

2019

# BLE520-A User Manual

BLUETOOTH LOW ENERGY MODULE BASED ON  
NRF52832

**Wuxi Ghostyu Electronics Co.,Ltd**

# Description

BLE520-A is a low-power, high-performance BLE module based on nRF52832. It supports Bluetooth 5.4 and is specially designed for IoT applications. It has a small size and excellent RF performance. It is very suitable for consumer smart items, IoT devices, embedded integrated Bluetooth function, using intelligent mobile terminal to realize data transmission and control.

- Support Bluetooth low energy 5.4 protocol stack
- 2Mbps Bluetooth connection speed
- 512KB Flash + 256KB RAM for most applications
- Up to 1.05dBm transmit power
- Comes with 128-bit AES hardware encryption

This document can help users quickly understand the interface definition, electrical performance, and structural dimensions of the BLE520-A module. Combined with this document and other application documents of the BLE520-A module, users can smoothly embed the module into various terminal designs.

# Product Appearance

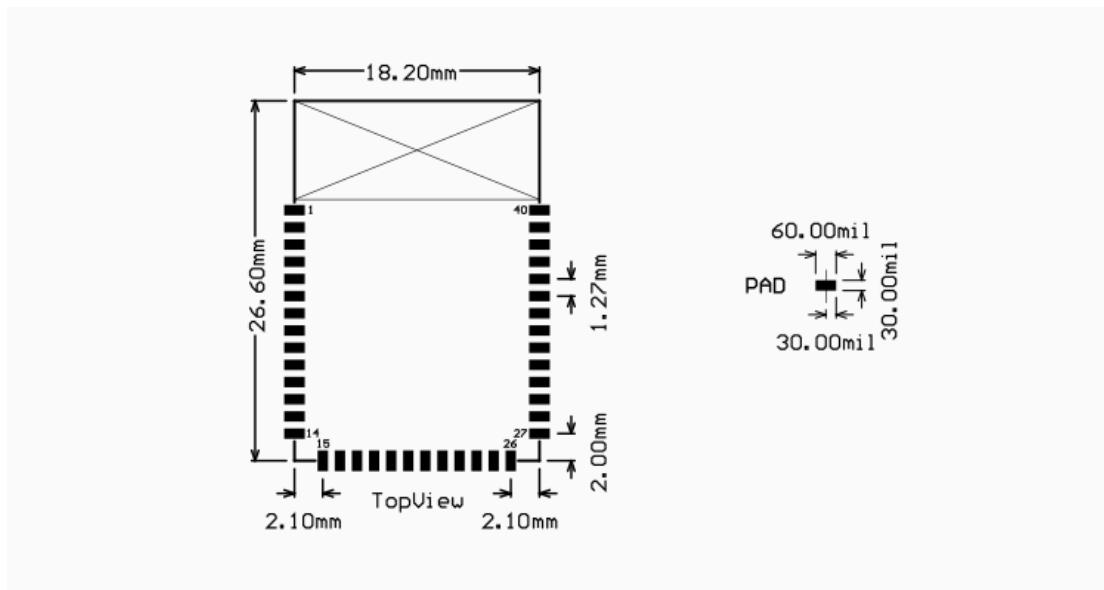


Basic parameters

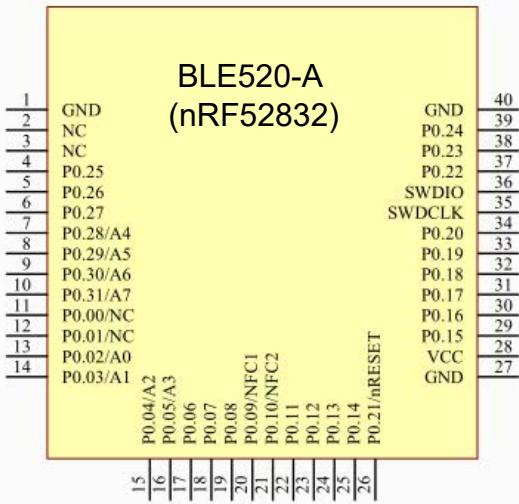
Type	Content
<b>Working frequency</b>	2402-2480MHz
<b>transmit power</b>	1dBm
<b>Receive sensitivity</b>	Receive sensitivity up to -96dBm
<b>transmit current</b>	Instantaneous 5mA@0dBm
<b>receive current</b>	Instantaneous 5mA
<b>Antenna type</b>	On board PCB Antenna
<b>Operating Voltage</b>	1.7V~3.6V
<b>Lowest power consumption</b>	0.3uA (chip sleep)
<b>chip memory</b>	NRF52832-QFAA
	Flash: 512Kb
	RAM: 64Kb
<b>Operating temperature</b>	-40°C~+85°C
<b>Module size</b>	18mm*26mm *2mm

## Dimensions and Footprint

The appearance size of BLE520-A is 18mm\*26mm\*2mm (error  $\pm 0.2\text{mm}$ ). The recommended package is shown in the figure below (top view, the chip is on the front side).



