

# Product

XIAO nRF52840 Sense Plus

## Introduction

As the first wireless product in the Seeed Studio XIAO family, Seeed Studio XIAO nRF52840 is equipped with a powerful Nordic nRF52840 MCU which integrates Bluetooth 5.0 connectivity. Meanwhile, it has a small and exquisite form-factor which can be used for wearable devices and Internet of Things projects. The single-sided surface-mountable design and the onboard Bluetooth antenna can greatly facilitate the rapid deployment of IoT projects.

In addition, there is an advanced version of this board, Seeed Studio XIAO nRF52840 Sense. It is integrated with two extra onboard sensors. One of them is a Pulse Density Modulation (PDM) Digital Microphone. It can receive audio data in real-time which allows it to be used for audio recognition. The other one is a 6-axis Inertial Measurement Unit (IMU), this IMU can be very useful in TinyML projects like gesture recognition. These onboard sensors provide a great convenience for users while the board is ultra-small.

The newly upgraded XIAO nRF52840 Plus and XIAO nRF52840 Sense Plus provide considerable increases in functionality and usability. The number of multifunctional pins

has been increased to 20, I2S and SPI resources have been added to support more complex projects, and the BAT pin has been repositioned for better soldering convenience, resulting in a more user-friendly hardware experience.

Compared to Seeed Studio XIAO RP2040, Seeed Studio XIAO nRF52840 contains richer interfaces. There is a tiny reset button on the side of the Type-C interface. On the other side, there is a 3-in-one LED (User LED) along with a Charge LED to indicate the charging status when a battery is connected. There are 11 digital I/O that can be used as PWM pins and 6 analog I/O that can be used as ADC pins. It supports all three common serial interfaces such as UART, I2C, and SPI. Same as Seeed Studio XIAO RP2040, it has an onboard 2 MB flash which means it can also be programmed using Arduino, MicroPython, CircuitPython, or other programming languages.

Seeed Studio XIAO nRF52840 Sense is compatible to the Seeed Studio XIAO expansion board.

