# WS7300 series modules

The WS7300 series modules are Wi-SUN wireless communication modules based on the VC7300BU chip. They are interoperable, reliable, high speed and have advanced wireless mesh communication technology to meet Wi-SUN standards and are widely used in wireless intelligent public networks and related applications.

## Products Features

-Operating Frequency Bands

- Operating bands 902~928MHz, 470~510MHz, 863~870MHz

-Modulation method

- Support GFSK modulation method

-High link budget

- Sensitivity up to -110dBm@PER10%/50kbps/h=1

- Maximum transmit power typical values.

High power version 29.5dBm

Medium power version 20dBm

-Protocol Standards

- Wi-SUN

-High Speed

- Communication rate of 50 to 300 Kbps

-Communication interface

-Serial port

-OTA support

-Security

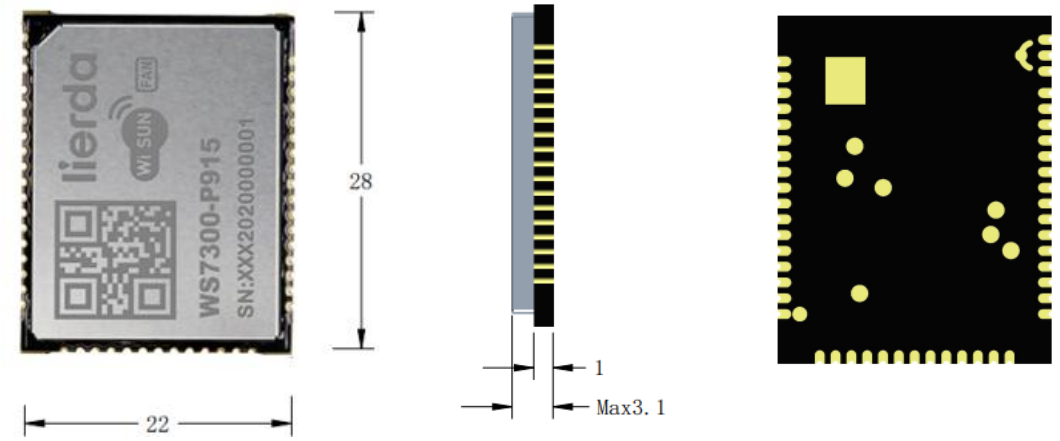
- IEEE 802.1x enterprise security level

-Applicable scenarios

- Smart Meters
- Smart Home
- Sensor Networks
- Smart Street Lighting

....

-Module size (mm)



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# Document revision history

| Version | Date | Authors | Description of change |
|---|---|---|---|
| Rev01 | 2020-08-05 | Youxc | Initial Version |
| Rev02 | 2020-09-10 | Youxc | MODE pin description change |
| Rev03 | 2020-09-21 | Youxc | functional block diagram update |
| Rev04 | 2020-11-18 | Youxc | Upper and lower current limits added |
| Rev05 | 2020-11-23 | Youxc | Modified 20dBm module power, added detailed pin descriptions, added test point coordinates |
| Rev06 | 2020-11-30 | Youxc | Add new test point behind the mark |
| Rev07 | 2020-12-17 | Youxc | 1. Update section 5.2.8 of reference design, add decoupling capacitor to pin recommendation, modify reset time to pull down reset pin; 2. Modify power consumption of medium power version |
| Rev08 | 2021-05-11 | Youxc、Lxy | Modify operating voltage range, add 470-510MHz module parameters, modify module pinout, modify maximum power consumption of 915 medium power version |
| Rev09 | 2021-09-06 | Youxc | 1.add 868M module parameters 2.add notes 3.add selection table |

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# 1 Introduction

The purpose of this document is to introduce the hardware features of our WS7300 series modules. You can use this document to quickly understand the electrical features, interface specifications and design references of the WS7300 series modules. The combination of interface protocols and command sets will help you to build Wi-SUN networks faster.

