BG96 PPP Application Note

LTE Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2018-01-31	Sherlock ZHAO/ Lucifer YAN	Initial

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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

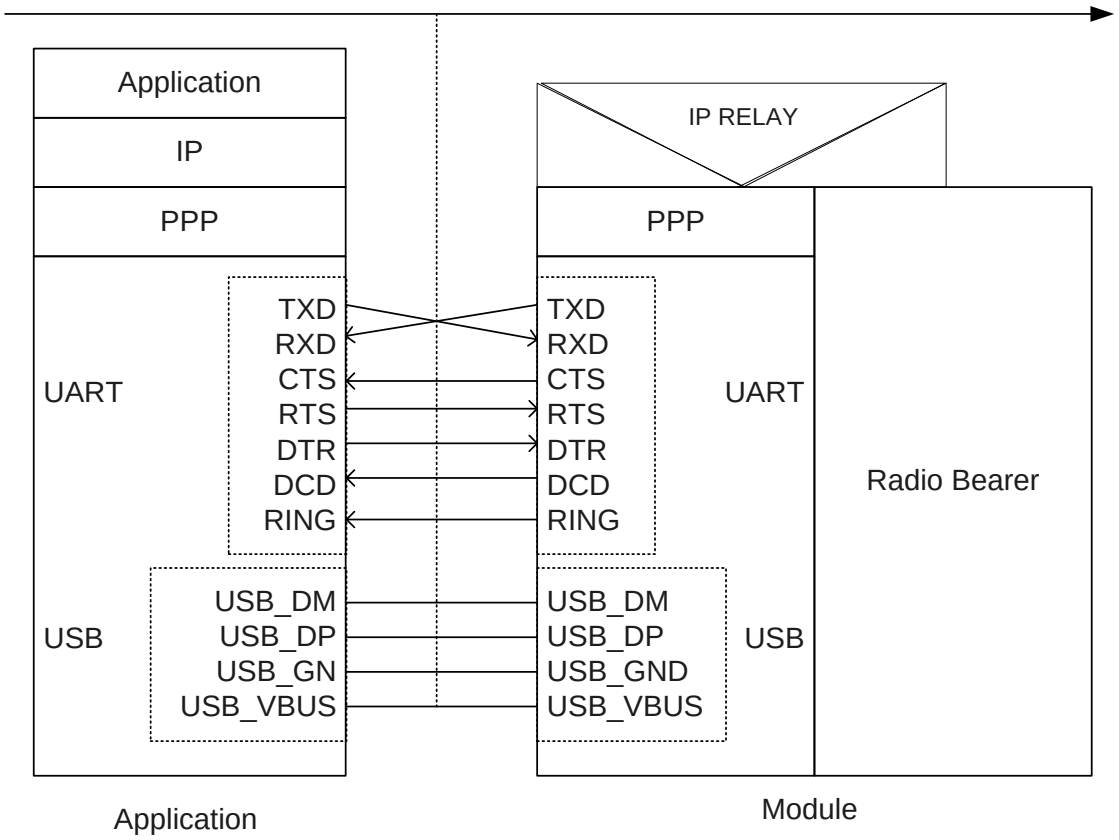

Figure 1: PPP Application Mode

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

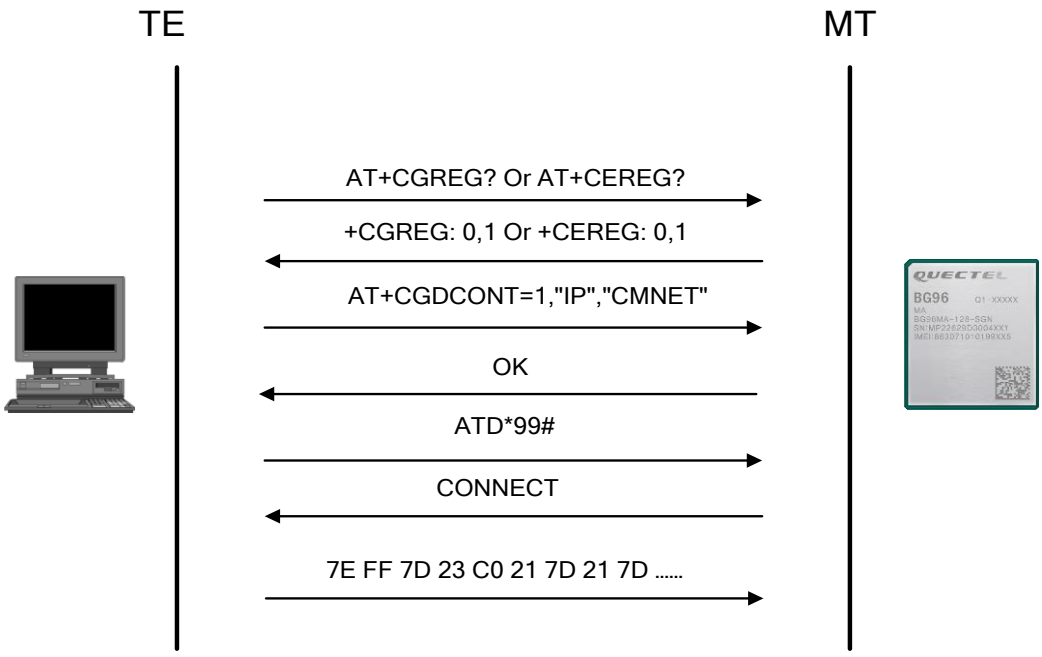

Figure 2: General Procedures for PPP Setup