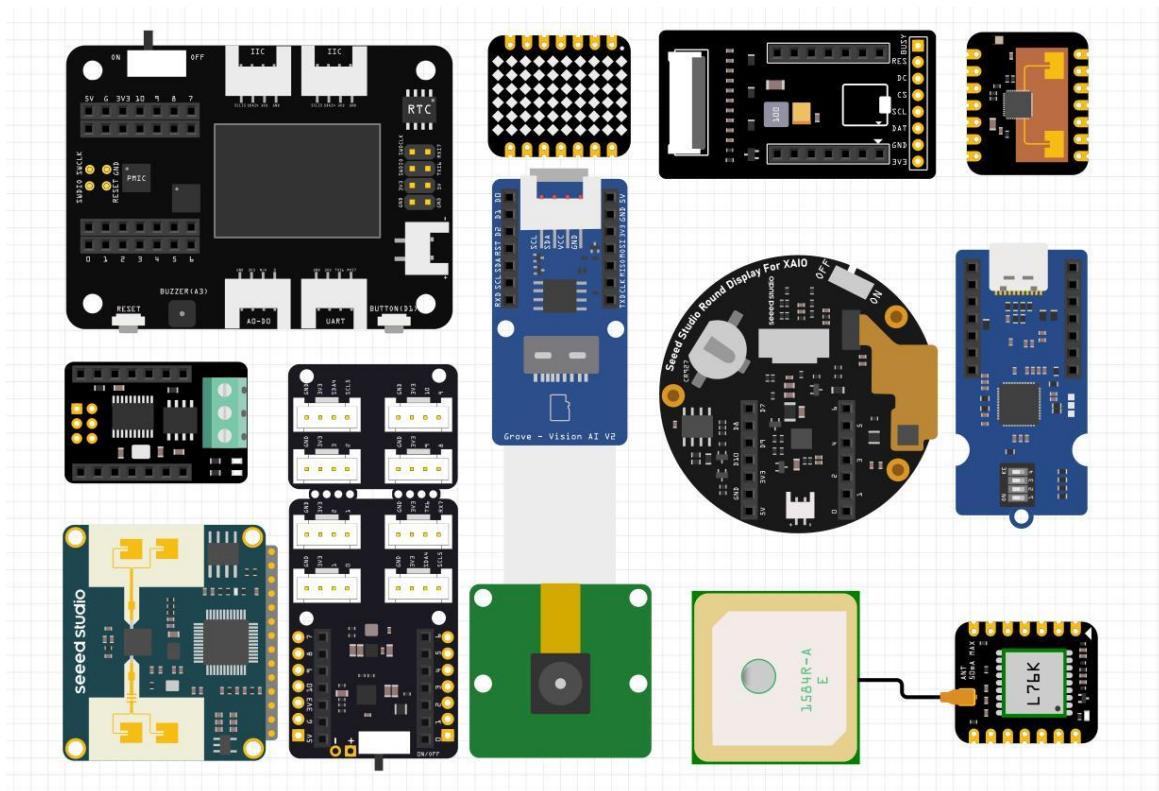
## Feature

Inspired by the unique SMD pins design of the [RICK TNY](#), we're now introducing the Seeed Studio XIAO Plus boards (available in XIAO nRF52840 Plus, XIAO nRF52840 Sense Plus, and XIAO ESP32S3 Plus) to include an updated design of more castellations and a new pad layout on the back.

Seeed Studio XIAO nRF52840 Sense Plus, powered by Nordic chipset with FPU, brings more SMD pins to this tiny Bluetooth sensor dev board. While maintaining all the capabilities of the standard version including onboard IMU and PDM microphone, Bluetooth 5.0, and low power consumption, this Plus variant features redesigned castellations and pad layout on the back, offering 9 additional GPIOs specifically for advanced Bluetooth projects requiring expanded I/Os via SMD board-to-board soldering. With native TensorFlow Lite, it's your ideal development platform for advanced embedded Machine Learning and AIoT projects.

- **High-Performance MCU:** Nordic Semiconductor's nRF52840 chip with FPU at 64 MHz, multiple development ports, compatible with Arduino/CircuitPython/MicroPython
- **Onboard Sensing:** Integrated 6-axis IMU and PDM microphone enable motion sensing and audio input, ideal for wearable devices and compact ML applications
- **Advanced Wireless Connectivity:** Bluetooth 5.0 with built-in antenna
- **Efficient Power Management:** 5  $\mu$ A deep sleep consumption with integrated Li-ion battery charging
- **Expanded 20 GPIOs:** 9 extra 1.27mm pitch SMD castellation pins beyond standard XIAO nRF52840
- **Universal Compatibility:** Standard backside layout (with aligned battery pads, and debugger pads) for more to-be-released XIAO expansion boards

- **Classic XIAO Form Factor:** 21 x 17.8mm design with 2.54mm pin headers, single-sided mounting for wearables and space-constrained projects
- **XIAO Accessory Add-ons Compatibility:** Natively compatible with all the XIAO accessory add-ons of expansion, connectivity modules (LoRa, CAN\_Bus, RS-485), sensors (2-Mic Array, Vision AI, mmWave Motion, Environmental sensing), and actuators (ePaper display, LED Matrix, relay and more).



As a new addition to the **Seeed Studio XIAO family**, the XIAO nRF52840 Plus remains the classic XIAO design (thumb-size, SMD, stamp holes). All these features make it a perfect fit for either space-limited applications, or a production-ready System on Module (SoM) for your PCBA designs. (check out our [Fusion Co-Create one-stop](#)

prototyping, producing and promoting services to explore how to scale up your XIAO-based designs).