《WS7300 Series Module BorderRouter Side Interface Protocols》

《WS7300 Series Module Node Side Interface Protocol》

《WS7300 Series Module Shell Command Set》

# 2 Product information

## 2.1 Functional block diagram

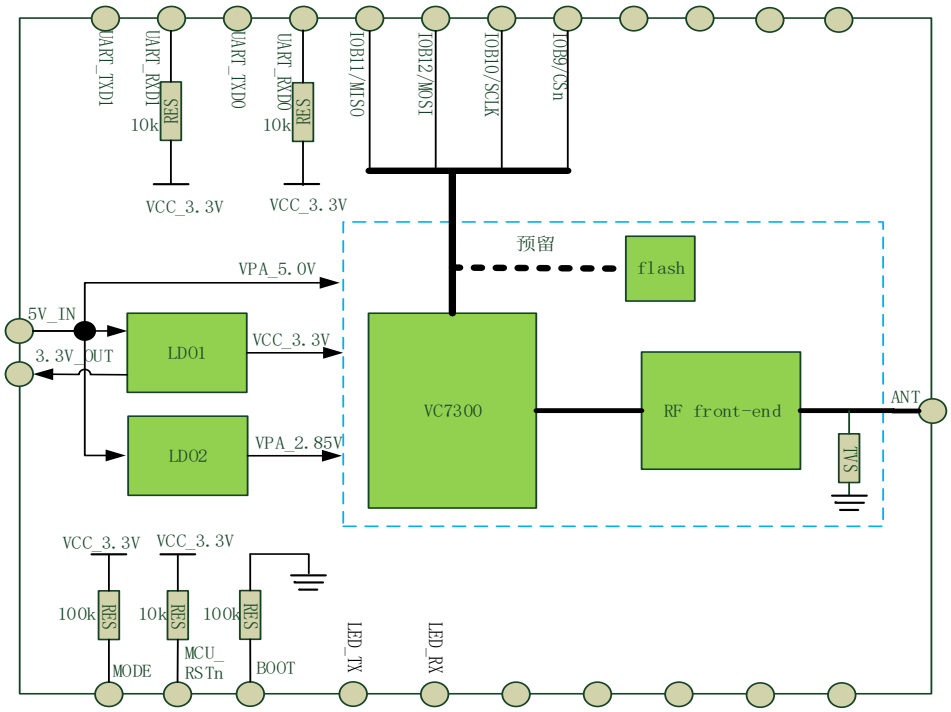



Figure 1 Internal block diagram of WS7300 series modules

Note: The above block diagram is only used to indicate the internal architecture of the modules.

## 2.2 Product Selection Guide

Users can follow the table below to understand the characteristics of specific products and choose a more suitable product.

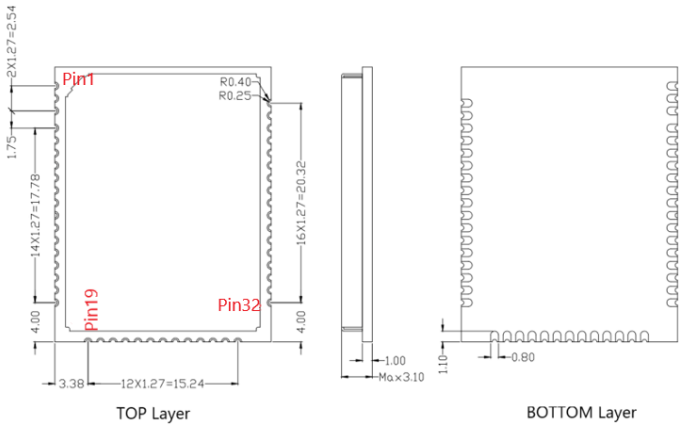
Table 1 WS7300 Series Module Selection Guide

| Model No. | Shield silkscreen | Product Features | Support band MHz | Transmit power dBm | Receive sensitivity dBm | Supply voltage V | Hardware |
|---|---|---|---|---|---|---|---|
| LSD4RF-3V930RN0 | WS7300-P915 | High power, high sensitivity | 902~928 | 30 | -110 | 5 | Node |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| LSD4RFC-2V9DRND01 | WS7300-915 | Medium power, high sensitivity | 902~928 | 20 | -110 | 5 | Node |
| LSD4RFC-4V7DRND02 | WS7300-470 | Medium power, high sensitivity | 470~510 | 20 | -110 | 5 | Node |
| L-WSMVB10-86PN4 | WS7300-868 | Medium power, high sensitivity | 863~870 | 14 | -110 | 5 | Node |
| LSD4RF-3V930R50 | WS7300-P915 | High power, high sensitivity | 902~928 | 30 | -110 | 5 | DL/T 645 |

