Pcie bringup

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Contents

PCIe mode Switch

Only when the module is in PCIe EP mode, functions such as sending AT commands, capturing log and dialing up can be realized.

For PCIe efuse such as RM520NGLAP, it can only work in PCIE EP mode. For AT version, you need to use the AT command to switch the PCIe mode.

You can query the current mode of the module by executing **AT+QCFG="pcie/mode",0** means PCIe EP mode and 1 means PCIe RC mode. If the module is in RC mode, you can execute **AT+QCFG="pcie/mode",0** and reboot the module to switch the PCIe mode to EP mode. For details about the AT command, see document [1].
You also need to execute the AT command **AT+QCFG="data_interface",1,0** to switch the USB to the PCIe.

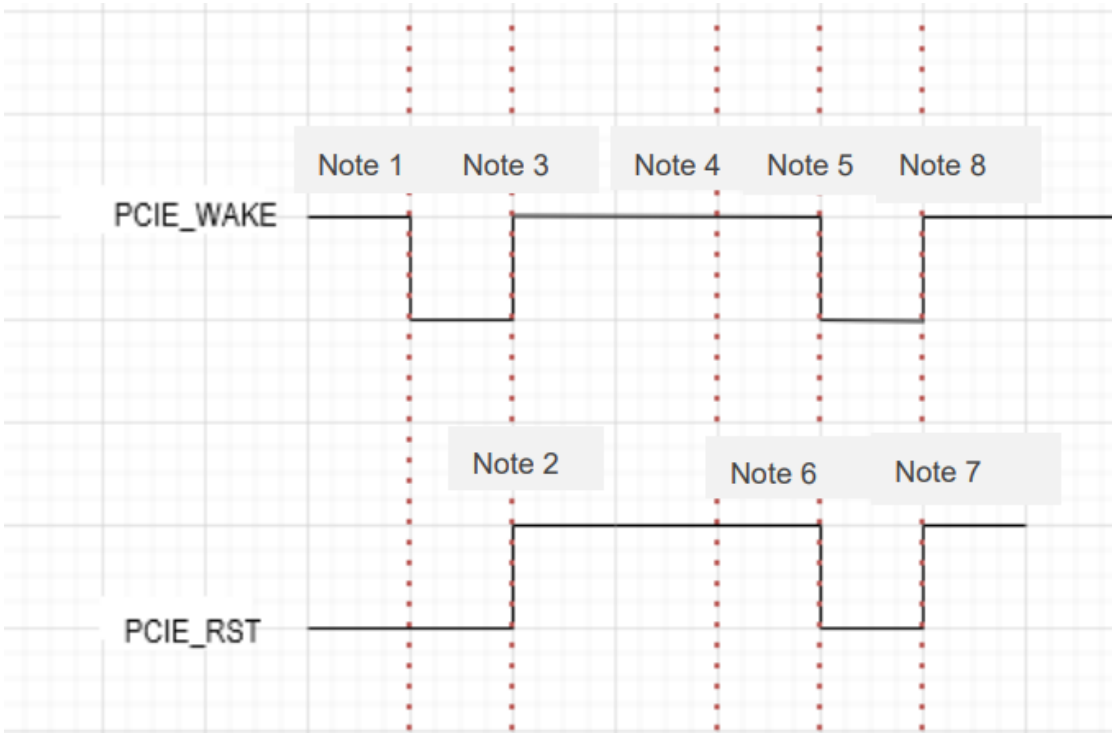
After the mode is switched successfully, you can power on the module and the host simultaneously and execute lspci on the command line of the host to list the recognized devices to check whether the module can be recognized normally. If the device ID of the module is correctly recognized, the PCIe mode is switched successfully.

```
AT+QCFG="data_interface"[,<network>,<diag>]
<network>
        0   network passing through USB.
        1   network passing through PCIE.
<diag>
```

0 diagnostic passing through USB.

PCIe Timing and Enumeration

In PCIe EP mode, if the module is rebooted due to any reason in use, it can re-establish a link and performs PCIe communication with the host.



When the module and host are booted normally or the module is rebooted, "Note 1" to "Note 8" in above figure are described as follows:

Module and host are booted normally

Note1: The module starts up and pulls down PCIE_WAKE to notify the host
Note2: After the host detects that PCIE_WAKE is pulled down, it pulls up PCIE_RST and starts the enumeration of PCIe.
Note3: After the module detects that PCIE_RST is pulled up, it pulls up PCIE_WAKE and starts the enumeration of PCIe.

