

Guangdong Yuefang Technology Co. Ltd

Module name: Wireless Module

Version number: LF_WM_FW_1.0.0

Model Name: LF-WM05

Days: 2020-10-20

Outline

The name of the module

- Wireless Module

characteristic

- Supports the 802.11 b/g/n standard, frequency range 2400M to 2483.5MHz
- Contains 276KB SRAM/128KB ROM/1Kb eFuse
- Operating voltage:DC 2.5 V to 3.6 V
- Wi-Fi-related features
 - Support for IEEE 802.11 b/g/n standard
 - 20MHz bandwidth
 - Supports STA, SoftAP and sniffer mode
 - PCB onboard antenna
- BLuetooth® low energy 5.0
 - BLE 5.0 Channel Selection#2 is supported
 - 1M PHY / Coded PHY / ADV extension is not supported
- Peripheral
 - 2*UART
 - 1*I2C
 - 5*PWM
 - 1*SPI
 - 1*SDIO
 - 1*12bit ADC
 - 1*10bit DAC
 - 13*GPIO

Scenario

- Smart Home / Home Appliances
- Smart transportation



- Smart lighting
- Intelligent security
- Industrial automation

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1. Introduction:

The LF-WM05 module is a low-cost, high-performance WIFI/BLE5.0 module based on the LF686C(32-bit RISC CPU with FPU) to create a cost-effective IoT module for customers. Figure 1 shows the hardware block diagram of the LF-WM05 module, consisting of the following three major parts:

- 32-bit RISC-V core CPU
- WiFi/BLE RF module
- Enrich peripherals

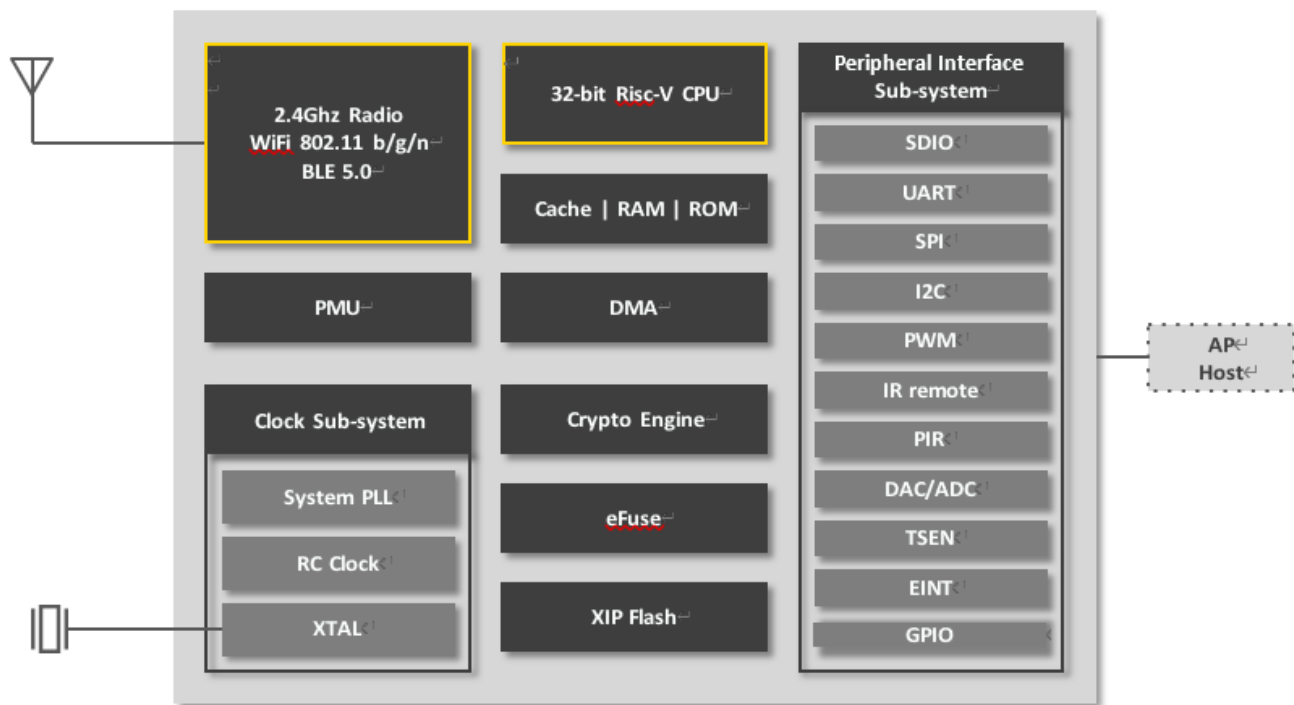


Figure 1 LF-WM05 hardware block diagram

thereinto:

- 32-bit RISC-V core CPU with up to 192MHz operating frequency
- Internal integration 276KB SRAM, 128KB ROM
- Supports high-speed UART, I2C, SPI, PWM, and multiple GPIO ports
- Enter typical voltage: 3.3V

1.1 Package size

The LF-WM05 patch module has a dimensions of (16.00±0.10) mm x (24.00±0.10) mm x

(3.00±0.10)mm. The exact dimensions are shown in Table 1.

Table 1 Module Size Reference Table

Long	Wide	High	PAD size	PIN foot spacing
24mm	16mm	3.0mm	1*1.4mm	2mm

The LF-WM05 module is designed in a stamp package as shown in Figure 2 for easy commissioning, easy disassembly and a variety of options for customer design. A total of 16 pins are drawn, with a 2mm pin spacing and evenly distributed on both sides of the module.

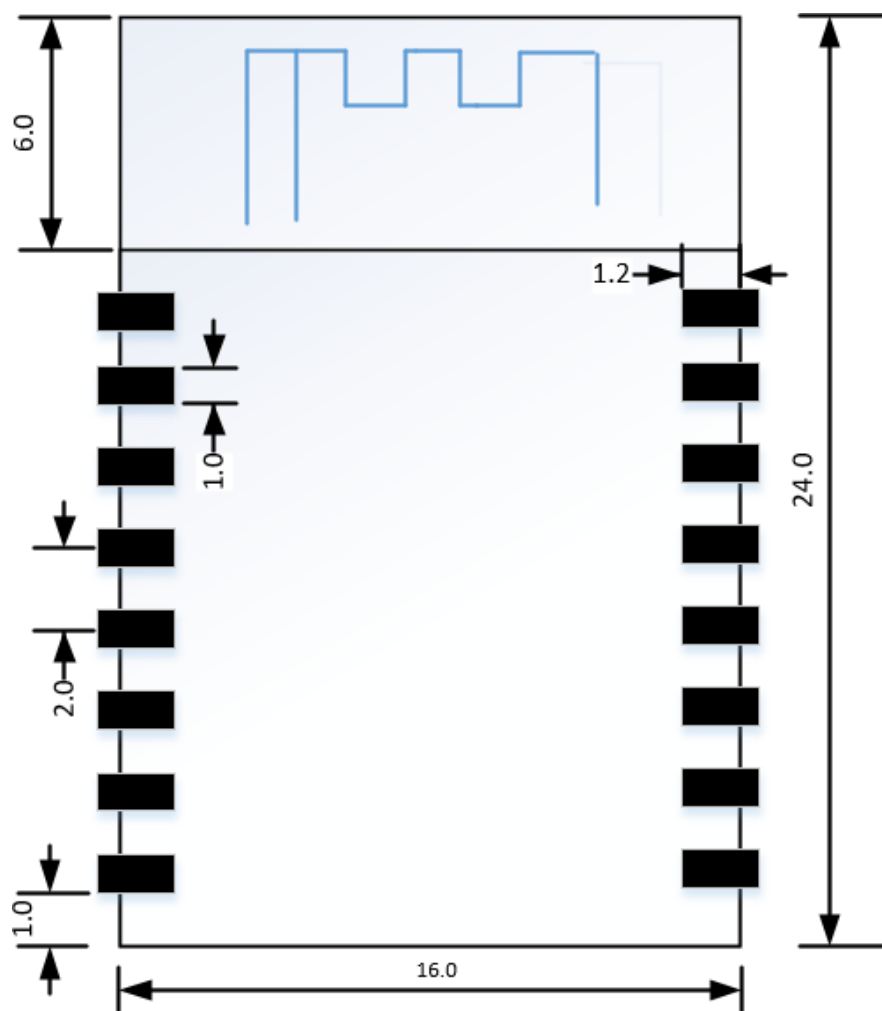


Figure 2 Stamp hole package dimensions

1.2 Pin definition

1.2.1 Pin distribution

The pin distribution of the LF-WM05 patch module is shown in Figure 3, resulting in a total of 16 feet, 13 GPIO, and one power, ground, and reset pin each.

