Linux 5G telecommunications Quick Start Guide

V1.2

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Version

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V0.1	2012/06/10	SS.Chang	draft version
V1.0	2012/06/17	SS.Chang	First released version

Contents

Purpose:

This Quick start guide introduce how to setting Fibocom FM150-NA & Quectel RM500Q-GL 5G function for Advantech user reference.

Target Audience:

For Advantech TSE, RBU AE, outsourcing service engineer(s) and End customer with the following knowledge:

- Linux installation and Linux network setting experience

Reference Table:

Following table is Advantech 5G Module **Part Number** list, and suggesting system installs 4 antennas for 5G telecommunications module test.

Model	Fibocom FM150-NA	Quectel RM500Q-GL
P/N	968DD00063	968DD00064
Size	52.0 x 30.0 x 2.3mm	52.0 x 30.0 x 2.3mm
Interface	M.2	M.2
Main Chip	Snapdragon X55 5G Modem	Snapdragon X55 5G Modem
Support Modes	5G Sub-6 , 4G/LTE, 3G, 2G	5G Sub-6 , 4G/LTE, 3G, 2G
Antenna	4	4
5GNR and 4G/LTE	DL: 4x4 MIMO UL:1x1 MIMO	DL: 4x4 MIMO UL:1x1 MIMO

FWA-1112/1212 can support 5G telecommunications module, and FWA-1010VC/1012VC/T011 do not support.

Model	5G telecommunications module support
FWA-1010VC	**Size limitation**
FWA-1012VC	**Size limitation**
FWA-T011	**Size limitation**
FWA-1112VC	Support
FWA-1212	Support

5G/LTE utility installation

1. Please check following table, Suggesting user installs Ubuntu Linux 21.04 (or above) version in the Advantech Wall-mount system,

2. 5G module needs new Ubuntu's mmcli utility, Ubuntu Linux 21.04 (or above) default is included these utilities, and early mmcli version doesn't support 5G bands.

OS	Ubuntu 18.04	Ubuntu20.04/20.10	**Ubuntu 21.04**
mmcli version	1.10	1.12	**1.14**
Fibocom FN-150 Quectel & RM500QGL_VH	Non-detecting	Only detecting 4G band	**Detecting 4G/5G**
mmcli support Modes	N/A	current: allowed: 3g, 4g; preferred: 4g	**current: allowed: 3g, 4g, 5g; preferred: 5g**

3. Please refer following command to install 5G utility

3.1 Login server and switch to administrator's privilege.

```
Login username: XXX
Login password: XXX
$ sudo su
$ XXX (login password)
```

3.2 connecting a network cable,and key-in following commands to get a DHCP from internet.

```
# dhclient -r
# dhclient
```

3.3 Update latest Ubuntu source list and apply to this server.

2.3.1 Key-in following command to activate new source list.

```
# apt update
```

2.3.2 Install essential packages.

```
# apt install net-tools
```

```
# apt install ethtool
# apt install modemmanager
```

2.3.4 Stop NetworkManager service.

```
# service NetworkManager stop
```

4. Please key-in following command to check 5G module detecting, ubuntu 21.04 can list 5G module detail information

(sample: Quectel RM500Q-GL)

```
# lsusb
Bus 002 Device 003: ID 0781:5583 SanDisk Corp. Ultra Fit
Bus 002 Device 002: ID 2c7c:0800 Quectel Wireless Solutions Co., Ltd. RM500Q-GL
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```

PS: older Ubuntu (ex: 18.04) doesn't list detail 5G module info.

```
# lsusb
Bus 002 Device 003: ID 0781:5583 SanDisk Corp.
Bus 002 Device 002: ID 2c7c:0800
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```

5. Check LTE drivers loaded, Fibocom FN-150 and Quectel & RM500QGL_VH are using cdc driver.

```
# lsmod | grep -i cdc
```

example:

```
# dmesg | grep -i cdc
cdc_mbim               20480  0
cdc_ncm                49152  1 cdc_mbim
cdc_wdm                28672  3 cdc_mbim,qmi_wwan
cdc_ether              20480  1 cdc_ncm
```

```
usbnet                 49152  4 cdc_mbim,cdc_ncm,qmi_wwan,cdc_ether
```

