Telit Cinterion

WE310K6 Module

Hardware User Guide

1VV0301856 Rev 4
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Confidential

Technical Documentation

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1 Applicability Table

Table 1: Applicability Table

Products
WE310K6-P
WE310K6-P M.2

2 Introduction

2.1 Scope

This document provides comprehensive details on the Telit WE310K6-P/M.2 Wi-Fi 6/Bluetooth® 5.2 combo modules, covering electrical specifications, mechanical characteristics, interface information, application insights, and manufacturing specifics. By using this document along with other user guides, you can attain a thorough understanding of the Telit WE310K6-P/M.2 module, facilitating the quick development of a wide range of products.

2.2 Audience

This document is intended for system integrators that are using the Telit WE310K6 module in their products.

2.3 Contact Information, Support

For technical support and general questions, e-mail:

- TS-EMEA@telit.com
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- TS-ONEEDGE@telit.com

Alternatively, use: https://www.telit.com/contact-us

Product information and technical documents are accessible 24/7 on our website: https://www.telit.com

2.4 Conventions

Note: Provide advice and suggestions that may be useful when integrating the module.

Danger: This information MUST be followed, or catastrophic equipment failure or personal injury may occur.

ESD Risk: Notifies the user to take proper grounding precautions before handling the product.

Warning: Alerts the user on important steps about the module integration.

All dates are in ISO 8601 format, that is YYYY-MM-DD.

2.5 Terms and Conditions

Refer to https://www.telit.com/hardware-terms-conditions/.

2.6 Disclaimer

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3 General Product Description

3.1 Overview

The WE310K6-P/M.2 is a fully integrated dual-band (2.4GHz/5GHz), dual-mode Wi-Fi (802.11 a/b/g/n/ac/ax) / Bluetooth® 5.2 combo module that allows users to add wireless connectivity to their products in a simple and cost-effective manner.

The WE310K6-P/M.2 supports 2-stream 802.11ax solutions with Multi-user MIMO, a Wireless LAN PCI Express network interface controller, and an HS-UART mixed interface. In a single chip, it combines a WLAN MAC, a 2T2R capable WLAN baseband, and RF.

The WE310K6-P/M.2 provides a complete solution for a high-performance integrated wireless and bluetooth device.

3.2 Product Variants

The Telit WE310K6 module is available in two variants, namely:

- WE310K6-P
- WE310K6-P M.2

WE310K6-P	WE310K6-P M.2
	

Figure 1: Product Variants

The WE310K6-P M.2 configuration involves mounting the WE310K6-P module to an M.2 interface adapter board that adheres to the following M.2 specification details:

- SDIO based Socket 1
- 2230 size type
- Incorporates a Key Type E design.

> **Note:** Provides advice and suggestions that may be useful when integrating the module. (EN) The integration of the WE310K6-P/M.2 module within the user application shall be done according to the design rules described in this manual.
>
> (IT) L'integrazione del modulo cellulare WE310K6-P/M.2 all'interno dell'applicazione dell'utente dovrà rispettare le indicazioni progettuali descritte in questo manuale.

(DE) Die Integration des WE310K6-P/M.2 Mobilfunk-Moduls in ein Gerät muß gemäß der in diesem Dokument beschriebenen Kunstruktionsregeln erfolgen.

(SL) Integracija WE310K6-P/M.2 modula v uporabniški aplikaciji bo morala upoštevati projektna navodila, opisana v tem priročniku.

(SP) La utilización del modulo WE310K6-P/M.2 debe ser conforme a los usos para los cuales ha sido deseñado descritos en este manual del usuario.

(FR) L'intégration du module cellulaire WE310K6-P/M.2 dans l'application de l'utilisateur sera faite selon les règles de conception décrites dans ce manuel.

[HE] השילוב של המודול הסלולרי WE310K6-P/M.2 באפליקציה של המשתמש יעשה בהתאם לכללי התכנון המתוארים במדריך זה.

3.3 Features

- CMOS MAC, Baseband PHY, and RF in a single chip for IEEE 802.11a/b/g/n/ac/ax compatible WLAN.
- Supports 20/40MHz at 2.4GHz and supports 20/40/80MHz at 5GHz band channels.
- Two Transmit and Two Receive paths, 20MHz / 40MHz/ 80MHz bandwidth transmission.
- Supports 802.11ac 2x2, Wave-2 compliant with MU-MIMO.
- Maximum PHY data rate up to 286.8Mbps using 20MHz bandwidth, 573.5Mbps using 40MHz bandwidth, and 1201Mbps using 80MHz bandwidth.
- Bluetooth 5 system (BT 5.2 Logo compliant)
- Compatible with Bluetooth v2.1+EDR
- Dual Mode support: Simultaneous LE and BR/EDR.
- Supports multiple Low Energy states.
- Integrated LTE - Wi-Fi/ Bluetooth® coexistence filter.
- Enhanced BT/WIFI Coexistence control to improve transmission quality in different profiles.
- Industrial grade temperature range.

Table 2: Main Feature

Feature	Specification
Technology	Wi-Fi + Bluetooth
Frequency Range	WLAN: 2.4G: 2412MHz ~ 2484MHz, 5G: 5150MHz ~ 5850MHz
	Bluetooth: 2402MHz ~ 2480MHz
Bluetooth standards	Bluetooth v5.2
Standard Supported	BR/EDR/LE
Wi-Fi Standards	802.11 ax/ac/a/b/g/n
Wi-Fi Bandwidth	Up to 80MHz
MIMO	2x2 MU-MIMO
Data Rate	WLAN: Up to 1200 Mbps

Feature	Specification
	Bluetooth: Up to 3Mbps
Modulation	WLAN: DBPSK, DQPSK, CCK, BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM
	Bluetooth: GFSK, π/4-DQPSK, 8-DPSK
Output Power	WLAN: Up to 18dBm
	Bluetooth: 5dBm
Interface Type	WLAN: PCIe
	Bluetooth: UART, PCM
Form Factor	WE310K6-P: LGA module, 95 pins WE310K6-P M.2: M.2 2230 E Key
Antenna	RF_S0/ANT2(Main): WLAN RF_S1/ANT1(AUX): WLAN/BT
Supply Voltage	Main: 3.3V DC
	VIO: 1.8V or 3.3V DC
Temperature Range	Operating: -40^{0}C to +85^{0}C
	Storage: -55^{0}C to +125^{0}C

3.4 Mechanical Specifications

Dimensions

The overall dimensions of the WE310K6 module:

- WE310K6-P: 18mm(L) x 15mm(W) x 2.6mm(H)
- WE310K6-P M.2: 30mm(L) x 22mm(W) x 3.4mm(H)

Weight

- WE310K6-P: 1.5g
- WE310K6-P M.2: 3g.

3.5 Block Diagram

The following figure shows a block diagram of the WE310K6-P/M.2 module and its major functional components.

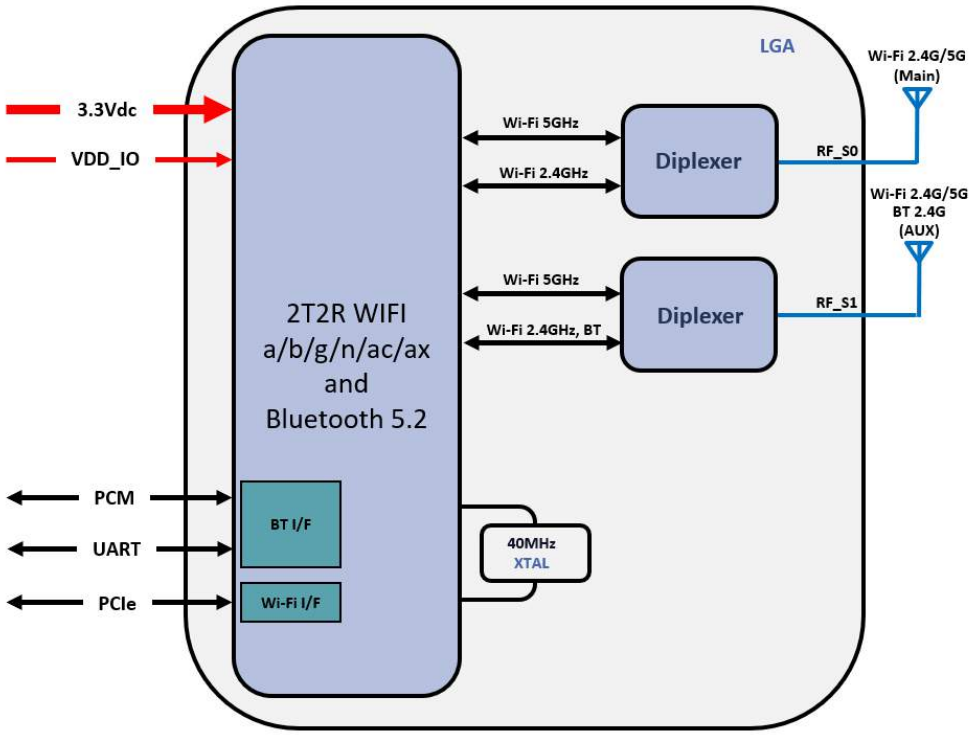

Figure 2: WE310K6-P Module Block Diagram

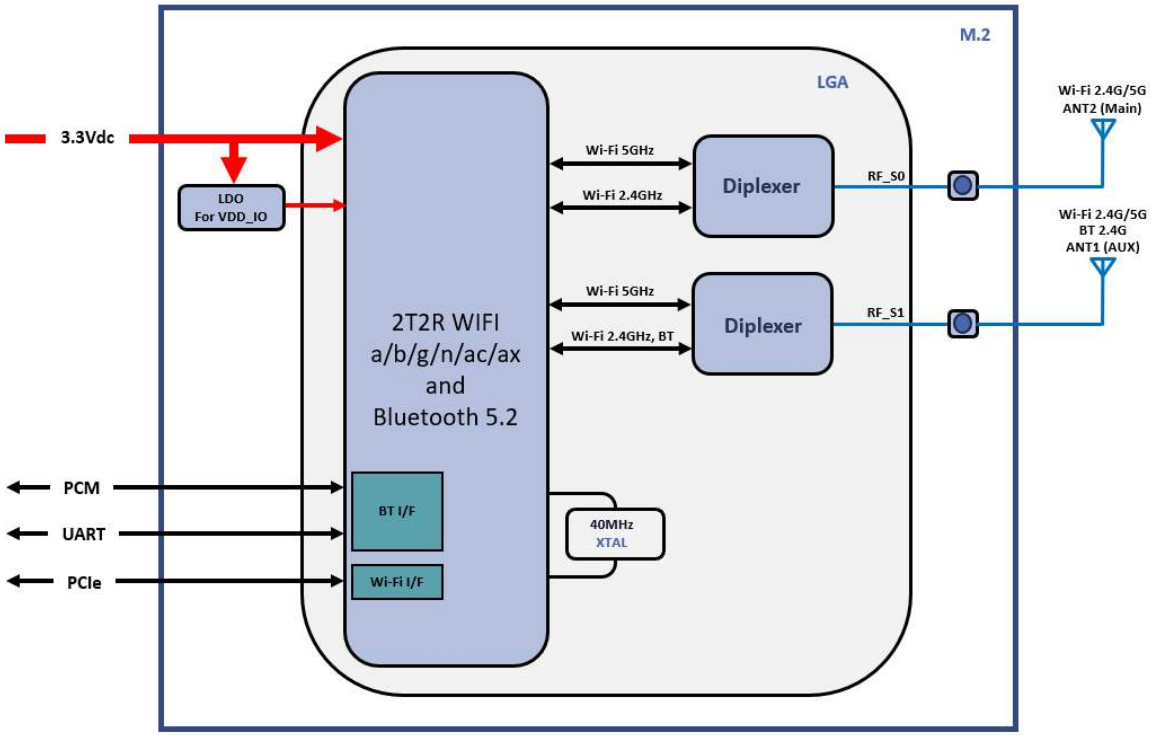

Figure 3: WE310K6-P M.2 Module Block Diagram

4 Pins Allocation

4.1 Pin-out

Table 3: PCIe

Pin	Signal	I/O	Function	Type	Comment
PCIe					
G1	PCIE_RX_P	I	PCI Express Receive Differential Pair-Plus	Analog Input	
H2	PCIE_RX_N	I	PCI Express Receive Differential Pair-Minus	Analog Input	
K2	PCIE_TX_P	O	PCI Express Transmit Differential Pair-Plus	Analog Output	
J1	PCIE_TX_N	O	PCI Express Transmit Differential Pair-Minus	Analog Output	
M2	REFCLK_P	I/O	PCI Express Differential Reference Clock Source - Plus	Analog Input/Output	
L1	REFCLK_N	I/O	PCI Express Differential Reference Clock Source - Minus	Analog Input/Output	
P2	PEWAKE	O	PCIe wake-up signal The host pull-up voltage can support 1.8V or 3.3V		Active Low Open drain
N1	CLKREQn	I/O	PCIe Reference Clock Request Signal The host pull-up voltage can support 1.8V or 3.3V		Active Low Open drain
T2	PERSTn	I	PCIe reset signal The host pull-up voltage can support 1.8V or 3.3V		Active Low

Table 4: UART

Pin	Signal	I/O	Function	Type	Comment
UART					
Y16	UART_RX	I	High-Speed UART Data In	VDD_IO	
AA15	UART_TX	O	High-Speed UART Data Out	VDD_IO	
Y18	UART_CTS	I	High-Speed UART CTS	VDD_IO	
AA17	UART_RTS	O	High-Speed UART RTS	VDD_IO	

Table 5: PCM

Pin	Signal	I/O	Function	Type	Comment
PCM					
C1	PCM_SYNC	O	PCM Synchronization control	VDD_IO	
F2	PCM_CLK	I/O	PCM Clock	VDD_IO	
D2	PCM_IN	I	PCM data Input	VDD_IO	
E1	PCM_OUT	O	PCM data Output	VDD_IO	

Table 6: Digital I/O

Pin	Signal	I/O	Function	Type	Comment
Digital I/O					
G4	WL_DIS_N	I/O	WLAN Radio-off function	VDD_IO	Active Low Internal PU(100K)
R4	BT_DIS_N	I/O	BT off function	VDD_IO	Active Low Internal PU(100K)
V7	HOST_WAKE_BT	I/O	BT wake on host side	VDD_IO	Active high NC if not used.
V9	BT_WAKE_HOST	I/O	BT wake on module side	VDD_IO	Active high NC if not used.
B2	WL_LED	O	WL LED Pin	3.3V	Active Low NC if not used.
P18	BT_LED	O	BT LED Pin	3.3V	Active Low NC if not used.

