RMU500-EKNM

EVB Kit User Guide

5G Module Series

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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.
SOS	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 fueling 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.

About the Document

Revision History

Version	Date	Author	Description
-	2021-09-27	Albert XU	Creation of the document
1.0	2021-10-13	Albert XU	First official released

Contents

Table Index

Figure Index

1 Introduction

This document introduces the EVB kit, RMU500-EKNM, for Quectel 5G M.2 modules, which is an assistant tool kit for engineers to develop and test the modules.

1.1. Applicable Modules

Table 1: Applicable Modules

Module Series	Models
5G	RM500Q-CN
	RM500Q-GL
	RM500Q-AE
	RM502Q-AE

2 General Overview

Quectel provides the RMU500-EKNM EVB kit for engineers to develop applications based on 5G M.2 modules and to test basic functionalities of the applicable modules.

2.1. Key Features

Table 2: Key Features

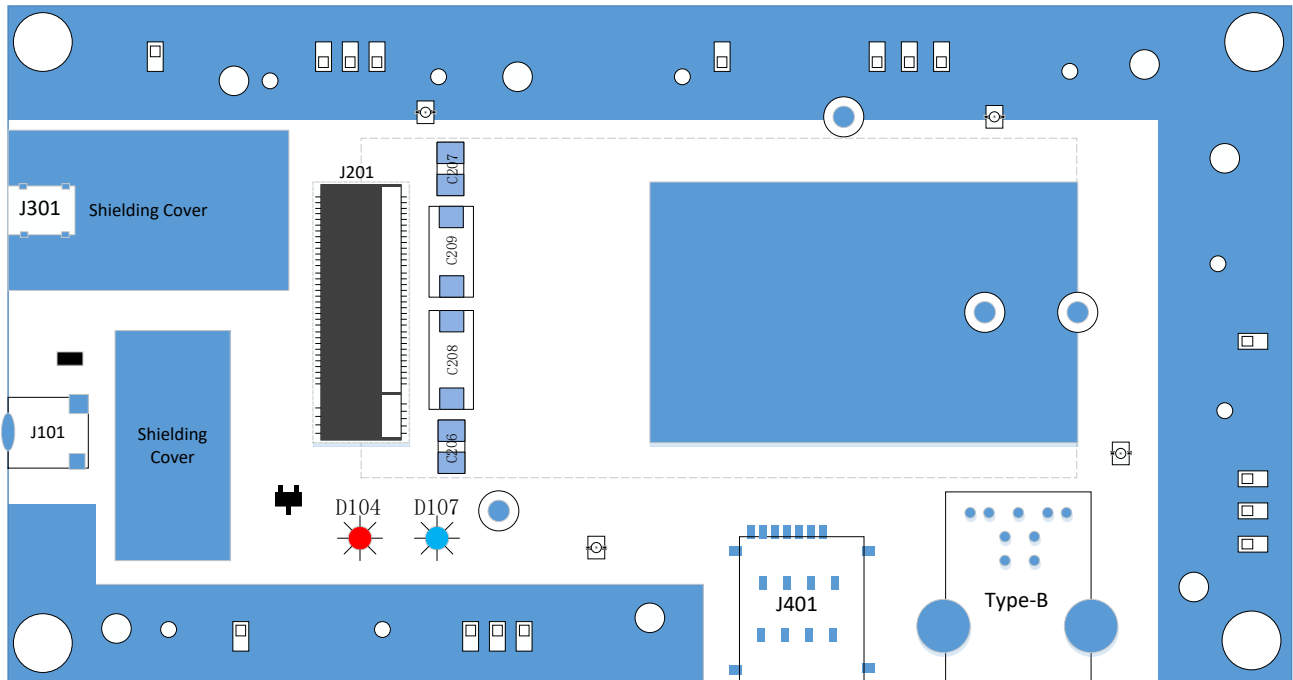| Features	Description
Power Supply	DC power supply: +5 V/ 2.5 A for the EVB
M.2 Interface	Interface to mount applicable 5G M.2 modules
(U)SIM Interface	Support 1.8/2.95 V (U)SIM card
USB Interface	● USB Type-C Interface ● USB 2.0 & USB 3.1
Status Indication	2 LEDs available for signal indication
Physical Characteristics	Size: 100 mm × 60 mm

2.2. Component Placement of the EVB

Figure 1: Component Placement of the EVB (Top View)

Table 3: Interfaces of the EVB

Interfaces	Reference Designator	Description
Power Supply	J101 (Power Jack)	The power jack on the EVB Typical supply voltage: +5 V/ 2.5 A
M.2 Interface	J201	The M.2 connecter for the module
USB Interface	J301	USB Type-C interface used for: ● data transmission ● power supply (typical supply voltage: +5 V/ 2 A)
(U)SIM Interface	J401	(U)SIM card connector
Indication LEDs	D104 (POWER_LED)	Power indicator, indicating whether the module's power supply is ready
	D107 (WWAN_LED)	RF status indicator for the module

2.3. Top and bottom View of the EVB

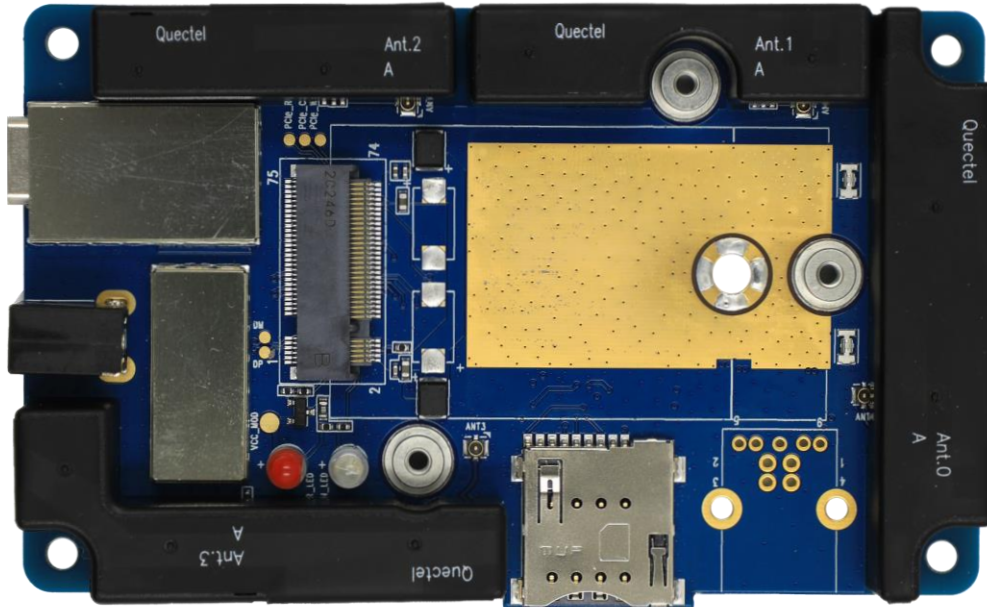The following figure shows the top view of the EVB.

