

FLM140D

Hardware Design

Wi-Fi&Bluetooth Module Series

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Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular or mobile terminal incorporating the module. Manufacturers of the cellular terminal should notify users and operating personnel of the following safety precautions by incorporating them into all product manuals. Otherwise, Quectel assumes no liability for customers' failure to comply with these precautions.



Full attention must be paid to driving at all times to reduce the risk of an accident. Using a mobile phone while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.



Switch off the cellular or mobile terminal before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If there is an Airplane Mode, it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on an aircraft.



Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.



Cellular terminals or mobiles operating over radio signal and cellular network cannot be guaranteed to connect in certain conditions, such as when the mobile bill is unpaid or the (U)SIM card is invalid. If emergency assistance is needed, use emergency call if the device supports it. To make or receive a call, the cellular or mobile terminal must be switched on in a service area with adequate cellular signal strength. In an emergency, the device with emergency call function cannot be used as the only contact method since network connection cannot be guaranteed under all circumstances.



The cellular or mobile terminal contains a transceiver. When it is ON, it receives and transmits radio signals. RF interference can occur if it is used close to TV sets, radios, computers, or other electric equipment.



In locations with explosive or potentially explosive atmospheres, obey all posted signs and turn off wireless devices such as mobile phones or other cellular terminals. Areas with explosive or potentially explosive atmospheres include fueling areas, below decks on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles such as grain, dust or metal powders.

About the Document

Revision History

Version	Date	Author	Description
-	2023-03-02	Devin YU	Creation of the document
1.0.0	2023-03-02	Devin YU	Preliminary

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1 Introduction

QuecOpen® is a solution where the module acts as the main processor. Constant transition and evolution of both the communication technology and the market highlight its merits. It can help you to:

- Realize embedded applications' quick development and shorten product R&D cycle
- Simplify circuit and hardware structure design to reduce engineering costs
- Miniaturize products
- Reduce product power consumption
- Apply OTA technology
- Enhance product competitiveness and price-performance ratio

This document defines FLM140D in QuecOpen® solution and describes its air interfaces and hardware interfaces, which are connected with your applications.

With this document, you can quickly understand module interface specifications, electrical and mechanical details, as well as other related information of the module. The document, coupled with application notes and user guides, makes it easy to design and set up mobile applications with the module.

Hereby, Quectel Wireless Solutions Co., Ltd. declares that the radio equipment type FLM140D is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address:

<http://www.quectel.com/support/technical.htm>



The device could be used with a separation distance of 20cm to the human body.

Table 1: Special Marks

Mark	Definition
*	Unless otherwise specified, when an asterisk (*) is used after a function, feature, interface, pin name, AT command, or argument, it indicates that the function, feature, interface, pin, AT command, or argument is under development and currently not supported; and the asterisk (*) after a model indicates that the sample of the model is currently unavailable.
[...]	Brackets ([...]) used after a pin enclosing a range of numbers indicate all pins of the same type. For example, SDIO_DATA[0:3] refers to all four SDIO pins: SDIO_DATA0, SDIO_DATA1, SDIO_DATA2, and SDIO_DATA3.

2 Product Overview

2.1. General Description

FLM140D is a high-performance MCU Wi-Fi and Bluetooth module for smart-home and industrial IoT terminals supporting IEEE 802.11b/g/n and Bluetooth 5.2 standards. The module provides multiple interfaces including UART, ADC* and PWM* for various applications.

FLM140D is a wave-soldering module with compact packaging. It includes:

- A 32-bit MCU running up to 120 MHz
- Built-in 256 KB RAM and 4 MB flash
- Supporting secondary development

Table 2: Basic Information

FLM140D	
Packaging type	Linker
Pin counts	11
Dimensions	(17.91 ±0.15) mm × (14.99 ±0.15) mm × (2.8 ±0.2) mm
Weight	Approx. 0.83 g

2.2. Key Features

Table 3: Key Features

Basic Information	
Protocols and Standards	● Wi-Fi Protocols: IEEE 802.11b/g/n ● Bluetooth protocol: Bluetooth 5.2 ● All hardware components are fully compliant with EU RoHS directive
Power Supply	VBAT Power Supply: ● 3.0–3.6 V ● Typ.: 3.3 V
Temperature Ranges	● Operating temperature ¹: -40 to +85 °C ● Storage temperature: -45 to +95 °C
EVB Kit	FLM140D TE-B ²
RF Antenna Interface	
Antenna Interface	● PCB antenna ● 50 Ω impedance
Application Interface ³	
Application Interface	UART, PWM*, ADC*

¹ Within the operating temperature range, the module's related performance meets IEEE and Bluetooth specifications.

² For more details about the EVB, see **document [1]**.

³ For more details about the interfaces, see **Chapter 3.3** and **Chapter 3.4**.

