RG50xQ&RM5xxQ Series
Data Call Application Note

5G Module Series

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About the Document

Revision History

Version	Date	Author	Description
-	2022-05-13	Ozzy ANG	Creation of the document
1.0	2022-10-08	Ozzy ANG	First official release

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1 Introduction

Quectel 5G RG50xQ series and RM5xxQ series modules support data call. This document introduces the data call methods as well as the corresponding steps and development considerations of these modules.

1.1. Applicable Modules

Table 1: Applicable Modules

Module Series	Module
RG50xQ	RG500Q series
	RG501Q-EU
	RG502Q series
RM5xxQ	RM500Q series
	RM502Q-AE
	RM505Q-AE
	RM510Q-GL

2 Data Call Methods

2.1. Data Call Scenarios

Data call scenarios can be classified by the:

1. **Communication method** between the host and the module in the data call:
   - QMI (application layer communication protocol)
   - MBIM (application layer communication protocol)
   - None (standard interface bottom layer communication protocol, such as Ethernet and Wi-Fi)

2. **Interface type** used for the data call:
   - USB
   - PCIe EP (module serves an EP device)
   - PCIe RC (module serves as a master)
     - Ethernet
     - WLAN (Wi-Fi)
   - RGMII

3. **Initiator** of the data call:
   - TE: Host initiates the data call.
   - AP: Module initiates the data call.

4. **Host operating system (OS)** for the data call:
   - Windows
   - Linux (Android)

2.2. Data Call Methods

According to the data call scenarios listed in ***Chapter 2.1***, the corresponding data call methods supported by the module are listed in the table below.

Table 2: Data Call Scenarios and Corresponding Data Call Methods

Interface Types	Initiators	Host OS	Communication Methods	Data Call Methods
USB	TE	Windows	QMI	NDIS
USB	TE	Linux	QMI	QMI_WWAN/GobiNet
USB	TE	Windows/Linux	MBIM	MBIM(USB)
PCIe EP	TE	Linux	QMI	PCIe_MHI_Rmnet
PCIe EP	TE	Windows/Linux	MBIM	PCIe_MHI_MBIM
USB	AP	Windows	-	RNDIS/ECM
USB	AP	Linux	-	ECM
RGMII/PCIe RC	AP	-	-	QMAP

NOTE

1. Except for QMAP, the other data call methods are named after the driver name.
2. For detailed steps of each data call method, see ***Chapter 3***.
3. The RNDIS data call method is not supported by default. If there is any requirement, you can contact Quectel Technical Support.
4. RNDIS method is not recommended for data call, and you can contact Quectel Technical Support for details.

3 Data Call Steps

3.1. NDIS Data Call (USB + TE + Windows + QMI)

1. Install NDIS driver Quectel_Windows_USB_Driver(Q)_For_NDIS, which is provided by Quectel on the host.
2. Connect the module to the host via USB cable.
3. Check if the driver “Quectel Wireless Ethernet Adapter” is loaded under “Network adapters” on the host as shown in the figure below:

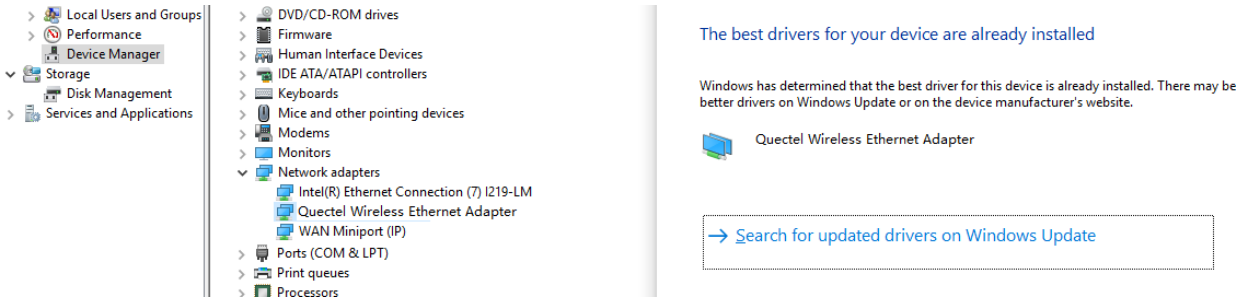

Figure 1: Confirm Driver Installation

4. Click the network icon in the lower right corner of the host taskbar to initiate a data call.

Figure 2: NDIS Data Call (USB + TE + Windows + QMI)

