MODEM LTE CAT NB2/MTC & GNSS

BG95-M2/M3 Modem – Daughterboard - User Manual

Purpose of the Document

The purpose of this document is to explain the technical specifications and manual for using the Cat NB2 NB-IoT & GNSS modem daugther board.

Document History

Version	Author	Date	Description
A	5G HUB	01.29.2025	Initial Document

Table of Contents

1 Package contents:

1.1 Cat NB2 NB-IoT USB Modem Package:

- Daughterboard for the Cat NB2/Cat M modem with LTE & GNSS antenna connectors.

1.2 Download

Arduino software can be downloaded from the following website:
https://github.com/5ghub/stm32

To use the board with Arduino IDE and start running Arduino projects and sketches, install the following software:

Install Arduino IDE for Windows from the following web site
https://www.arduino.cc/en/Main/Software

Download and Install LTE&GNSS modem driver for Windows OS:
https://github.com/5ghub/5G-NB-IoT/tree/master/Driver

Download and Install QNavigator and QCOM tools for Quectel BG95 here:
https://github.com/5ghub/5G-NB-IoT/tree/master/Tools

All the following software can be installed from the GitHub location here:
https://github.com/5ghub/stm32

LTE cellular connectivity on Windows OS for BG95

2 General Description

2.1 Overview

The Cat NB2 modem is a cellular and GPS daughterboard. The daughterboard has UFL connectors for LTE & GNSS antennas. The board is a powerful board that features a wireless modem. The wireless modem is BG95-M3 which is an embedded Cat NB2 wireless communication module. BG95 wireless modem provides a maximum data rate of 588 Kbps downlink and 1119 Kbps uplink. It provides data connectivity on LTE-FDD/GSM/EGPRS networks. It also provides GNSS to meet customers' specific application demands

The USB modem provides rich sets of Internet protocols, industry-standard interfaces (USB/UART/I^{2}C/Status Indicator) and abundant functionalities. The board offer a high integration level and enables integrators and developers to easily design their applications and take advantage of the board low power consumption, many functionalities, and USB drivers for Windows 7/8/8.1/10, Linux and Android.

The daughterboard works with STM32 MCU motherboard as USB dongle. The motherboard can be used as a standalone STM23 board. The motherboard USB is designed as a compact and complete development platform for STMicroelectronics ARM cortex-M0 core-based STM32F072C8T6 microcontroller with I2C, SPI, USART, CAN, 12-bit ADC, 12-bit DAC, GP comparators, internal 16KB SRAM and 128KB Flash, USB FS, Touch sensing, SWD debugging support.

The daughterboard is a rich hardware board that can be used for the 4G LTE wireless technology and enables a variety of smart applications for devices. It enables large number of applications such as wireless POS, smart metering, tracking, smart transportation, smart buildings, smart city, and smart homes.

The board is also compatible with Arduino and Arduino software (IDE). Arduino sketches and examples are provided with the kit and additional sketches can be developed and uploaded to the board.

2.2 Key Features

- Works with the STM32F072C8T6 MCU Motherboard
- Daughterboard has Quectel BG95-M3 Cat NB2/Cat M NB-IoT module
- UFL connectors for LTE & GNSS antenna
- Supports LTE NB-IoT and Machine Type Communications (MTC)
- Supports GSM/EDGE (only with BG95-M3)
- Global Frequency Band B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B28/B66/B71/B85 (B26/B27 for Cat.M1) for LTE and 850/900/1800/1900MHz for EGPRS
- Supports the protocols TCP/UDP/PPP/ SSL/ TLS/ FTP(S)/ HTTP(S)/ NITZ/ PING/ MQTT
- Supports SMS
- Supports GNSS technology (GPS, GLONASS, BeiDou/Compass, Galileo, QZSS)
- Compact board size of 65.1 mm x 32mm
- Nano USIM card slot
- Arduino IDE Compatible
- Works with Windows, Linux, or Android
- Ready for smart applications and development (smart home, smart city, smart transportation, smart metering, smart farming, smart waste management, asset tracking, location, navigation,

mapping, and timing applications). Applications such as Gas Detector, Soil PH Tester, Optical Sensor, Machinery Alarm System, Irrigation Controller, Elevator, Asset Tracking Electronics, Person/Pet Tracking, Water/Gas Metering, Smart Parking System, Fire Hydrant, Smoke Alarm, Trash Bin, Street Lighting

