BC95-GR-TE-B
User Guide

NB-IoT Module Series

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About the Document

Revision History

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-	2020-11-10	Glenn GE/ Jerry WANG	Creation of the document
1.0	2020-11-17	Glenn GE/ Jerry WANG	First official release

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1 Introduction

To help you develop applications with Quectel BC95-GR module conveniently, Quectel supplies a corresponding development board (BC95-GR-TE-B) to test the module. This document helps you quickly understand BC95-GR-TE-B interface specifications, electrical and mechanical details and know how to use it.

1.1. Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating the module. Manufacturers of the cellular terminal should notify users and operating personnel of the following safety information by incorporating these guidelines into all manuals of the product. Otherwise, Quectel assumes no liability for customers' failure to comply with these precautions.

	Full attention must be paid to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.
	Switch off the cellular terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If there is an Airplane Mode, it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on an aircraft.
	Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.
	Cellular terminals or mobiles operating over radio signal and cellular network cannot be guaranteed to connect in certain conditions, such as when the mobile bill is unpaid or the (U)SIM card is invalid. When emergency help is needed in such conditions, use emergency call if the device supports it. In order to make or receive a call, the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength. In an emergency, the device with emergency call function cannot be used as the only contact method considering network connection cannot be guaranteed under all circumstances.
	The cellular terminal or mobile contains a transceiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.
	In locations with explosive or potentially explosive atmospheres, obey all posted signs and turn off wireless devices such as mobile phone or other cellular terminals. Areas with explosive or potentially explosive atmospheres include fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles such as grain, dust or metal powders.

2 Product Concept

BC95-GR-TE-B is an NB-IoT development board which supports Arduino interfaces. Designed in 70.0 mm × 74.0 mm × 1.6 mm form factor, BC95-GR-TE-B can be used to develop and debug applications which communicate with mobile network operators' infrastructure equipment through NB-IoT radio protocols (3GPP Rel-13 and Rel-14).

2.1. Key Features

Table 1: Key Features of BC95-GR-TE-B

Features	Details
Power Supply	**USB interface:** Supply voltage: 4.75-5.25 V Typical supply voltage: 5.0 V **Arduino interface:** Supply voltage: 4.75-5.25 V Typical supply voltage: 5.0 V **External power supply interface:** Supply voltage: 5.0 V
Transmitting Power	23 dBm ±2 dB
Temperature Range	● Operating temperature: -25 °C to +75 °C [1] ● Extended temperature: -40 °C to +85 °C [2] ● Storage temperature: -40 °C to +90 °C
USIM Interface	Supports 1.8/3.0 V external USIM card
UART Switch	Switches communication objects of the main UART of the BC95-GR module
USB-UART Interface	Currently supports two UART ports: **Main UART (USB Serial Converter A):** ● Transmits data (including AT commands) ● The default baud rate is 9600 bps **Debug UART (USB Serial Converter C):** ● Obtains underlying logs through software debugging with CoolWatcher, a debugging tool

	● Upgrades software with QFlash
	● The default baud rate is 921600 bps
Arduino Interfaces	Connect with STM32 Nucleo-64 development board
RESET Button	Resets the BC95-GR module
Physical Characteristics	Size: (70.0 ±0.15) mm × (74.0 ±0.15) mm × (1.6 ±0.15) mm
Firmware Upgrade	Upgrades firmware via Debug UART and DFOTA
Antenna Interface	Connects to an antenna pad with 50 Ω impedance control
SMS*	Text and PDU mode

NOTES

1. [1] Within the operating temperature range, the module meets 3GPP specifications.
2. [2] Within the extended temperature range, the module keeps the ability to establish and maintain functions such as SMS and data transmission, without any unrecoverable malfunction. Radio spectrum and radio network will not be influenced, while one or more specifications, such as P_{out}, may undergo a reduction in value, exceeding the specified tolerances of 3GPP. When the temperature returns to the operating temperature range, the module will meet 3GPP specifications again.
3. "*" means under development.

2.2. Functional Diagram

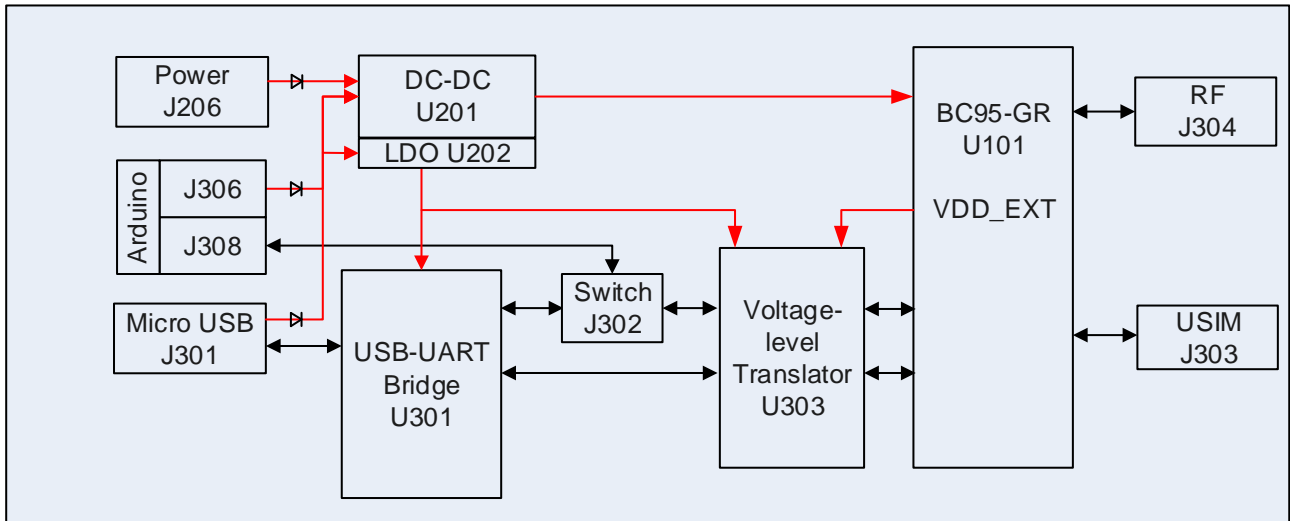The following figure shows the functional diagram of BC95-GR-TE-B.

