RG520N&RG525F&RG5x0F &RM5x0N Series eSIM LPA Application Note

5G Module Series

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About the Document

Revision History

Version	Date	Author	Description
-	2021-04-22	Remy SHI/ Ryker ZHANG	Creation of the document
1.0	2022-09-21	Ryker ZHANG	First official release
1.1	2024-01-12	Stark SHEN	1. Added applicable modules RG525F-NA, RG530F series, RM530N-GL and RM521F-GL; Updated RM520N-GL to RM520N series. 2. Added a note (Chapter 2.3.6). 3. Updated SM-DP server to SM-DP+ server (Chapter 2.3.8). 4. Updated the title and structure (Chapter 3). 5. Added a method for installing a profile by using an activation code with a confirmation code (Chapter 3.6.1). 6. Added a method for installing a profile by using the default SM-DP+ server address (Chapter 3.6.2). 7. Added the function of using eSIM LPAd software to delete profile and notify the SM-DP+ server (Chapter 3.7). 8. Updated the description (Chapter 3.8).
1.2	2025-02-10	Stark SHEN	1. Deleted RM521F-GL module. 2. Updated the declaration of AT command examples (Chapter 2.2). 3. Updated the default SM-DP+ server address in the command example (Chapter 2.3.8).

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1 Introduction

The embedded SIM (also called eSIM or eUICC, referred to as eSIM hereinafter) card is a new secure element designed to remotely manage multiple mobile network operator subscriptions and be compliant with GSMA specifications. Available in various form factors, either plugged-in or soldered, the eSIM is easy to integrate in any kind of device.

LPA (Local Profile Assistant) is able to download the encrypted profile to eSIM, and also provides end users with a local management interface so that they can manage profile on eSIM.

This document mainly introduces the eSIM profile related AT commands, how to install, delete and check a profile and common errors for profile installation.

1.1. Applicable Modules

Table 1: Applicable Modules

Module Family	Module
-	RG520N Series
-	RG525F-NA
RG5x0F	RG520F Series
	RG530F Series
RM5x0N	RM520N Series
	RM530N-GL

2 eSIM LPA AT Commands

2.1. AT Command Introduction

2.1.1. Definitions

- **<CR>** Carriage return character.
- **<LF>** Line feed character.
- **<...>** Parameter name. Angle brackets do not appear on the command line.
- **[...]** Optional parameter of a command or an optional part of TA information response. Square brackets do not appear on the command line. When an optional parameter is not given in a command, the new value equals its previous value or the default settings, unless otherwise specified.
- **Underline** Default setting of a parameter.

2.1.2. AT Command Syntax

All command lines must start with **AT** or **at** and end with **<CR>**. Information responses and result codes always start and end with a carriage return character and a line feed character: **<CR><LF><response><CR><LF>**. In tables presenting commands and responses throughout this document, only the commands and responses are presented, and **<CR>** and **<LF>** are deliberately omitted.

Table 2: Types of AT Commands

Command Type	Syntax	Description
Test Command	**AT+<cmd>=?**	Test the existence of the corresponding command and return information about the type, value, or range of its parameter.
Read Command	**AT+<cmd>?**	Check the current parameter value of the corresponding command.
Write Command	**AT+<cmd>=<p1>[,<p2>[,<p3>[...]]]**	Set user-definable parameter value.
Execution Command	**AT+<cmd>**	Return a specific information parameter or perform a specific action.

2.2. Declaration of AT Command Examples

The AT command examples in this document are provided to help you learn about the use of the AT commands introduced herein. The examples, however, should not be taken as Quectel's recommendations or suggestions about how to design a program flow or what status to set the module into. Sometimes multiple examples may be provided for one AT command. However, this does not mean that there is a correlation among these examples, or that they should be executed in a given sequence.
The URLs, domain names, IP addresses, usernames/accounts, and passwords (if any) in the AT command examples are provided for illustrative and explanatory purposes only, and they should be modified to reflect your actual usage and specific needs.

2.3. Description of AT Commands

2.3.1. AT+QESIM Query eSIM LPA Settings

This command queries the eSIM LPA settings.

AT+QESIM Query eSIM LPA Settings	
Test Command **AT+QESIM=?**	Response **+QESIM: "lpa_enable",(**list of supported **<enable>**s**)** **+QESIM: "profile_brief"** **+QESIM: "profile_detail",(**list of supported **<profile_ID>**s**)** **+QESIM: "eid"** **+QESIM: "delete_profile",(**list of supported **<profile_ID>**s**)** **+QESIM: "nickname",(**list of supported **<profile_ID>**s**),<**nickname>** **+QESIM: "def_svr_addr",<address>** **+QESIM: "disable_profile",(**list of supported **<profile_ID>**s**)** **+QESIM: "enable_profile",(**list of supported **<profile_ID>**s**)** **OK**
Maximum Response Time	300 ms
Characteristics	-

2.3.2. AT+QESIM="lpa_enable" Enable/Disable eSIM LPA

This command enables or disables the eSIM LPA.

