

Operator Manual

ATOM Ku BUC/SSPA 20/25/40/50W



Operator's Manual

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1. Introduction

1.1 OVERVIEW

This User's Guide covers the following product lines:

ATOMSKU020, ATOMSKU025, ATOMSKU040, ATOMSKU050

ATOMBKU020, ATOMBKU025, ATOMBKU040, ATOMBKU050

1.1.1 BUC - Block Up Converter and Amplifier

If this unit is a BUC, this unit converts IF to RF in the KU range for the frequencies specified in the original configuration of this unit and amplifies the power to the specified power.

1.1.2 SSPA – Solid State Power Amplifier

If this unit is an SSPA only, this unit amplifies the input signal to the specified power.

1.2 FEATURES

1.2.1 Inputs and Outputs

Table 1-1: Input and Outputs

	20W / 25W / 40W / 50W
Input Type	Female N-Type Connector
Output Type	Waveguide WR75 (default) Waveguide WR62 <i>(Adaptors are available to convert output type to SMA, TNC, or N-Type connectors. Please contact Norsat for more information.)</i>

1.2.2 Electrical Interface


M&C Connector – ten pin connector used to interface to a host computer. See **Chapter 2** for detailed description of pin outs.


Power Connector – four pin connector used to provide power to unit. See **Chapter 2** for detailed description of pin outs.


1.2.3 Fuse


On units equipped with the EMC/EMI filter option there is a fuse on the SAT-3300 (PCBA 039301) board. Reference designator is F1, Bel Fuse Inc. SMM 25 rated for 25A.


1.3 Cautions and Warnings


WARNING	
	Power to the unit must be shut off before the DC cable is disconnected and the DC cable and M&C cable must be disconnected before servicing.

WARNING	
	Do not allow equipment to be standing in water. While the BUC/SSPA is designed to be used outdoors, the equipment is not designed to operate in standing water. Failure to follow this precaution could result in electric shock and injury to persons.

CAUTION	
	Do not allow any items to fall into the unit from the waveguide opening.

CAUTION	
	Apply voltage to the AC/DC input connector only as specified in the original configuration of this unit. The application of a voltage outside the specified range may cause the unit to become damaged or non-functional.

CAUTION	
	Do not stand in front of waveguide during operation. Especially, do not look into the waveguide.

CAUTION	
	Electrostatic Discharge (ESD) can damage electronic circuits. The M&C and RF input connector center pins may be sensitive to ESD. Follow proper ESD precautions when handling these products.

2. Installation and Interface

2.1 Overview

The unit has three connectors on the input side of the housing and one waveguide port on the output side. The interface for these connectors is detailed in this document.

On the input side, there are the following connectors:

- J1 – Female N-type L-band IF Input
- J2 – Ten pin circular connector
- J3 – Four pin circular power connector

On the output side, there is one connector:

- J4 – WR75 or WR62 waveguide RF output (specify at time of order)

2.2 Mechanical Installation

The units are designed to be mounted via 6-32 size screws which must be supplied by the end user. There are a number of 6-32 UNC threaded holes on each face of the main housing to facilitate mounting in many different applications and in any orientation; please refer to Appendix A for exact mounting hole locations. The preferred mounting scheme is to fix the ATOM to the larger assembly using at least four mounting points on each of two opposite sides of the unit. Other arrangements are possible depending on the requirements of the application; please contact Norsat technical support for details. Please leave at least 1 inch of clearance around the fan air intakes.

The unit is entirely watertight and suitable for outdoor operation. All joints are O-ring sealed. The waveguide port J4 is not internally sealed, so the antenna feed must be sealed with a radome or window, and all waveguide joints should be O-ring sealed if water-tightness is required.

2.3 J1 – Input

2.3.1 BUC

The IF input is a 50 ohm type-N connector. The input is to be applied here (950-1700 MHz for Extended Band; 950-1450 MHz for Regular Band). Also, the 10 MHz signal input is diplexed onto this line. Therefore, the IF signal and 10 MHz reference are both traveling on this line. The connector is DC-blocked. Do not exceed +/- 50VDC on this port.

The 10-MHz signal should be accurate within +/-20ppm, otherwise the BUC may have difficulty phase locking to it. The 10-MHz should be free of sideband spurs, particularly close-in (under 100 kHz), as these may also cause failure to lock. Power level of the 10 MHz reference signal should be +/-10 dBm.

2.3.2 SSPA

In the SSPA-only configuration, this is the RF input. It is a precision type-N connector, with performance to 18GHz. No 10 MHz reference is required for SSPA-only operation.

2.4 J2 – Monitor and Control Interface

The serial interface is used to interface the unit to a host computer. All on-board sensors are read through this interface, including forward power monitoring. In default mute configuration (refer to section **Pin D: Shutdown (i.e. Mute Control)**), use of this connection is optional.

2.4.1 Pin Outs

The monitor and control interface is a ten pin connector

CAUTION: EXTREME CARE MUST BE USED WITH THIS CONNECTOR TO AVOID ELECTRO STATIC DISCHARGE (ESD). Many units have been damaged by improper ESD precautions. Always use industry-standard practices including wrist straps when coming within six inches of these connectors or any accessories or cables to be attached to this.

The connector is a cannon type connector with a 12-10 configuration with pins (Amphenol part number 71-533723-10P). This connector is a MIL-C-26482 Series 1 receptacle, Shell size 12, 10 pins. The connector is a “receptacle” and it has pins (as opposed to sockets), and requires the mating connector to be a “plug” with ten sockets. An example mating connector would be Amphenol #PT06A-12-10S. A range of other plug-compatible Amphenol part numbers for the mating connector may be used to add options to the plug such as right-angle, stress relief clamp, metal color/finish, etc. Please contact the connector manufacturer for more information and/or see Amphenol catalog 12-070.

The pin outs are given in Table 2-1 and shown in Figure 2-1.

