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PTR9611

*Bluetooth 5.1 Direction Finding Module
Bluetooth Long range Mode support
Embedded Cortex™ M4F 32 bit processor
Ideal choice of IoT and Smart product*

The PTR9611 ultra-low power Bluetooth 5 ready multiprotocol System on Module based on the nRF52811 from Nordic Semiconductor. The module can support Bluetooth 5.1 by upgrading the protocol stack. The module with an ARM® Cortex™ M4 32 bit processor, 192KB Flash/24KB RAM, Bluetooth 5.1 Direct Finding AOA/AOD support , provide a complete solution with no additional RF design, Bluetooth 5, allowing faster time to market, while simplifying designs, reducing BOM costs, also reduce the burden of Regulatory approvals to enter the world market. Making you more quickly into the Bluetooth smart application and remove the worries.

Direction Finding enables positioning solutions to not only rely on received signal strength indicator (RSSI), but also the actual direction of a signal. This improves accuracy significantly and opens new possibilities for applications in this segment. There are two types of methods for determining direction, angle of arrival (AoA), where the direction of the received signal is calculated, and angle of departure (AoD), where the direction of the transmitted signal is calculated. The Module is the perfect choice as a transmitter in both the AoA or AoD scenarios, with its low power character and connectivity features.

Features

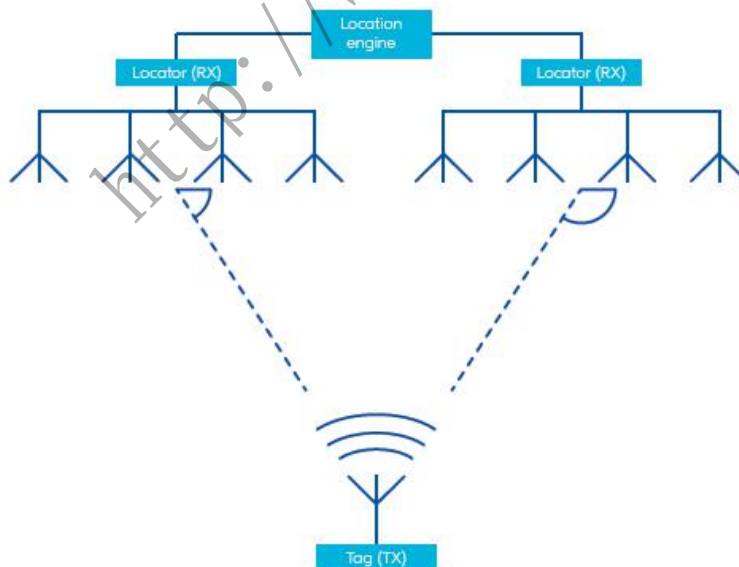
- System on Module(SOM) base on Nordic nRF52811
- Bluetooth® 5.1
 - -97dBm sensitivity in 1 Mbps Bluetooth® low energy mode
 - -104dBm sensitivity in 125 kbps Bluetooth® low energy mode (long range)
 - -20 to +4dBm TX power, configurable in 4 dB steps
 - On-air compatible with nRF52, nRF51, nRF24L, and nRF24AP Series
 - Supported data rates:
 - Bluetooth® 5.1: 2 Mbps, 1 Mbps, 500 kbps, and 125 kbps
 - Angle-of-arrival (AoA) and angle-of-departure (AoD) direction finding using Bluetooth®
 - Single-ended antenna output (on-chip balun)
 - 4.6 mA peak current in TX (0dBm)
 - 4.6 mA peak current in RX
 - RSSI (1 dB resolution)
- ARM® Cortex®-M4 32-bit processor, 64 MHz
- Flexible power management
 - 1.7 V to 3.6 V supply voltage range