Table 7: RF

Pin	Signal	I/O	Function	Type	Comment
RF					
A5	RF_S0	I/O	Main ANT WLAN 2.4G, 5G input/output	RF	
A15	RF_S1	I/O	AUX ANT WLAN 2.4G, 5G input/output BT RF input/output	RF	

Table 8: Power Supply

Pin	Signal	I/O	Function	Type	Comment
Power Supply					
W1	VBATT_3V3	-	Main power supply	3.3V	
AA3	VBATT_3V3	-	Main power supply	3.3V	
R1	VDD_IO	-	IO power supply	3.3V Or 1.8V(Default)	
A3	GND	-	Ground		
A7	GND	-	Ground		
A9	GND	-	Ground		
A13	GND	-	Ground		
A17	GND	-	Ground		
B4	GND	-	Ground		
B6	GND	-	Ground		
B10	GND	-	Ground		
B12	GND	-	Ground		
B14	GND	-	Ground		
B16	GND	-	Ground		
C19	GND	-	Ground		
D18	GND	-	Ground		
F8	GND	-	Ground		

Pin	Signal	I/O	Function	Type	Comment
F12	GND	-	Ground		
F18	GND	-	Ground		
G19	GND	-	Ground		
H6	GND	-	Ground		
H14	GND	-	Ground		
J19	GND	-	Ground		
K18	GND	-	Ground		
M18	GND	-	Ground		
N19	GND	-	Ground		
P6	GND	-	Ground		
P14	GND	-	Ground		
T8	GND	-	Ground		
T12	GND	-	Ground		
U1	GND	-	Ground		
V2	GND	-	Ground		
Y2	GND	-	Ground		
Y4	GND	-	Ground		
W19	GND	-	Ground		

Table 9: Reserved

Pin	Signal	I/O	Function	Type	Comment
Reserved					
A1	RESERVED	-	RESERVED		
A11	RESERVED	-	RESERVED		
B8	RESERVED	-	RESERVED		
B18	RESERVED	-	RESERVED		
D7	RESERVED	-	RESERVED		
D9	RESERVED	-	RESERVED		
D11	RESERVED	-	RESERVED		
D13	RESERVED	-	RESERVED		
E19	RESERVED	-	RESERVED		
G16	RESERVED	-	RESERVED		
H18	RESERVED	-	RESERVED		
J4	RESERVED	-	RESERVED		
J16	RESERVED	-	RESERVED		
L4	RESERVED	-	RESERVED		
L16	RESERVED	-	RESERVED		
L19	RESERVED	-	RESERVED		
N4	RESERVED	-	RESERVED		
N16	RESERVED	-	RESERVED		
R16	RESERVED	-	RESERVED		
R19	RESERVED	-	RESERVED		
T18	RESERVED	-	RESERVED		
U19	RESERVED	-	RESERVED		

Pin	Signal	I/O	Function	Type	Comment
V11	RESERVED	-	RESERVED		
V13	RESERVED	-	RESERVED		
V18	RESERVED	-	RESERVED		
Y6	RESERVED	-	RESERVED		
Y8	RESERVED	-	RESERVED		
Y10	RESERVED	-	RESERVED		
Y12	RESERVED	-	RESERVED		
Y14	RESERVED	-	RESERVED		
AA5	RESERVED	-	RESERVED		
AA7	RESERVED	-	RESERVED		
AA9	RESERVED	-	RESERVED		
AA11	RESERVED	-	RESERVED		
AA13	RESERVED	-	RESERVED		

Note: Unused Pins can be left floating.

Warning: Reserved pins must not be connected.

4.2 Pads Layout

Top View

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A			GND		RF_S0		GND		GND		RES		GND		RF_S1		GND		
B		WL_LED		GND		GND		RES		GND		GND		GND		GND		RES	
C	PCM_SYNC																		GND
D		PCM_IN					RES		RES		RES		RES					GND	
E	PCM_OUT																		RES
F		PCM_CLK						GND				GND						GND	
G	PCIE_RX_P			WL_DIS_N												RES			GND
H		PCIE_RX_N				GND								GND				RES	
J	PCIE_TX_N			RES												RES			GND
K		PCIE_TX_P																GND	
L	REFCLK_N			RES												RES			RES
M		REFCLK_P																GND	
N	CLKREQ_N			RES												RES			GND
P		PEWAKE				GND								GND				BT_LED	
R	VDD_IO			BT_DIS_N												RES			RES
T		PERSTn						GND				GND						RES	
U	GND																		RES
V		GND					HOST_WAKE_BT		BT_WAKE_HOST		RES		RES					RES	
W	VBATT_3V3																		GND
Y		GND		GND		RES		RES		RES		RES		RES		UART_RX		UART_CTS	
AA			VBATT_3V3		RES		RES		RES		RES		RES		UART_TX		UART_RTS		

Figure 4: WE310K6-P Pads Layout Top View

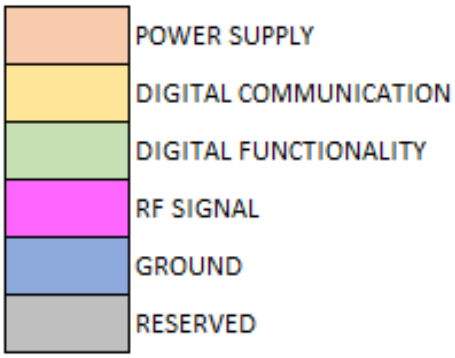

Figure 5: WE310K6-P PIN Out Legend

4.3 Pin-out M.2

Table 10: PCIe

Pin	Signal	I/O	Function	Type	Comment
PCIe					
35	PCIE_RX_P	I	PCI Express Receive Differential Pair-Plus	Analog Input	
37	PCIE_RX_N	I	PCI Express Receive Differential Pair-Minus	Analog Input	
41	PCIE_TX_P	O	PCI Express Transmit Differential Pair-Plus	Analog Output	
43	PCIE_TX_N	O	PCI Express Transmit Differential Pair-Minus	Analog Output	
47	PCIE_REFCLK_P	I/O	PCI Express Differential Reference Clock Source - Plus	Analog Input/Output	
49	PCIE_REFCLK_N	I/O	PCI Express Differential Reference Clock Source - Minus	Analog Input/Output	
55	PEWAKE#	O	PCIe wake-up signal	3.3V	Active Low Open drain
53	CLKREQ#	I/O	PCIe Reference Clock Request Signal	3.3V	Active Low Open drain
52	PERST#	I	PCIe reset signal	3.3V	Active Low

Table 11: UART

Pin	Signal	I/O	Function	Type	Comment
UART					
32	UART_RX	I	High-Speed UART Data In	1.8V	
22	UART_TX	O	High-Speed UART Data Out	1.8V	
36	UART_CTS	I	High-Speed UART CTS	1.8V	
34	UART_RTS	O	High-Speed UART RTS	1.8V	

Table 12: PCM

Pin	Signal	I/O	Function	Type	Comment
PCM					
10	PCM_SYNC	I/O	PCM Synchronization control	1.8V	
8	PCM_CLK	I/O	PCM Clock	1.8V	
14	PCM_IN	I	PCM data Input	1.8V	
12	PCM_OUT	O	PCM data Output	1.8V	

Table 13: Digital I/O

Pin	Signal	I/O	Function	Type	Comment
Digital I/O					
56	WL_DIS_N_3V3	I/O	WLAN Radio-off function	3.3V	Active Low Internal PU(100K)
54	BT_DIS_N_3V3	I/O	BT off function	3.3V	Active Low Internal PU(100K)

Pin	Signal	I/O	Function	Type	Comment
42	HOST_WAKE_BT	I/O	BT wake on host side	1.8V	Active high NC if not used
20	BT_WAKE_HOST_3V3	I/O	BT wake on module side	3.3V	Active high NC if not used
6	WL_LED	O	WL LED Pin	3.3V	Active Low Open drain NC if not used
16	BT_LED	O	BT LED Pin	3.3V	Active Low Open drain NC if not used

Table 14: Power Supply

Pin	Signal	I/O	Function	Type	Comment
Power Supply					
2	VDD_3V3	-	Main power supply	3.3V	
4	VDD_3V3	-	Main power supply	3.3V	
72	VDD_3V3	-	Main power supply	3.3V	
74	VDD_3V3	-	Main power supply	3.3V	
1	GND	-	Ground		
7	GND	-	Ground		
33	GND	-	Ground		
39	GND	-	Ground		
45	GND	-	Ground		
51	GND	-	Ground		
57	GND	-	Ground		
63	GND	-	Ground		
69	GND	-	Ground		
75	GND	-	Ground		
18	GND	-	Ground		

Table 15: Reserved

Pin	Signal	I/O	Function	Type	Comment
Reserved					
3	RESERVED	-	RESERVED		
5	RESERVED	-	RESERVED		
9	RESERVED	-	RESERVED		
11	RESERVED	-	RESERVED		
13	RESERVED	-	RESERVED		
15	RESERVED	-	RESERVED		
17	RESERVED	-	RESERVED		
19	RESERVED	-	RESERVED		
21	RESERVED	-	RESERVED		
23	RESERVED	-	RESERVED		
59	RESERVED	-	RESERVED		
61	RESERVED	-	RESERVED		

Pin	Signal	I/O	Function	Type	Comment
65	RESERVED	-	RESERVED		
67	RESERVED	-	RESERVED		
71	RESERVED	-	RESERVED		
73	RESERVED	-	RESERVED		
38	RESERVED	-	RESERVED		
44	RESERVED	-	RESERVED		
46	RESERVED	-	RESERVED		
48	RESERVED	-	RESERVED		
50	RESERVED	-	RESERVED		
58	RESERVED	-	RESERVED		
60	RESERVED	-	RESERVED		
62	RESERVED	-	RESERVED		
64	RESERVED	-	RESERVED		
66	RESERVED	-	RESERVED		
68	RESERVED	-	RESERVED		
70	RESERVED	-	RESERVED		
40	RESERVED	-	RESERVED		

Note: Unused Pins can be left floating.

Warning: Reserved pins must not be connected.

4.4 Pad Layout M.2

The following figures show the M.2 layout:

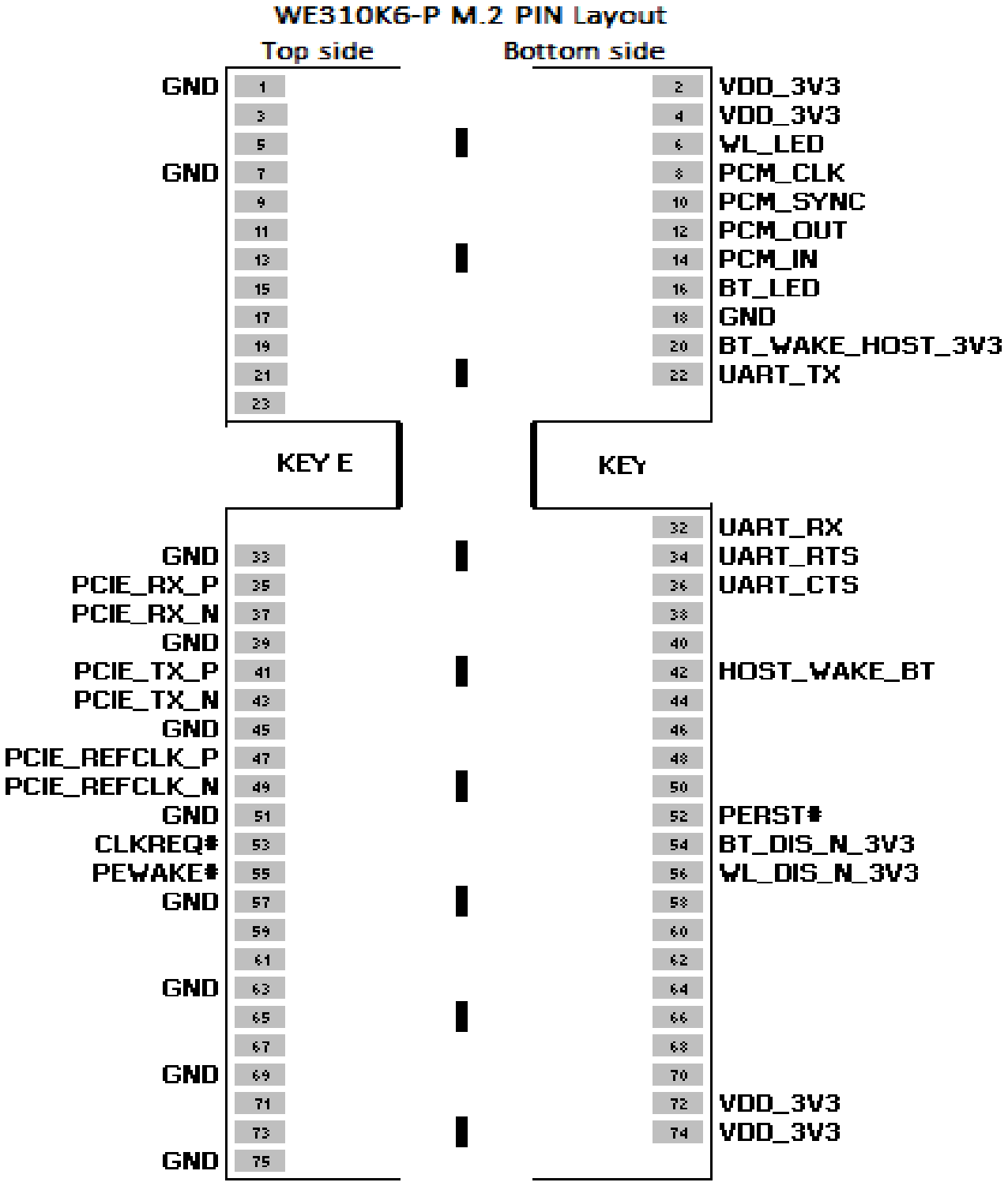

Figure 6: WE310K6-P M.2 Layout

5 Power Supply

The power supply circuitry and board layout are a very important part of the full product design and they strongly reflect on the product's overall performance, so the requirements and the guidelines that will follow should be read carefully for a proper design.

5.1 Power Supply Requirements

The WE310K6-P/M.2 can be directly supplied by a 3.3V power supply source capable of at least 500mA or higher. The voltage supply to all the required parts of the chipset is provided by an embedded switching regulator.

Table 16: Power Supply Requirements

Power Supply	Minimum	Typical	Maximum	Peak current
Main Power ratings	3.0V	3.3V	3.6V	2A

Table 17: PCIe Platform Power Rail Requirements

3.3V Power range	Ripple	Noise	Rise time	
			Minimum	Maximum
+/- 0.165V	300mVpp@ switching frequency>100KHz		0.5ms	5ms

5.2 Average Power Consumption

The table below shows the current consumption in different states. These measurements are obtained using a DC power analyzer.

Table 18: Module Power Consumption in Different States

Power Consumption		Typical Average (mA)
Standby		2.36
Idle (Wi-Fi in LPS mode, no scan)		3.3
LPS mode (with Wi-Fi Association)	2.4GHz	14.9
	5GHz	14.3
WOWLAN mode DTIM1	2.4GHz	4.4
	5GHz	3.2
WOWLAN mode DTIM3	2.4GHz	4
	5GHz	3.1
Wi-Fi 2G RX (continuous)	1x1 RX 11n HT40	123
	2x2 RX 11n HT40	158
Wi-Fi 5G RX (continuous)	1x1 RX 11ac VHT80	129
	2x2 RX 11ac VHT80	158
Bluetooth® wireless technology RX (peak current)		160
Bluetooth® wireless technology TX (at 5dBm)		190

5.3 WLAN Continuous Tx Power Consumption

The table below shows the current consumed by the module at different WLAN data rates. These measurements are obtained using a DC power analyzer.

