



CELLBOX USER GUIDE

CellBox User Guide

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Introduction

CellBox is a North American certified cellular modem terminal that provides LTE, EGPRS, and GPS connectivity.

This product has T-Mobile, AT&T, and PTCRB device-level certification as well as FCC certifications, allowing for direct and immediate use in most applications with no further certification required.

The product has two direct communication interfaces: (1) RS-232 via a custom adaptor cable to the on-board 8-pin Microfit connector and (2) micro USB. Note, the USB is recommended for communications only. Power should be provided over the custom 2-pin microfit edge adaptive cable.





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Variants

CellBox currently comes in a single version. This utilizes the Quectel BG95-M3 module for LTE category M1, NB1/NB2, EGPRS, and GNSS connectivity.

Dimensions

Table 1:

Length	72 mm (including SMA connectors)
Width	<ul style="list-style-type: none">• 5.0 cm (excluding anchors)• 6.93 cm (including anchors)
Height	1.89 cm
Weight	46.3 g

References

1. F3 Wireless [Modem Management Agent](#)
2. Quectel_BG95&BG77_AT_Commands_Manual_V1.0
3. Quectel_LTE_Windows_USB_Driver_For_MBIM_V1.0

Features

Table 2:

RF	<p>BG95-M3:</p> <ul style="list-style-type: none">• Supported LTE cat M1 bands B1/B2/B3/B4/B5/B8/B12/B13/B14/B18/B19/B20/B25/B26/B27/B28/B66//B85• Supported NB-IoT NB2 bands B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26*/B28/B66/B71/B85• Power Class 5<ul style="list-style-type: none">◦ Max Power Output: 20dBm±2dB◦ EGPRS Max Power Output: 33dBm• Maximum Data Speeds<ul style="list-style-type: none">◦ 375kbps (DL) and 1.12Mbps (UL)• EGPRS bands 850/900/1800/1900MHz with speeds<ul style="list-style-type: none">◦ 296kbps (DL), 236.8kbps(UL)
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<p>Connectors and Interfaces</p>	<ul style="list-style-type: none"> • SMA connectors <ul style="list-style-type: none"> ◦ LTE main antenna ◦ GPS antenna • One Micro USB connector for USB 2.0 communication <ul style="list-style-type: none"> ◦ BG95-M3: Supported data speeds of 1.5Mbps (Low-Speed) and 12Mbps (Full-Speed) • One 8-pin Micro-fit edge connector <ul style="list-style-type: none"> ◦ RS-232 communication ◦ DC Power Supply • One Push-Push SIM card holder <ul style="list-style-type: none"> ◦ 2FF size (link to SIM standard size) ◦ 1.8V only
<p>Environmental</p>	<p>Operating Temperatures</p> <ul style="list-style-type: none"> • -35° C to +75° C
<p>Approvals</p>	<ul style="list-style-type: none"> • Regulatory : FCC, ISED, CE • Industry: PTCRB, GCF • Network Carriers: <ul style="list-style-type: none"> ◦ Tested with AT&T ◦ Tested with T-Mobile ◦ Will work with other standard carriers ◦ Verizon not currently supported

