LA02305 Module User Manual

1. Introduction

1.1 Overview

The LA02305 is a Leedarson-developed universal Wi-Fi and Bluetooth SMART (BLE) combo module. It uses the Espressif Inc. ESP32-U4WDH System in Package that integrates an embedded 4MB flash.
The LA02305 contain 2 vision with different antenna type:
Type A: built in PCB Antenna
Type B: Add a Antenna connector, connect to external Antenna.

	
Type A	Type B

Figure 1.1.LA02305 Module

The LA02305 module is designed for a variety of IOT products such as Power Drivers, Sensors, Plugs, Lighting, Switches, etc.


Plug


Switch


Sensor


Down Light


Power Driver

Figure 1.2.Product Application

1.2 Key features

- Embedded Xtensa® 32-bit LX6 microprocessor, with clock up to 160MHz
- Data Memory: 520KB internal SRAM and 448KB internal ROM,4MB Flash
- Power supply voltage: 3.0V～3.6V
- Operating temperature: -40～105Deg-C
- Frequency of crystal oscillator: 40MHz\32.768KHz
- Operating frequency: 2400～2483.5MHz
- Support WIFI 802.11b/g/n up to 150Mbps
  Compliant with Bluetooth LE specifications
  Wi-Fi 802.11 b/g/n and BLE can't transmission simultaneous
- Interface:
  - Vertical Mount (Plug-In)
    - 6 PWMs (GPIOs)
    - 1 Available UART
    - 1 ADC
    - 1 Dedicated Triac Dimmer Detection Pin
  - Horizontal (SMD)
    - 6 PWMs (GPIOs)
    - 3 GPIOs
    - 1 Available UART
    - 2 ADC
    - 1 Dedicated Triac Dimmer Detection Pin

1.3 Block Diagram

The LA02305module is a highly-integrated, high-performance system with all the hardware components needed to enable 2.4GHz wireless connectivity and support Wi-Fi and BLE protocols.

Built around the ESP32-U4WDH Wireless SoC, the LA02305 includes, supply decoupling and filtering components, a 40MHz reference crystal, a 32.768KHz crystal, and an RF shield.

1.4 Power Supply

The LA02305requires a single nominal supply level of 3.3V. All the necessary decoupling and filtering components are included in the module. The supply voltage noise tolerance of the module should be less than 100mVpp and the supply current should be more than 500mA.

1.5 Module Certification Information

Table 1.1. Module Certification Information

Module	Certification Type	Certification Information
LA02305	FCC	2AB2Q-LA02305
	IC	10256A-LA02305

2. Electrical characteristics

2.1 Absolute maximum ratings

Stresses above those listed below may cause permanent damage to the device. This is a stress rating only and functional operation of the devices at those or any conditions above those indicated in the operation listing of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Table 2.1. Absolute maximum ratings

Symbol	Parameter	Min.	Max.	Units
VCC	Power Supply	-0.3	+3.6	V
GND	Ground of Module		0	V
VIO	Voltage of Module IO	-0.3	+3.6	V
Storage temperature		-40	+125	Deg-C
MSL	Moisture Sensitivity Level	3		
ESD HBM	Human Body Mode		±1.5	KV
ESD CDM	Charge Device Mode		±500	V

2.2 General Operating Conditions

This table specifies the general operating temperature range and supply voltage range for all supplies, the minimum and maximum values of all other tables are specified over this operating range, unless otherwise noted.

Table 2.2. General Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
VCC	Supply voltage, normal	3.0	3.3	3.6	V
TA	Operation temperature[1]	-40	25	105	Deg-C
ICC peak	Supply Current Peak[2]	-	400	450	mA
ICC average	Supply Current average[2]	-	150		mA

Note:

1. It refers in particular to the surface temperature on 40MHz reference crystal of the LA02305 when it is working, if the surface temperature of 40MHz reference crystal is above 105 Deg-C, the RF parameters will be worse.
2. It ismeasured when the module runs the RF test Firmware @ 10% duty cycle and 25 Deg-C ambient temperature.

