



SIM6600-eM2

User Manual

LTE Module

SIMCom Wireless Solutions Limited

Bldg.3, SIMCom Headquarter Bldg., Level 6 to 9, No.289, Linhong
RdChangning District, Shanghai P.R. China

Tel: 86-21-31575100

support@simcom.com

www.simcom.com

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SIMCom Wireless Solutions Limited

Bldg.3, SIMCom Headquarter Bldg., Level 6 to 9, No.289, Linhong Rd, Changning Dist., Shanghai, P.R.China

Tel: +86 21 31575100

Email: simcom@simcom.com

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1 Introduction

This document describes the electronic specifications, RF specifications, interfaces, mechanical characteristics and testing results of the SIMCom M.2 card. With the help of this document and other software application notes/user guides, users can understand and use SIM6600-eM2 to design and develop mobile and laptop applications quickly.

1.1 Product Outline

Aimed at the global market, SIM6600-eM2 supports WCDMA, LTE-TDD and LTE-FDD, support DL 2CA . The supported radio frequency bands are described in the table1.

Table 1: SIM6600-eM2 frequency bands

Standard	Frequency bands
WCDMA	B1/B2//B4/B5/B8
LTE(TDD)	B34/B38/B39/B40/B41
LTE(FDD)	B1/B2/B3/B4/B5/B7/B8/B12/B13/B17/B18/B19/B20/B25/B26/B28/B29/B30/B66/B71
2CA (DL)	B1+B1/B3/5/7/8/18/19/20/26/28/40; B2+B2/4/5/12/13/17/28/29/66/71; B3+B3/5/7/8/19/20/28/40; B4+B4/5/12/13/17/28/29/71; B5+B5/7/30/40/66; B7+B7/8/20/28; B8+B38/40/41; B12+B30/66; B13+B66; B20+B38; B25+B25/26; B26+B41; B28+B41; B29+B30/66; B40+B40; B41+B41; B66+B66/71; 1C; 2C; 3C; 5B; 7C; 8B; 38C; 40C; 41C; 66C (Note: B29 is only for secondary component carrier)
2CA (UL)	3C; 5B; 7C; 38C; 40C; 41C; 66C

With a physical dimension of 30.0*42.0*2.3 mm, SIM6600-eM2 can meet PCI Express M.2 Specification, and can meet almost any space requirement in users' applications.

With M.2 Type 3042-S3-B, SIM6600-eM2 had almost all common interface integrated, such as USB2.0, UIM card, digital audio(I2S or PCM), UART, I2C, GPIOs, MAIN ANT and DIV ANT , etc.

With all the interfaces, SIM6600-eM2 can also be utilized in the industrial handheld, machine-to-machine laptop application and especially the router/CPE.

1.2 Hardware Block Diagram

The block diagram of SIM6600-eM2 is shown as below:

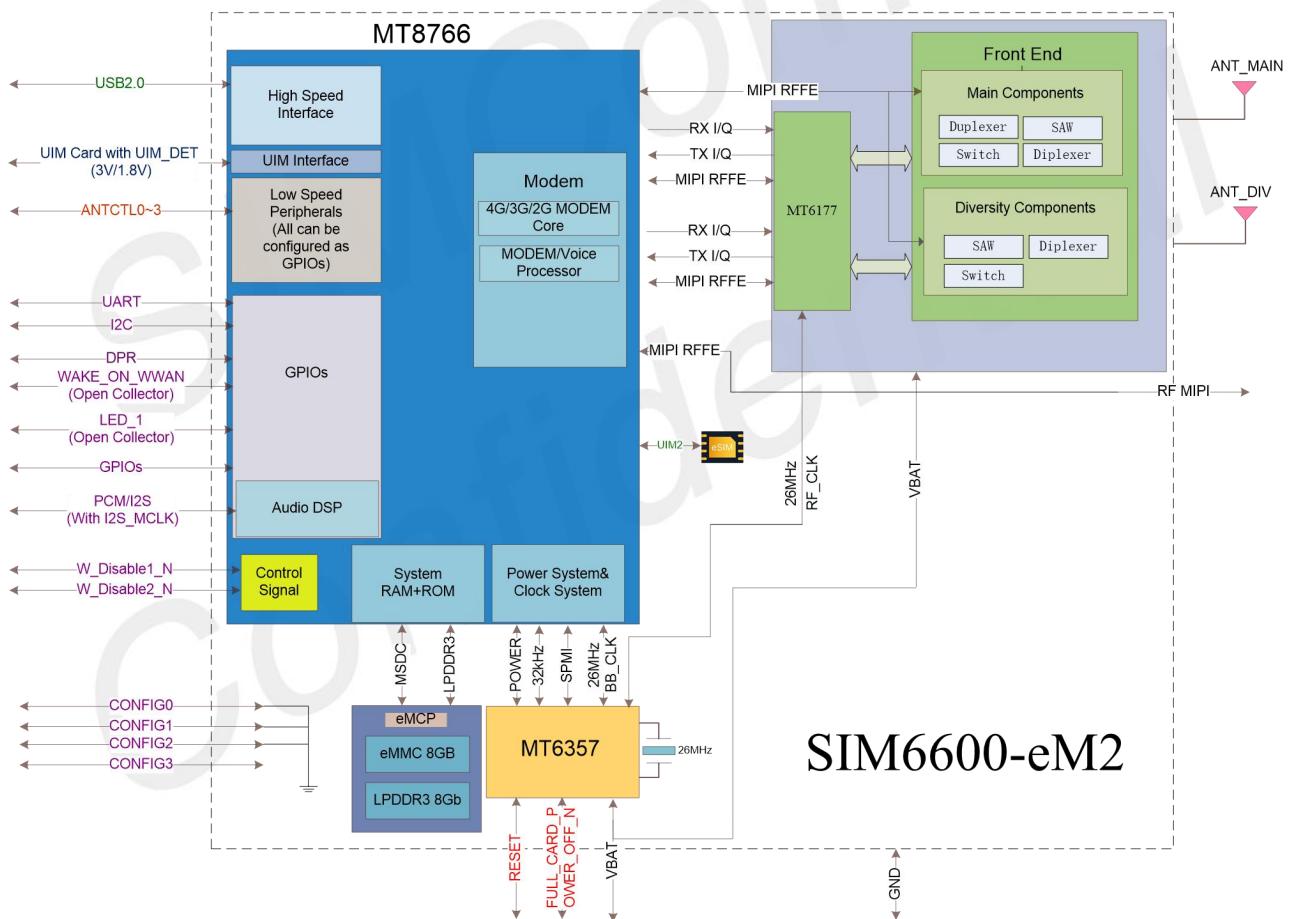


Figure 1: SIM6600-eM2 block diagram

1.3 Functional Overview

Table 2: General features

Feature	Implementation
Power supply	VBAT:3.135~4.4V Typical supply voltage: 3.7V
Power consumption	Current in sleep mode : TBD
Radio frequency bands	Please refer to the table 1
Transmitting power	WCDMA power class: 3 (0.25W) LTE power class: 3 (0.25W)
Data Transmission Throughput	UMTS R99 speed: 384 kbps DL/UL HSPA+: 11.5 Mbps(UL), 42 Mbps(DL) FDD-LTE :Max 300Mbps (DL Category7), 150Mbps (UL Category 13) TDD-LTE :Max 200Mbps (DL Category7), 84Mbps (UL Category 13)
Antenna	WCDMA/LTE main antenna. WCDMA/LTE diversity antenna
SMS	MT, MO, CB, Text and PDU mode SMS storage: USIM card or ME(default) Transmission of SMS alternatively over CS or PS.
USIM interface	Support identity card: 1.8V/ 3V
USIM application toolkit	Support SAT class 3, GSM 11.14 Release 98 Support USAT
Phonebook management	Support phonebook types: DC,MC,RC,SM,ME,FD,ON,LD,EN
Digital Audio feature	One I2S interface with dedicated main-clock for primary digital audio, the I2S also can be configured as PCM ● Half Rate (ETS 06.20) ● Full Rate (ETS 06.10) ● MCLK frequency: 12.288MHz (default) ● Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80) ● WCDMA AMR-NB ● VoLTE AMR-WB ● Echo Cancellation ● Noise Suppression
UART interface	UART: ● Baud rate: 300bps to 921600bps(default:115200bps) ● Can be used as the AT commands or data stream channel ● Multiplex ability according to GSM 07.10 Multiplexer Protocol ● Could be configured as GPIOs.
I2C interface	I2C: ● Apply to the "I2C Specification, version 3.0" ● Clock up to 400Kbps

USB	USB2.0: high speed interface, support USB operations at low-speed and full-speed, which refer to USB1.0 and USB1.1.
Firmware upgrade	Firmware upgrade over USB interface or FOTA
Physical characteristics	Size:30*42*2.3mm Weight:TBD
Temperature range	Operation temperature: -25°C to +70°C

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2 Package Information

2.1 Pin Assignment Overview

All functions of the M.2 card will be provided through 75 (including 8 notch pins) pads that will be connected to the customers' platform. The following figure is the pin assignment of the card.

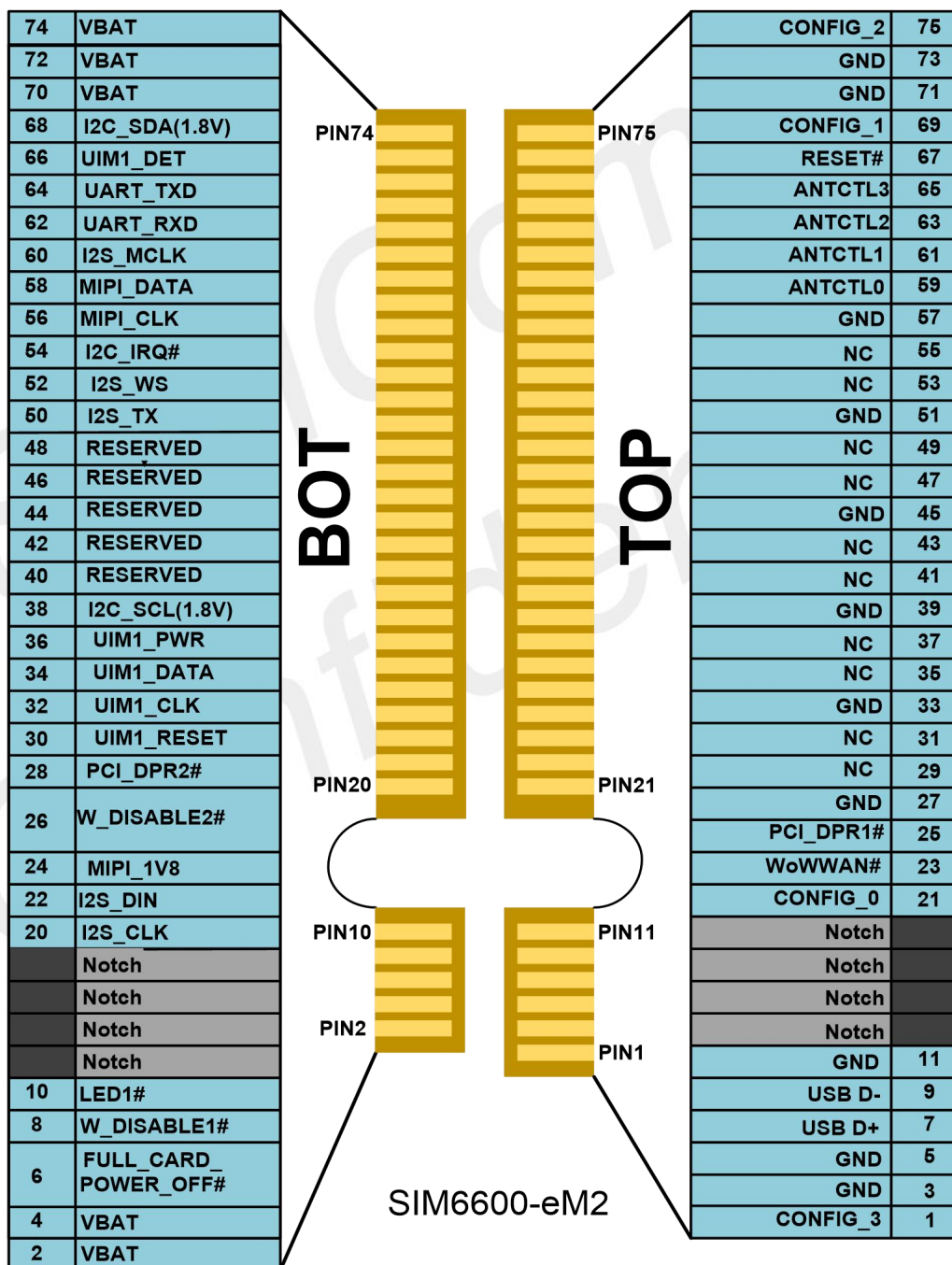


Figure 2: Pin assignment

2.2 Pin Description

Table 3: IO parameters definition

Pin type	Description
PI	Power input
PO	Power output
AI	Analog input
AIO	Analog input/output
DIO	Bidirectional digital input /output
DI	Digital input
DO	Digital output
DOH	Digital output with high level
DOL	Digital output with low level
PU	Pull up
PD	Pull down
OD	Open Drain

