



# **AM TELECOM**

## **Communication Module**

### **AMM5500**

### **Hardware User Guide**



**Rev 0.1**

**2021.04**

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## ■ Revision History

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## Introduction

This module is designed with a Qualcomm MDM9207 chipset solution. It supports LTE, GNSS with small size and thin 3.0mm thickness.

It will be given a best choice to all customers who want LTE wireless data communication. Any portable devices such as Laptop, Tablet PC and PDA, and various M2M devices can be designed with minimum efforts.



## 1.2. Interface parts specification

### 1.2.1. Coaxial RF connector

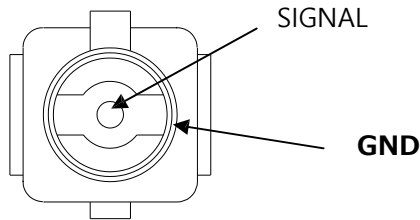


Figure 2. Coaxial connector

The terminal specifications of the RF interface connector (20279-001E-01) used in this product are as follows.

Connector	Signal	Terminal	Contents	Remarks
RF Interface Conn	RF Tx/Rx	SIGNAL	Tx/Rx Signal	Max 6GHz Support
		GND	GND	

The recommended RF connectors to connect with the product are listed below.

	RF Interface Conn (Module Part)	RF Interface Conn (Host Part)	Maker
1 <sup>st</sup>	20279-001E-01	MHF Receptacle	I-PEX
2 <sup>nd</sup>	U.FL-R-SMT(60)	U.FL Series	HIROSE

*Note : The product name differs depending on the diameter of cable used.  
Check with the manufacturer for details.*

### 1.2.2. Host interface connector

- Manufacturer : Kyocera
- Parts number : 24-6411-067-101-894B
- Dimension: 21.9 x 8.7 x 2.0mm



## 1.3. Modem specification

### 1.3.1. Modem Frequency specification

Technology		Uplink	Downlink	Comment
LTE	Band 1	1920 ~ 1980 MHz	2110 ~ 2170 MHz	FDD
	Band 2	1850 ~ 1910 MHz	1930 ~ 1990 MHz	
	Band 3	1710 ~ 1785 MHz	1805 ~ 1880 MHz	
	Band 4	1710 ~ 1755 MHz	2110 ~ 2155 MHz	
	Band 5	824 ~ 849 MHz	869 ~ 894 MHz	
	Band 7	2500 ~ 2570 MHz	2620 ~ 2690 MHz	
	Band 8	880 ~ 915 MHz	925 ~ 960 MHz	
	Band 9	1749.9 ~ 1784.9 MHz	1844.9 ~ 1879.9 MHz	
	Band 12	699 ~ 716 MHz	729 ~ 746 MHz	
	Band 17	704 ~ 716 MHz	734 ~ 746 MHz	
	Band 18	815 ~ 830 MHz	860 ~ 875 MHz	
	Band 19	830 ~ 845 MHz	875 ~ 890 MHz	
	Band 20	832 ~ 862 MHz	791 ~ 821 MHz	
	Band 26	814 ~ 849 MHz	859 ~ 894 MHz	
UMTS	Band 1	1920 ~ 1980 MHz	2110 ~ 2170 MHz	FDD
	Band 2	1850 ~ 1910 MHz	1930 ~ 1990 MHz	
	Band 4	1710 ~ 1755 MHz	2110 ~ 2155 MHz	
	Band 5	824 ~ 849 MHz	869 ~ 894 MHz	
	Band 6	830 ~ 840 MHz	875 ~ 885 MHz	
	Band 8	880 ~ 915 MHz	925 ~ 960 MHz	
	Band 19	830 ~ 845 MHz	875 ~ 890 MHz	
GSM	850	824.2 ~ 848.8 MHz	869.2 ~ 893.8 MHz	TDD
	900	880.2 ~ 914.8 MHz	925.2 ~ 959.8 MHz	
	1800	1710.2 ~ 1784.8 MHz	1805.2 ~ 1879.8 MHz	
	1900	1850.2 ~ 1909.8 MHz	1930.2 ~ 1989.8 MHz	

### 1.3.2. Electrical Specification

Parameter	Description	Min.	Typ.	Max.	Units
+VPWR	Operating voltage	3.4	3.8	4.2	V
VIH	High-level Input Voltage, CMOS	1.2	1.8	-	V
VIL	Low-level Input Voltage, CMOS	0	-	0.63	V
VOH	High-level Output Voltage, CMOS	1.2	1.8	-	V
VOL	Low-level Output Voltage, CMOS	0	0	0.45	V

*Note: Refer to 4.Current Consumption*

### 1.3.3. Environment Specification

Item	Spec.
Storage Temperature	-40°C to + 90°C
Operating Temperature	-40°C to + 85°C
Humidity (Operational)	85% relative humidity, Non-condensing
Vibration (Operational)	5 Hz to 500 Hz sinusoidal, 1.0G
Drop	No damages after 75cm drop over concrete floor
ESD [Electrostatic discharge]	+/- 1 kV Human Body Model