Module is rebooted

Note 4: Module is rebooted.
Note 5: After the module is rebooted successfully, it pulls down PCIE_WAKE to notify the host.
Note 6: After the host detects that PCIE_WAKE is pulled down, it executes the PCIe remove operation and pulls down PCIE_RST.
Note 7: The host executes the PCIe rescan operation to rescan and establish a link, and pulls up PCIE_RST.
Note 8: After the module detects that PCIE_RST is pulled up, it pulls up PCIE_WAKE and starts the enumeration of PCIe.

1. The PCIe wake-up and reset pins series are PCIE_WAKE and PCIE_RST respectively;
2. The interrupt processing for detecting PCIE_WAKE pin needs to be added to the main control code of the PCIe on the host: after the host detects that the module pulls down PCIE_WAKE, it executes PCIe remove and PCIe rescan operations.

Porting Driver

1. porting pcie_mhi driver as next

```
$ git diff drivers/Makefile
diff --git a/drivers/Makefile b/drivers/Makefile
index 77fbc52..e45837e 100644
--- a/drivers/Makefile
+++ b/drivers/Makefile
@@ -184,3 +184,4 @@ obj-$(CONFIG_FPGA)              += fpga/
 obj-$(CONFIG_FSI)                      += fsi/
 obj-$(CONFIG_TEE)                       += tee/
 obj-$(CONFIG_MULTIPLEXER)         += mux/
+obj-y              += pcie_mhi/
```

```
$ tree drivers/pcie_mhi/ -L 1
drivers/pcie_mhi/
 controllers
 core
 devices
 Makefile
```

2. check RG500 attach pcie_mhi driver successful

```
root@OpenWrt:/# lspci
00:00.0 Class 0604: 17cb:0302
01:00.0 Class ff00: 17cb:0306
```

```
root@OpenWrt:~# dmesg | grep mhi
[    138.483252] mhi_init Quectel_Linux_PCIE_MHI_Driver_V1.3.0.6
[    138.492350] mhi_pci_probe pci_dev->name = 0000:01:00.0, domain=0, bus=1, slot=0, vendor=17CB, device=0306
```

```
AT:
      /dev/mhi_DUN
QXDM
      ./QLog –p /dev/mhi_DIAG
DUMP
      ./QLog –p /dev/mhi_SAHARA
Upgrade
      ./QFirehose –p /dev/mhi_BHI
```

How to Use

AT_OVER_PCIE

```
root@imx6qsabresd:~# busybox microcom /dev/mhi_DUN
[    384.652992] [I][mhi_uci_open] Node open, ref counts 1
[    384.658144] [I][mhi_uci_open] Starting channel
[    384.662612] [I][__mhi_prepare_channel] Entered: preparing channel:32
[    384.680397] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[    384.685890] [I][__mhi_prepare_channel] Chan:32 successfully moved to start state
[    384.693312] [I][__mhi_prepare_channel] Entered: preparing channel:33
[    384.708692] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[    384.714324] [I][__mhi_prepare_channel] Chan:33 successfully moved to start state

RDY
```

```
+CFUN: 1

+CPIN: READY

+QUSIM: 1

+QIND: SMS DONE

+QIND: PB DONE
ati
Quectel
EM20
Revision: EM20GR01A01M4G

OK
at+cpin?
+CPIN: READY

OK
```

