Overview

Features

- Integrates extensive network protocols, with multi drivers and software support, compatible with different OS including Windows / Linux / Android.
- USB 3.1 port (USB 2.0 compatible) for connecting to PC, Raspberry Pi, or Jetson Nano host board to enable high-speed 5G communication.
- Standard M.2 B KEY slot, compatible with different 5G modules: RM500U-CN / RM500Q-GL / RM500Q-AE / RM502Q-AE series.
- Onboard UART, PWR, and RST control pin, built-in voltage level translator, enabled via DIP switch, for use with hosts like Raspberry Pi or Arduino.
- Onboard USB-C connector, enabled via a switch, for connecting the standalone power supply for the module, allows more loads, a stable and flexible power supply.
- Onboard power supply on/off switch, reset button, and LED indicator, easy to turn on/off the module or monitor the operating status.
- 2 x SIM card slot, dual card single standby, switchable via AT command. (Some 4G/5G modules do not support dual sim cards, depending on the actual supporting modules.)

- High-efficiency power supply circuit, up to 3A output current.

Version Options

This product is available with an optional 5G module and also with the optional case.

SIM8202G-M2

SIM8262E-M2

Without Case

With Case

Selection Guide

5G Sub-6		RM500U-CN	RM500Q-GL	RM500Q-AE	RM502Q-AE
					
Region / Provider		China	Global (except US)	Global (except China)	Global (except China)
Operating Temperature		-30 °C ~ +75 °C		-30 °C ~ +70 °C	
Extension Temperature		-40 °C ~ +85 °C			
Dimensions		30.0 × 52.0 × 2.3 (mm)			
Weight		8.9 (g)	8.7 (g)		
Power Supply		3.3~4.4 V, typical 3.7 V	3.135~4.4 V, typical 3.7 V		
Power Consumption		90 μA @ shutdown 3.7 mA @ hibernate TBD @ USB 2.0, idle TBD @ USB 3.0, idle	70 μA @ shutdown 4.0 mA @ hibernate 32 mA @ USB 2.0, idle 54 mA @ USB 3.0, idle	80 μA @ shutdown 4.2 mA @ hibernate 39 mA @ USB 2.0, idle 54.5 mA @ USB 3.0, idle	195μA @ shut down 4.7mA @ hibernate 41mA @ USB 2.0, idle 60mA @ USB 3.0, idle
Frequency Band					
5G	**5G NR NSA**	n41, n78, n79	n41, n77, n78, n79	n1, n2, n3, n5, n7, n8, n12, n20, n25, n28, n38, n40, n41, n48, n66, n71, n77, n78, n79	n1, n2, n3, n5, n7, n8, n12, n13, n14, n18, n20, n25, n26, n28, n29, n30, n38, n40, n41, n48, n66, n70, n71, n76, n77, n78, n79
	5G NR SA	n1, n28, n41, n77, n78, n79	n1, n2, n3, n5, n7, n8, n12, n20, n25, n28, n38, n40, n41, n48, n66, n71, n77, n78, n79		n1, n2, n3, n5, n7, n8, n12, n13, n14, n18, n20, n25, n26, n28, n29, n30, n38, n40, n41, n48, n66, n70, n71, n76, n77, n78, n79

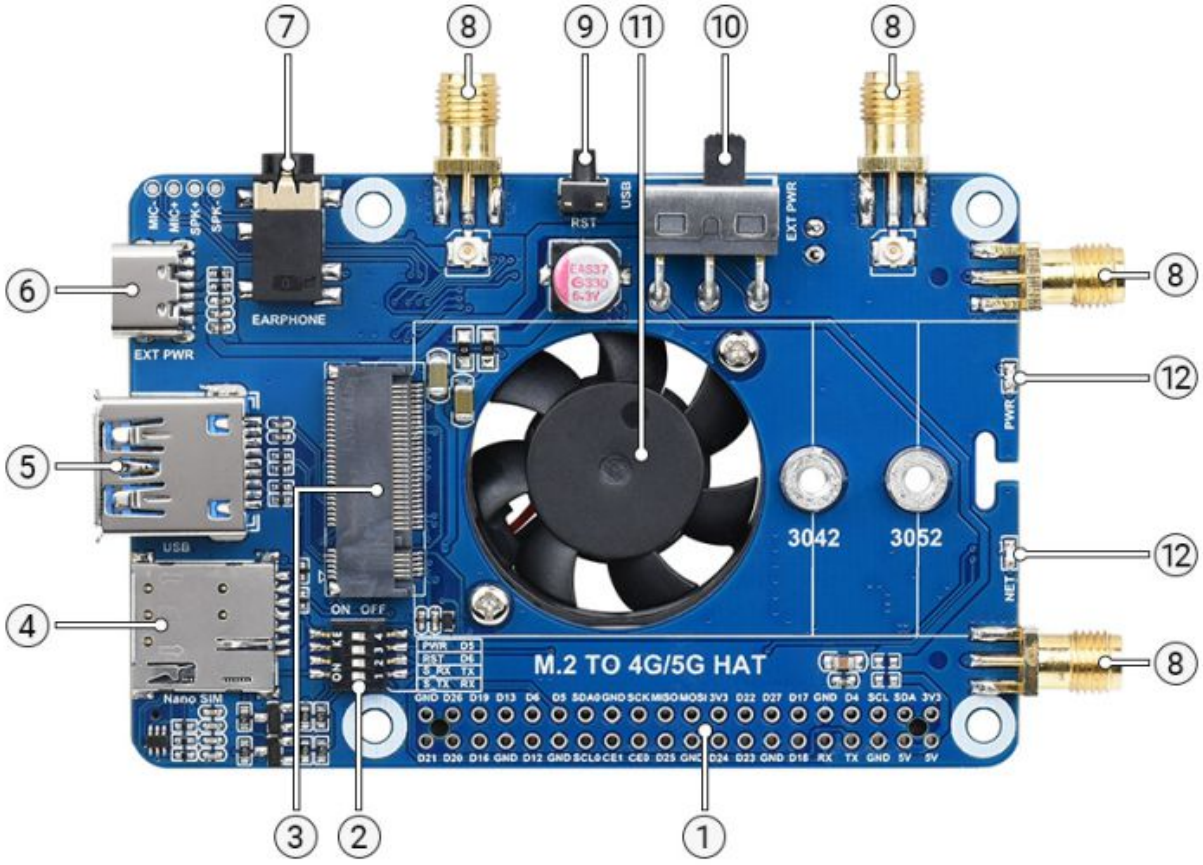
LTE	**LTE-FDD**	B1, B2, B3, B5, B7, B8, B20, B28	B1, B2, B3, B4, B5, B7, B8, B12(B17), B13, B14, B18, B19, B20, B25, B26, B28, B29, B30, B32, B66, B71		
	LTE-TDD	B34, B38, B39, B40, B41	B34, B38, B39, B40, B41, B42, B43, B48		
	LAA	-	B46		
UMTS	**WCDMA**	B1, B2, B5, B8	B1, B2, B3, B4, B5, B6, B8, B19		
GNSS		-	GPS / GLONASS / BeiDou (Compass) / Galileo		
Data Rate					
5G SA Sub-6		downlink 2 Gbps; uplink 1 Gbps	downlink 2.1 Gbps; uplink 900 Mbps	downlink 2.1 Gbps; uplink 450 Mbps	downlink 4.2 Gbps; uplink 450 Mbps
5G NSA Sub-6		downlink 2.2 Gbps; uplink 575 Mbps	downlink 2.5 Gbps; uplink 600/650 Mbps	downlink 2.5 Gbps; uplink 650 Mbps	downlink 5 Gbps; uplink 650 Mbps
LTE		downlink 600 Mbps; uplink 150 Mbps	downlink 1.0 Gbps; uplink 200 Mbps	downlink 1.0 Gbps; uplink 200 Mbps	downlink 2 Gbps; uplink 200 Mbps
UMTS		downlink 42.2 Mbps; uplink 11 Mbps	downlink 42 Mbps; uplink 5.76 Mbps		
*** means developing/planning/processing**					

Quectel_RM500Q-GL_5G_Specification： [Datasheets 1]

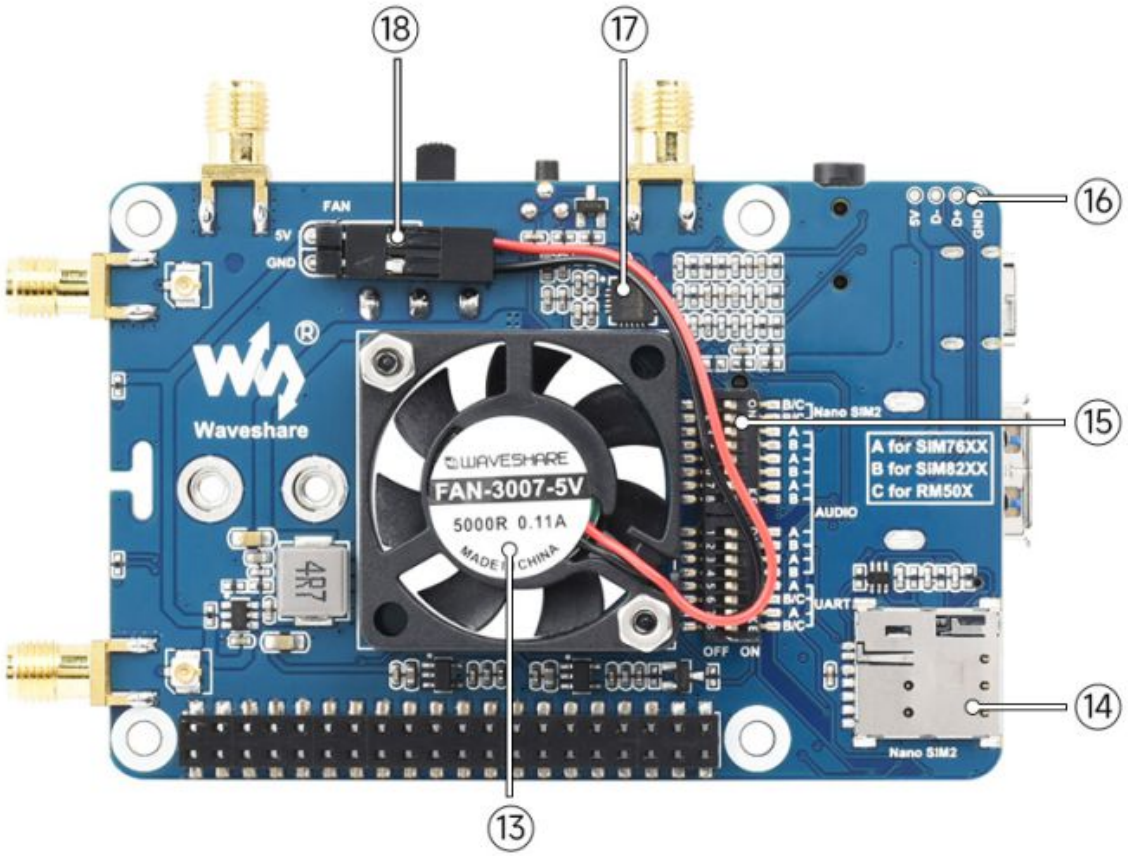
Quectel_RM500Q-AE_5G_Specification： [Datasheets 2]