Functional Architecture

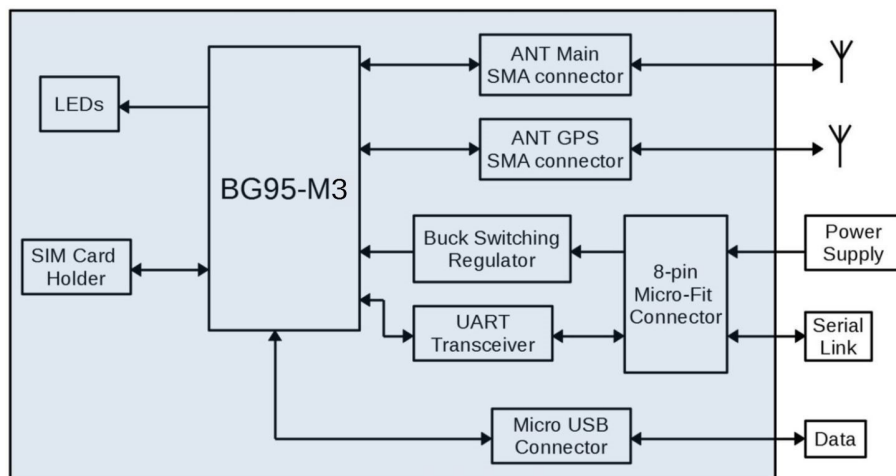


Figure 1: Block diagram for the BG95-M3 variant



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Interfaces

1. 8-pin Micro-Fit Connector

- This connector supplies the device with an external DC power supply within a voltage range of +5VDC to +24VDC and is equipped with internal ESD protection.
- The 8-pin is also the interface for the RS-232 Serial link.
- The UART baud rate maximum is 921600bps with a default of 115200bps.
- Debug UART is set to 115200bps

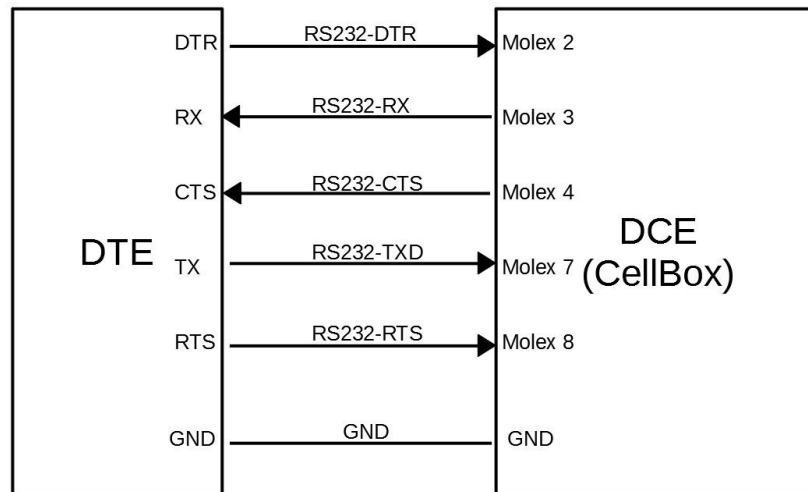


Figure 2: The Serial signal references

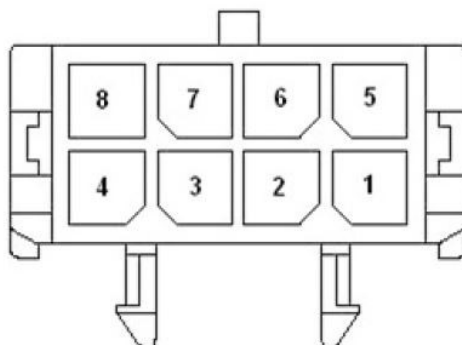


Figure 3: The pin location on the molex connector



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Table 3: The pinout for the 8-pin Micro-Fit connector

Pin #	Signal	I/O	Purpose	Voltage	Description
1	DCIN	I	Power Supply	4.5V to 24V	DC Input
2	RS232-DTR	I	RS232 Serial Communication	-5.5V to 5.5V	Data Terminal Ready
3	RS232-RXD	O	RS232 Serial Communication	-5.5V to 5.5V	Receive Serial Data
4	RS232-CTS	O	RS232 Serial Communication	-5.5V to 5.5V	Clear to Send
5	NC	-	-	-	No Connect
6	GND	GND	Ground	GND	Ground
7	RS232-TXD	I	RS232 Serial Communication	-5.5V to 5.5V	Transmit Serial Data
8	RS232-RTS	I	RS232 Serial Communication	-5.5V to 5.5V	Request to Send