Table 2-1: J2 Pin Outs

Connector Pin	Function	Description
A	TX- (RS-485)	Host computer TX- signal (signal into unit)
B	TX+ (RS-485)	Host computer TX+ signal (signal into unit)
C	RX+ (RS-485)	Host computer RX+ signal (signal out of unit)
D	SHUTDOWN	Controls Muting of Amplifier
E	RX (RS-232)	Host computer RX signals (signal out of unit)
F	TX (RS-232)	Host computer TX signals (signal into unit)
G	GND	Case Ground – Do not exceed 100mA
H	Reserved	Leave unconnected / open circuited
J	RX- (RS-485)	Host computer RX- signal (signal out of unit)
K	Reserved	Leave unconnected / open circuited

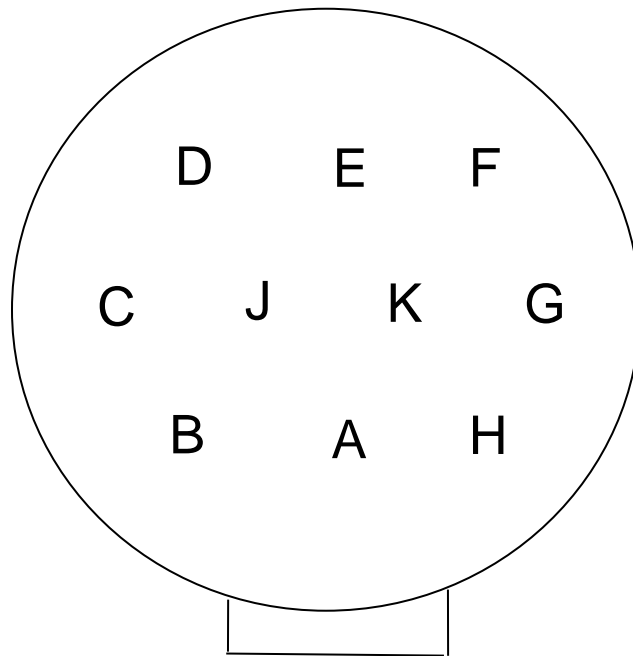


Figure 2-1: J2 Connector Pin Out, Viewed Looking at SSPA/BUC from the Outside

2.4.2 Pin D: Shutdown (i.e. Mute Control)

This pin implements the shutdown, or mute function, and the user should apply Ground to this pin to mute the amplifier. When muted, the unit power transistors are turned off, reducing power consumption and giving an RF output noise close to the thermal noise floor.

Pin D has an internal 50K-ohm resistor that can be configured as a pull-up to 4V, or as a pull down to ground. Because of the configurable pull-up / pull-down resistor, the unit can be configured to be active (i.e. not muted) when Pin D is left open circuited, therefore, no connection is necessary on pin D for the amplifier to operate normally.

Pin D is also configurable to be either active high or active low. When configured as active high, any voltage between 3.0 V and 5.0 V (relative to case ground) will mute the output. When configured as active low, any voltage between 0.0 V and 0.8 V (relative to case ground) will mute the output.

The case ground may be connected at any location on the outer metal shell of the unit.

2.4.3 Pin G: GND

Ground is connected to the amplifier housing. This pin is electrically connected to the outer aluminum shell and thus to the mounting screws used to hold down the unit. This is for small signal only; any high-current connections should use the external screws on the outside of the aluminum case.

2.4.4 Pin A, B, C, J: RS-485

These four pins form a standard RS-485 port, with RX+, RX-, TX+, TX-. Use Pin G as the ground reference for this port.

TX+ and TX- are the differential pair which carries a signal from the host computer to the unit. RX+ and RX- are the differential pair which carries a signal from the unit to the host computer. Ensure these are connected to the host computer RS-485 port accordingly.

- A TX- (RS-485) Host computer TX- signal (signal into unit)
- B TX+ (RS-485) Host computer TX+ signal (signal into unit)
- C RX+ (RS-485) Host computer RX+ signal (signal out of unit)
- J RX- (RS-485) Host computer RX- signal (signal out of unit)

2.4.5 Pin E, F: RS-232

Pins E and F form a standard RS-232 port, with RX and TX. Use Pin G as the ground reference for this port. Ensure these are connected to the host computer RS-232 port accordingly.

- E RX (RS-232) Host computer RX signals (signal out of unit)
- F TX (RS-232) Host computer TX signals (signal into unit)

2.5 Serial Port Software Interface

Communications to and from the serial interface is character based. Use any standard “Terminal” program with setup parameters as shown in Figure 2-2.

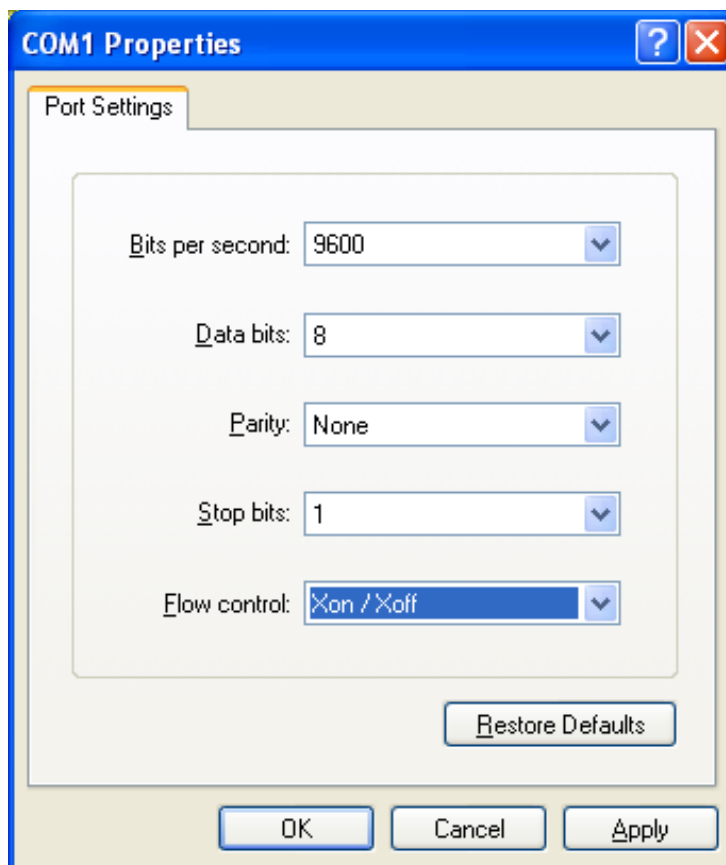


Figure 2-1: Setup Serial Port

2.5.1 Controller Responses

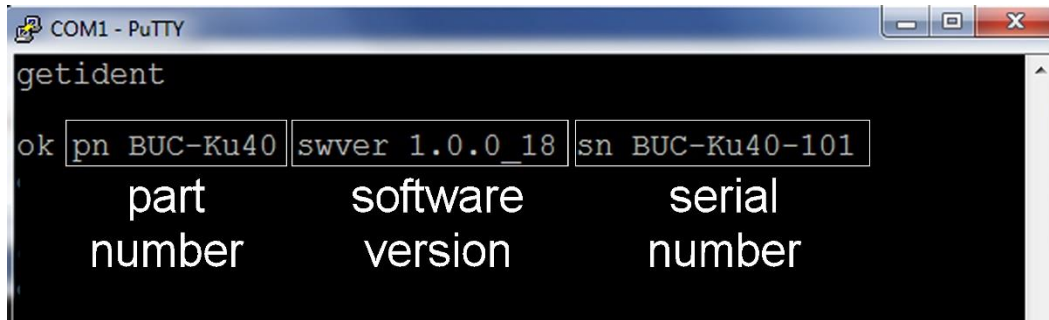
The unit will only generate messages in response to a command. Each command received will result in a single message reply, which may simply be an Acknowledge message.

