



WT0132C5-S5 Series Datasheet



Version 1.1



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Revision History

Version	Date	Developed/ Changed Content	Modifier By	Auditor
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1. Overview

1.1. Products Introduction

WT0132C5-S5 series module is an integrated dual-band Wi-Fi & BLE module designed based on Espressif ESP32-C5 series chipset launched by Wireless-Tag Technology Co., Limited. The WT0132C5-S5 supports 2.4 & 5G Wi-Fi6 (802.11ax), Bluetooth®5 (LE), Zigbee, and Thread (802.15.4), and is powerful with a rich set of peripheral interfaces supporting PCB antennae or I-PEX (Generation 3) RF coaxial connectors, and is designed for Internet of Things (IoT), industrial automation, healthcare, and consumer electronics applications.

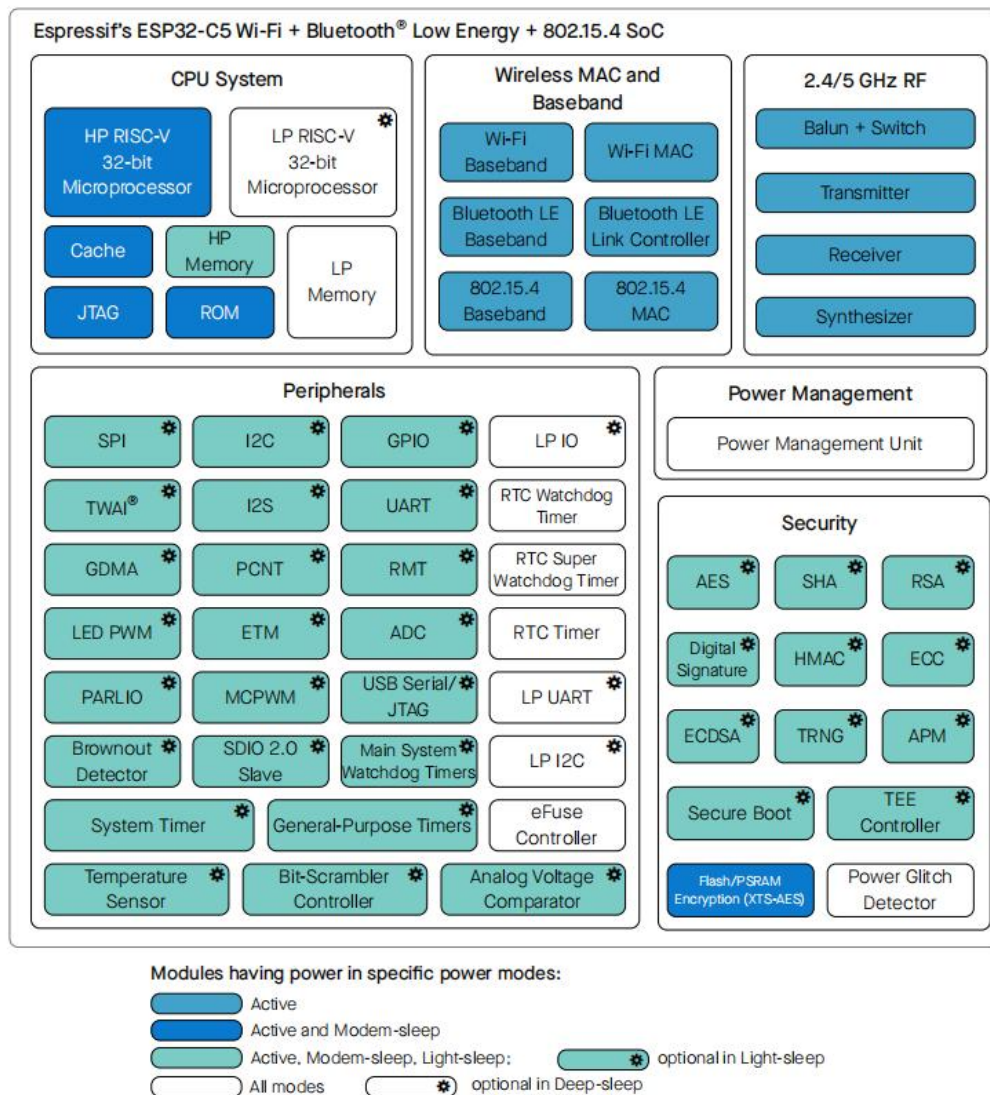


Figure 1: Main Chip Architecture Diagram

The WT0132C5-S5 series is available in two sizes, see the table below for more information.