AT+QESIM="lpa_enable" Enable/Disable eSIM LPA	
Write Command **AT+QESIM="lpa_enable"[,<enable>]**	Response If the optional parameter is omitted, query the current setting: **+QESIM: "lpa_enable",<enable>** **OK** If the optional parameter is specified, enable/disable the eSIM LPA: **OK** If there is any error: **ERROR**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configuration is saved automatically.

Parameter

<enable>	Integer type. Enable or disable the eSIM LPA.	
	0	Disable
	1	Enable

NOTE

If the eSIM LPA is disabled, **ERROR** is returned after the execution of other commands.

Example

```
AT+QESIM="lpa_enable"          //Query the currently configuration.
+QESIM: "lpa_enable",0

OK
AT+QESIM="lpa_enable",1        //Enable eSIM LPA.
OK
AT+QESIM="lpa_enable"          //Query the current settings.
+QESIM: "lpa_enable",1
```

OK

2.3.3. AT+QESIM="profile_brief" Query the Number of Profiles

This command queries the number of profiles in eSIM.

AT+QESIM="profile_brief" Query the Number of Profiles	
Write Command **AT+QESIM="profile_brief"**	Response **+QESIM: "profile_brief",<profile_number>** **OK** If there is any error: **ERROR**
Maximum Response Time	300 ms
Characteristics	-

Parameter

<profile_number>	Integer type. The number of profiles. Range: 1–8.

Example

```
AT+QESIM="profile_brief"          //Query the number of profiles.
+QESIM: "profile_brief",4

OK
```

2.3.4. AT+QESIM="profile_detail" Query Detailed Information of Profiles

This command queries the detailed information of profiles in eSIM.

AT+QESIM="profile_detail" Query Detailed Information of Profiles	
Write Command **AT+QESIM="profile_detail",<profile_ID>**	Response **+QESIM: "profile_detail",<ICCID>,<state>,<nickname>,<SPN>,<name>,<class>** **OK** If there is any error: **ERROR**

Maximum Response Time	300 ms
Characteristics	-

Parameter

<profile_ID>	Integer type. Profile ID. 1 Profile 1 2 Profile 2 3 Profile 3 4 Profile 4 5 Profile 5 6 Profile 6 7 Profile 7 8 Profile 8
<ICCID>	String without double quotes. ICCID (Integrated Circuit Card Identifier) number of the eSIM.
<state>	Integer type. The state of profile. 0 Inactive 1 Active
<nickname>	String type. The nickname of profile.
<SPN>	String type. The service provider name of profile.
<name>	String type. The name of profile.
<class>	Integer type. The type of profile. 0 Test profile 1 Provisioning profile 2 Operational profile

Example

```
AT+QESIM="profile_detail",1          //Query the detailed information of profile 1.
+QESIM: "profile_detail",89882470001117638 10F,0,"Profile1","Transatel","TSL_0131",2

OK
```

2.3.5. AT+QESIM="eid" Query eSIM ID

This command queries the eSIM ID.

AT+QESIM="eid" Query eSIM ID	
Write Command **AT+QESIM="eid"**	Response **+QESIM: "eid",<eSIM_ID>**

	OK If there is any error: **ERROR**
Maximum Response Time	300 ms
Characteristics	-

Parameter

<eSIM_ID>	String without double quotes. The eSIM ID.

Example

```
AT+QESIM="eid"          //Query the eSIM ID.
+QESIM: "eid",89033023424310000000001251649628

OK
```

2.3.6. AT+QESIM="delete_profile" Delete a Profile

This command deletes the profile with a specific profile ID. You can execute this command to delete the profile only after the profile is disabled by **AT+QESIM="disable_profile"**.

AT+QESIM="delete_profile" Delete a Profile	
Write Command **AT+QESIM="delete_profile",<profile_ID>**	Response **OK** Or **ERROR**
Maximum Response Time	300 ms
Characteristics	-

Parameter

<profile_ID>	Integer type. Profile ID. 1 Profile 1 2 Profile 2 3 Profile 3 4 Profile 4 5 Profile 5 6 Profile 6

	7	Profile 7
	8	Profile 8

NOTE

When you use this command to delete a profile, the SM-DP+ server is not notified of the successful deletion. To notify the SM-DP+ server of successful deletion, you can use the eSIM LPAd software to delete the profile (see ***Chapter 3.7*** for details).

