

Table 16: Amphenol USIM socket pin description

Pin	Signal	Description
C1	USIM_VDD	USIM Card Power supply.
C2	USIM_RST	USIM Card Reset.
C3	USIM_CLK	USIM Card Clock.
C5	GND	Connect to GND.
C6	VPP	NC
C7	USIM_DATA	USIM Card data I/O.

3.6 Analog audio interface

A7672X/7670X modules integrate audio codec and audio front end, provide 1 channel of analog audio MIC input interface and 1 channel of analog audio SPK output interface, customers can connect to the external phone handle for voice calls.

ADC: 90dB SNR@20~20kHz
 DAC: 95dB SNR@20~20kHz
 (Class-AB): THD<-85dB@32-ohm

Table 17: MIC input ADC parameter list

Parameter	MIN	Type	MAX	Unit
Clock frequency	-	6.144	-	MHz

Table 18: Analog audio Parameter

Parameter	条件	DR (Type.)	THD+N (Type.)	MAX Power
DAC	RL=10K	101dBA	-96dB(@vout -2dBv)	1.59Vp
Class-AB	Mono,32Ω Difference	100dBA	-90dB(0.00316%) (@20mW output)	37mW

3.6.1 Analog audio reference design

The analog audio recommendation circuit is as follows:

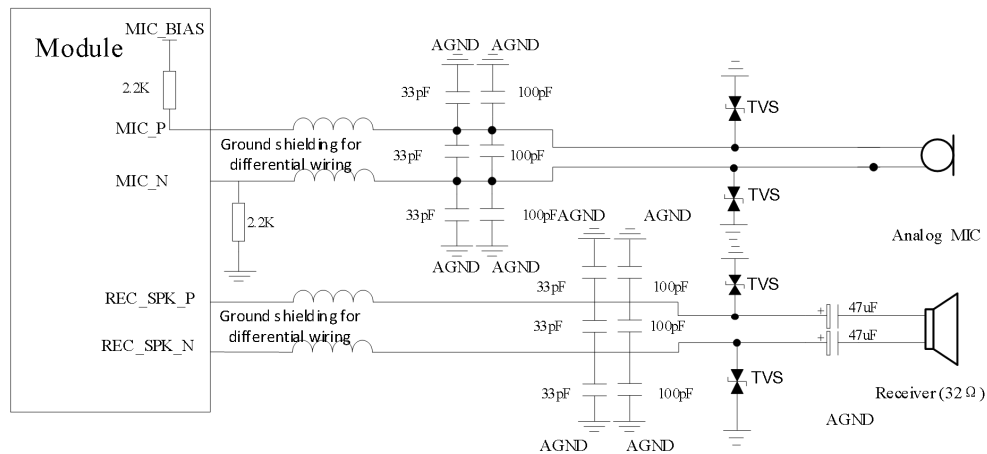


Figure 24: Analog audio interface reference circuit

3.7 Matrix keyboard interface

A7672X/7670X provides a 4*4 matrix keyboard interface.

Table 19: matrix keyboard PIN description

PIN Name	PIN NO.	I/O	Description	Note
MK_IN2	47	DI	Matrix keyboard input	If unused, keep it open.
MK_IN3	20	DI		
MK_IN5	68	DI		
MK_IN6	36	DI		
MK_OUT2	44	DO	Matrix keyboard output	If unused, keep it open.
MK_OUT3	21	DO		
MK_OUT5	67	DO		
MK_OUT6	35	DO		

The matrix keyboard interface recommendation circuit is as follows:

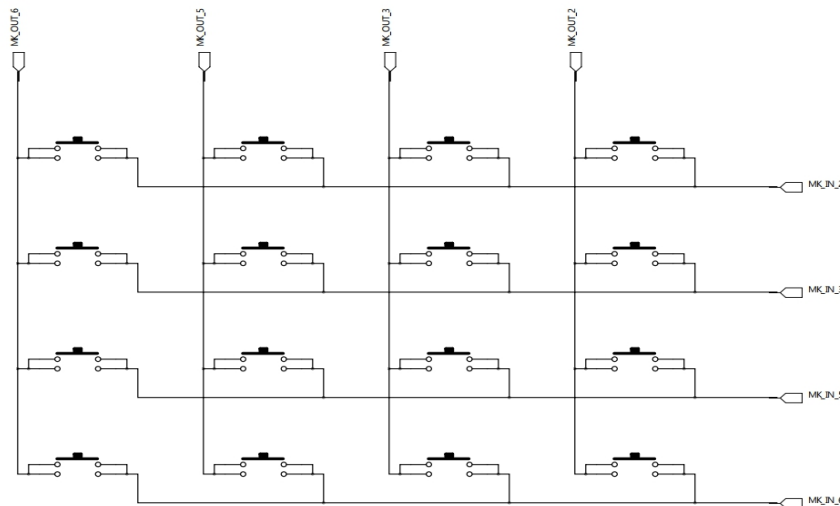


Figure 25: Matrix keyboard interface reference circuit

3.8 GPIO Interface

A7672X/A7670X module provides multiple GPIOs.

Table 20: Standard GPIO Resources of A7672X/A7670X

Pin No.	Pin name	AT command operation GPIO number	Pin typ.	Power domain	Default function	Pad Edge wakeup
19	GPIO1	GPIO1	IO	1.8V	PU	Yes
26	GPIO2	GPIO2	IO	1.8V	PD	Yes
48	GPIO3	GPIO3	IO	1.8V	PD	No
53	GPIO4	GPIO4	IO	1.8V	PU	Yes

3.9 I2C Bus

The module provides two sets of I2C interfaces, support standard speed clock frequency 100Kbps, support high speed clock frequency 400Kbps, its operation voltage is 1.8V.

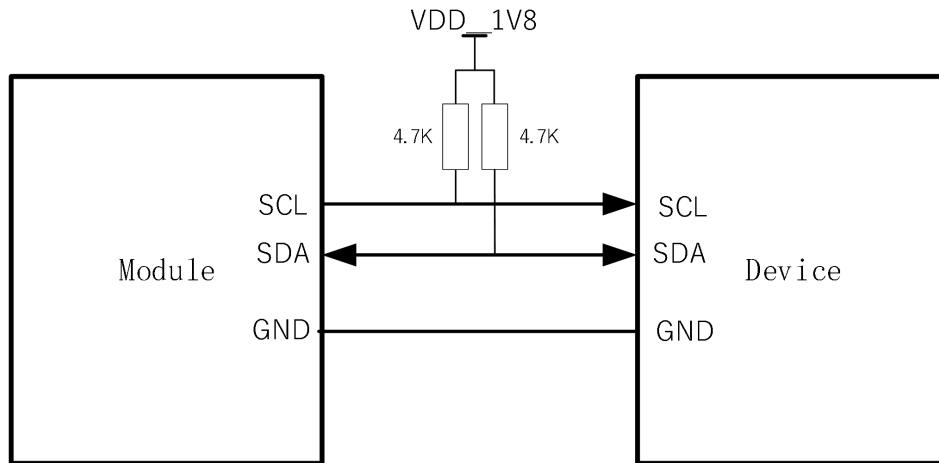


Figure 26: I2C reference circuit

NOTE

SCL and SDA have no pull-up resistor inside, external resistor is needed and the pulled power source must be VDD_1V8 output from the module.

3.10 Network status

The NETLIGHT pin is used to control Network Status LED, its reference circuit is shown in the following figure.

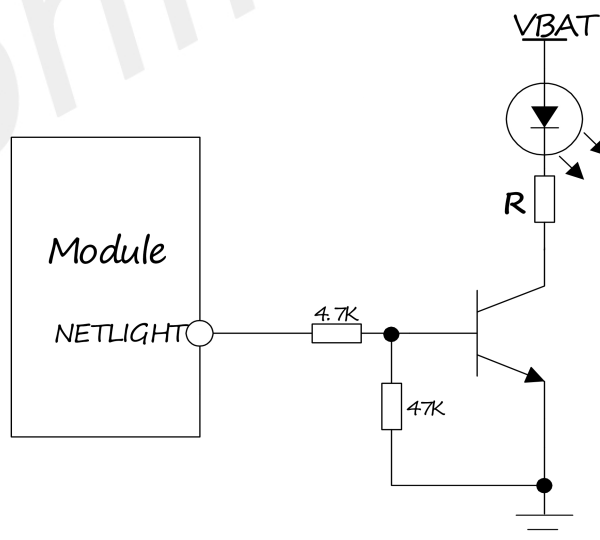


Figure 27: NETLIGHT reference circuit

NOTE

The value of the resistor named “R” depends on the LED characteristic.

The NETLIGHT signal is used to control the LED lights that indicate the status of the network. The working status of this pin is shown in the table below.