The pin signal description is as follows:



### Module Signal Description

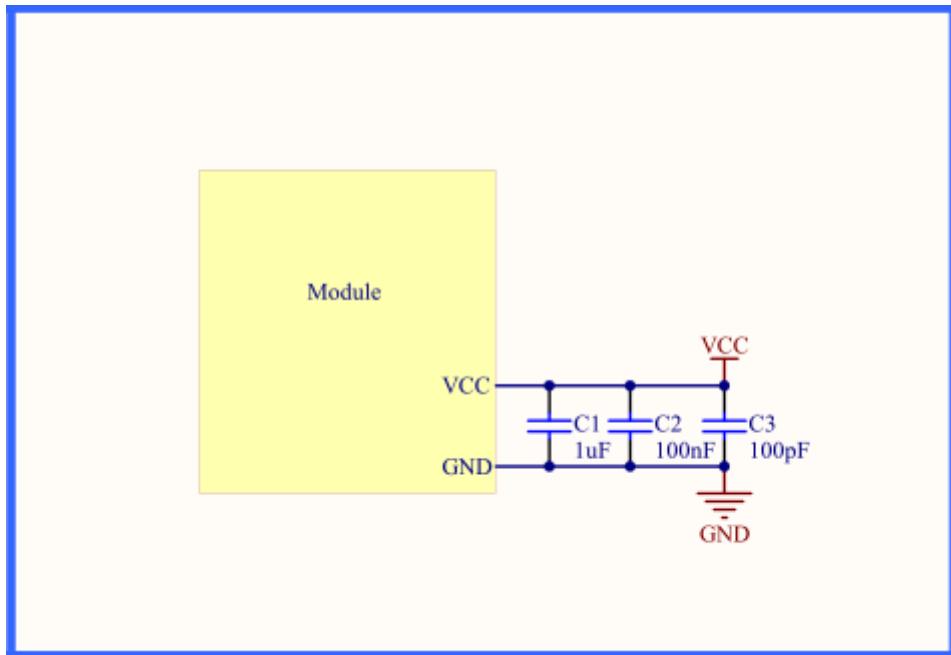
No	pin name	direction	Function Description
1	GND	-	Power ground
2	NC		Not Connect
3	NC		Not Connect
4	P0.25	two-way	General IO
5	P0.26	two-way	General IO
6	P0.27	two-way	General IO
7	P0.28/A4	two-way	General IO; Analog Input 4
8	P0.29/A5	two-way	General IO; Analog Input 5
9	P0.30/A6	two-way	General IO; Analog Input 6
10	P0.31/A7	two-way	General IO; Analog Input 7
11	P0.00/NC		Not Connect
12	P0.01/NC		Not Connect
13	P0.02/A0	two-way	General IO; Analog Input 0
14	P0.03/A1	two-way	General IO; Analog Input 1
15	P0.04/A2	two-way	General IO; Analog Input 2
16	P0.05/A3	two-way	General IO; Analog Input 3
17	P0.06	two-way	General IO
18	P0.07	two-way	General IO
19	P0.08	two-way	General IO
20	P0.09	two-way	General IO; NFC antenna pin NFC1
21	P0.10	two-way	General IO; NFC antenna pin NFC1
22	P0.11	two-way	General IO
23	P0.12	two-way	General IO

24	P0.13	two-way	General IO
25	P0.14	two-way	General IO
26	P0.21/RESET	two-way	General IO; Reset pin
27	GND	-	Power ground
28	VCC	-	Power input, voltage range: 1.7V~3.6V
29	P0.15	two-way	General IO
30	P0.16	two-way	General IO
31	P0.17	two-way	General IO
32	P0.18	two-way	General IO
33	P0.19	two-way	General IO
34	P0.20	two-way	General IO
35	SWCLK	input	SWD programming interface, SWCLK signal
36	SWDIO	two-way	SWD programming interface, SWDIO signal
37	P0.22	two-way	General IO
38	P0.23	two-way	General IO
39	P0.24	two-way	General IO
40	GND	-	Power ground