WT0132C5-S5 Series Model Number Comparison

Part Number	Flash	Antenna	Module Size (mm)
WT0132C5-S5-N4	4MB	PCB	24.00*16.00
WT0132C5-S5U-N4	4MB	IPEX	24.00*16.00

1.2.Product Features

- RISC-V 32-bit single-core processor at 240 MHz
- RISC-V MCU supporting 2.4GHz & 5GHz Wi-Fi6, BLE5, IEEE 802.15.4
- supports PCB antenna or I-PEX RF coaxial connector.
- Mature software support, based on Espressif's ESP-IDF IoT development framework.
- Complete security mechanism, including secure boot, flash encryption and hardware encryption gas pedal.

1.3.Product Pictures



Figure 2:WT0132C5-S5-N4(front)



Figure 3:WT0132C5-S5-N4 (back)



Figure 4:WT0132C5-S5U-N4(front)

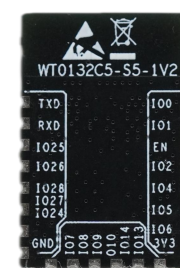


Figure 5:WT0132C5-S5U-N4(back)

1.4.Application Scenarios

- Smart Home
- Industrial Automation
- Consumer Electronics
- HMI Human Machine Interaction
- Healthcare
- Mobile Pay

2. Product Specification

2.1.Hardware Parameters

CPU	Core	32-bit RISC-V dual-core
	Main Frequency	240 MHz
Memory	ROM	320 KB
	SRAM	384 KB
	Flash	4MB
Peripheral Interface	GPIO	17
	SPI	1
	UART	2
	I2C	1
	I2S	1
	SDIO Slave	1
	LED PWM	1
	MCPWM	1
	12-bit multi-channel ADC	1
	Temperature sensor	1

3. Pin Definitions

3.1.Pin Layout

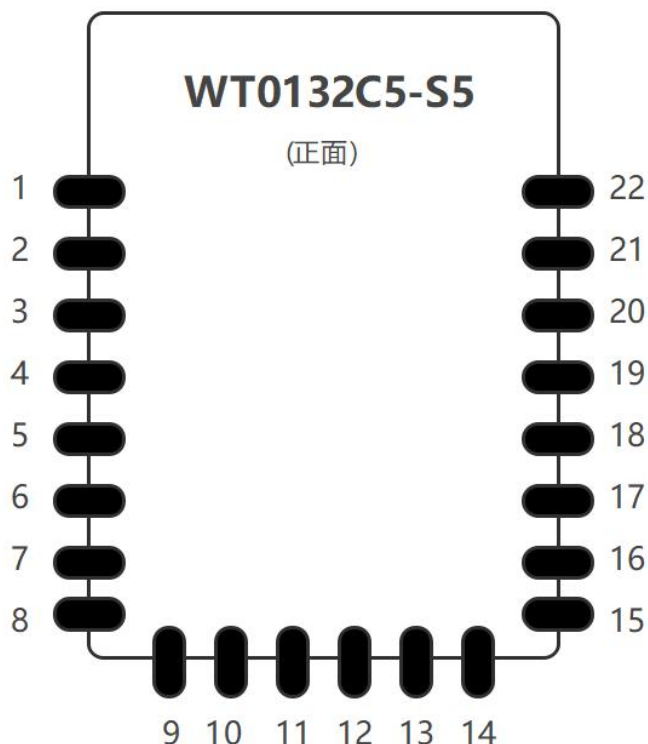


Figure 7: WT0132C5-S5 Pin Layout

3.2.Pin Description

Pin Definitions

No.	Name	Function
1	GPIO0	GPIO0, LP_GPIO0, XTAL_32K_P, LP_UART_DTRN
2	GPIO1	GPIO1, LP_GPIO1, XTAL_32K_N, LP_UART_DSRN, ADC1_CHO
3	CHIP_EN	Enable ESP32-C5 chip (internal 10K pull-up)
4	GPIO2	GPIO2, LP_GPIO2, MTMS, LP_UART_RTSN, ADC1_CH1, FSPIQ
5	GPIO4	GPIO4, LP_GPIO4, LP_UART_RXD, MTCK, ADC1_CH3, FSPIHD
6	GPIO5	GPIO5, LP_GPIO5, LP_UART_TXD, MTDO, ADC1_CH4, FSPIWP
7	GPIO6	GPIO6, LP_GPIO6, LP_I2C_SDA, ADC1_CH5, FSPICLK
8	VDD33	POWER(3.3V input)
9	GPIO13	GPIO13, USB_D-, SDIO_DATA3
10	GPIO14	GPIO14, USB_D+, SDIO_DATA2
11	GPIO10	GPIO10, SDIO_CMD, FSPICS0
12	GPIO9	GPIO9, PAD_COMP1, SDIO_CLK