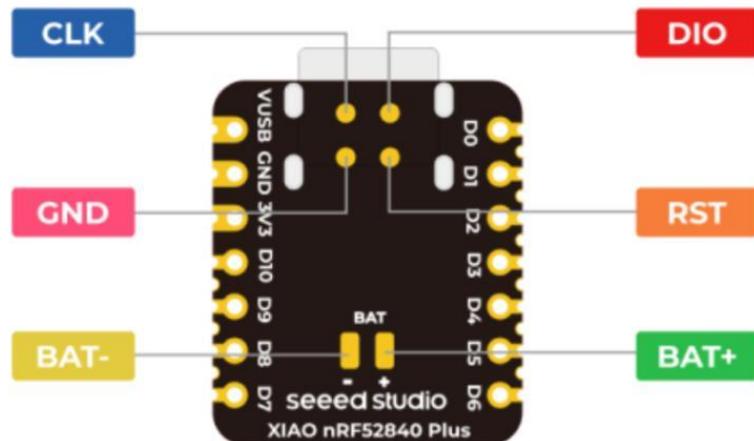
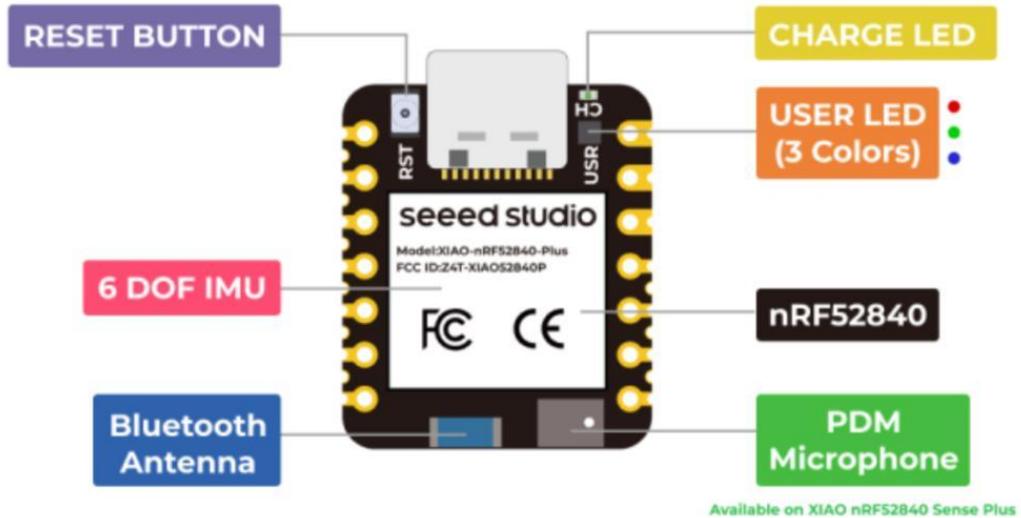
Note: XIAO SoM User Manual open-sources all hardware and software materials of XIAO, providing professional product design guidelines to help you accelerate ideas off the ground, streamline product design, providing a seamless experience from module selection to mass production. You can check [here](#) to see more info.

## Specification

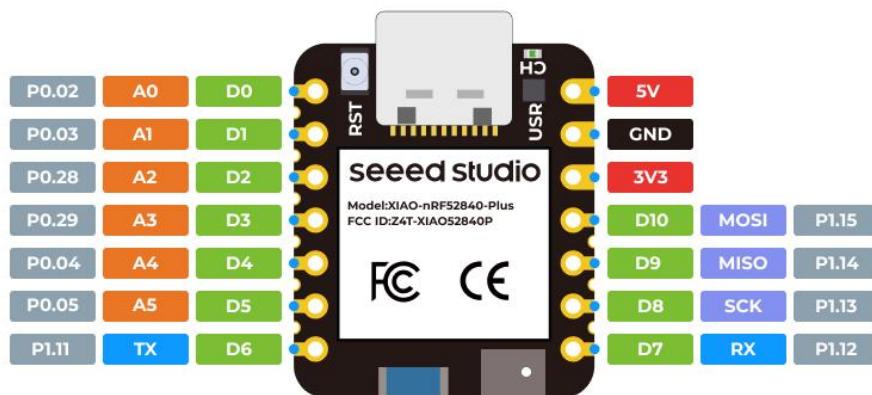
Item	Seeed Studio XIAO nRF52840	Seeed Studio XIAO nRF52840 Sense Plus	Seeed Studio XIAO nRF52840 Plus
Processor	Nordic nRF52840, ARM® Cortex®-M4 32-bit processor with FPU, 64 MHz		
Wireless Connectivity	Bluetooth 5.0/BLE		
Memory	256KB RAM, 1MB Flash 2MB onboard Flash		
Built-in Sensors	N/A	6 DOF IMU (LSM6DS3TR-C), PDM Microphone	N/A
Interfaces	1xI2C, 1xUART, 1xSPI	1xI2C, 2xUART, 2xSPI, 1xI2S	
PWM/Analog Pins	11/6	20/6	
Onboard Buttons	Reset Button		
Onboard LEDs	3-in-one LED/ Charge LED		
Battery Charge Chip	BQ25101		
Programming Languages	Arduino/MicroPython/ CircuitPython		

