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Abluetech PTR5415 Ultra High Performance Low Power Bluetooth 6.0 IOT Module Instruction Manual 📄

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Abluetech

Abluetech PTR5415 Ultra High Performance Low Power Bluetooth 6.0 IOT Module

- Support Bluetooth Low Energy 6.0
- Support BLE 2.4GHz
- Support Channel Sounding
- Multi-processor, powerful computing power, capable of running a variety of data algorithm models 128MHz MCU 1.5MB NVM 256KB RAM 3.2mA RX Power The radio supports 4Mbps rate

The PTR5415 is a button-cell-sized embedded system-level ultra-low-power Bluetooth multi-protocol module based on the Nordic nRF54L15. The module integrates an Arm Cortex-M33 processor core and a RISC-V coprocessor with a processor clock frequency of up to 128MHz, and the processors are optimized for specific workloads. The module is equipped with ample integrated internal memory, excellent performance, and ample memory, making it ideal for IoT products, running machine learning (ML) models, and edge sensor fusion applications.

The PTR5415 module helps simplify design, reduce costs, and speed up time to market. With professional design, strict quality control, and relevant certifications, the module can help customers quickly bring products to the global market without worries.
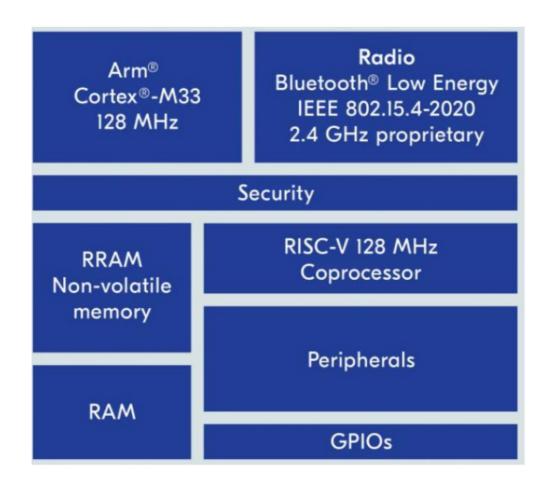
Features

- System-on-Module based on Nordic nRF54L15 core
- Support Bluetooth Low Energy, 2.4GHz
- Support Bluetooth mesh,Thread,Matter,Channel Sounding
- Support Bluetooth Low Energy 6.0
- 1 ARM® Cortex™ 33 processor, 1 RISC-V coprocessor
- 1.5MB NVM 256KB RAM
- 31 general-purpose I/Os, support configuration mapping, more flexible use of peripherals
- +8dBm output power, -104dBm receiving sensitivity
- 14-bit ADC, Comparator (COMP), Low Power Comparator (LPCOMP)
- Audio I2S interface
- Pulse Density Modulation (PDM) Interface
- RTC
- 7x Timer
- 2 x QDEC
- 5x SPI/TWI/UART
- 3x PWM
- 4 Mbps PHY
- Main processor
- 128 MHz Arm Cortex-M33
- TrustZone Floating point unit (FPU), digital signal processor (DSP)
- 256 KB RAM
- Coprocessor
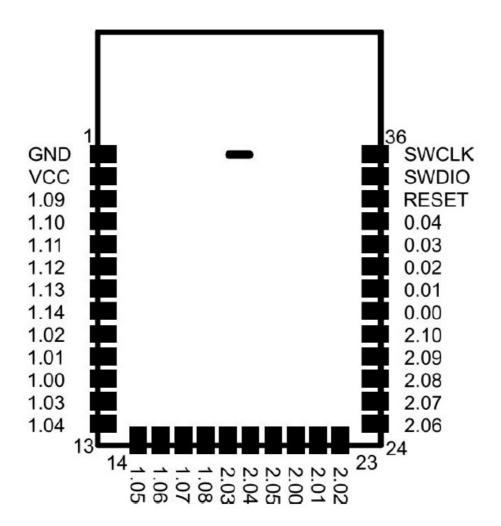- 128MHz RISC-V processor