13	GPIO8	GPIO8, PAD_COMP0, SDIO_DATA0
14	GPIO7	GPIO8, SDIO_DATA1, FSPID
15	GND	GROUND
16	GPIO24	GPIO24
17	GPIO27	GPIO27
18	GPIO28	GPIO28
19	GPIO26	GPIO26
20	GPIO25	GPIO25
21	U0RXD	GPIO12, U0RXD
22	U0TXD	GPIO11, U0TXD

3.3.Startup Item Configuration

3.3.1. Strapping Pins

The chip allows for configuring the following boot parameters through strapping pins and eFuse bits at power-up or a hardware reset, without microcontroller interaction.

- **Chip Boot Mode**

- Strapping pin: GPIO26, GPIO27 and GPIO28

- **ROM Message Printing**

- Strapping pin: GPIO27

- eFuse parameter:

EFUSE_UART_PRINT_CONTROL and EFUSE_DIS_USB_SERIAL_JTAG_ROM_PRINT

- **JTAG signal source**

- Strapping pin: GPIO7

- eFuse parameter:

EFUSE_DIS_PAD_JTAG, EFUSE_DIS_USB_JTAG, and EFUSE_JTAG_SEL_ENABLE

- **Crystal frequency selection**

- Strapping pin: MTMS(effective only in Joint Download Boot mode)

- eFuse parameter:EFUSE_XTAL_48M_SEL and EFUSE_XTAL_48M_SEL_MODE

The default values of all the above eFuse parameters are 0, which means that they are not burnt. Given that eFuse is one-time programmable, once programmed to 1, it can never be reverted to 0.

The default values of the strapping pins, namely the logic levels, are determined by pins' internal weak pull-up/pull-down resistors at reset if the pins are not connected to any circuit, or connected to an external high-impedance circuit.

Default Configuration of Strapping Pin

Strapping Pin	Default Configuration	Value
GPIO26	Floating	-
GPIO27	Weak pull-up	1
GPIO28	Weak pull-up	1
GPIO7	Floating	-
MTMS	Floating	-

To change the bit values, the strapping pins should be connected to external pull-down/pull-up resistors.

All strapping pins have latches. At system reset, the latches sample the bit values of their respective strapping pins and store them until the chip is powered down or shut down. The states of latches cannot be changed in any other way. It makes the strapping pin values available during the entire chip operation, and the pins are freed up to be used as regular IO pins after reset.

The timing of signals connected to the strapping pins should adhere to the *setup time* and *hold time* specifications in Table and Figure 8.

Description of Timing Parameters for the Strapping Pins

Parameter	Description	Min (ms)
t_{SU}	<i>Setup time</i> is the time reserved for the power rails to stabilize before the CHIP_PU pin is pulled high to activate the chip.	0