3.2. QMI_WWAN Data Call (USB + TE + Linux + QMI)

1. Contact Quectel Technical Support for installation packages of the following drivers and tool:
   - Quectel_Linux_USB_Serial_Option_Driver (Driver for TTY port, such as AT and DM.)
   - Quectel_Linux&Android_QMI_WWAN_Driver (Driver for usbnet data port)
   - QConnectManager_Linux (Data call tool)

2. Integrate/compile these drivers and tool on the host by executing **make install** in the driver file.
   - If multiple data call with driver is required, add parameter *qmap_mode=<number of data call channels>* in the command line when executing the command for loading the driver. Currently, the maximum number of data call channels is 4. For example:

     ```
     insmod qmi_wwan_q.ko qmap_mode=4
     ```

     qmap_mode=0 indicates a single data call without UL AGG.
     qmap_mode=1 indicates a single data with UL AGG.
     qmap_mode=2/3/4 indicates multiple data call with UL AGG.

   - If bridge mode with driver is required (i.e. to bridge the data call to other devices on the host to provide network access to these devices). You can refer to the following examples in */log* directory of quectel-CM source code package.

log/how_to_use_bridge.txt	Bridge mode for a single data call
/loghow_to_use_bridge_and_QMAP.txt	Bridge mode for multiple data call

3. Connect the module to the host via USB cable.

4. Perform a data call with quectel-CM tool.
   1) Execute **quectel-CM -h** to view the usage of the tool parameters..
   2) You can refer to the following examples in */log* directory of the tool source code package.

qmi_wwan_q.txt	Local single data call without using QMAP
qmi_wwan_q_bridge.txt	Single data call in bridge mode without using QMAP
qmi_wwan_q_qmap=1.txt	Local single data call with QMAP
qmi_wwan_q_qmap=1_bridge.txt	Single data call in bridge mode with QMAP
qmi_wwan_q_qmap=4.txt	Local multiple data call with QMAP
qmi_wwan_q_qmap=4_bridge.txt	Multiple data call in bridge mode with QMAP

NOTE

1. If multiple data call is required, QMAP feature of the module must be enabled.
2. QMAP feature of Quectel RG50xQ series and RM5xxQ series modules is enabled by default, i.e., even if *qmap_mode* is not configured when loading the driver, *qmap_mode=1* will be set automatically

when running the driver. Therefore, *qmi_wwan_q.txt* and *qmi_wwan_q_bridge.txt* examples are equivalent to *qmi_wwan_q_qmap=1.txt* and *qmi_wwan_q_qmap=1_bridge.txt* in practice.

3. Do **NOT** use Linux original drivers (qmi_wwan.ko and qcserial.ko) on the host when using Quectel modules. You can check if the Linux original drivers are installed by running **lsmod**. If the drivers are installed, you should run **rmmod** to uninstall them. Before connecting a Quectel module to the host, make sure that drivers qmi_wwan_q.ko and option.ko provided by Quectel are installed.

3.3. GobiNet Data Call (USB + TE + Linux + QMI)

1. Contact Quectel Technical Support for installation package of the following drivers and tool:
   - Quectel_Linux_USB_Serial_Option_Driver (Driver for TTY port, such as AT and DM.)
   - Quectel_Linux&Android_GobiNet_Driver (Driver for usbnet data port)
   - QConnectManager_Linux (Data call tool)

2. Integrate/compile these drivers and tool on the host by executing make install in the driver file.
   - If multiple data call with driver is required, add parameter *qmap_mode=<number of data call channels>* in the command line when executing the command for loading the driver. Currently, the maximum number of data call channels is 4. For example:

     ```
     insmod GobiNet.ko qmap_mode=4
     ```

     qmap_mode=0 indicates a single data call without UL AGG.
     qmap_mode=1 indicates a single data with UL AGG.
     qmap_mode=2/3/4 indicates multiple data call with UL AGG.

