



AMPAK Technology Inc.

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AMPAK Technology Inc.



AC4207NA

Data Sheet

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1. Introduction

1.1 Overview

AC4207 Mini PCIe is a 4G LTE module that communicates with mobile network operator infrastructure through the 3GPP Rel-10 radio protocol. Its core communication chipset is the Balong V711 multimode LTE terminal chipset solution developed by HiSilicon.

The AC4207 Mini PCIe module integrates RF Power Amplifier (PA), Switch, Crystal, PMU, MEMORY, Audio, and other units. It reserves interfaces such as UART, USB, PCM, GPIO, U/SIM, RESET, and analog voice for expanding various applications, facilitating customers' secondary product development.

The AC4207 Mini PCIe module supports LTE, WCDMA, and GSM, and is compatible with embedded operating systems such as WinCE/Linux/Android, featuring functions like voice calls, short messages, and high-speed data services.

The AC4207 Mini PCIe module adopts the PCI Express Mini Card 2.0 standard interface form, with dimensions of 30.9mm * 50.95mm * 4.65mm and a 52-pin PCI Express Mini Card 2.0 gold finger interface.

The AC4207 Mini PCIe module is a data communication module designed for wireless data connection application scenarios such as fixed wireless access terminals, security monitoring equipment, mobile office, industrial IoT, smart cities, and multimedia video terminals, capable of providing stable and high-speed communication services.

1.2 Main Performance

Supported Bands Description

Item	Description
LTE-FDD	B2/B4/B5/B12/B13/B14/B66/B71
	B2 UL: 1850–1910; B2 DL: 1930–1990; B4 UL: 1710–1755; B4 DL: 2110–2155; B5 UL: 824–849; B5 DL: 869–894; B12 UL: 699–716; B12 DL: 729–746; B13 UL: 746–756; B13 DL: 776–786; B14 UL: 788–798; B14 DL: 832–842; B66 UL: 1710–1780; B66 DL: 2110–2200; B71 UL: 663–698; B71 DL: 617–652

Functional Characteristics List

Item	Description
------	-------------

Power Supply	VBAT supply voltage range: 3.3V ~ 4.2V; typical supply voltage: 3.6V ~ 3.8V.
Power Consumption	Average maximum power consumption: 0.9A/3.8V; peak maximum power consumption: 2A/3.8V.
Transmit Power	LTE power class 3 (23dBm±2dB) WCDMA power class 3 (23dBm+1/-3dB) EGSM900 power class 4 (33dBm±2dB) DCS1800 power class 1 (30dBm±2dB) EGSM900 8-PSK power class E2 (27dBm±3dB) DCS1800 8-PSK power class E2 (26dBm±3dB)
Transmission Rate	FDD-LTE: Max 150Mbps (DL), 50Mbps (UL) TDD-LTE: Max 130Mbps (DL), 35Mbps (UL) WCDMA speed: 384 kbps DL/UL HSDPA: 42 Mbps (DL) HSUPA: 5.76 Mbps (UL) GPRS MAX 107Kbps (DL), 85.6Kbps (UL) EDGE MAX 296Kbps (DL), 236.8Kbps (UL)
RF Antenna Interface	50-ohm impedance characteristic, 2 antenna ports.
U/SIM Card Interface	Supports 1 external SIM card, 1.8/3.0V adaptive identification.
USB Interface	Supported, USB2.0 interface.
UART Interface	Supported, 2 UART ports in total, 1 for Debug UART.
PCM Interface	Supported, 1 PCM voice interface.
GPIO Interface	Supported, multiple reserved GPIOs for functional design of various interfaces.
RESET Interface	Supported, can be used for module hard reset.
WAKE Interface	Supported, can be used for module sleep/wake-up control.
W_DISABLE Interface	Supported, can be used for turning off/on the module's RF.
LED Interface	Supported, 1 LED indicator interface.
VOUT_1V8	Supported, 1 path of 1.8V/50mA output, can be used as 1.8V pull-up power for peripherals.
Short Message	Supported Text and PDU modes, Point-to-point MO and MT, Short message cell broadcast, Short message storage: stored in the module by default.

Voice	Supports 1 digital audio interface: PCM interface GSM: HR/FR/EFR/AMR/AMR-WB WCDMA: AMR/AMR-WB LTE: AMR/AMR-WB
AT Commands	Complies with 3GPP TS 27.007/27.005
Network Protocol Characteristics	Supports TCP/UDP/PPP/FTP/HTTP/NTP/PING protocols; Supports PAP (Password Authentication Protocol) and CHAP (Challenge Handshake Authentication Protocol).
Software Upgrade	Supports USB upgrade/FOTA.
RoHS	All components fully comply with EU RoHS standards.
Dimensions	Weight: TBD
Temperature Range	Normal operating temperature range: -30°C to +75°C Restricted temperature range: -40°C to +85°C Storage temperature range: -45°C to +90°C
Moisture Sensitivity Level	Level 3

