



**OFLYCOMM**

欧飞信科技

**O2066PM**

Wi-Fi Tri-band 2x2 MIMO DBS

802.11ax + Bluetooth 5.2

Module Datasheet

### Cover of Approval Sheet

PRODUCT NAME	Part No.	Description
O2066PM	FWAAO2066PM10	QCA2066 M.2 3.3V 2T2R 22*30* 2.7mm DBS 11ax BT5.2-UART External 3antenna Shield CAN
	FWAAO2066PM20	QCA2066 M.2 3.3V 2T2R 22*30* 2.7mm DBS 11ax BT5.2-USB External 3antenna Shield CAN

Customer: \_\_\_\_\_

Customer P/N: \_\_\_\_\_

Signature: \_\_\_\_\_

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**Revision History**

<b>Version</b>	<b>Date</b>	<b>Description</b>	<b>Draft</b>	<b>Approved</b>
V1.0	2022-04-06	-Preliminary Project version	CCJ	Turbo
V1.1	2022-06-30	-append current description	CCJ	Turbo
V1.2	2022-10-25	-Addition the description	CCJ	Turbo

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# 1. Overview

## 1.1 Introduction

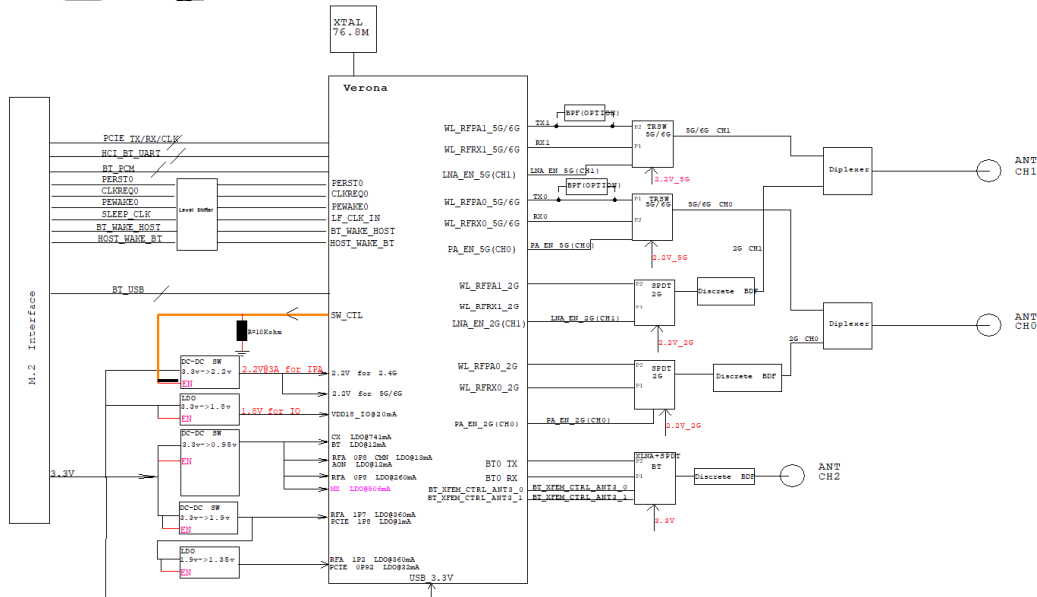
The O2066PM1 device is a highly integrated module supporting 802.11ax Wi-Fi and Bluetooth (BT) Milan. The O2066PM1 device supporting simultaneous operation on 2.4 GHz and 5 GHz, or 6 GHz, also known as Dual Band Simultaneous (DBS).

The wireless module complies with IEEE 802.11 a/b/g/n/ac/ax 2x2 MIMO standard and it can achieve up to a speed of 2975.6Mbps (5/6G 2x2 160MHz 11ax +2.4G 2x2 40MHz 11ax DBS). The integrated module provides PCIe interface for Wi-Fi, UART/PCM or USB interface for Bluetooth.

## 1.2 Features

- Supports 2x2 Multi-User Multiple-Input Multiple-Output (MU-MIMO).
- Dual Band Simultaneous (DBS), up to 3 Gbps data rate (5/6G 2x2 160MHz 11ax +2.4G 2x2 40MHz 11ax DBS).
- Tri-band 2.4 GHz/5 GHz/6 GHz support.
- 20MHz/40MHz channel bandwidth for 2.4 GHz and 20MHz/40MHz/80MHz/160 MHz channel bandwidth for 5 GHz/6 GHz.
- Seamless antenna sharing with Bluetooth, LTE, LTE-U, and 5G.
- Dynamic Frequency Selection (DFS, radar detection) .
- Offloading traffic for minimal host utilization at 802.11ac/ ax speeds.
- Low-power PCIe (with L1 substate) interface.
- Integrated close-loop power detector.
- Supports 2 Mbps Bluetooth Low Energy (BLE), BLE Long Range.
- Split ACL support for A2DP true stereo (earbuds) .
- Dedicated Bluetooth antenna, and concurrent with 5G WLAN.
- Dual eSCO and dual A2DP streams.
- Backward-compatible with previous Bluetooth standards.
- Standard M.2 2230 Key E Golden Finger interface.