3. Connect the module to the host via USB cable.

5. Perform a data call with quectel-CM tool.
   1) Execute **quectel-CM -h** to view the usage of the tool parameters.
   2) You can refer to the following examples in */log* directory of quectel-CM source code package.

gobinet.txt	Local single data call without using QMAP
gobinet_bridge.txt	Single data call in bridge mode without using QMAP
gobinet_qmap=1.txt	Local single data call with QMAP
gobinet_qmap=1_bridge.txt	Single data call in bridge mode with QMAP
gobinet_qmap=4.txt	Local multiple data call with QMAP
gobinet_qmap=4_bridge.txt	Multiple data call in bridge mode with QMAP

NOTE

1. To perform multiple data call, QMAP feature of the module must be enabled.
2. QMAP feature of Quectel RG50xQ series and RM5xxQ series modules is enabled by default, i.e., even if *qmap_mode* is not configured when loading the driver, *qmap_mode=1* will be set automatically when running the driver. Therefore, *gobinet.txt* and *gobinet_bridge.txt* examples are equivalent to *gobinet_qmap=1.txt* and *gobinet_qmap=1_bridge.txt* in practice.
3. Do **NOT** use Linux original driver qcserial.ko on the host when using Quectel modules. You can check if the Linux original drivers are installed by running **lsmod**. If the drivers are installed, you should run **rmmod** to uninstall them. Before connecting a Quectel module to the host, make sure that drivers GobiNet.ko and option.ko provided by Quectel are installed.

3.4. PCIe_MHI Data Call (PCIe + TE + Linux + QMI)

PCIe_MHI uses PCIe interface to initiate a data call. The host is a PCIe RC and the module is a PCIe EP. The data call steps are listed below:

1. Contact Quectel Technical Support for installation package of the following driver and tool:
   - Quectel_Linux_PCIE_MHI_Driver (Driver for MHI data port)
   - QConnectManager_Linux (Data call tool)

2. Integrate/compile these drivers and tool on the host by executing **make install** in the driver file.
   - If multiple data call with driver is required, add parameter *qmap_mode=<number of data call channels>* in the command line when executing the command for loading the driver. Currently, the maximum number of data call channels is 4. For example:

     ```
     insmod pcie_mhi.ko qmap_mode=4
     ```

     qmap_mode=0 indicates a single data call without UL AGG.
     qmap_mode=1 indicates a single data with UL AGG.
     qmap_mode=2/3/4 indicates multiple data call with UL AGG.

     View the device port loaded by the host, where /dev/mhi_DUN is the AT port.

3. Connect the module to the host via PCIe.

4. Perform a data call with quectel-CM tool.
   1) Execute **quectel-CM -h** to view the usage of the tool parameters.
   2) You can refer to the following examples in */log* directory of quectel-CM source code package.

pcie_mhi_qmap=1.txt	Local single data call with QMAP
pcie_mhi_qmap=1_bridge.txt	Single data call in bridge mode with QMAP
pcie_mhi_qmap=4.txt	Local multiple data call with QMAP
pcie_mhi_qmap=4_bridge.txt	Multiple data call in bridge mode with QMAP

NOTE

1. To perform multiple data call, QMAP feature of the module must be enabled.
2. QMAP feature of Quectel RG50xQ series and RM5xxQ series modules is enabled by default, i.e., even if *qmap_mode* is not configured when loading the driver, *qmap_mode=1* will be set automatically when running the driver.
3. Before connecting the module to the host, make sure that pcie_mhi.ko driver provided by Quectel is installed.

3.5. MBIM(USB) Data Call (USB + TE + Linux + MBIM)

1. Contact Quectel Technical Support for installation package of the following drivers and tool:
   - Quectel_Linux_USB_Serial_Option_Driver (Driver for TTY port, such as AT and DM.)
   - cdc_mbim_drv_Linux (Driver for usbnet data port)
   - QConnectManager_Linux (Data call tool)

2. Integrate/compile these drivers and tool on the host by executing **make install** in the driver file.

   To perform multiple data call with the driver, add *mbim_qmap_mode=<number of data call channels>* parameter in the command line when you execute the command for loading the driver. The maximum number of data call channels is 16. Example:

   ```
   insmod quec_cdc_mbim.ko mbim_qmap_mode=4
   ```

3. Connect the module to the host via USB cable.

4. Set the module network data call method to MBIM with **AT+QCFG="usbnet",2**. For details of the AT command, see ***document [1]***.