3 Application Interfaces

3.1. Pin Assignment

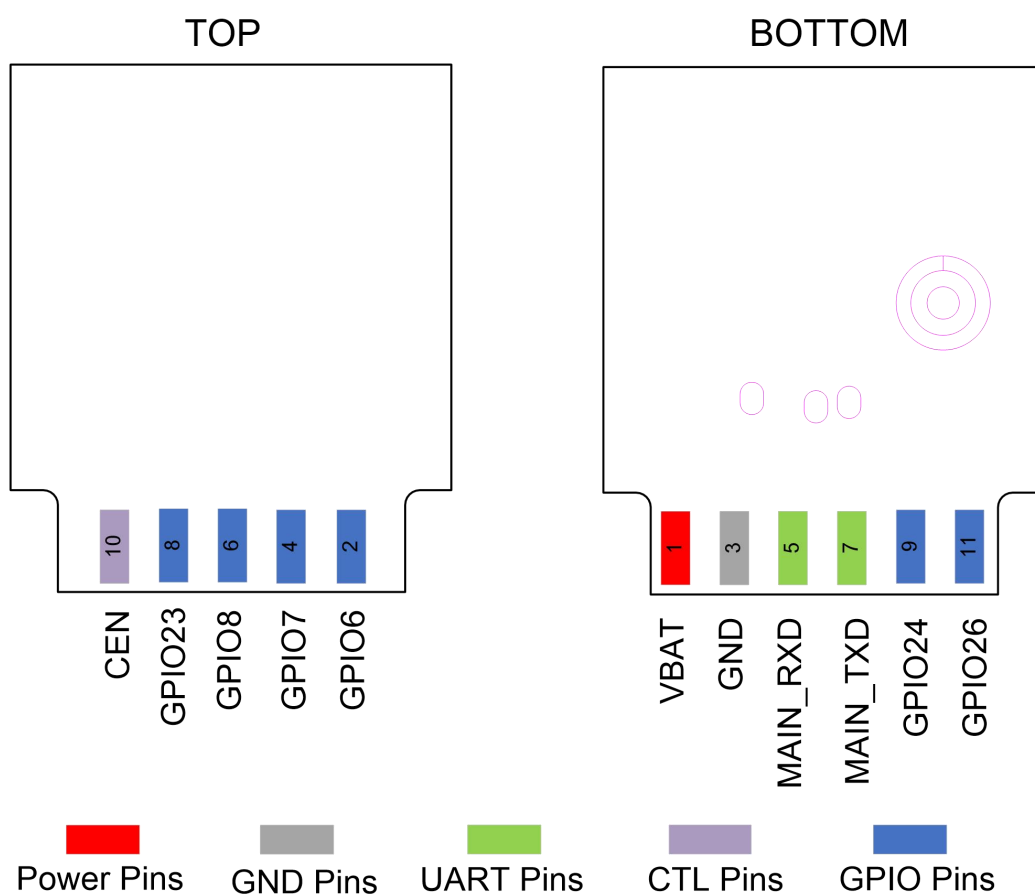


Figure 2: Pin Assignment

NOTE

1. The module supports UART × 1, PWM × 5 and ADC × 3 multiplexed with up to 8 GPIO pins. For more details, see **Chapter 3.3** and **Chapter 3.4**.
2. All GND pins should be connected to ground.

3.2. Pin Description

Table 4: I/O Parameter Description

Type	Description
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
PI	Power Input

DC characteristics include power domain and rated current, etc.

Table 5: Pin Description

Power Supply					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
VBAT	1	PI	Power supply for the module	Vmax = 3.6 V Vmin = 3.0 V Vnom = 3.3 V	It must be provided with sufficient current more than 0.3 A.
GND	3				
Control Signal					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
CEN	10	DI	Enable the module (default)	VBAT	Hardware enable; Internally pulled up to 3.3 V; Active high.
			Resets the module		Hardware reset; Internally pulled up to 3.3 V; Active low.
Main UART					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
MAIN_TXD	7	DO	Main UART transmit	VBAT	

MAIN_RXD	5	DI	Main UART receive		
GPIO Interfaces					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
GPIO6	2	DIO	General-purpose input/output	VBAT	Interrupt wakeup.
GPIO7	4	DIO			
GPIO8	6	DIO			
GPIO23	8	DIO			
GPIO24	9	DIO			
GPIO26	11	DIO			

3.3. GPIO Multiplexing

The module provides 8 GPIO interfaces by default. Pins are defined as follows:

Table 6: GPIO Multiplexing

Pin Name	Pin No.	Alternate Function 0 (GPIO No.)	Alternate Function 1	Alternate Function 2	Alternate Function 3
GPIO6	2	GPIO6	13M_CLK_OUT	PWM0	-
GPIO7	4	GPIO7	WIFI_ACTIVE	PWM1	-
GPIO8	6	GPIO8	BT_ACTIVE	PWM2	-
GPIO23	8	GPIO23	ADC3	-	-
GPIO24	9	GPIO24	ADC2	32K_CLK_OUT	PWM4
GPIO26	11	GPIO26	ADC1	IRDA	PWM5
MAIN_RXD	5	GPIO10	-	-	-
MAIN_TXD	7	GPIO11	-	-	-

NOTE

All GPIOs can be configured as interrupt source to interrupt the system in active mode or to wake it up from low power mode.

3.4. Application Interfaces

3.4.1. UART

The module supports one UART interface: the main UART. The module serves as DCE (Data Communication Equipment), which is connected in the traditional DCE-DTE (Data Terminal Equipment) mode.

Table 7: Pin Definition of UART

Pin Name	Pin No.	I/O	Description
MAIN_TXD	7	DO	Main UART transmit
MAIN_RXD	5	DI	Main UART receive

The main UART can be used for AT command communication and data transmission. The default baud rate is 921600 bps, and the maximum baud rate can reach 6 Mbps. The main UART is also available for firmware upgrade and supports a default baud rate of 921600 bps.

The main UART connection between DCE and DTE is illustrated below.