MBIM_OVER_PCIE.txt

```
root@OpenWrt:~# insmod pcie_mhi.ko mhi_mbim_enabled=1
root@OpenWrt:~# dmesg | grep mhi
[    65.587160] mhi_init Quectel_Linux_PCIE_MHI_Driver_V1.3.0.6
[    65.597089] mhi_pci_probe pci_dev->name = 0000:01:00.0, domain=0, bus=1, slot=0,
vendor=17CB, device=0306
[    65.602250] mhi_q 0000:01:00.0: BAR 0: assigned [mem 0x20300000-0x20300fff 64bit]
[    65.611690] mhi_q 0000:01:00.0: enabling device (0140 -> 0142)
[    65.619307] [I][mhi_init_pci_dev] msi_required = 5, msi_allocated = 5, msi_irq = 63
[    65.619327] [I][mhi_power_up] dev_state:RESET
[    65.619331] [I][mhi_async_power_up] Requested to power on
[    65.619449] [I][mhi_alloc_coherent] size = 114688, dma_handle = 6fca0000
[    65.619462] [I][mhi_init_dev_ctxt] mhi_ctxt->ctrl_seg = c221e000
[    65.619731] [I][mhi_async_power_up] dev_state:RESET ee:AMSS
[    65.619747] [I][mhi_pm_st_worker] Transition to state:READY
[    65.619760] [I][mhi_pm_st_worker] INVALID_EE -> AMSS
[    65.619764] [I][mhi_ready_state_transition] Waiting to enter READY state
[    65.619885] [I][mhi_async_power_up] Power on setup success
[    65.619897] [I][mhi_pci_probe] Return successful
[    65.665114] [I][mhi_ready_state_transition] Device in READY State
[    65.665125] [I][mhi_intvec_threaded_handlr] device ee:AMSS dev_state:READY,
pm_state:POR
```

```
[     65.665131] [I][mhi_intvec_threaded_handlr] device ee:AMSS dev_state:READY,
INVALID_EE
[     65.665133] [I][mhi_tryset_pm_state] Transition to pm state from:POR to:POR
[     65.665137] [I][mhi_init_mmio] Initializing MMIO
[     65.665142] [I][mhi_init_mmio] CHDBOFF:0x300
[     65.665151] [I][mhi_init_mmio] ERDBOFF:0x700
[     65.665156] [I][mhi_init_mmio] Programming all MMIO values.
[     65.786283] [I][mhi_dump_tre] carl_ev evt_state_change mhistate=2
[     65.786289] [I][mhi_process_ctrl_ev_ring] MHI state change event to state:M0
[     65.786295] [I][mhi_pm_m0_transition] Entered With State:READY PM_STATE:POR
[     65.786300] [I][mhi_tryset_pm_state] Transition to pm state from:POR to:M0
[     65.789734] [I][mhi_dump_tre] carl_ev evt_ee_state execenv=2
[     65.789739] [I][mhi_process_ctrl_ev_ring] MHI EE received event:AMSS
[     65.789756] [I][mhi_pm_st_worker] Transition to state:MISSION MODE
[     65.789767] [I][mhi_pm_st_worker] INVALID_EE -> AMSS
[     65.789771] [I][mhi_pm_mission_mode_transition] Processing Mission Mode Transition
[     65.789787] [I][mhi_init_timesync] No timesync capability found
[     65.789791] [I][mhi_pm_mission_mode_transition] Adding new devices
[     65.790570] [I][mhi_dtr_probe] Enter for DTR control channel
[     65.790577] [I][__mhi_prepare_channel] Entered: preparing channel:18
[     65.797036] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[     65.797051] [I][__mhi_prepare_channel] Chan:18 successfully moved to start state
[     65.797055] [I][__mhi_prepare_channel] Entered: preparing channel:19
[     65.802457] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[     65.802469] [I][__mhi_prepare_channel] Chan:19 successfully moved to start state
[     65.802485] [I][mhi_dtr_probe] Exit with ret:0
[     65.802748] [I][mhi_netdev_enable_iface] Prepare the channels for transfer
[     65.802772] [I][__mhi_prepare_channel] Entered: preparing channel:100
[     65.825279] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[     65.825293] [I][__mhi_prepare_channel] Chan:100 successfully moved to start state
[     65.825297] [I][__mhi_prepare_channel] Entered: preparing channel:101
[     65.835565] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[     65.835578] [I][__mhi_prepare_channel] Chan:101 successfully moved to start state
[     65.839141] [I][mhi_netdev_enable_iface] Exited.
[     65.839875] rmnet_vnd_register_device(rmnet_mhi0.1)=0
[     65.843278] net rmnet_mhi0 rmnet_mhi0.1: NSS context created
[     65.861808] [I][mhi_pm_mission_mode_transition] Exit with ret:0
[     68.625595] [I][__mhi_prepare_channel] Entered: preparing channel:12
[     68.634610] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[     68.634622] [I][__mhi_prepare_channel] Chan:12 successfully moved to start state
[     68.634625] [I][__mhi_prepare_channel] Entered: preparing channel:13
[     68.644978] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[     68.644987] [I][__mhi_prepare_channel] Chan:13 successfully moved to start state
