

FDS-BS07 Wireless Bluetooth Module Data Sheet

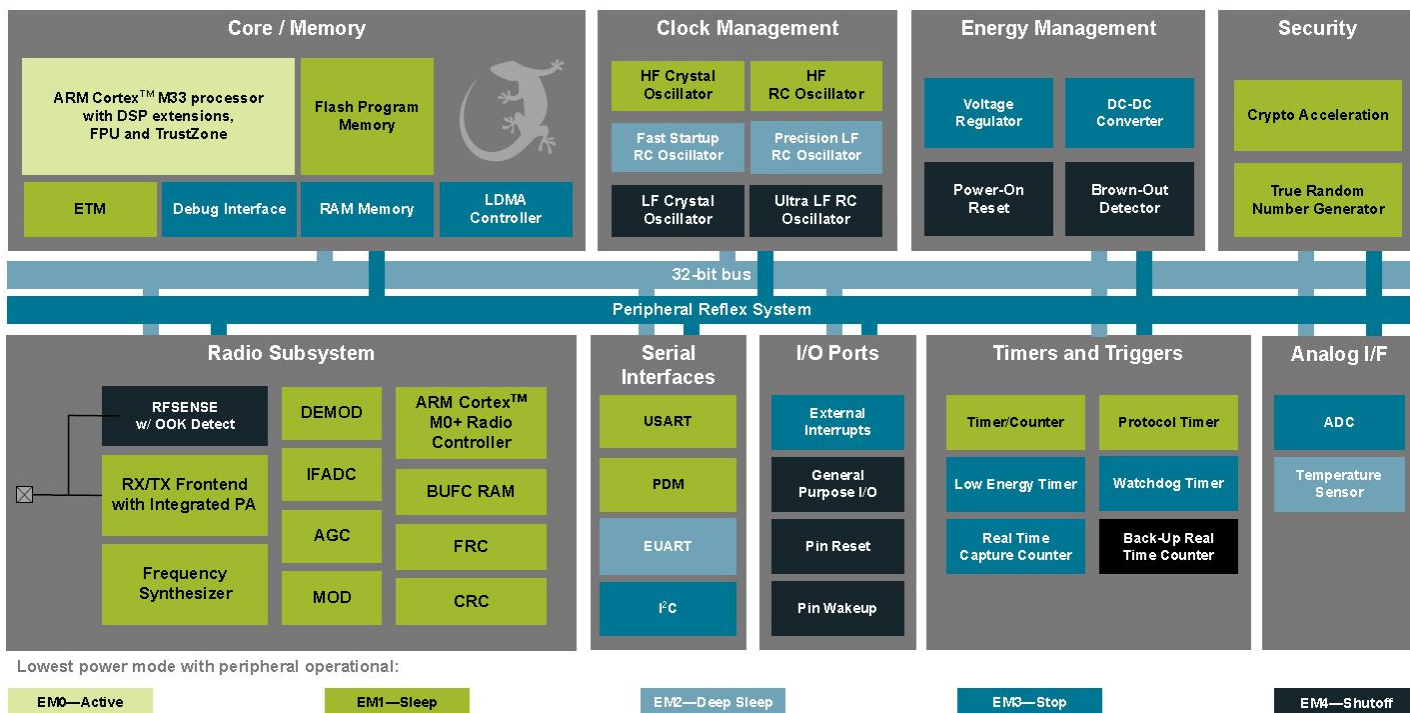
The FDS-BS07 is a module designed and built to meet the performance, security, and reliability requirements of battery-powered IoT products running on Bluetooth networks.

Based on the EFR32BG22 SoC, the FDS-BS07 enables Bluetooth® Low Energy connectivity while delivering best-in-class RF range and performance, future-proof capability for feature and OTA firmware updates, enhanced security features, and low energy consumption.

The FDS-BS07 is intended for a broad range of applications, including:

- Asset Tags and Beacons
- Connected Home
- Portable Medical
- Sports, Fitness, and Wellness devices
- Industrial and Building Automation

- Bluetooth 5.2
- Built-in antenna
- Up to 0 dBm TX power
- - sensitivity@1 Mbps GFSK
- 32-bit ARM Cortex-M33 core at up to 38.4 MHz
- 352/32 kB of Flash/RAM memory
- Optimal selection of MCU peripherals
- 12 GPIO pins
- -40 to + 85 °C
- 10.8 mm x 16.5 mm x 2.3 mm