## 1.3 Block Diagram



## 1.4 General Specification

Model Name	O2066PM
Product Description	Support WiFi6E+BT5.2
Dimension	L x W x H: 22 x 30 x 2.7 (typical) mm
Wi-Fi Interface	M.2 2230 Key E
BT Interface	UART/PCM or USB
Operating temperature	-30°C to 85°C*
Storage temperature	-40°C to 125°C

Note: The maximum ambient temperature of 802.11ax 160M MCS11 for long-term stable operation is less than or equal to 82°C.

## 1.5 Recommended Operating Rating

Feature		Minimum	Type	Maximum	Units
Operating Temperature		-30	25	85	°C
VCC		3.20	3.3	3.45	V
Power Consumption (Type VCC)	TX (2.4G HE40)	441 mA			
	RX (2.4G HE40)	147 mA			
	TX (5G HE160)	554 mA			
	RX (5G HE160)	211 mA			
	Power Up	118 mA			
	BT TX (1M@7dBm)	147 mA			
	BT RX	136 mA			

Note: Use QRCT tool, TX mode:EnablingContinuousModulatedTX;Duty Cycle:50%;TX Power Control:AutoPower, test the maximum current of the module 3.3V power supply when NSS=1.

## 2. RF Specification

### 2.1 Wi-Fi RF Specification

2.4GHz RF Specification	
Feature	Description
Operating Frequency	2.400~2.4835GHz
Standards	Wi-Fi: IEEE 802.11b/g/n/ac/ax & Wi-Fi compliant
Operating Channel	2.4GHz : Ch1~14
Modulation	802.11b : CCK 802.11 g/n/ac/ax : OFDM /1024-QAM, 256-QAM, 64-QAM, 16-QAM, QPSK, BPSK
PHY Data rates	Wi-Fi:802.11b:11,5.5,2,1Mbps 802.11g:54,48,36,24,18,12,9,6Mbps 802.11n: up to 300Mbps 802.11ac: up to 400Mbps 802.11ax:up to 3 Gbps data rate (2.4G 2x2+5G or 6G 2x2 11ax DBS)
Output Power, tolerance $\pm 1.5$ dB	

Protocol Standard	Data Rate	Spec.(dBm)	EVM(dBm)
802.11b	@11Mbps	19	≅ -9
802.11g	@54Mbps	16	≅ -25
802.11n	@HT40 MCS 7	16	≅ -28
802.11ac	@vHT40 MCS 9	14.5	≅ -32
802.11ax	@HE40 MCS 11	12.5	≅ -35
Receiver Sensitivity, CCK modulation PER ≅ 8%、OFDM modulation PER ≅ 10%			
Protocol Standard	Data Rate	Spec.(dBm)	
802.11b(20MHz)	1Mbps	-82	
	11Mbps	-76	
802.11g(20MHz)	6Mbps	-82	
	54Mbps	-64	
802.11n(20MHz)	MCS 0 NSS1	-82	
	MCS 7 NSS1	-64	
802.11n(40MHz)	MCS 0 NSS1	-79	
	MCS 7 NSS1	-61	
802.11ac(20MHz)	MCS 0 NSS1	-82	
	MCS 9 NSS1	-59	
802.11ac(40MHz)	MCS 0 NSS1	-79	
	MCS 9 NSS1	-57	
802.11ax(20MHz)	MCS 0 NSS1	-82	
	MCS 11 NSS1	-52	
802.11ax(40MHz)	MCS 0 NSS1	-79	
	MCS 11 NSS1	-49	
<b>5GHz RF Specification</b>			
Feature	Description		
Operating Frequency	5G:5.15 GHz ~ 5.845 GHz (5.0 GHz ISM Band)		
Standards	Wi-Fi: IEEE 802.11 a/n/ac/ax 2x2, Wi-Fi compliant		
Modulation	802.11 a/n/ac/ax : OFDM /1024-QAM、256-QAM、64-QAM、16-QAM、QPSK、BPSK		
PHY Data rates	Wi-Fi: 802.11a:54,48,36,24,18,12,9,6Mbps 802.11n: up to 300Mbps 802.11ac: up to 800Mbps (5G 2x2 VHT80) 802.11ax: up to 3 Gbps data rate (2.4G 2x2+5G 2x2 11ax DBS)		
Output Power, tolerance ± 1.5 dB			
Protocol Standard	Data Rate	Spec.(dBm)	EVM(dBm)
802.11a	@54Mbps	16.5	≅ -25
802.11n	@HT40 MCS 7	16	≅ -28
802.11ac	@vHT80 MCS 9	13.5	≅ -32
802.11ax	@HE160 MCS 11	11.5	≅ -35
Receiver Sensitivity,OFDM modulation PER ≅ 10%			
Protocol Standard	Data Rate	Spec.(dBm)	

