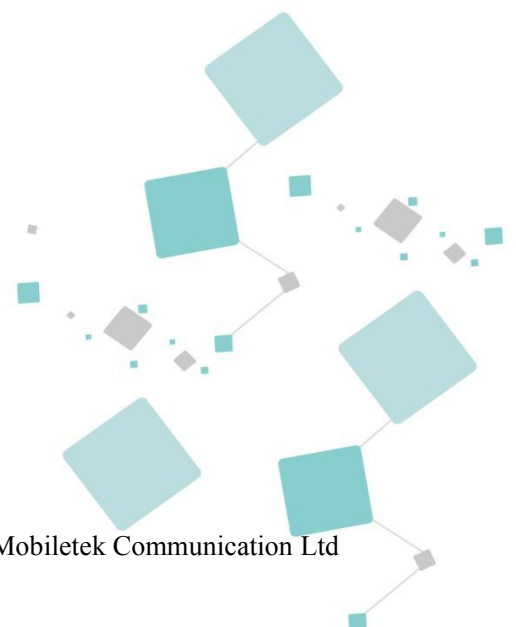


# **L710 EVB User Manual**

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**Version:** V1.0

**Date:** 2019-08-08



## Notice

Some features of the product and its accessories described herein rely on the software installed, capacities and settings of local network, and therefore may not be activated or may be limited by local network operators or network service providers.

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**FCC Caution:**

- (1) Exposure to Radio Frequency Radiation. This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.
- (2) Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.
- (3) This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- (4) Labelling requirements: 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.
- (5) if the host is marketed so that end users do not have straight forward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: Contains Transmitter Module FCC ID: 2AK9D-L710 or Contains FCC ID: 2AK9D-L710 must be used.

This Modular Approval is limited to OEM installation for mobile and fixed applications only. The antenna installation and operating configurations of this Modular, including any applicable source-based time averaging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of 2.1091.

## Version History

| Date      | Version | Description of change | Author |
|-----------|---------|-----------------------|--------|
| 2019-08-8 | V1.0    | Initial               |        |
|           |         |                       |        |

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# **1 About this document**

## **1.1 Scope of applications**

This document describes the basic specifications of the L710 IoT Module EVB (hereinafter referred to as

the L710) series product electrical characteristics, design guidance and hardware interface development guidance. Users should design according to this document requirement and guidance.

This document is only applicable to the application development of L710 series products.

## 1.2 Writing purpose

This document provides the design and development basis for the module product user. By reading this document, the user can have a whole understanding of our products, technical parameters have a clear understanding of product, and on the basis of this document user can help user complete 4G IoT wireless Internet access products or equipment application development. This hardware development document not only provides the function of product features and technical parameters, also provides product reliability test standard, business function and related implementation process, the RF performance and circuit design to guide the user. All are giving users a more comprehensive design reference.

This document describes the hardware interface of the L710 module EVB, can help user to quickly understand L710 EVB interface specifications, electrical and mechanical details, with the help of this document users can use L710 serial module to design and set-up various types of wireless terminals.

## Intended audience

This document is applicable to:

- Systems Design Engineer
- Structural Engineer
- Hardware Engineer
- Software Engineer
- Test Engineer

## Introduction

This document contains 5 chapters, contents as follows:

| Chapter                  | Content                                                           |
|--------------------------|-------------------------------------------------------------------|
| 1 Abstract               | Introduce L710 EVB basic technical SPEC.                          |
| 2 Power Supply           | Introduce L710 EVB power for the module.                          |
| 3 Key Description        | Introduce L710 EVB system control key                             |
| 4 Application interface  | Introduce L710 module and L710 EVB application interface          |
| 5 Accessory and Assembly | Introduce L710 EVB Accessory and assembly (hardware and software) |

## 1.3 Support and reference documentation list

In addition to the hardware development documentation, we also provide the development board

operation instruction manual and software development instruction manual based on this product. Table 1-1 is support for the list.

**Table 1- 1Support document list**

| No. | Document                     |
|-----|------------------------------|
| 1   | 《L710 AT Command User Guide》 |
| 2   | 《L710_Hardware_Design》       |
| 3   | 《L710_EVB_user manual》       |
| 4   | 《L710 Schematic checklist》   |
| 5   | 《L710 Layout checklist》      |
| 6   | 《L710_Reference Design. pdf》 |
| 7   | 《L710_xx_DECAL. sch》         |
| 8   | 《L710_xx_DECAL. PCB》         |
|     |                              |
|     |                              |

## 1.4 Abbreviations

Table 1-2 is the relevant abbreviation and English interpretation of the whole document.

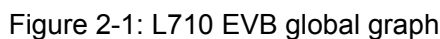
**Table 1- 2 Abbreviation**

| Abbreviation | FullnameinEnglish                           |
|--------------|---------------------------------------------|
| ESD          | Electro-Static discharge                    |
| USB          | Universal Serial Bus                        |
| UART         | Universal Asynchronous Receiver Transmitter |
| SDCC         | Secure Digital Card Controller              |
| USIM         | UniversalSubscriber Identification Module   |
| SPI          | Serial Peripheral Interface                 |
| I2C          | Inter-Integrated Circuit                    |
| PCM          | Pulse-coded Modulation                      |
| I/O          | Input/output                                |

|       |                                           |
|-------|-------------------------------------------|
| LED   | Light Emitting Diode                      |
| GPIO  | General-purpose Input/Output              |
| GSM   | Global Standard for Mobile Communications |
| GPRS  | General Packet Radio Service              |
| CDMA  | Code Division Multiple Access             |
| WCDMA | Wideband Code Division Multi Access       |
| UMTS  | Universal Mobile Telecommunication System |
| HSDPA | High Speed Downlink Packet Access         |
| HSUPA | High Speed Uplink Packet Access           |
| AGPS  | Assisted Global Positioning System        |
| BER   | Bit Error Rate                            |
| DL    | Downlink                                  |
| COEX  | WLAM/LTE-ISM coexistence                  |
| SMPS  | Switched-mode power supplies              |
| LTE   | Long Term Evolution                       |
| FDD   | Frequency Division Duplexing              |
| TDD   | Time Division Duplexing                   |
| IoT   | Internet of things                        |

## 2 Abstract

L710 Evaluation Board (silkscreen L506\_EVB ) Is specially designed for developing L710 serial module, To help developers to develop, debug, test L710 series 4 GIoT LTE module. Below and mark shows L710 the main functions of the development board. In this article, we will in the subsequent chapters on the function of each part is described.



1. The L710 USB port is on the EPI board, not on the EVB.
2. The power switch S2. This switch S2 can switch the corresponding power input way, Choose an external power adapter or direct bonding wire by external input 3.8 V dc power supply.
3. DB9 UART is serial port for module AT instruction, same as USB uart.
4. USB for Debug UART is used for user to retrieve the Debug information.
5. To facilitate the user's use, maintain a minimum system and we provide a power interface on the L710 EPI board.

L710 development board provides two methods for power supply: External DC 5 V adapter and 3.8 V DC power supply directly. Through an external DC 5 V adapter power supply, the power supply voltage regulator on the development board piece of power supply will be converted to about 3.8 V, power supply for the module. These two modes can be switched by S1. Switch S1 to the top when using DC 5V adapter and Switch S1 to the bottom when using battery power. The power indicator (LED1 next to the power switch) will light up when the system is powered on. As shown in the figure below:



Figure 3-1: L710 development board power in Status (orange Power LED Light up)

## 4 Key Description

L710 development board with a total of 5 top pressure switch and 14 dial switch. 5 top pressure for short press trigger control, 14 dial switch (single pole double throw) for the long time state toggle switch. The corresponding function on the L710 development board has a corresponding printing information, the function of the specific instructions are as follows:

### 4.1 Power on/off and RESET key

When power supply for the EVB, the power indicator will light up. The lower left corner of the PWRKEY button on the board, long press 500 MS, can open the module, and press the PWRKEY button

for more time, then reset the module.

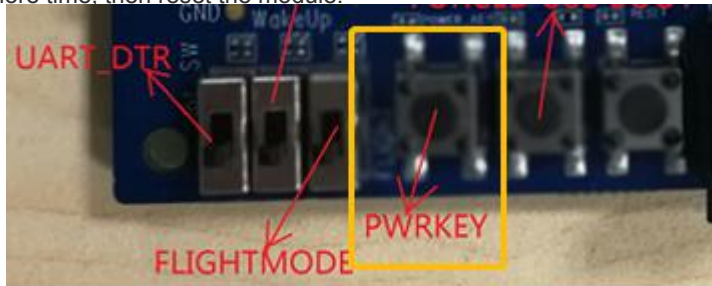


Figure 4-1: Power on/off reset key

## 4.2 FORCED USB download key

The L710 enables modules to enter forced download mode by pressing the FORCED USB BOOT button, at which point the FORCED USB BOOT will be pulled up to 1.8v. Before the system is powered on, press the FORCED USB BOOT key and the PWRKEY key at the same time to enable the L710 module to enter the forced download mode.



Figure 4-2: forced usb download key

## 4.3 WATCHDOG key

Press the WDOG key and the PWRKEY key at the same time will disable the watchdog function. Normally on, the watchdog function is enabled, the system will feed the dog regularly. The watchdog button is mainly used for software debug.