Example

```
AT+QESIM="profile_brief"          //Query the number of profiles.
+QESIM: "profile_brief",4

OK
AT+QESIM="delete_profile",2       //Delete profile 2
OK
AT+QESIM="profile_brief"          //Query the number of profiles.
+QESIM: "profile_brief",3

OK
```

2.3.7. AT+QESIM="nickname" Configure a Profile Nickname

This command configures the nickname of the profile with a specific profile ID.

AT+QESIM="nickname" Configure a Profile Nickname	
Write Command **AT+QESIM="nickname",<profile_ID>,<nickname>**	Response **OK** Or **ERROR**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configurations are saved automatically.

Parameter

<profile_ID>	Integer type. Profile ID.	
	1	Profile 1
	2	Profile 2
	3	Profile 3
	4	Profile 4

	5	Profile 5
	6	Profile 6
	7	Profile 7
	8	Profile 8
<nickname>	String type. The nickname of profile.	

Example

```
AT+QESIM="nickname",3,"Quectel"          //Configure the nickname of profile 3.
OK
AT+QESIM="profile_detail",3              //Query the detailed information of profile 3.
+QESIM: "profile_detail",89882470001117619 96F,0,"Quectel","Transatel","TSL_0131",2

OK
```

2.3.8. AT+QESIM="def_svr_addr" Update Default SM-DP+ Server Address

This command updates the default SM-DP+ server address.

AT+QESIM="def_svr_addr" Update Default SM-DP+ Server Address	
Write Command **AT+QESIM="def_svr_addr"[,<address>]**	Response If the optional parameter is omitted, query the current setting: **+QESIM: "def_svr_addr",<address>** **OK** If the optional parameter is specified, update the default SM-DP+ server address: **OK** Or **ERROR**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configuration is saved automatically.

Parameter

<address>	String type. The default SM-DP+ server address. No more than 255 characters in length.

Example

```
AT+QESIM="def_svr_addr","example.com.cn"      //Update the default SM-DP+ server address.
OK
AT+QESIM="def_svr_addr"                       //Query the current default SM-DP+ server address.
+QESIM: "def_svr_addr","example.com.cn"

OK
```

2.3.9. AT+QESIM="enable_profile" Enable a Profile

This command enables the profile with a specific profile ID.

AT+QESIM="enable_profile" Enable a Profile	
Write Command **AT+QESIM="enable",<profile_ID>**	Response **OK** Or **ERROR**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configuration is saved automatically.

Parameter

<profile_ID>	Integer type. Profile ID. 1 Profile 1 2 Profile 2 3 Profile 3 4 Profile 4 5 Profile 5 6 Profile 6 7 Profile 7 8 Profile 8

Example

```
AT+QESIM="enable_profile",2          //Enable profile 2.
OK

+CPIN: READY

+QUSIM: 1
```

```
+QIND: SMS DONE

+QIND: PB DONE
AT+QESIM="profile_detail",2          //Query the detailed information of profile 2.
+QESIM: "profile_detail",89886970000000003873,1,"Profile2","GCKOEM","DummyProfile",2

OK
```

2.3.10. AT+QESIM="disable_profile" Disable a Profile

This command disables the profile with a specific profile ID.

AT+QESIM="disable_profile" Disable a Profile	
Write Command **AT+QESIM="disable_profile",<profile_ID>**	Response **OK** Or **ERROR**
Maximum Response Time	300 ms
Characteristics	The command takes effect immediately. The configuration is saved automatically.

Parameter

<profile_ID>	Integer type. Profile ID.	
	1	Profile 1
	2	Profile 2
	3	Profile 3
	4	Profile 4
	5	Profile 5
	6	Profile 6
	7	Profile 7
	8	Profile 8

Example

```
AT+QESIM="disable_profile",2         //Disable profile 2.
OK
AT+QESIM="profile_detail",2          //Query the detailed information of profile 2.
+QESIM: "profile_detail",89886970000000003873,0,"Profile2","GCKOEM","DummyProfile",2

OK
```

3 Use of eSIM LPAd

This chapter describes how to install and delete profiles by eSIM LPA with the help of the eSIM LPAd software installed on your Linux PC.

3.1. Install Drivers

Install USB driver and QMI_WWAN driver on your Linux PC. Contact Quectel Technical Supports to assist in the installation of the drivers if necessary.

3.2. Install Development Software

You need to install the following software on your Linux PC for preparing the development environment.