Figure 1: Functional Diagram of BC95-GR-TE-B

2.3. Interface Distribution Diagram

The following figure shows the interface distribution diagram of BC95-GR-TE-B.
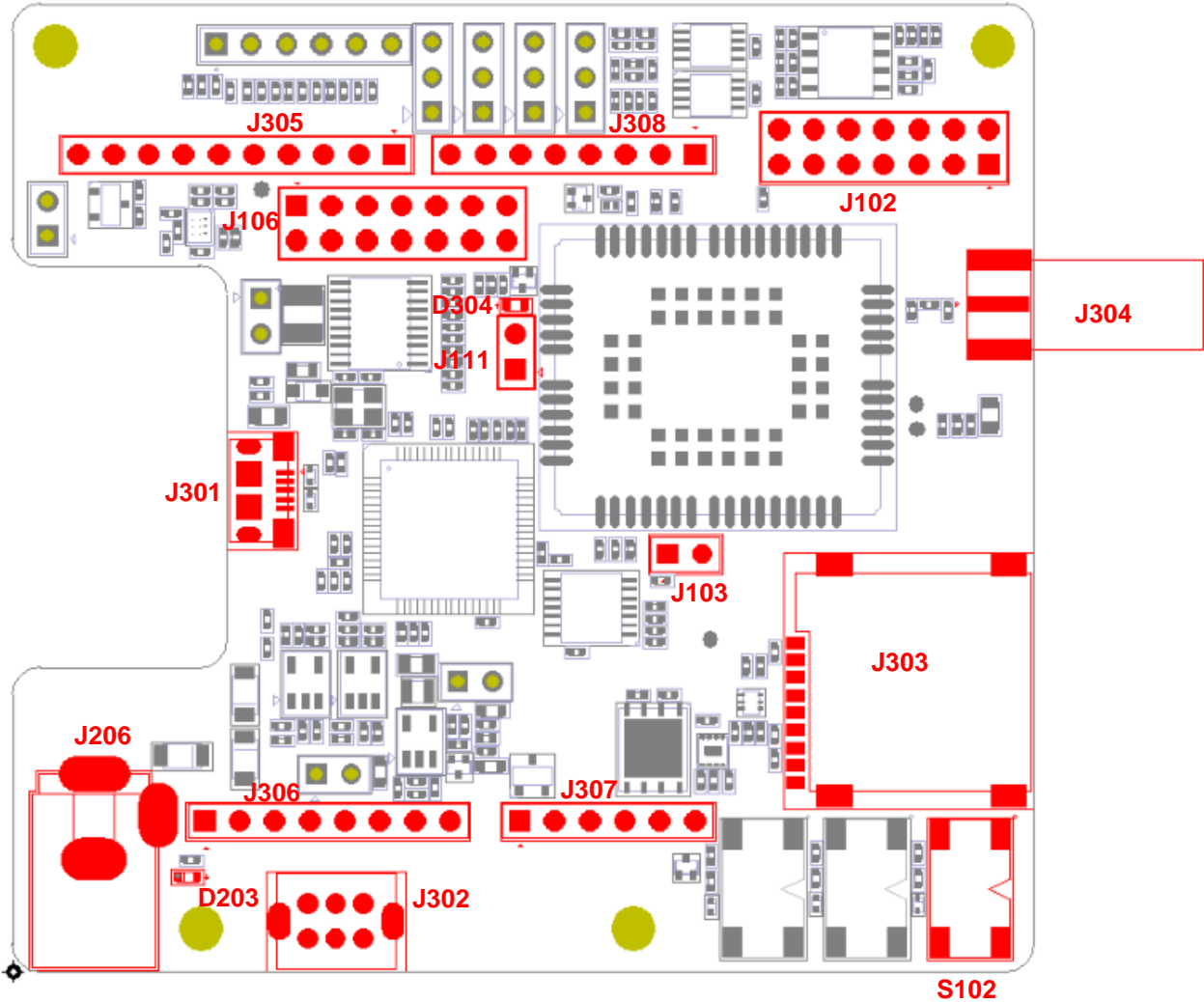

Figure 2: Interface Distribution Diagram of BC95-GR-TE-B

The table below lists the interfaces of BC95-GR-TE-B with descriptions.