## 2.3 Product size description

The exact dimensions of the module are shown in the following diagram:




Unit mm

Fig. 2 Dimensional drawing of WS7300 series modules

# 3 Product performance description

## 3.1 Product specifications

Table 2 WS7300 series module limit parameters

| Main parameters | Performance | | Remark |
|---|---|---|---|
| | Minimum | Maximum | |
| Supply voltage (V) | -0.3 | 5.5 | Exceeding the range may result in permanent damage to the module |
| Operating temperature (℃) | -40 | 85 | - |

Table 3 WS7300 series module operating parameters

| Main parameters | Performance | | | Remark |
|---|---|---|---|---|
| | Minimum | Typical values | Maximum | |
| Supply voltage (V) | 4 | 5 | 5.25 | Non-5V supply will work fine, but performance will be affected |

| | | | | | |
|---|---|---|---|---|---|
| Turn-off voltage（V） | | - | | 0.3 | It takes 100ms for the voltage to fall below 0.3V before it drops completely |
| Operating frequency band (MHz) | WS7300-P915<br>WS7300-915 | 902 | 915 | 928 | Customer-defined operating frequency |
| | WS7300-470 | 470 | 490 | 510 | |
| | WS7300-868 | 863 | 868 | 870 | |
| Frequency bias(KHz)[1] | | -3 | - | 3 | Factory frequency bias |
| Launch power consumption (mA) | | LSD4RFC-2V9DRND01 | | | |
| | | 120 | 130 | 155 | Factory power value transmit, tested with 50 Ohm load |
| | | LSD4RF-3V930RN0/ LSD4RF-3V930R50 | | | |
| | | 600 | 750 | 800 | Factory power value transmit, tested with 50 Ohm load |
| | | LSD4RFC-4V7DRND02 | | | |
| | | 120 | 140 | 160 | Factory power value transmit, tested with 50 Ohm load |
| | | L-WSMVB10-86PN4 | | | |
| | | 50 | 70 | 85 | Factory power value transmit, tested with 50 Ohm load |
| Receiving power consumption (mA) | | 32 | 38 | 45 | Continuous reception status |
| Transmitting power (dBm) | | LSD4RFC-2V9DRND01 | | | |
| | | 18.5 | 19.5 | 20.5 | Customer-defined transmitting power |
| | | LSD4RF-3V930RN0/ LSD4RF-3V930R50 | | | |
| | | 28.5 | 29.5 | 30.5 | Customer-defined transmitting power [2] |
| | | LSD4RFC-4V7DRND02 | | | |

If the module is in transmitting mode for a long time, the frequency deviation will change due to temperature effects

The table shows the power values when transmitting at 50kbps/h = 1/GFSK modulated waveform at maximum power, the user can set the required transmitting power according to their needs, see chapter 3.2.

| | | | | |
|---|---|---|---|---|
| | 18.5 | 19.5 | 21 | Customer-defined transmitting power |

Table 4 WS7300 Series Module Operating Parameters (continued)

| Main parameters | Performance | | | Remarks |
|---|---|---|---|---|
| | Minimum | Typical values | Maximum | |
| Transmitting power (dBm) | L-WSMVB10-86PN4 | | | |
| | 12.5 | 13 | 14 | Factory calibrated to 14dBm, customer definable transmit power up to 20dBm |
| Transmitted power flatness (dB) | - | ±0.5 | - | Individual module power vs. frequency |
| Reception sensitivity (dBm) | - | -110 | -108 | PER10%/50kbps/h=1/GFSK |
| Communication rate (bps) | - | 50k | 300k | - |
| Modulation method | GFSK | | | |
| Interface type | Stamp hole | | | 1.27mm Spacing |
| Communication protocols | UART | | | |
| Interface level | 3.3V | | | |
| Dimensions (mm) | 28*22*3.1 | | | |
| Standard | Wi-SUN | | | |
| RF port characteristic impedance (Ω) | 50 | | | |

## 3.2 Power description

If you want to change the output power, you can refer to the document "WS7300 Series Module Node Side Interface Protocol" or contact us to provide the API for power modification.

The current corresponding to the different transmitting power of the high power module is shown in the figure below. Note: This diagram shows the correspondence between typical values of power and power consumption.