- The board can be powered via the USB connector

2.3 Overview Diagrams

Figure 1. Daughterboard Overview Diagram

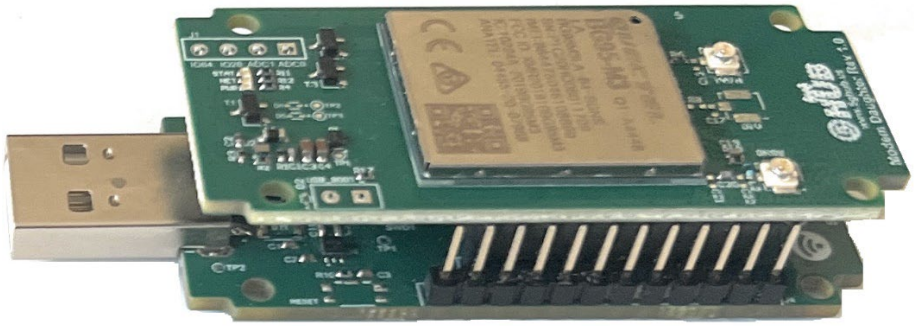


Figure 2. Daughterboard integrated with the STM32 Motherboard

2.4 Physical Characteristics

The width and length of the USB modem is 32 mm (width) by 65 mm (length). The board have two screw holes in each corner that allows the board to be attached to a surface or case.

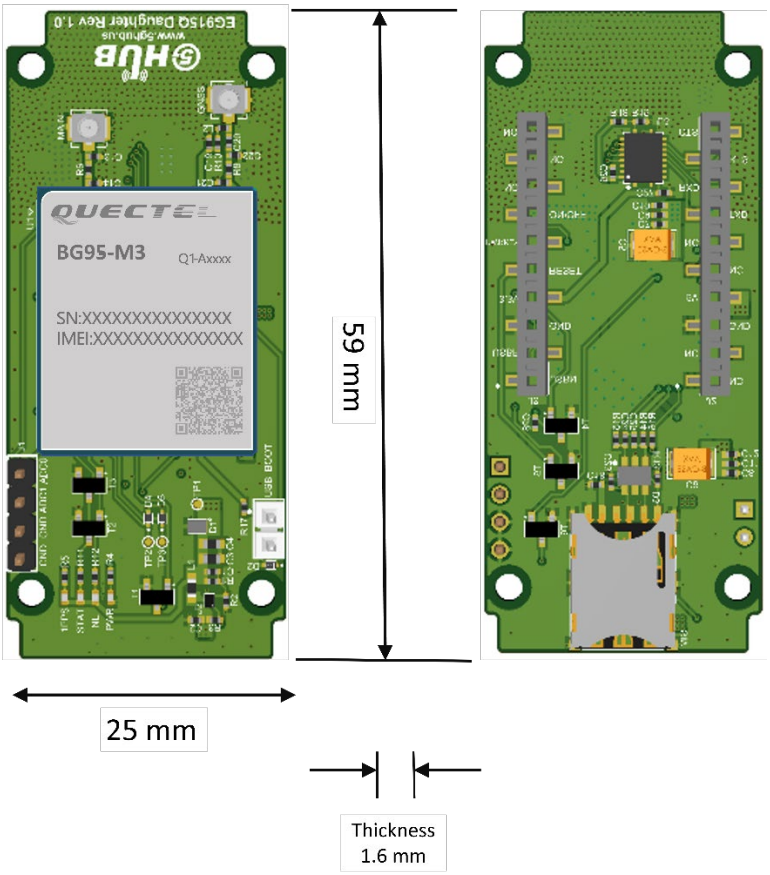


Figure 3. Physical Characteristics.