Figure 2: EVB Top View

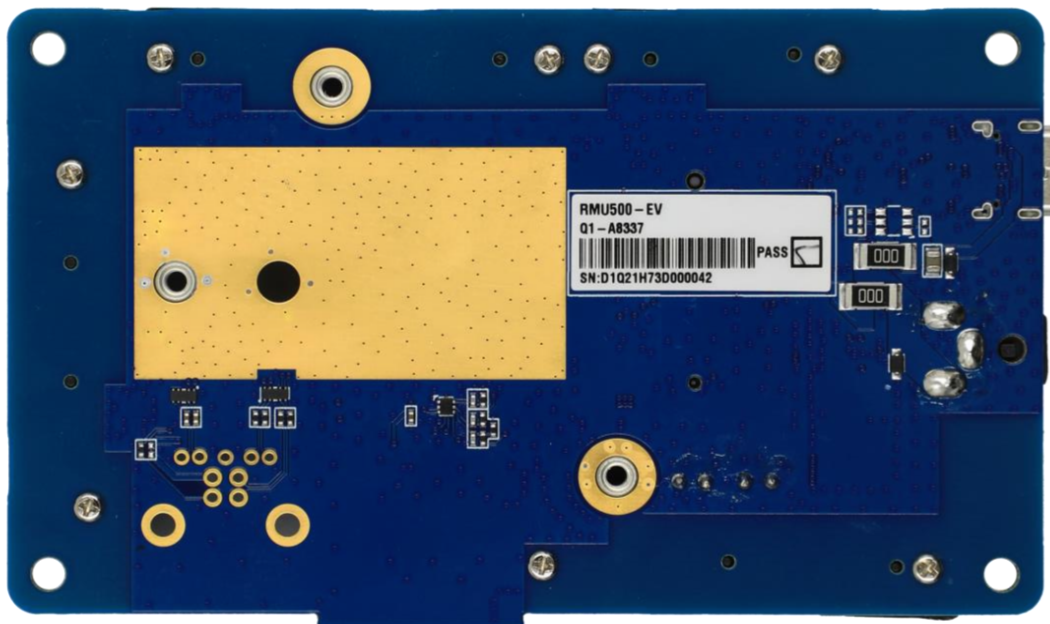The following figure shows the bottom view of the EVB.

Figure 3: EVB Bottom View

2.4. EVB Kit Accessories

Table 4: List of Accessories

Item	Description	Quantity (pcs)
Cable	Type-C to dual Type-A cable	1
	RF cables	4
Antenna	Antennas with brackets	4
Soft silicone pad	Thermal conductive pad	1
Heatsink	Black anodized AL6063	1
USB flash drive	Including the related documents, tools, and drivers for the module and RMU500-EKNM.	1
Screw	Used to clamp the module, antennas and heatsink on the EVB	19

NOTE

NONE of the applicable 5G M.2 modules are included as accessories of the RMU500-EKNM EVB kit. RF cables, heatsink, soft silicone pad, and screws are included as accessories.

3 Interface Application

This chapter describes the following hardware interfaces of RMU500-EKNM:

- Power supply (J101/J301)
- M.2 interface (J201)
- USB interface (J301)
- (U)SIM interface (J401)
- RF cables and antennas

It also provides information about the status indicator LEDs (D104/D107) to help you use the EVB.

3.1. Power Supply (J101/J301)

The EVB is powered by an external power adapter through the power jack (J101) on the EVB. It can also be powered by the USB interface (J301, referring to **Chapter 3.3**).

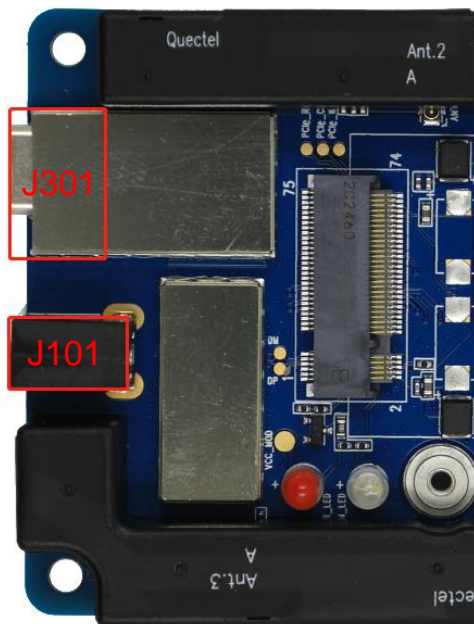The following figure shows the power supply interfaces of the EVB.

Figure 4: EVB Power Supply Interfaces

3.2. M.2 Interface (J201)

The M.2 connector is designed to accommodate the module. The following figure shows the M.2 connector on the EVB.
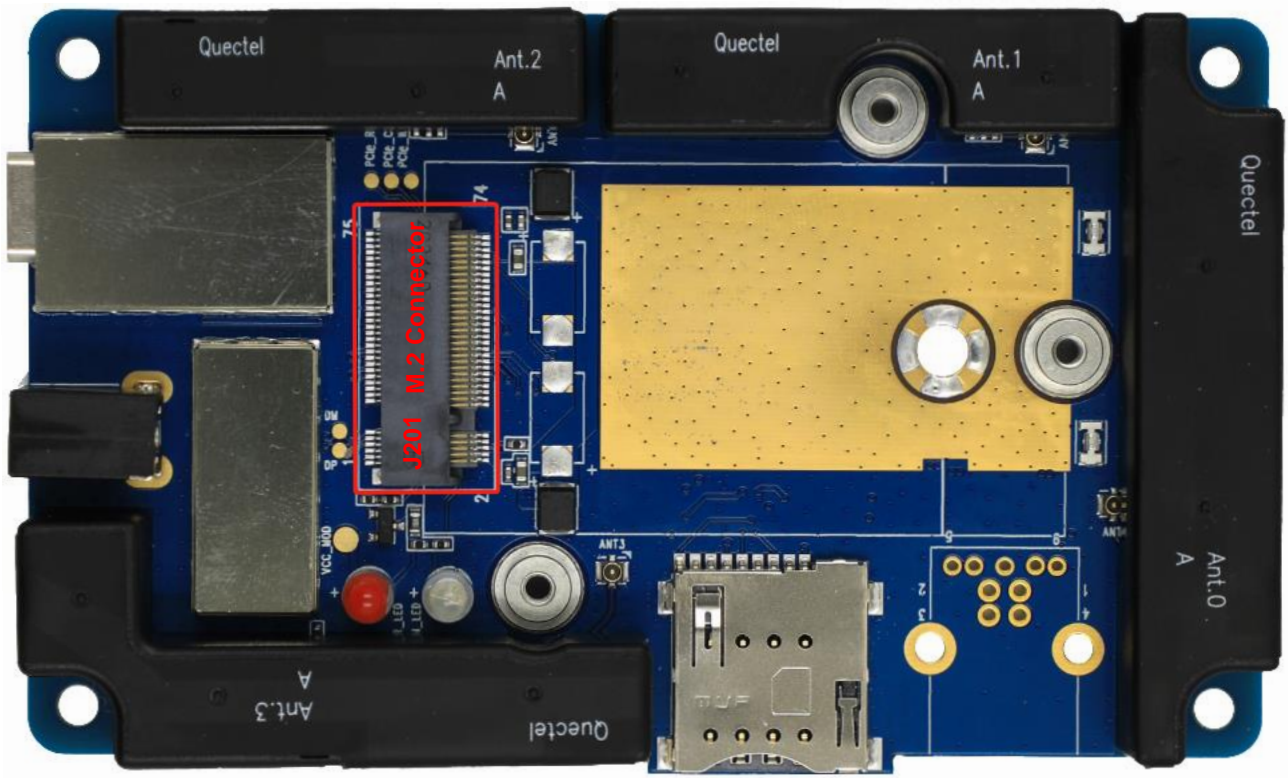