Table 19: WLAN 2.4GHz Continuous Tx Power Consumption

Wi-Fi 2.4GHz	Operation mode	RF Output (dBm)		Current mA@3.3V
		Main	AUX	
1TX	802.11b 1Mbps	17		410
	802.11b 11Mbps	17		408
	802.11g 6Mbps	17		428
	802.11g 54Mbps	17		427
	802.11n HT20 MCS0	16		418
	802.11n HT20 MCS7	16		416
	802.11n HT40 MCS0	15		401
	802.11n HT40 MCS7	15		399
	802.11ac VHT20 MCS0	16		402
	802.11ac VHT20MCS8	15		378
	802.11ac VHT40 MCS0	15		385
	802.11ac VHT40 MCS9	14		361
	802.11ax HE20 MCS0	16		389
	802.11ax HE20 MCS11	13		361
	802.11ax HE40 MCS0	15		391
	802.11ax HE40 MCS11	13		356
2TX	802.11b 11Mbps	14	14	689
	802.11g 54Mbps	14	14	667
	802.11n HT20 MCS15	13	13	645
	802.11n HT40 MCS15	12	12	631
	802.11ac VHT20 MCS8	12	12	598
	802.11ac VHT40 MCS9	11	11	571
	802.11ax HE20 MCS11	10	10	580
	802.11ax HE40 MCS11	10	10	574

Table 20: WLAN 5GHz Continuous Tx Power Consumption

Wi-Fi 5GHz	Operation mode	RF Output (dBm)		Current mA@3.3V
		Main	AUX	
1TX	802.11a OFDM 6Mbps	17		509
	802.11a OFDM 54Mbps	17		474

Wi-Fi 5GHz	Operation mode	RF Output (dBm)		Current mA@3.3V
		Main	AUX	
	802.11n HT20 MCS0	16		480
	802.11n HT20 MCS7	16		459
	802.11n HT40 MCS0	15		444
	802.11n HT40 MCS7	15		437
	802.11ac VHT20 MCS0	16		460
	802.11ac VHT20 MCS8	15		446
	802.11ac VHT40 MCS0	15		411
	802.11ac VHT40 MCS9	14		424
	802.11ac VHT80 MCS0	15		437
	802.11ac VHT80 MCS9	14		422
	802.11ax HE20 MCS0	16		466
	802.11ax HE20 MCS11	13		418
	802.11ax HE40 MCS0	15		445
	802.11ax HE40 MCS11	13		414
	802.11ax HE80 MCS0	15		444
	802.11ax HE80 MCS11	13		421
2TX	802.11a OFDM 54Mbps	14	14	753
	802.11n HT20 MCS15	13	13	729
	802.11n HT40 MCS15	12	12	695
	802.11ac VHT20 MCS8	12	12	693
	802.11ac VHT40 MCS9	11	11	684
	802.11ac VHT80 MCS9	11	11	678
	802.11ax HE20 MCS11	10	10	665
	802.11ax HE40 MCS11	10	10	674
	802.11ax HE80 MCS11	10	10	689

Danger: The equipment must be supplied by an external limited power source in compliance with clause 2.5 of the standard EN 60950-1.

PCB Design Guidelines

As components and PCBs continue to shrink and component density increases, heat dissipation becomes a crucial concern. Therefore, it is vital to pay special attention to the PCB stack-up and components placement. The following PCB design rules are aimed at enhancing RF immunity and facilitating better heat dissipation.

1. Use at least six layers of PCB technology.
2. Designate Layer 2 and Layer 4 primarily for ground connections.
3. On top of Layer 1 and at the bottom of Layer 6, place mainly ground plane interrupted just by component pads and RF antenna tracks.
4. Minimize tracks connecting Layer 3 to Layer 5 to prevent ground interruption and improve heat dissipation.
5. Reserve Layer 3 and Layer 5 exclusively for signals, where power lines are wider tracks and surrounded by ground to reduce the risk of crosstalk with other signals.
6. Use one layer for horizontal lines only, and another one for vertical lines. Fill the remaining space with the ground.
7. Use several vias to connect all ground planes and areas in all layers with possible through-hole drills.
8. Position components generating heat on the PCB's top side, providing ample space around them for improved airflow.
9. If it is a closed application, consider adding ventilation holes on both the top and bottom of the cover to facilitate airflow.

   Note: It is recommended to use 4-layer only if the number of interconnections allows for routing on Layer2 and Layer3 in a way that avoids overlapping between power lines and signal lines, and the module is operating continuously, so the heat dissipation is not a must. However, all other suggested guidelines outlined above must be fulfilling.
10. The top and bottom layers should primarily consist of a ground plane , with interruptions only at the locations of components pads, vias, and RF tracks.
11. Connect all ground areas avoiding isolated islands with several vias.
12. The PCB outline should be surrounded by GND vias interconnected from TOP to Bottom.

    Note: It is recommended to fill the free space in the inner layers with the ground.
13. Pay attention on establishing robust connectivity between all ground areas or planes to ensure a consistent equipotential node.

ESD Characteristics

The table below lists the ESD characteristics of the WE310K6-P/M.2 modules.

Table 21: ESD Characteristics

ESD	Value
Human Body Model (HBM)	±2000
Charge Device Model	±500

Power Supply Design Guidelines

It is recommended to add an external EMI filter to improve the quality of the power supply especially when the module will be embedded with other technologies, (i.e. Cellular).

The pi-greca filter composed of ferrite bead and 10pF capacitors (C2, C3) is used to provide a high impedance value for high-frequency signals, while the 100uF and 22uF capacitors (C1. C5, and C4) are used to bypass low frequencies from switching regulator circuit and to provide a supply tank for high current absorption.

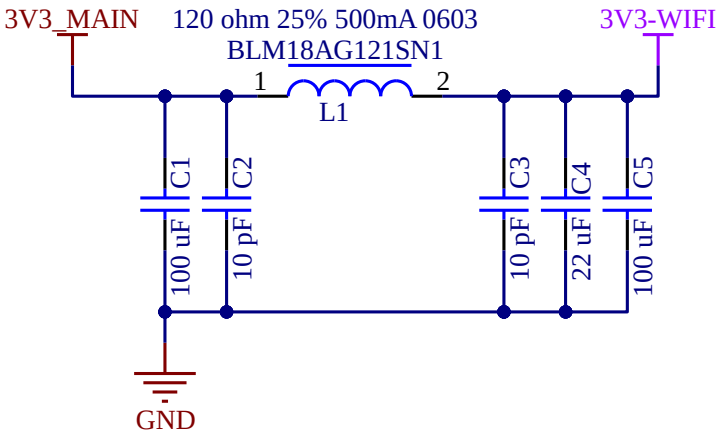

Figure 7: WE310K6-P EMI Filter Example Circuit

The figure above shows an example circuit with the minimum allowable capacitor values.

Table 22: Power Supply Requirement

Power Supply	Minimum	Typical	Maximum
Main Power ratings	3.0 V	3.3V	3.6 V

> **Note:** Ensure that the Extreme Operating Voltage Range MUST never be exceeded. Inadequate power supply design may result in significant voltage drops.

The hardware shutdown voltage of the module is 3.0V. If the voltage drops below 3.0V, the module hardware will be shut down.

Bypass Capacitors

To improve the harmonic filtering, it is recommended to add bypass capacitors, close to:

- Power sources and signals on input-output connectors
- At power supply output PADs.
- At component's power supply input PADs (even if shielded).
- Diodes in forwarding conduction, such as LEDs, on the anode and/or cathodes if not directly tied to a power net.
- Transistor bases, mainly for bipolar transistors, phototransistors, and opto-isolators
- Operational Amplifiers Inputs and supplies.

6 Digital Section

6.1 Logic Level

Table 23: Logic Levels-3.3V

Power Supply	Minimum	Typical	Maximum
V_{IH} Input high level	2.0V	3.3V	3.6V
V_{IL} Input low level	-	0	0.9V
V_{OH} Output high level	2.97V	-	3.3V
V_{OL} Output low level	0	-	0.33V

Table 24: Logic Levels-1.8V

Power Supply	Minimum	Typical	Maximum
V_{IH} Input high level	1.7V	1.8V	3.6V
V_{IL} Input low level	-	0	0.8V
V_{OH} Output high level	1.62V	-	1.8V
V_{OL} Output low level	0	-	0.18V

6.2 Power ON/OFF Sequences

The module power ON/OFF sequences are shown below:

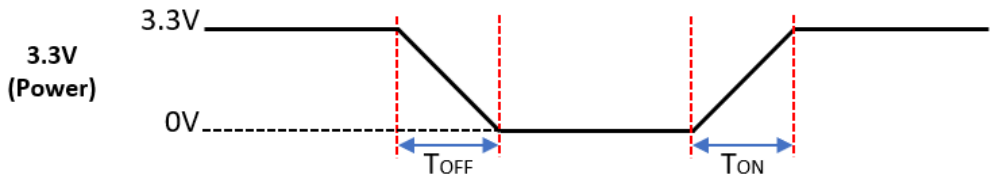

Figure 8: 3.3V Power ON/OFF sequences

Table 25: Timing Specification of Power ON/OFF sequence

Symbol	Minimum	Typical	Maximum	Unit
T_{OFF}	1.5	-	-	ms
T_{ON}	0.5	1.5	5	ms

The module PCIe bus Power sequences are shown below:

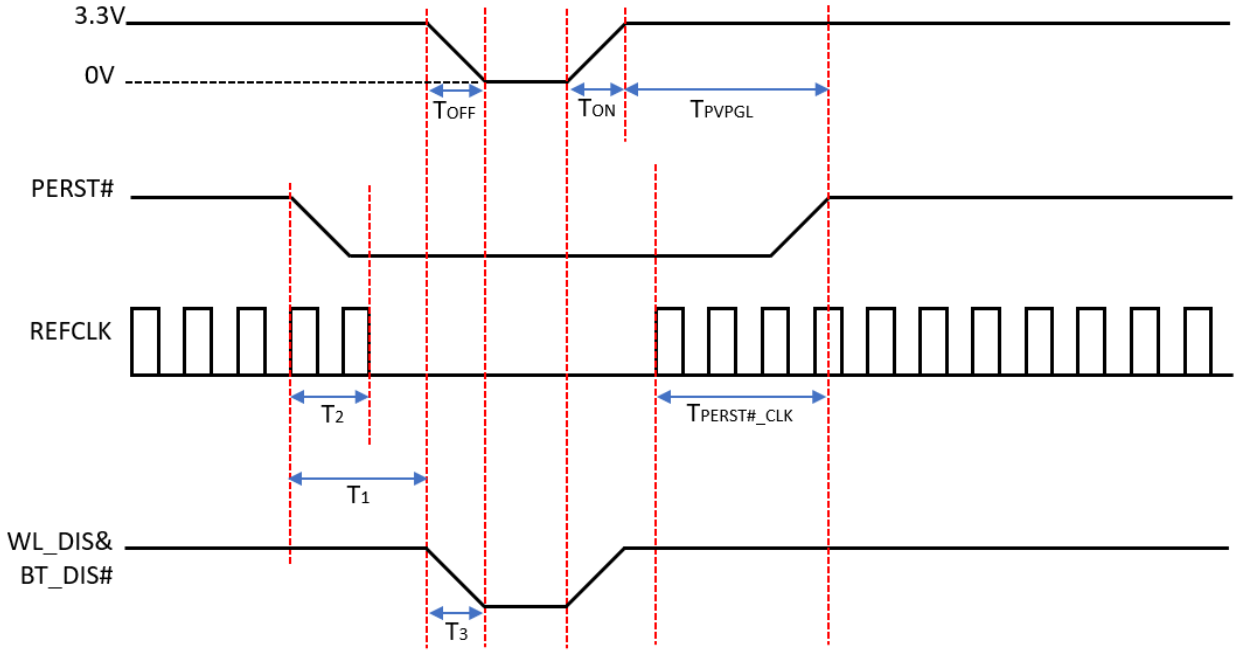

Figure 9: When WLAN is power off.

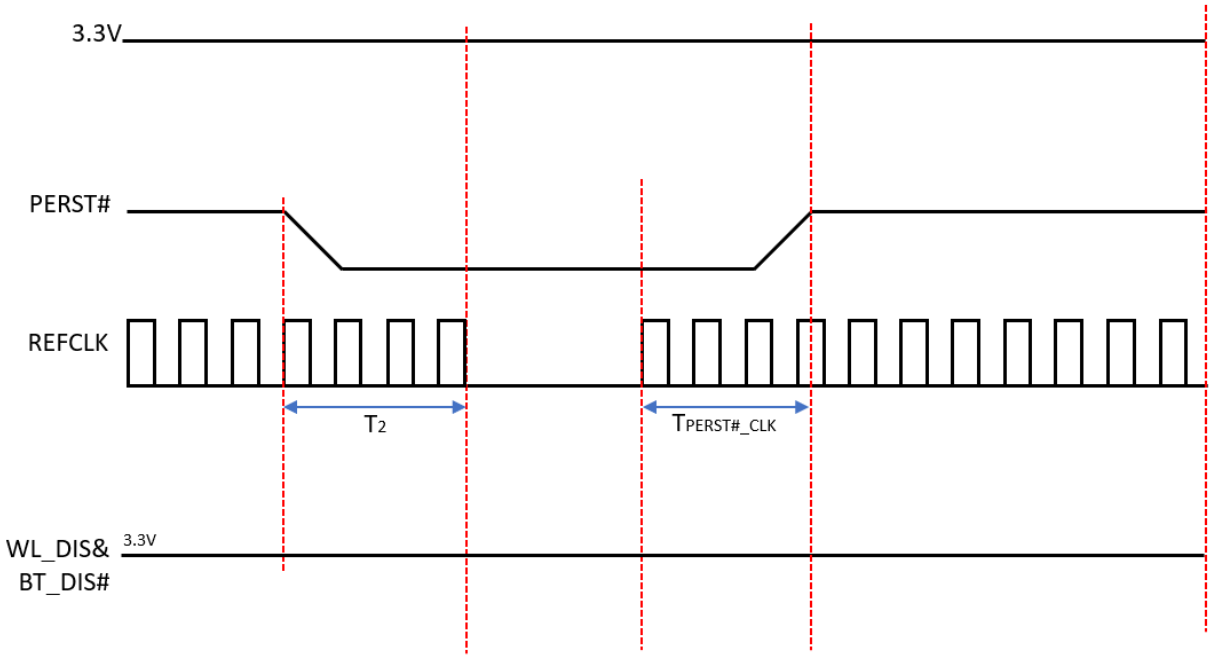

Figure 10: When WLAN is Not power off.

Table 26: PCIe Signal Timing Range

Symbol	Minimum	Typical	Maximum	Unit
T_{ON}	0.5	1.5	5	ms
T_{OFF}	1.5	-	-	ms
T_{PVPGL}	50ms (recommended) Implementation spec	-	-	ms
$T_{PERST\#\_CLK}$	100	-	-	us

Note:

- T_{ON} : The main power ramp-up duration.
- T_{OFF} : the main power-off duration.
- T_{PVPGL} : The duration from power valid to PERST# input inactive.
- $T_{PERST\#\_CLK}$: The duration from the reference clock becoming stable before PERST# inactive.
- T1 : The duration from PERST# goes active before the power on the connector is removed.
- T2 : The duration from clock to inactive after PERST# goes active.
- T3 : The duration from WL_DIS# and BT_DIS# goes asserted when the power on the connector is removed.
- T1/T2/T3 timing value should be greater than 0.

6.3 Communication Ports

UART

The UART interface is a 4-wire interface with RX, TX, CTS, and RTS. The interface supports the Bluetooth 2.0 UART HCI H4 and H5 specifications. The default baud rate is 115.2 k baud.

When the UART_CTS signal is set high, the device stops transmitting on the interface.