2.5 Daughterboard – Key Components

Figure 4. Daughterboard Top Side – Key Components

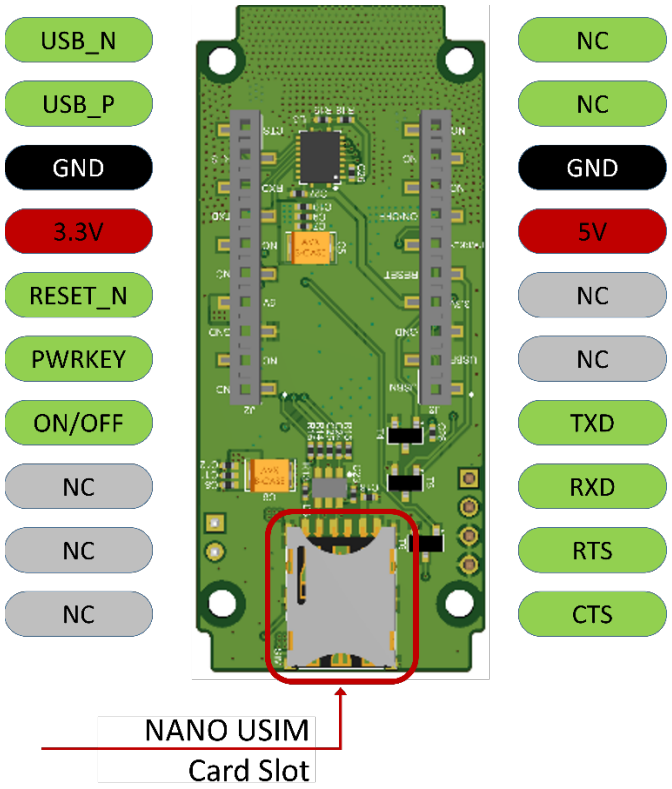


Figure 5. Daughterboard Bottom Side – Key Components

2.6 Hardware Specification

Technical Specification	
NB-IoT Module	Quectel BG95-M2 or BG95-M2
Dimension	25 mm (width) by 59 mm (length)
Weight	20 grams
Power Supply	From Motherboard
LED	PWR, NET, STATUS
Interfacing Logic Voltage Level (Operating Voltage)	3.3V
USB Switch (Motherboard)	1 switch to connect to MCU directly or BG95 directly
ADC	2 connected to BG95
USB	1 (Connected to Motherboard)
UART	1
USIM	Nano
GNSS	GPS, GLONASS, BeiDou/Compass, Galileo, QZSS
Antenna	1 main antenna and 1 GNSS antenna
Band	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B28/B66/B71/B85 (B26/B27 for Cat.M1) GSM/EGPR: 850/900/1800/1900MHz
Certification	FCC, IC, CE
Mobile Operator Certification	Verizon, AT&T, T-Mobile, Vodafone, Rogers, Telus, China telecom, China Mobile, China Unicom

2.7 PIN Description

PIN	STM32 pin	DIRECTION	Description
USB Connector	PA11 PA12	I/O	The USB modem is powered from the USB port (3.8V-5V) (Connected to Motherboard)
LED1 (Power)	-	O	LED which is ON when power supplied is supplied to the BG95-M3 daughterboard
LED (NET)	-	O	Indicate the BG95 operation status
LED (STAT)	-	O	Indicate the BG95 network activity status
USB Switch	-	I	1 switch to connect to MCU directly or BG95 directly
GND	-		Ground
ADC0	-	I	Connected to BG95. General purpose analogue to digital converter
ADC1	-	I	Connected to BG95. General purpose analogue to digital converter
TXD	PA0	O	UART connected between STM32 MCU and BG95 modem
RXD	PA1	I	UART connected between STM32 MCU and BG95 modem
CTS	PB7	I	UART connected between STM32 MCU and BG95 modem
RTS	PA15	O	UART connected between STM32 MCU and BG95 modem
RESET_N	PB2	O	Reset BG96
PWRKEY	PB15	O	Power On/Off BG95
ON/OFF	PB12	O	Power On/Off BG95
USIM	-	I	Used to insert a Nano USIM. Connected to BG95
USB Boot	-	I	Connected to BG95. Force the BG95 to enter emergency download mode (Not mounted)

3 Using the Board with Arduino IDE

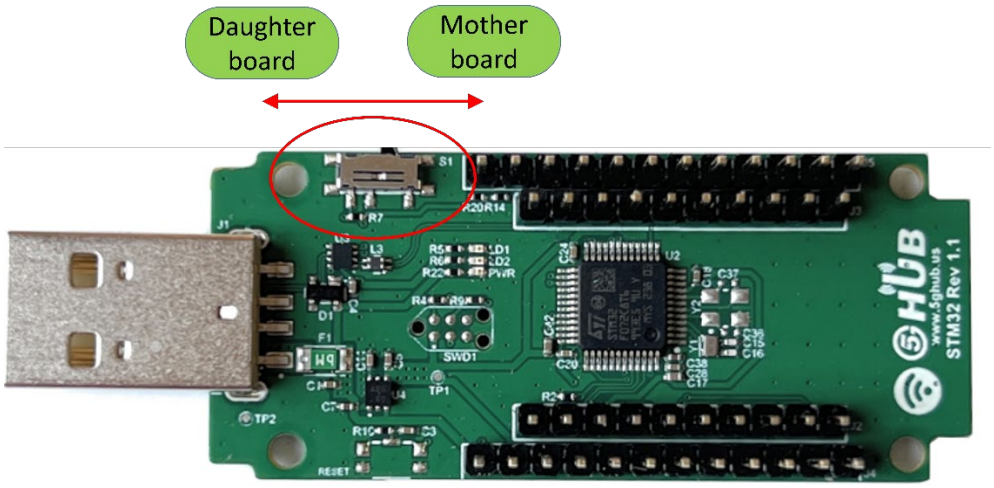
3.1 Installing the Software

To use the board with Arduino IDE and start running Arduino projects and sketches, install the following software:

3.2 Setting Up the Motherboard

Gently move the switch S1 left or right to make the USB port either connect to Motherboard (STM32) or daughterboard (BG95).

Follow the procedure in the STM32 user manual to upload STM32 bootloader and make the motherboard functioning.



3.3 **Connecting the USB Connector to the BG95 Modem**

Toggle the S1 switch to the daughterboard position, and then plugin the motherboard and daughterboard into a USB port. Windows detects the BG95 board, and it shows as seen below.