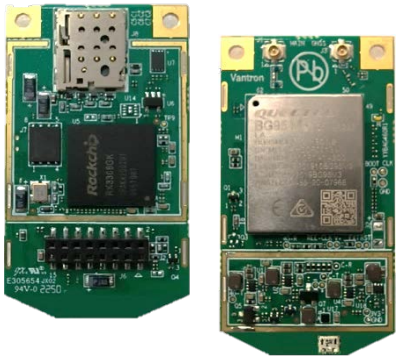
VT-MOB-LTEMQ/1Q/4Q-PB
CAT M/1/4 Cellular Card



User Manual

Version: 1.5

Revision History:

No.	Version	Description	Date
1	V1.0	First release	Oct. 20, 2021
2	V1.1	Modified AT commands	Jan. 7, 2022
3	V1.2	Modified local IP address	Mar. 14, 2022
4	V1.3	Added firmware upgrade	Aug. 23, 2022
5	V1.4	Updated the layout description based on the design scheme	Nov. 1, 2022
6	V1.5	Modified product specifications and setup description as per the design change	Apr. 19, 2023

Table of Contents

Foreword

Thank you for purchasing Vantron VT-MOB-LTEMQ/1Q/4Q-PB CAT M/1/4 Cellular card ("the cellular card" or "the Product"). This manual intends to provide guidance and assistance necessary on setting up, operating, or maintaining the Product. Please read this manual and make sure you understand the structure and functionality of the Product before putting it into use.

Intended Users

This manual is intended for:

- Device owners
- Technical support engineers
- Other users

Copyright

Disclaimer

While all information contained herein has been carefully checked to assure its accuracy in technical details and typography, Vantron does not assume any responsibility resulting from any error or features of this manual, nor from improper uses of this manual or the software.

It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without notice.

Technical Support and Assistance

Should you have any question about the Product that is not covered in this manual, contact your sales representative for solution. Please include the following information in your question:

- Product name and PO number;
- Complete description of the problem;
- Error message showing on the device, if any.

Vantron Technology, Inc.
Address: 48434 Milmont Drive, Fremont, CA 94538
Tel: (650) 422-3128
Email: sales@vantrontech.com

Regulatory Information

The Product is designed to comply with:

- Part 15 of the FCC Rules
- PTCRB

Please refer to **Appendix D** for Regulatory Compliance Statements.

Symbology

This manual uses the following signs to prompt users to pay special attention to relevant information.

⚠	Caution for latent damage to system or harm to personnel
	Attention to important information or regulations

Terminology/Acronym

Terminology/Acronym	Description
NC	No connection
VCC	Voltage common collector
GND	Ground
P (+)	Positive of difference signal
N (-)	Negative of difference signal
#	Active low signal
I	Input
O	Output
I/O	Input/output
P	Power or ground
A	Analog
OD	Open drain
CMOS	3.3 V CMOS
LVCMOS	Low Voltage CMOS
LVTTL	Low Voltage TTL

General Safety Instructions

The Product is supposed be installed by knowledgeable, skilled persons familiar with local and/or international electrical codes and regulations. For your safety and prevention of damage to the Product, please read and observe carefully the following safety instructions prior to installation and operation. Keep this manual well for future reference.

- Do not disassemble or otherwise modify the Product. Such action may cause heat generation, ignition, electronic shock, or other damages including human injury, and may void your warranty.
- Keep away from heat source, such as heater, heat dissipater, or engine casing.
- Do not insert foreign materials into the openings of the Product as it may cause the Product to malfunction or burn out.
- Use only the adapter and power cord that are approved for use with this Product. Otherwise, it may cause fire or explosion.
- Be sure that nothing rests on the power cable and that the cable is located at a place without risk of trips.
- Cut off the power before inspection of the Product to avoid human injury or product damage.

Precautions for Power Cables and Accessories

⚠ Use proper power source only. Make sure the supply voltage falls within the specified range.

⚠ Place the power cable properly at places without extrusion hazards.

⚠ Cleaning instructions:

- Power off before cleaning the Product
- Do not use caustic or aggressive liquids, vapor, or spray
- Clean with a damp cloth
- Do not try to clean exposed electronic components unless with a dust collector

⚠ Power off and contact Vantron technical support engineer in case of the following faults:

- The Product is damaged
- The temperature is excessively high
- Fault is still not solved after troubleshooting according to this manual

⚠ Do not use in combustible and explosive environment:

- Keep away from combustible and explosive environment
- Keep away from all energized circuits
- Unauthorized removal of the enclosure from the device is not allowed
- Do not change components unless the power cable is unplugged
- In some cases, the device may still have residual voltage even if the power cable is unplugged. Therefore, it is a must to remove and fully discharge the device before replacement of the components.

CHAPTER 1

INTRODUCTION

1.1 Product Overview

Vantron VT-MOB-LTEMQ/1Q/4Q-PB features an LTE CAT M/CAT 1/CAT 4 cellular card with an on-board SIM slot, offering an optimized solution for M2M and IoT applications. The card is based on Quectel BG95-M3/EG91 NAX DGR-128-SGNS/EG95 NAXD (data only) module that supports multiple FDD bands and employs a compact SMT form factor for size-constrained applications.

VT-MOB-LTEMQ/1Q/4Q-PB boasts a comprehensive set of hardware-based security features and low power consumption technology. It offers industry-standard interfaces and is designed for a wide range of M2M applications such as wireless POS, smart metering, tracking, wearable devices, etc.

1.2 Features

- LTE HD-FDD bands:
  B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26/B27/B28/B66/B85
- Maximum data transmission rates:

  CAT M: 88Kbps (downlink), 1119Kbps (uplink)

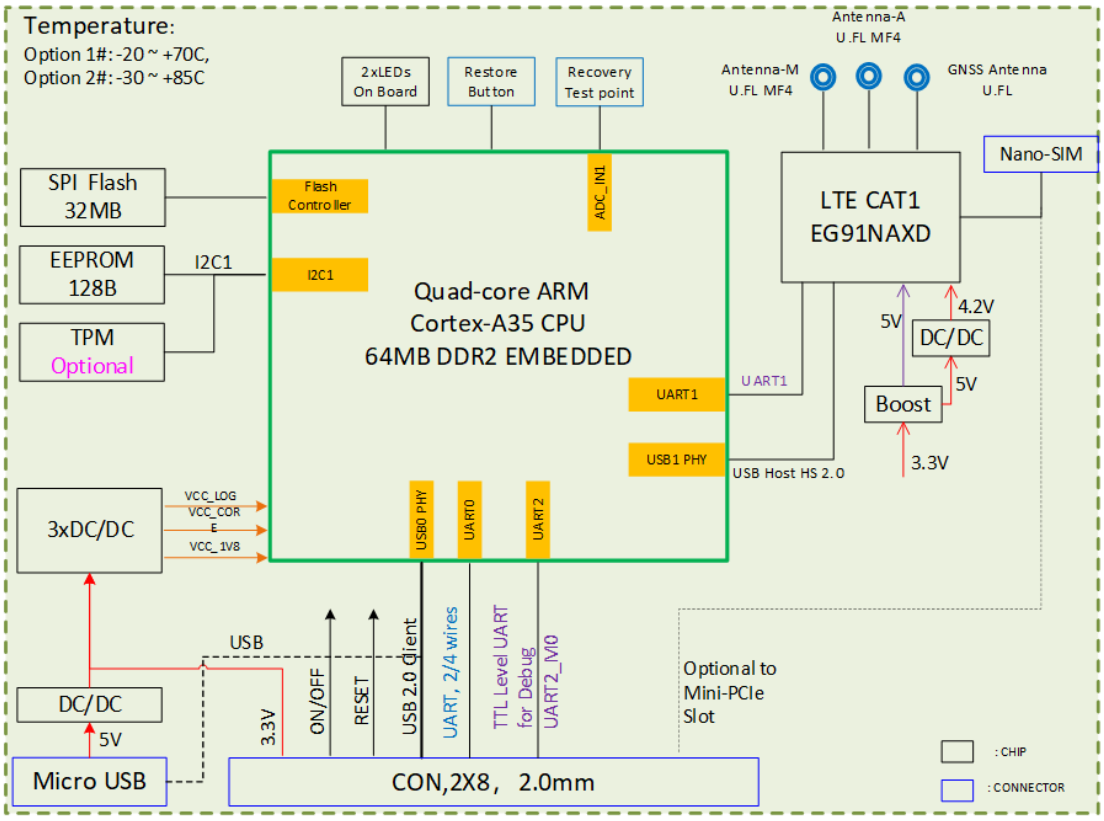
  CAT 1: 10Mbps (downlink), 5Mbps (uplink)

  CAT 4: 150Mbps (downlink), 50Mbps (uplink)
- Power input: 1.8V~5.5V
- Power consumption: ~3.5W (active mode)
- 4FF “Nano” SIM slot
- Operating temperature: -20°C ~ +85°C (Optional: -30°C ~ +85°C)
- 4G antenna connector: U.FL-R
- Control via AT commend set
- Dimensions: 57.8mm x 30mm

1.3 Reference

VT-MOB-LTEMQ/1Q/4Q-PB uses Quectel BG95/EG91/EG95 module, so please refer to https://www.quectel.com/lte-iot-modules for the latest information on the module.