1.3 Block Diagram

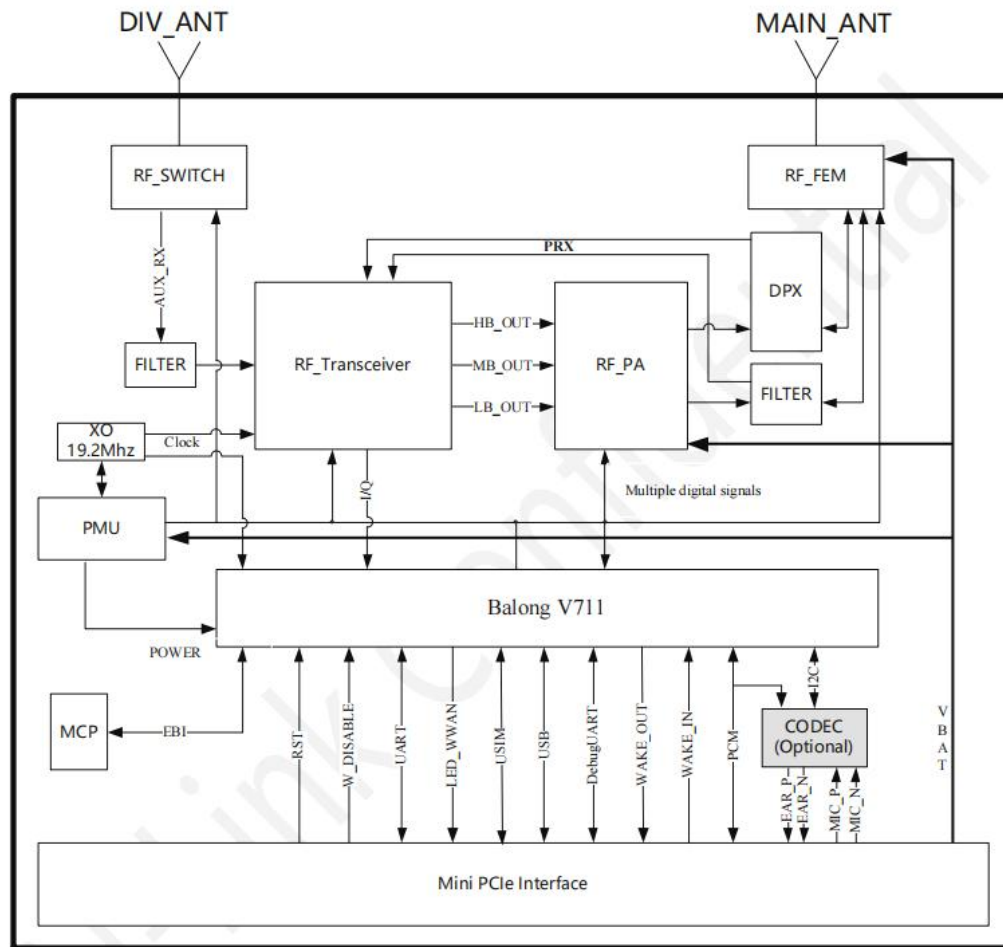


Figure 1-1 Global module High-level block diagram

2. Application Interfaces

The AC4207 Mini PCIe module has 52 gold finger interfaces. The following sections briefly describe the functions of each pin interface of the module.

2.3 Pin Distribution

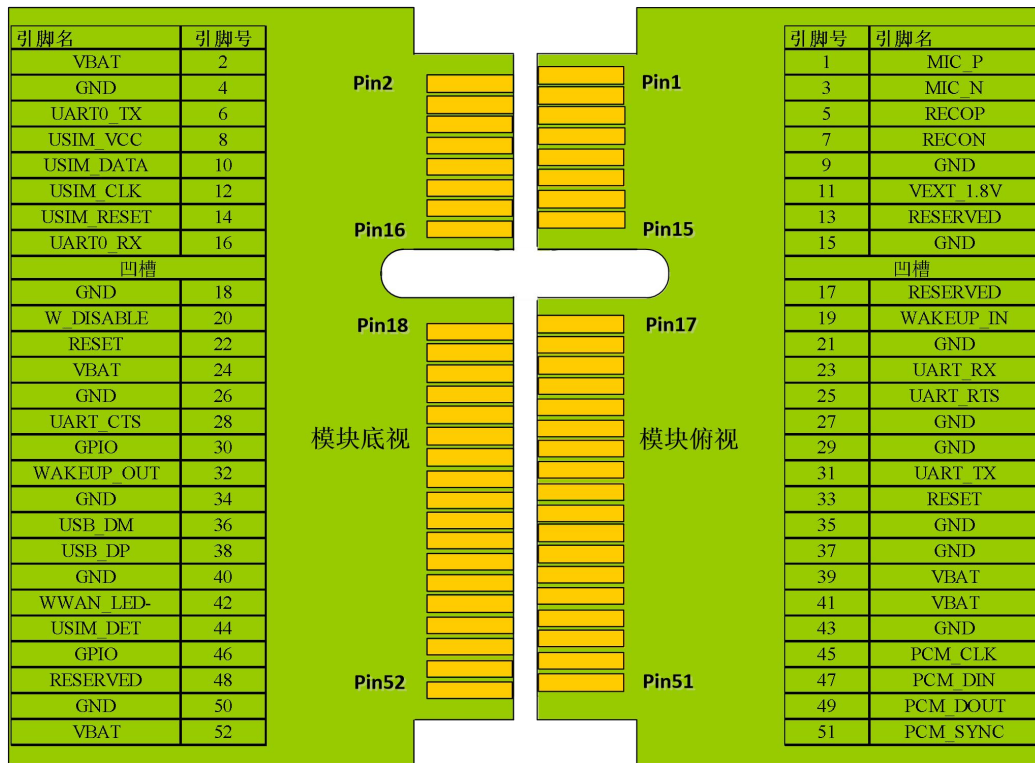


Figure 2-1 AC4207 Mini PCIe Pin Diagram

2.4 Pin Description

Pin No.	Pin Name	I/O	Description	Pin No.	Pin Name	I/O	Description
1	MIC_P	I	MIC Input Positive	2	VBAT	I	3.3~4.2V
3	MIC_N	I	MIC Input Negative	4	GND	-	
5	RECOP	O	Receiver Output Positive	6	UART0_TX	I/O	1.8V Debug UART
7	RECON	O	Receiver Output Negative	8	USIM_VCC	O	1.8/3.0V
9	GND	-		10	USIM_DATA	I/O	1.8/3.0V
11	VEXT_1.8V	O	1.8V/50mA Output	12	USIM_CLK	O	1.8/3.0V
13	RESERVED	-	TBD	14	USIM_RESET	O	1.8/3.0V
15	GND	-		16	UART0_RX	I/O	1.8V Debug UART
Notch							
17	RESERVED	-	TBD	18	GND	-	
19	WAKEUP_IN	I	1.8V, Low for Sleep	20	W_DISABLE	I	1.8V, Low to Turn Off RF
21	GND	-		22	RESET	I	1.8V, Active Low; Do not pull low unless

							necessary, and do not pull low during the power-on process.
23	UART_RX	I	1.8V, Module Receive	24	VBAT	I	3.3~4.2V
25	UART_RTS	I/O	1.8V, Module Request to Send	26	GND	-	
27	GND	-		28	UART_CTS	I/O	1.8V, Module Clear to Send
29	GND	-		30	GPIO	I/O	1.8V voltage level
31	UART_TX	O	1.8V, Module Transmit	32	WAKEUP_OUT	O	1.8V
33	RESET	I	1.8V, Active Low; Do not pull low unless necessary, and do not pull low during the power-on process.	34	GND	-	
35	GND	-		36	USB_DM	I/O	Support USB2.0
37	GND	-		38	USB_DP	I/O	Support USB2.0
39	VBAT	I	3.3~4.2V	40	GND	-	
41	VBAT	I	3.3~4.2V	42	WWAN_LED-	O	Open Drain
43	GND	-		44	USIM_DET	I	1.8V, SIM Card Hot-Swap Detection
45	PCM_CLK	I/O	1.8V	46	GPIO	I/O	1.8V
47	PCM_DIN	I	1.8V	48	RESERVED	-	TBD
49	PCM_DOUT	O	1.8V	50	GND	-	
51	PCM_SYNC	I/O	1.8V	52	VBAT	I	3.3 ~4.2V

3. Interface Application Description

The AC4207 Mini PCIe module integrates baseband, RF, analog voice, and other units. The following sections briefly describe each function.

