

BG96 PPP Application Note

LTE Module Series

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About the Document

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1 Introduction

This document gives a brief introduction on the PPP function of Quectel BG96 module, including application mode, procedures for PPP setup and termination, modes for PPP connection, and examples for PPP dial-up, etc.



2 Application Mode





The usage of PPP (Point-to-Point Protocol) is illustrated in the above figure. Either UART or USB can be used for PPP connection. The module provides a PPP server for application, and the application side provides a PPP client for the module. Meanwhile, the application side has to provide protocols such as TCP/IP, HTTP(S), etc. When PPP connection has been set up, the IP packet flow from the application side will be transmitted to Internet through the module.

Most standard operating systems (e.g. Windows, Unix/Linux) include the PPP protocol stack. For other operating systems which do not have existing application to set up PPP connection, it is very important to develop applicable application software to accomplish PPP connection first.



3 Procedures for PPP Setup and Termination

This chapter describes the PPP setup and termination procedures for the module. If PPP application software is intended to be developed, please read this chapter before programming.



3.1. General Procedures for PPP Setup

Figure 2: General Procedures for PPP Setup

After the module has registered on LTE Cat M1, LTE Cat NB1 or EGPRS network, please set APN for PPP by **AT+CGDCONT** and start PPP by **ATD*99#**. When **ATD*99#** is executed, the module enters into the procedure of PPP frame interaction which is carried out on the basis of standard Point-to-Point Protocol. Description about the module's packet interaction is included in the figure below. Please get more details about standard Point-to-Point Protocol from *RFC 1661*.



3.2. Recommended Procedures for PPP Setup



Figure 3: Flowchart of Recommended Procedures for PPP Setup



When the module is powered on, if the main UART is used, baud rate of the UART should be fixed by **AT+IPR=xxx;&W**. Before using **ATD*99#** to set up PPP, the status of (U)SIM card must be checked via **AT+CPIN?**. When (U)SIM card is ready, please check the network registration status periodically via **AT+CEREG?** or **AT+CGREG?** until the network condition is prepared.

NOTES

- Please ensure MCU and the module are synchronized successfully after rebooting the module. MCU sends AT<CR><LF> to the module every 100ms until OK is received from the module. If the UART is used, MCU fixes and saves baud rate via AT+IPR=xxx;&W after successful synchronization.
- 2. Please note that MCU has to wait for the response (for example **OK**, **CME error**, **CMS error**) to the previous AT command before inputting the next AT command. The module can be rebooted if there is no response in 60s.
- 3. It is strongly recommended that do NOT power on/off the module frequently. If the dial-up retry is failed for 3 times continuously, the module could be powered off/on (reset) immediately for the first time. After that, if the dial-up retry still fails, reset the module for the second time after 10 minutes, the third time after 30 minutes, and the fourth time after one hour.
- 4. If MCU fails to transmit data to network after PPP connection has been set up, please check the configuration of PPP and the state of network, and then reboot the module.

3.3. Procedures for PPP Termination

It is recommended to terminate the connection with LCP Terminate-Request message in PPP. This method must be operated in data mode.

TA can also terminate the connection by changing the DTR level. Please set DTR function by **AT&D2** first. This method must be operated in data mode as well.

Example

//USB/UART port is still in command mode before PPP connection has been setup. AT&D2 OK

When PPP dial-up is already existed, change the DTR level from low to high, and the data connection will be terminated automatically. USB/UART port will enter into command mode after PPP connection is terminated completely.

4 Modes for PPP Connection

4.1. Data Mode and Command Mode

The module communicates information (including AT commands and data) with application via USB/UART port. There are two working modes for the two ports: data mode and command mode.

The ports are in command mode before PPP is set up, and the module can execute AT commands in this state. When PPP negotiation is started, the ports will enter into data mode, and will keep in this mode when PPP connection is set up. In data mode, the module cannot execute AT commands.

Quectel BG96 module provides convenient methods to switch between the two modes.