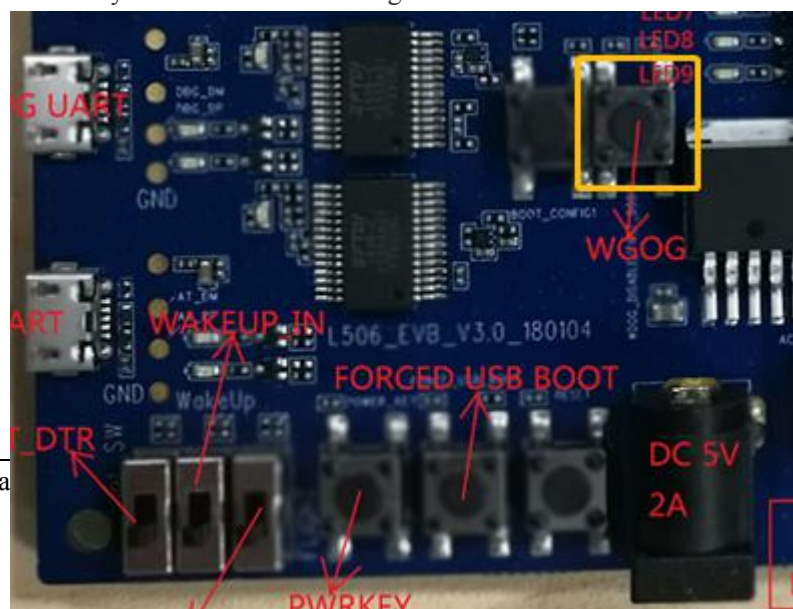


Figure 4-3: WDOG key

## 5 Application interface

### 5.1 UART DB9 Interface

There is a DB9 COM port on the L710 development board, and its signal pin is consistent with the signal on the L710 module. The serial interface as the main serial port can support complete 9 - line RS232. The COMS 1.8v level on the L710 module is converted to the standard RS232 level via serial port level conversion chip SP3238. Users can connect to PC or other terminal devices through DB9 serial port cable provided for serial port communication. Main serial port (this function has not been opened yet) supports hardware flow control for AT instruction, data transmission, etc. When using, you need to dial the switch S4 to the right as shown in the arrow direction below.



Figure5-1: L710 RS232 (DB9) Port

*Note: About the serial port baud rate associated Settings, please refer to L710 software user manual.*

## 5.2 USB (AT UART) Interface

In addition to the DB9 serial port described in 5.1 for AT communication, L506\_EVB\_V3 also provides a set of USB virtual serial ports with exactly the same functions as DB9 serial ports for AT instruction and data transmission. In use, also need to wave switch S4 to the right. DB9 serial port function is turned off after USB cable is plugged in. AT instruction and other functions can only be completed through this serial port.

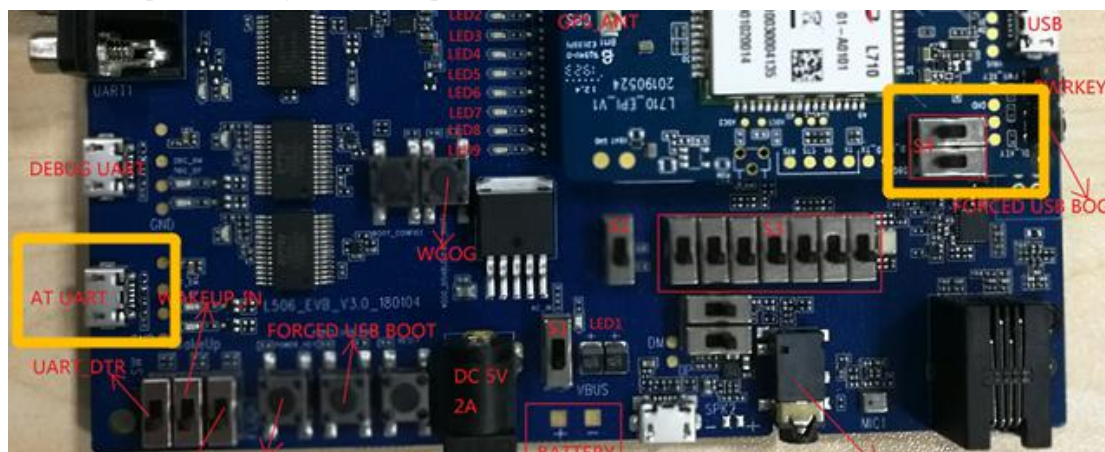


Figure5-2: USB (AT UART) Port

## 5.3 USB (DEBUG UART) Interface

When software is debugging and analyzing problems, LOG can be captured by USB virtual DEBUG serial port. In use, you need to dial the switch S4 to the left. After the serial port is inserted into USB, DB9 serial port is closed. Sending AT can only use the USB virtual serial port mentioned in 5.2.

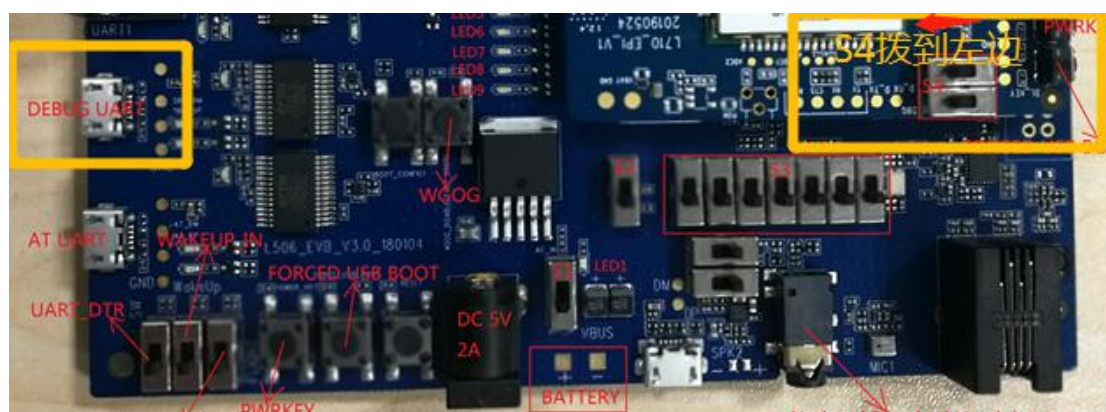


Figure5-3: USB (DEBUG UART) Port

## 5.4 USB 2.0 Interface

The L710 module supports USB 2.0 with a maximum USB transfer rate of 480Mbps. Software version download can be download through this USB serial port.



Figure5-4: USB 2.0 Port

## 5.5 SIMCard Interface

L710 support one single voltage (1.8V) SIM interface, but for the convenience of users, we have provided two SIM holder interface. it's standard SIM card slot and Micro SIM card slot. Each SIM slot automatic identification (correspond change the SIM support voltage) show as below figure:

*Note: Because L710 only support one SIM card port, so can't assemble two SIM card at the same time in your applications.*

If the audio codec chip MAX9867ETJ+ is used in L506\_EVB\_V3, the MIC input and sound output are through headphone channels. Earphones need to use Chinese standard earphones.

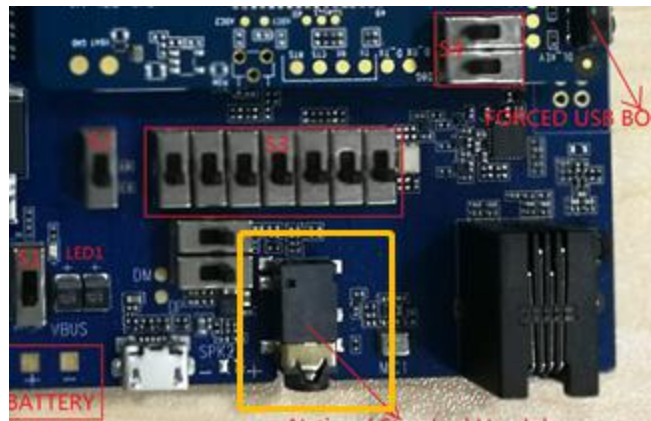


Figure5-6: Chinese standard earphone

The L710 antenna interface is located on the module load board mounted on the EVB board and provides two antenna interfaces, one of which is the main antenna port, directly connected to the antenna for wireless function, and the other is the GPS antenna interface. Main antenna interface adopts SMA head, connected to the supporting external antenna by cable; GPS antenna USES IPX interface. As shown in the figure below:

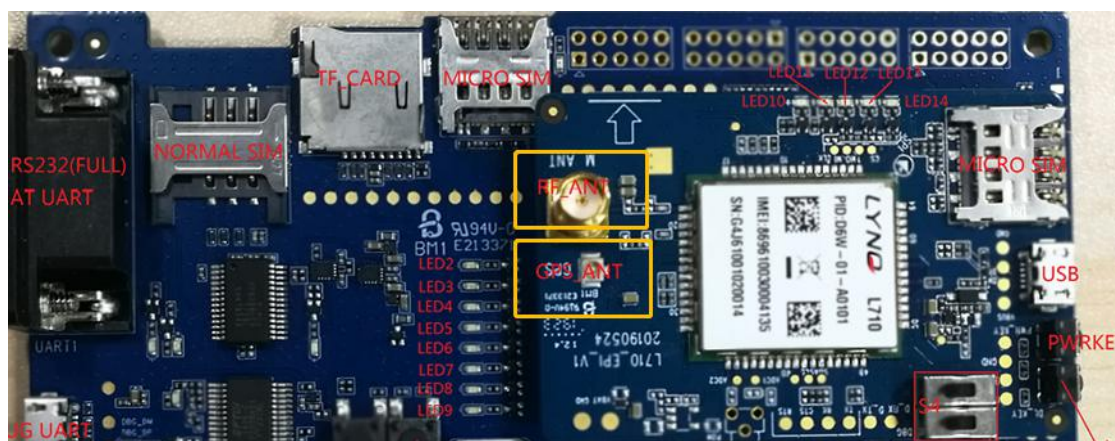


Figure5-7: Function module load plate and antenna interface

*Note: L710 has only one main antenna interface, and the user can only use ANT\_MAIN as the antenna interface when it is actually used.*

## 5.8 Audio interface (TBD)

The L710 module supports 1-channel PCM channel, which can also be reused as I2S signal. When using, switch S2 and S3 are needed to cooperate. The switch S2 is a software and hardware switch. When switching S2 to the top, the software can pull GPIO25 high level to make the power supply and crystal vibration of CODEC; When switching S2 to the bottom, the hardware automatically enables the power and crystal oscillator of CODEC. The switch S3 is the selection switch of CODEC. When switching S3 to the top, CODEC uses MAX9867ETJ+ chip. When using the MAX9867ETJ+ chip, the sound comes from the earphone, the Chinese standard earphone needs to be plugged in. Switch S3 to the bottom, the CODEC chip is NUA8814. At this time, the sound comes from the SPK end, and 8 ohm horn can be welded to the SPK end. Toggle switch as shown in the figure below:

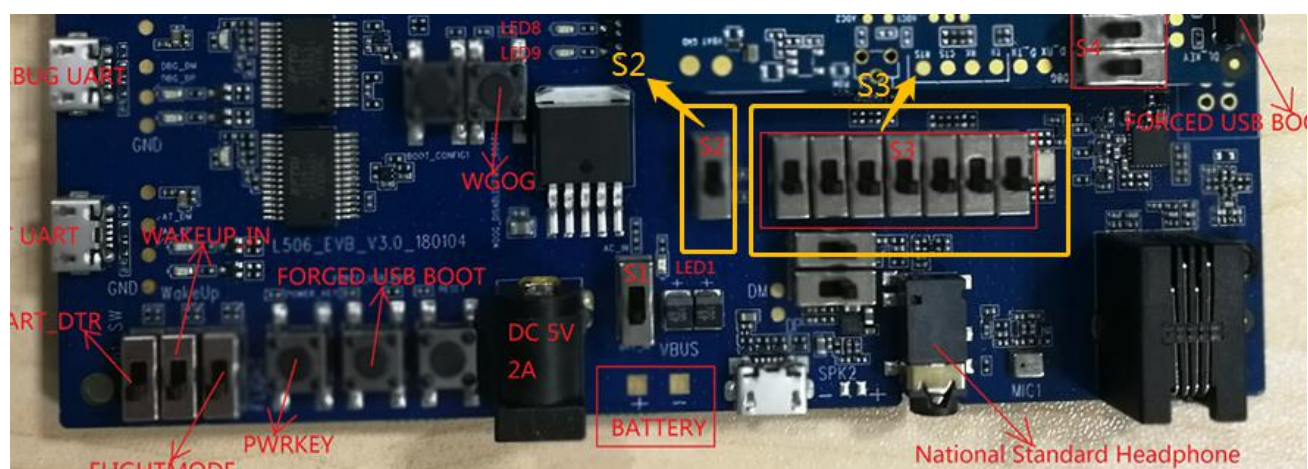
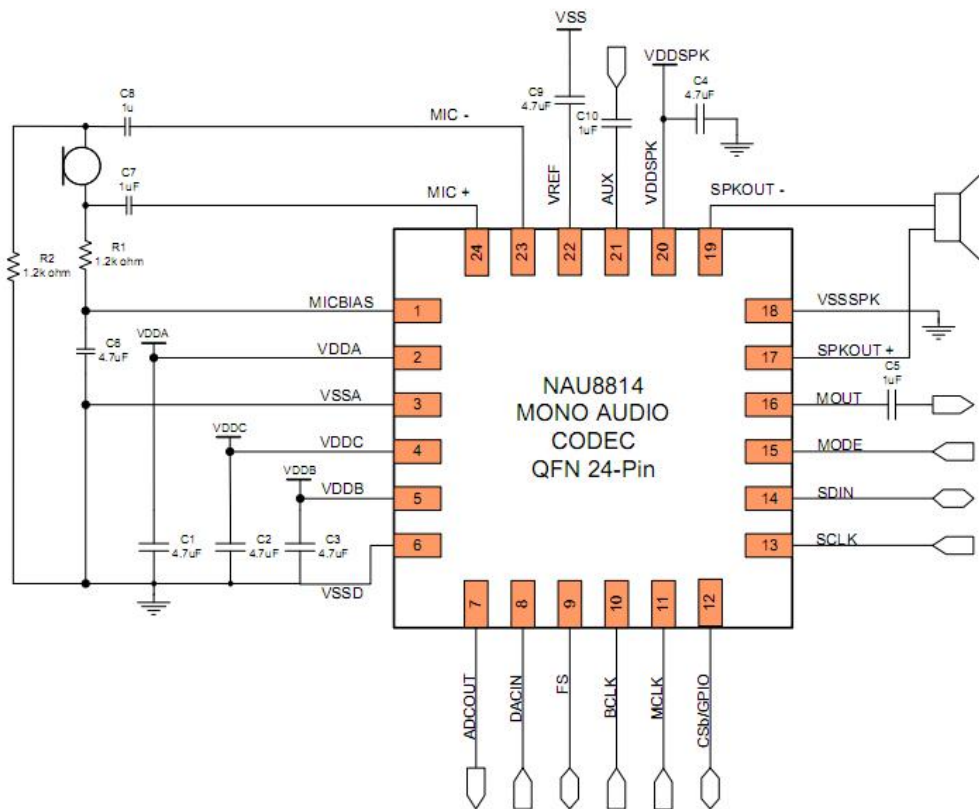


Figure5-8: CODEC SWITCH S2 S3

The default audio solution on EVB development board is NAU8814, so the external audio channel

is also developed based on NAU8814. The general block diagram is as follows:



*Note: Audio system is a very complicate system, it contains many factors, such as the sound chamber structure. Because in our EVB there is no sound chamber, so it only make sure the function is OK or not.*

## 5.9 LED indicating lamp

The development board has 13 functional indicators to indicate the status of different functional units. The definitions of each lamp are shown in table 1:

| number | name                    | describe                                                      |
|--------|-------------------------|---------------------------------------------------------------|
| LED1   | System supply indicator | LED on indicate that the system is powered on                 |
| LED2   | CODEC enable            | Switch S2 to the top, and software pull GPIO25 up, the LED on |
| LED3   | NETLIGHT                | Network indicator                                             |
| LED4   | I2C_SDA                 | I2C/GPIO Multiplexing channel                                 |
| LED5   | SPI_MISO_BLSP2          | SPI/GPIO Multiplexing channel                                 |
| LED6   | I2C_SCL                 | I2C/GPIO Multiplexing channel                                 |
| LED7   | WAKEUP_IN               | Wake up the interrupt                                         |

|       |           |                               |
|-------|-----------|-------------------------------|
| LED8  | STATUS    | System status indicator       |
| LED9  | ISINK     | ISINK                         |
| LED11 | MB_GPIO_0 | GPIO Enable Pin               |
| LED12 | SPI_CLK   | SPI/GPIO Multiplexing channel |
| LED13 | SPI_MOSI  | SPI/GPIO Multiplexing channel |
| LED14 | SPI_CS    | SPI/GPIO Multiplexing channel |