Table 2: Interfaces of BC95-GR-TE-B

Interface	Reference No.	Description
Power Supply Interfaces	J301	USB power supply interface
	J306	Arduino power supply interface

	J206	External power supply interface
USB-UART Interface	J301	Supports two UART ports
USIM Interface	J303	Micro USIM card connector
Arduino Interfaces	J305, J306, J307, J308	Standard Arduino interfaces
RF Antenna Interface	J304	RF SMA connector
UART Switch	J302	Switches the communication objects of BC95-GR's main UART: "MAIN UART TO USB" or "MAIN UART TO MCU"
RESET Button	S102	Resets the BC95-GR module
Power Indicator	D203	Indicates the power status
Network Indicator	D304	Indicates the network status
Test Points	J102, J103, J106, J111	Test the basic functionalities of the BC95-GR module

2.4. Arduino Interface Definition

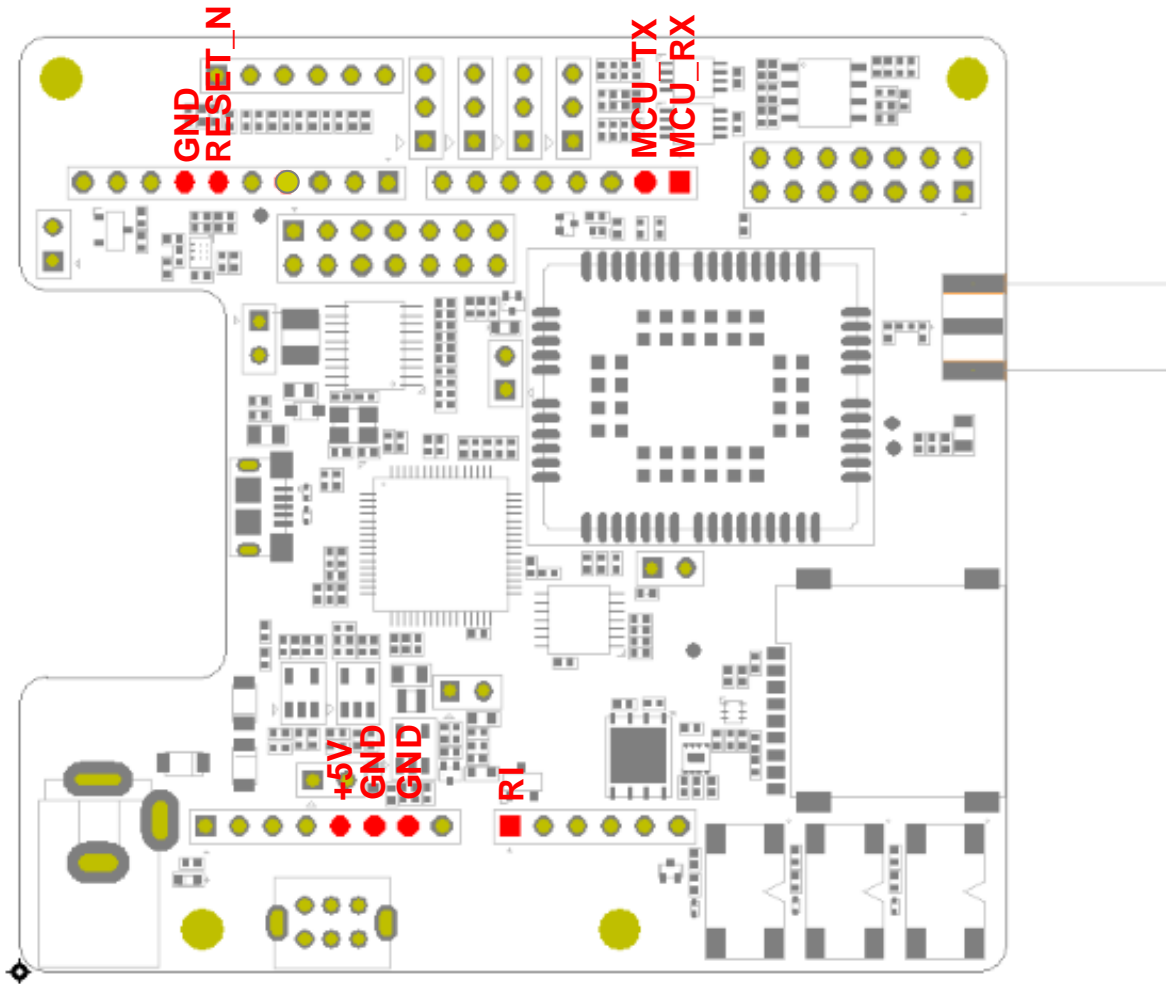The following figure shows the Arduino interface definition of BC95-GR-TE-B.

Figure 3: Arduino Interface Definition

3 Operating Procedures

This Chapter mainly illustrates the two operating procedures of BC95-GR-TE-B:

- You can use BC95-GR-TE-B alone to upgrade firmware and debug BC95-GR-based NB-IoT applications;
- You can also use it together with an STM32 Nucleo-64 development board via the Arduino interface to develop STM32-based NB-IoT applications.