The UART signal level ranges from 1.8V and 3.3V. The host provides the power source with the desired power level to the WE310K6-P/M.2 UART interface via the VDD_IO pin.

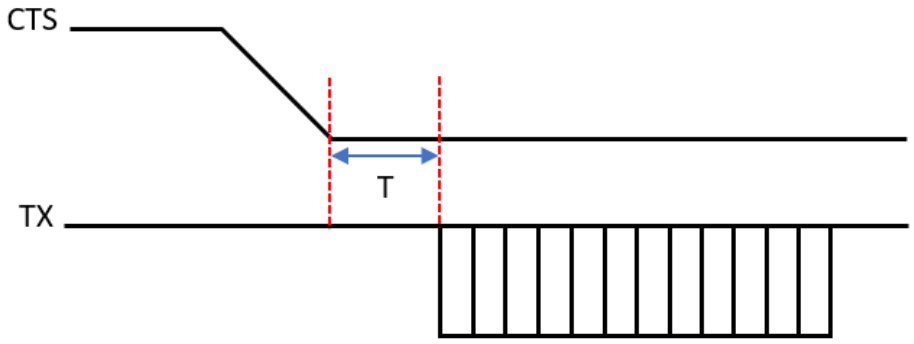

Figure 11: UART Timing Diagram

Table 27: UART Timing Characteristics

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Baud rate	-	115.2(default)	-	3000	Kbps
CTS low to TX_DATA on	T	0	2	-	ns

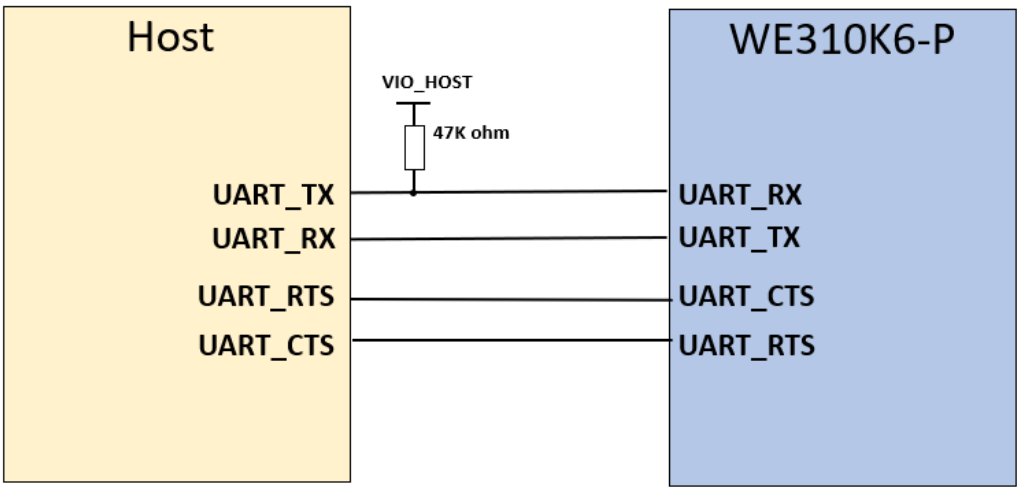

Figure 12: HCI Connection for H4 Protocol

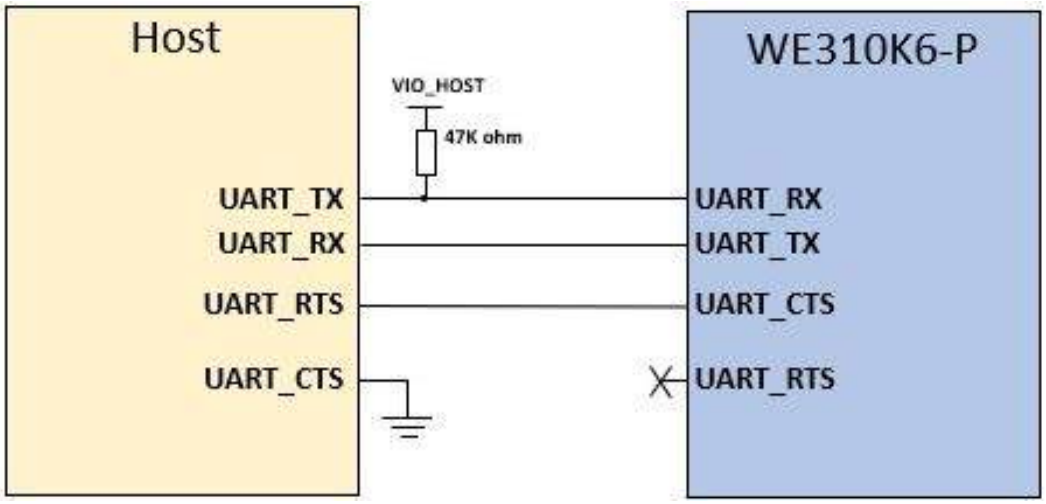

Figure 13: HCI Connection for H5 Protocol

Note: Reserve a 47K pull-high resistor on host TXD when this port is not in output mode for default. (if not sure, reserve a 47K resistor is recommended to avoid TXD floating).

PCIe

The WE310K6-P/M.2 module incorporates a PCIe interface, which requires the installation of AC-coupling series capacitors on the RX lines in both directions. To interface PCIe with the application board that controls the modem, 100nF capacitors should be installed on the PCIE_RX_P/M lines of the WE310K6-P/M.2.

The series capacitors are already placed on PCIE_TX_P/M lines inside the WE310K6-P/M.2 module.

When the PERST# is asserted during the power-on state, the WE310K-6 module returns to a pre-defined reset state. It becomes ready for initialization and configuration once the PERST# signal is de-asserted.

The WAKE# pin is used to re-enable the main power rail and reference clock for the PCI Express slot.

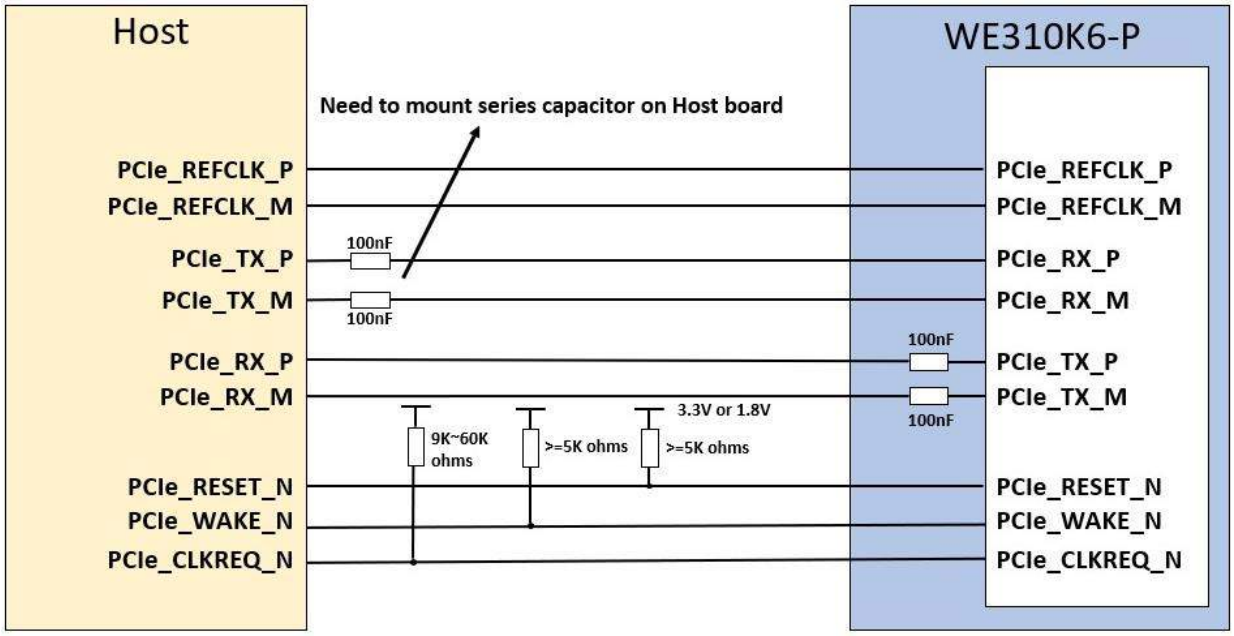

Figure 14: PCIe Interface Connection

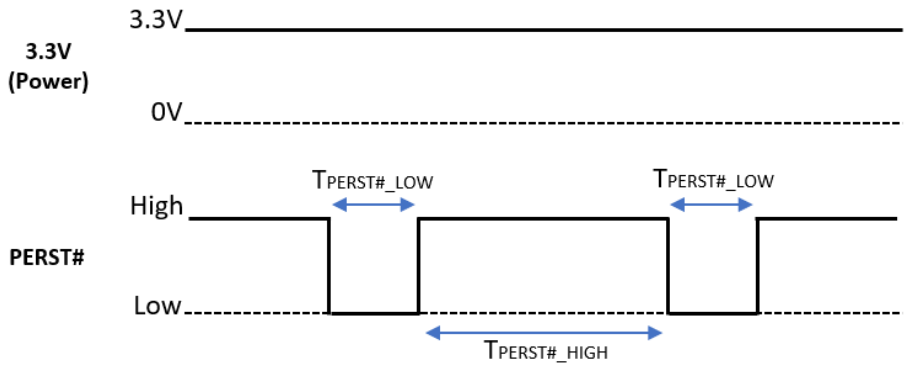

Figure 15: PCIe PERST# Timing sequence (if need at least twice)

Table 28: PCIe PERST Timing Parameters

Parameter	Minimum	Typical	Maximum	Unit	Comment
$T_{PERST\#\_LOW}$	6	10	-	ms	Low duration
$T_{PERST\#\_HIGH}$	400	500	-	ms	High duration

The below guidelines will provide general guidelines for the PCIe interface to improve signal integrity.

- All other sensitive/high-speed signals and circuits must be protected from PCIe corruption.
- PCIe signals must be protected from noisy signals (clocks, SMPS, and so forth)
- Pay extra attention to crosstalk, ISI, and intraplane skew and impedance discontinuities.
- PCIe Tx AC coupling capacitors are better placed close to the source or receiver side to keep good SI of route on the PCB.
- To maintain impedance balance, maintain positive and negative traces as balanced as possible in terms of the signal and its return path.

- Trace length matching between the reference clock, Tx, and Rx pairs are not required.
- External capacitors also should keep differential traces. Ensure not to stagger the capacitors. This can affect the differential integrity of the design and can create EMI.

Table 29: PCIe Routing Constraints

Guidance Type	Guideline	Requirement
General	Impedance	Gen2 : 85Ohms +/- 10% REFCLK : 100 Ohms +/- 10%
Intra-pair trace layout requirement - Mismatch	Host(both TX/RX pairs)	< 10mil
	Device(both TX/RX pairs)	< 5mil
Component	AC capacitance	100 nF

PCM

The WE310K6-P/M.2 supports a PCM digital audio interface that is used for transmitting digital audio/voice data to/from the Audio Codec.

The PCM signal level ranges from 1.8V to 3.3V. The host provides the power source with the desired power level to the WE310K6-P/M.2 PCM interface via the VDD_IO pin.

USB Layout Guidelines

- If third-party components are required for enhancing signal quality, position them in close proximity to the USB connector.
- There are relatively fast edge rates, so must be routed away from sensitive circuits and signals such as RF, audio, and crystal oscillator (XO).
- Maintain good isolation between the USB connector and RF antennas (especially those operating at 2.4 GHz).
- Route the RF signals operating at a 2.4 GHz frequency with the highest isolation possible from USB_SS_TX/RX traces.
- USB SS Tx AC coupling capacitors are better placed close to the source or the ESD/connector side to maintain good signal integrity of the main route on PCB.
- Route differential pairs in the inner layers with a solid GND reference to have good impedance control and to minimize discontinuities.
- Maintain isolation between the Tx pair, Rx pair, and DP/DM to avoid crosstalk.
- The SS-USB Tx and Rx differential pair maximum length is recommended to be less than 130 mm.
- For USB 2.0 signal, the maximum trace length should be less than 230 mm.

Table 30: USB Routing Constraints

Guidance Type	Guideline	Requirement	
		USB 3.1 Gen 2	USB 2.0
General	Data rate	10 Gbps	480 Mbps
	Insertion loss at 5 GHz (dB)	-7 dB	N/A

Guidance Type	Guideline	Requirement	
		USB 3.1 Gen 2	USB 2.0
	Impedance	85 ohms differential	
	Bus length	130 mm	230 mm
Length matching	Intra length match	< 0.7 mm	< 2 mm
Spacing	To all other signals	> 4 x line width	> 3 x line width
	Tx lane to Rx lane	> 4 x line width	N/A
Component	AC capacitance	220 nF	N/A

6.4 Digital Functionality

WL_DIS_N

WL_DIS_N can be defined as the WLAN Radio-off function with host interface remaining connected.

When WL_DIS_N is pulled to a low state, the WLAN Radio will be disabled. The keeping low duration must be more than T_{OFF_WL} period.

When WL_DIS_N is pulled to a high state, WLAN Radio will be enabled. The keeping high duration must be more than T_{ON_WL}.

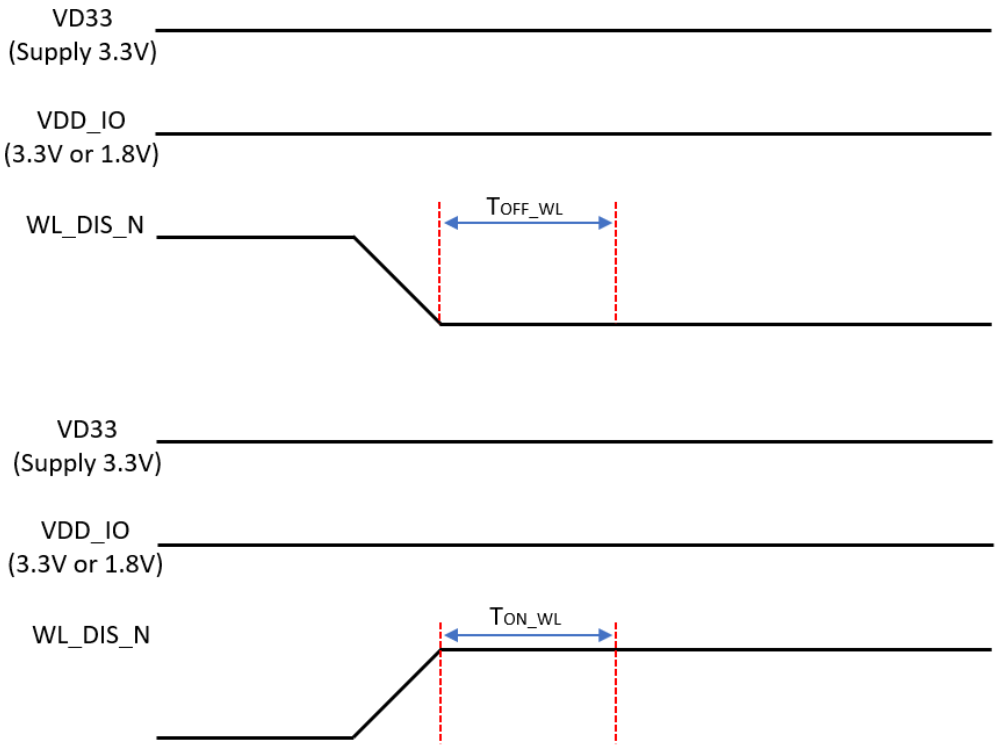

Figure 16: WLAN Radio ON/OFF Sequence

Table 31: WLAN Radio ON/OFF Timing Parameters

Parameter	Minimum	Typical	Maximum	Unit
T_{OFF_WL}	100	100	-	ms
T_{ON_WL}	100	100	-	ms

BT_DIS_N

BT_DIS_N can be defined as the BT off function with host interface remaining connected.