Table 3: Development Software

Name	Version	Description
make	3.81 and above	Compile source code
cURL	7.34.0 and above	HTTP(S) communication
OpenSSL	1.0.1f and above	Verify SSL certificate

For example, you can execute the following commands to install the above software under Ubuntu system:

```
sudo apt-get install make
sudo apt-get install libcurl4-openssl-dev
sudo apt-get install openssl
```

3.3. Install SSL Certificate (Optional)

If the eSIM profile provider has provided the SSL certificate, install it according to the following steps.

- Execute the following command in terminal window to install the certificate(s) under the directory of */usr/local/share/ca-certificates/*:

```
sudo cp ~/GSMA.crt /usr/local/share/ca-certificates/
```

- Execute the following command to update the SSL certificate:

```
sudo update-ca-certificates
```

3.4. Compile Source Code

Table 4: Directory Structure of Linux eSIM LPAd Source Code

Storage Path of Source Code	Description
./app	Application code folder, containing *main.c*
./common	Common definition
./http_manager	HTTP application management
/qmi_manager	QMI application management
./qmi_manager/legacy_qmi	Quectel Linux QMI device driver
./Makefile	Compile configuration file

Enter the root directory of eSIM LPAd source code and execute the following command to compile the source code:

```
sudo make
```

After compilation is completed, an executable file named *quectel_lpad* will be generated in the root directory of eSIM LPAd source code.

3.5. Confirm eSIM LPA Configuration

Make sure that the eSIM LPA is enabled. If not, enable it through **AT+QESIM="lpa_enable",1**.

3.6. Install the Profile

3.6.1. Install the Profile with Activation Code

Method 1: Obtain the activation code without the confirmation code from the operator. Execute the following command in terminal window to run *quectel_lpad* to install the profile using the activation code (replace the "$" in the activation code with "\$"):

```
sudo ./quectel_lpad -A [activation_code]
```

For example:

```
sudo ./quectel_lpad -A 1\$esim.quectel.com\$0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ\$
```

Method 2: Obtain the activation code with the confirmation code from the operator. Execute the following command in the terminal window to run *quectel_lpad* to install the profile using the activation code and using the activation code.

```
sudo ./quectel_lpad -A [activation_code] -C [Confirmation_code]
```

3.6.2. Install the Profile with Default SM-DP+ Server Address

First, execute **AT+QESIM="def_svr_addr"** to configure the default SM-DP+ address. Then, execute the following command in the terminal window to run *quectel_lpad* to install the profile by using the default SM-DP+ server address:

```
sudo ./quectel_lpad -A UseSMDP
```

3.6.3. Profile Installation Result

Due to the blocking mechanism in *quectel_lpad*, there is no log output during the installation and do not terminate the program at this moment. Log information can be printed in terminal window if debugging is required.

When the installation succeeds or fails, the following prompt will appear respectively in terminal window:

Figure 1: Prompt of Successful Installation

Figure 2: Prompt of Failed Installation

3.7. Delete the Profile

Execute the following command in a terminal window to run *quectel_lpad* to delete the profile:

```
sudo ./quectel_lpad -R [profile_id]
```

If the following prompt shows in the terminal window, the profile has been deleted and the SM-DP+ server has been successfully notified:

Figure 3: Prompt of Successful Profile Deletion

3.8. Check the Profile

After installing or deleting the profile successfully, you can check the profile information through **AT+QESIM="profile_brief"** and **AT+QESIM="profile_detail",<profile_ID>**.

4 Common Errors

This chapter mainly introduces the common errors for installation of the profile.

- **Network**

Common errors about network can be analysed from the error prompt and error code of cURL in log printed in terminal window, as follows:

1. Error code 6: hostname can't be resolved.
2. Error code 35: SSL connect error.

Replace the network environment and try to download the profile again. Firewalls and network agents may affect the installation of profile.

- **Server**

Common errors are as follows:

1. HTTP service unavailable (service issues, you need to consult the service provider).
2. The eSIM ID you request is not the same as the one saved in the SM-DP+ server (activation code has been used, you need to change activation code or consult the provider).

- **Module**

Errors can be reported during the installation if one of the following situations appears.

1. There is a problem with the profile package returned by the server.
2. The same profile has already been installed in eSIM card.

The most common situation is that the same profile has already been installed in eSIM card. When you encounter the situation, check the profile that has been installed, which can be distinguished by ICCID through **AT+QESIM="profile_detail",<profile_ID>**.

5 Appendix Reference

Table 5: Terms and Abbreviations

Abbreviation	Description
eSIM	embedded Subscriber Identity Module
eUICC	embedded Universal Integrated Circuit Card
GSMA	Global System for Mobile Communications Association
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
ICCID	Integrated Circuit Card Identifier
ID	Identifier
LPA	Local Profile Assistant
SM-DP+	Subscription Manager - Data Preparation+
SSL	Secure Sockets Layer