Typical Applications

- 2.4 GHz low-power Bluetooth application system
- Private 2.4GHz application system
- Machine learning models on edge devices
- Virtual reality and display enhancement
- Sensor fusion
- Advanced wearable devices
- Audio device

- Smart home

- Medical and health

- Industrial field

- Gaming

- Sensor fusion

- Electric mobile devices

- Building environment control/monitoring

- Low-power Bluetooth gateway

- Lighting products
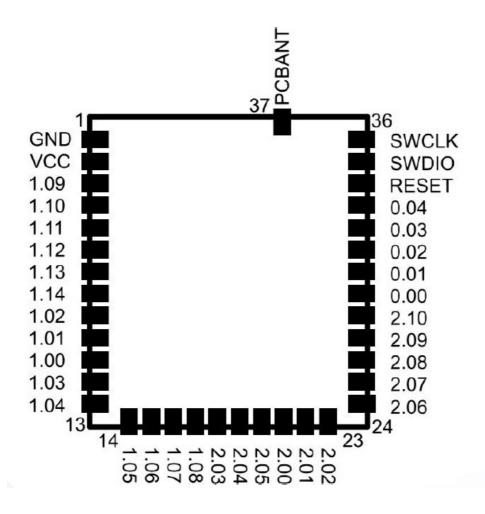
Internal Block Diagram

Module pin description (top view):

GND | 1
VCC
1.09
1.10
1.11
1.12
1.13
1.14
1.02
1.01
1.00
1.03
1.04
13
14

36 | SWCLK
SWDIO
RESET
0.04
0.03
0.02
0.01
0.00
2.10
2.09
2.08
2.07
2.06
24
23

1.05
1.06
1.07
1.08
2.03
2.04
2.05
2.00
2.01
2.02

PTR5415 (top view)

PTR5415X, PTR5415N (top view)
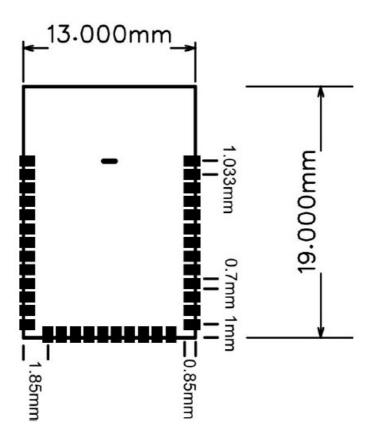
Pin number	Name	Pin Type	description
1	GND	Power	Grounding
2	VCC	Power	Power supply
3	P1.09	I/O	
4	P1.10	I/O	
5	P1.11	I/O	
6	P1.12	I/O	
7	P1.13	I/O	
8	P1.14	I/O	
9	P1.02	I/O	

10	P1.01	I/O	This pin is internally connected to a 32.768KHz crystal oscillator.
11	P1.00	I/O	This pin is internally connected to a 32.768KHz crystal oscillator.
12	P1.03	I/O	
13	P0.04	I/O	
14	P1.05	I/O	
15	P1.06	I/O	
16	P1.07	I/O	
17	P1.08	I/O	
18	P2.03	I/O	
19	P2.04	I/O	
20	P2.05	I/O	
21	P2.00	I/O	
22	P2.01	I/O	
23	P2.02	I/O	
24	P2.06	I/O	

25	P2.07	I/O	
26	P2.08	I/O	
27	P2.09	I/O	
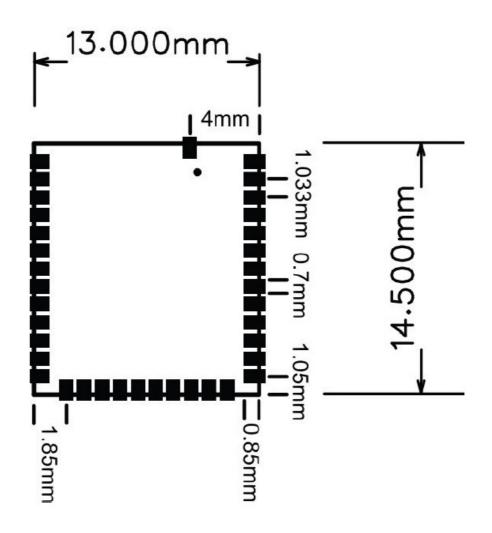
28	P2.10	I/O	
29	P0.00	I/O	
30	P0.01	I/O	
31	P0.02	I/O	
32	P0.03	I/O	
33	P0.04	I/O	
34	RESET	Reset	
35	SWDIO	SWD Program	
36	SWCLK	SWD Program	
37	ANT_PAD	RF	External antenna pin for PTR5415N version