3.1. Single Board

This section elaborates the operating procedure of using the BC95-GR-TE-B alone.
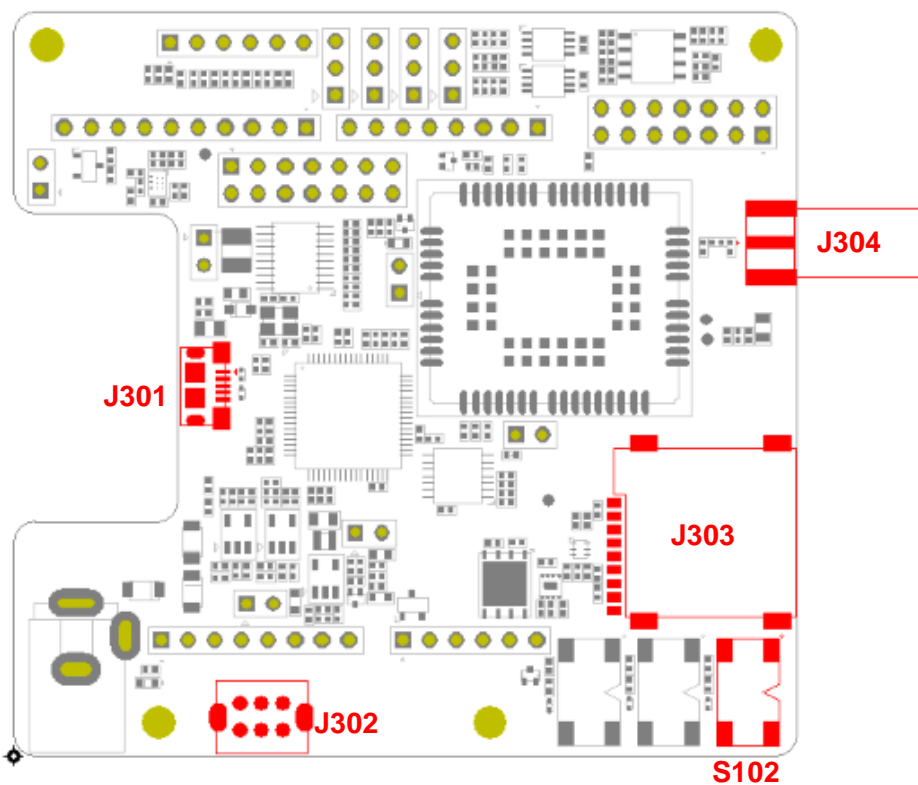
3.1.1. Interface Diagram

Figure 4: Interface Diagram of Using BC95-GR-TE-B Alone

3.1.2. Operating Procedure

1. Install a USB-UART driver. You can download it from the following address:
   http://www.ftdichip.com/Drivers/VCP.htm .
2. Insert a Micro USIM card into J303, and choose an appropriate USIM card according to different hardware versions of the BC95-GR module.
3. Connect a rod antenna with the SMA connector on J304 (RF antenna connector).
4. Switch J302 (UART Switch) to "MAIN UART TO USB" state.
5. Connect J301 to a PC via a Micro USB cable. When BC95-GR-TE-B is connected to the computer, UART information is shown on the "Device Manager" of the PC. "USB Serial Port (COM154)" (corresponding to "USB Serial Converter A") is connected to the main UART of BC95-GR and can be used for AT command communication and data transmission. "USB Serial Port (COM156)" (corresponding to "USB Serial Converter C") is connected to the debug UART of BC95-GR and can be used for debugging, debug log output and firmware upgrade. For details of port configuration, see *document [1]*.

Figure 5: UART Ports Displayed on PC

NOTE

In this procedure, you can use S102 to reset the module.