t_H	<i>Hold time</i> is the time reserved for the chip to read the strapping pin values after CHIP_PU is already high and before these pins start operating as regular IO pins.	3
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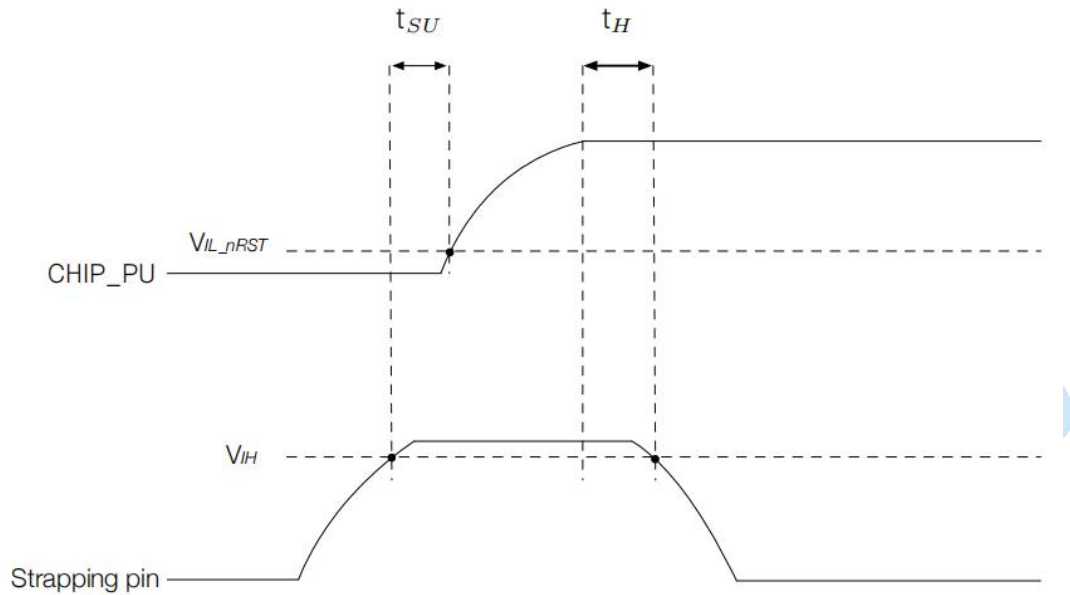


Figure 8: Visualization of Timing Parameters for the Strapping Pins

3.3.2. Chip Boot Mode Control

GPIO27,GPIO26 and GPIO28 control the boot mode after the reset is released.

Boot Mode	GPIO26	GPIO27	GPIO28
SPI Boot*	Any value	Any value	1*
Joint Download Boot 0	Any value	1	0
Joint Download Boot 1	0	0	0

*marks the default value and configuration.

Joint Download Boot mode 0 supports the following download methods:

- USB-Serial-JTAG Download Boot
- UART Download Boot

Joint Download Boot mode 1 supports the following download methods:

- UART Download Boot
- SDIO Download Boot

In SPI Boot mode, the ROM bootloader loads and executes the program from SPI flash to boot the system.

In Joint Download Boot 0 mode, users can download binary files into flash using UART0 or USB interfaces. It is also possible to download binary files into SRAM and execute it from SRAM.

In Joint Download Boot 1 mode, users can download binary files into flash using UART0 or SDIO interfaces. It is also possible to download binary files into SRAM and execute it from SRAM.

3.3.3. ROM Messages Printing Control

During the boot process, the messages by the ROM code can be printed to:

- **(Default) UART0 and USB Serial/JTAG controller**
- USB Serial/JTAG controller
- UART0

EFUSE_UART_PRINT_CONTROL and GPIO27 control ROM messages printing to **UART0** as shown in Table.

UART0 Code Printing	Register ²	eFuse ³	GPIO27
ROM messages are always printed to UART0 during boot [*]	0 [*]	0 (0b00) *	X ⁴
Print is enabled during boot		1 (0b01)	0
Print is disabled during boot			1
Print is disabled during boot		2 (0b10)	0
Print is enabled during boot			1
Print is disabled during boot		3 (0b11)	x
Print is disabled during boot	1	x	x

^{*}marks the default value and configuration.

² Register: LP_AON_STORE4_REG[0]

³ eFuse: EFUSE_UART_PRINT_CONTROL

⁴x: x indicates that the value has no effect on the result and can be ignored

EFUSE_DIS_USB_SERIAL_JTAG_ROM_PRINT controls the printing to USB Serial/JTAG controller as shown in Table.

USB Serial/JTAG ROM Code Printing	EFUSE_DIS_USB_SERIAL_JTAG_ROM_PRINT
Enabled [*]	0 [*]
Disabled	1
	Ignored

^{*}marks the default value and configuration.

3.3.4. JTAG Signal Source Control

The strapping pin GPIO7 can be used to control the source of JTAG signals during the early boot process. This pin does not have any internal pull resistors and the strapping value must be controlled by the external circuit that cannot be in a high impedance state.

GPIO7 is used in combination with EFUSE_DIS_PAD_JTAG, EFUSE_DIS_USB_JTAG, and EFUSE_JTAG_SEL_ENABLE.

JTAG Signal Source	eFuse 1 ²	eFuse 2 ³	eFuse 3 ⁴	GPI07
USB Serial/JTAG Controller ^{*6}	0*	0*	0*	x ⁵
			1	1
JTAG pins MTDI, MTCK, MTMS, and MTDO		x	x	0
		1		
USB Serial/JTAG Controller ⁶	1	0		x
JTAG is disabled		x		
		1		

*marks the default value and configuration.