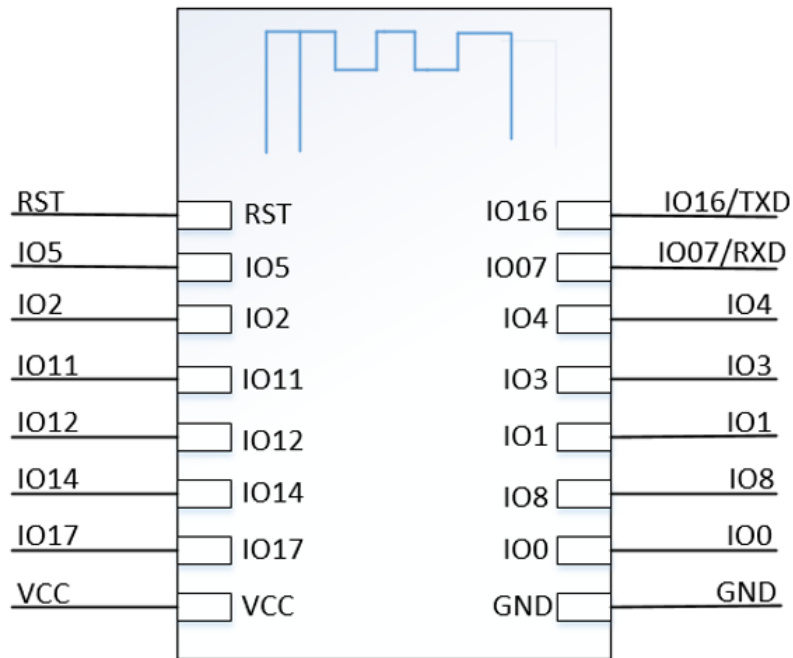


Figure 3 LF-WM05 Pin Definition

1.2.2 Pin definition

The LF-WM05 pin definition is shown in Table 2.

Table 2 LF-WM05 Pin Definition Table

Serial number	Pin name	Description of the function
1	RST	Reset the foot
2	IO_05	SDIO, SPI, I2C, UART, PWM, GPIO
3	IO_02	SDIO, SFLASH, SPI, I2C, UART, PWM, GPIO
4	IO_11	SPI, I2C, UART, PWM, AUXADC, GPIO
5	IO_12	SPI, I2C, UART, PWM, AUXADC, GPIO
6	IO_14	SPI, I2C, UART, PWM, AUXADC, GPIO
7	IO_17	SFLASH, SPI, I2C, UART, PWM, GPIO
8	VCC	3.3V

Serial number	Pin name	Description of the function
9	GND	GND
10	IO_00	SDIO, SFLASH, SPI, I2C, UART, PWM, GPIO
11	IO_08	SPI, I2C, UART, PWM, AUXADC, GPIO
12	IO_01	SDIO, SFLASH, SPI, I2C, UART, PWM, GPIO
13	IO_03	SDIO, SPI, I2C, UART, PWM, GPIO
14	IO_04	SDIO, SPI, I2C, UART, PWM, GPIO
15	IO_07	SPI, I2C, UART, PWM, AUXADC, GPIO
16	IO_16	SPI, I2C, UART, PWM, GPIO

Note: IO08 port needs to be pulled up when downloading burning, not when using it.

2. Electrical parameters

2.1 working conditions

The LF-WM05 module recommends working parameters as shown in Table 3.

Table 3 recommends working conditions

Parameter	Name	Minimum	Typical value	Maximum	Unit
Store the temperature	/	-40 °C	25°C	125 °C	/
Operating temperature	/	-30 °C	25°C	85 °C	/
Supply voltage	VDD	2.5	3.3	3.6	V
In-logic low level	V IL	-0.3	/	0.25 VDD	V
In-logic high level	V IH	0.75 VDD	/	VDD + 0.3	V
Output logic low level	V OL	/	/	0.1 VDD	V
Output logic high level	V OH	0.8 VDD	/	/	V

The maximum rating for electrostatic protection for the LF-WM05 module is shown in Table 4, and exceeding the maximum rating can cause permanent damage to the hardware.