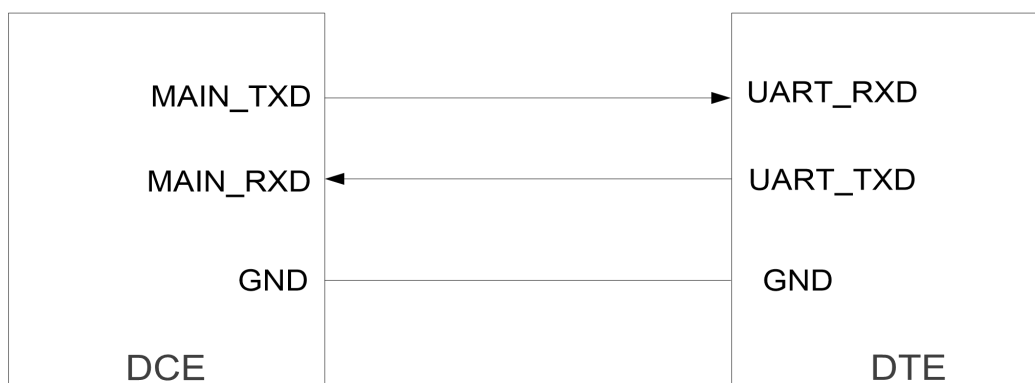


Figure 3: Main UART Connection

3.4.2. PWM Interfaces*

The module supports 5 PWM channels by default. Pin description of PWM interfaces are as follows.

Table 8: Pin Definition of PWM Interfaces

Pin Name	Pin No.	Multiplexing Function	I/O	Description
GPIO6	2	PWM0	DO	PWM0 out
GPIO7	4	PWM1	DO	PWM1 out
GPIO8	6	PWM2	DO	PWM2 out
GPIO24	9	PWM4	DO	PWM4 out
GPIO26	11	PWM5	DO	PWM5 out

3.4.3. ADC Interfaces*

The module supports 3 ADC interfaces by default, whose voltage range is 0–2.4 V. To improve ADC accuracy, surround ADC trace with ground.

Table 9: Pin Definition of ADC Interfaces

Pin Name	Pin No.	Multiplexing Function	I/O	Description
GPIO23	8	ADC3	AI	General-purpose ADC interface
GPIO24	9	ADC2	AI	General-purpose ADC interface
GPIO26	11	ADC1	AI	General-purpose ADC interface

Table 10: ADC Features

Parameter	Min.	Typ.	Max.	Unit
ADC Voltage Range	0	-	2.4	V
ADC Resolution Rate	-	TBD	-	bit

3.5. RF Antenna Interface

The module supports PCB antenna. The impedance of antenna port is 50 Ω .

3.5.1. Operating Frequencies

The operating frequencies of the module are listed below:

Table 11: Operating Frequencies (Unit: GHz)

Mode	Frequency
2.4 GHz Wi-Fi	2.400–2.4835
Bluetooth	2.400–2.4835

3.5.2. PCB Antenna

Table 12: PCB Antenna Specifications

Parameter	Requirement
Frequency Range (GHz)	2.400–2.500
Input Impedance (Ω)	50
VSWR	≤ 3
Gain (dBi)	TBD (Typ.)
Efficiency	TBD

When using the PCB antenna on the module, the module should be placed at the side of the motherboard. The distance between the PCB antenna and connectors, vias, traces pin headers, ethernet port and any other metal components on the motherboard should be at least 16 mm. All layers in the PCB of the motherboard under the PCB antenna should be designed as a keepout area.

4 Operating Characteristics

4.1. Power Supply

Power supply pin and ground pins of the module are defined in the following table.

Table 13: Pin Definition of Power Supply and GND Pins

Pin Name	Pin No.	I/O	Description	Min.	Typ.	Max.	Unit
VBAT	1	PI	Power supply for the module	3.0	3.3	3.6	V
GND	3						

4.1.1. Reference Design for Power Supply

The module is powered by VBAT, and it is recommended to use a power supply chip that can provide more than 0.3 A output current. For better power supply performance, it is recommended to parallel a 22 μ F decoupling capacitor, and two filter capacitors (1 μ F and 100 nF) near the module's VBAT pin. In addition, it is recommended to add a TVS near the VBAT to improve the surge voltage bearing capacity of the module. In principle, the longer the VBAT trace is, the wider it should be.

VBAT reference circuit is shown below:

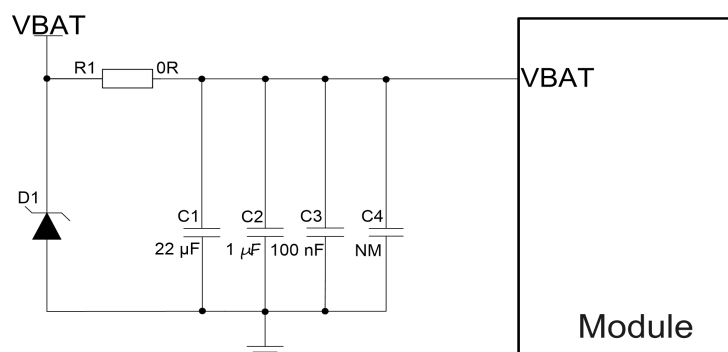


Figure 4: VBAT Reference Circuit

4.2. Turn On

After the module VBAT is powered on, keep the CEN pin at high level to realize the automatic startup of the module.

Table 14: Pin Definition of CEN

Pin Name	Pin No.	I/O	Description	Comment
CEN	10	DI	Enable the module	Hardware enable; Internally pulled up to 3.3 V; Active high.

The turn-on timing is shown below:

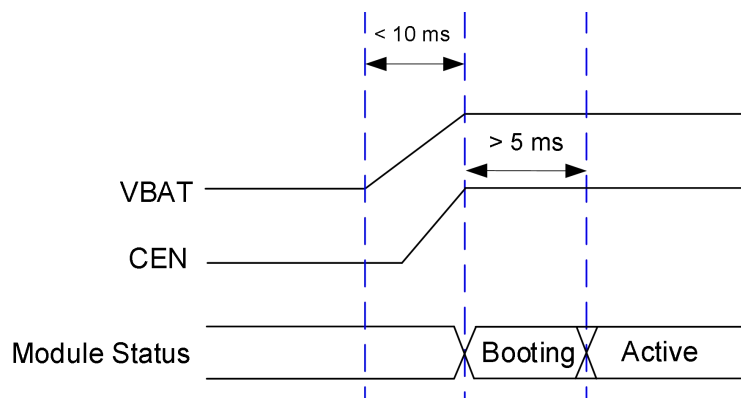


Figure 5: Turn-on Timing

4.3. Reset

Drive CEN low for at least 100 ms and then release it to reset the module.