Revised records

edition	date changed	revise content	
V 1.0	2022-10-14	First release	dylan

Contact us

Shenzhen Linkiing Technology co., Limited

Email: Dylan.xia@linkiing.com

Mobile phone: +86-013510925951

Floor 2, Building 5, Lihe Industrial Area, 1055 SongBai Road, Xili Town, Nanshan District, Shenzhen, China

1. Feature List

FDS-BS07 is a wireless module for Bluetooth 5.2. • Low-Power Wireless System-on-Chip • High Performance 32-bit 38.4 MHz ARM Cortex® -M33, with DSP instructions and floating-point unit for efficient signal processing • Up to 352kB flash program memory • 32 kB RAM data memory • 2.4 GHz radio • Radio Performance • -98.9 dBm sensitivity @1 Mbps GFSK • -96.2 dBm sensitivity @2 Mbps GFSK • TX power up to 0 dBm • Low System Energy Consumption • 26 µA/MHz in Active Mode (EM0) • 1.40 µA EM2 DeepSleep current (RTCC running from LFXO, Full RAM retention) • 3.6 mA TX current at 0 dBm output power • 4.1 mA RX current at 1 Mbps GFSK • Supported Modulation Format • GFSK • Protocol Support • Bluetooth Low power consumption (Bluetooth 5.2)	• Wide selection of MCU peripherals • Analog to Digital Converter (ADC) • 12-bit @ 1 Msps • 16-bit @ 76.9 ksps • UP to 12 General Purpose I/O pins with output state retention and asynchronous interrupts • 8 Channel DMA Controller • 12 Channel Peripheral Reflex System (PRS) • 4 × 16-bit Timer/Counter with 3 Compare/Capture/PWMchannels • 1 × 32-bit Timer/Counter with 3 Compare/Capture/PWMchannels • 32-bit Real Time Counter • 24-bit Low Energy Timer for waveform generation • 1 × Watchdog Timer • 2 × Universal Synchronous/Asynchronous Receiver/Transmitter (UART/SPI/SmartCard (ISO 7816)/IrDA/I2S) • 2 × I2C interface with SMBus support • Operation Range • 1.8 to 3.8 V • -40 to +85 °C • Security Features • Secure Boot with Root of Trust and Secure Loader (RTSL) • Hardware Cryptographic Acceleration for AES128/256, SHA-1, SHA-2 (up to 256-bit), ECC (up to 256-bit), ECDSA, and ECDH • True Random Number Generator (TRNG) compliant with NIST SP800-90 and AIS-31 • ARM® TrustZone®
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2. Ordering Information

Ordering Code	Chip part number	TX Power	Antenna	GPIO
FDS-BS07	EFR32BG22C112F352G M32	0dBm	PCB	12

3. System Overview

3.1 Block Diagram

The FDS-BS07 module is a highly-integrated, high-performance system, with all the hardware components needed to enable 2.4GHz wireless connectivity and supports Bluetooth Low Energy 5.2 protocol stack.

Built around the EFR32BG22 Wireless Gecko SoC, the FDS-BS07 includes a built-in antenna up to TX power of 0 dBm, The temperature rating of EFR32BG22 is -40-85°C, for operation in demanding environmental conditions.

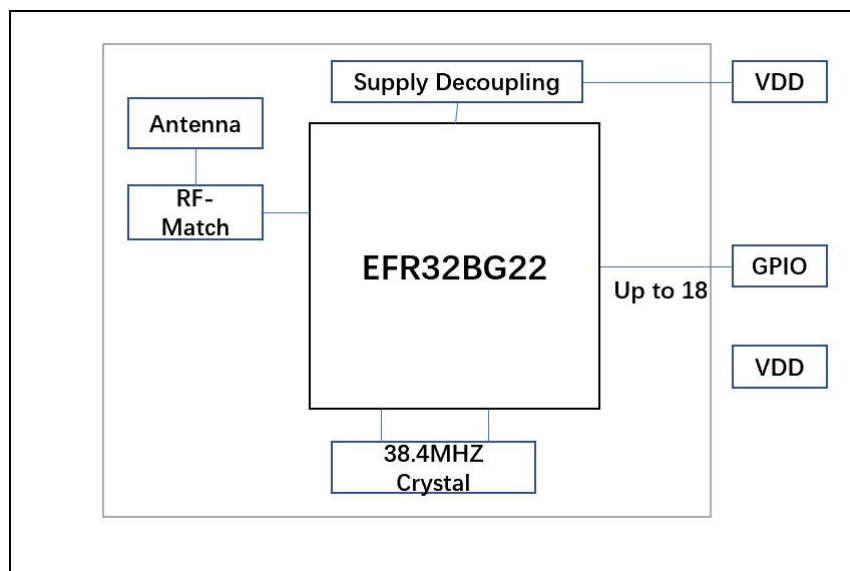


Figure 3.1. FDS-BS07 Block diagram

3.2 EFR32BG22

The EFR32BG22 SoC features a 32-bit ARM Cortex M33 core, a 2.4 GHz high-performance radio, 352KB Flash memory, a dedicated security core, a rich set of MCU peripherals, and a variety of clock management and serial interface options. For more chip information, please refer to: [《EFR32xG22 Wireless Gecko Reference Manual》](#) And "[EFR32BG22 Specifications](#)".