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- Fully automatic LDO and DC/DC regulator system
 - Fast wake-up using 64 MHz internal oscillator
 - 0.3 μA at 3 V in System OFF mode, no RAM retention
 - 0.5 μA at 3 V in System OFF mode with full 24 kB RAM retention
 - 1.5 μA at 3 V in System ON mode, with full 24 kB RAM retention, wake on RTC
 - 1.4 μA at 3 V in System ON mode, no RAM retention, wake on RTC
- 192 kB flash and 24 kB RAM
 - Nordic SoftDevice ready
 - Support for concurrent multi-protocol
 - 12-bit, 200 ksps ADC – 8 configurable channels with programmable gain
 - 64 level comparator, Temperature sensor
 - Up to 32 general purpose I/O pins
 - 4-channel pulse width modulator (PWM) unit with EasyDMA
 - Digital microphone interface (PDM)
 - 3x 32-bit timer with counter mode, 2x real-time counter (RTC)
 - 2x SPI master/slave with EasyDMA, I2C compatible 2-wire master/slave
 - UART (CTS/RTS) with EasyDMA, Programmable peripheral interconnect (PPI)
 - Single crystal operation
 - Dimensions: 24.3 x 17.5 x 1.8mm with Antenna, 1.27mm pin pitch.

Typical Applications:

- Beacons
- Real time locating systems
- Asset tracking
- Smart home- Bluetooth Low Energy GateWay
- - iBeacons™, Eddystone™, Indoor navigation
- - Lighting Products
- - Fitness devices, Wearables



Real time locating system the above figure shows the principle of a real time locating system (RTLS),

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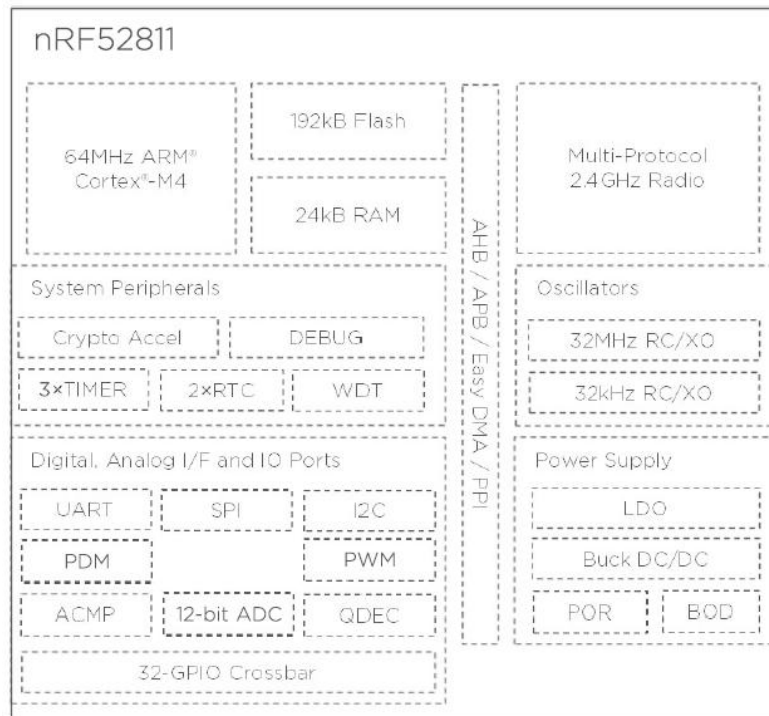
where the AoA method is used to determine the location of a tag. The tag is a transmitter, while the locators are receivers. Each locator determines which direction the signal is coming from using AoA, and together with the location engine they are able to calculate the location of the tag.

Quick Specifications:

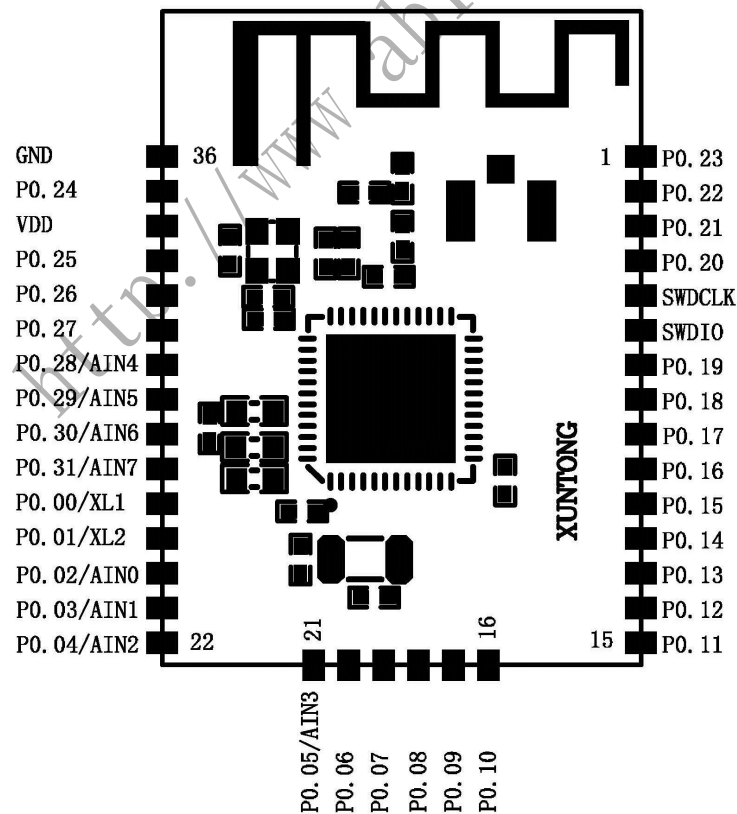
Multi-protocol	
Support	Bluetooth 5.1
Microprocessor	
Core	64 MHz 32-bit Arm Cortex-M4
Memory	192 KB Flash + 24 KB RAM
Radio	
Frequency	2.402GHz to 2.480GHz
Modulations	GFSK at 2/1 Mbps, Long range 125/500kbps
Transmit power	+4dBm to -20dBm in 4 dB steps.
Receiver sensitivity	Bluetooth 5.1: -104dBm at 125 kbps -100dBm at 500 kbps -97dBm at 1 Mbps -94dBm at 2 Mbps
Antenna	Integrated PCB Antenna/ Ext.IPX Antenna
Current Consumption	
TX only @ +4dBm, @ 3V, DC/DC enabled	7 mA
TX only @ 0 dBm, @ 3V, DC/DC enabled	4.6 mA
RX only @ 1 Mbps @ 3V, DC/DC enabled	4.6 mA
CPU @ 64MHz from flash @ 3V, DC/DC	2.2 mA
System On with RAM retention	1.5 μ A
System Off with no RAM retention	0.3 μ A
Operating conditions	
Power supply	1.7~3.6V
Operating temperature	-25~+85 °C

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Block diagram:



Pin Description of Module (Top View) :



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Pin	Name	Description	Note
Pin1	P0.23	Digital I/O	
Pin2	P0.22	Digital I/O	
Pin3	P0.21	Digital I/O	Configurable as pin reset.
Pin4	P0.20	Digital I/O	
Pin5	SWDCLK	HW debug and flash programming I/O	
Pin6	SWDIO	HW debug and flash programming I/O	
Pin7	P0.19	Digital I/O	
Pin8	P0.18	Digital I/O	
Pin9	P0.17	Digital I/O	
Pin10	P0.16	Digital I/O	
Pin11	P0.15	Digital I/O	
Pin12	P0.14	Digital I/O	
Pin13	P0.13	Digital I/O	
Pin14	P0.12	Digital I/O	
Pin15	P0.11	Digital I/O	
Pin16	P0.10	Digital I/O	NFC2
Pin17	P0.09	Digital I/O	NFC1
Pin18	P0.08	Digital I/O	
Pin19	P0.07	Digital I/O	
Pin20	P0.06	Digital I/O	
Pin21	P0.05	Digital I/O	AIN3
Pin22	P0.04	Digital I/O	AIN2
Pin23	P0.03	Digital I/O	AIN1
Pin24	P0.02	Digital I/O	AIN0
Pin25	P0.01/XL2	Digital I/O	
Pin26	P0.00/XL1	Digital I/O	
Pin27	P0.31	Digital I/O	AIN7
Pin28	P0.30	Digital I/O	AIN6
Pin29	P0.29	Digital I/O	AIN5
Pin30	P0.28	Digital I/O	AIN4
Pin31	P0.27	Digital I/O	
Pin32	P0.26	Digital I/O	
Pin33	P0.25	Digital I/O	
Pin34	VDD	Power Supply +1.7~3.6V	
Pin35	P0.24	Digital I/O	
Pin36	GND	Ground	

Note: An internal 4.7μF bulk capacitor has been included on the module. For those application that with heavy GPIO usage and/or current draw, it is good design practice to add additional bulk capacitance as required for your application.