In general, command responses are returned immediately, though the precise command-response delay varies slightly based on the specific command.

2.5.2 Message Definitions

getident

This command returns the part number, software revision and serial number of the unit.



```
COM1 - PuTTY
getident
ok pn BUC-Ku40 swver 1.0.0_18 sn BUC-Ku40-101
part      software      serial
number    version        number
```

Figure 2-2: Command getident

getstatus

This command instructs the unit to respond with fault flag, forward power and temperature. Note: reverse power, “revpwr”, in the response is a future enhancement and is not currently supported.

- A “0” after “fault” indicates no faults. A “1” indicates a fault. Use command “getfaults” to determine what fault exists.
- Power is in dBm.
- Temperature is in degrees C. The temperature scale is from –55 to 150 C, with approximately +/- 2 degrees C accuracy.



```
COM1 - PuTTY
getstatus
ok fault 0 fwdpwr -29.1 revpwr +4974.6 temp 51
fault      forward      reverse      internal
flag       power        power        temp
```

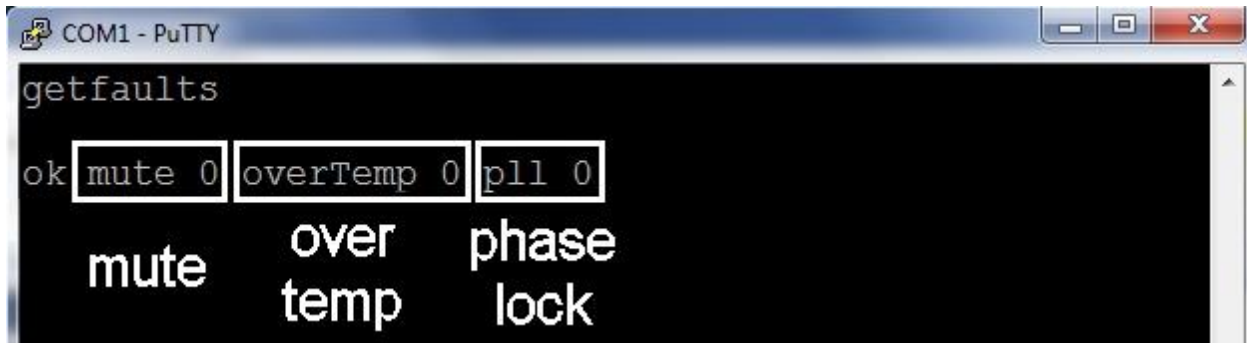
Figure 2-3: Command getstatus

getfaults

This command gets the status of the mute, over temperature and pll loss of lock.

For mute, “0” indicates the unit is in an unmuted state. A “1” indicates a muted state. Note that a “1” does not necessarily indicate an error as the unit could have been commanded into a mute state (see “setmute” command).

For over temp and pll, a value of “0” means no error and a value of “1” indicates an error.



```
COM1 - PuTTY
getfaults
ok mute 0 overTemp 0 pll 0
mute over phase
temp lock
```

Figure 2-4: Command getfaults

resetfaults

This command clears faults under certain conditions. Note that the “mute” fault code indicates muted state, not necessarily an error. Since the unit can be commanded into mute state, without a fault, the “resetfaults” command will not clear a mute fault in this situation.

The temperature sensor has a trip point (above which a fault is triggered) and a reset point (below which a fault is automatically cleared.) The reset point is set below the trip point to provide hysteresis. See [Table 2-2](#) for Trip and Reset Points.

The resetfaults command will clear an overtemp fault which has been tripped if the unit is currently below the trip point. If the fault mode sensor value is above the trip point, the fault cannot be cleared. Some faults may not have a reset point, and must be reset through the “resetfaults” command.

Table 2-2: Fault Trip and Reset Points

Fault Condition	Trip Point	Reset Point
Mute	N/A	N/A
Over Temperature	85C	75C
PLL Loss of Lock	N/A	N/A

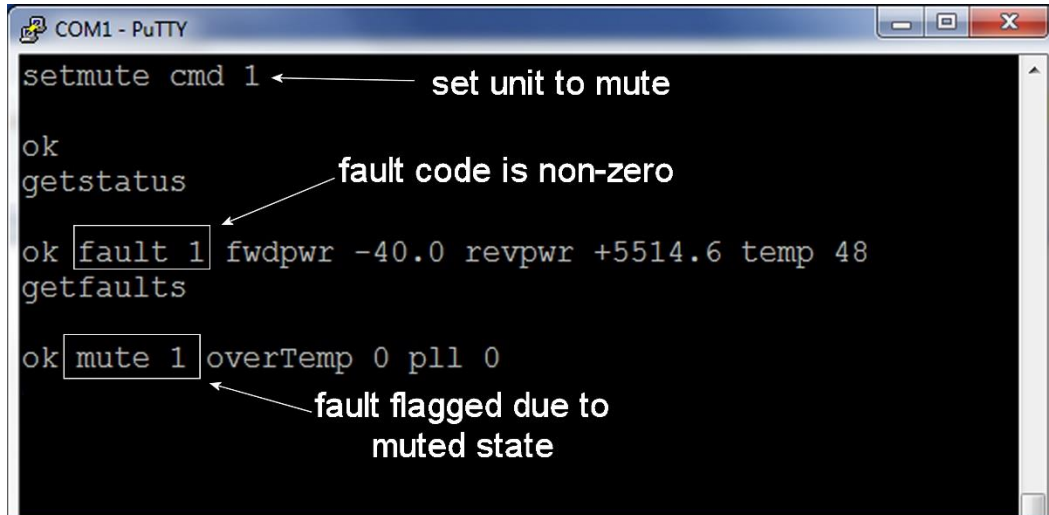


```
COM1 - PuTTY
resetfaults
ok
```

Figure 2-5: Command resetfaults

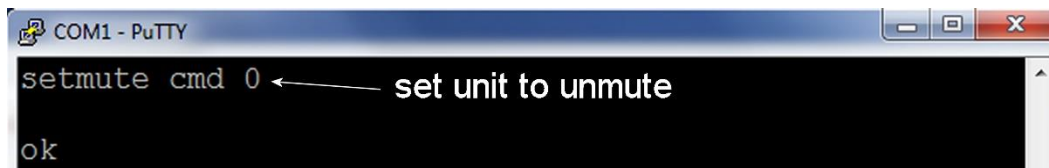
setmute

This command sets the software mute state of the unit. If the command code is 1, the amplifier will be muted. If the command code is 0, the amplifier mute will be controlled as shown in Section [Mute Logic](#). The mute state can be monitored by examining the MUTE code in the “getfaults” message.



```
COM1 - PuTTY
setmute cmd 1 ← set unit to mute
ok
getstatus
ok fault 1 fwdpwr -40.0 revpwr +5514.6 temp 48
getfaults
ok mute 1 overTemp 0 pll 0
      ← fault flagged due to muted state
```