## 1.4. RF specifications

### 1.4.1. RX/TX frequency specification - LTE mode

Item	Specification					Comment		
	BW	DL conf	UL conf			Condition	Unit	
			Mod	RB	RB idx			
Maximum Output Power (Class III)	1.4MHz	NA	QPSK	1.4MHz 1,5 RB	Low/ High	22.0dBm +/- 2.0dB	dBm	
	5MHz			5MHz 1,8 RB				
	10MHz			10MHz 1,12 RB				
	15MHz			15MHz 1,16 RB				
	20MHz			20MHz 1,18 RB				
Minimum Output Power	1.4MHz	NA	QPSK	1.4MHz 6RB	0	<- 39	dBm	
	5MHz			5MHz 25 RB				
	10MHz			10MHz 50 RB				
	15MHz			15MHz 75 RB				
	20MHz			20MHz 100 RB				
Frequency Error	1.4MHz	QPSK	QPSK	1.4MHz 6RB	0	$ \Delta f  \leq (0.1 \text{ PPM} + 15 \text{ Hz})$	Hz	
	5MHz			5MHz 25,20 RB				
	10MHz			10MHz 50,25,20 RB				
	15MHz			15MHz 75,50,25,20 RB				
	20MHz			20MHz 100,75,50,25,20 RB				
EVM	1.4MHz 5MHz 10MHz 15MHz 20MHz	NA	QPSK	1.4MHz 1,6RB	Low/ High	< 17.5	%	
				5MHz 25,8 RB				
				10MHz 50,12 RB				
				15MHz 75,16 RB				
				20MHz 100,18 RB				
				16QAM	1.4MHz 1,6RB	Low/ High		<12.5
					5MHz 25,8 RB			
					10MHz 50,12 RB			
					15MHz 75,16 RB			
					20MHz 100,18 RB			

Minimum Sensitivity Level	1.4MHz 5MHz 10MHz 15MHz 20MHz	QPSK full RB	QPSK	10MHz 50 RB	0	B1 < -96.3 B2 < -94.3 B3 < -93.3 B5 < -94.3 B7 < -94.3 B8 < -93.3 B12 < -93.3 B20 < -93.3	dBm
Maximum input Level	10MHz	64QAM Cat4 50RB	QPSK	10MHz 50 RB	0	> - 25.7	dBm

### 1.4.2. RX/TX frequency specification - WCDMA mode

Item	Specification
Maximum Output Power (Class III)	+23.0 dBm / 3.84 MHz, +/- 2.0dB
Minimum Transmit Power	< -50 dBm / 3.84 MHz
Adjacent Channel Leakage Power Ratio	> 33 dB @ ±5 MHz, > 43 dB @ ±10 MHz
Reference Sensitivity. Level	BER < 0.001 when $\hat{I}_{or} = -106.7$ dBm / 3.84 MHz (B1) BER < 0.001 when $\hat{I}_{or} = -104.7$ dBm / 3.84 MHz (B5) BER < 0.001 when $\hat{I}_{or} = -103.7$ dBm / 3.84 MHz (B8)
Maximum Input Level	BER < 0.001 when $\hat{I}_{or} = -25$ dBm / 3.84 MHz

### 1.4.3. RX/TX frequency specification - GSM mode

Item	Band	Specification
Maximum Output Power	GSM850 (Class IV) GSM900 (Class IV) GSM1800 (Class I) GSM1900 (Class I)	+32.5 dBm, +/- 1.0dB +32.5 dBm, +/- 1.0dB +28.5 dBm, +/- 1.0dB +28.5 dBm, +/- 1.0dB
Reference Sensitivity Level	GSM850 (Class IV) GSM900 (Class IV) GSM1800 (Class I) GSM1900 (Class I)	-105dBm 이하 (BER<2.43%)

## 2. Interface Connector

### 2.1. Pin assignment

Pin Name	Pin NO	Pin NO	Pin Name
GND	1	2	VCC
GND	3	4	VCC
GND	5	6	POWER_KEY
USB_D+	7	8	Reserved <sup>(*1)</sup>
USB_D-	9	10	Reserved <sup>(*1)</sup>
GND	11	12	Notch <sup>(*2)</sup>
Notch <sup>(*2)</sup>	13	14	Notch <sup>(*2)</sup>
Notch <sup>(*2)</sup>	15	16	Notch <sup>(*2)</sup>
Notch <sup>(*2)</sup>	17	18	Notch <sup>(*2)</sup>
Notch <sup>(*2)</sup>	19	20	UART1_RTS
Reserved <sup>(*1)</sup>	21	22	UART1_TXD
WAKE_UP	23	24	UART1_RXD
WIFI_EN	25	26	Reserved <sup>(*1)</sup>
GND	27	28	UART1_DCD
UART2_TXD	29	30	USIM_RESET
UART2_RXD	31	32	USIM_CLK
GND	33	34	USIM_DATA
SDIO_CMD	35	36	USIM_PWR
SDIO_CLK	37	38	UART1_RI
GND	39	40	Reserved <sup>(*1)</sup>
SGMII_RX_P	41	42	Reserved <sup>(*1)</sup>
SGMII_RX_M	43	44	Reserved <sup>(*1)</sup>
GND	45	46	Reserved <sup>(*1)</sup>
JTAG_TMS	47	48	UART1_CTS
Reserved <sup>(*1)</sup>	49	50	UART1_DSR
GND	51	52	SGMII_TX_P
JTAG_TCK	53	54	SGMII_TX_M
JTAG_SRST_N	55	56	Reserved <sup>(*1)</sup>
GND	57	58	UART1_DTR
SDIO_DATA0	59	60	Reserved <sup>(*1)</sup>
SDIO_DATA1	61	62	READY
SDIO_DATA2	63	64	USB_DISABLE
SDIO_DATA3	65	66	SGMII_MDIO_CLK
RESET_KEY	67	68	SGMII_MDIO_DATA
ETH_RESET_N	69	70	VCC
GND	71	72	VCC
GND	73	74	VCC
ETH_INT_N	75		