4.1.1. Switch from Data Mode to Command Mode

4.1.1.1. Change DTR Level to Switch from Data Mode to Command Mode

When PPP connection is already existed and the USB/UART port is in data mode, the ports can be switched to command mode by changing DTR level from low to high (**AT&D1** should be set first). The module will return **OK** when switched to command mode successfully.

4.1.1.2. Use Sequence +++ to Switch from Data Mode to Command Mode

The other way to switch USB/UART port from data mode to command mode is using sequence "+++" when PPP connection has been set up successfully. To prevent the "+++" escape sequence from being misinterpreted as data, the following sequence should be followed:

- 1) Do not input any character within 1s or longer before inputting "+++".
- 2) Input "+++" within 1s, and no other characters can be inputted during the time.
- 3) Do not input any character within 1s after "+++" has been inputted.

When such particular sequence "+++" is received, the USB/UART port will switch from data mode to command mode, and the module will return **OK** for the operation.



NOTE

Please make sure the above operations are performed after completion of PPP negotiation. If not, above operations will terminate the PPP negotiation and make USB/UART port quit from data mode. When USB/UART port is switched to command mode after accomplishing PPP negotiation, the data will be treated as AT command and the module still remains PPP connection.

4.1.2. Switch from Command Mode to Data Mode

4.1.2.1. Use ATO to Switch from Command Mode to Data Mode

Example

//When PPP connection exists, and USB/UART port is in command mode.
ATO
CONNECT 150000000
 //Indicates that TA has entered into data mode, and all data
 inputted from USB/UART port will be treated as PPP frames.

4.2. Handle URC in Data Mode

The URC for incoming calls and short messages will not be reported to the PPP dial-up port in data mode during PPP connection. But the level of module's RI pin will change from high to low for 120ms as an indication. According to the RI pin status, MCU can switch the port to command mode to process the call or short message. After switching to command mode, the URC will be reported to the port if the incoming call or short message still exists.

4.3. Data Carrier Detection (DCD) Mode

DCD mode is determined by **AT&C**. If **AT&C0** is set, the DCD pin will not be used to indicate the data carrier status. If **AT&C1** is set, the DCD pin will be used to indicate the data carrier status. The pin will keep at low level when data carrier exists or PPP negotiation begins, otherwise it will keep at high level.

NOTE

When switching module's USB/UART port from data mode to command mode (using "+++"), the DCD state does not change.



5 PPP Dial-up Operation

This chapter mainly introduces how to establish PPP dial-up in Windows system. For detailed operation in Linux, please refer to *Quectel_WCDMA<E_Linux_USB_Driver_User_Guide*.

5.1. Preparation

It is necessary to finish the following steps before establishing a PPP dial-up connection in Windows.

- 1. Connect the module to PC and enter the PIN code if the (U)SIM card PIN is locked.
- 2. Make sure the (U)SIM card can successfully register on LTE Cat M1, LTE Cat NB1 or EGPRS network.

5.2. Modem Configuration

5.2.1. Add a New Modem

If there is no **Standard 19200 bps Modem** been installed, a new standard modem needs to be added to the modem section of the control panel.



 Click button "Start" → "Settings" → "Control Panel" → "Phone and Modem Options", as shown in the following figure.



Figure 4: Phone and Modem Options Icon in Control Panel



2. Double click "**Phone and Modem Options**", and select "**Modems**" → "**Add…**" to add a new modem, as shown in the following figure.