General Purpose I/O:

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The general purpose I/O is organized as one port enabling access and control of the 32 available GPIO pins through one port. Each GPIO can be accessed individually with the following user configurable features:

- Input/output direction
- Output drive strength
- Internal pull-up and pull-down resistors
- Wake-up from high or low level triggers on all pins
- Trigger interrupt on all pins
- All pins can be used by the PPI task/event system; the maximum number of pins that can be interfaced through the PPI at the same time is limited by the number of GPIOTE channels
- All pins can be individually configured to carry serial interface or quadrature demodulator signals

Hardware RESET:

There is on-chip power-on reset circuitry, But can still be used in external reset mode, in this case, GPIO pin P0.21 as an external hardware reset pin. In order to utilize P0.21 as a hardware reset, the UICR registers PSELRESET[0] and PSELRESET[1] must be set alike, to the value of 0x7FFFFFFF. When P0.21 is programmed as RESET, the internal pull-up is automatically enabled.

HW debug and flash programming of Module :

The Module support the two pin Serial Wire Debug (SWD) interface and offers flexible and powerful mechanism for non-intrusive debugging of program code. Breakpoints, single stepping, and instruction trace capture of code execution flow are part of this support.

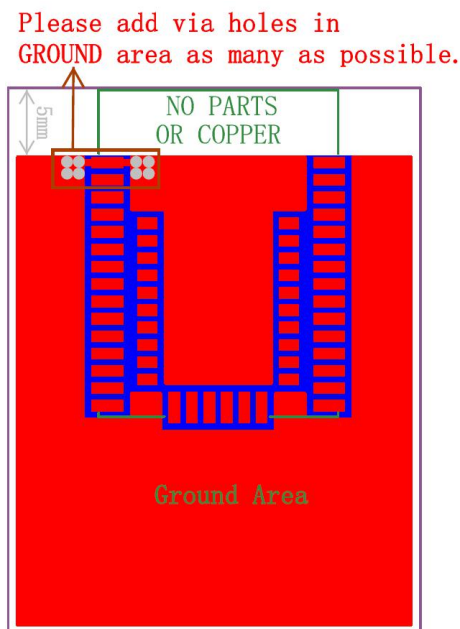
Pin	Flash Program interface
SWDIO	Debug and flash programming I/O
SWCLK	Debug and flash programming I/O

This is the hardware debug and flash programming of module, J-Link Lite support, please refer www.segger.com.

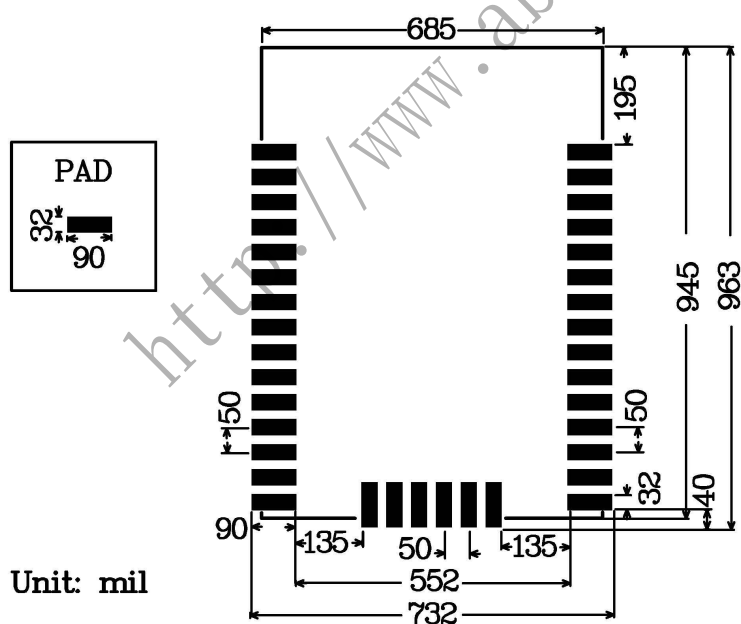
Recommended RF Layout & Ground Plane:

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The module integrated antenna requires a suitable ground plane to radiate effectively. The area under and extending out from the antenna portion of the module should be kept clear of copper and other metal. The module should be placed at the edge of the PCB with the antenna edge facing out. Reducing the ground plane will reduce the effective radiated power. Please add as more as possible via holes on the mother board near the GND pin of module, this will be good for the RF performance of system board.