3.2. Multi-boards

This section elaborates the operating procedure of using the BC95-GR-TE-B in conjunction with an STM32 Nucleo-64 development board.
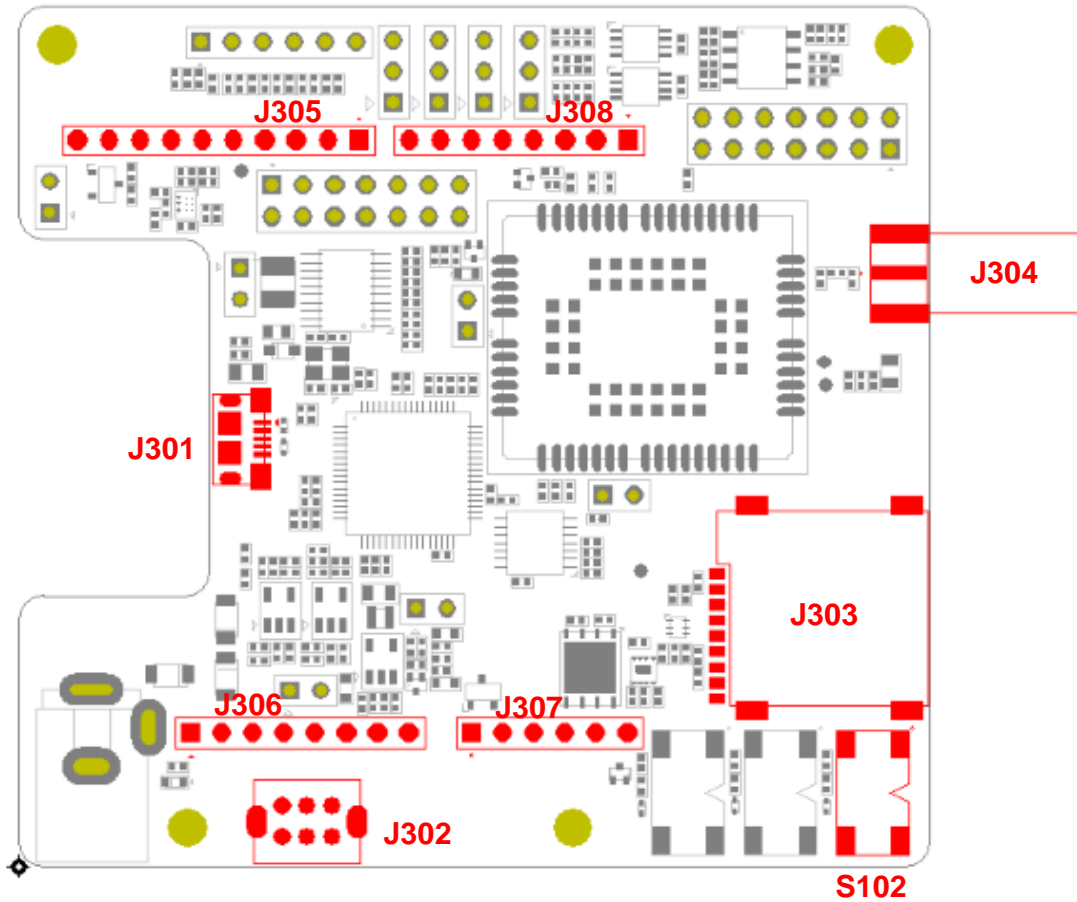
3.2.1. Interface Diagram
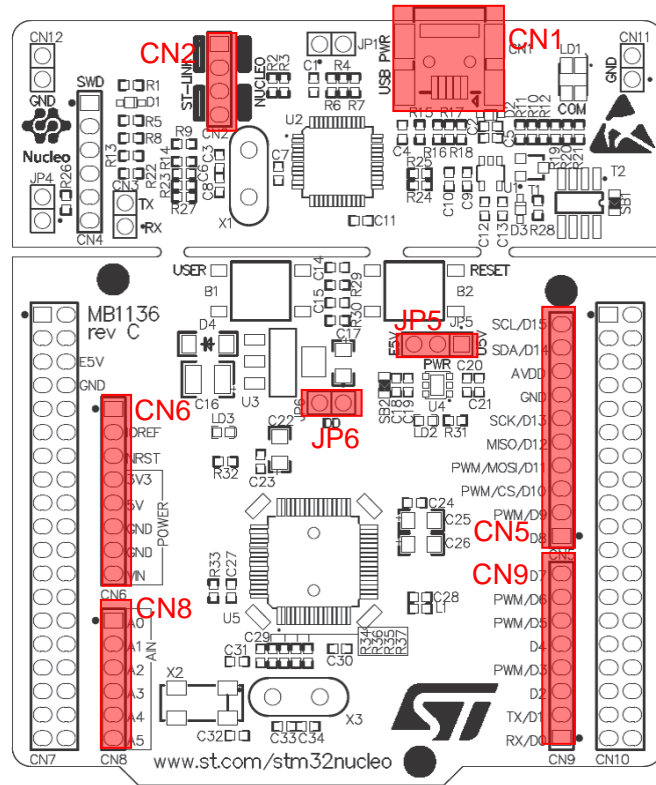

Figure 6: Interface Diagram of Using Multi-boards

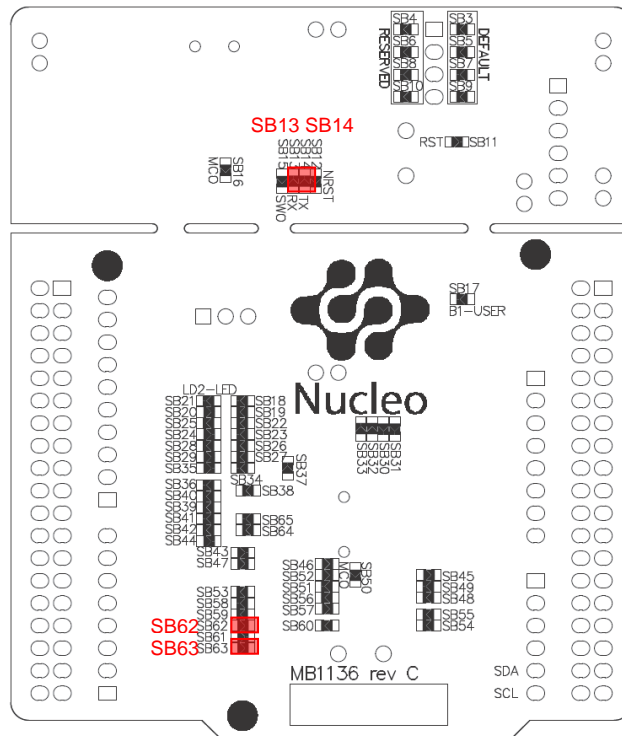**Figure 7: STM32 Nucleo-64 Interface Diagram (Top View)**

Figure 8: STM32 Nucleo-64 Modification Diagram (Bottom View)

3.2.2. Operating Procedure

1. Install a driver for the STM32 Nucleo-64 development board. You can download it from the following address:
http://www.st.com/content/st_com/en/products/evaluation-tools/product-evaluation-tools/mcu-eval-tools/stm32-mcu-eval-tools/stm32-mcu-nucleo/nucleo-l476rg.html.