Table 21: 2G mode NETLIGHT pin status

NETLIGHT pin status	Module status
Always On	Searching Network
200ms ON, 200ms OFF	Data Transmit
800ms ON, 800ms OFF	Registered network
OFF	Power off / Sleep

Table 22: LTE mode NETLIGHT pin status

NETLIGHT pin status	Module status
Always On	Searching Network
200ms ON, 200ms OFF	Data Transmit/Registered
OFF	Power off / Sleep

3.11 GNSS interface

A7672X/A7670X support GNSS function interface. GNSS provides 2 power supply input interfaces, 1 GNSS power enable control switch, 1 UART interface and 1 pulse synchronous clock signal interface, which are described in detail as follows.

Table 23: GNSS interface description

PIN Name	PIN NO	I/O	Description	Note
GNSS_VBKP	116	PI	GNSS backup power input	Power supply range 1.4V~3.6V, I _{VBKP} =1mA (Typical, GNSS_VBKP=1.8V)。
1V8_GNSS	97	PI	GNSS Vcore、VDDIO input	The supply voltage shall not be less than 1.8V, and routing width should more than 0.5mm.
GNSS_PWRCTL	98	DI	GNSS Vcore、VDDIO power enable control	Active high。 Solution 1: Connect to GPIO, recommend use MK_IN_3(PIN20)。 Solution 2: Connect to MCU GPIO。

GNSS_RXD	96	DI	GNSS UART RX	1.8V power domain。 Solution 1: Use 1K resistor to connect UART3_TXD (PIN50) of the module in series。 Solution2:Connect to MCU UART_TX。
GPS_TXD	95	DO	GNSS UART TX	1.8V power domain。 Solution 1: Use 1K resistor to connect UART3_RXD (PIN49) of the module in series。 Solution2 : Connect to MCU UART_RX
1PPS	100	DO	GNSS pulse synchronous clock signal	If unused, keep it open.

GNSS recommended reference design solution 1:

A7672X/A7670X module itself provides power, power enable and UART transmission to GNSS, the recommended reference design as follow:

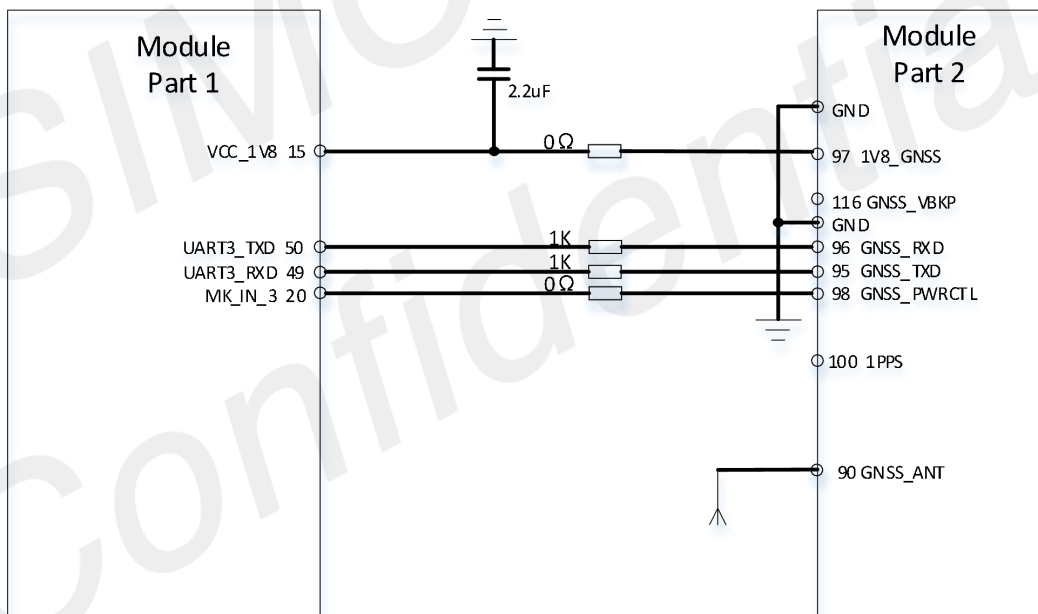


Figure 28: GNSS reference design (Non-standalone GNSS solution)

GNSS recommended reference design solution 2:

The external MCU provides power, power enable and UART transmission to GNSS, this solution is used for scenarios where GNSS can work standalone without the module powering up. The recommended reference design as follow:

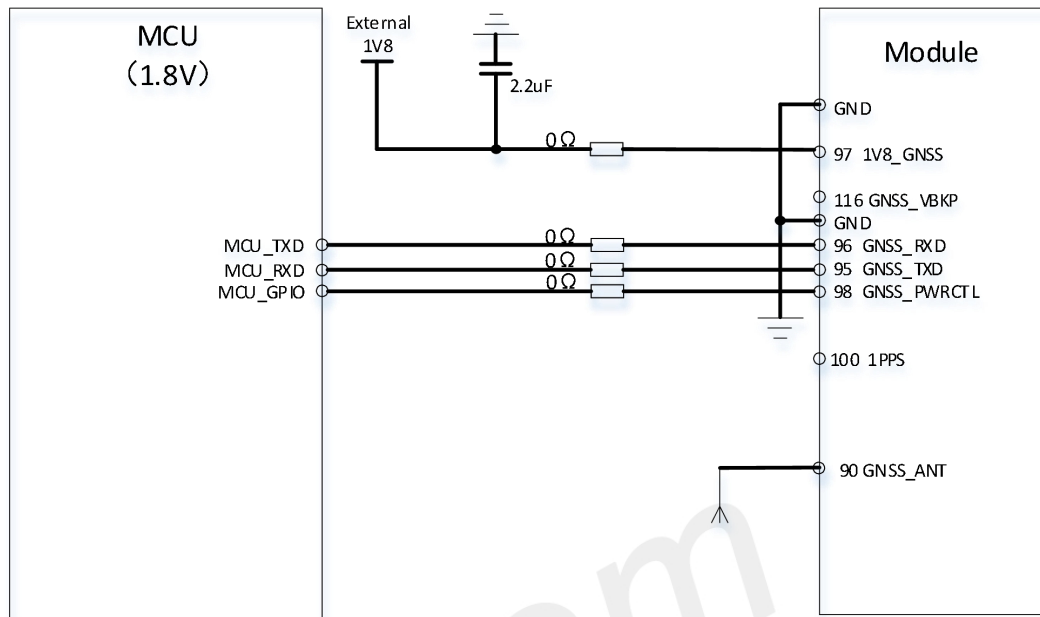


Figure 29: GNSS reference design (standalone GNSS solution)

NOTE

1. Please series in 10K resistors for serial communication lines with non-standalone GNSS solution to prevent leakage current to the serial ports of GNSS chip.
2. The standalone GNSS reference design is only applicable to 1.8V power domain MCU. If the MCU is not 1.8V power domain, a level shift circuit should be added.
3. The Vcore power for GNSS 1V8_GNSS has higher requirements for power supply, PCB routing should as short as possible, and the routing width is required to be at least 0.5mm
4. In some condition, it may be necessary to send dynamic loading code to GNSS chip through serial port. If having dynamic loading requirement, it is recommended to use reference design solution 1(non-standalone GNSS solution). Customers should let MCU realize the dynamic loading process by yourself if used reference design solution 2(standalone GNSS solution).
5. GNSS_VBKP power supply input is a necessary condition for hardware hot start, which can ensure the performance index of GNSS hot start to reach the optimal state, but when 1.8V input, the typical current consumption value is 1mA; Customers can choose the software AP-Flash hot start scheme, GNSS_VBKP can remain suspended; Compared with GNSS_VBKP hardware hot boot, AP-Flash has lower performance indicators.
6. The principle of the hot startup of AP-Flash software is that GNSS will download the located ephemeris data to the internal FLASH of the module before the module shutdown . GNSS will download the relevant ephemeris data of the last location to achieve rapid positioning when it is powered on next time. Detailed usage method reference document [1].

3.12 SPI LCD interface

A7672X/A7670X module provides a set of SPI LCD interface, which only supports LCD module of 1 data line. The LCD interface of the module does not have specified LCD_TE signal pin. If necessary, you can choose GPIO to simulate the use of LCD_TE signal. It is recommended to use module pin 44 (MK_OUT_2) as the LCD_TE signal.

It is recommended to reserve decoupling capacitor on the power supply for LCD, and reserve 0 Ω resistor in series for debugging. At the same time, 0 Ω in series is reserved on the data line to facilitate the adjustment of signal quality and prevent signal reflection, overshoot.