Table 15: Pin Definition of CEN

Pin Name	Pin No.	I/O	Description	Comment
CEN	10	DI	Resets the module	Hardware reset; Internally pulled up to 3.3 V; Active low.

The reference design for resetting the module are shown below. An open collector driving circuit can be used to control the CEN pin.

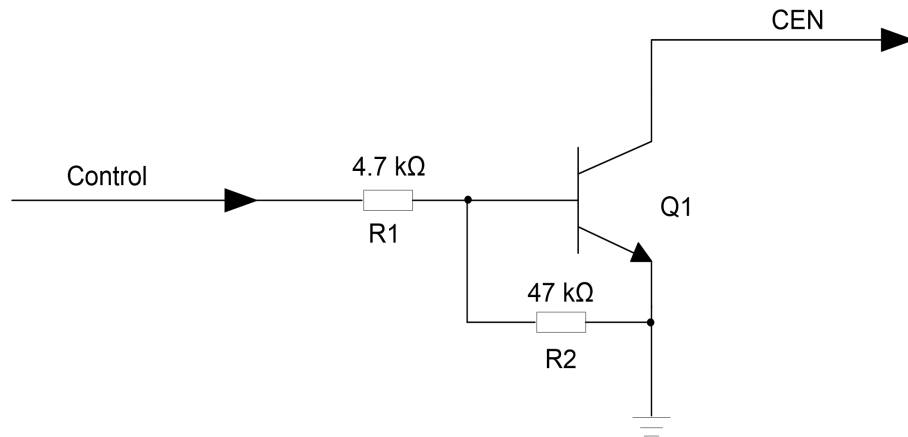


Figure 6: Reference Circuit of CEN by A Using Driving Circuit

Another way to control the CEN is by using a button directly. When pressing the button, an electrostatic strike may generate from finger. Therefore, a TVS component shall be placed near the button for ESD protection.

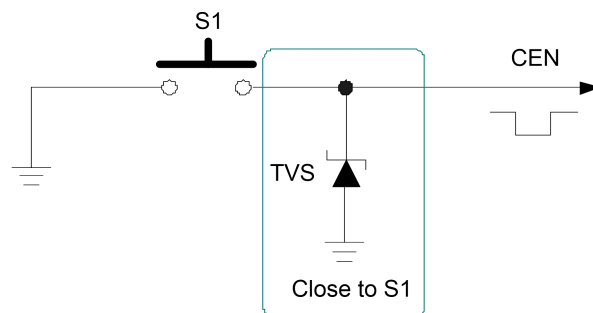


Figure 7: Reference Circuit of CEN with A Button

The module reset timing is illustrated in the following figure.

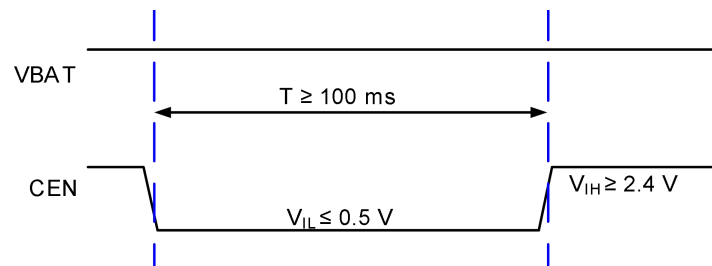


Figure 8: Reset Timing

4.4. Download Mode

Keep the input signal of CEN at low level during resetting or power-up and the module will enter download mode. In the download mode, the firmware can be download through the main UART. During the hardware design, the CEN pin of the module is connected to the RTS of the serial port chip, or the GPIO is controlled according to the following waveform, otherwise the download will fail.

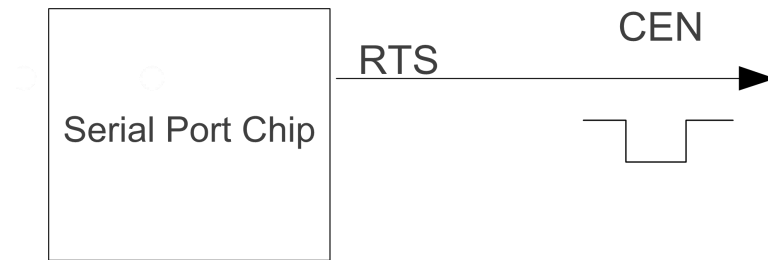


Figure 9: Reference Design for Download Mode

5 RF Performances

5.1. Wi-Fi Performances

Table 16: Wi-Fi Performances

Operating Frequency			
2.4 GHz: 2.400–2.4835 GHz			
Modulation			
BPSK, QPSK, CCK, 16QAM, 64QAM			
Operating Mode			
- AP - STA			
Transmission Data Rate			
802.11b: 1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps 802.11g: 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, 54 Mbps 802.11n: HT20 (MCS 0–7)			
Condition	EVM	Unit: dBm, Tolerance: ± 2 dB	
		Transmitting Power @ Typ.	Receiving Sensitivity @ Typ.
2.4 GHz	$\leq 35\%$	802.11b @ 1 Mbps	TBD
		802.11b @ 11 Mbps	TBD
	≤ -5 dB	802.11g @ 6 Mbps	TBD
		802.11g @ 54 Mbps	TBD
	≤ -5 dB	802.11n, HT20 @ MCS 0	TBD
		802.11n, HT20 @ MCS 7	TBD

5.2. Bluetooth Performances

Table 17: Bluetooth Performances

Operating Frequency		
2.400~2.4835 GHz		
Modulation		
GFSK		
Operating Mode		
BLE		
Condition	Unit: dBm, Tolerance: ± 2 dB	
	Transmitting Power @ Typ.	Receiving Sensitivity @ Typ.
BLE (1 Mbps)	TBD	TBD

6 Electrical Characteristics & Reliability

6.1. Absolute Maximum Ratings

Absolute maximum ratings for power supply and voltage on digital and analog pins of the module are listed in the following table.

