BC66-TE-B User Guide

LPWA Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2018-08-01	Speed SUN	Initial
2.0	2018-10-23	Speed SUN	1. Updated the layout of BC66-TE-B's components. 2. Updated the description of USB interface (increased the number of UART interfaces into 4).
2.1	2019-06-03	Speed SUN	1. Updated USB-UART driver download link (Chapter 3.1.2). 2. Updated bottom view of BC66-TE-B (Figure 13).

Contents

About the Document **2**
Contents **3**
Table Index **4**
Figure Index **5**

1 Introduction **6**
1.1. Safety Information 6

2 Product Concept **8**
2.1. Key Features 8
2.2. Functional Diagram 9
2.3. Interface Distribution Diagram 10
2.4. Arduino Interface Definition 12

3 Operation Procedures **14**
3.1. Operation Procedure with Single Board 14
3.1.1. Interface Diagram of Using BC66-TE-B Alone 15
3.1.2. Operation Procedures of Using BC66-TE-B Alone 16
3.2. Operation Procedure with Multi Boards 16
3.2.1. Interface Diagram of Using Multi Boards 17
3.2.2. Operation Procedures of Using Multi Boards 19
3.2.3. Description of Pin Connection 19

4 Electrical and Reliability Characteristics **21**
4.1. Absolute Maximum Ratings 21
4.2. Operation and Storage Temperatures 21

5 Mechanical Dimensions **23**
5.1. Mechanical Dimensions of BC66-TE-B 23
5.2. Top/Bottom View of BC66-TE-B 24

6 BC66-TE-B Kit and Accessories **25**
6.1. BC66-TE-B Kit 25
6.2. BC66-TE-B Kit Accessories 26

7 Appendix A References **27**

Table Index

TABLE 1: KEY FEATURES OF BC66-TE-B 8
TABLE 2: INTERFACES OF BC66-TE-B 12
TABLE 3: PIN CONNECTION BETWEEN BC66-TE-B AND STM32-L476RG MCU 19
TABLE 4: ABSOLUTE MAXIMUM RATINGS 21
TABLE 5: OPERATION AND STORAGE TEMPERATURES OF BC66 MODULE 21
TABLE 6: ACCESSORIES LIST 26
TABLE 7: RELATED DOCUMENTS 27
TABLE 8: TERMS AND ABBREVIATIONS 27

Figure Index

FIGURE 1: FUNCTIONAL DIAGRAM OF BC66-TE-B 10
FIGURE 2: INTERFACE DISTRIBUTION DIAGRAM OF BC66-TE-B 11
FIGURE 3: ARDUINO INTERFACE DEFINITION 13
FIGURE 4: INTERFACE DIAGRAM OF USING BC66-TE-B ALONE 15
FIGURE 5: UART PORTS DISPLAYED ON PC 16
FIGURE 6: INTERFACE DIAGRAM OF USING MULTI BOARDS 17
FIGURE 7: STM32 NUCLEO-64 BOARD INTERFACE DIAGRAM (TOP VIEW) 18
FIGURE 8: STM32 NUCLEO-64 BOARD MODIFICATION DIAGRAM (BOTTOM VIEW) 18
FIGURE 9: ST-LINK INTERFACE DISPLAYED ON PC 19
FIGURE 10: PIN CONNECTION BETWEEN BC66-TE-B AND STM32-L476RG MCU 20
FIGURE 11: DIMENSIONS OF BC66-TE-B (TOP VIEW) 23
FIGURE 12: TOP VIEW OF THE BC66-TE-B 24
FIGURE 13: BOTTOM VIEW OF THE BC66-TE-B 24
FIGURE 14: BC66-TE-B KIT ASSEMBLY 25
FIGURE 15: BC66-TE-B AND THE ACCESSORIES 26

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	**USB interface:** Supply voltage range: 4.75V~5.25V Typical supply voltage: 5.0V **Arduino interface:** Supply voltage range: 4.75V~5.25V Typical supply voltage: 5.0V
Transmitting Power	23dBm±2dB
Temperature Range	Operation temperature range: -35°C ~ +75°C [1)] Extended temperature range: -40°C ~ +85°C [2)] Storage temperature range: -40°C ~ +90°C
USIM Interface	Support 1.8V external USIM card
UART Switch	Used to switch the communication object of BC66 main UART port
USB Interface	Support three UART ports **Main UART (Interface0):** ● Used for AT command communication and data transmission. ● By default, the module is in auto-baud mode, and it supports automatic baud rates not exceeding 115200bps. When powering on the module, the MCU has to send **AT** command consecutively to synchronize baud rate with the module. When **OK** is returned, it

	indicates the baud rate has been synchronized successfully. When the module is woken up from PSM or idle mode, the baud rate synchronized during start-up will be used directly. ● Also can be used for firmware upgrade, and in such case, the baud rate is 921600bps by default. **Auxiliary UART (Interface1):** ● Used for firmware debugging ● Default baud rate: 115200bps **Debug UART (Interface2):** ● Used for firmware debugging ● Default baud rate: 115200bps **Reserved UART (Interface3)**
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. [1)] Within operation temperature range, the module is 3GPP compliant.
2. [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.