Phon	e and Modem Options	? 2	3				
Dial	ing Rules Modems Advanced	I					
	The list below displays the location from which you ar	locations you have specified. Select the e dialing.	Phone an	d Modem Op	tions		? 🗙
Lo	ocations:		Disling R.	loo Modems	Adupped		
	Location	Area Code	Dialing N	iles moderns	Auvanceu		
0	O My Location	0551		The following	modems are installed:	:	
			Mode	n		Attached To	
	New.	Edit Delete			Add	Remove Prop Cancel	erties
		Windows will now try to detect your mode continuing, you should: 1. If the modem is attached to your computer, make sure it is turned of 2. Quit any programs that may be us the modem. Click Next when you are ready to continu ✓ Don't detect my modem; I will select in www.com Windows will now try to detect your mode the modem. Click Next when you are ready to continu www.com Click Next when you are ready to continu www.com	em. Before n. ng ie. : from a list.	Cancel			

Figure 5: Add a New Modem



 Install the new modem according to the instructions on the screen: select "Standard 19200 bps Modem" and a port ("COM3") which will be installed; click "Next" button, till the configuration is finished. Refer to the following three figures for details.



Figure 6: Select Model of the Modem



Add Hardware Wizard	
Install New Modem Select the port(s) you w	vant to install the modem on.
	You have selected the following modem: Standard 19200 bps Modem On which ports do you want to install it? All ports Selected ports COM3
	< Back Next > Cancel

Figure 7: Select a Port



Figure 8: Installed Successfully



5.2.2. Configure the Modem Driver

Select the **"Standard 19200 bps Modem**" which has been installed; click **"Properties**" button; choose **"Maximum Port Speed**" as **"115200**" (default value); click **"Advanced**" to configure **"Extra Settings**"; and then input **AT+CGDCONT=1,"IP","CMNET**" command, as illustrated below.

Phone and Modem Options	
Dialing Rules Modems Advanced	
The following modems are installed:	Standard 19200 bps Modem Properties
Modem Attached To Standard 19200 bps Modem CDM3 Add Remove Properties OK Cancel Apply	Port: COM3 Speaker volume Low High Maximum Port Speed I15200 Dial Control Wait for dial tone before dialing
Standard 19200 bps Moden General Modem Diagnostics Extra Settings Extra initialization commands: AT+CGDCONT=1,"IP","CM	Advanced Driver NET" NET" OK Cancel

Figure 9: Configure the Modem Driver



NOTE

In the example above, the settings predefine a PDP context whose CID=1, PDP type=IP and APN=CMNET. CMNET is the APN for the network provider China Mobile and it should be replaced with the value provided by customers' actual network provider.

5.3. Dial-up Network Configuration

5.3.1. Create a New Connection

1. Open "Control Panel" and double click "Network Connections", and then click "Create a new connection" from the right list of "Network Tasks", as illustrated below.



Figure 10: Create a New Connection



2. Click "Next" button and choose "Connect to the network at my workplace" → "Next", and then select "Dial-up connection", as illustrated in the following figure.

New Connection Wizard			
	Welcome to the New Connection Wizard This wizard helps you: Connect to the Internet. Connect to a private network, such as your workplace network. Set up a home or small office network. To connect to a wireless network, view wireless network? To continue, click Next. Kext> Cancel	New Connection Wizard Network Connection Type What do you want to do? Connect to the Intern Connect to the Internet s Connect to the Internet s Connect to the Internet s Gonnect to the usiness m a field office, or another Set up a home or sma Connect to an existing hu Set up an advanced Connect directly to anoth set up this computer so to	et so you can browse the Web and read email. ork at my workplace etwork (using dial-up or VPN) so you can work from home, location. all office network ome or small office network or set up a new one. connection ter computer using your serial, parallel, or infrared port, or hat other computers can connect to it.
	New Connection Network Connection How do you want to connect to the network at your work Create the following connection: Image: Original connection Connect using a modem and a regular phone line or a Network (ISDN) phone line. Image: Original connect to the network using a virtual private network Internet.	place?	< Back Next > Cancel

Figure 11: Set up the New Connection



5.3.2. Configure the Connection

Enter word (for example "test") in "Company Name" as the connection name, and then click "Next" button and enter number (for example "*99#") in "Phone number", as illustrated below.