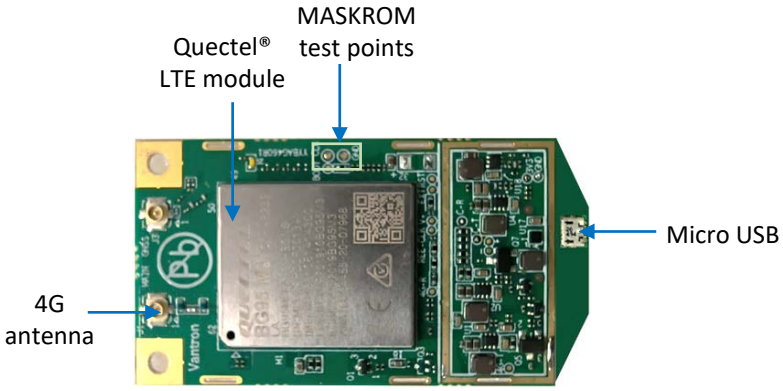
1.4 Block Diagram



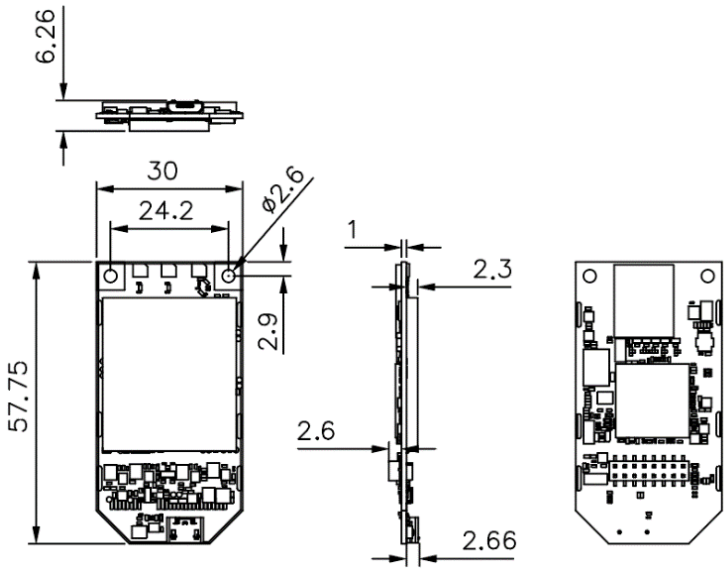
1.5 Specifications

VT-MOB-LTEMQ/1Q/4Q-PB		
System	CPU	RK3308GK, Quad-core ARM Cortex-A35, 1.2GHz (Max.)
	Memory	DDR2 64MB (embedded)
	Storage	32MB SPI NOR flash for OS & program
		2Kb EEPROM for parameters etc.
	OS supported	Supports drivers for Windows 7/8/8.1/10/11, Linux, Android
	LTE category	LTE CAT M/CAT 1/CAT4
	Frequency band	LTE FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26/B27/B28/B66/B85
	Max. Data transmission rates	CAT M: 88Kbps (downlink), 1119Kbps (uplink) CAT 1: 10Mbps (downlink), 5Mbps (uplink) CAT 4: 150Mbps (downlink), 50Mbps (uplink)
	GNSS	GPS & Beidou (Accuracy: within 25m under theoretical conditions; scan interval: 15 min.)
Interface	Module	Quectel BG95-M3 for CAT M Quectel EG91 NAX DGR-128-SGNS for CAT 1 Quectel EG95 NAXD (Data only) for CAT 4
	I/Os	1 x On-board Nano SIM slot 1 x 4G/LTE antenna 1 x Micro USB
	Board to board connector (2 x 8 x 1.27mm)	1 x USB 2.0 Client for main CPU (Virtual USB Ethernet Port, Plug and Play)
		1 x UART
		3 x GPIO
		1 x Power on signal
		1 x Reset signal
		1 x SIM signal
Security	TPM	ATMEL: ATECC508A-SSHDA-T/B (Optional)
Power	Input	1.8V~5.5V DC, Typ. 3.3V (via the B2B connector) or 5V (via the Micro USB)
	Consumption	Active mode: ~3.5W
Mechanical	Dimensions	57.8mm x 30mm
Environment Condition	Temperature	Operating: -20°C ~ +85°C (Optional: -30°C ~ +85°C) Storage: -40°C ~ +105°C
	Certificate	FCC, PTCRB Carrier: Verizon / AT&T

1.6 Product Layout



1.7 Product Outlines



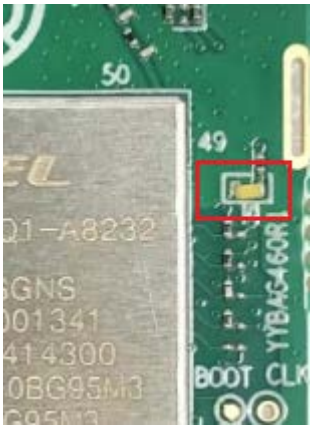
CHAPTER 2

INTERFACES AND CONNECTION

2.1 Interfaces

2.1.1 LED indicator

There is a power indicator on the front of the cellular card, which lights up when the cellular card is powered on.



2.1.2 Nano SIM slot

The Nano SIM slot supports a 4FF nano SIM card operating at 1.8V.

2.1.3 RF interfaces

There are two antenna interfaces (for 4G LTE and GNSS) on the card, and the GNSS antenna interface is not available for the moment. The interface applies an U. FL-R connector to connect an FPC antenna or rubber stick antenna.

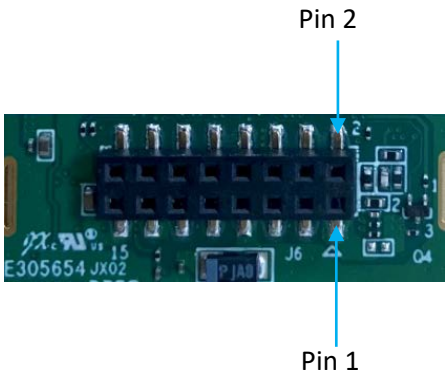
2.1.4 Micro USB

The Micro USB interface shares the same USB signals with the B2B connector for the system power on, AT command communication, data transmission, troubleshooting, firmware upgrade, etc. With the Micro USB interface, users do not need to use a mini PCIe adapter to connect the cellular card for that purpose.

2.1.5 B2B connector

The cellular card implements a B2B connector (socket) to offer signals for power, UART, USB etc. It is **reserved** for mating with a mini PCIe adapter that has the pin headers (male).

Since the Micro USB interface and the B2B connector share the same USB signals, the cellular card comes with a stand-alone configuration or stacked configuration. In a stand-alone configuration, the Micro USB interface is used for the troubleshooting and AT communication, while in the stacked configuration, the cellular card is supposed to mate with a mini PCIe adapter for that purpose.



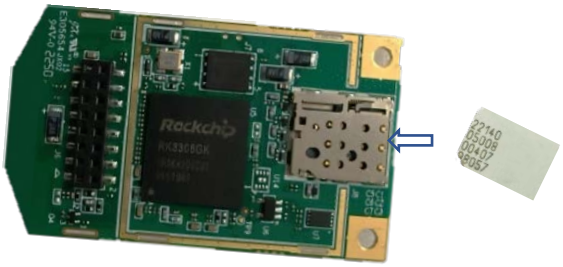
Pinout description:

Pin	Name	Type	Description
1	VCC_3V3	P	3.3V DC power in
2	WAKE_UP (3.3V)	O	Output high level, used to wake up external equipment
3	SIM_PWR	P	SIM card power output (Support 1.8V)
4	SIM_DATA	I/O	SIM card data input/output
5	SIM _RST	O	SIM card reset signal
6	SIM _CLK	O	SIM card clock signal output
7	GND	P	Ground
8	CPU_PWR_ON_R	/	Modem Power on signal, active high (Support 3.3V)
9	USB_ DM	I/O	USB 2.0 Data signal DM
10	PCIE_RST (1.8V)	I	Reset signal, active low
11	USB _DP	I/O	USB 2.0 Data signal DP
12	SIM_DET	O	SIM card reset signal, active low (Support 1.8V）

13	GND	P	Ground
14	UART_TX (3.3V)	O	Serial data transmission
15	VCC_3V3	P	3.3V DC power in
16	UART_RX (3.3V)	I	Serial data reception

2.2 Setting up the Cellular Card

1. Insert a nano SIM card to the SIM slot with the gold contacts facing down and the cut-off corner on the left;



2. Push the card into the slot till it clicks;
3. Attach an antenna to the U. FL-R connector on the card;

4. Use the Micro USB cable (included in the package) to connect the cellular card to a host PC via the Micro USB interface.