²eFuse 1: EFUSE_DIS_PAD_JTAG

³eFuse 2: EFUSE_DIS_USB_JTAG

⁴eFuse 3: EFUSE_JTAG_SEL_ENABLE

⁵x: x indicates that the value has no effect on the result and can be ignored

⁶In Joint Download Boot 1 mode, the USB Serial/JTAG controller is forcibly disabled, and the JTAG signal only comes from JTAG pins. If PAD_JTAG is also disabled, then JTAG is disabled.

3.3.5. Crystal Frequency Selection

ESP32-C5 supports crystal frequencies of 40 MHz and 48 MHz. Boot modes together with MTMS, EFUSE_XTAL_48M_SEL, and

EFUSE_XTAL_48M_SEL_MODE collectively control the crystal frequency.

Crystal Frequency	Boot Mode	eFuse 1 ²	eFuse 2 ³	MTMS
40 MHz [*]	SPI Boot [*]	x ⁴	Even number of 1 [*]	x
48 MHz			Odd number of 1	
40 MHz	Joint Download Boot	1	Even number of 1	
48 MHz			Odd number of 1	
40 MHz	0/1	0*	x*	0 ⁵
48 MHz				1 ⁵

*marks the default value and configuration.

²eFuse 1: EFUSE_XTAL_48M_SEL_MODE

³eFuse 2: EFUSE_XTAL_48M_SEL

⁴x: x indicates that the value has no effect on the result and can be ignored.

⁵In Joint Download Boot 0/1 mode, users need to set the signal level on MTMS strapping pin.

4. Electrical Characteristics

4.1. Absolute Maximum Limit Value

Exceeding the absolute maximum ratings may result in permanent damage to the device. This is an emphasized rating only and does not address the functional operation of the device under these or other conditions beyond those indicated in these specifications. Prolonged exposure to absolute maximum rating conditions may affect module reliability.

4.2. Power Consumption Characteristics

update soon

4.3. Recommended Working Conditions

Parameter	Description	Min	Typ	Max	Unit
VCC	Power pin voltage	3.0	3.3	3.6	V
I _{VCC}	Supply current from external power supply	0.5	-	-	A
T _A	Operating Temperature	-40	-	85	°C

5. Storage Condition

Prerequisite	Parameters
Storage condition	Non-condensing atmosphere < 40°C /90 %RH in sealed MBBs
Conditions of use	168 hours at 25 ± 5°C , 60 % RH.
Moisture sensitivity	3 levels