Table 5-1: LED

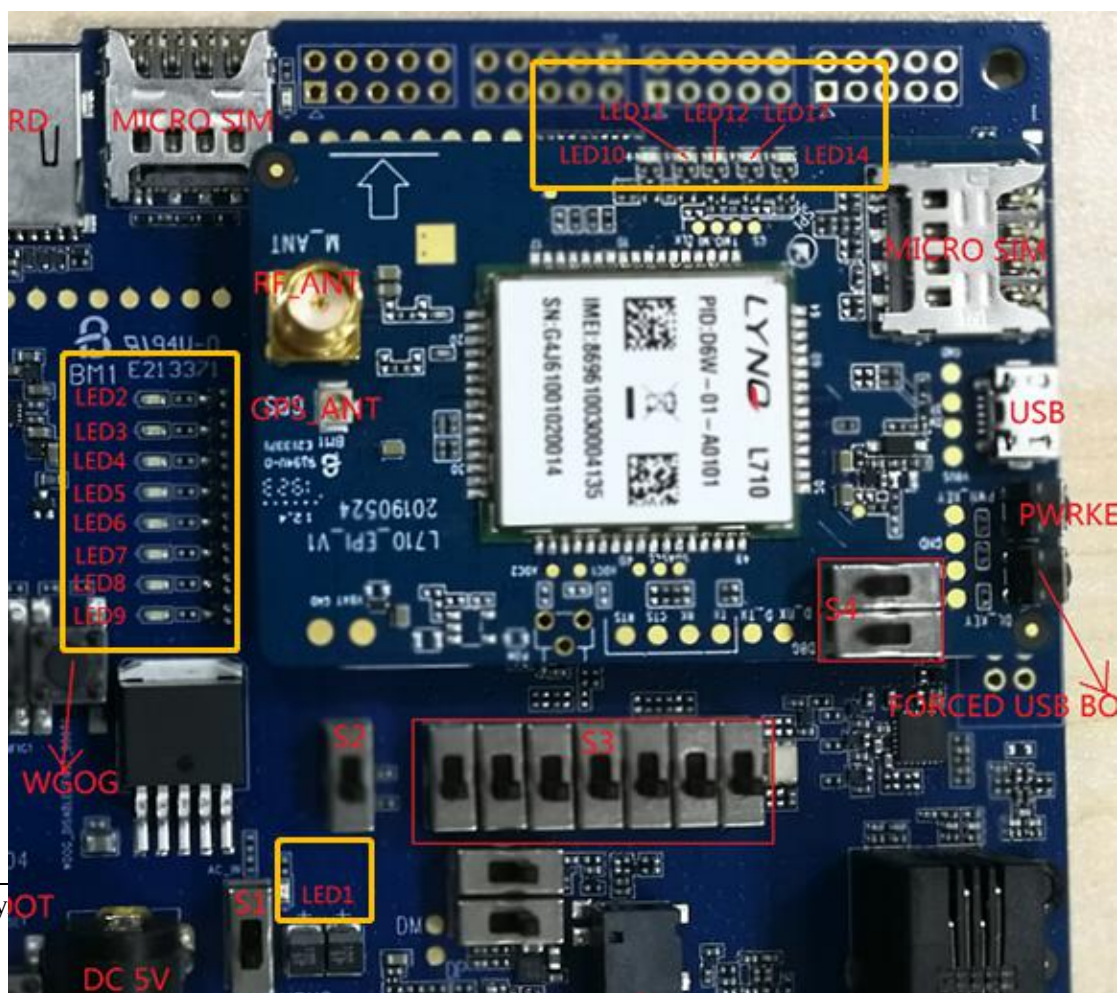


Figure5-9: Status indicator

*Note: For configuration and inquiry of each indicator light and toggle switch, please refer to the L710 software manual document*

## 5.10 The others

Development board reserved 1 groups of external connection pin interface, used for debugging the peripheral devices and production test purpose. The corresponding interface definition and physical objects as shown in the figure below:

|                                                                                    |              |                    |
|------------------------------------------------------------------------------------|--------------|--------------------|
|  | 1 VPH_PWR    | 30 NC              |
|                                                                                    | 2 VPH_PWR    | 29 GND             |
|                                                                                    | 3 VPH_PWR    | 28 FORCED_USB_BOOT |
|                                                                                    | 4 GND        | 27 WAKEUP_IN       |
|                                                                                    | 5 NC         | 26 GND             |
|                                                                                    | 6 NC         | 25 ADC2            |
|                                                                                    | 7 RESERVED   | 24 ADC1            |
|                                                                                    | 8 GND        | 23 RESERVED        |
|                                                                                    | 9 SIM_POWER  | 22 RESERVED        |
|                                                                                    | 10 SIM_RESET | 21 NC              |
|                                                                                    | 11 SIM_CLOCK | 20 RESERVED        |
|                                                                                    | 12 SIM_DATA  | 19 PHONE_ON        |
|                                                                                    | 13 GND       | 18 GND             |
|                                                                                    | 14 NC        | 17 ISINK           |
|                                                                                    | 15 MCLK      | 16 STATUS          |

Figure5-10: For Test Module Main Interface

In addition, for the convenience of users, we also can all use the module to the interface of the derivation, using 2.54 mm spacing standard dupont line can be connected. Interface is located in the development board above the upper right corner, specific interface function as shown in the figure

below:

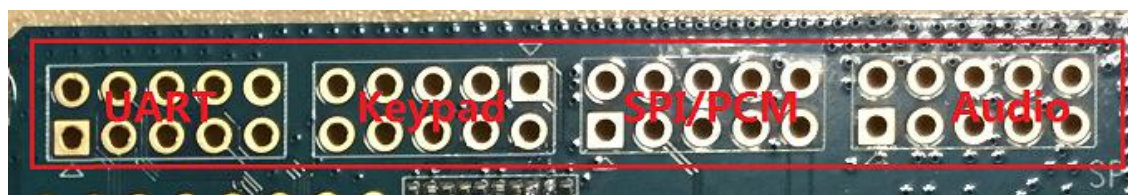


Figure5-11: Function interface

| UART       |           |              |              |           |
|------------|-----------|--------------|--------------|-----------|
| 2 LED_RED  | 4 UART_RX | 6 UART_CTS_N | 8 UART_RTS_N | 10 GND    |
| 1 UART_DTR | 3 UART_TX | 5 UART_DCD   | 7 UART_RI    | 9 VPH_PWR |

| Keypad |      |      |      |      |
|--------|------|------|------|------|
| 9 NC   | 7 NC | 5 NC | 3 NC | 1 NC |
| 10 NC  | 8 NC | 6 NC | 4 NC | 2 NC |

| I2C/SPI/PCM |                  |           |                  |           |
|-------------|------------------|-----------|------------------|-----------|
| 2 I2C_SCL   | 4 SPI_MISO_BLSP2 | 6 I2C_SDA | 8 SPI_CS_N_BLSP2 | 10 GND    |
| 1 PCM_CLK   | 3 PCM_IN         | 5 PCM_OUT | 7 PCM_SYNC       | 9 VPH_PWR |

| Audio       |             |       |              |               |
|-------------|-------------|-------|--------------|---------------|
| 2 EAR_OUT_N | 4 EAR_OUT_P | 6 GND | 8 SPK_OUT_P1 | 10 SPK_OUT_N1 |
| 1 MIC1_P    | 3 MIC1_N    | 5 GND | 7 MIC1_IN_P  | 9 MIC1_IN_M   |

Table 5-2

*Note: the above figure and above table are the corresponding relations between form and practice.*

## 6 Accessories and Assembly

### 6.1 EVB Assembly

EVB board parts altogether consists of four parts: 1) the EVB board substrate, 2) module board, 3) module loading board connection EVB board substrate connection column and nuts, 4) EVB board pillar base plate and screw.



L710 module and loading board



EVB



column and nutPillar and the screw



Figure 6-1: EVB Assemble

## 6.2 EVB Accessory

L710 development board will provide the corresponding accessories, when unpacking the case, please check the accessories are complete. Under normal circumstances, A complete set of equipment should include power adapter (A) DC power supply line, Micro USB cable (B), (C) rod antenna, (D) RF cable line.

As shown in the figure below:



Figure 6-2: Accessories and the connection diagram

## 6.2 .1 Antenna description

Type: Single-stage sub-antenna

GSM 850/1900:Gain: 3dBi

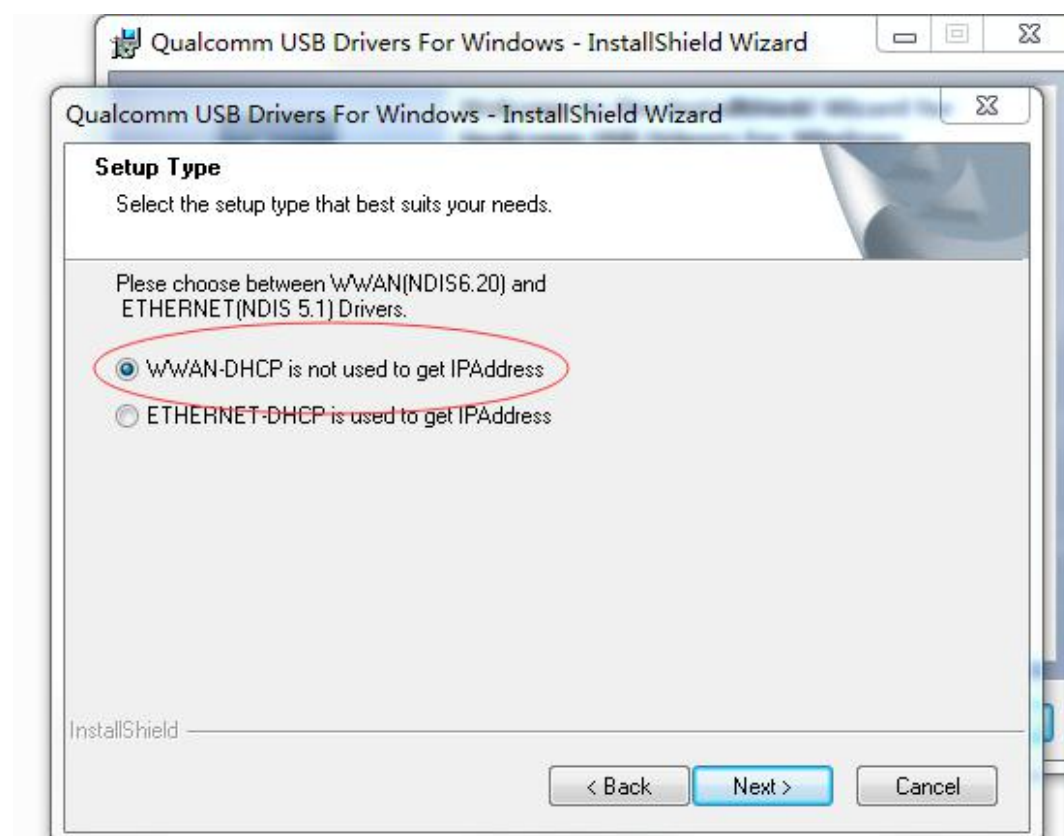
NB-IoT B2/CAT-M B2:Gain: 3dBi

NB-IoT B4,B5,B12,B13,B26;CAT-M B4,B5,B12,B13,B26 :Gain: 4dBi

Support band: CATM/NB B2,B4,B5,B12,B13,B26, GSM 850MHZ PCS 1900MHZ

## 6.3 Driver install

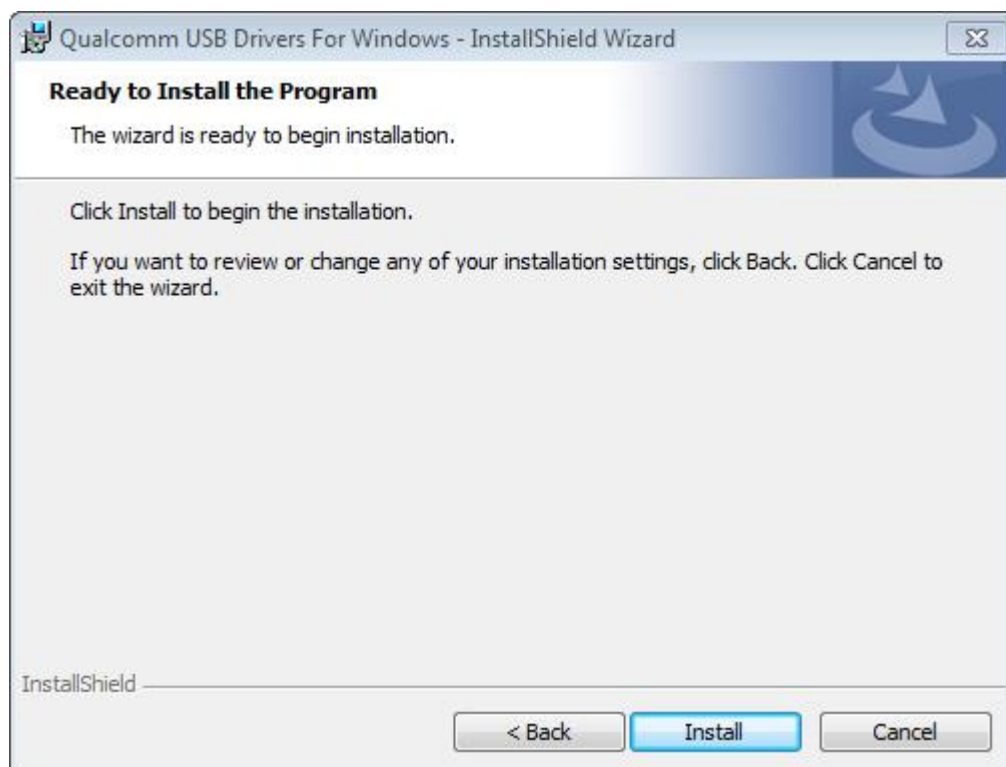
Unzip file: QUD.WIN.1.1 Installer\_10037.3.zip and click setup.exe to install driver



Select “WWAN-DHCP is not used to get IPAddress”, then Next



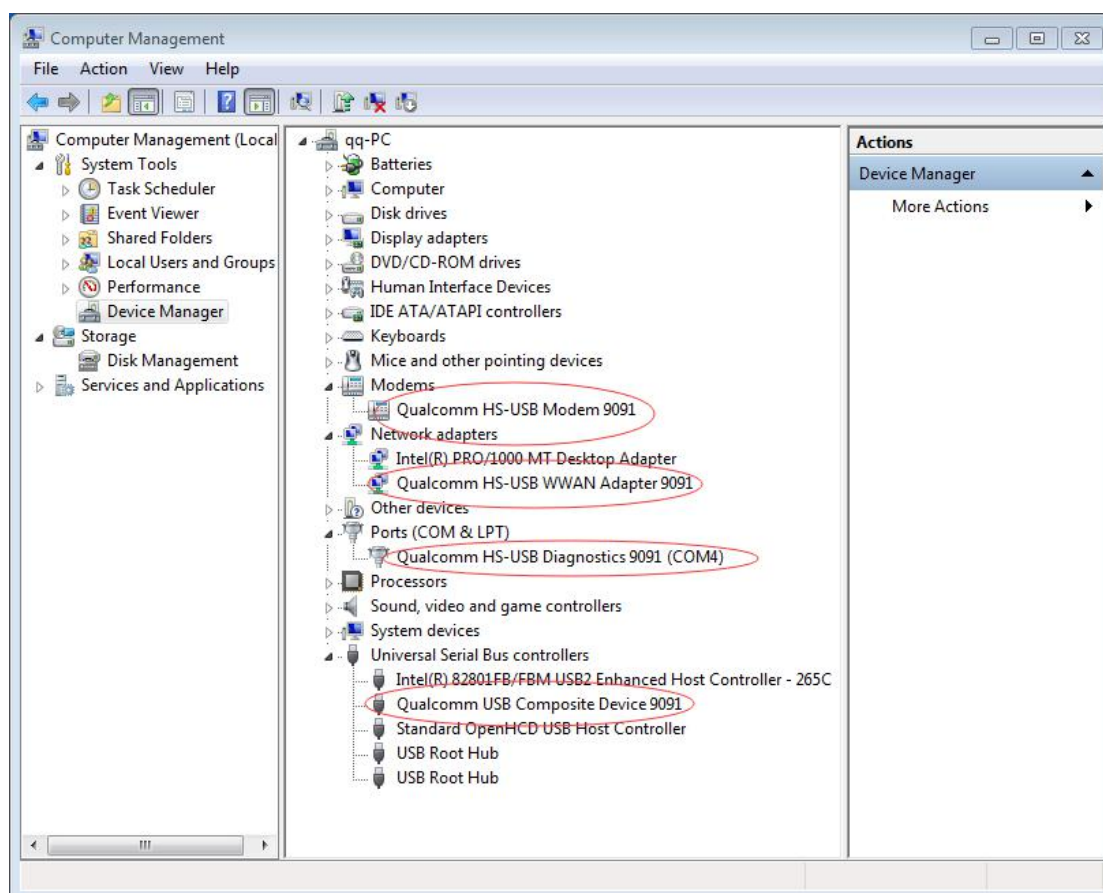
Select “I accept the terms in the license agreement”, then Next





Check “Always trust software from “QUALCOMM” Incorporated” , then Install

Power on the L710 module and connect USB cable, Drivers have been installed successfully if the Device Manager panel display the following:

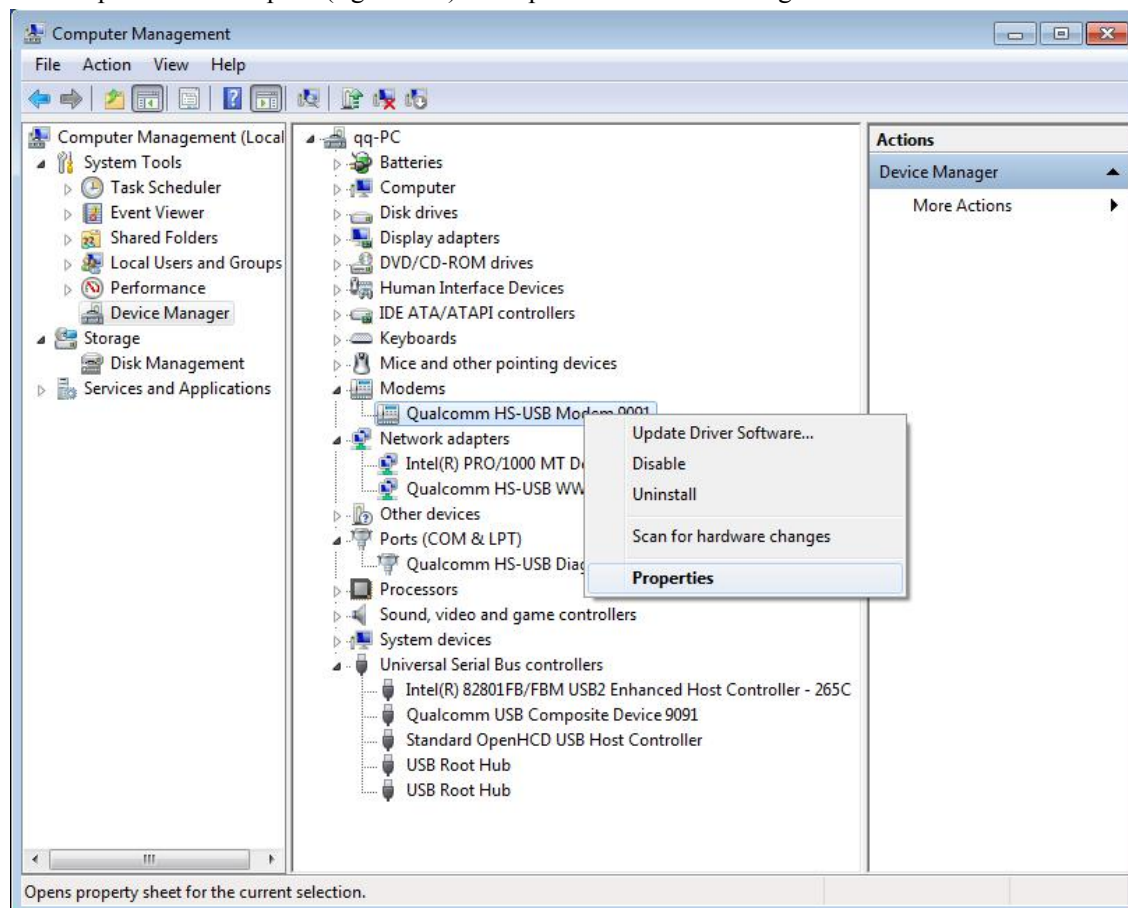


## 6.4 Dial configuration

Please refer to the following steps to complete third dial-up configuration.

The testing card is china mobile SIM

1. Open win->Computer(right click) ->Properties->Device Manager



2. On Advance TAB, type `AT+CGDCONT=1,"IP","CMNET"` and save it

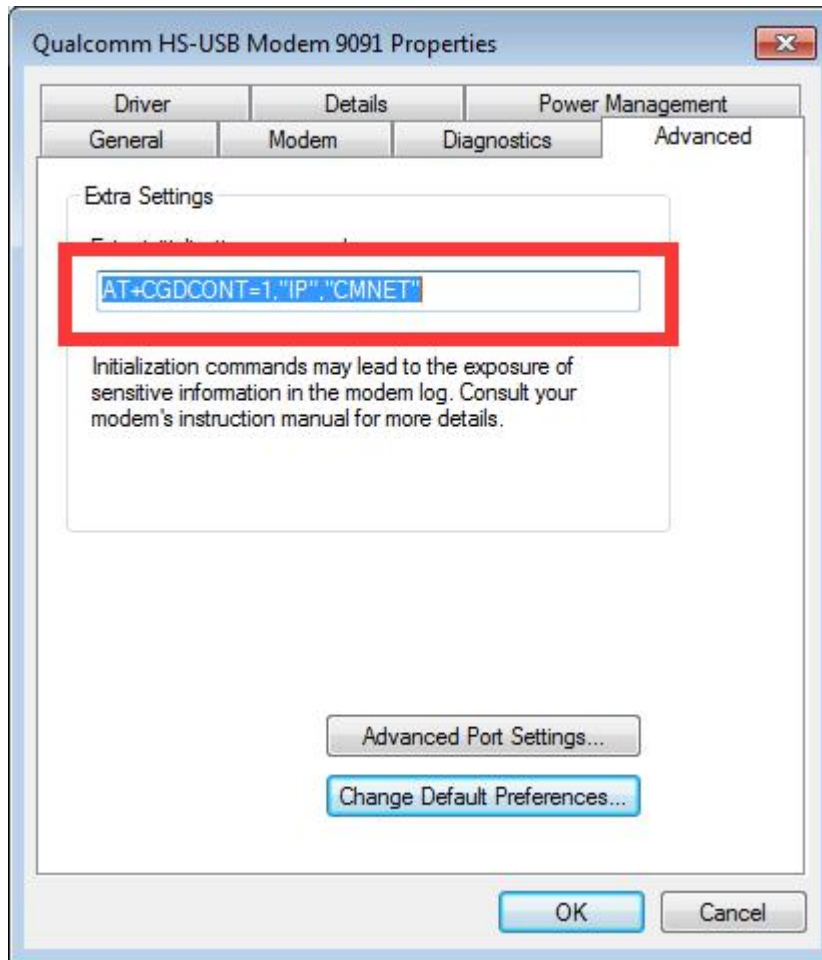
NOTES:

The third argument for APN, defined by operators.

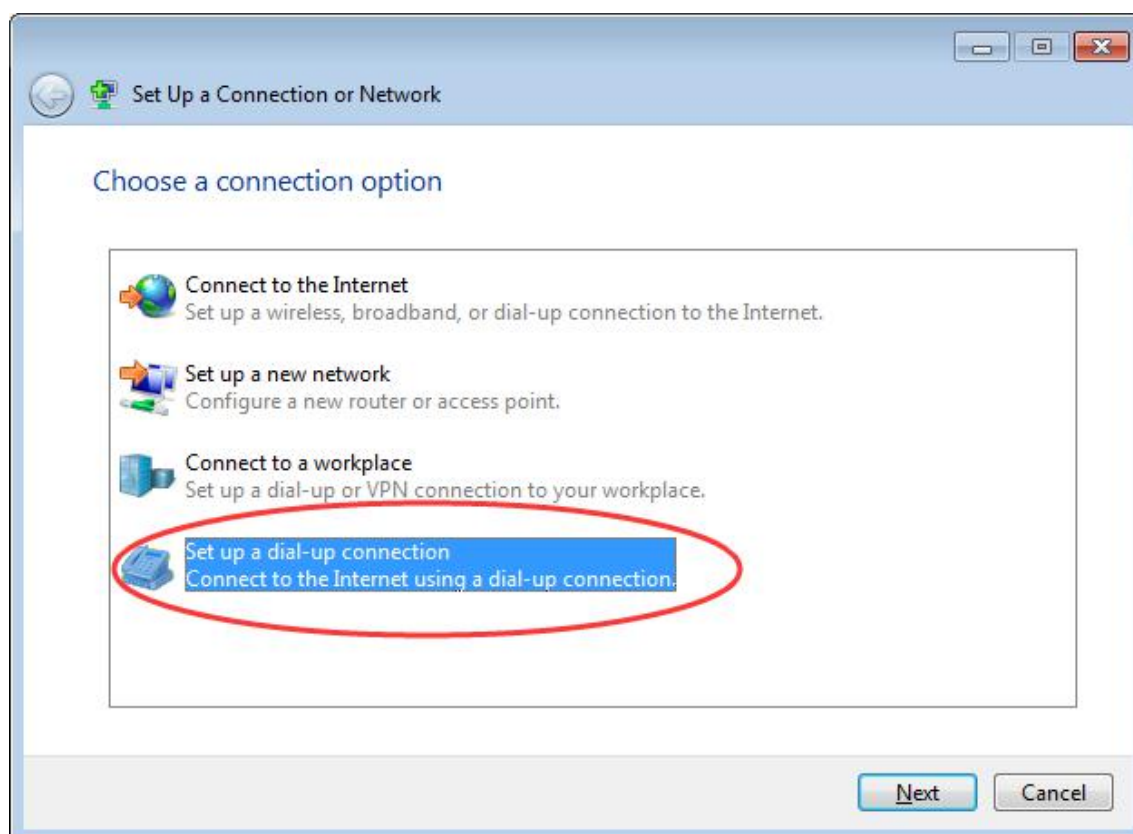
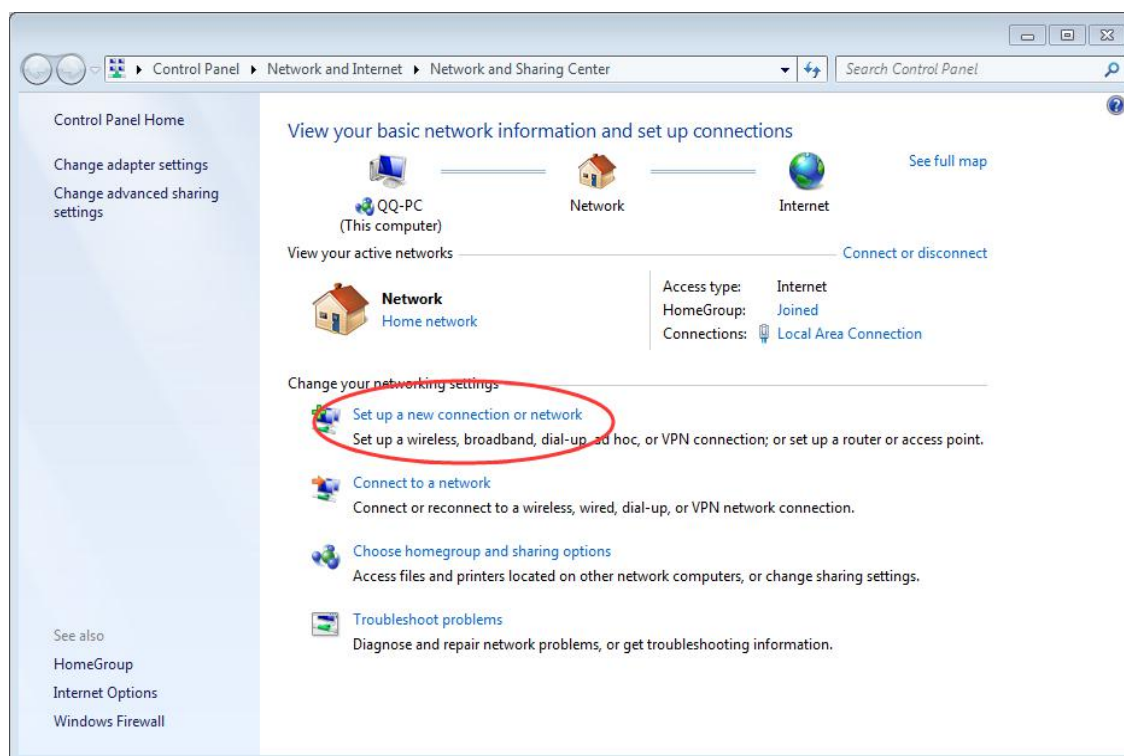
China unicom 2g network: uninet

