

LTE

to test the EM7455 Card (+ NGFF Key-B Adapter) on the BPI-R3 (mPCIe Slot)

<https://www.bipom.com/documents/sierra/4117727%20AirPrime%20EM-MC74xx%20AT%20Command%20Reference%20r4.pdf>

Kernel-Options:

```
CONFIG_USB_USBNET=m
CONFIG_USB_SERIAL_OPTION=m
CONFIG_USB_SERIAL_QUALCOMM=m
CONFIG_USB_NET_CDC_MBIM=m
CONFIG_USB_NET_QMI_WWAN=m
```

Needed tools:

```
root@bpi-r3:~# apt install libqmi-utils libmbim-utils
```

i'm using a Congstar-SIM

APN-settings:

<https://forum.congstar.de/thread/46325-mobil-surfen-mit-congstar-manuelle-einstellungen-zum-mobil-en-internet-apn/>

QMI-Mode

Step-by-step guide with qmicli:

<https://techship.com/faq/how-to-step-by-step-set-up-a-data-connection-over-qmi-interface-using-qmicli-and-in-kernel-driver-qmi-wwan-in-linux/>

```
root@bpi-r3:~# qmicli --device=/dev/cdc-wdm0 --get-expected-data-format
802-3
root@bpi-r3:~# qmicli --device=/dev/cdc-wdm0 --wda-get-data-format
[/dev/cdc-wdm0] Successfully got data format
      QoS flow header: no
      Link layer protocol: 'raw-ip'
      Uplink data aggregation protocol: 'disabled'
      Downlink data aggregation protocol: 'disabled'
      NDP signature: '0'
      Downlink data aggregation max datagrams: '0'
      Downlink data aggregation max size: '0'
root@bpi-r3:~# ip link set dev wwan0 down
root@bpi-r3:~# echo Y > /sys/class/net/wwan0/qmi/raw_ip
root@bpi-r3:~# ip link set dev wwan0 up
```

```
root@bpi-r3:~# qmicli --device=/dev/cdc-wdm0 -p --uim-verify-pin=PIN1,1234
[/dev/cdc-wdm0] PIN verified successfully

root@bpi-r3:~# qmicli --device=/dev/cdc-wdm0 -p --uim-get-card-status
[/dev/cdc-wdm0] Successfully got card status
Provisioning applications:
    Primary GW: slot '1', application '1'
    Primary 1X: session doesn't exist
    Secondary GW: session doesn't exist
    Secondary 1X: session doesn't exist
Slot [1]:
    Card state: 'present'
    UPIN state: 'not-initialized'
        UPIN retries: '0'
        UPUK retries: '0'
    Application [1]:
        Application type: 'usim (2)'
        Application state: 'ready'
        Application ID:
            A0:00:00:00:87:10:02:FF:49:94:20:89:03:10:00:00
        Personalization state: 'ready'
        UPIN replaces PIN1: 'no'
        PIN1 state: 'enabled-verified'
            PIN1 retries: '3'
            PUK1 retries: '10'
        PIN2 state: 'enabled-not-verified'
            PIN2 retries: '3'
            PUK2 retries: '10'

root@bpi-r3:~#
```

```
qmicli -p -v -d /dev/cdc-wdm0 --wds-stop-network=disable-autoconnect --
client-cid=37
qmicli -v -p --device=/dev/cdc-wdm0 --wds-set-ip-family=6
qmicli -d /dev/cdc-wdm0 --wds-get-profile-list=3gpp
qmicli -d /dev/cdc-wdm0 --wds-get-channel-rates
qmicli -d /dev/cdc-wdm0 --dms-set-fcc-authentication
qmicli -d /dev/cdc-wdm0 --dms-get-operating-mode
```

MBIM-Mode

<https://gist.github.com/Juul/e42c5b6ec71ce11923526b36d3f1cb2c#connecting-using-mbim>

first Test

```
root@bpi-r3:~# modprobe cdc_mbim

/etc/mbim-network.conf:
APN=internet.v6.telekom
```