Table 24: LCD interface description

PIN Name	PIN NO	I/O	Description	Note
LCD_BL_PWM	101	DO	LCD backlight PWM signal	
LCD_SPI_CLK	102	DO	SPI clock	
LCD_SPI_TXD	103	DO, DI	SPI data (Bidirectional)	
LCD_SPI_RXD	104	DI	SPI data	
LCD_SPI_CS	105	DO	SPI CS	
LCD_RST	106	DO	LCD reset	
LCD_DCX	107	DO	LCD command/parameter selection	

The recommended reference design of SPI LCD as follow:

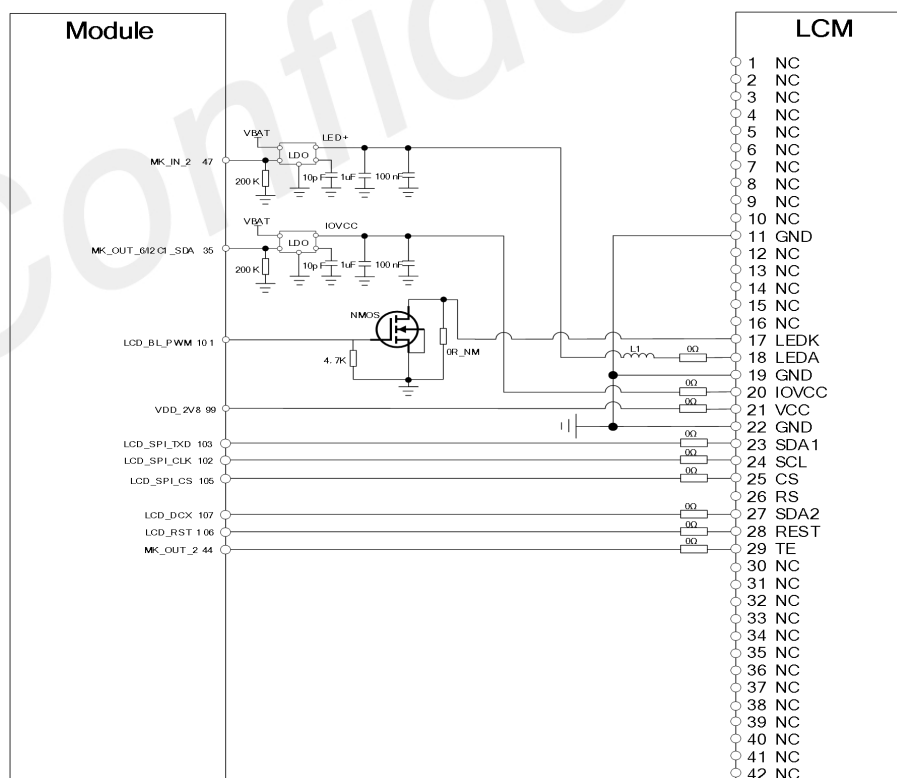


Figure 30: SPI LCD reference design

3.13 SPI camera interface

A7672X/A7670X only supports SPI camera interface, supports up to 0.3MP pixel encoding, does not support video mode.

Table 25: SPI camera interface description

PIN Name	PIN NO	I/O	Description	Note
CAM_I2C_SDA	117	DI, DO	CAM I2C data	
CAM_I2C_SCL	118	DO	CAM I2C clock	
CAM_PWDN	119	DO	CAM power down	
CAM_RST	120	DO	CAM reset	
CAM_MCLK	121	DO	CAM main clock	
CAM_SPI_D0	122	DI	CAM SPI DATA 0	
CAM_SPI_D1	123	DI	CAM SPI DATA 1	
CAM_SPI_CLK	124	DO	CAM SPI clock	

The recommended reference design of SPI camera as follow:

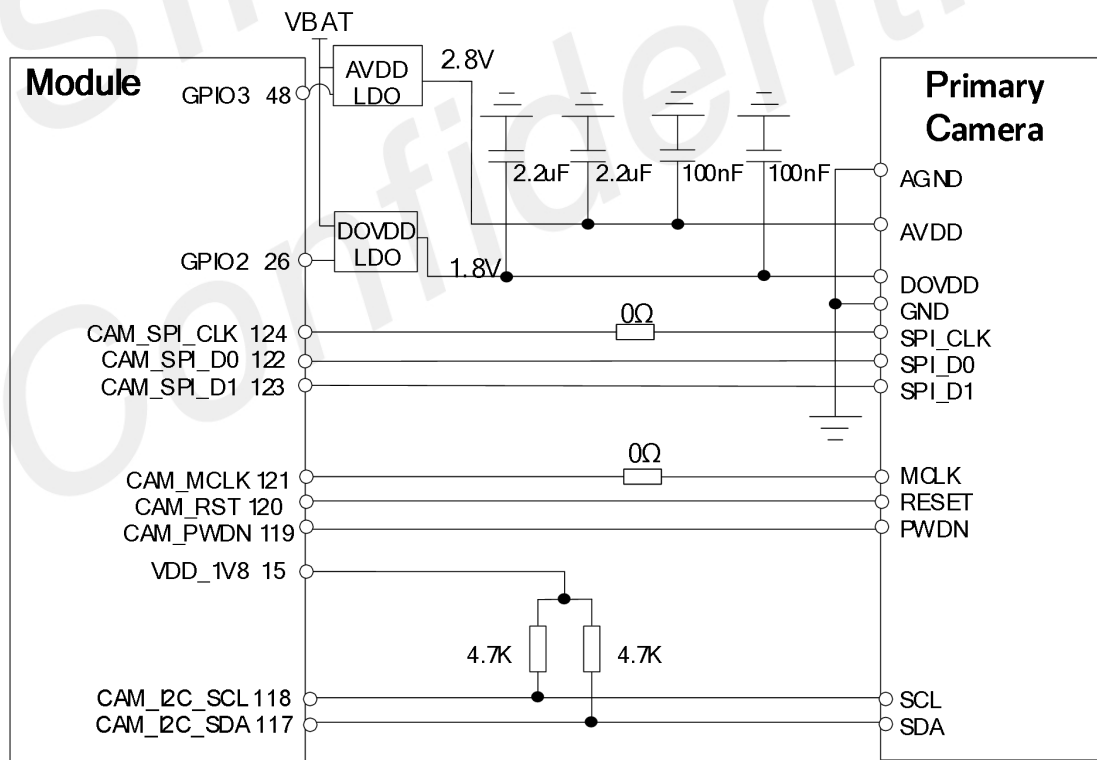


Figure 31: SPI camera reference design

3.14 Bluetooth interface

A7672X/A7670X module has integrated Bluetooth function inside, and only one BT antenna is left on the module interface. A7672X/A7670X Support BT5.0 protocol specification, compatible with BLE low power mode and traditional BT mode; It only supports Bluetooth data transmission and does not support VoiceOverPCM & VoHCl.

3.15 Another interface

3.15.1 ADC

A7672X/A7670X have 1 general ADC and 1 dedicated VBAT_ADC pins. VABT_ADC just available for digitizing battery voltage. These electronic specifications are shown in the following table.

Table 26: General ADC electronic characteristics

Characteristics	Min.	Typ.	Max.	Unit
Resolution	–	9	-	Bits
Input Range	0	-	1.8	V

Table 27: VBAT_ADC electronic characteristics

Characteristics	Min.	Typ.	Max.	Unit
Resolution	–	9	-	Bits
Input Range	0	-	1.8	V

NOTE

“AT+CADC” can be used to read the voltage of the ADC pin, for more details, please refer to document [1].

The recommended reference design of VBAT_ADC as follow:

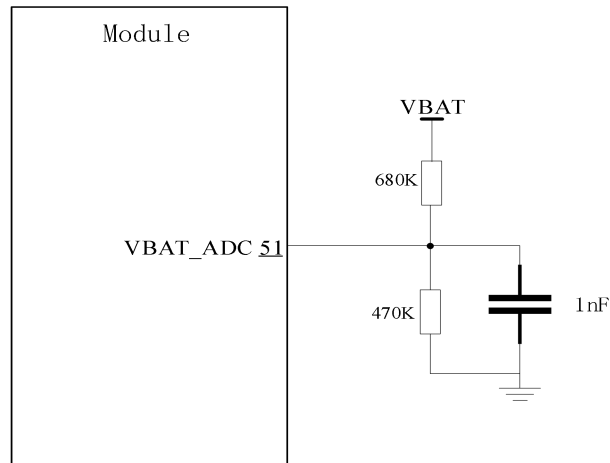


Figure 32: VBAT_ADC reference design

3.15.2 LDO

A7672X/A7670X has 2 LDO outputs: VDD_1V8 and VDD_2V8.

VDD_1V8 is the module's system IO power supply, which can only provide a current capacity of 50mA. It cannot be used as a high current drive source. It can be used as a power supply for module 1V8_GNSS (PIN97).

VDD_2V8 is the module 2.8V LDO power output, which can only provide a current capacity of 50mA. It cannot be used as a high current drive source. It can be used as a power supply for LCD VCC_2V8.

Table 28: VDD_1V8 Electrical characteristics

Symbol	Description	Min.	Typ.	Max.	Unit
V _{DD_1V8}	Output voltage	-	1.8	-	V
I _o	Output current	-	-	50	mA

Table 29: VDD_2V8 Electrical characteristics

Symbol	Description	Min.	Typ.	Max.	Unit
V _{DD_2V8}	Output voltage	-	2.8	-	V
I _o	Output current	-	-	50	mA

NOTE

VDD_1V8 is the system power supply. If the damage will affect the system startup, it is recommended that customers add TVS protection. The recommended model is ESD56051N.

