

BC66-TE-B User Guide

NB-IoT Module Series

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About the Document

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1 Introduction

In order to help customers develop applications with Quectel BC66 module conveniently, Quectel supplies corresponding development board (BC66-TE-B) to test the module. This document can help customers quickly understand BC66-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 BC66 module. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel, and incorporate these guidelines into all manuals supplied with the product. If not so, Quectel assumes no liability for customers' failure to comply with these precautions.



Full attention must be given 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 the device offers an Airplane Mode, then it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on boarding the 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 signals and cellular network cannot be guaranteed to connect in all possible conditions (for example, with unpaid bills or with an invalid (U)SIM card). When emergent help is needed in such conditions, please remember using emergency call. 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.



The cellular terminal or mobile contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV set, radio, computer or other electric equipment.



In locations with potentially explosive atmospheres, obey all posted signs to turn off wireless devices such as your phone or other cellular terminals. Areas with potentially explosive atmospheres include fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles such as grain, dust or metal powders, etc.

2 Product Concept

BC66-TE-B is a NB-IoT development board which supports Arduino interface. Designed in 70.0mm × 74.0mm × 1.6mm form factor, BC66-TE-B can be used either alone or in conjunction with STM32 Nucleo-64 development board, so as to develop and debug applications which communicate with infrastructures of mobile network operators through NB-IoT radio protocols in 3GPP Rel. 13.

2.1. Key Features

The following table describes the detailed features of BC66-TE-B.

Table 1: Key Features of BC66-TE-B

Feature	Details
Power Supply	<p>USB interface: Supply voltage range: 4.75V~5.25V Typical supply voltage: 5.0V</p> <p>Arduino interface: Supply voltage range: 4.75V~5.25V Typical supply voltage: 5.0V</p>
Transmitting Power	23dBm±2dB
Temperature Range	<p>Operation temperature range: -35°C ~ +75°C ¹⁾</p> <p>Extended temperature range: -40°C ~ +85°C ²⁾</p> <p>Storage temperature range: -40°C ~ +90°C</p>
USIM Interface	Support 1.8V external USIM card
UART Switch	Used to switch the communication object of BC66 main UART port
USB Interface	<p>Support three UART ports</p> <p>Main UART port (Ch A):</p> <ul style="list-style-type: none"> ● Used for AT command communication and data transmission, and only support 115200bps baud rate ● Can also be used for firmware upgrading, and only support 921600bps baud rate ● When the module is communicating with MCU, please keep Ch A

	<p>unconnected</p> <p>Debug UART port (Ch B):</p> <ul style="list-style-type: none"> ● Used for firmware debugging ● Only support 921600bps baud rate <p>Auxiliary UART port (Ch B):</p> <ul style="list-style-type: none"> ● Used for AT command communication and data transmission ● Only support 921600bps baud rate
Arduino Interface	Used for connection with STM32 Nucleo-64 development board
RESET Button	Used to reset BC66 module
PWRKEY Button	Used for power on and off BC66 module
Physical Characteristics	Size: (70.0±0.15)mm × (74.0±0.15)mm × (1.6±0.15mm)
Firmware Upgrade	Firmware upgrade via main UART port or DFOTA*
Antenna Interface	50Ω characteristic impedance

NOTES

- 1) Within operation temperature range, the module is 3GPP compliant.
- 2) Within extended temperature range, the module remains the ability to establish and maintain an SMS*, data transmission, etc. There is no unrecoverable malfunction. There are also no effects on radio spectrum and no harm to radio network. Only one or more parameters like P_{out} might reduce in their value and exceed the specified tolerances. When the temperature returns to the normal operating temperature levels, the module will meet 3GPP specifications again.
3. "*" means under development.

2.2. Functional Diagram

The following figure shows a block diagram of BC66-TE-B.

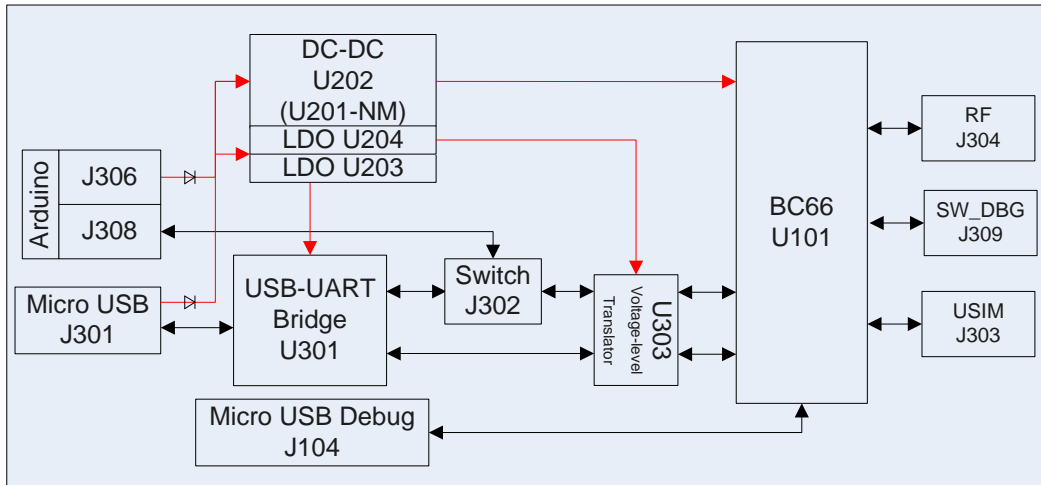


Figure 1: Functional Diagram of BC66-TE-B

2.3. Interface Distribution Diagram

The following figure shows the interface distribution diagram of BC66-TE-B.