2.3 DC Specifications

Unless otherwise indicated, typical conditions are: VCC=3.3V.TA=25Deg-C。

Table 2.3. DC Specifications

Symbol	Parameter(condition)	Min.	Typ.	Max.	Units
VIH	Input high voltage	0.75xVCC	-	VCC	V
VIL	Input low voltage	GND	-	0.25xVCC	V
VOH	Output high voltage	0.8xVCC	-	-	V
VOL	Output low voltage	-	-	0.1xVCC	V
IOH	Output high current	-	40	-	mA
IOL	Output low current	-	28	-	mA
RPU	Pull-up resistance	-	45	-	kΩ
RPD	Pull-down resistance	-	45	-	kΩ
ITX 802.11b peak	Transmit 11b DSSS 1Mbps Pout=+19dBm	-	382		mA
ITX 802.11b average	Transmit 11b DSSS 1Mbps Pout=+19dBm	-	148	-	mA
ITX 802.11b peak	Transmit 11b DSSS 11Mbps Pout=+19dBm	-	378	-	mA
ITX 802.11b average	Transmit 11b DSSS 11Mbps Pout=+19dBm	-	146	-	mA
ITX 802.11g peak	Transmit 11g OFDM 6Mbps Pout=+17dBm	-	332	-	mA
ITX 802.11g average	Transmit 11g OFDM 6Mbps Pout=+17dBm	-	139	-	mA
ITX 802.11g peak	Transmit 11g OFDM 54Mbps Pout=+13 dBm	-	272	-	mA
ITX 802.11g average	Transmit 11g OFDM 54Mbps Pout=+13 dBm	-	130	-	mA
ITX 802.11n peak	Transmit 11n OFDM MCS0 Pout=+17.5 dBm	-	328	-	mA
ITX 802.11n average	Transmit 11n OFDM MCS0 Pout=+17.5 dBm	-	140	-	mA
ITX 802.11n peak	Transmit 11n OFDM MCS7 Pout=+12 dBm	-	256	-	mA
ITX 802.11n average	Transmit 11n OFDM MCS7 Pout=+12 dBm	-	128	-	mA
IRX 802.11b/g/n	Rx average current	-	108	-	mA
ITX BLE	Pout=8 dBm	-	236	-	mA
ITX BLE average	Pout=8 dBm	-	184	-	mA
IRXBLE	Rx average current	-	115	-	mA
Note: The current is measured with the module runningthe RF test Firmware @ 10% duty cycle					

2.4 RF Specifications

Unless otherwise indicated, typical conditions are: VCC=3.3V TA=25Deg-C。

Table 2.4. Wi-Fi Specifications

Symbol	Description	Min.	Typ.	Max.	Units
Fop	Operating frequencies	2412	-	2462	MHz
PRF11b	11b DSSS 1Mbps output power	-	-	-	dBm
	11b DSSS 11Mbps output power	-	-	-	dBm
PRF11g	11g OFDM 6Mbps output power	-	-	-	dBm
	11g OFDM 54Mbps output power	-	-	-	dBm
PRF11n	11n OFDM HT20 MCS0 output power	-	-	-	dBm

Table 2.5. BLE Specifications

Symbol	Description	Min.	Typ.	Max.	Units
Fop	Operating frequencies	2402	-	2480	MHz
PRFLE	LE Output Power	-	-	-	dBm
	LE Out Power Control range	-	-	-	dB
	LE Out Power Control step	-	-	-	dB
PSENSLE	LE Receiver sensitivity	-	-	-	dBm
	LE Maximum receiving level	-	-	-	dBm

2.5 Antenna Specifications

2.5.1 Internal PCB Antenna Specifications

Antenna Picture	
Antenna Type	PCB Antenna
Antenna Peak Gain	4.0dBi
Operating Band	2400 MHz ~ 2483.5 MHz

2.5.2 External Antenna Specifications

Antenna Picture	
Antenna Type	PCB Antenna
Antenna Peak Gain	3.7 dBi
Operating Band	2400 MHz ~ 2483.5 MHz