4 RF Specifications

4.1 GSM/LTE Specifications

Table 30: Conducted transmission power

Frequency	Power	Min.
EGSM900	33dBm \pm 2dB	5dBm \pm 5dB
DCS1800	30dBm \pm 2dB	0dBm \pm 5dB
EGSM900 (8-PSK)	27dBm \pm 3dB	5dBm \pm 5dB
DCS1800 (8-PSK)	26dBm +3/-4dB	0dBm \pm 5dB
LTE-FDD B1	23dBm +/-2.7dB	<-40dBm
LTE-FDD B2	23dBm +/-2.7dB	<-40dBm
LTE-FDD B3	23dBm +/-2.7dB	<-40dBm
LTE-FDD B4	23dBm +/-2.7dB	<-40dBm
LTE-FDD B5	23dBm +/-2.7dB	<-40dBm
LTE-FDD B7	23dBm +/-2.7dB	<-40dBm
LTE-FDD B8	23dBm +/-2.7dB	<-40dBm
LTE-FDD B20	23dBm +/-2.7dB	<-40dBm
LTE-FDD B28	23dBm +/-2.7dB	<-40dBm
LTE-FDD B66	23dBm +/-2.7dB	<-40dBm
LTE-TDD B34	23dBm +/-2.7dB	<-40dBm
LTE-TDD B38	23dBm +/-2.7dB	<-40dBm
LTE-TDD B39	23dBm +/-2.7dB	<-40dBm
LTE-TDD B40	23dBm +/-2.7dB	<-40dBm
LTE-TDD B41	23dBm +/-2.7dB	<-40dBm

Table 31: GSM Operating bands

Frequency	Receiving	Transmission
EGSM900	925~960MHz	880~915 MHz
DCS1800	1805~1880 MHz	1710~1785 MHz

Table 32: E-UTRA operating bands

E-UTRA	UL Freq.	DL Freq.	Duplex Mode
--------	----------	----------	-------------

1	1920~1980 MHz	2110~2170 MHz	FDD
2	1850~1910MHz	1930~1990MHz	FDD
3	1710~1785 MHz	1805~1880 MHz	FDD
4	1710~1755MHz	2110~2155MHz	FDD
5	824 ~ 849 MHz	869 ~ 894MHz	FDD
7	2500~2570MHz	2620~2690MHz	FDD
8	880~915 MHz	925~960 MHz	FDD
20	832~862MHz	791~821MHz	FDD
28	703~748MHz	758~803MHz	FDD
66	1710~1780MHz	2110~2200MHz	FDD
34	2010~2025MHz	2010~2025MHz	TDD
38	2570~2620 MHz	2570~2620 MHz	TDD
39	1880~1920 MHz	1880~1920 MHz	TDD
40	2300~2400 MHz	2300~2400 MHz	TDD
41	2535~2655 MHz	2535~2655 MHz	TDD

Table 33: Conducted receive sensitivity

Frequency	Receive sensitivity(Typical)	Receive sensitivity(MAX)
EGSM900	< -109dBm	3GPP
DCS1800	< -108dBm	3GPP
LTE FDD/TDD	See table 34.	3GPP

Table 34: Reference sensitivity (QPSK)

E-UTRA Band	3GPP standard						Actual 10 MHz	Duplex Mode
	1.4 MHz	3MHz	5MHz	10MHz	15 MHz	20 MHz		
1	-	-	-100	-97	-95.2	-94	-98.5	FDD
2	-102.7	-99.7	-98	-95	-93.2	-92	TBD	FDD
3	-101.7	-98.7	-97	-94	-92.2	-91	-98.1	FDD
4	-104.7	-101.7	-100	-97	-95.2	-94	TBD	FDD
5	-103.2	-100.2	-98	-95	-	-	-98.6	FDD
7			-98	-95	-93.2	-92	-98	FDD
8	-102.2	-99.2	-97	-94	-	-	-98.1	FDD
20			-97	-94	-91.2	-90	-99	FDD
28		-100.2	-98.5	-95.5	-93.7	-91	TBD	FDD
66	-104.2	-101.2	-99.5	-96.5	-94.7	-93.5	TBD	FDD
34	-	-	-100	-97	-95.2	-	-97.5	TDD
38	-	-	-100	-97	-95.2	-94	-98.6	TDD
39	-	-	-100	-97	-95.2	-94	-97.8	TDD

40	-	-	-100	-97	-95.2	-94	-98.2	TDD
41	-	-	-98	-95	-93.2	-92	-98.6	TDD

4.2 GSM/LTE Antenna Requirements

For better overall performance, it is recommended that the antenna design refer to the index requirements in the following table.

Table 35: GSM/LTE antenna requirements

Passive	Recommended standard
operating band	See table 31 and table 32
Direction	omnidirectional
Gain	> -3dBi (Avg)
Input impedance	50 ohm
Efficiency	> 50 %
Maximum input power	50W
VSWR	< 2
Isolation	>20dB
PCB insertion loss(<1GHz)	<0.5dB
PCB insertion loss(1GHz~2.2GHz)	<1dB
PCB insertion loss(2.3GHz~2.7GHz)	<1.5dB

4.3 GNSS Specifications

Table 36: GNSS operating bands

Type	Frequency
GPS	1575.42±1.023MHz
GLONASS	1597.5~1605.8MHz
BeiDou	1561.098±2.046MHz

Table 37: GNSS performance

GNSS	GPS	BeiDou	GLONASS
------	-----	--------	---------

Tracking sensitivity	-160dBm	-159.5dBm	-153dBm
Capture sensitivity	-154dBm	-154dBm	-152dBm
Hot start TTFF	<1s		
Cold start TTFF	<40s		
Accuracy	<2m		

4.4 GNSS Antenna Requirements

Table 38: Recommended Antenna Characteristics (GNSS)

Passive	Recommended standard
operating band	L1: 1559~1609MHZ
Direction	Hemisphere, face to sky
Input impedance	50 ohm
Maximum input power	50W
VSWR	< 2
Plan category	RHCP or Linear
Passive antenna gain	0dBi
Active antenna gain	-2dBi
Active antenna noise figure	< 1.5
Built-in antenna LNA gain	20dB(Typ.)
Total antenna gain	< 18 dB
Coaxial insertion loss	<1.5dB

4.5 Bluetooth specifications

A7672X/A7670X Support BT5.0 protocol specification, compatible with BLE low power mode and traditional BT mode.

Table 39: Bluetooth performance

Frequency				
2.402GHz~2.483GHz				
TX performance				
TX Power	DH5	2DH5	3DH5	
	6	TBD	TBD	dBm
RX performance				
RX sensitivity	DH5	2DH5	3DH5	

	-93	-93	-87	dBm
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4.6 Antenna Reference Design

4.6.1 Passive Antenna for GSM/LTE/GNSS/Bluetooth

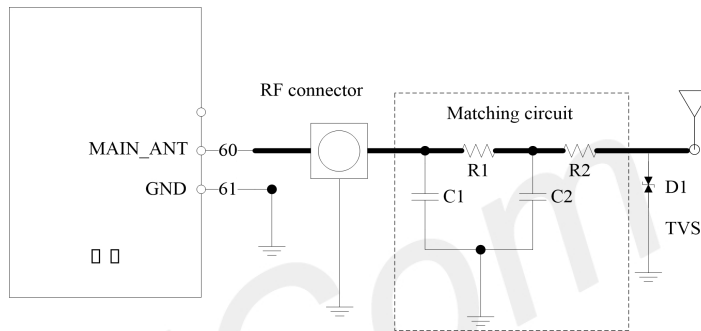


Figure 33: Passive antenna reference

NOTE

GNSS active antenna design is default solution. Strongly suggest to cut off GNSS active antenna supply by AT+CVAUXS=0, if customer design is passive antenna for GNSS.

In above figure, the component R1/R2/C1/C2 is reserved for antenna matching, the value of components can only be got after the antenna tuning, usually provided by the antenna factory. Among them, R1 and R2 paste 0Ω, C1 and C2 do not paste by default. The component D1 is a Bidirectional ESD Protection device, which is suggested to add to protection circuit, the recommended Part Numbers of the TVS are listed in the following table:

Table 40: TVS part number list

Package	Type	Supplier
0201	CE0201S05G01R	SOCAY
0402	PESD0402-03	PRISEMI

4.6.2 Active Antenna for GNSS

Default power supply value is controlled by AT+CVAUXV, default is 3V, which should meet the antenna requirement. For example, "AT+CVAUXV=2800" sets power supply 2.8V.