When BT_DIS_N is pulled to a low state, BT will be disabled. The keeping low duration must be more than BT_DIS_LOW.

When this pin is pulled to a low state, UART interface will be also disabled.

When BT_DIS_N is pulled to a high state, BT will be enabled. The keeping high duration must be more than BT_DIS_HIGH.

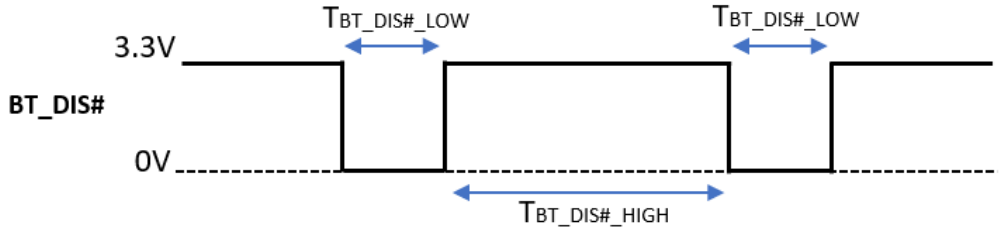

Figure 17: Bluetooth ON/OFF Sequence

Table 32: Bluetooth ON/OFF Timing Parameters

Parameter	Minimum	Typical	Maximum	Unit
BT_DIS#_LOW	200	-	-	ms
BT_DIS#_HIGH	500	-	-	ms

BT_WAKE_HOST

BT_WAKE_HOST is the output pin for the WE310K6 module. It generates a waveform that is then transmitted to the Host. Upon receiving this waveform, the Host is expected to wake up from its suspended state.

HOST_WAKE_BT

HOST_WAKE_BT is the input pin for the WE310K6 module. When the Host lowers this pin, it signals that the Bluetooth functionality is suspended. In response, WE310K6 enters a low-power mode (LPS).

7 RF Section

7.1 Wi-Fi Tx Power

The following table lists the WLAN conducted Tx power at 25°C @3.3V power supply.

Table 33: Wi-Fi 2.4GHz Tx Power

Operation Mode	802.11 EVM	Tx Output Power (± 2dBm)
802.11b_1ss_CCK_11Mbps	-9.1	17
802.11g_1ss_OFDM_54Mbps	-25	17
802.11n_1ss_HT20_MCS7	-27	16
802.11n_1ss_HT40_MCS7	-27	15
802.11ac_1ss_VHT20_MCS8	-30	15
802.11ac_1ss_VHT40_MCS9	-32	14
802.11ax_1ss_HE20_MCS11	-35	13
802.11ax_1ss_HE40_MCS11	-35	13

Table 34: Wi-Fi 5GHz Tx Power

Operation Mode	802.11 EVM	Tx Output Power (± 2dBm)
802.11a_1ss_OFDM_54Mbps	-25	17
802.11n_1ss_HT20_MCS7	-27	16
802.11n_1ss_HT40_MCS7	-27	15
802.11ac_1ss_VHT20_MCS8	-30	15
802.11ac_1ss_VHT40_MCS9	-32	14
802.11ac_1ss_VHT80_MCS9	-32	14
802.11ax_1ss_HE20_MCS11	-35	13
802.11ax_1ss_HE40_MCS11	-35	13
802.11ax_1ss_HE80_MCS11	-35	13

7.2 Wi-Fi Rx Sensitivity

Wi-Fi Rx sensitivity at 25°C @3.3V power supply.

Table 35: Wi-Fi 2.4GHz Rx Sensitivity

Operation Mode	Data Rate	Rx Sensitivity (dBm)
802.11b_1ss_CCK	1Mbps	-97
	11Mbps	-89
802.11g_1ss_OFDM	6Mbps	-93
	54Mbps	-76

Operation Mode	Data Rate	Rx Sensitivity (dBm)
802.11n_1ss_HT20	MCS0	-93
	MCS7	-75
802.11n_1ss_HT40	MCS0	-91
	MCS7	-72
802.11ac_1ss_VHT20	MCS0	-93
	MCS8	-71
802.11ac_1ss_VHT40	MCS0	-91
	MCS9	-66
802.11ax_1ss_HE20	MCS0	-94
	MCS11	-65
802.11ax_1ss_HE40	MCS0	-91
	MCS11	-62

Table 36: Wi-Fi 5GHz Rx Sensitivity

Operation Mode	Data Rate	Rx Sensitivity (dBm)
802.11a_1ss_OFDM	6Mbps	-93
	54Mbps	-76
802.11n_1ss_HT20	MCS0	-93
	MCS7	-74
802.11n_1ss_HT40	MCS0	-90
	MCS7	-71
802.11ac_1ss_VHT20	MCS0	-93
	MCS8	-70
802.11ac_1ss_VHT40	MCS0	-90
	MCS9	-65
802.11ac_1ss_VHT80	MCS0	-87
	MCS9	-62
802.11ax_1ss_HE20	MCS0	-92
	MCS11	-64
802.11ax_1ss_HE40	MCS0	-90
	MCS11	-61
802.11ax_1ss_HE80	MCS0	-88
	MCS11	-59

7.3 Bluetooth® Tx Power

The following table lists the BT/BLE conducted Tx power at 25°C @3.3V power supply.

Table 37: Bluetooth® Wireless Technology Tx Power

Technology	Packet Type	Modulation	Tx Output Power (dBm)
Bluetooth® Classic	BR 1M	GFSK	5.0
	EDR 2M	π/4 DQPSK	5.0
	EDR 3M	8DPSK	5.0
Bluetooth® Low Energy	LE 1M	GFSK	5.0
	LE 2M	GFSK	5.0

7.4 Bluetooth® Rx Sensitivity

Bluetooth® wireless technology Rx sensitivity at 25°C @3.3V power supply.

Table 38: Bluetooth® Wireless Technology Rx Sensitivity

Technology	Packet Type	Modulation	Rx Sensitivity (dBm)
Bluetooth® Classic	BR 1M	GFSK	-90
	EDR 2M	π/4 DQPSK	-93
	EDR 3M	8DPSK	-87
Bluetooth® Low Energy	LE 1M	GFSK	-98
	LE 2M	GFSK	-95

7.5 General Design Rules added as RF Design Guidelines

For the WE310K6-P, you will need to use an external antenna connected to the antenna pad of the module, such as an RF connector or SMA connector.

In this case, considering the position of the external antenna with respect to other boards is very important. the conductive planes close to the antenna can modify the impedance seen by the antenna or detune it.

- The WE310K6-P module features a 50Ω antenna pad that should be connected to the antenna connector (or integrated antenna) using a transmission line.
- Maintain an impedance as close as possible to 50Ω throughout the RF track, including the RF pad.
- The length of the trace or connection line should be kept as short as possible.
- The location of the external antenna and RF port of the module should be kept away from any noise sources and digital traces.

To avoid step impedance, try to track RF trace as much equal as possible to the pad with the matching components.

- To have a good impedance control consider using a Grounded coplanar waveguide structure (G-CPW) line.

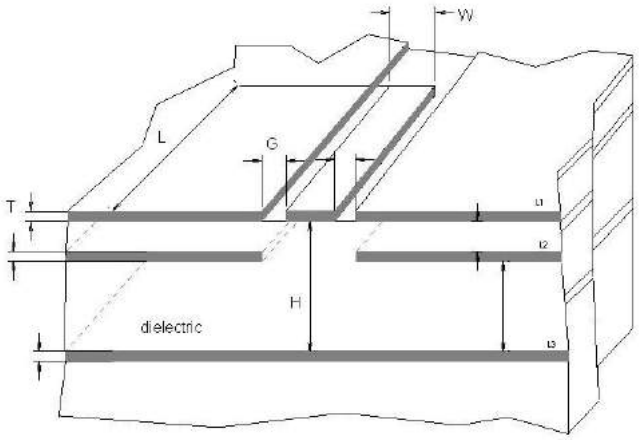

Figure 18: Coplanar Waveguide Dimensioning Example

The final dimensions depend on the use of stack-up. The WE310K6-P needs to be tuned in relationship to the stack-up used.

The following image shows the suggested layout for the Antenna pad connection.

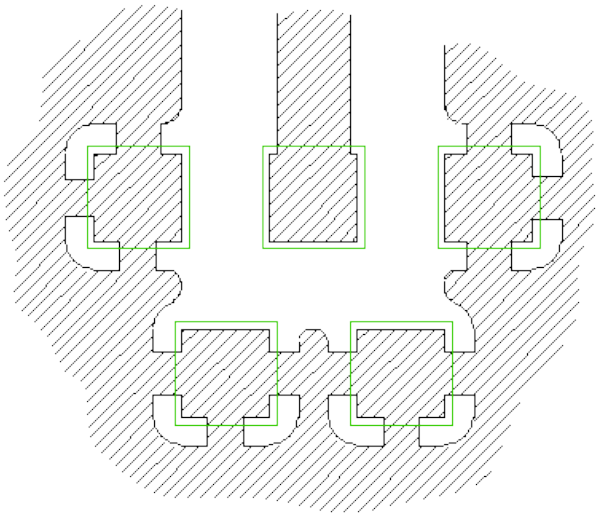

Figure 19: Layout for the Antenna pad connection

A matching network might be needed in between the external antenna and RF port to better match the impedance to minimize the return loss.

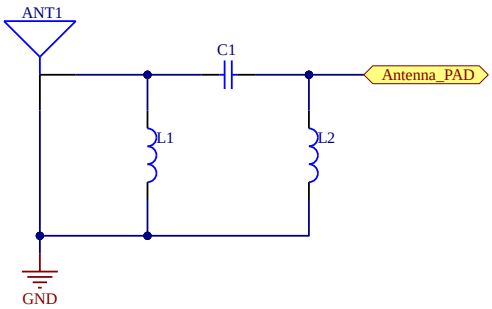

Figure 20: Minimal RF Matching Network Circuitry

The network topology depicted in the figure above comprises three passive components.

7.6 Antenna Requirements

Antenna Specification

The antenna specifications used by Telit Cinterion for certifications are listed in the table below. Customer can choose antenna having similar specifications.

Note: Gain should be lesser than the mentioned specifications.

Note: This specification is applicable for both main and Aux antenna.

Table 39: Antenna Specification

Frequency Range	Requirement
Frequency bands	2.412~2.484GHz 4.9~5.925GHz
VSWR	< 2.2:1 recommended
Max Gain (dBi)	2.412~2.484GHz: 2.5 4.9~5.925GHz: 4.5
Max Input Power (W)	50
Input Impedance (Ω)	50
Polarization Type	Vertical

To resue Telit's FCC certification for our module, the antenna on the application board shall have gain ≤2.5dBi@2.4GHz and ≤4.5dBi@5GHz. The separation distance between the user and/or bystander and the device's radiating element must be greater than 20cm and no other radiating element must be present inside the application closer than 20cm to our antenas. However, a separate test for any other radiating element could be necessary.

Telit recommends dipole antenna T-AT9552 from Atel-antennas.

Antenna Connector

The WE310K6-P M.2 module is furnished with a set of RF MHF-4 Receptacles from I-PEX with an impedance of 50 Ω.

For more information about mating connectors, please consult https://www.i-pex.com.

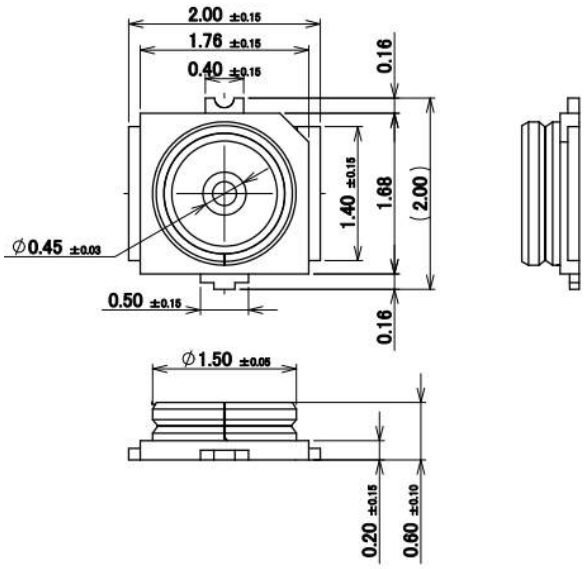

Figure 21: MHF-4 RF Connector

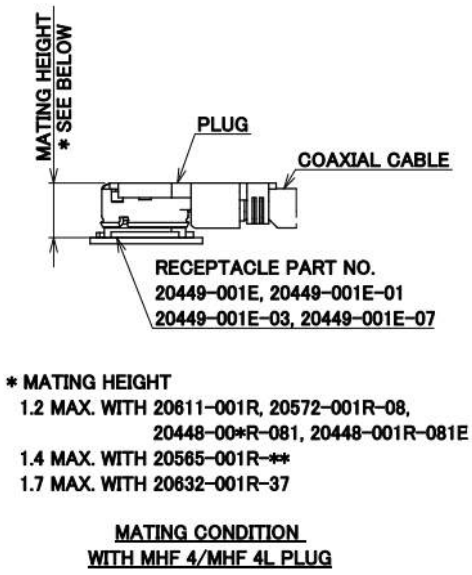

Figure 22: MHF-4 Receptacle

Antenna Cable

The cables used for connecting between the module and the Wi-Fi/Bluetooth antenna must possess a 50-ohm impedance. The mismatched impedance between the module and the cables can lead to a significant degradation in RF performance.

Table 40: Antenna Cable

Type	Requirements
2.412 ~ 2.484GHz	Cable insertion loss < 1dB
4.9 ~ 5.925GHz	Cable insertion loss < 1dB
Impedance must be 50 Ohm. Avoid coupling with other signals.	

Antenna Installation Guidelines

- Install the antenna in a place with Wi-Fi/Bluetooth signal coverage.
- Antenna must not be installed inside metal cases.
- Antenna must be installed according to the antenna manufacturer instructions.
- The Antenna integration should not perturb the radiation pattern described in the documentation of the Antenna manufacturer.
- It is preferable to obtain an omnidirectional radiation pattern.

8 Mechanical Design

8.1 WE310K6-P

The following is the bottom view and mechanical design of the Telit WE310K6-P/M.2 module.