3. Pin Definition

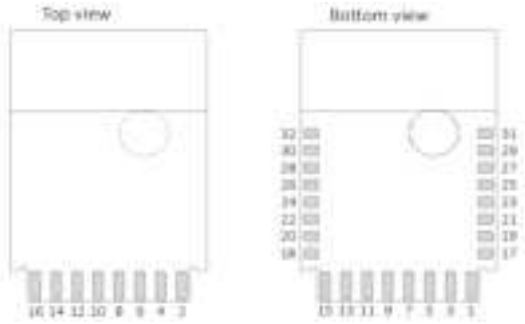

Figure 3.1.Vertical Mount (Plug-In)

Table 3.1. Plug-In pin definition

Module No	Pin of IC	Pin Definition	Pin Function Description	Direction
1	17_MTMS	PWM1/IO0	PWM channel 1 output / GPIO 0	I/O
2	GND	GND	Ground of Module	--
3	15_GPIO26	PWM2/IO1	PWM channel 2 output / GPIO 1	I/O
4	40_U0RXD	RX0	FACTORY_UART_RX data in (RX)	I
5	17_MTMS	PWM3/IO2	PWM channel 3 output / GPIO 2	I/O
6	41_U0TXD	TX0	FACTORY_UART_TX data out (TX)	O

7	21_MTDO	PWM4/IO3	PWM channel 4 output / GPIO 3	I/O
8	9_CHIP_PU	RESET	Reset, Low Active	I
9	24_GPIO4	PWM5/IO4	PWM channel 5 output / GPIO 4	I/O
10	10_VDET_1	FAC	FACTORY MODE enable, low active	I
11	35_GPIO18	PWM6/IO5	PWM channel 6 output / GPIO 5	I/O
12	5_SENSOR_VP	ADC0	Analog-to-Digital Converter	I
13	GND	GND	Ground of Module	--
14	16_GPIO27	TX1	HOST_UART_RX (data out from ESP32) , need an external pull up	O
15	1,3,4,19,26,37,43,46	VCC	Power Supply	--
16	14_GPIO25	RX1	HOST_UART_TX (data in to ESP32) , need an external pull up	I

Note:

1. AC_TRIAC_DETECT is used to detect if a device is powered through a triac dimmer and to determine the dimmer settings. The circuit that feeds this signal should give a scaled DC voltage representation of the average AC voltage integrated over approximately 200ms.If the triac is set to chop the AC waveform 50%, the AC_TRIAC_DETECT signal should be at 50% of VCC.If the triac dimmer is turned up completely, the AC waveform will be minimally chopped and the AC_TRIAC_DETECT signal should be at 100% of VCC.

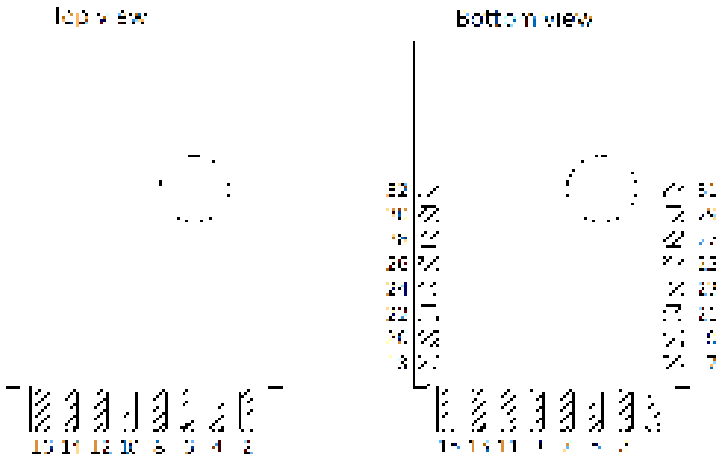

Figure 3.2. Horizontal (SMD)