[     69.170666] net rmnet_mhi0: link_state 0x0 -> 0x1
```

```
[     69.177035] [I][mhi_netdev_open] Opened net dev interface
[     71.655431] [I][mhi_netdev_open] Opened net dev interface

root@OpenWrt:~# ./quectel-CM &
[04-02_04:14:12:134] Quectel_QConnectManager_Linux_V1.6.0.5
[04-02_04:14:12:134] Find /sys/bus/usb/devices/4-1 idVendor=0x2c7c idProduct=0x800,
bus=0x004, dev=0x002
[04-02_04:14:12:135] network interface '' or qmidev '' is not exist
[04-02_04:14:12:135] netcard driver = pcie_mhi, driver version = V1.3.0.6
[04-02_04:14:12:135] Modem works in MBIM mode
[04-02_04:14:12:135] apn (null), user (null), passwd (null), auth 0
[04-02_04:14:12:135] IP Proto MBIMContextIPTypeIPv4
[04-02_04:14:12:154] mbim_read_thread is created
sh: can't create /sys/class/net/rmnet_mhi0/mbim/link_state: nonexistent directory
[04-02_04:14:12:156] system(echo 0 > /sys/class/net/rmnet_mhi0/mbim/link_state)=256
[04-02_04:14:12:185] system(ip address flush dev rmnet_mhi0)=0
[04-02_04:14:12:187] system(ip link set dev rmnet_mhi0 down)=0
[04-02_04:14:12:188] mbim_open_device()
[04-02_04:14:12:605] mbim_device_caps_query()
[04-02_04:14:12:610] DeviceId:         869710030002905
[04-02_04:14:12:610] HardwareInfo: 0
[04-02_04:14:12:610] mbim_set_radio_state( 1 )
[04-02_04:14:12:613] HwRadioState: 1, SwRadioState: 1
[04-02_04:14:12:613] mbim_subscriber_status_query()
[04-02_04:14:12:620] SubscriberReadyState NotInitialized -> Initialized
[04-02_04:14:12:620] mbim_register_state_query()
[04-02_04:14:12:625] RegisterState Unknown -> Home
[04-02_04:14:12:625] mbim_packet_service_query()
[04-02_04:14:12:629] PacketServiceState Unknown -> Attached
[04-02_04:14:12:629] mbim_query_connect(sessionID=0)
[04-02_04:14:12:633] ActivationState Unknown -> Deactivated
[04-02_04:14:12:633] mbim_set_connect(onoff=1, sessionID=0)
[     69.170666] net rmnet_mhi0: link_state 0x0 -> 0x1
[04-02_04:14:12:680] ActivationState Deactivated -> Activated
[     69.177035] [I][mhi_netdev_open] Opened net dev interface
[04-02_04:14:12:680] mbim_ip_config(sessionID=0)
[04-02_04:14:12:683] < SessionId = 0
[04-02_04:14:12:683] < IPv4ConfigurationAvailable = 0xf
[04-02_04:14:12:683] < IPv6ConfigurationAvailable = 0x0
[04-02_04:14:12:683] < IPv4AddressCount = 0x1
[04-02_04:14:12:683] < IPv4AddressOffset = 0x3c
[04-02_04:14:12:683] < IPv6AddressCount = 0x0
[04-02_04:14:12:683] < IPv6AddressOffset = 0x0
[04-02_04:14:12:683] < IPv4 = 10.129.59.93/30
```

```
[04-02_04:14:12:683] < gw = 10.129.59.94
[04-02_04:14:12:683] < dns1 = 211.138.180.2
[04-02_04:14:12:683] < dns2 = 211.138.180.3
[04-02_04:14:12:683] < ipv4 mtu = 1500
sh: can't create /sys/class/net/rmnet_mhi0/mbim/link_state: nonexistent directory
[04-02_04:14:12:684] system(echo 1 > /sys/class/net/rmnet_mhi0/mbim/link_state)=256
[04-02_04:14:12:689] system(ip link set dev rmnet_mhi0 up)=0
[04-02_04:14:12:692] system(ip -4 address flush dev rmnet_mhi0)=0
[04-02_04:14:12:694] system(ip -4 address add 10.129.59.93/30 dev rmnet_mhi0)=0
[04-02_04:14:12:697] system(ip -4 route add default via 10.129.59.94 dev rmnet_mhi0)=0
[04-02_04:14:12:699] system(ip -4 link set dev rmnet_mhi0 mtu 1500)=0

root@OpenWrt:~# ifconfig rmnet_mhi0
rmnet_mhi0 Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          UP RUNNING NOARP  MTU:1500  Metric:1
          RX packets:99379 errors:0 dropped:0 overruns:0 frame:0
          TX packets:176569 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1528181052 (1.4 GiB)  TX bytes:62467192 (59.5 MiB)

root@OpenWrt:~# ifconfig rmnet_mhi0.1
rmnet_mhi0.1 Link encap:UNSPEC  HWaddr 02-50-F4-00-00-00-00-00-00-00-00-00-00-00-00-00
          inet addr:10.129.59.93  Mask:255.255.255.252
          inet6 addr: fe80::50:f4ff:fe00:0/64 Scope:Link
          UP RUNNING NOARP  MTU:1500  Metric:1
          RX packets:1089360 errors:0 dropped:0 overruns:0 frame:0
          TX packets:176581 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1521449058 (1.4 GiB)  TX bytes:57525792 (54.8 MiB)

# adjust CPU load balancing
root@OpenWrt:~# echo 2 > /sys/class/net/rmnet_mhi0/queues/rx-0/rps_cpus
root@OpenWrt:~# echo 4 > /sys/class/net/rmnet_mhi0.1/queues/rx-0/rps_cpus
root@OpenWrt:~# echo 2000 > /proc/sys/net/core/netdev_max_backlog
root@OpenWrt:~# cat /sys/class/net/rmnet_mhi0/queues/rx-0/rps_cpus
2
root@OpenWrt:~# cat /sys/class/net/rmnet_mhi0.1/queues/rx-0/rps_cpus
4
root@OpenWrt:~# cat /proc/sys/net/core/netdev_max_backlog
2000
```