Figure 5: M.2 Connector of the EVB

3.3. USB Interface (J301)

The EVB provides a Type-C USB connector (J301) for the connection with a host. Type-C USB can be used for data transmission. Also, it can be used as power supply interface to power on the EVB.
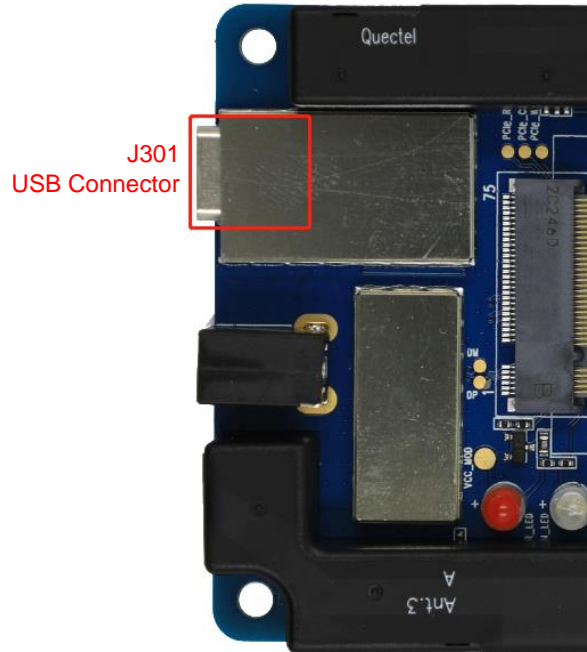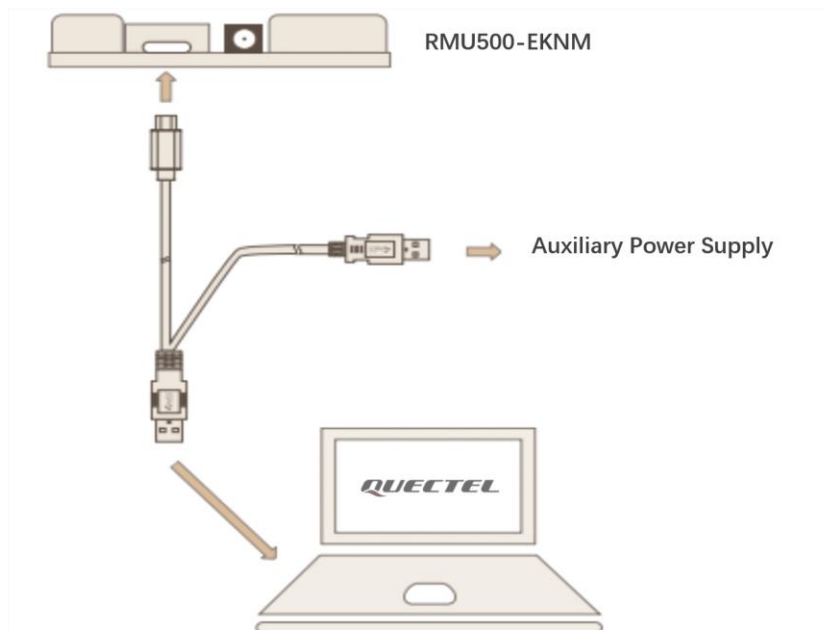

Figure 6: USB Connector

Figure 7: Connection Between PC and EVB

One end of Type-A is connected to the computer, and, when necessary (e.g., when power supply from the Type-A connected to the PC is inadequate), the other end is connected to the auxiliary power supply.

3.4. (U)SIM Interface (J401)

The EVB has an 8-pin push-push type (U)SIM card (1.8/2.95 V) connector (J401). The following figure shows a simplified connection schematic for the (U)SIM card connecter.
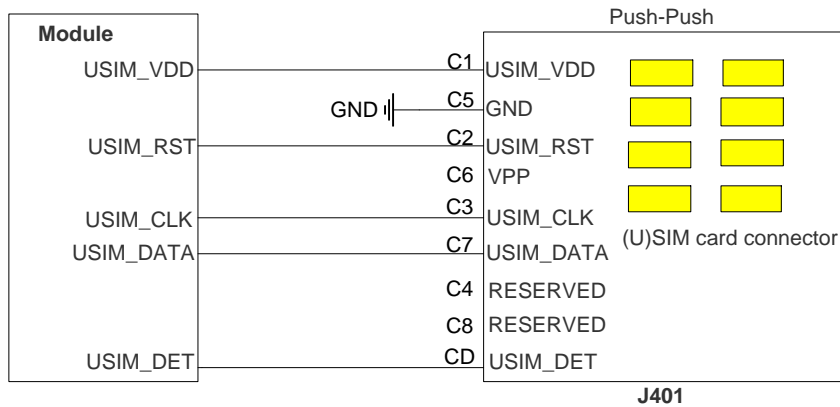

Figure 8: Simplified Connection Schematic for (U)SIM Card Connector J401

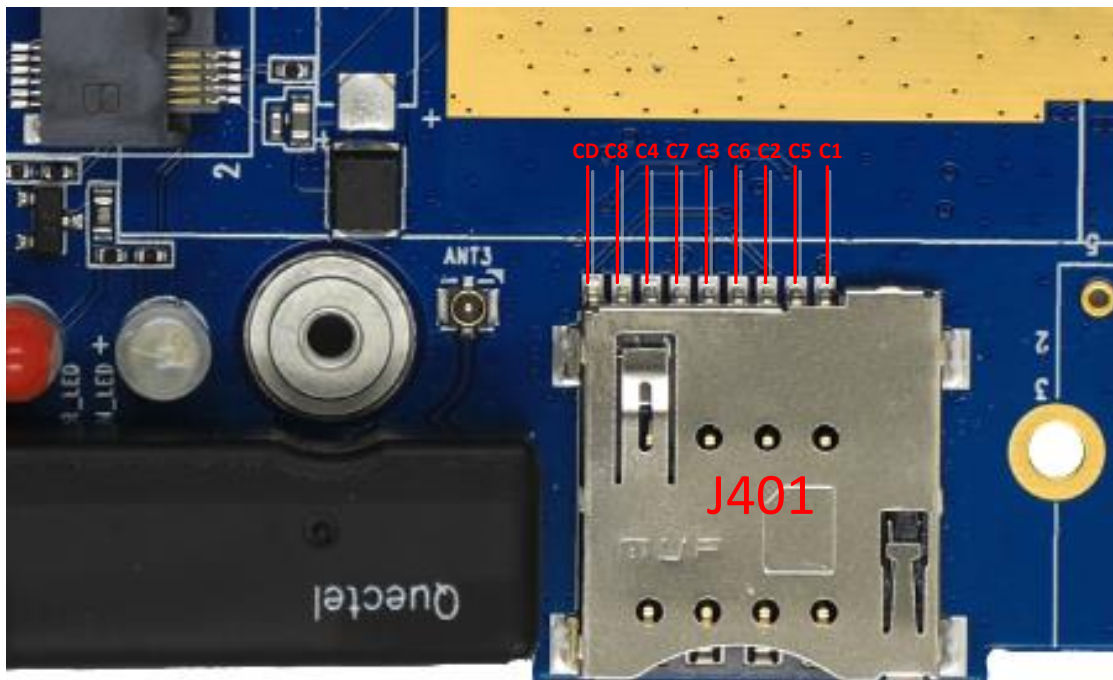The figure and table below illustrate the pin assignment and pin definition of (U)SIM card connector.

Figure 9: Pin Assignment of (U)SIM Card Connector J401

Table 5: Pin Definition of J401

Pin No.	Pin Name	I/O	Function
C1	USIM_VDD	PO	(U)SIM card power supply
C2	USIM_RST	DO	(U)SIM card reset
C3	USIM_CLK	DO	(U)SIM card clock
C4	RESERVED	-	Not connected
C5	GND	-	Ground
C6	VPP	-	Not connected
C7	USIM_DATA	DIO	(U)SIM card data
C8	RESERVED	-	Not connected
CD	USIM_DET	DI	(U)SIM card detection

3.5. Status Indicator (D104/D107)

The EVB provides two status indicator LEDs (D104 and D107). The following figure shows the positions of these indicators.
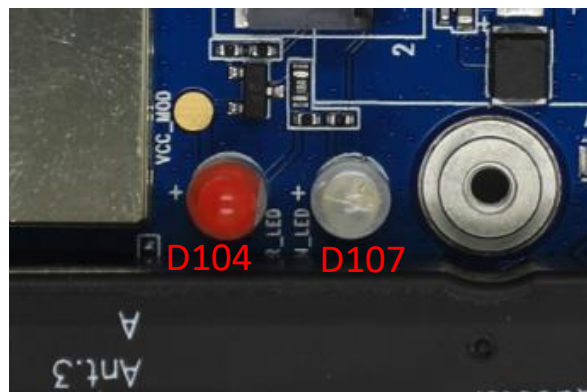

Figure 10: Status Indicators

Table 6: Description of Status Indicator LEDs

Reference Designator	Description
D104 (POWER_LED)	Power indicator, indicating whether the module's power supply is ready. Light on: power on Light off: power off
D107 (WWAN_LED)	RF status indicator for the module. Light on: RF function is enabled Light off: RF function is disabled