Table 4: IO parameters definition

Voltage domain	Parameter	Min	Typ	Max
P3	VDD_P3=1.8V DVDD18			
	VOH High level output	1.35V	-	1.8V
	VOL Low level output	0V	-	0.4V
	VIH High level input	1.2V	1.8V	2.1V
	VIL Low level input	-0.3V	-	0.63V
P4	VDD_P4=1.8V			
	VOH High level output	1.4V	-	1.8V
	VOL Low level output	-	0V	0.22V
	VIH High level input	1.4V	1.8V	-
	VIL Low level input	-	0V	0.27V
	VDD_P4=3.0V			
	VOH High level output	2.7V	3.0V	3.1V
	VOL Low level output	-	0V	0.36V
	VIH High level input	2.0V	-	3.15V
	VIL Low level input	-	0V	0.4V

Table 5: Pin description

Pin name	Pin No.		Electrical Description	Description	Comment
Power supply					
VBAT	2,4,70,72,74		PI	M,2 card power supply, voltage range: 3.135 ~ 4.4V, typical 3.7V.	User should connect these pins together.
GND	3,5,11,27,33,39,45,51,57,71,73			Ground	
System Control					
FULL_CARD_POWER_OFF#	6		DI,PD	H: WWAN powers on. L: WWAN go to sleep mode.	It's internally pulled to Low. It's 3.3V tolerant but can be driven by either 1.8V or 3.3V GPIO.
Reset#	67	P3	DI,PU	System reset control input, active low.	RESET_N has been pulled up to 1.8V via resistor internally.
W_DISABLE1#	8		DI	WWAN RF Disable, active low.	It's 3.3V tolerant but can be driven by either 1.8V or 3.3V GPIO.
W_DISABLE2#	26		DI	GNSS disable, active low.Reserved.	It's 3.3V tolerant but can be driven by either 1.8V or 3.3V GPIO.
WoWWAN#	23		OD	Wake on the host.Active low.	
Configuration pins					
CONFIG0	21		GND	Connect to ground	SIM6600-eM2 module is configured as the WWAN USB2.0 interface type.
CONFIG1	69		GND	Connect to ground	
CONFIG2	75		GND	Connect to ground	
CONFIG3	1		NC	Not connected	
USB2.0					
USB_D+	7		AIO	Positive line of the differential, bi-directional USB signal.	Main communication interface. USB2.0 data rate up to 480Mbps.
USB D-	9		AIO	Negative line of the differential, bi-directional USB signal.	
UIM interface					
UIM1_PWR	36		PO	Power supply for UIM1 card.	1.8V/3.0V voltage domain,all lines
UIM1_DATA	34	P4	DIO	UIM1 Card data I/O, which no need reserve Pull up	

				resistor to UIM1_PWR.	of UIM interface
UIM1_CLK	32	P4	DO	UIM1 clock signal.	should be
UIM1_RESET	30	P4	DO	UIM1 Reset control.	protected against
UIM1_DET	66	P3	DI	UIM1 card detect.	ESD.
RESERVED	48				If unused, please
RESERVED	42				keep open.
RESERVED	44				
RESERVED	46				
RESERVED	40				

Antenna control interface*

ANTCTL0	59	P3	DO	Antenna tuner control 0	1.8V voltage domain. If unused, please keep open.
ANTCTL1	61	P3	DO	Antenna tuner control 1	
ANTCTL2	63	P3	DO	Antenna tuner control 2	
ANTCTL3	65	P3	DO	Antenna tuner control 3	
MIPI_DATA	58	P3	DIO	MIPI interface tunable ANT, MIPI data	
MIPI_CLK	56	P3	DO	MIPI interface tunable ANT, MIPI clock	
MIPI_1V8	24	P3	PO	1.8V power output for antenna tuner	

I2S interface*

I2S_CLK	20	P3	DI	I2S serial clock,Reserved	1.8V voltage domain. If unused, keep them open.
I2S_RX	22	P3	DO	I2S Serial receive data,Reserved	
I2S_TX/ANT_TUNER_CFG	50	P3	DO	I2S Serial transmit data,can mux as ANT_TUNER_CFG or GPIO,reserved	
I2S_WS	52	P3	DO	I2S word alignment/select,Reserved	
I2S_MCLK	60	P3	DO	I2S main clock,Reserved	

I2C interface

I2C_SDA	68	P3	DIO	I2C data signal	1.8V voltage domain.Internal pulled up to 1.8V. If unused, please keep open.
I2C_SCL	38	P3	DO	I2C clock signal	
I2C_IRQ#	54	P3	DI	I2C interrupt request,can mux as GPIO	

UART interface

UART_RXD	62	P3		UART receive data,can mux as GPIO.	1.8V voltage domain.
UART_TXD	64	P3		UART transmit data,can mux as GPIO.	

Other pins

LED1#	10		OD		The module
-------	----	--	----	--	------------

					status indicator via LED devices Active low
PCI_DPR1#*	25		DI	Dynamic power reduction - Body SAR control signal1#	
PCI_DPR2#*	28		DI	Dynamic power reduction - Body SAR control signal2#	It's 3.3V tolerant but can be driven by either 1.8V or 3.3V GPIO.
NC					
NC	29,31, 35,37, 41,43, 47,49, 53,55			NC	NC pins,please keep open.
Notch					
Notch	12,13, 14,15, 16,17, 18,19			Notch	

NOTE

“*” means under development.

2.3 Mechanical Information

The following figure shows the package outline drawing of the M.2 card.

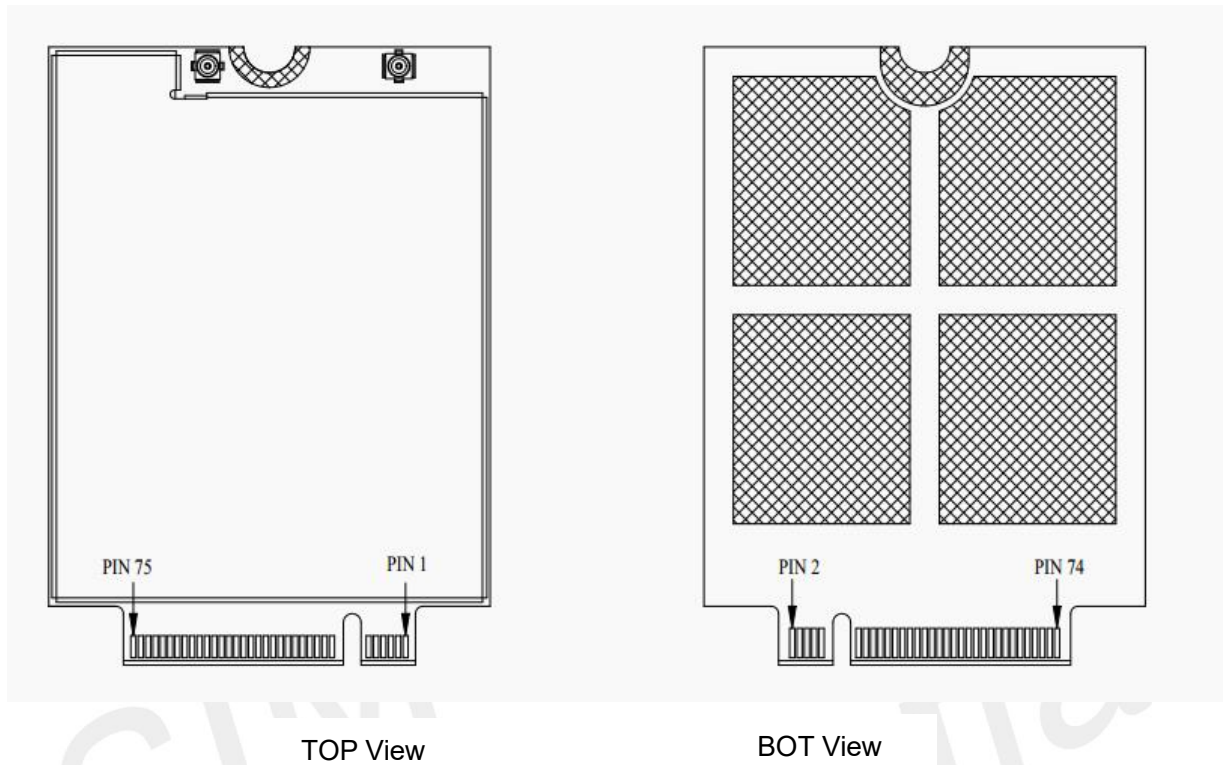


Figure 3: Pin out diagram

2.4 Package Dimensions

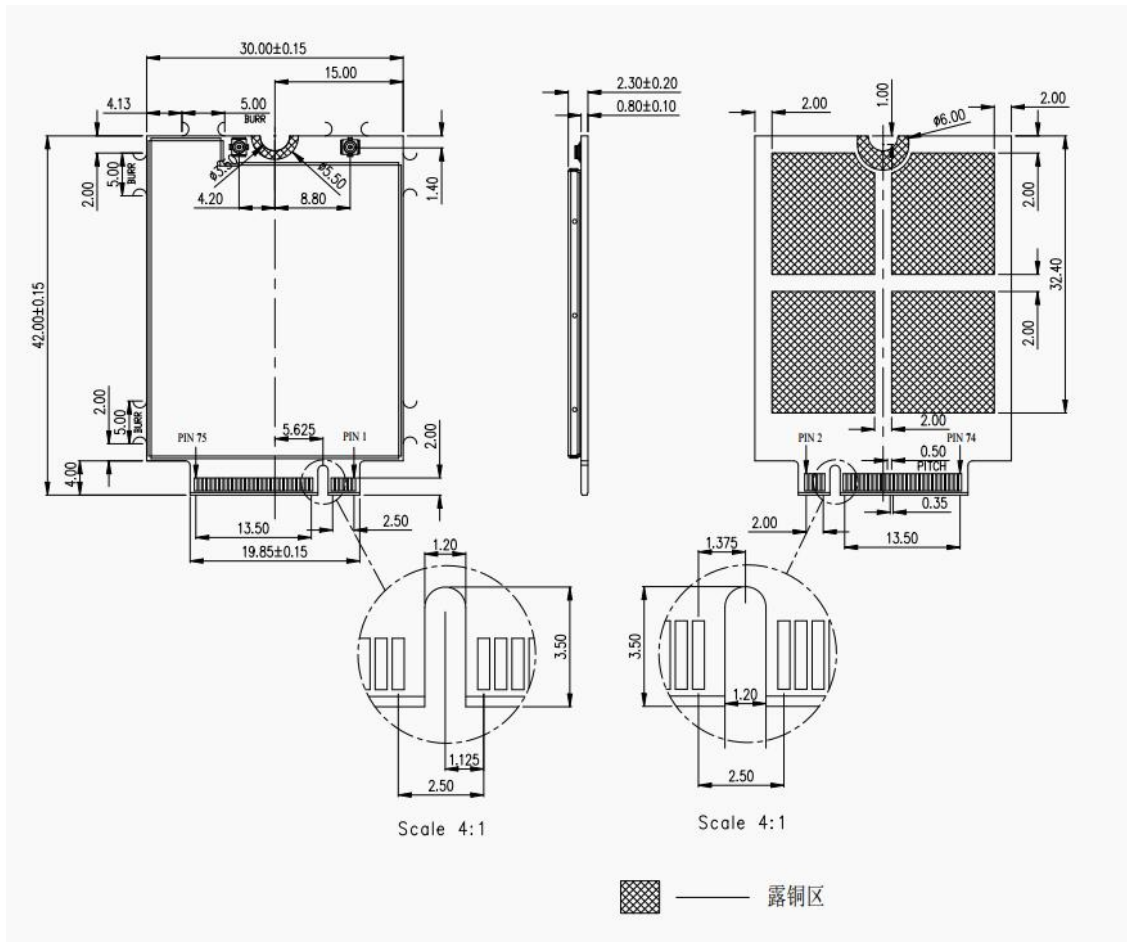


Figure 4: Dimensions of SIM6600-eM2 (Unit: mm)

3 Interface Application

3.1 Power Supply

The recommended power supply of SIM6600-eM2 is 3.7V and the voltage ranges from 3.135 V to 4.4 V. The SIM6600-eM2 has 5 power pins and 11 Ground pins, to ensure the SIM6600-eM2 card works normally, all the pins must be connected. The connector pin is defined to support 500mA current per pin continuously.