2. Micro USB Connector

- This connector provides a path for data transmission, direct communications with a PC using AT commands, GNSS NMEA output, software debugging, and firmware upgrades. **Note: In order to utilize the USB, the interfacing PC must have the USB drivers provided by Quectel on their website.**
<https://www.quectel.com/product/bg95.htm>
- USB pins
 - Pin 1: +5VDC
 - Pin 2: D-
 - Pin 3: D+
 - Pin 4: No Connect
 - Pin 5: Ground
- The BG95-M3 variant supports full-speed and low-speed

3. SIM

- CellBox is equipped with an externally accessible SIM interface. The interface is protected by internal ESD protection
- SIM type: 2FF Mini
- SIM Insertion type: Push-Push
- SIM pins
 - VCC
 - Reset
 - Clock
 - I/O
 - Detect



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4. RF Interfaces

- Both variants provide an SMA connector for GPS use with an external terminal antenna and are equipped to support an active antenna. The GPS interface has a nominal impedance of 50Ω .
- The BG95-M3 variant provides an SMA connector for LTE Cat-M communication with an external terminal antenna. The RF transmission interface has a nominal impedance of 50Ω .

5. LEDs

- CellBox uses two LEDs to communicate the status of the device.
 - NETLIGHT is tied to a green light. This light indicates the network status.
 - STATUS is tied to a red light. This light indicated that the device is adequately powered and is fully ON.

