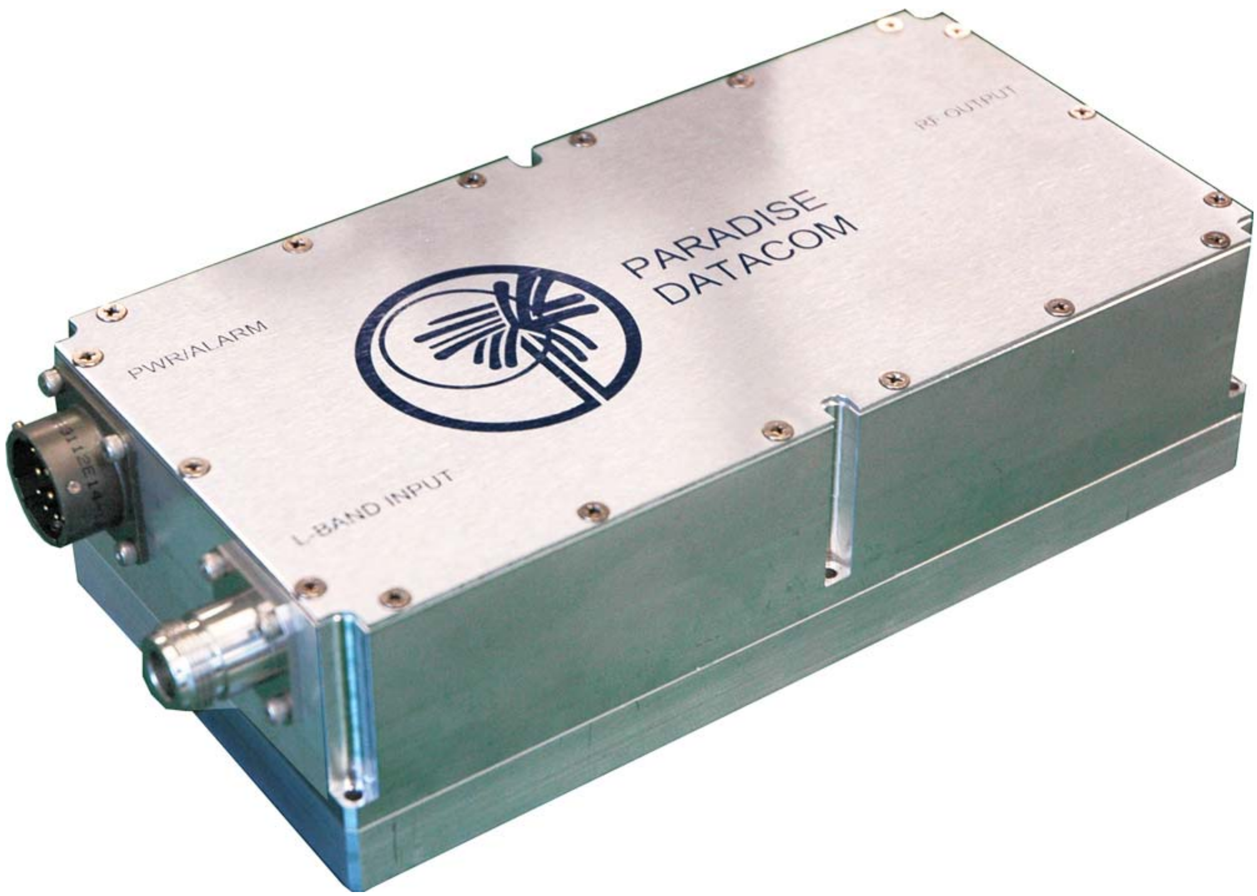
µBUC
VSAT Block Up Converter Operations Manual



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1.0 Introduction

Paradise Datacom's Micro VSAT Block Up Converters (µBUCs) have been designed to offer the maximum utility in VSAT systems while maintaining the highest possible reliability.

The µBUCs are capable of using an external 10 MHz reference signal to phase lock the internal local oscillator. They are designed to work over the 950 to 1825 MHz L-Band IF frequency range, and have a variety of input power options.

1.1 BUC Output Power

Single-box Paradise Datacom µBUCs are available in the following output power levels:

- 10W X-Band (UBUCX10AAXXXXX)
- 20W X-Band (UBUCX20AAXXXXX)
- 10W Ku-Band (UBUCK10AAXXXXX)
- 20W Ku-Band (UBUCK20AAXXXXX)
- 25W Ku-Band (UBUCK25AAXXXXX)

1.2 Physical Characteristics

Paradise Datacom has developed this series of Block Up Converters especially for highly mobile commercial and military applications. The µBUC is ideal for use in any Fly-Away or Manpack application where miniature form factor and light weight are requirements.