## 2.2. Pin Description

Block	Pin NO	Pin name	IN /OUT(*2)	Pin Voltage	Description
Power	1	GND	-	-	Ground
	3	GND	-	-	Ground
	5	GND	-	-	Ground
	11	GND	-	-	Ground
	27	GND	-	-	Ground
	33	GND	-	-	Ground
	39	GND	-	-	Ground
	45	GND	-	-	Ground
	51	GND	-	-	Ground
	57	GND	-	-	Ground
	71	GND	-	-	Ground
	73	GND	-	-	Ground
	2	VCC	PI	3.8V	Main power(3.4V ~ 4.2V)
	4	VCC	PI	3.8V	Main power(3.4V ~ 4.2V)
	70	VCC	PI	3.8V	Main power(3.4V ~ 4.2V)
72	VCC	PI	3.8V	Main power(3.4V ~ 4.2V)	
74	VCC	PI	3.8V	Main power(3.4V ~ 4.2V)	
Notch	12	Notch	-	-	-
	13	Notch	-	-	-
	14	Notch	-	-	-
	15	Notch	-	-	-
	16	Notch	-	-	-
	17	Notch	-	-	-
	18	Notch	-	-	-
	19	Notch	-	-	-
USB Interface	7	USB_D+	B		USB data (+)
	9	USB_D-	B		USB data (-)
USIM Interface	30	USIM_RESET	DO	2.85V/1.8 V	USIM Reset
	32	USIM_CLK	DO	2.85V/1.8 V	USIM Clock
	34	USIM_DATA	B	2.85V/1.8 V	USIM Data
	36	USIM_PWR	PO	2.85V/1.8 V	USIM Power

UART Interface	20	UART1_RTS	DI	1.8V	UART1 Input for Request to send signal(RTS) from DTE (HOST → MODULE)
	22	UART1_TXD	DI	1.8V	UART1 Serial data input from DTE (HOST → MODULE)
	24	UART1_RXD	DO	1.8V	UART1 Serial data output from DTE (HOST ← MODULE)
	28	UART1_DCD	DO	1.8V	UART1 data carrier detect (HOST ← MODULE)
	38	UART1_RI	DO	1.8V	UART ring indicator (HOST ← MODULE)
	48	UART1_CTS	DO	1.8V	UART1 Output for Clear to Send signal(CTS) to DTE (HOST ← MODULE)
	50	UART1_DSR	DO	1.8V	UART1 data set ready (HOST ← MODULE)
	58	UART1_DTR	DI	1.8V	UART1 data terminal ready (HOST → MODULE)
	29	UART2_TXD	DI	1.8V	UART2 Serial data input from DTE (HOST → MODULE)
	31	UART2_RXD	DO	1.8V	UART2 Serial data output from DTE (HOST ← MODULE)
DEBUG Interface	47	JTAG_TMS	-	-	JTAG mode select input
	53	JTAG_TCK	-	-	JTAG clock input
	55	JTAG_SRST_N	-	-	JTAG reset (for debugging)
In/Out Interface	6	POWER_KEY	DI	1.5~2.4V	Power on / off control (Active high)
	23	WAKE_UP	DO	1.8V	HOST Wake Up Signal
	62	READY	DO	1.8V	The boot sequence completed successfully.
	64	USB_DISABLE	DI	1.8V	Active low signal to USB_DISABLE
	67	RESET_KEY	DI	1.8V	Hardware reset (Active Low)
WLAN Interface	25	WIFI_EN	DO	1.8V	WLAN enable
	35	SDIO_CMD	B	1.8V	WLAN Command
	37	SDIO_CLK	B	1.8V	WLAN Clock
	59	SDIO_DATA_0	B	1.8V	WLAN Data bit 0
	61	SDIO_DATA_1	B	1.8V	WLAN Data bit 1
	63	SDIO_DATA_2	B	1.8V	WLAN Data bit 2
	65	SDIO_DATA_3	B	1.8V	WLAN Data bit 3
Ethernet	41	SGMII_RX_P	AI	-	SGMII receive - plus