Figure 2-6: Command setmute - mute unit



```
COM1 - PuTTY
setmute cmd 0 ← set unit to unmute
ok
```

Figure 2-7: Command setmute - unmute unit

2.5.3 Command Response

The CLI operates on a command response format. Each time a command is entered, a response will be displayed. If a command executed correctly, an “ok” along with potential parameters and values will be displayed. Otherwise, “err” will be displayed along with a description of the error.

The potential errors that may be displayed are:

- Invalid Command – The command was not recognized
- Invalid Parameter – The parameter was not recognized
- Invalid Value – The value was invalid for the command/parameter
- Missing Parameter – A required parameter was not provided

Each command response will have the following format:

<CR><LF><msg><CR><LF>

where msg is as described above and in the commands summary and example tables below. Note that a response is enveloped by leading and trailing <CR><LF> characters.

Table 2-3: Commands Summary

Command	Param-Value Pairs	Response Format (enveloping <CR><LF> characters not shown)
getident	None	ok pn <part#> swver <swver#> sn <serial#> where: <part#> = unit part number label <swver#> = software version label <serial#> = unit serial number label
getstatus	None	ok fault <fault#> fwdpwr <fwdpwr#> revpwr <revpwr#> temp <temp> where: <fault#> = fault flag, either 0 (no fault) or 1 (fault) . Use the getfaults command to determine the specific fault(s) <fwdpwr#> = forward power value, in dBm <revpwr#> = currently not used but reserved for reverse power <temp> = internal system temperature in degrees Celsius
getfaults	None	ok mute <mute_flag> overTemp <temp_flag> pll <pll_flag> where: <mute_flag> = 0 (unit unmuted) or 1 (unit muted) <temp_flag> = 0 (temp ok) or 1 (error - over temp condition exists) <pll_flag> = 0 (pll ok) or 1 (error – pll loss of lock)
resetfaults	None	ok
setmute	cmd (0 1) 0 = unmute 1 = mute	ok

2.5.4 Mute Logic

The unit will be muted when any of the following conditions exist:

1. A software mute command is issued through the serial interface.
2. A mute command/signal is issued through the discrete SHUTDOWN line (**Pin D: Shutdown (i.e. Mute Control)**).
3. A fault condition exists.

2.6 J3 – DC Power

Units typically require 20V to 56V DC power. Refer to the specific configuration of the unit for the exact voltage range. Power is supplied through a four pin type cannon connector. Two pins are used to deliver the positive connection and two pins are used for the negative connection in order to reduce resistance. The negative connection is internally connected to case ground. The negative power connection may alternatively be applied directly to the outer aluminum case.

The external power supply must be capable of supplying 165W, 305W or 350W for the 25W, 40W or 50W ATOMs respectively. For CE compliant operation the external power supply must have overcurrent protection with a current limit between 20A and 23A. The DC power cable must be capable of safely carrying at least 10A continuous for 25W ATOMs and 20A continuous for 40W, 50W and low voltage 25W ATOMs. Note that the power supply connection should not be made with the power live. The unit should not be powered on until all input and output connections have been made.

2.6.1 Connector Type

The J3 connector is a four pin cannon type cylindrical connector (AMPHENOL PT07A-12-4P). This connector is a MIL-DTL-26482 Series 1 receptacle, Shell size 12, 4 pins. (The pins are size #16) The connector is a “receptacle” and it has pins (as opposed to sockets), and requires the mating connector to be a “plug” with four sockets. An example mating connector would be Amphenol # PT06E-12-4S-SR. A range of other plug-compatible Amphenol part numbers for the mating connector may be used to add options to the plug such as right-angle, stress relief clamp, metal color/finish, etc. Please contact the connector manufacturer for more information and/or see Amphenol catalog 12-070.

2.6.2 J3 Connector Pin Outs

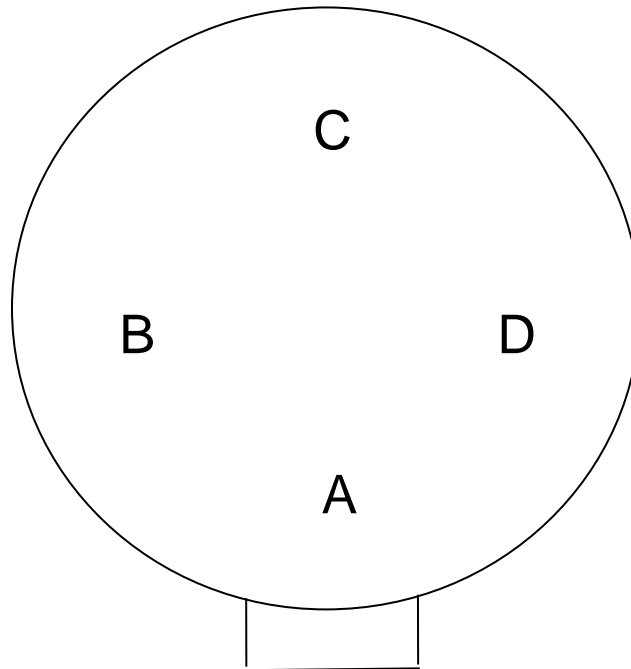


Figure 2-8: J3 Connector Pin Out, Viewed Looking at SSPA/BUC from the Outside

Table 2-4: J3 Connector Pin Out

Pin	Name
A	Ground or V-
B	V+
C	V+
D	Ground or V-

Positive voltage is applied to pins B and C (connected internally). Negative voltage is applied to pins A and D (connected internally).

Pins A and D are connected internally to case ground.

2.7 J4 – RF Output


The output is a standard WR75 or WR62 square waveguide. Specify which flange is to be installed at time of order. Both types of flanges have a groove for an O-ring seal, which is highly recommended to keep moisture out of the unit.