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

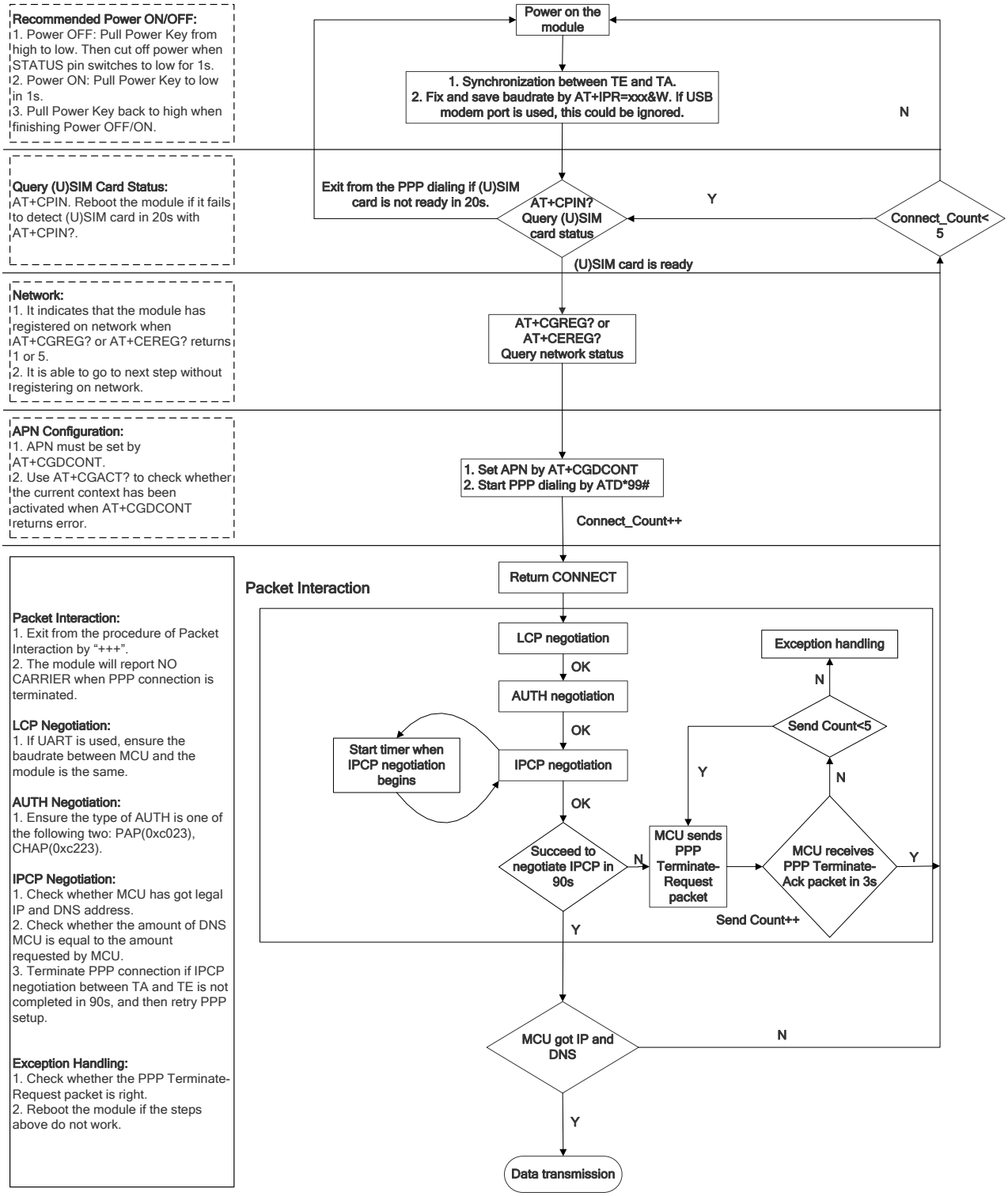

Figure 3: Flowchart of Recommended Procedures for PPP Setup

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

1. 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&LTE_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.

1. Click button “**Start**” → “**Settings**” → “**Control Panel**” → “**Phone and Modem Options**”, as shown in the following figure.

