Purpletooth®

2.4GHz Wireless Modem

Direct Sequence Spread Spectrum

PT-209G/219G

User Manual

Version 2.2

REnex TECHNOLOGY

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This document is produced for users of Purpletooth® PT-209G/219G, the spread spectrum wireless modem from REnex Technology Limited. It covers the operating principles and capabilities of Purpletooth® PT-209G/219G. It is highly recommended to read this document before using Purpletooth® PT-209G/219G in order to operate it correctly and have its best performance.

WARNING

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This manual contains information of proprietary interest to REnex Technology Limited. It is supplied in confidence to purchasers and other authorized users of Purpletooth® PT-209G/219G Wireless Modem. By accepting this material, the recipient agrees that the contents will not be copied or reproduced, in whole or part, without prior written consent of REnex Technology Limited.

The electronic equipment described in this manual generates, uses, and radiates radio frequency energy. Operation of this equipment in a residential area may cause radio interference, in which case the user, at his/her own expense, will be required to take whatever measures necessary to correct the interference.

Information in this document is subject to change without notice.
REnex Reference Number: R-001-4000-018
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FCC Information

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- **Reorient or relocate the receiving antenna.**
- **Increase the separation between the equipment and receiver.**
- **Connect the equipment into an outlet on a circuit different from that to which the receiver is needed.**
- **Consult the dealer or an experienced radio/TV technician for help.**

RS-232 DB9 shielded cable with ferrite must be used with this unit to ensure compliance with the Class B FCC limits.

CAUTION: The model number PT-209G and PT-219G have maximum transmitted output power of 0.07 Watt. It is recommended that the transmit antenna be kept at least 20 cm away from nearby persons to satisfy FCC RF exposure requirements. The antenna and transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

CAUTION:
RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE.

DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS.

WARRANTY

REnex Technology Limited (REnex) warrants this product to the original owner purchased directly from REnex or an authorized distributor to be free of defects and workmanship for a period of one year from the date of purchase.

REnex's obligation under this warranty is limited to replacing or repairing defective parts of our product under normal use and service. REnex is not liable for any damage, which results from abnormal use, abuse, improper operation, accident or inability to use this product.

Contents

1. General

1.1 Product Overview

The Purpletooth® PT-209G/219G Direct Sequence Spread Spectrum (DSSS) Wireless Modem is a high performance wireless modem. It is designed to provide a long distance, high data rate and robust platform for applications. It offers data communication capabilities to application equipment via standard interfaces. Neither additional hardware nor software modification is required in the application equipment to work with PT-209G/219G. By using a pair of PT-209G/219G modems, users can transfer data between almost all types of equipment that use asynchronous serial interfaces. The small size and superior performance of PT-209G/219G make it an ideal solution for many applications. Typical examples are:

- Traffic control
- Remote monitoring
- Telemetry
- Remote camera/robot control
- Mobile video transmission
- Environmental monitoring
- Emergency rescue
- Premises security
- Logistics

PT-209G is the standard version that conforms to the FCC, CE and China SRRC regulations. While PT-219G is an enhanced version that bears the UL Class 1 Division 2/ATEX Group 2 Category 3 safety classification in addition to the FCC, CE and China SRRC radio approvals.

1.2 Features

Key features of PT-209G/219G:

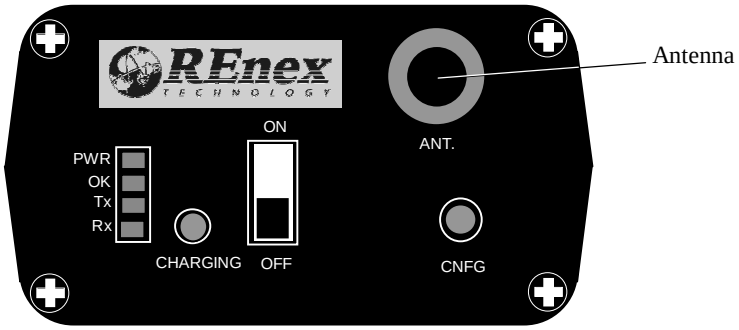
- Operates in license-free frequency band
- Supports serial data I/O with handshaking and hardware flow controls
- Supports high speed and high throughput data transfers via USB and Ethernet ports
- Provides error-free data connections via built-in CRC-16 error detection and automatic re-transmission
- Offers high data rate and support long distance
- Adopts the advanced Direct Sequence Spread Spectrum (DSSS) technology to provide high interference immunity to protect on-air data from signal interferences and malicious data trappings
- Supports various data applications with efficient communication protocols
- Easy to use, plug-and-play without specific software requirement