Also, for outdoor installations, after bolting the waveguide-to-waveguide connection, it is recommended to add RTV silicone compound as a sealant around the entire perimeter of the joint where the flanges meet. This will provide extra protection against water ingress at the flange-to-flange interface.

The unit is supplied with two screw lengths (four 6-32x3/8" and four 6-32x7/16"); it is the users responsibility to ensure that the appropriate length of screw is used. There should be at least 4 threads of engagement (0.125") with the holes in the waveguide flange.

2.8 Ground Connection



The ground connection point on the main housing is indicated by the symbol . The unit is supplied with a 10-32 screw and internal tooth lock washers for grounding purposes. It is highly recommended that the unit is grounded according to national and local electrical codes before use.

2.9 EMC Considerations

For optimal EMC performance the following are recommended:

- Use a high quality DC cable that's shielded, grounded at both ends and not longer than necessary for the application.
- Use a high quality M&C cable that's shielded, grounded at both ends and not longer than necessary for the application.
- Place two ferrite clamps such as Laird-Signal Integrity Products 28A3851-0A2 on the DC cable closest to the ATOM.
- Make sure the GND stud is connected according to national and local electrical codes.
- If a serial to USB converter is used its case should be locally grounded if possible.
- Use a high quality DC power source with the lowest possible voltage ripple and noise.