QMI_OVER_PCIE

disable **ccflags-y += -DCONFIG_MHI_NETDEV_MBIM** in pcie_mhi/Makefile

root@OpenWrt:~# insmod pcie_mhi.ko

```
root@OpenWrt:~# dmesg | grep mhi
[    138.483252] mhi_init Quectel_Linux_PCIE_MHI_Driver_V1.3.0.6
[    138.492350] mhi_pci_probe pci_dev->name = 0000:01:00.0, domain=0, bus=1, slot=0, vendor=17CB, device=0306
[    138.497564] mhi_q 0000:01:00.0: BAR 0: assigned [mem 0x20300000-0x20300fff 64bit]
[    138.506952] mhi_q 0000:01:00.0: enabling device (0140 -> 0142)
[    138.514562] [I][mhi_init_pci_dev] msi_required = 5, msi_allocated = 5, msi_irq = 63
[    138.514581] [I][mhi_power_up] dev_state:RESET
[    138.514587] [I][mhi_async_power_up] Requested to power on
[    138.514728] [I][mhi_alloc_coherent] size = 114688, dma_handle = 72160000
[    138.514734] [I][mhi_init_dev_ctxt] mhi_ctxt->ctrl_seg = c221f000
[    138.515030] [I][mhi_async_power_up] dev_state:RESET ee:AMSS
[    138.515056] [I][mhi_pm_st_worker] Transition to state:READY
[    138.515067] [I][mhi_pm_st_worker] INVALID_EE -> AMSS
[    138.515073] [I][mhi_ready_state_transition] Waiting to enter READY state
[    138.515210] [I][mhi_async_power_up] Power on setup success
[    138.515227] [I][mhi_pci_probe] Return successful
[    138.589013] [I][mhi_ready_state_transition] Device in READY State
[    138.589029] [I][mhi_intvec_threaded_handlr] device ee:AMSS dev_state:READY, pm_state:POR
[    138.589038] [I][mhi_intvec_threaded_handlr] device ee:AMSS dev_state:READY, INVALID_EE
[    138.589041] [I][mhi_tryset_pm_state] Transition to pm state from:POR to:POR
[    138.589046] [I][mhi_init_mmio] Initializing MMIO
[    138.589050] [I][mhi_init_mmio] CHDBOFF:0x300
[    138.589060] [I][mhi_init_mmio] ERDBOFF:0x700
[    138.589065] [I][mhi_init_mmio] Programming all MMIO values.
[    138.706124] [I][mhi_dump_tre] carl_ev evt_state_change mhistate=2
[    138.706132] [I][mhi_process_ctrl_ev_ring] MHI state change event to state:M0
[    138.706140] [I][mhi_pm_m0_transition] Entered With State:READY PM_STATE:POR
[    138.706146] [I][mhi_tryset_pm_state] Transition to pm state from:POR to:M0
[    138.708699] [I][mhi_dump_tre] carl_ev evt_ee_state execenv=2
[    138.708706] [I][mhi_process_ctrl_ev_ring] MHI EE received event:AMSS
[    138.708726] [I][mhi_pm_st_worker] Transition to state:MISSION MODE
[    138.708736] [I][mhi_pm_st_worker] INVALID_EE -> AMSS
[    138.708742] [I][mhi_pm_mission_mode_transition] Processing Mission Mode Transition
```

```
[    138.708758] [I][mhi_init_timesync] No timesync capability found
[    138.708764] [I][mhi_pm_mission_mode_transition] Adding new devices
[    138.709785] [I][mhi_dtr_probe] Enter for DTR control channel
[    138.709794] [I][__mhi_prepare_channel] Entered: preparing channel:18
[    138.715378] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[    138.715397] [I][__mhi_prepare_channel] Chan:18 successfully moved to start state
[    138.715403] [I][__mhi_prepare_channel] Entered: preparing channel:19