Quectel_RM502Q-AE_5G_Specification： [Datasheets 3]

What's On Board



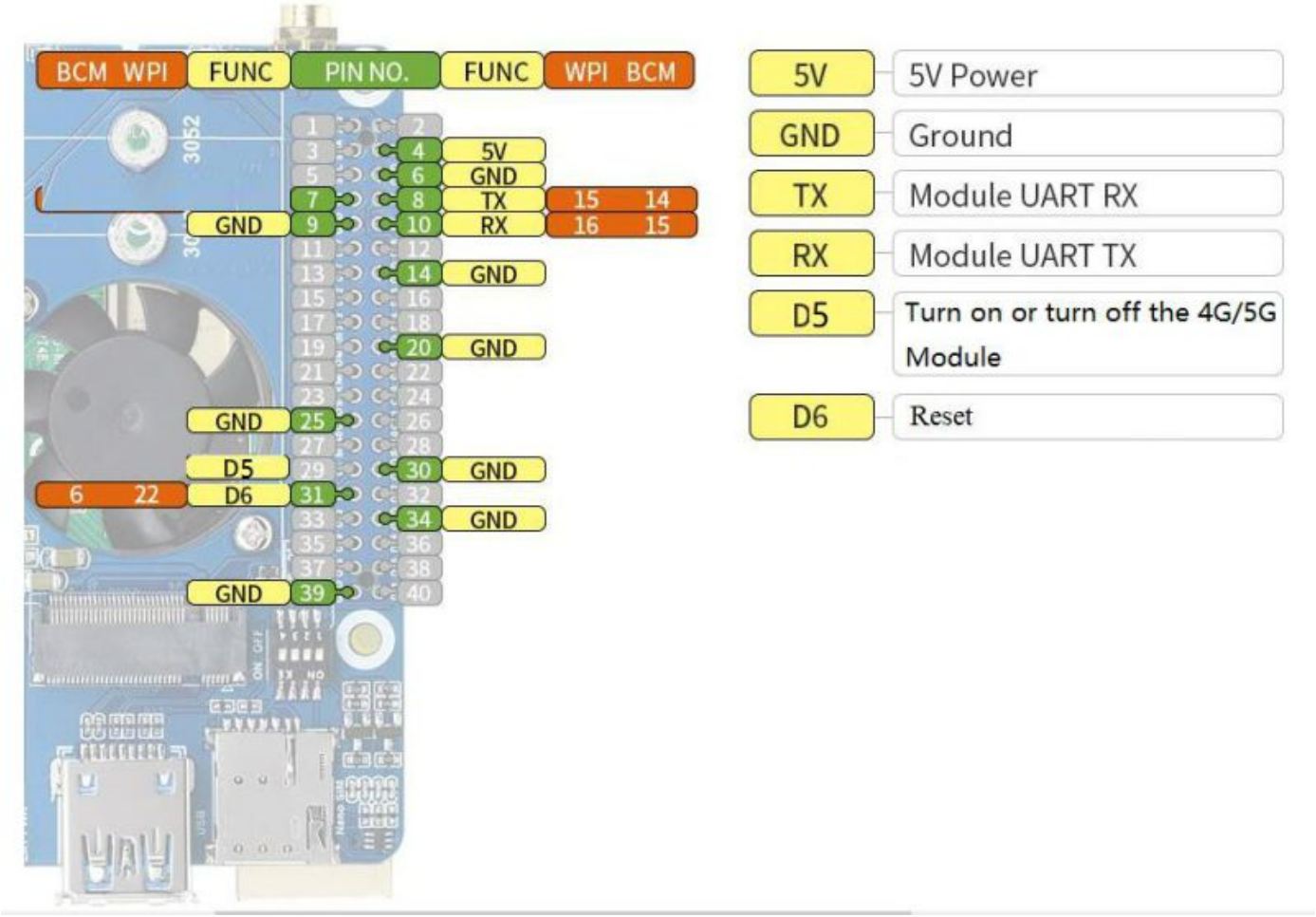
Number	Name	Description
①	Raspberry Pi GPIO Header	Easily connect to Raspberry Pi
②	Switch	Enable the corresponding pin
③	M.2 Interface	Compatible with RM500U-CN / RM500Q-CN / RM500Q-GL /RM50XQ-AE and other series of 5G modules
④	SIM Card Holder	Onboard two SIM card slots, dual card single standby. The default SIM1 card slot works, SIM2 is on the back, requires module support, and must be switched through AT commands
⑤	USB 3.1 Connector	Backward compatible with USB 2.0, can be used to connect to PC/Raspberry Pi/Jetson Nano, etc.
⑥	USB Type-C Connector	5V 3A input; stable and flexible power supply
⑦	Audio Port	SIM82XX series support audio function, RM50XX series do not support this audio function
⑧	Antenna Connector	Onboard four-way antenna, strong signal
⑨	Reset Switch	One-key reset
⑩	Power Switch	To facilitate the power supply mode of the control module: ——If set to USB, the module will provide power through the "⑤.USB3.1 interface"; ——If set to EXT PWR, the module will provide power through the "⑥.USB Type-C interface" external power supply
⑪	Cooling Fan	Cool down the Raspberry Pi and 5G module at the same time
⑫	Indicator	Check the module running status anytime, anywhere


18
17
16
15
14
13
FAN
5V
GND
Waveshare
WAVESHARE
FAN-3007-5V
5000R 0.11A
MADE IN CHINA
5V
D-
D+
GND
Nano SIM2
A for SIM76XX
B for SIM82XX
C for RM50X
AUDIO
UART
OFF ON
Nano SIM2

Number	Name	Description
⑬	Cooling Fan	Simultaneously cooling Raspberry Pi and 5G modules
⑭	SIM Card Slot 2	Switchable via AT command (module is required)
⑮	Module Setting Switch	Switch A to ON for SIM7600X / A7906X / IM7906X / SIM7912X series 4G M.2 module; Switch B to ON, for SIM8202X / SIM8200EA / SIM8262X series 5G M.2 module; Switch C to ON, for RM50X / RM520N-GL / EM06X series 5G / LTE-A M.2 module
⑯	USB Interface Pad	USB 2.0 interface pad
⑰	NAU8810X Audio Chip	For SIMN7600X / SIM8XXX series module, does support RM5XX and EM06XX series module
⑱	Fan Header	5V power supply for cooling fan

Pinout Definition

After connecting to Raspberry Pi, these pins (TX, RX, D4 and D6) can be connected or not through the DIP switch:



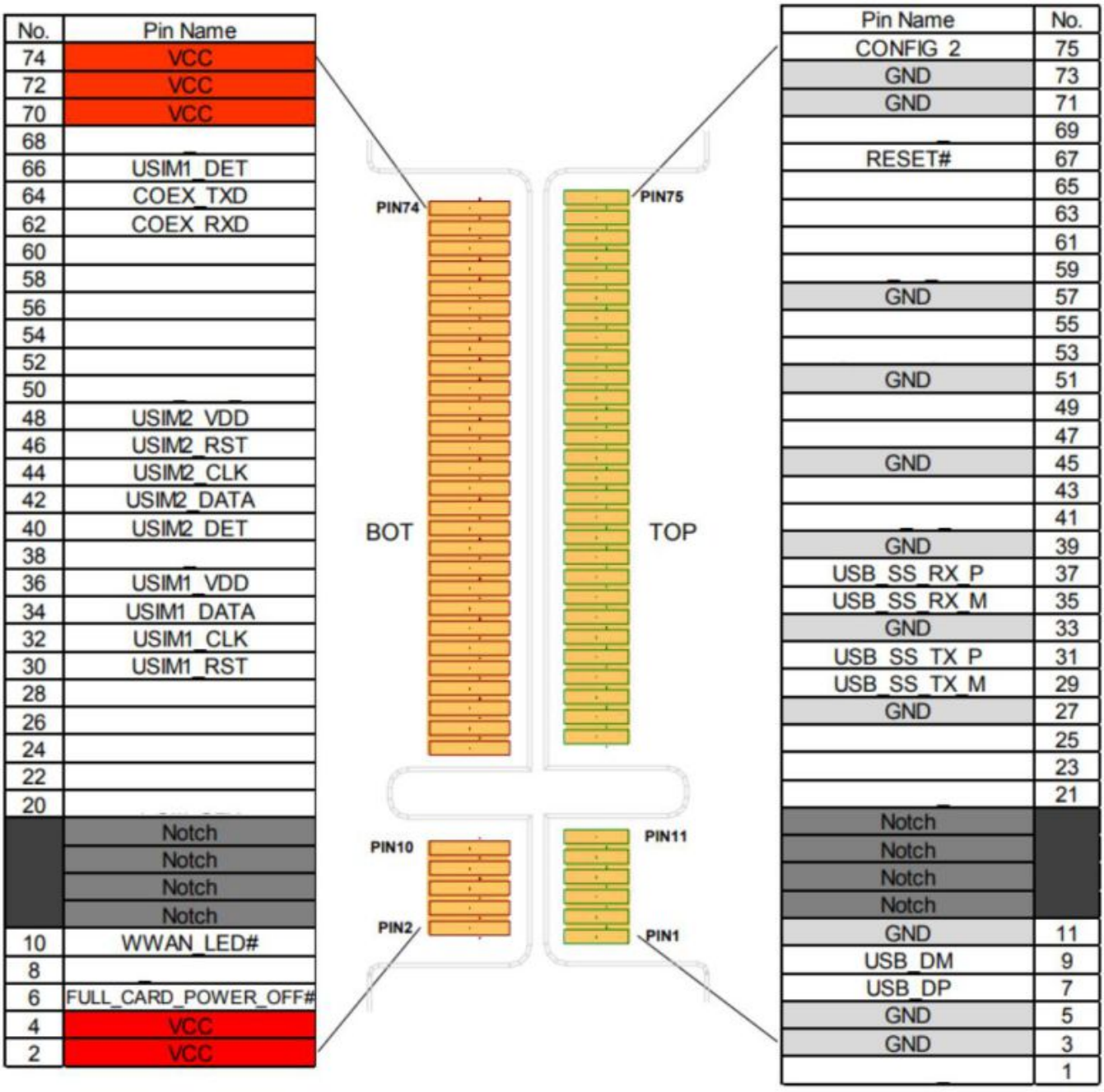
4G/5G modules function testing

Category	4G/5G Module	Network Communication	GNSS Positioning	Voice calls through Earphone Port	Dual SIMs	UART Interface	External Power Supply?
5G	SIM8202G-M2	5G/4G/3G	Support	Support	Support	Support	Optional, but recommended
5G	SIM8200EA-M2	5G/4G/3G	Support	Support	Support	Support	Optional, but recommended
5G	RM500U-CN	5G/4G/3G	NOT Support	NOT Support	Support	Support	Recommended
5G	RM500Q-GL	5G/4G/3G	Support	NOT Support	Support	NOT Support	Recommended
5G	RM500Q-AE	5G/4G/3G	Support	NOT Support	NOT Support	NOT Support	Recommended
5G	RM502Q-AE	5G/4G/3G	Support	NOT Support	NOT Support	NOT Support	Recommended
LTE-A	EM06-E	LTE-A/4G/3G	NOT Support	NOT Support	NOT Support	NOT Support	Optional