Please present **AT&T** or **Verizon** the pre-certified modem name **VT-MOB-LTEMQ-EVS**, **VT-MOB-LTE1Q-EVS**, or **VT-MOB-LTE4Q-EVS** for the CAT M, CAT 1 or CAT 4 cellular card, respectively before applying a SIM card from the cellular carrier.

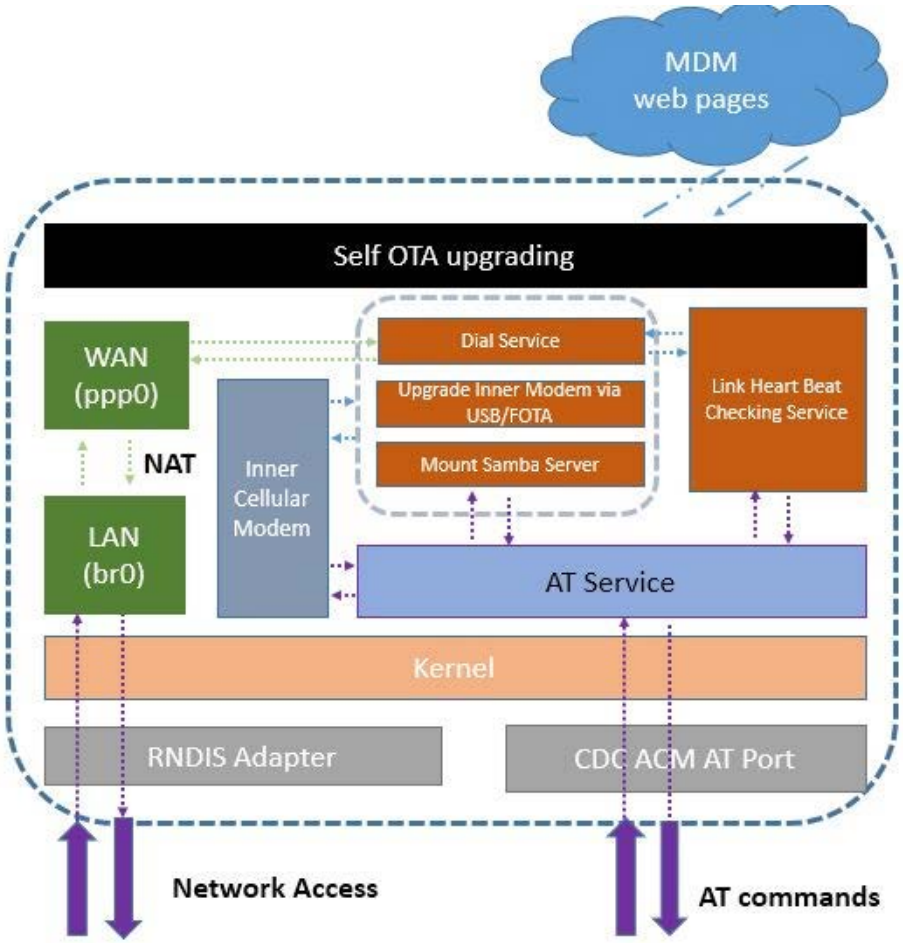
CHAPTER 3

GETTING STARTED

3.1 Network Setup

Typically, we send AT commands to the Micro USB interface (in the stand-alone configuration) or the serial port (in the stacked configuration) (both collectively referred to as "the serial console") to control the cellular card and access the network via Remote Network Driver Interface Specification (RNDIS) network adapter.

The following is a typical topology for the network service of the cellular card.



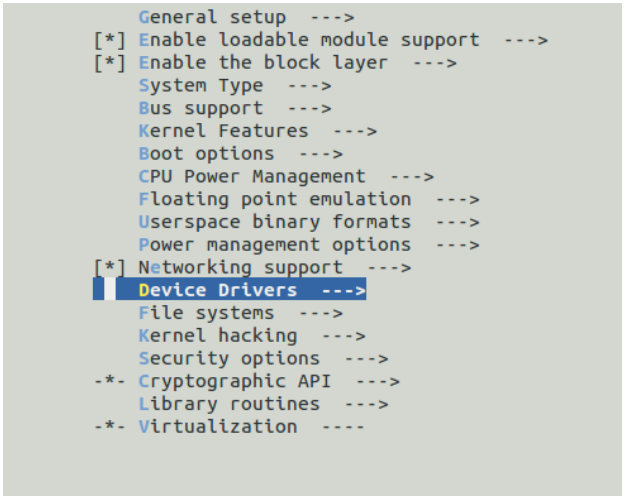
Before you proceed with the network setup, please make sure you have set up the cellular card as per the instructions in 2.2.

3.1.1 Kernel setup

1. Connect the cellular card and a Linux host via a Micro USB cable (for connection via the Micro USB interface) or a USB-to-serial adapter (for connection via the serial port with signals from the B2B connector), and enter the kernel source code directory;

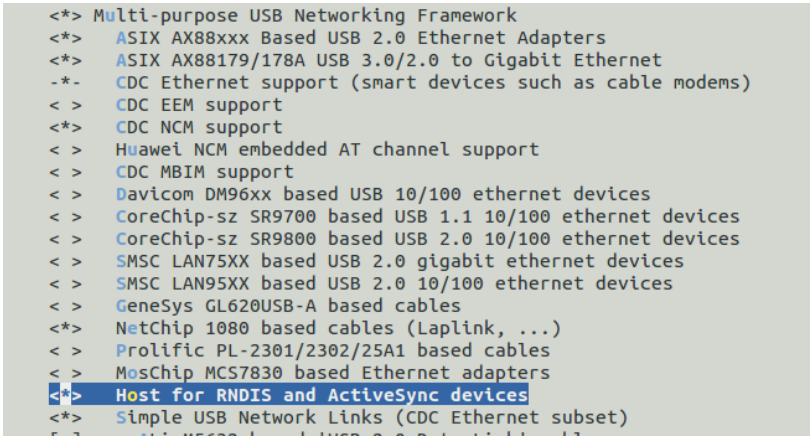
2. Input the following command in the terminal to open the configuration menu of the kernel;

```
make menuconfig
```



3. Select **Device Drivers** --> **USB support** --> **USB Modem (CDC ACM) support** in sequence and return to **Device Drivers**;

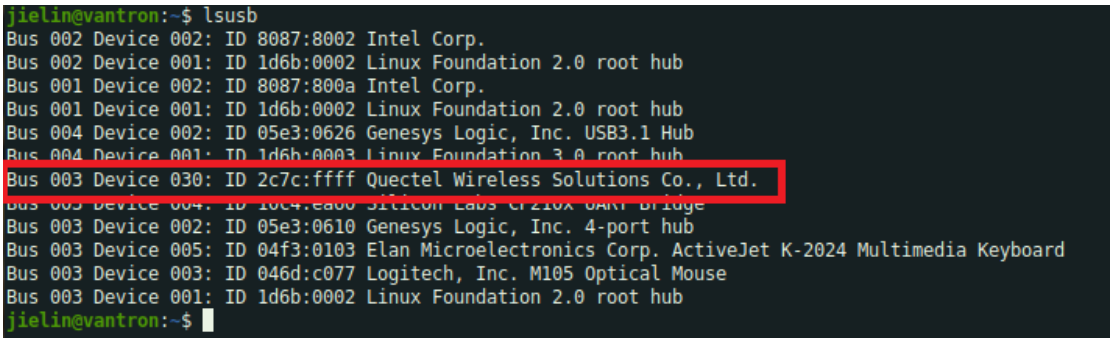
4. Select **Network device support** --> **USB Network Adapters** --> **Multi-purpose USB Networking Framework** in sequence, then enable **Host for RNDIS and ActiveSync devices**;



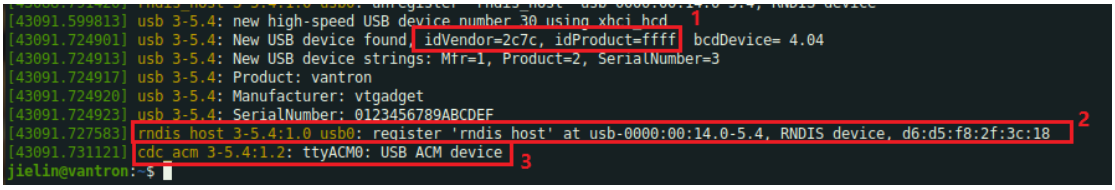
5. Save and exit the configuration menu.