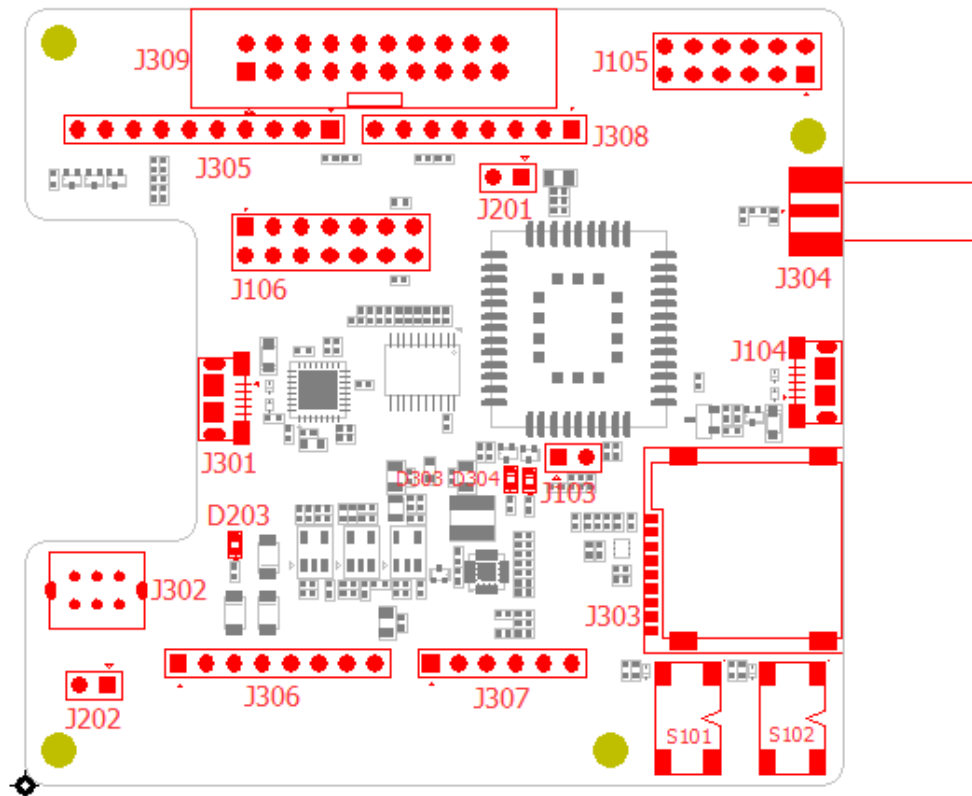


Figure 2: Interface Distribution Diagram of BC66-TE-B

Table 2: Interfaces of BC66-TE-B

Interface	Designator	Description
Power Supply Interfaces	J301	USB power supply interface
	J202	External power supply interface
	J306	Arduino power supply interface
USB Interface	J301	Support two UART ports: Ch A and Ch B
USIM Interface	J303	Micro USIM card connector
Arduino Interface	J305, J306, J307, J308	Standard Arduino interface
RF Antenna Interface	J304	RF SMA connector
UART Switch	J302	Used to switch communication object of BC66 main port: “ MAIN UART TO USB” or “MAIN UART TO MCU”
Turn on/off Button	S101	Used to Turn on/off for BC66 module
RESET Button	S102	Used to reset BC66 module
Power Indicator	D203	Used to indicate the power on/off status
PSM Indicator	D303	Used to indicate PSM status
Network Status Indicator	D304	Used to indicate network status
JTAG Interface	J309	Used to debug firmware
Test Points	J103, J105, J106, J201	Used to test the basic functionality of BC66 module

2.4. Arduino Interface Definition

The following figure shows the Arduino interface definition of BC66-TE-B.