[    138.720201] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[    138.720218] [I][__mhi_prepare_channel] Chan:19 successfully moved to start state
[    138.720236] [I][mhi_dtr_probe] Exit with ret:0
[    138.720590] [I][mhi_netdev_enable_iface] Prepare the channels for transfer
[    138.720630] [I][__mhi_prepare_channel] Entered: preparing channel:100
[    138.757230] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[    138.757253] [I][__mhi_prepare_channel] Chan:100 successfully moved to start state
[    138.757259] [I][__mhi_prepare_channel] Entered: preparing channel:101
[    138.774352] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[    138.774370] [I][__mhi_prepare_channel] Chan:101 successfully moved to start state
[    138.778137] [I][mhi_netdev_enable_iface] Exited.
[    138.779018] rmnet_vnd_register_device(rmnet_mhi0.1)=0
[    138.782283] net rmnet_mhi0 rmnet_mhi0.1: NSS context created
[    138.800865] [I][mhi_pm_mission_mode_transition] Exit with ret:0

root@OpenWrt:~# ./quectel-CM &
root@OpenWrt:~# [04-02_04:12:16:477] Quectel_QConnectManager_Linux_V1.6.0.5
[04-02_04:12:16:477] Find /sys/bus/usb/devices/4-1 idVendor=0x2c7c idProduct=0x800,
bus=0x004, dev=0x002
[04-02_04:12:16:478] network interface '' or qmidev '' is not exist
[04-02_04:12:16:478] netcard driver = pcie_mhi, driver version = V1.3.0.6
[04-02_04:12:16:479] qmap_mode = 1, qmap_version = 9, qmap_size = 16384, muxid =
0x81, qmap_netcard = rmnet_mhi0.1
[04-02_04:12:16:479] Modem works in QMI mode
[04-02_04:12:16:505] cdc_wdm_fd = 7
[04-02_04:12:17:506] QmiThreadSendQMITimeout pthread_cond_timeout_np timeout
[04-02_04:12:18:516] Get clientWDS = 19
[04-02_04:12:18:520] Get clientDMS = 1
[04-02_04:12:18:524] Get clientNAS = 3
[04-02_04:12:18:527] Get clientUIM = 1
[04-02_04:12:18:531] Get clientWDA = 1
[04-02_04:12:18:535] requestBaseBandVersion RM500QGLAAR03A01M4G_BETA_20200107F
1    [Dec 30 2019 17:00:00]
[04-02_04:12:18:539] qmap_settings.rx_urb_size = 16384
[04-02_04:12:18:539] qmap_settings.ul_data_aggregation_max_datagrams    = 16
[04-02_04:12:18:539] qmap_settings.ul_data_aggregation_max_size          = 8192
[04-02_04:12:18:539] qmap_settings.dl_minimum_padding                    = 0
```

```
[04-02_04:12:18:550] requestSetLoopBackState(loopback_state=1, replication_factor=14)
[04-02_04:12:18:557] requestGetSIMStatus SIMStatus: SIM_ABSENT
[04-02_04:12:18:560] requestGetProfile[1] ///0
[04-02_04:12:18:563] requestRegistrationState2 MCC: 0, MNC: 0, PS: Detached, DataCap:
UNKNOW
[04-02_04:12:18:565] requestQueryDataCall IPv4ConnectionStatus: DISCONNECTED
[04-02_04:12:18:566] ifconfig rmnet_mhi0.1 down
[04-02_04:12:18:571] ifconfig rmnet_mhi0.1 0.0.0.0
ifconfig: SIOCSIFFLAGS: Network is down
[04-02_04:12:18:575] SetLoopBackInd: loopback_state=1, replication_factor=14
[04-02_04:12:18:591] requestSetupDataCall WdsConnectionIPv4Handle: 0xe40182a0
[04-02_04:12:18:601] ifconfig rmnet_mhi0 up