## Hardware Reference Designs

### Power Interface

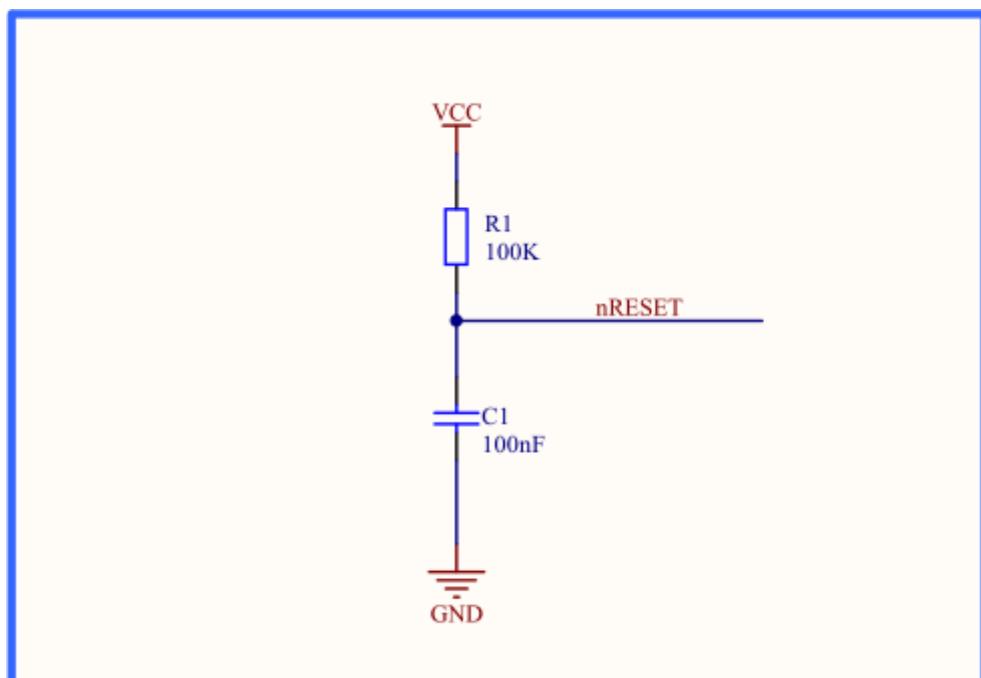
Power input range: 1.7V~3.6V, the typical voltage is 3.3V, the power supply capacity is required to be at least 50mA, and the power supply ripple is required to be low, the VCC pin is reserved for filter capacitors, 1uF+100nF+100pF is recommended, if the application The environment is relatively harsh, often subject to ESD interference or high EMC requirements. It is recommended to connect magnetic beads in series and TVS tubes in parallel to increase the module's stability.



## Reset function

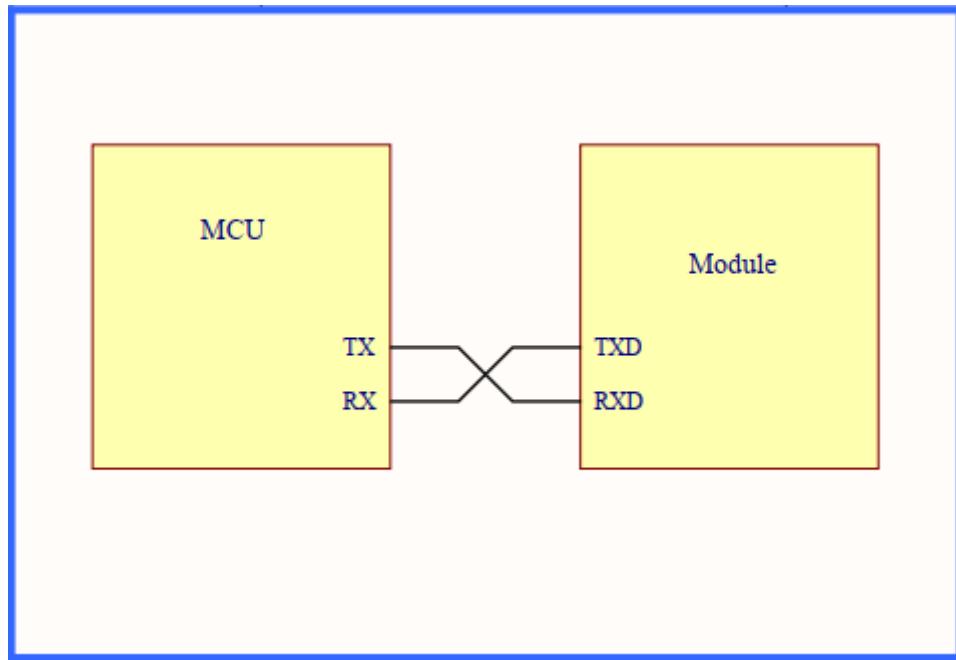
Reset is a hardware reset pin, used for module reset, active low, pull low for at least 200ms, and then pull high or suspend to reset.