PROXY=yes

```
root@bpi-r3:~# mbimcli --device=/dev/cdc-wdm0 --query-device-caps
[/dev/cdc-wdm0] Device capabilities retrieved:
    Device type: 'remote'
    Cellular class: 'gsm'
    Voice class: 'no-voice'
    SIM class: 'removable'
    Data class: 'umts, hsdpa, hsupa, lte'
    SMS caps: 'pdu-receive, pdu-send'
    Ctrl caps: 'reg-manual'
    Max sessions: '8'
    Custom data class: 'unknown'
    Device ID: '352733105743066'
    Firmware info: 'SWI9X30C_02.24.03.00'
    Hardware info: 'EM7455'
root@bpi-r3:~# mbim-network /dev/cdc-wdm0 start
Loading profile at /etc/mbim-network.conf...
    APN: internet.v6.telekom
    APN auth protocol: unset
    APN user: unset
    APN password: unset
    mbim-proxy: yes
Querying subscriber ready status 'mbimcli -d /dev/cdc-wdm0 --query-
subscriber-ready-status --no-close --device-open-proxy'...
[/dev/cdc-wdm0] Subscriber ready status retrieved: Ready state: 'device-
locked'
Subscriber ID: 'unknown' SIM ICCID: '89490200001355851497' Ready info:
'none' Telephone numbers: (0) 'unknown' [/dev/cdc-wdm0] Session not closed:
TRID: '4'
Saving state at /tmp/mbim-network-state-cdc-wdm0... (TRID: 4)
Querying registration state 'mbimcli -d /dev/cdc-wdm0 --query-registration-
state --no-open=4 --no-close --device-open-proxy'...
[/dev/cdc-wdm0] Registration status: Network error: 'unknown' Register
state: 'deregistered' Register mode: 'automatic' Available data classes:
'unknown' Curren
t cellular class: 'gsm' Provider ID: 'unknown' Provider name: 'unknown'
Roaming text: 'unknown' Registration flags: 'packet-service-automatic-
attach' [/dev/cdc-wdm0] Session not closed: TRID: '6'
Saving state at /tmp/mbim-network-state-cdc-wdm0... (TRID: 6)
Attaching to packet service with 'mbimcli -d /dev/cdc-wdm0 --attach-packet-
service --no-open=6 --no-close --device-open-proxy'...
error: operation failed: PinRequired
Saving state at /tmp/mbim-network-state-cdc-wdm0... (TRID: 8)
Starting network with 'mbimcli -d /dev/cdc-wdm0 --
connect=apn='internet.v6.telekom' --no-open=8 --no-close --device-open-
proxy'...
error: operation failed: PinRequired
Network start failed
[/dev/cdc-wdm0] Session not closed: TRID: '10'
Saving state at /tmp/mbim-network-state-cdc-wdm0... (TRID: 10)
```

```
root@bpi-r3:~#
```

so it looks like pin-problem and i tried this:

```
root@bpi-r3:~# mbimcli --device=/dev/cdc-wdm0 -p --enter-pin=1234
[/dev/cdc-wdm0] PIN operation successful
[/dev/cdc-wdm0] PIN info:
    PIN state: 'locked'
    PIN type: 'pin2'
    Remaining attempts: '3'
root@bpi-r3:~# mbim-network /dev/cdc-wdm0 start
Loading profile at /etc/mbim-network.conf...
    APN: internet.v6.telekom
    APN auth protocol: unset
    APN user: unset
    APN password: unset
    mbim-proxy: yes
Loading previous state from /tmp/mbim-network-state-cdc-wdm0...
    Previous Transaction ID: 10
error: no actions specified
Clearing state at /tmp/mbim-network-state-cdc-wdm0...
Querying subscriber ready status 'mbimcli -d /dev/cdc-wdm0 --query-
subscriber-ready-status --no-close --device-open-proxy'...
[/dev/cdc-wdm0] Subscriber ready status retrieved: Ready state:
'initialized' Subscriber ID: '26201704168zzzz' SIM ICCID:
'8949020000135585yyyy' Ready info: 'none' Telephone numbers: (1)
'+491512025xxxx' [/dev/cdc-wdm0] Session not closed:
TRID: '4'
Saving state at /tmp/mbim-network-state-cdc-wdm0... (TRID: 4)
Querying registration state 'mbimcli -d /dev/cdc-wdm0 --query-registration-
state
--no-open=4 --no-close --device-open-proxy'...
[/dev/cdc-wdm0] Registration status: Network error: 'unknown' Register
state: 'deregistered' Register mode: 'automatic' Available data classes:
'unknown' Current cellular class: 'gsm' Provider ID: 'unknown' Provider
name: 'unknown' Roaming
text: 'unknown' Registration flags: 'packet-service-automatic-attach'
[/dev/cdc-wdm0] Session not closed: TRID: '6'
Saving state at /tmp/mbim-network-state-cdc-wdm0... (TRID: 6)
Attaching to packet service with 'mbimcli -d /dev/cdc-wdm0 --attach-packet-
service --no-open=6 --no-close --device-open-proxy'...
error: operation failed: RadioPowerOff
Saving state at /tmp/mbim-network-state-cdc-wdm0... (TRID: 8)
Starting network with 'mbimcli -d /dev/cdc-wdm0 --
connect=apn='internet.v6.telekom' --no-open=8 --no-close --device-open-
proxy'...
error: operation failed: RadioPowerOff
Network start failed
[/dev/cdc-wdm0] Session not closed: TRID: '10'
Saving state at /tmp/mbim-network-state-cdc-wdm0... (TRID: 10)
```

```
root@bpi-r3:~#
```

change Mode

Caution this may break functionality!