3.1.2 Identifying the devices

1. Type the command "**lsusb**" in the Linux terminal to identify the VID and PID of the cellular card;



2. Input the command "**dmesg**" to identify the device names of the serial console and RNDIS network adapter (in some cases, the name of the RNDIS network adapter might change).



To sum up, the device names of the serial console and RNDIS network adapter enumerated in Linux system as illustrated above are as follows.

Device name	Device type	Kernel driver
2c7c:ffff	VID:PID of the cellular card	/
usb0 (or eth0)	RNDIS network adapter	rndis_host for usb0;
/dev/ttyACM0	Serial console	cdc_acm

3.1.3 Setting up the serial console

For the purpose of sending AT commands, a serial communication program such as minicom or microcom could be used in the Linux system. If the cellular card is connected to a host PC running Windows system, terminal emulators such as PUTTY or MobaXterm could be used.

The settings of the serial console are **115200 8N1** by default.

Open the serial console with minicom:

```
root@~# minicom -b 115200 -D /dev/ttyACM0
```

Or open with microcom:

```
root@~ # microcom -s 115200 /dev/ttyACM0
```

3.2 Establishing RNDIS Network Connection

Please configure the network settings to establish an RNDIS network connection for the first-use of the cellular card. Once the RNDIS network connection is set up, you can refer to the next section (3.3) for the automatic dial-up of the cellular card in the future use.

3.2.1 General notes

AT commands primarily used for setting up the network connection are "**AT^NDISDUP=<CID>,1[,<APN>]**" and "**AT^NDISSTATQRY?**".

AT^NDISDUP=<CID>,1[,<APN>]: to enable the RNDIS data interface on the cellular card

AT^NDISSTATQRY?: to query the status of the cellular data connection

These two AT commands shall be used for network connection every time when the cellular card reboots.

Please note that:

- Initialize the cellular card with the parameters (PDP CID, PDP TYPE, APN, Username, Password…) you received from the carrier for only once
- You need set up the RNDIS Network Adapter every time when the cellular card reboots

3.2.2 AT commands to activate the network connection

1. Figure out the device name of the serial console as instructed in 3.1.2 (assume the device name is /dev/ttyACM0);
2. Open the serial console with microcom;

```
root@~ # microcom -s 115200 /dev/ttyACM0
```

3. Use the following AT commands for communication;

```
root@~ # microcom -s 115200 /dev/ttyACM0
☆Enable the local echo
ATE1
OK

☆Confirm if the SIM card is ready
AT+CPIN?
+CPIN: READY ⟶ SIM card is detected and PIN is not needed, if ERROR is returned, please
               check the SIM card
OK

☆Set the dial number
AT^SETDIALNUM=*99#  ⟶ Set the dial number

OK

☆Set the PDP Type
AT^SETPDPTYPE=IPV4  ⟶ Set the PDP type, could be IP/IPV4V6

OK

☆ Enable the RNDIS data interface on the cellular card
AT^NDISDUP=<CID>,1[,<APN>[,<username>,<password>]]

OK  ⟶  <CID> CID will typically be 1, so the command may be AT^NDISDUP=1,1;
       <APN> The APN is provided by the carrier when you apply for a SIM card.
             The AT command could be: AT^NDISDUP=1,1,"vzwinternet"
       <username> and <password> are typically provided by the carrier, and
             sometimes the carrier may not require a username and password
             to authenticate the cellular network. If not, ignore the parameters.
```

☆Query the registration status of the device

AT+CEREG?;+CGREG?

+CEREG: 0,1 → "X,1" means registered to carrier's network. The network connection is not set up if "X,0", "X,2","X,3" is returned, then please check the APN and antenna connection, then try again.

+CGREG: 0,4

OK

☆Query the signal strength

AT+CSQ

+CSQ: 31,2 → The signal quality is 31. The value should be greater than 9, otherwise you shall check the antenna connection.

OK

☆Perform a heartbeat test

AT#HTBT?

#HTBT: 1,6000,60 → The heartbeat test service is enabled. The timeout for every single test is 6000ms, the interval between two tests is 60s.

OK

AT#HTBTADD? → Set the IP addresses or domain name for sending the heartbeat test to, edit it as follows "AT#HTBTADD=<xx.xx.xx.xx>[,<xx.xx.xx.xx>[,<xx.xx.xx.xx>[,<xx.xx.xx.xx>[,<xx.xx.xx.xx>]]]]" if needed.

8.8.8.8,223.5.5.5,1.0.0.1,114.114.114.114

OK

☆Query the status of the cellular data connection

AT^NDISSTATQRY?

^NDISSTATQRY: 1 → Network connection is established. If the response is 0, please wait a moment, then try again.

OK

```
☆Get the public IP address
AT#GETPUBLICIP ——> Get the public IP address
#GETPUBLICIP:10.70.32.151

OK
```

4. After all commands are sent, press the "CTRL" and "A" keys simultaneously to activate the microcom command mode;
5. Then press “CTRL” and “X” keys simultaneously to terminate the microcom session and exit.

The texts in different colors in above command table are distinguished as follows:

- indicates the main function of an AT command;
- represents a specific AT command;
- indicates the response of an AT command;
- are detailed description of an AT command response.

All settings with these AT commands will be stored in the system NVM.

After the network connection is activated, you can follow 3.3 Setting up the RNDIS Network Adapter and 3.4 Accessing the Internet for the next steps.

3.3 Setting up the RNDIS Network Adapter

Once the network connection is set up with success, the next step is to configure the RNDIS network adapter properly.

Assume the device name of the RNDIS network adapter is identified as **usb0** with the "**dmesg**" command in the Linux terminal.

- Option 1: Set up RNDIS network adapter automatically:

```
root@~# ifconfig usb0 up
root@~# udhcpc -i usb0
udhcpc (v1.21.1) started
Setting IP address 0.0.0.0 on usb0
Sending select for 192.168.253.100...
Lease of 192.168.253.100 obtained, lease time 86400
Setting IP address 192.168.253.100 on usb0
Deleting routers
route: ioctl 0x890c failed: No such process
Adding router 192.168.253.1
Recreating /etc/resolv.conf
 Adding DNS server 192.168.253.1
```

- Option 2: Set up RNDIS network adapter manually:

```
root@~# ifconfig usb0 192.168.253.100 netmask 255.255.255.0 up
root@~# route del default
root@~# route add default gw 192.168.253.1
root@~# echo "nameserver 192.168.253.1" >> /etc/resolv.conf
root@~# sync
```

3.4 Accessing the Internet

Once the RNDIS network adapter is set up, input the following command to check if the network connection has established properly.

```
vantron@~$ ping www.yahoo.com
PING www.yahoo.com (124.108.103.104) 56(84) bytes of data.
round-trip min/avg/max = 0.799/1.042/1.726 ms
PING www.baidu.com (61.135.169.125): 56 data bytes
64 bytes from 61.135.169.125: seq=0 ttl=53 time=675.660 ms
64 bytes from 61.135.169.125: seq=1 ttl=53 time=505.146 ms
64 bytes from 61.135.169.125: seq=2 ttl=53 time=575.010 ms
64 bytes from 61.135.169.125: seq=3 ttl=53 time=464.935 ms
64 bytes from 61.135.169.125: seq=4 ttl=53 time=414.991 ms

--- www.baidu.com ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 414.991/527.148/675.660 ms
```

3.5 Automatic Dial-up

Automatic RNDIS dial-up only works when the RNDIS network connection has been established as indicated in 3.2 Establishing an RNDIS Network Connection and the related parameters such as **PDP CID**, **PDP TYPE, APN**, **Username**, **Password** are stored into the system NVM.

When the automatic RNDIS dial-up is enabled, the cellular card will be set up automatically after reboot.

AT command primarily used to enable the automatic RNDIS dail-up is "**AT^AUTODIAL=1**".

Make sure the RNDIS network connection has been established before you proceed, then use the microcom to open the serial console and run the AT commands.