Table 6: VBAT pins electronic characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
VBAT	Module power voltage	3.135	3.7	4.4	V
I_{VBAT(peak)}	Module power peak current in normal mode.	-	-	1	A
I_{VBAT(power-off)}	Module power current in power off mode.	-	50	-	uA

3.1.1 Power Supply Design Guide

Make sure that the voltage on the VBAT pins will never drop below 3.135V, even during a transmit event, when current consumption may rise up to 1.0A. If the voltage drops below 3.135V, the module will be powered off automatically.

NOTE

Be sure the power supply for VBAT pins can support more than 1.0A, using a total of more than 100uF capacitors is recommended, in order to avoid the voltage drop to lower than 3.135V.

Some multi-layer ceramic chip (MLCC) capacitors (0.1/1uF) with low ESR in high frequency band can be used for EMC.

These capacitors should be put as close as possible to VBAT pads. Also, users should keep VBAT trace on circuit board wider than 1.0 mm to minimize PCB trace impedance. The following figure shows the recommended circuit.

If the VBAT generated by a switch mode power supply, it is suggested to add a bead to suppress the

Interference. Recommend part of FB101 is BLM21PG300SN1D or MPZ2012S221A.

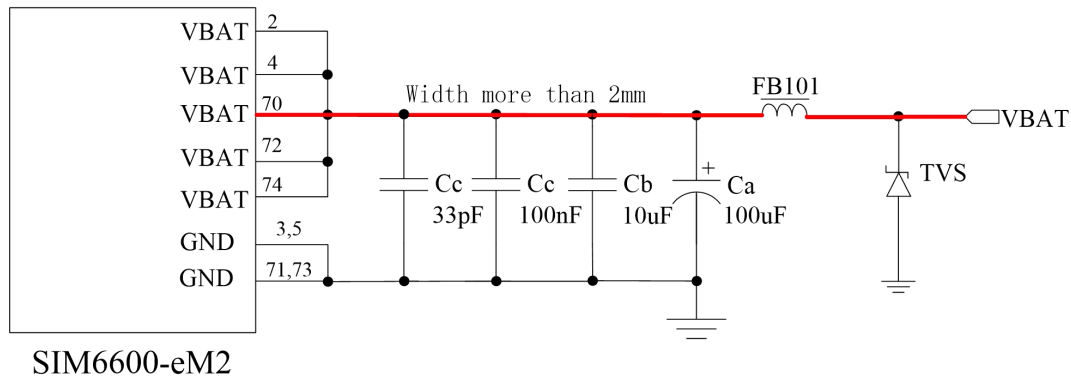


Figure 5: Power supply application circuit

NOTE

1. The test condition: The voltage of power supply for VBAT is 3.7V, Ca is 100 μ F tantalum capacitor (ESR=0.7 Ω).
2. PIN3,5,71,73 are the main return current path of module, these pins should be coppered by a ground plane to main ground.
3. All other GND pins also need connect to ground.

In addition, in order to guard for over voltage protection, it is suggested to use a TVS diode to protect the M.2 card. TVS diode should be placed near VBAT pins.

Table 7: Recommended TVS diode list

No.	Manufacturer	Part Number	VRWM	Package
1	JCET	ESDBW5V0A1	5V	DFN1006-2L
2	WAYON	WS05DPF-B	5V	DFN1006-2L
3	WILL	ESD5611N	5V	DFN1006-2L
4	WILL	ESD56151W05	5V	SOD-323

3.1.2 Recommended Power Supply Circuit

It is recommended that a switching mode power supply or a linear regulator power supply is used. It is important to make sure that all the components used in the power supply circuit can resist the current which could be more than 1A.

The following figure shows the linear regulator reference circuit with 5V input and 3.7V output.

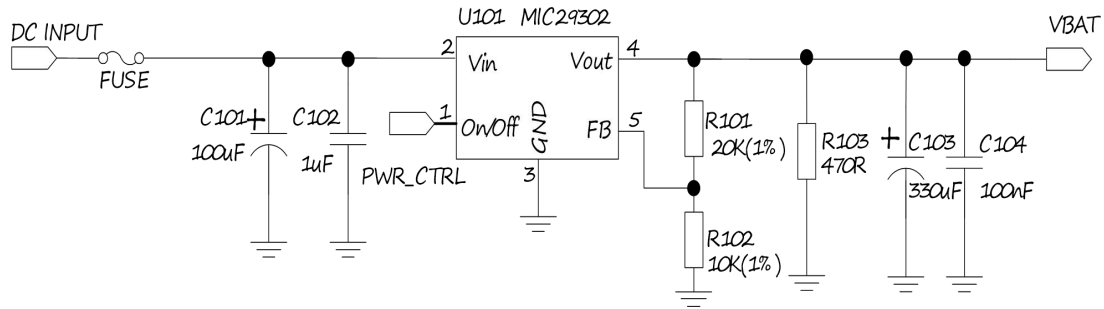


Figure 6: Linear regulator reference circuit

If there is a high dropout between input and VBAT, or the efficiency is extremely important, then a switching mode power supply will be preferable. The following figure shows the switching mode power supply reference circuit with 12V input and 3.7V output.

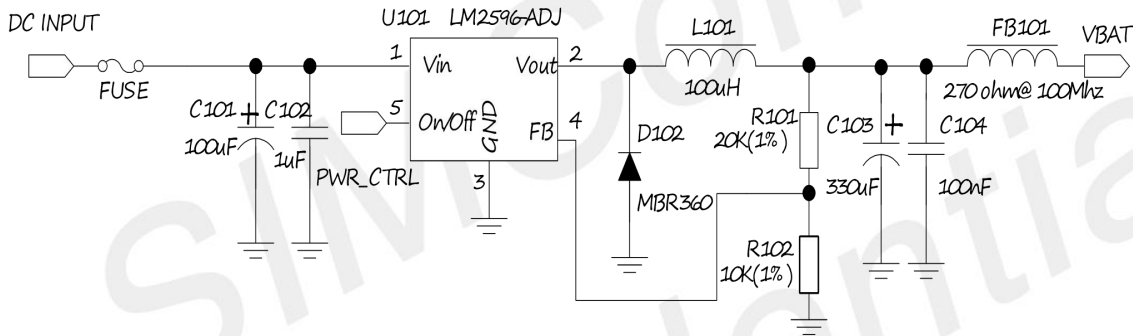


Figure 7: Switching mode power supply reference circuit

NOTE

1. The Switching Mode power supply solution for VBAT must be chosen carefully against Electro Magnetic Interference and ripple current from depraving RF performance.
2. PWR_CTRL must connect to host in case that the module system crash.

3.2 FULL_CARD_POWER_OFF#

Module can be powered on by pulling the FULL_CARD_POWER_OFF# pin up to high level through GPIO.

FULL_CARD_POWER_OFF# signal is an active low input signal and will turn the module on when asserted high (≥ 1.7 V) and module will disconnect usb and go to sleep mode when asserted low (≤ 0.2 V). This pin is 3.3V tolerant and can be driven by either 1.8V or 3.3V GPIO .

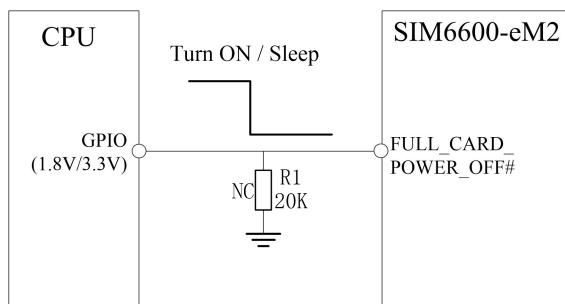


Figure 8: Reference power on/sleep circuit

NOTE

Note: Module could be automatically power on by connecting FULL_CARD_POWER_OFF# pin to 3.3V power via 0R resistor directly.

3.2.1 Power on

The power-on scenarios are illustrated in the following figure.

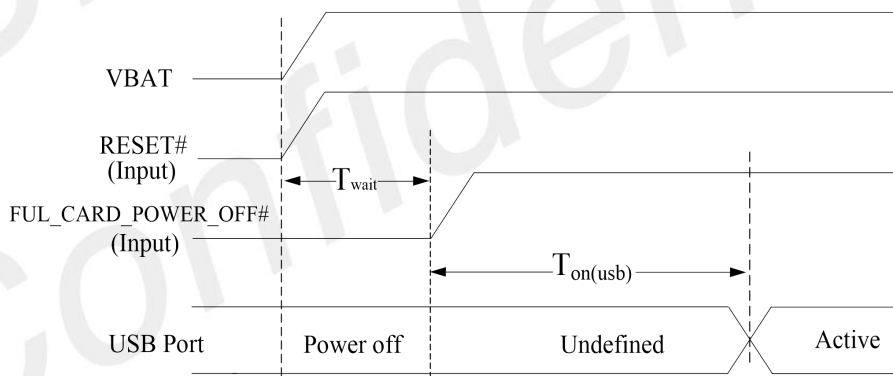


Figure 9: Power on timing sequence

Table 8: Power on timing and electronic characteristic

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_{wait}	The time which is used to wait the VBAT to be stable.	TBD	-	-	ms
$T_{on(usb)}$	The time from power-on issue to USB port ready	-	TBD	-	s
V_{IH}	Input high level voltage on FUL_CARD_POWER_OFF# pin	1.0	1.8	4.4	V
V_{IL}	Input low level voltage on FUL_CARD_POWER_OFF# pin	-0.3	0	0.2	V

3.2.2 Power off

The following methods can be used to power off the card.

- Method 1: Power off Module by AT command .
- Method 2: over-voltage or under-voltage automatic power off.
- Method 3: over-temperature or under-temperature automatic power off.

NOTE

- 1.The over-temperature and over-voltage function is disable by default.
2. If the temperature is outside the range of -25~+75℃, some warning will be reported via AT port. If the temperature is outside the range of -40~+85℃, Module will be powered off automatically.(if the function is enabled).
- 3.The power off AT command is being developed.

These procedures will make the M.2 card disconnect from the network and allow the software to enter a safe state, and save data before the card be powered off completely.

3.2.3 Sleep mode

When FULL_CARD_POWER_OFF# is pulled down,module will go to sleep mode,system will save power. Pulling down the FULL_CARD_POWER_OFF# pin is illustrated in the following figure.