Interface	43	SGMII_RX_M	AI	-	SGMII receive - minus
	52	SGMII_TX_P	AO	-	SGMII transmit - plus
	54	SGMII_TX_M	AO	-	SGMII transmit - minus
	69	ETH_RESET_N	DO	2.85V	Ethernet PHY reset
	75	ETH_INT_N	DI	1.8V	Ethernet PHY interrupt
	66	SGMII_MDIO_CLK	DO	2.85V	SGMII Clock
	68	SGMII_MDIO_DAT A	B	2.85V	SGMII Data
Reserved	8	Reserved <sup>(*1)</sup>	-	-	-
	10	Reserved <sup>(*1)</sup>	-	-	-
	21	Reserved <sup>(*1)</sup>	-	-	-
	26	Reserved <sup>(*1)</sup>	-	-	-
	40	Reserved <sup>(*1)</sup>	-	-	-
	42	Reserved <sup>(*1)</sup>	-	-	-
	44	Reserved <sup>(*1)</sup>	-	-	-
	46	Reserved <sup>(*1)</sup>	-	-	-
	49	Reserved <sup>(*1)</sup>	-	-	-
	56	Reserved <sup>(*1)</sup>	PO	1.8V	1.8V_output for Digital supply voltage
60	Reserved <sup>(*1)</sup>	-	-	-	

**[Remark]**

***B : Bi-directional***

***DI : Digital Input into Module***

***DO : Digital Output from Module***

***PI : Power input into Module***

***PO : Power output from Module***

## 3. Modem Interface Description

### 3.1. Power supply

Requirement of Input Voltage is refer to the below table

N	Item	Pin NO	Min	Typ	Max	Units	Comments
1	Supply Voltage VCC	2, 4, 70, 72, 74	3.4	3.8	4.2	V	
2	VIH (High-level Input Voltage)		1.2	1.8	2.1	V	
3	VIL (Low-level Input Voltage)		0	0	0.6	V	
4	VOH (High-level Output Voltage)		1.2	1.8	2.1	V	
5	VOL (Low-level Output Voltage)		0	0	0.45	V	

*Note : The Operating Voltage Range MUST never be exceeded; care must be taken when designing the application's power supply section to avoid having an excessive voltage drop.*

*If the voltage drop is exceeding the limits it could cause a Power Off of the module.*

*Overshoot voltage (regarding Max Extended Operating Voltage) and drop in voltage*

*(regarding Min Extended Operating Voltage) MUST never be exceeded;*

*The "Extended Operating Voltage Range" can be used only with completely assumption and application of the HW User guide suggestions.*

### 3.2. USB Interface

This module supports the USB 2.0 Specification.

It is used for diagnostic monitoring and data transfer.

Differential line (D+,D-) impedance should be designed closely to 90Ω.

Pin no.	Pin name	Pin description	Direction
9	USB_D-	USB data (-)	Bidirectional
7	USB_D+	USB data (+)	Bidirectional

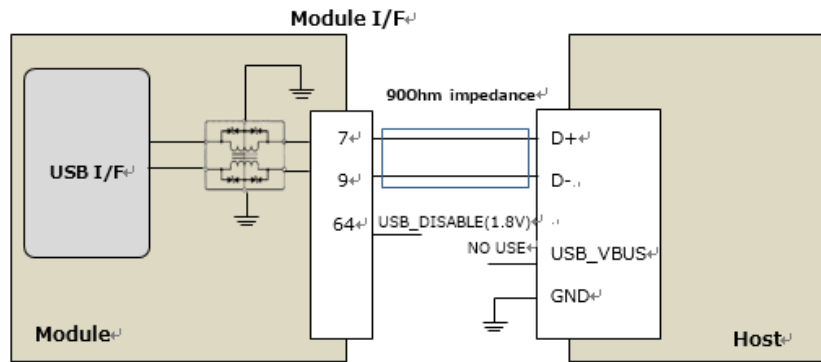


Figure 3. USB interface circuit

### 3.3. USIM Interface

This module supports UIM interface as the below table.

Pin no.	Pin name	Pin description	Direction
36	UIM_PWR	UIM power	Output
32	UIM_CLK	UIM clock	Output
30	UIM_RESET	UIM reset	Output
34	UIM_DATA	UIM data	Output/Input

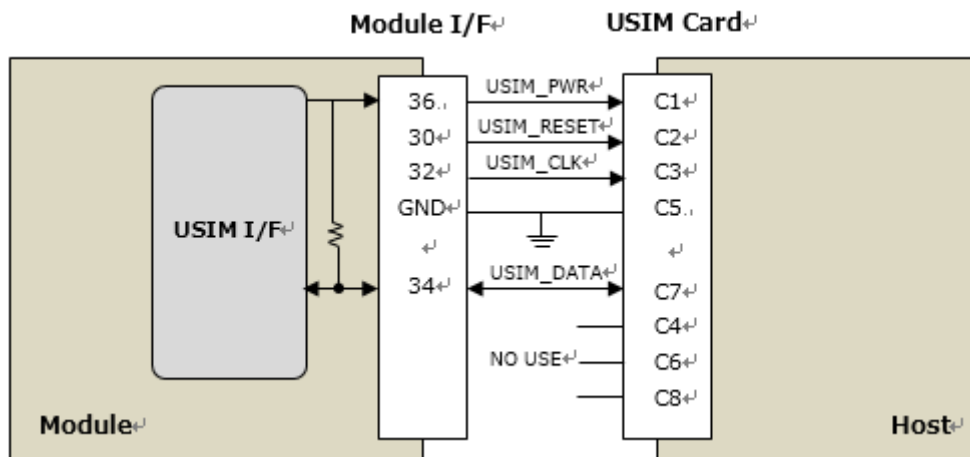


Figure 4. USIM Interface design

### 3.4. UART Interface

UART pins are used to communicate AT-COMMAND and DATA.