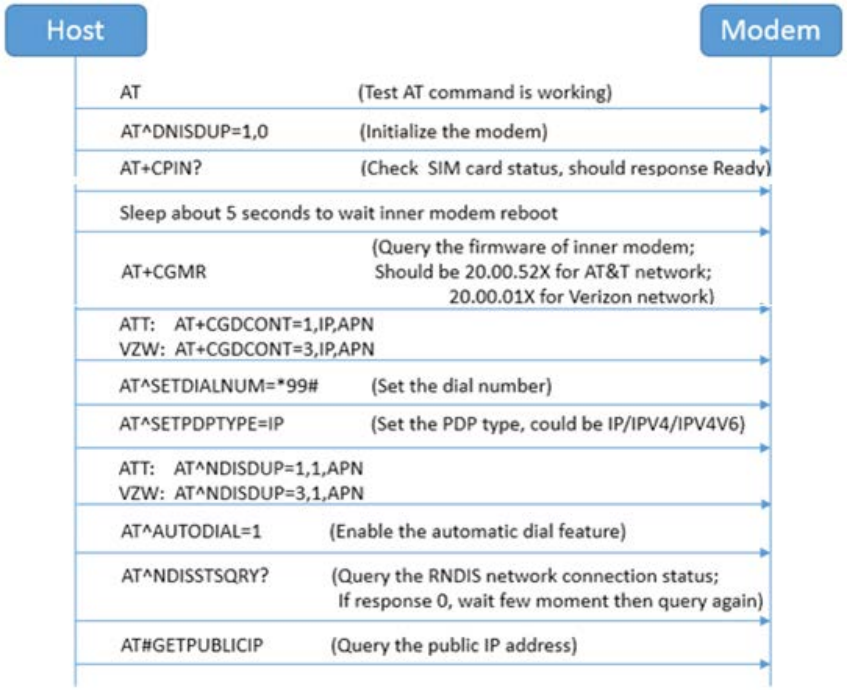
```
root@~ # microcom -s 115200 /dev/ttyACM0
☆Enable the local echo
ATE1

OK
☆Enable the automatic dial-up after reboot
AT^AUTODIAL=1

OK
```

After all commands are sent, press the "CTRL" and "A" keys simultaneously to activate the microcom command mode. Then press “CTRL” and “X” keys simultaneously to terminate the microcom session and exit.

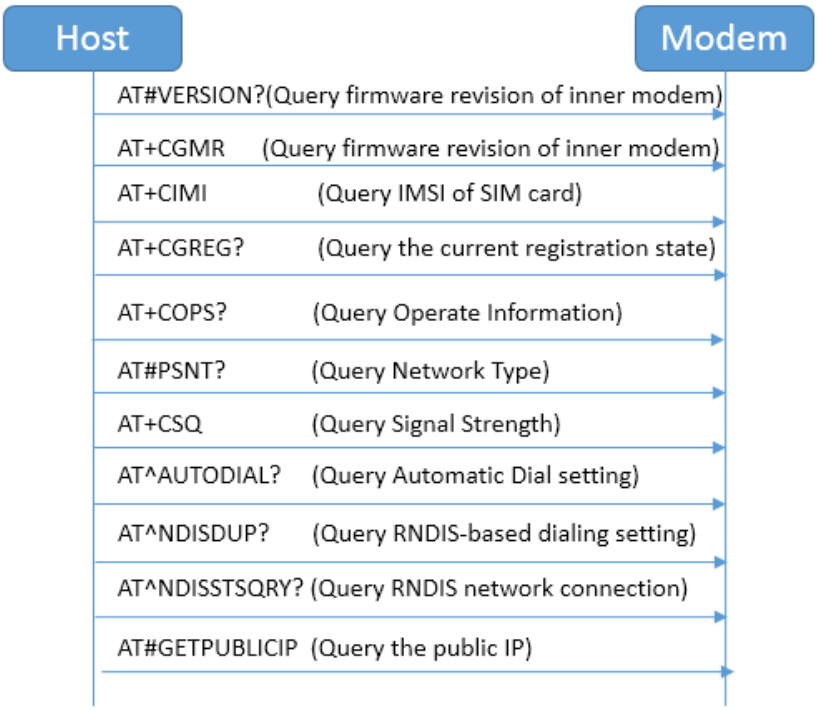
The texts in different colors in above command table are distinguished as follows:

- indicates the main function of an AT command;
- represents a specific AT command;
- indicates the response of an AT command;
- are detailed description of an AT command response.

Below is a flow chart for bringing up the cellular card ("modem" equals the cellular card).



Below is a list of the AT commands that could be used for querying the status of the cellular card ("modem" equals the cellular card).



3.6 Disconnecting RNDIS Network

AT commands primarily used to disconnect an RNDIS network are "**AT^NDISDUP=1,0**" and "**AT^NDISSTATQRY?**".

"**AT^NDISDUP=1,0**": to terminate the cellular network connection

"AT^NDISSTATQRY?": to query the status of the cellular network connection

Open the serial console with microcom and follow the steps below for disconnecting the network.

```
root@~ # microcom -s 115200 /dev/ttyACM0
☆Enable the local echo
ATE1

OK

☆Deactivate the RNDIS network connection
AT^NDISDUP=1,0 ⟶ AT^NDISDUP=<cid>,<connect>, if <connect> is set to 0,
                 the network connection of the cellular card will be terminated
OK


☆Query the status of the cellular data connection
AT^NDISSTATQRY?
^NDISSTATQRY: 0 ⟶ network is disconnected

OK
```

After all commands are sent, press the "CTRL" and "A" keys simultaneously to activate the microcom command mode. Then press "CTRL" and "X" keys simultaneously to terminate the microcom session and exit.

The texts in different colors in above table are distinguished as follows:

- indicates the main function of an AT command;
- represents a specific AT command;
- indicates the response of an AT command;
- are detailed description of an AT command response.

Please note that:

1. The operation takes effect immediately.
2. After the de-activation, the cellular card will not establish a network connection anymore until you perform **either** of the following operations:
   - Send the AT command:

     "AT^NDISDUP=<cid>,1[,<APN>[,<username>[,<password>]]]"
   - Enable the **Automatic RNDIS Dial-up** and reboot the cellular card

Please refer to **Appendices A, B, C** for general/network-related AT commands, firmware upgrade AT commands.

CHAPTER 4

FIRMWARE UPGRADE

4.1 Upgrade with AndroidTool

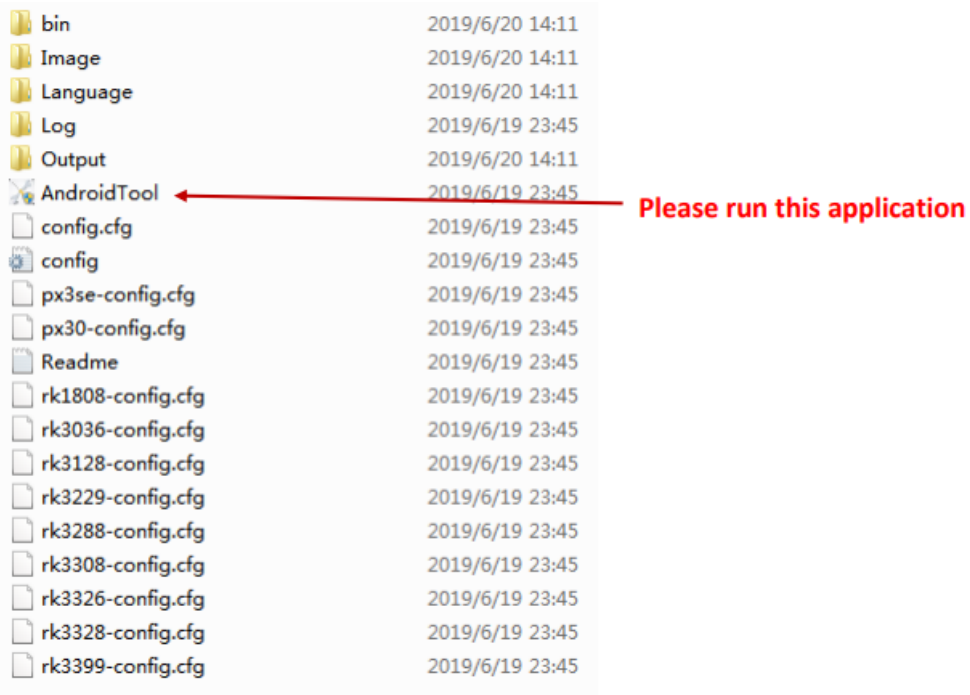
Please be aware that using of AndroidTool for the firmware upgrade applies only to host PCs running Windows system other than Linux or other systems.