Table 3.2. SMD pin definition

Module No	Pin of IC	Pin Definition	Pin Function Description	Direction
1	17_MTMS	PWM1/IO0	PWM channel 1 output / GPIO 0	I/O
2	GND	GND	Ground of Module	--
3	15_GPIO26	PWM2/IO1	PWM channel 2 output / GPIO 1	I/O
4	40_U0RXD	RX0	FACTORY_UART_RX data in (RX)	I
5	17_MTMS	PWM3/IO2	PWM channel 3 output / GPIO 2	I/O

6	41_U0TXD	TX0	FACTORY_UART_TX data out (TX)	O
7	21_MTDO	PWM4/IO3	PWM channel 4 output / GPIO 3	I/O
8	9_CHIP_PU	RESET	Reset, Low Active	I
9	24_GPIO4	PWM5/IO4	PWM channel 5 output / GPIO 4	I/O
10	10_VDET_1	FAC	FACTORY MODE enable, low active	I
11	35_GPIO18	PWM6/IO5	PWM channel 6 output / GPIO 5	I/O
12	5_SENSOR_VP	ADC0	Analog-to-Digital Converter	I
13	GND	GND	Ground of Module	--
14	16_GPIO27	TX1	HOST_UART_RX (data out from ESP32) , need an external pull up	O
15	1,3,4,19,26,37,43, 46	VCC	Power Supply	--
16	14_GPIO25	RX1	HOST_UART_TX (data in to ESP32) , need an external pull up	I
17	10_VDET_1	FAC	FACTORY MODE enable, low active	I
18	14_GPIO25	RX1	HOST_UART_TX (data in to ESP32) , need an external pull up	I
19	9_CHIP_PU	RESET	Reset, Low Active	I
20	16_GPIO27	TX1	HOST_UART_RX (data out from ESP32) , need an external pull up	O
21	41_U0TXD	TX0	FACTORY_UART_TX data out (TX)	O
22	42_GPIO21	IO8	GPIO8	I/O
23	40_U0RXD	RX0	FACTORY_UART_RX data in (RX)	I
24	GND	GND	Ground of Module	--
25	--	NC	--	--
26	5_SENSOR_VP	ADC0	Analog-to-Digital Converter	I
27	--	NC	--	--
28	39_GPIO22	IO9	GPIO9	I/O
29	23_GPIO0	IO7	GPIO7	I/O
30	11_VDET_2	ADC2	Analog-to-Digital Converter	I
31	GND	GND	Ground of Module	--
32	GND	GND	Ground of Module	--

Note:

1. AC_TRIAC_DETECT is used to detect if a device is powered through a triac dimmer and to determine the dimmer settings. The circuit that feeds this signal should give a scaled DC voltage representation of the average AC voltage integrated over approximately 200ms.If the triac is set to chop the AC waveform 50%, the AC_TRIAC_DETECT signal should be at 50% of VCC.If the triac dimmer is turned up completely, the AC waveform will be minimally chopped and the AC_TRIAC_DETECT signal should be at 100% of VCC.