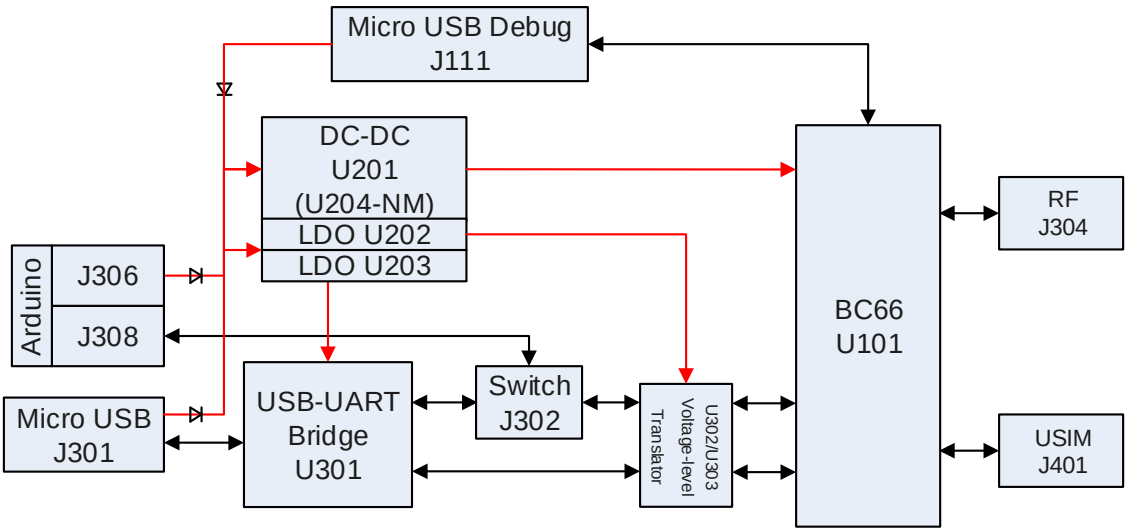

Figure 1: Functional Diagram of BC66-TE-B

2.3. Interface Distribution Diagram

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

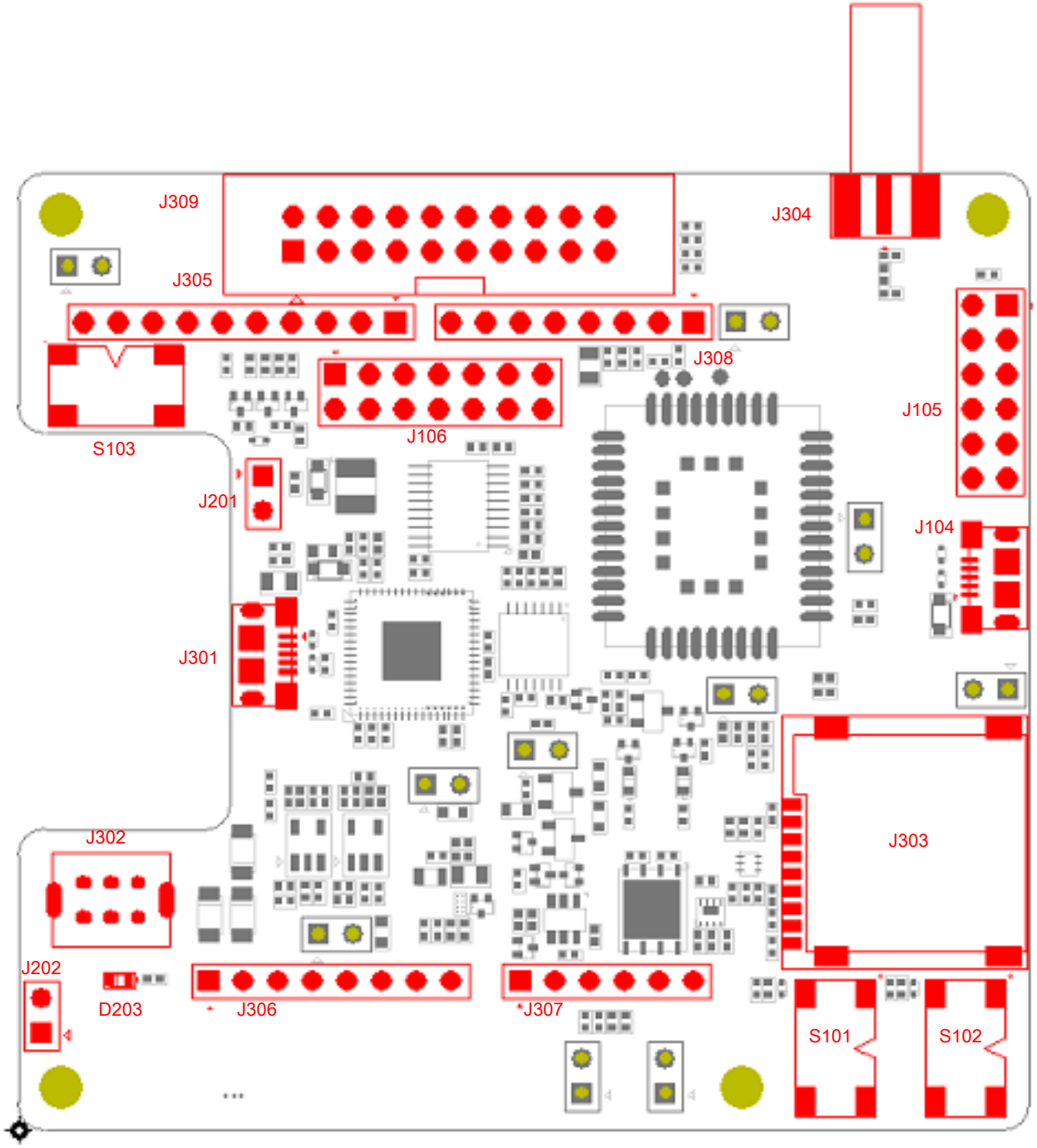

Figure 2: Interface Distribution Diagram of BC66-TE-B

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-UART Interface	J301	Support 3 UART ports: Interface 0/1/2
USIM Interface	J303	Micro-SIM card connector
USB Interface	J104	Get BC66 USB log
Arduino Interfaces	J305, J306, J307, J308	Standard Arduino interfaces
RF Antenna Interface	J304	RF SMA connector
UART Switch	J302	Used to select the communication object of BC66's main UART: "MAIN UART TO USB" or "MAIN UART TO MCU"
PWRKEY Button	S101	Used to turn on BC66 module
RESET Button	S102	Used to reset BC66 module
PSM Wakeup Button	S103	Used to wake up BC66 from PSM mode
Power Indicator	D203	Used to indicate the power on/off status
JTAG Interface	J309	Used to debug firmware