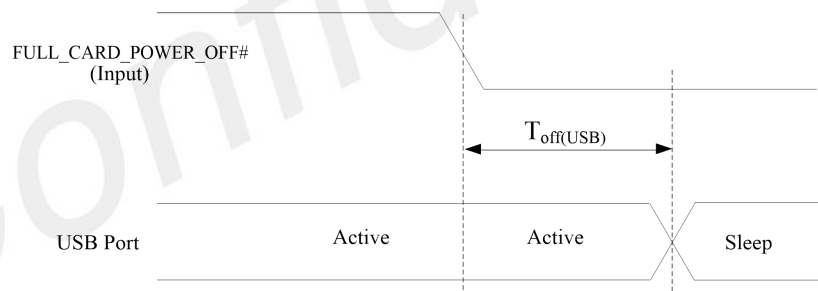


Figure 10: Sleep timing sequence

Table 9: Sleep timing and electronic characteristic

Symbol	Parameter	Time value			Unit
		Min.	Typ.	Max.	
T _{off(usb)}	The time from sleep issue to USB disconnect	-	TBD	-	s

3.3 Reset Function

Module can be reset by pulling the RESET# pin down to low level.

NOTE

This function is only used as an emergency reset, when power off AT command have lost efficacy.

The RESET# pin has been pulled up with a resistor to 1.8V internally, so it does not need to be pulled up externally. It is strongly recommended to put a 100pF capacitor and an ESD protection diode close to the RESET# pin. Please refer to the following figure for the recommended reference circuit.

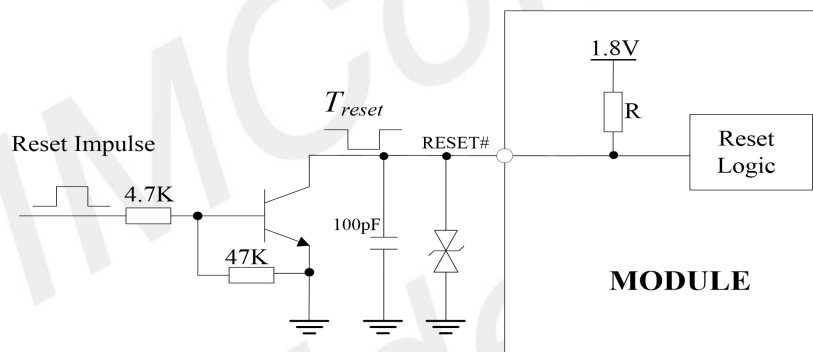


Figure 11: Reference reset circuit

Table 10: RESET pin electronic characteristic

Symbol	Description	Min.	Typ.	Max.	Unit
T_{reset}	The active low level impulse time on RESET_N pin to reset Module	-	50	-	ms
V_{IH}	Input high level voltage	1.2	1.8	2.1	V
V_{IL}	Input low level voltage	-0.3	0	0.4	V

3.4 UART interface

Module provides a 2-wire UART (universal asynchronous serial transmission) interface as DCE (Data Communication Equipment). AT commands and data transmission can be performed through UART interface.

The following figures show the reference design.

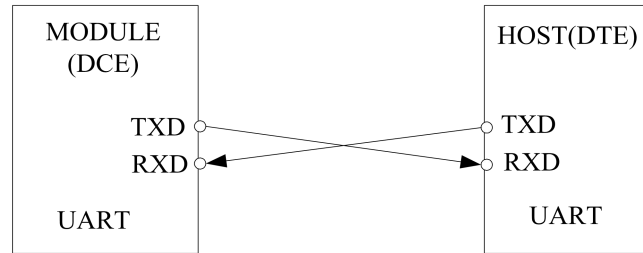


Figure 12: UART modem

The Module UART is 1.8V voltage interface. If user's UART application circuit is 3.3V voltage interface, the level shifter circuits should be used for voltage matching. The TXB0102RGYR provided by Texas Instruments is recommended. The following figure shows the voltage matching reference design.

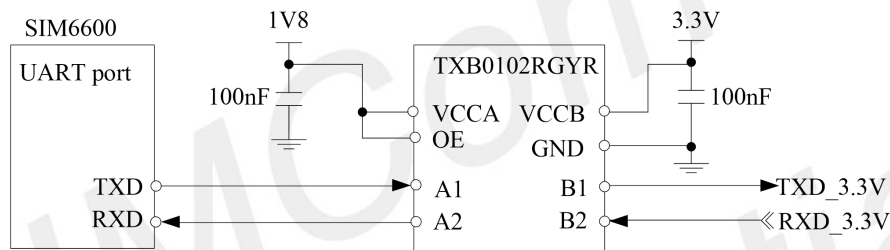


Figure 13: Reference circuit of level shift

NOTE

Module supports the following baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600. The default band rate is 115200bps.

3.5 I2C Interface

Module provides an I2C interface compatible with I2C specification, version 3.0, with clock rate up to 400 kbps. Its operation voltage is 1.8V.

The following figure shows the I2C bus reference design.

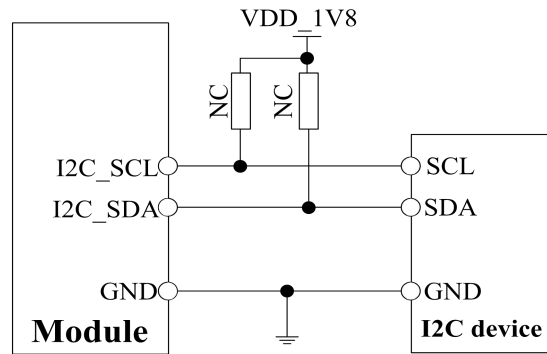


Figure 14: I2C reference circuit

NOTE

SDA and SCL have pull-up resistors in Module, 2 external pull up resistors are reserved.

3.6 WoWWAN#

The WoWWAN# pin is an open drain signal which can be used as an interrupt signal to the host. Normally it will keep high logic level until certain conditions such as receiving SMS, voice call (CSD, video) or URC reporting, then WoWWAN# will change to low logic level to inform the host (client PC), the pulse time is 1 second.

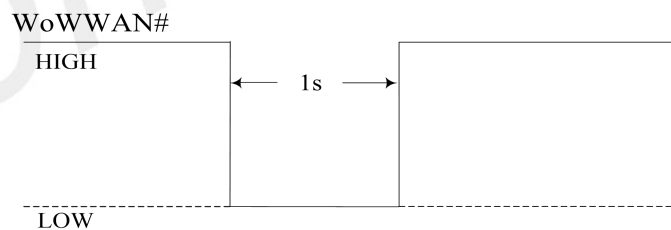


Figure 15: WoWWAN# behaviour (SMS and URC report)

WAKE_ON_WWAN Reference circuit is recommended in the following figure.

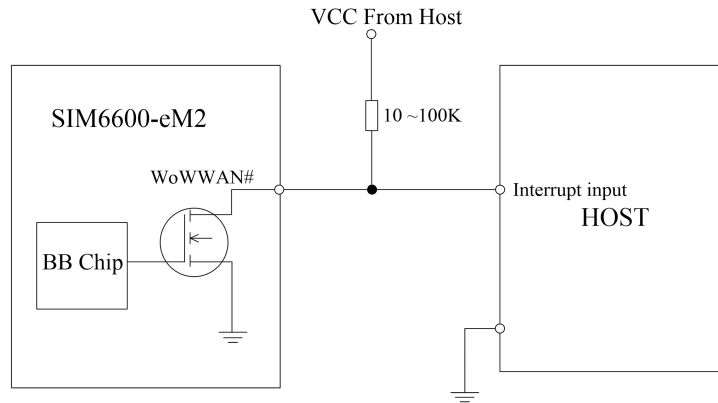


Figure 16: WOWWAN# reference circuit

3.7 USB2.0 Interface

SIM6600-eM2 supports one USB2.0 interface. The module supports three USB speeds: low-speed (1.5Mbps), full-speed (12Mbps) and high-speed (480Mbps).

NOTE

1. The USB_D- and USB_D+ nets must be traced by 90Ohm+/-10% differential impedance.
2. USB NOT support OTG function and USB charging function.

Module is used as a USB device by default. When FULL_CARD_POWER_OFF# is pulled down, USB will disconnect, module will go to sleep mode which can reduce power consumption. Pull high the FULL_CARD_POWER_OFF#, USB will reconnection.

The reference schematic is as following:

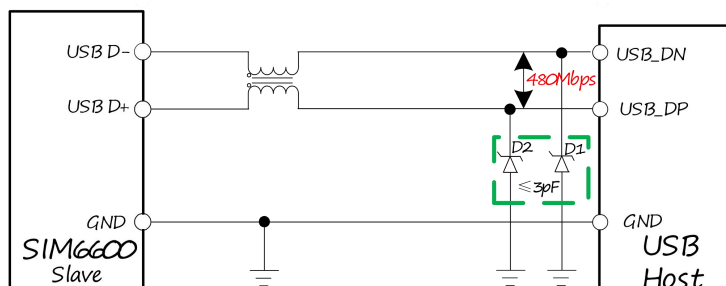


Figure 17: USB reference circuit

Because of the high bit rate on USB bus, more attention should be paid to the influence of the junction capacitance of the ESD component on USB data lines.

Typically, for the USB2.0 signals (USB D- and USB D+), the capacitance should not be more than 3pF. It is recommended to use an ESD protection component such as ESD9M5.0ST5G provided by On Semiconductor (www.onsemi.com).

3.8 UIM Interface

Module supports both 1.8V and 3.0V UIM Cards.

Table 11: UIM electronic characteristic in 1.8V mode (UIM-PWR=1.8V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
UIM-PWR	LDO power output voltage	1.75	1.8	1.95	V
V _{IH}	High-level input voltage	0.65*UIM-PWR	-	UIM-PWR +0.3	V
V _{IL}	Low-level input voltage	-0.3	0	0.35*UIM-PWR	V
V _{OH}	High-level output voltage	UIM-PWR -0.45	-	UIM-PWR	V
V _{OL}	Low-level output voltage	0	0	0.45	V

Table 12: UIM electronic characteristic 3.0V mode (UIM-PWR=2.85V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
UIM-PWR	LDO power output voltage	2.75	2.85	3.05	V
V _{IH}	High-level input voltage	0.65*UIM-PWR	-	UIM-PWR +0.3	V
V _{IL}	Low-level input voltage	-0.3	0	0.25*UIM-PWR	V
V _{OH}	High-level output voltage	UIM-PWR -0.45	-	UIM-PWR	V
V _{OL}	Low-level output voltage	0	0	0.45	V

3.8.1 USIM Application Guide

It is recommended to use an ESD protection component such as ESDA6V1-5W6 produced by ST (www.st.com) or SMF12C produced by ON SEMI (www.onsemi.com). Note that the USIM peripheral circuit should be close to the USIM card socket. The following figure shows the 6-pin SIM card holder reference circuit.

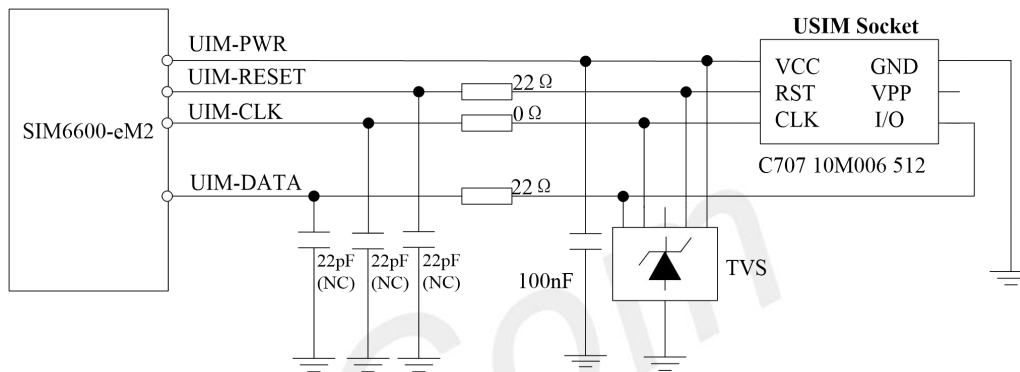


Figure 18: USIM interface reference circuit

The SIM Detect pin is used for detection of the UIM card hot plug in. User can select the 8-pin UIM card holder to implement UIM card detection function.

The following figure shows the 8-pin SIM card holder reference circuit.