Size Description

PTR5415

PTR5415X、PTR5415N

Specifications

Parameters	Min	Typical	Max	unit
Radio				
Operating frequency	2402		2480	MHz
Maximum output power		+8		dBm
Receiving sensitivity, @BLE 1 Mbps		-100		dBm
Power consumption				
Transmit peak current 0dBm		5		mA
Receive peak current BLE @ 1Mbps		3.2		mA

		0.6		uA
System sleep current		0.6		uA
Operating temperature				
Operating temperature range	-30		85	°C
Supply voltage				
VDD	1.7		3.6	V

Absolute Maximum Ratings:

Parameters	**Min**	**Max**	**unit**
Supply voltage			
VDD	-0.3	+3.9	V
VSS		0	V
I/O Pin voltage			
VI/O, VDD ≤3.6 V	-0.3	VDD+0.3	V
VI/O, VDD >3.6 V	-0.3	+3.9	

Note: Forcibly exceeding one or more limit values will cause permanent damage to the module.

Application Notes:

Design Description

1. The recommendations in this manual must be followed to ensure that the module operates properly.
2. The power supply of the module must be a stable voltage without AC ripple. If noise is present, appropriate filtering and decoupling must be performed.
3. After the module is installed, no mechanical stress should be applied to the module.

4. Keep the module away from other high-frequency devices that may interfere with operation, such as other transmitters and devices that generate high-frequency signals.

5. Avoid static electricity, electrostatic discharge and high voltage, which may cause damage to the module. Operators must wear anti-static rings and implement electrostatic protection measures to prevent human static electricity from damaging the chip and firmware.

6. Care should be taken to avoid abnormal supply voltage of the chip on the module due to poor welding short circuit or open circuit of the main board power supply circuit, resulting in chip damage.

Transport and storage

1. During the production and transportation of the module, please take protective measures to prevent the precision parts on the module from being damaged (it is recommended to use anti-collision materials to buffer the reflow furnace exit and assembly, testing, and transportation processes to avoid collisions).

2. Do not expose the module to the following conditions: corrosive gases such as Cl2, H2S, NH3, SO2 or NOX, extreme humidity or salty air, long-term exposure to direct sunlight, and temperatures exceeding the specified storage temperature.

3. Do not apply mechanical stress to the module.

4. Avoid dropping or impacting the module.

5. Avoid static electricity, electrostatic discharge, and high voltage, which may cause damage to the module.

ATTENTION

CONSERVE PRECAUTIONFOR HANDLING ELECTROSTATIC SENSITIVE DEVICES

Moisture sensitivity

The module is a humidity-sensitive component. During the reflow soldering operation, please strictly follow the regulations of IPC/JEDEC IPC/JEDEC IPC/JEDEC J-STDSTD-020. The module should be baked, dried and dehumidified before assembly.
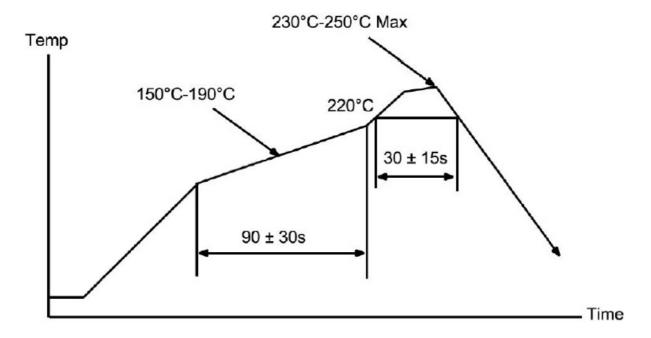
CAUTION

MOISTURE

SENSITIVE DEVICES

Life support applications

The modules are not designed for life support applications. Customers who use or sell products for these applications must agree to do so at their own risk.

