

Confidentiality Level: Confidential

## **SPECIFICATION**

### Product Brochure

# **Radio Module NTX-1**

## REVISION HISTORY.

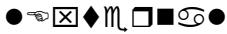
VERSION	DATE	BOARD ID	PAGE	DESCRIPTION	AUTHOR
V0.1	2024.12.12	A23036_V1	All	First Issued	LRF

## 1. Features

### Chip Solution

- Espressif ESP32-S3R2
- Nanjing Qinhang CH32V208CBU6

### RF Interface

-  generation IPEX Interface
-  2.4G antenna

### Working frequency

- BLE : 2402MHz~2480MHz ; cover
- WIFI : 2400MHz~2483.5MHz

### band package size

- 35mm \* 18.5mm \* 3.7mm (with shielding (height))
- Stamp hole, SMD 51 pin + 2 EPAD

### Wireless Standard

- 802.11 b/g/n ;
- BLE 5.3

### Application scenarios

-  lighting control scene

### Signal bandwidth

- 802.11 b/g 20MHz
- 802.11n 20/40MHz
- BLE 1/2M

### RF Power

- WIFI max 20dBm @ 802.11b
- BLE max 7dBm @ 1M/2M

### Receiving sensitivity

- -97dBm @ 802.11b
- -97dBm @ BLE 1M

## 2. Block Diagram (Functional Block Diagram)

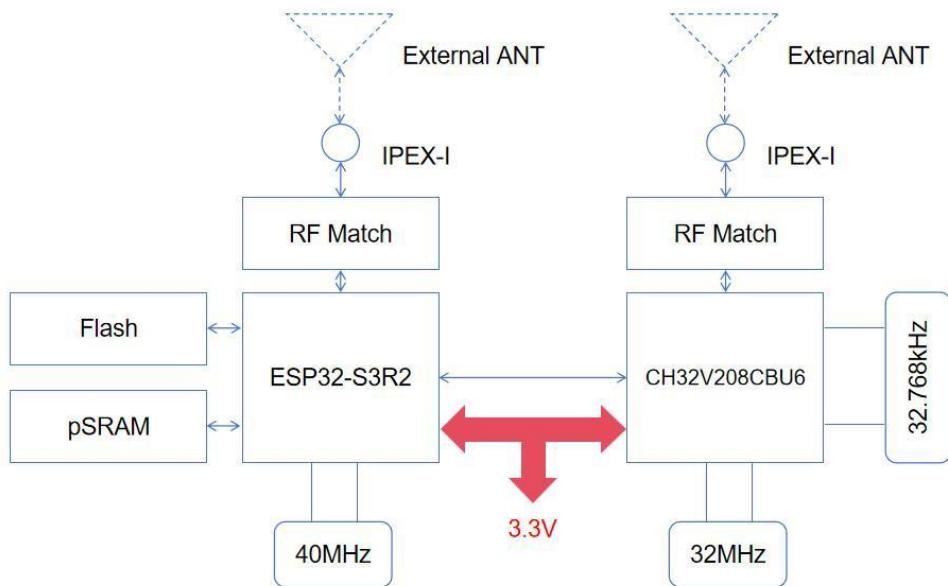


Figure 1 Block Diagram

## 3. Package Outline and Mounting (Appearance and installation dimensions)

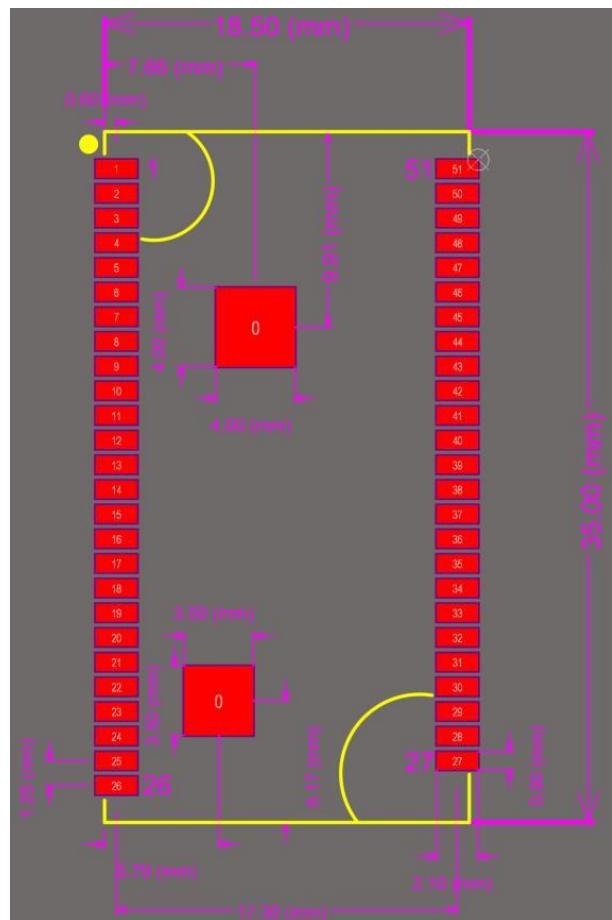


Figure 2 Package Outline

## 4. Pin Definition (Pin Definition)

serial number	name	Chipset	illustrate
0	EP/GND	-	Connect to ground, need to have good thermal conductivity
1	GND	-	Connecting Ground
2	IO0/LP	ESP32	GPIO4 Low power control pin
3	IO1	ESP32	GPIO5, not used
4	IO2	ESP32	GPIO6, not used
5	IO3	ESP32	GPIO7, not used
6	IO4	ESP32	GPIO8
7	IO5/IRQ_D	ESP32	GPIO9 Data event, interrupt pin
8	IO6/IRQ_S	ESP32	GPIO10 SPI events, interrupt pins
9	IO7/UART0_RX	ESP32	GPIO11 Using ESP32 UART1
10	IO8/UART0_T_X	ESP32	GPIO12 Using ESP32 UART1
11	IO9/SPI0_CS	ESP32	GPIO13 Using ESP32 SPI2, the module acts as a slave
12	IO10/SPI0_CLK	ESP32	GPIO14 Using ESP32 SPI2, the module acts as a slave
13	IO11/SPI0_MISO	ESP32	GPIO15 Using ESP32 SPI2, the module acts as a slave
14	IO12/SPI0_MOSI	ESP32	GPIO16 Using ESP32 SPI2, the module acts as a slave

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15	IO13/NC	ESP32	GPI019
16	IO14/NC	ESP32	GPI020
17	VCC	-	
18	GND	-	
19	IO15	CH32	GPIO-PA7

20	IO16	CH32	GPIO – PB0
21	IO17	CH32	GPIO – PA9
22	IO18	CH32	GPIO – PA10
23	IO19	CH32	SWCLK
24	IO20	CH32	SWDIO
25	IO21	CH32	GPIO – PA11
26	IO22	CH32	GPIO – PA12
27	GND		
28	IO23/BOOT0	CH32	BOOT0
29	IO24/DMX_D E	CH32	GPIO – PB3 DMX/RDM interface, DE control pin
30	IO25/DMX_R E	CH32	GPIO – PB4 DMX/RDM interface, RE control pin
31	IO26/DMX_R X	CH32	GPIO – PB11 DMX/RDM interface, RXD receiving pin
32	IO27/DMX_T X	CH32	GPIO – PB10 DMX/RDM interface, TXD receiving pin
33	IO28/nRST2	CH32	Reset pin
34	IO29	ESP32	GPIO38
35	IO30/NC	ESP32	GPIO39
36	IO31/NC	ESP32	GPIO40
37	IO32/NC	ESP32	GPIO41
38	IO33/NC	ESP32	GPIO42
39	IO34/NC	ESP32	GPIO43
40	IO35/NC	ESP32	GPIO44
41	IO36	ESP32	GPIO46
42	GND	-	
43	GND	-	
44	GND	-	
45	GND	-	

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46	GND	-	
47	IO37	ESP32	GPI03

48	IO38	ESP32	GPI02
49	IO39	ESP32	GPI01
50	IO40	ESP32	GPI00
51	IO41/nRST1	ESP32	Reset pin

## 5. General Requirements

No.	Feature	Description
1	Operation Voltage Operating Voltage Range	3.3V+/-0.3
2	Current Consumption Maximum current	700mA
3	Ripple *	$\leq 200\text{mV}$
4	Operation Temperature scope	0°C to +40°C
5	Antenna Type	External antenna
6	Storage Temperature	-40°C to +85°C

\* Ripple: It is defined as the ripple requirement of the power supply from the motherboard to the module

**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: 2A2Y8-NTX1".

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 instructions will not be made available to the end user.

**Integration instructions for host product manufacturers according to KDB 996369 D03****OEMManual v01**

- **List of applicable FCC rules**

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

- **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 module can be used for mobile applications with a maximum 2.95 dBi antenna. The host manufacturer installing this module into their product must ensure that the final composed 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 shown 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 Junhua Lin (2871121859@qq.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 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).

**● Limited module procedures**

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

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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.

**● Trace antenna designs**

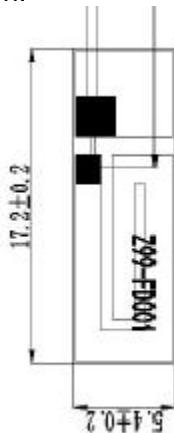
Please perform the Trace antenna design that followed the specifications of the antenna.

The concrete contents of a check are the following three points.

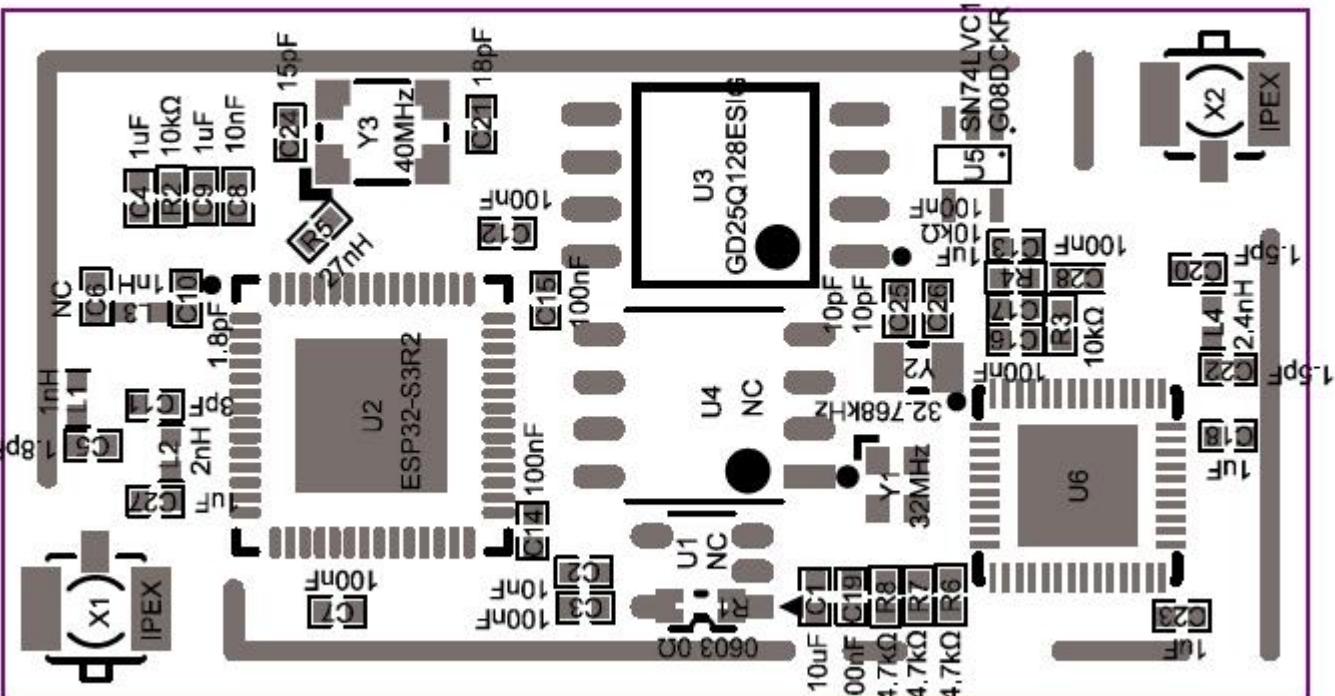
- 1) It is the same type as the antenna type of antenna specifications. Confirm the same size as the Gerber file.
- 2) An antenna gain is lower than a gain given in antenna specifications. Measure the gain, and confirm the peak gain is less than 2.95dBi.
- 3) The emission level is not getting worse. Measure the spurious, and confirm degradation of less than 3dB than spurious value of worst of report used for the application.

Dipole Antenna specification

You can see antenna size is  $17.2 \pm 0.2\text{mm} \times 5.4\text{mm} \pm 0.2\text{mm}$  From below Specification.



Please refer to the chart below for PCB size of RF line terminal.



For BT: Connect the FPC antenna to the PCB at the position of the X2 connector.

[The line between the FPC antenna and the WiFi module] must be 50 ohm.

C22-L4-C20 (1.5pF-2.4nH-1.5pF) .

For WiFi: Connect the FPC antenna to the PCB at the position of the X1 connector.

[The line between the FPC antenna and the WiFi module] must be 50 ohm.

C10-L3-C6-L1-C5 (1.8pF-1nH-NC-1nH-1.8pF) .

#### ● 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.

#### ● 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 2.95dBi.

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Frequency band	Antenna Type	Model Number	Max Gain
2400-2500MHz	FPC Antenna	Z99-FD001-2.4G-1.13-L100MM-IPEX	2.08
2400-2500MHz	FPC Antenna	Z99-FD001-2.4G-1.13-L450MM-IPEX	0.26
2400-2500MHz	FPC Antenna	Z99-FD001-2.4G-1.13-L150MM-IPEX	2.95

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.).

**● Label and compliance information**

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID: 2A2Y8-NTX1 With their finished product.

**● 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 Junhua Lin (2871121859@qq.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.

**● 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 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.

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The antenna(s) used for this transmitter must not transmit simultaneously with any other antenna or transmitter.