802.11a(20MHz)	6Mbps	-82	
	54Mbps	-64	
802.11n(20MHz)	MCS 0 NSS1	-82	
	MCS 7 NSS1	-64	
802.11n(40MHz)	MCS 0 NSS1	-79	
	MCS 7 NSS1	-64	
802.11ac(20MHz)	MCS 0 NSS1	-82	
	MCS 9 NSS1	-57	
802.11ac(40MHz)	MCS 0 NSS1	-79	
	MCS 9 NSS1	-54	
802.11ac(80MHz)	MCS 0 NSS1	-76	
	MCS 9 NSS1	-51	
802.11ax(20MHz)	MCS 0 NSS1	-82	
	MCS 11 NSS1	-52	
802.11ax(40MHz)	MCS 0 NSS1	-79	
	MCS 11 NSS1	-49	
802.11ax(80MHz)	MCS 0 NSS1	-76	
	MCS 11 NSS1	-46	
802.11ax(160MHz)	MCS 0 NSS1	-73	
	MCS 11 NSS1	-43	
<b>6GHz RF Specification</b>			
Feature	Description		
Operating Frequency	6G: 5.925 GHz ~ 7.125 GHz		
Standards	Wi-Fi: IEEE 802.11 a/n/ac/ax 2x2, Wi-Fi compliant		
Modulation	802.11 a/n/ac/ax : OFDM /1024-QAM, 256-QAM, 64-QAM, 16-QAM, QPSK, BPSK		
PHY Data rates	Wi-Fi: OFDM:54,48,36,24,18,12,9,6Mbps 802.11ax:up to 3 Gbps data rate (2.4G 2x2+6G 2x2 11ax DBS)		
Output Power, tolerance $\pm 1.5$ dB			
Protocol Standard	Data Rate	Spec.(dBm)	EVM(dBm)
802.11a	@54Mbps	13.5	$\leq -25$
802.11n	@HT40 MCS 7	13.5	$\leq -28$
802.11ac	@vHT80 MCS 9	13	$\leq -32$
802.11ax	@HE160 MCS 11	10.5	$\leq -35$
Receiver Sensitivity,OFDM modulation PER $\leq 10\%$			
Protocol Standard	Data Rate	Spec.(dBm)	
802.11a(20MHz)	6Mbps	-82	
	54Mbps	-64	
802.11ax(20MHz)	MCS 0 NSS1	-82	
	MCS 11 NSS1	-52	
802.11ax(40MHz)	MCS 0 NSS1	-79	



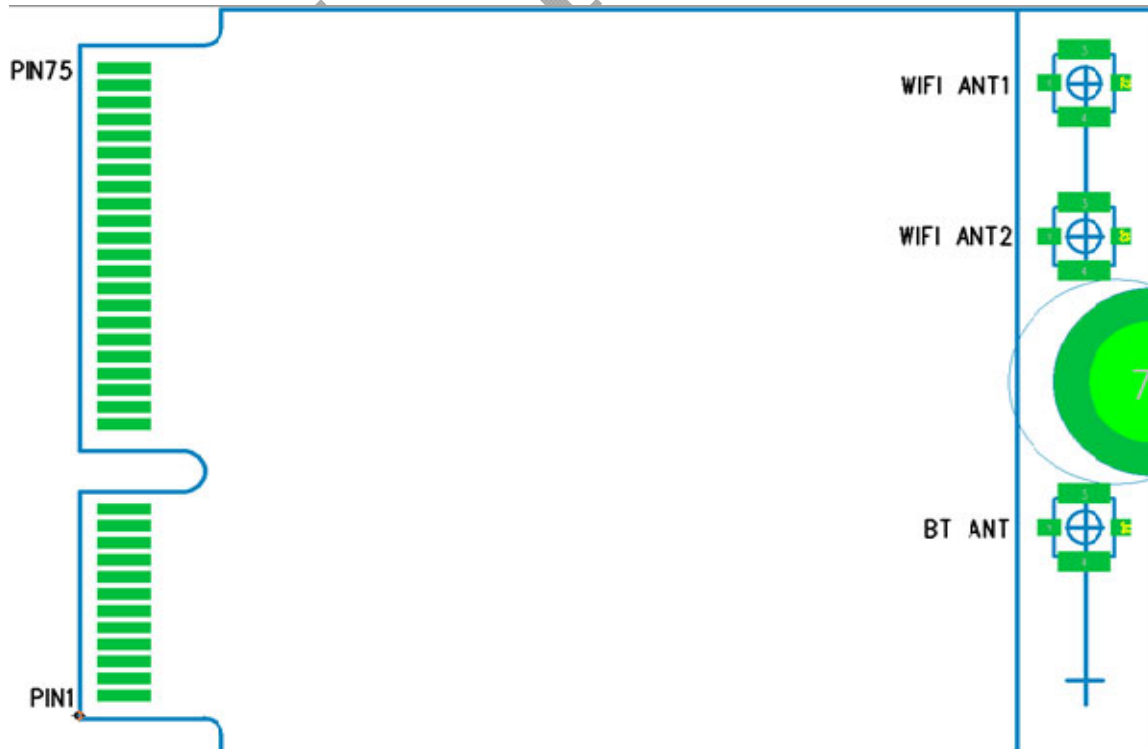
	MCS 11 NSS1	-49
802.11ax(80MHz)	MCS 0 NSS1	-76
	MCS 11 NSS1	-46
802.11ax(160MHz)	MCS 0 NSS1	-73
	MCS 11 NSS1	-43