LTE-A	A7906E	LTE-A/4G/3G	NOT Support	NOT Support	NOT Support	NOT Support	Optional
4G	SIM7600G-H-M2	4G/3G/2G	Support	Support	NOT Support	Support	Optional

4G/5G Module Compatibility

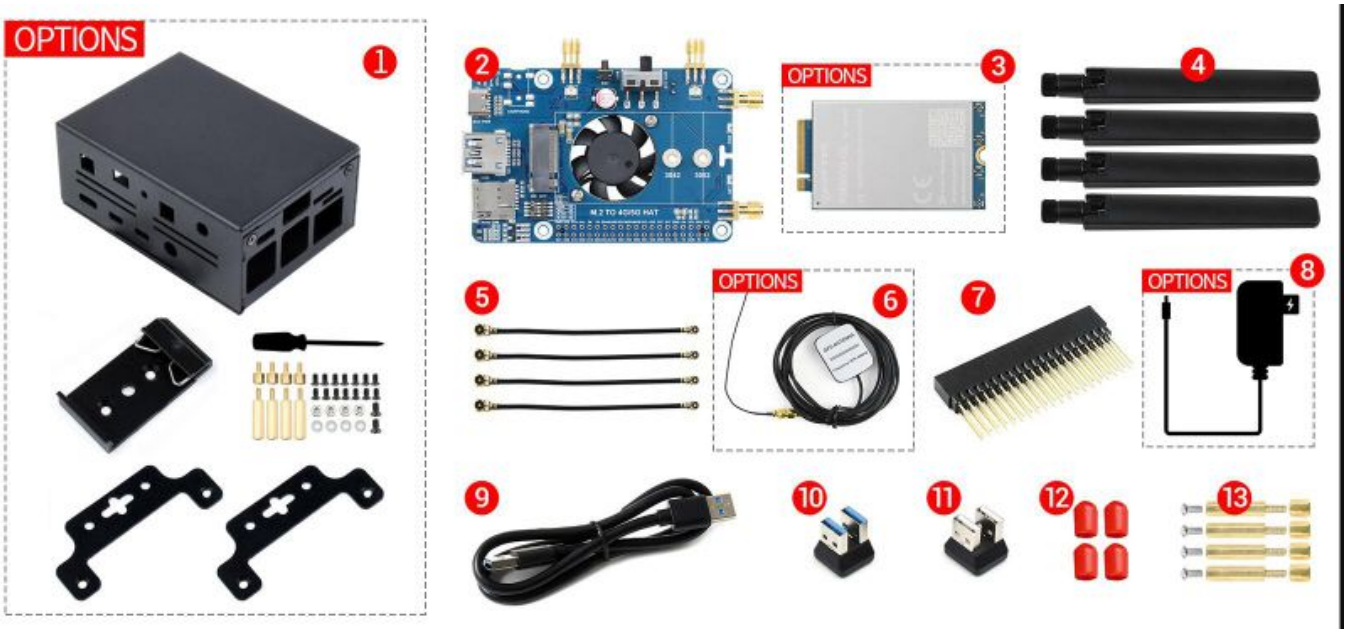
If you need to use the M.2 TO 4G/5G HAT for other 4G/5G modules, you can refer to the M.2 connection diagram below, check whether there is any pin conflict, and then connect to test:



Working With Windows

Hardware Preparation

- In addition to the items in the package,

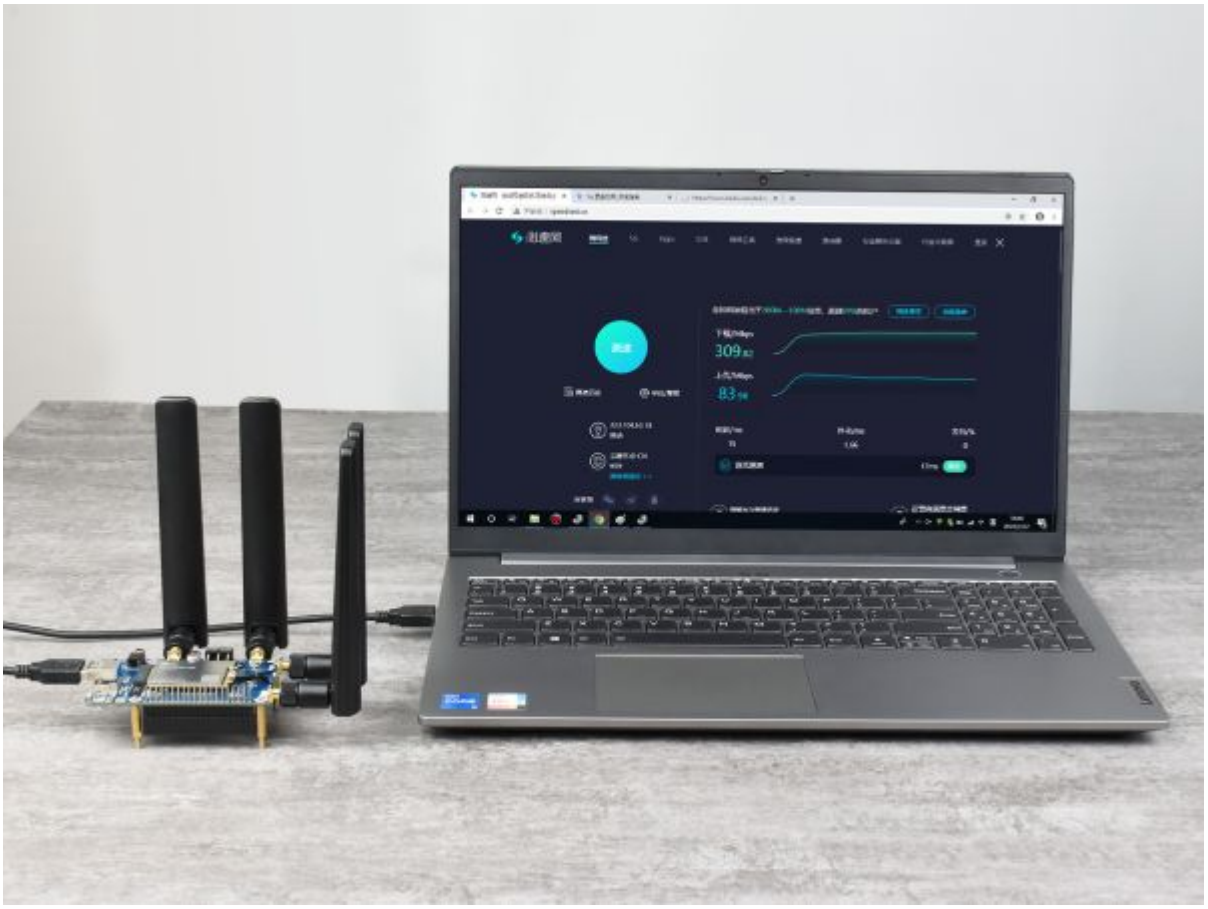


- you need to prepare the following items:

```
* A 5G SIM card (no downtime and 5G enabled);
* A computer with a Windows operating system  (Such as Windows 10)
* A headphone cable with a microphone (optional);
```

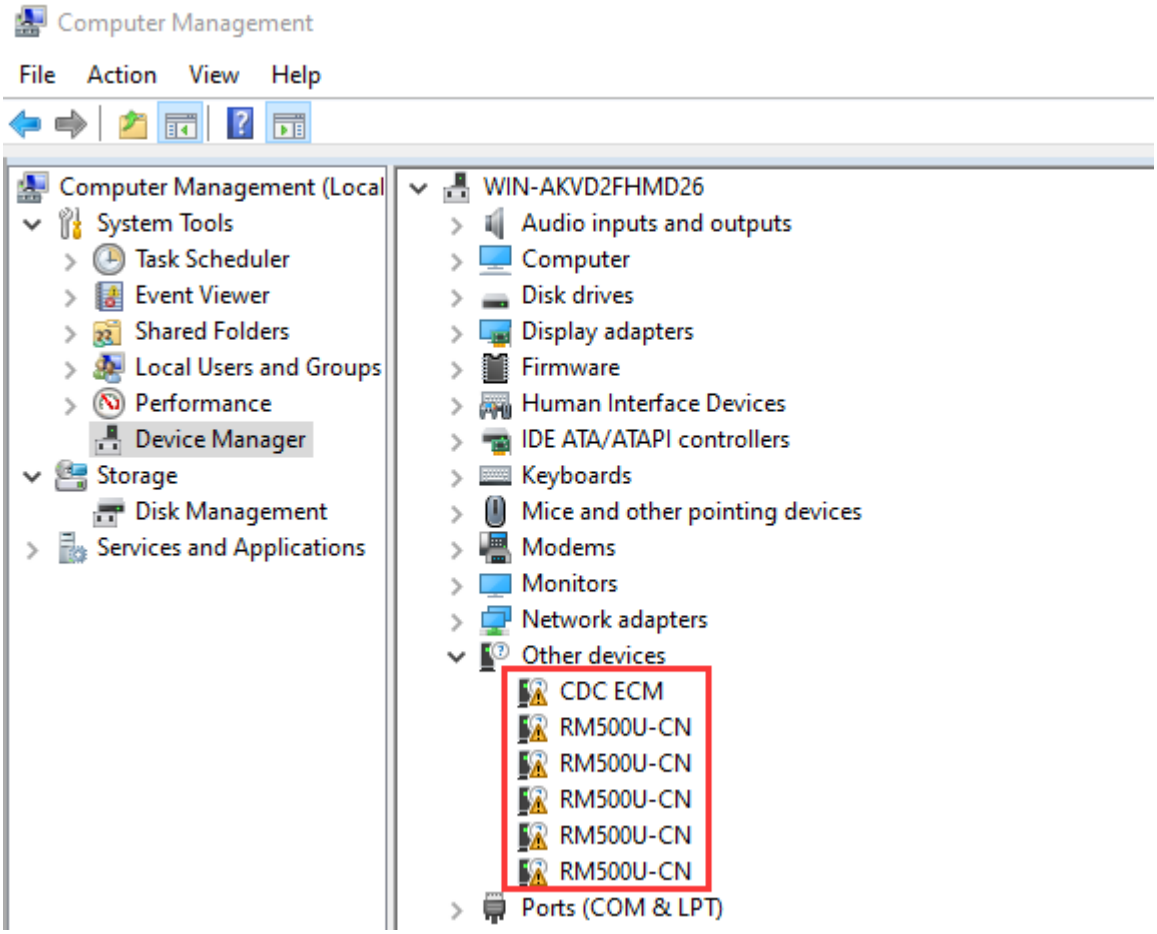
Hardware Connection

Connect the 5G HAT with a usb3.0 cable, and connect an external 5V power supply to the Type-C power supply port of the 5G HAT, as shown in the figure:

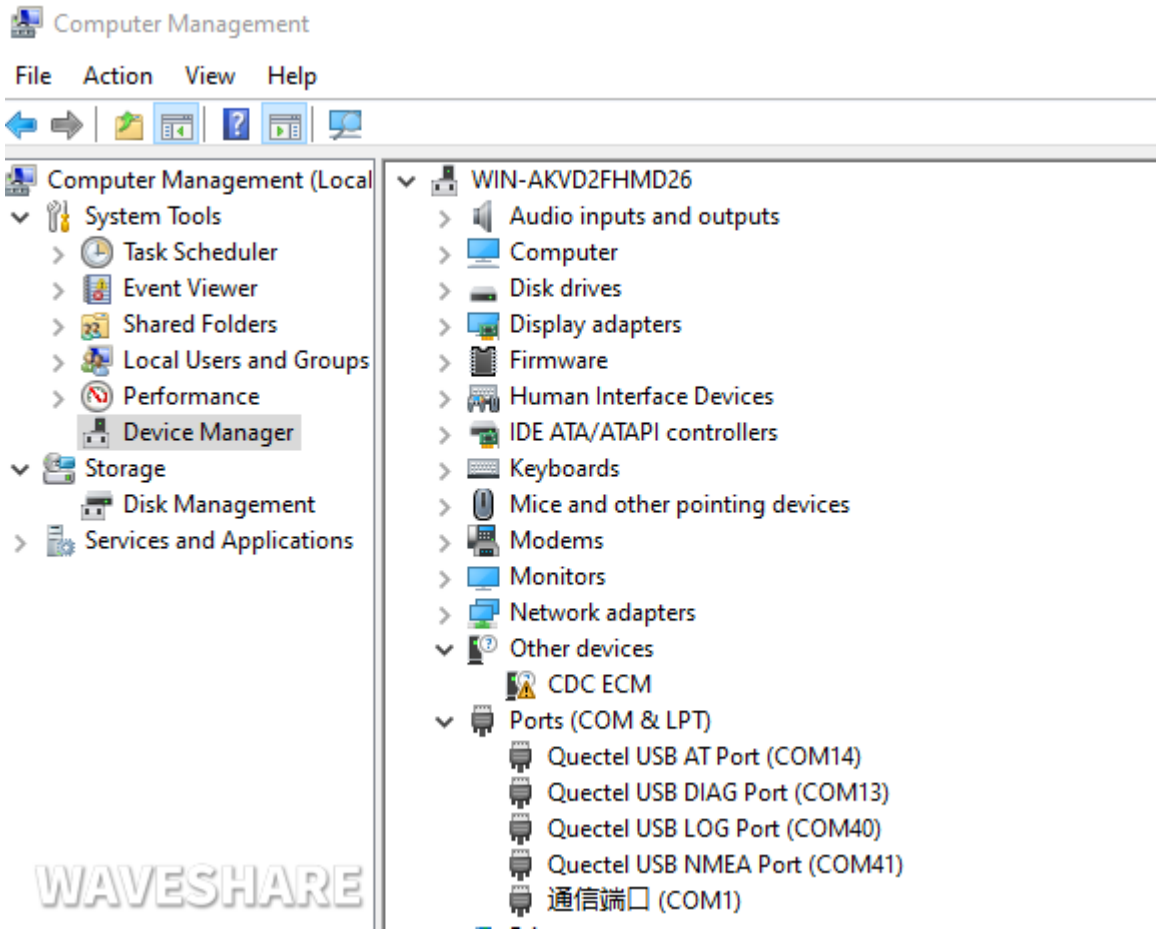


Install drivers

- After connecting the 5G HAT to the computer through a double-ended usb3.0 data cable, there will be a series of devices without drivers installed on other devices:



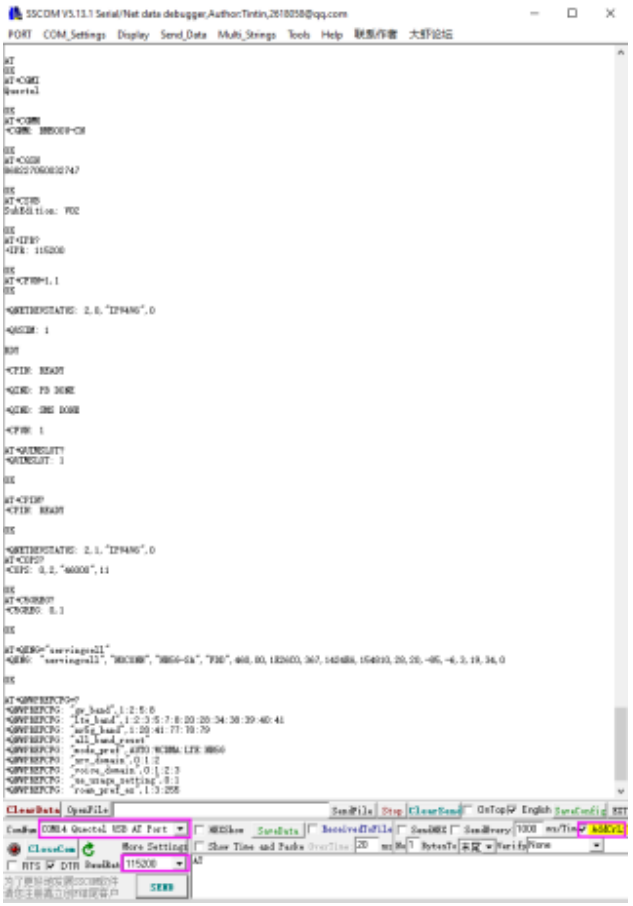
- Download the driver to your computer and unzip the compressed package.
- Enter the RM50X_Driver directory.
- Click setup.exe to install the driver. After the installation is complete, the device manager will generate the following devices:



RM50XQ-Driver： [Software 1]

Common AT Commands

EM25X, EM06E and RM50X series 4G/5G module support AT command control, some basic AT commands are shown in the table below:


SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2018058@qq.com
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
ClearData OpenFile SendFile Stop ClearSend OnTop English SaveConfig
COM4 Quectel USB AT Port
CloseCom More Settings
RTS DTR BaudRat 115200
SEND

Command	Description	Return Value
AT	AT test command	OK
ATE	ATE1 sets echo ATE0 turns off echo	OK
AT+CGMI	Query module manufacture	OK
AT+CGMM	Query module model	OK
AT+CGSN	Query product serial number	OK
AT+CSUB	Query module version and chip	OK
AT+CGMR	Query the firmware version serial number	OK
AT+IPR?	Set the module hardware serial port baud rate	+IPREX: OK
AT+CFUN=1,1	Reset module	OK
AT+QUIMSLOT?	Query SIM card selection: Return 1, select SIM card 1; Return 2, select SIM card 2	+QUIMSLOT: 1/2 OK
AT+CPIN?	Query the status of the SIM card and return READY, indicating that the SIM card can be recognized normally	+CPIN: READY
AT+COPS?	Query the current operator, the operator information will be returned after normal networking	+COPS: OK
AT+C5GREG?	Query 5G network registration status	+C5GREG: OK
AT+QENG="servingcell"	Query UE system information	
AT+CNMP	Network mode selection command: "mode_pref": Automatic "nr5g_band" : 5G NR "lte_band": LTE only "gw_band": WCDMA only	OK

Quectel_RG50xQ_RM5xxQ_Series_AT_Commands_Manual : [Datasheets 4]

SSCom Serial Assistant Tool: [Software 2]

SIM Card Selection

The 5G HAT has two SIM card slots onboard, a dual SIM card, and single standby, which can be switched and enabled by AT command.

- SIM card 1 is selected by default, You can use the following command to query and confirm:

```
AT+QUIMSLOT?
```

- To switch SIM card 2, please use the following command:

```
AT+QUIMSLOT=2
```

Dual SIM Card Switching

- Switch back to SIM card 1, please use the following command:

```
AT+QUIMSLOT=1
```

- Check whether the corresponding card slot recognizes the SIM card:

```
AT+CPIN?
```