2. Install a USB-UART driver. You can download it from the following address:
http://www.ftdichip.com/Drivers/VCP.htm .

3. Remove two 0-ohm resistors of SB13 and SB14 with soldering iron, and solder them onto SB62 and SB63 respectively.

4. Short-circuit pin 1 and pin 2 of CN2, pin 3 and pin 4 of CN2, pin 1 and pin 2 of JP5, and pin 1 and pin 2 of JP6 respectively.

5. Insert a Micro USIM card into J303, and choose an appropriate USIM card according to hardware versions of BC95-GR module.

6. Connect a rod antenna with SMA connector on J304 (RF antenna connector).

7. Switch J302 (UART Switch) to the "MAIN UART TO MCU" state.

8. Connect the Arduino interfaces to the STM32 Nucleo-64 development board by connecting J305, J306, J307 and J308 of BC95-GR-TE-B to CN5, CN6, CN8 and CN9 respectively.

9. Connect CN1 of the STM32 Nucleo-64 development board to a PC via a Mini USB cable. When the BC95-GR module is powered on, device information is shown on the "Device Manager" of the PC.
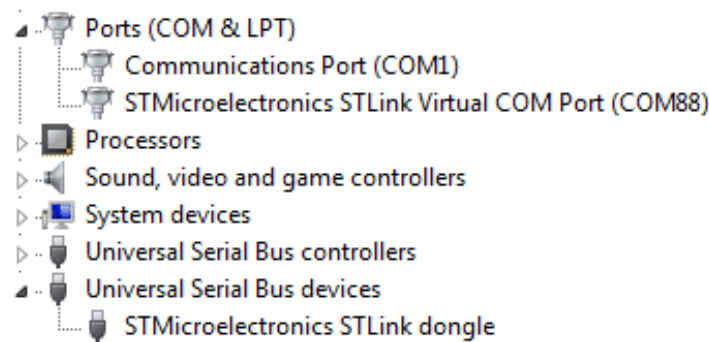
Figure 9: ST-LINK Interface Displayed on PC

3.2.3. Description of Pin Connection

The table below shows the pin connection between BC95-GR-TE-B and STM32-L476RG MCU.

Table 3: Pin Connection Between BC95-GR-TE-B and STM32-L476RG MCU

No.	MCU (Morpho)	Arduino		BC95-GR-TE-B	Description
1	PA2	D1	CN9-2	MCU_TX	Connects to the RX of the main UART

2	PA3	D0	CN9-1	MCU_RX	Connects to the TX of the main UART
3	PA5	D13	CN5-6	RESET_N	Active high
4	PA0	A0	CN8-1	RI	Ring indication signal
5	+5 V	+5 V	CN6-5	+5 V	5.0 V power supply
6	GND	GND	CN5-7, CN6-6, CN6-7	GND	Ground

The following figure shows the pin connection between BC95-GR-TE-B and STM32-L476RG MCU.
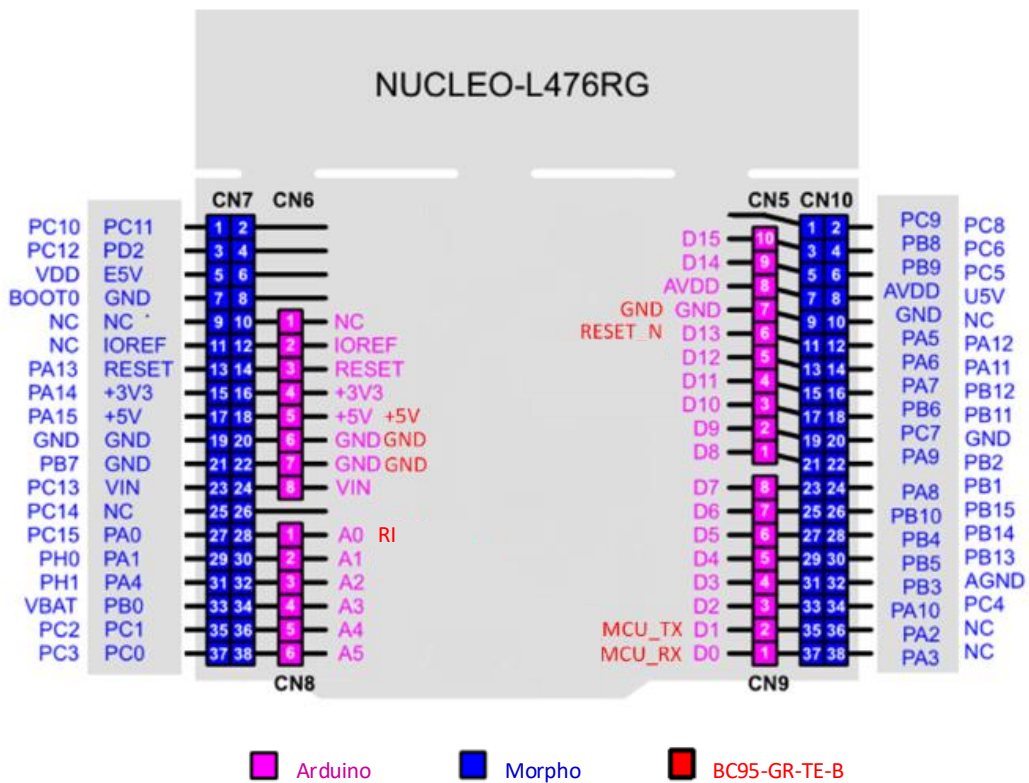

Figure 10: Pin Connection Between BC95-GR-TE-B and STM32-L476RG MCU

4 Electrical Performance & Reliability

4.1. Absolute Maximum Ratings

Absolute maximum ratings for power supply and voltage on digital and analog pins of the BC95-GR module are listed in the following table.