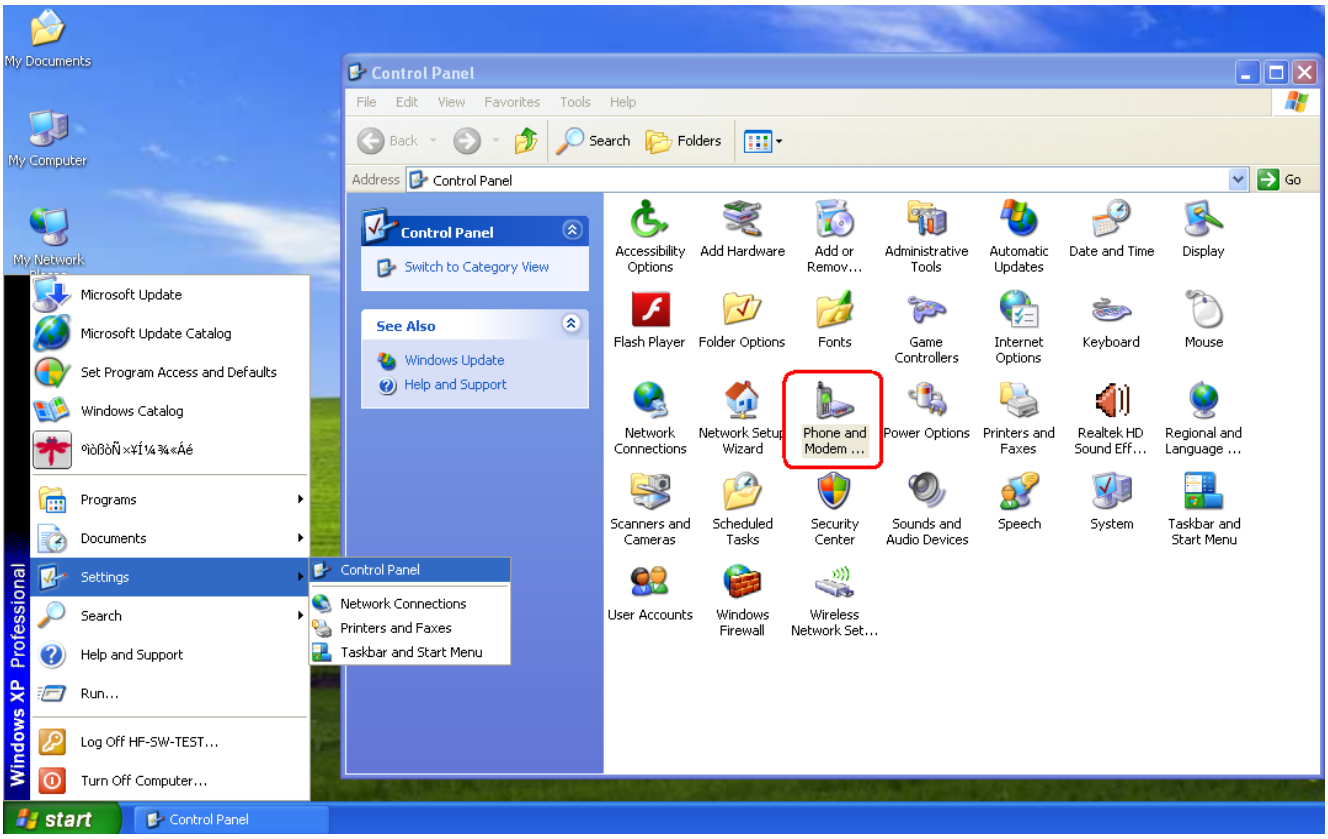

Figure 4: Phone and Modem Options Icon in Control Panel

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

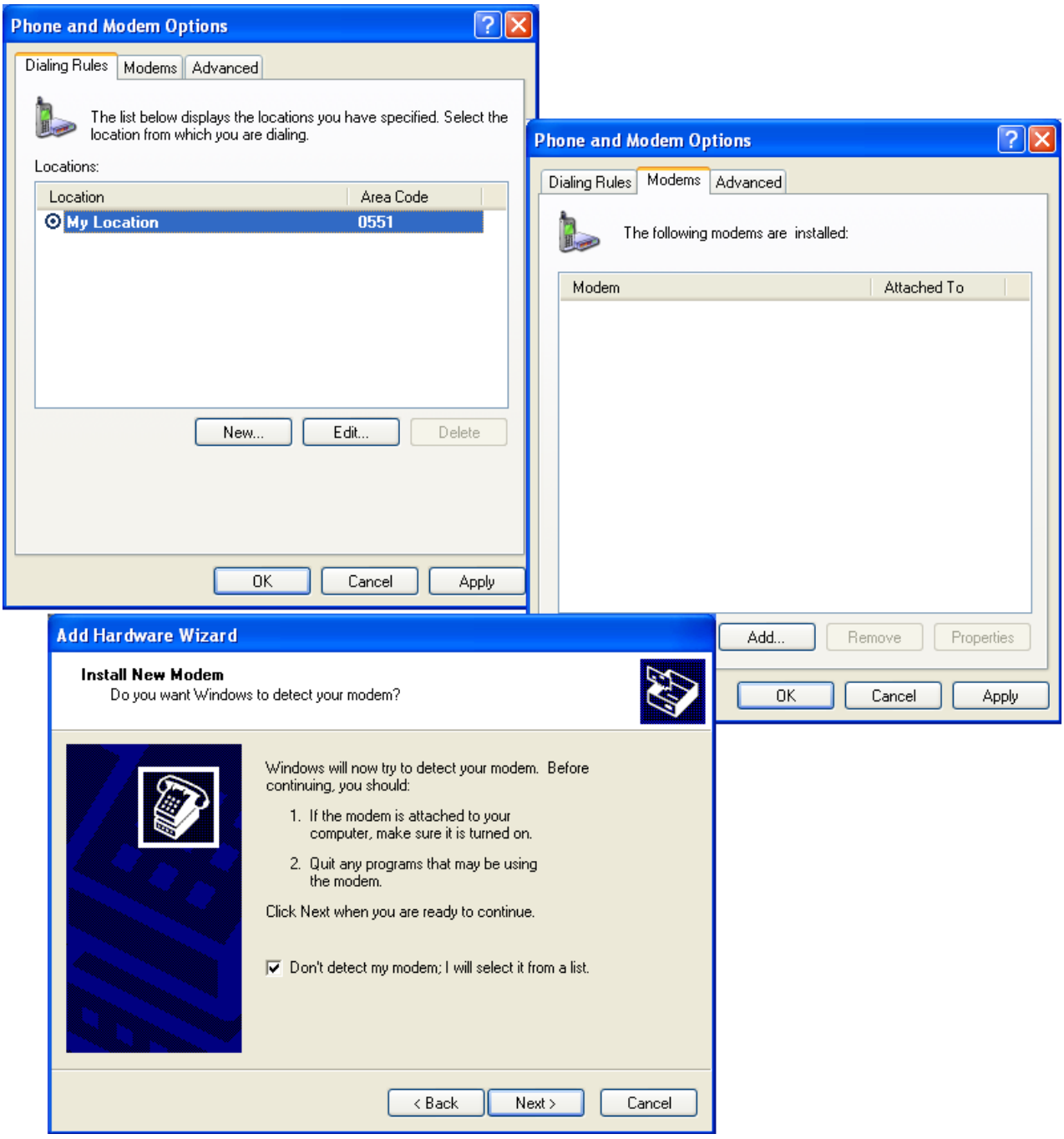

Figure 5: Add a New Modem

3. 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.