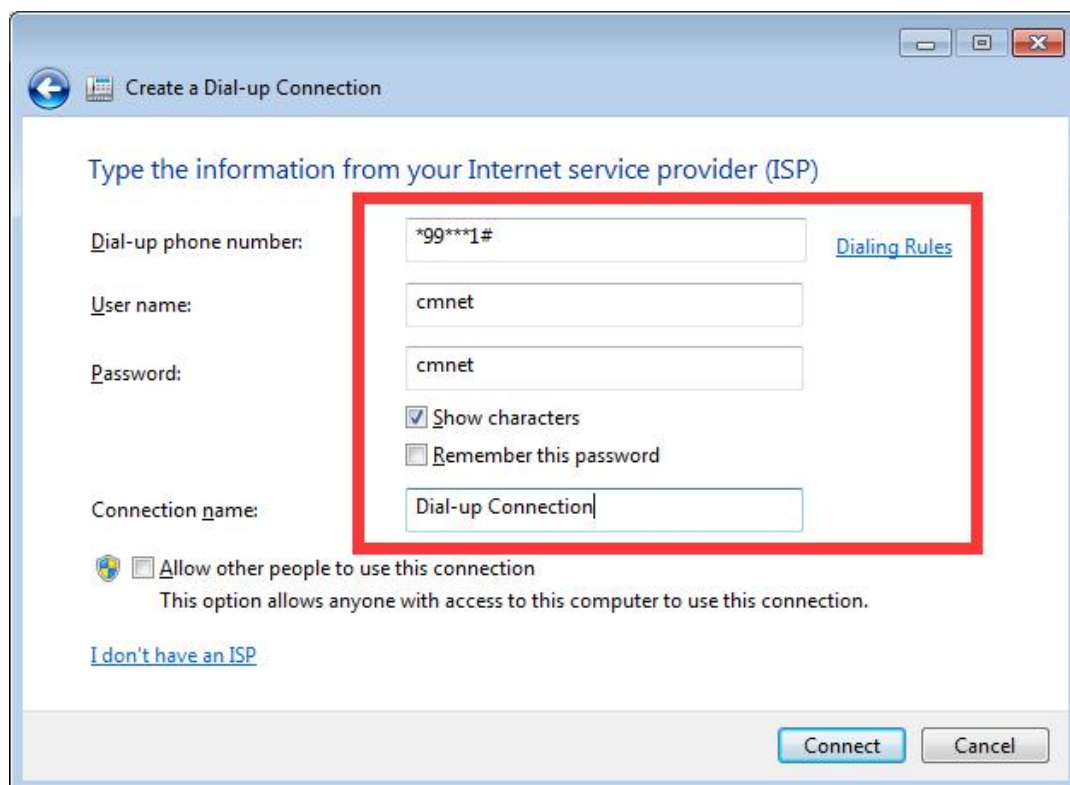
China unicom 3g network: 3gnet

China mobile: cmnet or cmwap



3. Open Network and Sharing Center, then set up a new connection or network



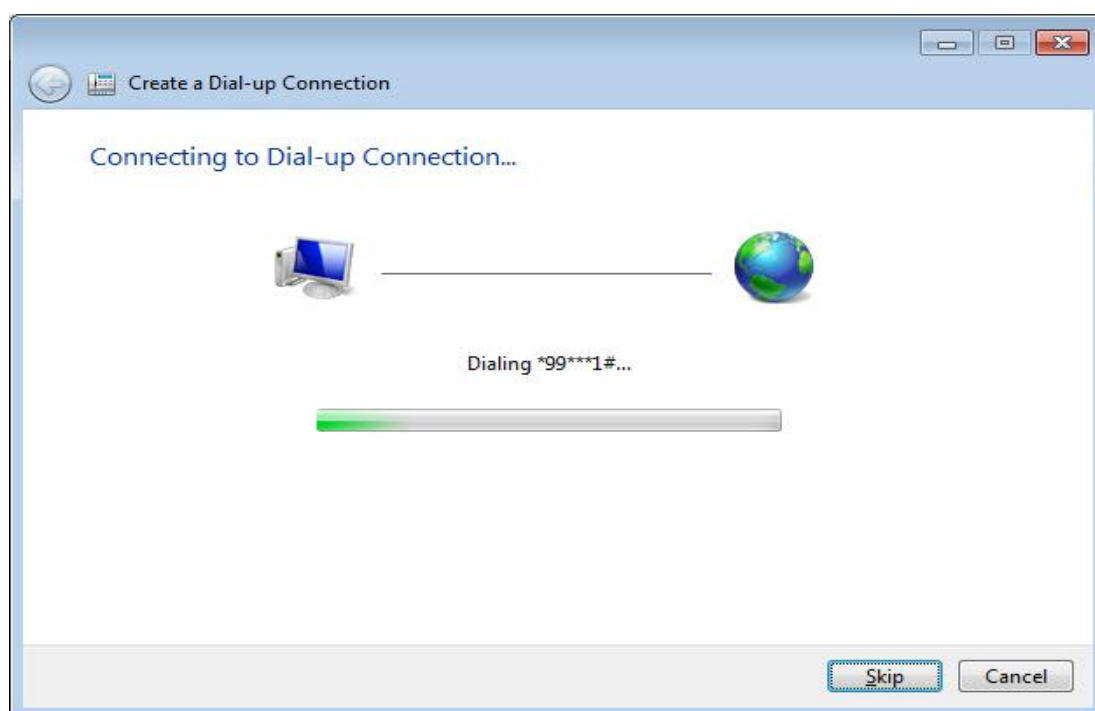


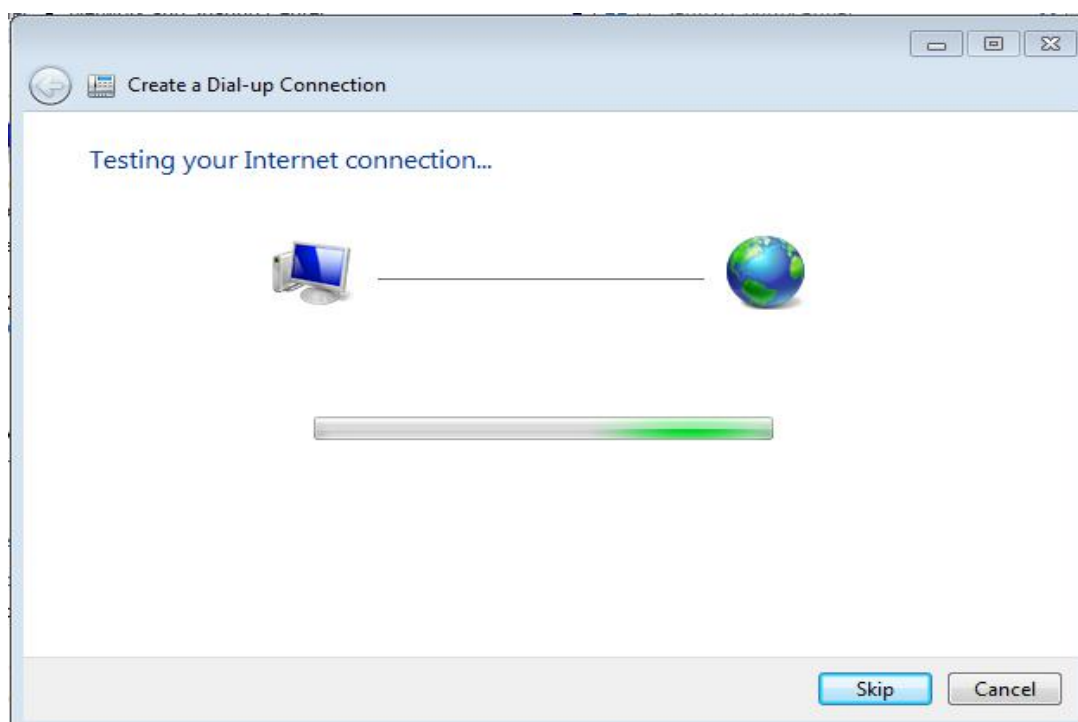
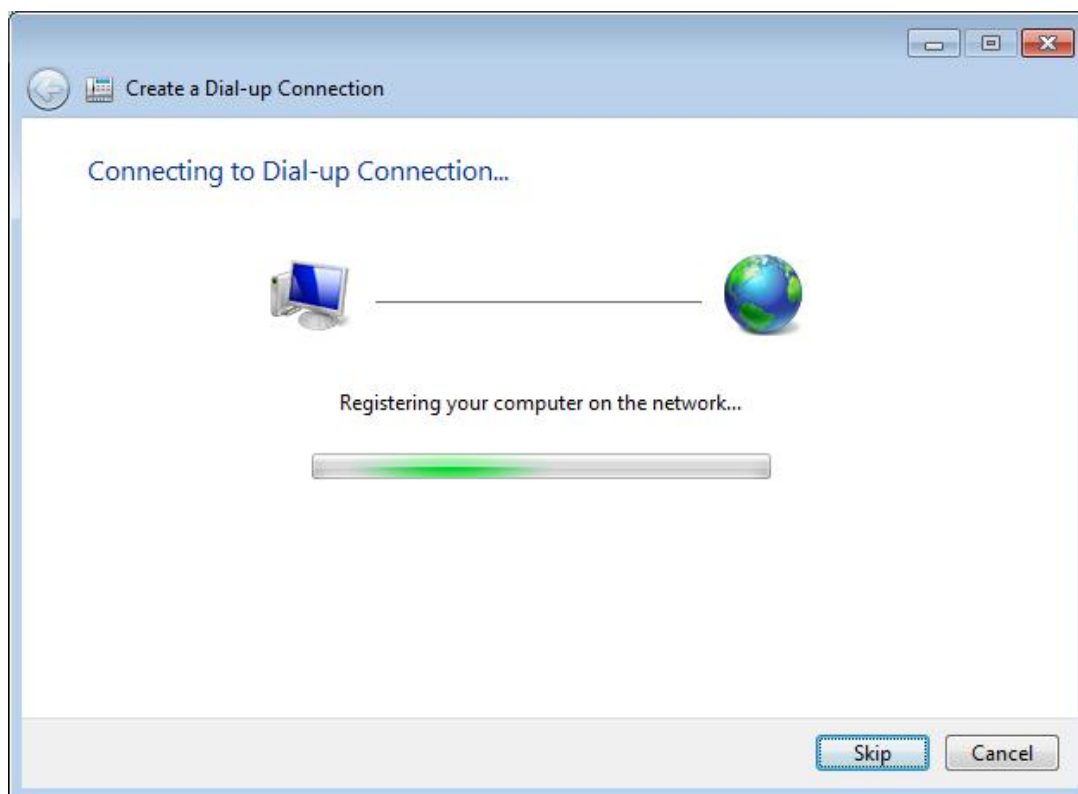
Type Dial-up phone number, User name, Password, then Connect

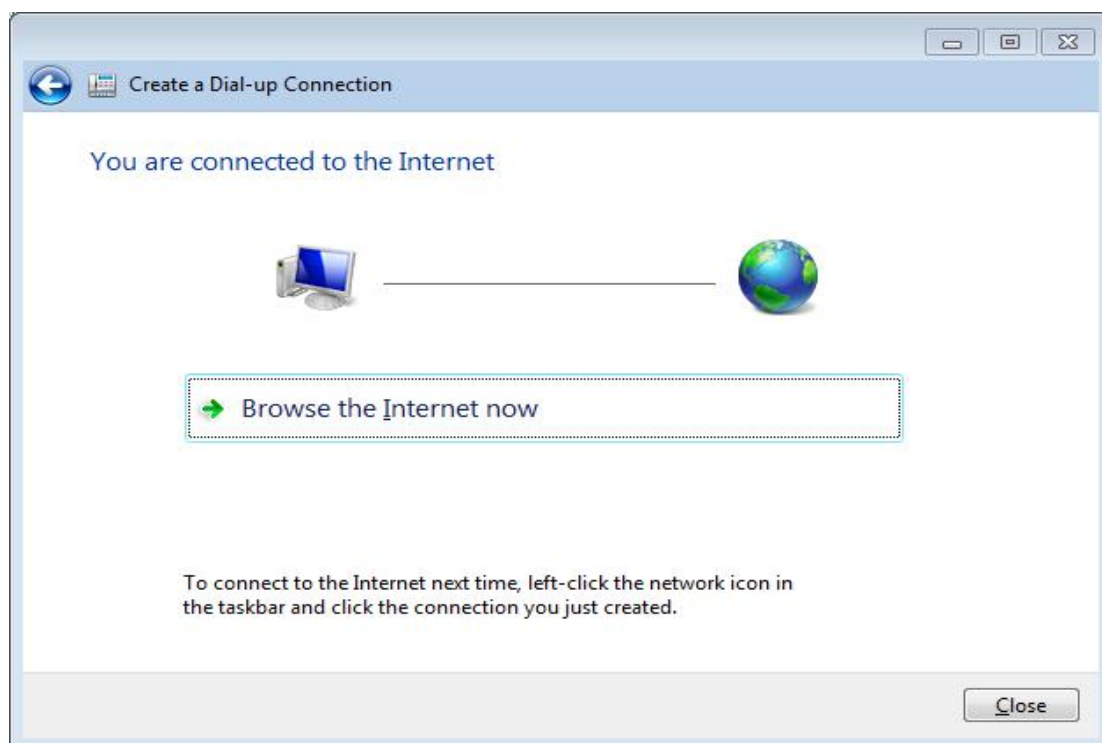
NOTES:

\*99\*\*\*1# cmnetcmnet just for china mobile

Please consult the operators to obtain information before connect







Connected to the network successfully

## 6.5 Radio frequency function

RF Function Overview:

- Multi -Band Half Duplex FDD-LTE NB/CATM B2/B4/B5/B12/B13/B26
- GSM 2 BAND: GSM850 PCS1900

The operating frequency range of the transmitter is shown in table 2-1.

Table 2- 1 RF frequency band

| Working band | Upstream band (Uplink) | Downlink frequency (Downlink) |
|--------------|------------------------|-------------------------------|
| FDD_LTE B2   | 1850 MHz — 1910 MHz    | 1930 MHz — 1990MHz            |
| FDD_LTE B4   | 1710 MHz — 1755MHz     | 2110 MHz — 2155MHz            |
| FDD_LTE B5   | 824 MHz~849 MHz        | 869 MHz~894 MHz               |
| FDD_LTE B12  | 699 MHz~716 MHz        | 729 MHz~746 MHz               |
| FDD_LTE B13  | 777 MHz~787 MHz        | 746 MHz~756 MHz               |
| FDD_LTE B26  | 814 MHz~849 MHz        | 859 MHz~894 MHz               |
| GSM850       | 824 MHz — 849MHz       | 869 MHz — 894 MHz             |
| GSM1900      | 1850 MHz — 1910MHz     | 1930 MHz — 1990MHz            |

Table 2-2 Conducted transmission power

| Working Band | Max Power | Min Power |
|--------------|-----------|-----------|
|--------------|-----------|-----------|

|             |                 |                |
|-------------|-----------------|----------------|
| FDD_LTE B2  | 20dBm +/-2.7dB  | <-40dBm        |
| FDD_LTE B4  | 20dBm +/-2.7dB  | <-40dBm        |
| FDD_LTE B5  | 20dBm +/-2.7dB  | <-40dBm        |
| FDD_LTE B12 | 20dBm +/-2.7dB  | <-40dBm        |
| FDD_LTE B13 | 20dBm +/-2.7dB  | <-40dBm        |
| FDD_LTE B26 | 20dBm +/-2.7dB  | <-40dBm        |