Table 4: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
VBAT	0	+4.35	V
Voltage at Digital Pins	TBD	3.2	V
Voltage at Analog Pins	TBD	1.8	V

4.2. Operating and Storage Temperatures

Table 5: Operating and Storage Temperatures

Parameter	Min.	Typ.	Max.	Unit
Operating Temperature [1]	-25	+25	+75	ºC
Extended Temperature [2]	-40		+85	ºC
Storage Temperature	-40		+90	ºC

NOTES

1. [1] Within the operating temperature range, the module meets 3GPP specifications.
2. [2] Within the extended temperature range, the module keeps the ability to establish and maintain

functions such as SMS and data transmission, without any unrecoverable malfunction. Radio spectrum and radio network will not be influenced, while one or more specifications, such as P_{out}, may undergo a reduction in value, exceeding the specified tolerances of 3GPP. When the temperature returns to the operating temperature range, the module will meet 3GPP specifications again.

5 Mechanical Dimensions

This Chapter describes the mechanical dimensions of BC95-GR-TE-B. All dimensions are measured in mm. The tolerances for dimensions are ±0.15 mm.

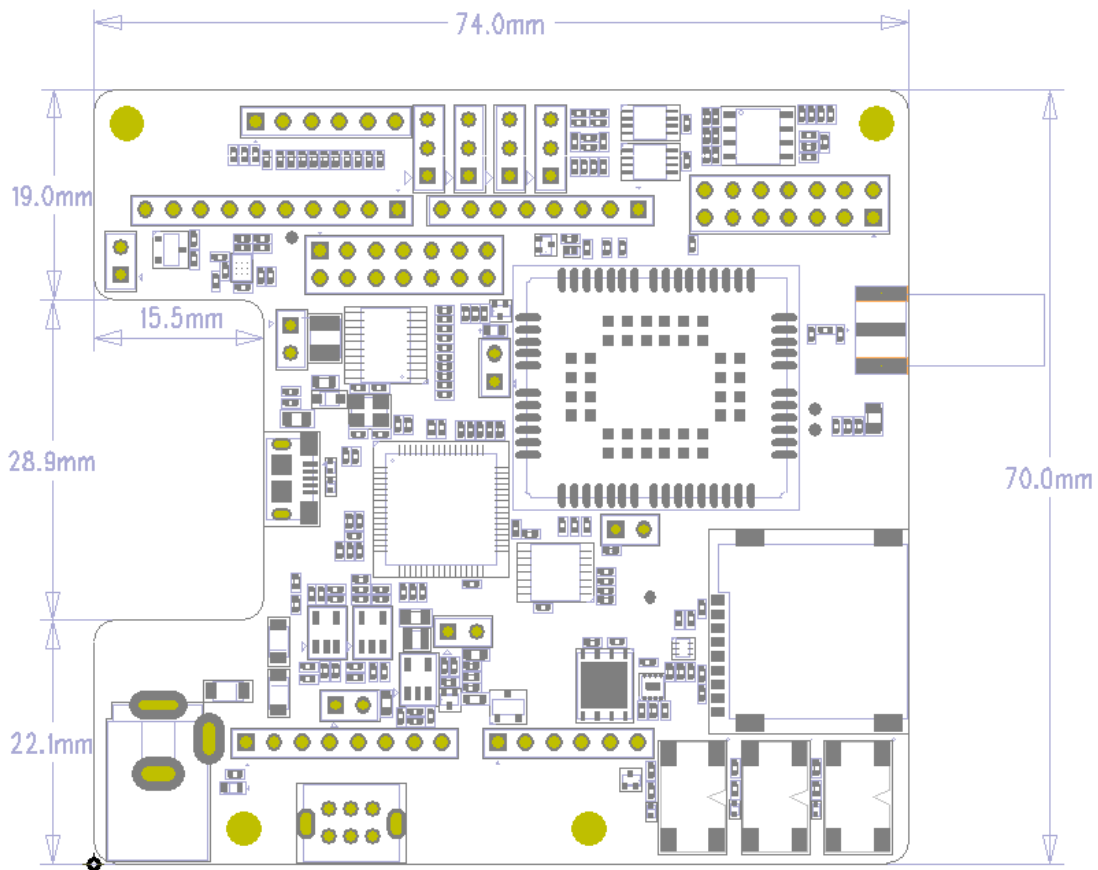## 5.1. Mechanical Dimensions of BC95-GR-TE-B