6. Please key-in following command to check 5G module detecting by mmcli

```
# mmcli -L
```

Example:

```
# mmcli -L
 /org/freedesktop/ModemManager1/Modem/0 [Quectel] EM06-E
```

7. Please key-in following command to check 5G module status.

```
# mmcli -m 0
  ----------------------------
    General  |         dbus path: /org/freedesktop/ModemManager1/Modem/0
             |         device id: 0f1cd0cadb2287e4c8b56c59d66b209d73e6f7da
    ----------------------------
    Hardware |      manufacturer: Quectel
             |             model: RM500QGL_VH
             | firmware revision: RM500QGLABR10A02M4G
             |      h/w revision: 20000
             |         supported: gsm-umts, lte, 5gnr
             |           current: gsm-umts, lte, 5gnr
             |      equipment id: 863305040185794
    ----------------------------------
    System   |            device: /sys/devices/pci0000:00/0000:00:15.0/usb2/2-2
             |           drivers: option1, qmi_wwan
             |            plugin: quectel
             |      primary port: cdc-wdm0
             |             ports: cdc-wdm0 (qmi), ttyUSB0 (qcdm), ttyUSB1 (gps),
             |                    ttyUSB2 (at), ttyUSB3 (at), wwx0ed18cec02f8 (net)
    ----------------------------
```

```
Status    |             lock: sim-pin
          |    unlock retries: sim-pin (3), sim-puk (10), sim-pin2 (3), sim-puk2 (10)
          |            state: locked
          |       power state: on
          |    signal quality: 0% (cached)
----------------------------

Modes     |         supported: allowed: 3g; preferred: none
          |                    allowed: 4g; preferred: none
          |                    allowed: 3g, 4g; preferred: 4g
          |                    allowed: 3g, 4g; preferred: 3g
          |                    allowed: 5g; preferred: none
          |                    allowed: 3g, 5g; preferred: 5g
          |                    allowed: 3g, 5g; preferred: 3g
          |                    allowed: 4g, 5g; preferred: 5g
          |                    allowed: 4g, 5g; preferred: 4g
          |                    allowed: 3g, 4g, 5g; preferred: 5g
          |                    allowed: 3g, 4g, 5g; preferred: 4g
          |                    allowed: 3g, 4g, 5g; preferred: 3g
          |           current: allowed: 3g, 4g, 5g; preferred: 5g
----------------------------

Bands     |         supported: utran-1, utran-3, utran-4, utran-6, utran-5, utran-8,
          |                    utran-2, eutran-1, eutran-2, eutran-3, eutran-4, eutran-5, eutran-7,
          |                    eutran-8, eutran-12, eutran-13, eutran-14, eutran-17, eutran-18,
          |                    eutran-19, eutran-20, eutran-25, eutran-26, eutran-28, eutran-29,
          |                    eutran-30, eutran-32, eutran-34, eutran-38, eutran-39, eutran-40,
          |                    eutran-41, eutran-42, eutran-43, eutran-46, eutran-48, eutran-66,
          |                    eutran-71, utran-19
          |           current: utran-1, utran-3, utran-4, utran-6, utran-5, utran-8,
          |                    utran-2, eutran-1, eutran-2, eutran-3, eutran-4, eutran-5, eutran-7,
```

```
                |                  eutran-8, eutran-12, eutran-13, eutran-14, eutran-17, eutran-18,
                |                  eutran-19, eutran-20, eutran-25, eutran-26, eutran-28, eutran-29,
                |                  eutran-30, eutran-32, eutran-34, eutran-38, eutran-39, eutran-40,
                |                  eutran-41, eutran-42, eutran-43, eutran-46, eutran-48, eutran-66,
                |                  eutran-71, utran-19
  ----------------------------
  IP            |         supported: ipv4, ipv6, ipv4v6
  ----------------------------
  SIM           |         dbus path: /org/freedesktop/ModemManager1/SIM/0
```

PS1: Please check following table. Please check SIM installation when SIM status reports fail,

Item	description
SIM detecting fail	Status | state: failed | failed reason: sim-missing | power state: on | signal quality: 0% (cached)
SIM detecting Pass	Status | lock: sim-pin | unlock retries: sim-pin (3) | state: locked | power state: on | signal quality: 0% (cached)
SIMM connects with base-station	Status | unlock retries: sim-pin2 (3) | state: connected | power state: on | access tech: umts | signal quality: 35% (recent)

PS2: Please check LTE mode after SIM function. When current mode doesn't list 5G message, please check mmcli version, SIM and LTE module.