3.6. RF Cables and Antennas

3.6.1. Antenna Design

The following figure is a typical reference design for antennas of the EVB kit.
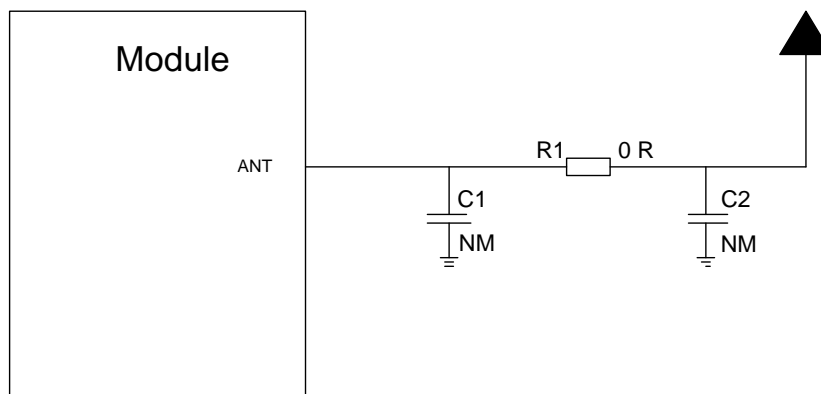

Figure 11: Reference Design for Antennas

The matching circuit is composed of C1, C2 and R1 for antenna impedance modification. The value of R1 is 0 Ω, while C1 and C2 are not mounted by default.
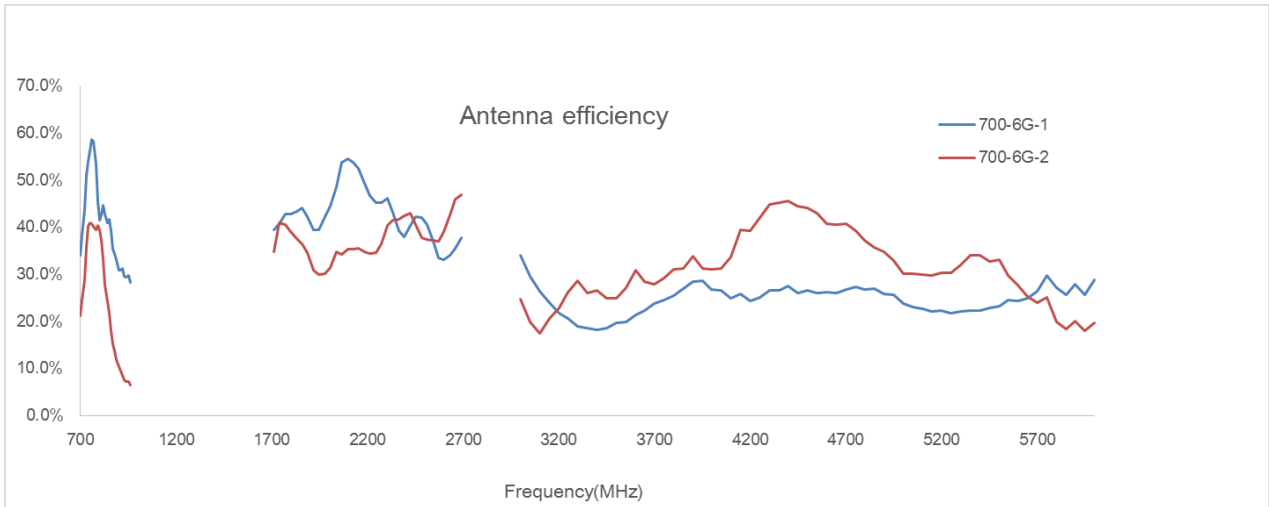
3.6.2. Antenna Efficiency

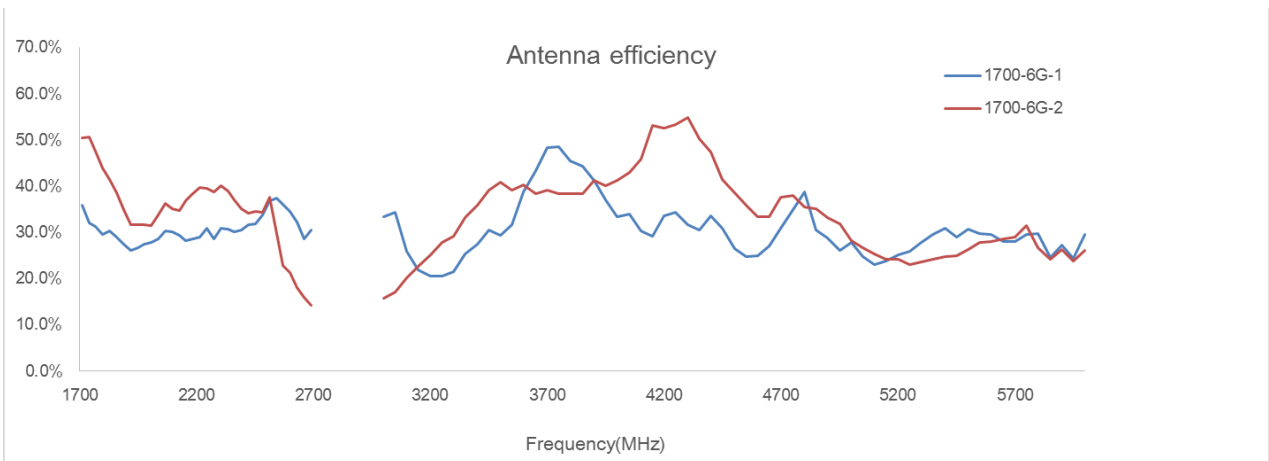**Figure 12: Antenna Efficiency at 700–960 MHz and 1.7–6 GHz**

Figure 13: Antenna Efficiency at 1.7–6 GHz

NOTE

All measurements are done for the antennas of the RMU500-EKNM EVB kit with Agilent E5071C ENA network analyzer and OTA chamber.

3.6.3. Antenna Specification

The specification of antennas is provided in the following table.

Table 7: Antenna Specification

Antenna	Specification
Ant 0	Frequency Range: 0.7–6 GHz Input Impedance: 50 Ω
Ant 1	Frequency Range: 1.7–6 GHz Input Impedance: 50 Ω
Ant 2	Frequency Range: 1.7–6 GHz Input Impedance: 50 Ω
Ant 3	Frequency Range: 0.7–6 GHz Input Impedance: 50 Ω

The cable assembly varies when different modules are used with this EVB kit. The installations for RM500Q-CN and RM500Q-GL are the same, so does that for RM500Q-AE and RM502Q-AE). The following figures illustrate these cable connections.
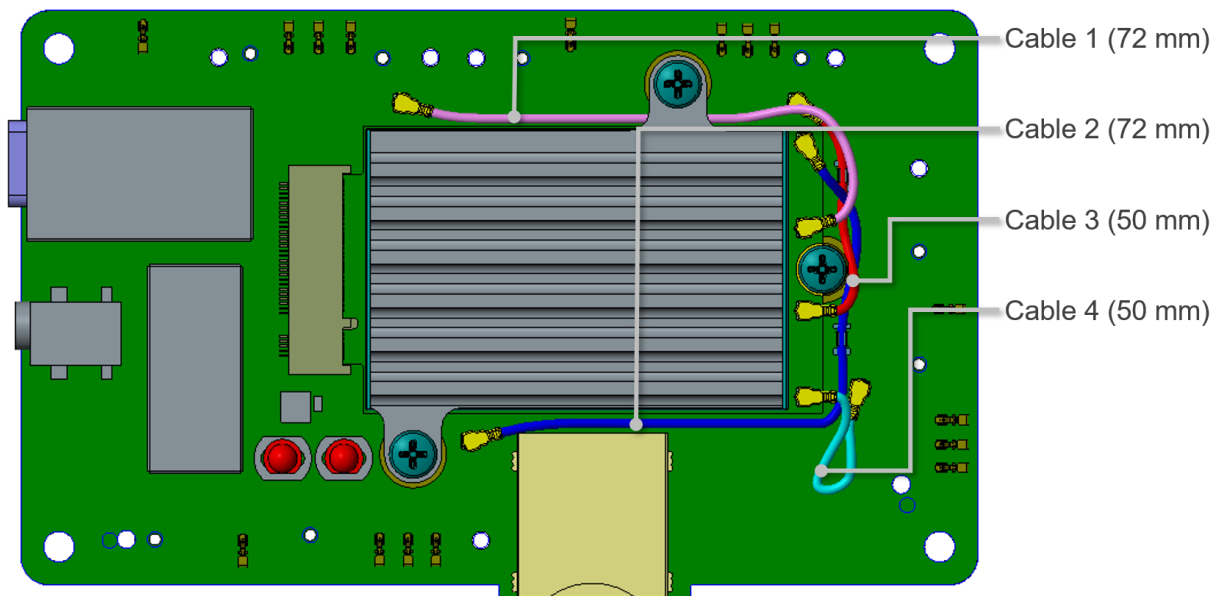