4. Package Specifications

4.1 Dimension

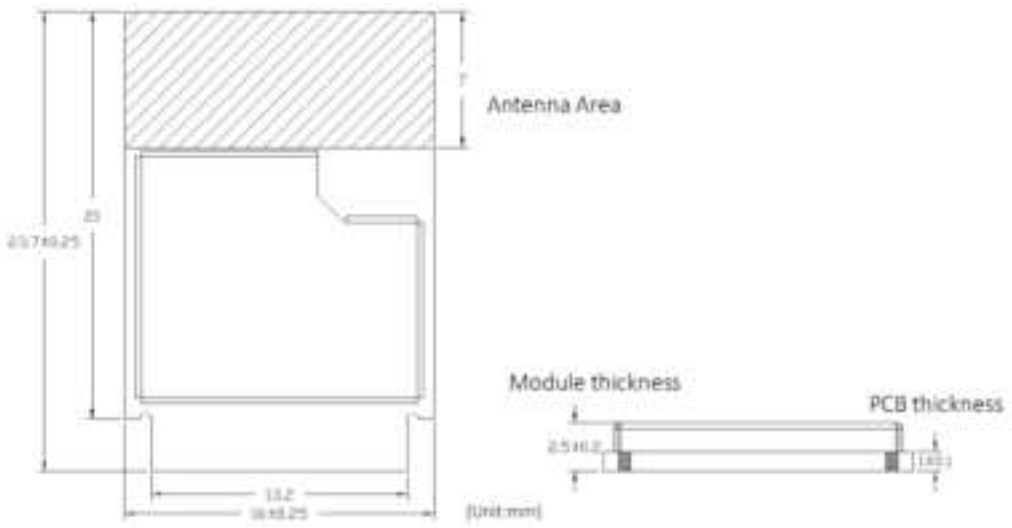

Figure 4.1.Module Dimensions (Unit: mm)

Note: The type B's PCB Antenna Area is no connected.

4.2 PCB Pads Information

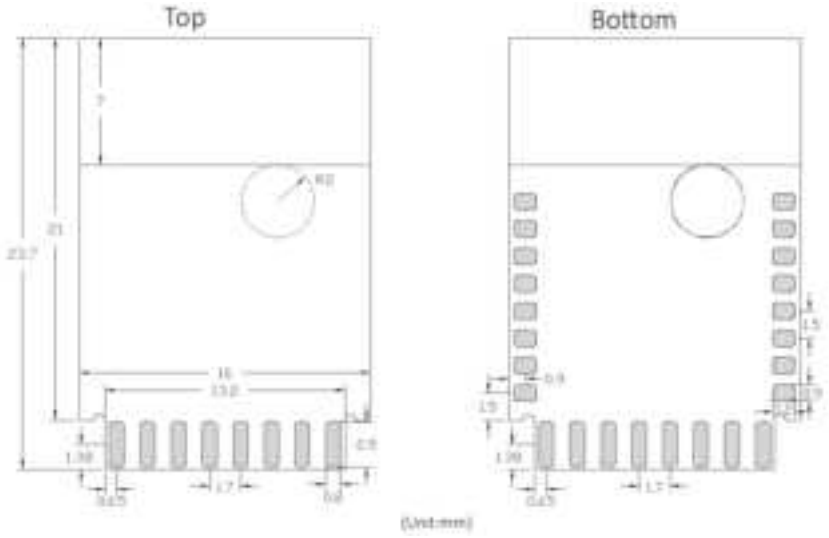

Figure 4.2.Pad Size (Unit: mm)

4.3 Plug-in Land pattern example

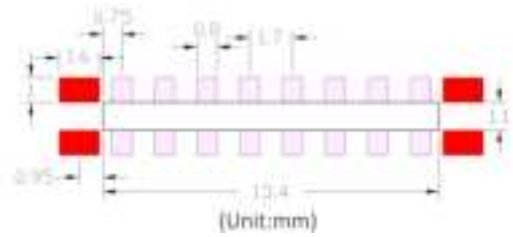

Figure 4.3.Plug-in PCB Land Pattern (Unit: mm)

Please see below lay-out:

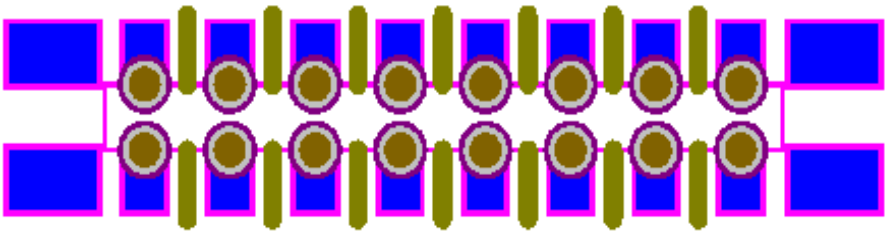

Figure 4.4.Plug-in PCB Land Pattern (Unit: mm)