Getting Started

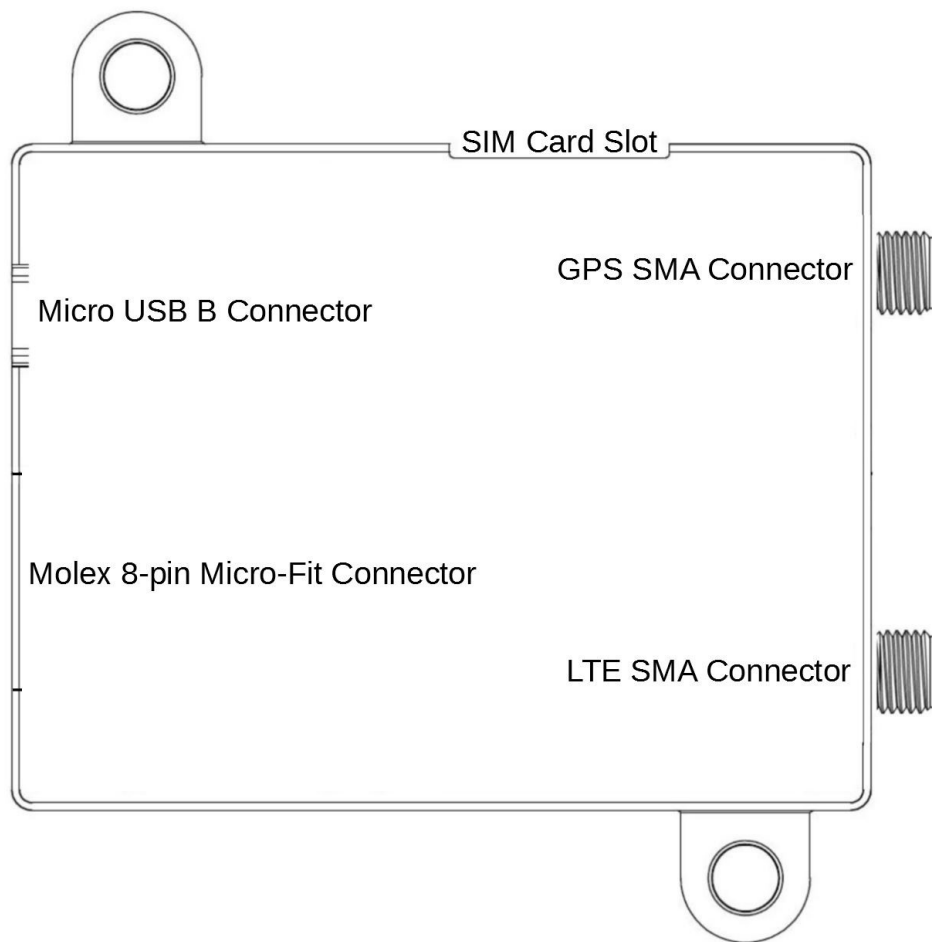


Figure 4: The location of the CellBox connections as seen from above



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- 1)** Insert a 2FF SIM card into the SIM holder. The SIM holder is a push-push type and will lock the SIM card when fully inserted. Push the card into the holder until there is a click.
- 2)** Connect an SMA compatible antenna to the main RF SMA connector. It is recommended that an intermediate coaxial cable is used.
- 3)** For GPS use, connect an SMA compatible antenna to the GPS SMA connector. Note: For GPS use, the set up does not require the LTE antenna(s). The connector is shown in Figure 4.
- 4)** To supply power and for the optional RS232 communication, connect the adaptive cable to the 8-pin Micro-fit connector on the DUT.
Molex connector PN: 0430450800
Pre-made Molex cable assembly PN: 0451320810
- 5)** For USB communication, insert a micro USB into the connector on the device and the other end to a PC/tester. The PC/tester will require the Quectel USB drivers to be installed prior to communications with the device. They can be found at <https://www.quectel.com/product/bg95.htm>.

General AT Commands

Protocol: The “AT” or “at” prefix must be set at the beginning of each command line. To terminate a command line enter <CR>, where <CR> is the carriage return.

For more in depth commands, refer to the Quectel AT commands for the respective module.

- Display product identification information
 - Execute command: **ATI**
 - Response example: **Quectel -> <objectID> -> Revision: <revision> -> OK**
- Request TA Revision Identification of Software Release
 - Execute command: **AT+GMR**
- Request International Mobile Equipment Identity (IMEI)
 - Execute command: **AT+GSN**
- Set all current parameters to manufacturer defaults
 - Execute command: **AT&F**
- Display current configuration
 - Execute command: **AT&V**
- Display SIM card information
 - Execute command: **AT+CIMI**



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Common AT Command errors

Table 5:

Error code	Meaning
501	Invalid parameter(s)
502	Operation not supported
503	GNSS subsystem busy
504	Session is ongoing
507	Function not enabled
516	Not fixed now
549	Unknown error

GNSS

To maintain serial communication with the device and retrieve GPS information simultaneously, the USB interface must be used. With the device setup as shown above, open a terminal program and connect to the port used for serial communication (RS232 connection). This terminal will be used to issue commands and view the device status. The setup for the port is as follows:

Speed: 115200
Data: 8 bit
Parity: none
Stop bits: 1 bit
Flow control: none

Then, connect a USB cable from the device to the PC and open another terminal window. This window should connect to the port called: "USB NMEA Port." This terminal will output NMEA data while the GPS is active. The setup for this port is the same as for the serial communications port.

AT Commands:

For more commands, refer to the GNSS AT command manual for the Quectel module of interest.

- Turn on the GNSS
 - Execute command: **AT+QGPS=1**
 - Response: **OK**
- Activate the active antenna
 - Execute command: **AT+QCFG="GPIO",**
- Obtain positioning information
 - Execute command: **AT+QGPSLOC?**
 - Response: **+QGPSLOC: <location>**
 - Location returned in latitude and longitude



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- Acquisition of NMEA sentences by first enabling acquisition, then obtaining
 - Execute command: **AT+QGPSCFG="nmeasrc",1**
 - Response: **OK**
 - Execute command: **AT+QGPSGNMEA="GGA"**
 - Response: **+QGPSGNMEA: <GGA sentence>**
- Turn off the GNSS
 - Execute command: **AT+QGPSEND**
 - Response: **OK**