Table 4 Maximum rating for electrostatic protection

Parameter	Minimum	Maximum	Unit
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ESD Protection (HBM)	/	2000	V
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2.2 Hardware and software parameters

Type	Parameter	Illustrate
Wireless parameters	WIFI protocol	802.11 b/g/n
	Frequency range	2400M ~ 2483.5MHz
Hardware parameters	The data interface	UART/I2C/SPI/IR remote control
		GPIO/PWM
	Operating voltage	2.5 V ~ 3.6 V
	Operating current	The average current is 80mA
	The current is supplied	Minimum 500mA
	Operating temperature	-30°C ~ 85 °C
	Package size	(16.00±0.10) mm x (24.00±0.10) mm x (3.00±0.10) mm
Software parameters	Wireless network mode	Supports STA, SoftAP, and sniffer mode
	Security mechanisms	WPA/WPA2
	Type of encryption	WEP/TKIP/AES
	Upgrade the firmware	Local serial burn / cloud upgrade / host download burn
	Software development	Supports customers to customize servers and provide the SDK required for secondary development
	Network protocols	IPv4, TCP/UDP/HTTP

2.3 Power parameters

Table 5 LF-WM05 Power Parameters

Mode		Remark	Power consumption at 25°C			
			Minimum	Typical value	Maximum	Unit
RX	11b	/	/	35	/	mA
	11g	/	/	39	/	
	11n	/	/	39	/	

TX		Duty 50%	/	190	/	
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	11b - 11Mbps @21dBm	Duty 99%	/	310	/	
	11g - 54Mbps @18dBm	Duty 50%	/	145	/	
		Duty 99%	/	230	/	
	11n - MCS7 @17dBm	Duty 50%	/	130	/	
		Duty 99%	/	215	/	
MCU	Run	Freq@192MHz	/	22	/	uA
	StandBy	Freq@<10MHz	/	2	/	
Sleep	PDS7	Fast recover	/	12	/	
Hibernate	HBN	RTC or GPIO wakeup	/	0.5	/	
Shut-down	/	/	/	0.1	/	

3 RF parameters

3.1 RX features

Table 6 RX features

Mode		Test data at 25 °C			
		Minimum	Typical value	Maximum	Unit
RX receives sensitivity	11b - 1Mbps	/	-98	/	dBm
	11b - 11Mbps	/	-91	/	
	11g - 6Mbps	/	-93	/	
	11g - 54Mbps	/	-77	/	
	11n - MCS0	/	-93	/	
	11n - MCS7	/	-73	/	
Maximum receive level	11b - 1Mbps	/	5	/	dBm
	11n - MCS0	/	-4	/	
	11n - MCS7	/	-13	/	
Adjacent channel suppression	11b - 1Mbps	/	40	/	dB
	11b - 11Mbps	/	40	/	

	11g - 6Mbps	/	36	/
	11g - 54Mbps	/	22	/
	11n - MCS0	/	36	/
	11n - MCS7	/	19	/
S11	/	/	<-10	/

3.2 TX features

Table 7 TX features

mode		Test data at 25 °C			
		Minimum	Typical value	Maximum	Unit
Transfer power	11b - 1Mbps	/	17.5	21	dBm
	11b - 11Mbps	/	17.7	21	
	11g - 6Mbps	/	17.3	19	
	11g - 54Mbps	/	17.3	18	
	11n - MCS0	/	16.2	19	
	11n - MCS7	/	15.2	17	
EVM	11g - 54Mbps	/	-28	/	dB
	11n - MCS7	/	-30	/	
Frequency offset	11b - 1Mbps	/	-0.95	/	ppm
	11b - 11Mbps	/	0.71	/	
	11g - 6Mbps	/	-0.82	/	
	11g - 54Mbps	/	-0.95	/	
	11n - MCS0	/	-0.78	/	
	11n - MCS7	/	-0.73	/	

4.MCU

4.1 CPU

LF-WM05 built-in ultra-low power LeapFive LF686C 32-bit RISC processor , CPU Clock speeds can be reached up to 192 MHz,backing Wi-Fi Protocol stack,deep sleep mode consumes

up to $<1\mu\text{A}$. The CPU includes the following interfaces.