3.1 Power On

When the VBAT supply input reaches the minimum operating voltage, the external RESET input is kept in high-impedance or high level, and the module will automatically power on when PWRON_N is pulled low (PWRON_N is normally pulled low by default on the Mini PCIe module).

3.2 Power Off

Default setting: The module will turn off when the VBAT supply is disconnected.

3.3 Power Supply Input

The power supply input of the module uses a DC voltage source, which needs to meet the instantaneous peak current of 2A/3.8V during transmission pulses and a continuous load current of 1A/3.8V. The DC-DC is selected with a 3.8V/ ≥ 2 A specification. Voltage drops, noise, interference, etc., in the input voltage will directly affect the working performance of the module. To remove interference and compensate for voltage drops, it is recommended to use a combination of 4 tantalum capacitors of 220uF (with low ESR), 100nF, 100pF, and 33pF. The filter capacitors should be placed as close as possible within 3mm of the module's power supply pins. It is recommended to use a 4.5V surge protection tube and TVS tube at the module's power supply input. For better protection, an OVP chip is recommended.

VBAT has a requirement on the rise time: VBAT must rise from 2V to 3.5V within 10mS; otherwise, the module will consider it under-voltage and fail to power on.

For surge absorption tubes, reference models such as PTVSHC3D4V5B/PRISEMI and ESDBT4V5D3/JECT can be selected; if space permits, a package with higher power can be chosen. For OVP chips, reference models such as SY6884PYC/Silergy and SGM40661/SGM can be selected, and OVP chips with low internal resistance and large overcurrent should be used.

3.4 Power Supply Output

The power management unit of the module provides a digitally regulated power supply output, which can power low-power peripheral devices. The output voltage and maximum current corresponding to the pins are as follows.

Pin No.	Pin Name	Description	Output Voltage	Output Current
11	VEXT_1.8V	Power Output	1.8V	50mA
8	USIM_VCC	SIM Card Power Supply	1.8/3.0V	50mA

3.5 Reset

Pulling down the RESET pin of the AC4207 Mini PCIe module triggers a module restart. At any other time when a module restart is not required, the RESET pin must be kept in a high-impedance state to avoid false triggering and abnormal module operation. Do not mistakenly pull down the RESET_IN_N pin during normal use such as power-on.

Note: It is recommended to use the RESET pin function only when the AT command-controlled RESET fails.

The internal pull-up power supply of the RESET signal in the AC4207 Mini PCIe module is 1.8V. It is not recommended to pull it up again in the external circuit. The RESET is always high during normal module operation. The RESET requires ESD protection and should be placed close to the module pins. The following figure is a schematic diagram of the RESET reference circuit.

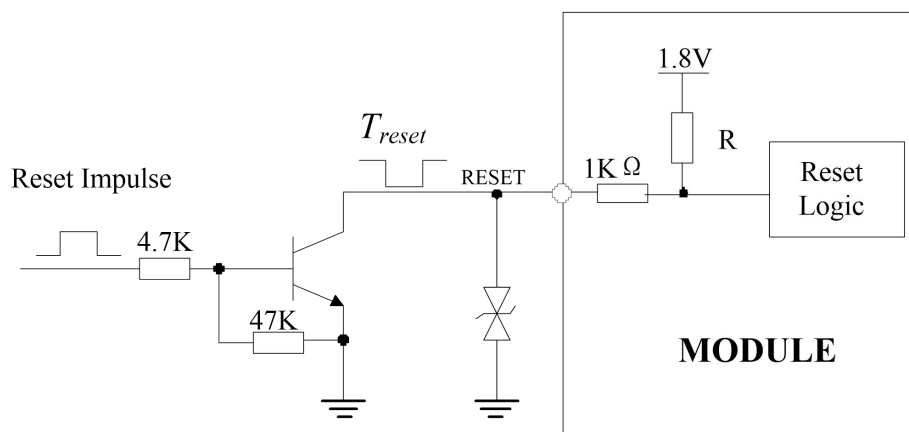


Figure 3-1 RESET Circuit Reference Schematic Diagram

Treset is recommended to be around 200 milliseconds.

3.6 SIM Card

The AC4207 Mini PCIe module supports 1 built-in eSIM (optional configuration), and an external SIM card holder can also be selected. The external SIM supports 1.8/3.0V voltage, and the system will detect the SIM type during startup. To ensure stability, the following guidelines should be followed for SIM card wiring:

(1) The wiring length from the module pins to the SIM card holder should not exceed 10cm as much as possible to obtain good EMC performance;(2) The SIM card position and wiring should be kept away from any EMI sources, such as antennas and digital signal lines;(3) Crossing of the SIM card clock line and data line should be avoided. It is recommended to separate the wiring and separate them with ground lines;(4) The SIM card signal lines should use TVS tubes with low capacitance (<30pF) for ESD protection;(5) For the SIM card signal lines RST\DATA\CLK, reserve a 22-ohm series resistor and a 33pF shunt capacitor to ground to ensure EMI and RF interference protection.(6) To ensure stable working voltage of the SIM card, the 2.2uF+100nF energy storage decoupling capacitor of USIM_VCC should be placed close to the SIM card holder.

The following figure is a schematic diagram of the reference design of the SIM circuit.

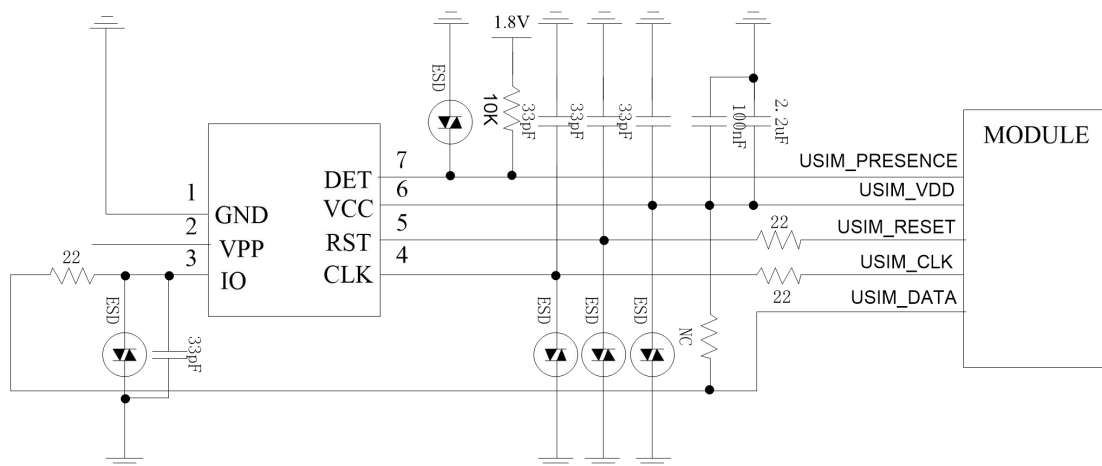


Figure 3-2 USIM Card Circuit Reference Schematic Diagram

The AC4207 Mini PCIe module supports hot-swap detection. The pin USIM_DET (voltage domain 1.8V) is the hot-swap detection signal. The default detection status is:

Low level: No card

High level: Card present

Note: If the hot-swap function is not used, USIM_DET can be left floating or pulled up to the module's VOUT_1.8V.

3.7 USB2.0 Interface

USB2.0 supports high-speed (480Mbps). OTG function and charging function are not supported by default.

USB_DM/USB_DP are differential signals. The PCB wiring should be controlled according to $90\ \Omega$ differential impedance, and the PCB manufacturer should be instructed to produce according to the requirements. The junction capacitance of the ESD device is recommended to be $\leq 0.3\text{pf}$.

USB2.0 is an interface that needs to be led out by default, used for software download, debugging, AT commands, sending and receiving data packets, etc.

The following figure is a schematic diagram of the USB circuit design reference. A 90-ohm EMI device in series is reserved in the USB path to prevent possible EMC or RF interference issues.

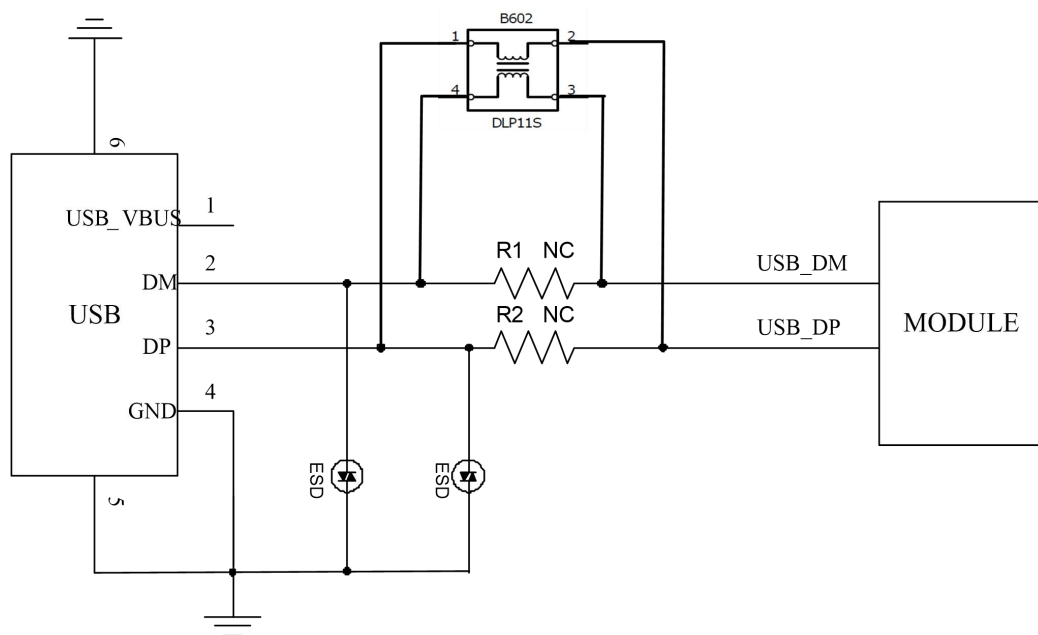


Figure 3-3 USB2.0 Interface Circuit Reference Schematic Diagram

3.8 UART Interface

The AC4207 Mini PCIe module supports one 2-wire/4-wire 1.8V serial port, which can be used for AT command transmission and control. The circuit design reference when hardware flow control is not considered is as follows:

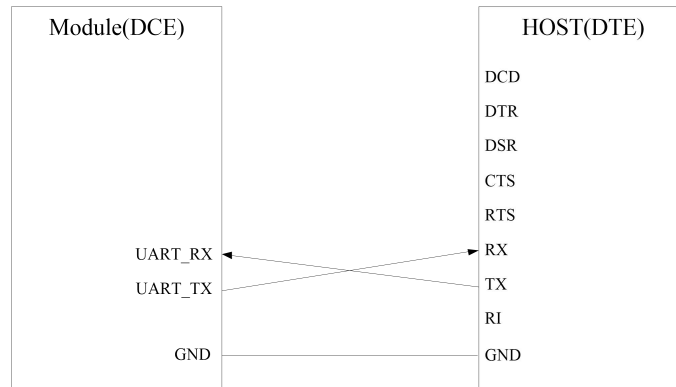


Figure 3-4 UART Connection Design Diagram Without Flow Control

The serial port of the AC4207 Mini PCIe module is 1.8V level. A level converter is required for customers' 3.3V serial port applications, and TI's TXS0104EPWR is recommended. The following circuit design can be referenced:

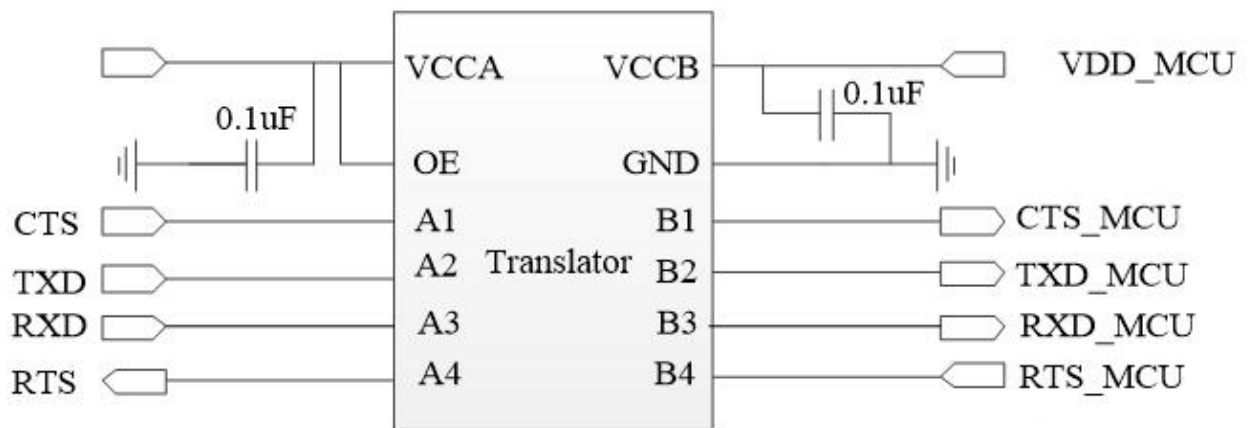


Figure 3-5 Level Converter Chip Reference Circuit

If only a 2-wire serial port is used and the requirements for serial port speed are not high, the following circuit design can be referenced:

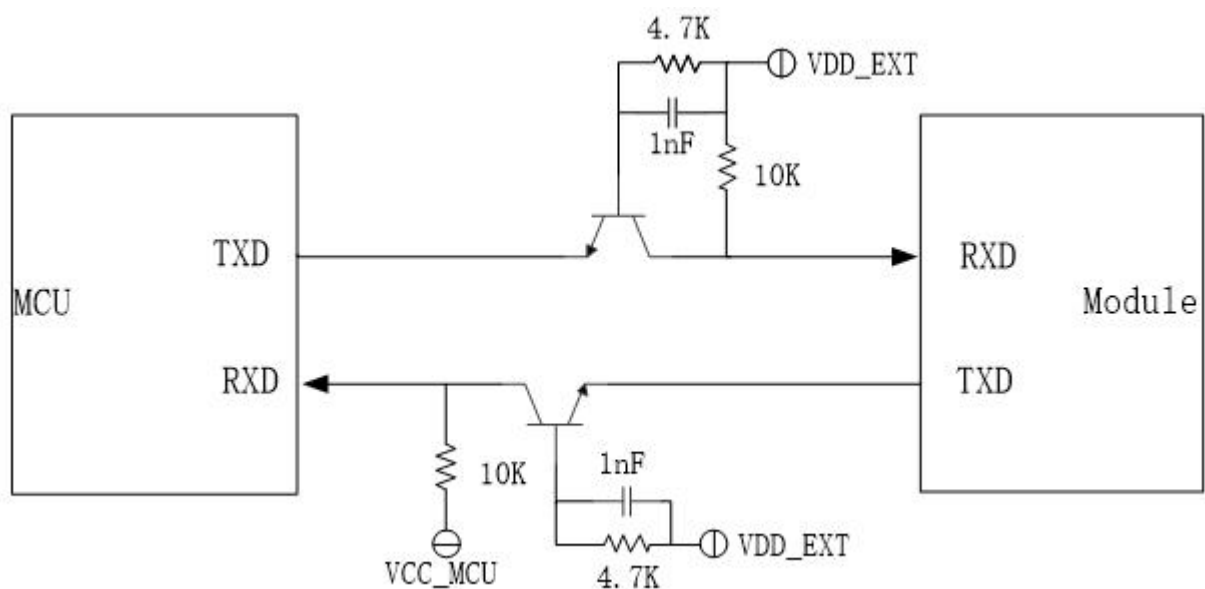


Figure 3-6 Level Conversion Transistor Reference Circuit

3.9 Analog Voice Interface

The AC4207 Mini PCIe module provides a set of analog voice interfaces. The reference design is shown in the following figure.

MIC Channel:(1) The MIC is a differential channel. The PCB wiring should be fully grounded and kept away from interference sources.(2) The MIC channel has built-in MICBIAS and pull-up/down resistors inside the module. Only TVS/bead/pF filter capacitors are needed externally.(3) Bidirectional TVS should be used, and pF-level capacitors should be used for the shunt capacitor to ground and the cross capacitor.

Receiver Channel:(1) The receiver is a differential channel by default, connected to both ends of the receiver. The PCB wiring should be fully grounded and kept away from interference sources.(2) Bidirectional TVS should be used, and pF-level capacitors should be used for the shunt capacitor to ground and the cross capacitor.

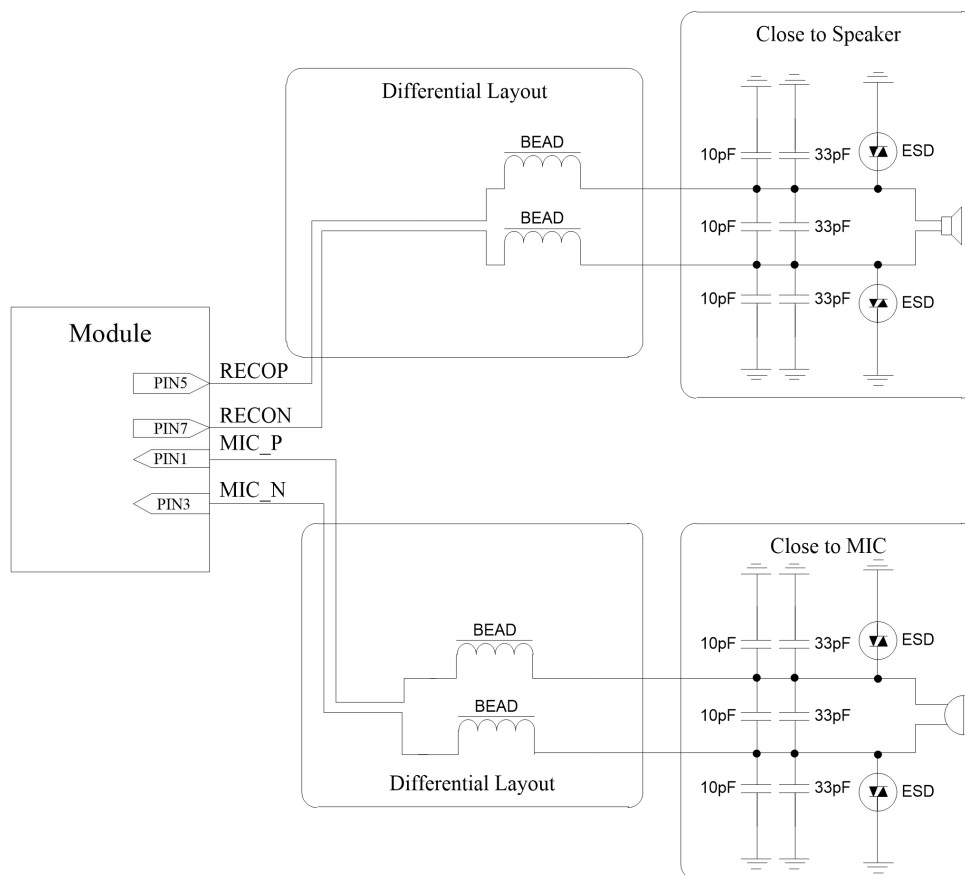


Figure 3-7 Analog Voice Interface Circuit

3.10 PCM Interface

The AC4207 Mini PCIe module provides 1 set of PCM digital voice interfaces, which supports MASTER mode by default, with CLK 2048KHZ, SYNC 8KHZ, and 16bit linear.