### 2.2 BT RF Specification

Feature	Description		
Operating Frequency	2.402~2.480GHz		
Number of Channels	79 channels		
Standards	Bluetooth V5.2		
Modulation	8DPSK, $\pi/4$ DQPSK, GFSK		
PHY Data rates	Supports 2Mbps Bluetooth Low Energy(BLE),BLELong Range		
Output Power	Min(dBm)	Typical(dBm)	Max(dBm)
		7	10
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-92	
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)		-92	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-85	

## 3.Pin Assignments

### 3.1 Pin Outline



### 3.2 Pin Definition

#### Top side

NO	Name	Type	Description	Voltage
1	GND1	-	Ground	
3	BT USB D+	I/O	The usb1.1 interface is only valid for BT USB modules	
5	BT USB D1	I/O	The usb1.1 interface is only valid for BT USB modules	
7	GND2	-	Ground	
9	NC	-		
11	NC	-		
13	NC	-		
15	NC	-		
17	NC	-		
19	NC	-		
21	NC	-		
23	NC	-		
33	GND3	-	Ground	
35	PERP0	I	PCIe RX differential signals	
37	PERN0	I		
39	GND4	-	Ground	
41	PETP0	O	PCIe TX differential signals	
43	PETN0	O		
45	GND5	-	Ground	
47	REFCLKP0	I	PCIe clock differential input signal	
49	REFCLKN0	I		
51	GND6	-	Ground	
53	CLKREQ0#(I/O)(0/3.3V) ①	I/O	PCIe reference clock request signal, open drain, active low	3.3V
55	PEWAKE0#(I/O)(0/3.3V) ①	I/O	PCIe wake up host, open drain, active low	3.3V
57	GND7	-	Ground	
59	RESERVED_PERP1	-	NC	
61	RESERVED_PERN1	-	NC	
63	GND8	-	Ground	
65	RESERVED_PETP1	-	NC	
67	RESERVED_PETN1	-	NC	
69	GND9	-	Ground	
71	RESERVED_REFCLKP1	-	NC	
73	RESERVED_REFCLKN1	-	NC	
75	GND9	-	Ground	

**Bottom side**

NO	Name	Type	Description	Voltage
2	3_3V_1	P	Power supply	3.3V
4	3_3V_2	P	Power supply	3.3V
6	NC	-	RESERVED	
8	PCM_CLK	I/O	BT PCM clock ( Only valid for UART modules)	1.8V
10	PCM_SYNC	I/O	BT PCM sync ( Only valid for UART modules)	1.8V
12	PCM_OUT	O	BT PCM data out ( Only valid for UART modules)	1.8V
14	PCM_IN	I	BT PCM data in ( Only valid for UART modules)	1.8V
16	NC	-	RESERVED	
18	GND11	-	Ground	
20	UART_WAKE_N ①	O	BT wake up host signal ( Only valid for UART modules)	3.3V
22	UART_TXD(O)(0/1.8V)	O	BT UART interface ( Only valid for UART modules)	1.8V
32	UART_RXD(I)(0/1.8V)	I		1.8V
34	UART_RTS(O)(0/1.8V)	O	BT UART request to send ( Only valid for UART modules)	1.8V
36	UART_CTS(I)(0/1.8V)	I	BT UART clear to send ( Only valid for UART modules)	1.8V
38	NC	-		
40	NC	-		
42	NC	-		
44	WAKE_BT ①	I	Host wake up BT signal	3.3V
46	LTE_COEX_TXD	O	RESERVED/LTE coexistence UART TXD	1.8V
48	LTE_COEX_RXD	I	RESERVED/LTE coexistence UART RXD	1.8V
50	SUSCLK_32KHZ ①	I	Sleep clock input	3.3V
52	PERST0#(I)(0/3.3V) ①	I	PCIe reset module,internal weak pull down	3.3V
54	NC	-	RESERVED	
56	NC	-	RESERVED	
58	NC	-	RESERVED	
60	NC	-	RESERVED	
62	NC	-		
64	NC	-		
66	NC	-		
68	NC	-		