Table 18: Absolute Maximum Ratings (Unit: V)

Parameter	Min.	Max.
VBAT	-0.3	3.9
Voltage at Digital Pins	-0.3	3.9
Voltage at ADC[1:3]	0	2.4

6.2. Power Supply Ratings

Table 19: Module Power Supply Ratings (Unit: V)

Parameter	Description	Condition	Min.	Typ.	Max.
VBAT	Power supply for the module	The actual input voltages must be kept between the minimum and maximum values.	3.0	3.3	3.6

6.3. Wi-Fi Power Consumption

Table 20: Power Consumption in Low Power Modes

Mode	Typ.	Unit
Light Sleep	TBD	μA
Deep Sleep	TBD	μA
DTIM1	TBD	mA
DTIM3	TBD	mA
OFF	TBD	μA

Table 21: Power Consumption in Non-signaling Modes (Unit: mA)

Condition	Typ.
802.11b, Tx 1 Mbps @ TBD	TBD
802.11b, Tx 11 Mbps @ TBD	TBD
802.11g, Tx 6 Mbps @ TBD	TBD
802.11g, Tx 54 Mbps @ TBD	TBD
802.11n HT20, Tx MCS 0 @ TBD	TBD
802.11n HT20, Tx MCS 7 @ TBD	TBD

6.4. Digital I/O Characteristics

Table 22: VBAT I/O Characteristics (Unit: V)

Parameter	Description	Min.	Max.
V_{IH}	High-level Input Voltage	$0.7 \times V_{BAT}$	$V_{BAT} + 0.2$
V_{IL}	Low-level Input Voltage	-0.3	$0.3 \times V_{BAT}$
V_{OH}	High-level Output Voltage	$0.9 \times V_{BAT}$	V_{BAT}
V_{OL}	Low-level Output Voltage	0	$0.1 \times V_{BAT}$

6.5. ESD Protection

Static electricity occurs naturally and may damage the module. Therefore, applying proper ESD countermeasures and handling methods is imperative. For example, wear anti-static gloves during the development, production, assembly and testing of the module; add ESD protection components to the ESD sensitive interfaces and points in the product design.

Table 23: ESD Characteristics (Unit: kV)

Model	Test Result	Standard
Human Body Model (HBM)	± 4	ANSI/ESDA/JEDEC JS-001-2017
Charged Device Model (CDM)	± 0.25	ANSI/ESDA/JEDEC JS-002-2018

7 Mechanical Information

This chapter describes the mechanical dimensions of the module. All dimensions are measured in millimeters (mm), and the dimensional tolerances are ± 0.2 mm unless otherwise specified.