2.4. Arduino Interface Definition

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

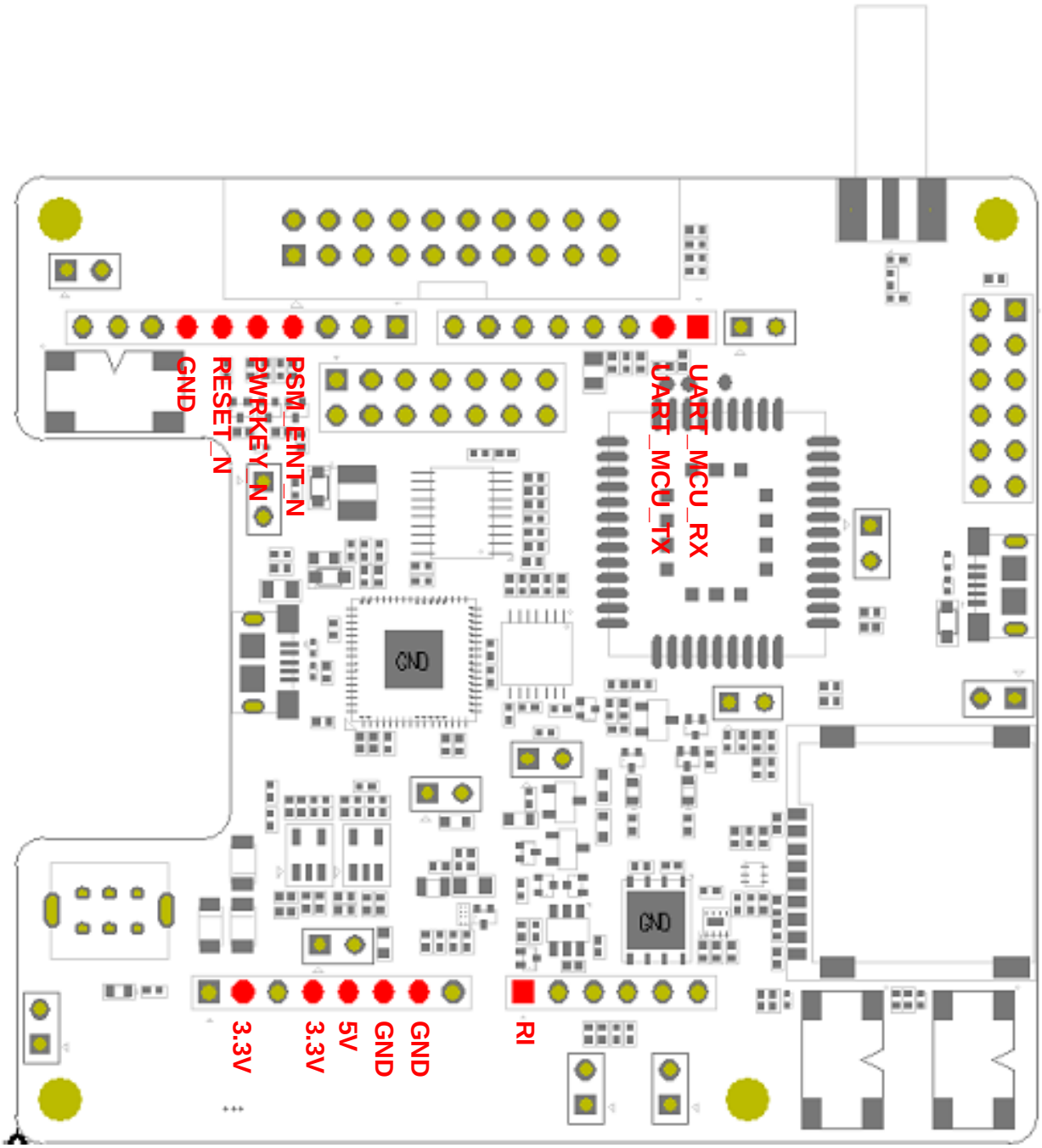

Figure 3: Arduino Interface Definition

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

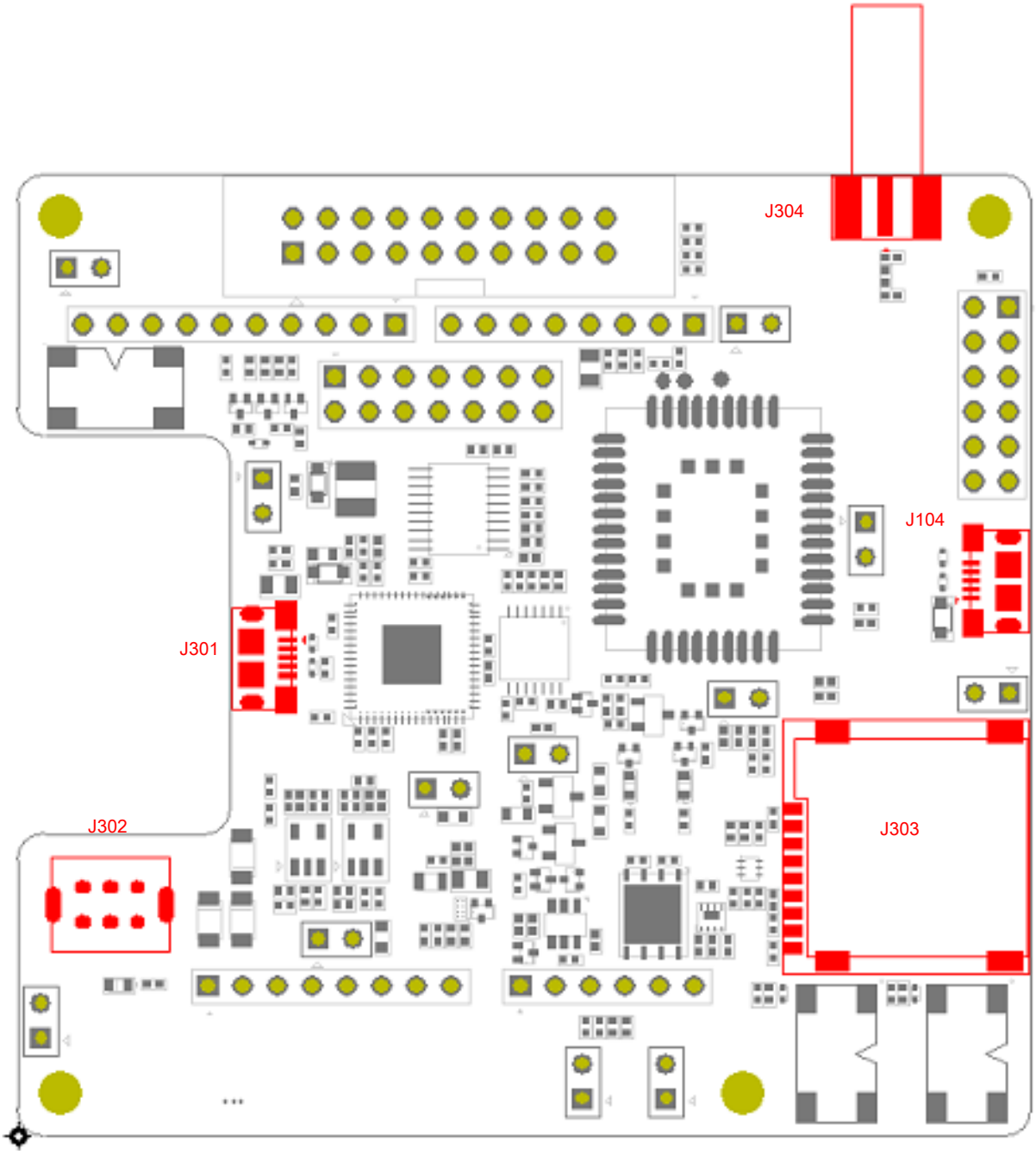

Figure 4: Interface Diagram of Using BC66-TE-B Alone

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.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers.
2. Insert a Micro-SIM 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. **Interface0** is the main UART port and can be used for AT command communication, data transmission and firmware upgrading. **Interface1/2** are auxiliary UART and debug UART respectively, both of which can be used to output log for firmware debugging. For details of UART configuration, please refer to *Quectel_BC66_Hardware_Design.*

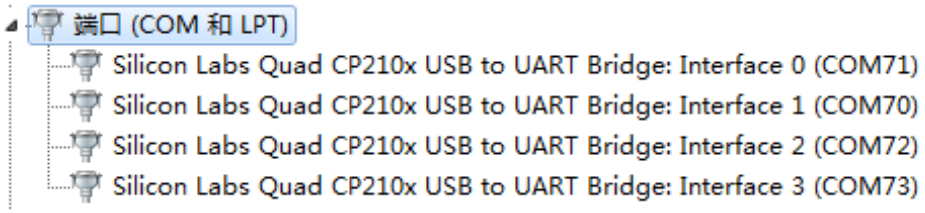

Figure 5: UART Ports Displayed on PC

NOTE

In the procedure, S101 can be used to turn on BC66 module, S102 can be used to reset the module, and S103 can be used to wake up the module from PSM.