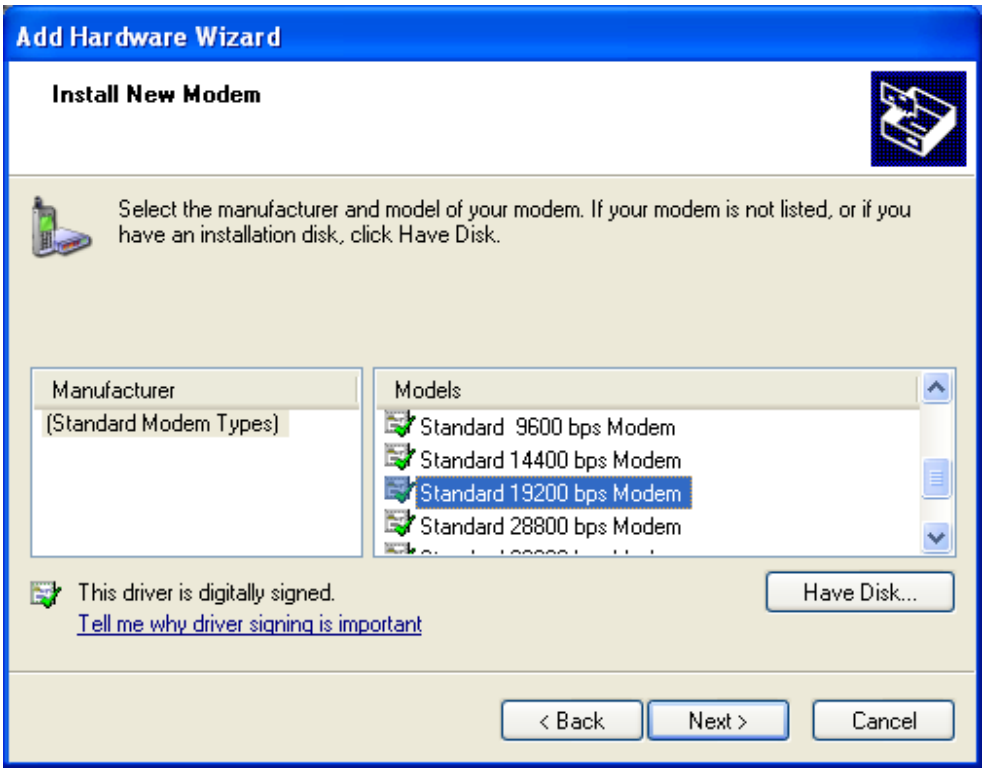

Figure 6: Select Model of the Modem

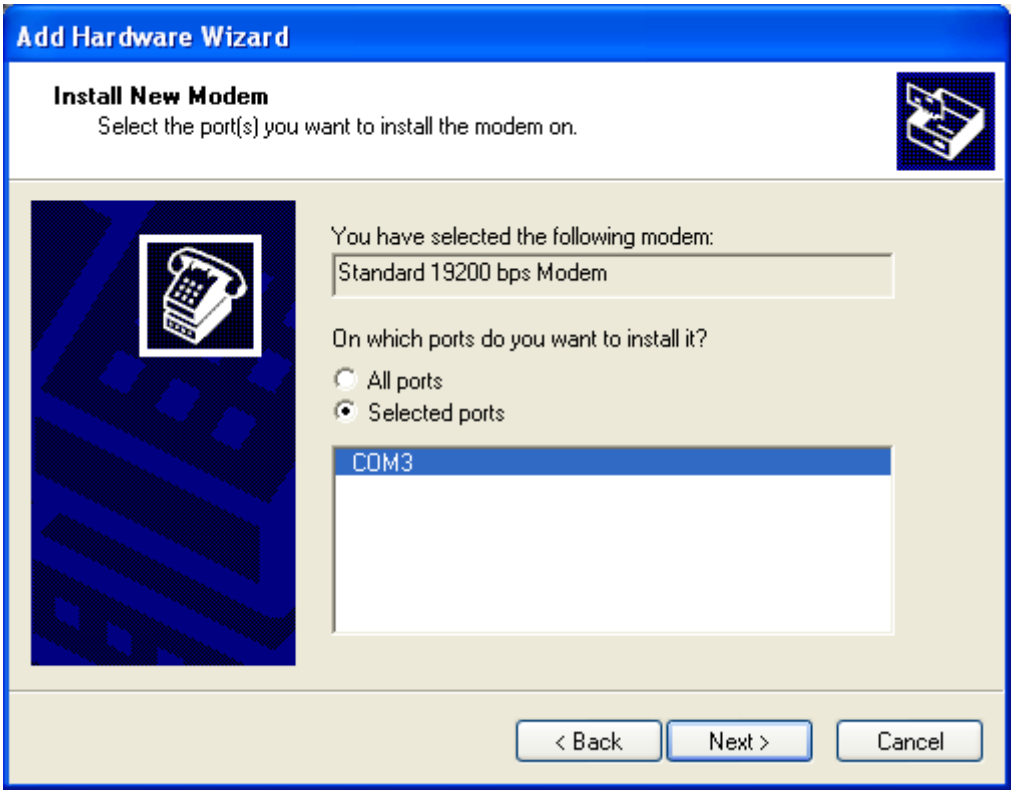

Figure 7: Select a Port

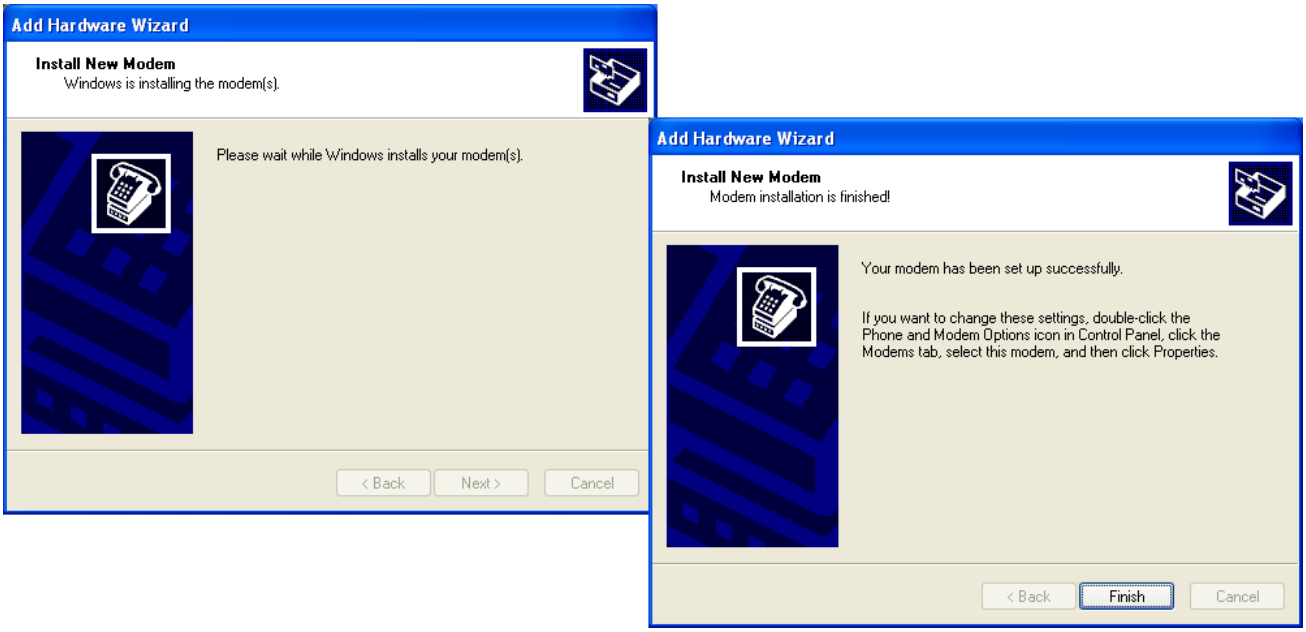

Figure 8: Installed Successfully