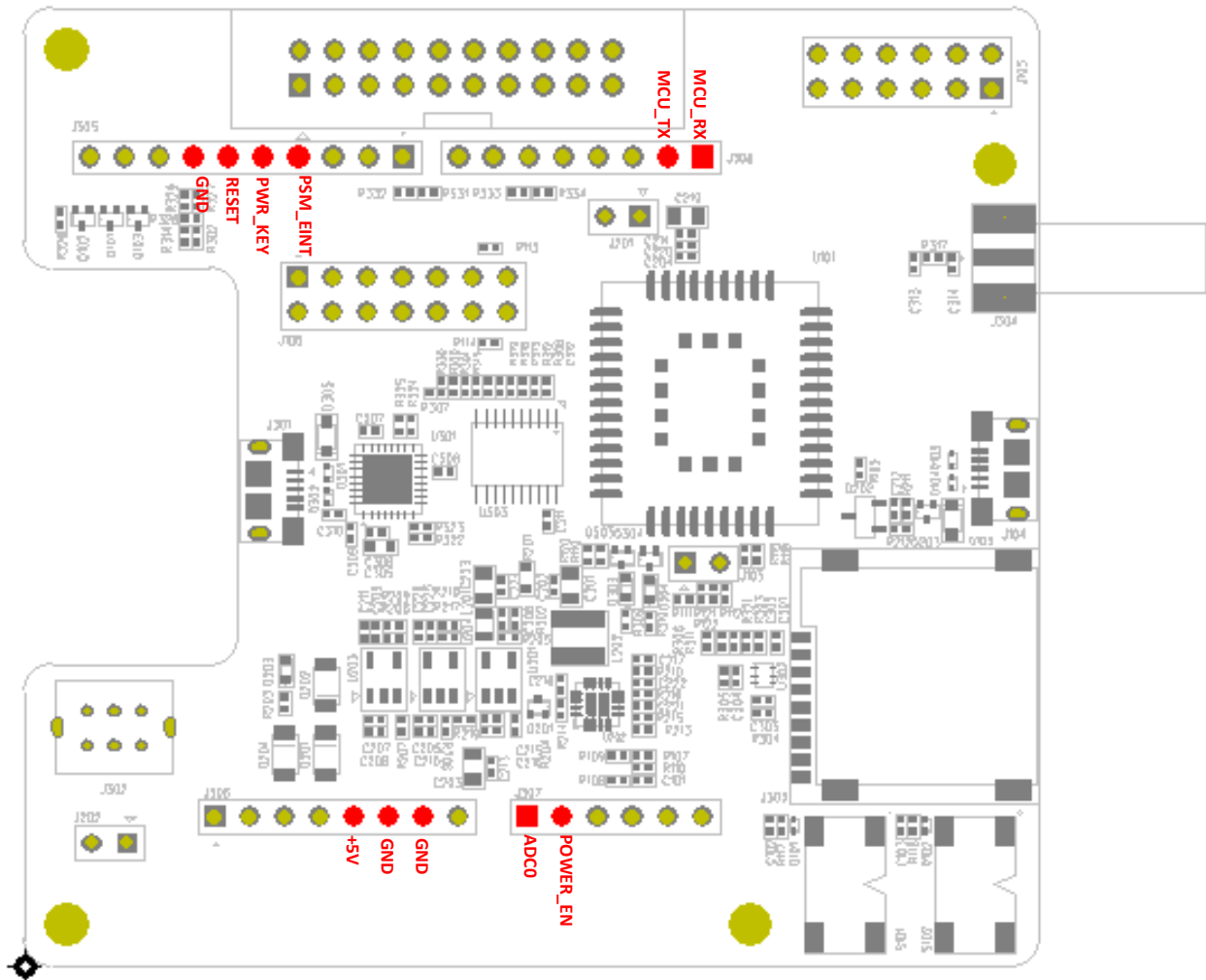


Figure 3: Arduino Interface Definition

3 Operation Procedures

This chapter mainly illustrates the operation procedures of BC66-TE-B. BC66-TE-B can be used alone to upgrade firmware and debug applications based on BC66 module. Also, it can be used in conjunction with an STM32 Nucleo-64 development board via Arduino interface to develop NB-IoT applications based on STM32. The following describes the operation procedures of BC66-TE-B in different operation modes.

3.1. Operation Procedure with Single Board

This chapter elaborates the operation procedure of using the BC66-TE-B alone.