The reference design of the module's PCM is shown in the following figure.

Note: The module's analog voice function (implemented by connecting the built-in Audio Codec through this set of PCM inside the module) is shared with this set of PCM digital voice interfaces, and only one of them can be selected.

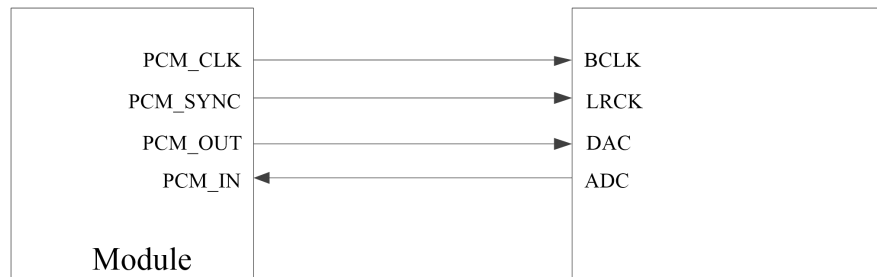


Figure 3-8 PCM Digital Voice Interface Circuit

3.11 LED Interface

The WWAN_LED- of the AC4207 Mini PCIe module can be connected to an LED for network status indication. The circuit design reference is shown in the following figure:

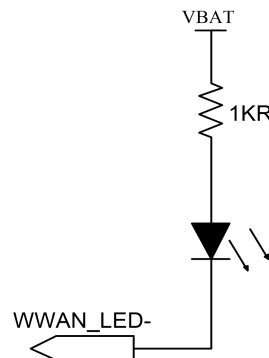


Figure 3-9 WWAN_LED- Connected to LED Circuit

The default blinking definition of WWAN_LED- connected to an LED is referenced in the following table:

Mode	LED Status	Description
1	Fast Blink (100ms On/1000ms Off)	Network Searching
2	Slow Blink(100ms On/2000ms Off)	Registration Successful
3	Rapid Blink(100ms On/500ms Off)	Data Transmission
4	Off	Flight Mode, Power Off State, or Error State (No SIM Card or

Registration Failure)

3.12 WAKEUP_IN and WAKEUP_OUT Interfaces

The AC4207 Mini PCIe module can control module sleep and wake-up through the WAKEUP_IN pin; the module has an internal pull-up. The output level of WAKEUP_OUT is used to indicate the sleep and wake-up status of the module. Both WAKEUP_IN and WAKEUP_OUT are 1.8V levels, and should not be used exceeding 1.8V. For details, refer to the following table:

Pin Name	I/O	Pin No.	Description
WAKEUP_IN	I	19	High Level: Wake up the module; Low Level: The module enters sleep mode.
WAKEUP_OUT	O	32	High Level: The module is in wake-up mode; Low Level: The module is in sleep mode.

The recommended reference circuit for WAKEUP_IN is as follows:

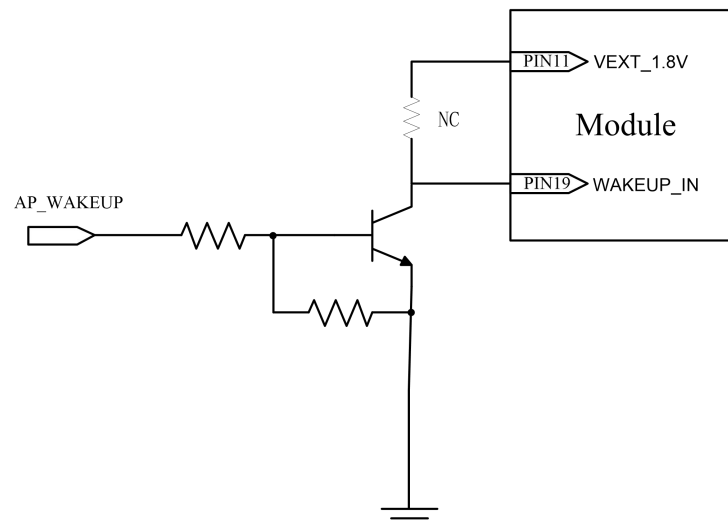


Figure 3-10 WAKEUP_IN Reference Circuit

3.13 W_DISABLE Interface

The AC4207 Mini PCIe module can turn off the module's RF communication function through W_DISABLE; the

module's RF can be turned off in two ways: software and hardware. For specific descriptions, refer to the following table:

W_DISABLE	AT Command	Description
High Level	AT+CFUN=1	Enable RF
High Level	AT+CFUN=0 AT+CFUN=4	Disable RF
Low Level	AT+CFUN=0 AT+CFUN=4	Disable RF

The recommended reference circuit for the W_DISABLE interface is as follows:

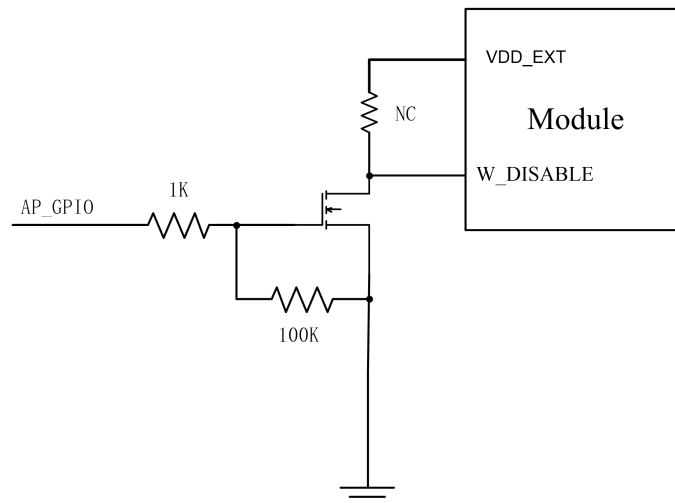


Figure 3-11 W_DISABLE Reference Circuit

3.14 USB Suspend

The AC4207 Mini PCIe module supports the USB suspend/resume function. The host suspends the module through the USB bus and then executes the sleep process to smoothly enter the sleep state; the host sends a resume to the module through USB to wake up the module. After the module enters the sleep state, the overall current will drop below 5mA, and USB, serial port, and console will not be able to communicate.