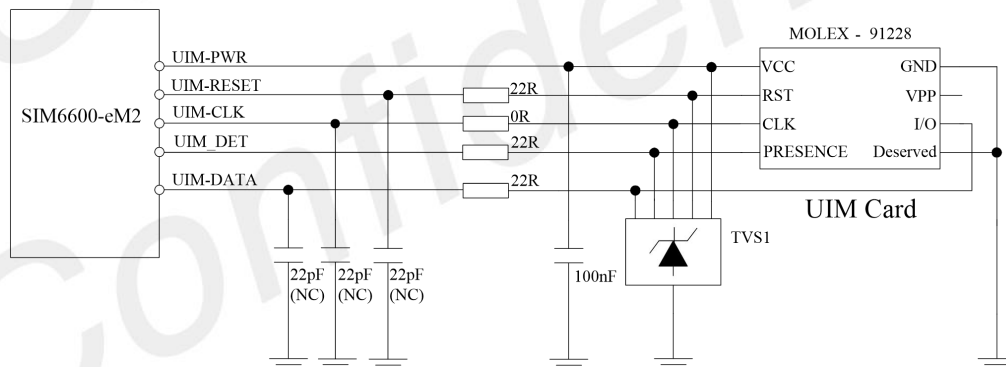


Figure 19: UIM interface reference circuit with UIM_DET

If the UIM card detection function is not used, user can keep the SIM Detect pin open.

3.8.2 USIM layout guide

SIM card circuit is susceptible, the interference may cause the SIM card failures or some other situations, so it is strongly recommended to follow these guidelines while designing:

- Make sure that the SIM card holder should be far away from the antenna while in PCB layout.
- SIM traces should keep away from RF lines, VBAT and high-speed signal lines.

- The traces should be as short as possible.
- Keep SIM holder's GND connect to main ground directly.
- Shielding the SIM card signal by ground.
- Recommended to place a 0.1~1uF capacitor on UIM-PWR line and keep close to the holder.
- The rise/fall time of UIM-CLK should not be more than 40ns.
- Add some TVS and the parasitic capacitance should not exceed 60pF.

3.9 I2S Interface*

Module provides an I2S interface for external codec, which comply with the requirements in the Phillips I2S Bus Specifications.

NOTE

“*” means the I2S function is under developing.

3.10 DPR*

DPR (Dynamic Power Reduction) signal is used by SIM6600-eM2 to assist in meeting regulatory SAR (Specific Absorption Rate) requirements for RF exposure. The signal is provided by a host system proximity sensor to the wireless device to provide an input trigger causing a reduction in the radio transmit output power. The module have 2 DPR pins.

User can use AT command to active this function, if do not need this function, this pin can be keep floating.

Table 13: DPR interface

Pin no	Pin Name	Pin status	Function
25	PCI_DPR1#	Low	Max transmitting power will be reduced
		High	Max transmitting power will not be reduced (default)
28	PCI_DPR2#	Low	Max transmitting power will be reduced
		High	Max transmitting power will not be reduced (default)

NOTE

“*” means the DPR function is under developing.

3.11 CONFIG Pins

These signals provide the means to indicate the specific configuration of the module. SIM6600-eM2 is configured as WWAN-USB2.0.

Table 14: CONFIG Pins

Pin no	Pin Name	Description
21	CONFIG_0	Connected to GND internally.
69	CONFIG_1	Connected to GND internally.
75	CONFIG_2	Connected to GND internally.
1	CONFIG_3	No Connect internally.

In the M.2 specification, the 4 pins are defined as below:

Table 15: Config interface

Config_0 (Pin 21)	Config_1 (Pin 69)	Config_2 (Pin 75)	Config_3 (Pin 1)	Module type and Main host interface	Comments
GND	GND	GND	NC	WWAN – USB 2.0	Vender defined

3.12 LED1#

LED1# is open drain output and is used to allow SIM6600-eM2 to provide network status via LED which will be provided by the host.

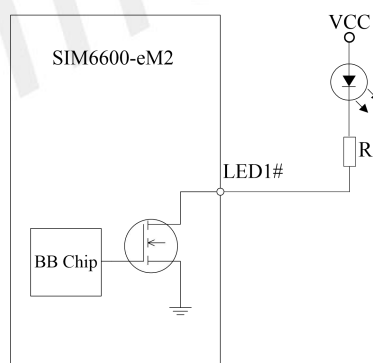


Figure 20: LED1# reference circuit

NOTE

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

Table 16: LED1# pin status

NETLIGHT pin status	Module status
Always On	Searching Network; Call Connect(include VOLTE,SRLTE)
200ms ON, 200ms OFF	Data Transmit; 4G registered;
800ms ON, 800ms OFF	3G registered network
OFF	Power off ;Sleep

3.13 W_DISABLE1#

The W_DISABLE1# pin controls SIM6600-eM2 to enter or exit the flight mode, when the W_DISABLE1# signal is asserted to low level, all RF functions would be disabled. When the W_DISABLE1# signal is not asserted, the RF function will be active if it was not disabled by other means such as software.

Its reference circuit is shown in the following figure.

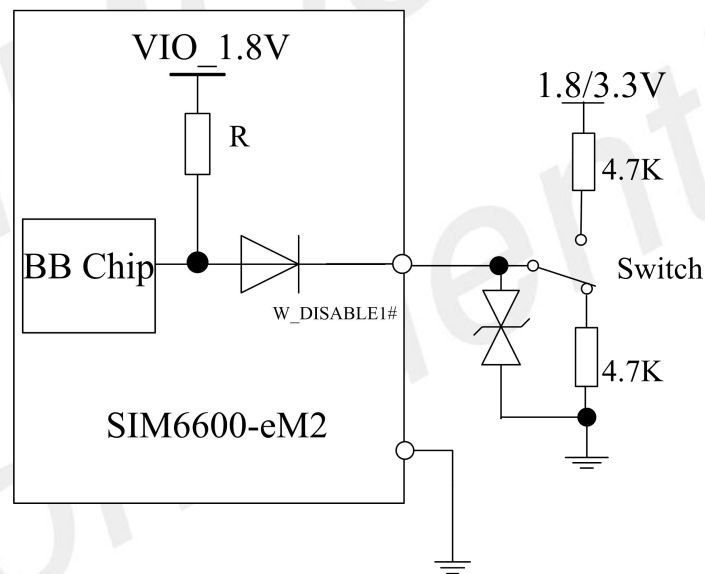


Figure 21: Flight mode switch reference circuit

W_DISABLE1# pin status as below:

Table 17: FLIGHT MODE pin status

FLIGHTMODE pin status	Module operation
Input Low Level	Flight Mode: RF is closed
Input High Level	RF is working

3.14 ANTCTRL interface

ANTCTL[0:3] are used for tunable antenna control and should be routed to an appropriate antenna control circuitry.

The following table are the definitions for antenn control interfaces.

Table 18: Definition of antenna control interface

Pin Name	Pin No.	Electrical Description	Description	Comments
ANTCTL0	59	DO	Antenna tuner control0	
ANTCTL1	61	DO	Antenna tuner control1	1.8V voltage domain.If
ANTCTL2	58	DO	Antenna tuner control2	unused,please keep open
ANTCTL3	56	DO	Antenna tuner control3	

NOTE

This function is under development,for details please contact SIMCom support teams.

3.15 W_DISABLE2#

The W_DISABLE2# pin controls SIM6600-eM2 to disable the GNSS function.When the W_DISABLE2# signal is pulled to low level, the GNSS function would be disabled. SIM6600-eM2 have no GNSS function,this pin is reserved.

4 Antenna Interfaces

SIM6600-eM2 provides a main antenna interface, a diversity antenna interface . The antenna ports have an RF impedance of 50Ω.

4.1 Operating Frequency

Table 19: SIM6600-eM2 Operating frequencies

WCDMA Band	Uplink (UL)	Downlink (DL)	Duplex Mode
WCDMA B1	1920 ~1980 MHz	2110 ~2170 MHz	FDD
WCDMA B2	1850 ~1910 MHz	1930 ~1990 MHz	FDD
WCDMA B4	1710 ~1755 MHz	2110 ~2155 MHz	FDD
WCDMA B5	824 ~849 MHz	869 ~894MHz	FDD
WCDMA B8	880 ~915 MHz	925 ~960 MHz	FDD
LTE B1	1920 ~1980 MHz	2110 ~2170 MHz	FDD
LTE B2	1850 ~1910 MHz	1930 ~1990 MHz	FDD
LTE B3	1710 ~1785 MHz	1805 ~1880 MHz	FDD
LTE B4	1710 ~1755 MHz	2110 ~2155 MHz	FDD
LTE B5	824 ~849 MHz	869 ~894MHz	FDD
LTE B7	2500~2570MHz	2620~2690MHz	FDD
LTE B8	880 ~915 MHz	925 ~960 MHz	FDD
LTE B12	699 ~716 MHz	729 ~746 MHz	FDD
LTE B13	777 ~787 MHz	746 ~756 MHz	FDD
LTE B17	704 ~716 MHz	734 ~746 MHz	FDD
LTE B18	815 ~830 MHz	860 ~875 MHz	FDD
LTE B19	830 ~845 MHz	875 ~890 MHz	FDD
LTE B20	832~862MHz	791~ 821MHz	FDD
LTE B25	1850 ~1915 MHz	1930 ~1995 MHz	FDD
LTE B26	814 ~849 MHz	859 ~894 MHz	FDD
LTE B28	703~748MHz	758~803MHz	FDD
LTE B29	N/A	717 ~728 MHz	FDD
LTE B30	2305 ~2315 MHz	2350 ~2360 MHz	FDD
LTE B66	1710 ~1780 MHz	2110 ~2200 MHz	FDD
LTE B71	663 ~698 MHz	617 ~652 MHz	FDD
LTE B34	2010 ~2025 MHz	2010 ~2025 MHz	TDD
LTE B38	2570 ~2620 MHz	2570 ~2620 MHz	TDD
LTE B39	1880 ~1920 MHz	1880 ~1920 MHz	TDD
LTE B40	2300 ~2400 MHz	2300 ~2400 MHz	TDD

LTE B41	2496 ~2690 MHz	2496 ~2670 MHz	TDD
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NOTE

LTE-FDD B29 supports Rx only and is only for secondary component carrier.

4.2 Antenna Installation

4.2.1 Antenna Requirements

The following table shows the requirements on main antenna and Diversity antenna.

Table 20:WCDMA/LTE antenna

Passive	Recommended standard
Direction	Omni directional
Gain	> -3dBi (Avg)
Input impedance	50 Ω
Efficiency	> 30 %
VSWR	< 2
Cable insertion Loss <1GHz	<1dB
Cable insertion Loss 1GHz~2.2GHz	<1.5dB
Cable insertion Loss 2.3GHz~2.7GHz	<2dB

4.2.2 Recommended RF Connector for Antenna Installation

When choosing antennas, user should pay attentions to the connector on antenna which should match with the connector on the module.

The standard 2x2 mm size RF receptacle connectors have been used on SIM6600-eM2. The dimension of the connector on SIM6600-eM2 is 2.0*2.0*0.6mm.

Shows the RF connector dimension in the following figure:

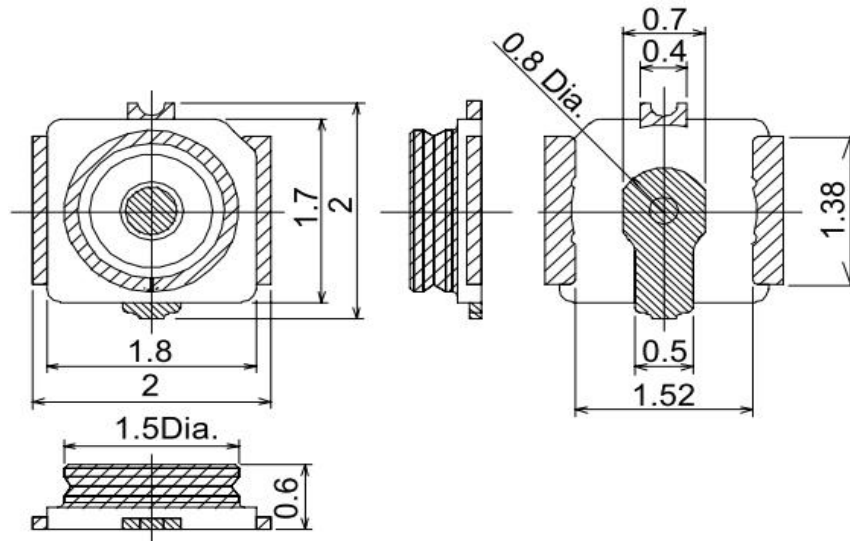


FIGURE1. Construction

Scale: Free
Tolerances Unless
Otherwise Specified: ± 0.2
Unit: mm

Figure 22: Antenna connector

The major specifications of the RF connector as below:

Table 21: the major specifications of the RF connector

Item	Specification
Nominal Frequency Range	DC to 6 GHz
Nominal Impedance	50 Ω
Temperature Rating	-40 $^{\circ}$ C to + 85 $^{\circ}$ C
Initial Contact Resistance (without conductor resistance)	Center contact 20.0m Ω max. Outer contact 20.0m Ω max.
Voltage Standing Wave Ratio (V.S.W.R.)	Meet the requirements of 1.3max.(DC~3GHz) 1.45max.(3GHz~6GHz)

There are two kinds of coaxial cables mating the RF connector in the SIM6600-eM2, SIMCom recommend use Murata and SUZHOU KELI, and the Part Number is MXFR32HP1000 of the Murata and KLC-2058 of the KELI.