NOTE1: This manual has been provided as a guide and reference for installing and using PT-209G/219G wireless modems. It is assumed that users of PT-209G/219G modem have either system integration or system design experience.

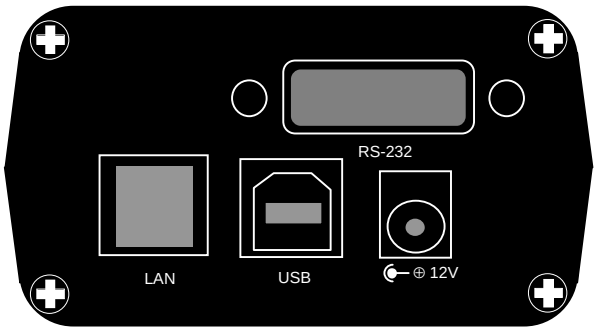
2. Physical/Electrical Attributes

2.1 PT-209G/219G Physical Layout

The following diagrams illustrate the front and rear panels of PT-209G/219G.



(a) Front panel



(b) Rear panel

Figure 1. Front and rear panels of PT-209G/219G modem.

Photos of PT-209G/219G are depicted in the following figures:

Figure 2. Photos of PT-209G/219G modem.

2.2 LED Indications

Five LED's are installed in PT-209G/219G modem as shown in Figure 1 (a). They indicate the status of the modem and their definitions are listed in the following table:

Table 1. LED indications

	On	**Off**	**Dim**	**Flash**
Rx LED	-	No data receive	Data link in active	Receiving data
Tx LED	-	No data send out	Data link in active	Sending out data
OK LED*	Procedure success	No procedure/ procedure failed	-	Procedure in progress
Power LED	-	Power down	Power up	In power saving mode
Charging LED	Red: Charging; Green: Fully charged			

* Procedure means the slave registration/de-registration procedures. It is off in normal operations.

2.3 RS-232 DB-9 Connection

Pin assignments of the RS-232 port are as follows:

Table 2 Pin assignments of the RS-232 port

RS-232 port pin no.	Pin name	Signal direction
1	DCD	-
2	RXD	Output
3	TXD	Input
4	DTR	Input
5	GND	-
6	DSR	Output
7	RTS	Input
8	CTS	Output
9	RI	-

3. Setup PT-209G/219G

3.1 Setting up Connections

PT-209G/219G modems are shipped from REnex with a pre-configured setting. They can operate "out of the box". Hence, the only thing users need to do is to make the appropriate connections between the modem and their equipment via the RS-232 port, the USB port or the Ethernet port, and then power up. The master and slave(s) shall communicate properly. For using the USB port, you may need to install a driver for the first time plugging in your system. Please follow the *"Purpletooth® Family USB Driver Installation Guide"* for the installation procedure.

3.2 Checking the Link

After finishing the physical connection setup mentioned above, PT-209G/219G should be ready. If the performance of the communication link is not satisfactory or any linking problem is found, the following steps may help you locate the problem.