Appendix A Mechanical Drawings

Drawings – 20W and 25W

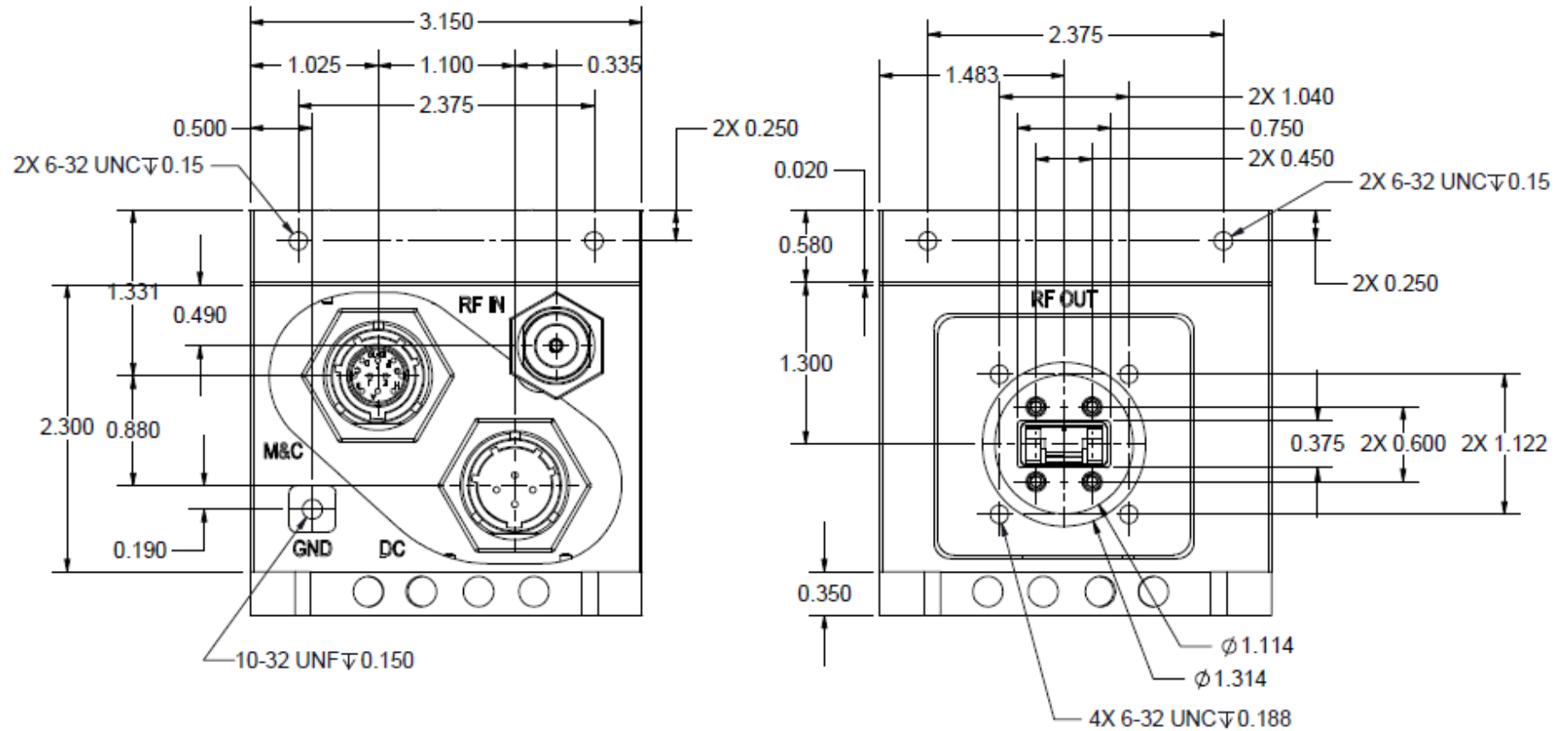


Figure A-1: 20W and 25W Interconnect Locations

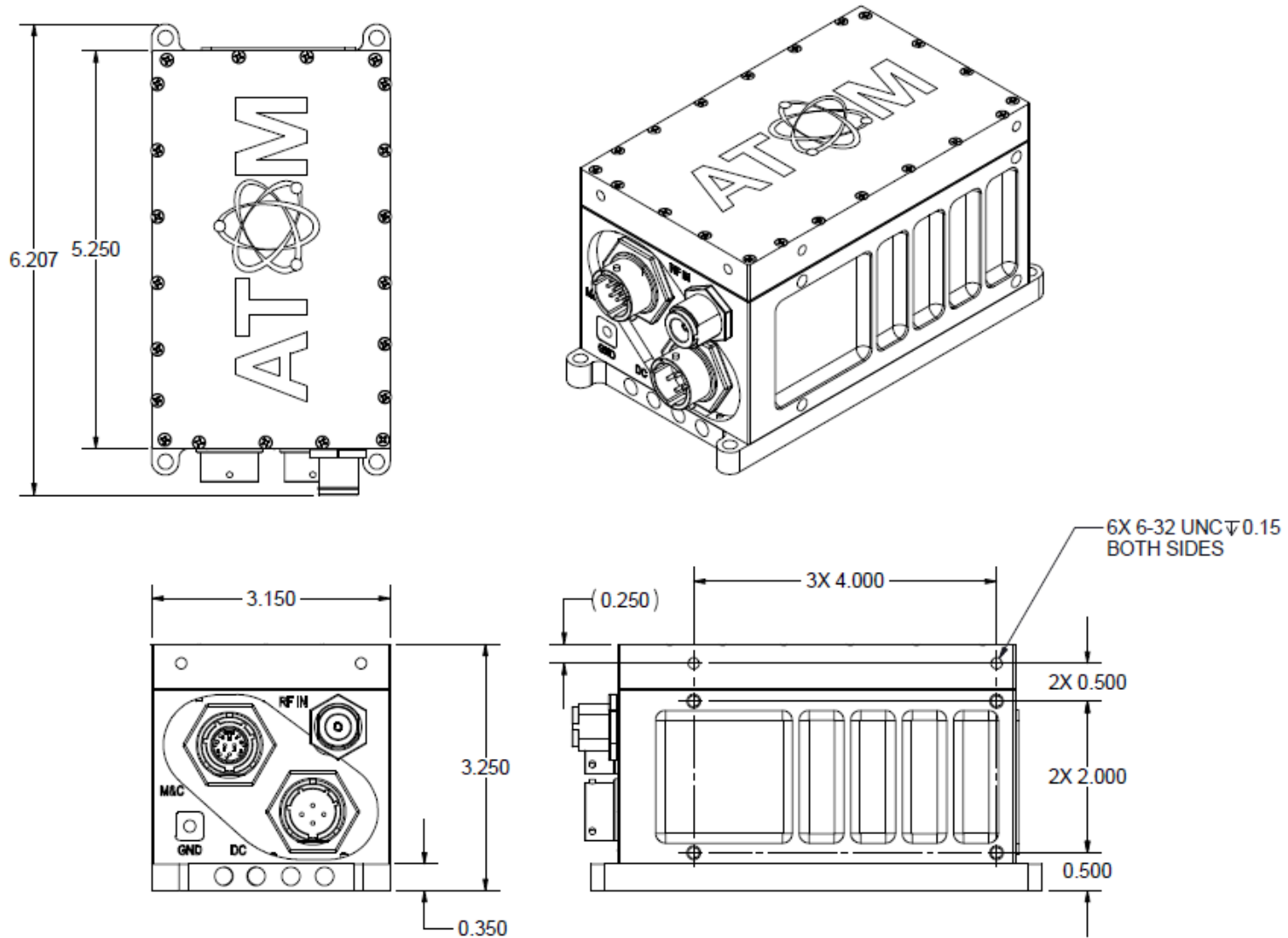


Figure A-2: 20W and 25W KU SSPA/BUC Assembly, without Fans

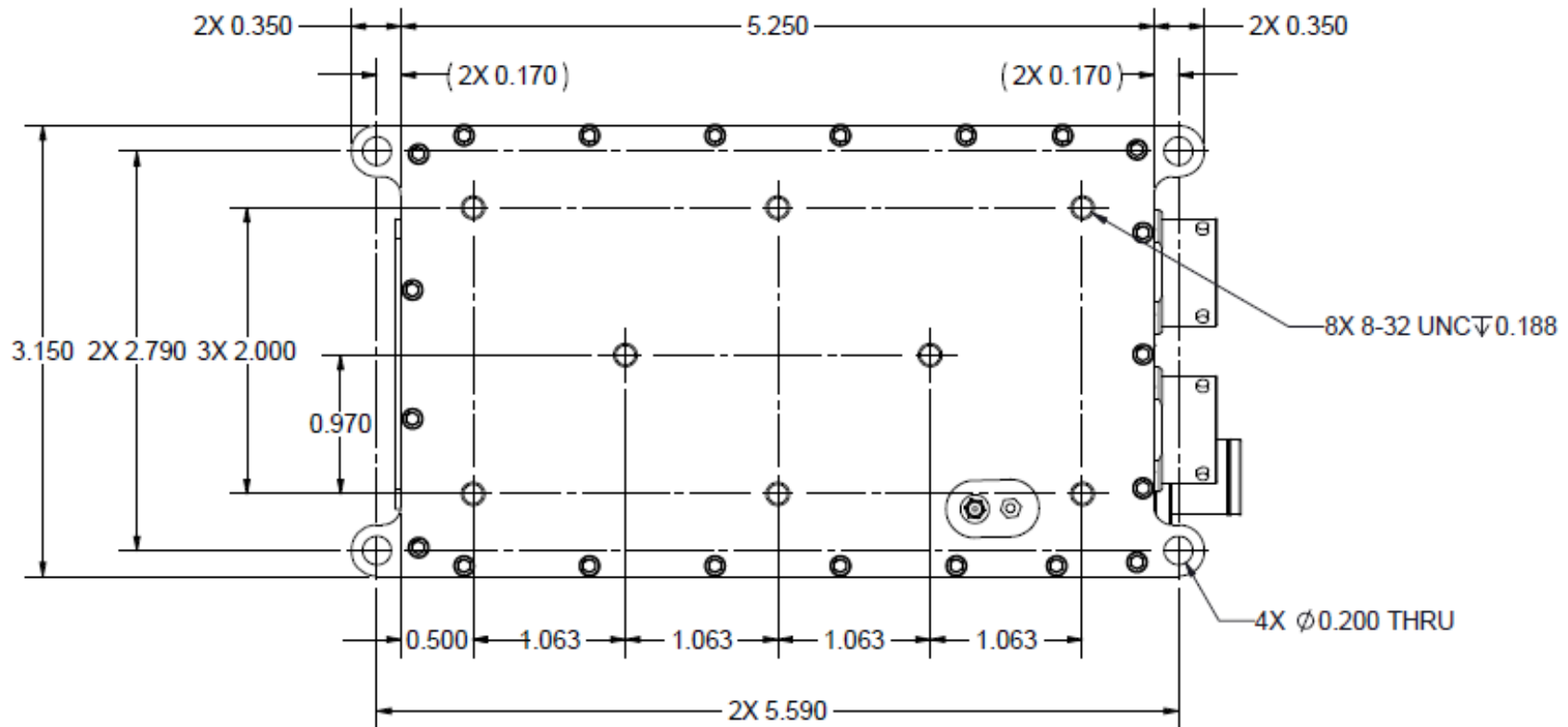


Figure A-3: 20W and 25W Base Plate Mounting Locations

Drawings – 40W and 50W

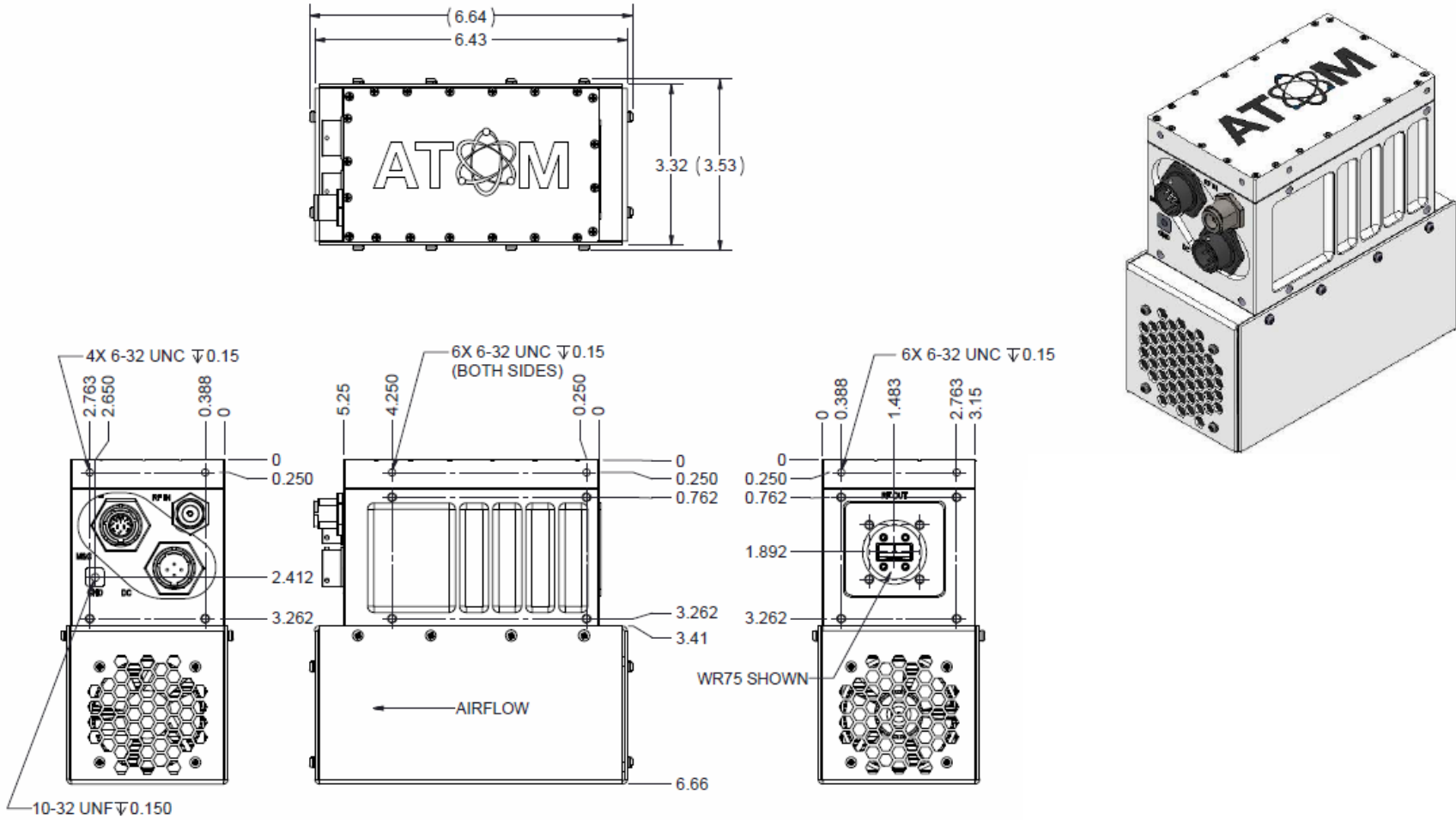


Figure A-4: 40W and 50W KU SSPA/BUC Assembly, with Fans

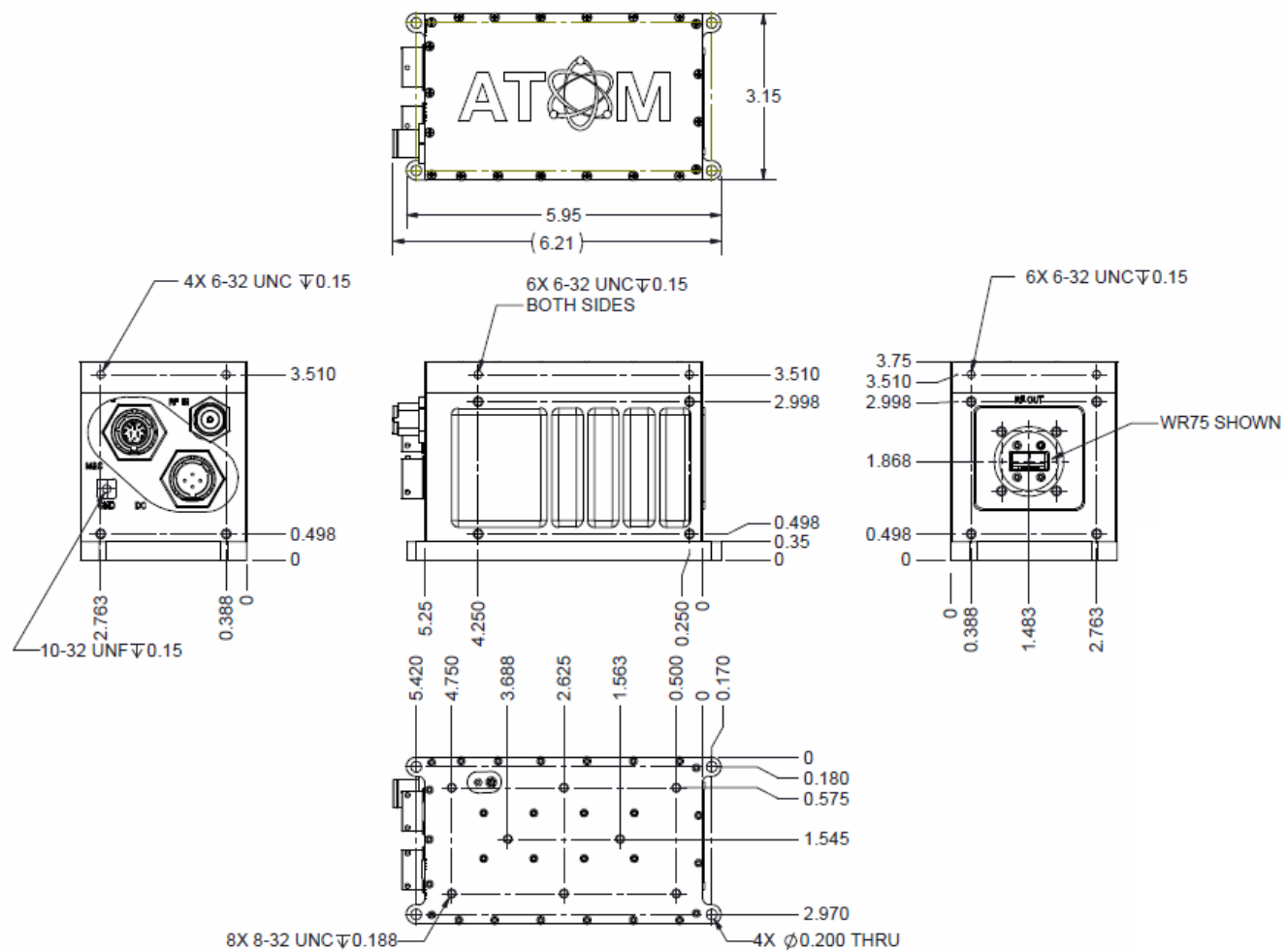


