C (J3)	Serial Interfaces (RS-232, RS-485)	MS 3112E12-10P (M)	MS 3116F12-10S (F)
AC LINE (J5)	AC Supply (90 to 264 V AC; 110 / 220 V AC, autoranging)	MS3102R-10SL-3P (M)	MS3106F-10SL-3S (F)
(J7)	OUT Waveguide Output	WR – 75 (grooved)	WR – 75 (flat)

TABLE 7: AC LINE (J5) – PIN ASSIGNMENTS	
Pin	**Description**
A	LINE
B	GROUND
C	NEUTRAL

3. UNPACKING AND INSTALLATION

This Section contains instructions for the site preparation, unpacking and the installation of an SSPB.

3.1 INITIAL INSPECTION

Inspect the shipping container for damage. If the container or cushioning material is damaged, immediately contact the carrier that delivered the equipment and submit a damage report. Failure to do so could invalidate all future claims.

3.2 UNPACKING

Carefully unpack and remove all of the items from the shipping container (inspect the interior of the container for damage). Save all of the packing material until completing a visual inspection. Verify that all of the items listed on the packing list are present. Inspect all of the items for evidence of damage, which might have occurred during the shipment. If damage seems evident, immediately contact the carrier that delivered the equipment and file a claim. Failure to do so could invalidate future claims. Check the unit thoroughly for damaged or loose parts. After completing a visual inspection, proceed to the next step.

3.3 INSTALLATION

Installation of the SSPB includes the following four phases:

- Mechanical installation
- Electrical installation
- RF connections
- Cooling considerations

3.3.1 MECHANICAL INSTALLATION

The SSPB is designed for hub-mount (outdoors) applications.

Figure 1: Product Outline at page 12 shows the overall mechanical dimensions of this SSPB.

3.3.2 ELECTRICAL CONNECTIONS

Electrical connections to the SSPB consist of the M&C Serial Interfaces (RS-485 & RS-232) applied to (J2) connector and the prime power AC LINE applied to the AC Line Connector (J5). For the connector location, see **Figure 3:** Connectors at page 16.

CAUTION: Do NOT apply AC Power to the unit before connecting all connectors, electrical and RF, to their proper connecting cables and wave-guides.

Perform the electrical connections as follows:

- Using the connector provided in the shipping kit (item 5, **TABLE 10** at page 37, construct an M&C Interfaces cable with a pin assignment as shown in **TABLE 8** at page 21.
- Using the connector provided in the shipping kit (item 4, **TABLE 10** at page 37, construct an AC Supply cable with a pin assignment as shown in **TABLE 7** at page 17.
- Verify that the AC power source is turned OFF.
- Connect the SSPB to the AC power source. For the correct input voltage level refer to **TABLE 4** at page 15.

3.3.3 RF CONNECTIONS

The following RF connections are provided by the SSPB:

- RF input (J1) – N-Type Female, see
- Figure 3: Connectors at page 16. The user needs a N-Type male connector for the interface connection.

- RF output (J7) - WR-75 waveguide flange (grooved), see **Figure 3:** Connectors at page 16. The user needs a WR-75 flat waveguide flange. Use the provided gasket (item 11 in **TABLE 10** at page 37). It is strongly recommended to install the delivered pressure window (item 3 in **TABLE 10** at page 37) between the output of the unit and the waveguide leading to the antenna in order to protect the unit from any ingress from the W/G system.

- Attach the correct RF cable with mating connector to their corresponding connector ports on the SSPB.

- Wrap mastic tape (item 6 of **TABLE 10** at page 37) around all of the SSPB connectors in order to prevent water/humidity ingress, which may result in damage.

- Squeeze the tape tightly, ensuring that both ends of the tape have formed around the connector and the cable.

- Turn the AC power source ON.

CAUTION: All connectors that are not used must be closed with adequate caps, in order to prevent environmental ingress (water, dust) into the unit.

3.3.4 COOLING CONSIDERATIONS

The SSPB is forced-air cooled. The cooling fans are configured for 12 V DC operation, supplied by the main power supply of the unit. Depending on environmental conditions, the airflow opening may become obstructed by debris, reducing the efficiency of the cooling system.

NOTE: The cooling fans rotation speed is temperature dependent.

Inspect the unit periodically to ensure that the grill of the fans intake and all openings on the unit are free of any obstructions. Insufficient air-cooling will significantly impact upon the SSPB longevity.

4. INTERFACES

4.1 SYSTEM CONTROL CONNECTOR

The System Control interface connector is located at port (RS485) of the SSPB. This is a 10-pin MS3112E12-10P (male) connector with pin assignments as shown in **TABLE 8** below.

The RS-485 and RS-232 serial interfaces allow for the external monitoring and control of the SSPB.

TABLE 8: SYSTEM CONTROL (RS485) – PIN ASSIGNMENTS

Pin	Type	Signal Name	Description
A	Ground	GND	Safety ground / Shield
B	Output	RS-485 TX+	RS-485 Serial transmit TX+
C	Output	RS-485 TX-	RS-485 Serial transmit TX-
D	Input	RS-485 RX+	RS-485 Serial receive RX+
E	Input	RS-485 RX-	RS-485 Serial receive RX-
F	Output	RS-232 TXD	RS-232 Serial transmit TX Data
G	Input	RS-232 RXD	RS-232 Serial receive RX Data
H	-	COM	Common
J	DC Voltage Source	+5 V DC	+5 V DC power source (for Hand-Held Terminal)
K	-	N/C	Not Connected

4.2 LED INDICATOR

The LED indicator displays the status of the unit:

- When the LED is lit GREEN, it indicates the unit is functioning properly and it is in RF ON state
- When the LED is blinking GREEN, it indicates that the unit is functioning properly and it is in MUTE state
- When the LED is lit RED, it indicates the FAULT state of the unit
- When the LED is not lit, the unit is not powered (or the power supply failed).

5. PRE POWER AND CHECKOUT

This Section contains the pre-power and checkout procedure for the SSPB model SSPBMg-KX50-CSE.

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

5.1 PRE-POWER PROCEDURES

Before applying prime power to the SSPB, verify that the following conditions are met:

- The voltages of the station AC prime power matches those marked on the ID label; it is 90 to 264 V AC (110 / 220 V AC, autoranging) for this unit.
- The prime power station is properly grounded.
- All connections are tight, no wires are pinched, and no other hardware has loosened while handling the SSPB.
- The main power switch on the prime power station is turned OFF.
- The RF input and RF output ports are connected to a matched source and a proper load capable to withstand full CW RF power see **TABLE 2** at (page 14).
- The heatsink is not obstructed.
- The cooling fans are not obstructed.

CAUTION: Failure to verify these pre-power conditions may damage the SSPB causing it to malfunction. Operating the SSPB before verifying the above conditions may void the warranty.

6. MAINTENANCE

This Section describes the scheduled maintenance procedure for the SSPB.

CAUTION: Improper maintenance of the SSPB may void the warranty.

6.1 PREVENTIVE MAINTENANCE

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

WARNING: Personnel performing maintenance on this system must have the proper training and become thoroughly familiar with the related safety requirements and issues. Read and practice the safety guidelines as described in (**Section 1** at page 6).