If the host does not support the USB suspend function, the module can enter the sleep mode by externally controlling the disconnection of the USB bus (i.e., disconnecting USB_DP and USB_DM).

3.15 Antenna Interface

The antenna interface definition of the AC4207 Mini PCIe module is shown in the following figure. The RF antenna interface is a standard 50-ohm connection.



Figure 3-12 Module Antenna Schematic Diagram

4. Electronics Specification

4.1 Power Supply Limit Characteristics

The VBAT supply characteristics of the AC4207 Mini PCIe module are described in the following table.

Parameter	Description	Min	Typ	Max	Unit
VBAT	VBAT Supply Voltage	3.3	3.6~3.8	4.2	V
	RMS Average Supply Current	0		0.9	A
	VBAT Peak Supply Current	0		1	A
	Allowable Voltage Drop During Burst Transmission (At GSM900 maximum transmit power class)	0	100	300	mV

4.2 I/O Interface Limit Characteristics

The I/O characteristics of the AC4207 Mini PCIe module are described in the following table.

Signal	VL		VH		Unit
	Min	Max	Min	Max	

Digital Input	-0.3	$0.3 \cdot V_{DD-PX}$	$0.7 \cdot V_{DD-PX}$	$V_{DD-PX} + 0.3$	V
Digital Output	GND	0.45	$V_{DD-PX} - 0.45$	V_{DD-PX}	V

Remarks:

VDD-PX is the high level of the digital interface, VDD-PX = 1.8V.

VH: Logic High Level; VL: Logic Low Level.

4.3 Service Power Consumption

The service mode power consumption of the AC4207 Mini PCIe module is described in the following table (3.8V/2A@25°C).

Parameter	Description	Condition	Typical Value	Unit
I_{VBAT}	Power Off Mode	Module Power Off Leakage	52	uA
	Sleep Mode	AT+CFUN=0 (USB Disconnected)	1.2	mA
		GSM MFRMS=5 (USB Disconnected)	2.0	mA
		WCDMA DRX=8 (USB Disconnected)	1.5	mA
		LTE DRX=8 (USB Disconnected)	2.1	mA
	Idle Mode	AT+CFUN=0 (USB Disconnected)	55	mA
		GSM MFRMS=5 (USB Disconnected)	60	mA
		WCDMA DRX=8 (USB Disconnected)	60	mA
		LTE DRX=8 (USB Disconnected)	55	mA
	LTE Data Transmission	FDD- LTE Band 1 10M@23.20dBm	TBD	mA
		FDD- LTE Band 3 10M@23.30dBm	TBD	mA
		FDD- LTE Band 5 10M@23.00dBm	TBD	mA
		FDD- LTE Band 8 10M@23.10dBm	TBD	mA
		TDD- LTE Band 34 10M@22.90dBm	TBD	mA
		TDD- LTE Band 38 10M@23.10dBm	TBD	mA
		TDD- LTE Band 39 10M@23.10dBm	TBD	mA

		TDD- LTE Band 40 10M@23.30dBm	TBD	mA
		TDD- LTE Band 41 10M@23.10dBm	TBD	mA

4.4 Reliability Characteristics

The environmental reliability characteristics of the AC4207 Mini PCIe module:

Test Item	Test Condition	
Low Temperature Storage Test	Temperature: $-45^{\circ}\text{C}\pm 3^{\circ}\text{C}$, continuous for 24 hours in power-off state	
High Temperature Storage Test	Temperature: $+90^{\circ}\text{C}\pm 3^{\circ}\text{C}$, continuous for 24 hours in power-off state	
Temperature Shock Test	In power-off state, maintain at -45°C and $+90^{\circ}\text{C}$ for 0.5h each, temperature transition time $< 3\text{min}$, total 24 cycles	
High Temperature and Humidity Test	Temperature: $+90^{\circ}\text{C}\pm 3^{\circ}\text{C}$, humidity: 90~95%RH, continuous for 24 hours in power-off state	
Low Temperature Operation Test	Temperature: $-30^{\circ}\text{C}\pm 3^{\circ}\text{C}$, continuous for 24 hours in working state	
High Temperature Operation Test	Temperature: $+75^{\circ}\text{C}\pm 3^{\circ}\text{C}$, continuous for 24 hours in working state	
Vibration Test	Conduct vibration test according to the requirements shown in the following table:	
	Frequency	Random Vibration ASD (Acceleration Spectral Density)
	5~20Hz	0.96m2/s3
	20~500Hz	0.96m2/s3(at 20Hz), -3 dB/octave for the rest of the range
Connector Life Test	Board-to-board connector interface: 50 insertions/extractions; RF antenna interface cable: 30 insertions/extractions	

ESD Test	1. When the module is in call state, test the antenna interface, power PAD, and large-area ground. ESD shall meet: 1) Contact discharge shall pass $\pm 2\text{KV}$ and $\pm 4\text{KV}$ test levels 2) Air discharge shall pass $\pm 2\text{KV}$, $\pm 4\text{KV}$, and $\pm 8\text{KV}$ test levels 2. When the module is in power-off state, test the SIM card holder of the EVB. ESD shall meet: 1) Contact discharge shall pass $\pm 2\text{KV}$ test level 2) Air discharge shall pass $\pm 2\text{KV}$ and $\pm 4\text{KV}$ test levels
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4.5 ESD Characteristics

Although the AC4207 Mini PCIe module has considered ESD issues in design and implemented ESD protection, ESD problems may still occur during module transportation and secondary development. Therefore, developers should consider ESD protection for the final product and refer to the interface design in this document. The allowable ESD discharge range of the AC4207 Mini PCIe module is referenced in the following table (Temperature: 25°C , Humidity: 45%).

Test Object	Air Discharge	Contact Discharge
VBAT,GND	$\pm 8\text{KV}$	$\pm 4\text{KV}$
Antenna Port	$\pm 8\text{KV}$	$\pm 4\text{KV}$
Other Ports	$\pm 2\text{KV}$	$\pm 0.5\text{KV}$

4.6 Temperature Range

The AC4207 Mini PCIe module is recommended to work in an environment of $-30\sim+75^{\circ}\text{C}$. It is recommended that the application side consider temperature control measures under harsh environmental conditions. At the same time, the restricted operating temperature range of the module is provided. When used within the restricted temperature range, the function is normal, but some RF indicators may deteriorate. It is also recommended that the module application terminal be stored under certain temperature conditions. Beyond this range, the module may not work normally or may be damaged.