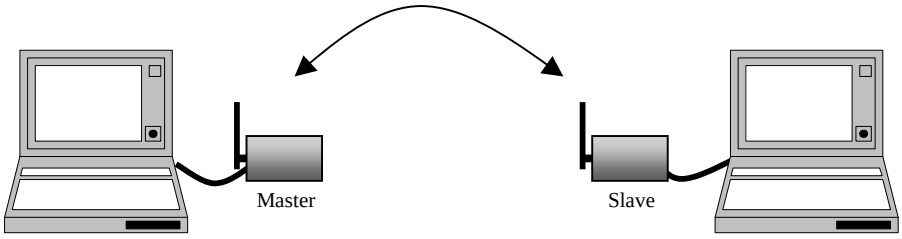


Figure 3. Basic network mode.

1. Connect each modem to a serial port of a PC using direct RS-232 cable.
2. Start a terminal program such as *Hyper Terminal* (http://www.hilgraeve.com, it may be found in Microsoft Windows OS) for each serial port. Make sure the baud rate and data format settings agree with those of PT-209G/219G.
3. Characters typed at the master's terminal should appear at that of the slave's and vice versa.
4. The TX LED should flash during transmitting data to the RF link.
5. The RX LED should flash during receiving data from the RF link.
6. Adjust the modem separation and the antenna direction to locate positions with the best performance.

NOTE 2: PT-209G/219G is highly sensitive to obstacles in its communication path. Make sure the communicating modems are in line-of-sight. Otherwise, the performance may drop significantly.
NOTE 3: Antenna height is a critical factor. Try to put the antenna at a position as high as possible.

3.3 Using the USB Port

An Internet access driver, called NDIS-USB driver, is provided in the CD-ROM inside the delivery package. You can follow the installation guide in the CD-ROM to install it. After that, you can access the Internet via a networked PC and a pair of PT-209G/219G as illustrated below:

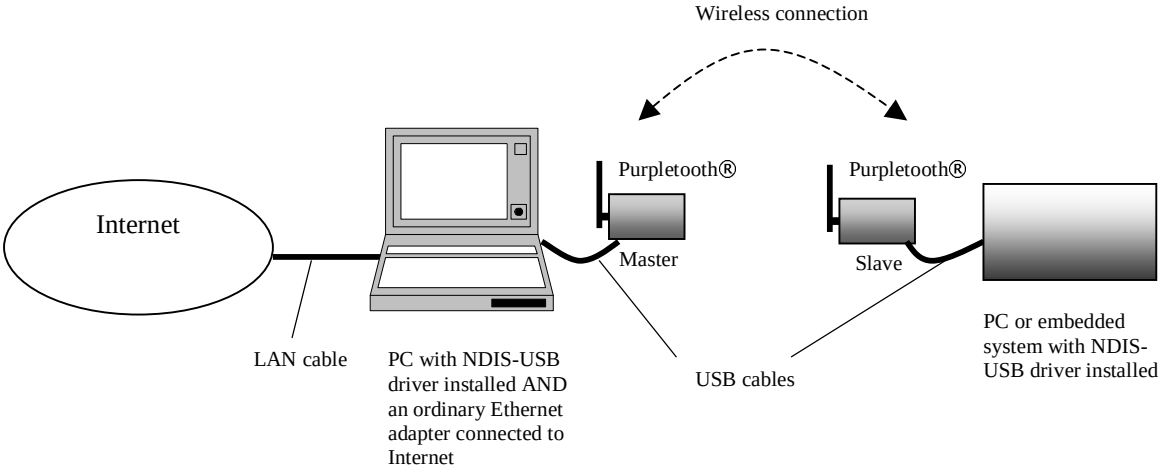


Figure 4. A PC or an embedded system can access the Internet via a pair of Purpletooth® modems and another PC with NDIS-USB driver installed.

In the recent release, the Windows® 2000 and Windows® XP versions of NDIS-USB driver are provided. Please refer to "*Purpletooth® Family USB Driver Installation Guide*" for the installation and usage details.