Software upgrade can be performed thru this UART

Pin no.	Pin name	Pin description	In/Out	Direction (Module ↔ Host)
24	UART1_RXD	Receive Data	O	Module → Host
22	UART1_TXD	Transmit Data	I	Module ← Host
48	UART1_CTS	Clear to send	O	Module → Host

20	UART1_RTS	Request to send	I	Module ← Host
50	UART1_DSR	Data set ready	O	Module → Host
58	UART1_DTR	Data terminal ready	I	Module ← Host
28	UART1_DCD	Data carrier detect	O	Module → Host
38	UART1_RI	Ring indicator	O	Module → Host
31	UART2_RXD	Receive Data	O	Module → Host
29	UART2_TXD	Transmit Data	I	Module ← Host

*Note: If the module is off, a leakage is generated when voltage is supplied at pin. It should be careful when you design.*

### 3.5. WLAN Interface

This module supports WLAN interface as the below table.

When using the WLAN interface, refer to the below table and connect all signal lines to the host.

Pin no.	Pin name	Pin description	In/Out	Direction
25	WIFI_EN	WLAN enable	O	Module → Host
35	SDIO_CMD	WLAN Command	I / O	Module ↔ Host
37	SDIO_CLK	WLAN Clock	I / O	Module ↔ Host
59	SDIO_DATA_0	WLAN Data bit 0	I / O	Module ↔ Host
61	SDIO_DATA_1	WLAN Data bit 1	I / O	Module ↔ Host
63	SDIO_DATA_2	WLAN Data bit 2	I / O	Module ↔ Host
65	SDIO_DATA_3	WLAN Data bit 3	I / O	Module ↔ Host

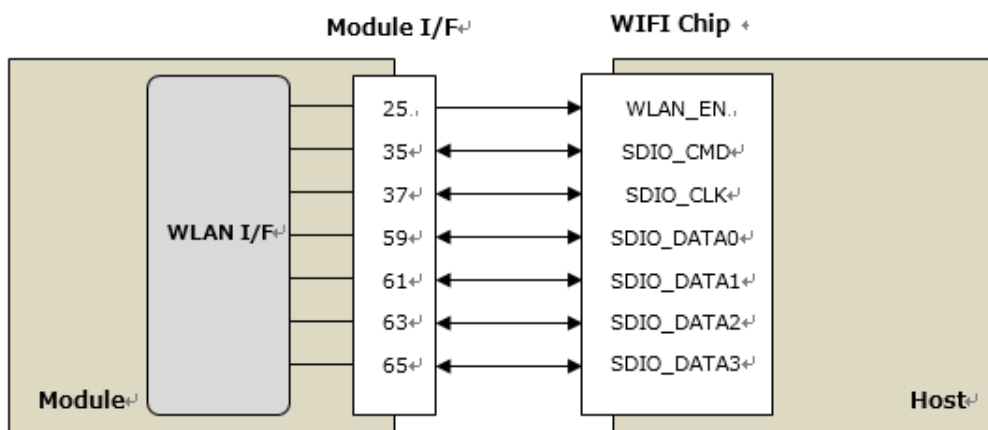


Figure 5. WLAN Interface connection

### 3.6. Ethernet Interface

This module supports Ethernet interface as the below table.

When using the Ethernet interface, refer to the below table and connect all signal lines to the host.

Pin no.	Pin name	Pin description	In/Out	Direction
41	SGMII_RX_P	SGMII receive - plus	I	Module ← Host
43	SGMII_RX_M	SGMII receive - minus	I	Module ← Host
52	SGMII_TX_P	SGMII transmit - plus	O	Module → Host
54	SGMII_TX_M	SGMII transmit - minus	O	Module → Host
66	SGMII_MDIO_CLK	SGMII Clock	O	Module → Host
68	SGMII_MDIO_DATA	SGMII Data	I / O	Module ↔ Host
69	ETH_RESET_N	Ethernet PHY reset	O	Module → Host
75	ETH_INT_N	Ethernet PHY interrupt	I	Module ← Host