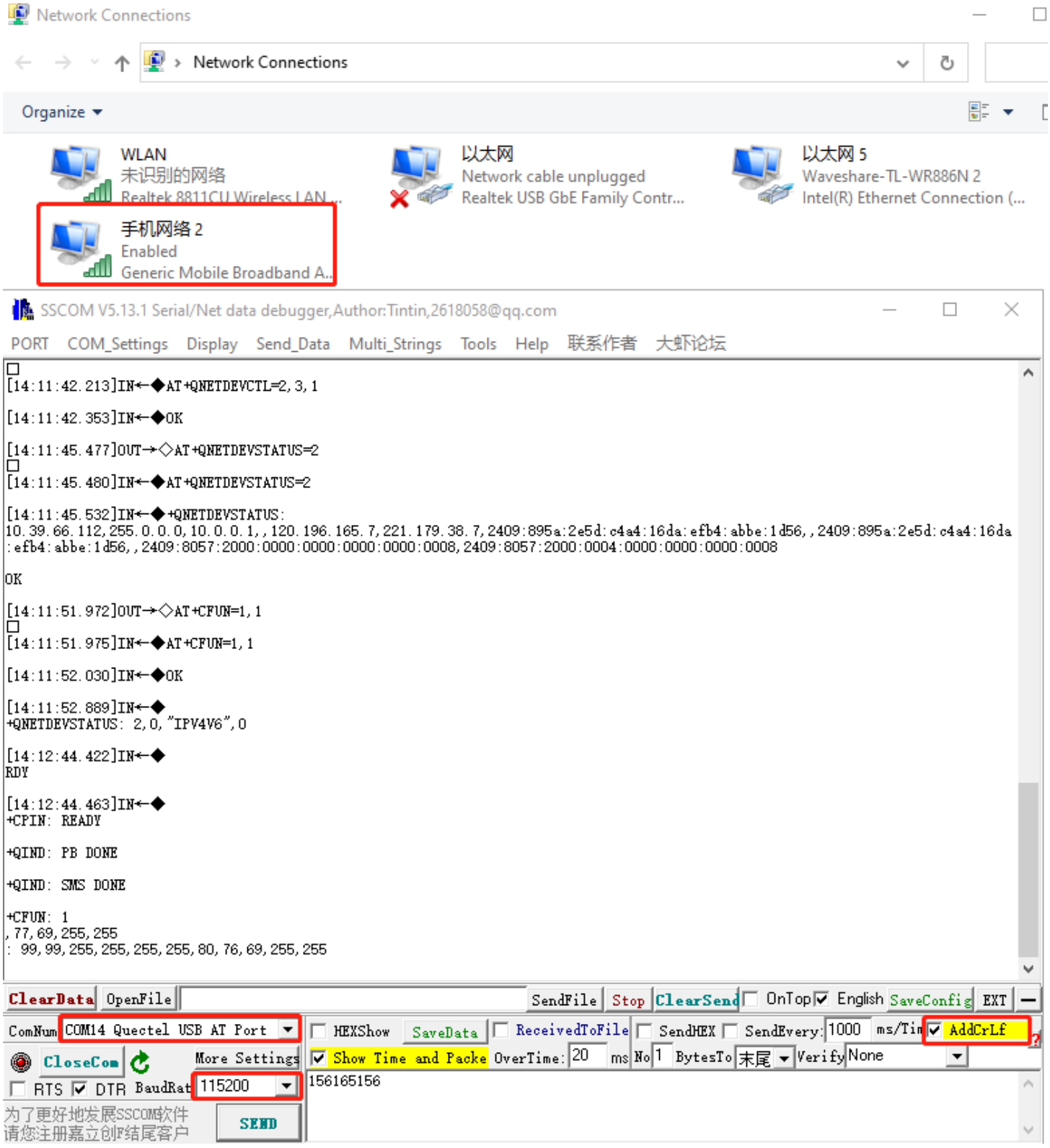
RM500U-CN and RM500Q-GL support Dual SIMs, but RM500Q-AE and RM502Q-AE modules do not support dual SIM cards.

MBIM Dial-up Internet Access

- Download and install the driver.
- Open the RM50X AT port and send the following commands to dial up the Internet:

```
AT+QENG="servingcell"
AT+QCFG="usbnet",2
AT+CFUN=1,1
```

- After dialing and restarting, the mobile network card appears on the computer network connection interface, and the dialing is successful.

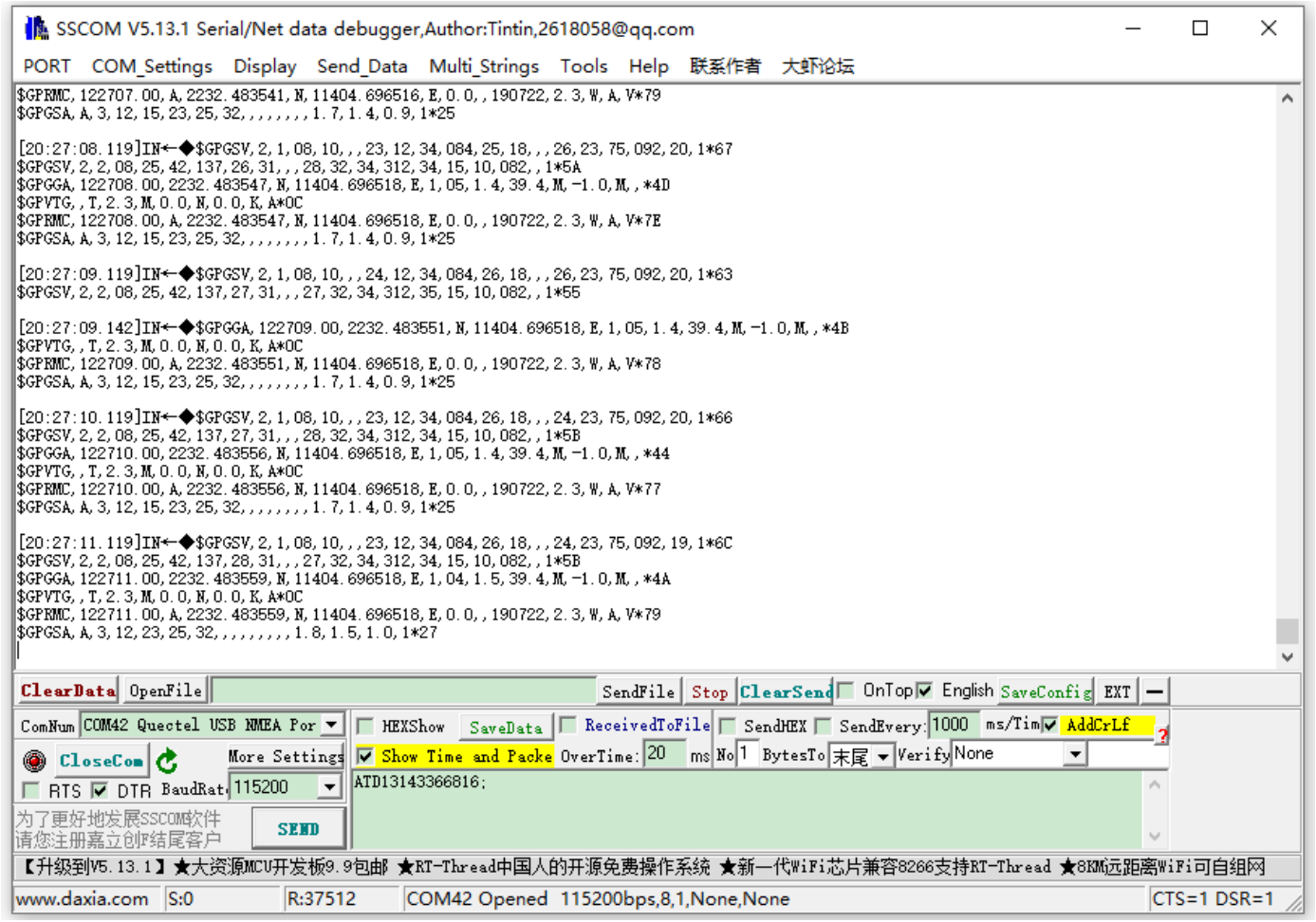

Network Connections
Network Connections
Organize
WLAN
未识别的网络
Realtek 8811CU Wireless LAN ...
以太网
Network cable unplugged
Realtek USB GbE Family Contr...
以太网 5
Waveshare-TL-WR886N 2
Intel(R) Ethernet Connection (...
手机网络 2
Enabled
Generic Mobile Broadband A...
SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
[14:11:42.213]IN←◆AT+QNETDEVCTL=2,3,1
[14:11:42.353]IN←◆OK
[14:11:45.477]OUT→◇AT+QNETDEVSTATUS=2
[14:11:45.480]IN←◆AT+QNETDEVSTATUS=2
[14:11:45.532]IN←◆+QNETDEVSTATUS:
10.39.66.112,255.0.0.0,10.0.0.1,,120.196.165.7,221.179.38.7,2409:895a:2e5d:c4a4:16da:efb4:abbe:1d56,,2409:895a:2e5d:c4a4:16da:efb4:abbe:1d56,,2409:8057:2000:0000:0000:0000:0000:0008,2409:8057:2000:0004:0000:0000:0000:0008
OK
[14:11:51.972]OUT→◇AT+CFUN=1,1
[14:11:51.975]IN←◆AT+CFUN=1,1
[14:11:52.030]IN←◆OK
[14:11:52.889]IN←◆
+QNETDEVSTATUS: 2,0,"IPV4V6",0
[14:12:44.422]IN←◆
RDY
[14:12:44.463]IN←◆
+CPIN: READY
+QIND: PB DONE
+QIND: SMS DONE
+CFUN: 1
,77,69,255,255
: 99,99,255,255,255,255,80,76,69,255,255
ClearData OpenFile SendFile Stop ClearSend OnTop English SaveConfig EXT
ComNum COM14 Quectel USB AT Port
HEXShow SaveData ReceivedToFile SendHEX SendEvery: 1000 ms/Tim AddCrLf
CloseCom More Settings
Show Time and Packe OverTime: 20 ms No 1 BytesTo 末尾 Verify None
RTS DTR BaudRat 115200
156165156
为了更好地发展SSCOM软件
请您注册嘉立创P结尾客户
SEND

RM50XQ-Driver： [Software 1]