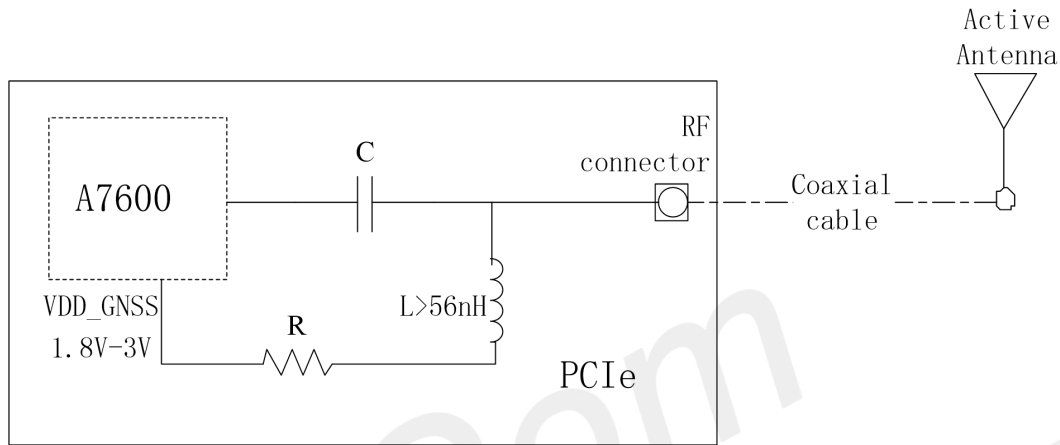


Figure 34: Active antenna reference

4.7 PCB layout

Users should pay attention to the impedance design of PCB layout from the module ANT port to the antenna connector, and the length of the PCB trace should be within 20 mm, and far away from interference signals such as power & clock. It is recommended to reserve RF Switch Connector for conduction test. The reference model of RF Switch Connector is: ECT 818011998.

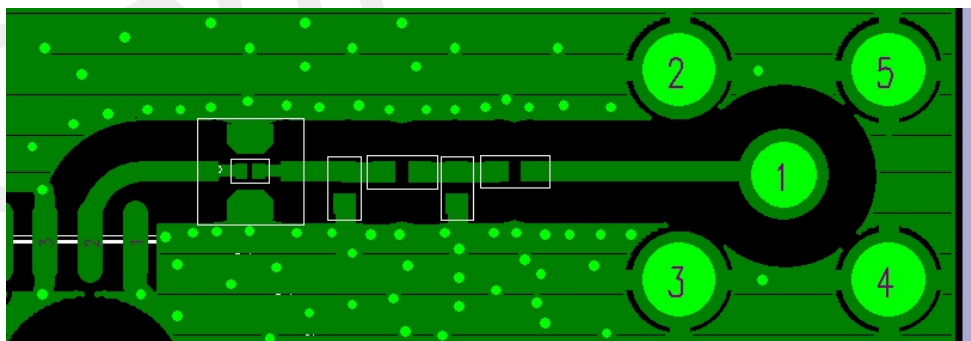


Figure 35: Reference PCB layout

5 Electrical Specifications

5.1 Absolute maximum ratings

Absolute maximum rating for digital and analog pins of A7672X/A7670X are listed in the following table, exceeding these limits may cause permanent damage to the module.

Table 41: Absolute maximum ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage on VBAT	-0.5	-	4.8	V
Voltage on USB_VBUS	-0.5	-	5.4	V
Voltage at digital pins (GPIO, I2C, UART, PCM)	-0.3	-	2.0	V
Voltage at IO pins (USIM)	-0.3	-	2.0	V
Voltage at PWRKEY, RESET	-0.3	-	4.8	V

5.2 Operating conditions

Table 42: Recommended operating ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage at VBAT	3.4	3.8	4.2	V
Voltage at USB_VBUS	3.0	5.0	5.4	V

Table 43: 1.8V Digital I/O characteristics*

Parameter	Description	Min.	Typ.	Max.	Unit
V _{IH}	High-level input voltage	VCC*0.7	1.8	VCC+0.2	V
V _{IL}	Low-level input voltage	-0.3	0	VCC*0.3	V
V _{OH}	High-level output voltage	VCC-0.2	-	-	V
V _{OL}	Low-level output voltage	0	-	0.2	V
I _{OH}	High-level output current (no pull down resistor)	-	-	13	mA
I _{OL}	Low-level output current (no pull up resistor)	-	-	13	mA
I _{IH}	Input high leakage current (no pull-down resistor)	-	-	10	uA
I _{IL}	Input low leakage current (no pull up resistor)	-10	-	-	uA

NOTE

These parameters are for digital interface pins, such as GPIO, I2C, UART, and USB_BOOT.

The operating temperature of A7672X/A7670X is listed in the following table.

Table 44: Operating temperature

Parameter	Min.	Typ.	Max.	Unit
Normal operation temperature	-10	25	50	°C
Extended operation temperature*	-40	25	85	°C
Storage temperature	-45	25	90	°C

NOTE

The performance will be reduced slightly from the 3GPP specifications if the temperature is outside the normal operating temperature range and still within the extreme operating temperature range.

5.3 Operating Mode

5.3.1 Operating Mode Definition

The table below summarizes the various operating modes of A7672X/A7670X product.

Table 45: Operating mode Definition

Mode	Function
Normal operation	GSM/ LTE Sleep In this case, the current consumption of module will be reduced to the minimal level and the module can still receive paging message and SMS.
	GSM/LTE Idle Software is active. Module is registered to the network, and the module is ready to communicate.
	GSM/ LTE Talk Connection between two subscribers is in progress. In this case, the power consumption depends on network settings such as DTX off/on, FR/EFR/HR, hopping sequences, and antenna.
	GSM/LTE Standby Module is ready for data transmission, but no data is currently sent or received. In this case, power consumption depends on

		network settings.
	GPRS/EDGE/LTE Data transmission	There is data transmission in progress. In this case, power consumption is related to network settings (e.g., power control level); uplink/downlink data rates, etc.
Minimum functionality mode		AT command 'AT+CFUN=0' AT+CSCLK=1 can be used to set the module to a minimum functionality mode without removing the power supply. In this mode, the RF part of the module will not work and the USIM card will not be accessible, but the serial port and USB port are still accessible. The power consumption in this mode is lower than normal mode.
Flight mode		AT command 'AT+CFUN=4' or pulling down the FLIGHTMODE pin can be used to set the module to flight mode without removing the power supply. In this mode, the RF part of the module will not work, but the serial port and USB port are still accessible. The power consumption in this mode is lower than normal mode.
Power off		Module will go into power off mode by sending the AT command 'AT+CPOF' or pull down the PWRKEY pin, normally. In this mode the power management unit shuts down the power supply, and software is not active. The serial port and USB are is not accessible.

5.3.2 Sleep mode

In sleep mode, the current consumption of module will be reduced to the minimal level, and module can still receive paging message and SMS.

Several hardware and software conditions must be satisfied together in order to let A7672X/A7670X enter into sleep mode:

- USB condition
- Software condition
- UART condition

NOTE

Before designing, pay attention to how to realize sleeping/waking function and refer to Document [24] for more details.

5.3.3 Minimum functionality mode and Flight mode

Minimum functionality mode ceases majority function of the module, thus minimizing the power consumption. This mode is set by the AT command which provides a choice of the functionality levels.

- AT+CFUN=0: Minimum functionality
- AT+CFUN=1: Full functionality (Default)
- AT+CFUN=4: Flight mode

If A7672X/A7670X has been set to minimum functionality mode, the RF function and SIM card function will be closed. In this case, the serial port and USB are still accessible, but RF function and SIM card will be unavailable.

If A7672X/A7670X has been set to flight mode, the RF function will be closed. In this case, the serial port and USB are still accessible, but RF function will be unavailable.

When A7672X/A7670X is in minimum functionality or flight mode, it can return to full functionality by the AT command "AT+CFUN=1".

5.4 Current Consumption

The current consumption is listed in the table below.

Table 46: Current consumption on VBAT Pins (VBAT=3.8V)

GSM sleep/idle mode	
Current under CFUN=0, CSCLK=1	TBD
GSM supply current (GNSS off, without USB connection)	Sleep mode@BS_PA_MFRMS=2 Typical: TBD Idle mode@BS_PA_MFRMS=2 Typical: TBD
LTE sleep/idle mode	
LTE supply current (GNSS off, without USB connection)	Sleep mode@DRX=0.32STypical: TBD Idle mode @DRX=0.32STypical: TBD
GSM Talk	
EGSM 900	@power level #5 Typical: 320 mA
DCS1800	@power level #5 Typical: 262 mA
GPRS	
EGSM900(2 Rx,4 Tx)	@power level #5 Typical: 630mA
DCS1800(2 Rx,4 Tx)	@power level #0Typical:395mA
EGSM900(3Rx, 2 Tx)	@power level #5 Typical:370mA
DCS1800(3Rx, 2 Tx)	@power level #0Typical:275mA
EDGE	
EGSM900(2 Rx,4 Tx)	@power level #8Typical:460mA
DCS1800(2 Rx,4 Tx)	@power level #2Typical:300mA
EGSM900(3Rx, 2 Tx)	@power level #8Typical: 336mA
DCS1800(3Rx, 2 Tx)	@power level #2Typical:208mA

LTE Cat1

LTE-FDD B1	@10MHz	23dBm	Typical :600 mA
LTE-FDD B2	@10MHz	23dBm	Typical :TBD
LTE-FDD B3	@10MHz	23dBm	Typical :600 mA
LTE-FDD B4	@10MHz	23dBm	Typical :TBD
LTE-FDD B5	@10MHz	23dBm	Typical :580 mA
LTE-FDD B7	@10MHz	23dBm	Typical :540mA
LTE-FDD B8	@10MHz	23dBm	Typical :520mA
LTE-FDD B20	@10MHz	23dBm	Typical :540mA
LTE-FDD B28	@10MHz	23dBm	Typical :TBD
LTE-FDD B66	@10MHz	23dBm	Typical :TBD
LTE-TDD B34	@10MHz	23dBm	Typical :260mA
LTE-TDD B38	@10MHz	23dBm	Typical :340 mA
LTE-TDD B39	@10MHz	23dBm	Typical :260 mA
LTE-TDD B40	@10MHz	23dBm	Typical :340mA
LTE-TDD B41	@10MHz	23dBm	Typical :340mA

5.5 ESD Notes

A7672X/A7670X is sensitive to ESD in the process of storage, transporting, and assembling. When A7672X/A7670X is mounted on the users' mother board, the ESD components should be placed beside the connectors which human body may touch, such as SIM card holder, audio jacks, switches, keys, etc. The following table shows the A7672X/A7670X ESD measurement performance without any external ESD component.