Regulatory Information

FCC ID and IC Number

Device	FCC ID	ISED Number
BG95-M3 Variant	XMR201910BG95M3	10224A-2019BG95M3

Mechanical Details

Mechanical Drawings

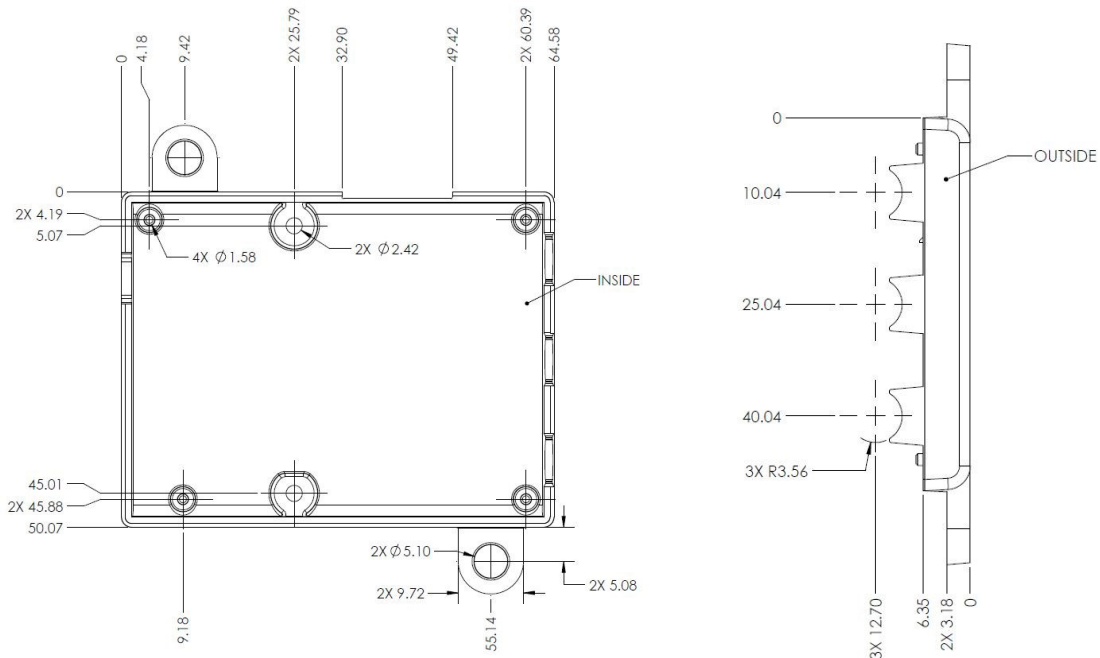


Figure 8: The base of the enclosure



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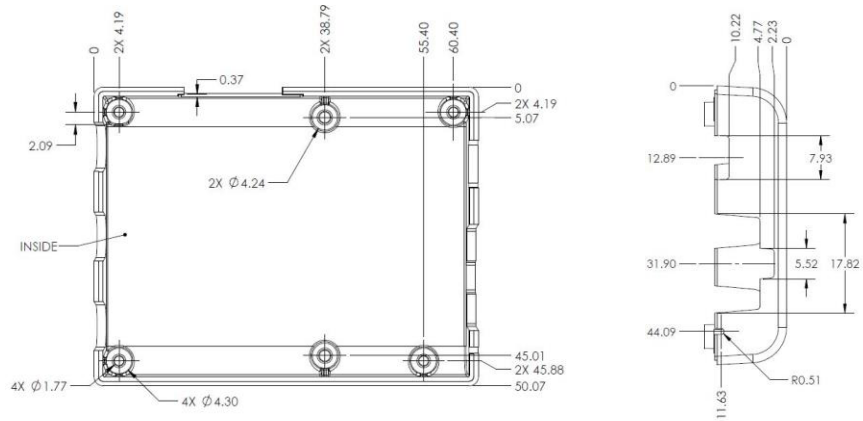


Figure 9: The cover of the enclosure