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.

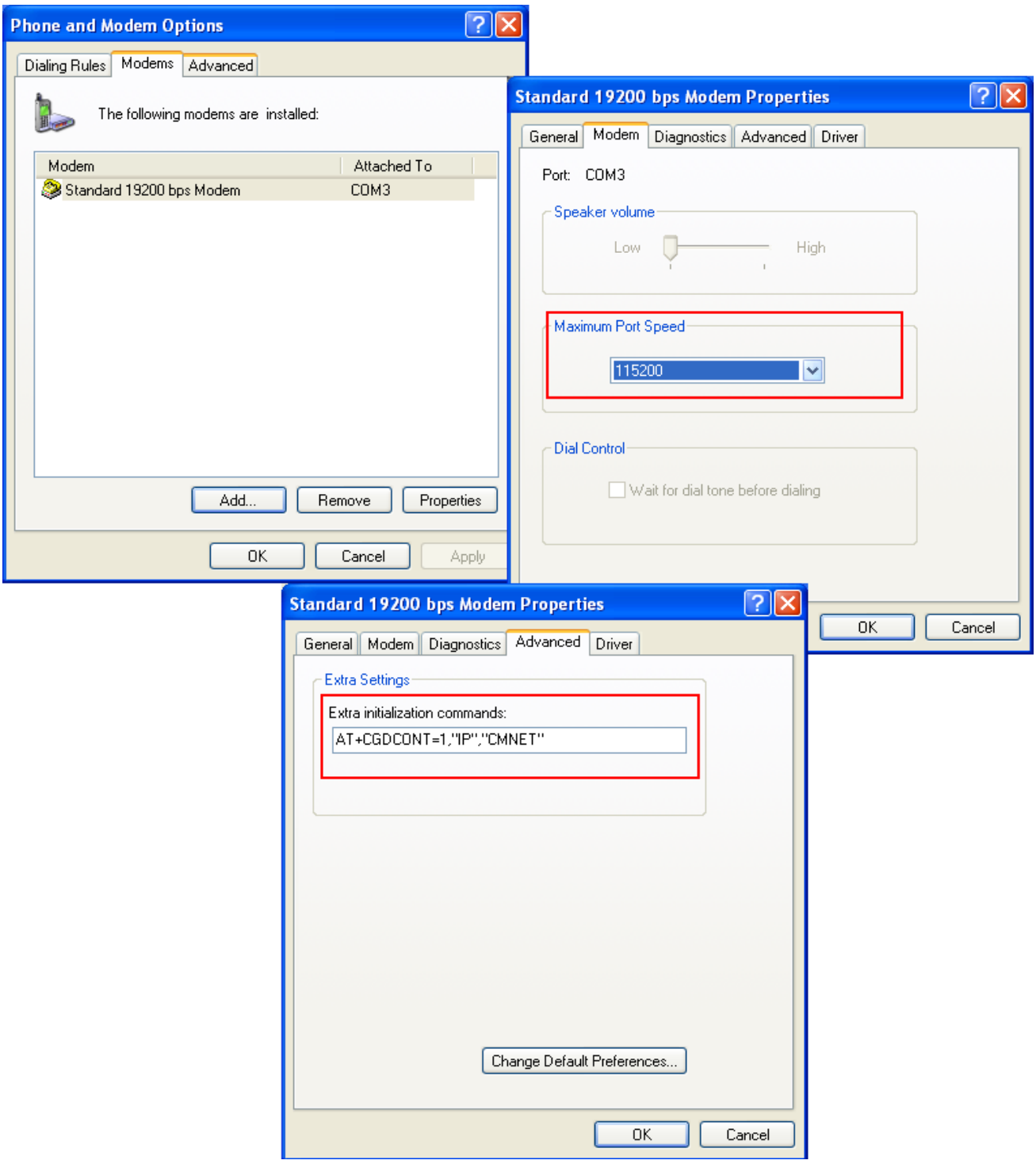

Figure 9: Configure the Modem Driver

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.