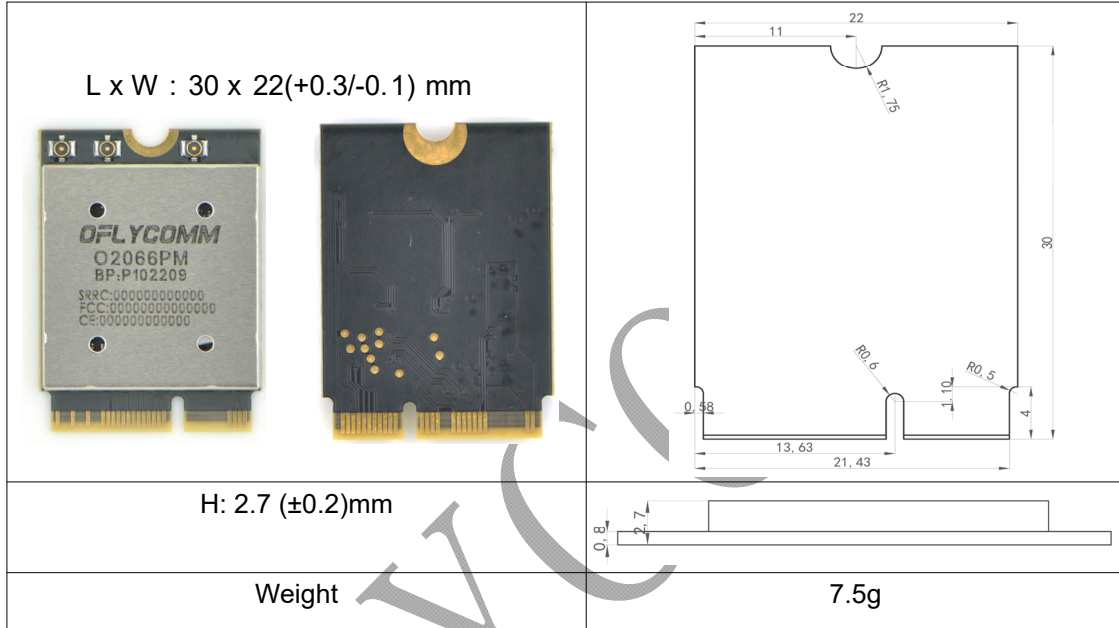
70	NC			
72	3_3V_3	P	Power supply	3.3V
74	3_3V_4	P	Power supply	3.3V

Note: The I/O level of the pin marked ① is 3.3V, and the other I/O level is 1.8V.

## 4. Dimensions

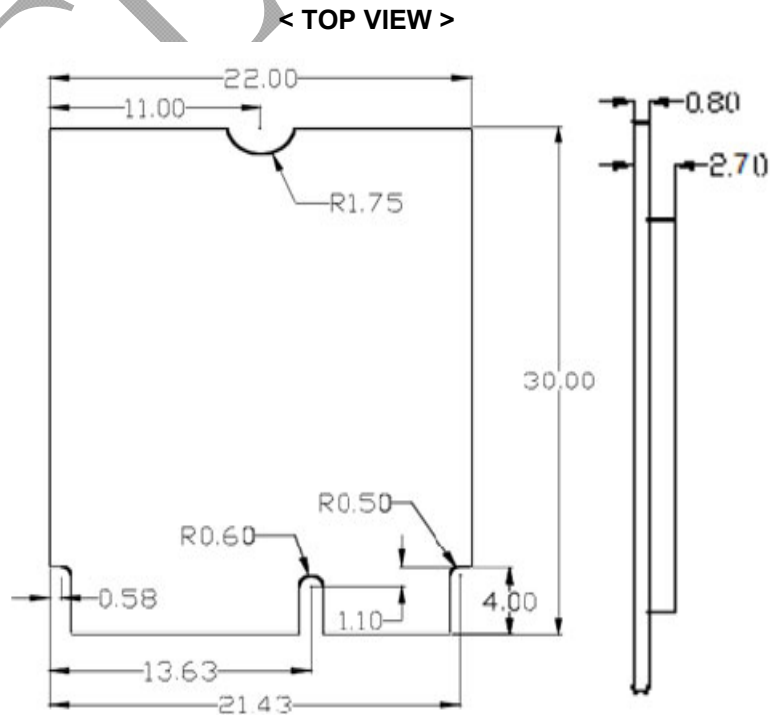
### 4.1 Physical Dimensions and Module Photo

(Unit: mm)