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

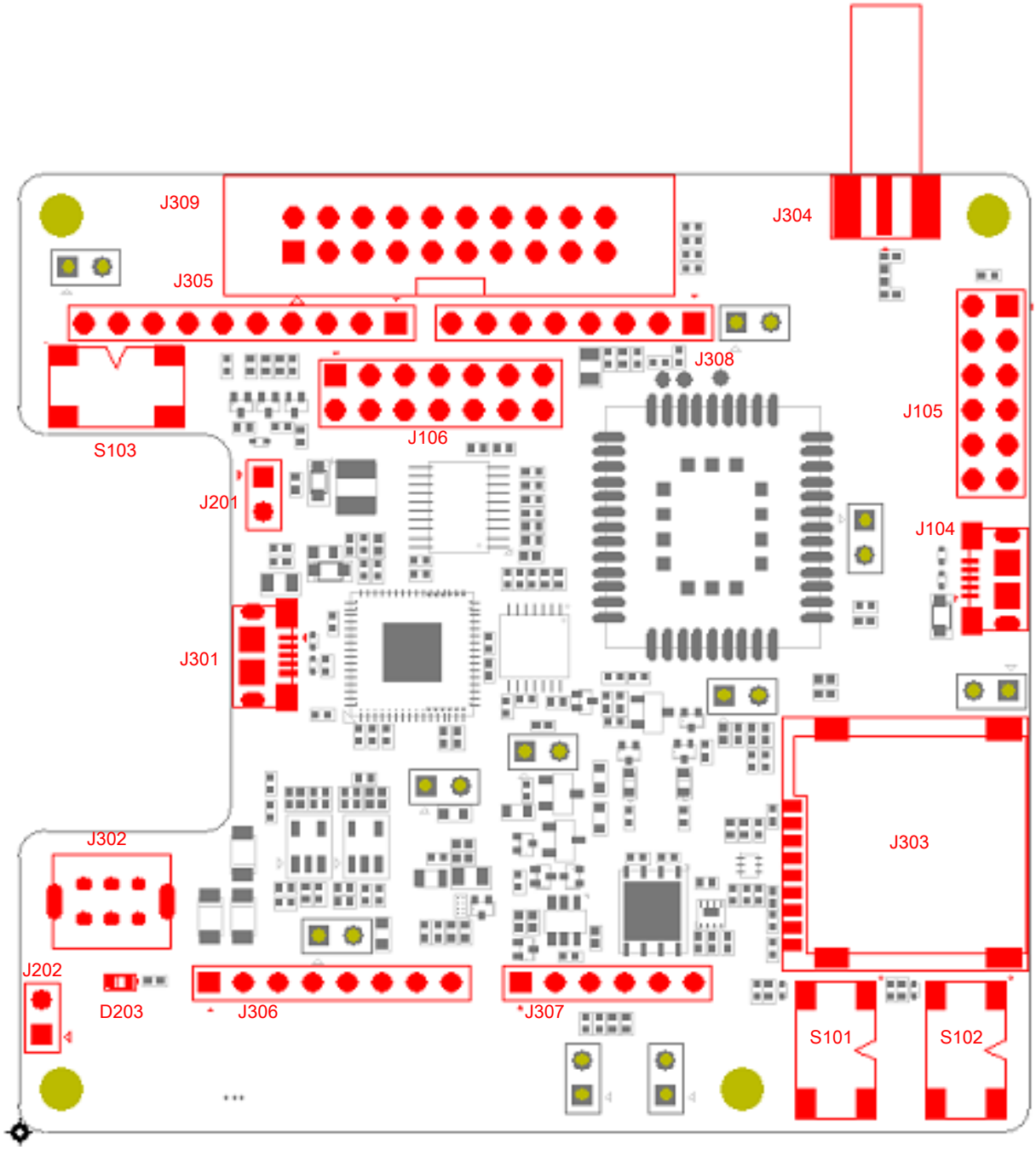

Figure 6: Interface Diagram of Using Multi Boards

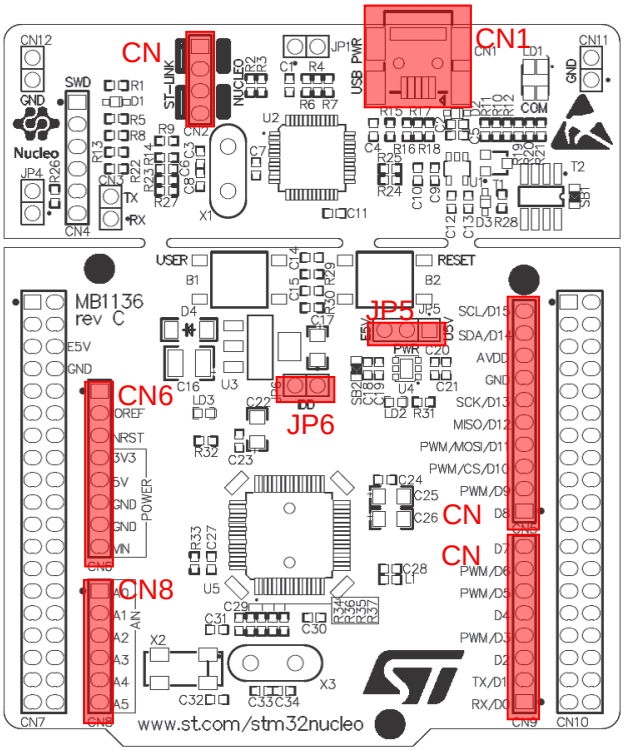

Figure 7: STM32 Nucleo-64 Board Interface Diagram (Top View)

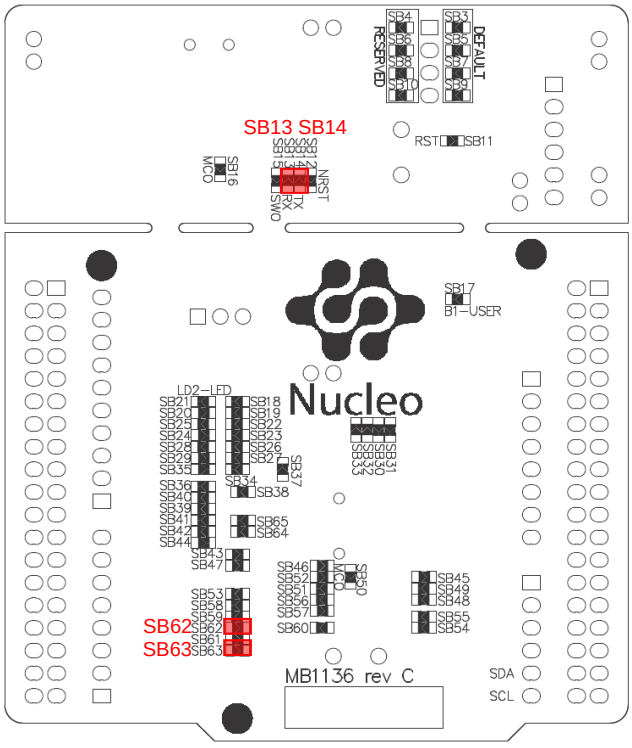

Figure 8: STM32 Nucleo-64 Board Modification Diagram (Bottom View)

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.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers.