5 Electrical Specifications

5.1 Absolute maximum ratings

Absolute maximum rating for digital and analog pins of Module are listed in the following table:

Table 22: Absolute maximum ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage at VBAT pins	-0.3	-	4.7	V
Voltage at digital pins (GPIO,I2C,UART, I2S)	-0.3	-	2.1	V
Voltage at digital pins (UIM)	-0.3	-	3.05	V
Voltage at FULL_CARD_POWER_OFF#	-0.3	-	4.7	
Voltage at RESET#	-0.3	-	2.1	

5.2 Operating conditions

Table 23: Recommended operating ratings

Parameter	Min.	Typ.	Max.	Unit
Voltage at VBAT	3.135	3.7	4.4	V

Table 24: 1.8V Digital I/O characteristics*

Parameter	Description	Min.	Typ.	Max.	Unit
V _{IH}	High-level input voltage	1.17	1.8	2.1	V
V _{IL}	Low-level input voltage	-0.3	0	0.63	V
V _{OH}	High-level output voltage	1.35	-	1.8	V
V _{OL}	Low-level output voltage	0	-	0.45	V
I _{OH}	High-level output current(no pull down resistor)	-	TBD	-	mA
I _{OL}	Low-level output current(no pull up resistor)	-	TBD	-	mA
I _{IH}	Input high leakage current (no pull down resistor)	-	-	TBD	uA
I _{IL}	Input low leakage current(no pull up resistor)	TBD	-	-	uA

NOTE

These parameters are for digital interface pins, such as UART, I2C, I2S, RESET#, ANTCTL and GPIOs (DPR, SIM DETECT).

The operating temperature of Module is listed in the following table.

Table 25:Operating temperature

Parameter	Min.	Typ.	Max.	Unit
Normal operation temperature(3GPP compliant)	-25	25	70	°C
Extended operation temperature*	TBD	TBD	TBD	°C
Storage temperature	-40	25	80	°C

NOTE

Module is able to make and receive voice calls, data calls, SMS and make UMTX/LTE traffic in extended operation temperature. 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 Module product.

Table 26: Operating mode Definition*

Mode	Function
Normal operation	UMTS/LTE Sleep Pull down the FULL_CARD_POWER_OFF# pin,set the module to a sleep mode. In this case, the current consumption of module will be reduced to a very low level and the module can still receive paging message and SMS.
	UMTS/LTE Idle Software is active. Module is registered to the network, and the Module is ready to communicate.
	UMTS/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.
	UMTS/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.
	UMTS/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.
Flight mode		Pulling down the W_disable1# 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" , then pull down the FULL_CARD_POWER_OFF# 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.

NOTE

These AT Command is under development,for details please contact SIMCom support teams.

5.3.2 Sleep mode

In sleep mode, the current consumption of Module will be reduced to a very low level, and Module can still receive paging message and SMS.

Several hardware and software conditions must be satisfied in order to let Module enter into sleep mode:

1. UART condition
2. USB condition
3. Software condition

NOTE

Before designing, pay attention to how to realize sleeping/waking function.

5.4 Current Consumption

The current consumption is listed in the table below.

Table 27:Current consumption on VBAT Pins (VBAT=3.7V)

UMTS sleep mode			
WCDMA supply current (without USB connection)	Sleep mode @DRX=9 Typical: TBD mA		
	Idle mode@DRX=9 Typical: 49.4 mA		
LTE sleep mode			
LTE FDD supply current (without USB connection)	Sleep mode Typical: TBD mA		
	Idle mode Typical:48.7 mA		
LTE TDD supply current (without USB connection)	Sleep mode Typical: TBD mA		
	Idle mode Typical:49.5 mA		
UMTS Talk			
WCDMA B1	@Power 23dBm Typical: 668mA		
WCDMA B2	@Power 23dBm Typical: 585 mA		
WCDMA B4	@Power 23dBm Typical: 622 mA		
WCDMA B5	@Power 23dBm Typical: 580 mA		
WCDMA B8	@Power 23dBm Typical: 575 mA		
HSDPA data			
WCDMA B1	@Power 23dBm Typical: 668 mA		
WCDMA B2	@Power 23dBm Typical: 585 mA		
WCDMA B4	@Power 23dBm Typical: 622 mA		
WCDMA B5	@Power 23dBm Typical: 580 mA		
WCDMA B8	@Power 23dBm Typical: 575 mA		
LTE data			
LTE-FDD B1	@5MHz	23dBm	Typical: 766 mA
	@10MHz	23dBm	Typical: 776 mA
	@20MHz	23dBm	Typical: 781 mA
LTE-FDD B2	@5MHz	23dBm	Typical: 644 mA
	@10MHz	23dBm	Typical: 634 mA
	@20MHz	23dBm	Typical: 635 mA
LTE-FDD B3	@5MHz	23dBm	Typical: 699 mA
	@10MHz	23dBm	Typical: 701 mA
	@20MHz	23dBm	Typical: 703 mA
LTE-FDD B4	@5MHz	23dBm	Typical: 644 mA
	@10MHz	23dBm	Typical: 647 mA
	@20MHz	23dBm	Typical: 653 mA
LTE-FDD B5	@5MHz	23dBm	Typical: 630 mA
	@10MHz	23dBm	Typical: 635 mA
LTE-FDD B7	@5MHz	23dBm	Typical: 740 mA
	@10MHz	23dBm	Typical: 766 mA
	@20MHz	23dBm	Typical: 763 mA
LTE-FDD B8	@5MHz	23dBm	Typical: 709 mA
	@10MHz	23dBm	Typical: 724 mA
LTE-FDD B12	@5MHz	23dBm	Typical: 603 mA
	@10MHz	23dBm	Typical: 610 mA
LTE-FDD B13	@5MHz	23dBm	Typical: 745 mA
	@10MHz	23dBm	Typical: 736 mA
LTE-FDD B17	@5MHz	23dBm	Typical: 612 mA
	@10MHz	23dBm	Typical: 617 mA
LTE-FDD B18	@5MHz	23dBm	Typical: 662 mA
	@10MHz	23dBm	Typical: 686 mA

LTE-FDD B19	@5MHz	23dBm	Typical: 619 mA
	@10MHz	23dBm	Typical: 635 mA
LTE-FDD B20	@5MHz	23dBm	Typical: 683 mA
	@10MHz	23dBm	Typical: 677 mA
	@20MHz	23dBm	Typical: 697 mA
LTE-FDD B25	@5MHz	23dBm	Typical: 655 mA
	@10MHz	23dBm	Typical: 654 mA
	@20MHz	23dBm	Typical: 653 mA
LTE-FDD B26	@5MHz	23dBm	Typical: 636 mA
	@10MHz	23dBm	Typical: 638 mA
LTE-FDD B28	@5MHz	23dBm	Typical: 624 mA
	@10MHz	23dBm	Typical: 626 mA
	@20MHz	23dBm	Typical: 625 mA
LTE-FDD B29	N/A		
LTE-FDD B30	@5MHz	23dBm	Typical: 685 mA
	@10MHz	23dBm	Typical: 681 mA
LTE-FDD B66	@5MHz	23dBm	Typical: 657 mA
	@10MHz	23dBm	Typical: 665 mA
	@20MHz	23dBm	Typical: 654 mA
LTE-FDD B71	@5MHz	23dBm	Typical: 711 mA
	@10MHz	23dBm	Typical: 702 mA
LTE-TDD B34	@5MHz	23dBm	Typical: 533 mA
	@10MHz	23dBm	Typical: 573 mA
LTE-TDD B38	@5MHz	23dBm	Typical: 549 mA
	@10MHz	23dBm	Typical: 606 mA
	@20MHz	23dBm	Typical: 591 mA
LTE-TDD B39	@5MHz	23dBm	Typical: 581 mA
	@10MHz	23dBm	Typical: 615 mA
	@20MHz	23dBm	Typical: 550 mA
LTE-TDD B40	@5MHz	23dBm	Typical: 730 mA
	@10MHz	23dBm	Typical: 758 mA
	@20MHz	23dBm	Typical: 744 mA
LTE-TDD B41	@5MHz	23dBm	Typical: 600 mA
	@10MHz	23dBm	Typical: 593 mA
	@20MHz	23dBm	Typical: 577 mA

5.5 RF Output Power

The following table shows the RF output power of SIM6600-eM2 module.

Table 28: Conducted Output Power

Frequency	Max	Min
WCDMA Bands	23dBm + 2/-2dB	< -50dBm
LTE-FDD Bands	23dBm + 1.5/-1.5dB	< -40dBm
LTE-TDD Bands	23dBm + 1.5/-1.5dB	< -40dBm

5.6 Conducted Receive Sensitivity

The following tables show conducted RF receiving sensitivity of SIM6600-eM2 module.

Table 29:SIM6600-eM2 Conducted RF Receiving Sensitivity

Frequency	Primary (Typ.)	Diversity (Typ.)
WCDMA B1	-110.5	NA
WCDMA B2	-111	NA
WCDMA B4	-112	NA
WCDMA B5	-112	NA
WCDMA B8	-110.5	NA
LTE-FDD B1(10M)	-97	-97.6
LTE-FDD B2(10M)	-98	-98.4
LTE-FDD B3(10M)	-98.5	-98
LTE-FDD B4(10M)	-98.5	-97.2
LTE-FDD B5(10M)	-97.5	-98
LTE-FDD B7(10M)	-97.5	-98.2
LTE-FDD B8(10M)	-97.5	-98
LTE-FDD B12(10M)	-99	-98.1
LTE-FDD B13(10M)	-98.5	-99.1
LTE-FDD B17(10M)	-99	-99.3
LTE-FDD B18(10M)	-97.5	-99
LTE-FDD B19(10M)	-98	-98.2
LTE-FDD B20(10M)	-98.5	-99.2
LTE-FDD B25(10M)	-98.5	-98.2
LTE-FDD B26(10M)	-98	-98.8
LTE-FDD B28(10M)	-98	-99
LTE-FDD B29(10M)	-98.3	-98.3
LTE-FDD B30(10M)	-98	-98.8
LTE-FDD B66(10M)	-98.8	-97.5
LTE-FDD B71(10M)	-98.5	-99
LTE-FDD B34(10M)	-98.5	-98.6
LTE-FDD B38(10M)	-98.5	-98.6
LTE-FDD B39(10M)	-98.5	-98.9
LTE-FDD B40(10M)	-98	-97.6
LTE-FDD B41(10M)	-97.5	-97.1

NOTE

The data in above table are gotten at static condition.
Per 3GPP specification.

5.7 ESD

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

Table 30: The ESD performance measurement table (Temperature: 25℃, Humidity: 45%)

Part	Contact discharge	Air discharge
VBAT, GND	+/-4KV	+/-8KV
Antenna port	+/-4KV	+/-8KV
FULL_CARD_POWER_OFF#	+/-2KV	+/-4KV
USB	+/-2KV	+/-4KV
RESET_N	+/-2KV	+/-4KV
UIM Card	+/-2KV	+/-4KV
Other PADs	+/-2KV	+/-4KV

NOTE

When install RF antenna cable,must turn off power of the module.