6.1.1 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. With the AC power disconnected or switched off, check that all of the connectors and plugs are seated properly in their mating-connectors and have not been damaged. Replace any damaged connector plugs and reset any that are dislodged.

2. Inspect the electrical wiring for signs of discolored, broken or poor insulation. Repair or replace as required.

3. Check for other defects such as breakage, fungus, deterioration, excess moisture and mounting integrity.

6.1.2 CHECKING THE COOLING FANS

The cooling fans are located at the lateral side of the SSPB. Verify that the fans are operating smoothly. Any suspect noise may indicate wear and the respective fan will have to be replaced. Check for debris or dust in the fans intake and in all openings on the unit. Any obstruction may reduce the efficiency of the cooling system. The fans 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.

7. RS-232 SERIAL COMMUNICATION

7.1 HAND-HELD TERMINAL

```
50 Watt Kx-Band SSPB
>
```

ENTER

ENTER or H ENTER

ENTER

```
LIST OF COMMANDS
STA Display status
RF  Set Tx output
    to ON or OFF
```

ENTER

```
ATT  Set Att
  0.0 to 21.0 dB
GAIN Set gain
  47.0 to 68.0 dB
```

ENTER

```
BAUD Set RS232 baud
SER  Display SN
VER  Display Version
RS485 Set RS485 intf
```

ENTER

```
ADDRESS Set NMS addr
T1  Sel hand-held
T2  Sel Term VT100
>
```

Figure 4: Hand-held Terminal HELP Menu

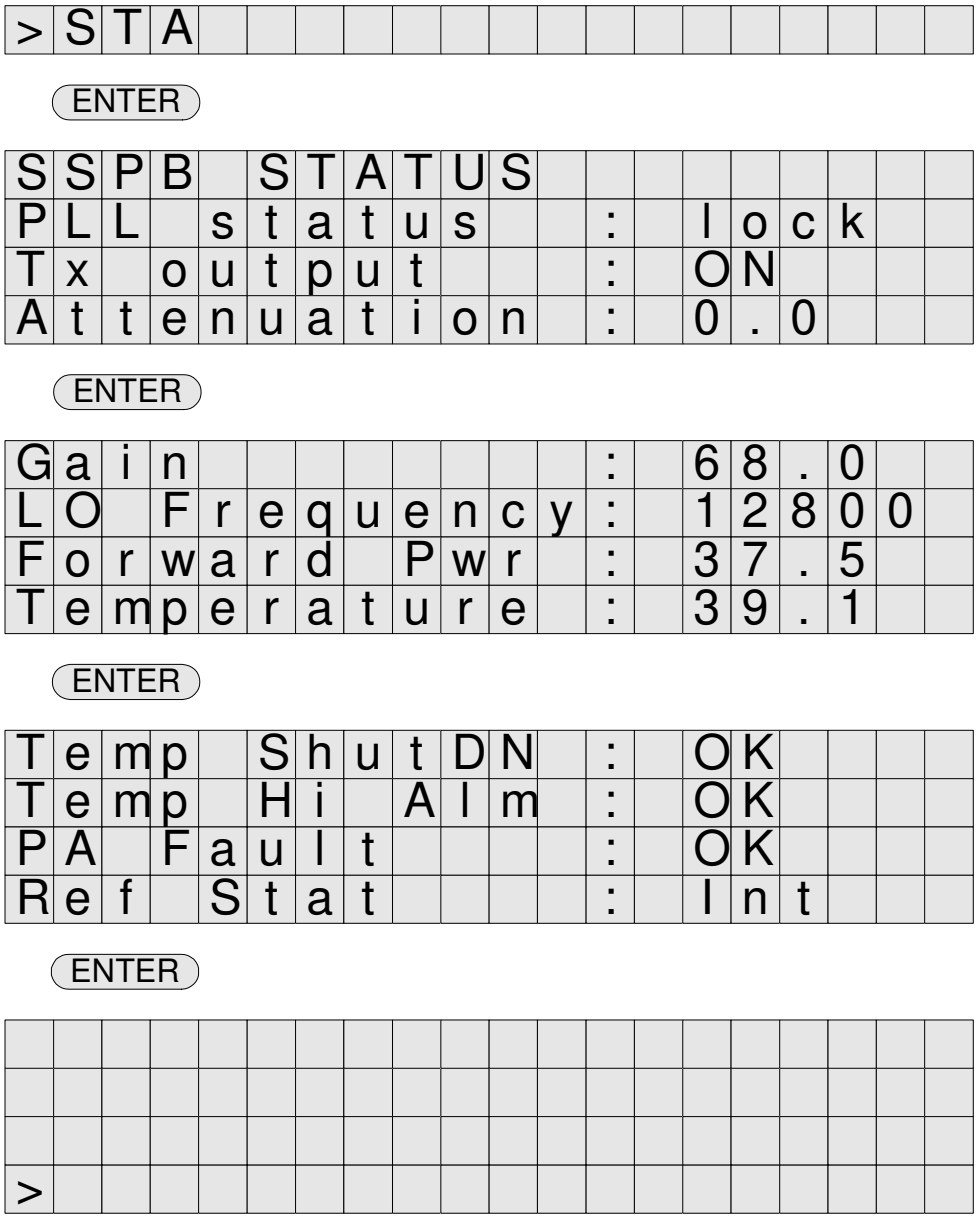

Figure 5: Hand-held Terminal STATUS Menu

NOTE: The RS-232 serial communication may be achieved with a hand-held terminal or with a PC (Video Terminal VT-100 communication). To set the communication for hand-held terminal, use the command "**T1**"; to set the communication for VT-100, use the command "**T2**" (see **Figure 4** and **Figure 6**).

7.2 RS-232 PC TERMINAL

For RS-232 VT communication, use the following communication parameters:

- Bits per second: 9600
- Data Bits: 8
- Parity: None
- Stop bits: 1
- Flow Control: None

TABLE 9: SERIAL INTERFACE RS-232 CONNECTION INFORMATION

Serial Interface RS-232 Pin	Active Condition	RS-232 at PC Pin	
		DB-9	DB-25
G	RS232 RXD	3	2
F	RS232 TXD	2	3
J	+5 V DC power source (for Hand-Held Terminal)	-	-
H	Common	5	7