Table 47: The ESD performance measurement table (Temperature: 25°C, Humidity: 45%.)

Part	Contact discharge	Air discharge
VBAT, GND	+/-5K	+/-10K
Antenna port	+/-5K	+/-10K
USB interface	+/-4K	+/-8K
UART interface	+/-4K	+/-6K
Other PADs	+/-1K	+/-2K

NOTE

Test conditions: The module is on the SIMCom development board (the development board has the necessary ESD protection devices)

6SMT Production Guide

6.1 Top and Bottom View of A7672X/A7670X

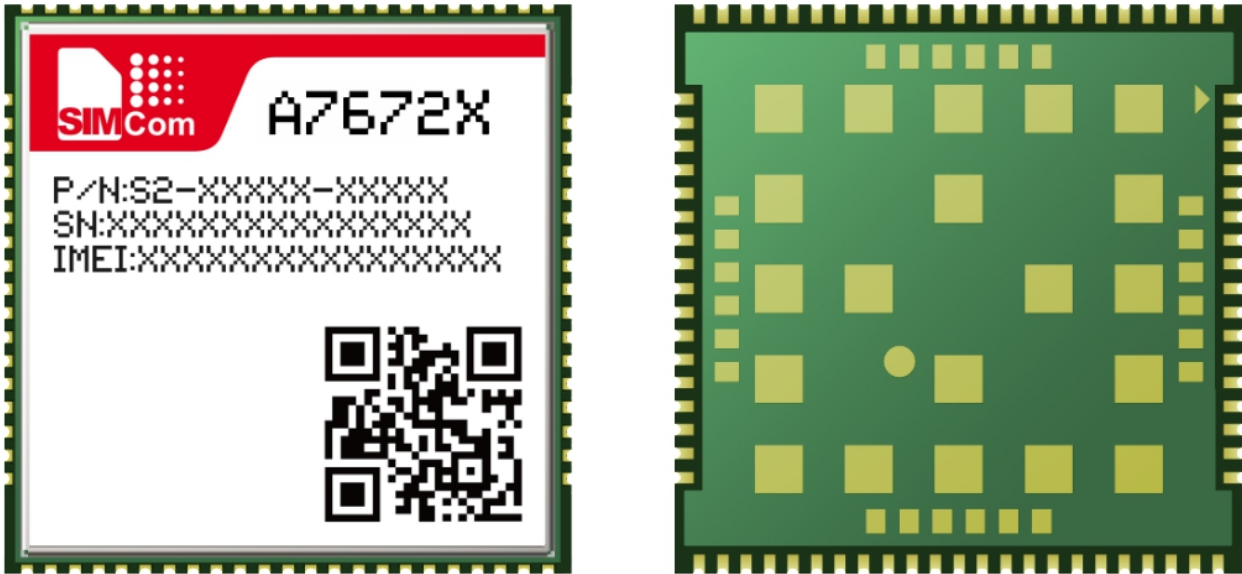


Figure 36: Top and bottom view of A7672X

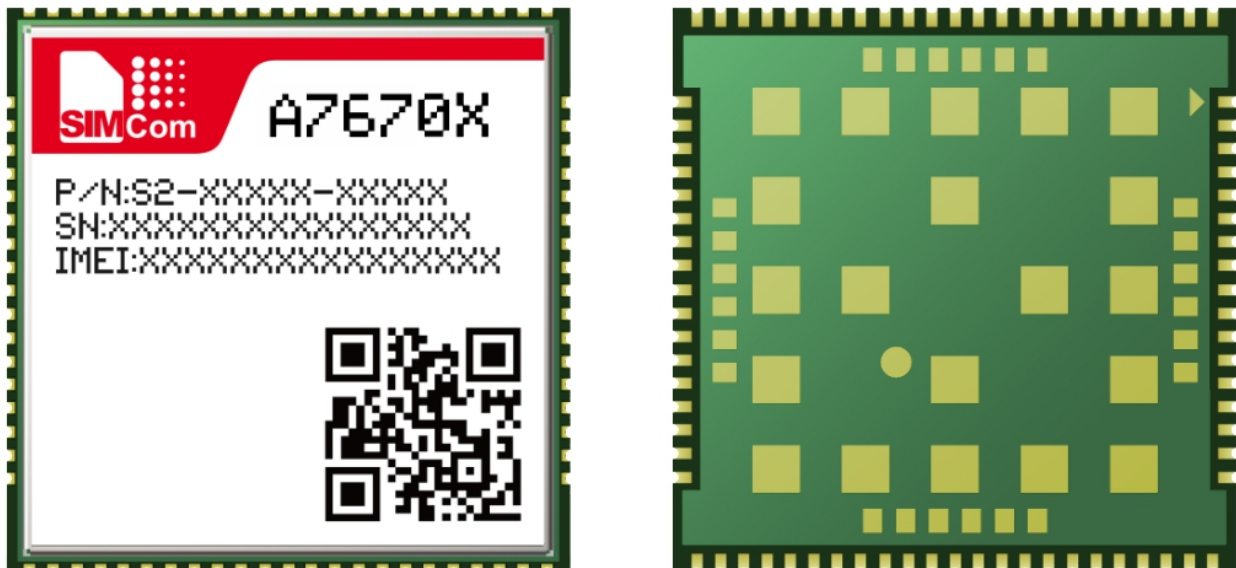


Figure 37: Top and bottom view of A7670X

NOTE

The above is the design effect diagram of the module for reference. The actual appearance is subject to the actual product.

6.2 Label Information

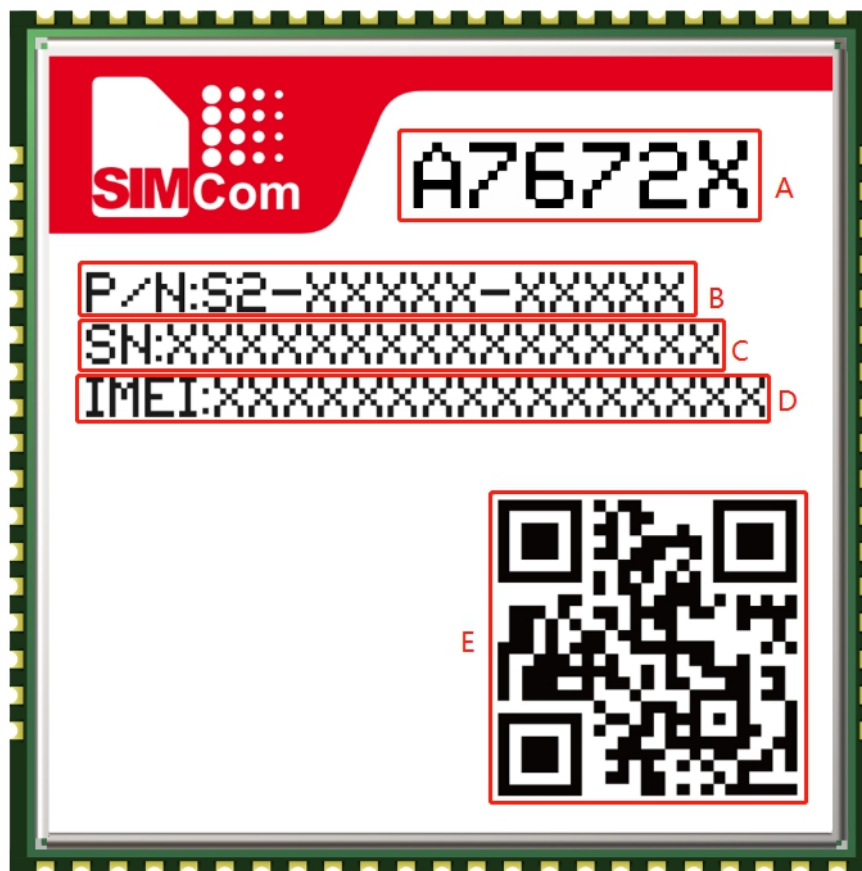


Figure 38: Label information for A7672X



Figure 39: Label information for A7670X

Table 48: The description of label information

No.	Description
A	Project name
B	Part number
C	Serial number
D	IMEI number
E	QR code

6.3 Typical SMT Reflow Profile

SIMCom provides a typical soldering profile. Therefore, the soldering profile shown below is only a generic recommendation and should be adjusted to the specific application and manufacturing constraints.