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-SIM 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.

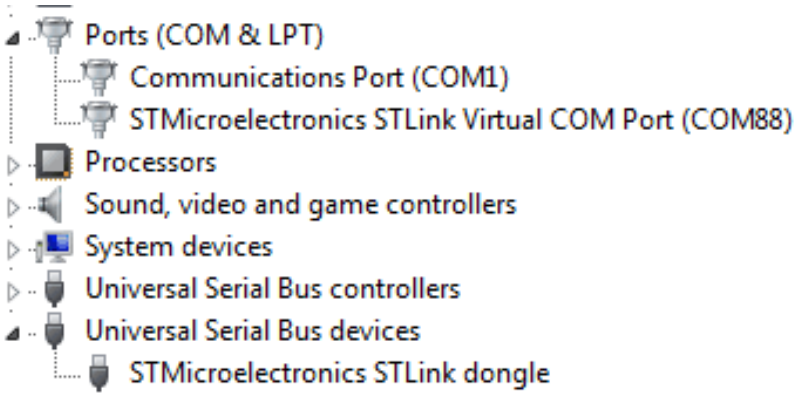

Figure 9: ST-LINK Interface Displayed on PC

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

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	RI	Ring indicator
8	+5V	+5V	CN6-5	+5V	5.0V power supply
9	GND	GND	CN5-7, CN6-6, 7	GND	GND
10	+3.3V	+3.3V	CN6-4	+3.3V	3.3V power supply
11	+3.3V	IOREF	CN6-2	+3.3V	3.3V power supply