PCB Footprint (Top View) :



Radio Specifications:

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Parameter	Min.	Typ.	Max.	Unit
Frequency Range	2402		2480	MHz
Maximum Output Power		+4		dBm
Rx Sensitivity Level, BLE1 Mbps		-97		dBm
Rx Sensitivity Level, BLE Long Range 125 kbps		-104		dBm
Data Rate on air	125		2000	kbps
Operating Temperature Range	-40	25	85	°C

Radio current consumption (transmitter):

Parameter	Min.	Typ.	Max.	Unit
TX only current (DC/DC, 3 V) PRF = +4 dBm		7		mA
TX only current (DC/DC, 3 V) PRF = +0 dBm		4.6		mA
TX only current (DC/DC, 3 V) PRF = -4 dBm		3.6		mA
TX only current (DC/DC, 3 V) PRF = -8 dBm		3.2		mA
TX only current (DC/DC, 3 V) PRF = -20 dBm		2.5		mA

Radio current consumption (Receiver):

Parameter	Min.	Typ.	Max.	Unit
RX only current (DC/DC, 3 V) 1 Mbps BLE		4.6		mA
RX only current (DC/DC, 3 V) 2 Mbps BLE		5.2		mA

Operating Conditions:

Parameter	Min.	Typ.	Max.	Unit
Supply voltages				
VDD	1.7	3.0	+3.6	V
Operating Temperature Range	-40	25	85	°C

Absolute Maximum Ratings:

Parameter	Min.	Max.	Unit
Supply voltages			
VDD	-0.3	+3.9	V
VSS	0	0	V
I/O pin voltage			
Voltage on GPIO pins ($V_{CC} \leq 3.6V$)	-0.3	$V_{DD} + 0.3$	
Voltage on GPIO pins ($V_{CC} > 3.6V$)	-0.3	+3.9	
RF input level		10	dBm
Environmental			
ESD Human Body Model		2	KV
ESD Human Body Model Class		2	
ESD Charged Device Model		500	V

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Storage temperature	-40	125	°C
Flash memory Endurance		10000	Write/erase cycles

Note: Exceeding one or more of the limiting values may cause permanent damage to the module.

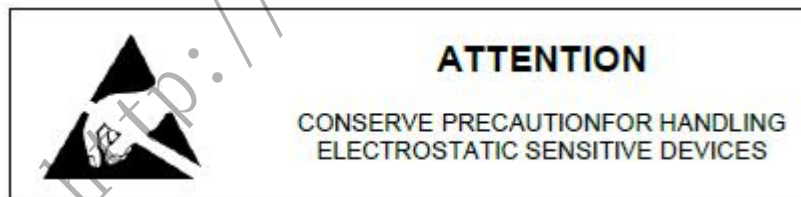
Notes and Cautions:

Design Notes

- (1) It is critical to following the recommendations of this document to ensure the module meets the specifications.
- (2) Power supply must be free of AC ripple voltage. If such noise is present, it is critical to provide proper filtering and decoupling.
- (3) The module should not be stressed mechanically after installation.
- (4) Exposing the module to significant temperatures will result in degradation and decreased lifetime.
- (5) Keep module away from other high frequency devices which may interfere with operation such as other transmitters and devices generating high frequencies.
- (6) Avoid static electricity, ESD and high voltage as these may damage the module.

Handling and Storage

- (1) Keep module away from other high frequency devices which may interfere with operation such as other transmitters and devices generating high frequencies.
- (2) Do not expose the module to the following conditions: Corrosive gasses such as Cl₂, H₂S, NH₃, SO₂, or NO_x Extreme humidity or salty air Prolonged exposure to direct Sunlight Temperatures beyond those specified for storage.
- (3) Do not apply mechanical stress.
- (4) Do not drop or shock the module.
- (5) Avoid static electricity, ESD and high voltage as these may damage the module.