The reset circuit has been set inside the module, because no external reset is required, the internal reset circuit is shown in the following figure:



## UART serial port

The level of the serial port changes with the change of the input voltage of the module. The recommended VCC voltage is 3.3V. If the module is powered by 3.3V, the serial port TXD and RXD can be directly connected to the 3.3V MCU serial port (the module TXD is connected to the MCU RX, the module RXD connected to the TX of the MCU).



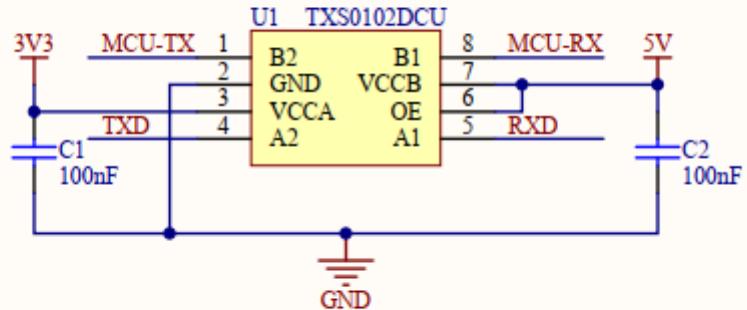
When the module level does not match the MCU level, such as the Arduino serial port 5V, adding a level conversion circuit between the module serial port and the Arduino serial port is recommended. There are two ways:

Using level conversion chip

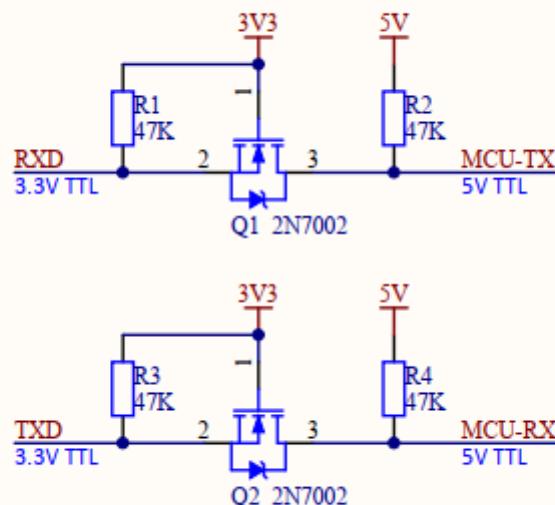
Use an MOS tube circuit.

The recommended circuit of the level conversion chip is as follows. The chip model used is TI's TPS0102DCUR, two-way communication (without direction control), only need to pay attention that VCCA is smaller than VCCB.