Figure A-5: 40W and 50W KU SSPA/BUC Assembly, without Fans

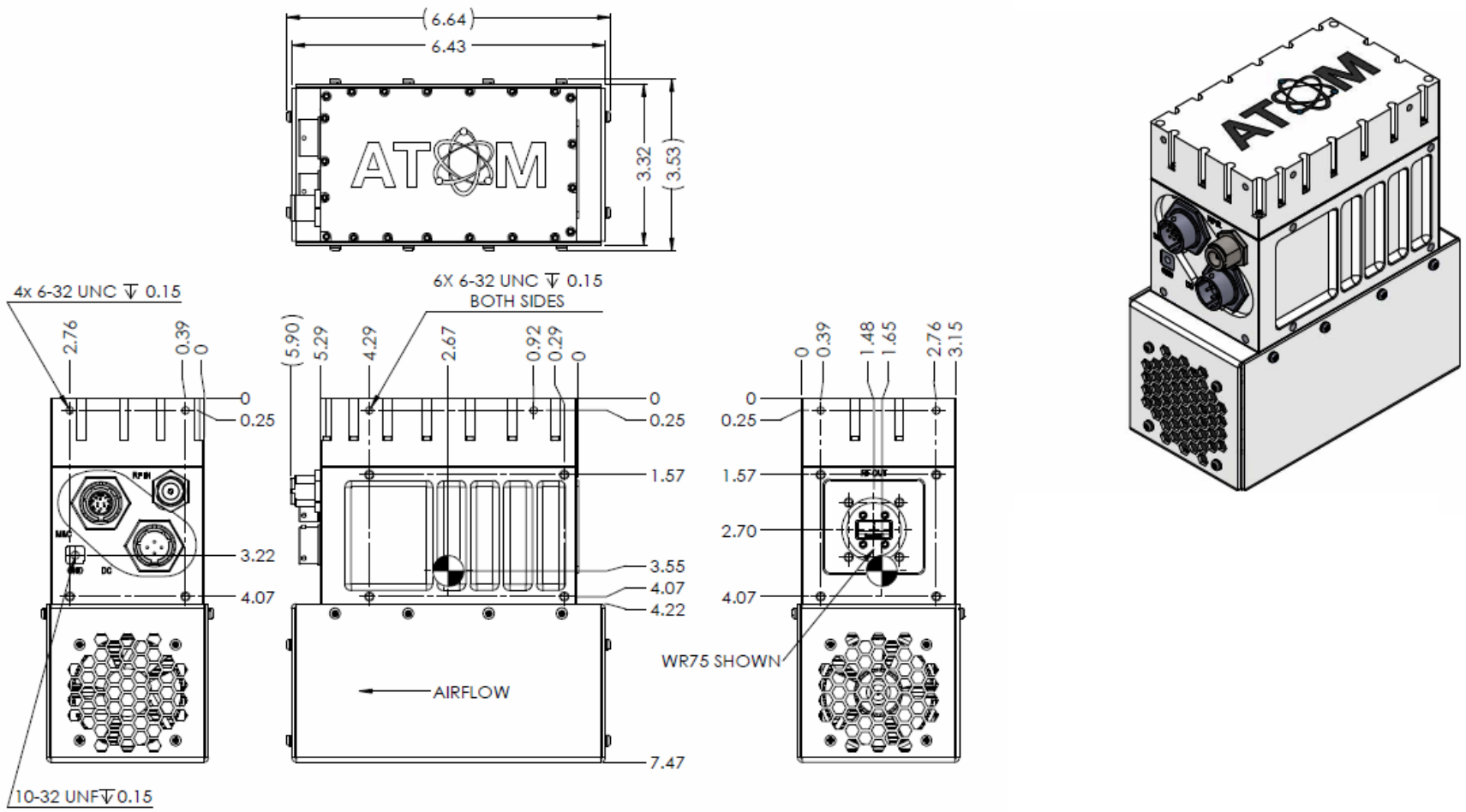


Figure A-6: 40W and 50W KU SSPA/BUC Assembly, with Fans and EMC/EMI Filter Option

Appendix B Acronyms and Abbreviations

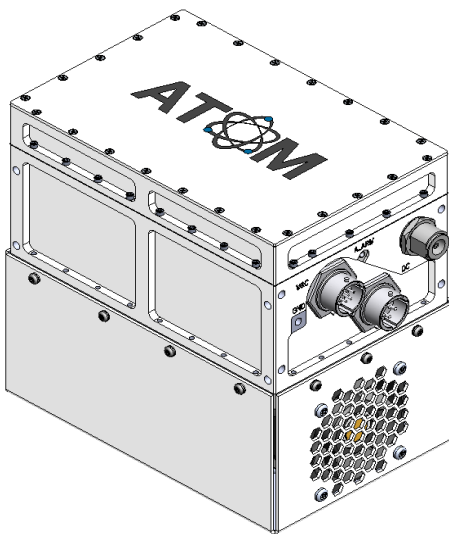
The following is a list of acronyms and abbreviations referenced in this document.

Table B-1: Acronyms and Abbreviations

Acronym	Definition
BUC	Block Upconverter
AMP	Amplifier
C	Celsius
<CR>	Carriage Return character (ASCII)
dBm	Decibel-milliwatts
DC	Direct Current
ESD	Electrostatic Discharge
freq	Frequency
GHz	Gigahertz
GND	Ground
IF	Intermediate Frequency
kHz	kilohertz
<LF>	Line Feed character (ASCII)
M&C	Monitor and Control
MHz	Megahertz
mm	Millimeter
N/A	Not Applicable
ppm	Pulses per minute
RF	Radio Frequency
RX	Receive
SSPA	Solid State Power Amplifier
TX	Transmit
V	Volt
VDC	Volts Direct Current



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ABOUT NORSAT

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