Figure 11: Dimensions of BC95-GR-TE-B (Top View)
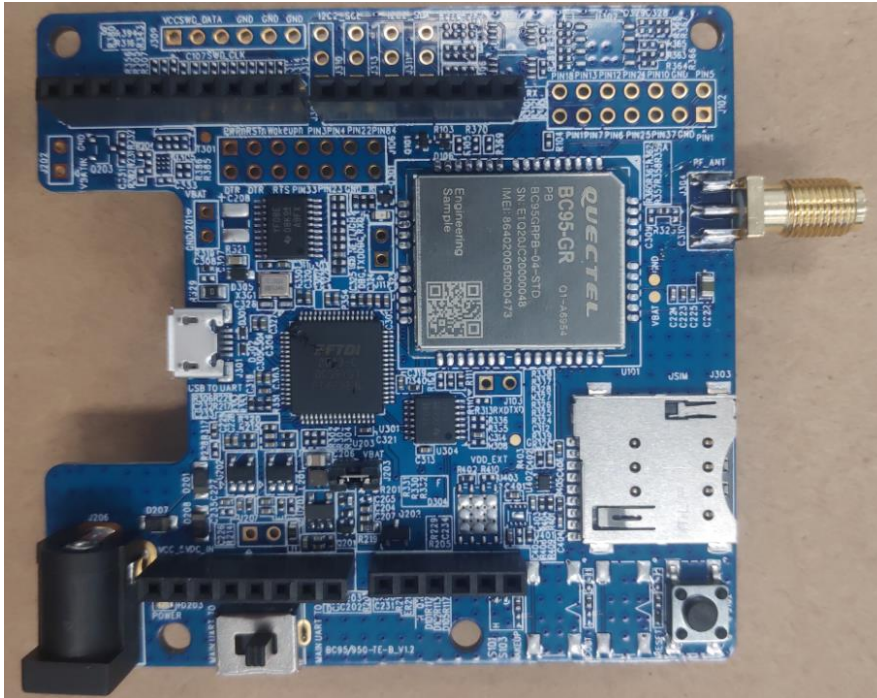
5.2. Top and Bottom Views of BC95-GR-TE-B
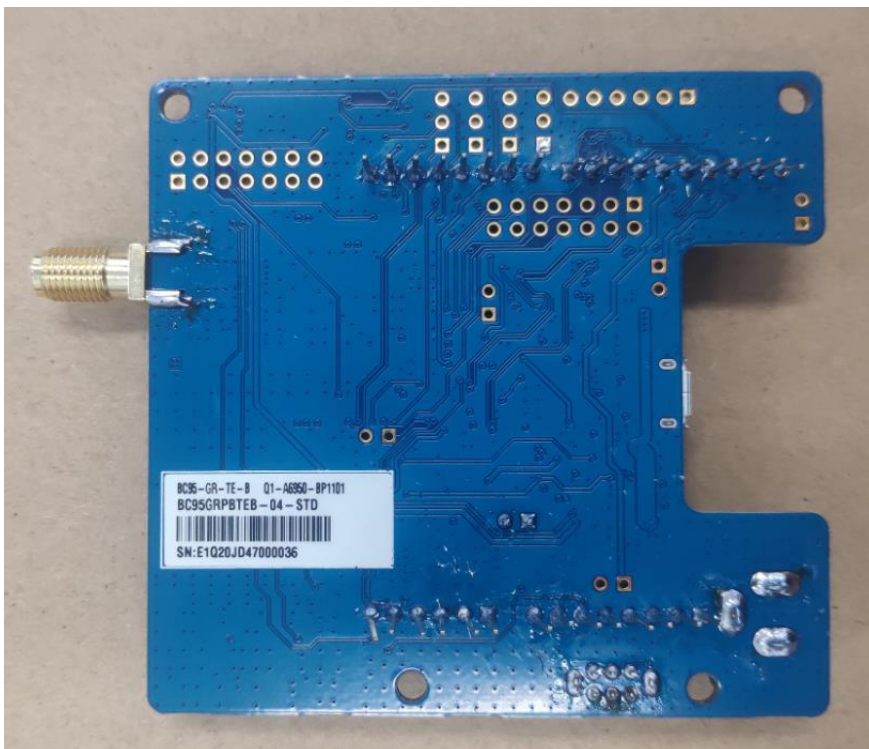

Figure 12: Top View of BC95-GR-TE-B

Figure 13: Bottom View of BC95-GR-TE-B

6 BC95-GR-TE-B Kit and Accessories

6.1. BC95-GR-TE-B Kit

Figure 14: BC95-GR-TE-B Kit Assembly

6.2. BC95-GR-TE-B Kit Accessories

Figure 15: BC95-GR-TE-B and Accessories

Table 6: Accessories List

Item	Description	Quantity
Antenna	NB-IoT antenna with SMA connector	1
Cable	Micro USB cable	1
Instruction Sheet	Describes BC95-GR-TE-B connection, details of accessories, etc.	1

7 Appendix References

Table 7: Related Document

No.	Document Name	Description
[1]	Quectel_BC95-GR_Hardware_Design	The hardware design of Quectel BC95-GR module

Table 8: Terms and Abbreviations

Abbreviation	Description
3GPP	3rd Generation Partnership Project
3GPP Rel-13	3GPP Release 13
3GPP Rel-14	3GPP Release 14
bps	Bit(s) Per Second
dBm	Decibel Relative to One Milliwatt
DFOTA	Delta Firmware Upgrade Over-the-air
LED	Light Emitting Diode
LPWA	Low-Power Wide-Area
MCU	Microcontroller Unit
NB-IoT	Narrow Band Internet of Things
PC	Personal Computer
RF	Radio Frequency
SMA	SubMiniature Version A
SMS	Short Message Service

TBD	To Be Determined
UART	Universal Asynchronous Receiver & Transmitter
USB	Universal Serial Bus
USIM	Universal Subscriber Identification Module