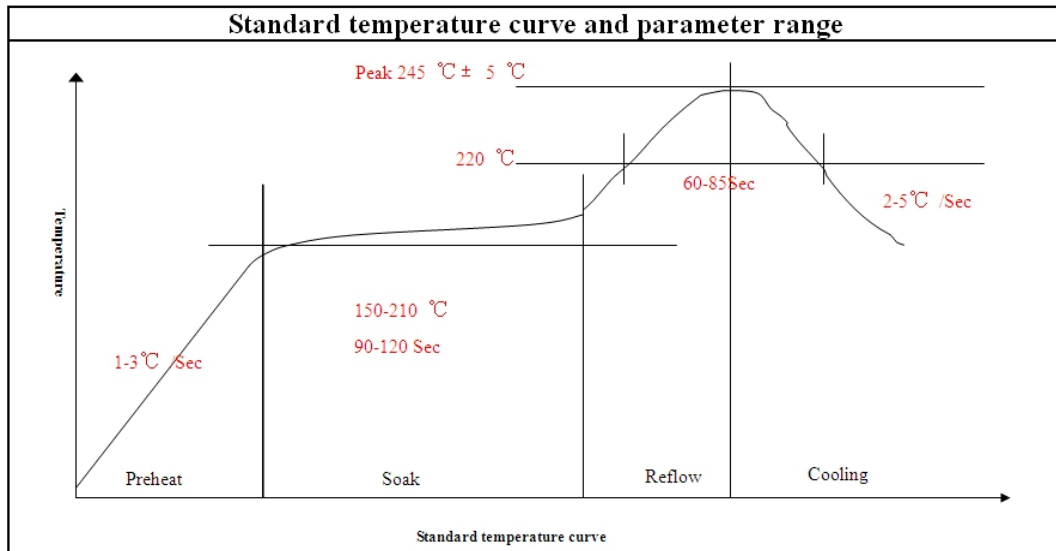


Figure 40: The ramp-soak-spike reflow profile of A7672X/A7670X

NOTE

For more details about secondary SMT, please refer to the document [21].

6.4 Moisture Sensitivity Level (MSL)

A7672X/A7670X is qualified to Moisture Sensitivity Level (MSL) 3 in accordance with JEDEC J-STD-033.

The following table shows the features of Moisture Sensitivity Level (MSL). After seal off, storage conditions must meet the following table. If the storage time was expired, module must be baking before SMT.

Table 49: Moisture Sensitivity Level and Floor Life

Moisture Sensitivity Level (MSL)	Floor Life (out of bag) at factory ambient ≤30°C/60% RH or as stated
1	Unlimited at ≅ 30°C/85% RH
2	1 year at ≅ 30°C/60% RH
2a	4 weeks at ≅ 30°C/60% RH
3	168 hours at ≅ 30°C/60% RH
4	72 hours at ≅ 30°C/60% RH
5	48 hours at ≅ 30°C/60% RH
5a	24 hours at ≅ 30°C/60% RH
6	Mandatory bake before use. After bake, it must be reflowed within the time limit specified on the label.

NOTE

IPC / JEDEC J-STD-033 standard must be followed for production and storage.

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7Packaging

A7672X/A7670X module support tray packaging.

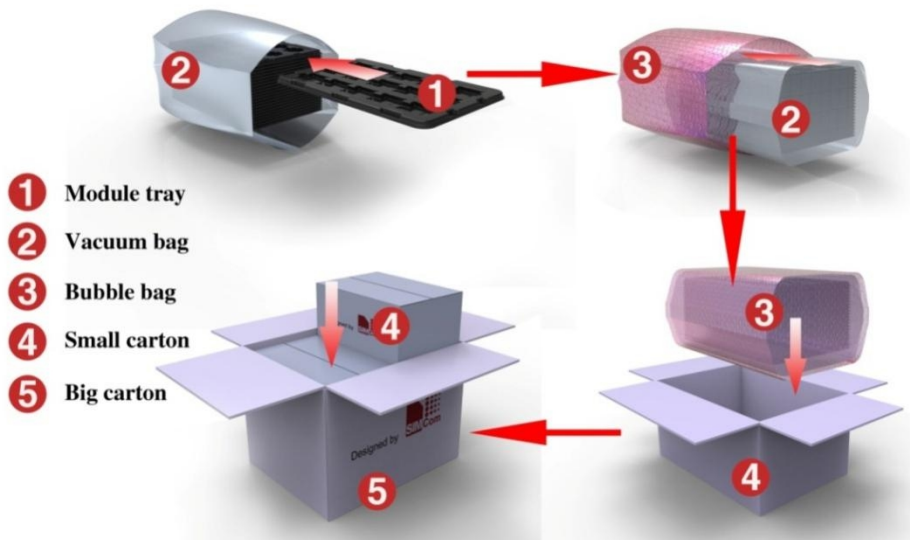


Figure 41: packaging diagram

Module tray drawing:

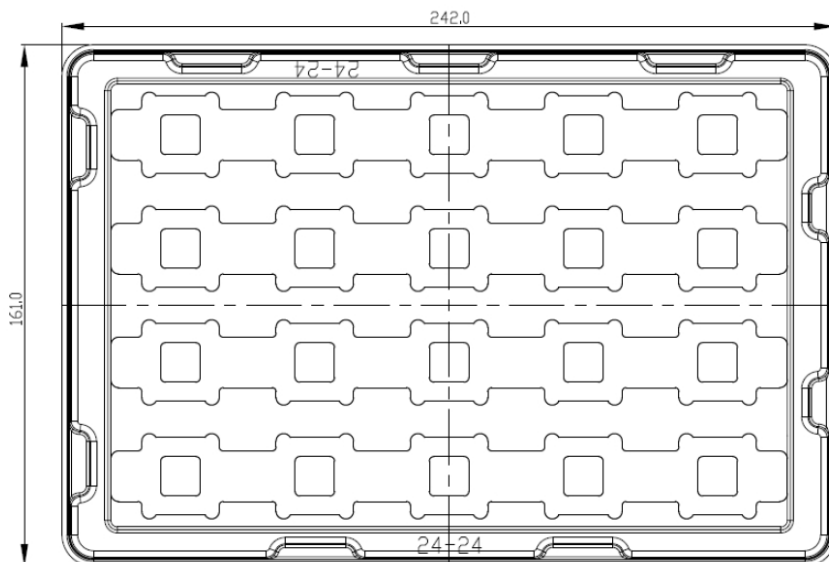


Figure 42: Tray drawing

Table 50: Tray size

Length ($\pm 3\text{mm}$)	Width ($\pm 3\text{mm}$)	Module number
242.0	161.0	20

Small carton drawing:

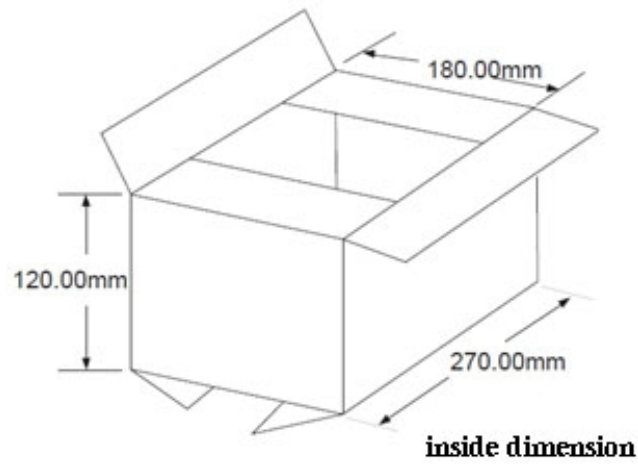


Figure 43: Small carton drawing

Table 51: Small Carton size

Length ($\pm 10\text{mm}$)	Width ($\pm 10\text{mm}$)	Height ($\pm 10\text{mm}$)	Module number
270	180	120	20*20=400

Big carton drawing:

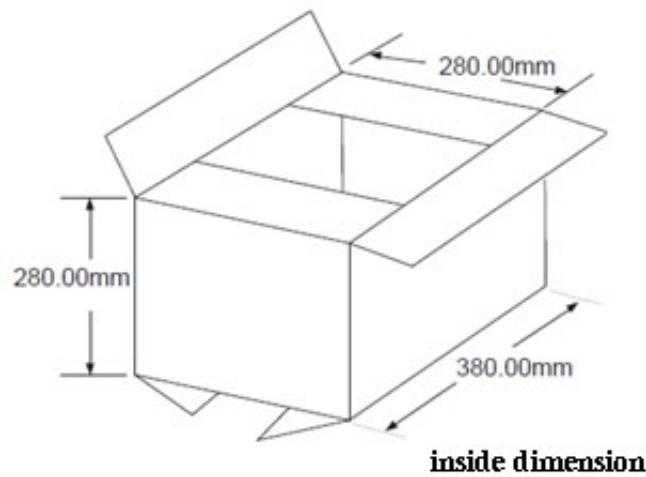


Figure 44: Big carton drawing

Table 52: Big Carton size

Length ($\pm 10\text{mm}$)	Width ($\pm 10\text{mm}$)	Height ($\pm 10\text{mm}$)	Module number
380	280	280	400*4=1600

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8 Appendix

8.1 Coding Schemes and Maximum Net Data Rates over Air Interface

Table 53: Coding Schemes and Maximum Net Data Rates over Air Interface

Multislotdefinition(GPRS/EDGE)			
Slot class	DL slot number	UL slot number	Active slot number
1	1	1	2
2	2	1	3
3	2	2	3
4	3	1	4
5	2	2	4
6	3	2	4
7	3	3	4
8	4	1	5
9	3	2	5
10	4	2	5
11	4	3	5
12	4	4	5
GPRS coding scheme	Max data rata (4 slots)		Modulation type
CS 1 = 9.05 kb/s / time slot	36.2 kb/s		GMSK
CS 2 = 13.4 kb/s / time slot	53.6 kb/s		GMSK
CS 3 = 15.6 kb/s / time slot	62.4 kb/s		GMSK
CS 4 = 21.4 kb/s / time slot	85.6 kb/s		GMSK
EDGE coding scheme	Max data rata (4 slots)		Modulation type
MCS 1 = 8.8 kb/s/ time slot	35.2 kb/s		GMSK
MCS 2 = 11.2 kb/s/ time slot	44.8 kb/s		GMSK
MCS 3 = 14.8 kb/s/ time slot	59.2 kb/s		GMSK
MCS 4 = 17.6 kb/s/ time slot	70.4 kb/s		GMSK
MCS 5 = 22.4 kb/s/ time slot	89.6 kb/s		8PSK
MCS 6 = 29.6 kb/s/ time slot	118.4 kb/s		8PSK
MCS 7 = 44.8 kb/s/ time slot	179.2 kb/s		8PSK
MCS 8 = 54.4 kb/s/ time slot	217.6 kb/s		8PSK
MCS 9 = 59.2 kb/s/ time slot	236.8 kb/s		8PSK
LTE-FDD device category	Max data rate (peak)		Modulation type

(Downlink)		
Category M1	1Mbps	QPSK/16QAM
LTE-FDD device category (Uplink)		
Category M1	375kbps	QPSK/16QAM

8.2 Related Documents

Table 54: Related Documents

NO.	Title	Description
[1]	A7600 Series AT Command Manual_V1.00.04	AT Command Manual
[2]	ITU-T Draft new recommendation V.25ter	Serial asynchronous automatic dialing and control
[3]	GSM 07.07	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[4]	GSM 07.10	Support GSM 07.10 multiplexing protocol
[5]	GSM 07.05	Digital cellular telecommunications (Phase 2+); Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
[6]	GSM 11.14	Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[7]	GSM 11.11	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[8]	GSM 03.38	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[9]	GSM 11.10	Digital cellular telecommunications system (Phase 2) ; Mobile Station (MS) conformance specification ; Part 1: Conformance specification
[10]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[11]	3GPP TS 34.124	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[12]	3GPP TS 34.121	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[13]	3GPP TS 34.123-1	Technical Specification Group Radio Access Network; Terminal conformance specification; Radio transmission and reception (FDD)
[14]	3GPP TS 34.123-3	User Equipment (UE) conformance specification; Part 3: Abstract Test Suites.
[15]	EN 301 908-02 V2.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000. Third Generation cellular networks; Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive
[16]	EN 301 489-24 V1.2.1	Electromagnetic compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for

		radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment
[17]	IEC/EN60950-1(2001)	Safety of information technology equipment (2000)
[18]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[19]	GCF-CC V3.23.1	Global Certification Forum - Certification Criteria
[20]	2002/95/EC	Directive of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
[21]	Module secondary-SMT-UGD-V1.xx	Module secondary SMT Guidelines
[22]	A7600Series_UART_Application Note_V1.xx	This document describes how to use UART interface of SIMCom modules.
[23]	Antenna design guidelines for diversity receiver system	Antenna design guidelines for diversity receiver system
[24]	A7600 Series_SleepMode_Application Note_V1.xx	Sleep Mode Application Note
[25]	A7600 Series_UIM HOT SWAP_Application Note_V1.00	This document introduces UIM card detection and UIM hot swap.

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8.3 Terms and Abbreviations







Table 55: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
BER	Bit Error Rate
BD	BeiDou
BTS	Base Transceiver Station
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DSP	Digital Signal Processor
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
DAM	Downloadable Application Module
DPO	Dynamic Power Optimization
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FCC	Federal Communications Commission (U.S.)
FD	SIM fix dialing phonebook
FDMA	Frequency Division Multiple Access
FR	Full Rate
GMSK	Gaussian Minimum Shift Keying
GNSS	Global Navigation Satellite System
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global Standard for Mobile Communications
HR	Half Rate
I2C	Inter-Integrated Circuit
IMEI	International Mobile Equipment Identity
LTE	Long Term Evolution
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated

NMEA	National Marine Electronics Association
PAP	Password Authentication Protocol
PBCCH	Packet Switched Broadcast Control Channel
PCB	Printed Circuit Board
PCS	Personal Communication System, also referred to as GSM 1900
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock
SIM	Subscriber Identification Module
SMS	Short Message Service
SMPS	Switched-mode power supply
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter
VSWR	Voltage Standing Wave Ratio
SM	SIM phonebook
NC	Not connect
EDGE	Enhanced data rates for GSM evolution
ZIF	Zero intermediate frequency
WCDMA	Wideband Code Division Multiple Access
VCTCXO	Voltage control temperature-compensated crystal oscillator
SIM	Universal subscriber identity module
UMTS	Universal mobile telecommunications system
UART	Universal asynchronous receiver transmitter
PSM	Power saving mode
FD	SIM fix dialing phonebook
LD	SIM last dialing phonebook (list of numbers most recently dialed)
MC	Mobile Equipment list of unanswered MT calls (missed calls)
ON	SIM (or ME) own numbers (MSISDNs) list
RC	Mobile Equipment list of received calls
SM	SIM phonebook
NC	Not connect

8.4 Safety Caution

Table 56: Safety Caution

Marks	Requirements
	When in a hospital or other health care facility, observe the restrictions about the use of mobiles. Switch the cellular terminal or mobile off, medical equipment may be sensitive and not operate normally due to RF energy interference.
	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it is switched off. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. Forgetting to think much of these instructions may impact the flight safety, or offend local legal action, or both.
	Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.
	Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.
	Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for hands free operation. Before making a call with a hand-held terminal or mobile, park the vehicle.
	GSM cellular terminals or mobiles operate over radio frequency signals and cellular networks and cannot be guaranteed to connect in all conditions, especially with a mobile fee or an invalid SIM card. While you are in this condition and need emergent help, please remember to use emergency calls. In order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency call if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may have to deactivate those features before you can make an emergency call. Also, some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.

9 Notes

9.1 List of applicable FCC rules

The A7672X and A7670X module meet the requirements of FCC part 15C (15.247). They specifically establish the 20dB Occupied Bandwidth, Peak Output Power, Radiated Spurious Emission, Carrier Frequencies Separation, Restricted Band of Operation and Band Edge (Out of Band Emissions), Hopping Channel Number, Dwell Time, Pseudorandom Frequency and Hopping Sequence.

9.2 Summarize the specific operational use conditions

The EUT support External R-SMA antenna for Bluetooth, the antenna gain is 3.39dBi, and the antenna cannot be replaced by other authorized antennas.

9.3 Limited module procedures

The module is a single module.

9.4 RF exposure considerations

This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body. "This module is designed to comply with the FCC statement, A7672SA FCC ID is: 2AJYU-8BAE001 and A7670SA FCC ID is: 2AJYU-8BAE002".

9.5 Antennas

The EUT support External R-SMA antenna for Bluetooth, the antenna gain is 3.39dBi, and the antenna cannot be replaced by other authorized antennas.

9.6 Label and compliance information

The host system using this module should have label in a visible area indicated the following texts: "Contains FCC ID: 2AJYU-8BAE001" or "Contains FCC ID: 2AJYU-8BAE002".

9.7 Information on test modes and additional testing requirements

Dong Guan Gentech Instrument Electronic Co.,Ltd. can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

9.8 Additional testing, Part 15 Subpart B disclaimer

The module comply with FCC Part 15 Subpart B.

FCC Statement

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.

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

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 connected.
- Consult the dealer or an experienced radio/TV technician for help.