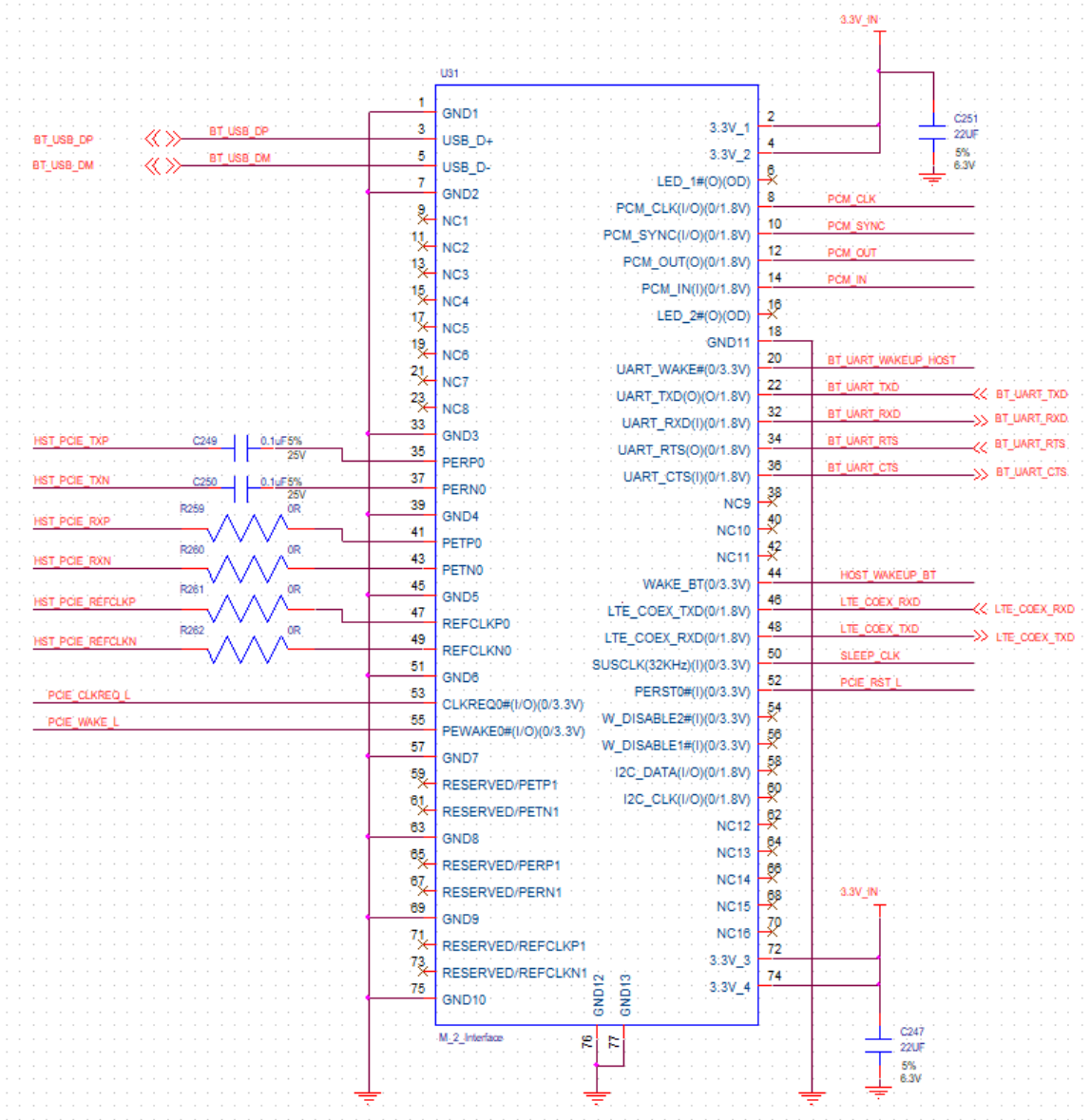
### 4.2 Module Physical Dimensions

(Unit: mm)



# 5 Reference Design

## 5.1 Reference schematic



**Note:**

- a) C247, C251 should be closed to host.
- b) The power supply “3.3V\_IN” switching noise is less than 100mV and the ripple is less than 30 mV.
- c) PCIe differential signals should be followed 100 Ohm impedance.
- d) For the I/O interface voltage, please refer to chapter 5 pin definition.
- e) For the 1.8V interface, such as PCM, UART and some I/O, if the host voltage level is 3.3V or 5V, need to add level shift circuit.