3.1.1. Interface Diagram of Using BC66-TE-B Alone

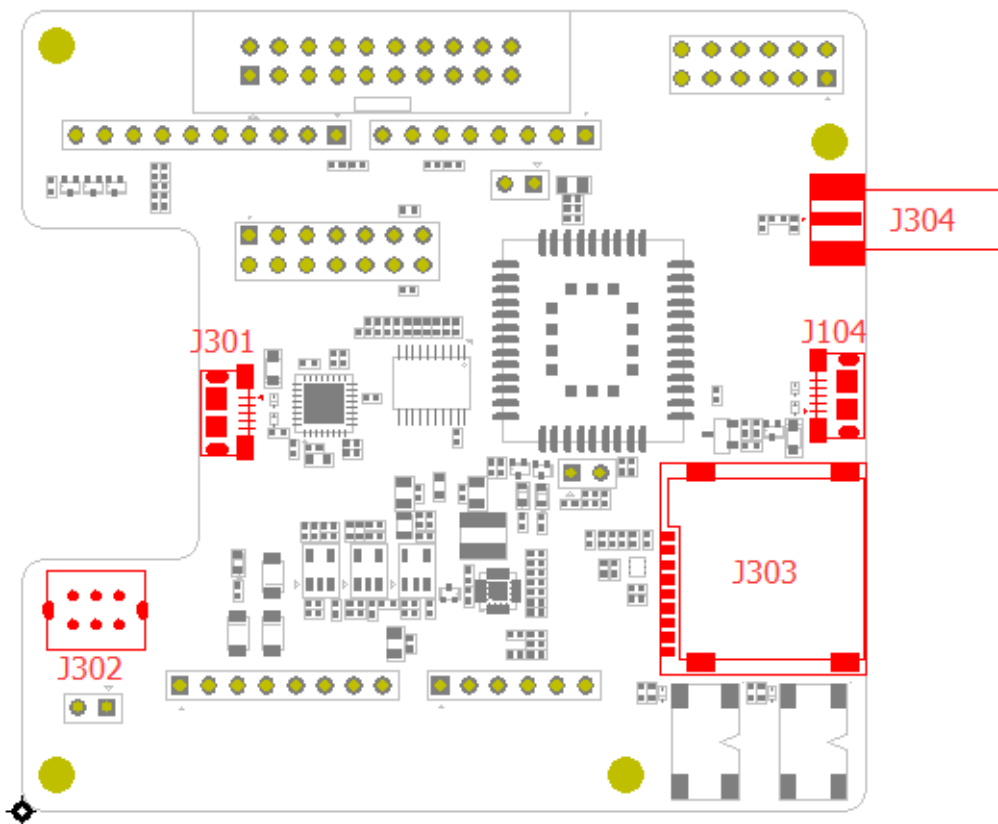


Figure 4: Interface Diagram of Using BC66-TE-B Alone

3.1.2. Operation Procedures of Using BC66-TE-B Alone

1. Install USB-UART driver which can be downloaded from the following link:
<https://www.exar.com/product/interface/uarts/usb-uarts/xr21v1412>;
2. Insert a Micro USIM card into J303, and please note that a NB-IoT USIM card should be selected;
3. Connect the rod antenna with SMA connector on J304 (RF antenna connector);
4. Switch J302 (UART Switch) to “MAIN UART TO USB” state;
5. Connect the J301 (USB power supply interface) with PC via Micro USB cable. After turning on BC66-TE-B, UART port information will be shown on “Device Manager” of PC. CH A is the main UART port and can be used for AT command communication, data transmission and firmware upgrading. CH B is the debug UART port and can be used to view log for firmware debugging. For details of port configuration, please refer to *Quectel_BC66_Hardware_Design*.



Figure 5: UART Ports Displayed on PC

NOTE

In the procedure, S101 can be used to turn on/off BC66 module, and S102 can be used to reset the module.

3.2. Operation Procedure with Multi Boards

This chapter elaborates the operation procedure of using the BC66-TE-B in conjunction with an STM32 Nucleo-64 development board.