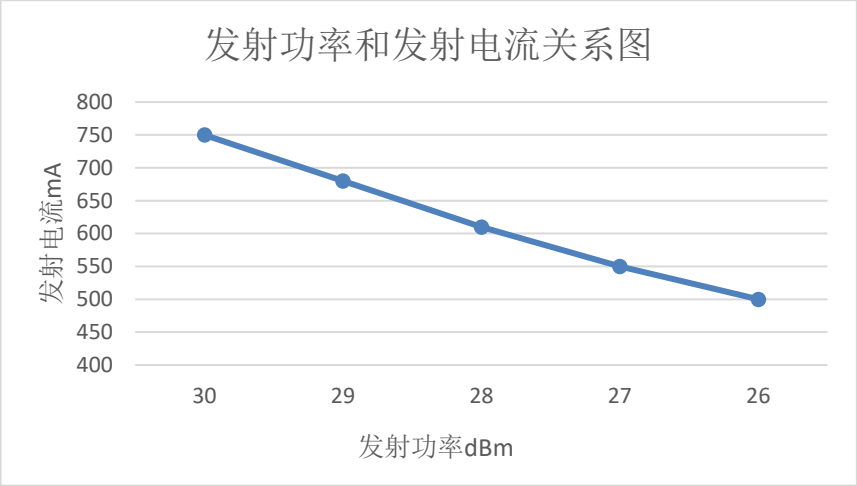



Fig. 3 High power module transmit power-current relationship

# 4 Product pinout

## 4.1 Module Pinout Electrical Characteristics

Table 5 WS7300 Series Module Pinout Electrical Characteristics

| Main parameters | Performance | | | $V_{DDIO}$ | Remark |
|---|---|---|---|---|---|
| | Minimum | Typical values | Maximum | | |
| $V_{IH}$(V) | 2.0 | - | - | 3.3V | - |
| $V_{IL}$(V) | - | - | 0.3 $V_{DDIO}$ | 3.3V | - |
| $V_{OH}$(V) | 2.4 | - | - | 3.3V | - |
| $V_{OL}$(V) | - | - | 0.8 | 3.3V | - |
| IO pull current（mA） | - | 4 | - | 3.3V | - |
| IO filling current（mA） | | 4 | - | 3.3V | - |