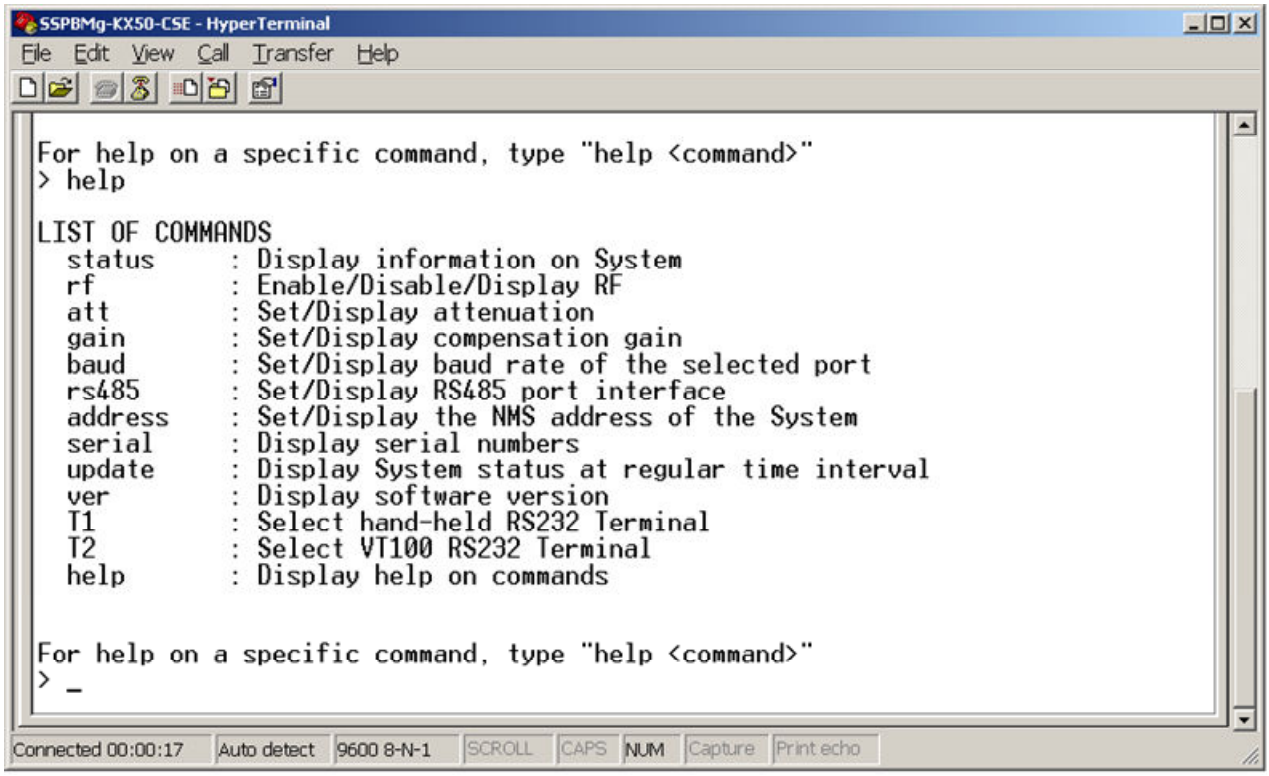

Figure 6: HyperTerminal RS-232 Communication – "help" command and response

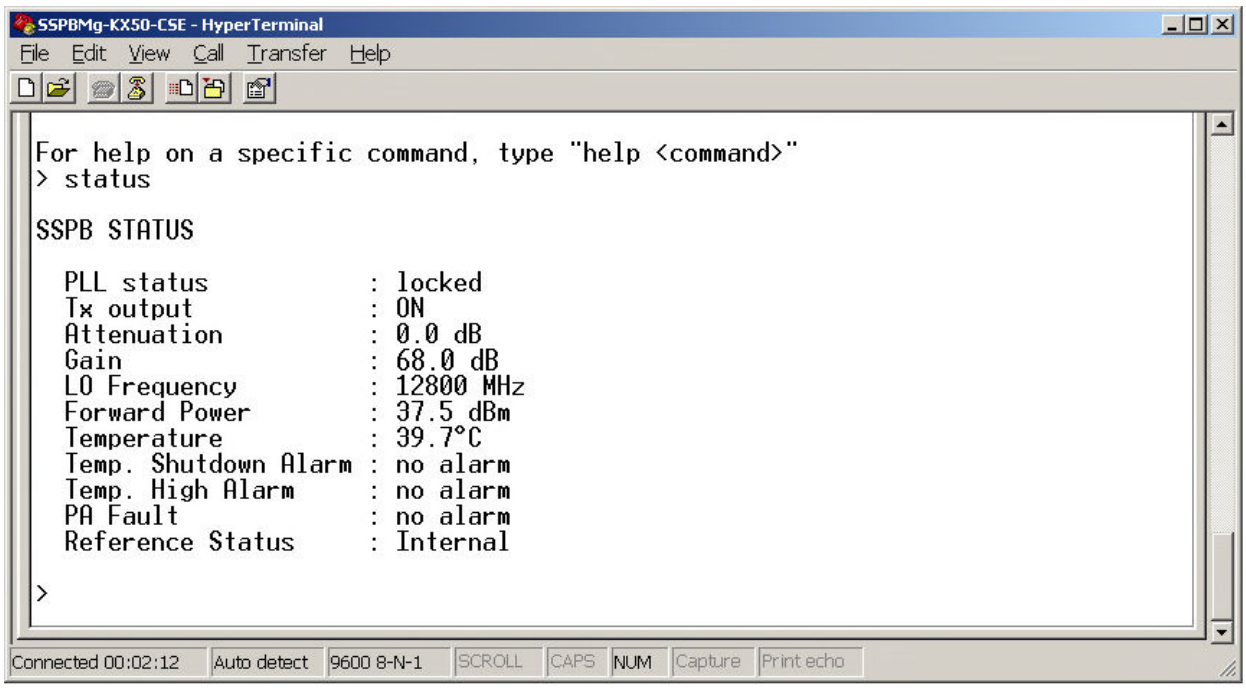

Figure 7: HyperTerminal RS-232 Communication – "status" command and response

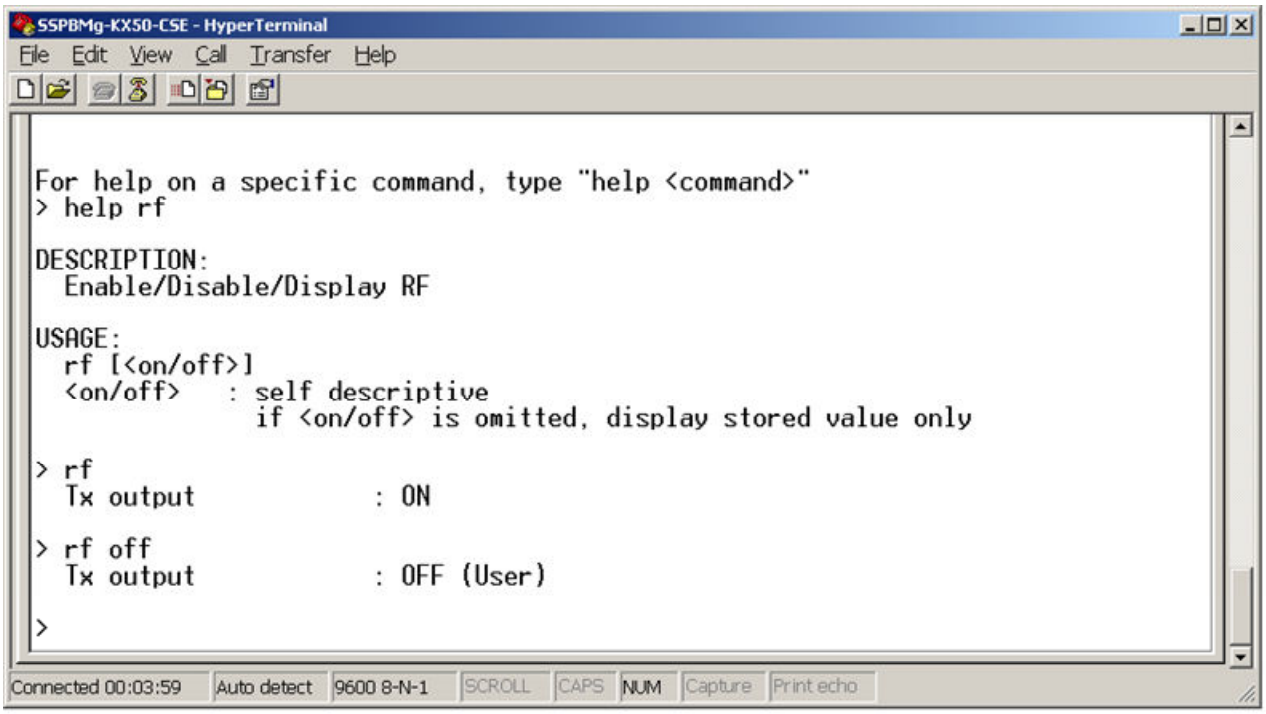

Figure 8: HyperTerminal RS-232 Communication – "help rf", "rf" and "rf off" commands and responses