## 5.2 External Antenna

When the customer selects an external antenna, the external antenna selected must meet the parameter requirements specified ,Impedance 50Ω

### 5.3 Real-world Testing

2.4G Real-world Testing					
Protocol Standard		channel	Power (dBm)	EVM(dB)	Rx Sensitivity (dBm)
802.11g(54Mps)	ANT0	2412	15.7	-35.3	-72
		2437	15.9	-35.5	-73
		2472	16.1	-35.1	-73
	ANT1	2412	16.2	-34.2	-73
		2437	16.1	-35.7	-73
		2472	16.4	-34.2	-73
802.11ax(HE20_MCS11)	ANT0	2412	13.6	-38.9	-58
		2437	13.3	-39	-58
		2472	13.8	-39.2	-58
	ANT1	2412	13.9	-37.5	-58
		2437	14.2	-38.7	-58
802.11ax(HE40_MCS11)	ANT0	2422	12.9	-37.2	-55
		2462	12.8	-37.9	-55
	ANT1	2422	13.2	-37.2	-55
		2462	13.1	-38.9	-55
5G Real-world Testing					
Protocol Standard		channel	Power (dBm)	EVM(dB)	Rx Sensitivity (dBm)
802.11a(54Mps)	ANT0	5180	16.9	-33.6	-73
		5500	16.8	-32.9	-73
		5825	16.6	-33.2	-73
	ANT1	5180	16.7	-33.1	-73
		5500	16.6	-33.2	-73
		5825	16.9	-32.9	-73
802.11ax(HE20_MCS11)	ANT0	5180	13.8	-38.6	-59
		5600	13.7	-36.8	-59
		5825	13.1	-38.4	-59
	ANT1	5180	13.8	-38.8	-59
		5600	13.2	-39.4	-59
		5825	13.6	-38.5	-59
802.11ax(HE80_MCS11)	ANT0	5290	12.2	-36.8	-54
		5690	11.8	-37.9	-54
		5775	12.3	-37.1	-54
	ANT1	5290	12.8	-37.4	-54
		5690	12.9	-37.8	-54
		5775	13	-36	-54
802.11ax(HE160_MCS1)	ANT0	5250	11.9	-36.4	-51

1)		5570	11.6	-36.5	-50
	ANT1	5250	12.2	-37.1	-51
		5570	12.1	-36.6	-51
6G Real-world Testing					
Protocol Standard		channel	Power (dBm)	EVM(dB)	Rx Sensitivity (dBm)
802.11a(54Mps)	ANT0	6015	14.3	-31.6	-73
		6515	13.4	-33.4	-73
		7115	13.8	-33.6	-73
	ANT1	6015	14.5	-33	-73
		6515	14.3	-39.7	-73
		7115	13.5	-32.8	-73
802.11ax(HE20_MCS11)	ANT0	6015	13.1	-38.3	-59
		6515	12.5	-38.7	-59
		7115	12	-38.3	-59
	ANT1	6015	12.9	-36.5	-59
		6515	12.1	-40.2	-59
		7115	12.8	-37.1	-59
802.11ax(HE80_MCS11)	ANT0	5985	11.6	-36.9	-54
		6545	11.6	-36.8	-54
		7025	11.1	-37.9	-54
	ANT1	5985	11.6	-37.2	-54
		6545	11.3	-37.2	-53
		7025	11.1	-37.3	-54
802.11ax(HE160_MCS11) 1)	ANT0	6025	11.1	-37.2	-51
		6505	11	-37.7	-50
		6985	10.4	-37.4	-50
	ANT1	6025	10.5	-37.6	-51
		6505	10.7	-37	-50
		6985	10.1	-36.2	-50

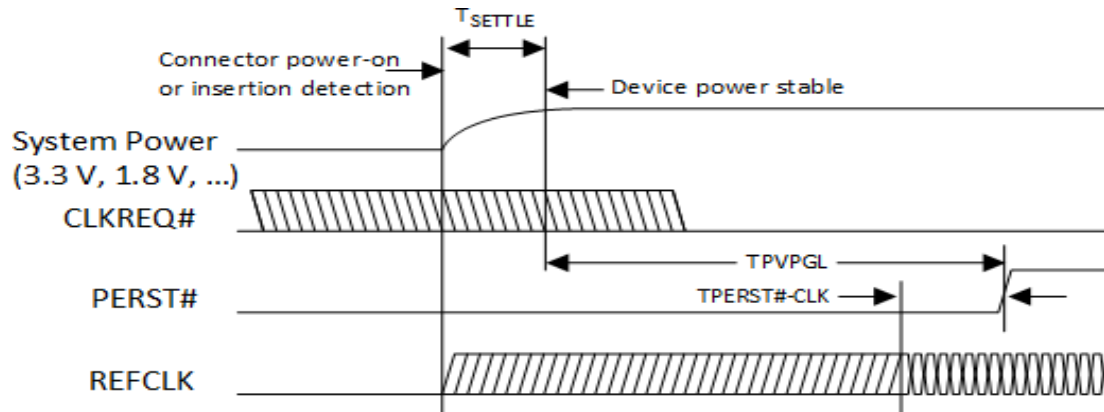
Description: The test environment is: temperature 25 °C humidity 60%

## 6 Host Interface Timing Diagram

### 6.1 PCIe powerup sequence timing

Supports PCIe Gen 3 interface for WLAN.