5. Start a data call with quectel-CM.

   1) Execute **quectel-CM -h** to check help information of quectel-CM.
   2) Refer to the following examples in */log* directory of quectel-CM source code package.

cdc_mbim.txt	Local single data call with QMAP
cdc_mbim_vlan.txt	Local multiple data call with QMAP

NOTE

1. To perform multiple data call, QMAP feature of the module must be enabled.
2. QMAP feature of Quectel RG50xQ series and RM5xxQ series modules is enabled by default, i.e., even if *qmap_mode* is not configured when loading the driver, *qmap_mode=1* will be set automatically when running the driver.
3. Do **NOT** use Linux original driver qcserial.ko on the host when using Quectel modules. You can check if the Linux original drivers are installed by running **lsmod**. If the drivers are installed, you should run **rmmod** to uninstall them. Before connecting a Quectel module to the host, make sure that driver quec_cdc_mbim.ko provided by Quectel is installed.

3.6. MBIM(USB) Data Call (USB + TE + Windows + MBIM)

1. Connect the module to the host via USB cable.
2. Set the module network card data call method to MBIM with **AT+QCFG="usbnet",2**. For details of the AT command, see ***document [1]***.
3. Make sure that the driver loaded for the device in Windows system is the default MBIM driver.
4. Click the network icon in the lower right corner of the host task bar to initiate a data call.

Figure 3: MBIM Data Call (USB + TE + Windows + MBIM)

3.7. PCIe_MHI_MBIM Data Call (PCIe + TE + Windows + MBIM)

1. Contact Quectel Technical Support for installation package of the following driver and install it: Quectel_sdx55-windows-pcie-driver

2. Connect the module to the host via PCIe.

3. Set the module network card data call method to MBIM with **AT+QCFG="pcie_mbim",1**. For details of the AT command, see ***document [1]***.

4. Confirm that the driver loaded by the host Windows system for the device is the driver provided by Quectel. If not, please contact Quectel Technical Support.

5. Click the network icon in the lower right corner of the host taskbar to initiate a data call.

Figure 4: MBIM Data Call (PCIe + TE + Windows + MBIM)

3.8. PCIe_MHI_MBIM Data Call (PCIe + TE + Linux + MBIM)

This data call uses PCIe interface to initiate a data call. The host serves as a PCIe RC and the module serves as a PCIe EP. The data call steps are listed below:

1. Contact Quectel Technical Support for installation package of the following driver and tool:
   - Quectel_Linux_PCIE_MHI_Driver (Driver for MHI data port)
   - QConnectManager_Linux (Data call tool)

2. Integrate/compile these drivers and tool on the host by executing **make install** in the driver file.
   - To enable the driver in MBIM mode, add *mhi_mbim_enabled=1* in the command line when executing the command for loading the driver.
   - If multiple data call with driver is required, add parameter *qmap_mode=<number of data call channels>* in the command line when executing the command for loading the driver. Currently, the maximum number of data call channels is 4. For example:

```
insmod pcie_mhi.ko mhi_mbim_enabled=1 qmap_mode=4
```

qmap_mode=0 indicates a single data call without UL AGG.
qmap_mode=1 indicates a single data with UL AGG.
qmap_mode=2/3/4 indicates multiple data call with UL AGG.

View device port loaded by the host, where /dev/mhi_DUN is the AT port.

3. Connect the module to the host via PCIe.

4. Set the module NIC data call method to MBIM with **AT+QCFG="pcie_mbim",1**. For details of the AT command, see ***document [1]***.

5. Start a data call with quectel-CM.

   1) Execute **quectel-CM -h** to check help information of quectel-CM.
   2) Refer to the following examples in /log directory of quectel-CM source code package.

pcie_mhi_mbim.txt	Local single data call with QMAP
pcie_mhi_mbim_qmap=4.txt	Local multiple data call with QMAP

NOTE

1. To perform multiple data call, QMAP feature of the module must be enabled.
2. QMAP feature of Quectel RG50xQ series and RM5xxQ series modules is enabled by default, i.e., even if *qmap_mode* is not configured when loading the driver, *qmap_mode=1* will be set automatically when running the driver.
3. Before connecting the module to the host, make sure that pcie_mhi.ko driver provided by Quectel is installed.

3.9. ECM Data Call (USB + AP + Linux)

1. Contact Quectel Technical Support for the installation package of the following driver: Quectel_Linux_USB_Serial_Option_Driver (Driver for TTY port, such as AT and DM.)