Cable 1 (72 mm)
Cable 2 (72 mm)
Cable 3 (50 mm)
Cable 4 (50 mm)

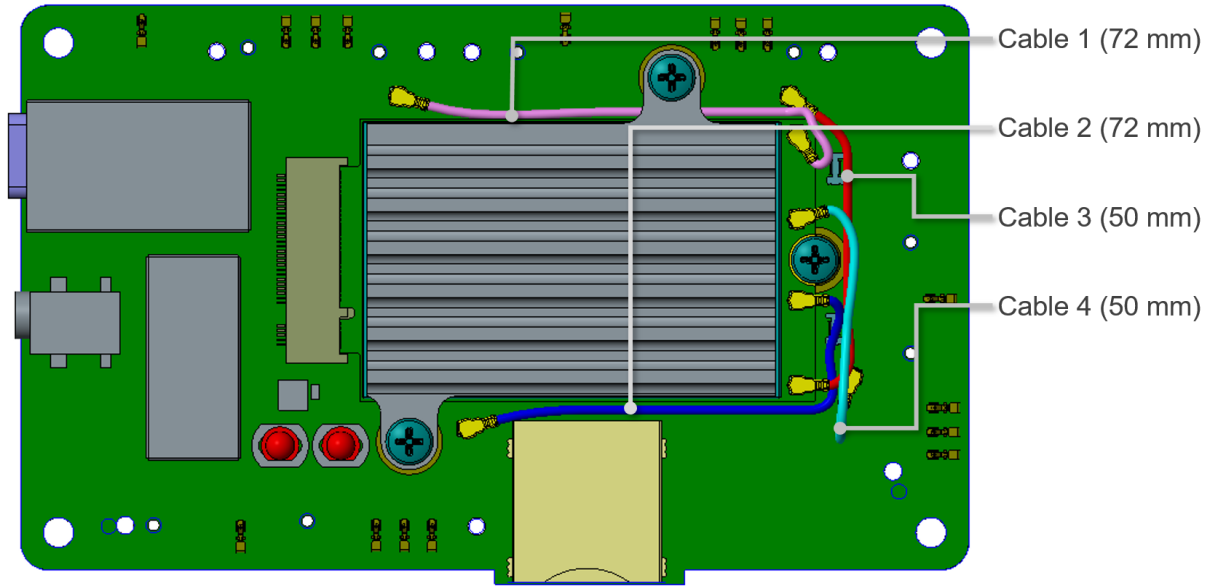**Figure 14: RM500Q-CN/RM500Q-GL RF cable Sequence**

Figure 15: RM500Q-AE/RM502Q-AE RF Cable Sequence

NOTE

1. Ant 0–3 have been assembled on the EVB to prevent damage during transportation.
2. The RM500Q-CN module, which supports GNSS L1 + L5, cannot support L5 in this case because the frequency range of Ant 1 is 1.7–6 GHz.

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4 EVB Operation Procedures

This chapter introduces how to assemble and use the RMU500-EKNM EVB kit to test and evaluate the module.

4.1. Component Assembling Steps

Please follow these steps to assemble the product.

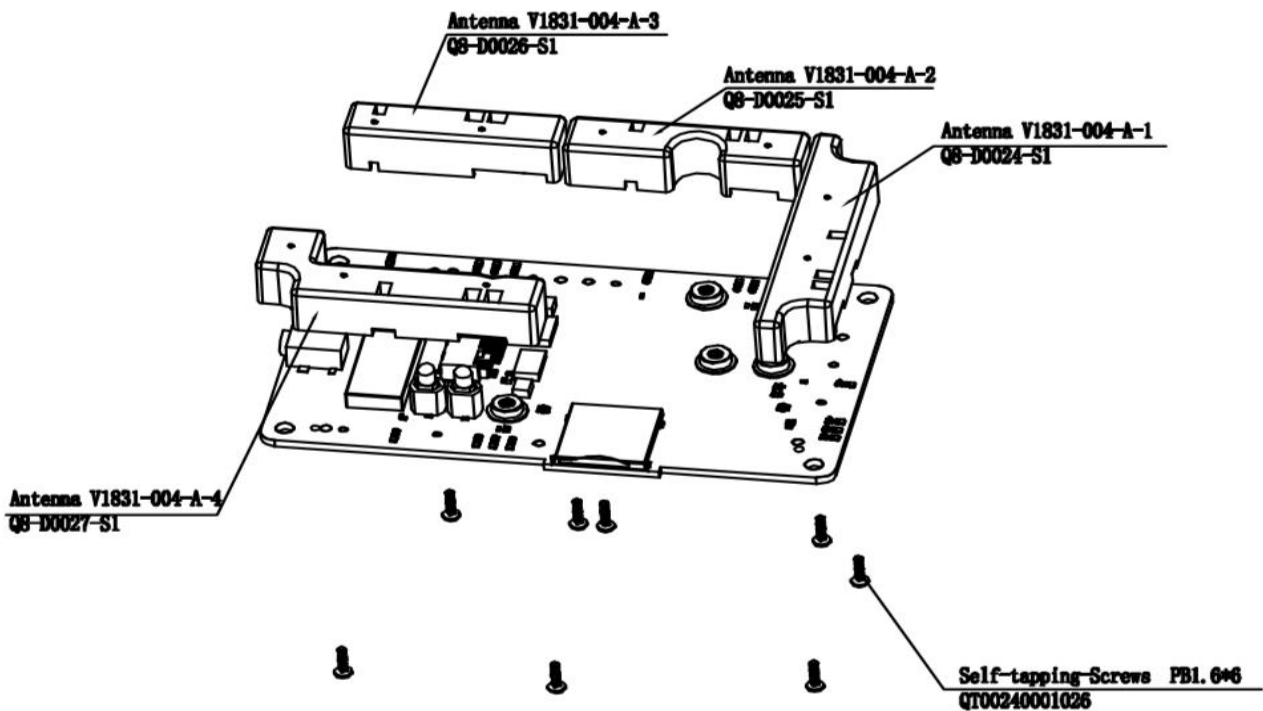**Step 1:** Remove the antennas one by one, and keep the antennas and screws.