6. Reflow Soldering Curve

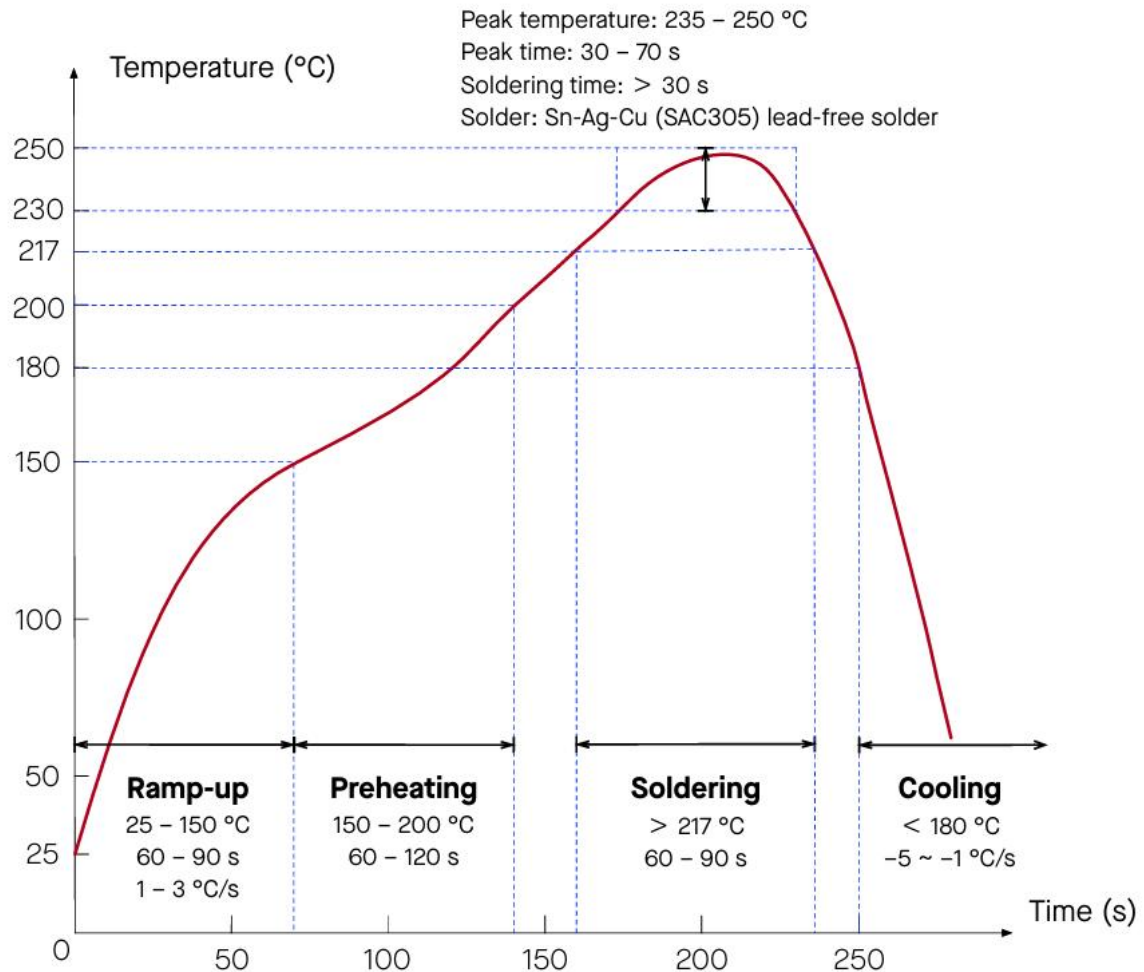


Figure 11: Reflow Soldering Temperature Curve

7. Contact Us

Official website: www.wireless-tag.com

Contact Email: gtm@wireless-tag.com

Technical support e-mail: technical@wireless-tag.com

8. Manufacturer's name and address

WIRELESS-TAG Technology Co.,limited

801, Block A, Building 6, Shenzhen International Innovation Valley,
DashiRoad, Xili Community, Xili Street, Nanshan District, Shenzhen.

9. Warning

FCC

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.

Class B equipment warning message

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 20cm Statement

This equipment complies with FCC radiation exposure limits set forth for an



uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

BLE Specification:

Operation Frequency: 2402~2480MHz

Number of Channel: 40

Modulation: GFSK

Zigbee Specification:

Operation Frequency: 2405~2480MHz

Number of Channel: 16

Modulation: GFSK

WiFi 2.4G Specification:

Operation Frequency: 2412-2472MHz(for EU),2412-2462MHz(for FCC)

Number of Channel: 13(for EU),11(for FCC)

Modulation: DSSS, OFDM

WiFi 5G Specification:

Operation Frequency: 5G(UINII-1): 5180-5240MHz &
5G(UINII-3):5745-5825MHz

Number of Channel: 5

Modulation: OFDM

Wi-Fi Radio Frequency

2.4G Wi-Fi RF Transmitter and Receiver (TX/RX) Specifications

Mode/Rate	Power/dBm
BLE GFSK	5.69dBm
2.4GWIFI	14.21dBm
Zigbee	16.88dBm

5G Wi-Fi RF Transmitter and Receiver (TX/RX) Specifications

Mode/Rate	Power/dBm
5GWIFI	13.54dBm

The module can be used for mobile or applications with a maximum antenna. The host manufacturer 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. 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.

Specific operational use conditions

The module is a module with BLE, WIFI 2. 4G, WIFI 5G and Zigbee function.

Declaration of Conformity

The simplified EU declaration of conformity referred to in Article 10(9) shall be provided as follows: Hereby, WIRELESS-TAG Technology Co.,limited declares that the radio equipment type WT0132C5-S5_S5U are compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address: www.wireless-tag.com



Manufacturer: WIRELESS-TAG TECHNOLOGY CO., LIMITED

Address of Manufacturer: 801, Block A, Building 6, Shenzhen International
Innovation Valley, Dashi 1st Road, Xili Community, Xili Street, Nanshan District,
Shenzhen, China