4.4 SMD Land pattern example

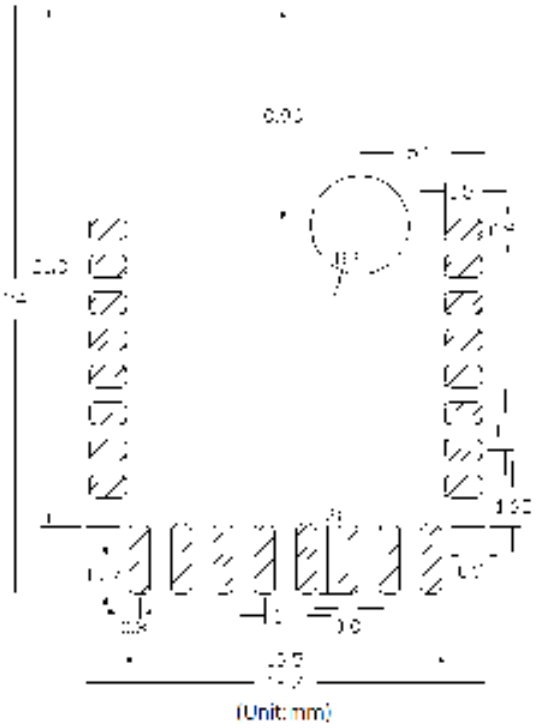

Figure 4.5.SMD PCB Land Pattern (Unit: mm)

5. Soldering Recommendations

Refer tobelow information for SMT temperature settings. Note that the number of times of reflow should not above 2 times.

Table 5.1. SMT temperature setting

Set points(℃)										
Zone	1	2	3	4	5	6	7	8	9	10
Top	140	180	190	180	180	190	245	260	265	210
Bottom	140	180	190	180	180	190	245	260	265	210
Conveyor Speed（cm/min）：130.0										