7.1. Mechanical Dimensions

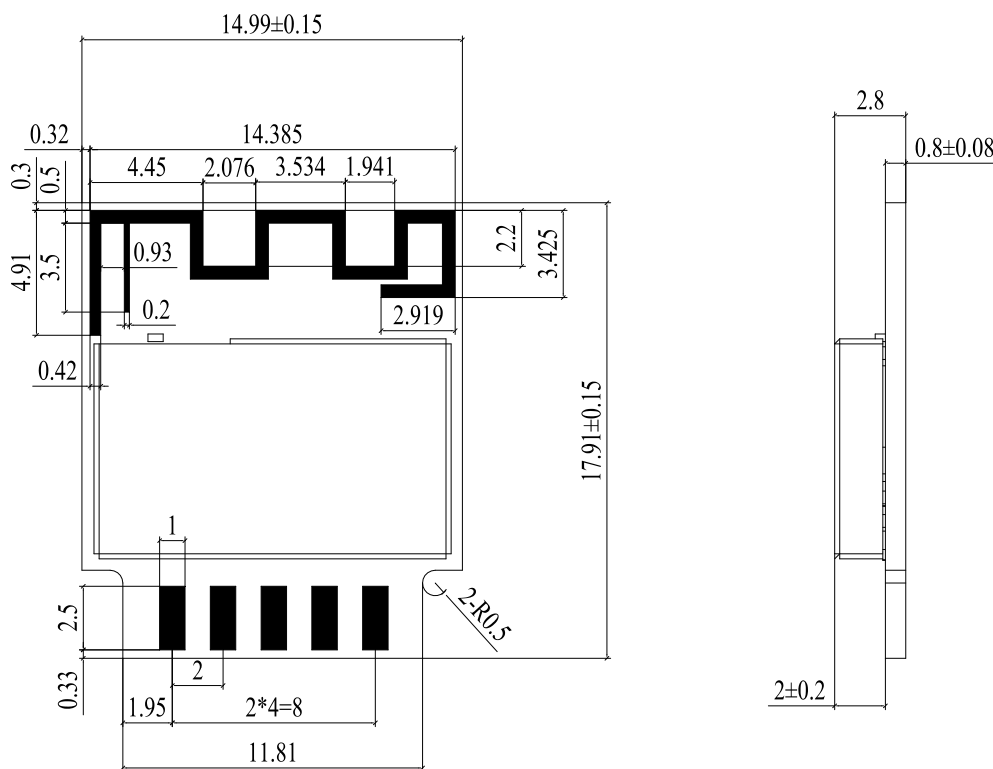


Figure 10: Top and Side Dimensions

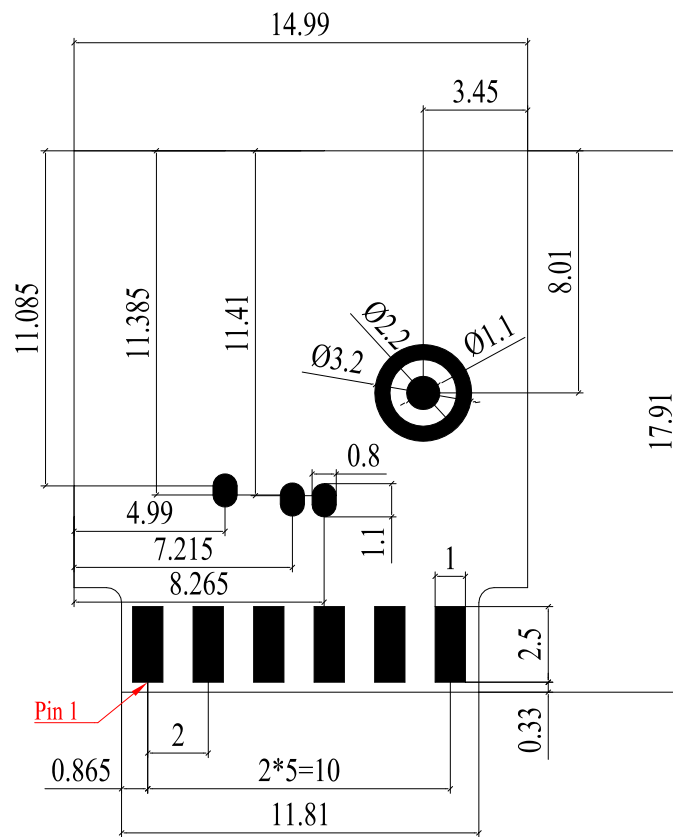


Figure 11: Bottom Dimensions (Bottom View)

NOTE

The package warpage level of the module conforms to the *JEITA ED-7306* standard.

7.2. Recommended Footprint

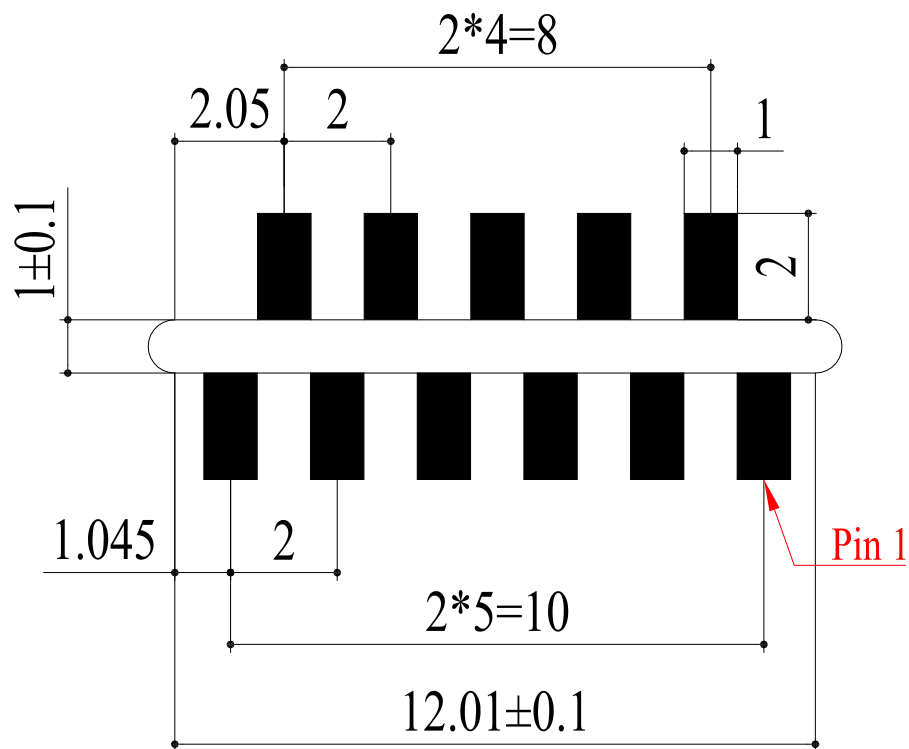


Figure 12: Recommended Footprint

NOTE

Keep at least 3 mm between the module and other components on the motherboard to improve soldering quality and maintenance convenience.