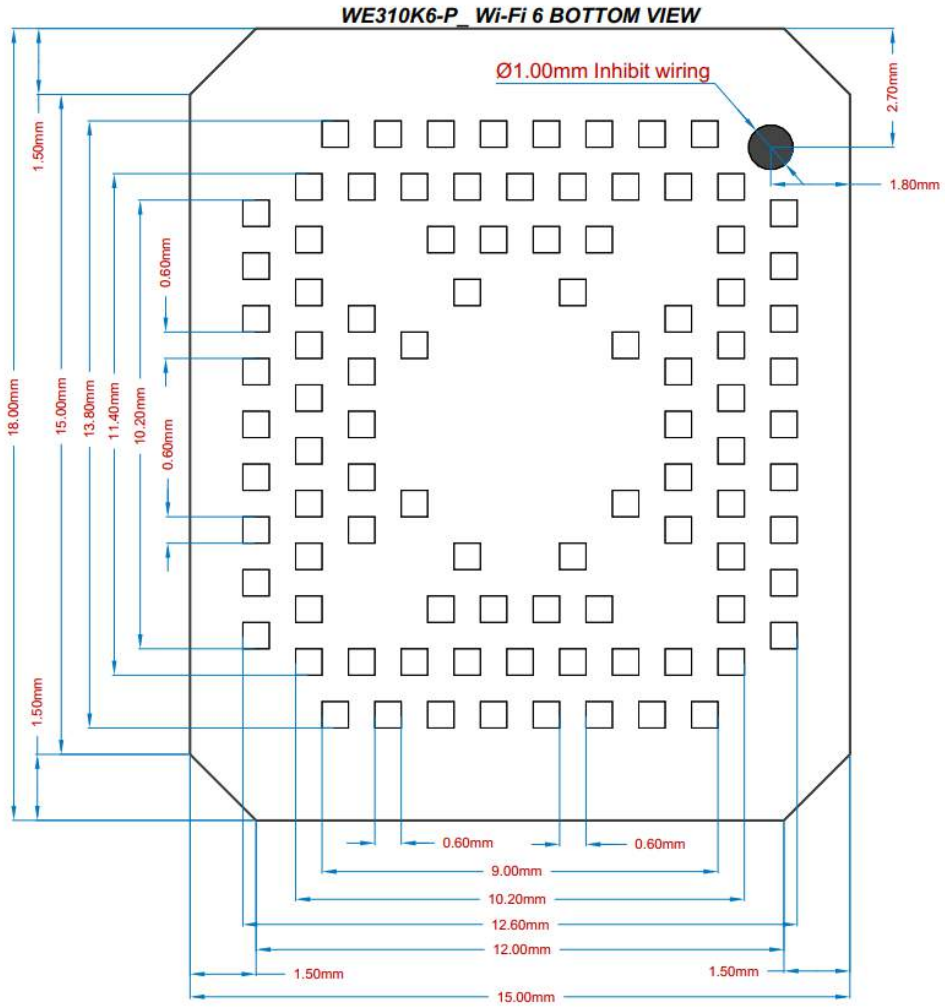

Figure 23: WE310K6-P Bottom View

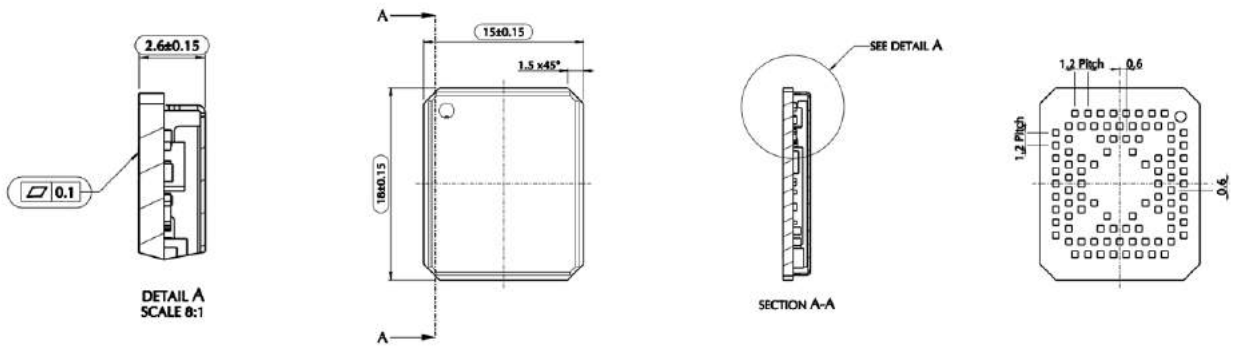

Figure 24: WE310K6-P Mechanical Design

8.2 WE310K6-P M.2

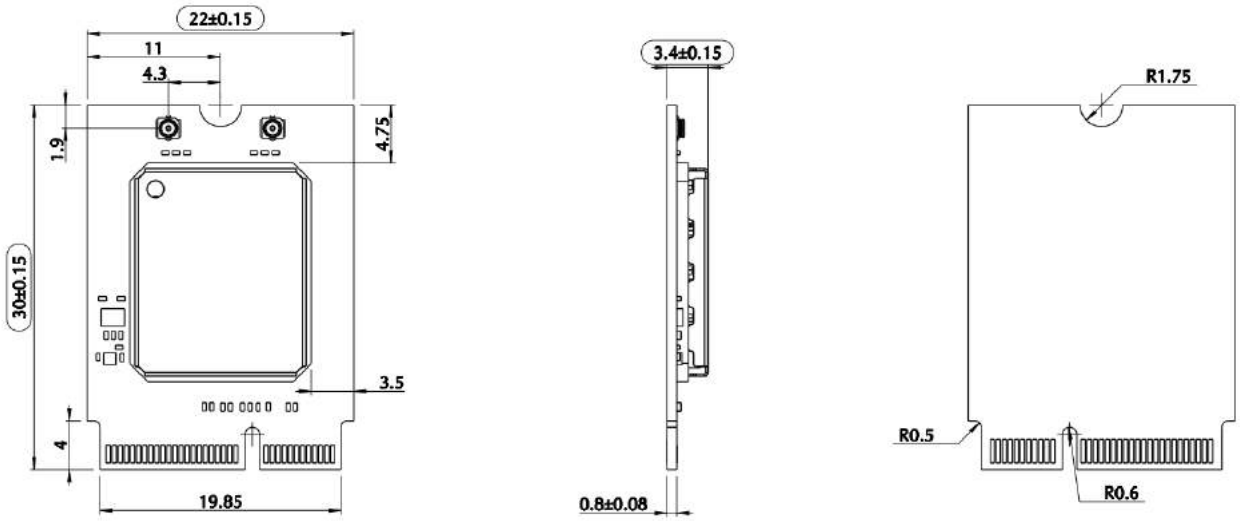

Figure 25: WE310K6-P M.2 Mechanical Design

9 Application PCB Design

The WE310K6-P modules have been designed to be compliant with a standard lead-free Surface Mount Technology (SMT) process.

9.1 PCB Pad Design

The solder pads on the PCB are recommended to be of the Non-Solder Mask Defined (NSMD) type.

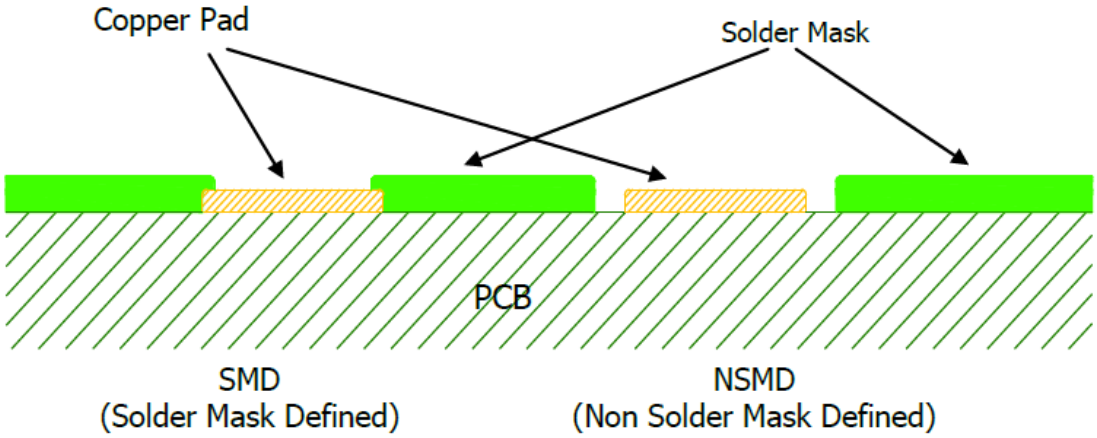

Figure 26: PCB Pad Design

9.2 Recommendations for PCB Pad Dimensions

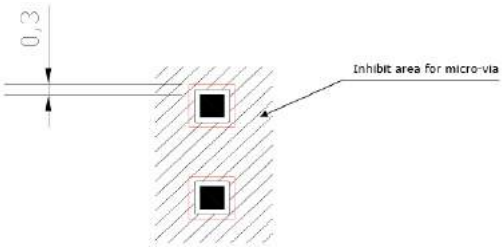

Figure 27: PCB Pad Dimensions

It is not recommended to place a via or micro-vias that are not covered by solder resist around the pads in an area of 0.3 mm, unless it carries the same signal as the pad itself. Micro vias inside the pads are allowed.

Holes in the pad are only allowed for blind holes and not for through holes.

Table 41: Recommendations for PCB Pad Surfaces

Finish	Layer Thickness (um)	Properties
Electroless Ni / Immersion Au	3 –7 / 0.03 – 0.15	Good solder ability protection, high shear force values

The PCB must be able to resist the higher temperatures, which occur during the lead-free process. This issue should be discussed with the PCB-supplier. In general, the wettability of tin-lead solder paste on the described surface plating is better compared to lead-free solder paste.

It is not necessary to panel the application PCB. However, it is recommended to use milled contours and predrilled board breakouts; scoring or v-cut solutions are NOT recommended.

9.3 Cleaning

In general, cleaning the module mounted on the carrier board is not recommended.

- Residues between the module and the host board cannot be easily removed with any cleaning method.
- Cleaning with water or any organic solvent can lead to capillary effects where the cleaning solvent is absorbed into the gap between the module and the host board or even leaks inside the module (due to the gap between the module shield and PCB). The combination of soldering flux residues and encapsulated solvent could lead to short circuits between conductive parts. The solvent could also damage the module label.
- Ultrasonic cleaning could damage the module permanently. Especially for crystal oscillators where the risk of damaging is very high.

9.4 Stencil

The layout of the stencil openings can be the same as the recommended footprint (1:1). The suggested thickness of stencil foil is greater than 120 µm.

9.5 Solder Paste

Table 42: Recommended Solder Paste Type

	Lead-Free
Solder Paste	Sn/Ag/Cu

It is recommended using only “no clean” solder paste to avoid modules cleaning after assembly.

9.6 Solder Reflow

Recommended solder reflow profile:

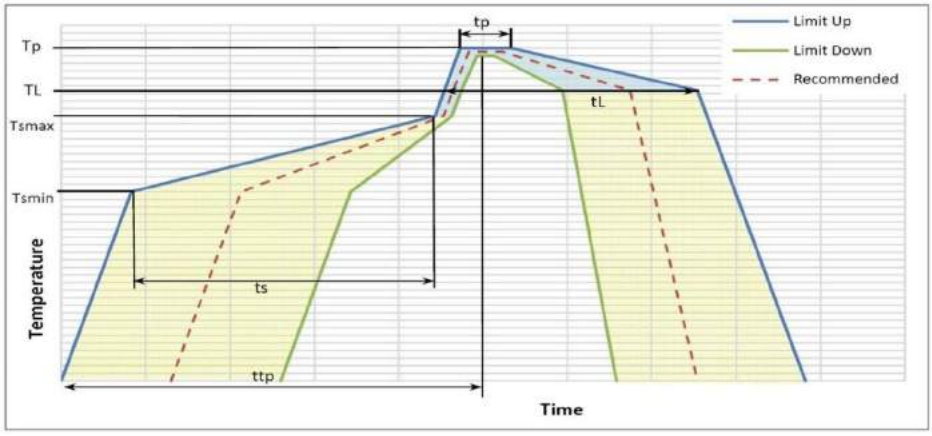

Figure 28: Recommended Solder Reflow Profile

Table 43: Profile Feature Recommendations

Profile Feature	Pb-Free Assembly Free
Average ramp-up rate (T_L to T_P)	3°C/second max
Preheat • Temperature Min (Tsmin) • Temperature Max (Tsmax) • Time (min to max) (ts)	 150°C 200°C 60-180 seconds
Tsmax to TL • Ramp-up Rate	 3°C/second max
Time maintained above: • Temperature (TL) • Time (tL)	 217°C 60-150 seconds
Peak Temperature (Tp)	245 +0/-5°C
Time within 5°C of actual Peak Temperature (tp)	10-30 seconds
Ramp-down Rate	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

Note: All temperatures refer to the topside of the package, measured on the package body surface.

Warning: The WE310K6-P Module Withstands One Reflow Process Only.

Warning: The above solder reflow profile represents the typical SAC reflow limits and does not guarantee adequate adherence of the module to the customer application throughout the temperature range. Users must optimize the reflow profile depending on the overall system taking into account such factors as thermal mass and warpage.

10 Packaging

10.1 WE310K6-P Tray

The WE310K6-P modules are packaged in trays of 98 pieces each when small quantities are required (such as for testing and evaluation purposes).

These trays are not designed for use in SMT processes for pick and place handling.

The following is the packaging process:

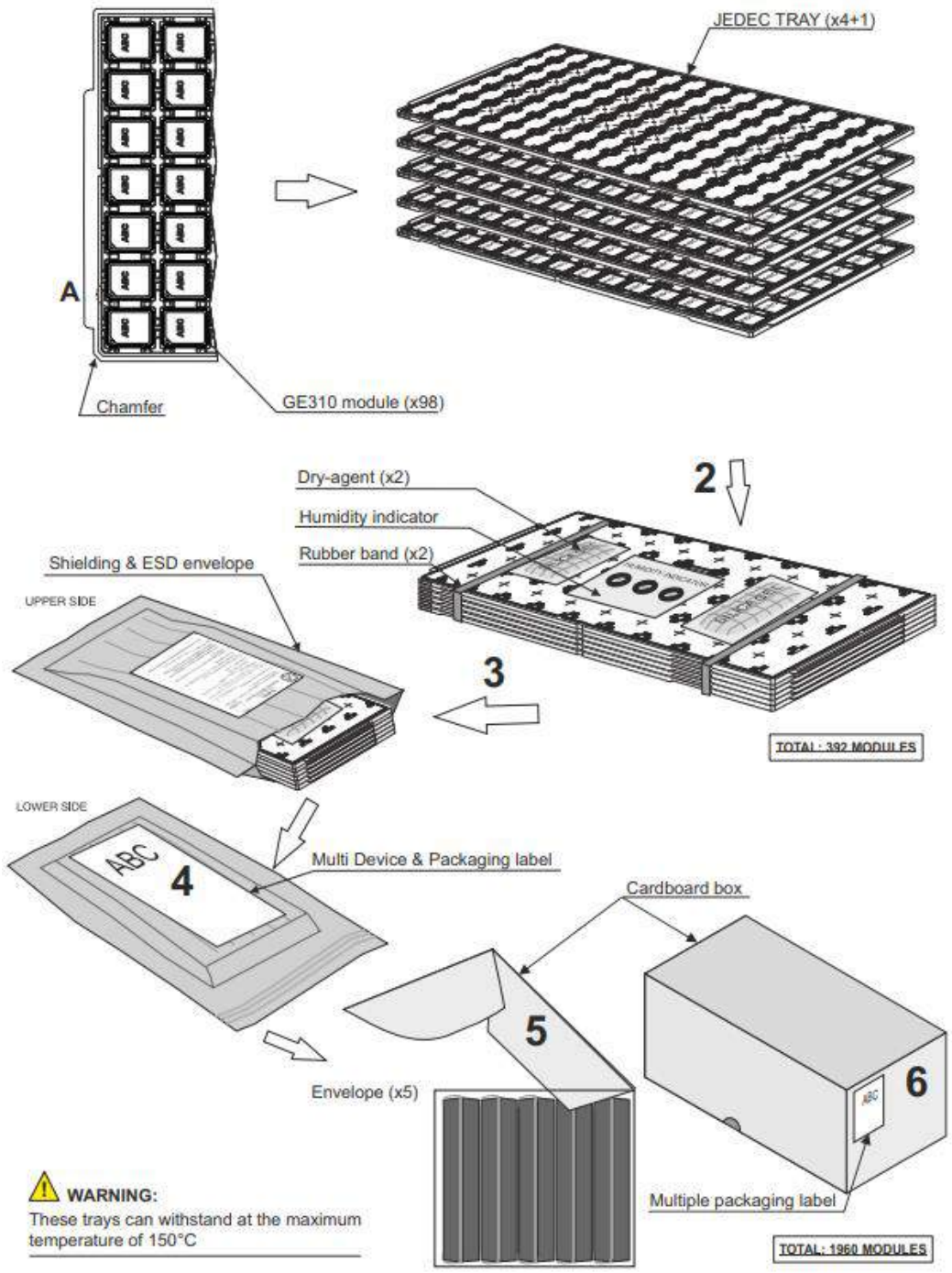

Figure 29: WE310K6-P Tray Packaging

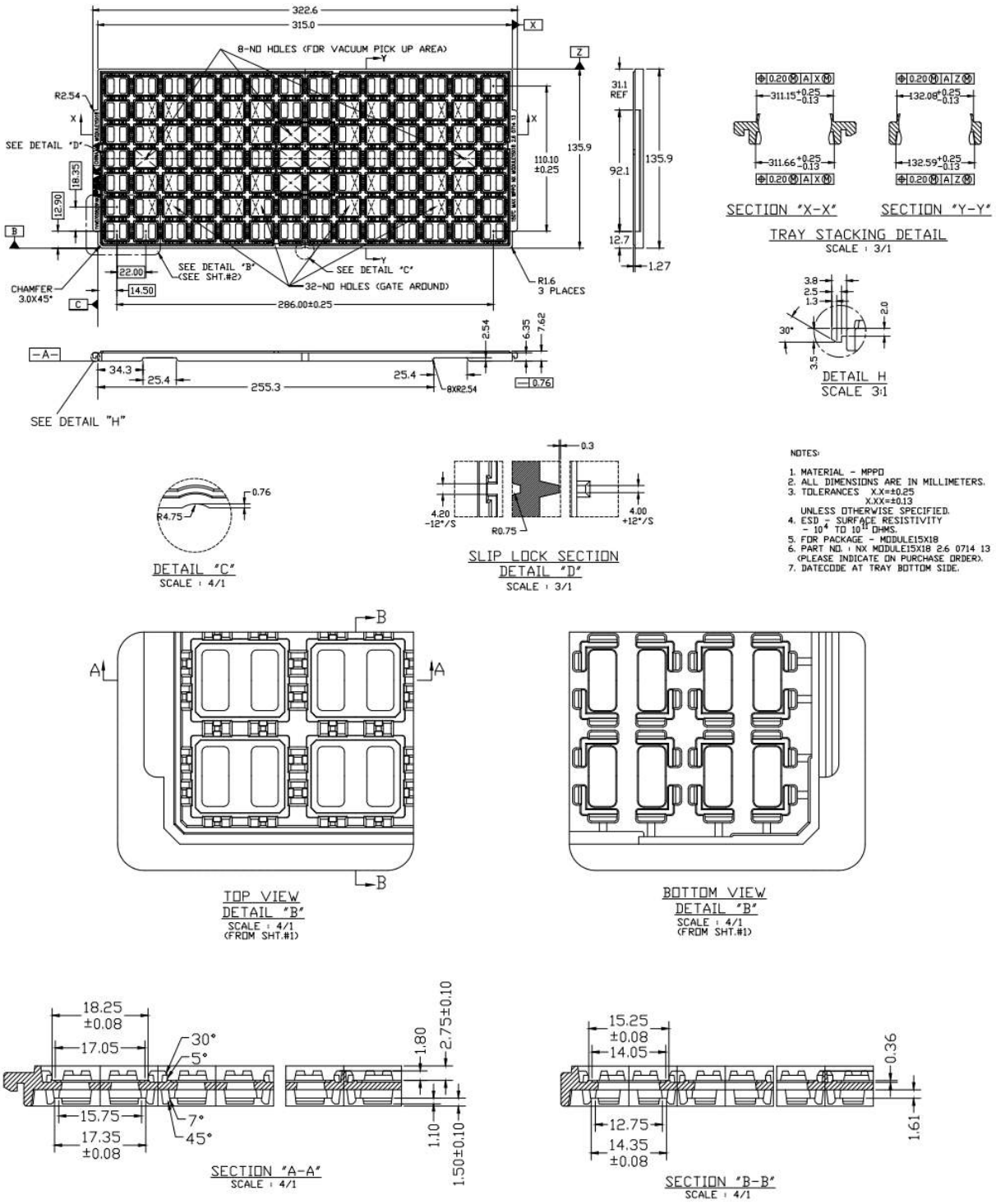

Figure 30: WE310K6-P Tray Dimensions

10.2 WE310K6-P M.2 Tray

The WE310K6-P M.2 modules are packaged in trays of 40 pieces each when small quantities are required (such as for testing and evaluation purposes).

These trays are not designed for use in SMT processes for pick and place handling.

The following is the packaging process:

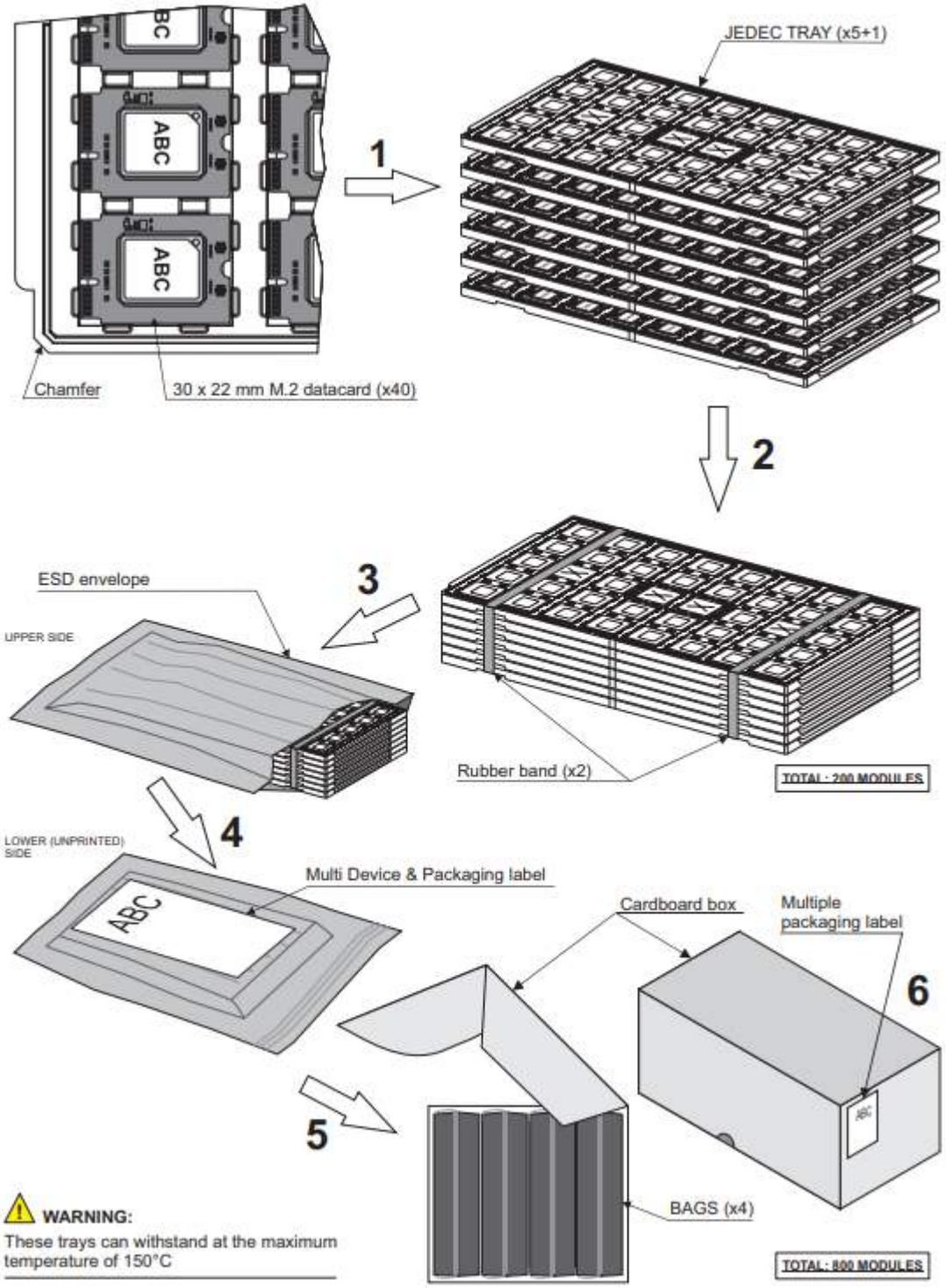

Figure 31: WE310K6-P M.2 Tray Packaging

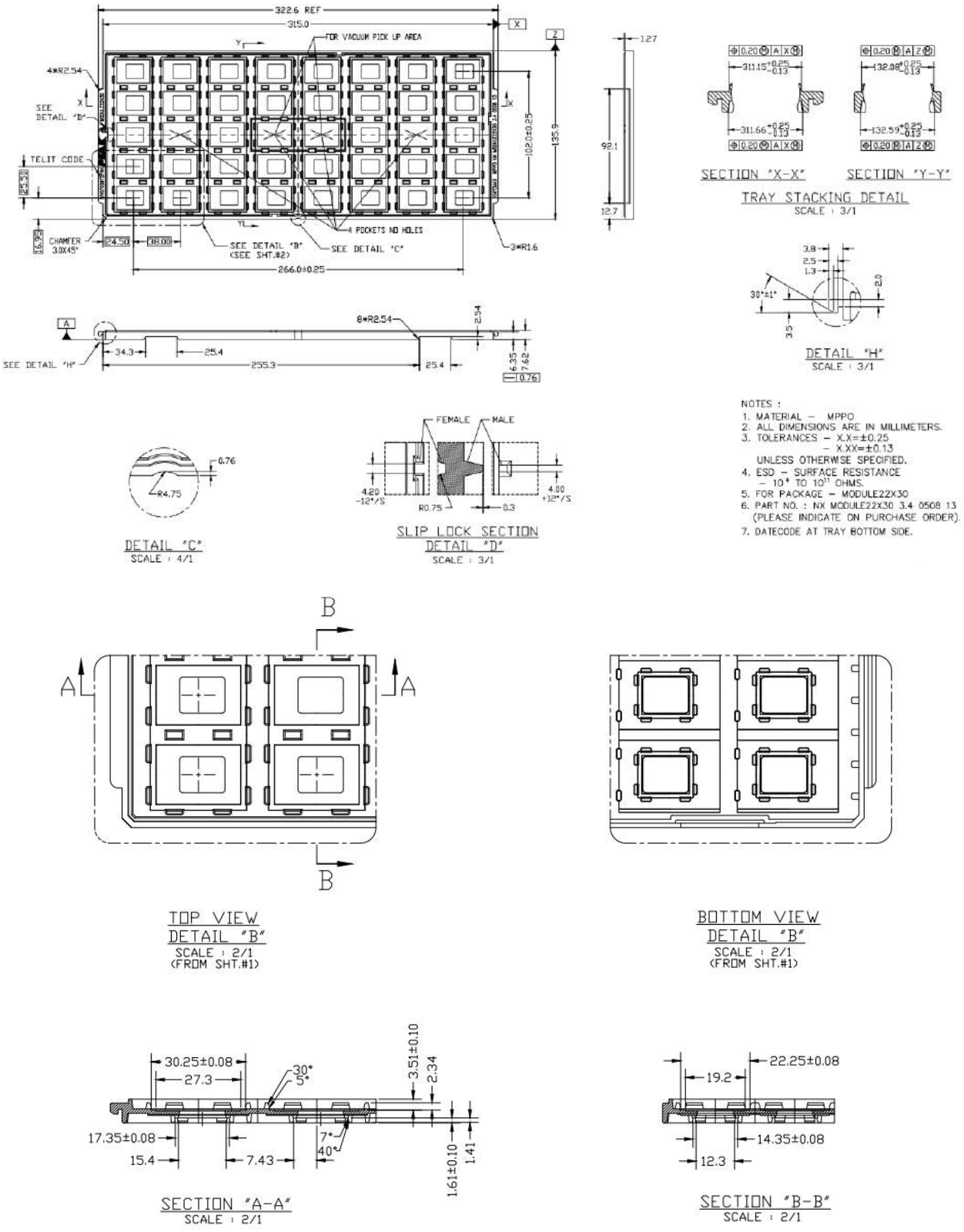

Figure 32: WE310K6-P M.2 Tray Dimensions

10.3 Reel

The WE310K6-P can be packaged on reels of 1000 pieces each. Refer to the figure below for guidance on positioning the modules within the carrier.