New Connection Wizard	
Connection Name Specify a name for this connection to your workplace.	
Type a name for this connection in the following box.	
Company Name	New Connection Wizard
test For example, you could type the name of your workplace or the name of a server you will connect to.	Phone Number to Dial What is the phone number you will use to make this connection?
	Type the phone number below.
	Phone number:
	^{33#}
	You might need to include a '1' or the area code, or both. If you are not sure you need the extra numbers, dial the phone number on your telephone. If you hear a modem sound, the number dialed is correct.
< Back Next > Cancel	
New Connection Wizard	
Completi Wizard Vou have succe create the follow test • Share with	Image: the New Connection Image: stully completed the steps needed to sing connection: Image: nall users of this computer Image: stully completed the steps needed to sing connection:
The connection Connections fold Add a shorter To create the co	will be saved in the Network Jer. ut to this connection to my desktop ynnection and close this wizard, click Finish.
	< Back Finish Cancel

Figure 12: Configure the Connection



5.3.3. Configure the Dial-up Tool

Click "**Properties**" button from the popup window. Then click "**Configure...**" button to configure the "**Standard 19200 bps Modem**". And finally select "**115200**" from the drop-down list of "**Maximum speed**". Click "**OK**" button to finish the configuration. Refer to the following figure for details.

Connect test	
User name: Password: Save this user name and password for the following use Me only Anyone who uses this computer Dial: *99# Dial Cancel Properties He	Image: Construction General Options Security Networking Advanced Connect using: Image: Modem - Standard 19200 bps Modem (COM3) Image: Configure Phone number Area code: Phone number: Image: Modem - Standard 19200 bps Modem (COM3) Image: Configure Phone number: Image: Modem - Standard 19200 bps Modem (COM3) Image: Configure Phone number: Image: Modem - Standard 19200 bps Modem (COM3) Image: Configure Phone number: Image: Modem - Standard 19200 bps Modem (COM3) Image: Configure Image: Configure Phone number: Image: Modem - Standard 19200 bps Modem (COM3) Image: Configure <
Modem Configuration Standard 19200 bps Modem (COM3) Maximum speed (bps): Modem protocol Hardware features Enable hardware flow control Enable modem error control Enable modem compression Show terminal window Enable modem speaker	OK Cancel

Figure 13: Configure the Dial-up Tool



5.3.4. Establish the Dial-up Connection

Right click "test" which was created as the new connection and then click "**Connect**" \rightarrow "**Dial**" from network connections. The dial-up connection is established successfully when the prompt box "test is **now connected**" is popped up. Refer to the following figure for details.



Figure 14: Establish the Dial-up Connection



6 Appendix A References

Table 1: Related Documents

SN	Document Name	Remark
[1]	Quectel_BG96_AT_Commands_Manual	BG96 AT commands manual
[2]	Quectel_WCDMA<E_Linux_USB_Driver_User_ Guide	Linux USB driver user guide for WCDMA<E modules

Table 2: Terms and Abbreviations

Abbreviation	Description
APN	Access Point Name
СНАР	Challenge Handshake Authentication Protocol
DCD	Data Carrier Detection
DNS	Domain Name Server
DTR	Data Terminal Ready
GPRS	General Packet Radio Service
GSM	Global System of Mobile Communication
IP	Internet Protocol
IPCP	IP Control Protocol
LCP	Link Control Protocol
MCU	Micro Control Unit
MS	Mobile Station
PAP	Password Authentication Protocol



PDP	Packet Data Protocol
PIN	Personal Identification Number
PPP	Point-to-Point Protocol. The Point-to-Point Protocol is designed for simple links which transport packets between two ports. These links provide full-duplex simultaneous bi-directional operation, and are assumed to deliver packets in order. It is intended that PPP provides a common solution for easy connection of a wide variety of hosts, bridges and routers.
RI	Ring Indicator
ТА	Terminal Adapter
TE	Terminal Equipment
UART	Universal Asynchronous Receiver Transmitter
(U)SIM	(Universal) Subscriber Identity Module