1.2.1 Housing

The housing of the µBUC is composed of machined aluminum. The housing cover is brushed aluminum (6061-T6), 0.06" thick. Figure 1-1 shows an outline drawing of the Ku- or X-Band µBUC.

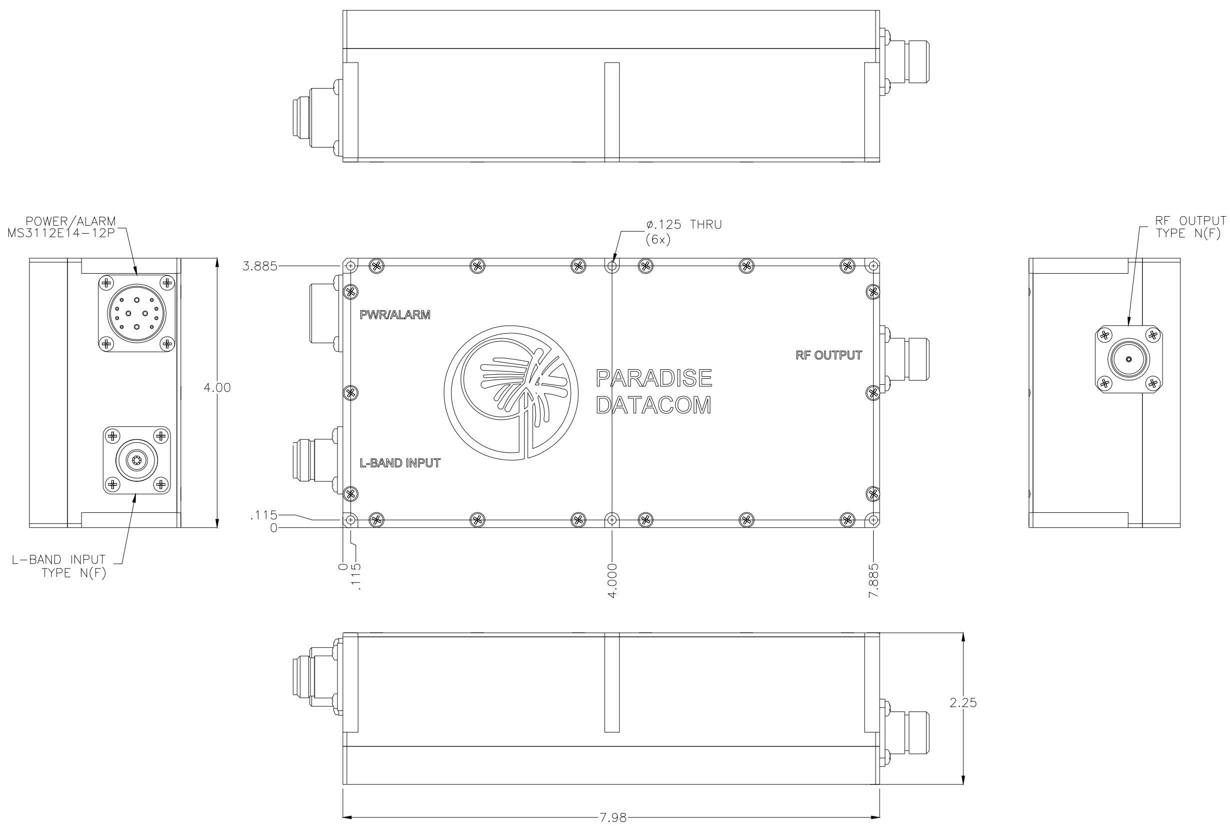


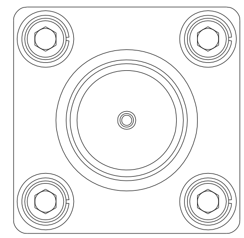
Figure 1-1: Outline Drawing, µBUC, Ku- or X-Band

NOTE: The housing needs to be attached to a heat sink to dissipate the heat generated by the microelectronics. There are six (6) thru holes (.125" dia.) available to bolt the unit to the heat sink. See Section 2: Mounting the Unit.

1.2.2 Connectors

The µBuc utilizes three connectors to facilitate operation of the unit: the L-Band Input Connector (J1); the RF Output Connector (J2); and the Power/Alarm Connector (J3).