7.3. Top and Bottom Views

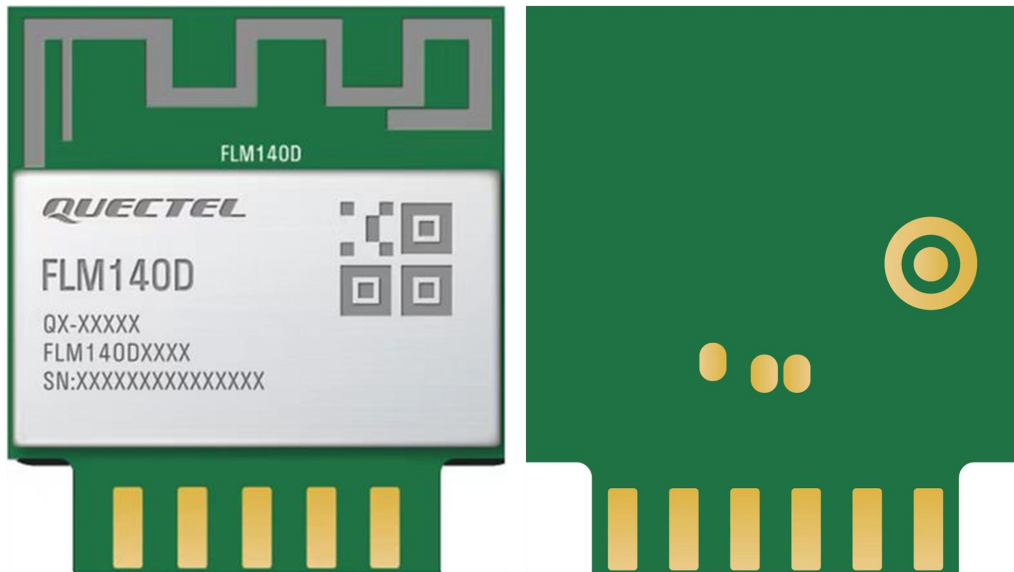


Figure 13: Top and Bottom Views

NOTE

Images above are for illustrative purposes only and may differ from the actual module. For authentic appearance and label, please refer to the module received from Quectel.

8 Storage and Packaging

8.1. Storage Conditions

The module is provided with vacuum-sealed packaging. MSL of the module is rated as 3. The storage requirements are shown below.

1. Recommended Storage Condition: the temperature should be 23 ± 5 °C and the relative humidity should be 35–60 %.
2. Shelf life (in a vacuum-sealed packaging): 12 months in Recommended Storage Condition.
3. Floor life: 168 hours ⁴ in a factory where the temperature is 23 ± 5 °C and relative humidity is below 60 %. After the vacuum-sealed packaging is removed, the module must be processed in reflow soldering or other high-temperature operations within 168 hours. Otherwise, the module should be stored in an environment where the relative humidity is less than 10 % (e.g., a dry cabinet).
4. The module should be pre-baked to avoid blistering, cracks and inner-layer separation in PCB under the following circumstances:
 - The module is not stored in Recommended Storage Condition;
 - Violation of the third requirement mentioned above;
 - Vacuum-sealed packaging is broken, or the packaging has been removed for over 24 hours;
 - Before module repairing.
5. If needed, the pre-baking should follow the requirements below:
 - The module should be baked for 8 hours at 120 ± 5 °C;
 - The module must be soldered to PCB within 24 hours after the baking, otherwise it should be put in a dry environment such as in a dry cabinet.

⁴ This floor life is only applicable when the environment conforms to *IPC/JEDEC J-STD-033*. It is recommended to start the solder reflow process within 24 hours after the package is removed if the temperature and moisture do not conform to, or are not sure to conform to *IPC/JEDEC J-STD-033*. Do not unpack the modules in large quantities until they are ready for soldering.

NOTE

1. To avoid blistering, layer separation and other soldering issues, extended exposure of the module to the air is forbidden.
2. Take out the module from the package and put it on high-temperature-resistant fixtures before baking. If shorter baking time is desired, see *IPC/JEDEC J-STD-033* for the baking procedure.
3. Pay attention to ESD protection, such as wearing anti-static gloves, when touching the modules.

8.2. Packaging Specifications

This chapter describes only the key parameters and process of packaging. All figures below are for reference only. The appearance and structure of the packaging materials are subject to the actual delivery.

The module adopts carrier tape packaging and details are as follow:

8.2.1. Carrier Tape

Carrier tape dimensions are detailed below:

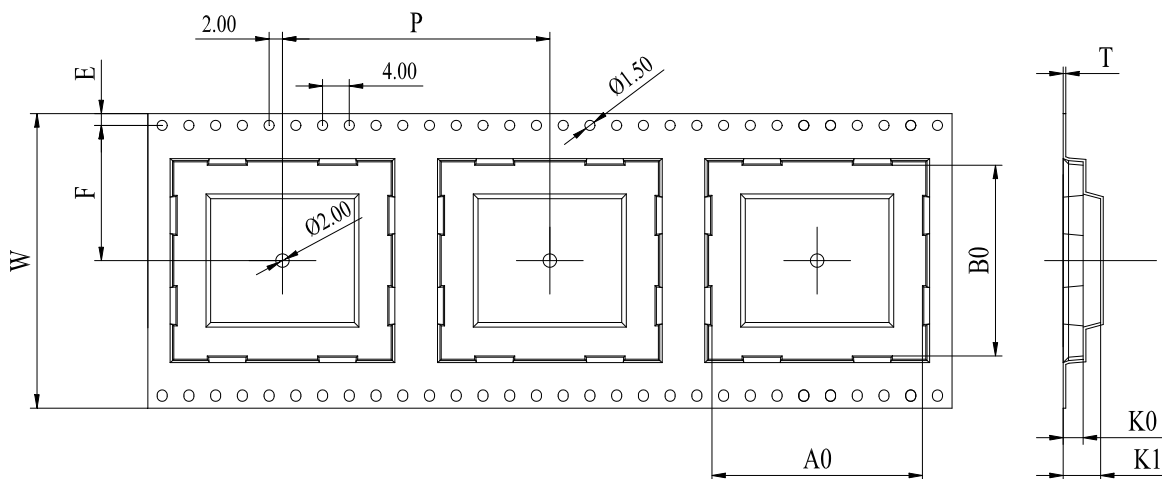


Figure 14: Tape Specifications

Table 24: Carrier Tape Dimension Table (Unit: mm)