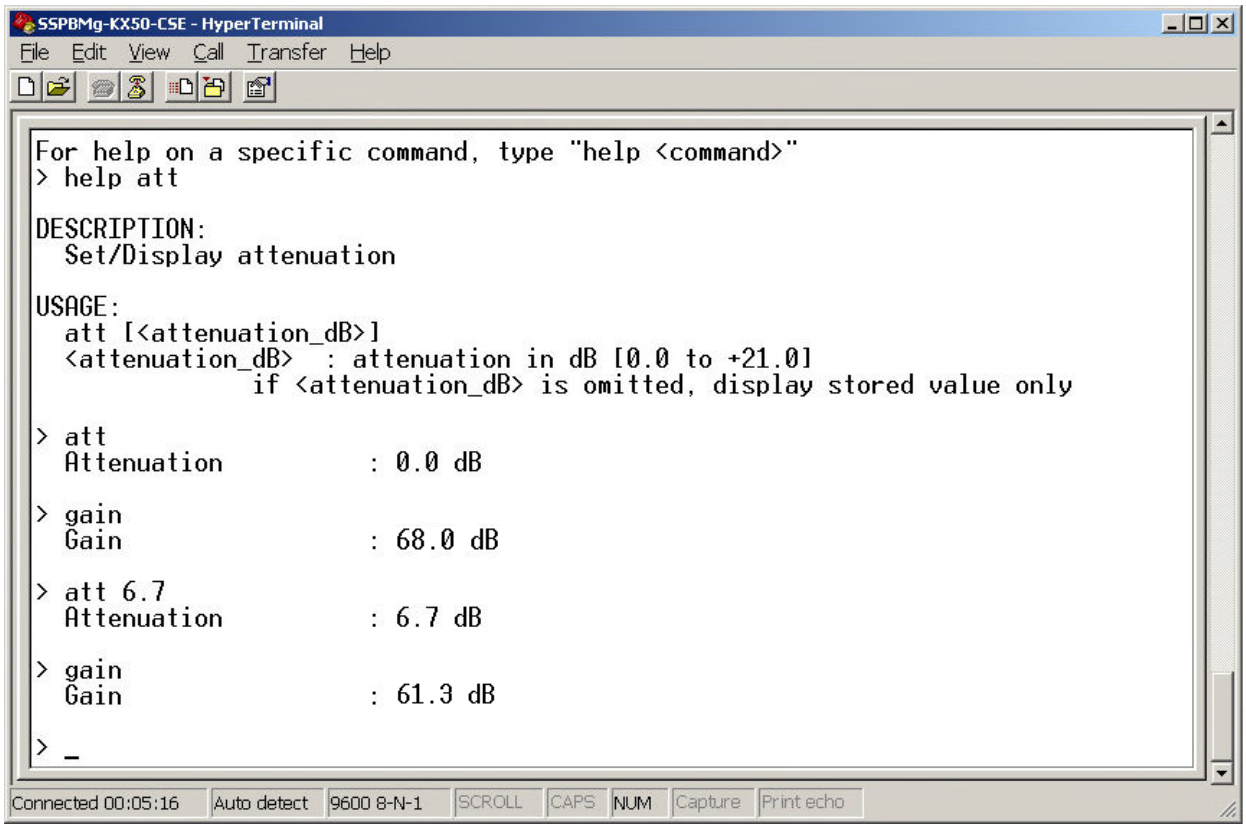

Figure 9: HyperTerminal RS-232 Communication – “help att”, “att”, “gain”, “att <value>”, and “gain” commands and responses

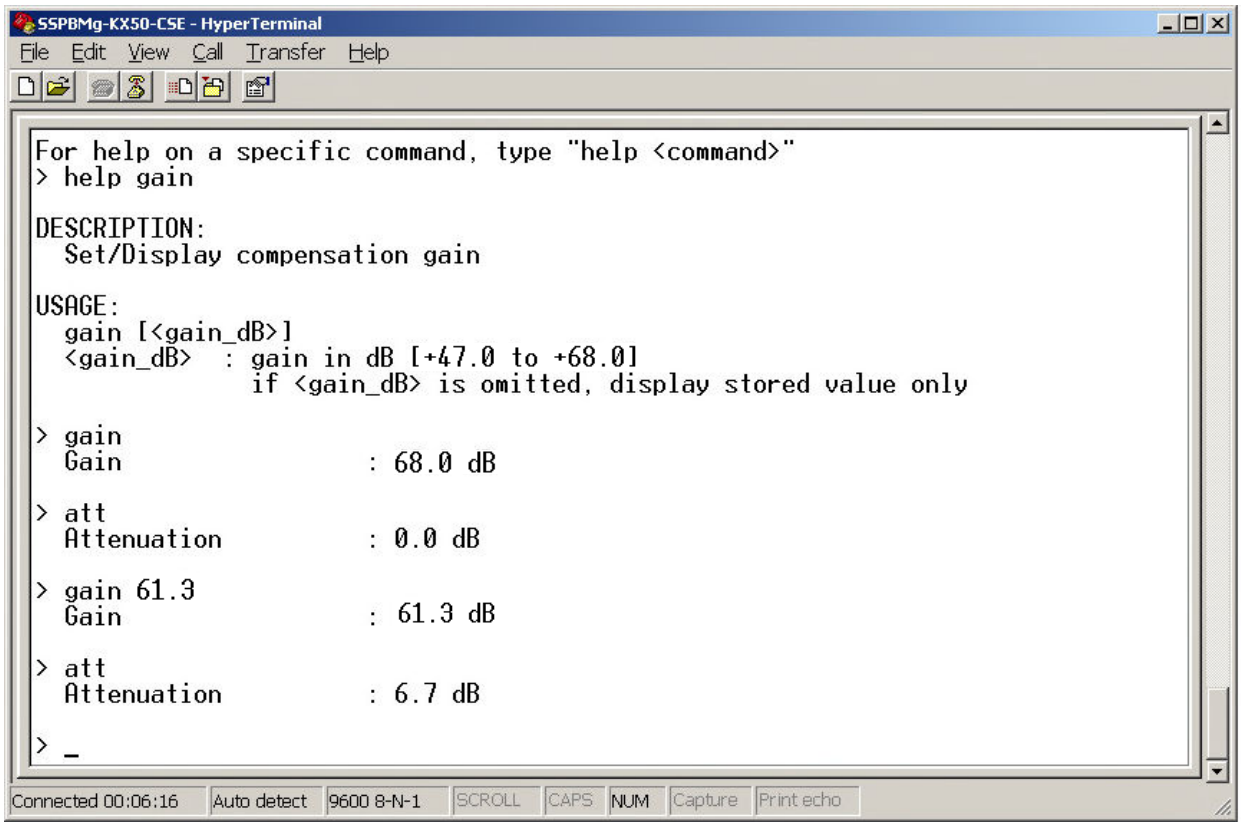

Figure 10: HyperTerminal RS-232 Communication – “help gain”, “gain”, “att”, “gain <value>”, and “att” commands and responses