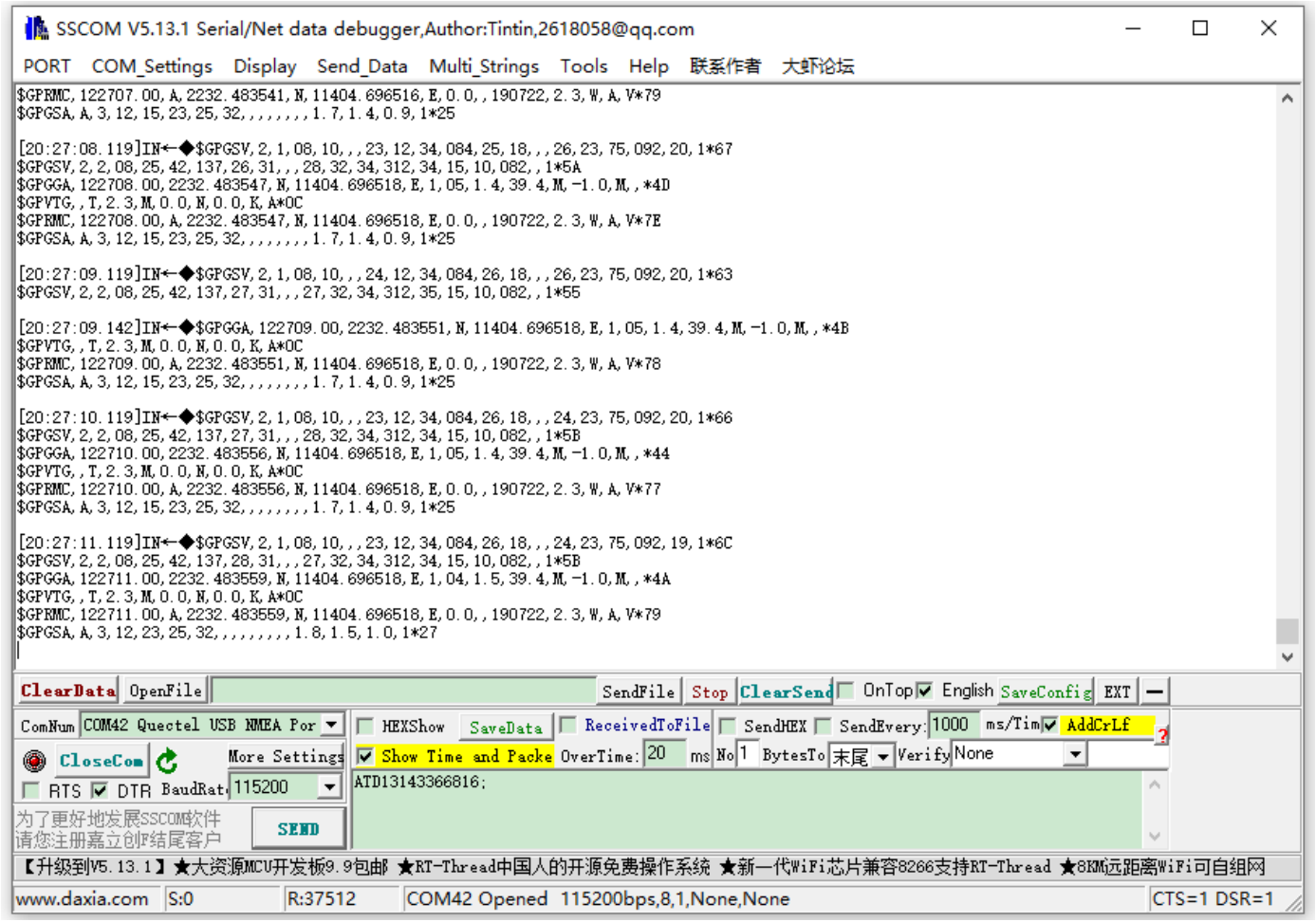
GPS Positioning

Connect the passive GPS antenna to the GNSS antenna interface of the module(RM500Q-GL is ANT2;RM500Q-AE and RM502Q-AE is ANT3), and place the antenna outdoors facing the sky.Then send the AT command to turn on the GPS:

```
AT+QGPS=1          //Turn on GPS positioning
AT+QGPSLOC=0       //Get GPS positioning
```



Now open the NEMA port, you can get GPS data:



Finally, turn off the GPS, you can use the AT command:

```
AT+QGPS=0          //Turn off GPS positioning
```

Quectel_RG50xQ_RM5xxQ_Series_GNSS_Application_Note： [Datasheets 5]

Working with Raspberry Pi

Hardware Connection

Connect the 5G HAT with a double-ended usb3.0 data cable, and connect an external 5V power supply to the Type-C power supply port of the 5G HAT, as shown in the figure:

Raspberry Pi	Pi 4B	Pi 3B/3B+	CM4-IO-BASE
USB adapter	USB3.0 adapter	USB2.0 adapter	USB3.0 adapter
Connection			
Note	It is recommended to connect an external 5V power supply at the arrow.		

If it is used for PI4B, there is a matching case , and the installation diagram is as follows:

The use of Raspberry Pi OS

This configuration is only needed for the first time.

Please download the newest Raspberry Pi OS, All the settings are based on Kernel 5.5, if you use the old version, please update first. Make sure your Kernel version is up-to-date, or else you may face issues with the driver.

5G ECM Mode Dial-up

Step 1. Uninstall Modem Manager and Network Manager

Open a terminal and run the following commands to uninstall Modem Manager and Network Manager:

```
sudo apt purge modemmanager -y
sudo apt purge network-manager -y
```

Step 2. Test 5G Module

- Driver Testing:
  Make sure the option USB-serial driver is properly loaded to the module interfaces. Check it with the `usb-devices` command.

```
pi@raspberrypi:~ $ usb-devices
T:  Bus=02 Lev=01 Prnt=01 Port=00 Cnt=01 Dev#=  3 Spd=5000 MxCh= 0
D:  Ver= 3.20 Cls=00(&gt;ifc ) Sub=00 Prot=00 MxPS= 9 #Cfgs=  1
P:  Vendor=2c7c ProdID=0800 Rev=04.14
S:  Manufacturer=Quectel
S:  Product=RM502Q-AE
S:  SerialNumber=377628d2
C:  #Ifs= 5 Cfg#= 1 Atr=a0 MxPwr=896mA
I:  If#=0x0 Alt= 0 #EPs= 2 Cls=ff(vend.) Sub=ff Prot=30 Driver=option
I:  If#=0x1 Alt= 0 #EPs= 3 Cls=ff(vend.) Sub=00 Prot=00 Driver=option
I:  If#=0x2 Alt= 0 #EPs= 3 Cls=ff(vend.) Sub=00 Prot=00 Driver=option
I:  If#=0x3 Alt= 0 #EPs= 3 Cls=ff(vend.) Sub=00 Prot=00 Driver=option
I:  If#=0x4 Alt= 0 #EPs= 3 Cls=ff(vend.) Sub=ff Prot=ff Driver=qmi_wwan
```

- Testing with AT command:

```
sudo apt-get install minicom
sudo minicom -D /dev/ttyUSB2
```

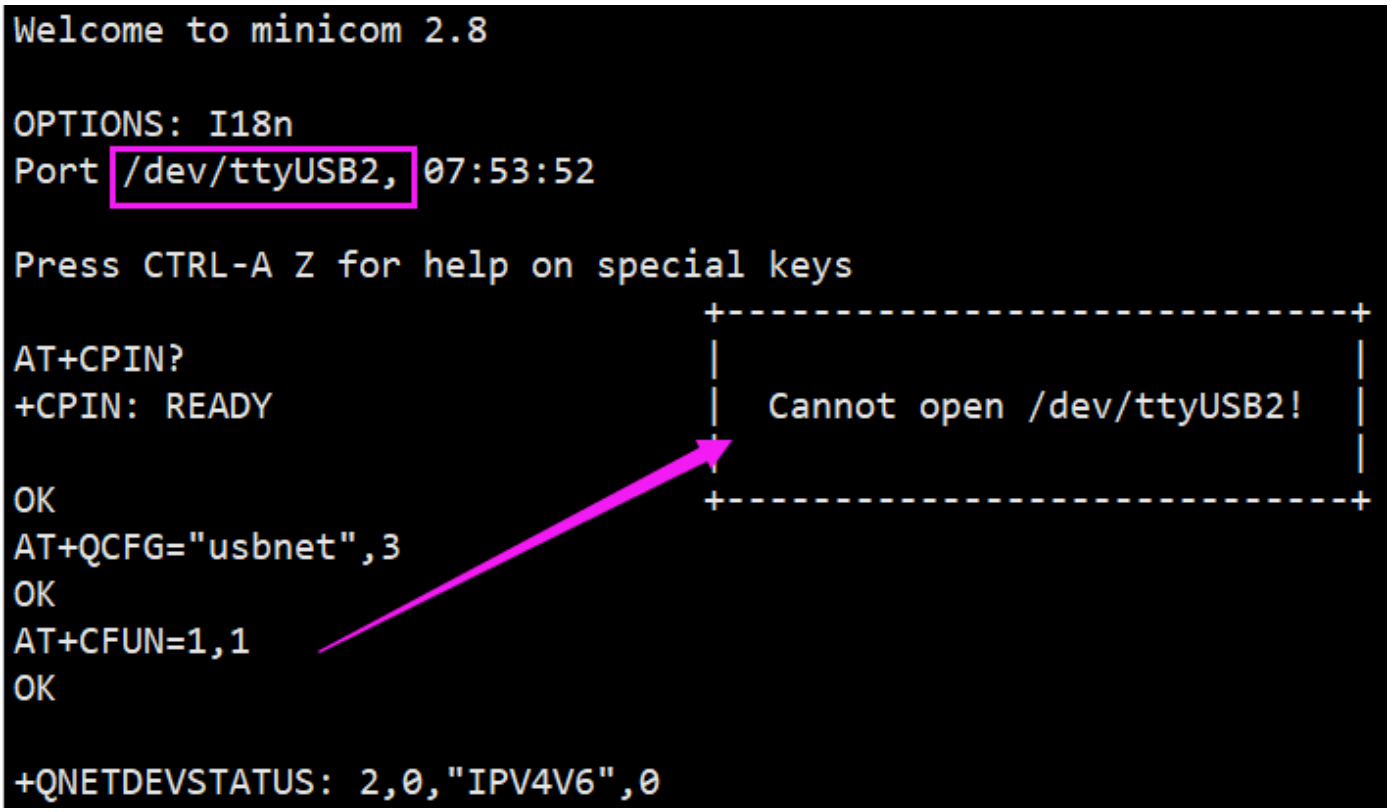
```
Welcome to minicom 2.7.1

OPTIONS: I18n
Compiled on Aug 13 2017, 15:25:34.
Port /dev/ttyUSB2

Press CTRL-A Z for help on special keys

AT
OK
```

Step 3. Networking Setup with AT Commands

```
AT+QCFG="usbnet",1
AT+CGDCONT=1,"IPV4V6","YOUR_APN"
AT+CFUN=1,1
```

Wait for the modem to boot again. It may take 30 seconds. Once the modem reboots, the minicom will be activated again.

After the reboot, open a new Linux terminal and check for usbX in the network interface using ifconfig or ipaddr commands.



- After rebooting the module, the NET indicator is on, and you can use the following commands to check the network. (Optional)

```
AT+QENG="servingcell"
```

- Use the following commands to get the IP and set up the DNS:

```
sudo dhclient -v usb0
sudo apt-get install udhcpc
sudo udhcpc -i usb0
sudo route add -net 0.0.0.0 usb0
```

Step 4. Test 5G Network

After dialing, the Raspberry Pi can see usb0 get the ip by the following command, enter the command `ifconfig usb0` or `ifconfig`.