[04-02_04:12:18:607] ifconfig rmnet_mhi0.1 up
[04-02_04:12:18:613] you are use OpenWrt?
[04-02_04:12:18:614] should not calling udhcpc manually?
[04-02_04:12:18:614] should modify /etc/config/network as below?
[04-02_04:12:18:614] config interface wan
[04-02_04:12:18:614]       option ifname     rmnet_mhi0.1
[04-02_04:12:18:614]       option proto      dhcp
[04-02_04:12:18:614] should use "/sbin/ifstaus wan" to check rmnet_mhi0.1 's status?
[04-02_04:12:18:614] busybox udhcpc -f -n -q -t 5 -i rmnet_mhi0.1
udhcpc: started, v1.28.3
udhcpc: sending discover
udhcpc: sending select for 192.168.48.171
udhcpc: lease of 192.168.48.171 obtained, lease time 7200
[04-02_04:12:18:809] udhcpc: ifconfig rmnet_mhi0.1 192.168.48.171 netmask
255.255.255.248 broadcast +
[04-02_04:12:18:819] udhcpc: setting default routers: 192.168.48.172

root@OpenWrt:~# ifconfig rmnet_mhi0
rmnet_mhi0 Link encap:Ethernet    HWaddr 02:50:F4:00:00:00
          inet6 addr: fe80::50:f4ff:fe00:0/64 Scope:Link
          UP RUNNING NOARP    MTU:1500    Metric:1
          RX packets:2 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:608 (608.0 B)    TX bytes:672 (672.0 B)

root@OpenWrt:~# ifconfig rmnet_mhi0.1
rmnet_mhi0.1 Link encap:UNSPEC    HWaddr 02-50-F4-00-00-00-00-00-00-00-00-00-00-
00-00-00
          inet addr:192.168.48.171    Mask:255.255.255.248
          inet6 addr: fe80::50:f4ff:fe00:0/64 Scope:Link
          UP RUNNING NOARP    MTU:1500    Metric:1
```

```
          RX packets:2 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:592 (592.0 B)    TX bytes:656 (656.0 B)

# adjust CPU load balancing
root@OpenWrt:~# echo 2 > /sys/class/net/rmnet_mhi0/queues/rx-0/rps_cpus
root@OpenWrt:~# echo 4 > /sys/class/net/rmnet_mhi0.1/queues/rx-0/rps_cpus
root@OpenWrt:~# echo 2000 > /proc/sys/net/core/netdev_max_backlog
root@OpenWrt:~# cat /sys/class/net/rmnet_mhi0/queues/rx-0/rps_cpus
2
root@OpenWrt:~# cat /sys/class/net/rmnet_mhi0.1/queues/rx-0/rps_cpus
4
root@OpenWrt:~# cat /proc/sys/net/core/netdev_max_backlog
2000
```

QXDM_OVER_PCIE

```
root@imx6qsabresd:~# ./QLog -p /dev/mhi_DIAG -s log &
root@imx6qsabresd:~# [000.000]QLog Version: Quectel_QLog_Linux&Android_V1.2.4
[    298.597963] [I][mhi_uci_open] Node open, ref counts 1
[    298.605601] [I][mhi_uci_open] Starting channel
[    298.612159] [I][__mhi_prepare_channel] Entered: preparing channel:4
[    298.629906] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[    298.635415] [I][__mhi_prepare_channel] Chan:4 successfully moved to start state
[    298.642749] [I][__mhi_prepare_channel] Entered: preparing channel:5
[    298.658043] [I][mhi_dump_tre] carl_ev evt_cmd_comp code=1
[    298.663543] [I][__mhi_prepare_channel] Chan:5 successfully moved to start state
[000.075]open /dev/mhi_DIAG ttyfd = 3
[000.075]Press CTRL+C to stop catch log.
[000.096]qlog_logfile_create log/20160920_145758_0000.qmdl logfd=4
[005.268]recv: 0M 70K 490B    in 5181 msec
```