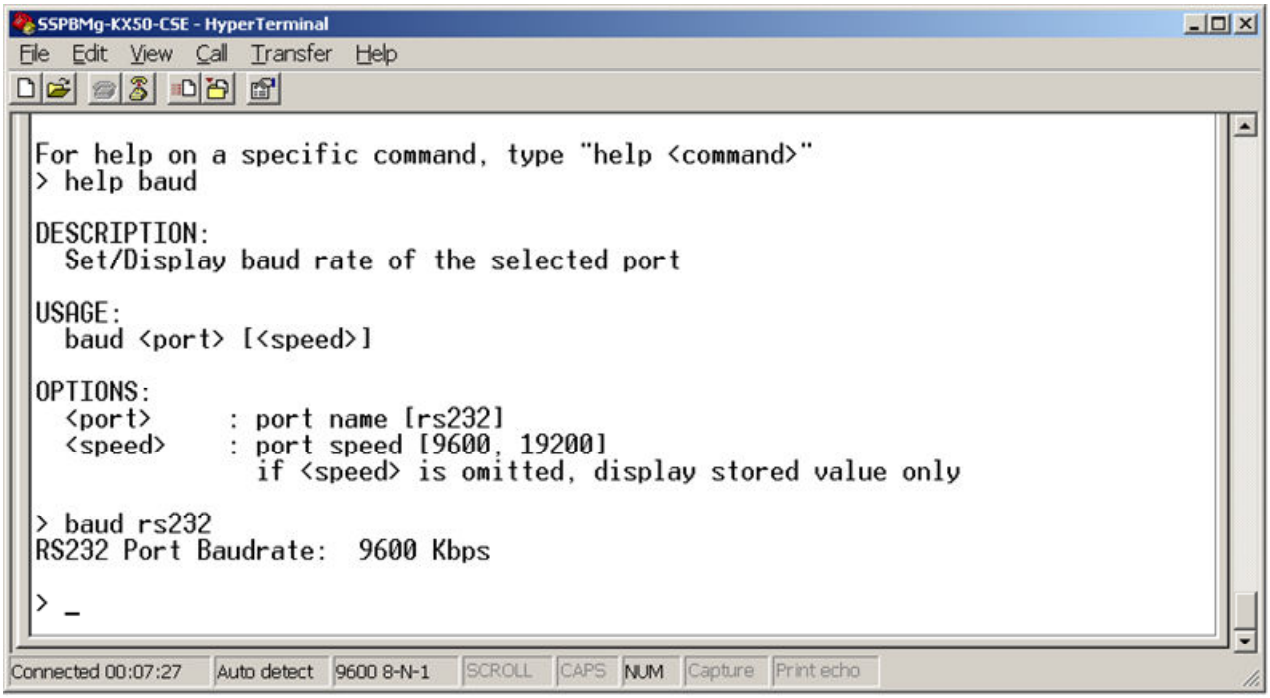

Figure 11: HyperTerminal RS-232 Communication – "help baud" and "baud rs232" commands and responses

NOTE: The baud rate may be set only for RS-232 serial interface (to 9600 or to 19200 bauds). After re-setting the baud rate, the communication program used (HyperTerminal or other VT communication programs) must be set for the new baud rate.

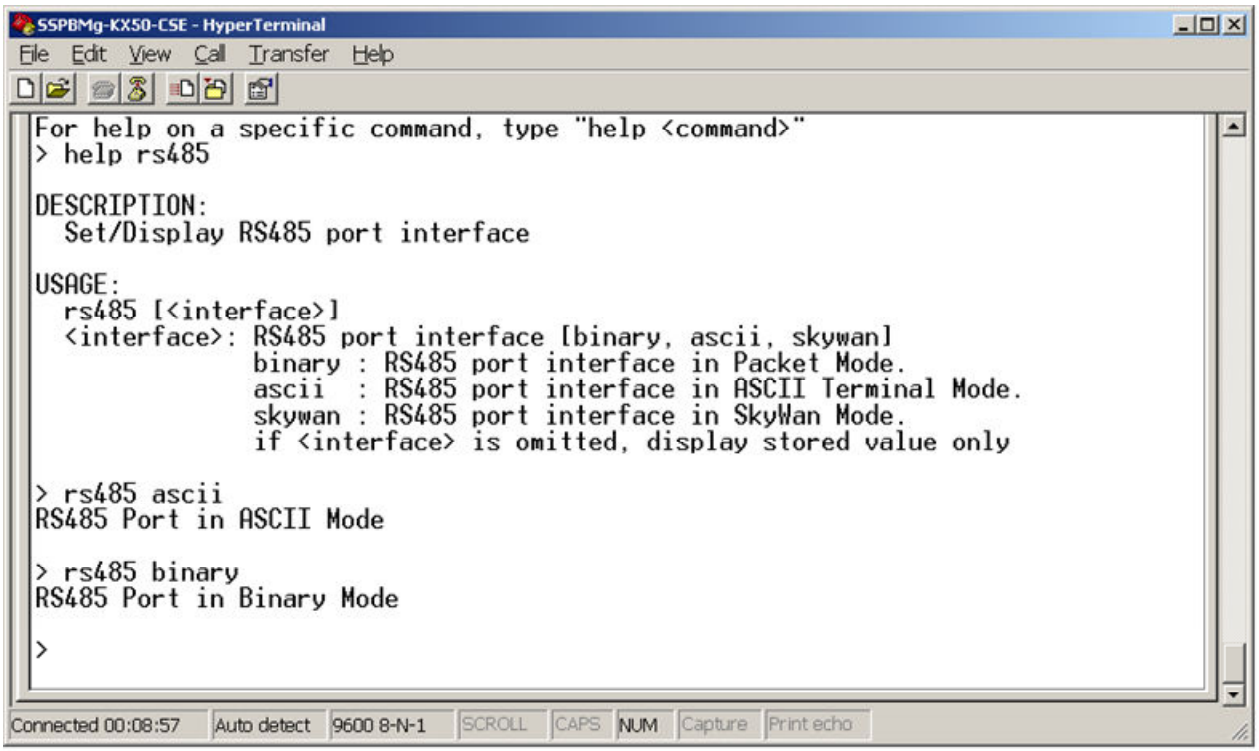

Figure 12: HyperTerminal RS-232 Communication – "help rs485", "rs485", "rs485 ascii", and "rs485 binary" commands and responses

NOTE: The rs485 parameter may be set to **ascii**, to **binary**, or to **skywan**.