1.2.2.1 L-Band Input Connector (J1) [Type N (f)]

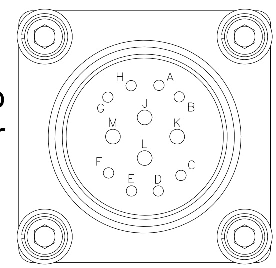


This connector is a Type N female connector, used to introduce an L-Band signal and 10 MHz reference to the µBUC.

1.2.2.2 RF Output Connector (J2) [Type N (f)]

The RF output used on the µBUC is a Type N female connector.

1.2.2.3 Power/Alarm Connector (J3) [MS3112E14-12P]



This connector is an 12-socket MS-type connector and is used to communicate alarm signals between the µBUC and a modem or computer. It is also provides primary power to the unit.

The pin-outs for this connector are shown in Table 1-1.

Table 1-1: Power Alarm Connector (J3)

PIN	DESCRIPTION	DETAILS
A	Reserved	Reserved
B	Reserved	Reserved
C	GND	
D	HIGH TEMPERATURE FAULT	Open Collector (Open on Fault)
E	SUMMARY FAULT	Open Collector (Open on Fault)
F	MUTE INPUT	Connect to ground to unmute µBUC
G	GND	
H	NC	Reserved
J	-48VDC/-24VDC	
K	+48VDC/+24VDC	
L	-48VDC/-24VDC	
M	+48VDC/+24VDC	

The mating connector, part number MS3116F14-12S, is supplied with the unit. See Section 3: Cable Connections for a description of how to build the power/alarm cable.

1.3 Electrical Characteristics

See Appendix A for the specification sheet for the Paradise Datacom μBUC.

1.3.1 Frequency Bands

Table 1-2 shows the frequency bands available in the Paradise Datacom μBUC. Also shown are the associated IF input, LO frequency and RF output for each frequency band.

Table 1-2: Frequency Bands

Band	Frequency Plan	IF Input (MHz)	LO Freq. (GHz)	RF Output (GHz)
X	Standard X-Band	950 - 1450	6.950 GHz	7.90 - 8.40
Ku	Standard Ku-Band	950 - 1450	13.050 GHz	14.00 - 14.50
Ku	Extended Ku-Band	950 - 1700	12.800 GHz	13.75 - 14.50

Custom frequency bands are available upon request.

1.3.2 Gain and Limits

Table 1-3 shows the Gain, Saturated power and power at P_{1dB} for the various μBUC models.

Table 1-3: BUC Output Power Levels (Gain, P_{sat} and P_{1dB})

Model Number	Gain (dB)	P_{sat}/P_{1dB} (dBm)	P_{sat}/P_{1dB} (Watts)
UBUCX10AAXXXXX	60	40.5 / 40.0	11 / 10
UBUCX20AAXXXXX	60	43.5 / 43.0	22 / 20
UBUCK10AAXXXXX	50	40.5 / 40.0	11 / 10
UBUCK20AAXXXXX	50	43.0 / 42.0	20 / 16
UBUCK25AAXXXXX	50	44.0 / 43.0	22 / 20

1.3.3 Local Oscillator Phase Noise

Table 1-4 shows the phase noise of the μBUC's local oscillator.

Table 1-4: Local Oscillator Phase Noise

Offset	Guaranteed Max.	Typical	Units
10 Hz	-30	-60	dBc/Hz
100 Hz	-60	-75	dBc/Hz
1 KHz	-65	-75	dBc/Hz
10 KHz	-75	-100	dBc/Hz
100 KHz	-90	-110	dBc/Hz
1 MHz	-90	-122	dBc/Hz

1.3.4 IF to RF Gain Characteristics

Gain Flatness over full band (including temperature effects): ±2.0 dB
Gain Slope per 40 MHz: ±0.25 dB
Gain Level Variation over temperature: 0 ±2.0 dB @ -40 to +60 °C baseplate (X-Band) and -30 to +60 °C baseplate (Ku-Band)

1.3.5 External Reference

The µBUC locks to a 10 MHz external reference signal of -10 dBm to +5 dBm. The external reference must be diplexed on the L-Band Input Connector (J1).

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2.0 Introduction

Paradise Datacom's µBUC needs to be mounted to a thermally conductive heatsink to dissipate heat away from the unit. The heatsink must have a thermal resistance as shown in the following table, Table 2-1: Heatsink Thermal Resistance.

Table 2-1: Heatsink Thermal Resistance

Unit	Thermal Resistance
10W X-Band	0.275 °C/W
20W X-Band	0.230 °C/W
10W Ku-Band	0.230 °C/W
20W Ku-Band	0.150 °C/W
25W Ku-Band	0.125 °C/W

2.0.1 Mounting the BUC to the Heat Sink

Apply a thin coat of heatsink grease (Type Z9 Heat Sink Compound) to the bottom of the µBUC and to the area of the heatsink which will be covered by the unit.