Figure 16: Assembling (Step One)

Step 2: Attach the thermal conductive pad, insert the module, and lock the screw.
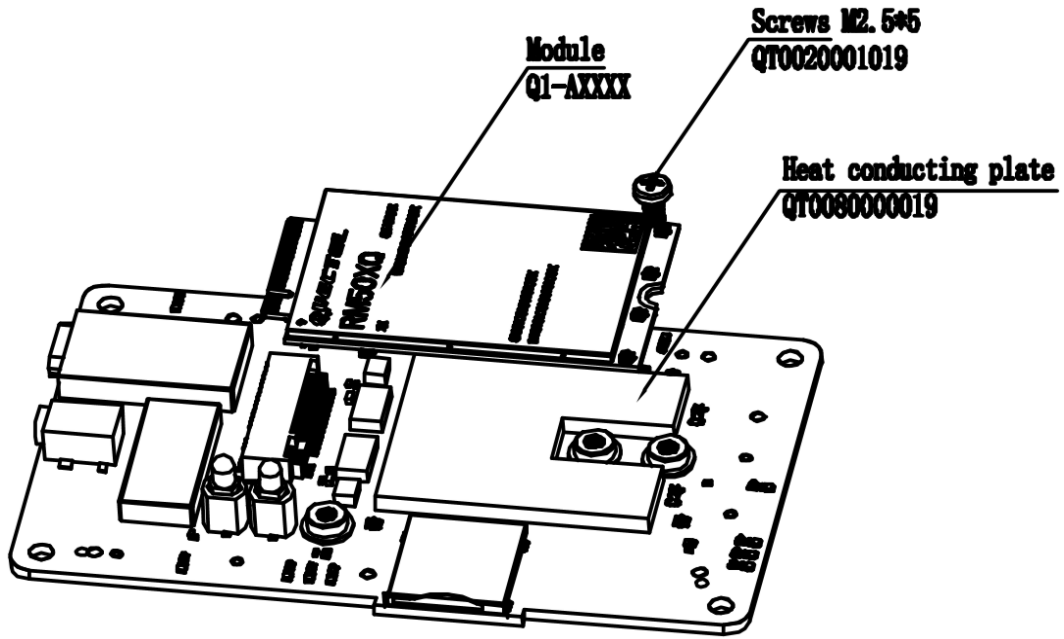

Figure 17: Assembling (Step Two)

Step 3: Insert four RF cables. There are two RF cable assembling methods when the EVB kit is used with different modules.
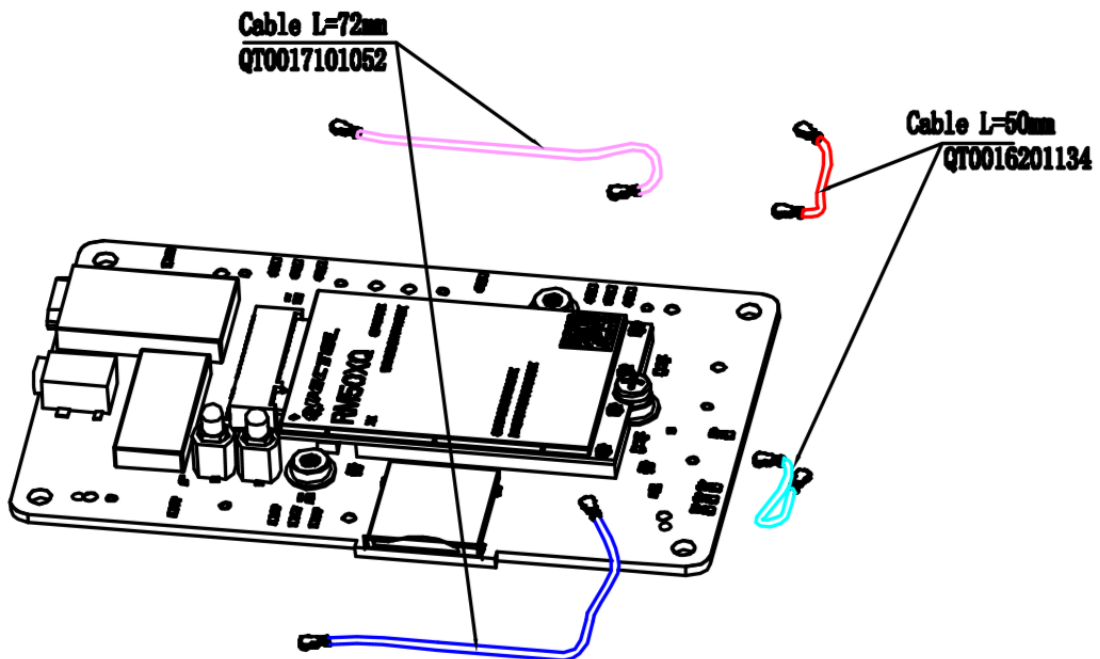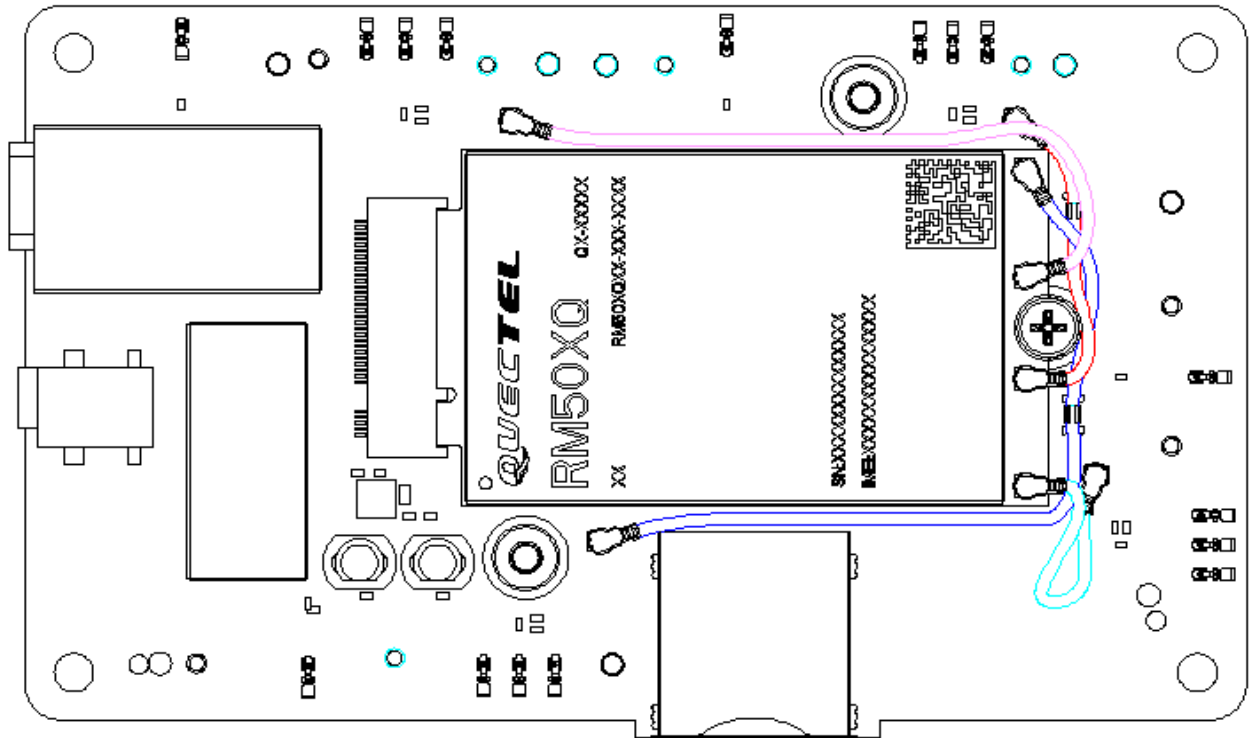

Figure 18: Assembling (Step Three)