Parameter	Min	Typ	Max	Unit
Operating Temperature	-30	+25	+75	$^{\circ}\text{C}$

Restricted Operating Temperature	-40~-30		+75~+85	°C
Storage Temperature	-45		+90	°C

5. RF support

5.1 Operating Frequency

The operating frequency of the AC4207 Mini PCIe module is described in the following table:

3GPP Band	TX	RX	Unit
LTE B1	1920~1980	2110~2170	MHz
LTE B3	1710~1785	1805~1880	MHz
LTE B5	824~849	869~894	MHz
LTE B8	880~915	925~960	MHz
LTE B34	2010~2025	2010~2025	MHz
LTE B38	2570~2620	2570~2620	MHz
LTE B39	1880~1920	1880~1920	MHz
LTE B40	2300~2400	2300~2400	MHz
LTE B41	2300~2400	2555~2655	MHz

5.2 RF Transmit Characteristics

The RF transmit output characteristics of the AC4207 Mini PCIe module are described in the following table (3.8V/2A@25°C):

Band	Max	Min
FDD-LTE		
B1	23dBm±2dB	≤-39 dBm
B3	23dBm±2dB	≤-39 dBm
B5	23dBm±2dB	≤-39 dBm
B8	23dBm±2dB	≤-39 dBm
TDD-LTE		
B34	23dBm±2dB	≤-39 dBm

Band	Max	Min
B38	23dBm±2dB	≤-39 dBm
B39	23dBm±2dB	≤-39 dBm
B40	23dBm±2dB	≤-39 dBm
B41	23dBm±2dB	≤-39 dBm

5.3 RF Receive Characteristics

The RF receive characteristics of the AC4207 Mini PCIe module are described in the following table (3.8V/2A@25°C):

Band	Receive sensitivity Conducted Index in Shielded Environment			
	Main Set	Diversity	Main Set+ Diversity	3GPP Requirement
FDD-LTE(10MHz)				
B1	<-99		-101dBm	-96.3dBm
B3	<-98.5		-100.5dBm	-93.3dBm
B5	-98dBm		-101dBm	-94.3dBm
B8	-97dBm		-100dBm	-93.3dBm
TDD-LTE(10MHz)				
B34	-96dBm		-99dBm	-96.3dBm
B38	-97dBm		-100dBm	-96.3dBm
B39	-96dBm		-99dBm	-96.3dBm
B40	-97dBm		-100dBm	-96.3dBm
B41	-96dBm		-99dBm	-94.3dBm

5.4 Antenna Interface and Requirements

The antenna interface definition of the AC4207 Mini PCIe module is shown in the following figure. The RF antenna interface is a standard 50-ohm connection.



Figure 5-1 Module Antenna Schematic Diagram

The antenna index requirements for the main and diversity antennas of the AC4207 Mini PCIe module are described in the following table:

Band	VSWR	Gain		Efficiency	SAR	TRP (dBm)	TIS (dBm)
B1 FDD-LTE	≤2:1	>0dBi	>-4dBi	>40%	<1.6 W/Kg	17	<-90
B3 FDD-LTE						17	<-90
B5 FDD-LTE						17	<-90
B8 FDD-LTE						17	<-90
B34 TDD-LTE						17	<-87
B38 TDD-LTE						17	<-87
B39 TDD-LTE						17	<-87
B40 TDD-LTE						17	<-87
B41 TDD-LTE						17	<-87

6. Mechanical Information

6.1 Module 3D Characteristics

We provide 3D drawings of the AC4207 Mini PCIe module to facilitate 3D model modeling. Please contact technical support for 3D drawings.

6.2 Physical Pictures



Figure 6-1 Module Top View

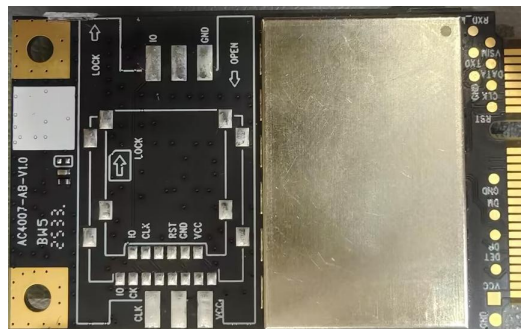


Figure 6-2 Module Bottom View

Note: The pictures are for reference only. Sub-model, SN, IMEI and other information are not fixed.

Integration instructions for host product manufacturers according to KDB996369 D03 OEM Manual v012.2 List of applicable FCC rules FCC Part 15 Subpart C 15.247&15.207&15.209&15.407 2.3 Specific operational use conditions The module LTE Module is a module with 4G function. Operation Frequency: LTE Band 2 : Tx: 1850MHz – 1910MHz, Rx: 1930MHz – 1990MHz; LTE Band 4 : Tx: 1710MHz – 1755MHz, Rx: 2110MHz – 2155MHz; LTE Band 5 : Tx: 824MHz – 849MHz, Rx: 869MHz – 894MHz; LTE Band 12 : Tx: 699MHz – 716MHz, Rx: 729MHz – 746MHz; LTE Band 13 : Tx: 777MHz – 787MHz, Rx: 746MHz – 756MHz; LTE Band 14 : Tx: 788MHz – 798MHz, Rx: 758MHz – 768MHz; LTE Band 66 : Tx: 1710MHz – 1780MHz, Rx: 2110MHz – 2200MHz; LTE Band 71 : Tx: 663MHz – 698MHz, Rx: 617MHz – 652MHz. The module can be used for mobile or applications with the maximum; The host manufacturer installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual. 2.4 Limited module procedures Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212. 2.5 Trace antenna designs Not applicable. The module has its own antenna, and doesn't need a host's printed board microstrip trace antenna etc.

2.6 RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users' body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization

This device is intended only for host manufacturers under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the internal antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique' antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host

manufacturer is still responsible for testing their end-product for any additional compliance requirements

required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID: ZQ6-AC4207-NA" with their finished product.

2.9 Information on test modes and additional testing requirements

Data transfer module demo board can control the EUT work in RF test mode at specified test channel. Additional testing, Part 15 Subpart B disclaimer.

The module without unintentional-radiator digital circuit, so the module does not required an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247&15.207 & 15.209&15.407 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the

host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant

(when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

FCC Statement

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

Radiation Exposure Statement

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment and it also complies with Part 15 of the FCC RF Rules. This equipment should be installed and operated with a minimum distance 20cm between the device and your body.

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.