Spread the heatsink grease evenly over the entire surface using a putty spreader for a consistent coating.

Attach the µBUC to the heatsink, securing it to the plate with six (6) customer-supplied hold-down screws through the 0.125 through holes in the uBUC plate. Alternate tightening the hardware at opposite corners to prevent the heatsink grease from being squeezed out at one end of the unit.

Remove the hold-down screws and remove the unit from the heatsink and inspect the coverage of the thermal grease. If any voids are present, add more thermal grease to that area and reattach the unit to the heatsink in the manner described above.

Use a cotton swab to remove any heatsink grease that was squeezed beyond the edges of the unit.

2.0.2 Cooling the Heat Sink

A forced-air convection fan should be used to facilitate the dispersal of heat from the heatsink. Paradise Datacom recommends using a fan that displaces at least 110 CFM, such as the Comair Rotron model number MD48B1-E2.

2.1 Environmental Considerations

The μBUC houses sensitive microelectronics that are susceptible to environmental hazards, such as extreme temperatures, moisture and vibration.

Operational temperature: -40 to +60 °C

Storage temperature: -40 to +70 °C

Relative Humidity: 95%, non-condensing

Altitude: No temperature de-rating to 10,000 ft, (3000 m); De-rate maximum temperature by 2°C per 1,000 ft (300 m) beyond 10,000 ft.

Shock tolerance: 50 g p-p, 11 msec pulses

Vibration tolerance: 3g rms 30 min. 5-2000 Hz

3.0 Power/Alarm Cable

Input power to the Paradise Datacom µBUC is provided through Port J3, the Power/ Alarm Connector. A mating connector (MS3116F14-12S), supplied with the unit, should be used to create the Power/Alarm Cable.

Standard µBUC operation is at +48 VDC, but an optional +24 VDC µBUC is available.

Table 3-1 shows the power requirements for the various µBUC models.

Table 3-1: µBUC Power Requirements (@ max current draw)

Model Number	24 VDC	48 VDC	Units
UBUCX10AAXXXXX	4.6	2.0	Amps
UBUCX20AAXXXXX	5.4	2.3	Amps
UBUCK10AAXXXXX	6.3	2.7	Amps
UBUCK20AAXXXXX	9.2	4.2	Amps
UBUCK25AAXXXXX	10.4	4.8	Amps

3.0.1 DC Cable Sizing

Typical power supply cables manufactured by Paradise Datacom use multi-conductor cable of AWG #18. If the cable can be exposed to the environment, the cable jacket insulation should be UV resistant.

The µBUCs use DC/DC converters that operate as constant power devices. Though the units operate over a wide range of input voltage, the lower the input voltage becomes, the larger the current that is drawn. This in turn causes even higher voltage drops over the power supply cable. A good design rule is to ensure that the µBUC has at least 40 VDC present at the Power/Alarm Connector (Port J3).

Thus to calculate power supply cable voltage drop use the following guideline.

AWG#18 wire resistance: $R = \frac{6.5\Omega}{1000\ ft} = 0.0065\ \Omega/ft.$

The DC load of 10W Ku-Band µBUC = 2.7 Amps @ 48VDC. First consider the load power dissipated by the µBUC by noting the current draw for the 10W Ku-Band µBUC from Table 3-1.

$$P_{load} = 48\ v * 2.7\ Amps = 129\ W$$

Then calculate the current drawn at 40VDC into the µBUC.

$$I_{load} = \frac{129W}{40V} = 3.2 Amps$$

With the power supply producing 48VDC and allowing for an 8VDC voltage drop across the cable, the maximum cable length can then be determined. See Figure 3-1.