6 Appearance

6.1 Top and Bottom View of Module

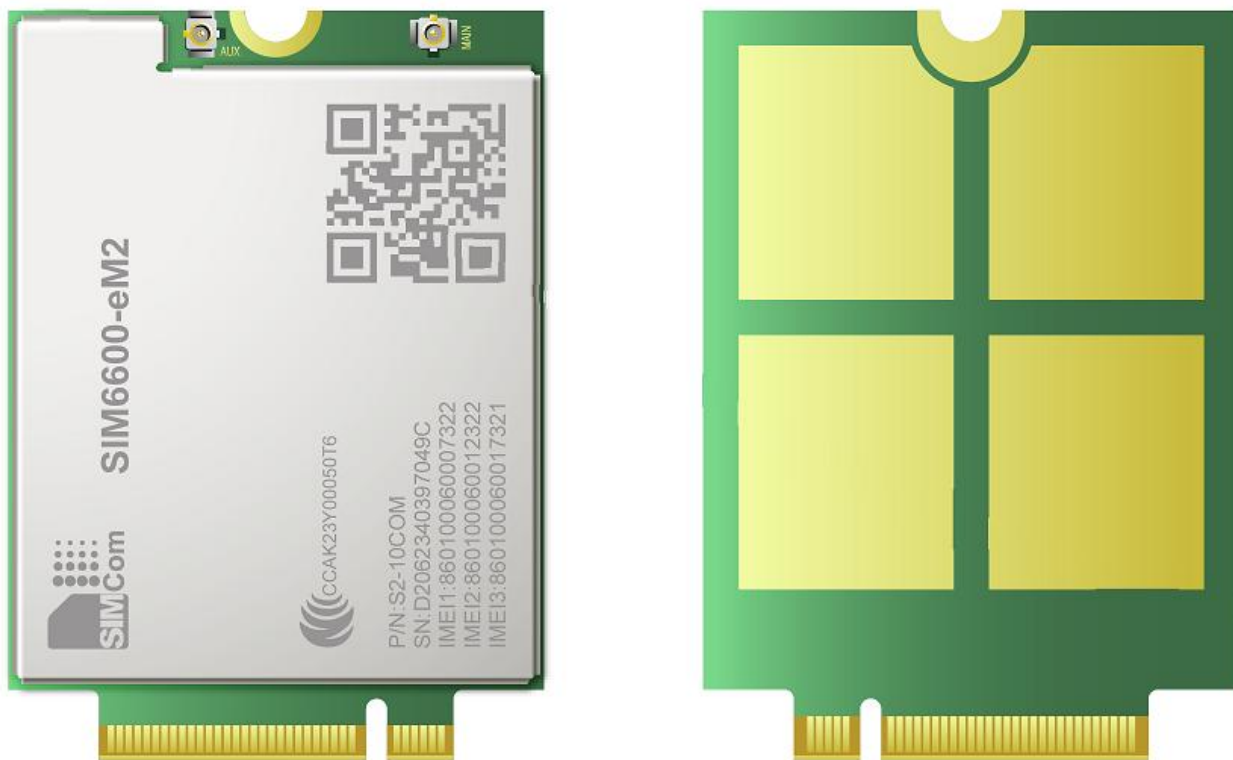


Figure 23: Top and bottom view of Module

6.2 Label Description Information

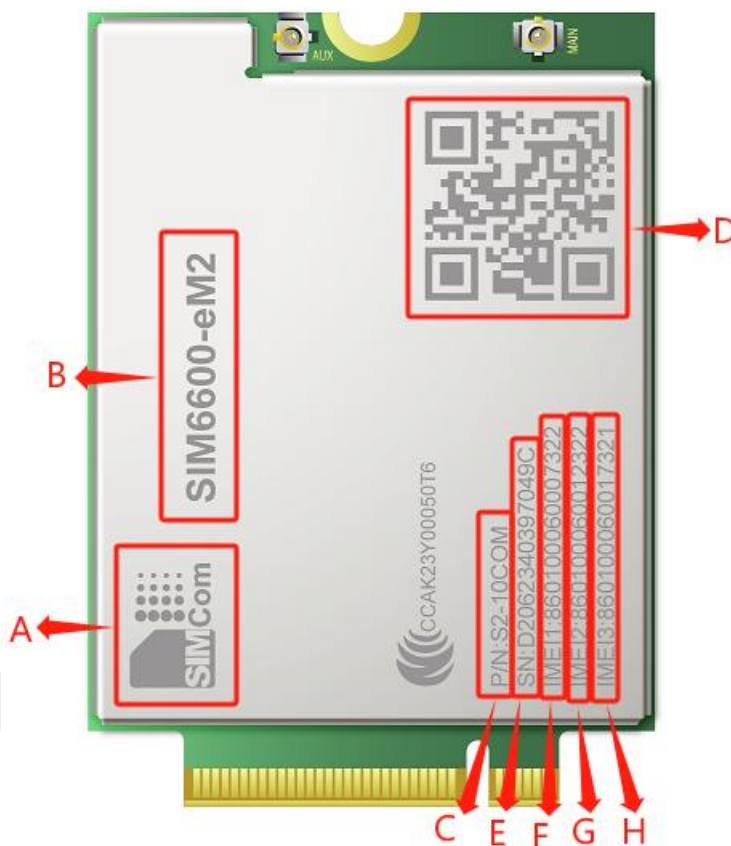


Figure 24: Label information

Table 31: The description of label information

No.	Description
A	LOGO
B	Project name
C	Product code
D	QR code
E	Serial number.The 5th to 8th represent the production date.For example,2340 represents production in the 40th week of 2023.
F	International mobile equipment identity I
G	International mobile equipment identity II
H	International mobile equipment identity III

NOTE

Figure 23 and Figure 24 are the design effect diagrams of the module for reference only. The actual appearance is subject to the actual product.

7 Install SIM6600-eM2 to Board

The module should be install well by the connector and screw as the following figure illustration. The module Stand-off and mounting screw also serve as part of the module Electrical Ground path. The Stand-off should be connected directly to the ground plane on the platform. So that when the module is mounted and the mounting screw is screwed on to hold the module in place, this will make the electrical ground connection from the module to the platform ground plane.

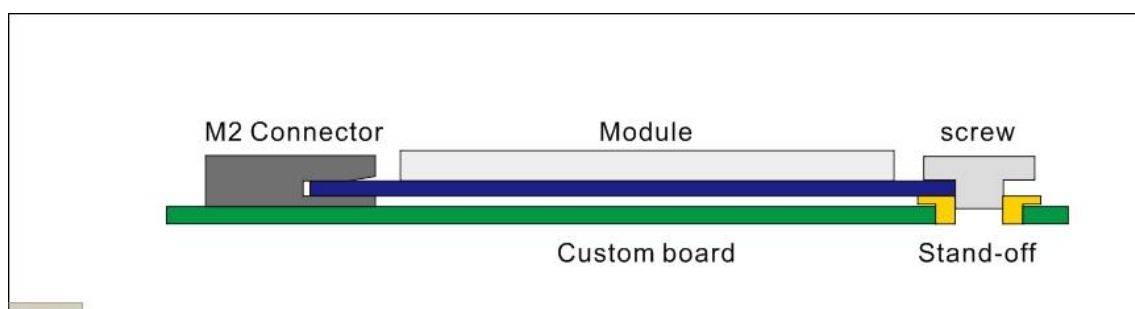


Figure 25: Equipment diagram

8 Thermal Design

Customer should pay attentions to the thermal design of SIM6600-eM2, for the mass data application, the module would work in max power status and last long time, the temperature of module would increase quickly, especially in high temperature environment.

Module reserved a ground plane on the bottom side for the heat dissipating, customer could conduct the heat to the large board by the silica gel, and the surface copper area on large board should be more than 900 mm².

For better thermal performance, customer could use a heat sink device to conduct the heat to the air.

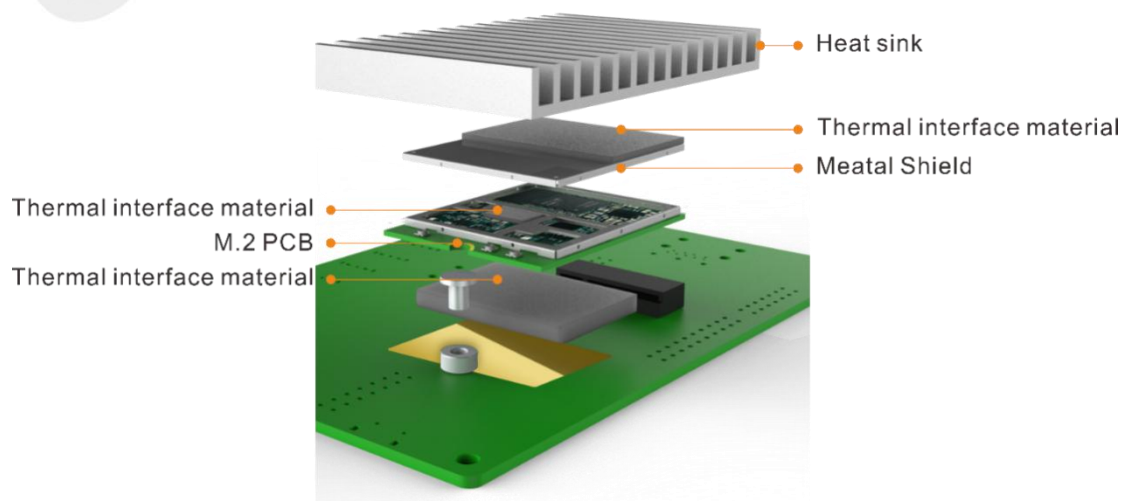


Figure 26: Thermal design diagram

Table 32: The silica gel selection guide

Item	Test method	Recommend value	Unit
Specific Gravity	ASTMD792	3.2±0.1	g/cc
Continuous use Temp	EN344	-40~+220	°C
Volume Resistivity	ASTMD257	1.0*10 ¹¹	Ω-CM
Voltage Endurance	ASTMD149	4	KV/mm
Flame Rating	UL-94	V-0	
Conductivity	ASTMD5470	8	w/m-k

9 Packaging

Module support tray packaging.

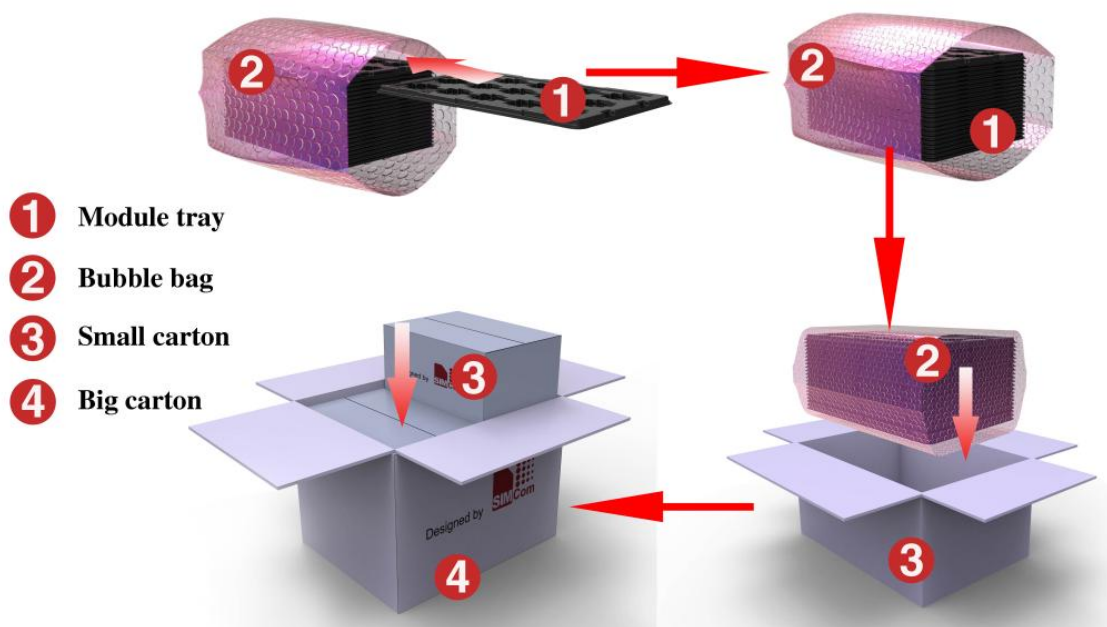


Figure 27: Packaging diagram

Module tray drawing:

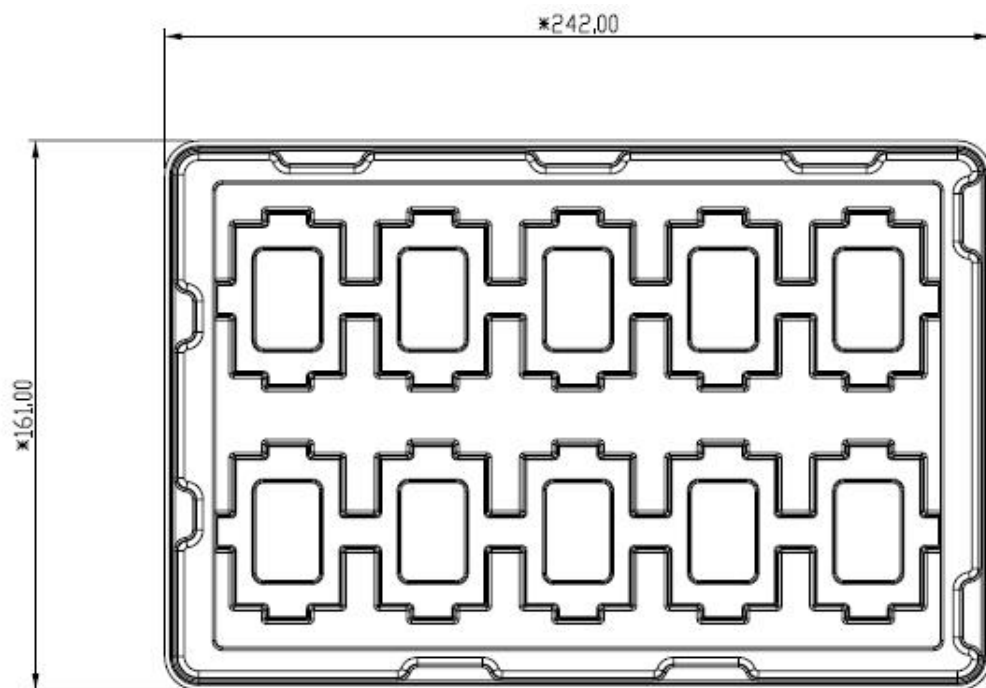


Figure 28: Tray drawing

Table 33: Tray size

Length ($\pm 3\text{mm}$)	Width ($\pm 3\text{mm}$)	Number
245.0	165.0	10

Small carton drawing:

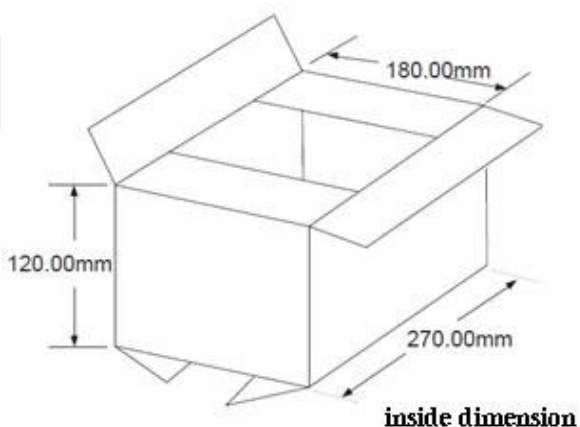


Figure 29: Small carton drawing

Table 34: Small Carton size

Length ($\pm 10\text{mm}$)	Width ($\pm 10\text{mm}$)	Height ($\pm 10\text{mm}$)	Number
------------------------------	-----------------------------	------------------------------	--------

270

180

120

10*20=200

Big carton drawing:

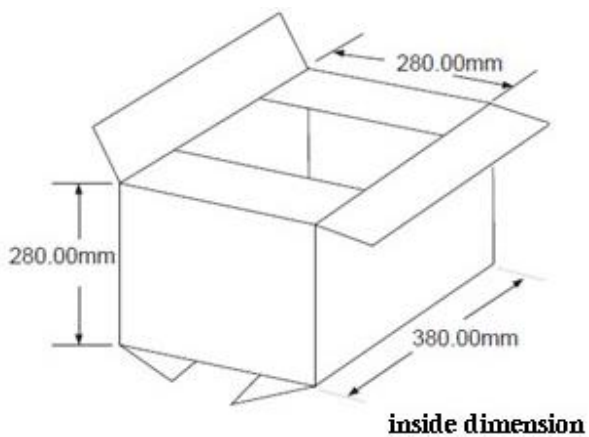


Figure 30: Big carton drawing

Table 35: Big Carton size

Length ($\pm 10\text{mm}$)	Width ($\pm 10\text{mm}$)	Height ($\pm 10\text{mm}$)	Number
380	280	280	200*4=800

10 Appendix

10.1 Coding Schemes and Maximum Net Data Rates over Air Interface

Table 36: Coding Schemes and Maximum Net Data Rates over Air Interface

HSDPA device category	Max data rate (peak)	Modulation type
Category 1	1.2Mbps	16QAM, QPSK
Category 2	1.2Mbps	16QAM, QPSK
Category 3	1.8Mbps	16QAM, QPSK
Category 4	1.8Mbps	16QAM, QPSK
Category 5	3.6Mbps	16QAM, QPSK
Category 6	3.6Mbps	16QAM, QPSK
Category 7	7.2Mbps	16QAM, QPSK
Category 8	7.2Mbps	16QAM, QPSK
Category 9	10.2Mbps	16QAM, QPSK
Category 10	14.4Mbps	16QAM, QPSK
Category 11	0.9Mbps	QPSK
Category 12	1.8Mbps	QPSK
Category 13	17.6Mbps	64QAM
Category 14	21.1Mbps	64QAM
Category 15	23.4Mbps	16QAM
Category 16	28Mbps	16QAM
Category 17	23.4Mbps	64QAM
Category 18	28Mbps	64QAM
Category 19	35.5Mbps	64QAM
Category 20	42Mbps	64QAM
Category 21	23.4Mbps	16QAM
Category 22	28Mbps	16QAM
Category 23	35.5Mbps	64QAM
Category 24	42.2Mbps	64QAM
HSUPA device category	Max data rate (peak)	Modulation type
Category 1	0.96Mbps	QPSK
Category 2	1.92Mbps	QPSK
Category 3	1.92Mbps	QPSK
Category 4	3.84Mbps	QPSK
Category 5	3.84Mbps	QPSK
Category 6	5.76Mbps	QPSK
Category 7	11.5Mbps	16QAM

LTE-FDD device category (Downlink)	Max data rate (peak)	Modulation type
Category 1	10Mbps	QPSK/16QAM/64QAM
Category 2	50Mbps	QPSK/16QAM/64QAM
Category 3	100Mbps	QPSK/16QAM/64QAM
Category 4	150Mbps	QPSK/16QAM/64QAM
Category 5	300Mbps	QPSK/16QAM/64QAM
Category 6	300Mbps	QPSK/16QAM/64QAM
Category 7	300Mbps	QPSK/16QAM/64QAM
Category 8	300Mbps	QPSK/16QAM/64QAM
Category 9	450Mbps	QPSK/16QAM/64QAM
Category 10	600Mbps	QPSK/16QAM/64QAM
Category 11	600Mbps	QPSK/16QAM/64QAM/256QAM
Category 12	600Mbps	QPSK/16QAM/64QAM/256QAM
Category 13	600Mbps	QPSK/16QAM/64QAM/256QAM
LTE-FDD device category (Uplink)	Max data rate (peak)	Modulation type
Category 1	5Mbps	QPSK/16QAM
Category 2	25Mbps	QPSK/16QAM
Category 3	50Mbps	QPSK/16QAM
Category 4	50Mbps	QPSK/16QAM
Category 5	75Mbps	QPSK/16QAM/64QAM
Category 6	50Mbps	QPSK/16QAM
Category 7	150Mbps	QPSK/16QAM

10.2 Related Documents

Table 37: Related Documents

NO.	Title	Description
[1]	ITU-T Draft new recommendation V.25ter	Serial asynchronous automatic dialing and control
[2]	GSM 07.07	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[3]	GSM 07.10	Support GSM 07.10 multiplexing protocol
[4]	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)
[5]	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
[6]	GSM 11.11	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[7]	GSM 03.38	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[8]	GSM 11.10	Digital cellular telecommunications system (Phase 2) ; Mobile Station (MS) conformance specification ; Part 1: Conformance specification
[9]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[10]	3GPP TS 34.124	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[11]	3GPP TS 34.121	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[12]	3GPP TS 34.123-1	Technical Specification Group Radio Access Network; Terminal conformance specification; Radio transmission and reception (FDD)
[13]	3GPP TS 34.123-3	User Equipment (UE) conformance specification; Part 3: Abstract Test Suites.
[14]	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
[15]	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
[16]	IEC/EN60950-1(2001)	Safety of information technology equipment (2000)
[17]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[18]	GCF-CC V3.23.1	Global Certification Forum - Certification Criteria
[19]	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)
[20]	SIM7X00 Series_UART_Application Note_V1.xx	This document describes how to use UART interface of SIMCom modules.
[21]	Antenna design guidelines for diversity receiver system	Antenna design guidelines for diversity receiver system

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10.3 Terms and Abbreviations

Table 38: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
BER	Bit Error Rate
BTS	Base Transceiver Station
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DRX	Discontinuous Reception
DSP	Digital Signal Processor
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
EVDO	Evolution Data Only
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
HSPA	High Speed Packet Access
HSIC	High-speed Inter-chip
I2C	Inter-Integrated Circuit
IMEI	International Mobile Equipment Identity
LTE	Long Term Evolution
MDIO	Management Data Input/Output

MMD	MDIO manageable device
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
SPI	serial peripheral interface
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
SGMII	Serial gigabit media independent interface
NC	Not connect
EDGE	Enhanced data rates for GSM evolution
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
ZIF	Zero intermediate frequency
WCDMA	Wideband Code Division Multiple Access
VCTCXO	Voltage control temperature-compensated crystal oscillator
USIM	Universal subscriber identity module
UMTS	Universal mobile telecommunications system
UART	Universal asynchronous receiver transmitter

10.4 Safety Caution

Table 39: 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.

FCC Caution

§ 15.19 Labeling 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.

§ 15.21 Information to user.

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

§ 15.105 Information to the user.

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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

KDB 996369 D03 OEM Manual v01 Requirement

2.2 List of applicable FCC rules

Device compliance with FCC part 22/24/27/90

2.3 Summarize the specific operational use conditions

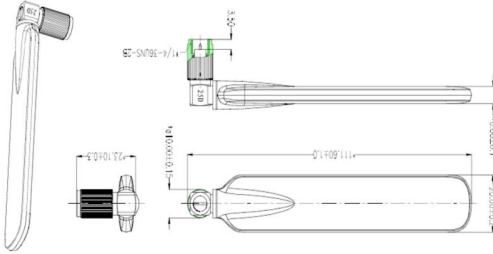
Device only a single modular transmitter, that support WCDMA/ LTE

2.4 Limited module procedures

Device only a single modular transmitter, single module approval

2.5 Trace antenna designs

With a PIFA antenna, maximum antenna gain is 3.12dBi



2.6 RF exposure considerations

The device complies with FCC Part 2.1901 RF exposure evaluation with 20cm distance

2.7 Antennas

With a PIFA antenna, maximum antenna gain is 3.12dBi

2.8 Label and compliance information

The label include FCC ID: 2AJYU-8MH0012, and other compliance information statement provide in the user manual .

And the host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID: 2AJYU-8MH0012” when use this module.

2.9 Information on test modes and additional testing requirements

2.10 Additional testing, Part 15 Subpart B disclaimer