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Reflow temperature-time curve

Customized hardware and software development and design services

We have many years of rich experience in the field of intelligent IoT wireless connection modules, and can provide a wide range of customized hardware and software design and module manufacturing services, sharing advanced wireless product technology with you. Our customized development services include but are not limited to the following:

- Customized hardware design, including module, RF and antenna design
- Low-power Bluetooth firmware development
- iOS and Android App development
- Cloud platform development

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- We have carefully proofread and checked this manual, but cannot guarantee that this manual is completely free of errors and omissions. We reserve the right to amend, modify and/or improve the product and/or its specifications at any time without prior notice.

Ordering Information:

Model	Description
PTR5415	Full Bluetooth multi-protocol embedded system-level module, onboard PCB antenna
PTR5415X	Full Bluetooth multi-protocol embedded system-level module, external antenna through IPEX4 socket
PTR5415N	Full Bluetooth multi-protocol embedded system-level module, external antenna via module's antenna pin PAD

FCC Statement

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

1. This de vice 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.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant 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 in stalled 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 ca use 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 important announcement

Radiation Exposure Statement

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

Important Note:

In the event that these conditions cannot 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 cannot 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: 2AA72-PTR54L15

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.

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

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

List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter.

Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

Limited module procedures

Not applicable

Trace antenna designs

Not applicable

RF exposure considerations

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

Antennas

This radio transmitter has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Model	Type	Peak Gain(dBi)
2400-2500MHz	PCB antenna	2.11dBi

Label and compliance information

The final end product must be labeled in a visible area with the following "Contains FCC ID:

Information on test modes and additional testing requirements

Host manufacturer which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C:15.247 and 15.209 requirement, only if the test result comply with FCC part 15.247 and 15.209 requirement, then the host can be sold legally.

Integration instructions for host product manufacturers according to KDB 996369 D03

OEM Manual v01

Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.

Note EMI Considerations

We recommend to use "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties. The host manufacturer is responsible for ensuring compliance with the applicable FCC rules for the transmitters operating individually and simultaneously. This includes compliance for the summation of all emissions from all outputs occupying the same or overlapping frequency ranges, as defined by the applicable rules.

How to Make Changes – Important Note

In the event that these conditions cannot 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 cannot be used on the final product. In these circumstances, OEM integrator contact Grantees to make permissive changes or the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

As long as all conditions above are met, further transmitter test will not be required. However the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Ablue Technology

- E-mail: info@abluetech.com

Frequently Asked Questions

- **Q: What is the power consumption of the PTR5415 module?**

  A: The module has a power consumption of 5 mA for transmit peak current, 3.2 mA for receive peak current, and 0.6 uA for system sleep current.
- **Q: Can the PTR5415 module support machine learning models on edge devices?**

  A: Yes, the module is designed to support machine learning models on edge devices among other applications.
- **Q: What is the operating temperature range of the PTR5415 module?**

  A: The operating temperature range of the module is from -30°C to 85°C.

Documents / Resources

Abluetech PTR5415 Module Specifications	Abluetech PTR5415 Ultra High Performance Low Power Bluetooth 6.0 IOT Module [pdf] Instruction Manual PTR5415, PTR5415 Ultra High Performance Low Power Bluetooth 6.0 IOT Module, Ultra High Performance Low Power Bluetooth 6.0 IOT Module, High Performance Low Power Bluetooth 6.0 IOT Module, Low Power Bluetooth 6.0 IOT Module, Bluetooth 6.0 IOT Module, Module

References

- [User Manual](#)

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🏷️ Abluetech, Bluetooth 6.0 IOT Module, High Performance Low Power Bluetooth 6.0 IOT Module, Low Power Bluetooth 6.0 IOT Module, Module, PTR5415, PTR5415 Ultra High Performance Low Power Bluetooth 6.0 IOT Module, Ultra High Performance Low Power Bluetooth 6.0 IOT Module

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