W	P	T	A0	B0	K0	K1	F	E
44	24	0.4	15.4	18.3	3.3	4.6	20.2	1.75

8.2.2. Plastic Reel

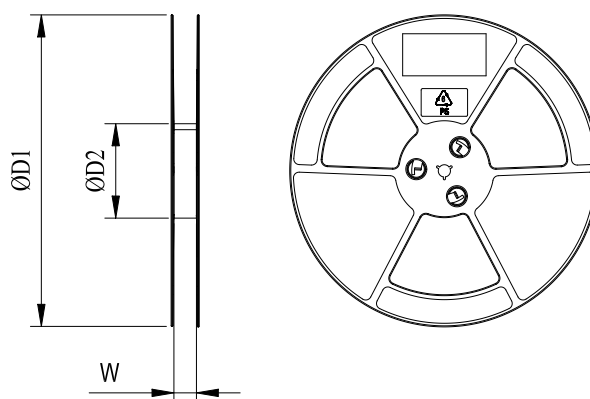
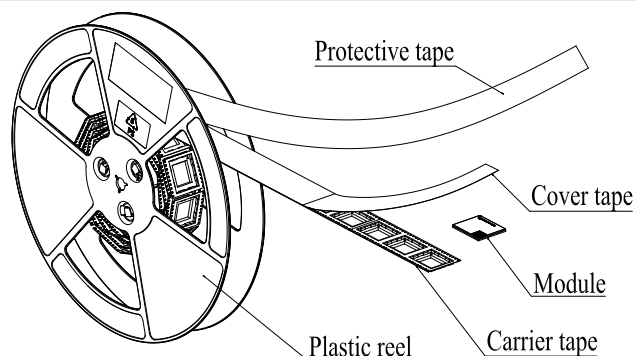


Figure 15: Plastic Reel Dimension Drawing

Table 25: Plastic Reel Dimension Table (Unit: mm)

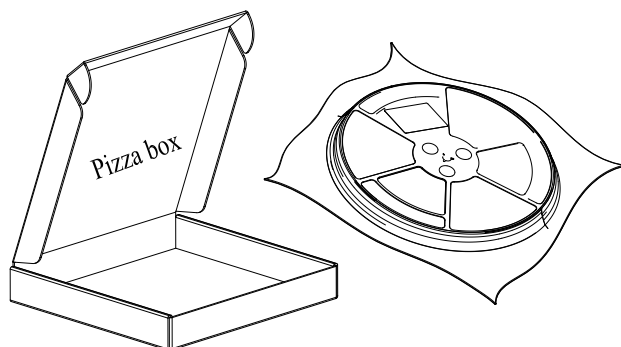
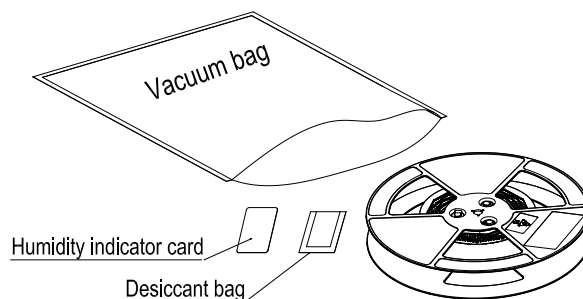
ØD1	ØD2	W
330	100	44.5

8.2.3. Packaging Process



Place the module into the carrier tape and use the cover tape to cover it; then wind the heat-sealed carrier tape to the plastic reel and use the protective tape for protection. 1 plastic reel can load 500 modules.

Place the packaged plastic reel, 1 humidity indicator card and 1 desiccant bag into a vacuum bag, vacuumize it.



Place the vacuum-packed plastic reel inside the pizza box.

Put 4 packaged pizza boxes into 1 carton box and seal it. 1 carton box can pack 2000 modules

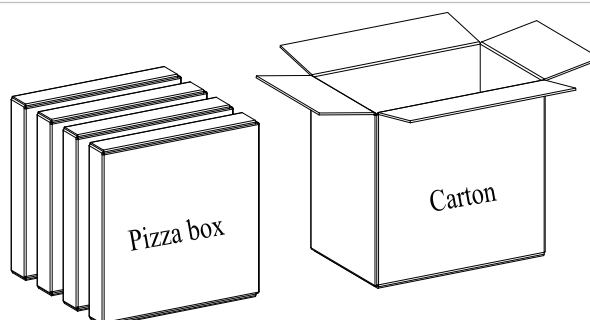


Figure 16: Packaging Process

9 Appendix References

Table 26: Reference Documents

Document Name
[1] Quectel_FLM140D_TE-B_User_Guide

Table 27: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
AP	Access Point
BLE	Bluetooth Low Energy
BPSK	Binary Phase Shift Keying
CCK	Complementary Code Keying
CDM	Charged Device Model
DCE	Data Communications Equipment
DTE	Data Terminal Equipment
DTIM	Delivery Traffic Indication Message
ESD	Electrostatic Discharge
GFSK	Gauss frequency Shift Keying
GND	Ground
GPIO	General-Purpose Input/Output
HT	High Throughput
I/O	Input/Output

IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
LNA	Low Noise Amplifier
Mbps	Million Bits Per Second
OTA	Over-the-Air
PA	Power Amplifier
PCB	Printed Circuit Board
PMU	Power Management Unit
PWM	Pulse Width Modulation
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RoHS	Restriction of Hazardous Substances
RAM	Random Access Memory
RF	Radio Frequency
STA	Station
TBD	To Be Determined
UART	Universal Asynchronous Receiver/Transmitter
V_{IH}	High-level Input Voltage
V_{IL}	Low-level Input Voltage
V_{max}	Maximum Voltage
V_{min}	Minimum Voltage
V_{nom}	Normal Voltage Value
V_{OH}	High-level Output Voltage
V_{OL}	Low-level Output Voltage
VSWR	Voltage Standing Wave Ratio
Wi-Fi	Wireless Fidelity

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 Part 15 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/IC 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: XMR2023FLM140D"

"Contains IC: 10224A-2023FLM140D "

The FCC ID/IC ID can be used only when all FCC/IC compliance requirements are met.

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 15.247 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.

IC

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."

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.

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.