Compliant to PCIe Gen 3 powerup sequence timing.

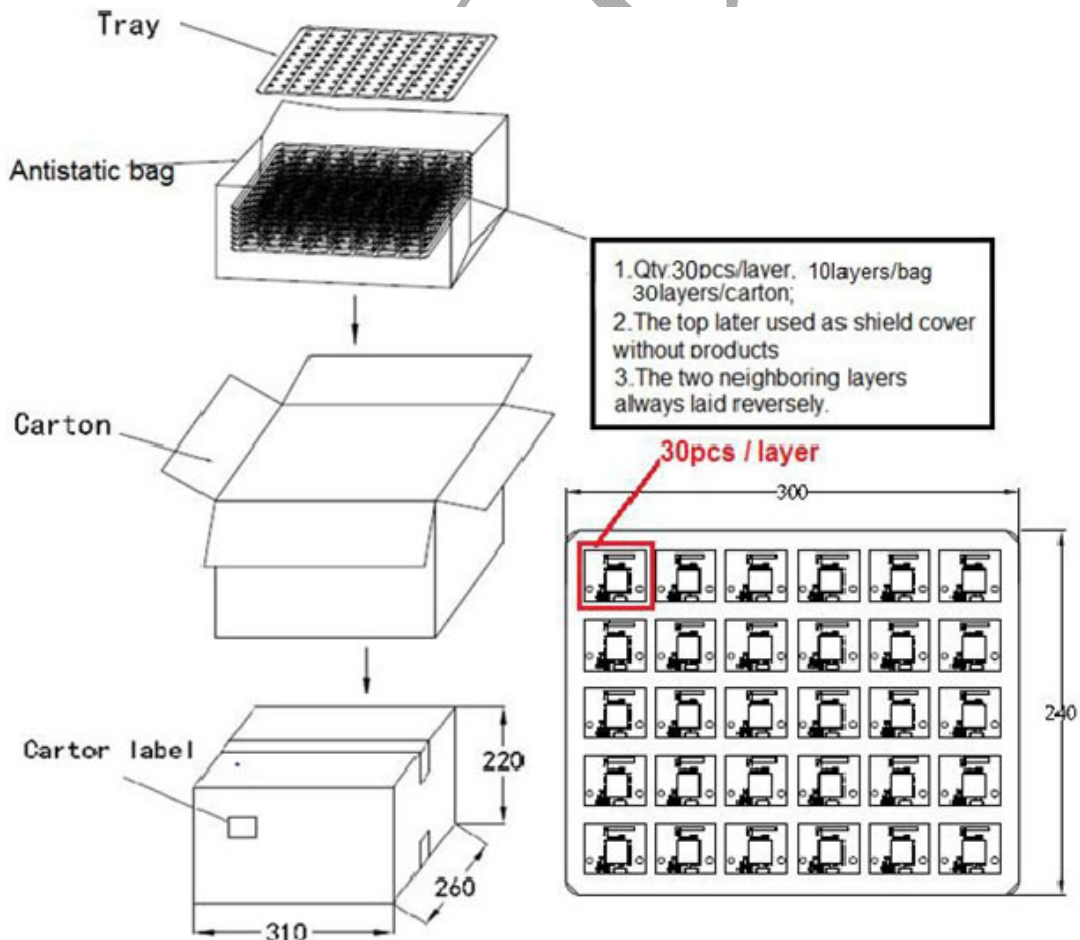


Symbol	Parameter	Min	Max	Units
$T_{PVPG}$	Power Valid* to PERST# input inactive	Implementation specific; recommended 50 ms		ms
$T_{PERST\#-CLK}$	REFCLK stable before PERST# inactive	100		$\mu$ s

Note: \*Power Valid when all the voltage supply rails have reached their respective  $V_{min}$ .

## 7 Package

### 7.1 Reel





## 7.2 Storage Temperature And Humidity

The Modules is a Moisture Sensitive Device level 3, in according with standard IPC/JEDEC J-STD-020, take care all the relatives requirements for using this kind of components.

Moreover, the customer has to take care of the following conditions:

- a) Calculated shelf life in sealed bag: 12 months at <math>40^{\circ}\text{C}</math> and <math>90\%</math> relative humidity (RH).
- b) Environmental condition during the production:  $30^{\circ}\text{C}$  / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5.
- c) The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition.
- d) "IPC/JEDEC J-STD-033A paragraph 5.2" is respected.
- e) Baking is required if conditions b) or c) are not respected.
- f) Baking is required if the humidity indicator inside the bag indicates 10% RH or more.

**THE END**