Item	description
Link mode: 5G	Modes | supported: allowed: 3g; preferred: none | allowed: 4g; preferred: none | allowed: 3g, 4g; preferred: 4g | allowed: 3g, 4g; preferred: 3g | allowed: 5g; preferred: none | allowed: 3g, 5g; preferred: 5g | allowed: 3g, 5g; preferred: 3g | allowed: 4g, 5g; preferred: 5g | allowed: 4g, 5g; preferred: 4g | allowed: 3g, 4g, 5g; preferred: 5g | allowed: 3g, 4g, 5g; preferred: 4g | allowed: 3g, 4g, 5g; preferred: 3g | current: allowed: 3g, 4g, 5g; preferred: 5g
Link mode: 4G	Modes | supported: allowed: 3g; preferred: none | allowed: 4g; preferred: none | allowed: 3g, 4g; preferred: 3g | allowed: 3g, 4g; preferred: 4g | current: allowed: 3g, 4g; preferred: 4g

8. Following table is first 5G/LTE module initial commands, when user needs to initial second 5G/LTE command, please change parameter from 0 to 1.

   PS1: 0 mean first 5G module, and 1 mean second 5G module.

   PS2: <id> mean “connection name”, it can be naming “lte1” or other ID

Description	**Command for 5G/LTE module 0**
Unlock SIM	# mmcli -i 0 --pin=<PIN code>
Check module statue	# mmcli -m 0
Generate connection	# nmcli c add type gsm ifname cdc-wdm0 con-name <id> apn internet
Start connection	# nmcli c up <id>
Restart wwan port	# nmcli r wwan on
Check connection IP	# nmcli connection show <ID> | grep -i ip4

Following segment is a 5G link script example, user may refer following script to make it’s system

```
#!/bin/bash


    cdc_device=`mmcli -m 0 | grep "primary port" | awk '{print $4}' | cut -d"'" -f 2`
    pin_code="0000"
    connection_name=lte1
    apn="internet"


    echo Check if lte1 exists or not
    connection=`nmcli c | grep lte1 | awk '{print $1}'`
    if [ "$connection" != "$connection_name" ]; then
                echo lte1 does not exist
                echo Please make sure ModemManager or network-manager is enabled
                echo cdc device name is $cdc_device
                echo add nmcli connection
                  nmcli c add type gsm ifname $cdc_device con-name $connection_name apn $
```

```
    apn
    else
                echo lte1 exist
    fi

    echo unlock SIM pin code
      mmcli -i 0 --pin=$pin_code
    echo enable $connection_name. Wait for 10 seconds
    sleep 10
    echo start $connection_name.
 nmcli c up $connection_name
```

When command reports following message, it means 5G/LTE module to success link base-status,

```
Connection successfully activated (D-Bus active path:
/org/freedesktop/NetworkManager/ActiveConnection/2)
```

9. User can key-in following command to check 5G/LTE signal status.

Fibocom FM150-NA with 4 antenna	Quectel RM500QGL with 4 antenna
tse@tse:/home$ **mmcli -m 0 --signal-setup=10** Successfully setup extended signal information retrieval tse@tse:/home$ **sudo mmcli -m 0 --signal-get** ---------- Signal | refresh rate: 10 seconds ---------- LTE | rssi: -32.00 dBm | rsrq: -12.00 dB | rsrp: -63.00 dBm | s/n: 9.40 dB	tse@tse:/home$ **mmcli -m 0 --signal-setup=10** Successfully setup extended signal information retrieval tse@tse:/home$ **sudo mmcli -m 0 --signal-get** ---------- Signal | refresh rate: 10 seconds ---------- LTE | rssi: -38.00 dBm | rsrq: -11.00 dB | rsrp: -68.00 dBm | s/n: 4.60 dB