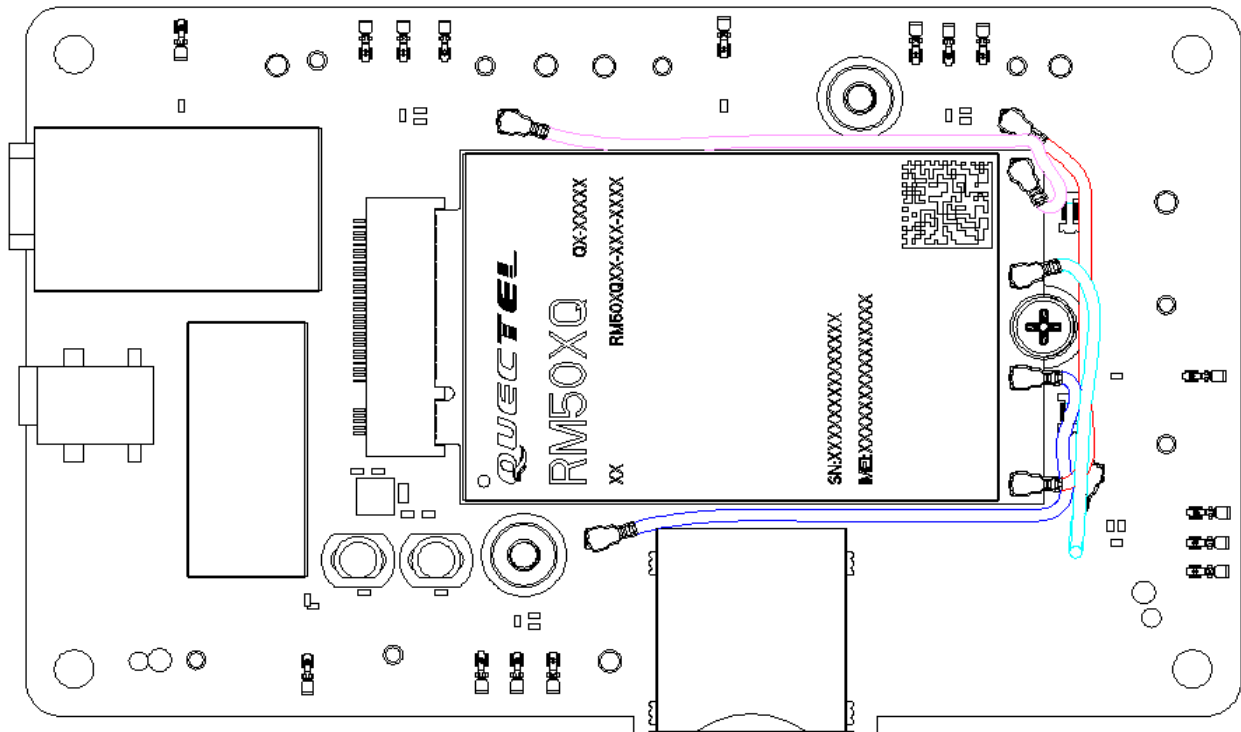**Figure 19: RM500Q-CN/RM500Q-GL RF Cable Assembly**

Figure 20: RM500Q-AE/RM502Q-AE RF Cable Assembly

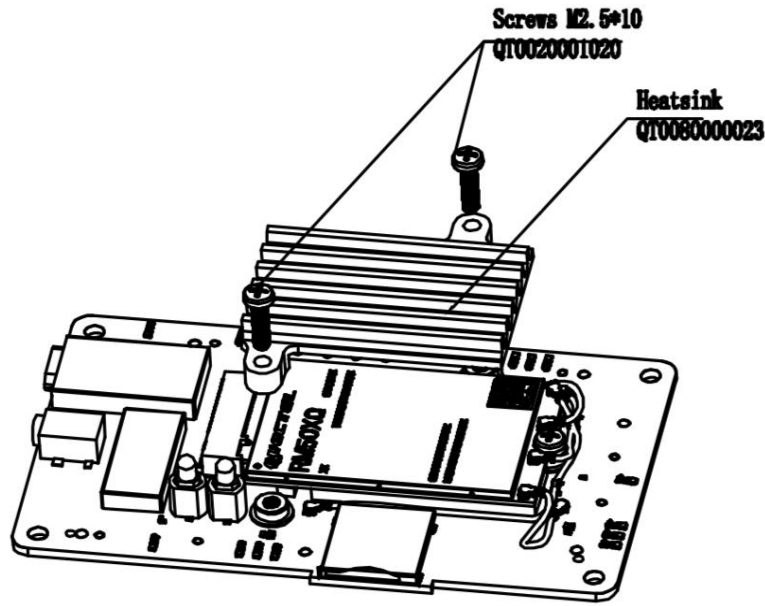**Step 4:** Place the heatsink on the module and tighten the screws.

Figure 21: Assembling (Step Four)

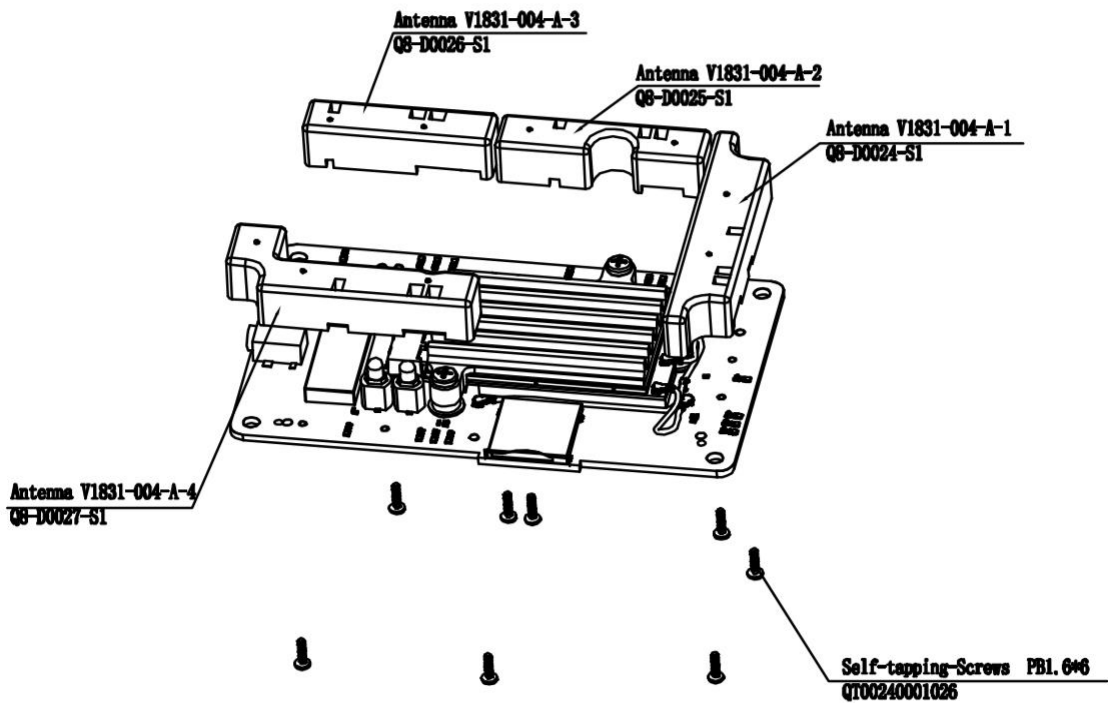**Step 5:** Assemble the antenna in turn and tighten the screws.

Figure 22 Assembling (Step Five)

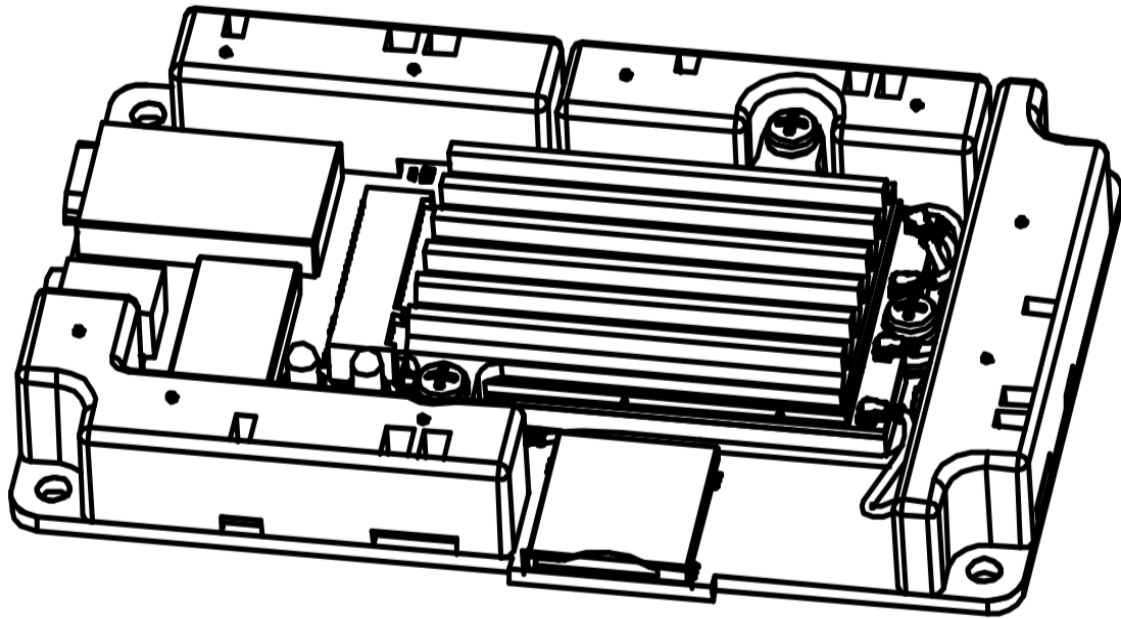Then, the assembly is finished. The assembled EVB kit is shown below.