4.1.1 Prerequisites

- A VT-MOB-LTEMQ/1Q/4Q-PB CAT M/1/4 cellular card
- A host PC running Windows system
- A release package that has the files and tools necessary for the firmware upgrade

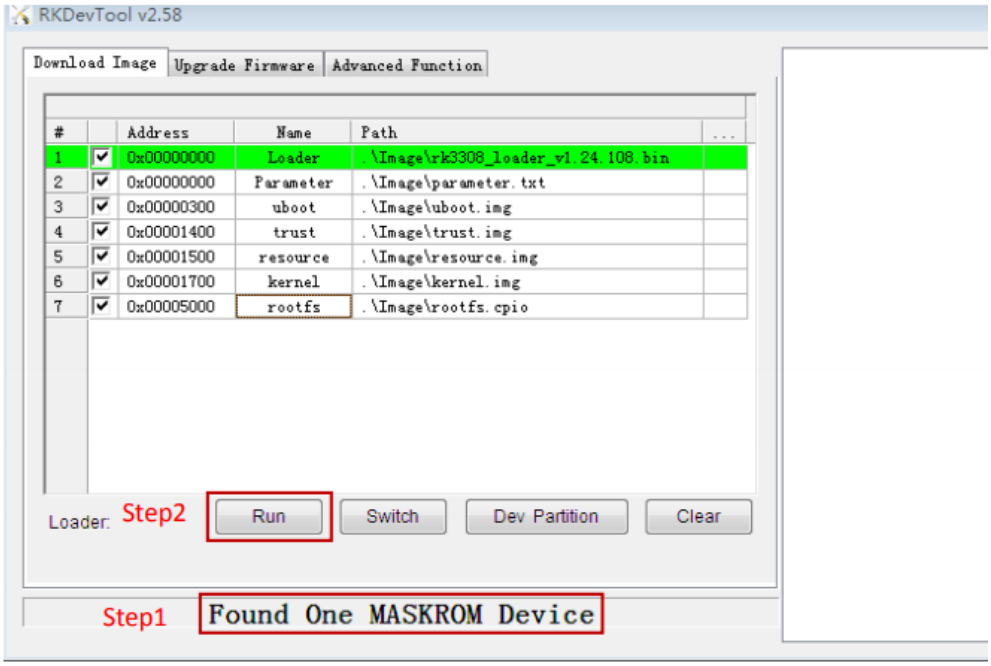
4.1.2 Firmware upgrade

1. Unzip **AndroidTool.zip** in the following path: **<Release Package>/SW/tools**, open the folder and look for **AndroidTool**;
2. Double click **AndroidTool** to run this application;



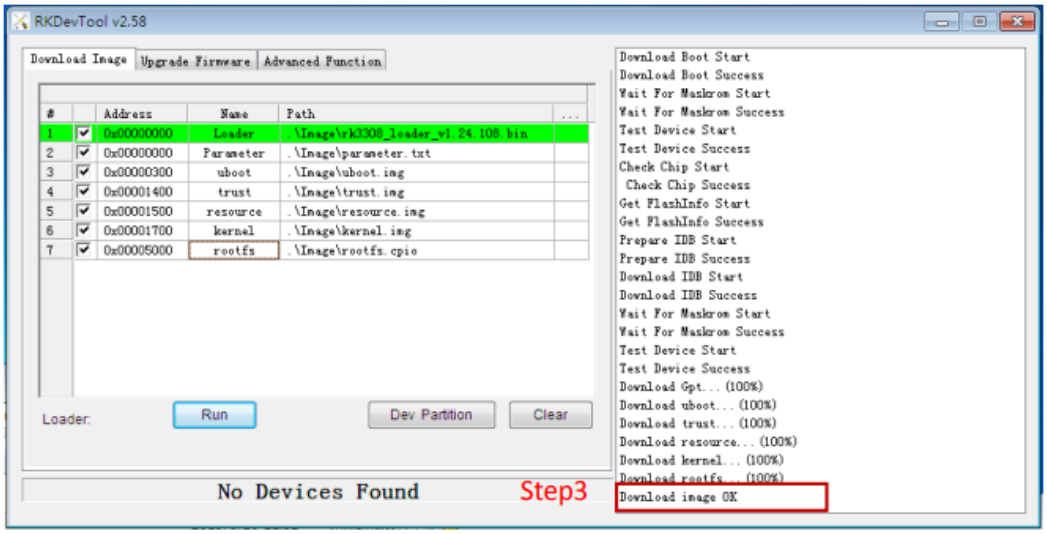
3. Use tweezers or other tools to short the MASKROM test points (CLK & GND) and do not release;
4. Connect the cellular card to the Windows host via the Micro USB cable;

5. If there is a prompt for having identified the MASKROM device at the bottom of the upgrade interface, release the MASKROM test points and click **RUN** to initiate the upgrade process;



6. It will take about 3 minutes for the upgrade to complete;

7. When **download image OK** shows up on the status box, the upgrade finishes;



8. Disconnect the cellular card from the host PC.

If AndroidTool fails to detect the device, please install another driver in the path: **tools/DriverAssitant_vxxx.zip**.

4.2 Upgrade Via Local Network

When the cellular card is connected to a host PC and powered up, the firmware upgrade could be finished with AT commands or console login.

Please be aware that only the following two packages will be used with the approaches mentioned in this section:

XOS_SelfUpgrade_VT-MOB-LTExxx_<Version>.tar.gz

XOS_SelfUpgradeEraseall_VT-MOB-LTExxx_<Version>.tar.gz

4.2.1 Upgrade with AT command

1. Transfer the upgrade package "XOS_SelfUpgrade_VT-MOB-LTExxx_<Version>.tar.gz' to the cellular card **via TFTP**. For example, type the following command in a Linux host, and the package will be identified in the path **/tmp** of the cellular card;

```
# busybox tftp -p -l XOS_SelfUpgrade_VT-MOB-LTExxx_<Version>.tar.gz 192.168.253.1
```

2. Then get the MD5 hash value;

```
# md5sum XOS_SelfUpgrade_VT-MOB-LTExxx_<Version>.tar.gz

1cebefe7016766ac8cb9b60689834287 XOS_SelfUpgrade_VT-MOB-LTExxx_<Version>.tar.gz
```

3. Assume the device name of the serial console is /dev/ttyACM0, open it and type the AT command below for the upgrade.

```
# minicom -b 115200 -D /dev/ttyACM0

AT#MOBUPDATE="XOS_SelfUpgrade_VT-MOB-LTExxx_<Version>.tar.gz","1cebefe7016766ac8cb9b60689834287"
```

After the upgrade succeeds, the cellular card will reboot automatically.

4.2.2 Upgrade after console login

1. Transfer the upgrade package 'XOS_SelfUpgrade_VT-MOB-LTExxx_<Version>.tar.gz' to the cellular card **via TFTP**. For example, please type the following command in a Linux host, and the package will be identified in the path **/tmp** of the cellular card:

```
# busybox tftp -p -l XOS_SelfUpgrade_VT-MOB-LTExxx_<Version>.tar.gz
192.168.253.1
```

2. Login the console of the cellular card (via the Micro USB interface);
3. Start the upgrade.

```
# exec_upgrade.sh /tmp/XOS_SelfUpgrade_VT-MOB-LTExxx_<Version>.tar.gz
```

CHAPTER 5

DISPOSAL AND WARRANTY

5.1 Disposal

When the device comes to end of life, you are suggested to properly dispose of the device for the sake of the environment and safety.

Before you dispose of the device, please back up your data and erase it from the device.

It is recommended that the device is disassembled prior to disposal in conformity with local regulations. Please ensure that the abandoned batteries are disposed of according to local regulations on waste disposal. Do not throw batteries into fire or put in common waste canister as they are explosive. Products or product packages labeled with the sign of “explosive” should not be disposed of like household waste but delivered to specialized electrical & electronic waste recycling/disposal center.

Proper disposal of this sort of waste helps avoid harm and adverse effect upon surroundings and people’s health. Please contact local organizations or recycling/disposal center for more recycling/disposal methods of related products.

5.2 Warranty

Product Warranty

VANTRON warrants to its CUSTOMER that the Product manufactured by VANTRON, or its subcontractors will conform strictly to the mutually agreed specifications and be free from defects in workmanship and materials (except that which is furnished by the CUSTOMER) upon shipment from VANTRON. VANTRON's obligation under this warranty is limited to replacing or repairing at its option of the Product which shall, within **24 months** after shipment, effective from invoice date, be returned to VANTRON's factory with transportation fee paid by the CUSTOMER and which shall, after examination, be disclosed to VANTRON's reasonable satisfaction to be thus defective. VANTRON shall bear the transportation fee for the shipment of the Product to the CUSTOMER.