### A Side Voltage < B Side Voltage

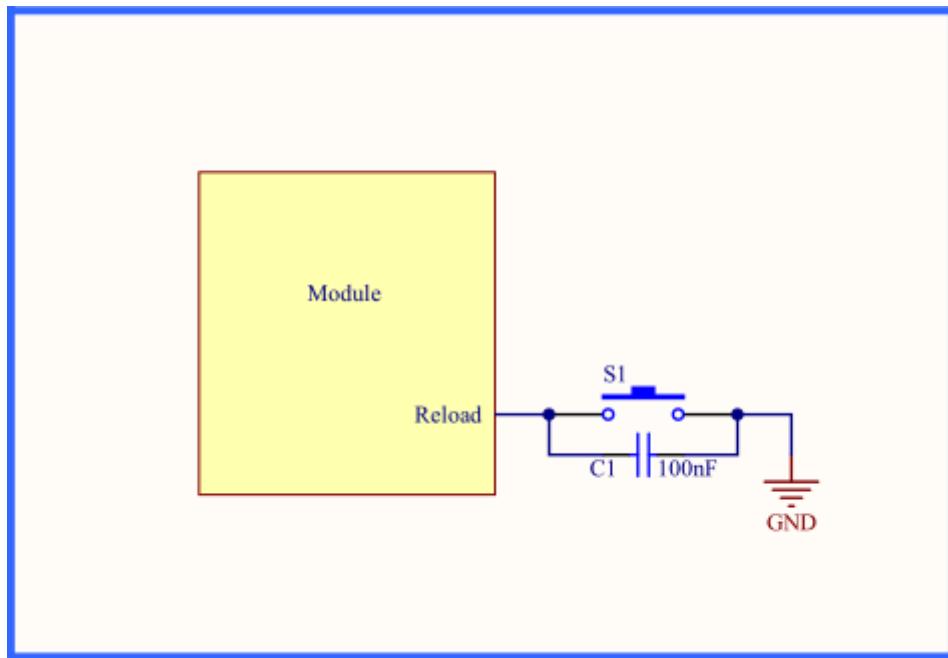


The MOS tube level conversion circuit uses the N-MOS model 2N7002, which supports two-way communication and is extremely low cost. (Yes, you read that right; the circuits of TXD and RXD are precisely the same, so there is no need to switch directions).



### Restore factory parameters

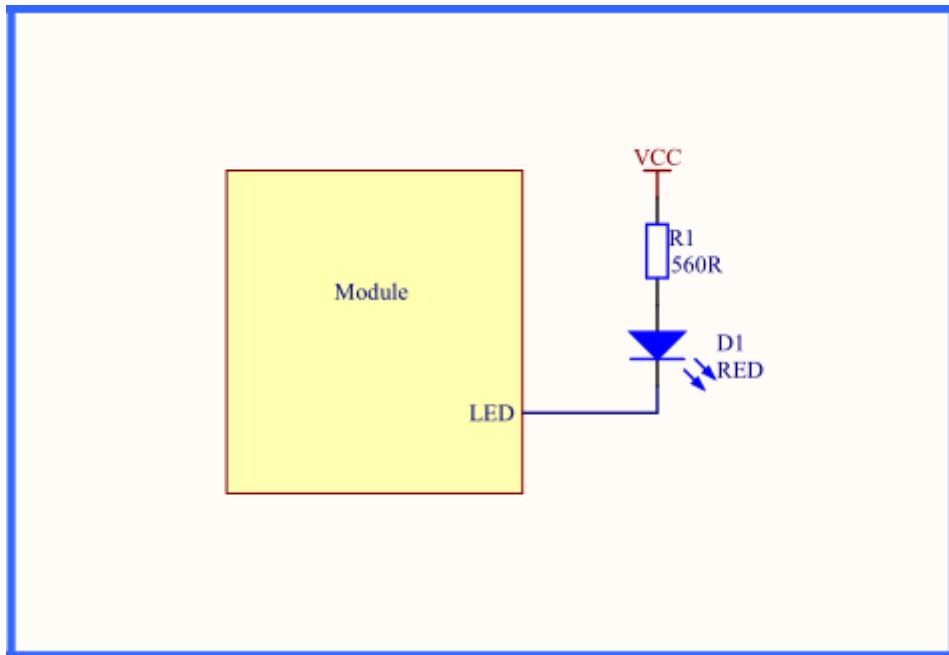
Reload is the pin for restoring the factory settings. Low level is active. Pulling Reload low for at least 5 seconds will restore the module to the factory state.



## Indicator light interface

The LED pin is active low and can be connected to a light-emitting diode to indicate the current working status of the module. The recommended circuit is shown in the figure below (if VCC is lower than 3V, it is recommended to add a triode driver, but the pull-down of the LED pin is prohibited). Connect an indicator light in series between the LED pin of the module and the power supply VCC. The status of the indicators is as follows:

state	light status
When the module is powered on	On for 1 second and then off
When the broadcast is off	extinguished
When the broadcast is on	Alternate flashing, cycle 1s, on for 200ms;
When there is no data connected	Heartbeat flashing, cycle 2s, bright 20ms;
When there is data connected	High-frequency flicker, cycle 200s, bright 40ms;