## 4.2 Module pinout indication

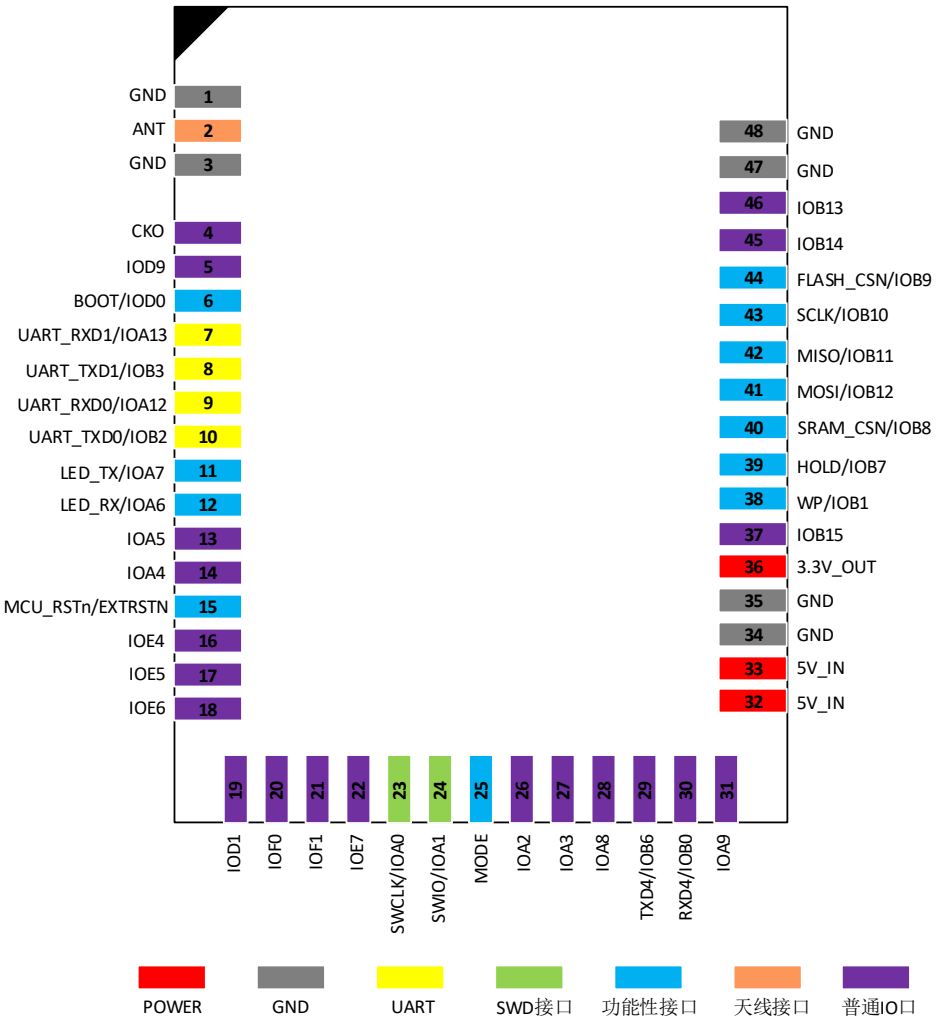



Fig. 4 WS7300 series module pinout indication

## 4.3 Module Pin Function Classification

### 4.3.1 Power supply

Table 6 WS7300 Series Module Power Supply Pinout

| LSD4RF-3V930RN0 LSD4RFC-2V9DRND01 LSD4RFC-4V7DRND02 | | | | | |
|---|---|---|---|---|---|
| **Pin Name** | **Pin No.** | Instructions | **Pin Type**[3] | DC characteristics | Remark |
| 5V_IN | 32<br>33 | Module power input | PI | $V_{max}$= 5.25V<br>$V_{type}$= 5V<br>$V_{min}$= 4V | Performance can be affected when not powered by 5V |
| 3.3V_OUT | 36 | Module provides power output | PO | $V_{type}$ =3.3V<br>$I_{omax}$ = 50mA | Customers are advised to use this pin for level shifting or low current applications |
| GND | 1,3,34,35,47,48 | Ground | G | - | - |

### 4.3.2 Serial port

[3] (Pin type: "O"=Output, "I"= Input, "P"=Power, "G"=Ground)

Table 7 WS7300 series module serial port pin descriptions

| LSD4RF-3V930RN0 LSD4RFC-2V9DRND01 LSD4RFC-4V7DRND02 | | | | | |
|---|---|---|---|---|---|
| **Pin Name** | **Pin NO.** | Instructions | **Pin type** | DC characteristics | Remark |
| UART_RXD1 | 7 | Debugging the serial port | I/O | $R_{pu}$ = 10k | RX internal pull-up, debug serial port, baud rate 115200, parity bit NONE data bit 8 stop bit 1 |
| UART_TXD1 | 8 | Debugging the serial port | I/O | - | |
| UART_RXD0 | 9 | Data serial port | I/O | $R_{pu}$ = 10k | RX internal pull-up, main serial port, baud rate 115200, parity bit NONE data bit 8 stop bit 1 |
| UART_TXD0 | 10 | Data serial port | I/O | - | |

### 4.3.3 SWD interface

Table 8 WS7300 series module SWD interface description

| LSD4RF-3V930RN0 LSD4RFC-2V9DRND01 LSD4RFC-4V7DRND02 | | | | | |
|---|---|---|---|---|---|
| **Pin Name** | **Pin No.** | Instructions | **Pin type** | DC characteristics | Remark |
| SWCLK | 23 | SWD Clock signals | I/O | - | MODE = 0 This pin is for SWCLK function MODE = 1 This pin is for general purpose IO,IOA1 |
| SWIO | 24 | SWD Data signals | I/O | - | MODE = 0 This pin is for SWIO function MODE = 1 This pin is for general purpose IO,IOA0 |