3.3 Antenna

The FDS-BS07 module include a built-in PCB antenna with the characteristics detailed in the table below.

Table 3.1 Antenna Efficiency and Peak Gain

Parameter	With optimal layout	Antenna efficiency, gain and radiation pattern are highly dependent on the application PCB layout and mechanical design. Refer to the Design Guidelines for recommendations to achieve optimal antenna performance.
Efficiency	-7.64 到 -6.11dB	
Peak gain	1.22dBi	

3.4 Security Features

The following security features are available on the EFR32BG22 SoC:

- Secure Boot with Root of Trust and Secure Loader (RTSL)
- Cryptographic Accelerator
- True Random Number Generator (TRNG)
- Security debug with Lock/Unlock

For more information, please refer to the Efr32bg22C112 Datasheet and User Manual.

4. Electrical Characteristics

4.1 Absolute Maximum Ratings

Parameter	Symbol	Test condition	Min	Typ	Max	Unit
Storage temperature range	T _{stg}		-40	—	+125	°C
Voltage on any supply pin	V _{ccmax}		-0.3	—	3.8	V
DC voltage on any GPIO pin	V _{DIGPIN}		-0.3	—	V _{IOVDD} +0.3	V
Total current into VCC power lines	I _{cc MAX}	Source	—	—	200	mA
GND total current	I _{GNDMAX}	S INK	—	—	200	mA
Current per I/O pin	I _{IOMAX}	Sink	—	—	50	mA
		Source	—	—	50	mA
Current for all I/O pins	I _{IOALLMAX}	Sink	—	—	200	mA
		Source	—	—	200	mA

4.2 Normal operating parameters

Parameter	Symbol	Test condition	Min	Typ	Max	Unit
Operating ambient temperature range	T _A	-I temperature grade	-40	—	+85	°C
VCC Supply voltage	V _{cc}		1.71	3	3.8	V
IOVDD opetating supply voltage(All IOVDD pins)	V _{IOVDD}		1.71	3	3.8	V

4.3 Radio Current Consumption @ 3V

RF current consumption measured with MCU is in EM1, HCLK = 38.4MHz, and all MCU peripheral disabled. T_A: 25 °C.

Parameter	Symbol	Test condition	Min	Typ	Max	Unit
Current consumption in receive mode, active packet repton	I _{RX_ACTIVE}	1 Mbit/s, 2GFSK, f = 2.4 GHz, Bluetooth stack running	—	3.6	—	m A
		2 Mbit/s, 2GFSK, f = 2.4 GHz, Bluetooth	—	4.0	—	m A

		stack running				
Current consumption in receive mode, Stack running	I _{RX_LISTEN}	1 Mbit/s, 2GFSK, f = 2.4 GHz, Bluetooth stack running	–	3.6	–	m A
		2 Mbit/s, 2GFSK, f = 2.4 GHz, Bluetooth stack running	–	4.0	–	m A
Current consumption in transmit mode	I _{TX}	f = 2.4 GHz, CW, 0 dBm PA, 0 dBm output power, VSCALE1, EM1P (Radio clocks only)	–	4.1	–	m A

4.4 RF General Characteristics

Conditions: T_A=25 °C, VCC=3.0V. Measured with RF center frequency of 2.45G.

Parameter	Symbol	Test condition	Min	Typ	Max	Unit
RF tuning frequency range	F _{Range}		2400	–	2483.5	M HZ
Maximum TX output power	POUT _{MAX}	0 dBm PA	–	0	–	d Bm
Sensitivity	SENS	Signal is reference signal, 37 byte payload	–	-98.9	–	d Bm
		Signal is reference signal, 255 byte payload	–	-97.4	–	d Bm
		With non-ideal signals	–	-96.9	–	d Bm