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

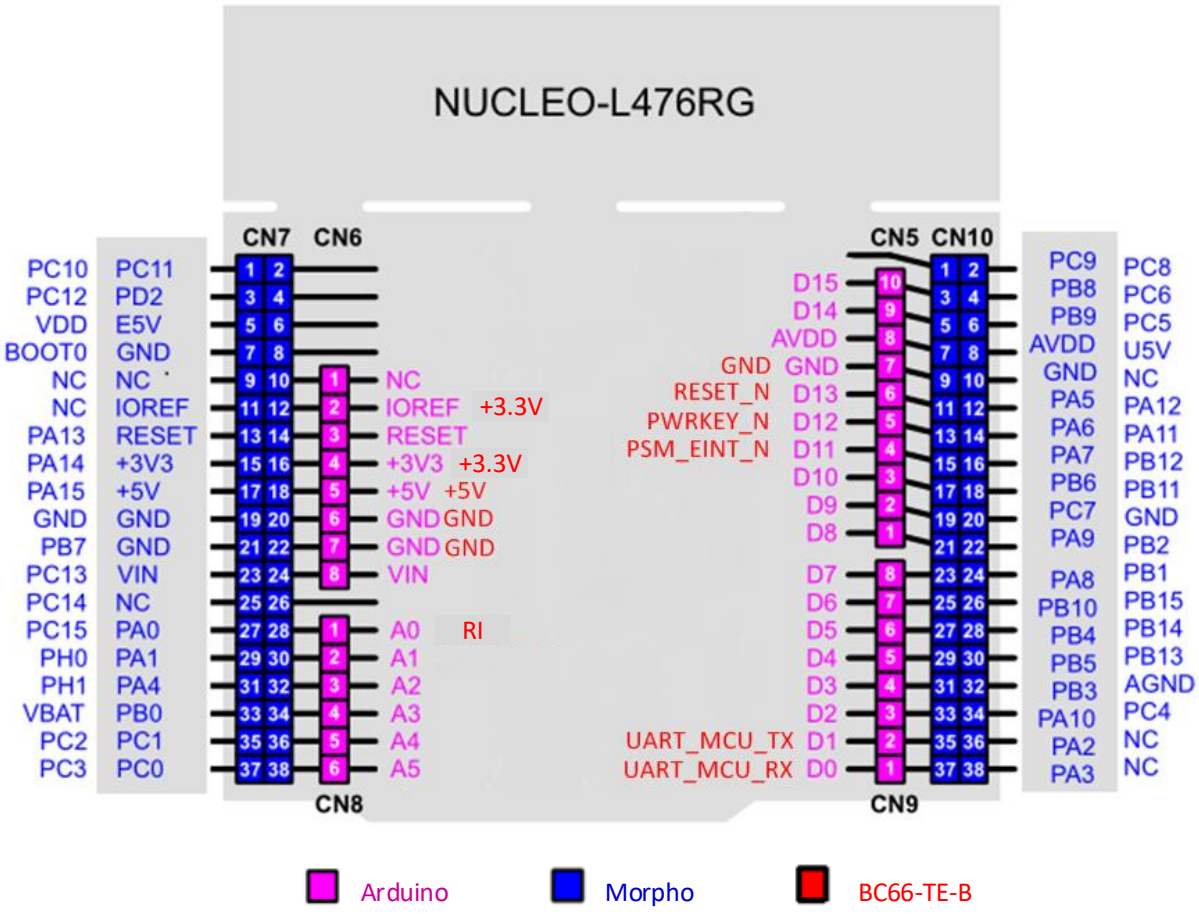

Figure 10: Pin Connection between BC66-TE-B and STM32-L476RG MCU

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	2.1	3.63	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	ºC

Extended Temperature Range[2)]	-40	+85	ºC
Storage Temperature Range	-40	+90	ºC

NOTES

1. [1)] Within operation temperature range, the module is 3GPP compliant.
2. [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 ±0.15mm.