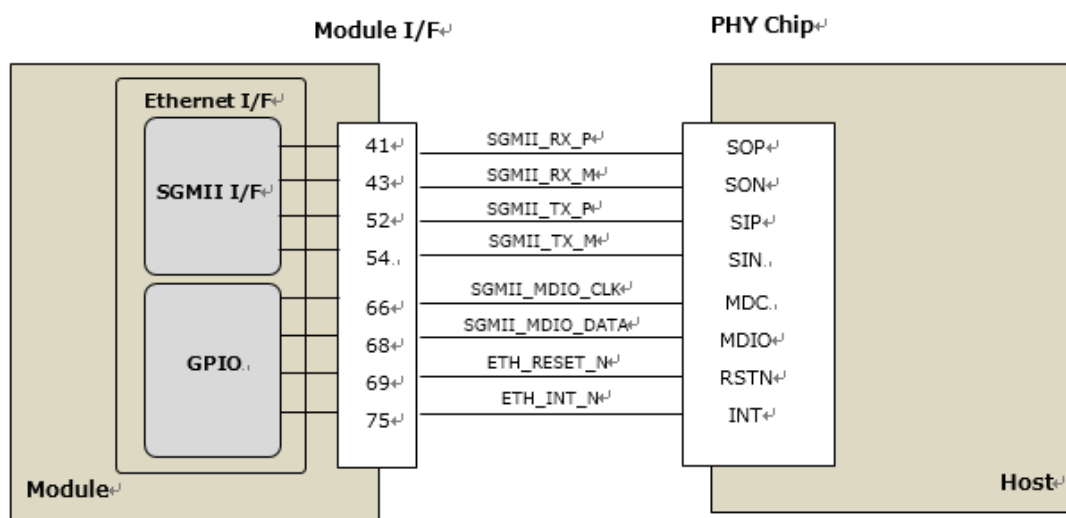


Figure 6. Ethernet Interface Connection

## 3.7. In/Out Interface

### 3.7.1. POWER\_KEY

This pin must keep high for more than 1 second to turn on the module, then the module will turn on. Also, It must keep high for more than 3 second to turn off the module, then the module will turn off automatically.

Pin no.	Pin name	Pin description	Direction
6	POWER_KEY	Power On or Off control Active high	Input

*Note : an unexpected power shutdown can cause critical damage.*

*After performing power off sequence in the module, it should be designed to cut off the power supply in the host.*

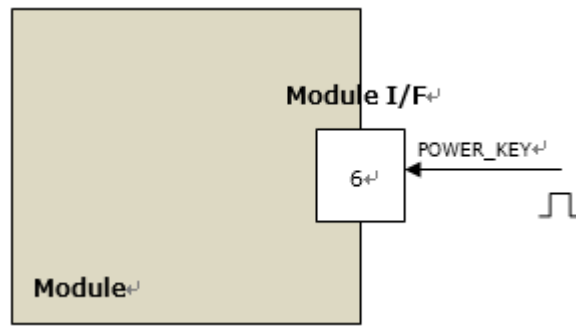


Figure 7. Power\_Key Circuit

### 3.7.2. RESET\_KEY

This pin is for hardware reset of this module. To reset, it must keep low for more than 2.5 seconds and the maximum time is less than 5 seconds.

Pin no.	Pin name	Pin description	Direction
67	RESET_KEY	Hardware Reset, Active low Internal pulled-up to 1.8V	Input

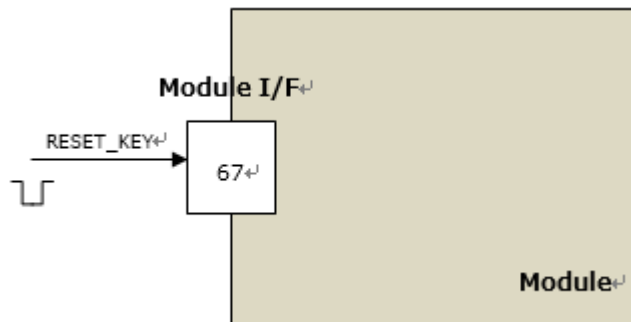


Figure 8. RESET\_KEY Circuit

**Note :** (1) This hardware reset must be designed to be controlled by the host.

*In case of any communication problems, it is recommended that the host should perform reset in hardware and software manner.*

(2) Only in case SW reset can not solve the problem, apply the hardware reset.

(3) During hardware reset, I/O pins connected to module including UART pins should be asserted to be Low level or open state.

*Otherwise, power leakage can cause an malfunction and the module can not be worked.*

### 3.7.3. WAKE\_UP

This pin is used to request that the system return from asleep/suspended state to service a function initiated wake event.

Pin no.	Pin name	Pin description	Direction
23	WAKE_UP	This pin is used to wake host. It will output a 1s low pin. Active low	output

**Note:** If the module is off, a leakage is generated when voltage is supplied at pin. It should be careful when you design.

### 3.7.4. USB\_DISABLE

This pin is used when you do not use the USB function.

Pin no.	Pin name	Pin description	Direction
64	USB_DISABLE	Active low signal to disable USB operation	Input

*Note: Please do Not Connect, if you do not use this pin.*

### 3.7.5. READY

This pin is used to indicate the system is boot-up complete.

Pin no.	Pin name	Pin description	Direction
62	READY	Active high ,boot-up complete	Output

## 3.8. Reserved

To use reserved pins, you must inform to the AM Telecom co.Ltd.

Current purpose of reserved pins is as the below table.