5. Pin Definitions

5.1 Module Pinout

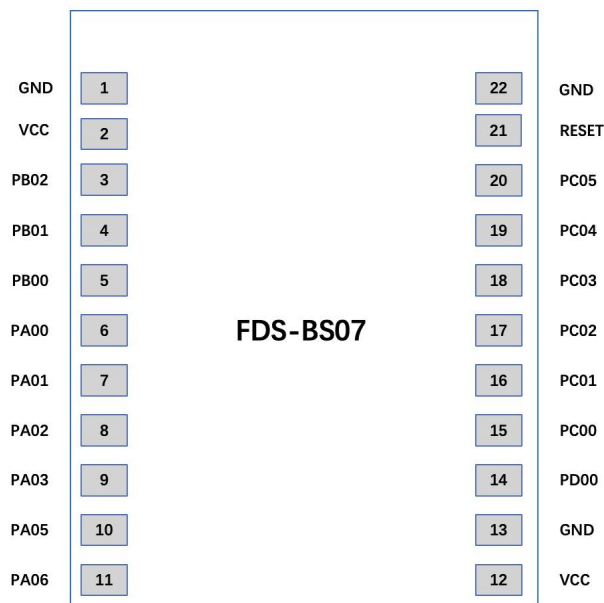


Figure 5.1 FDS-BS07 Module Pinout

Table 6.1 FDS-BS07 Pin Definitions

Module Pin	Pin Description	Chip Pin		Module Pin	Pin Description	Chip Pin
1	GND	GND		12	VCC	3.3V
2	VCC	3.3V		13	GND	GND
3	GPIO	B01		14	GPIO	D00
4	GPIO	B00		15	GPIO	C00
5	GPIO	A00		16	GPIO	C01
6	NC			17	GPIO	C02
7	GPIO	A01		18	GPIO	C03
8	GPIO	A02		19	GPIO	C04
9	GPIO	A03		20	GPIO	C05
10	VCC	3.3V		21	RST	RST
11	GND	GND		22	GND	GND

6. 6. Package Outline

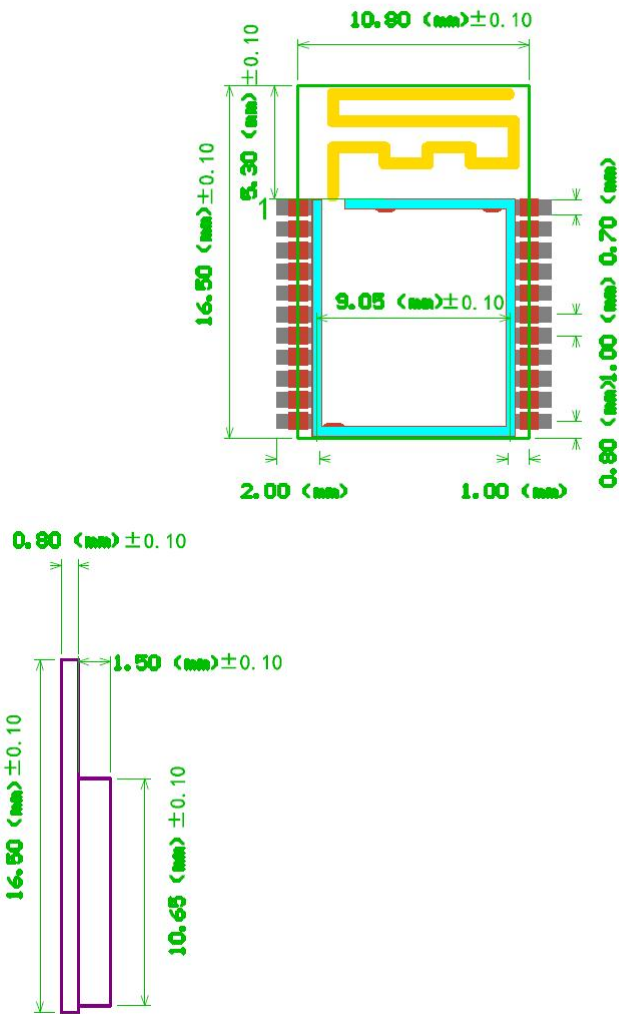
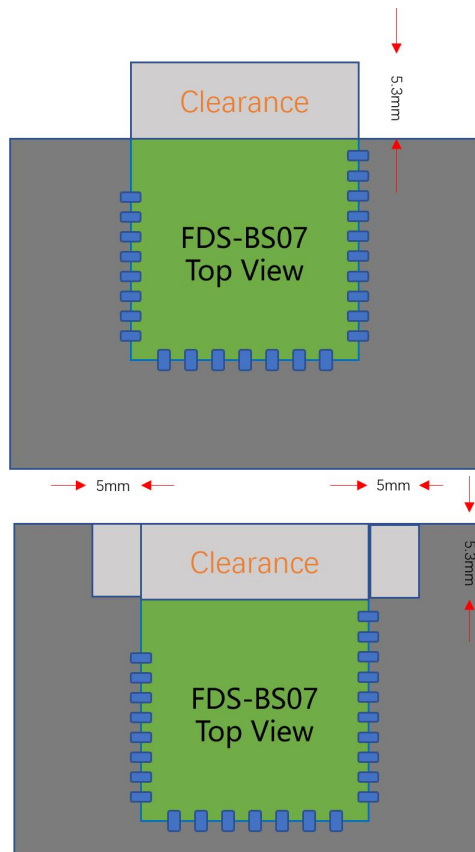