## Hardware Overview

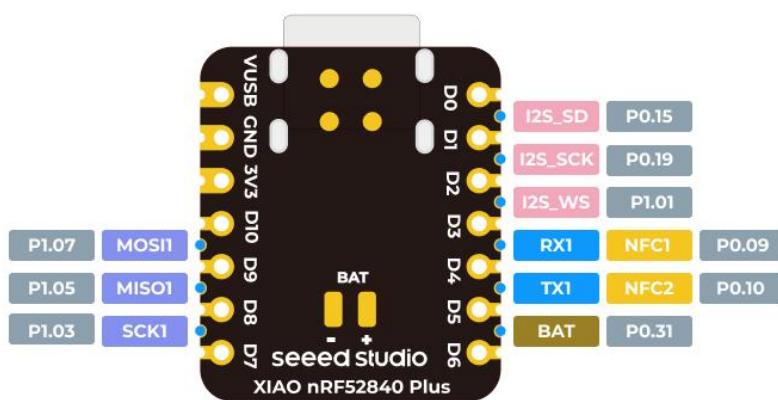
- *Onboard*



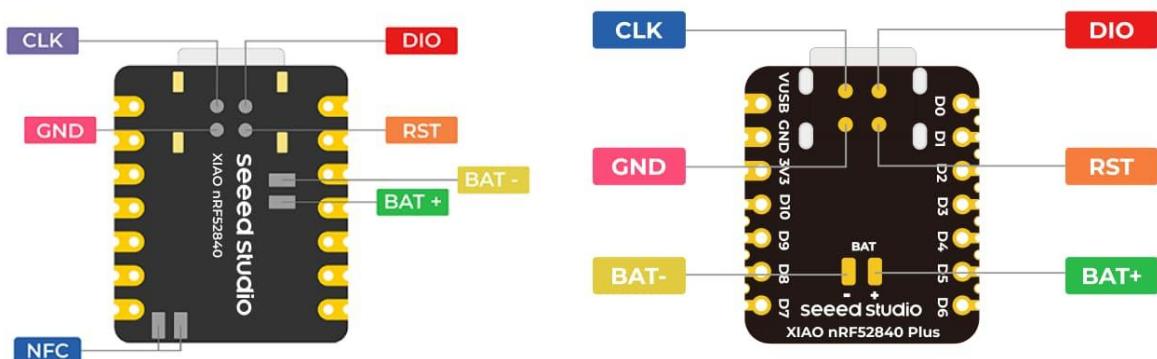
- *PinOut*



Analog      Digital      BAT      Power      GND      NFC      SPI      UART      Pin No.      I2S



- XIAO nRF52840 back vs XIAO nRF52840 Plus back



# Application

- Small and flexible wearable device
- Wifi/Bluetooth controlled wireless connection project
- Embedded Machine Learning Project
- IoT and TinyML AI applications
- Mini Arduino projects

## Documents

[Getting Started with Seeed Studio XIAO nRF52840 Series](#) | Seeed Studio Wiki

Schematic

## ECCN/HTS

HSCODE	8543709990
USHSCODE	8543708800
UPC	
EUHSCODE	8543709099
COO	CHINA

## Part List

Seeed Studio XIAO nRF52840 Sense Plus	x1
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Please note Seeed Studio XIAO Plus doesn't come with [7-pin headers](#) as it's designed for SMD board-to-board soldering. If you'd love to have the 7-pin headers, make sure to add them to the cart.

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#### FCC Interference Statement

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 complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment

**\*RF warning for Mobile device:**

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.

The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: Z4T-XIAO52840P".

Additionally, the following statement should be included on the label and in the final product's user manual:

"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 interferences, and
- (2) this device must accept any interference received, including interference that may cause undesired operation." The module is limited to installation in applications. Separate approval is required for all other operating configurations, including portable configuration with respect to Part 2.1093 and different antenna configurations. A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end - use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together. This Module is full modular approval, it is limited to OEM installation ONLY. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module.

Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable. (OEM) Integrator is reminded to assure that these installation

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instructions will not be made available to the end user.

## **Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01**

### **2.2 List of applicable FCC rules**

FCC Part 15 Subpart C 15.247 & 15.207 & 15.209 & 15.205

### **2.3 Specific operational use conditions**

When installed in smart terminal products, the host manufacturer must negotiate with the module manufacturer on the final installation method in the system. The host manufacturer installing this module into their product must ensure that the final compost product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer 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.