| GSM850      | 33dBm $\pm$ 2dB | 5dBm $\pm$ 5dB |
| PCS1900     | 30dBm $\pm$ 2dB | 0dBm $\pm$ 5dB |

Table 2-3 Reference sensitivity (QPSK)

| Channel bandwidth |                                    |                                          |                                                |                                                      |             |
|-------------------|------------------------------------|------------------------------------------|------------------------------------------------|------------------------------------------------------|-------------|
| E-UTRA Band       | 200 KHz (CAT NB1) REF SENS (Total) | 200 KHz (CAT NB1) REF SENS (EPRE @15KHz) | 200 KHz (CAT NB1) NB-PDSCH repetitions (Total) | 200 KHz (CAT NB1) NB-PDSCH repetitions (EPRE @15KHz) | Duplex Mode |
| 2                 | -113                               | -123.8                                   | TBD                                            | = Total – 10.8dBm                                    | HD-FDD      |
| 4                 | -113                               | -123.8                                   | TBD                                            | = Total – 10.8dBm                                    | HD-FDD      |
| 5                 | -114                               | -124.8                                   | TBD                                            | = Total – 10.8dBm                                    | HD-FDD      |
| 12                | -114                               | -124.8                                   | TBD                                            | = Total – 10.8dBm                                    | HD-FDD      |
| 13                | -114                               | -124.8                                   | TBD                                            | = Total – 10.8dBm                                    | HD-FDD      |
| 26                | -114                               | -124.8                                   | TBD                                            | = Total – 10.8dBm                                    | HD-FDD      |