2. Integrate/compile the above driver on the host by executing **make install** in the driver file.

3. Connect the module to the host via USB cable.

4. Set the module data call method to ECM with **AT+QCFG="usbnet",1** via AT port /dev/ttyUSB2 (the third TTY port of the module) when booting the module for the first time. For details of the AT command, see ***document [1]***.

5. Reboot the module.

6. After the module is rebooted, the host matches the Linux original ECM driver automatically and generates a virtual Ethernet interface usb0 based on USB. The module performs a data call internally and provides network access to the host via NAT. The host only needs to send DHCP to ECM network card to request the IP address.

7. To enable multiple data call in Linux based on ECM, see ***document [2]***.

NOTE

Do **NOT** use Linux original driver qcserial.ko on the host when using Quectel modules. You can check if the Linux original drivers are installed by running **lsmod**. If the drivers are installed, you should run **rmmod** to uninstall them. Before connecting a Quectel module to the host, make sure that driver option.ko provided by Quectel is installed.

3.10. ECM Data Call (USB + AP + Windows)

1. Contact Quectel Technical Support for the installation package of the following driver: Quectel_LTE_Windows_USB_Driver_For_ECM and then install the driver.

2. Connect the module to the host via USB cable.

3. Set the module NIC data call method to ECM with **AT+QCFG="usbnet",1** via AT port when you start the module for the first time. For details of the AT command, see ***document [1]***.

4. Reboot the module.

5. Make sure that ECM provided by Quectel is installed and loaded on the device. Then the host generates a virtual Ethernet interface based on USB and obtains IP address through DHCP automatically.

Figure 5: ECM Data Call (USB + AP + Windows)

3.11. QMAP Data Call (RGMII/PCIe RC + AP)

1. Contact Quectel Technical Support for the installation package of the following driver: Quectel_Linux_USB_Serial_Option_Driver (Driver for TTY port, such as AT and DM.)

2. Integrate/compile the above driver on the host by executing **make install** in the driver file.

3. Reboot the module and configure the target interface.

   - If RGMII is used:
     1) Enable RGMII network card with **AT+QETH="rgmii"**. For details of the AT command, see ***document [1]***.
     2) Enable the data call with **AT+QMAP**. You can also enable IPPassthrough as needed with **AT+QMAP**. For details of the AT command, see ***document [3]***.

   - If PCIe_RC_ETH such as PHY chip RTL8125PHY or AQC107 is used:
     1) Enable the corresponding PHY driver with **AT+QETH="eth_driver"**. For details of the AT command, see ***document [1]***.
     2) Enable the data call with **AT+QMAP**. You can also enable IPPassthrough as needed with **AT+QMAP**. For details of the AT command, see ***document [3]***.

4. To enable multiple data call in Linux environment based on Ethernet, see ***document [2]***.

NOTE

Do **NOT** use Linux original driver qcserial.ko on the host when using Quectel modules. You can check if the Linux original drivers are installed by running **lsmod**. If the drivers are installed, you should run **rmmod** to uninstall them. Before connecting a Quectel module to the host, make sure that driver option.ko provided by Quectel is installed.

4 Appendix References

Table 3: Related Documents

Document Name
[1] Quectel_RG50xQ&RM5xxQ_Series_AT_Commands_Manual
[2] Quectel_RG50xQ&RM5xxQ_Series_Multiple_Data_Call_Application_Note
[3] Quectel_RG50xQ&RM5xxQ_Series_AT+QMAP_Command_Manual

Table 4: Terms and Abbreviations

Abbreviation	Description
AP	Application Processor
DHCP	Dynamic Host Configuration Protocol
ECM	Ethernet Control Model
ETH	Ethernet
IP	Internet Protocol
MBIM	Mobile Broadband Interface Model
MHI	Modem Host Interface
NAT	Network Address Translation
NDIS	Network Driver Interface Specification
PCIe EP	PCI Express Endpoint Device
PCIe RC	PCI Express Root Complex
QMI	Qualcomm Message Interface

RGMII	Reduced Gigabit Media Independent Interface
TE	Terminal Equipment
UL AGG	Uplink Aggregation
USB	Universal Serial Bus
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Network
WWAN	Wireless Wide Area Network