Moisture Sensitivity

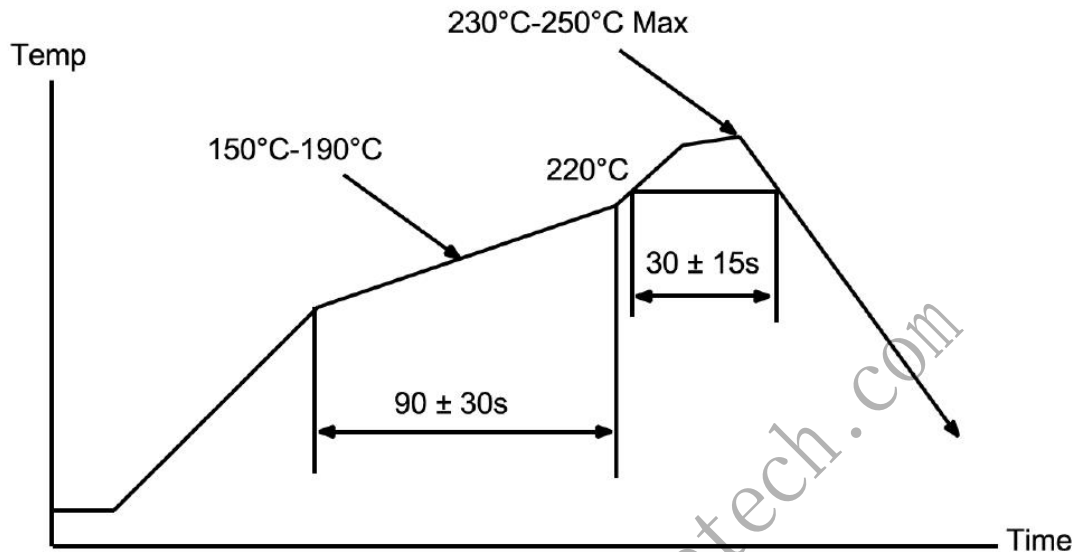
All plastic packages absorb moisture. During typical solder reflow operations when SMDs are mounted onto a PCB, the entire PCB and device population are exposed to a rapid change in ambient temperature. Any absorbed moisture is quickly turned into superheated steam. This sudden change in vapor pressure can cause the package to swell. If the pressure exerted exceeds the flexural strength of the plastic mold compound, then it is possible to crack the package. Even if the package does not crack, interfacial delamination can occur.

Since the device package is sensitive to moisture absorption, it is recommended to bake the product

before assembly.



Solder Reflow Temperature-Time Profile



Life Support Applications

Products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Customers using or selling these products for use in such applications do so at their own risk.

Additional Customization

We provide extensive customization, design and manufacturing services to ensure the perfect fit for your product. Our wide selection of modules allows developers to create any number of products. Should you need more information and assistance in integrating this module or developing your product, please contact us.

- Custom Hardware design including Modules, RF and Antenna Design
- Bluetooth Low Energy and Firmware Development
- Mobile Apps for iOS and Android
- Cloud Platform

Trademarks

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Right and Statements

- Reserves the right to make corrections, modifications, and/or improvements to the product and/or its specifications at any time without notice.
- Assumes no liability for the user's product and/or applications.
- We have a strict and careful check and collation, but can not guarantee this manual without any errors and omissions.
- The contents of this manual by copyright protection laws and regulations, without our prior written authorization of any person shall, in any way to copy the copy or manual, this manual will all or any part of any form in any cable or wireless network transmission, or be compiled and translated into any other format, text or code.
- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not use harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- 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.

Ordering Information:

Part Number	Description
PTR9611	Bluetooth 5.1 System on Module, On board PCB antenna
XIPX-SMA-10	IPX to SMA Converter RF cable , use for IPX type connector of RF module to SMA type Antenna.
PTR9611-EVB	Evaluation boards for module, with key, LED, I/O extend

FCC Statement

FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Integral antenna with antenna gain 0 dBi

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.

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

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.

FCC Radiation Exposure Statement

This modular complies with FCC 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.

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 Transmitter Module FCC ID: 2AWMN-PTR9611 Or Contains FCC ID: 2AWMN-PTR9611"

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. 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.
- (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.

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

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with limit modular approval should perform the test of radiated & conducted emission and spurious emission, etc. according to FCC part 15C : 15.247 and 15.209 & 15.207 , 15B Class B requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 & 15.207 , 15B Class B requirement, then the host can be sold legally.