Figure 23: Assembled EVB Kit

4.2. Turn On the Module

1. Finish the assembling steps above.

2. Insert a (U)SIM card into the (U)SIM card connector on the EVB.

3. Insert the USB cable (Type-C to dual Type-A). Connect the type-C end to the EVB, one Type-A end to the computer, and the other Type-A end to an auxiliary power supply. The module will be turned on automatically when the EVB is powered through the USB interface (J301) or the power jack (J101).

4.3. Communication Via USB Interface

1. Power on the module according to the procedure in *Chapter 4.1*.

2. When the EVB is connected to a PC with the USB Type-C cable through the USB interface, run the USB driver disk on the PC to install the USB driver. For details about USB driver installation, see *document [1]*. The USB port numbers can be viewed in Device Manager of the PC when the USB driver is installed, as shown below.

Figure 24: USB Ports

3. Install and then use QCOM provided by Quectel to realize the communication between the module and the PC.

The following figure shows the COM Port Setting of QCOM: select correct "**COM Port**" (USB AT Port which is shown in the figure above) and set correct "**Baudrate**" (e.g. 115200 bps). For more details about QCOM usage and configuration, see **document [2]**.
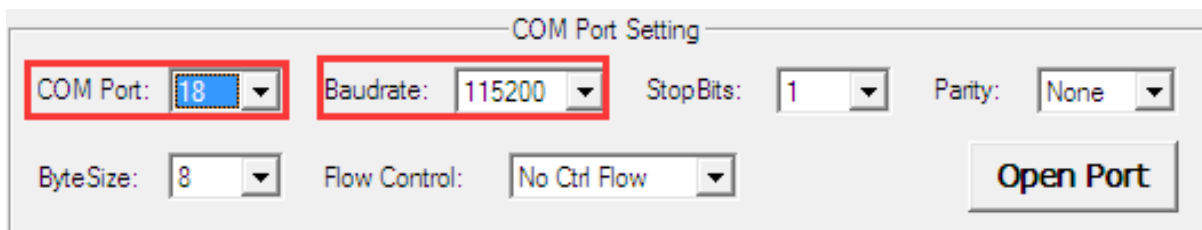

Figure 25: COM Port Setting Field on QCOM (USB AT Port Connection)

4.4. Firmware Upgrade

Firmware of the module is upgraded via USB port by default, please follow the procedures below to upgrade the firmware.

1. Install and open the firmware upgrade tool, QFlash, on the PC and then turn on the module according to the procedures in **Chapter 4.2**.

2. Click the "**COM Port**" dropdown list and select the Port No. corresponding to "Quectel USB DM Port" in the Device Manager.

3. Click the "**Load FW Files**" button and choose the firmware package.

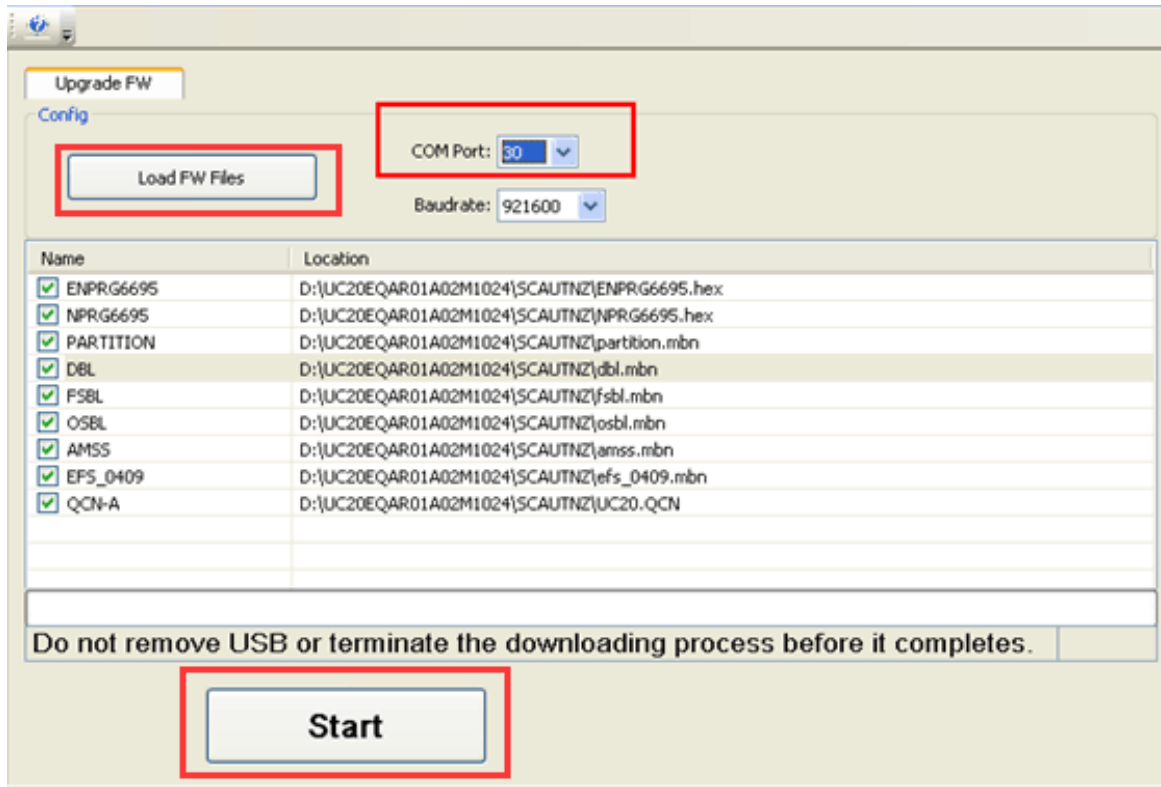4. Click the "**Start**" button to upgrade the firmware.

Figure 26: Configurations for Firmware Upgrade

For more details about QFlash usage and configuration, see *document [3]*.

4.5. Turn Off the Module

There are two methods to turn off the module.

● Hardware method: the module will be turned off after the power supply is disconnected.
● Software method: the module can be turned off with **AT+QPOWD** command, which is a preferred and safer method. The module will log off from the network and save data before shutdown.

5 Appendix References

Table 8: Related Documents

Document Name
[1] Quectel_LTE&5G_Windows_USB_Driver_Installation_Guide
[2] Quectel_QCOM_User_Guide
[3] Quectel_QFlash_User_Guide
[4] Quectel_RG50xQ&RM5xxQ_Series_AT_Commands_Manual

Table 9: Terms and Abbreviations

Abbreviation	Description
COM	Communication Port
DC	Direct Current
DI	Digital Input
DO	Digital Output
EVB	Evaluation Board
GND	Ground
I/O	Input/Output
LED	Light Emitting Diode
NC	Not Connected
PC	Personal Computer
PCB	Printed Circuit Board

PO	Power Output
RF	Radio Frequency
SD	Secure Digital
SIM	Subscriber Identity Module
UART	Universal Asynchronous Receiver & Transmitter
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identity Module

PO   Power Output