3.2.1. Interface Diagram of Using Multi Boards

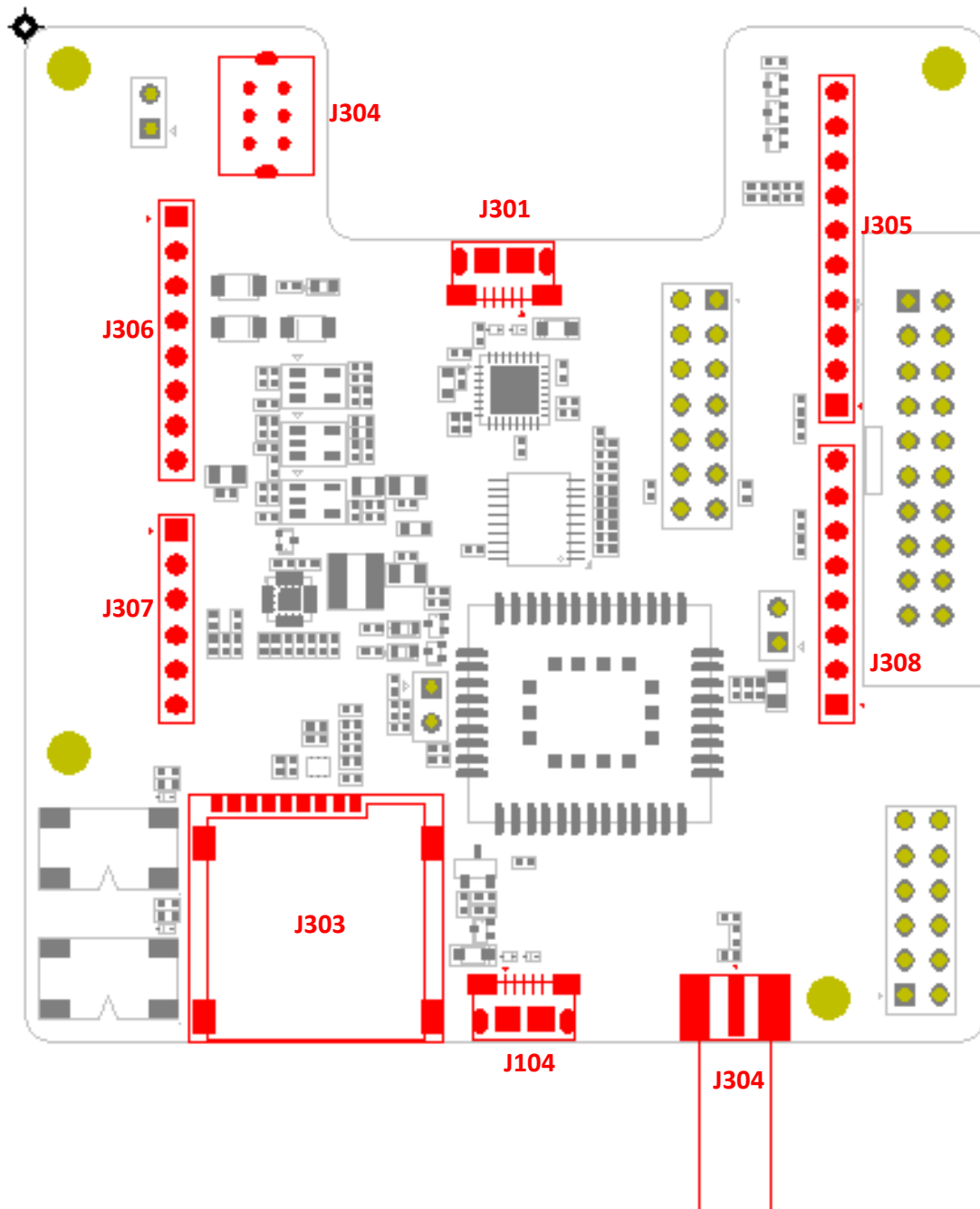


Figure 6: Interface Diagram of Using Multi Boards

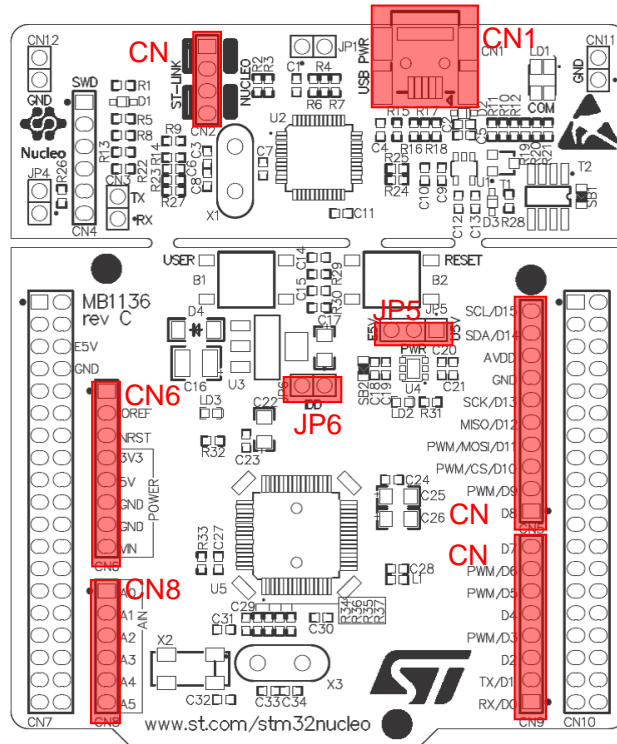


Figure 7: STM32 Nucleo-64 Board Interface Diagram (Top View)

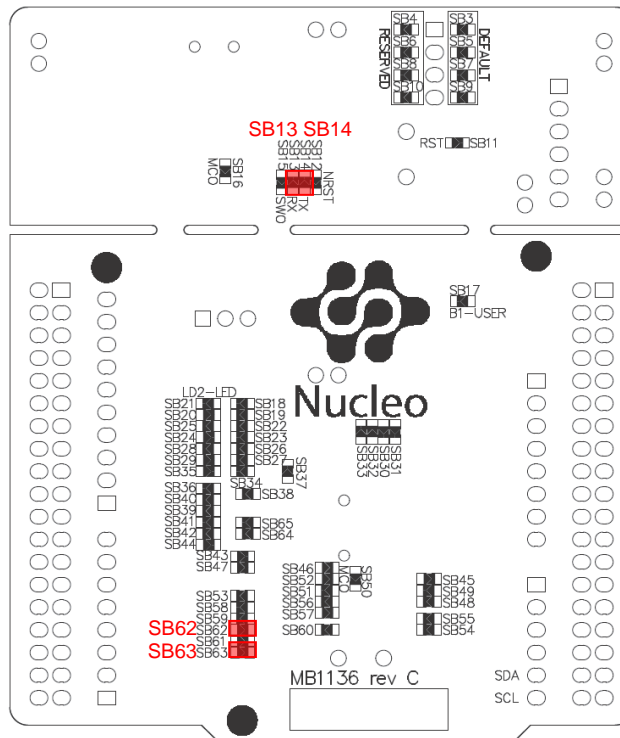


Figure 8: STM32 Nucleo-64 Board Modification Diagram (Bottom View)