- The configurable RAM/ROM connector for the internal storage controller and external Flash can be connected
- Connect the data RAM connector of the storage controller
- Access the AHB port of the register

4.2 storage

The LF-WM05 chip has a built-in storage controller that includes ROM and SRAM. With 276KB SRAM, 128KB ROM, and 1Kb eFuse. 2MB Flash is integrated inside the chip.

4.3 Crystal

The LF-WM05 enables the use of 40MHz crystals, which are selected with an accuracy of ± 10 PPM, and load capacitor of less than 12pF.

Note:

- The accuracy of the selected crystal itself needs to be $10\text{ppm}\pm$, and the operating temperature of the crystal is $-30\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$;
 - The location of the crystal oscillator should be as close as possible to the XTAL Pins of the chip (the traces should not be too long), and the traces of the crystal oscillator must be grounded and shielded.
 - The input and output lines of the crystal cannot be punched into the line, i.e. they cannot cross layers. The input and output lines of the crystal cannot cross, nor can the cross-layer cross-overs.
 - The capacitance of the switch of the input and output of the crystal should be placed near the left and right side of the chip and should not be on the line as far as possible.
 - Crystals Below can not go up frequency digital signal, the best case is the crystal below do not take any signal lines, crystal TOP surface of the copper-paved area the bigger the better.
- Crystals are sensitive devices, and there can be no magnetic induction devices around the crystal, such as large inductors.

5. Assembly information and production guidance

5.1 Assembly dimensions

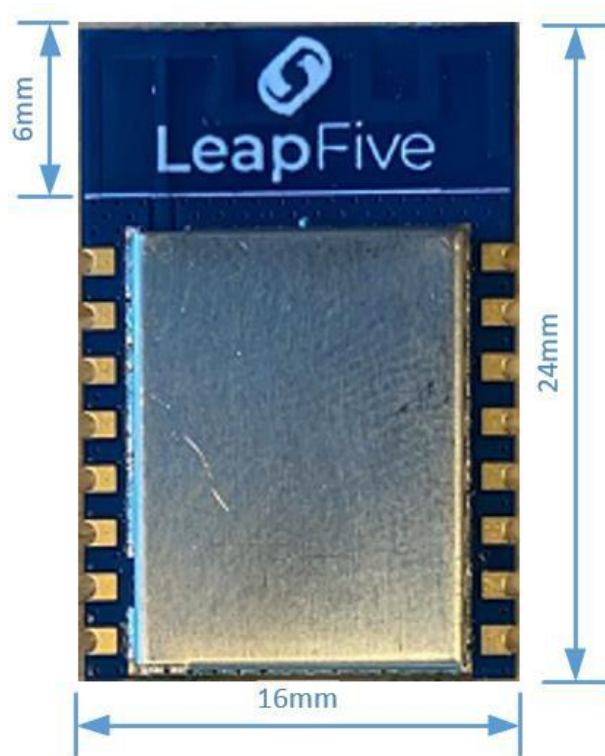


Figure 4 LF-WM05 Assembly Dimensions

5.2 PCB antenna clearance area

When using a PCB antenna on a WIFI module, as shown in Figure 5, you need to ensure that the motherboard PCB antenna is at least as far away from other metal devices more than 16mm.