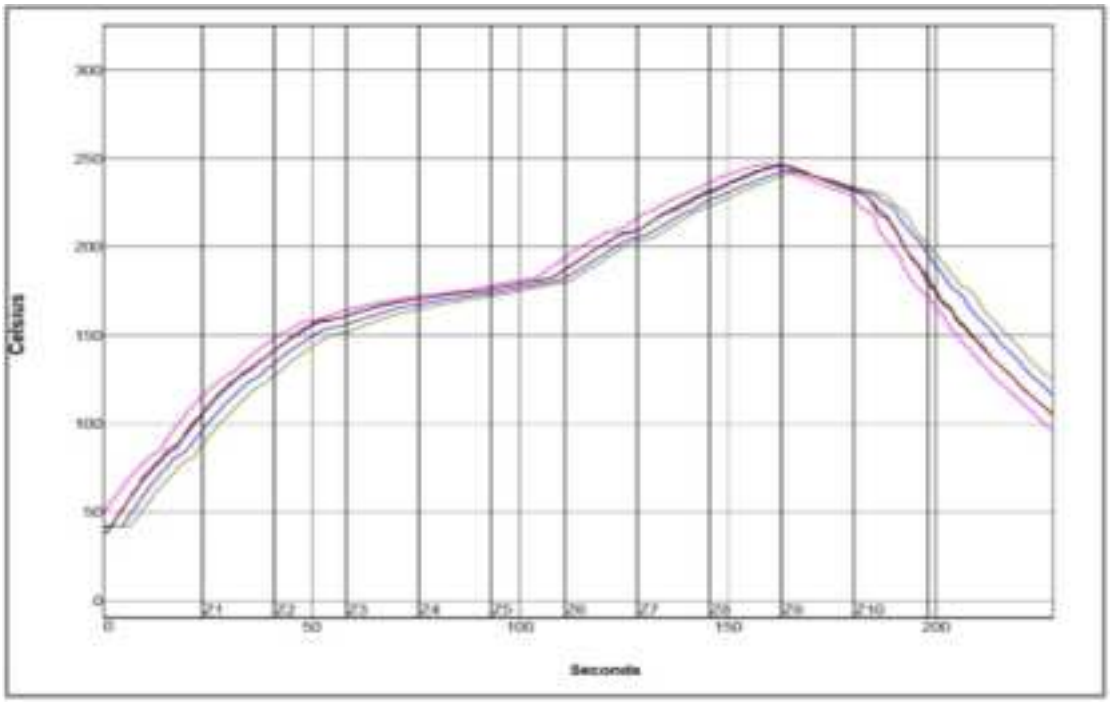

Figure 5.1.SMT temperature setting curve

6. Declaration

FCC Statement

1. This device complies with Part 15 of the FCC Rules. Operation is subject to the following twoconditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may causeundesired operation.

15.21

Note: The grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications could void the user's authority to operate the equipment.

15.105(b)

NOTE: 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 or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment complies with ISEDC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.This equipment should be installed and operated with a minimum distance of 20cm between the radiator &your body.

Conforme aux limitesd'exposition de rayonnement RF ISEDC établiespour un environnement non contrôlé. Cetémetteur ne doit pas être co-implanté oufonctionner en onjunction avec toute autreantenne ou transmetteur. Cet équipement doit être installé et utiliséavec une distance minimale de 20cm entre leradiateur&votre corps.

Regulatory Module Integration Instructions

1.1 List of applicable FCC rules

This device complies with part 15.247 of the FCC Rules.

1.2 Summarize the specific operational use conditions

This module can be applied in HID, sports and fitness sensors , health sensors, mobile accessories as well as smart home. The input voltage to the module should be nominally 3.0-3.6V DC , typical value 3V DC and the ambient temperature of the module should not exceed 105℃ .

1.3 Limited module procedures

Not applicable

1.4 Trace antenna designs

Not applicable

1.5 RF exposure considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment .This equipment should be installed and operated with minimum distance 20cm between the radiator& your body. If the device built into a host as a portable usage, the additional RF exposure evaluation may be required as specified by 2.1093.

1.6 Antennas

The module have PCB antenna

1.7 Label and compliance information

The outside of final products that contains this module device must display a label referring to the enclosed module. This exterior label can use wording such as: "Contains Transmitter Module FCC ID: 2AB2Q-LA02305 " , or "Contains FCC ID: 2AB2Q-LA02305 ",Any similar wording that expresses the same meaning may be used.

1.8 Information on test modes and additional testing requirements

a)The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions

limits or band edge limits (e.g., where a different antenna may be causing additional emissions).
b)The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

C)If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference has been corrected

The LA02035 module is based on ESP32-U4WD chip .support standard Bluetooth HCI UART commands. For the testing module on your product, user can refer to specification of the Bluetooth/WIFI system on how to corfigure and evaluate the module.This specification can also be found on the official Bluetooth website: https://www.bluetooth.org/en- us/specification/adopted-specifications.

1.9 Additional testing , Part 15 subpart B disclaimer

The final host I module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device .

The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369.

Frequency spectrum to be investigated

For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation.

Operating the host product

When testing the host product, all the transmitters must be operating.The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. In certain conditions it might be appropriate to use a technology-specific call box (test set) where accessory devices or drivers are not available.

When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) andIor active scanning. In these cases， this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4， ANSI C63.10 and ANSI C63.26 for further general testing details.

The product under test is placed into a normal 'paired' mode with another BLE device, as per the normal intended use of the product (for example, transferring data).

IC Label Instructions:

The outside of final products that contains this module device must display a label referring to the enclosed module. This exterior label can use wording such as: “Contains Transmitter Module IC: 10256A-LA02305”， or“Contains IC: 10256A-LA02305”, Any similar wording that expresses the same meaning may be used

Instructions d’etiquetage IC: L’exterieur des produits finis contenant ce module doit afficher une etiquette faisant reference au module inclus. Cette etiquette exterieure peut utiliser des libelles tels que: contient le module emetteur IC: “ 10256A-LA02305 ”ou“ contient IC:10256A-LA02305 ”， tout libelle similaire exprimant le meme sens peut etre utilise