The module should be installed and operated with minimum distance 20cm between the radiator & your body. and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. When the host is a portable device, it is necessary to take a SAR test with your set mounting this module. Class II permissive change application is necessary using the SAR report. Please contact kevin (kevin@sziton.com). And an application for a Class II permissive change from a Mobile equipment to a Portable equipment is also required.

Note) Portable equipment : Equipment for which the spaces between human body and antenna are used within 20cm. Mobile equipment : Equipment used at position in which the spaces between human body and antenna exceeded 20cm.

1. According to the following requirements of the power supply DC3.3V, power up, about 3 seconds to to complete the initial.
2. iphone/Android mobile phone BT/WIFI function to open, search to the corresponding Wireless network adapter name (name can be changed according to customer production requirements), click the name of the BT/WIFI and select the connection.
3. open application software (need to install the company's specific application software development, application software interface can be customized according to customer's product requirements).

### **2.4 Limited module procedures**

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The module is a Single module.

Requirement per 15.212 and KDB 996369 D01	Explanation from Grantee (do not write yes/no, but explain why product complies/how it is achieved)
The radio elements must have the radio frequency circuitry shielded. Physical components and tuning capacitor(s) may be located external to the shield, but must be on the module assembly.	Has RF shielding.
The module must have buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.	The modular have buffered modulation/data inputs.
The module must contain power supply regulation on the module.	The modular transmitter have its own power supply regulation.(DC 3.3V)
The module must contain a permanently attached antenna, or contain a unique antenna connector, and be marketed and operated only with specific antenna(s), per §§ 15.203, 15.204(b), 15.204(c), 15.212(a), 2.929(b).	Antenna restrictions are added in the manual. The antenna needs to be professionally installed.
The module must demonstrate compliance in a stand-alone configuration.	The module was tested in a stand-alone configuration, please refer to the Setup Photo for the detail
The module must be labeled with its permanently affixed FCC ID label, or use an electronic display (see KDB Publication 784748).	Please refer to label sample exhibit - host labeling is described in integration manual
The module must comply with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.	The required FCC rule has been fulfilled and all the instructions for the maintaining compliance have been clearly stated in the User Manual.
The module must comply with RF exposure requirements	The MPE evaluation with 20cm distance restriction is submitted for the compliance of RF Exposure requirement.

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## 2.5 RF exposure considerations

The module complies with FCC radiation exposure limits set forth for an uncontrolled environment. The module should be installed and operated with minimum distance 20cm between the radiator & your body.

## 2.6 Antennas

This module has been approved to operate with the antenna types listed below, with the maximum permissible gain indicated. The module antenna requires professional installation, and the antenna type cannot be changed. The gain cannot exceed 2.09dBi.

Frequency band	Antenna Type	Max Gain
2400-2500MHz	Ceramic Antenna	2.09(dBi)

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This device is intended only for host manufacturers under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna; The module shall be only used with the External antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique' antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

## **2.7 Label and compliance information**

Host product manufacturers need to provide a physical or e-label stating

"Contains FCC ID: Z4T-XIAO52840P With their finished product.

## **2.8 Information on test modes and additional testing requirements**

The module complies with FCC radiation exposure limits set forth for an uncontrolled environment. The module should be installed and operated with minimum distance 20cm between the radiator & your body. and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. When the host is a portable device, it is necessary to take a SAR test with your set mounting this module. Class II permissive change application is necessary using the SAR report. Please contact kevin (kevin@sziton.com). And an application for a Class II permissive change from a Mobile equipment to a Portable equipment is also required.

Note) Portable equipment : Equipment for which the spaces between human body and antenna are used within 20cm. Mobile equipment : Equipment used at position in which the spaces between human body and antenna exceeded 20cm.

Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

## **2.9 Additional testing, Part 15 Subpart B disclaimer**

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.207 & 15.209 & 15.205 and that the host product manufacturer is responsible for compliance to any

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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.

**2.11 The user manual of the end product should include:**

- a) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
- b) The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.
- c) 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.
- d) This device is restricted to indoor use.
- e) The antenna(s) used for this transmitter must not transmit simultaneously with any other antenna or transmitter.