Out-of-Warranty Repair

VANTRON will furnish the repair services for the Product which are out-of-warranty at VANTRON's then-prevailing rates for such services. At customer's request, VANTRON will provide components to the CUSTOMER for non-warranty repair. VANTRON will provide this service as long as the components are available in the market; and the CUSTOMER is requested to place a purchase order up front. Parts repaired will have an extended warranty of 3 months.

Returned Products

Any Product found to be defective and covered under warranty pursuant to Clause above, shall be returned to VANTRON only upon the CUSTOMER's receipt of and with reference to a VANTRON supplied Returned Materials Authorization (RMA) number. VANTRON shall supply an RMA, when required within three (3) working days of request by the CUSTOMER. VANTRON shall submit a new invoice to the CUSTOMER upon shipping of the returned products to the CUSTOMER. Prior to the return of any products by the CUSTOMER due to rejection or warranty defect, the CUSTOMER shall afford VANTRON the opportunity to inspect such products at the CUSTOMER's location and no Product so inspected shall be returned to VANTRON unless the cause for the rejection or defect is determined to be the responsibility of VANTRON. VANTRON shall in turn provide the CUSTOMER turnaround shipment on defective Product within **fourteen (14) working days** upon its receipt at VANTRON. If such turnaround cannot be provided by VANTRON due to causes beyond the control of VANTRON, VANTRON shall document such instances and notify the CUSTOMER immediately.

Appendix A: General AT Commands

- **Query the Software Version-AT#VERSION**

#VERSION-Query Software Version	
AT#VERSION	**Description:** Query the software version of Vantron cellular card. **Response(s):** <CR><LF><**Version**><CR><LF><CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
AT#VERSION?	**Description:** Query the software version of Vantron cellular card. **Response(s):** <CR><LF><**Version**><CR><LF><CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
Example	**Input:** AT#VERSION? **Output:** VT-XOS_1.9 10/29/18 **Output:** OK
Note	

- **Query Modem Identity-AT#GETMM**

#GETMM–Query Modem Identity	
AT#GETMM	**Description:** Query the identity of Vantron cellular card. **Response(s):** <CR><LF><**Module** **Series**>,<**MCUNumber**><CR><LF><CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF> **Parameter(s):** <**Module Series**>-The category of the cellular card. 1. CAT1- indicates the modem is of VT-MOB-LTE1 series. 2. CATM- indicates the modem is of VT-MOB-LTEM series. <**MCU Number**>-The number of MCU.
Example	**Input:** AT#GETMM **Output:** CAT1,1052 **Output:** OK
Note	

- **Restore to Default Settings-AT#REDEFAULT**

#REDEFAULT–Restore to Default Settings	
AT#REDEFAULT	**Description:** Set the Vantron cellular card to default settings. **Response(s):** <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
Example	**Input:** AT#REDEFAULT **Output:** OK
Note	The Vantron cellular card will reboot automatically soon after responding to this AT command.

- **Reboot the Cellular Card-AT#MREBOOT**

#MREBOOT– Reboot the Cellular Card	
AT#MREBOOT	**Description:** Reboot the Vantron cellular card. **Response(s):** <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
Example	**Input:** AT#MREBOOT **Output:** OK
Note	The Vantron cellular card will reboot automatically soon after responding to this AT command.

- **Manage NVM Settings Commit-AT#MSYSNVM**

#MSYSNVM–Manage NVM Settings Commit	
AT#MSYSNVM	**Description:** Confirm if the Vantron cellular card commits the changes of NVM settings to the flash. If you enable the **Automatic RNDIS Dial-up** feature for RNDIS network setup, there's no need to set <commit> to 0; while if you issue AT commands to set **Dial Number** / **PDP Type** / **APN** /etc. every time after the cellular card is powered up, please set <commit> to 1. **Parameter(s):** <**commit**>: (default **1**) 0 – Do not commit the changed NVM settings 1 – Commit the changed NVM settings **Response(s):** <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
Example	**Input:** AT#MSYSNVM=0 **Output:** OK
AT#MSYSNVM?	Query the current settings
Note	This AT command should be issued every time after the cellular card is powered up.

- **Issue Shell Commands to the Cellular Card -AT#MSYSCMD**

# MSYSCMD–**Issue Shell Commands to the Cellular Card**	
AT# MSYSCMD =<shell commands>	**Description:** Issue shell commands from the host to the cellular card for execution **Parameter(s):** **<shell commands>:** Shell commands issued by the Host **Response(s):** <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
Example	**Input:** AT# MSYSCMD=echo 'hello world' > /root/test **Output:** OK
Note	

Appendix B: Network Commands

- **Set the Dial Number-AT^SETDIALNUM**

^SETDIALNUM–Set the Dial Number	
AT^SETDIALNUM **=<dial number>**	**Description:** Set the Dial Number. **Parameter(s):** <**dial number**> - specific of GPRS functionality and causes the MT to perform whatever actions are necessary to establish communication between the TE and the external PDN. Dial Number:***<**gprs_sc**>[***<**addr**>][***[<**L2P**>][***[<**cid**>]]]]**#** <**gprs_sc**> - GPRS Service Code, a digit string (value 99) which identifies a request to use the GPRS <**addr**> - a string that identifies the called party in the address space applicable to the PDP. <**L2P**> - a string that indicates the layer 2 protocol to be used. For communication software that does not support arbitrary characters in the dial string, the following numeric equivalents shall be used:1 – PPP <**cid**> - a digit which specifies a particular PDP context definition (see **+CGDCONT** command). **Response(s):** <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>

AT^SETDIALNUM?	Query the current settings
Example	**Input:** AT^SETDIALNUM=*99***1# **Output:** OK
Note	The settings are stored to system NVM by default.

- **Set the PDP Type-AT^SETPDPTYPE**

^SETPDPTYPE–Set the PDP Type	
AT^SETPDPTYPE **=<PDP_type>**	**Description:** Set the PDP type. **Parameter(s):** <**PDP_type**> (Packet Data Protocol type) A string parameter which specifies the type of the packet data protocol. **IP** Internet Protocol (IETF STD 5) **IPV4V6** Dual PDN Stack **Response(s):** <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
AT^SETPDPTYPE?	Query the current settings
Example	**Input:** AT^SETPDPTYPE=IPV4V6 **Output:** OK
Note	The settings are stored to system NVM by default.

- **Set up RNDIS Dial-up-AT^NDISDUP**

^NDISDUP-Set RNDIS-Based Dial-up	
AT^NDISDUP **=<cid>** **,<connect>** **[,<APN>** **[,<username>** **[,<password>]]]**	**Description:** Set RNDIS-based dial-up. **Parameter(s):** <**cid**> - a digit which specifies a particular PDP context definition (see **AT+CGDCONT** command). <**connect**>: 0 - Deactivate the RNDIS network connection 1 - Active the RNDIS network connection <**APN**> - (Access Point Name) a string parameter which is a logical name used to select the GGSN or the external packet data network. If the value is empty (“”) or omitted, then the subscription value will be requested. <**username**> - user name in format of character string (0 to 128 bytes) <**password**> - password in format of character string (0 to 128 bytes) **Response(s):** <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
AT^NDISDUP?	Query the current settings
Example	Activate the connection: **Input:** AT^NDISDUP=1,1,3gnet,card,card

	Output: OK Deactivate the connection: **Input:** AT^NDISDUP=1,0 **Output:** OK
Note	1. This operation takes effect immediately to Activate/ Deactivate a network connection. 2. The settings are stored to system NVM by default. 3. If the **Automatic RNDIS Dial-up** feature is not enabled, users need type AT command "AT^NDISDUP=<cid>,1[,<APN>[,<username>[,<password>]]]" to activate network connection every time when the cellular card reboot. 4. The cellular card will not try to establish a network connection anymore after receiving AT command "AT^NDISDUP=<cid>,0" until you perform **either** of the following operations: • Send the AT command: "AT^NDISDUP=<cid>,1[,<APN>[,<username>[,<password>]]]" • Enable the **Automatic RNDIS Dial-up** feature and reboot the cellular card