### 4.3.4 Functional interfaces

Table 9 WS7300 series module functional interface descriptions

| LSD4RF-3V930RN0 LSD4RFC-2V9DRND01 LSD4RFC-4V7DRND02 | | | | | |
|---|---|---|---|---|---|
| **Pin Name** | **Pin No.** | Instructions | **Pin type** | DC characteristics | **Remark** |
| MCU_RSTn | 15 | Reset pins | I | $R_{pu}$ =10k | Internal pull-up, active low |
| BOOT | 6 | Start-up method selection | I | $R_{pd}$ =100k | Internal drop down，<br>BOOT = 0: Embedded flash boot.<br>BOOT = 1: Internal ROM boot |
| MODE | 25 | Mode selection | I | $R_{pu}$ = 100k | Internal pull-up，<br>MODE = 0: Debug mode<br>MODE = 1: Normal mode |
| LED_TX | 11 | Communication instructions | O | - | This pin is pulled low when data is sent from the data serial port |
| LED_RX | 12 | Communication | O | - | This pin is pulled low |

| | | | | | |
|---|---|---|---|---|---|
| | | instructions | | | when data is received on the data serial port |
| SRAM_CSN | 40 | SRAM chip selection | O | - | Chip select signal for SRAM |
| MOSI | 41 | SPI MOSI | O | - | SPI MOSI |
| MISO | 42 | SPI MISO | I | - | SPI MISO |
| SCLK | 43 | SPI CLK | O | - | SPI CLK |
| FLASH_CSN | 44 | Flash chip selection | I | - | Chip select signal for Flash |
| HOLD | 39 | - | O | | FLASH write protect pin |
| WP | 38 | - | O | | FLASH HOLD Pins |

### 4.3.5 Antenna interface

Table 10 WS7300 series module antenna interface description

| LSD4RF-3V930RN0 LSD4RFC-2V9DRND01 LSD4RFC-4V7DRND02 | | | | | |
|---|---|---|---|---|---|
| **Pin Name** | **Pin No.** | Instructions | **Pin type** | DC characteristics | **Remark** |
| ANT | 2 | Antenna pins | I/O | 50Ω 阻抗 | Maximum module input power should not exceed 10dBm, otherwise there is a risk of module damage |

### 4.3.6 Other interfaces

Table 11 Other interface descriptions for WS7300 series modules

| LSD4RF-3V930RN0 LSD4RFC-2V9DRND01 LSD4RFC-4V7DRND02 | | | | | |
|---|---|---|---|---|---|
| **Pin Name** | **Pin No.** | Instructions | **Pin type** | DC characteristics | **Remark** |
| CKO | 4 | Clock signal output | O | - | Overhang |
| IOD9 | 5 | GPIO | I/O | - | Overhang |
| IOA5 | 13 | GPIO/ External interrupts 5 | I/O | - | Overhang |
| IOA4 | 14 | GPIO/ External interrupts 4 | I/O | - | Overhang |
| IOE4 | 16 | GPIO/ADC channel 4 | I/O | - | Overhang |
| IOE5 | 17 | GPIO/ADC channel 5 | I/O | - | Overhang |
| IOE6 | 18 | GPIO/ADC channel 6 | I/O | - | Overhang |
| IOD1 | 19 | GPIO | I/O | - | Overhang |
| IOF0 | 20 | GPIO | I/O | - | Overhang |
| IOF1 | 21 | GPIO | I/O | - | Overhang |
| IOE7 | 22 | GPIO/ADC 通道 7 | I/O | - | Overhang |
| IOA2 | 26 | GPIO/ External interrupts 2 | I/O | - | Overhang |
| IOA3 | 27 | GPIO/ External interrupts 3 | I/O | - | Overhang |
| IOA8 | 28 | GPIO/ External interrupts 8 | I/O | - | Overhang |
| TXD4 | 29 | GPIO/ Serial port 4 | I/O | - | Overhang |
| RDX4 | 30 | GPIO/ Serial port 4 | I/O | - | Overhang |

| | | | | | |
|---|---|---|---|---|---|
| IOA9 | 31 | GPIO/ External interrupts 9 | I/O | - | Overhang |
| IOB15 | 37 | GPIO | I/O | - | Overhang |
| IOB14 | 45 | GPIO/IIC SDA | I/O | - | Overhang |
| IOB13 | 46 | GPIO/IIC SCL | I/O | - | Overhang |

Specific multiplexing functions can be found in the VC7300BU datasheet, which can be used by users according to their needs.

# Conformity

**FCC regulatory conformance：**
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

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

FCC Radiation 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 & your body.

**ORIGINAL EQUIPMENT MANUFACTURER (OEM) NOTES**

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: **2AOFDWS7300-P915**". 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 mobile or fixed 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