USR-MB706 User Manual

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1. Introduction

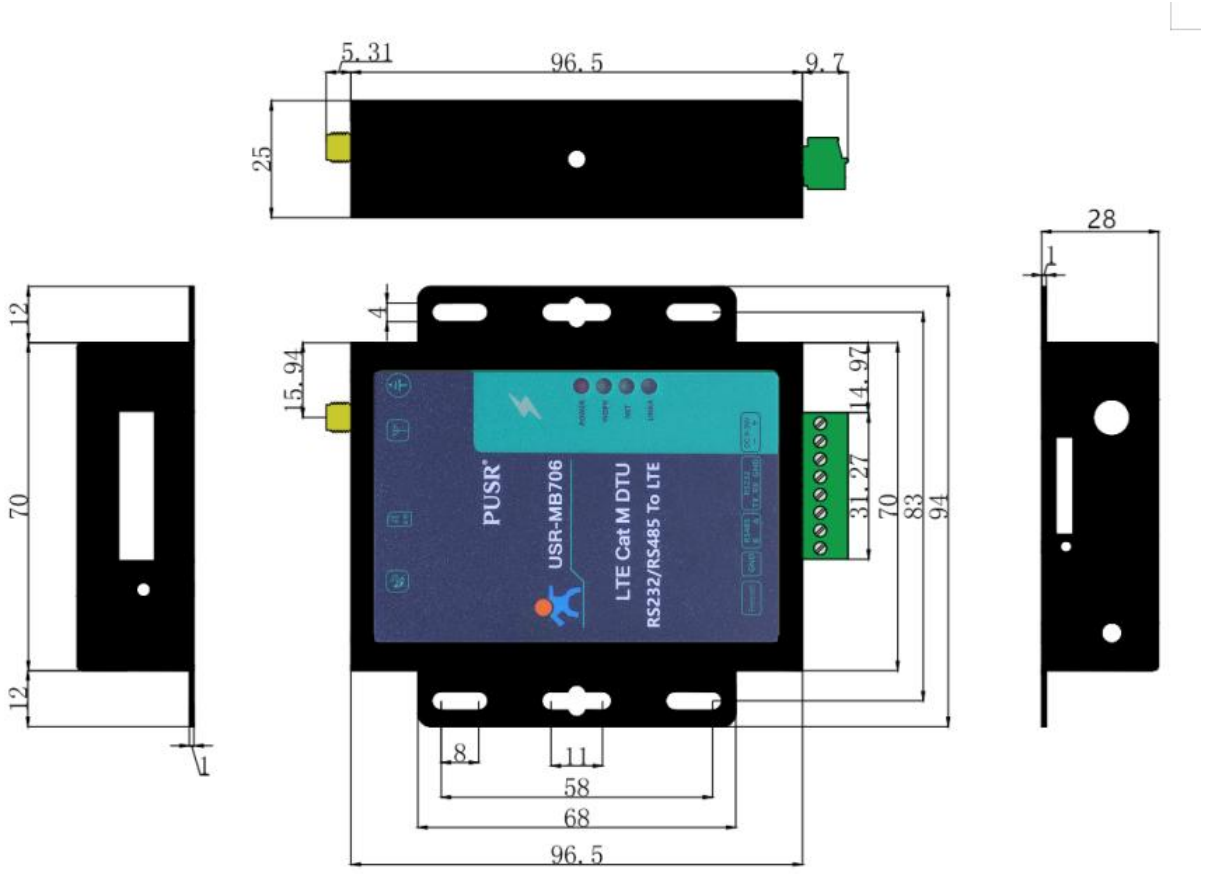
1.1. Overview

USR-MB706 is a LTE Cat M serial modem which supports GNSS. It supports LTE Cat M1, LTE Cat NB2, and EDGE/GPRS compatible, covers global frequency bands. It has perfect software function, supports transparent transmission, HTTPD Client, SMS mode and AT command configuration. Also, it is simple to configure, has high reliability and built-in hardware watchdog, supports FOTA upgrading. USR-MB706 adopts terminal interface design, RS232/RS485 interface easy to connect to serial port sensors, PLC, IPC, and controller, meets the needs of different application scenarios such as meter reading, security monitoring, vehicle positioning, alarms, asset tracking, etc.

Please open our official website for more information:

https://www.pusr.com/products/RS232/RS485-serial-to-LTE-cat-M-modem-MB706.html

1.2. Dimensions

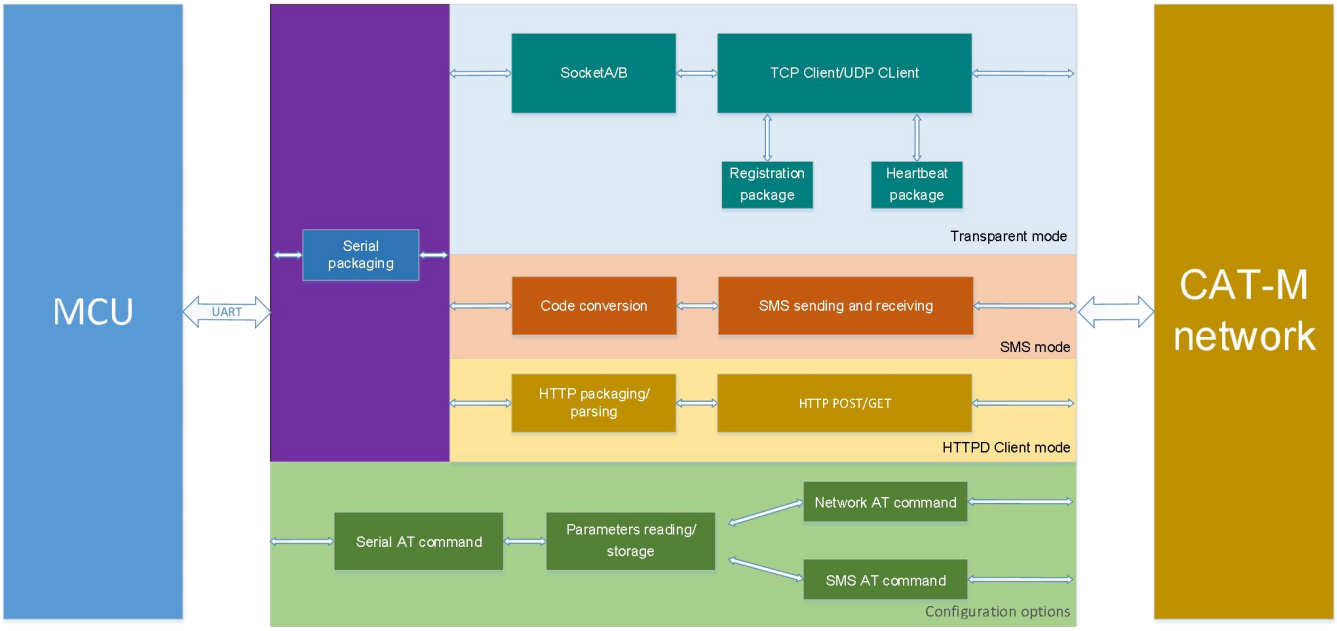


1.3. Specification

Parameters		Description
Basic Parameters	Standard	Cat.M1/Cat.NB2/EGPRS
	Power Supply	DC 9V~36V
	Consumption	Average: 30.99mA-43.05mA, maximum: 175.08mA (12V)
	Indicators	POWER: Indicates power status, always on after power supply.
		WORK: Indicates operation status, flashes every 1s in normal operation, flashes every 500ms in positioning.
		NET: Indicates network connection status, always on after connecting to the network.
		LINKA: Indicates socket A connection status, always on after connecting successfully.
	SIM/USIM	1.8V, 2FF
	UART Interface	RS232/RS485, baud rate 2400~230400 (bps)
	Antenna Interface	SMA female interface
Appearance	Dimensions (mm)	105*94*28(L*W*H)
	Weight (g)	<110g
Temperature	Operation Temperature	-35℃~ +75℃
	Storage Temperature	-40℃~ +85℃
Humidity	Operation Humidity	5%~95% (non-condensing)
Transmission Speed	Cat.M1	588Kbps DL/1119Kbps UL (half-duplex)
	Cat.NB2	127Kbps DL/158.5Kbps UL
	EDGE	296Kbps DL/236.8Kbps UL
	GPRS	107Kbps DL/85.6Kbps
Frequency Bands	Cat.M1	B1/2/3/4/5/8/12/13/18/19/20/25/26/27/28/66/85
	Cat.NB2	B1/2/3/4/5/8/12/13/18/20/25/28/66/71/85
	GSM/EDGE	850/900/1800/1900 MHz
TX Power	Cat.M1	B1/2/3/4/5/8/12/13/18/19/20/25/26/27/28/66/85：21dBm+1.7/-3 dB
	Cat.NB2	B1/2/3/4/5/8/12/13/18/20/25/28/66/71/85：21dBm+1.7/-3 dB
	GSM850/EGSM900	33dBm±2dB
	DCS1800/PCS1900	30dBm±2dB
Rx Sensitivity	Cat.M1	B1/2/3/4/5/8/12/13/18/19/20/25/26/27/28/66/85：-106dBm
	Cat.NB2	B1/2/3/4/5/8/12/13/18/20/25/28/66/71/85：-114dBm
	GSM850/EGSM900	-107dBm
	DCS1800/PCS1900	-107dBm
Software	Operation Mode	Transparent mode, HTTPD Client mode, SMS mode
	Configuration Command	AT+Command
	Network Protocol	TCP/UDP/DNS/FTP/HTTP/IPV4/IPV6
	Number of Sockets	2

	User Configuration	Serial AT commands, network AT commands, SMS AT commands
	Heartbeat Package	Support user-defined heartbeat
	Identity Package	Supports user-defined identity package/ICCID/IMEI
	FOTA Upgrading	Support
	GNSS	Support
	Base Station Geolocation	Support
	FTP Upgrading	Support
	Modbus RTU to TCP	Support

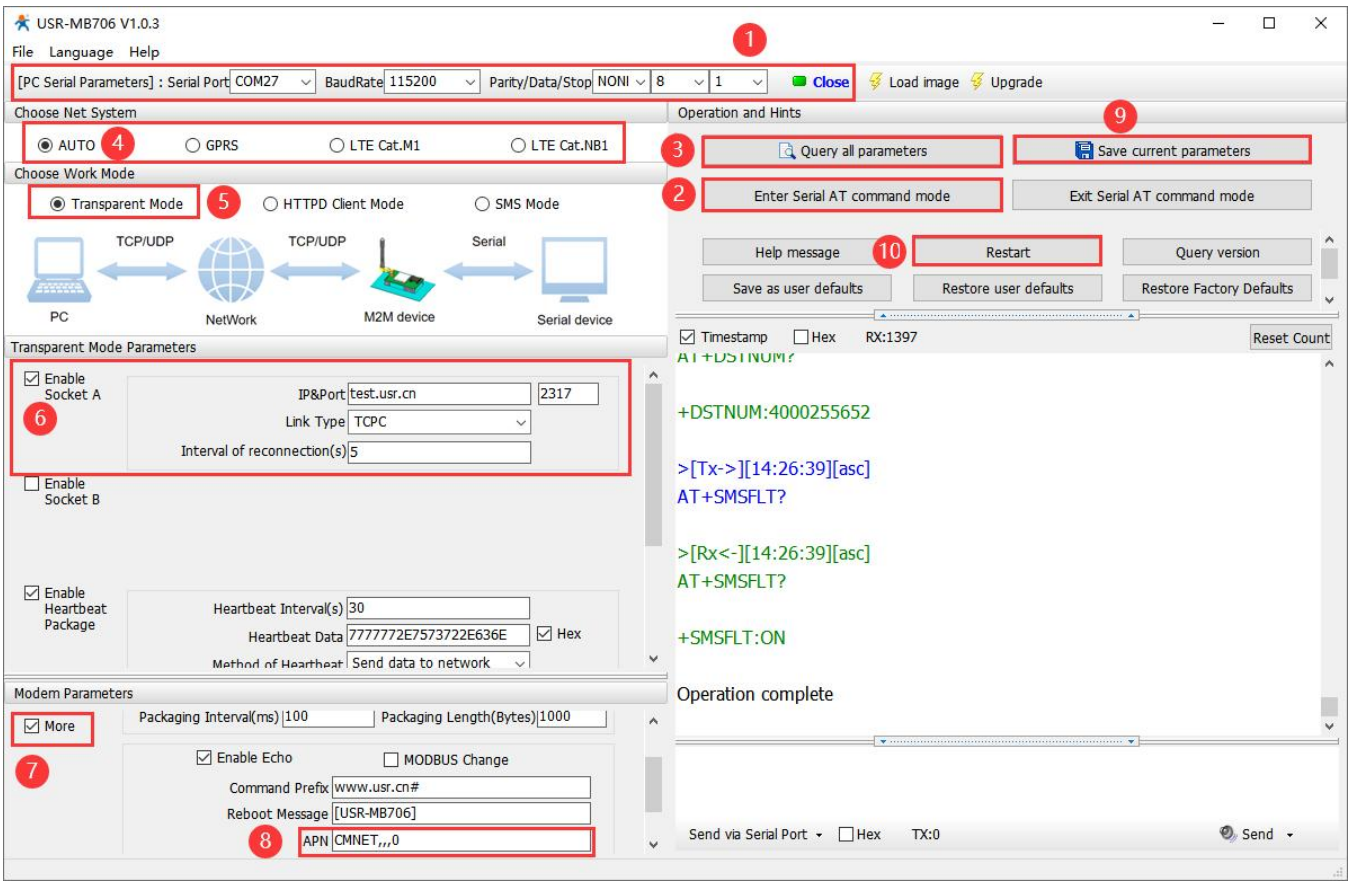
2. Features



2.1. Network Mode

MB706 support CAT M1, cat NB2, EGPRS three network modes. After configuring the network modes, users do not need to care about the connection status between the device and base station, just need simple configuration to connect it to the network.

Configure via Setup software:



Configure via AT commands:

	Commands	Description
1	+++a	Enter AT command mode
2	AT+NWSCMOD=0	Set the network status to “AUTO”
3	AT+WKMOD=NET	Set the work mode to “Transparent mode”
4	AT+SOCKAEN=ON	Enable Socket A
5	AT+SOCKA=TCPC,test.usr.cn,2317	Set socket A to TCP Client
6	AT+Z	Restart the device

Note:

NWSCMOD parameters:

0: Auto

1: GPRS

2: CAT M1 & CAT NB2

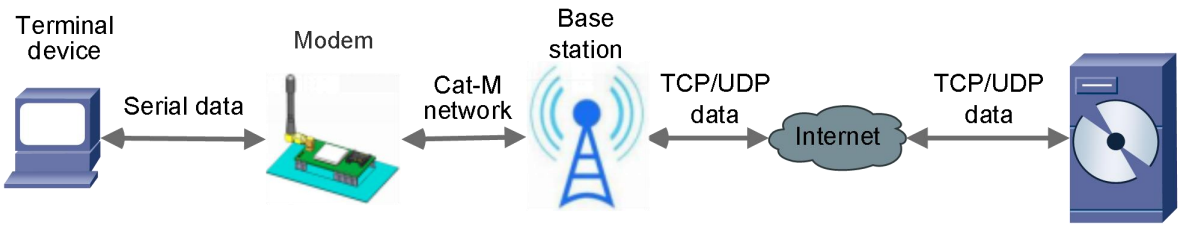
3: CAT M1

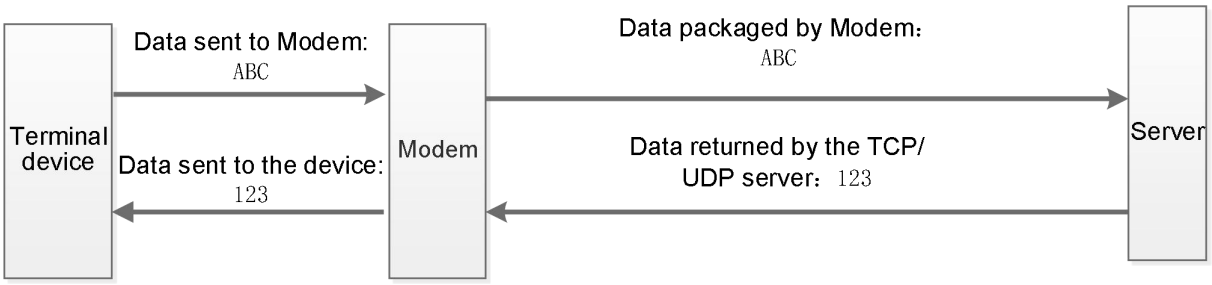
4: CAT NB2

2.2. Operation Mode

USR-MB706 has three working modes: Transparent mode, HTTPD Client mode, SMS mode.

2.2.1. Transparent Mode





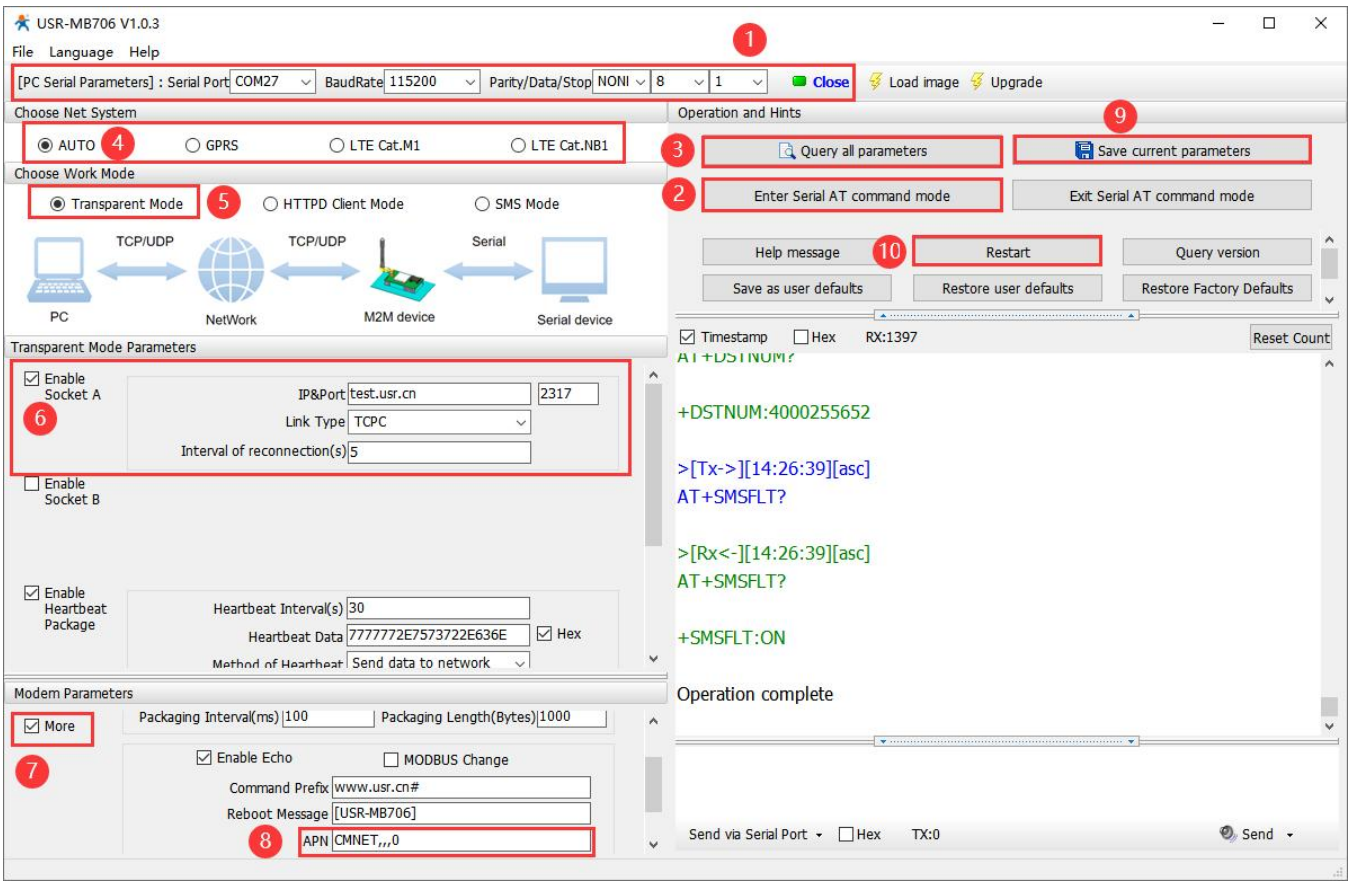
In this mode, user's serial device can directly send data to the specified network server through MB706. Module can also receive data from the server and directly forward to the serial device.

In this mode, users do not need to pay attention to the data conversion process between serial port and network data packets. They only need to set simple parameters to realize the transparent transmission of data between serial devices and network servers.

MB706 supports 2 socket connections, Socket A and Socket B, which are independent of each other. Only Socket A supports as TCP Client, TCP Server and UDP Client. Socket B supports TCP Client and UDP Client .

It supports up to 3 TCP Clients when works as a TCP Server. Because the conventional operator network can not be accessed through the external network, so for the Server function need to use a dedicated APN card .

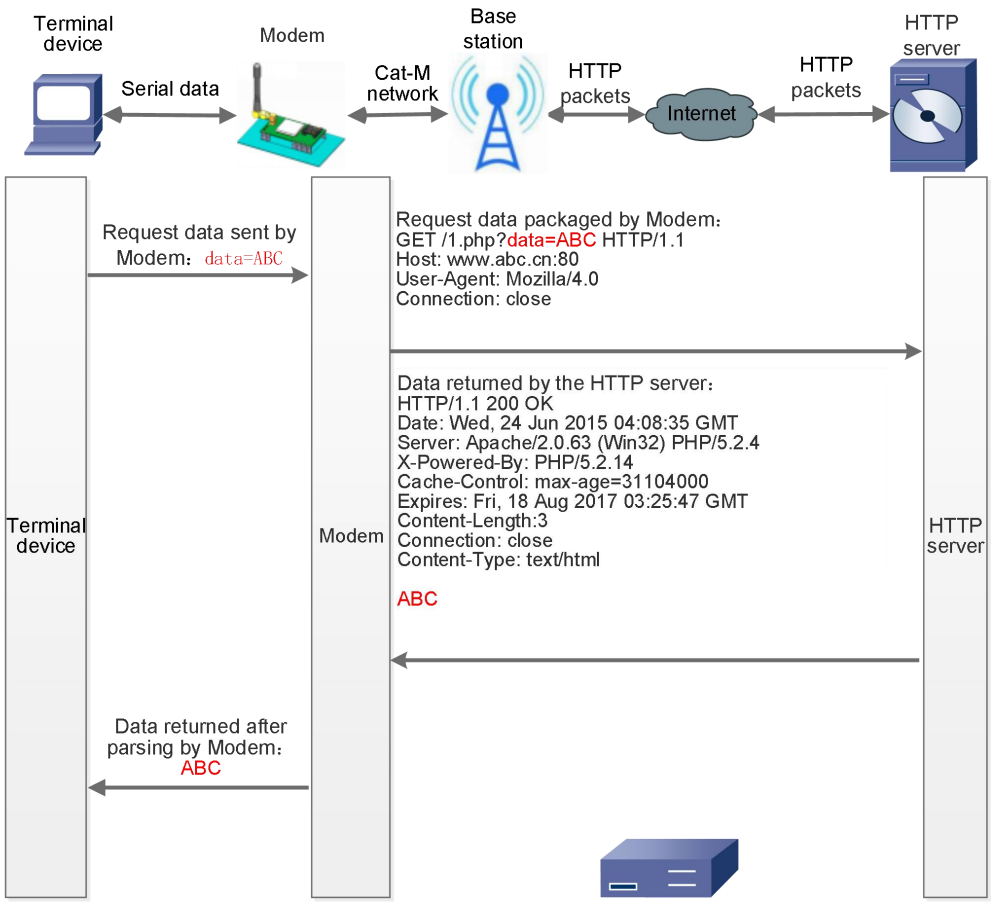
Configure via setup software:



Configure via AT commands:

	Command	Description
1	+++a	Enter serial AT command mode
2	AT+WKMOD=NET	Set to transparent mode
3	AT+SOCKAEN=ON	Enable socket A
4	AT+SOCKA=TCPC,test.usr.cn,2317	Set the remote IP and port of socket A
5	AT+Z	Restart the device

2.2.2. HTTPD Client mode

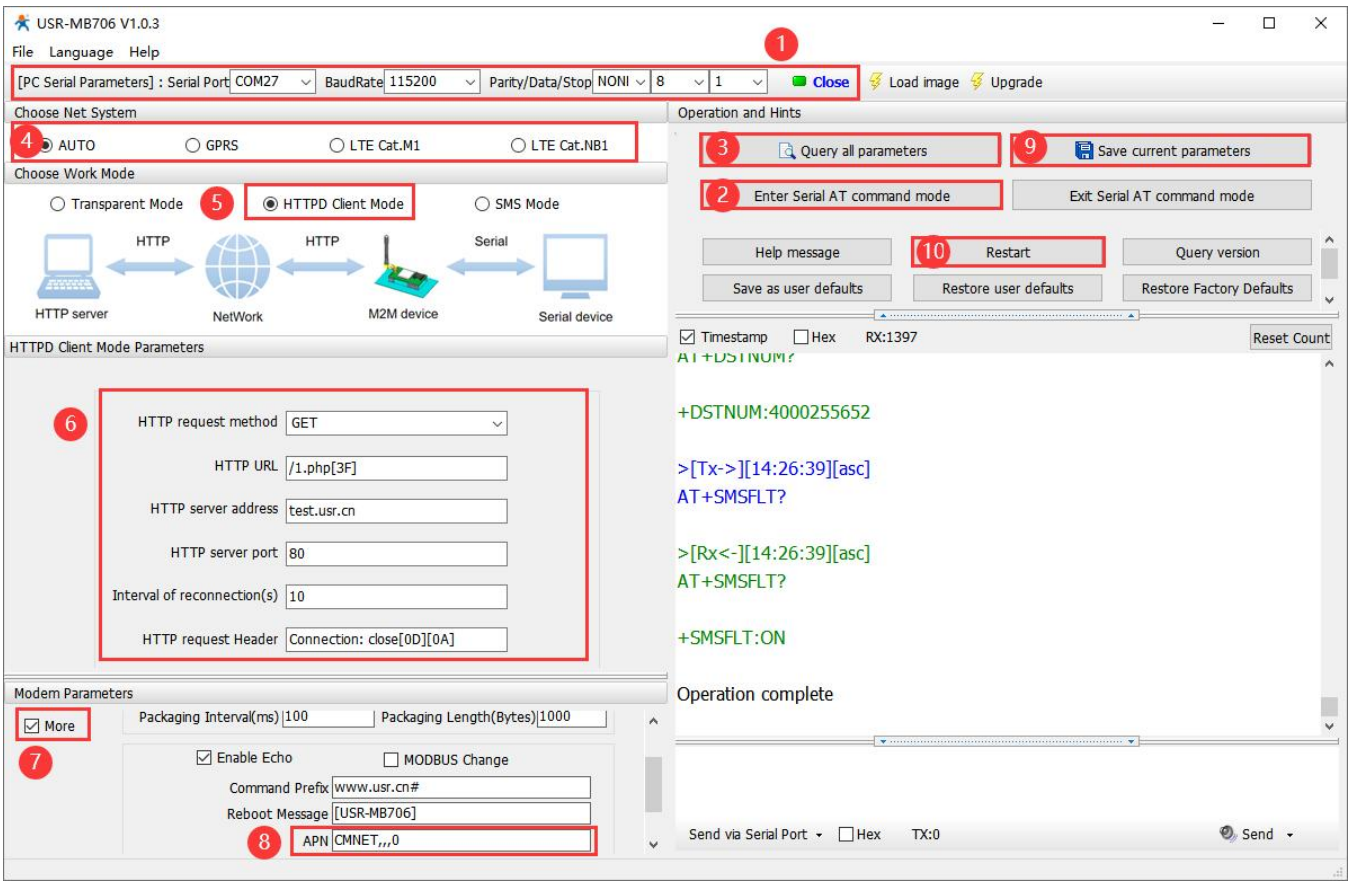


In this mode, user's terminal device can send request data to the specified HTTP server through this module, then the module receives data from HTTP server, parses and sends data to the serial device.

User does not need to pay attention to the data conversion process between the serial data and the network data packet, and can achieve the data request from the serial device to the HTTP server through simple parameter settings.

The module will filter out the received HTTP protocol header data by default, only output user data to the serial port. Customers can choose whether to filter HTTPD header data by AT command.

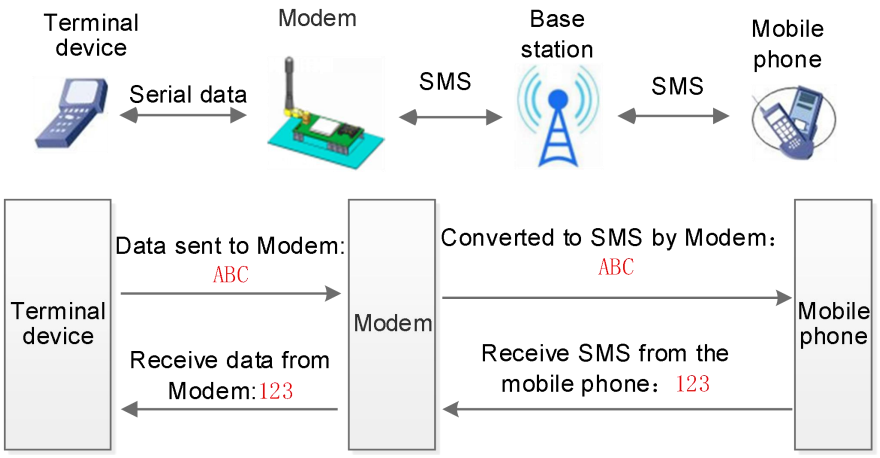
Configure via setup software:



Configure via AT commands:

	Commands	Description
1	+++a	Enter serial AT command mode
2	AT+WKMOD=HTTPD	Set the work mode to HTTPD Client
3	AT+HTPTP=GET	Set HTTP request method
4	AT+HTPURL=/1.php[3F]	Set HTTP request URL
5	AT+HTPSV=test.usr.cn,80	Set HTTP server address and port
6	AT+HTPHD=Connection: close[0D][0A]	Set HTTP request header
7	AT+HTPTO=10	Set HTTP request timeout
8	AT+HTPFLT=ON	Set whether to filter HTTP header
9	AT+Z	Restart the device

2.2.3. SMS Mode

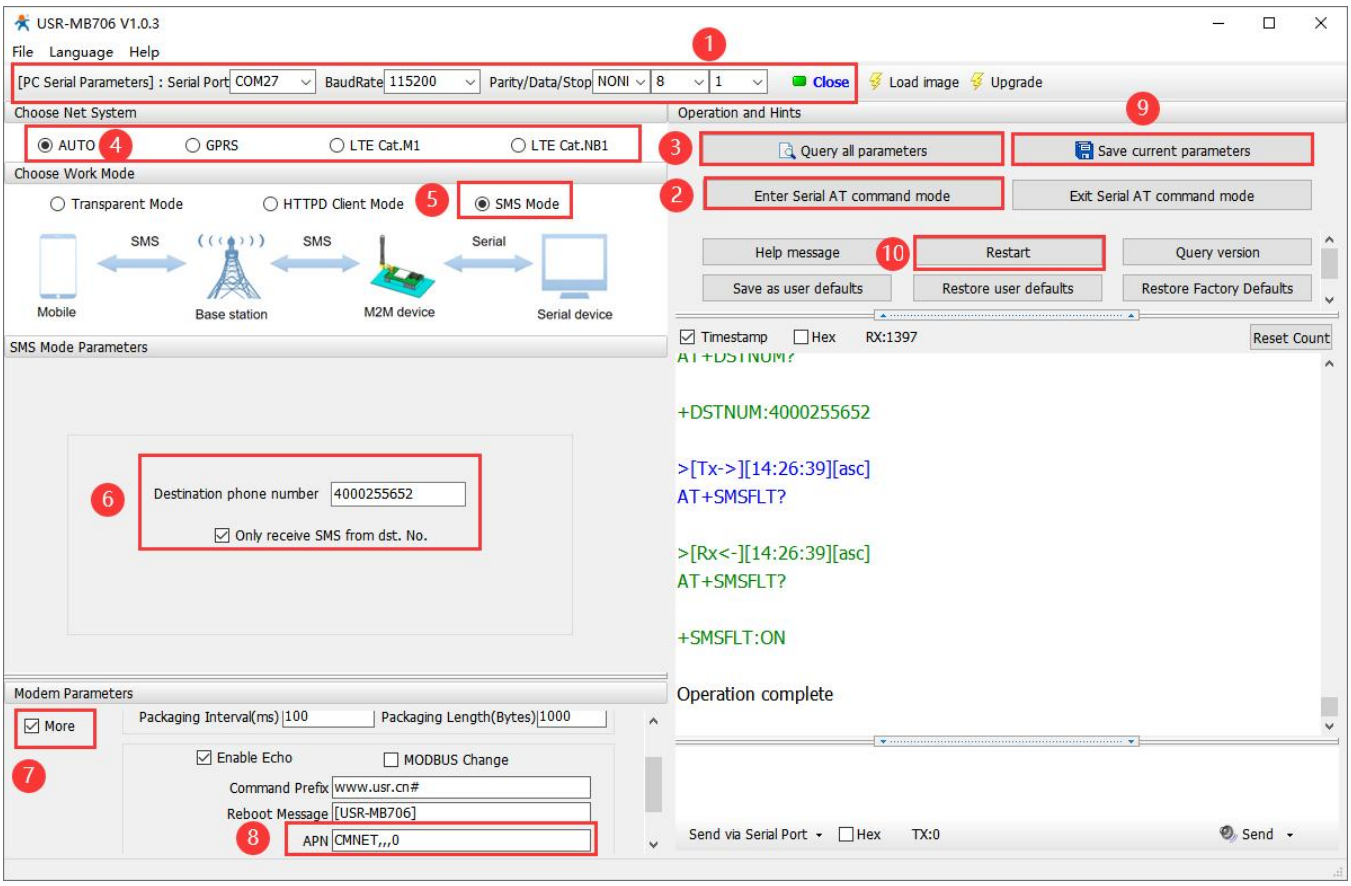


In this mode, user's serial device can send SMS to the specified mobile phone and receive SMS from any mobile phone. User can decide whether to transmit the data of the specified mobile phone to the serial device through settings.

Users do not need to pay attention to the data conversion process between serial port data and SMS. They only need to set simple parameters to realize transparent data communication between mobile phones and serial port devices.

If the user's serial device is placed in a remote place, MB706 can be used to check the running status of the device or control the running parameters by sending and receiving SMS.

Configure via setup software:



Configure via AT commands:

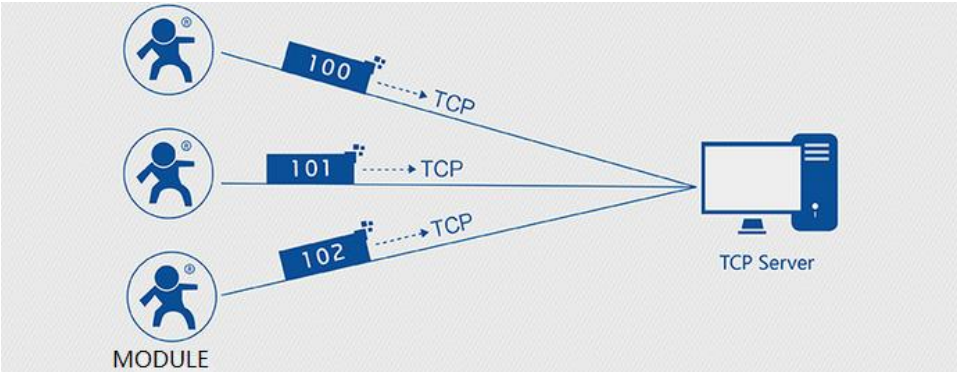
	Commands	Description
1	+++a	Enter serial AT command mode
2	AT+WKMOD=SMS	Set the work mode to SMS
3	AT+DSTNUM=10086	Set destination phone number
4	AT+SMSFLT=ON	Enable SMS filtering function
5	AT+Z	Restart the device

Note:

1. The destination phone number of SMS should be added with the international number.
2. When non-target mobile phone number filtering is enabled, the non-target mobile phone number can still query or set parameters.

2.3. General Function

2.3.1. Identity Package



In network transparent mode, user can set the device to send identity package to the server. Identity package is intended to allow the server to identify the data from which device or to use it as a password to obtain authorization for the server's functions. Identity package can be sent when the module establishes a connection with the server, or be added at the forefront of each data packet to form a data packet to be sent to the network. Identity package data can be ICCID code, IMEI code, CLOUD, or User-defined data.

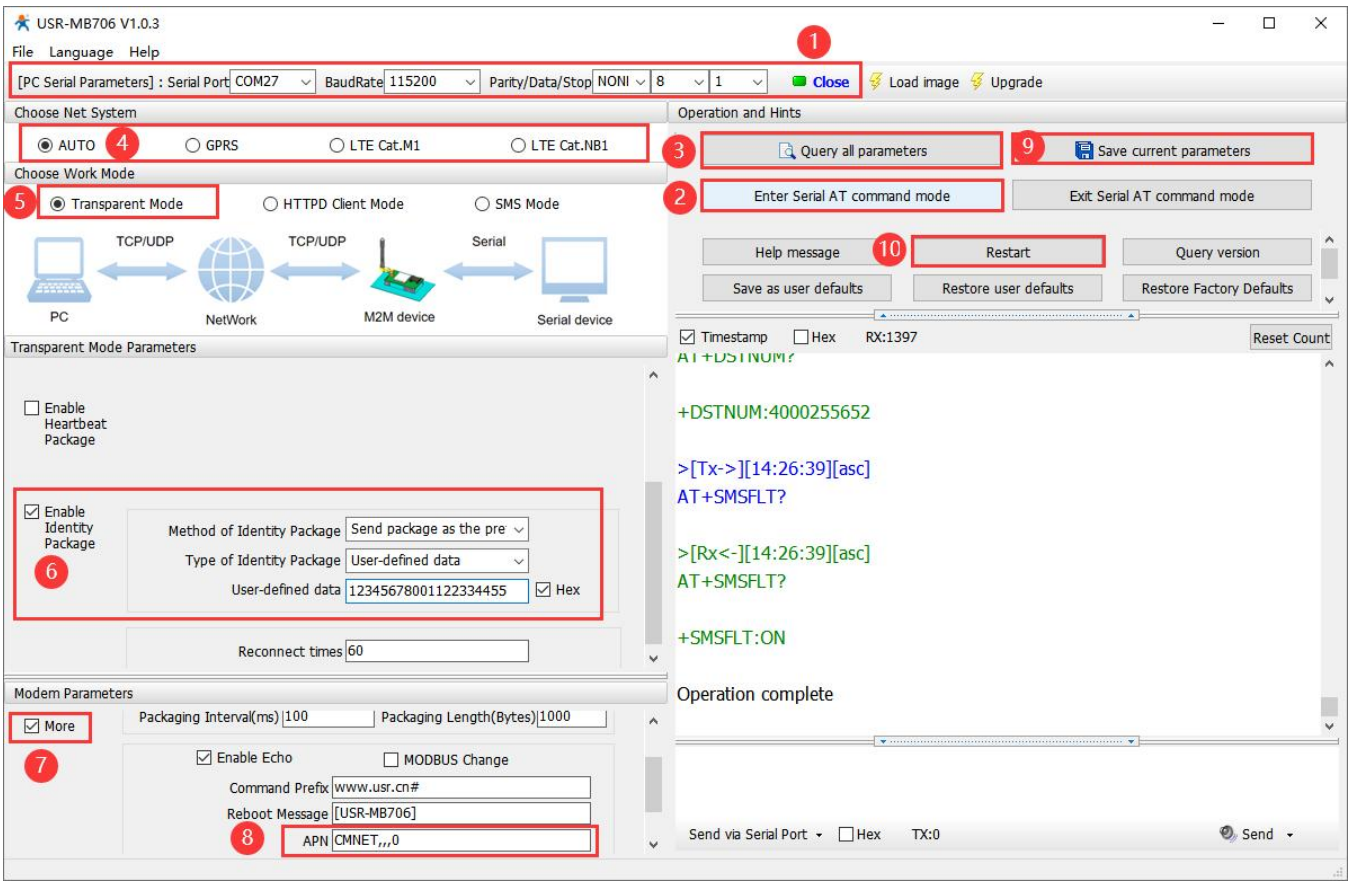
ICCID: Unique SIM identification code, for applications based on SIM card identification.

IMEI: Unique identification code of the Internet module, which is mainly used in device identification, has nothing to do with SIM card.

CLOUD: Cloud ID and password when connecting to PUSR Cloud.

USER: User-defined data.

Configure via setup software:



Configure via AT commands:

	Command	Description
1	+++a	Enter serial AT command mode
2	AT+WKMOD=NET	Set the work mode to “Transparent mode”
3	AT+REGEN=ON	Enable identity package function
4	AT+REGTP=USER	Set the identity package to user-defined data
5	AT+REGDT=7777772E7573722E636E	Set user-defined data, hexadecimal string
6	AT+REGSND=LINK	Set the type as the prefix of each data packet
7	AT+S	Save parameters and restart the device

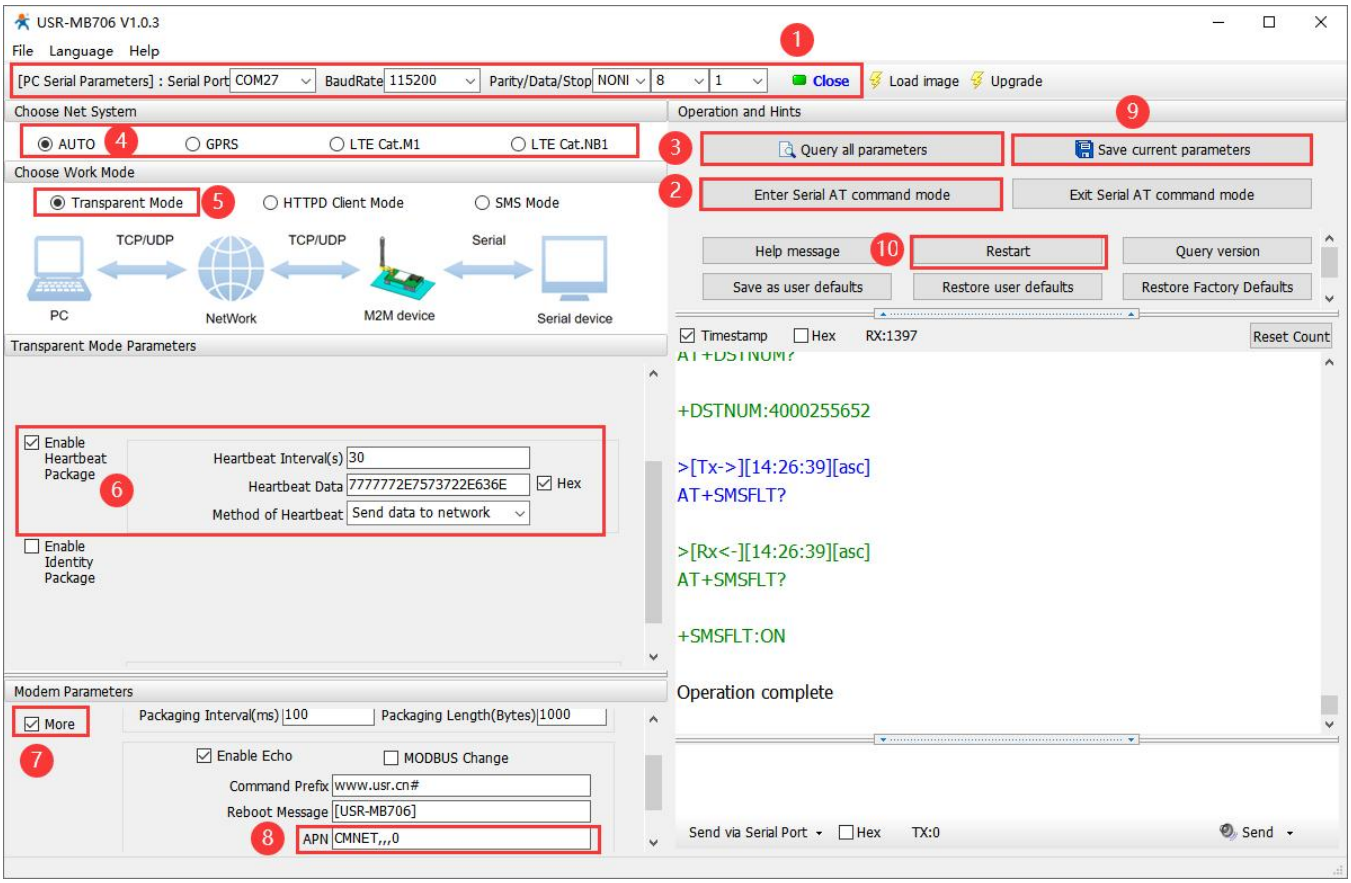
2.3.2. Heartbeat Package

In network transparent mode, user can send the heartbeat package from the module to meet specific requirements.

Heartbeat package can be sent to the network or serial port device. The main purpose of sending to the network is to keep the connection stable and reliable, to ensure the normal connection of the module, and at the same time, to let the server know the online status of the module.

In the application of fixed query commands sent by the server to the device, in order to reduce communication traffic, user can choose to send heartbeat package (query commands) to the serial device instead of sending query commands from the server, so as to save traffic and respond faster.

Configure via setup software:



Configure via serial AT commands:

	Commands	Description
1	+++a	Enter serial AT command mode
2	AT+WKMOD=NET	Set the work mode to “Transparent mode”
3	AT+HEARTEN=ON	Enable heartbeat package function
4	AT+HEARTSND=NET	Set the heartbeat method to network
5	AT+HEARTDT=7777772E7573722E636E	Set the heartbeat data, HEX format
6	AT+HEARTTM=30	Set the heartbeat sending interval to 30s
7	AT+S	Save the parameters and restart the device

2.3.3. Base Station Geolocation

USR-MB706 supports LBS base station geolocation function, and can obtain general location of the device through the operator's network. Base station geolocation information is obtained through AT command, which can be used flexibly with serial AT and SMS AT command.

Command	Function	Default parameter
AT+LBS	Query station positioning information	Empty

Note: This function does not obtain positioning information directly (E.g: latitude and longitude information), but base station location information. Users need to obtain direct positioning information through calculation on a third-party platform. Third-party location information services are generally require charges. User can go to the URL to convert the actual location to test:

http://www.minigps.net/cellsearch.html (This URL is for testing only and we cannot guarantee stability)

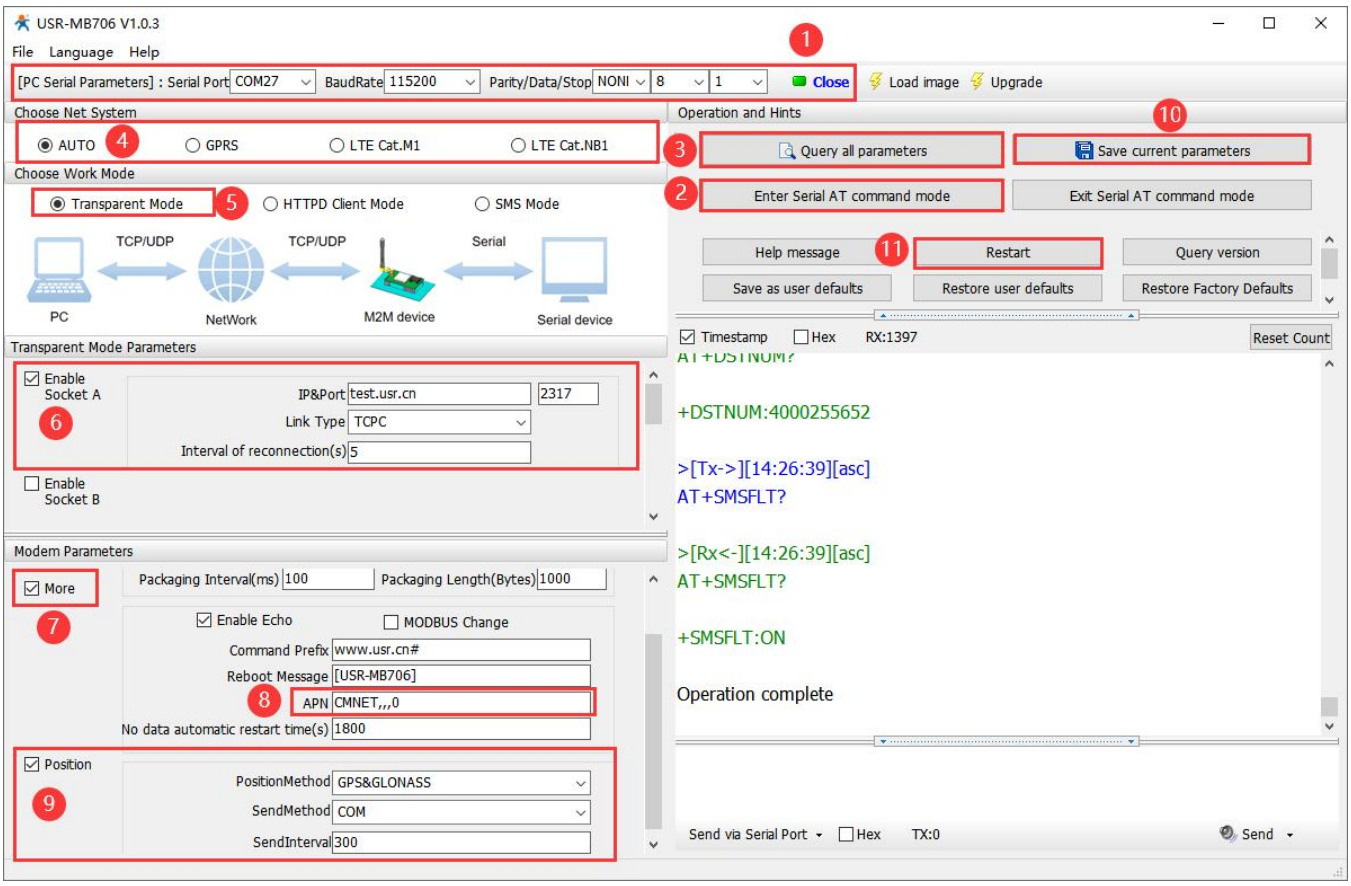
Query interface is shown below:

Click the query to get the converted location information:

2.3.4. GNSS

USR-MB706 supports multiple positioning modes, including GPS, beidou, glonass and galileo, the positioning data can be sent to the network server or serial port. Users can choose the positioning mode and the NMEA statement to be output.

Configuring via setup software:



Configure via serial AT commands:

	Commands	Description
1	+++a	Enter serial AT command mode
2	AT+WKMOD=NET	Set the work mode to “Transparent mode”
3	AT+GNSSEN=ON	Enable GNSS function
4	AT+GNSSENTH=1	Enable other positioning methods except GPS
5	AT+GNSSSND=COM,500	Set the sending methods and interval of the positioning data
6	AT+GSGPLOC=1	Set the output format of the positioning data
7	AT+S	Save all parameters and restart the device

In addition to the above settings, you need to configure network connections such as Socket A and Socket B. For details, please check section 4.1.1. After setting all parameters, save and restart the device. After MB706 connects to the network, it will send positioning data to the serial port every 500 seconds.

Except obtaining positioning data by periodic reporting, you can also query GPS data by using the GSGPLOC command.

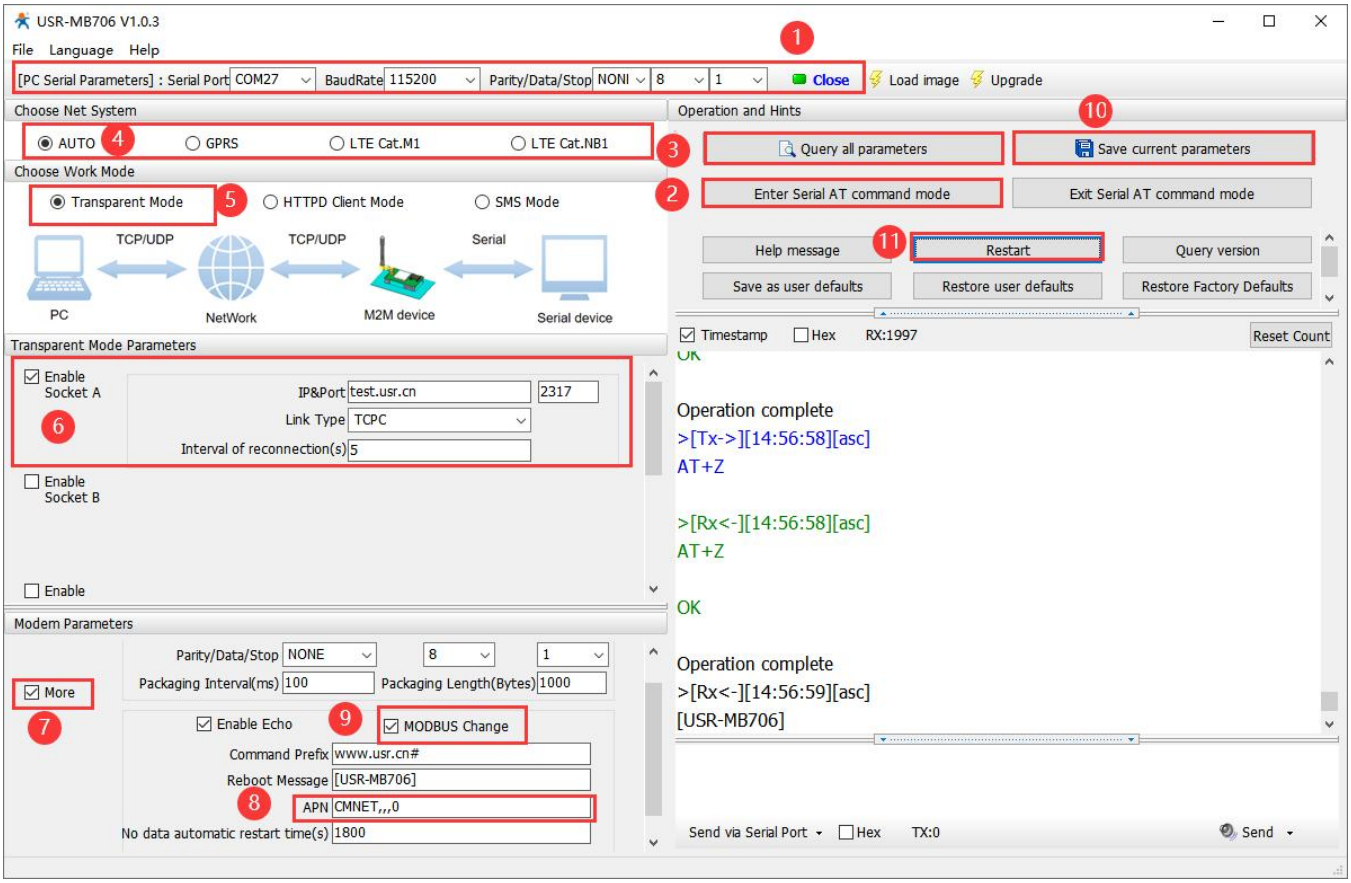
Note:

1. When there is data sent in positioning mode, positioning will be stopped and continued after data transmission is completed.
2. The longest continuous positioning time is 120s.

2.3.5. Modbus RTU to Modbus TCP

In transparent mode, if the serial device transmits data through Modbus RTU protocol and the server communicates through Modbus TCP protocol, users can enable Modbus function. After this function is enabled, USR-MB706 converts the Modbus TCP protocol data sent by the server to Modbus RTU data and sends it to the serial device, and converts the Modbus RTU protocol data sent by the serial device to Modbus TCP data and sends it to the server.

Configure via setup software:

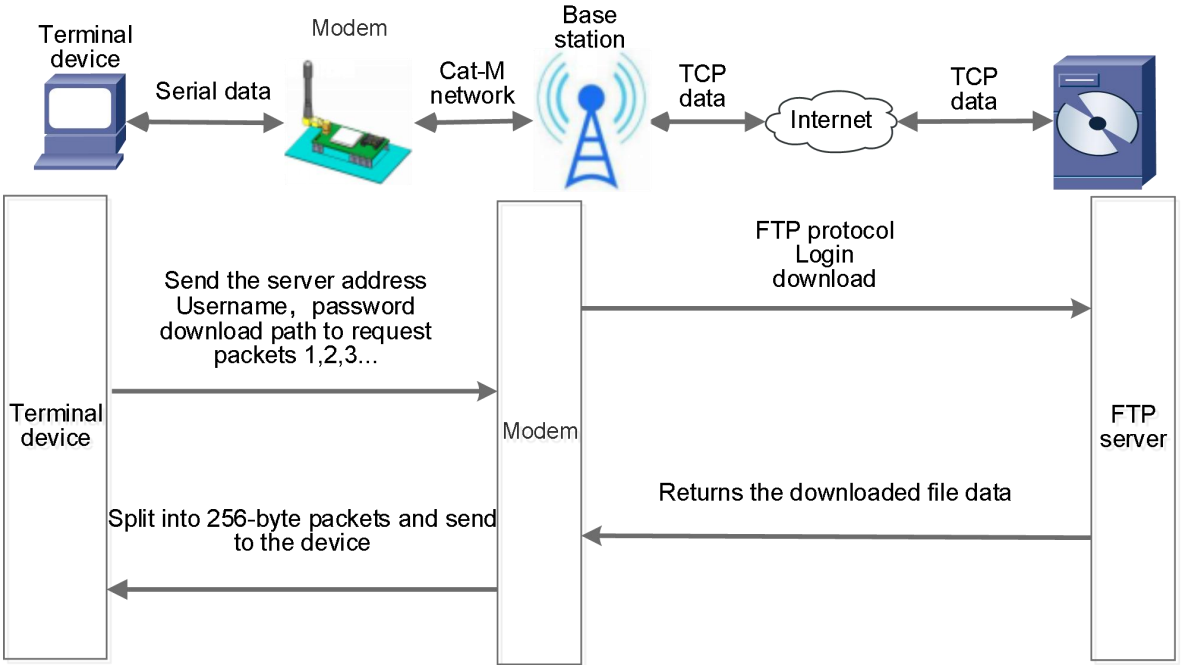


Configure via serial AT commands:

	Commands	Operation
1	+++a	Enter serial AT commands mode
2	AT+WKMOD=NET	Set to transparent mode
3	AT+SOCKAEN=ON	Enable socket A
4	AT+SOCKA=TCPC,test.usr.cn,2317	Set socket A to TCP Client
5	AT+MODBUSEN=ON	Enable Modbus RTU to Modbus TCP conversion
6	AT+S	Save parameters and restart the device

2.3.6. FTP Upgrading

MB706 supports FTP upgrade protocol, user's device can request files on FTP server by special protocol through serial port. The file of the server can be split into small packets with a maximum size of 256 bytes for transmission, which is convenient for customer device to upgrade or download large files remotely.
For details, please refer to "USR FTP Upgrade protocol".



2.3.7. Indicators

There are four LED indicators on MB706, including PWR, WORK, NET and LINKA. Indicator status is explained as follows:

Indicators	Function	Description
POWER	Power indicator	Always on after power supply.
WORK	System status.	Flashes every 1s in normal operation, flashes every 500ms in positioning.
NET	Network status.	Always on after registering to network.
LINKA	Socket A connection status	Always on after socket A establishing connection.

2.3.8. Hardware Reset

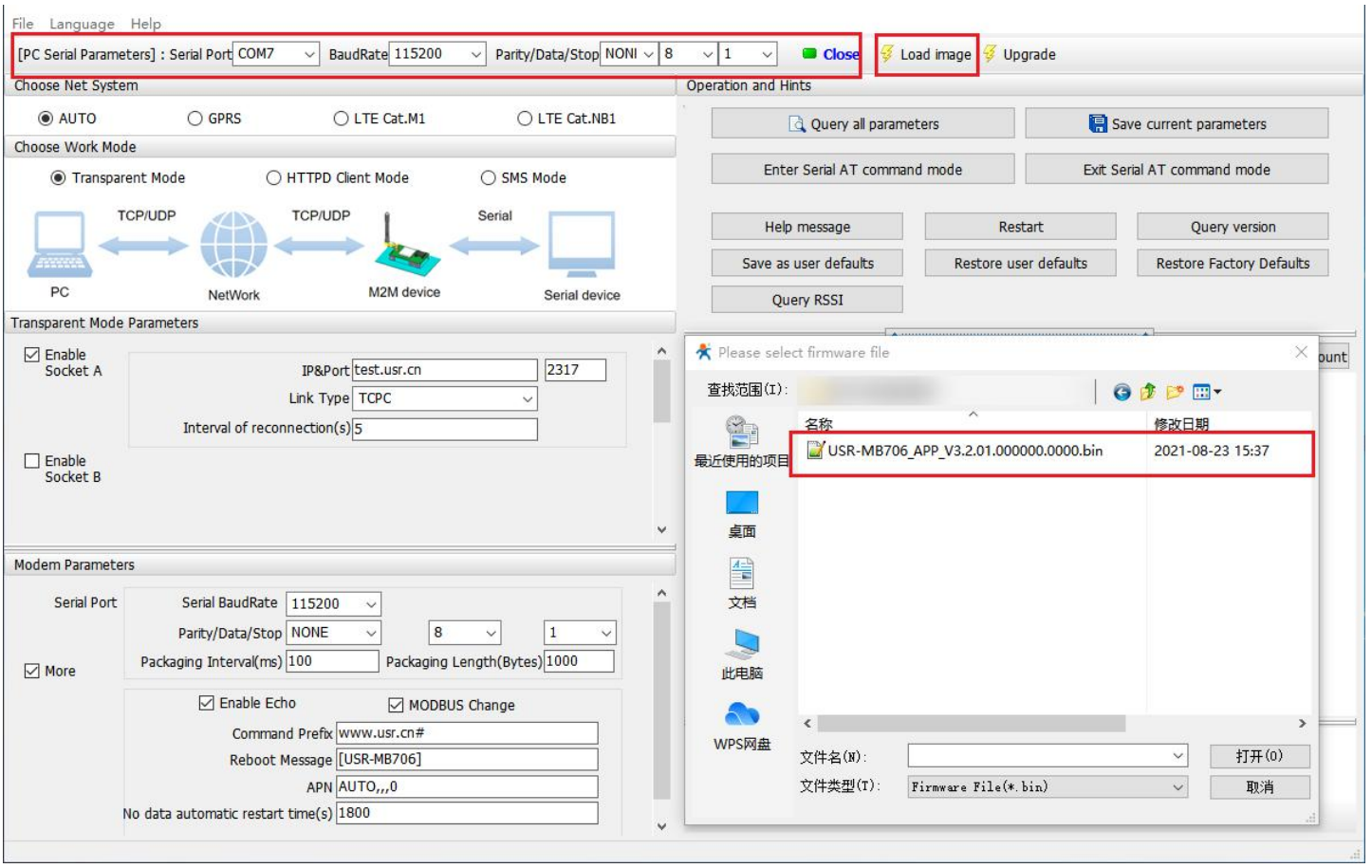
After power on the device, press and hold the “Reload” button for 3~15s and release it to restore to factory settings. Less than 3s or greater than 15 seconds is invalid.

2.3.9. Firmware Upgrading

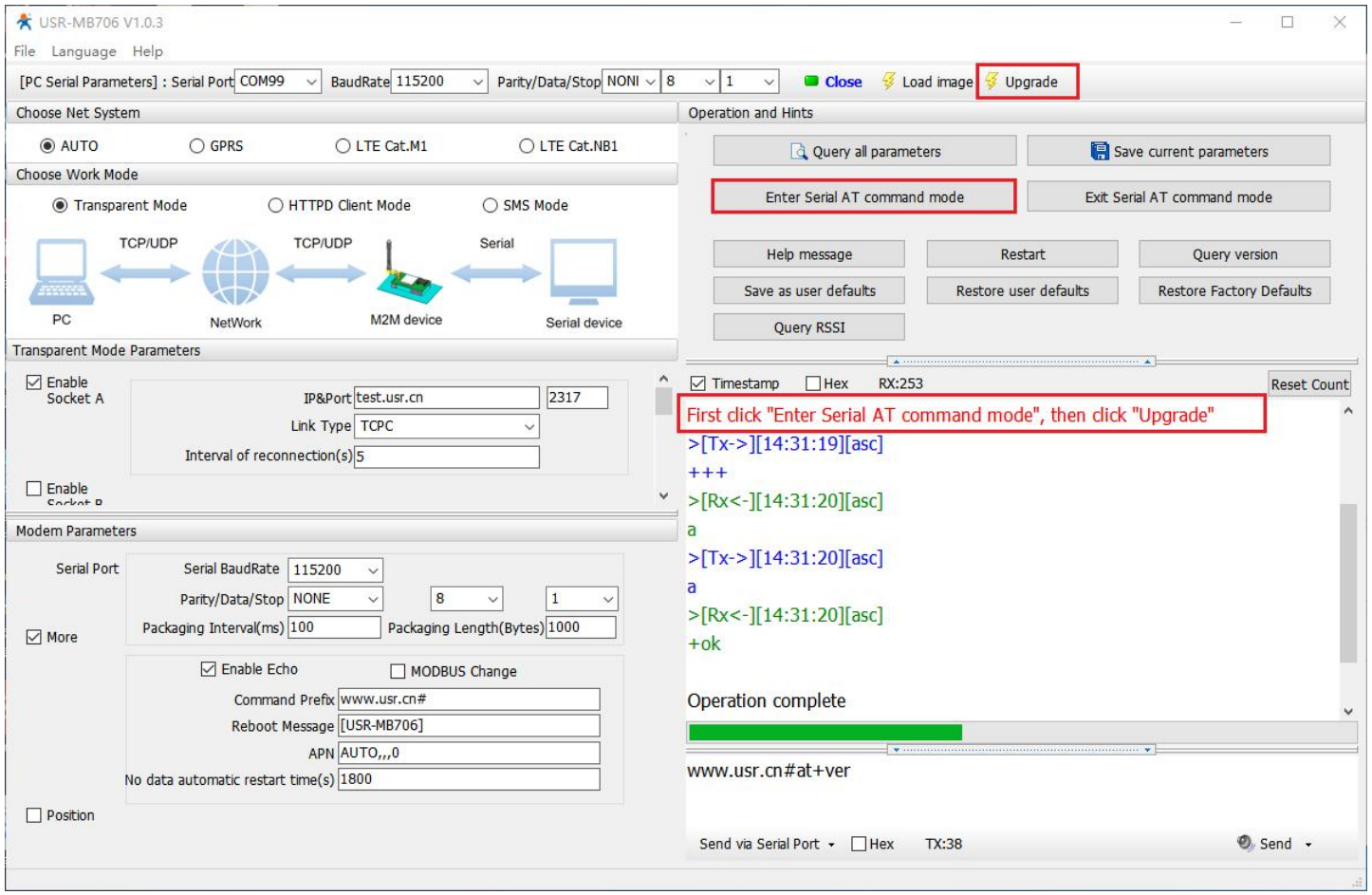
2.3.9.1. Serial Upgrading

USR-MB706 supports upgrading firmware via serial port.

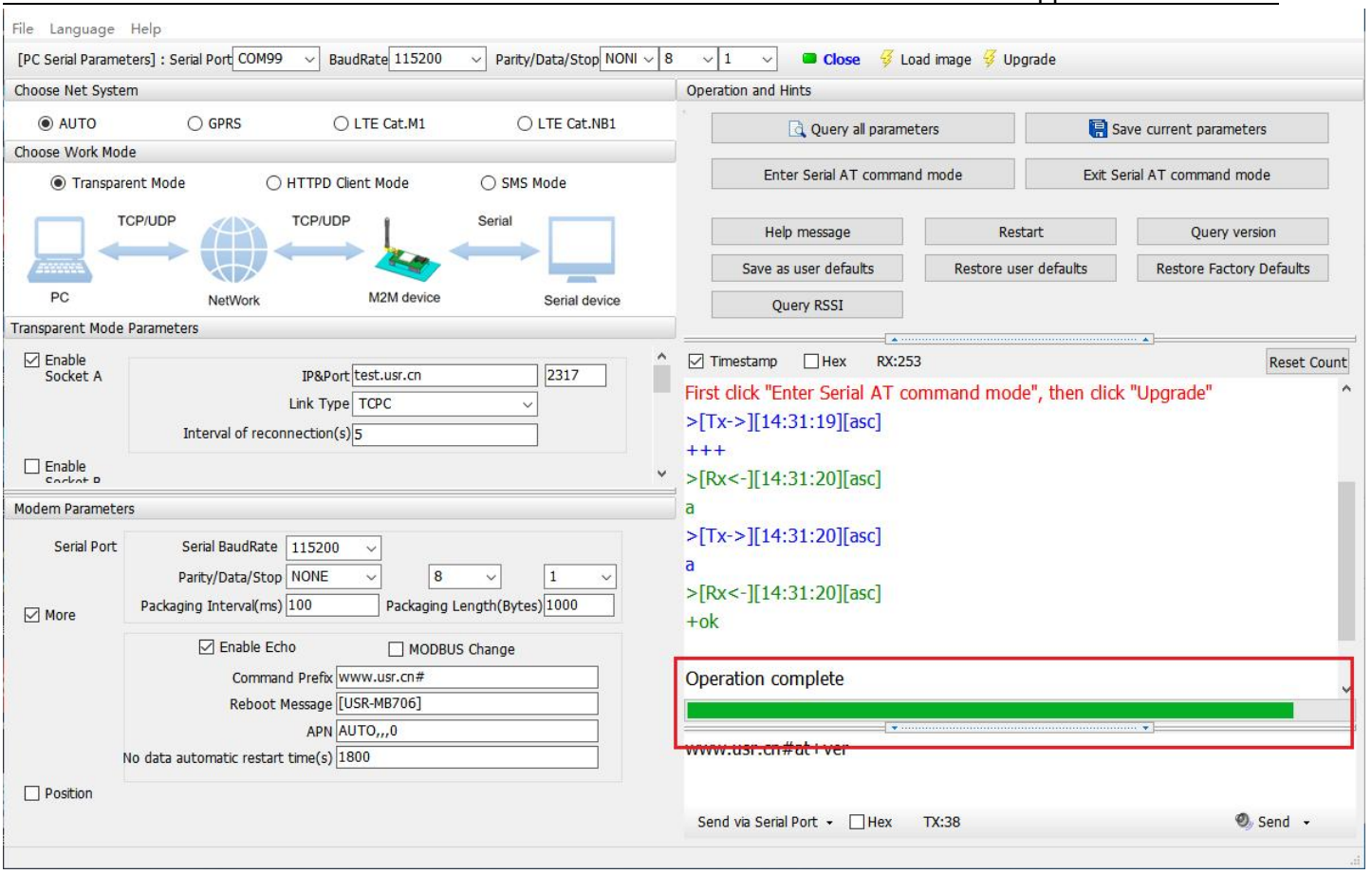
(1) Set the baud rate to 115200, data bit to 8, stop bit to 1, no parity. Open the serial port, click “Load Fw”, select the firmware to be upgraded.



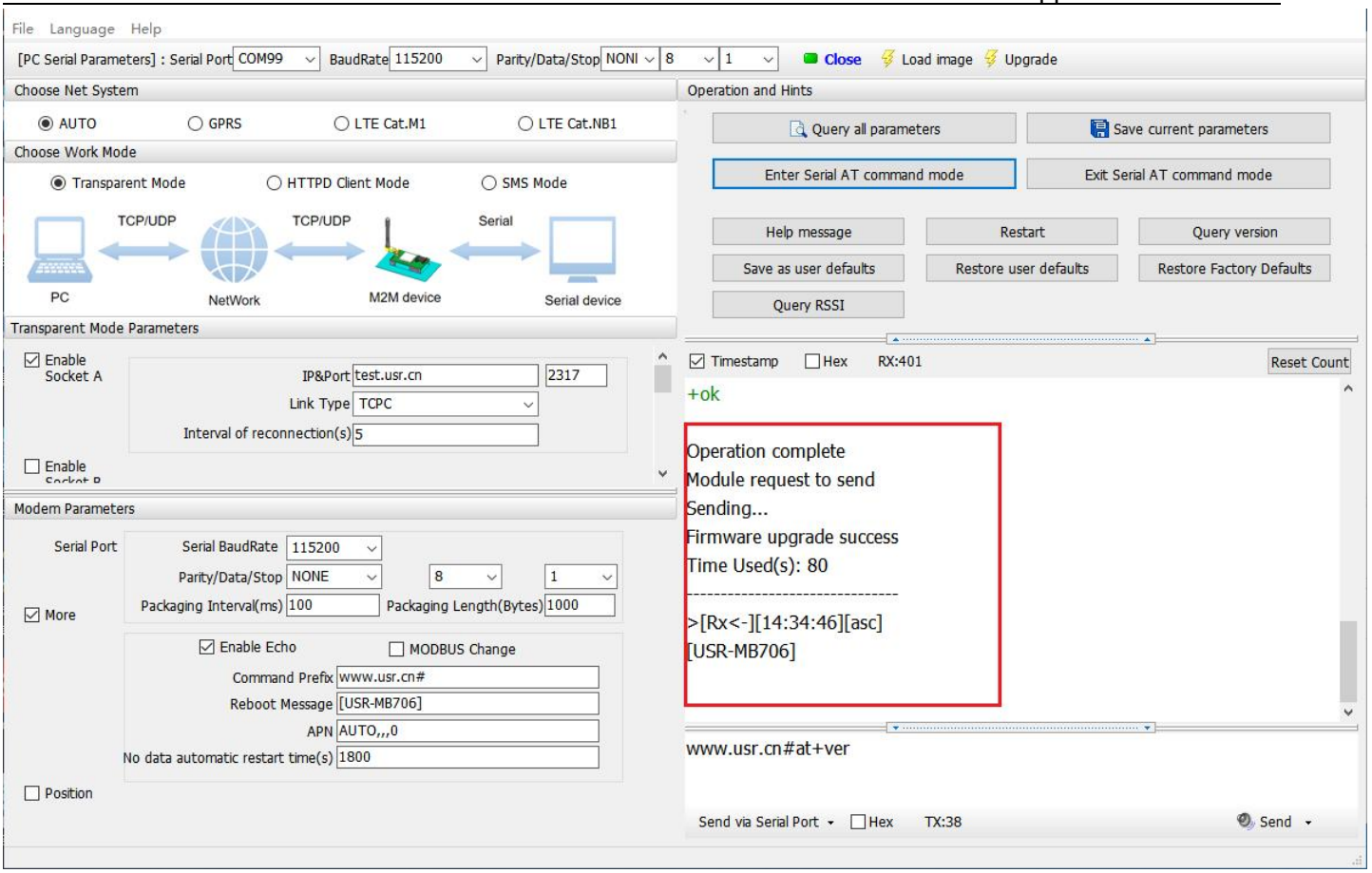
(2) Perform operations as prompted and wait for the upgrade.



(3) Firmware is downloading.



(4) Firmware update is completed and the device will restart.



2.3.9.2. Remote Upgrading

MB706 queries by polling request the server every 30 minutes by default to get whether there is an upgrade demand. If the upgrade is needed, the system will download the firmware data from the server, if not, the system will sleep and wait for the next poll.The polling time of Fota upgrade can be set via “AT+FOTATIME” with a range of 10~65535s. Set to 0 to close the upgrade request.

3. Serial Port

3.1. Basic Parameters

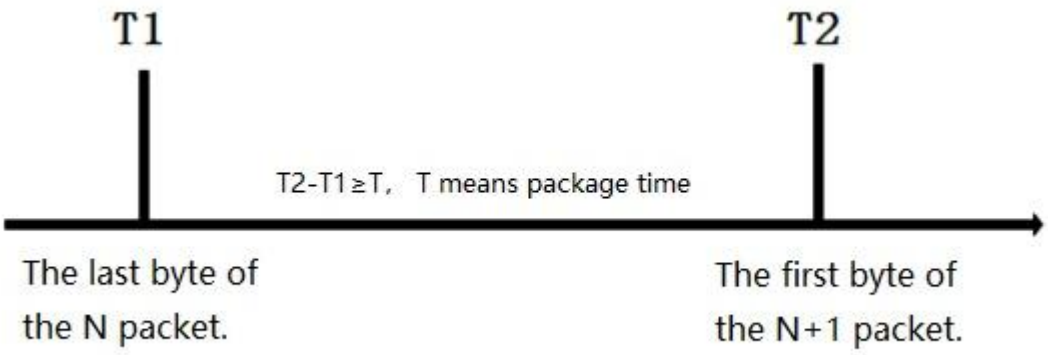
Item	Parameter
Baud rate	RS232: 2400,4800,9600,14400,19200,28800, 33600,38400,57600,115200,230400
	RS485: 2400,4800,9600,14400,19200,28800, 33600,38400,57600,115200,230400
Data bits	8
Stop bits	1,2

Parity bit	NONE EVEN ODD

3.2. Frame Mechanism

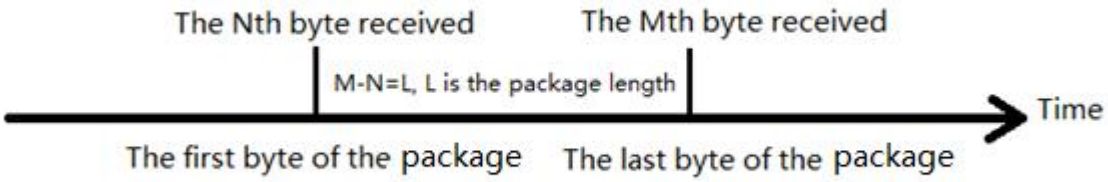
3.2.1. Time Trigger

When MB706 receives data from the UART, it continuously checks the interval of two adjacent bytes. If the interval time is greater or equal to a certain "time threshold", then a frame is considered finished, otherwise the data is received until greater or equal to the packet length byte set. This frame is sent to the network as a TCP or UDP packet. The "time threshold" here is the time between packages. The range of settable is 100ms~60000ms. Factory default: 100ms.
This parameter can be set by AT command, AT+UARTFT=<time>.



3.2.2. Length Trigger

When MB706 receives data from the UART, it constantly checks the number of bytes received. If the number of bytes received is equal to a certain "length threshold", a frame is considered to have ended, otherwise the packaging time is waiting for the end. This frame is sent to the network as a TCP or UDP packet. The "length threshold" here is the package length. The settable range is 100~1000. Factory default 1000.
(Note: when using “command password +AT command” function, the package length must be larger than the “command password +AT command”, otherwise AT command is invalid)
This parameter can be set by AT command, AT+UARTFL=<length>.



3.3. Network Data Output Port

We need to set the output serial port of the MB706 network data. Setting commands and parameters as follows:

Command	Descriptions
AT+CMDPT=RS232	Data sent from network is output on 232 serial port.
AT+CMDPT=RS485	Data sent from network is output on 485 serial port.
AT+CMDPT=RSALL	Data sent from network is output on 232 and 485 port.（Default）

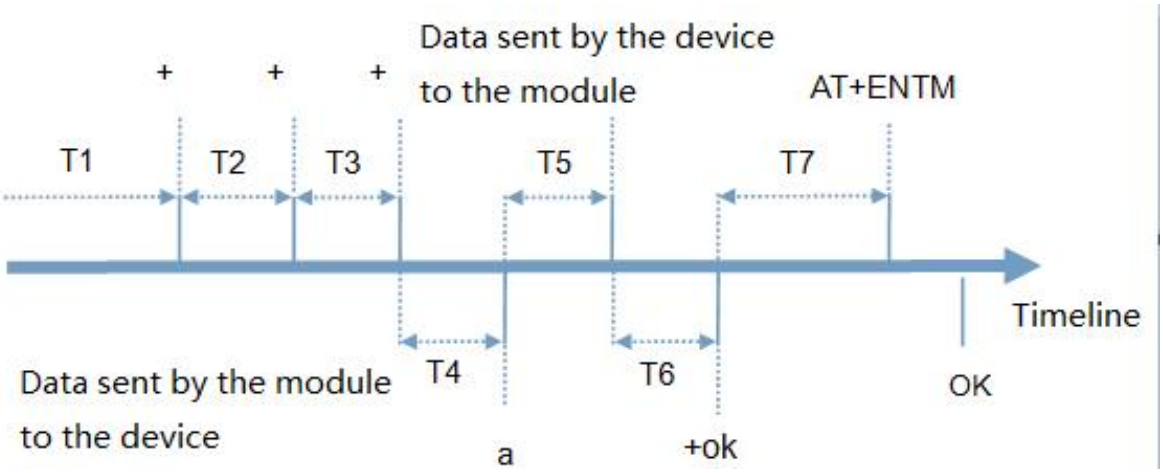
In order to ensure the data output efficiency, please select one serial port as the network data output port according to needs.

4. Parameter Settings

Users can configure MB706 via configuration utility, serial AT commands, network AT commands and SMS AT commands.
Configuration utility download address: **https://www.pusr.com/Support/download_hits.html?id=533**

4.1. Configuration via AT Commands

When the device works in transparent mode, HTTP mode or SMS mode, can switch to "AT command mode" by sending time-specific data by serial port. When the operation is completed in "AT command mode", send specific commands to return to the previous working mode.
For detailed AT commands, please refer to **LTE CAT M AT Commands Manual.**



Time sequence of switching from transparent mode to “AT Command mode” :

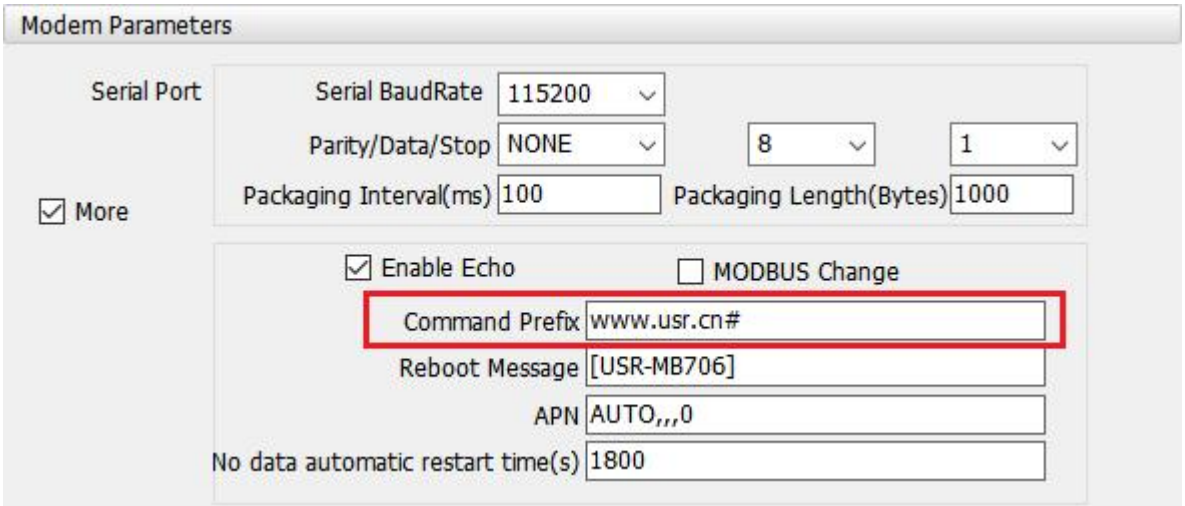
1. Serial device continuously sends "+++" to the device. After receiving "+++", the device will send an "a" to the serial device.
2. No data can be sent during a packaging cycle before sending "+++".
3. When the serial device receives “a”, a “a” must be sent to the device within 3 seconds.
4. After receiving 'a', the device returns "+ok" and enter “temporary command mode”.
5. After receiving "+ok", the device has enter "temporary command mode" and now can send AT command to it.

Time sequence of switching from AT command mode to transparent mode:

1. Serial device sends "AT+ENTM" to G786-G.
2. After receiving the command, sends "OK" to the serial device and returns to the previous working mode.
3. After the serial device receives "OK", it will return to previous working mode.

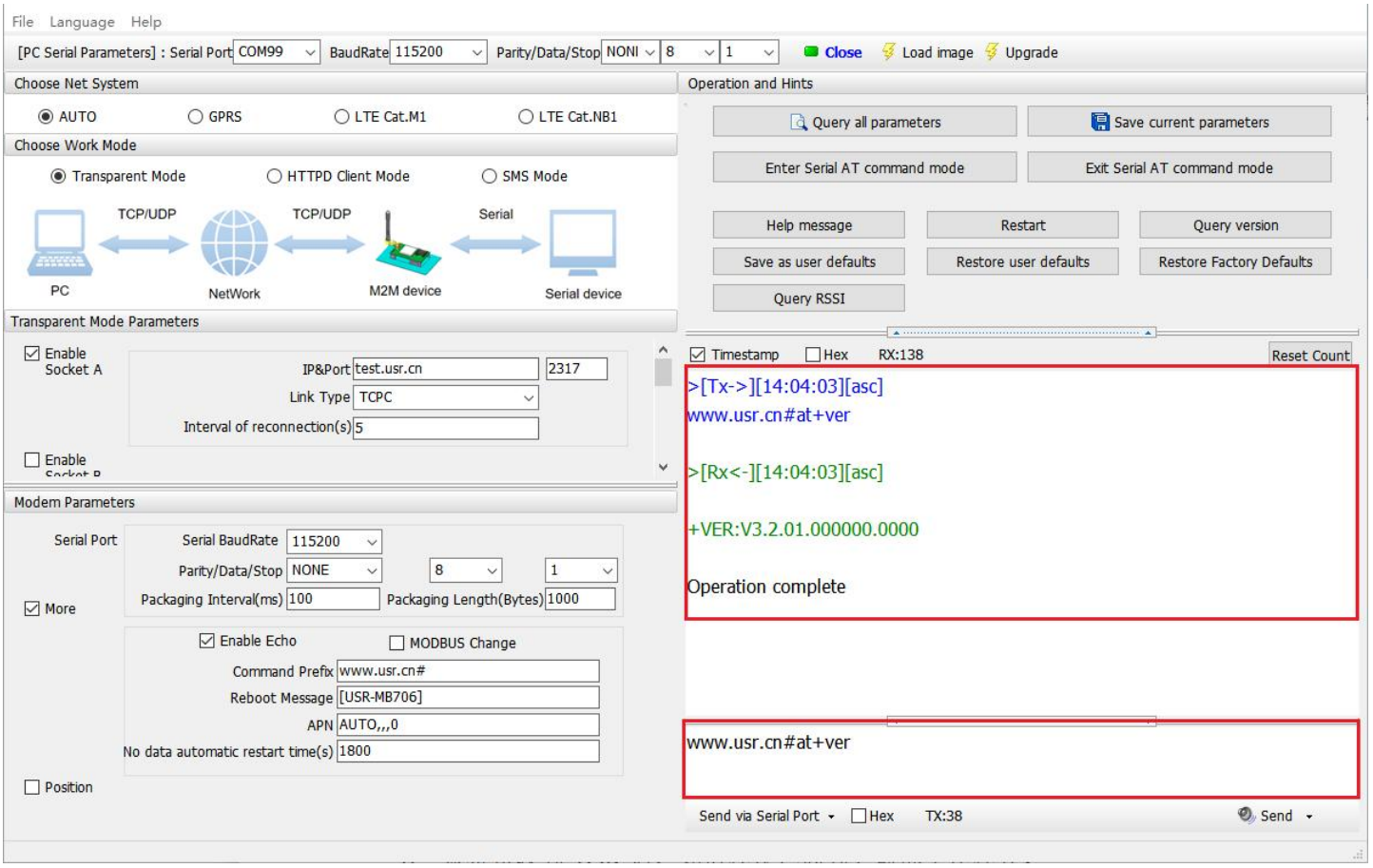
4.2. Serial AT Commands

In transparent mode, we can directly send “Command prefix+AT command” to query and configure the parameters without changing to command mode.



User can use “AT+CMDPW” to query or configure the command prefix, it defaults to “www.usr.cn#”.

After configuration, restart the device. Then send “www.usr.cn#AT+VER” from the serial port, we will receive the response from the module. (Please note there is a line feed after the command)



4.3. Network AT Commands

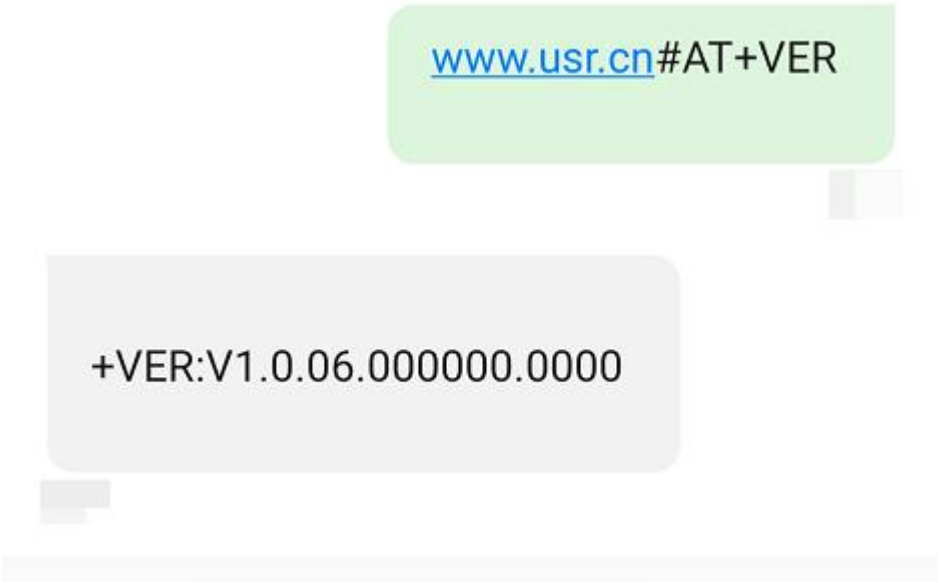
In transparent mode, user can send “command prefix+AT command” to query and configure parameters. Network AT commands are used to query or configure the parameters from remote server, which is similar to serial AT commands.

For example, we can send “www.usr.cn#AT+VER” to to query the firmware version from server side (there is a line feed after the command):

4.4. SMS AT Commands

We can send “Command prefix+ AT Commands” via SMS to query and configure the parameters of the device if we know the phone number of the SIM card in the device.

For example, we can send “www.usr.cn#AT+VER” to the phone number of the device via SMS to query the firmware version, there is a line feed after the command.


www.usr.cn#AT+VER
+VER:V1.0.06.000000.0000

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7. Revision History

Version	Date	Author	Description
1.0.0	2022.04.13	Hongmin, Peng	Initial