3.2.2. Operation Procedures of Using Multi Boards

1. Install driver for STM32 Nucleo-64 board, which can be downloaded from the following link:
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 USB-UART driver which can be downloaded from the following link:
<https://www.exar.com/product/interface/uarts/usb-uarts/xr21v1412>;
3. Remove the two 0Ω resistors (SB13 and SB14) by soldering iron, and then solder them onto SB62 and SB63 respectively;
4. Short-circuit pin 1 & 2 of CN2, pin 3 & 4 of CN2, pin 1 & 2 of JP5 and pin 1 & 2 of JP6;
5. Insert a Micro USIM card into J303, and please note that a NB-IoT USIM card should be selected;
6. Connect the rod antenna with SMA connector on J304 (RF antenna connector);
7. Switch J302 (UART Switch) to “MAIN UART TO MCU” state;
8. Connect BC66-TE-B with STM32 Nucleo-64 board via Arduino interface, and please connect J305, J306, J307 and J308 of BC66-TE-B to CN5, CN6, CN8 and CN9, respectively.
9. Connect CN1 of STM32 Nucleo-64 board with PC via Mini USB cable. After powering on BC66 module, device information will be shown on the “Device Manager” of PC.

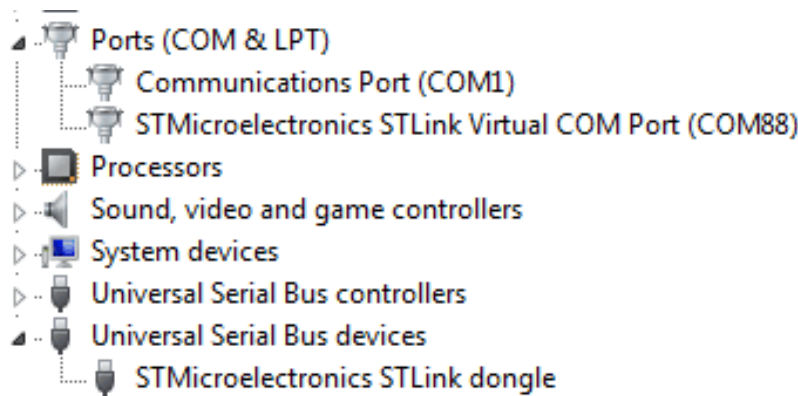


Figure 9: ST-LINK Interface Displayed on PC

3.2.3. Description of Pin Connection

The table below shows the pin connection between BC66-TE-B and STM32-L476RG MCU, one kind of STM32 Nucleo-64 board.

Table 3: Pin Connection between BC66-TE-B and STM32-L476RG MCU

No.	MCU (Morpho)	Arduino		BC66-TE-B	Remark
1	PA2	D1	CN9-2	UART_MCU_TX	Main UART port RX
2	PA3	D0	CN9-1	UART_MCU_RX	Main UART port TX

3	PA1	A1	CN8-2	POWER_EN	Enable LDO
4	PA7	D11	CN5-4	PSM_EINT_N	External interrupt for PSM
5	PA6	D12	CN5-5	PWRKEY_N	Active high
6	PA5	D13	CN5-6	RESET_N	Active high
7	PA0	A0	CN8-1	ADC0	Analog to digital converter interface
8	+5V	+5V	CN6-5	+5V	5.0V power supply
9	GND	GND	CN5-7, CN6-6, 7	GND	Ground

The following figure shows the pin connection between BC66-TE-B and STM32-L476RG MCU.

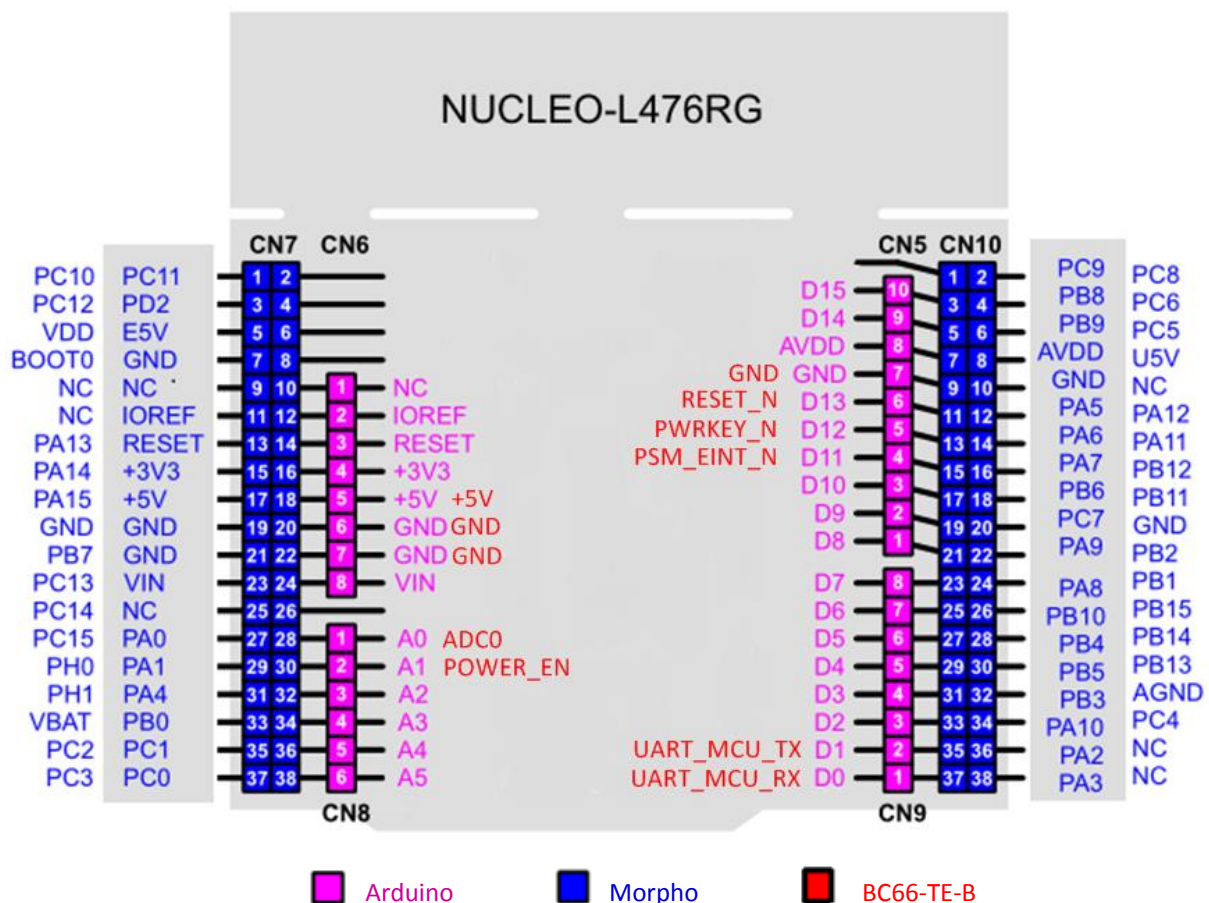


Figure 10: Pin Connection between BC66-TE-B and STM32-L476RG MCU

4 Electrical and Reliability Characteristics

4.1. Absolute Maximum Ratings

Absolute maximum ratings for power supply and voltage on digital and analog pins of the BC66 module are listed in the following table.

Table 4: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
+5V	-0.3	6	V
VBAT	TBD	TBD	V
Current of Power Supply	TBD	TBD	A
Voltage at Digital Pins	TBD	TBD	V
Voltage at Analog Pins	TBD	TBD	V
Voltage at Digital/Analog Pins in Power down Mode	TBD	TBD	V

4.2. Operation and Storage Temperatures

The operation and storage temperatures of BC66 module are listed in the following table.

Table 5: Operation and Storage Temperatures of BC66 Module

Parameter	Min.	Typ.	Max.	Unit
Operation Temperature Range ¹⁾	-35	+25	+75	°C

Extended Temperature Range ²⁾	-40	+85	°C
Storage Temperature Range	-40	+90	°C

NOTES

- 1) Within operation temperature range, the module is 3GPP compliant.
- 2) Within extended temperature range, the module remains the ability to establish and maintain an SMS*, data transmission, etc. There is no unrecoverable malfunction. There are also no effects on radio spectrum and no harm to radio network. Only one or more parameters like P_{out} might reduce in their value and exceed the specified tolerances. When the temperature returns to the normal operating temperature levels, the module will meet 3GPP specifications again.
3. “*” means under development.

5 Mechanical Dimensions

This chapter describes the mechanical dimensions of BC66-TE-B. All dimensions are measured in mm. The tolerances for dimensions are $\pm 0.15\text{mm}$.

5.1. Mechanical Dimensions of BC66-TE-B

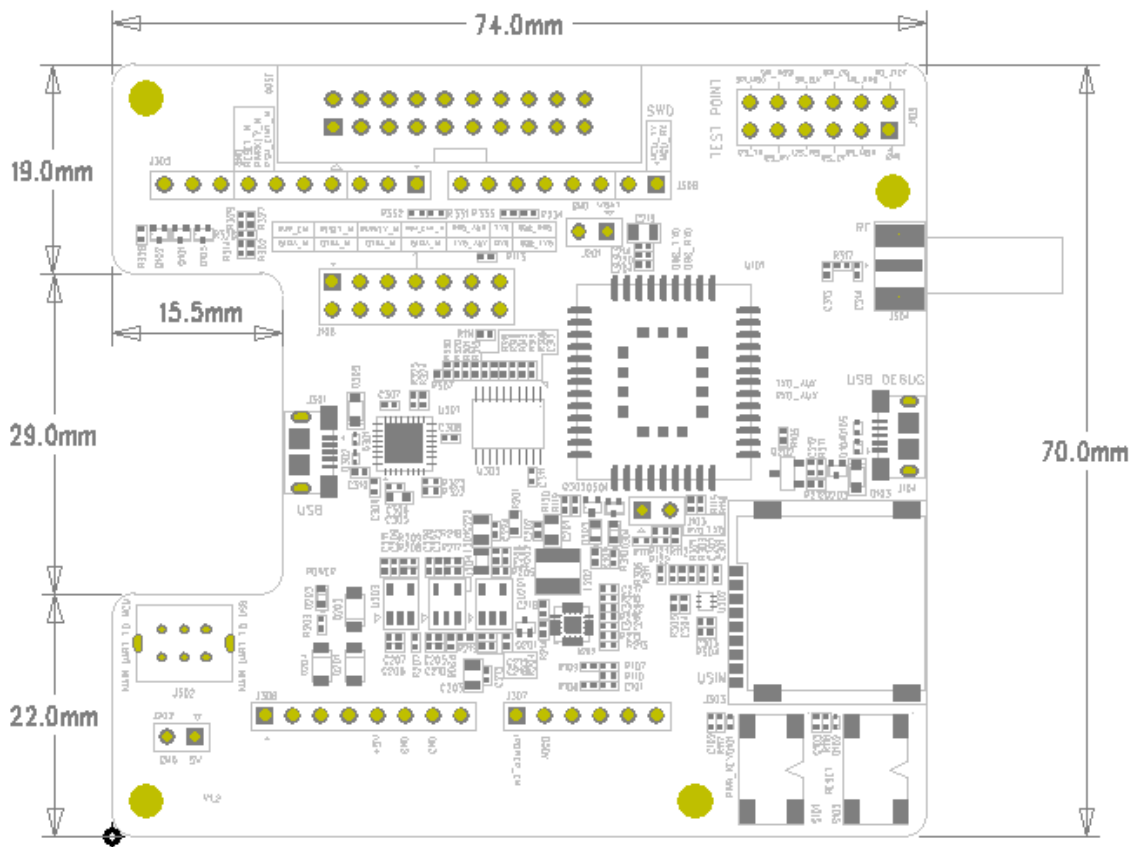


Figure 11: Dimensions of BC66-TE-B (Top View)

5.2. Top/Bottom View of BC66-TE-B

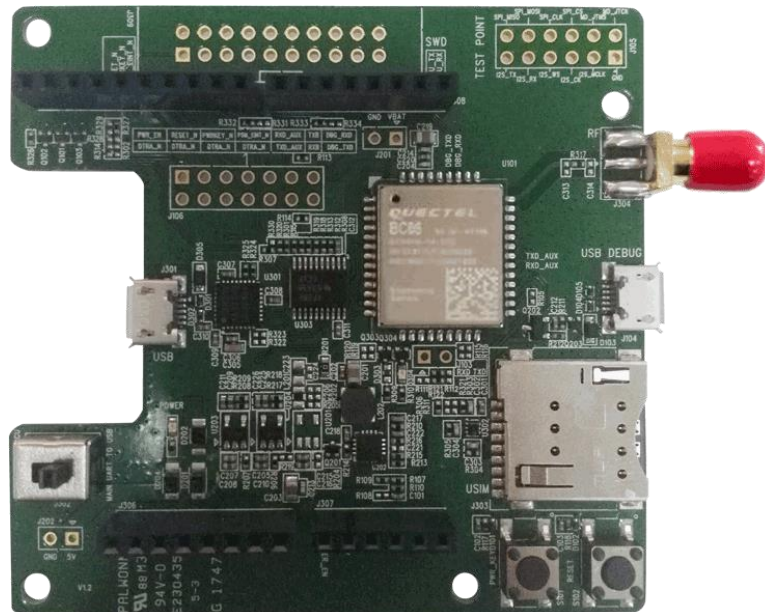


Figure 12: Top View of the BC66-TE-B



Figure 13: Bottom View of the BC66-TE-B

6 BC66-TE-B Kit and Accessories

6.1. BC66-TE-B Kit



Figure 14: BC66-TE-B Kit Assembly

6.2. BC66-TE-B Kit Accessories



Figure 15: BC66-TE-B and the Accessories

Table 6: Accessories List

Item	Description	Quantity
Antenna	NB-IoT antenna with SMA connector	1
Cable	Micro USB cable	1
Instruction Sheet	A sheet of paper giving instructions for BC66-TE-B connection, details of accessories, etc.	1

7 Appendix A References

Table 7: Related Documents

No.	Document Name	Remark
[1]	Quectel_BC66_Hardware_Design	BC66 hardware design

Table 8: Terms and Abbreviations

Abbreviation	Description
DFOTA	Delta Firmware Upgrade Over-the-air
MCU	Microcontroller Unit
NB-IoT	Narrow Band Internet of Things
SMA	SubMiniature Version A
UART	Universal Asynchronous Receiver & Transmitter
USB	Universal Serial Bus
USIM	Universal Subscriber Identification Module