ORBCOMM®

WHERE DATA DRIVES DECISIONS

PT 6100

Hardware Guide

PT120, Version 01

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PREFACE

Purpose

This guide is an overview of the hardware characteristics and specifications for the PT 6100 device.

Notation

Hardware components and hardware labels in this document might not be exactly as shown and are subject to change without notice.

CAUTION: This safety symbol warns of possible hazards to personnel, equipment, or both. It includes hazards that will or can cause personal injury, property damage, or death if the hazard is not avoided.

Note: A note indicates information with no potential hazard. A note indicates points of interest or provides supplementary information about a feature or task.

Numbered lists indicate a series of steps required to complete a task or function.

Bulleted lists highlight information where order or sequence is not crucial.

Device and Battery Warnings

CAUTION: Always follow local disposal guidelines to properly dispose of the Lithium-ion battery and the device.

CAUTION: Store in a cool, well-ventilated area. Elevated temperatures will result in shortened battery life.

CAUTION: DO NOT replace the battery. Changing the battery without ORBCOMM's permission could violate regulatory conformity.

CAUTION: DO NOT throw the internal battery or the device into fire.

CAUTION: This device is designed to operate with an ORBCOMM specified antenna. Changing the antenna could violate regulations, therefore a recertification process may be required for the device. As such, ORBCOMM does not recommend you use a different antenna other than the ones specified in this guide. Should the customer require a different antenna, please contact ORBCOMM's Hardware Integrity & Certification group.

WEEE Statement

Disposal of this device should be handled according to all national laws and regulations.

The mark shown to the right is in compliance with Waste Electrical and Electronic Equipment Directive 2012/19/EU (WEEE). The mark indicates the requirement NOT to dispose the equipment as unsorted municipal waste, but use the return and collection systems according to local law.	

1 PRODUCT OVERVIEW

The PT 6100 (model number PT6100) is a low cost, versatile tracking and monitoring device capable of cellular communications over various cellular networks using multiband radios and nested module footprints as well as optional satellite communications through the ST 2100 device. It is primarily targeted towards the refrigerated transportation market. Two RS-232 ports are available to control and monitor equipment controllers. In addition, the PT 6100 includes interfaces to external wired sensors and peripherals.

The PT 6100 uses a rugged, IP67 enclosures that house all electronics and power control. External antennas interface through IP67 RF connectors and diversity BLE providing cellular and GNSS.

The PT 6100 can be powered externally through the main connector or through the internal rechargeable battery.

Available configurations:

- PT 6100 cellular device (p/n - PT6100-xxxx-x)
    - with 2 x RS-232 (console and reefer)

1.1 Features and Benefits

The PT 6100 offers the following features and benefits:

- Configurable for specific customer requirements
- Single or dual-mode module models to communicate with the network
- Remote firmware updates over-the-air via cellular or locally via diagnostic port
- Wide operational temperature range
- Accelerometer
- Rugged, compact, and easy to install
- Powerful web applications and third-party integration
- Factory installed SIM card

1.2 Sensors

Add powerful ORBCOMM sensors for added visibility and reporting (APPENDIX 1).

Contact your ORBCOMM Account Manager to discuss the features and options available to suit your business requirements.

1.3 Peripherals

The following options are supported based on the model of PT 6100.

- Cell/GPS/BLE Antenna
- ST 2100

1.4 Web Platform

- ORBCOMM Transportation Platform (OTP) is a single, unified, next-generation analytics and reporting cloud-based platform that puts everything in one place. The scalable platform can accommodate any size of operation whether the customer has one or 100,000-plus assets. The comprehensive platform also integrates with sensors for fuel, doors, cargo, temperature, and more for unparalleled visibility.
- ORBCOMM DeviceCloud (ODC) is a single interface for managing multiple networks and devices, where connectivity and device-specific messaging is abstracted to a common interface and messaging API.
- CargoWatch® is a web application that delivers near-real-time alerts on trailer status, location, history, as well as arrival and departure, providing greater visibility and utilization for fleet managers.

1.5 Programmability

The device can be upgraded through the RS-232 port and by cellular over-the-air.

1.6 Installation

This device was specifically designed for flexible, quick and easy installation.

Refer to the PT 6100 installation guide available from your ORBCOMM Account Manager or ORBCOMM Customer Care.