A. Technical Specifications

	PT-209G/219G
RF Frequency	2.400 to 2.4835 GHz, carrier at 2.4476 GHz
Spread Spectrum	Direct Sequence (DSSS)
Processing Gain	11.4 – 17.4 dB
Antenna	Dipole antenna (RO-IK-0504 from Radiall), 50 ohm load / *Magnet mount antenna (TQC-2400AIP from Kenbotong Communication Ltd.) / *Omni-directional antenna (HTQ-2.4-10 from Xian Haitian Antenna Tech. Co., Ltd.)
Operating Range	Up to 5 km (15 km for HTQ-2.4-10 antenna) in line-of-sight
Maximum E.I.R.P.	100 mW (20 dBm)
Receiver Sensitivity	-96 dBm at 10^{-6} BER
RF Channel Bandwidth	32 MHz (Null-to-null)
Communication Method	Time division duplex (TDD)
Network Protocol	Purpletooth® Adaptive Intelli-Polling
Error Control	CRC and ARQ
Baseband Modulation	BPSK and QPSK
Channel Data Rate	256 Kbps, 512 Kbps, Up to 1 Mbps
I/O Interface	RS232, USB# and RJ-45 ports
Supply Voltage	12 V
Maximum Current Consumption	535 mA at 7.4 V during transmission 310 mA at 7.4 V during reception 85 mA at 7.4 V during sleep
Battery	Rechargeable, 7.2V/1550mAh
Operating Temperature	-20 ^{o}C to 70 ^{o}C, (-4 ^{o}F to 158 ^{o}F)
Humidity	20 % to 90 % non-condensing
Dimensions (L × W × H)	157 × 76 × 45 mm (without antenna)
Weight	512 g

*TQC-2400AIP and HTQ-2.4-10 are optional for US shipment only.
USB port cannot be used in hazardous environment under UL/ATEX classifications.

B. Antenna Specifications

Model: RO-IK-0504

Electrical Item	Specifications	Remarks
Type of antenna	Dipole antenna	
Frequency range	2.40 ~ 2.48 GHz	
Electrical length	1 / 2 λ	
Nominal impedance	50 Ohm	
Polarization	Vertical	
V.S.W.R	Less than 2.0	
Peak gain	1.5 dBi	
Mechanical Item	**Specifications**	**Remarks**
Element	RG-316 cable	
Sleeve	Urethane	Black
Base	Nylon 66	Black
Connector	SMA male	Ni plate
Antenna total length	168 ± 3 mm	

Model: TQC-2400AIP

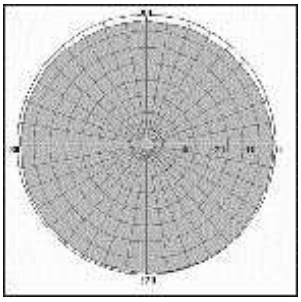
Electrical Item	Specifications
Type of antenna	Magnet mount antenna
Frequency range	2.400 ~ 2.483 GHz
Nominal impedance	50 Ohm
Polarization	Vertical
V.S.W.R.	Less than 1.5
Gain	7 dBi
Mechanical Item	**Specifications**
Length	300 mm
Mount	90 mm diameter magnet
Cable	300 mm
Connector	SMA male

* Manufacturer: Kenbotong Communication Ltd.

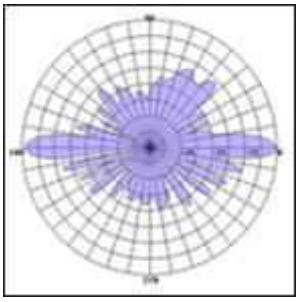
Model: HTQ-2.4-10

Electrical Item	Specifications
Type of antenna	Omni-directional antenna
Frequency range	2.400 ~ 2.500 GHz
Nominal impedance	50 Ohm
Polarization	Vertical
V.S.W.R	Less than 1.4
Gain	10 dBi
Mechanical Item	**Specifications**
Length	824 mm
Diameter	ϕ20 mm
Cable	500 mm
Connector	SMA male

Antenna radiation pattern diagrams:



Horizontal direction



Vertical direction

* Manufacturer: Xian Haitian Antenna Technologies Co., Ltd.