- **Query the status of the cellular data connection -AT^NDISSTATQRY**

^NDISSTATQRY-Query the status of the cellular data connection	
AT^NDISSTATQRY?	**Description:** Query the connection status of the RNDIS-based Dial-up. <**status**> 0 - The network connection is deactivated. 1 - The network connection is active. **Response(s):** <CR><LF>^NDISSTATQRY: <**status**><CR><LF><CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
Example	When the connection is deactivated: **Input:** AT^NDISSTATQRY? **Output:** ^NDISSTATQRY: 0 **Output:** OK When the connection is active: **Input:** AT^NDISSTATQRY? **Output:** ^NDISSTATQRY: 1 **Output:** OK
Note	

- **Automatic RNDIS Dial-up after Reboot-AT^AUTODIAL**

^AUTODIAL–Set Automatic RNDIS Dial-up	
AT^AUTODIAL **=<n>**	**Description:** Set the **Automatic RNDIS Dial-up** feature to be enabled or not for network connection after the cellular card reboots. **Parameter(s):** <**n**>: 0 - Disable the automatic dial-up (default) 1 - Enable the automatic dial-up **Response(s):** <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
Example	Enable the automatic dial-up: **Input:** AT^AUTODIAL=1 **Output:** OK Disable the automatic dial-up: **Input:** AT^AUTODIAL=0 **Output:** OK
Note	1. This command takes effect after the cellular card reboots; 2. The settings are stored to system NVM by default. 3. Firstly, please setup network connection with the correct **PDPCID**, **APN**, **Username**, **Password** with AT^NDISDUP, then confirm if the cellular card has a network connection with

	AT^NDISSTATQRY?. At this point, these valid parameters will be stored in the cellular card. Next time the cellular card will set up network connection automatically after reboot when it receives command **AT^AUTODIAL=1**.
^AUTODIAL–Get the Setting of Automatic Dial-up	
AT^AUTODIAL?	**Description:** Query the current settings of automatic dial-up. **Parameter(s):** <**stat**>: 0 - the automatic dial-up is disabled (default) 1 - the automatic dial-up is enabled **Response(s):** <CR><LF>+AUTODIAL: <**stat**><CR><LF>OK<CR><LF>
Example	When automatic dial-up is disabled: **Input:** AT^AUTODIAL? **Output:** +AUTODIAL: 0 **Output:** OK When automatic dial-up is enabled: **Input:** AT^AUTODIAL? **Output:** +AUTODIAL: 1 **Output:** OK

- **Query Public IP-AT#GETPUBLICIP**

#GETPUBLICIP–Query Public IP	
AT#GETPUBLICIP	**Description:** Query the Public IP address of the cellular card. **Response(s):** <CR><LF>#GETPUBLICIP:<**Public IP address**><CR><LF><CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
Example	When the connection is deactivated: **Input:** AT#GETPUBLICIP **Output:** #GETPUBLICIP:0.0.0.0 **Output:** OK When the connection is active: **Input:** AT#GETPUBLICIP **Output:** #GETPUBLICIP:xxx.yyy.zzz.www **Output:** OK
Note	

- **Set Link Heartbeat Checking Service-AT#HTBT**

#HTBT–Set Link Heartbeat Checking Service	
AT#HTBT =<n>[,<single ping timeout>[,<ping interval>]]	**Description:** Set Link Heartbeat Checking Service **Parameter(s):** <**n**>: 0 - Disable the Link Heartbeat Checking Service 1 - Enable the Link Heartbeat Checking Service (default) <**single ping timeout**> - the timeout of every single Ping is 1000-65535 ms (default **6000**) <**ping interval**> - the interval between two ping tests is 10-65535 s <default **60**> **Response(s)**: <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
AT#HTBT?	Query the current settings
Example	**Input:** AT#HTBT=1,6000 **Output:** OK
Note	Note: 1. We recommend you keep the Link Heartbeat Checking Service enabled all the time to check the network connection and keep it online. 2. The settings are stored to system NVM by default.

- **Set the IP Addresses of Link Heartbeat Checking Service-AT#HTBTADD**

#HTBTADD–Set the IP Addresses of Link Heartbeat Checking Service	
AT#HTBTADD =<IP address1> [,<IP address2> [,<IP address3> [,<IP address4> [,<IP address5>]]]]	**Description:** Set the IP addresses of Link Heartbeat Checking Service. **Parameter(s):** <**IP address[1-5]**>- address of the remote host, string type. This parameter can be any valid IP address in the format: "xxx.xxx.xxx.xxx" (Link Heartbeat Checking Service needs multiple IP addresses by default: **8.8.8.8,223.5.5.5,1.0.0.1,114.114.114.114**) **Response(s):** <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
AT#HTBTADD?	Query the current settings
Example	**Input:** AT#HTBTADD=8.8.8.8,1.0.0.1,114.114.114.114 **Output:** OK
Note	1. Please set a reachable IP address for the Inner Link Heartbeat Checking Service, otherwise the cellular card might end up with a bad state. 2. The settings are stored to system NVM by default.

- **Send Ping Request-AT#HTBTPING**

#HTBTPING–Send Ping Request	
AT#HTBTPING **=<IP address>** **[,<retryNum>]** **[,<Timeout>]**	**Description:** Send Ping Request. **Parameter(s):** <**IP address**>- address of the remote host, string type. This parameter can be any valid IP address in the format: "xxx.xxx.xxx.xxx" <**retryNum**> - the number of Ping Request to send 1-64 (default **3**) <**Timeout**> - the timeout of every single Ping 1-65535ms (default **1000**) **Response(s)**: <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
Example	**Input:** AT#HTBTPING=8.8.8.8 **Output:** OK
Note	

Appendix C: Firmware Upgrade Commands

#MOBUPDAT-Firmware Upgrade	
AT#MOBUPDATE= **<file_name>** **,<file_md5_value>** **[,<n>]**	**Description:** Upgrade the firmware of the cellular card. **Parameter(s):** <**file_name**> - The name of the upgrade file. <**file_md5_value**> - MD5 value of the upgrade file. <**n**>: 0 – Not restore to factory system NVM settings during upgrade 1 – Restore to factory system NVM settings during upgrade If <n> is ignored, it will not restore to factory system NVM settings during upgrade. **Response(s):** <CR><LF>OK<CR><LF> In case of an MT-related error: <CR><LF>ERROR<CR><LF>
Example	**Input:** AT#MOBUPDATE="XOS_SelfUpgrade_VT-MOB-MPCIE-4G_VXXX.tar.gz","1cebefe7016766ac8cb9b60689834287" **Output:** OK
Note	1. The upgrade file must be transmitted to the cellular card via the TFTP service first. Assume the device name of the RNDIS adapter device is usb0 in Ubuntu system, issue the following commands: **Input:** ifconfig usb0 up **Input:** udhcpc -i usb0

	Input: tftp -p -l XOS_SelfUpgrade_VT-MOB-MPCIE-4G_VXXX.tar.gz 192.168.253.1 (Assume the default IP address of the cellular card is 1*92.168.253.1)*. 2. This command will restore to factory system NVM settings automatically during the upgrading process when the firmware revision is older than 2020-07-06. 3. This command will ignore the parameter <n>, when the firmware revision is older than 2020-07-06. 4. The cellular card will reboot automatically soon after responding to this AT command.

Appendix D: Regulatory Compliance Statements

FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

Note: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate this equipment.

ESD Precautions

While setting up an electronic system or handling electronic components, certain precautions and proper handling procedures should be followed to prevent ESD-induced failures. Handling the Product without proper ESD protection may destroy or damage it permanently.

- There should not be any hand contact while transporting or storing electrostatic discharge sensitive (ESDS) components. This can be achieved by placing components in static-safe containers.
- It is important to place ESDS components in static-protected areas before taking them from their packages.
- Be careful to keep ESDS components in their respective anti-static containers until they are moved to static-protected workstations.
- No human touch is permitted on the pins and leads of ESDS components or ESDS circuitries.
- While touching ESDS components or circuits, personnel should be properly grounded.
- There is no plastic, foam, or vinyl allowed in static-protected workstations.

Heat Related Concerns

The Product may become very warm during normal use. It complies with the user-accessible surface temperature limits defined by the International Standards for Safety. Still, sustained contact with warm surfaces for long periods of time may cause discomfort or injury. To reduce potential heat-related concerns, follow these guidelines:

- Keep the Product and its adapter in a well-ventilated area when in use or charging. Allow for adequate air circulation under and around the Product.
- If the Product is used for long periods, its surface can become very warm. While the temperature may not feel hot to the touch, if you maintain physical contact with the Product for a long time, your skin might suffer a low-heat injury.
- Never place the Product or the adapter on furniture or any other surface that might be marred by exposure to heat since the screen itself and the surface of the adaptor may increase in temperature during normal use.