5.1. Mechanical Dimensions of BC66-TE-B

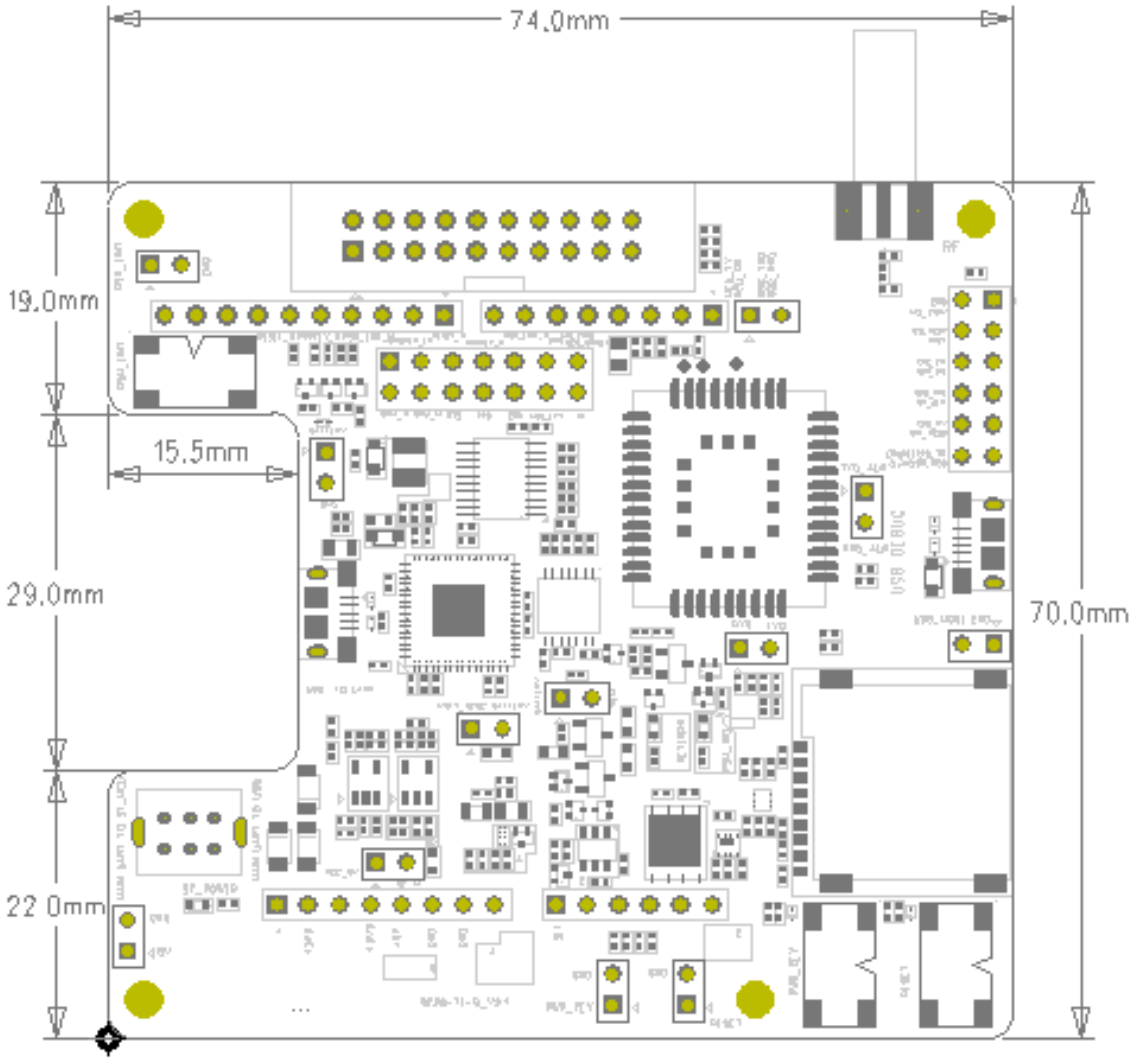

Figure 11: Dimensions of BC66-TE-B (Top View)

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

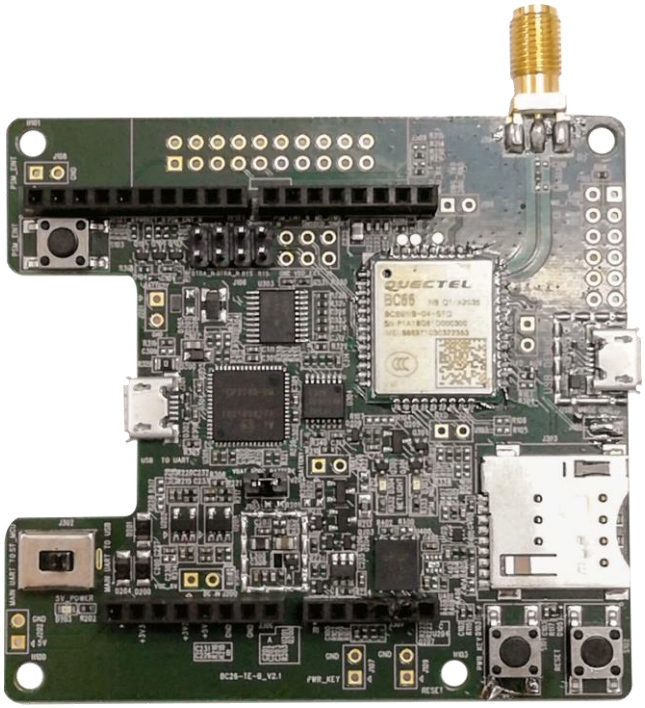

Figure 12: Top View of the BC66-TE-B

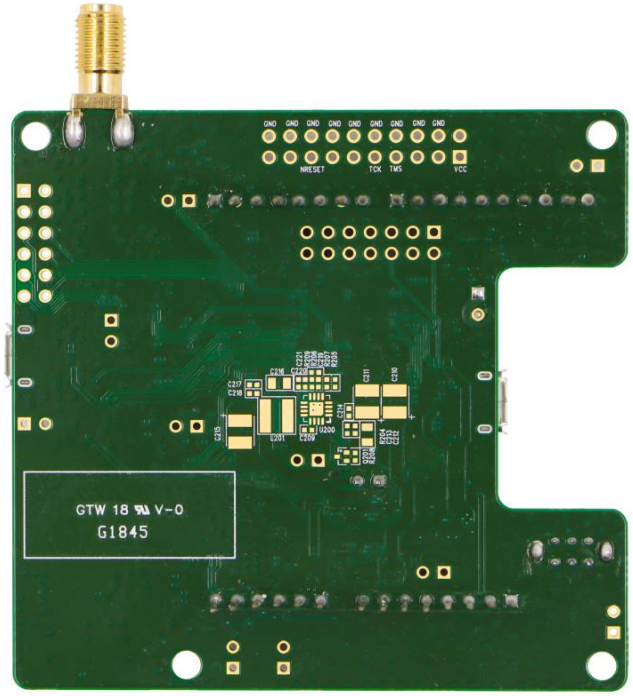

Figure 13: Bottom View of the BC66-TE-B

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
(U)SIM	(Universal) Subscriber Identification Module