Pin no.	Pin name	Pin description	Remark
8	Reserved	General Purpose Input Output Port	
10	Reserved	General Purpose Input Output Port	
21	Reserved	General Purpose Input Output Port	
26	Reserved	General Purpose Input Output Port	
40	Reserved	General Purpose Input Output Port	
42	Reserved	General Purpose Input Output Port	
44	Reserved	General Purpose Input Output Port	
46	Reserved	General Purpose Input Output Port	
47	JTAG_TMS	JTAG mode select input	
53	JTAG_TCK	JTAG clock input	
55	JTAG_SRST_N	JTAG reset for debug	
49	Reserved	General Purpose Input Output Port	
56	Reserved	1.8V_output for Digital supply voltage	
60	Reserved	General Purpose Input Output Port	



## 4. Current Consumption

The current consumption of the module is listed as below table. The listed current consumption is tested when the power supply of module is 3.3 V.

Mode	Typ.	Unit	Condition
Peak current	1	A	VCC
Data Call	300	mA	Band 7 CH BW=10MHz, TX=0dBm
	770	mA	Band 7 CH BW=10MHz, TX=22.5dBm

## 5. Mechanical Design Guide

### 5.1. PCB layout guide

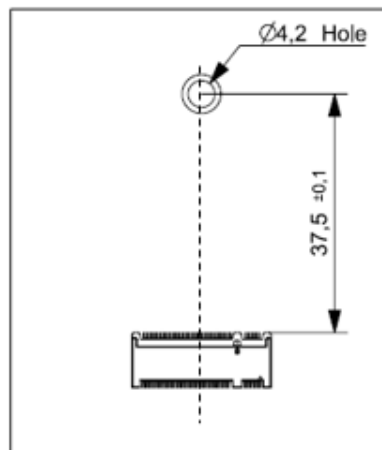


Figure 9. Modem layout guide

## 5.2. Insert nut

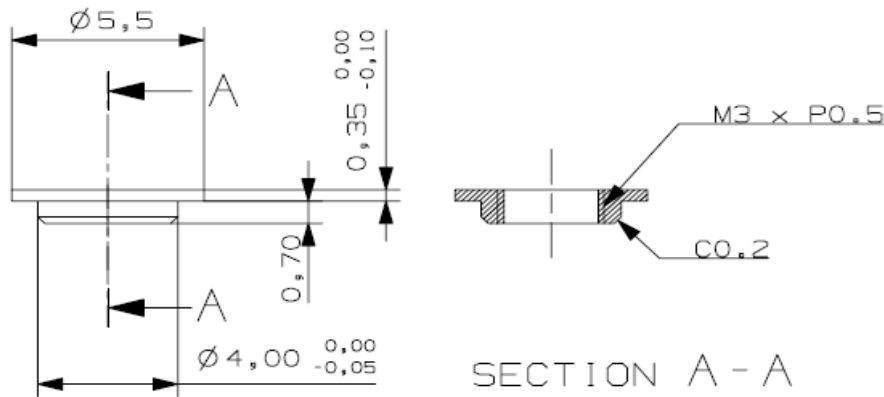


Figure 10. Insert nut guide

**Note:** (1) Insert nut must be connected to GND for RF radiation performance.

(2) This guide is based on PCI express®M.2 connector (Kyocera part no. 24 6411 067 101 894B).

*In case of using different kind of connector, customer should consider if the insert nut and screw need to be changed.*

## 5.3. Screw

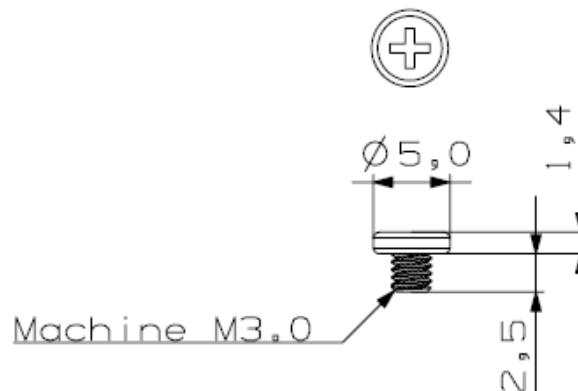


Figure 11. Screw guide

**Note:** This guide is based on PCI express®M.2 connector (Kyocera part no. 24 6411 067 101 894B).

*In case of using different kind of connector, customer should consider if the insert nut and screw need to be changed.*

## 6. Cautions

### 6.1. Safety precautions

This module should be used at authorized places or environments due to frequency jamming possibility while operating. If occur any issues when the module operates at not authorized places or environments, AM TELECOM does not have any responsibility.

- ① Do not use at life-saving places or areas such as hospitals or medical facilities. Also, should be 'power-off' nearby medical appliances in order to prevent errors caused by radio frequency interference while operating medical appliances or life-support system.
- ② Keep 'Power-off' at not authorized places in airport and airplane while taking off and landing in flight. It might be brought a risk of accident due to radio frequency jamming.
  - The limitation is different per each air flight company. So, follow instructions of each flight company.
- ③ Do not use at places of combustible storage and handling such as gas stations or chemical manufacturing plants in order to prevent from explosion or fire.

### 6.2. Product handling precautions

- ① Be careful not to excessive static applied.