Make sure all known modules are loaded:

```
root@bpi-r3:~# modprobe qmi_wwan
root@bpi-r3:~# modprobe qcserial
root@bpi-r3:~# modprobe cdc_mbim
```

Get and switch mode (device open param should match your current Mode):

```
root@bpi-r3:~# qmicli -d /dev/cdc-wdm0 --device-open-mbim --dms-swi-get-usb-
composition
[/dev/cdc-wdm0] Successfully retrieved USB compositions:
      USB composition 6: DM, NMEA, AT, QMI
[*] USB composition 8: DM, NMEA, AT, MBIM
      USB composition 9: MBIM

root@bpi-r3:~# qmicli -d /dev/cdc-wdm0 --device-open-qmi --dms-swi-get-usb-
composition
[/dev/cdc-wdm0] Successfully retrieved USB compositions:
[*] USB composition 6: DM, NMEA, AT, QMI
      USB composition 8: DM, NMEA, AT, MBIM
      USB composition 9: MBIM

root@bpi-r3:~# qmicli -d /dev/cdc-wdm0 --device-open-mbim --dms-swi-set-usb-
composition 6
```

After that you will be prompted to set device offline and do reset.

troubleshooting

In my case no device is recognized by driver (no serial ttyUSBx too). Fixed this by adding usb-id in qcserial and qmi_wwan driver.

But before i tried these steps:

i saw in dmesg only this (also after cold-reset):

```
[ 3.592655] usb 1-1.1: new high-speed USB device number 4 using xhci-mtk
[ 3.823392] usb 1-1.1: config 1 has an invalid interface number: 8 but
max is 3
[ 3.830719] usb 1-1.1: config 1 has no interface number 1
```

with this i have got access to the AT-Interface:

lsusb:

```
Bus 001 Device 004: ID 413c:81c2 Dell Computer Corp. DW5811e Snapdragon™ X7
LTE
```

unlock ttyUSBx with option-module:

```
root@bpi-r3:~# modprobe option
[ 229.747728] usbcore: registered new interface driver option
[ 229.753429] usbserial: USB Serial support registered for GSM modem (1-
port)

root@bpi-r3:~# echo 413c 81c2 >/sys/bus/usb-serial/drivers/option1/new_id
[ 300.293186] option 1-1.1:1.0: GSM modem (1-port) converter detected
[ 300.299755] usb 1-1.1: GSM modem (1-port) converter now attached to
ttyUSB0
[ 300.307011] option 1-1.1:1.2: GSM modem (1-port) converter detected
[ 300.313657] usb 1-1.1: GSM modem (1-port) converter now attached to
ttyUSB1
[ 300.320968] option 1-1.1:1.3: GSM modem (1-port) converter detected
[ 300.327741] usb 1-1.1: GSM modem (1-port) converter now attached to
ttyUSB2
[ 300.336533] option 1-1.1:1.8: GSM modem (1-port) converter detected
[ 300.343262] usb 1-1.1: GSM modem (1-port) converter now attached to
ttyUSB3
```

now only with “minicom -D /dev/ttyUSB2”. (commandmode with Ctrl+AA, because already via Minicom on the R3)

ATE1

OK

AT!ENTERCND="A710"

OK

AT!CUSTOM?

!CUSTOM:

GPSENABLE	0x04
GPSSEL	0x01
IPV6ENABLE	0x01
SIMLPM	0x01
USBSERIALENABLE	0x01

SINGLEAPNSWITCH 0x01

OK

AT!USBCOMP?

Config Index: 1

Config Type: 1 (Generic)

Interface bitmask: 0020010D (diag,nmea,modem,rmnet0,ubist)

OK

AT!USBCOMP=?

!USBCOMP:

AT!USBCOMP=<Config Index>,<Config Type>,<Interface bitmask>

<Config Index> - configuration index to which the composition applies, s

<Config Type> - 1:Generic, 2:USBIF-MBIM, 3:RNDIS

config type 2/3 should only be used for specific

Sierra

customized VID/PID should use config type 1

<Interface bitmask> - DIAG - 0x00000001,

NMEA - 0x00000004,

MODEM - 0x00000008,

RMNET0 - 0x00000100,

RMNET1 - 0x00000400,

MBIM - 0x00001000,

e.g.

10D - diag, nmea, modem, rmnet interfaces enabled

1009 - diag, modem, mbim interfaces enabled

The default configuration is:

```
at!usbcomp=1,1,10F
```

OK

can't set default-mode, but the following fixes it and go back to mbim-mode after a cold-boot (ttyUSB accessible via options-module too)

```
AT!USBCOMP=1,1,100D
```

OK

```
AT!RESET
```

OK

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