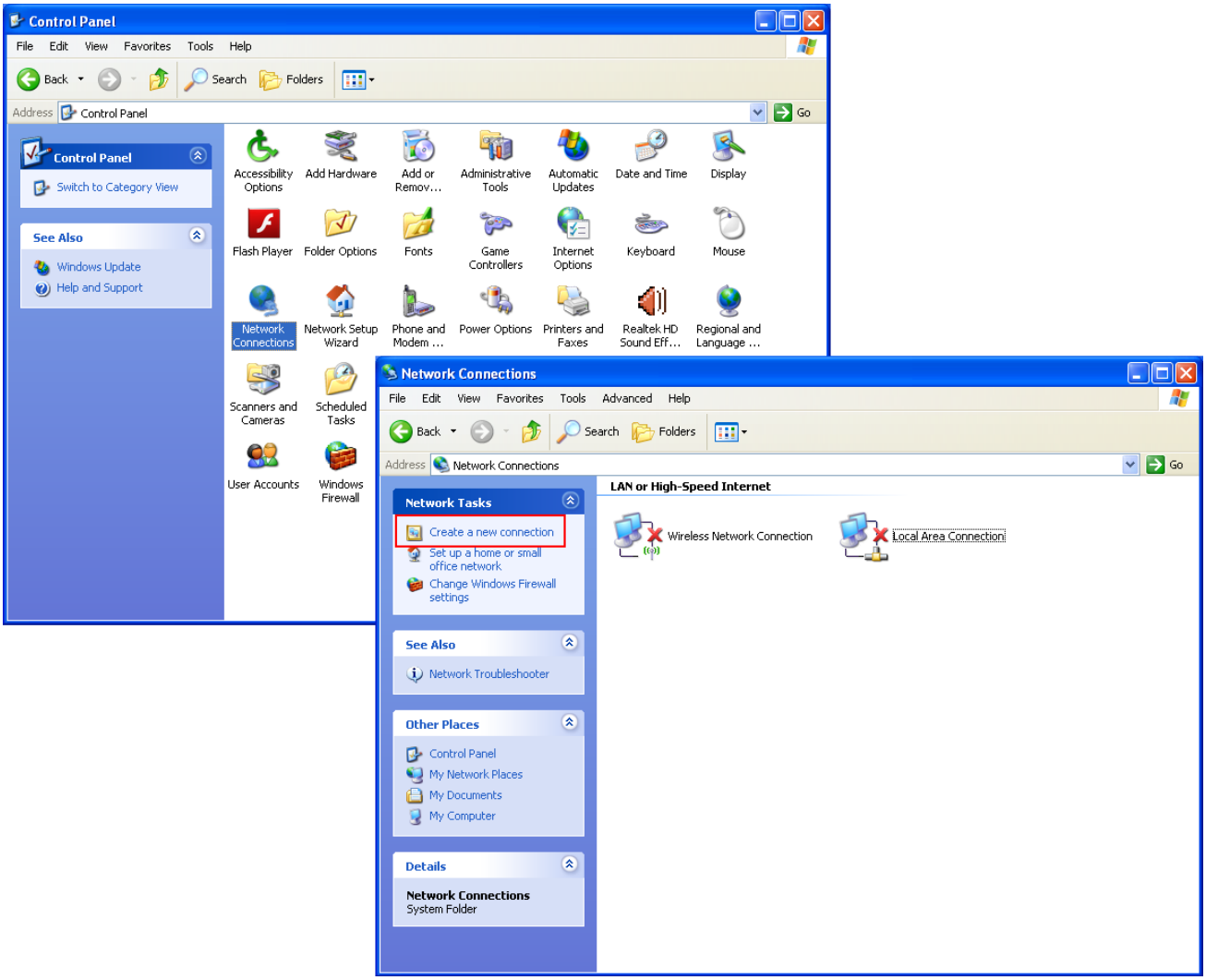

Figure 10: Create a New Connection

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.

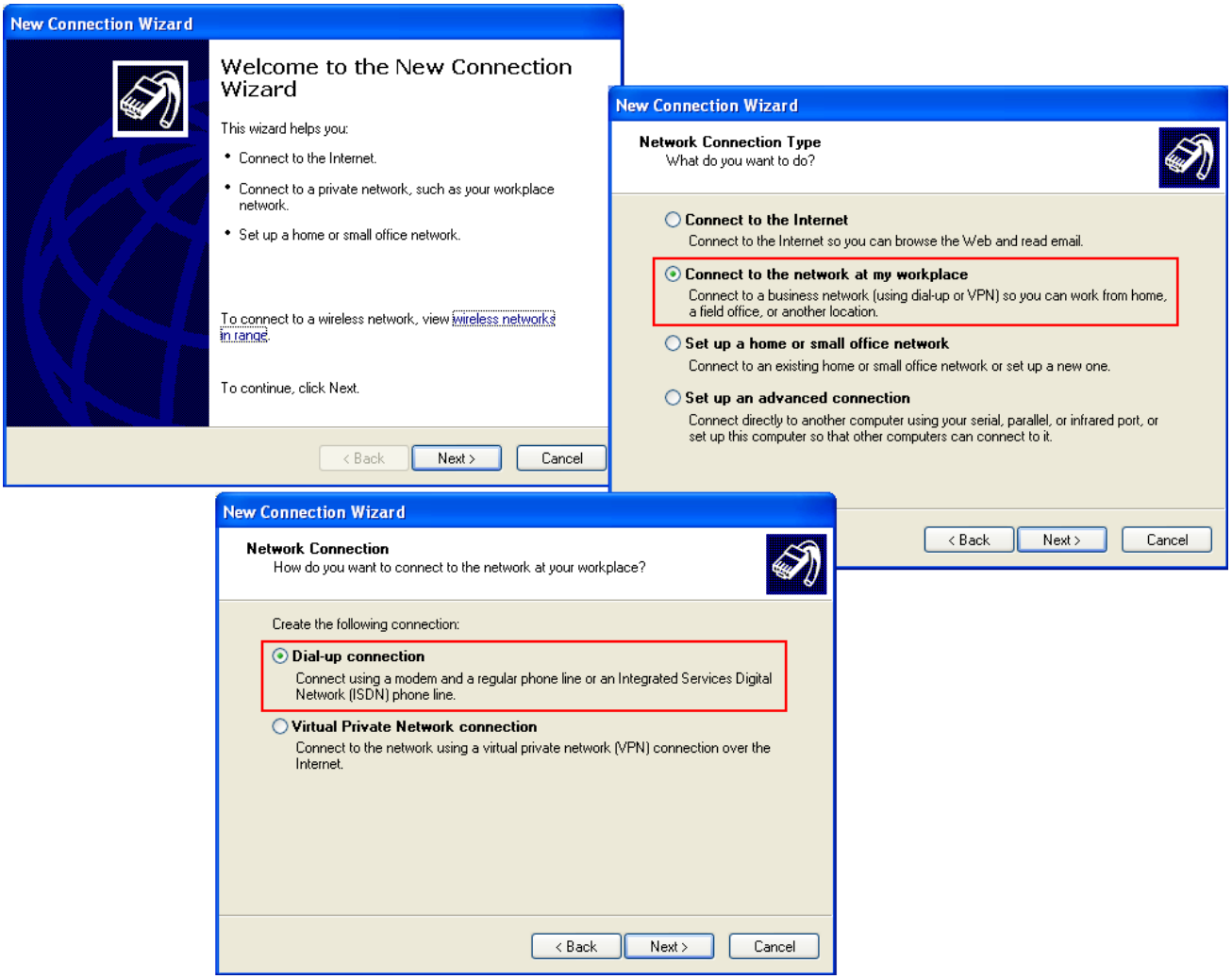

Figure 11: Set up the New Connection

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.