- When this parameter is set to **ascii**, the RS-485 serial interface will work as a VT serial interface (the same windows as for RS-232 serial interface will be available on RS-485 interface).
- When the rs485 is set to **binary**, the RS-485 serial interface will work in a packet mode using the communication protocol described in **APPENDIX A: RS-485 SERIAL COMMUNICATION PROTOCOL** at page 39. In this case, the proposed GUI (see **Figure 13** at page 34) may be used to monitor and control the SSPB.
- When the rs485 is set to **skywan**, the RS-485 serial interface will work also in a packet mode, but using the SKYWAN communication protocol described in **APPENDIX B: RS-485 SKYWAN SERIAL COMMUNICATION PROTOCOL** at page 43.

8. RS-485 SERIAL COMMUNICATION

The RS-485 serial communication is based on the protocol in **11 APPENDIX A: RS-485 SERIAL COMMUNICATION PROTOCOL** at page 39.

Note that in order to connect the RS-485 of the unit to the RS-232 interface of a PC an adequate RS-485/RS-232 adapter should be used.

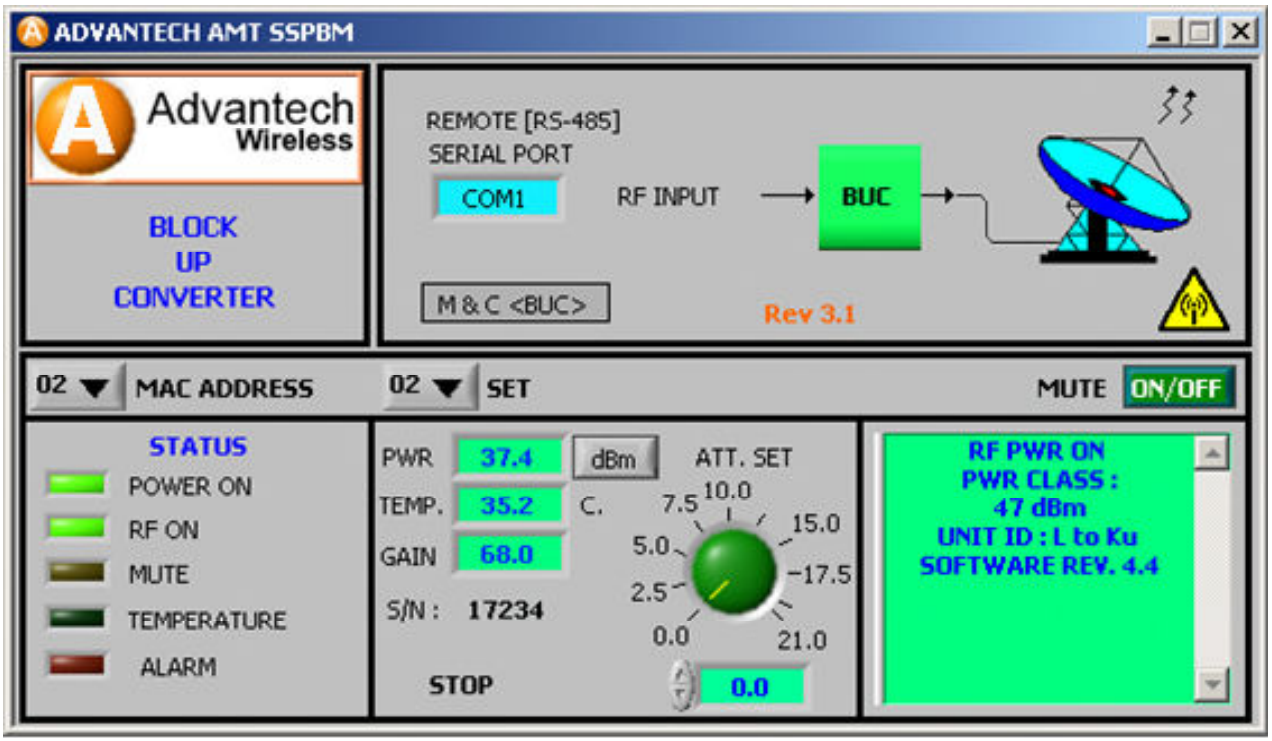

Figure 13: Graphical User Interface (GUI) – RS-485 Communication based on RS-485 Protocol

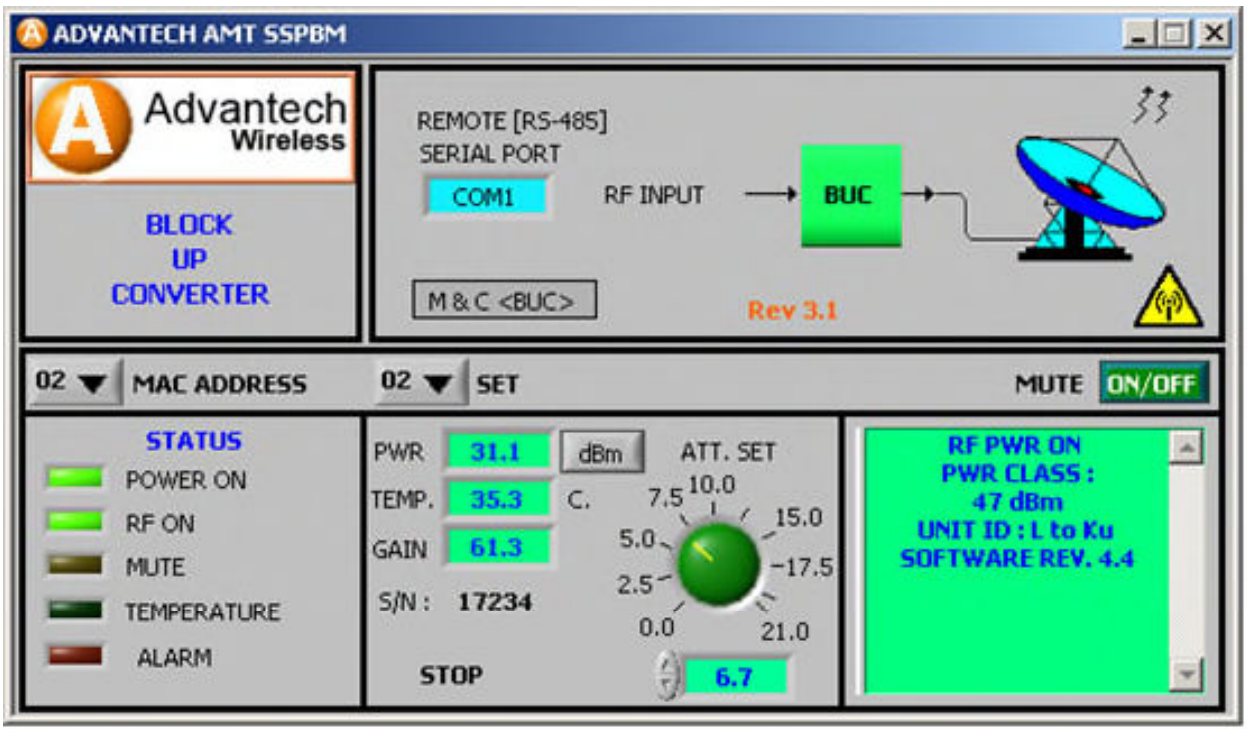

Figure 14: Graphical User Interface (GUI) – RS-485 Communication based on RS-485 Protocol – Attenuation Set