The performance will be able decline if static with over  $\pm 2\text{KV}$  is applied.

- ② Do not give a shock or impact or dropping.

If give strong shock or impact or dropping, those will be reasons about damage or breakdown or failure. Manufacture does not have responsibility if troubles are made by users.

- ③ Do not modify or take apart or fix.

If do above, risk will be happened such as product damage or breakdown or electric shock or fire. Manufacture does not have responsibilities on those cases.

- ④ Do not give damages or removals to product label.

It will be very hard to identify the product, so that AS is not available.

- ⑤ Be careful to tighten screws not to give excessive forces.

- ⑥ Always use and store at room temperature.

- ⑦ Avoid water or humidity directly.

- ⑧ Use antistatic gloves while handling.

- ⑨ Try connecting after checking any foreign materials on Connector or Pad.

If any foreign material is on connector, contact failure can be happened. Please clean the area, and then connect. Be careful not to give any damage.

- ⑩ Do not touch bottom side by hands while connecting.

- ① Do not presses the shield CAN. It can cause electrical short or declining RF performance by the CAN damage.

## 7. Acronyms

Word	Description
<b>BW</b>	<b>Band Width</b>
<b>dB</b>	<b>A type of (relative) scale that represents the difference of some value as Log</b>
<b>dBm</b>	<b>An abbreviation for the power ratio in dB of the measured power referenced to one milliwatt (mW).</b>
<b>DL</b>	<b>Down-Link</b>
<b>ESD</b>	<b>Electro Static Discharge</b>
<b>FDD</b>	<b>Frequency Division Duplex</b>
<b>GPIO</b>	<b>General Purpose Input Output</b>
<b>GPS</b>	<b>Global Positioning System</b>
<b>LTE</b>	<b>Long Term Evolution</b>
<b>MCS</b>	<b>Modulation and Coding Scheme</b>
<b>PPM</b>	<b>Parts Per Million</b>
<b>QAM</b>	<b>Quadrature Amplitude Modulation</b>
<b>QPSK</b>	<b>Quadrature Phase Shift Keying</b>
<b>RF</b>	<b>Radio Frequency</b>
<b>Sensitivity</b>	<b>The minimum input pin to be specified value of the output power (or SNR/BER/BLER) in a wireless receiver.</b>
<b>UL</b>	<b>Up-Link</b>
<b>USB</b>	<b>Universal Serial Bus</b>
<b>USIM</b>	<b>Universal Subscriber Identity Module</b>
<b>MODEM</b>	<b>MOdulator and DEModulator</b>
<b>MIMO</b>	<b>Multiple-input and multiple-output</b>
<b>PS_HOLD</b>	<b>Power supply hold signal to PMIC</b>
<b>JTAG</b>	<b>Joint Test Action Group</b>
<b>Cat</b>	<b>Category</b>
<b>PCB</b>	<b>Printed Circuit Board</b>

# 8. OEM/Integrators Installation Guide

## Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions).  
The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).  
The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

## End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: “Contains FCC ID: 2AZDW-AML550”  
The FCC ID can be used only when all FCC compliance requirements are met.

## Antenna Installation

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
- (2) The transmitter module may not be co-located with any other transmitter or antenna.
- (3) Only antennas of the equal or less gains as shown below may be used with this module:

Frequency Band	700 MHz	800 MHz	1700 MHz	1900 MHz	2500 MHz
Max. Gain (dBi)	6.6	5.6	5.0	3.5	9.0

Note: The above gain is considered cable loss..

When using an antenna higher than the gain mentioned above, the conducted output power must be reduced, and the product may require C2PC filing with additional tests and RF exposure evaluation.

In the event that these conditions cannot be met (for example higher than max gain or co-location with another transmitter), then the FCC/IC authorization is no longer considered valid and the FCC ID/IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC/IC authorization.

## Manual Information to the End User

The OEM integrator 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.

## Federal Communication Commission Interference 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.

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 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.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

## List of applicable FCC rules

This module has been tested and found to comply with part 22, part 24, part 27, part 90 requirements for Modular Approval.

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, 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.

## This device is intended only for OEM integrators under the following conditions: (For module device use)

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

## Radiation Exposure Statement

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

## Industry Canada Statement

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

The device could automatically discontinue transmission in case of absence of information to transmit, or operational failure. Note that this is not intended to prohibit transmission of control or signaling information or the use of repetitive codes where required by the technology.

L'appareil peut interrompre automatiquement la transmission en cas d'absence d'informations à transmettre ou de panne opérationnelle. Notez que ceci n'est pas destiné à interdire la transmission d'informations de contrôle ou de signalisation ou l'utilisation de codes répétitifs lorsque cela est requis par la technologie.

## This device is intended only for OEM integrators under the following conditions: (For module device use)

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

## Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

- 1) L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et
- 2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 2 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

## IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or colocation with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

## NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

## End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC: 27086-AML550".

## Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 20cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 27086-AML550".

## Manual Information To the End User

The OEM integrator 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.

## Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

## Radiation Exposure Statement

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

## Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.



## 9. Contact Information

### ➤ Korea

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