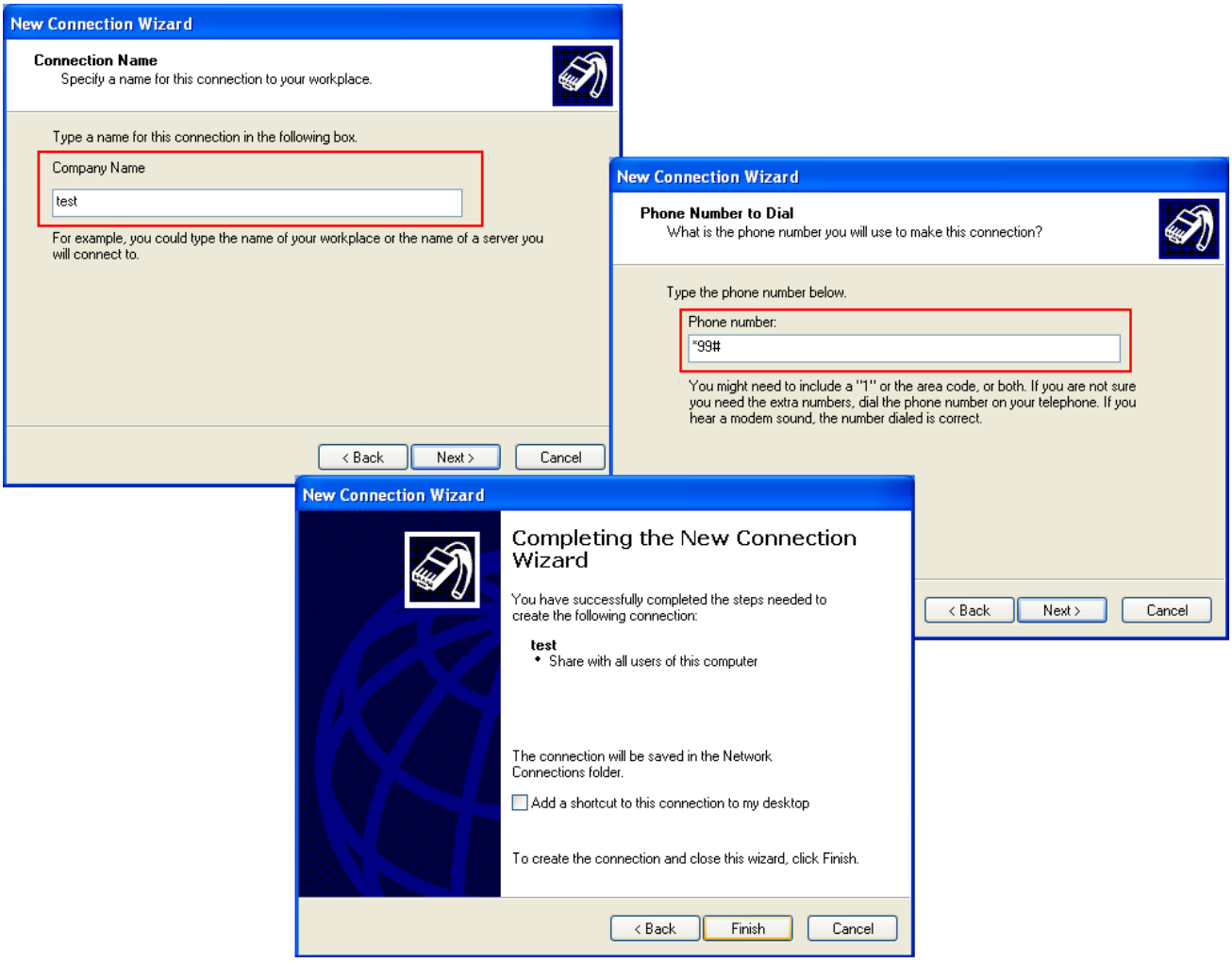

Figure 12: Configure the Connection

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.