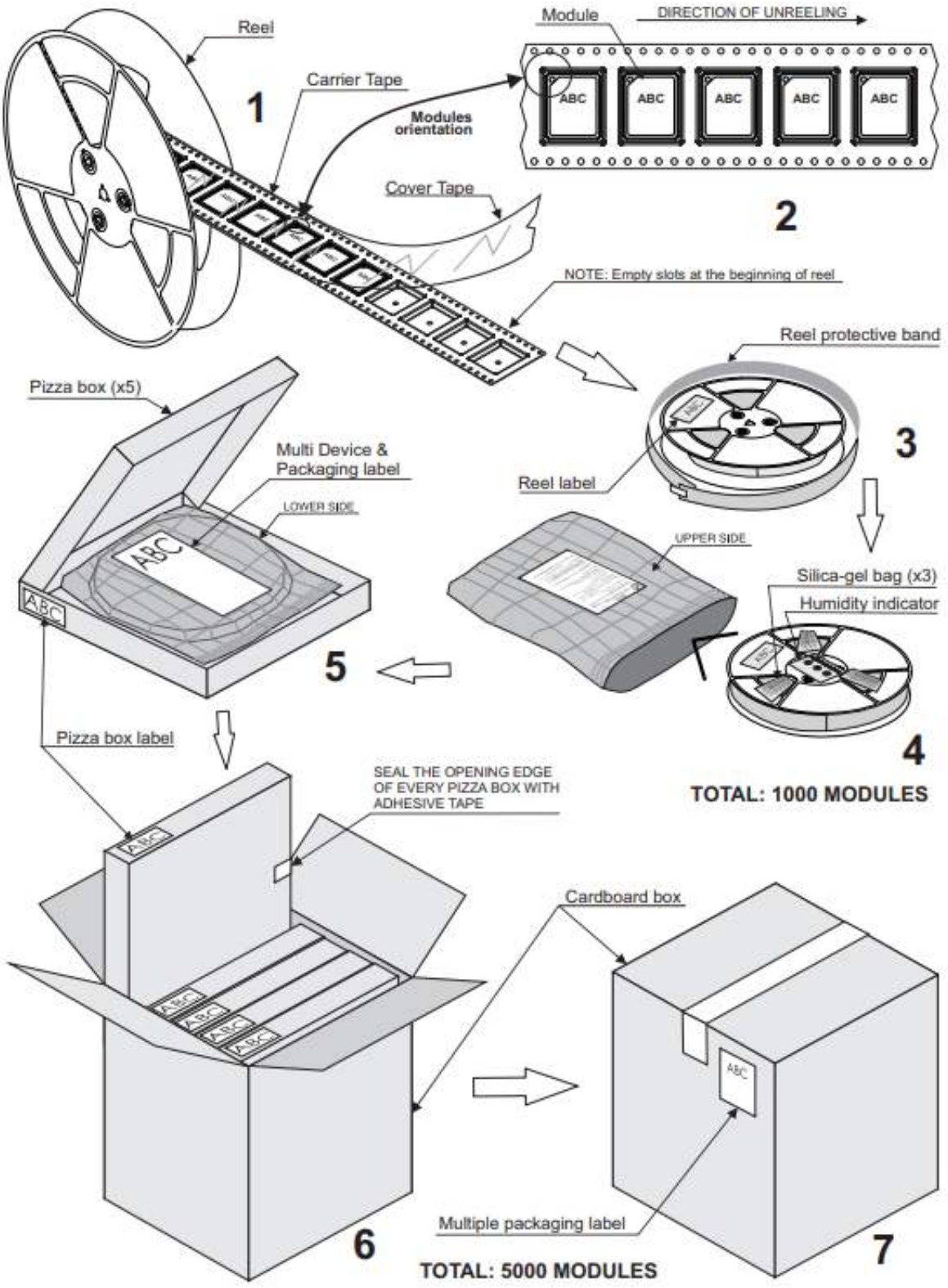

Figure 33: Module Positioning into the Carrier

10.4 Packaging Detail

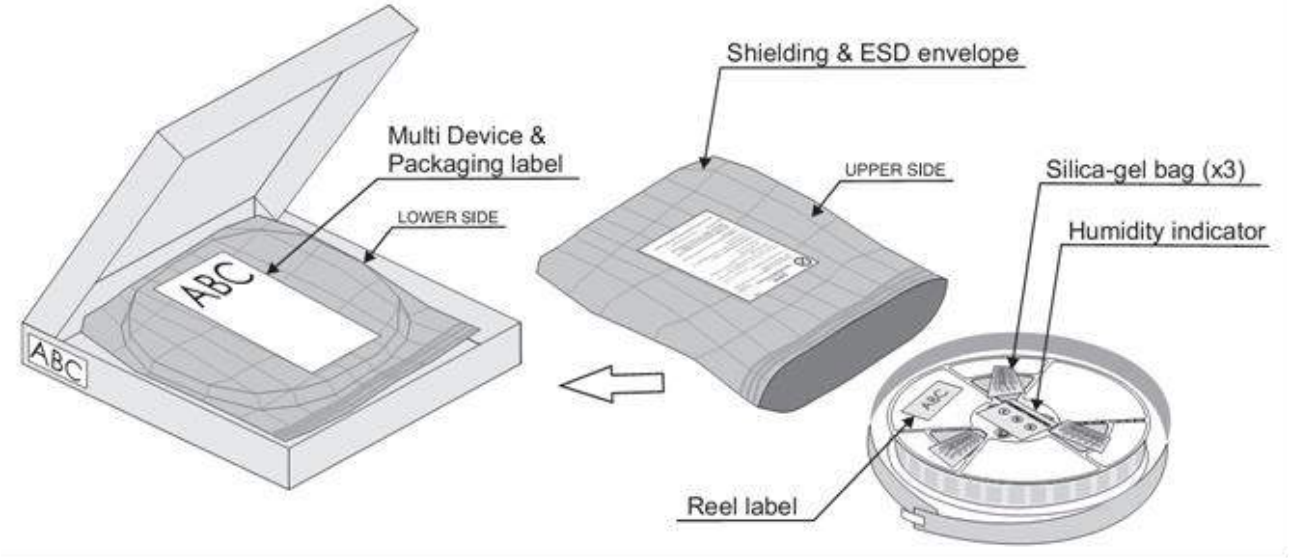

Figure 34: Packaging Detail

10.5 Moisture Sensitivity

The WE310K6-P/M.2 is a Moisture Sensitive Device level 3, according to standard IPC/JEDEC J-STD-020, and takes care of all the relative requirements for using this kind of component.

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

a. Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH).

b. An environmental condition during the production: 30°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 b) "IPC/JEDEC J-STD-033D paragraph 5.2" is respected

d. Baking is required if conditions b) or c) are not respected

e. Baking is required if the humidity indicator inside the bag indicates 10% RH or more.

11 Conformity Assessment Issues

11.1 Approvals Compliance Summary

Table 44: Legend Description

Legend	Description
●	The equipment is compliant
●	Type approval is in progress
	The equipment is not compliant

Table 45: Americas Approvals Compliance Summary

Region	Americas									
Country & Type Approval	AR ENACOM	BR ANATEL	CA ISED	CO CRC	MX IFETEL	PE MTC	US FCC	BOL ATT	ECU ARCOTEL	PY CONATEL
WE310K6-P			●				●			
WE310K6-P M.2			●				●			

Table 46: EMEA Approvals Compliance Summary

Region	EMEA	
Country & Type Approval	EU RED	UK UKCA
WE310K6-P	●	
WE310K6-P M.2	●	

Note: For approvals not included in the above, contact Telit Technical Support.

11.2 Americas Approvals

USA FCC

FCC Certificates

The FCC Grants can be found here: https://www.fcc.gov/oet/ea/fccid

Applicable FCC Rules

Parts 15C, 2.1091

FCC Regulatory Notices

Modification Statement

Telit has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

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 interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Wireless Notice

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This transmitter must not be co-located or operate in conjunction with any other antenna or transmitter. The antenna should be installed and operated with a minimum distance of 20 cm between the radiator and your body

FCC Class B digital device notice

This equipment has been tested and found to comply with the limits for a Class B digital device, according 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 per 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 taking one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to 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.

Information for the OEMs and Integrators

The following statement must be included with all versions of this document supplied to an OEM or integrator but should not be distributed to the end user.

1. This device is intended for OEM integrators only.
2. See the full Grant of Equipment document for other restrictions

Manual Information to the End User

The OEM integrator should be aware not to provide information to the end-user on 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/warming as shown in this manual

Information on test modes and additional testing requirements

The module has been evaluated in mobile stand-alone conditions. For operational conditions other than a stand-alone modular transmitter in a host (multiple, simultaneously transmitting modules or other transmitters in a host), additional testing may be required (collocation, retesting...). If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements of FCC Part 2.1093.

Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only authorized by the FCC for the specific rule parts (for example, FCC transmitter rules) listed on the grant, and the host product manufacturer is responsible for compliance with 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 circuity), 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. The end product with an embedded module may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized per FCC Part 15.

Trace Antenna Designs

See 7.5 General Design Rules added as RF Design Guidelines

FCC Antenna Info

This radio transmitter has been approved by FCC to operate with the antenna types listed below with the maximum allowable gain indicated. Antenna types not included in this list, with a gain greater than the maximum gain indicated for that type, are strictly prohibited from use with this device.

Type Max Gain

Omnidirectional 2.5dBi@2.4GHz band

Omnidirectional 4.5dBi@5GHz band

Le présent émetteur radio a été approuvé par ISDE pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Type Gain Maximal

Omnidirectional 2.5dBi@2.4GHz band

Omnidirectional 4.5dBi@5GHz band.

Labelling requirements for the host device

The host device shall be properly labelled to identify the modules within the host device. The certification label of the module shall be visible at all times when installed in the host device, otherwise, the host device must be labelled to display the FCC ID of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows.

Contains FCC ID: RI7WE310K6P

Canada ISED

ISED Database

The products ISED certified can be found here:

Les produits certifiés ISED peuvent être trouvés ici:
https://sms-sgs.ic.gc.ca/equipmentSearch/searchRadioEquipments?execution=e1s1&lang=en

ISED Regulatory Notices

Modification Statement / Déclaration de modification

Telit has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

Telit n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tout changement ou modification peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur.

Interference Statement / Déclaration d'interférence

This device complies with Industry Canada licence-exempt RSS standard(s). 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 applicables RSS standards d'Industrie Canada. 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 for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems; the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall comply with the e.i.r.p. limit; and the maximum antenna gain permitted for devices in the band 5725-5825 MHz shall comply with the e.i.r.p. limits specified for point-to-point and non point-to-point operation as appropriate.

Le dispositif de fonctionnement dans la bande 5150-5250 MHz est réservé à une utilisation en intérieur pour réduire le risque d'interférences nuisibles à la co-canal systèmes mobiles par satellite, le gain d'antenne maximal autorisé pour les appareils dans les bandes 5250-5350 MHz et 5470-5725 MHz doit se conformer à la pire limite, et le gain d'antenne maximal autorisé pour les appareils dans la bande 5725-5825 MHz doivent être conformes avec le pire limites spécifiées à point-à-ponctuelles et non point-à-point de fonctionnement selon qu'il convient.

Radio Exposure Notice / Avis d'exposition radio

This device complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets the RSS-102 of the ISED radio frequency (RF) Exposure rules. Antenna gain must be less than the values reported in the table below:

Le présent appareil est conforme à l'exposition aux radiations FCC / ISED définies pour un environnement non contrôlé et répond aux directives d'exposition de la fréquence de la FCC

radiofréquence (RF) et RSS-102 de la fréquence radio (RF) ISED règles d'exposition. Gain de l'antenne doit être ci-dessous:

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenne ou autre émetteur.

This equipment must be installed and operated following provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and consider removing the no-collocation statement.

Cet équipement doit être installé et utilisé conformément aux instructions fournies et la ou les antennes utilisées pour cet émetteur doivent être installées pour fournir une distance de séparation d'au moins 20 cm de toutes les personnes et ne doivent pas être co-localisées ou fonctionner en conjonction avec toute autre antenne ou émetteur. Les utilisateurs finaux et les installateurs doivent recevoir les instructions d'installation de l'antenne et envisager de supprimer la déclaration de non-collocation.

Information on test modes and additional testing requirement / Informations sur les modes de test et exigences de test supplémentaires

The module has been evaluated in mobile stand-alone conditions. For operational conditions other than a stand-alone modular transmitter in a host (multiple, simultaneously transmitting modules or other transmitters in a host), additional testing may be required (collocation, retesting...) If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements IC RSS-102.

Le module a été évalué dans des conditions mobiles autonomes. Pour des conditions de fonctionnement autres qu'un émetteur modulaire autonome dans un hôte (plusieurs modules transmettant simultanément ou d'autres émetteurs dans un hôte), des tests supplémentaires peuvent être nécessaires (colocalisation, retest...) Si ce module est destiné à être utilisé dans un appareil portable , vous êtes responsable de l'approbation séparée pour satisfaire aux exigences SAR IC RSS-102.

Trace antenna designs

See 7.5 General Design Rules added as RF Design Guidelines

Summary of the specific operational use conditions

See 7.6 Antenna Requirements

Labelling requirements for the host device /
Exigences d'étiquetage pour le périphérique hôte

The host device shall be properly labelled to identify the modules within the host device. The certification label of the module shall be visible at all times when installed in the host device, otherwise, the host device must be labelled to display the IC of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

L'appareil hôte doit être étiqueté comme il faut pour permettre l'identification des modules qui s'y trouvent. L'étiquette de certification du module donné doit être posée sur l'appareil hôte à un endroit bien en vue en tout temps. En l'absence d'étiquette, l'appareil hôte doit porter une étiquette donnant le IC du module, précédé des mots « Contient un module d'émission », du mot « Contient » ou d'une formulation similaire exprimant le même sens, comme en tableau suivant.

Contains IC: 5131A-WE310K6P

CAN ICES-3 (B) / NMB-3 (B)

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de classe B est conforme à la norme canadienne ICES-003.

11.3 EMEA Approvals

EU RED

EU Declaration of Conformity

Following the above Approval Compliance Summary table, where applicable (green dot), hereby, Telit Communications S.p.A declares that the equipment complies with Directive 2014/53/EU.

The full text of the EU Declaration of Conformity is available at the following internet address: https://www.telit.com/red

Text of 2014/53/EU Directive (RED) requirements can be found here:
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0053

RED/UKCA Antennas

This radio transmitter has been approved under RED/UKCA to operate with the antenna types listed below with the maximum permissible gain indicated. The usage of a different antenna in the final hosting device may need a new assessment of host conformity to RED/UKCA.

Table 47: RED Antenna Type

Model	Antenna Type
WE310K6-P	Omnidirectional Dipole Antenna
WE310K6-P M.2	≤2.5dBi@2.4GHz, ≤4.5dBi@5GHz

UK UKCA

UKCA Declaration of Conformity

Following the above Approval Compliance Summary table, where applicable (green dot), hereby, Telit Communications S.p.A declares that the equipment complies with the Radio Equipment Regulations 2017 for UKCA.

The full text of the UKCA declaration of conformity is available at the following internet address: https://www.telit.com/ukca

The UKCA requirements can be found here:
https://www.gov.uk/guidance/using-the-ukca-marking

11.4 RoHS and REACH Info

RoHS Info

Any requests for information related to RoHS certifications can be addressed to Chemical.Certifications@telit.com.

REACH Info

Any requests for information related to REACH certifications can be addressed to Chemical.Certifications@telit.com.

12 Acronyms and Abbreviations

Table 48: Acronyms and Abbreviations

Acronym	Definition
BT	Bluetooth®
BR	Basic Rate
CLK	Clock
CMOS	Complementary Metal – Oxide Semiconductor
CTS	Clear To Send
EVB	Evaluation Board
EDR	Enhanced Data Rate
HCI	Host Controller Interface
HS	High Speed
I/O	Input Output
LTE	Long Term Evolution
LGA	Land Grid Array
LE	Low energy
MIMO	Multiple Input Multiple Output
O/D	Open Drain
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PHY	Physical Layer
PCIE	Peripheral Component Interconnect Express
PERST	Power Enable and Reset
RTS	Request To Send
RF	Radio Frequency
SIM	Subscriber Identification Module
SOC	System-on-Chip
SMPS	Switching Mode Power Supply
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver Transmitter
WLAN	Wireless LAN

13 Related Documents

Refer to https://dz.telit.com/ for current documentation and downloads.

Table 49: Related Documents

S.no	Doc Code	Document Title
1	1VV0301859	WE310K6-P EVB Hardware User Guide
2	1VV0301865	WE310K6 Wi-Fi BT NIC Software User Guide

14 Document History

Table 50: Document History

Revision	Date	Changes
4	2024-07-11	Updated Block diagram Added External antenna information Updated labels
3	2024-06-18	Updated module IDs
2	2024-05-09	Updated ISED Regulatory Notices
1	2024-04-22	Restructured the document Added FCC and IC ID Updated 5.2 Average Power Consumption. Updated 5.3 WLAN continuous Tx Power Consumption. Updated section 6.4 Digital Functionality Updated 7 RF Section: WIFI, BT, Antenna spec and table. Added 10.2 WE310K6-P M.2 Tray
0	2023-09-07	Initial Release

From Mod.0818 Rev.11

Technical Documentation