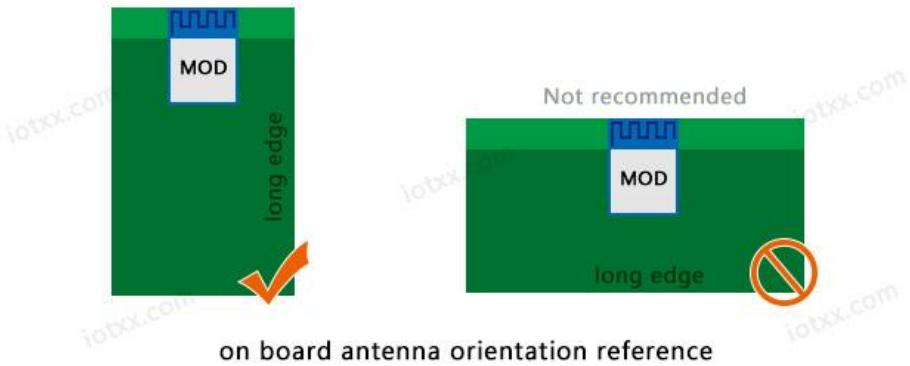
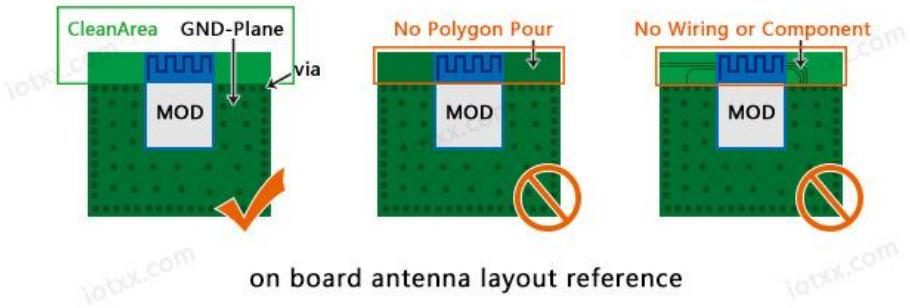
## RF Interface

- BLE520-A On-Board PCB Antenna

If the on-board antenna is used, the following layout requirements must be followed:

- On the user's PCB board, the area corresponding to the module antenna is a clear area (no components, traces, copper plating, etc.)
- The antenna is more than 10mm away from the metal and more than 10mm away from the surrounding high components. The antenna is extremely sensitive to metal. The antenna is too close to the metal, which affects the performance of the antenna. At the same time, the metal has a shielding effect on the radio frequency signal.
- The antenna part cannot be blocked by the metal casing. It is not recommended to use a closed metal casing with a window only at the antenna position.

- The module must be placed on the edge of the board, and the antenna must be unobstructed in at least two directions. The recommended location of the module is shown in the figure below.



### **Caution**

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

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:** 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.

### **RF 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 20cm between the radiator and your body.

### **FCC Label Instructions**

If using a permanently affixed label, the modular transmitter must be labeled with its own FCC identification number, and, if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains FCC ID: 2A8HX-BLE520-A".

Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement.

# OEM Guidance

- **Applicable FCC rules**

This device complies with part 15.247 of the FCC Rules.

- **The specific operational use conditions**

This module can be used in IoT devices. The input voltage to the module is nominally 3.3 V DC. The operational ambient temperature of the module is -40 °C ~ 85 °C. have a PCB antenna permanently attached to the module.

- **Limited module procedures**

N/A

- **Trace antenna designs**

N/A

- **Additional RF exposure statement**

The modular transmitter must comply with any applicable RF exposure requirements (as defined §2.1091 and §2.1093,) in its final configuration, per KDB996369 D03.

- **Antennas**

Antenna type: PCB antenna; Peak antenna gain : 0.76dBi

- **Label and compliance information**

An exterior label on OEM's end product can use wording such as the following: "Contains Transmitter Module FCC ID: 2A8HX-BLE520-A" or "Contains FCC ID: 2A8HX-BLE520-A"

- **Information on test modes and additional testing requirements**

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).

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.

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 have been corrected.

The final host / 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.

- **Additional testing, Part 15 Sub part B disclaimer**

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. 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.

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 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) and/or 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 for further general testing details.

The product under test is set into a link/association with other device, as per the normal intended use of the product. To ease testing, the product under test is set to transmit at a high duty cycle, such as by sending a file or streaming some media content.