Figure 6.1 Top and Side Views

7. Design Guidelines

- (1) It is recommended not to install in a metal housing.
- (2) PCB layout: The antenna of the Bluetooth module (the left and right side and front end of the antenna) is strictly prohibited under the floor and trace, if it can be hollowed out better.

7.1 recommended layout scheme:



Solution 1: Antenna outside the PCB;

Solution 2: Antenna aligned to the edge of PCB, carved / without copper below

8, matters needing attention:

- (1) The use environment of Bluetooth, wireless signal applications are greatly affected by the surrounding environment, such as trees, metals and other obstacles will absorb the wireless signal to a certain extent, so that in practical application, the distance of data transmission is affected to a certain extent.
- (2) Because the Bluetooth modules are equipped with the existing system, placed in the case, because the metal case shields the RF signals. So it is not recommended not to install in metal housing.
- (3) PCB board: in the antenna part of the Bluetooth module, the metal will weaken the function of the antenna. When giving the module board, the module antenna (left and right and front end of the antenna) is strictly prohibited from laying the ground and wiring. It will be better if possible.

9, Notes on module production process

- 1、 Before production, check the materials. If there is any moisture, it needs to be baked to remove moisture. The baking conditions are:
 - a) The palletized material tray cannot withstand high temperatures above 40 °C. The module needs to be removed from the transportation tray and baked in a constant temperature oven of $120\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}/4\text{H}$;
 - b) Baking constant temperature oven for rolled materials: $60\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}/8\text{H}$;

- 2、 Steel mesh engraving requirements, internal cutting and external expansion: In principle, the effective welding surface of the module is in the bottom area and side. Internal cutting is to prevent bottom tin connection, and generally internal cutting is 0.2mm. External expansion is to strengthen the welding strength of the side. Generally, the external expansion range on three sides is between 0.3mm-0.8mm, depending on the size of the solder pad. It is recommended to expand 0.3mm on both sides and 0.8mm on the external side.
- 3、 Printing requirements, solder paste storage temperature/shelf life: 2-8 °C /6 months, thawing time: 4 hours, stirring time: 5 minutes, usable time: 4-6 hours. Use solder paste with good activity, such as Qianzhu solder paste or solder paste containing 3-4 grams of silver per kilogram.
- 4、 Reflow soldering requirements, RoHS process furnace temperature setting: Normal peak temperature 242-245 °C for 10 seconds, Between: 160-217 °C for 80-95 seconds, Over: 220 °C for 50-65 seconds, Upward: 1-3 °C/second.

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 device 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.

FCC Caution:

- Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- The country code selection is for non-US model only and is not available to all US model.

► RF Exposure Information (SAR)

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.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC 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 FCC authorization.

End Product Labeling : The final end product must be labeled in a visible area with the following:

Contains FCC ID: 2A8JX-FDS-BS07

To be provided at a later date

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.

Industry Canada statement

- ❶ 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.
- ❶ 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.
- ❷ This Class B digital apparatus complies with Canadian ICES-003.
- ❷ Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.
- ❸ This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter, except tested built-in radios.
- ❸ Cet appareil et son antenne ne doivent pas être situés ou fonctionner en conjonction avec une autre

antenne ou un autre émetteur, exception faites des radios intégrées qui ont été testées.

- ④ The County Code Selection feature is disabled for products marketed in the US/ Canada.
- ④ La fonction de sélection de l'indicatif du pays est désactivée pour les produits commercialisés aux États-Unis et au Canada.

FOR DEVICE (>20cm from body / low power)

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 final end product must be labelled in a visible area with the following: The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the Industry Canada certification number of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: 3221-FDS-BS07

This End equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body. Cet équipement devrait être installé et actionné avec une distance minimum de 20 centimètres entre le radiateur et votre corps.

The thisThe end user manual shall include all required regulatory information/warning as shown in this manual.