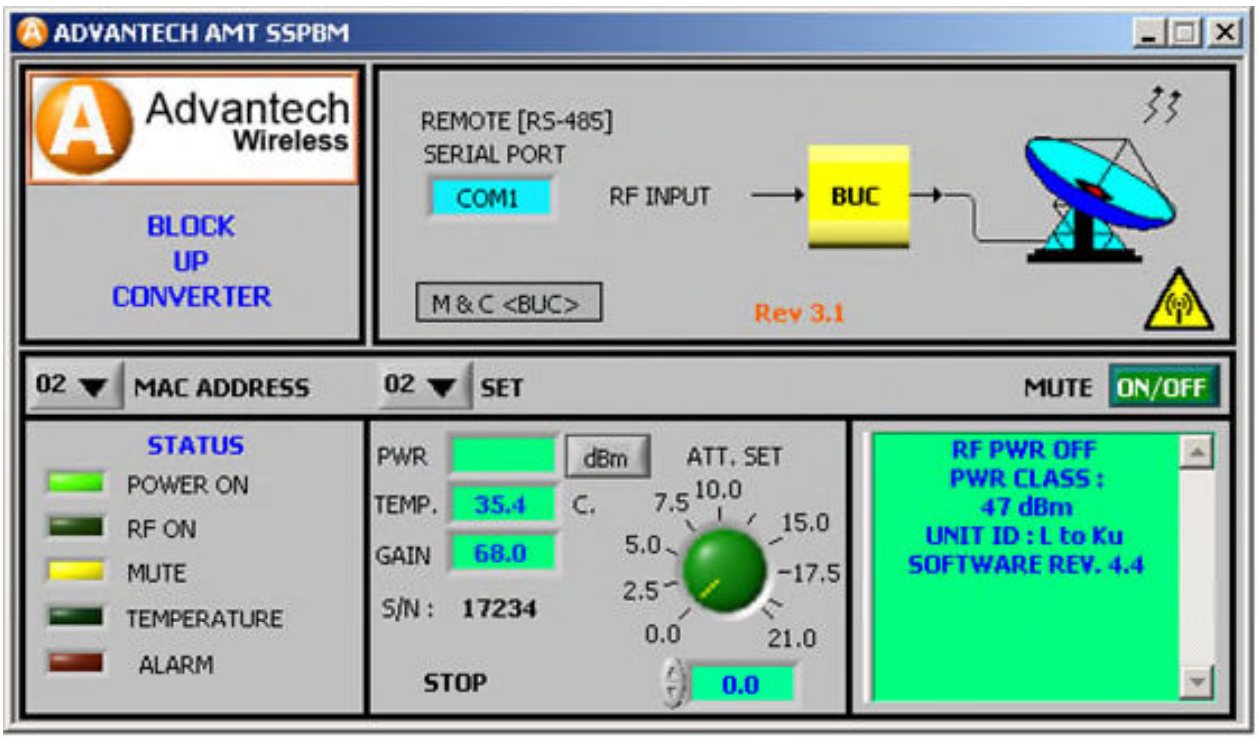

Figure 15: Graphical User Interface (GUI) – RS-485 Communication based on RS-485 Protocol – Mute Set

9. PACKING LIST

TABLE 10: PACKING LIST (SHIPPING KIT P/N 19G-3323A0-3N1)			
Item	**Quantity**	**Description**	**Part #**
1.	1	Installation and Operating Manual	PM GR0-3521A0-3N1 Rev. 4
2.	1	Extended Ku-Band 50 Watt SSPB, model SSPBMg-KX50-CSE	GR0-3521A0-3N1
3.	1	Pressure Window Assembly	230-160762-001
4.	1	Connector Circular 5015 Straight Plug 10 Shell 3 Sockets MS3106F10SL-3S	631-310610-001
5.	1	Connector Circular 26482 Straight Plug 12 Shell 10 Sockets MS3116F12-10S	631-311612-005
6.	1 roll	Tape Electrical Moisture Sealing 3/4x15FT 3M 2242	709-224200-001
7.	4	6-32 Hex Nut 18-8 Stainless Steel (SS)	801-632010-001
8.	4	6-32x1/2" Machine Screw Hex Head 18-8 SS	802-632090-001
9.	4	6-32x3/4" Machine Screw Hex Head 18-8 SS	802-632090-002
10.	4	#6 Split Washer 18-8 SS	803-600100-001
11.	1	Gasket D-Ring WR75 Silicone Conductive	820-075000-001

10. SAFETY AND EMC COMPLIANCE

Advantech Wireless products are compliant with the 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.

11. APPENDIX A: RS-485 SERIAL COMMUNICATION PROTOCOL

11.1 INTRODUCTION

This Section describes the RS485 serial interface for interconnection between External Network Management System (NMS) and Advantech Wireless units.

This protocol supports 2 and 4 wires RS485 interface 9600.N.8.1.

11.2 FRAME STRUCTURE

Each frame starts with the start byte **0x55**. After this start byte, each frame consists of 7 bytes.

First byte:

Master (NMS) to Slave (Advantech Wireless unit): Address of correspondent Advantech Wireless unit (0x01 to 0x0F).

Slave to Master: When Advantech Wireless unit sends the response frame to NMS, it left shifts its unit address by 4. For example, the unit with address 0x05 will send 0x50 in the address byte.

Second byte:

Master to Slave: Command byte. The command codes are described in **TABLE 11**.

Slave to Master: First data or status byte

Third, forth, fifth and sixth bytes:

Master to Slave: Value of parameter or expansion of command (third byte, if applicable)

Slave to Master: Remaining data or status bytes

Seventh byte:

Check sum, calculated as algebraic sum of bytes 1 to 6.

All not used bytes are always set to 0xAA.

The format for gain, attenuation, power level and temperature is a 2-bytes hexadecimal value in 0.1 dB, 0.1 dBm, 0.1 °C (signed integer).

11.3 COMMANDS

These commands go only from master-slave direction.