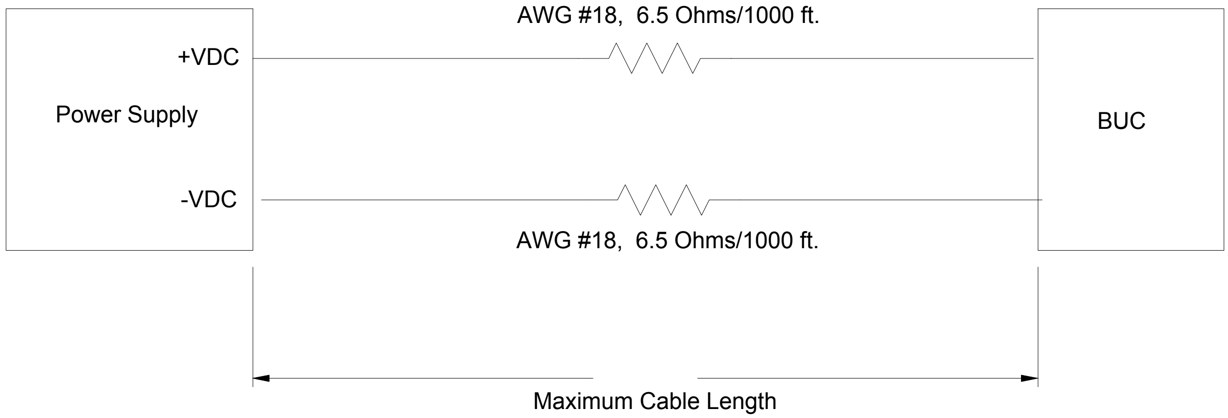

Figure 3-1: Calculating maximum cable length

The total cable resistance accounting for both the source and return wire is then.

R= 2 * 0.0065 = 0.013 Ohms/ft.

The maximum cable resistance that can be tolerated and result in an 8V drop is then.

$$\frac{8v}{3.2A} = 2.5\Omega$$

The maximum power supply cable length can then be determined by the following.

$$\frac{2.5\Omega}{.013} = 192 \quad ft.$$

3.0.2 Open Collector Alarm Outputs (J3)

The open collector alarm outputs will require external pull-up resistors. They are capable of sinking up to 20 mA current at 30 VDC. The open collector outputs are pulled to ground under normal operating conditions and switch to high impedance state during an alarm condition.

Summary Alarm: high on any fault condition: under voltage, under current, temperature or phase lock;
Temperature Alarm: High when the amplifier's baseplate temperature rises above its acceptable threshold of 90°C. A 5°C hysteresis window exists in the temperature alarm.

3.0.3 Mute Input (J3)

Pin F of the Power/Alarm Connector (J3) is the mute input pin. The µBUC will power up muted. This line must be pulled to ground (C or G) to enable the amplifier.

3.1 IFL Cable Design

Both the L-Band Input and RF Output utilize N-type connectors, which should be connected to the L-Band source and RF feed respectively via IFL cabling.

Consideration should be given to using a high quality IFL between the indoor and outdoor equipment. The system designer must always consider the total cable loss for a given length and also the implications of the slope of attenuation across the following bandwidths, depending on the µBUC frequency:

Standard X-Band	950 - 1450 MHz
Standard Ku-Band	950 - 1450 MHz
Extended Ku-Band	950 - 1700 MHz

Table 3-2 gives the approximate attenuation vs. frequency for a variety of cable types.

Table 3-2: Common Coaxial Cable Characteristics

Cable Type	Center Conductor DC Resistance per 1000 ft.	Outer Diameter (inches)	Attenuation at 950 MHz dB per 100 ft.	Attenuation at 1450 MHz dB per 100 ft.	Slope across band for 100 ft. cable (dB)	Slope across band for 300 ft. cable (dB)
RG-214	1.7	.425	7.8	11.3	3.5	10.5
Belden 8214	1.2	.403	6.8	9.2	2.4	7.2
Belden 7733	.9	.355	5.8	8.3	2.5	7.5
Belden 9914	1.2	.403	4.5	6.3	1.8	5.4
Belden 9913	.9	.403	4.2	5.6	1.4	4.2

It is recommended to use a quality grade of 50 ohm cable such as Belden 9913, 9914, or 7733. Check the manufacturer's technical data to make sure that the insulation is sufficient for the particular installation including the cable's temperature range. Also make sure that the coaxial connector from the IFL cable to the unit input is wrapped with a weather sealing tape to prevent water intrusion into the coaxial cable. See Section 3.2.

3.2 Sealing Connectors

All connections should be wrapped with self-amalgamating, weather-resistant electrical tape, provided. Make sure each connector is clean and dry before applying the electrical tape. Apply electrical tape to all MS- and N-type connectors that could be exposed to moisture.

Starting at the cable end, wrap the weather-resistant electrical tape around the connector and overlap by half the width of the tape. Continue wrapping until the connection mating point is enveloped. Wrap an extra turn around the base of the connector.

Press and smooth the tape with your fingers to form a good seal. The tape surface should be uniform in appearance with no visible gaps or protrusions.

The following pages comprise the documentation listed below:

Specification Sheet, µBUC, Ku- & X-Band (207267)

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