- Now check the assigned IP address and test the connection.

```
ifconfig usb0
```

```
pi@raspberrypi:~ $ ifconfig usb0
usb0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.225.60  netmask 255.255.255.0  broadcast 192.168.225.255
        inet6 fe80::8543:f6a0:e678:2e20  prefixlen 64  scopeid 0x20
        ether 4a:aa:f8:62:36:bb  txqueuelen 1000  (Ethernet)
        RX packets 73  bytes 5047 (4.9 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 100  bytes 15116 (14.7 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

```
pi@raspberrypi:~ $ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.10.31  netmask 255.255.252.0  broadcast 192.168.11.255
        inet6 fe80::d7bd:fb60:b560:554d  prefixlen 64  scopeid 0x20<link>
        ether dc:a6:32:e6:84:86  txqueuelen 1000  (Ethernet)
        RX packets 69088  bytes 6541966 (6.2 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 1008  bytes 108052 (105.5 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 44  bytes 5258 (5.1 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 44  bytes 5258 (5.1 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

usb0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.35.89.172  netmask 255.0.0.0  broadcast 10.255.255.255
        inet6 2409:895a:2e0f:292f:cc46:137b:fb3d:6bb7  prefixlen 64  scopeid 0x0<global>
        inet6 fe80::1625:b52a:e758:2013  prefixlen 64  scopeid 0x20<link>
        ether b2:77:b3:a0:36:4f  txqueuelen 1000  (Ethernet)
        RX packets 37  bytes 7728 (7.5 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 161  bytes 27992 (27.3 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

wlan0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        ether dc:a6:32:e6:84:87  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

```
ping waveshare.com -I usb0
```

```
pi@raspberrypi:~ $ ping waveshare.com -I usb0
PING waveshare.com (104.26.11.134) from 192.168.10.27 usb0: 56(84) bytes of data.
64 bytes from 104.26.11.134 (104.26.11.134): icmp_seq=1 ttl=52 time=87 ms
64 bytes from 104.26.11.134 (104.26.11.134): icmp_seq=2 ttl=52 time=82 ms
64 bytes from 104.26.11.134 (104.26.11.134): icmp_seq=3 ttl=52 time=92 ms
64 bytes from 104.26.11.134 (104.26.11.134): icmp_seq=4 ttl=52 time=73 ms
64 bytes from 104.26.11.134 (104.26.11.134): icmp_seq=5 ttl=52 time=75 ms
```

5G Network Test

In the Linux system, you can install speedtest_cli to test:

```
## Raspberry Pi OS
sudo apt install speedtest-cli
speedtest      # or use speedtest_cli
```

or

```
## OpenWRT
opkg update
opkg install python3
opkg install python3-pip
pip install speedtest_cli
speedtest      # or use speedtest_cli
```

Troubleshooting

Check if the module detects SIM:

```
AT+CPIN? # Should return READY
```

Check if the module is registered to the network:

```
AT+CEREG? # Should return 0,1 or 0,5
```

Check if the APN is correct and has an IP: AT+CGCONTRDP?

```
AT+CGCONTRDP # Should return APN details and IP address.
```

5G Network Speed Test

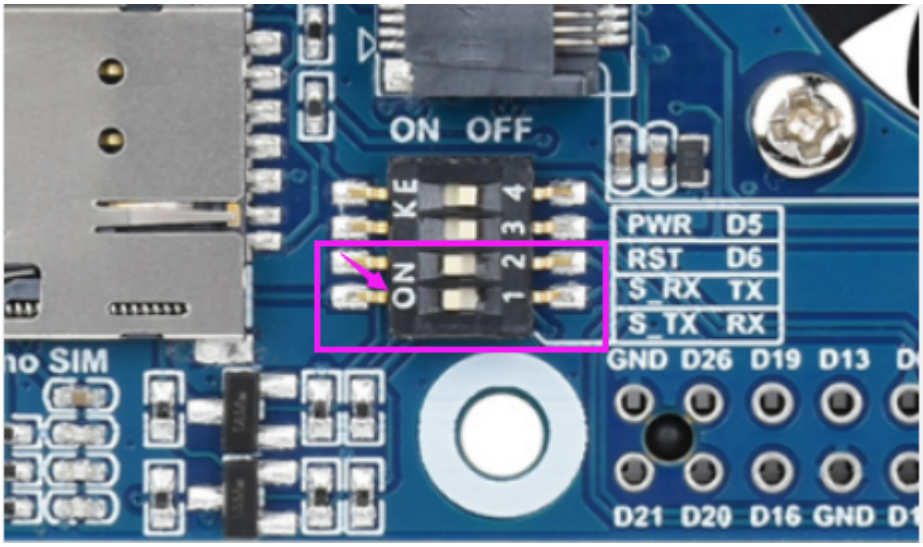
In the speed measurement part, because the Raspberry Pi comes with a Gigabit Ethernet port, and there are few USB network cards above Gigabit, we use the SpeedTest For Python tool to perform speed measurement by the commands. Connect to the terminal of OpenWrt and enter the commands one by one to measure the speed:

```
## OpenWRT
opkg update
opkg install python3
opkg install python3-pip
pip install speedtest_cli
speedtest      # or use speedtest_cli
```

When the SIM8202G module is registered to the 5G network and has a good signal, it connects to OpenWrt's hotspot (5.8G) through the cell phone, and the cell phone can measure the speed up to about 100 megabytes, the actual speed measurement may be different, for reference only.

Raspberry Pi minicom Serial Port Debugging

1. Insert the module into the Raspberry Pi and set the S_TX and S_RX of the dipswitch to ON.



2. Install minicom, minicom is the serial port debugging tool for Linux.

Use minicom to open ttyUSB2:

```
sudo minicom -D /dev/ttyUSB2
```

Send to enable the UART serial port:

```
AT+CCUART=1
```

3. Open ttyS0 via minicom - ttyS0 is the serial port of the Raspberry Pi 3B/3B+/4B, and the default baud rate is 115200.

```
sudo minicom -D /dev/ttyS0
```

4. Raspberry Pi 2B/zero, the user serial device number is ttyAMA0; you can use the following command line to confirm that serial0 is the selected serial device number, as follows:

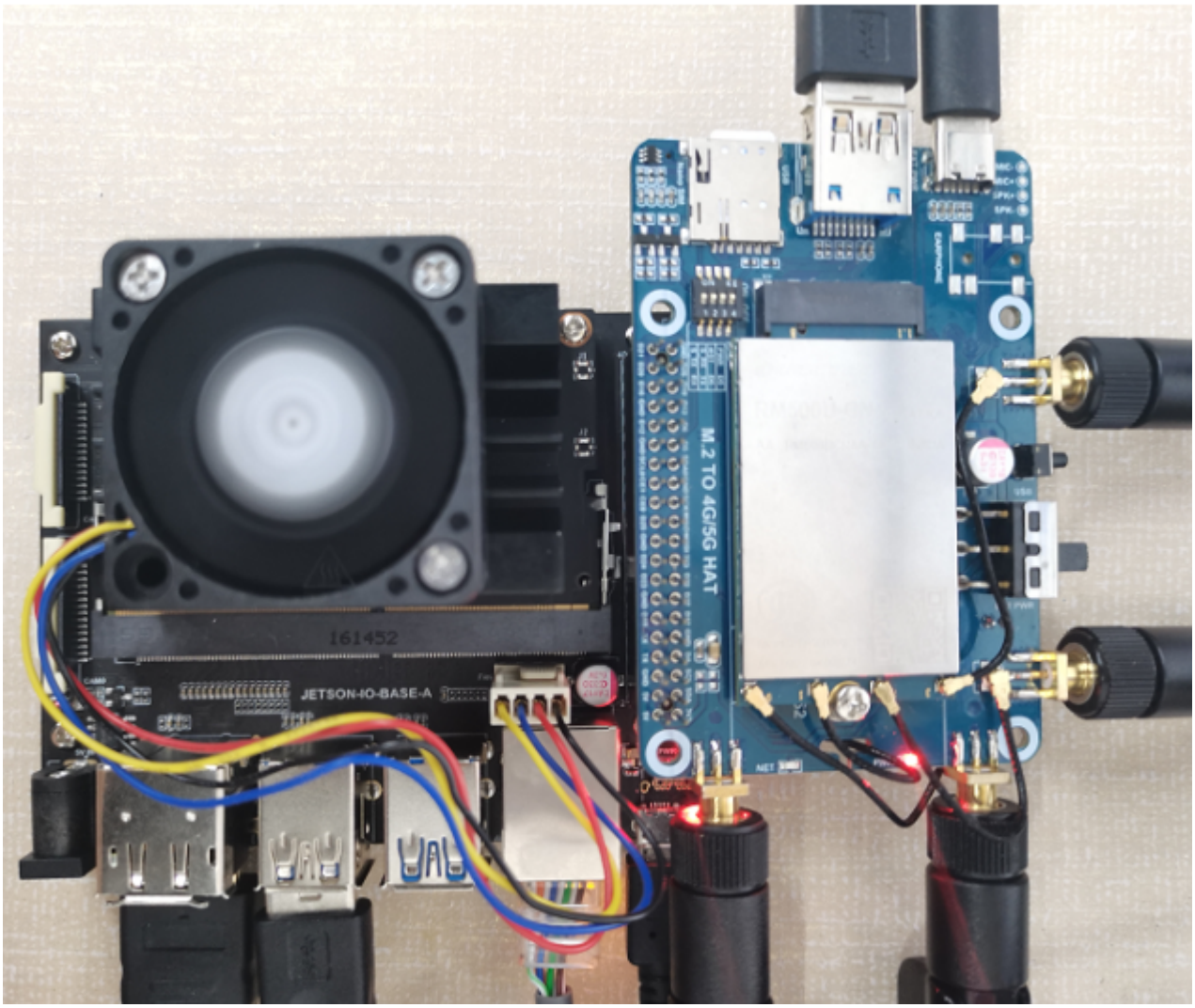
```
ls -l /dev/serial*
```

```
pi@raspberrypi:~ $ ls -l /dev/serial*          WAVESHARE
lrwxrwxrwx 1 root root 5 Jul  7 08:35 /dev/serial0 -> ttyS0
lrwxrwxrwx 1 root root 7 Jul  7 08:35 /dev/serial1 -> ttyAMA0
```

Working with Jetson Nano

Hardware Connection

Connect the 5G HAT with a double-ended usb3.0 data cable, and connect an external 5V power supply to the Type-C power supply port of the 5G HAT, as shown in the figure:



Load USB Device Descriptor

In order to identify the module, the module's VID and PID information needs to be added to the file [kernel].

- View VID and PID of RM500U.

```
lsusb
```

```
jetson@jetson-desktop:~$ lsusb
Bus 002 Device 003: ID 2c7c:0800
Bus 002 Device 002: ID 2109:0817 VIA Labs, Inc.
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 003: ID 8087:0a2b Intel Corp.
Bus 001 Device 002: ID 2109:2817 VIA Labs, Inc.
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```

Added VID sum PID.

```
sudo apt-get install unzip
wget https://files.waveshare.com/upload/0/09/RM5XXQ_For_Jetson_nano.zip
unzip RM5XXQ_For_Jetson_nano.zip
sudo chmod 777 -R RM5XXQ_For_Jetson_nano
cd RM5XXQ_For_Jetson_nano
sudo ./install.sh
sudo reboot
```

> Please do not delete or modify the four directory files of option directory, default.script, and install.sh, otherwise it will affect the loading of device descriptors!

After successfully adding the PID and restarting Jetson nano, enter the following command in the command line interface to display five device symbols USB0-USB4.

```
ls /dev/ttyUSB*
```

```
jetson@jetson-desktop:~$ ls /dev/ttyUSB*
/dev/ttyUSB0  /dev/ttyUSB1  /dev/ttyUSB2  /dev/ttyUSB3
```

RNDIS

- Enable minicom.

```
sudo apt-get install minicom
sudo minicom -D /dev/ttyUSB2
```

- Send the following command ECM in minicom.