2 SPECIFICATIONS

2.1 Temperature

2.1.1 PT 6100

Parameter	Value
Operating Temperature Range using external power	-40° to +75°C (-40°F to +167°F)
Storage Temperature Range	-40° to +60°C (-40°F to +140°F)

2.1.2 Internal Battery

Parameter	Value
Operating Temperature Range	-30°C to +60°C (-22°F to +140°F)
Charging Temperature Range	0°C to +40°C (32°F to +104°F)

2.2 Electrical

2.2.1 Input Range

Parameter	Value
Power Supply Voltage	9 to 32 V DC (charging voltage range 12 to 32 V)

2.2.2 Power Consumption

The typical input currents in each operating mode are detailed below, for an external supply of 12V.

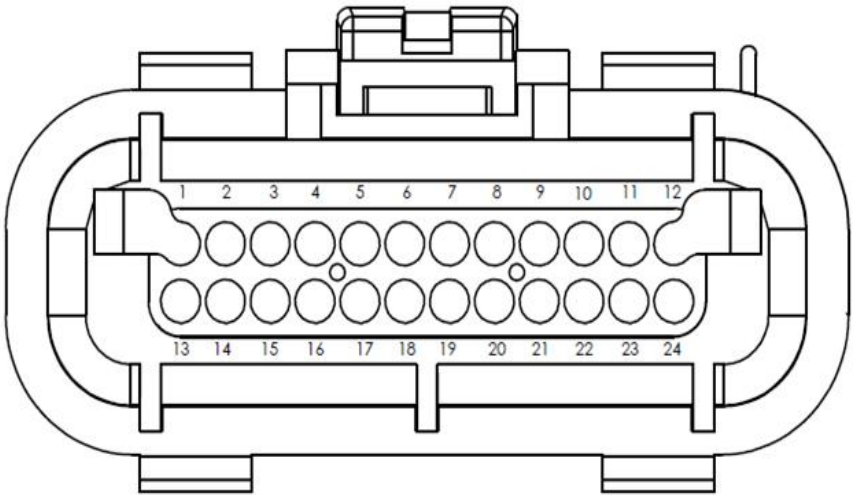
Mode of Operation	Current
Sleep + Power Save	200 µA
Cellular Transmit	2000 mA
Cellular Receive	80 mA
Battery Charging	750 mA
Normal (Reefer Comms)	35 mA
Maximum Continuous	1750 mA

2.3 Connectors

2.3.1 Connector Pin Assignment

This, 24-pin Delphi, connector is IP67 rated when mated. Many of the signals have dedicated functions, but some have alternate uses. The signals available on the connector are shown below. The electrical specification describes the functions in more detail.

Figure 1: Connector (View on Device)



2.3.2 Pin Assignment

Table 1 maps to the layout shown in Figure 1.

Table 1: Electrical Pin Assignment

J2 Pin	Signal	Primary Function	Secondary Function
1	AUX_SERIAL_B	RS-485	-
2	AUX_SERIAL_A	RS-485	-
3	GND	Ground from the asset	-
4	OFF_KEY	External reset	-
5	PWR_BOX_RST	Power control clock	Reefer power input
6	TEMP_SENSOR_1	Temperature sensor input	Tire inflation input
7	SPARE_RS232_TX	Auxiliary RS-232 transmit (output)	ST 2100 interface
8	REEFER_TX_RS	Reefer RS-232 transmit (output)	Mi-Jack RS-232 transmit (output)
9	REEFER_RX_RS	Reefer RS-232 receive (input)	Mi-Jack RS-232 receive (input)
10	PWR_BOX_MUX_CTRL	Power control data	IBOX power input
11	DOOR (BKR1)	Door sensor input	Reefer RS-232 external mux control
12	TEMP_SENSOR_3	Temperature sensor input	Humidity input
13	TEMP_SENSOR_2	Temperature sensor input	Humidity input
14	FUEL_PWR	12 V output for fuel sensor	12 V output for humidity sensor
15	TRAILER_HOOK (ACV)	Trailer hook input	-
16	FUEL_IN	Fuel sensor analog input	Flow meter input
17	GND	Ground from the asset	-

J2 Pin	Signal	Primary Function	Secondary Function
18	SPARE_RS232_RX	Auxiliary RS-232 receive (input)	ST 2100 interface
19	GND	Ground from the asset	-
20	CONSOLE_RX_RS	Console RS-232 receive (input)	-
21	CONSOLE_TX_RS	Console RS-232 transmit (output)	-
22	GND	Ground from the asset	-
23	GND	Ground from the asset	-
24	REEFER_12/24 V	12/24 V input from reefer	-

2.4 I/O Descriptions

2.4.1 Power Control Interface

The device includes an interface to communicate with an ORBCOMM power control device. The clock line is an open drain output tied directly to reefer voltage, and the data line is internally pulled up to reefer voltage. Logic low is a short to ground.

The power control devices are accessories that allow remote and local control of the reefer microcontroller power supply.

The power control interface signals are multiplexed with other functions. The clock input is multiplexed with IBOX wake-up output and 12 V reefer power indicator. The data I/O is multiplexed with the IBOX power control input

Power control interface specifications:

Parameter	Min.	Typical	Max.	Units
Clock Output High	9	-	16	V
Clock Maximum Current	-	-	0.5	A
Data Output High	9	-	16	V
Data Output Low	-	0	-	V
Data Pull-up Resistance	-	10	-	kΩ
Data Input Low	-	-	1.1	V

2.4.2 Reefer Power Indicator

The device includes an input to sense the presence of power to the reefer microcontroller. This input expects a 12V input from the reefer to determine if the microcontroller is powered. The reefer power indicator is multiplexed with the IBOX wake-up output and power control clock output.

Reefer power indicator specifications:

Parameter	Min.	Max.	Units
Input High	3.0	17	V
Input Low	-	1.0	V

2.4.3 IBOX Wake-Up Output

The device includes an output to control an IBOX wake-up signal. The output is a 12V open drain output.

Parameter	Min.	Typical	Max.	Units
Output High	9	12.1	12.7	V
Output Maximum Current	-	-	0.5	A

2.4.4 IBOX Power Control Input

The device includes an input to sense the status of the IBOX power controller. This input expects a 12V input from the reefer to determine if the IBOX is powered. It is internally pulled down. The IBOX power control input is multiplexed with the power control data I/O.

Parameter	Min.	Typical	Max.	Units
Input High	10.2	-	12.1	V
Input Low	-	-	3.6	V
Pull-down Resistance	-	15	-	kΩ

2.4.5 Door Input

The device includes a low voltage digital input for use with a contact closure switch. The door sensor is weakly pulled up inside the PT 6100 to conserve current when the switch is closed. The door input can accept normally open or normally closed switches. Switch type must be configured in the firmware. This interface is multiplexed with Mi-Jack multiplexer control.

Door input specifications:

Parameter	Min.	Typical	Max.	Units
Pull-up Voltage	-	3.3	-	V
Pull-up Resistance	-	301	-	kΩ
Voltage Input	-0.3	-	3.3	V

2.4.6 Mi-Jack Multiplexer Control

The device includes a low voltage digital output used to control a serial port multiplexer. The serial port multiplexer allows the PT 6100 to share a single RS-232 port to interface with two devices, the reefer microcontroller and Mi-Jack door lock. This interface is multiplexed with the door input.

Mi-Jack multiplexer control specifications:

Parameter	Min.	Typical	Max.	Units
Output High	2.4	-	-	V
Output Low	-	-	0.4	V

2.4.7 Temperature Sensor Inputs

The device includes three temperature inputs to interface with thermistors. The input is specifically designed for the ORBCOMM thermistor temperature probe. Temperature sensor inputs are multiplexed with the humidity sensor inputs.

Temperature sensor specifications:

Parameter	Min.	Typical	Max.	Units
Pull-up Resistance	-	7.5	-	kΩ
Pull-up Voltage	-	3.0	-	V
Input Impedance	100	-	-	GΩ
Measurement Accuracy	less than 1%			

2.4.8 Humidity Sensor Inputs

The device includes three analog inputs to interface to ORBCOMM humidity sensors. Humidity sensor inputs are multiplexed with the temperature sensor inputs.

Humidity sensor input specifications:

Parameter	Min.	Max.	Units
Maximum Voltage Range	-0.1	3.4	V
Measurement Voltage Range	0	3	V
Expected Humidity Sensor Voltage Range	0	1	V
Measurement Accuracy	2%		

2.4.9 12 V Power Output

The device includes a switched power output for external sensor power.

FUEL_PWR power output specifications:

Parameter	Min.	Max.	Units
Voltage Output (enabled)	12.4	12.7	V
Voltage Output (disabled)	-	0	V
Current Output	-	500	mA

SW_12V power output specifications:

Parameter	Min.	Max.	Units
Voltage Output (enabled)	11.6	12.6	V
Voltage Output (disabled)	-	0	V
Current Output	-	2	A

2.4.10 Fuel Sensor Input

The device includes an analog input to interface to the ORBCOMM fuel sensor. The fuel sensor input is multiplexed with the flow meter input.

Fuel sensor input specifications:

Parameter	Min.	Typical	Max.	Units
Maximum Voltage Range	-0.6	-	6.6	V
Measurement Voltage Range	0	-	6	V

Parameter	Min.	Typical	Max.	Units
Expected Fuel Sensor Voltage Range	0	-	5	V
Measurement Accuracy	1.4	-	-	%

2.4.11 Flow Meter Input

The device includes a digital input for interfacing to the ORBCOMM flow meter. The flow meter output is a 20 Hz pulse with modulated signal with a voltage range of 0 to 6 V. The flow meter input is multiplexed with the fuel sensor input.

Flow meter input specifications:

Parameter	Min.	Typical	Max.	Units
Maximum Voltage Range	-0.6	-	6.6	V
Expected Frequency	-	20	-	Hz

2.4.12 Trailer Hook Input

The device includes an analog input for detecting the presence of a trailer and measuring the trailer voltage.

Trailer hook specifications:

Parameter	Min.	Typical	Max.	Units
Maximum Voltage Range	-1.5	-	16.5	V
Measurement Voltage Range	0	-	15	V
Frequency	-	20	-	Hz
Accuracy	1.4	-	-	%

2.4.13 Off Key

The PT 6000 includes an input to allow a local hard reset of the device. This interface is an open circuit during normal operation. When a reset is required, a low pulse on the OFF_KEY performs a hard reset.

OFF_KEY specifications:

Parameter	Min.	Typical	Max.	Units
Reset Voltage	0	-	0.3	V
Run Voltage	0.4	-	3.3	V
Pull-up Resistance	-	49.9	-	kΩ

2.5 Serial Interfaces

2.5.1 Console RS-232

The Console RS-232 interface defaults to the following settings: 115,200 bit/s, 1 start, 8 data, 1 stop bit, and no parity.

The console serial interface is intended for control, configuration, and monitoring of the PT 6100. It is typically disconnected during normal operation.

The processor wakes on RS-232 activity based on the status signal from the RS-232 driver. This status signal is shared with the reefer RS-232 interface.

The electrical characteristics of the console RS-232 interface are:

Parameter	Min.	Typical	Max.	Units
Rx input lower threshold for DTE connected	-	-	-2.7	V
Rx input upper threshold for DTE connected	2.7	-	-	V
Rx input threshold for DTE disconnected	-0.3	-	0.3	V
Serial Rx input low threshold	0.6	1.1	-	V
Serial Rx input high threshold	-	1.6	2.4	V
Serial Tx low output (3 kΩ load)	-	-5.4	-5	V
Serial Tx high output (3 kΩ load)	5	5.4	-	V

2.5.2 Reefer RS-232

The reefer RS-232 interface defaults to the following settings: 115,200 bit/s, 1 start, 8 data, 1 stop bit, and no parity.

It is designed for communication with the reefer microcontroller. In some applications this serial interface can be externally multiplexed to communicate with other accessories, such as the Mi-Jack lock.

The processor wakes on RS-232 activity based on the status signal from the RS-232 driver. This status signal is shared with the console RS-232 interface.

The electrical characteristics of the reefer RS-232 interface are the same as the console RS-232 interface.

2.5.3 Spare RS-232

The baud rate is configurable up to 115,200 bps.

The spare serial interface is intended for communication with other devices such as the AG400 or the ST 2100. Contract your Account Manager or ORBCOMM Customer Care for product guides.

The electrical characteristics of the spare RS-232 interface are the same as the console RS-232 interface.

2.5.4 RS-485

The RS-485 interface is intended for communication with peripheral devices like the CS 500 cargo camera or other RS-485 peripherals.

The electrical characteristics of the interface are:

Parameter	Min.	Typical	Max.	Units
Input common mode voltage	-20	-	20	V
Differential Input threshold	-200	-120	-10	mV
Output common mode voltage	-1.0	-	3.0	V
Differential drive output, 54 Ω load	1.1	1.3	-	V
Voltage tolerance	-60	-	60	V

2.6 RF Specifications

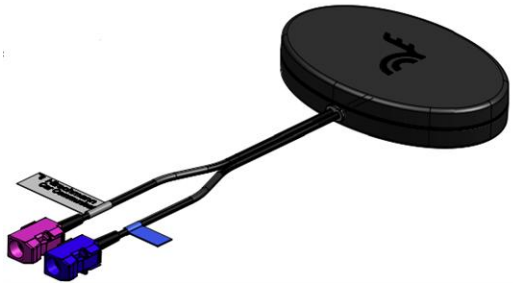
2.6.1 Cellular Performance

Maximum transmitting power:

Technology / Band	(dBm)
GSM 850 / EGSM 900	33 ±2
DCS1800 / PCS1900	30 ±2
WCDMA all bands	23 ±2
LTE FDD	23 ±2
LTE TDD	23 ±2

2.6.2 Dual GSM / GNSS Puck Antenna

The dual GSM / GNSS antenna (p/n OEM100364) is a low elevation, 3 m, adhesive mount puck antenna also available in kit p/n ST100950, which includes a mounting bracket.



Puck Dimensions	102 mm x 66 mm x 20 mm (4.0 in x 2.6 in x 0.79 in)
Temperature range	-40°C to +85°C (-40°F to +185°F)
IP rating (IEC 60529)	IP66

Following are the cellular specifications for the antenna.[1]

Connector	FAKRA female (violet)
Frequency band	Low: 824 to 960 MHz Mid: 1710 to 2170 MHz
Antenna gain	0 dBic
Impedance	50 Ohm
VSWR	≤2

[1]Values shown are from the manufacturer's datasheet.

Following are the GPS specifications for the antenna.[1]

Connector	FAKRA female (blue)
Frequency range	1.57542 GHz (L1-band)
Antenna gain	2 dBic min.
Amplification	26 ±2 dB typical
Impedance	50 Ohm
Polarization	RHCP
Voltage supply	2.7 V to 5.5 V DC
Current consumption	≤ 13 mA typical 10 mA

2.7 GNSS

Table 2: GNSS Specifications

Parameter	GPS/GLONASS	GPS	GLONASS	BeiDou
Time to First Fix[1]				
Cold Start	26 s	30 s	31 s	39 s
Hot Start	1 s	1 s	1 s	1 s
Aided Start	3 s	3 s	3 s	7 s
Sensitivity				
Tracking and Navigation	-164 dBm	-164 dBm	-163 dBm	-160 dBm
Cold Start	-148 dBm	-147 dBm	-145 dBm	-143 dBm
Hot Start	-157 dBm	-156 dBm	-155 dBm	-155 dBm
Accuracy				
Horizontal Position (CEP) [2]	2.5 m	2.5 m	4.0 m	3.0 m
Velocity Accuracy	0.05 m/s			
Heading Accuracy	0.3 degrees			

2.8 Internal Battery

2.8.1 Battery Supply Voltage Measurement

The PT 6000 can measure its input supply voltage over the range 5 to 8.4 V, to an accuracy of ±1.0%.

[1] All satellites at -130 dBm.

[2] CEP, 50%, 24 hours static, -130 dBm

2.8.2 Battery Controller

The battery system includes hardware battery control that monitors and controls the charge and discharge of the device's battery pack.

Discharge is controlled such that no battery discharge is allowed over the battery pack maximum discharge temperature. The high temperature cutoff requirement is to ensure CE safety compliance.

Discharge can also be separately enabled by the processor.

Charging is limited to between the minimum and maximum charging temperature of the battery pack. Temperature is monitored using the thermistor internal to the battery pack.

Charge controller electrical specifications:

Parameter	Min.	Typical	Max.	Units
External Supply Voltage	12	-	32	V
Charge Current	-	212	-	mA
Charge temperature - Low-Cost Battery	0 (32)	-	40 (104)	°C (°F)
Float Voltage	-	7.97	-	V
Charge Time	-	-	4	Hours
Battery Chemistry	Lithium-ion Cell			

The device includes a rechargeable 7.4V nominal battery pack able to supply the current necessary for all operational modes. The battery pack includes a protection circuit with internal NTC sensor that provides all required UN 38.3 protection, including over discharge, overcharge, and over current protections. The battery pack meets UN 38.3 and IEC62133.

The electrical specifications of the battery pack are:

Parameter	Min.	Typical	Max.	Units
Capacity	1200	-	-	mAh
Voltage (nominal)	-	7.4	-	V
Maximum Pulsed Current Output	3	-	-	A
Maximum Continuous Current Output	1.2		-	A
Over Discharge Limit	-	6.0	-	V
Discharge Temperature	-30 (-22)	-	60 (140)	°C (°F)
Charge Temperature	0 (32)	-	45 (113)	°C (°F)

2.8.3 Battery Dimensions

The dimensions of the battery are:

Parameter	Value
Dimensions	67 L x 31 W x 12.2 H mm (2.6 x 1.2 x 0.5 in)

2.9 Memory

Parameter	Value
Write-Erase Cycles (over operating life)	100 000
External Flash	32 MB
External EEPROM	2 MB
Internal SRAM	786 kB
Internal Flash	2 MB (512 kB 100,000 cycles, balance 10,000 cycles)

2.10 Accelerometer

The accelerometer is important in low power applications where it is critical to save power while the asset is stationary.

To minimize false motion detects and excess power usage, the internal motion thresholds are configurable.

Accelerometer Minimum Specifications:

Parameter	Condition	Min.	Typical	Max.	Units
Acceleration Range	software selectable	-	±2	-	g
		-	±4	-	g
		-	±8	-	g
		-	±16	-	g
Bandwidth Filtering	Selectable via digital interface (high performance mode)	0.625	-	400	Hz
Sensitivity	2 g	-	4096	-	LSB/g
	4 g	-	2048	-	LSB/g
	8 g	-	1024	-	LSB/g
	16 g	-	512	-	LSB/g

2.11 Cellular Module

The device includes a module capable of global cellular communications over LTE, 2G, and 3G networks. The cellular modem is only powered on, when the device has messages to deliver. The modem is powered down after a configurable amount of idle time (15 seconds by default), and the device can not receive messages when the modem is powered down.

The cellular module specifications are:

Parameter	Minimum Specification
LTE Category	Category 1
LTE Bands	1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 25, 26, 28, 34, 38, 39, 40, 41, and 66
UMTS/HSPA+ Bands	1, 2, 4, 5, 6, 8, and 19
GSM Bands	2, 3, 5, and 8 (PCS1900/DCS1800/GSM850/EGSM900)

2.12 Bluetooth Module

The device includes an internal BLE antenna and an optional external BLE antenna. Transmit power is split 50/50 between the two antennas.

The BLE characteristics are below.

Parameter	Min.	Typical	Max.	Units
Frequency	2400	-	2483.5	MHz
BLE Version Compliance	-	5.0	-	-
Receive Sensitivity	-	-94[1]	-	dBm
Transmit Power	-	7.5	8	dBm
Available RAM	256	-	-	kB
Available Flash	1	-	-	MB
Peripherals Available	4	-	19	-

2.12.1 BLE External Memory

The device includes 2 MB of nonvolatile onboard flash storage for data for use with the Bluetooth Low Energy subsystem. The flash is capable of 100,000 write-erase cycles over its operating life.

2.13 PT 6100 LEDs

To help diagnose performance, the PT 6100 incorporates a series of LEDs on its top cover, which provides visual feedback. Refer to Table 3 to determine whether the PT 6100 is operating correctly.

Table 3: PT 6100 LED Description

Event	Green	Duration (sec)	Frequency (Hz)	Yellow	Duration (sec)	Frequency (Hz)	Red	Duration (sec)	Frequency (Hz)
Startup	ON	20	-	ON	20	-	OFF	OFF	OFF
Micro Comm	Blink 3x	1.2	2	OFF	OFF	OFF	OFF	OFF	OFF
Micro OFF/Not Detected	Blink 7x	0.7	10	OFF	OFF	OFF	OFF	OFF	OFF
Micro Read Error	OFF	OFF	OFF	OFF	OFF	OFF	Blink 7x	0.7	10
U-blox Comm/Antenna Error	OFF	OFF	OFF	OFF	OFF	OFF	Blink 3x	1.2	2
GSM Error: No Comm	OFF	OFF	OFF	Blink 3x	1.2	2	OFF	OFF	OFF
GSM Warning: No Service	OFF	OFF	OFF	Blink 7x	0.7	10	OFF	OFF	OFF

2.14 Mechanical

Parameter	Value
Dimensions (excludes connector body)	193 L x 109 W x 38 H mm (7.5 x 4.3 x 1.5 in)

[1]Varies by data rate.

3 COMPLIANCE

FCC (United States of America) CFR47 Part 15

- CONTAINS IC: 10224A-2022EG21GL; 8595A-NINAB30
- FCC compliance statement

  This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

ISED (Canada) ICES-003

- CONTAINS IC: 10224A-2022EG21GL; 8595A-NINAB30
- IC compliance statement:

  This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

  Le present appareil est conforme aux CNR d'Industrie Canada applicable aux appareils radio exempts de licence. L'exploitation est autorisee aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioelectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement.

RF Exposure & Non-modification Warning

RF Exposure statement This equipment complies with the radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and any part of the human body.

Non-modification Warning statement Equipment changes or modifications not expressly approved by the party responsible for FCC compliance, could void the user's authority to operate the equipment and could create a hazardous condition.

CE Mark (Europe) RED 2014/53/EU

- Declaration of Conformity

  Hereby, ORBCOMM Inc. declares that the radio equipment types listed in this document comply with Directive 2014/53/EU.

  The full text of the EU declaration of conformity is available from https://www2.orbcomm.com/eudoc.

Ingress Protection

- IP67

RoHS

- Restriction of Hazardous Substances (RoHS) [1]

PTCRB

Brazil Anatel

Para informações do produto homologado acesse o site: https://sistemas.anatel.gov.br/sch

[1] European Union's (EU) Directive 2015/863/EU "Restriction of Hazardous Substances" (RoHS) in Electronic and Electrical Equipment.

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Environmental

Parameter	Description
Humidity	The device meets all its specifications during exposure to 90% relative humidity at +85°C (185°F), per the test methodology of SAE J1455, section 4.2.3 (8-hour humidity cycle per figure 4a).
Vibration	The device meets all its specifications during exposure to random vehicular vibration levels per SAE J1455, section 4.9.4.2 figures 6, 7, and 8, and MIL-STD-810G, section 514.6, figure 514.6C-1.
Mechanical Shock	The device meets all its specifications after exposure to positive and negative saw tooth shock pulses with peaks of 20 G and durations of 11 ms as specified in MIL-STD-810G, section 516.6, Procedure I, section 2.3.2c.
Altitude	The device meets all specifications after a nonoperating 12.2 km (7.6 miles) altitude test as detailed in SAE J1455, section 4.9.3, except with an ambient temperature of -40°C (-40°F).
Thermal Shock	The device meets all of its specifications after a thermal shock test as detailed in SAE J1455, section 4.1.3.2
Drop Test	The device meets all its specifications after a handling drop test as specified in SAE J1455, section 4.11.3.1
Salt Spray Atmosphere	The device meets all of its specifications after a salt spray test as detailed in SAE J1455, section 4.3.3.1.
Immersion	The device meets all of its specifications after a 6-hour alternating hot/cold saltwater immersion test as detailed in SAE J1455, section 4.3.3.2.
Steam Cleaning and Pressure Washing	The device meets all of its specifications after a pressure wash test as detailed in SAE J1455, section 4.5.3.
Fungus	The device meets all of its specifications after a fungus test as detailed in SAE J1455, section 4.6.3.
Dust and Sand Bombardment	The device meets all of its specifications after a dust and sand bombardment test as detailed in SAE J1455, section 4.7.3.
ESD	All electrical interfaces shall operate normally after being subjected to 8 kV ESD contact discharge per IEC 61000-4-2, level 4. (Enclosure) The device meets all its specifications after exposure of the enclosure to 6 kV ESD contact discharge per IEC 61000-4-2, level 3.
Ingress Protection	IP67

Parameter	Description
Exposure to Chemicals and Oils	The device meets all of its specifications after a light to moderate splash test as detailed in SAE J1455 section 4.4.3.2, for the following chemicals: Window Washer Solvent Diesel Fuel Alcohol Degreasers Steam Kerosene Spray Paint Ether Ammonia Gasoline Fuel Additives Anti-Freeze Water Mixture Soap and Detergents Waxes Freon Paint Strippers Dust Control Agents (magnesium chloride) Moisture Control Agents (calcium chloride) Aluminum brightener (acid wash)