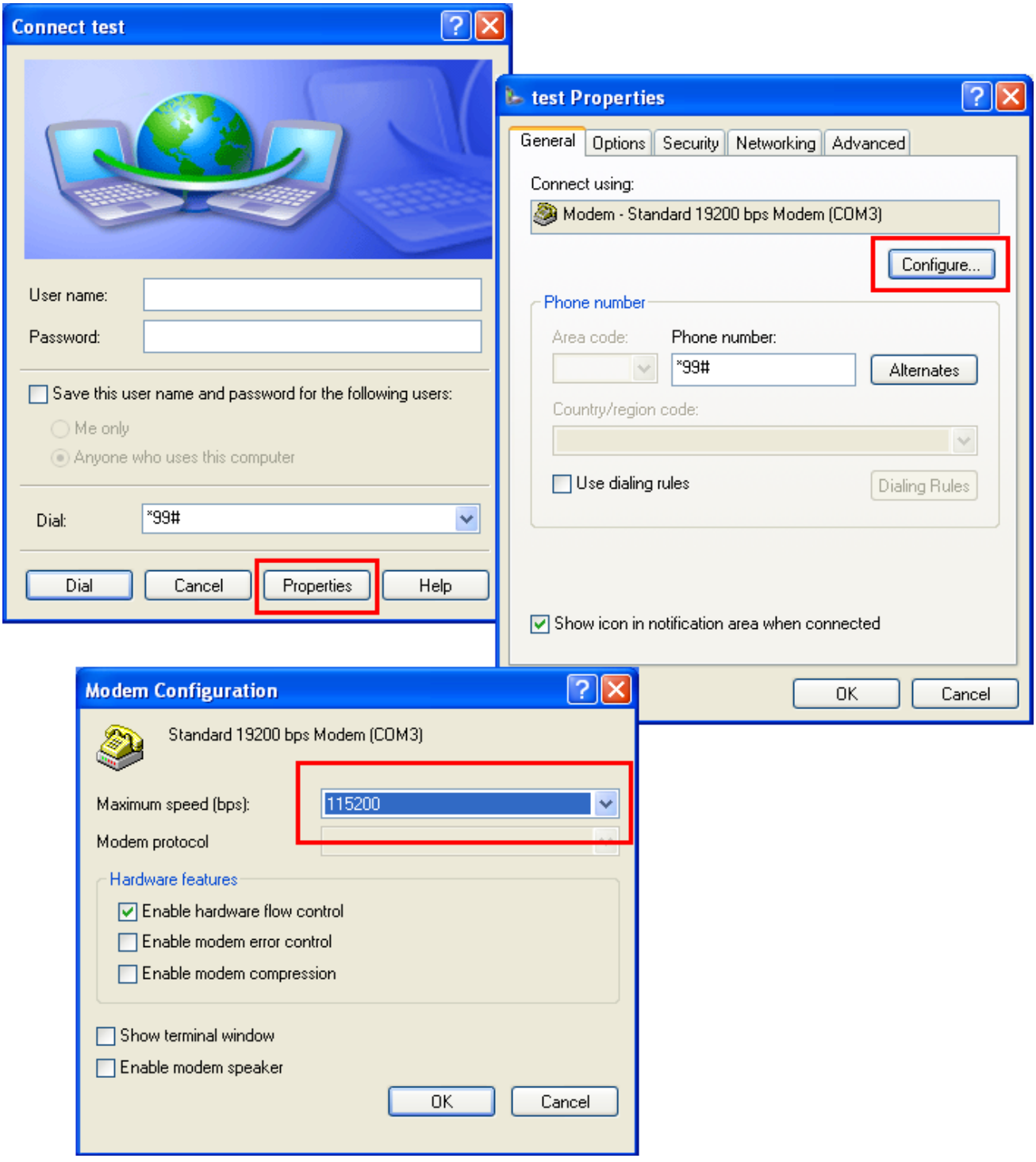

Figure 13: Configure the Dial-up Tool

5.3.4. Establish the Dial-up Connection

Right click "**test**" which was created as the new connection and then click "**Connect**" → "**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.

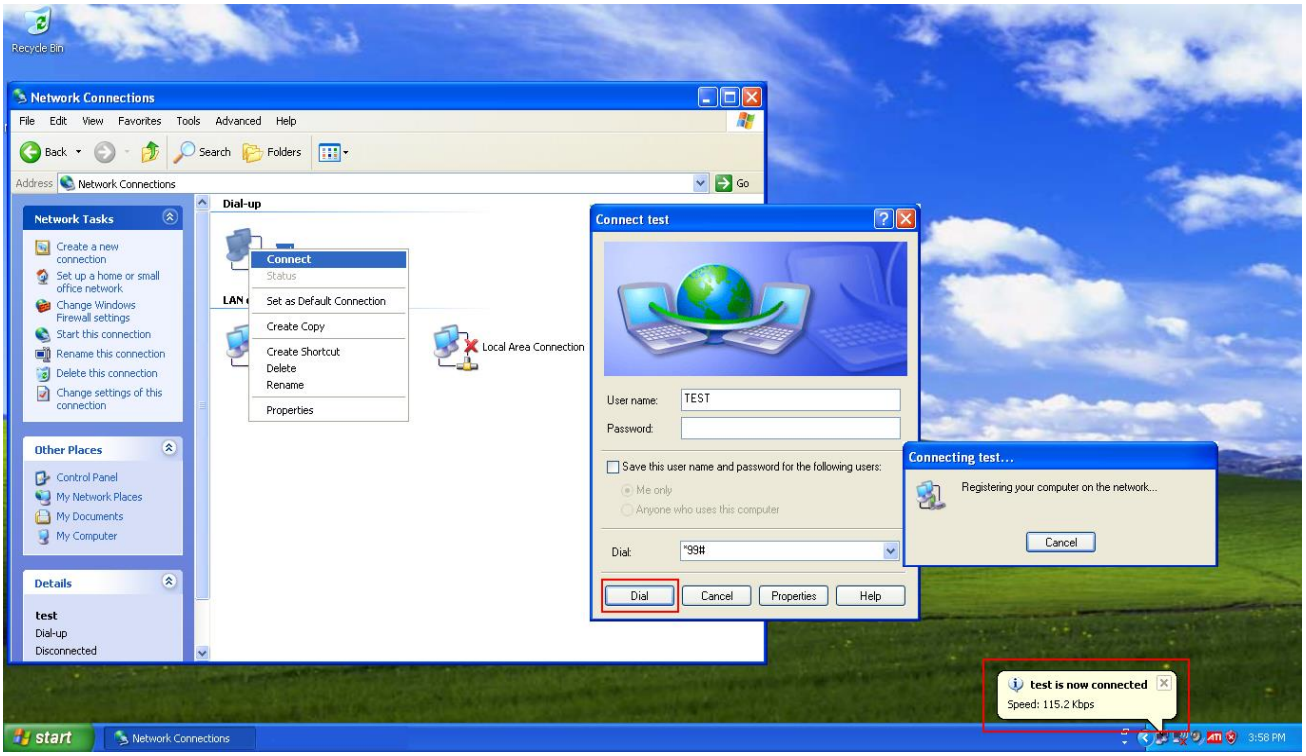

Figure 14: Establish the Dial-up Connection

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&LTE_Linux_USB_Driver_User_Guide	Linux USB driver user guide for WCDMA&LTE modules

Table 2: Terms and Abbreviations

Abbreviation	Description
APN	Access Point Name
CHAP	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
TA	Terminal Adapter
TE	Terminal Equipment
UART	Universal Asynchronous Receiver Transmitter
(U)SIM	(Universal) Subscriber Identity Module