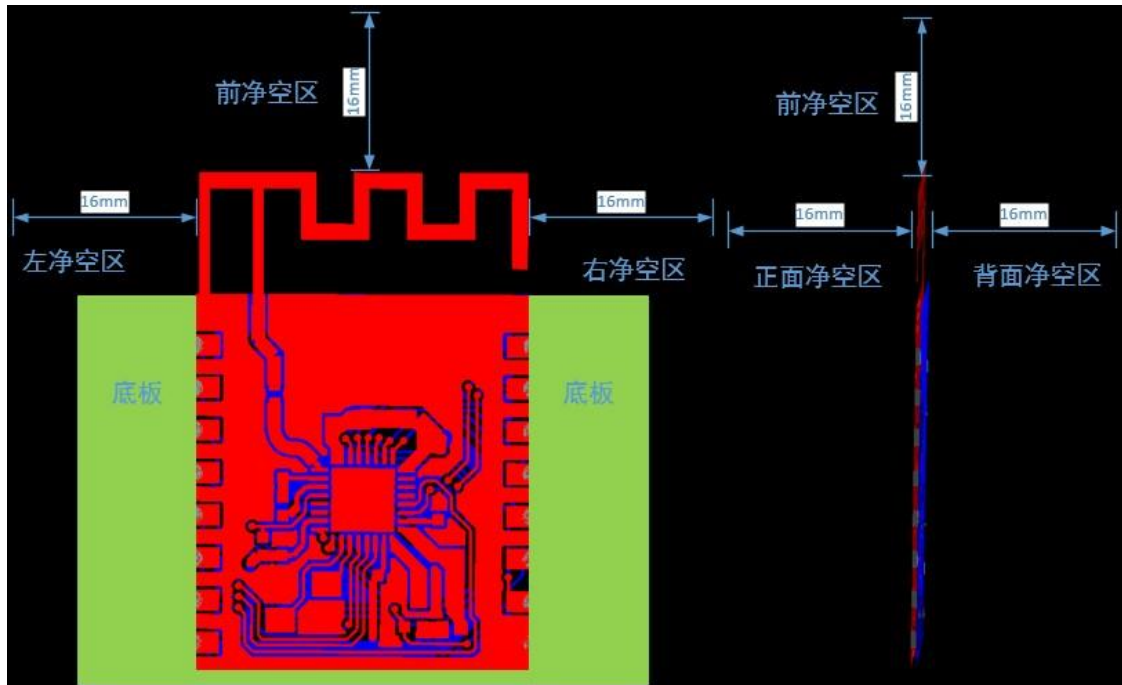


Figure 5 Map of the clearance area of the PCB antenna

5.3 Production precautions

- The LF-WM05 module must be sliced by an SMT machine and baked before the patch.
- The instrument required for the SMT patch
 - Reflow welding patch machine
 - AOI tester
 - Caliber 6-8mm nozzle
- Bake the required equipment
 - Cabinet oven
 - Anti-static, high temperature tray
 - Anti-static high temperature gloves
- In the production process of the operators of each station must wear static gloves;
- After baking, wait for the module to naturally cool down to the temperature of 36°C, before wearing static gloves to take out, so as not to burn;

FCC statements:

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.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

The device has been evaluated to meet general RF exposure requirement, The device can be used in portable exposure condition without restriction. Federal Communication Commission (FCC) Radiation Exposure Statement Power is so low that no RF exposure calculation is needed.

This device is intended only for OEM integrators under the following conditions: 1.The antenna must be installed such that 20 cm is maintained between the antenna and users. 2. The transmitter module may not be co-located with any other transmitter or antenna. As long as the two conditions above are met, additional transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for the installed module.

Important Note: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Federal Communications Commission of the U.S. Government (FCC) and the Canadian Government authorizations are no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator shall be responsible for re-evaluating the end-product (including the transmitter) and obtaining a separate FCC authorization in the U.S. and Canada.

OEM Integrators – End Product Labeling Considerations: This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: " Contains, FCC ID:2AZXW-LF-WM05". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

OEM Integrators – End Product Manual Provided to the End User: The OEM integrator shall not provide information to the end user regarding how to install or remove this RF module in end product user manual. The end user manual must include all required regulatory information and warnings as outlined in this document.

IC statements:

This device complies with Industry Canada license-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.

Cet appareil est conforme avec Industrie Canada RSS exemptes de licence standard(s).

Son fonctionnement est soumis aux deux conditions suivantes:

- (1) cet appareil ne peut pas provoquer d'interférences, et
- (2) cet appareil doit accepter toute interférence, y compris celles pouvant causer un mauvais fonctionnement de l'appareil.

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

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada. 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 20cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements IC 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.

The wireless module has been labelled with its own IC number. If the IC number is not visible when the module is installed inside another device, the outside of the finished product into which the module is installed must display a label referring to the enclosed module. This exterior label can use wording as follows:

Contains transmitter module IC: 27307-LFWM05 or Contains IC: 27307-LFWM05