TABLE 11: COMMANDS

No	Description	2nd byte	3, 4, 5 &6 bytes	Respond. 2,3,4,5,6 bytes.
1	Request condition status	0x01 or 0x2A	0xAA AA AA AA	See **TABLE 12**
2	Mute/Unmute command	0x02	0x5A AA AA AA To mute 0xA5 AA AA AA To unmute	See **TABLE 12**
3	Change Unit Address	0x03	Byte 3 = Unit Address Valid address = 0x01 to 0x0F Byte 4,5,6 : 0xA5	See **TABLE 12**
4	Set gain/attenuation.	0x05	Byte 3=0x5A To set Gain Byte 3=0x55 To set Attenuation Byte 4,5: Gain/Attenuation value to set Byte 6: 0xAA	See **TABLE 12**
5	Read Identification	0x07	0xAA AA AA AA	See **TABLE 13**
6	Read serial number	0x08	0xAA AA AA AA	5 ASCII characters
7	Read gain/attenuation	0x0A	0x5A AA AA AA To read gain 0x55 AA AA AA To read attenuation	Byte 2, 3: Gain value
8	Read elapse time (future cmd)	0x0C	0xAA AA AA AA	Byte 2, 3: days Byte 4: hours. Byte 5,6: 0xAA
9	Read gain/attenuation range	0x0D	0x5A AA AA AA To read gain range 0x55 AA AA AA To read attenuation range	See **TABLE 14**
10	Read Hot Spot temperature	0x12	0xAA AA AA AA	Byte 2, 3: Temperature Byte 4,5,6: 0xAA
11	Read forward power level	0x25	0xAA AA AA AA	Byte 2,3: Forward power Byte 4,5,6: 0xAA

11.4 RESPONSES TO COMMANDS FROM SLAVE TO MASTER

11.4.1 CONDITION STATUS RESPONSE

TABLE 12: CONDITION STATUS RESPONSE					
Bit No	**2nd byte**	**3rd byte**	**4th byte**	**5th byte**	**6th byte**
0	Output level MS byte	Output level LS byte	0x00	Status 1-on, 0-off	0
1				1- Sum Alarm	0
2				0	0
3				Power class 5 bits From 30dBm – step 1 dBm (0 = 30dBm)	0
4					0
5					0
6					0
7					0

11.4.2 READ IDENTIFICATION RESPONSE

TABLE 13: READ IDENTIFICATION RESPONSE					
Bit No	**2nd byte**	**3rd byte**	**4th byte**	**5th byte**	**6th byte**
0	1 – Up	1- Rx spectrum inv 0- not Rx spectrum inv	0x00 – N/A 0x01 – 70 to L 0x02 – 70 to C 0x03 – 70 to Ku 0x04 – 140 to L 0x05 – 140 to C 0x06 – 140 to Ku 0x07 –L to C 0x08 –L to Ku 0x09 – L Interface 0x0A – L to DBS 0x0B – L to X	0x00	Software version number 0xXX
1	1 – Down	0			
2	1 – PA	0			
3	0	0			
4	0	0			
5	0	0			
6	0	0			
7	0	0			

11.4.3 READ GAIN/ATTENUATION RANGE RESPONSE

TABLE 14: READ GAIN/ATTENUATION RANGE RESPONSE					
Bit No	**2nd byte**	**3rd byte**	**4th byte**	**5th byte**	**6th byte**
0	MS byte minimum value	LS byte minimum value	0x5A	MS byte maximum value	LS byte maximum value
1					
2					
3					
4					
5					
6					
7					

12. APPENDIX B: RS-485 SKYWAN SERIAL COMMUNICATION PROTOCOL

For remote operation, the SSPB is equipped with a monitor and control function. The M&C function contains all of the relevant data concerning the control and status signals of the SSPB. This is achieved by using a four-wire RS485 signal.

12.1 HARDWARE CONSIDERATIONS

In order to use the RS485 serial communication between a DB-9 serial connector of a PC and the 10-pin MS connector (M&C) of the SSPB, an adaptor RS-485/RS-232 should be used. Follow the wiring described in **TABLE 8**.

12.2 RS-485 INTERFACE ON 4 WIRES

This is a 4-wire full-duplex interface.

In order to maintain synchronization, the RS485 receiver will reset if a message is not completed within 50 msec of initiation.

12.3 TRANSMISSION PROTOCOL

Baud Rate	9600 bps
Data Bits	8
Parity	none
Stop Bits	1
Minim Response Time	10 msec
Maximum Response Time	20 msec

If the SSPB does not respond within the maximum response time, the controller should cyclically repeat the command.

The SSPB is equipped with a calibrated power sensor for measuring the power delivered to the antenna from the rated output value to the 20-dB back off. This value, in dBm, is available through the M&C RS485 Interface for the monitoring of the power level and the ALC. The reported power accuracy is ± 1.0 dB absolute and ± 0.5 dB relative.

12.3.1 TRANSMISSION INTERFACE

A request packet (see **TABLE 15**) is sent by the IDU and the respective response packet (see **TABLE 16**) by the SSPB. The IDU is the bus master. The SSPB is only allowed to respond if the first byte of the request packet matches its address and the checksum is consistent.

Upon reception of a request packet the SSPB will perform the following consistency checks:

1) Verify that the checksum is consistent.
2) Verify that the packet address corresponds with the SSPB address.
3) Verify that the received command corresponds to a defined command.
4) Verify that, if data is required for the command, its value is valid.

If the received packet passes test (1) and test (2) but fails in test (3) or in test (4), a response packet will be returned. Bit #2 of byte #5 will be set to 1 to indicate that an inconsistency was detected in the request packet.

12.3.2 COMMAND MESSAGE STRUCTURE (IDU TO SSPB)

TABLE 15: COMMAND MESSAGE STRUCTURE			
Byte	**Name**	**Description**	**Value**
1	Address	Address of SSPB	0x01 to 0x0F
2	Command	Request Status Transmit ON/OFF Change Address Set Input Frequency Not applicable for these units	0x01 0x02 0x03 0x04 Not applicable for these units
3	Data Byte 1	Not used if command = 0x01 Tx control if command = 0x02 New address if command = 0x03 Input Frequency if command = 0x04 Not applicable for these units	0xAA 0 = OFF, 1 = ON 0x01 to 0x0F MS byte (most significant byte) Not applicable for these units
4	Data Byte 2	Not used if command = 0x01 Not used if command = 0x02 Not used if command = 0x03 Input Frequency if command = 0x04 Not applicable for these units	0xAA 0xAA 0xAA LS byte (least significant byte) Not applicable for these units
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 – 6, modulo 256	

12.3.3 RESPONSE MESSAGE STRUCTURE (SSPB TO IDU)

TABLE 16: RESPONSE MESSAGE STRUCTURE			
Byte	**Name**	**Description**	**Value**
1	Address	Address of SSPB shifted left by 4	0x10 to 0xF0
2	Level Byte 1	MS byte of Tx output power	-
3	Level Byte 2	LS byte of Tx output power	-
4	Temperature	Hot Spot Temperature in °C	-
5	Status Byte 1	Bit 0: Temperature out of range Bit 1: PLL out of lock Bit 2: Checksum error Bit 3: Tx Status Bit 4 – 7: Power Class	1: OOR, 0: normal 1: OOL, 0: normal 1: error in command message, 0: normal 1: Tx ON, 0: Tx OFF 0x1 to 0xF
6	Status Byte 2	Bits 0 – 3: Not used Bits 4 – 7: Software Version	0xAA 0x0 to 0xF
7	Checksum	Algebraic sum of bytes 1 - 6	

12.3.4 DATA FIELD DEFINITIONS

1) Tx Power Level: Unsigned integer in 1/100 dBm
2) Input Frequency: Unsigned integer in MHz (Not applicable for these units)
3) Temperature: Signed character in °C
4) Power Class: See table below. (Power levels for the Ku-Band are included).

Value	0x1	0x2	0x3	0x4	0x5	0x6	0x7	0x8	0x9	0xA	0xB	0xC
Power	2W	4W	5W	8W	10W	16W	20W	25W	40W	60W	30W	125W