```
AT+CPIN?
AT+QCFG="usbnet",3
AT+CFUN=1,1
```

```
Welcome to minicom 2.7.1

OPTIONS: I18n
Compiled on Aug 13 2017, 15:25:34.
Port /dev/ttyUSB2, 14:32:49

Press CTRL-A Z for help on s+------------------------------+
                           |                              |
AT+QENG="servingcell"      |  Cannot open /dev/ttyUSB2!   |
+QENG: "servingcell","NOCONN|                              |6,100,1,5,5,30513,-94,-12,7
                           +------------------------------+
OK
AT+QCFG="usbnet",3
OK
AT+CFUN=1,1
OK
```

After the module restarts, and the NET light is on, use the following command to check the network status (optional).

```
AT+QENG="servingcell"
```

Get the IP and set the DNS with the following commands:

```
sudo dhclient -v usb1
sudo apt-get install udhcpc
sudo udhcpc -i usb1
sudo route add -net 0.0.0.0 usb1
```

After dialing, you can see that usb1 gets the IP through the following command:

```
ip route
```

```
jetson@jetson-desktop:~$ ip route
default via 10.0.0.1 dev usb1
default via 192.168.11.1 dev eth0 proto dhcp metric 20100
10.0.0.0/8 dev usb1 proto kernel scope link src 10.3.53.182
169.254.0.0/16 dev docker0 scope link metric 1000 linkdown
172.17.0.0/16 dev docker0 proto kernel scope link src 172.17.0.1 linkdown
192.168.8.0/22 dev eth0 proto kernel scope link src 192.168.10.29 metric 100
```

Test usb1 networking status.

```
 ping -I usb1 www.baidu.com
```

```
jetson@jetson-desktop:~$ ping -I usb1 www.baidu.com
PING www.a.shifen.com (14.215.177.38) from 10.3.53.182 usb1: 56(84) bytes of data.
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=1 ttl=53 time=230 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=2 ttl=53 time=70.7 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=3 ttl=53 time=576 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=4 ttl=53 time=256 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=5 ttl=53 time=40.6 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=6 ttl=53 time=83.6 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=7 ttl=53 time=71.5 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=8 ttl=53 time=61.9 ms
```

Resources

Software

1. RM50XQ-Driver
2. RM500U Serial debugging assistant

- Qnavigator

Assembly drawing

- Case Assembly Drawing

Datasheets

1. Quectel_RM500Q-GL_5G_Specification_V1.3
2. Quectel_RM500Q-AE_5G_Specification_V1.1
3. Quectel_RM502Q-AE_5G_Specification_V1.2
4. Quectel_RG50xQ_RM5xxQ_Series_AT_Commands_Manual_V1.2
5. Quectel_RG50xQ_RM5xxQ_Series_GNSS_Application_Note_V1.1

- Quectel_RG50xQ_RM5xxQ_Series_DFOTA_Application_Note_V1.0
- Quectel_RG50xQ_RM5xxQ_Series_FTM_Application_Note_V1.0
- Quectel_RG50xQ%26RM5xxQ_Series_5G_Network_Status_Judgement_Introduction_V1.1
- Quectel_RG50xQ_RM5xxQ_Series_5G_Network_Searching_Scheme_Introduction_V1.0
- Quectel_RG50xQ_RM5xxQ_Series_Software_Thermal_Management_Guide_V1.0
- Quectel_RM500Q-AE%26RM502Q-AE_Hardware_Design_V1.0
- Quectel_RM50xQ_Series_Hardware_Design_V1.2

- Quectel_RM50xQ_Series_Reference_Design_V1.3
- Quectel_RM500Q-GL_3D_Dimensions_V1.2.zip
- Quectel_RM502Q-AE_3D_Dimensions_V1.1.zip

FAQ

Question:What should I do if the NET light does not light up and I am not registered to the network?

Answer:

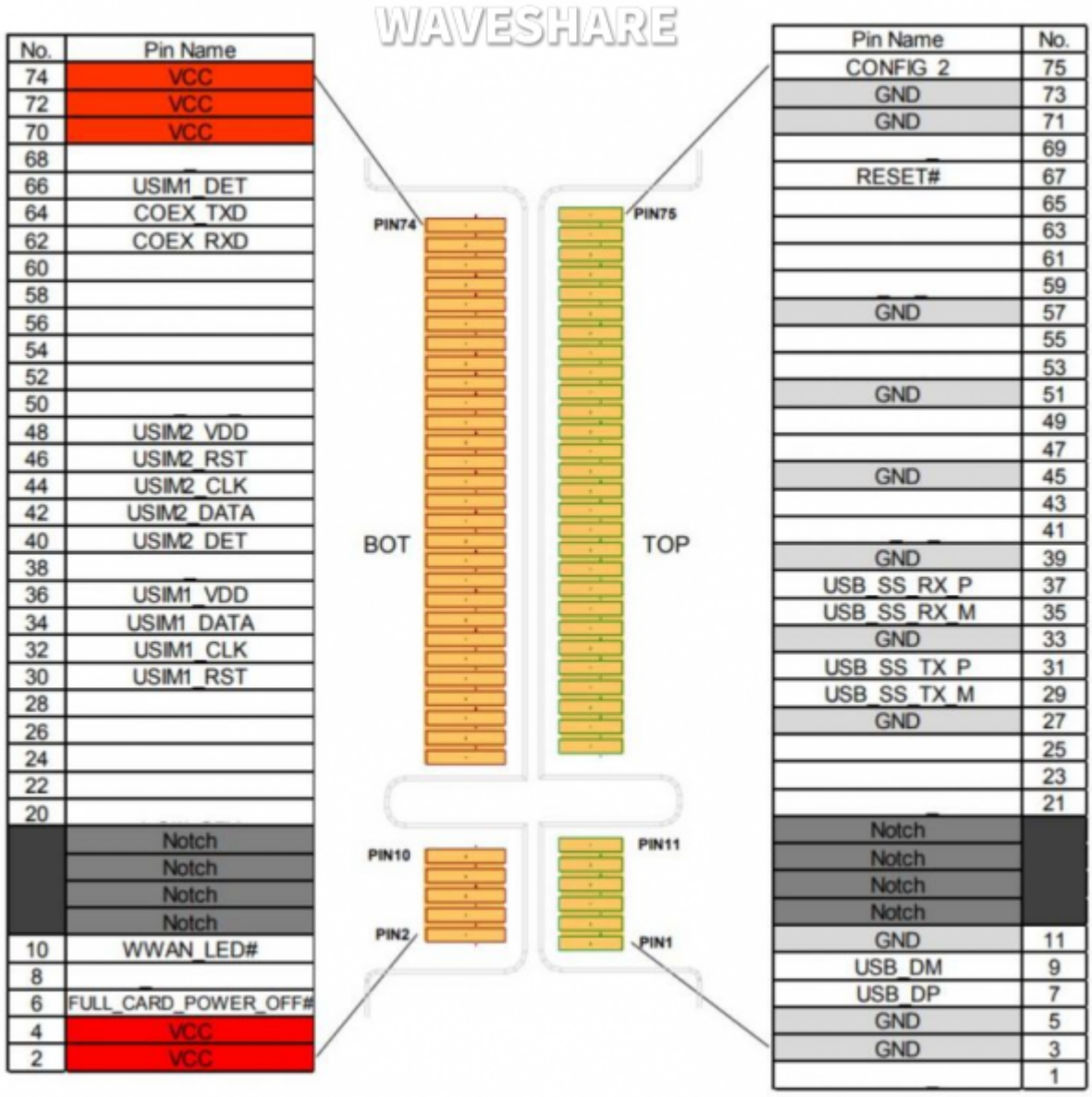
- Please check whether the SIM card and the antenna are connected, and note that four antennas must be connected.
- Please check the hardware connection and use AT Log to check the network connection.

```
AT+CPIN?
AT+COPS?
AT+QCSQ
AT+QENG="servingcell"
```

```
AT+CPIN?
+CPIN: READY

OK

+QNETDEVSTATUS: 2,1,"IPV4V6",0
AT+COPS?
+COPS: 0,2,"46000",11

OK
AT+C5GREG?
+C5GREG: 0,1

OK

AT+QENG="servingcell"
+QENG: "servingcell","NOCONN","NR5G-SA","FDD",460,00,1E26C0,367,1424E6,154810,28,20,-85,-6,3,19,34,0

OK
```

Question: Can the module be connected to another board? Can the board be connected to other modules with an M2 interface?

Answer:



Question: What platforms are the RM50X module based on?

Answer:

RM500U-CN: based on Zhanrui

RM500Q-GL: based on the Qualcomm platform, supports GNSS positioning, mainly for China

RM500q-AE/RM502Q-AE: based on the Qualcomm platform, supports GNSS positioning, mainly for countries except for China.

Question:After receiving the Raspberry Pi, it keeps restarting, what is the reason?

Answer:

The 5G module requires a lot of power, especially at the moment of network access; the power supply capacity of the Raspberry Pi is limited, and the 5V (3A) power supply can be connected to the onboard TYPE-C interface.

Question:It cannot connect to the network after rebooting the Raspberry Pi?

Answer:

When using the external power supply, RM500U does not reboot after rebooting the Raspberry Pi, you can use the commands to restart RM500U.

Question:What dial-up types of RM500X?

Answer:

As shown below:

```
AT+QCFG="usbnet",0 driver type is NDIS(QMI));
AT+QCFG="usbnet",1 The driver type is ECM;
AT+QCFG="usbnet",2 The driver type is MBIM; (RM5XXQ support)
AT+QCFG="usbnet",3 The driver type is RNDIS
AT+QCFG="usbnet",5 The driver type is NCM;
```

Question:The module has been powered on, why does the input command not respond?

Answer:
Use the following command to turn on the echo, and press Enter after entering: (Blind typing is required here)

```
ATE1
```

Question:How to check the frequency band of the operator?

Answer:
It can be inquired at the following website:

https://www.frequencycheck.com

Question:How to confirm whether the Raspberry Pi hardware serial port is ttyS0 or ttyAMA0?

Answer:

Raspberry Pi 2B/zero, with user serial device number ttyAMA0;

```
ls -l /dev/serial*
```

You can confirm that serial0 is the selected serial device number with the following command line, as follows:

```
pi@raspberrypi:~ $ ls -l /dev/serial*          WAVESHARE
lrwxrwxrwx 1 root root 5 Jul  7 08:35 /dev/serial0 -> ttyS0
lrwxrwxrwx 1 root root 7 Jul  7 08:35 /dev/serial1 -> ttyAMA0
```

Question:Why does the USB power supply fail to power off when the computer is used, but the power goes off when the Raspberry Pi is used, and the NET light does not light up for a while?

Answer:

The USB power supply capability of the Raspberry Pi is worse than that of the computer. It needs to be connected to an external power supply. Please set the switch to EXT PWR, and connect the HAT interface to a 5V 3A power supply: