SIM7600E-H 4G HAT

Overview

The SIM7600E-H 4G HAT is a 4G/3G/2G communication and GNSS positioning module, which supports LTE CAT4 up to 150Mbps for downlink data transfer. it is pretty low power consumption.

You can connect this 4G module with computer to surf the Internet, or attach it onto Raspberry Pi to enable functions like 4G high speed connection, wireless communication, making telephone call, sending SMS, global positioning, etc.

Note: this is a region-specific module, please check the supported bands before placing order.

Features

- Raspberry Pi connectivity, compatible with Raspberry Pi Zero/Zero W/Zero WH/2B/3B/3B+
- Supports dial-up, telephone call, SMS, MMS, mail, TCP, UDP, DTMF, HTTP, FTP, etc.
- Supports GPS, BeiDou, Glonass, LBS base station positioning
- Onboard USB interface, to test AT Commands, get GPS positioning data, and so on
- Onboard CP2102 USB to UART converter, for serial debugging
- Breakout UART control pins, to connect with host boards like Arduino/STM32
- SIM card slot, supports 1.8V/3V SIM card
- TF card slot for storing data like files, messages, etc.
- Onboard audio jack and audio decoder for making telephone call
- 2x LED indicators, easy to monitor the working status
- Onboard voltage translator, operating voltage can be configured to 3.3V or 5V via jumper
- Baudrate: 300bps ~ 4Mbps (default: 115200bps)
- Autobauding baudrate: 9600bps ~ 115200bps
- Control via AT commands (3GPP TS 27.007, 27.005, and V.25TER command set)
- Supports SIM application toolkit: SAT Class 3, GSM 11.14 Release 99, USAT
- Comes with development resources and manual (examples for Raspberry Pi/Arduino/STM32)

Note: Does not contain Raspberry Pi

Communications Specifications

	LTE	WCDMA / TD-SCDMA / CDMA 2000	EDGE	GSM/GPRS
Band	LTE-FDD B1/B3/B5/B7/B8/B20 LTE-TDD B38/B40/B41	UMTS/HSPA+ B1/B5/B8	GSM/GPRS/EDGE 900/1800 MHz	
Generation	4G	3G	2.5G	2G
Emitting power	0.25W		0.5W@EGSM900 0.4W@DCS1800	2W@GSM900 1W@DCS1800
Data Speed	LTE CAT 4 Uplink≤50 Mbps Downlink≤150 Mbps	UMTS Uplink≤384Kbps Downlink≤384Kbps HSPA+ Uplink≤5.76Mbps Downlink≤42Mbps	EDGE Uplink≤236.8kbps Downlink≤236.8kbps	GPRS Uplink≤85.6kbps Downlink≤85.6kbps
SIM Card	Normal SIM (Not Included)			
Applicable Region	Southeast Asia, West Asia, Europe, Africa			

GNSS Specifications

- Receiver type
  - 16-channel
  - C/A code

- Sensitivity
  - Tracking: -159 dBm (GPS) / -158 dBm (GLONASS) / TBD (BD)
  - Cold starts: -148 dBm
- Time-To-First-Fix (open air)
  - Cold starts: <35s
  - Hot starts: <1s
- Accuracy
  - Position: <2.5m CEP

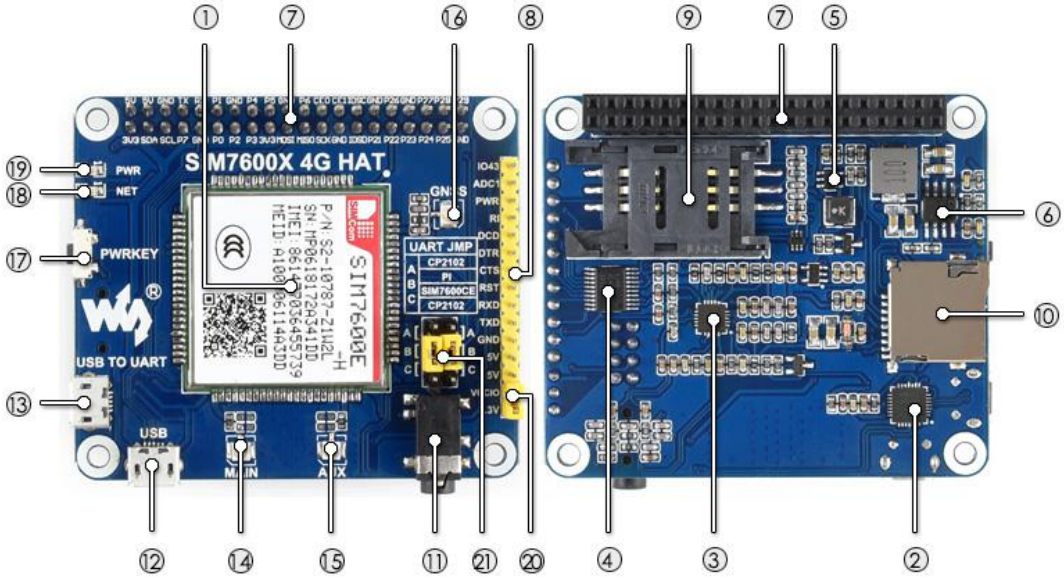
SMS and Audio Specifications

- SMS
  - Supported types: MT, MO, CB, Text, PDU
  - Storage: USIM card and ME (default)
- Audio feature
  - Supports echo cancellation
  - Supports noise reduction

Other Specifications

- Power supply: 5V
- Operating voltage: 5V/3.3V (configured via jumper)
- Operating temperature: -30°C ~ 80°C
- Storage temperature: -45°C ~ 90°C
- Dimension: 56.21mm x 65.15mm

What's on Board



1. **SIM7600E-H**
2. **CP2102 USB to UART converter**
3. **NAU8810 audio decoder**
4. **TXS0108EPWR voltage translator**: translates 3.3V/5V into 1.8V
5. **MP2128DT power chip**
6. **MP1482 power chip**
7. **Raspberry Pi GPIO header:** for connecting with Raspberry Pi
8. **SIM7600 control interface**: for connecting with host boards like Arduino/STM32
9. **SIM card slot**: supports 1.8V/3V SIM card
10. **TF card slot**: allows file/SMS/... storage
11. **3.5mm earphone/mic jack**
12. **USB interface**: for testing AT Commands, getting GPS positioning data, etc.
13. **USB to UART interface**: for serial debugging, or login to Raspberry Pi
14. **MAIN antenna connector**
15. **AUX antenna connector**
16. **GNSS antenna connector**
17. **Power switch**
18. **Network status indicator**
19. **Power indicator**
20. **Operating voltage selection jumper:**

    VCCIO - 3.3V: set operating voltage as 3.3V

    VCCIO - 5V: set operating voltage as 5V

21. UART selection jumper：

A: access Raspberry Pi via USB to UART

B: control the SIM7600 by Raspberry Pi

C: control the SIM7600 via USB to UART

Contents

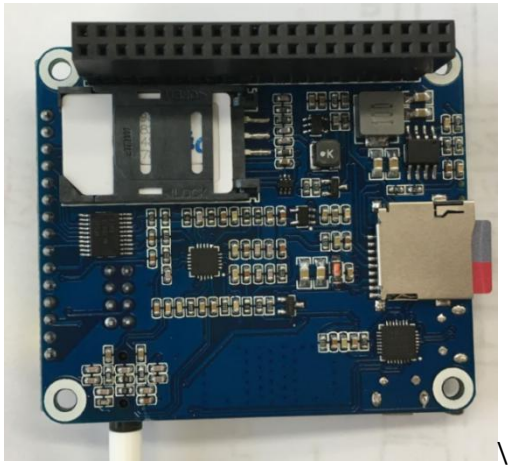
1. Hardware configuration

1.1. Hardware configuration

This module comes with GSM antenna, LTE antenna and micro USB cable. Besides these you should prepare a 4G sim card and a microphone cable with microphone:

1) Insert the SIM card to the card slot, Insert the headphone cable and connect the LTE antenna.
2) Connect the USB interface of SIM7600E-H 4G HAT to PC with a micro USB cable. Then the PWR indicator will keep bright.

3) Press the PWRKEY button and hold for 1s, the NET indicator will blink as below. Generally, the NET indicator will fast flash firstly (1 time per second), which means that the module has not logged in the Network. After logging in, the indicator become to flash slowly (1 time every three seconds). Up to the local LTE network, this process that logging in will last several seconds to dozens of seconds.



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If you take too much time to log in and failed, please check that whether the LTE antenna is connected correctly, and whether the SIM card is usable and insert correctly.

4) Install SIM7600 driver (windows driver: www.waveshare.com/wiki/File:SIM7X00-Driver.7z) Open Device Manager to get the corresponding COM port number of SIM7600. For example, the AT Port is COM19 as below. Users need to choose the correct port according to the Manager.

Figure: Devices Manager

SimTech HS-USB AT Port 9001 (COM25)
SimTech HS-USB Audio 9001 (COM24)
SimTech HS-USB Diagnostics 9001 (COM28)
SimTech HS-USB NMEA 9001 (COM27)

NOTE:

The default hardware of SIM7600CE 4G HAT needs to be turned on by button. If the hardware needs to be turned on automatically, you can use a connection line to connect the PWR and GND pins on the module pin, so that it can automatically turn on, as shown in the figure below.

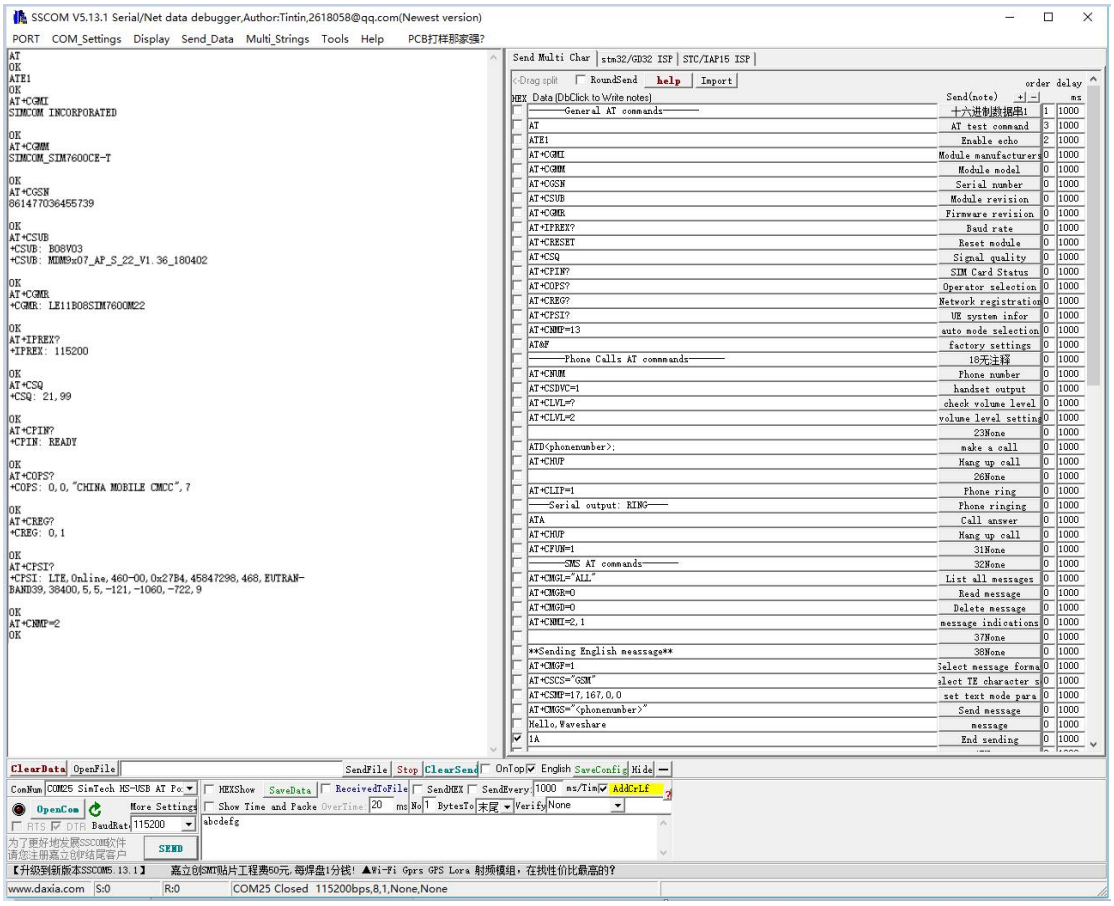
2. At Test Instructions

2.1. General AT commands

Commands	Description	Return
AT	AT test command	OK

ATE	ATE1: Enable echo ATE0: Disable echo	OK
AT+CGMI	Module manufacturers	OK
AT+CGMM	Module model	OK
AT+CGSN	Serial number	OK
AT+CSUB	Module revision	OK
AT+CGMR	Firmware revision	OK
AT+IPREX	Set baud rate	+IPREX: OK
AT+CRESET	Reset module	OK
AT+CSQ	Check signal quality	+CSQ: 17,99 OK
AT+CPIN?	SIM Card Status	+CPIN: READY
AT+COPS?	Operator selection	+COPS: OK
AT+CREG?	Network registration	+CREG: OK
AT+CPSI?	UE system infor	
AT+CNMP	Mode selection: 2：Automatic 13：GSM only 38：LTE only 48 ： Any modes but LTE … ….	OK

For more details, please refer to the documentation：Series_AT Command Manual_V1.07

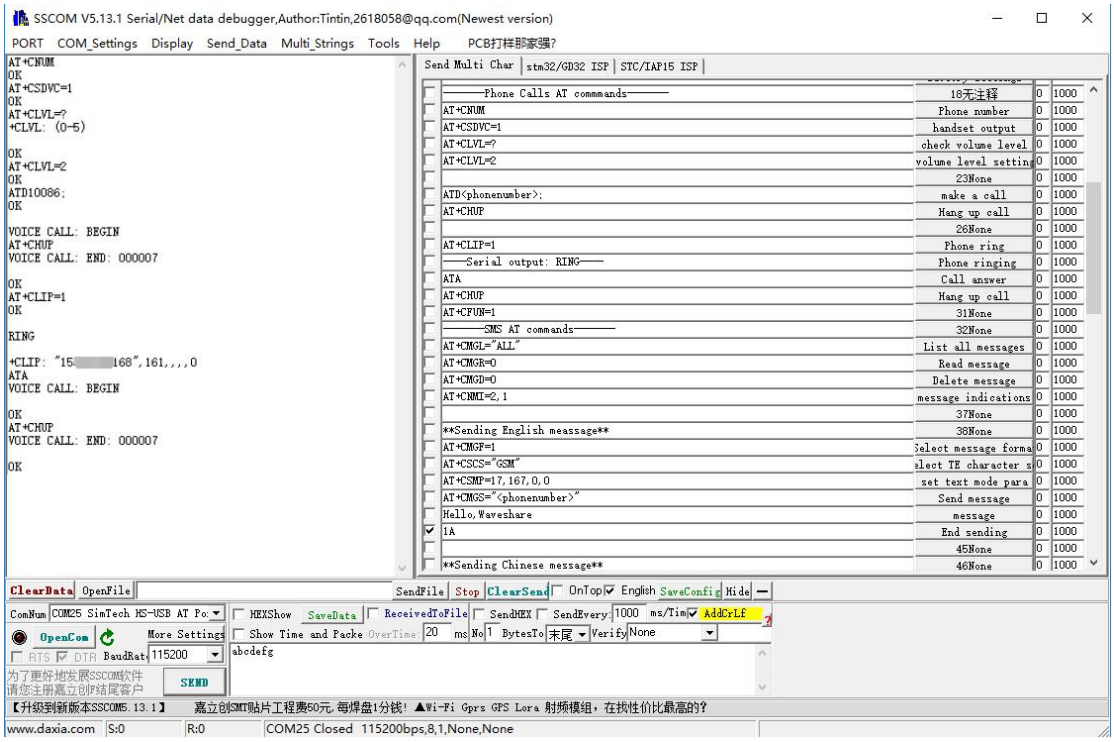


2.2. Make calls and answer calls

1) Insert the SIM card, connect the LTE antenna and connect the USB interface of SIM7600E-H 4G HAT to PC. Then press the PWRKEY to power on the board;
2) Check whether the indicators blink correctly (PWR's and NET's flashes).
3) Send AT commands as bellow:

Commands	Description	Return
AT+CNUM	Phone number (Not all SIM cards Support)	+CNUM OK
AT+CSDVC	AT+CSDVC=1： Handset output AT+CSDVC=3： Speaker output	OK
AT+CLVL=?	check volume level	OK
AT+CLVL=2	volume level set to 2	OK
ATD<phone_number>;	Make calls	OK

AT+CHUP	Hang up call	OK
AT+CLIP=1	Phone ring	OK
ATA	Call answer	OK

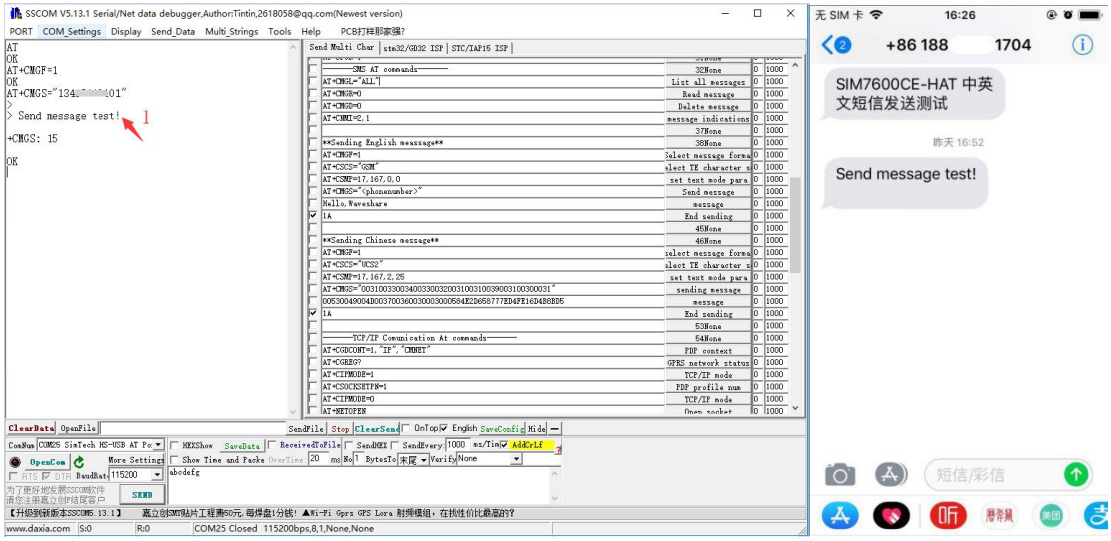


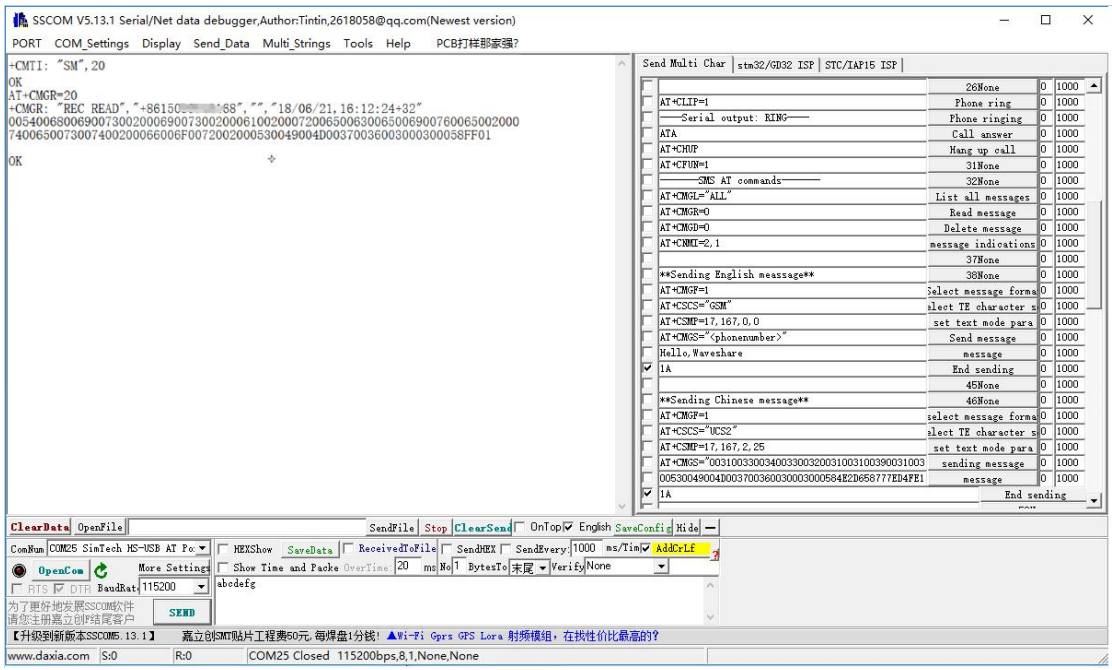
2.3. Send and receive messages

1. Plug the SIM card, connect the LTE antenna and and connect the USB interface of SIM7600E-H 4G HAT to PC. Then press the PWRKEY to power on the board;
2. Check whether the indicators blink correctly (PWR's and NET's flashes).
3. Send AT commands as bellow:

Commands	Description	Return
AT+CMGF=1	select message format	OK
AT+CSCS="GSM"	Select TE character set: GSM	OK
AT+CSMP	set text mode para	OK
AT+CMGS="<phonenumber>"	Send message	OK

AT+CNMI=2,1	message indications	OK
AT+CMGR=1	Read message 1	OK



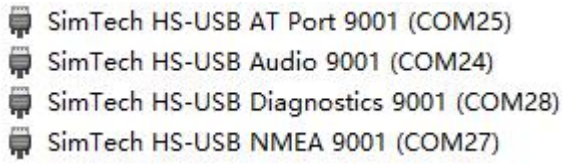


2.4. GPS Debugging

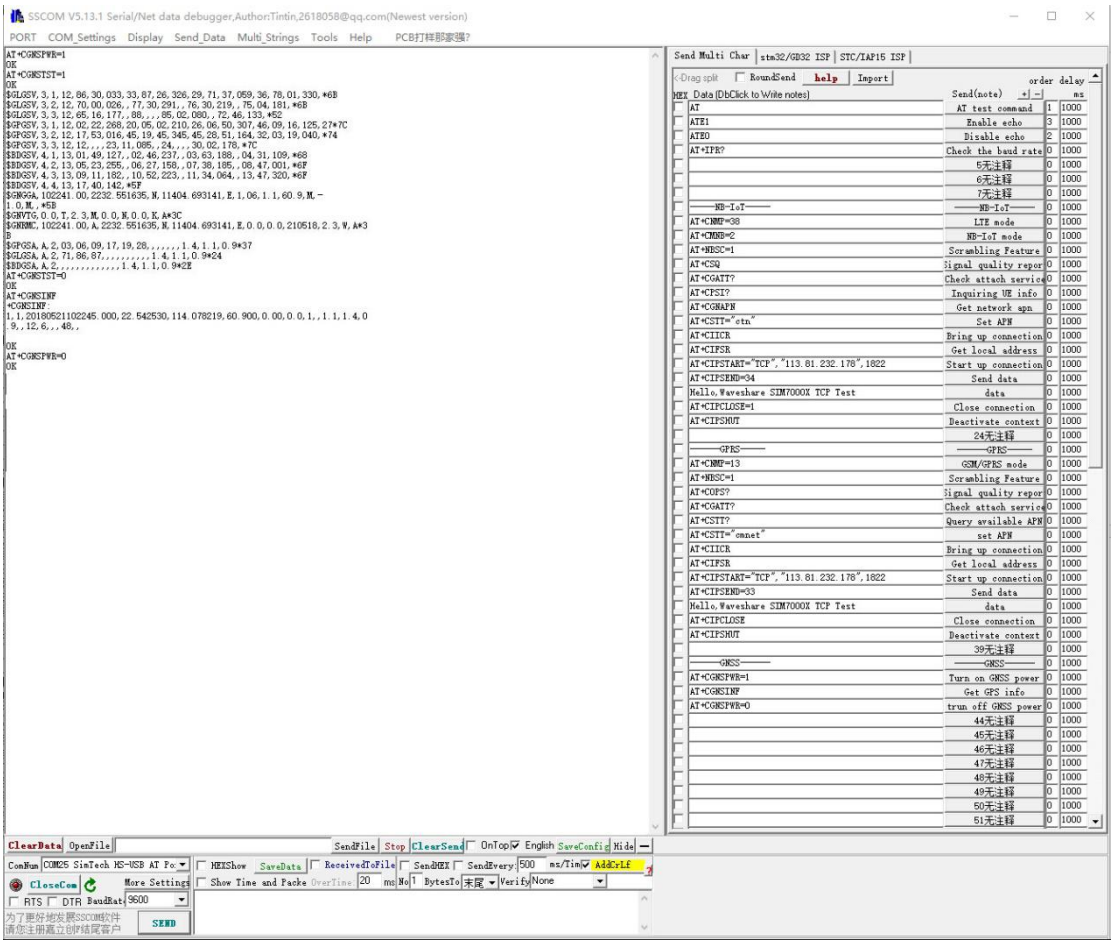
Commands	Description	Return
AT+CGPS	GNSS Power Control:	OK

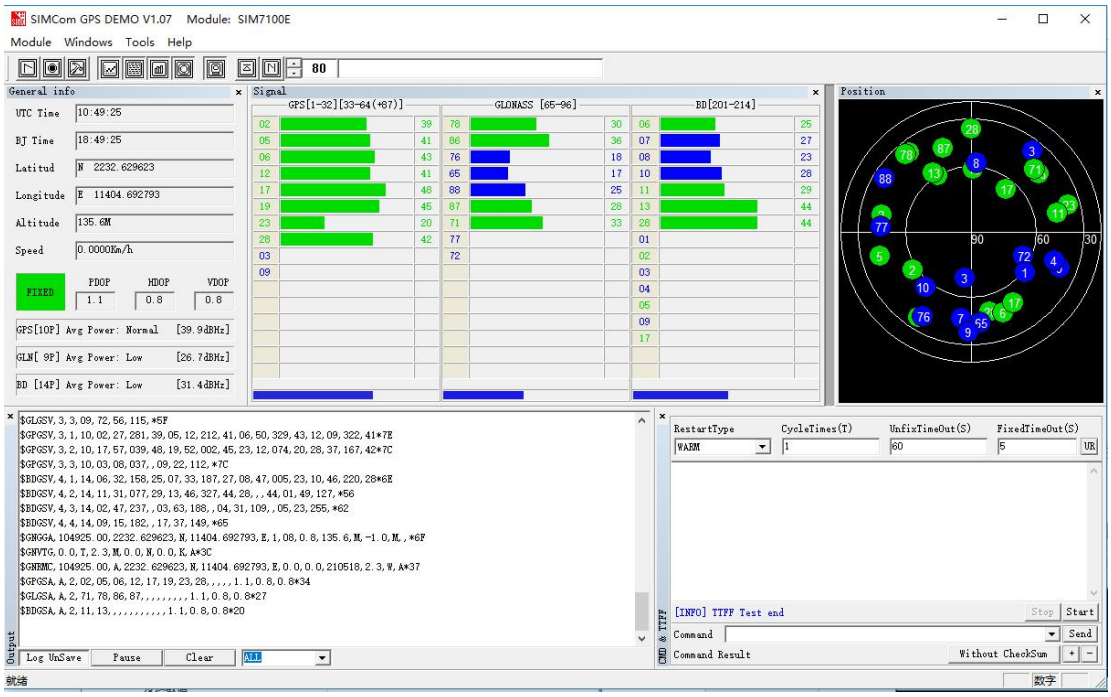
	AT+CGPS =1:Turn on AT+CGPS =0:Turn off	
AT+CGPSINFO	GNSS navigation information parsed from NMEA sentences	+CGNSINF: OK

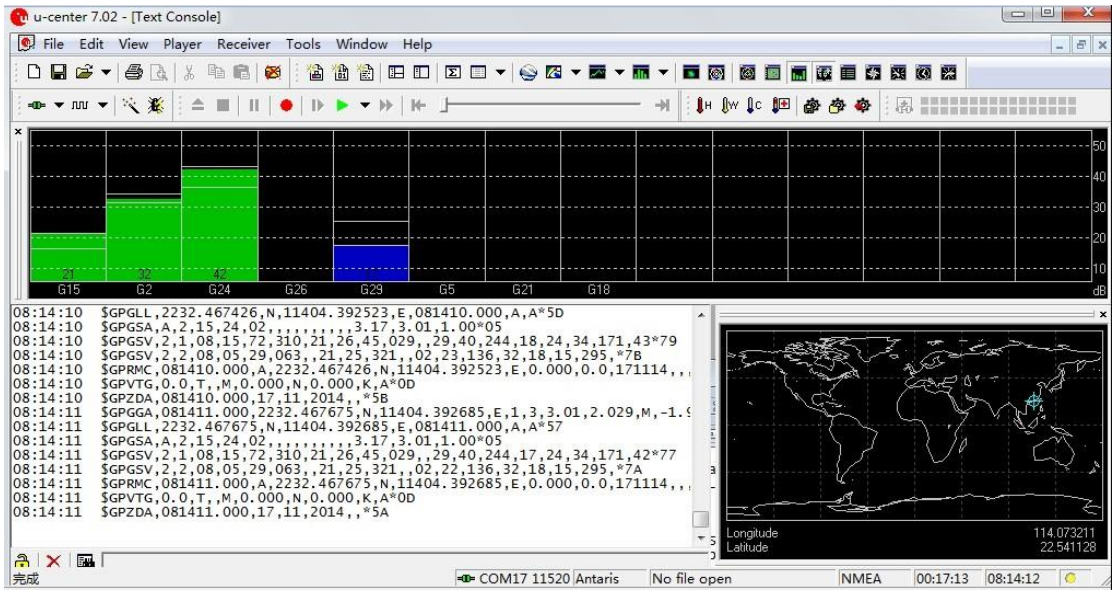
1) Connecting the GPS antenna, and place the receiver on open area outdoor
2) AT+CGPS =1 //Turn on power of GPS
3) Open u-center and set the Port and Baudrate (NMEA Port,COM27)



4) AT+CGNSINF // Print the GPS information
5) AT+CGPS =0 //Turn off power of GPS



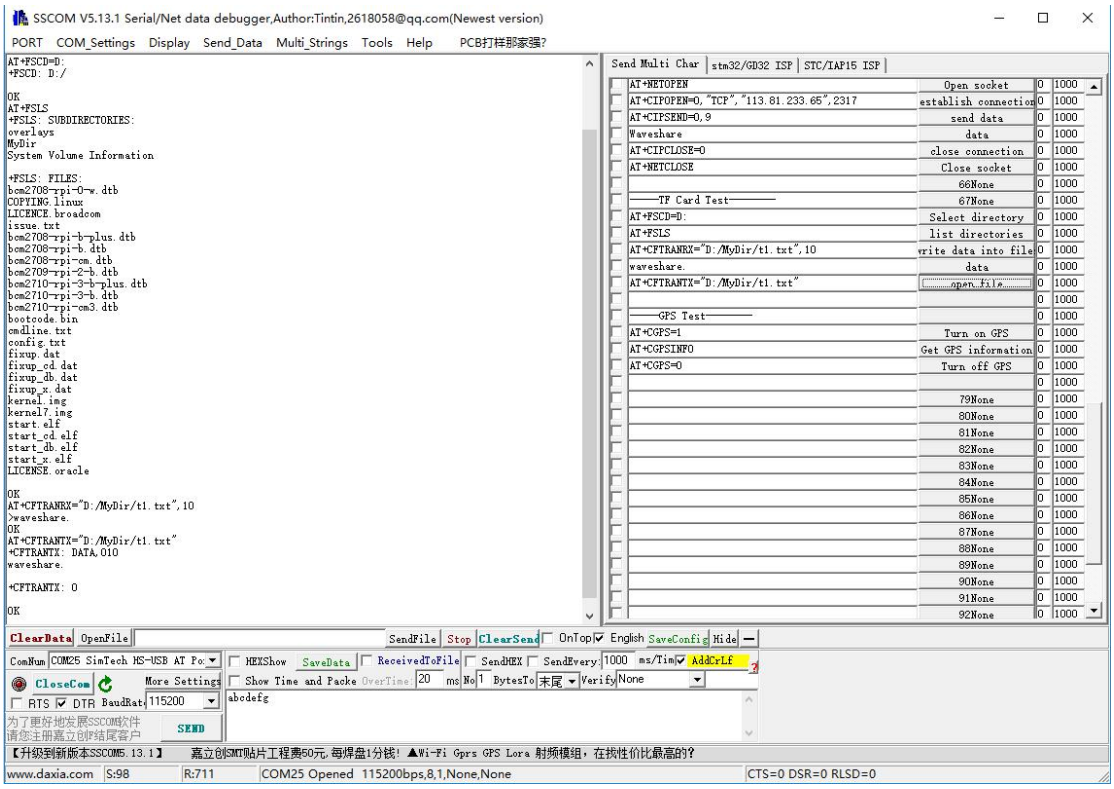




2.5. TF Card Test

1. Plug the SIM card, connect the LTE antenna and and connect the USB interface of SIM7600E-H 4G HAT to PC. Then press the PWRKEY to power on the board;
2. Check whether the indicators blink correctly (PWR's and NET's flashes).
3. Send AT commands as bellow:

Commands	Description	Return
AT+FSCD=D:	Select directory	OK
AT+FSLS	list directories	+FSLS: OK
AT+CFTRANRX	write data into files	> OK
AT+CFTRANTX	open file	+CFTRANTX: OK



2.6. GPRS Debugging

LOCAL VIRTUAL SEVERS SETTINGS

Virtual servers define the mapping between service ports of WAN and web servers of LAN. All requests from Internet to service ports of WAN will be redirected to the computer (web servers of LAN) specified by the server IP. (see your router's guide manual)

4) Log in Management Console of your router with browser (read your router's guide manual for specific address)

5) Set Port：1822 (The Port can't be conflict to other's. Here we set 1822)

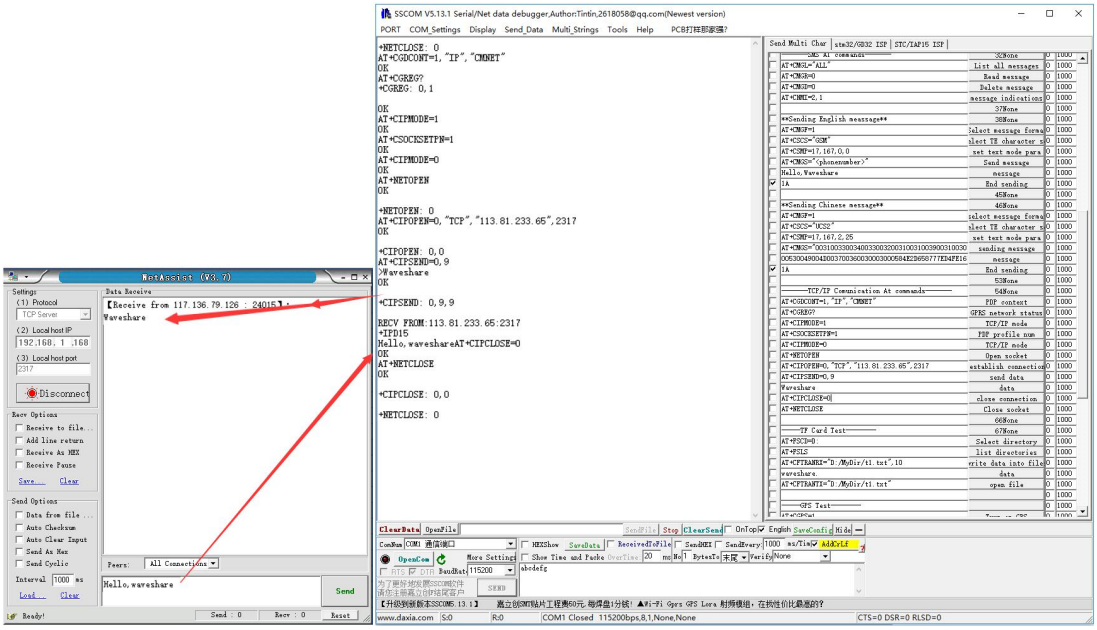
Set LAN IP address of your computer (you can run CMD on your computer, and execute command ipconfig to enquiry the address of IPv4), 192.168.6.168 as examples

6) You can search "IP" on browser to get your WAN IP address.

GPRS TEST

1. Plug the SIM card, connect the LTE antenna and and connect the USB interface of SIM7600E-H 4G HAT to PC. Then press the PWRKEY to power on the board;
2. Check whether the indicators blink correctly (PWR's and NET's flashes).
3. Send AT commands as bellow:

命令	说明	返回值
AT+CGDCONT=1,"IP","CMNET"	PDP context	OK
AT+CGREG?	GPRS network status	+ CGREG: OK
AT+CIPMODE=1	TCP/IP mode	OK
AT+CSOCKSETPN=1	PDP profile number	OK
AT+NETOPEN	Open socket	+NETOPEN:
AT+CIPOPEN=0,"TCP","113.81.233.65",2317	establish connection	+CIPOPEN:
AT+CIPSEND=0,9	Send data of a specific size	>
AT+CIPSEND=0,	Send data of a fixed size	>
1A	(HEX format) Tell module to send data	+CIPSEND:
AT+CIPCLOSE	close connection	+CIPCLOSE:
AT+NETCLOSE	Close socket	+NETCLOSE:



3. Using with Raspberry Pi

3.1. Interface overview

The default relationship between SIM7600 control pins and Raspberry Pi IOs is shown in Table 1.

Table 1: The relationship between SIM7600 control pins and Raspberry Pi IOs

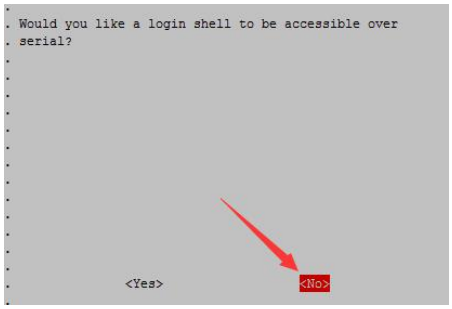
SIM7600	IO of Raspberry Pi B+	Description
5V	5V	Power supply (5V)
GND	GND	Ground
TXD	RXD (BCM P15)	UART pin
RXD	TXD (BCM P14)	UART pin
PWR	P22 (BCM P6)	Power up the module
FLIGHTMODE	P7 (BCM P4), Pull high enable flight mode	Flight mode

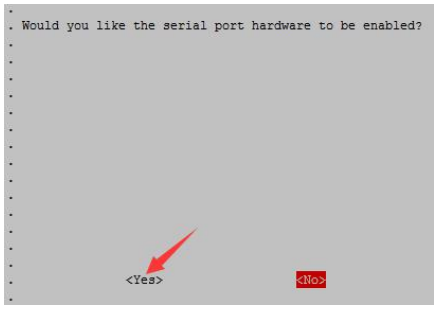
3.2. UART configuration of Raspberry Pi

Because UART of Raspberry Pi is used for Linux console output by default, if we want to use the UART, we need to change the settings. Executing this command to enter the configuration page ：

```
sudo raspi-config
```

Choose Advanced `Options -> Serial -> no`, to disable Linux's use of console UART





Open /boot/config.txt file, find the below statement and uncomment it to enable the UART. You can directly append it at the end of file as well.

```
enable_uart=1
```

Then reboot.

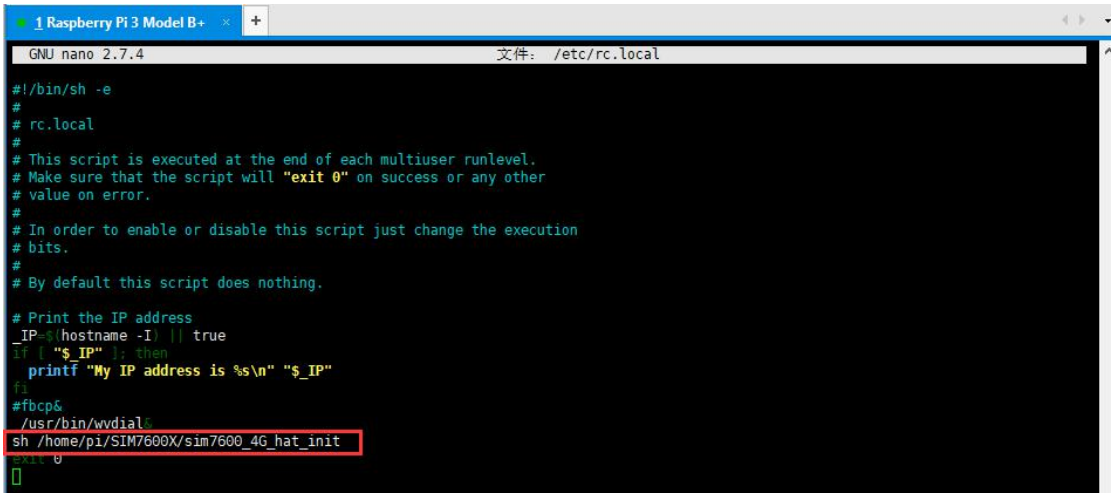
3.3. Init the Raspberry Pi

1、 Download the raspberry pi demo code to /home/pi/ directory.

```
wget https://www.waveshare.com/w/upload/2/29/SIM7600X-4G-HAT-Demo.7z
sudo apt-get install p7zip-full
7z x SIM7600X-4G-HAT-Demo.7z   -r -o/home/pi
sudo chmod 777 -R /home/pi/SIM7600X-4G-HAT-Demo
```

2、 Open the /etc/rc.local file, then add the context below:

```
sh /home/pi/SIM7600X-4G-HAT-Demo/Raspberry/c/sim7600_4G_hat_init
```



3.4. Minicom for UART debugging on Raspberry Pi

Inserting the module to Raspberry Pi and plug the jumper B,

Install minicom， minicom is a text-based modem control and terminal emulation program for Linux：

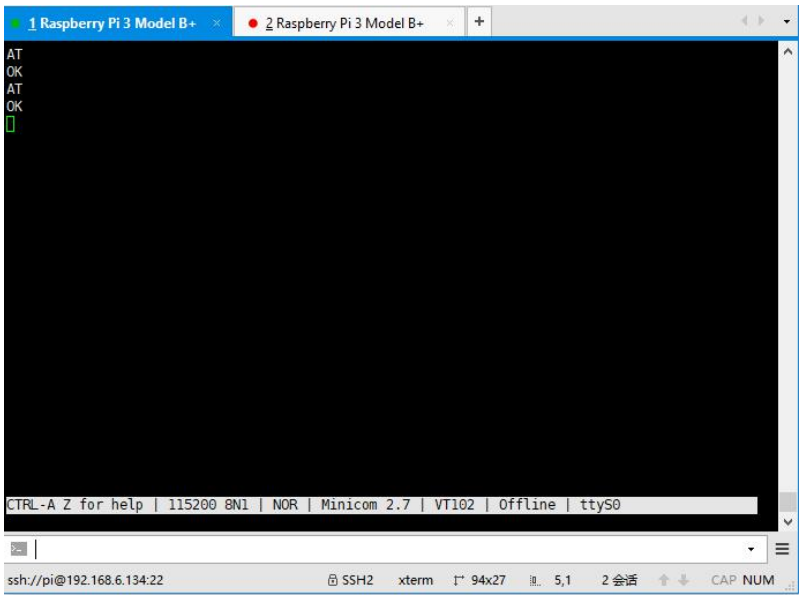
```
sudo apt-get install minicom
```

Execute command: `minicom -D /dev/ttyS0`（ttyS0 is the UART of Raspberry Pi 3B）

Baud rate is 115200 by default. If you need to change the baud rate, for example 9600, you can add the parameter -b 9600.

The user UART device of Raspberry Pi 2B/Zero is ttyAMA0, and ttyS0 of Raspberry Pi 3B

Testing Bluetooth function as examples:



3.5. Examples

1、Download the demo code from wiki and copy to the Raspberry Pi (/home/pi/SIM7600X)

2、Enter the bcm2835 directory, compile and install the BCM2835 library:

```
chmod +x configure && ./configure && sudo make && sudo make install
```

3、 Compile and run the demo (for example:PhoneCall):

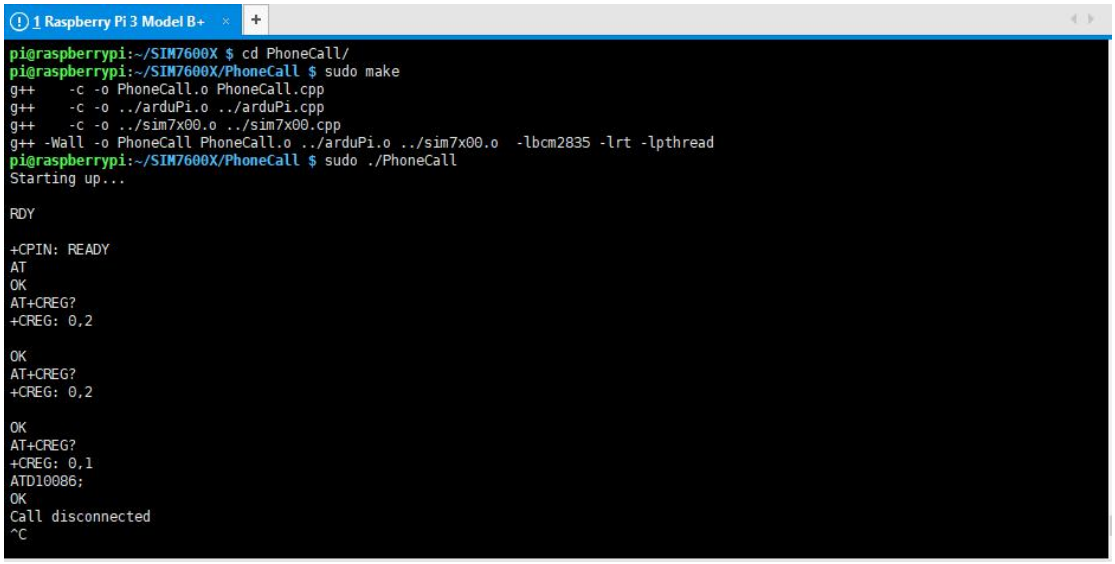
Clean up: sudo make clean

Recompile: sudo make

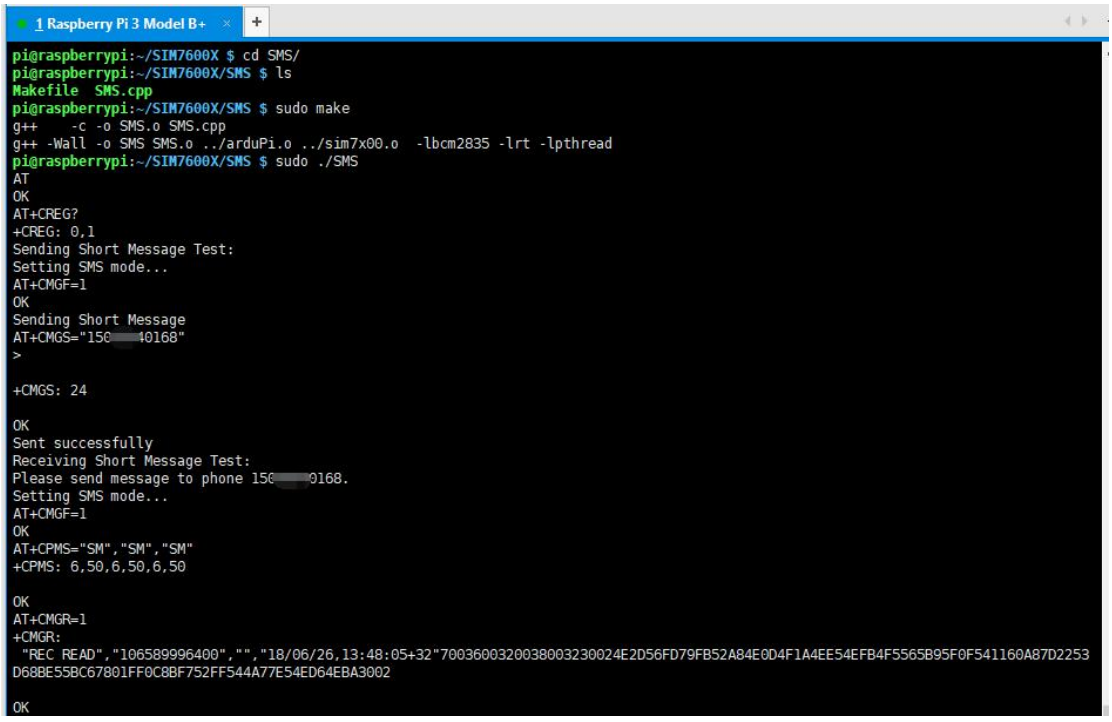
Run the program: sudo ./PhoneCall

Combination command: sudo make clean && sudo make && sudo ./PhoneCall

3.5.1. PHONECALL



3.5.2. SMS



3.5.3. GPS

```
pi@raspberrypi:~/SIM7600X/GPS $ sudo make clean && sudo make && sudo ./GPS
rm -f *.o GPS
g++    -c -o GPS.o GPS.cpp
g++ -Wall -o GPS GPS.o ../arduPi.o ../sim7x00.o  -lbcm2835 -lrt -lpthread
AT
OK
AT+CREG?
+CREG: 0,1
Start GPS session...
AT+CGPS=1,1
OK
AT+CGPSINFO
+CGPSINFO:
,,,,,,,,

OK
AT+CGPSINFO
+CGPSINFO:
,,,,,,,,

OK
AT+CGPSINFO
+CGPSINFO:
2232.643279,N,11404.697531,E,300618,085520.0,96.0,0.0,0.0

OK
Latitude is 22.544054 N
Longitude is 114.078293 E
Day Month Year is 300618
UTC time is 085520
AT+CGPS=0
OK
```

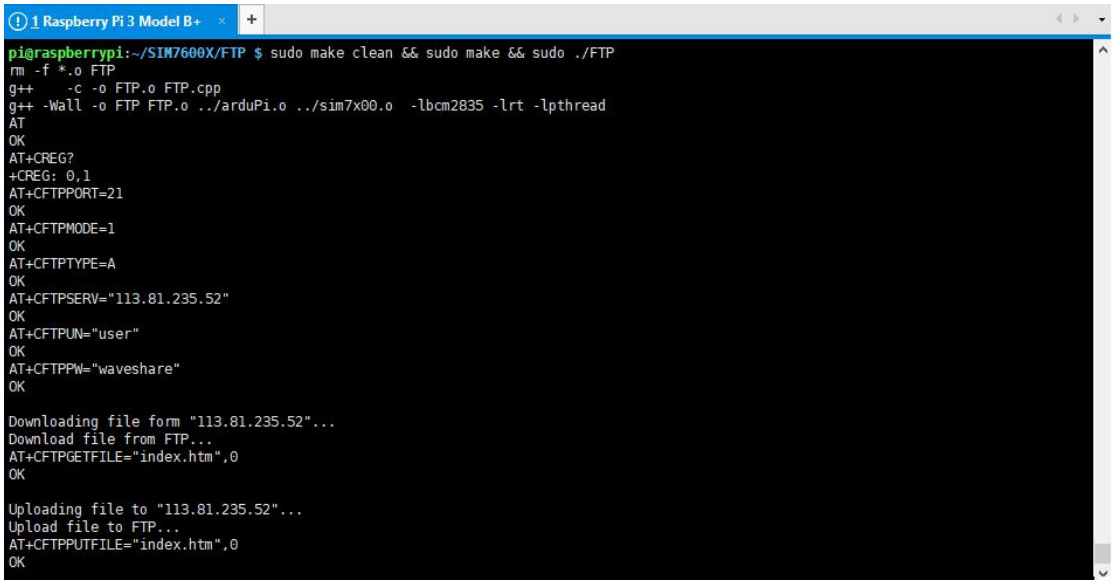
3.5.4. TCP

```
pi@raspberrypi:~/SIM7600X/TCP $ sudo make clean && sudo make && sudo ./TCP
rm -f *.o TCP
g++    -c -o TCP.o TCP.cpp
g++ -Wall -o TCP TCP.o ../arduPi.o ../sim7x00.o  -lbcm2835 -lrt -lpthread
AT
OK
AT+CREG?
+CREG: 0,1
AT+CREG?
+CREG: 0,1
AT+CGREG?
+CGREG: 0,1
AT+CGSOCKCONT=1,"IP","CMNET"
OK
AT+CSOCKSETPN=1
OK
AT+CIPMODE=0
OK
AT+NETOPEN
OK
AT+IPADDR
+IPADDR:
AT+CIPOPEN=0,"TCP","118.190.93.84",2317
OK
AT+CIPSEND=0,
>

OK
Send Message:Waveshare Successfully!
AT+CIPCLOSE=0
OK

+CIPCLOSE: 0,0
AT+NETCLOSE
OK
```

3.5.5. FTP



4. Using with Arduino

4.1. Interface overview

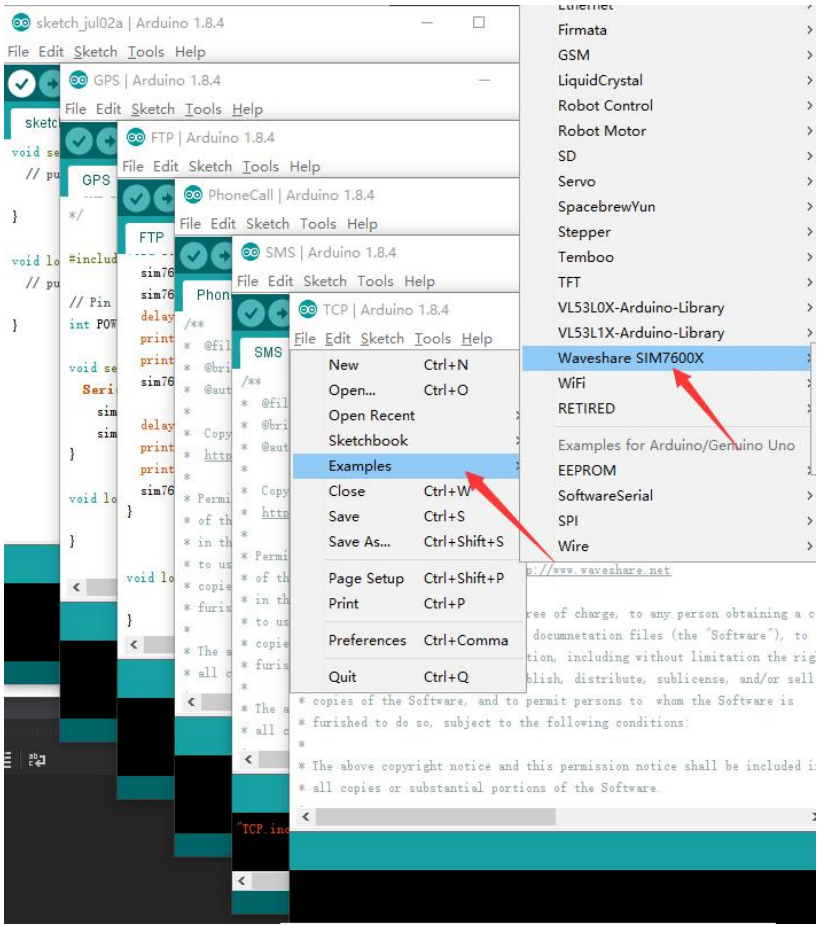
The default relationship between SIM7600 control pins and Arduino is shown in Table 1.

Table 2: The relationship between SIM7600 control pins and Arduino

SIM7600	Arduino UNO /UNO PLUS	Description
5V	5V	Power supply (5V)
GND	GND	Ground
TXD	0 (RX)	UART pin
RXD	1 (TX)	UART pin
PWR	2	Power up the module

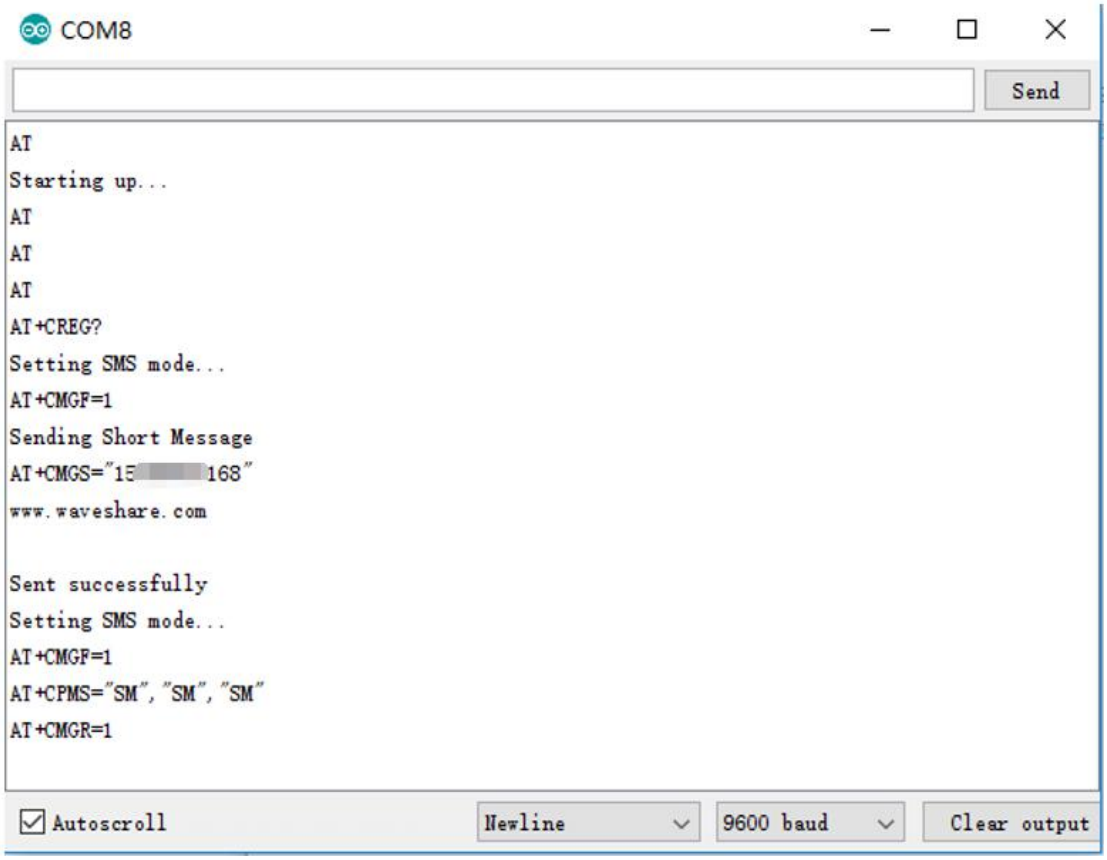
4.2. Install Arduino Library

1. Download the Arduino demo code and copy the Waveshare_SIM7600X_Arduino_Library folder to {the Arduino software installation path}/Library/ .
2. Run the Arduino IDE, then select the example code as below:

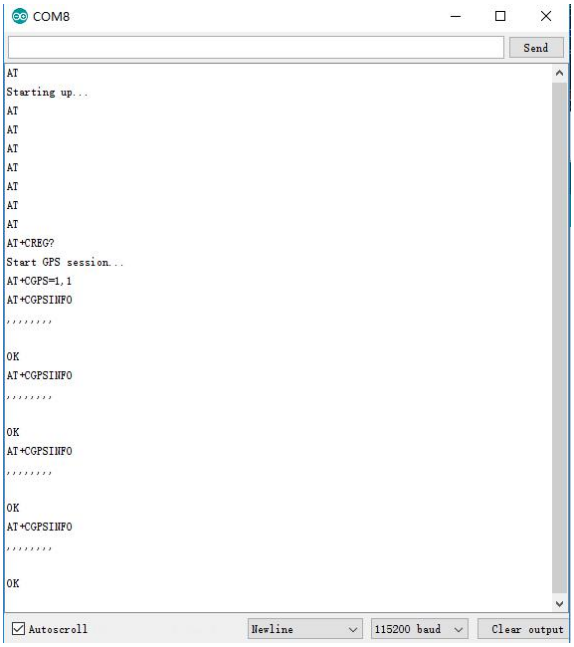


4.2.1. PHONECALL

4.2.2. SMS


COM8
Send
AT
Starting up...
AT
AT
AT
AT+CREG?
Setting SMS mode...
AT+CMGF=1
Sending Short Message
AT+CMGS="15 168"
www.waveshare.com
Sent successfully
Setting SMS mode...
AT+CMGF=1
AT+CPMS="SM","SM","SM"
AT+CMGR=1
Autoscroll
Newline
9600 baud
Clear output

4.2.3. GPS


COM8
Send
AT
Starting up...
AT
AT
AT
AT
AT
AT
AT
AT+CREG?
Start GPS session...
AT+CGPS=1,1
AT+CGPSINFO
,,,,,,,,
OK
AT+CGPSINFO
,,,,,,,,
OK
AT+CGPSINFO
,,,,,,,,
OK
AT+CGPSINFO
,,,,,,,,
OK
Autoscroll
Newline
115200 baud
Clear output

4.2.4. TCP

4.2.5. FTP


COM8
Send
AT
AT
AT+CREG?
AT+CFTPPORT=21
AT+CFTPMODE=1
AT+CFTPTYPE=A
AT+CFTPSERV="113.81.235.52"
AT+CFTPUN="user"
AT+CFTPPW="waveshare"
Download file from FTP...
AT+CFTPGETFILE="index.htm",0
Upload file to FTP...
AT+CFTPPUTFILE="index.htm",0
Autoscroll
Newline
9600 baud
Clear output