EWM293-470TxxS User Manual

AT command 470MHz-510MHz 20dBm/30dBm wireless data transmission module



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1 Product Overview

1.1 Product Introduction

Domestic long-distance Sub-1G wireless data transmission module launched by Chengdu Ebit . It has the characteristics of high speed , long transmission distance and low cost . It works in the 470MHz-510MHz frequency band, with a typical transmission power of 20/30dBm, and is integrated with transceiver. Users can configure the module's transmission power, working channel, serial port rate and other parameters through AT commands according to actual needs.

EWM293-470T20S/EWM293-470T30S provides general AT commands based on UART and flexible parameter configuration capabilities. Users can complete the configuration of various parameters such as module transmission power, operating frequency, rate, operating mode, etc. according to application requirements, and quickly realize wireless data transmission and reception.



EWM293-470T20S



EWM293-470T30S

1.2 Features

- Domestic chip solution, using domestic TurMass transmission technology;
- EWM293-470T20S size 16*26 mm;
- EWM293-470T30S size 25*40.5mm;
- The communication distance can reach 5km/10km (under clear and open environment, antenna gain 3dBm, antenna height 2 meters, airspeed 1.868kbps) ;
- Supports rates from 0.441 kbps to 85.106 kbps ;
- Achieve 20 dBm /30dBm power output ;
- Flexible and diverse working modes, synchronous mode supports time division duplex;
- Support AT commands;
- Support data transparent transmission mode ;
- Low cost and flexible application ;
- Industrial standard design, supports long-term use at -40 ~ + 85 ℃ ;
- Dual antennas are optional (IPEX -1 / stamp hole) , which is convenient for users to develop and integrate.

1.3 Application Scenario

- Smart cities;
- Smart agriculture;
- Smart home;
- Smart meter reading;
- Intelligent transportation, etc.
- IoT industrial equipment;

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2 Working Parameters

2.1 Specifications

Parameter name	Parameter Value						Remark
	EWM293-470T20S			EWM293-470T30S			
Working frequency band	470MHz～510MHz						Configurable frequency band
Air speed	0.441 kbps ~ 85.106 kbps						-
Receiving sensitivity	-129dBm			-1 32 dBm			@1.8kbps
Modulation	DPFSK						Modulation Technology
Transmit power	20dBm±1dBm			30dBm±1dBm			@3.3V
RF Interface	IPEX-1/Stamp Hole						Equivalent impedance is about 50 Ω
Packaging	SMD						-
Interface	Stamp Holes (Pitch 1.27mm)			Stamp Holes (Pitch 2.00mm)			-
Communication interface	UART Serial Port						Support AT commands
Serial port configuration	115200 bps 8 N 1						-
Dimensions	16 * 26 mm			25 * 40.5 mm			-
Product Net Weight	-			-			-
	Minimum	Typical Value	Maximum	Minimum	Typical Value	Maximum	
Operating voltage (V)	1.8	5	5.5	1.8	5	5.5	≥5V can guarantee output power, more than 5.5 V may cause burnout
Operating temperature (°C)	-40	-	+85	-40	-	+85	Industrial-grade design
Operating humidity (%)	10	-	90	10	-	90	-
Sleep current (uA)	-	1.5	-	-	2.7	-	
Emission current (mA)	-	85.5	-	-	572.8	-	Instantaneous power consumption when transmitting at maximum transmit power
Receive current (mA)	-	16.9	-	-	17.8	-	

2.2 Serial port configuration parameters

The serial port baud rate is 115200 bps , 8 data bits, 1 stop bit, no parity, and the parameter settings are as shown below :

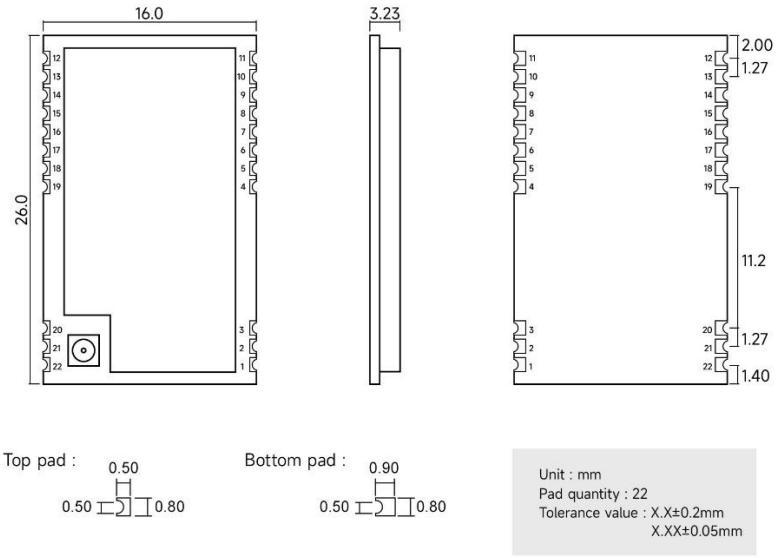
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project	Parameter Value
Baud rate	115200 bps
Data bits	8
Stop bits	1
Check digit	none

3 Mechanical Dimensions and Pin Definition

3.1 EWM293-470T20S mechanical dimensions and pin definition



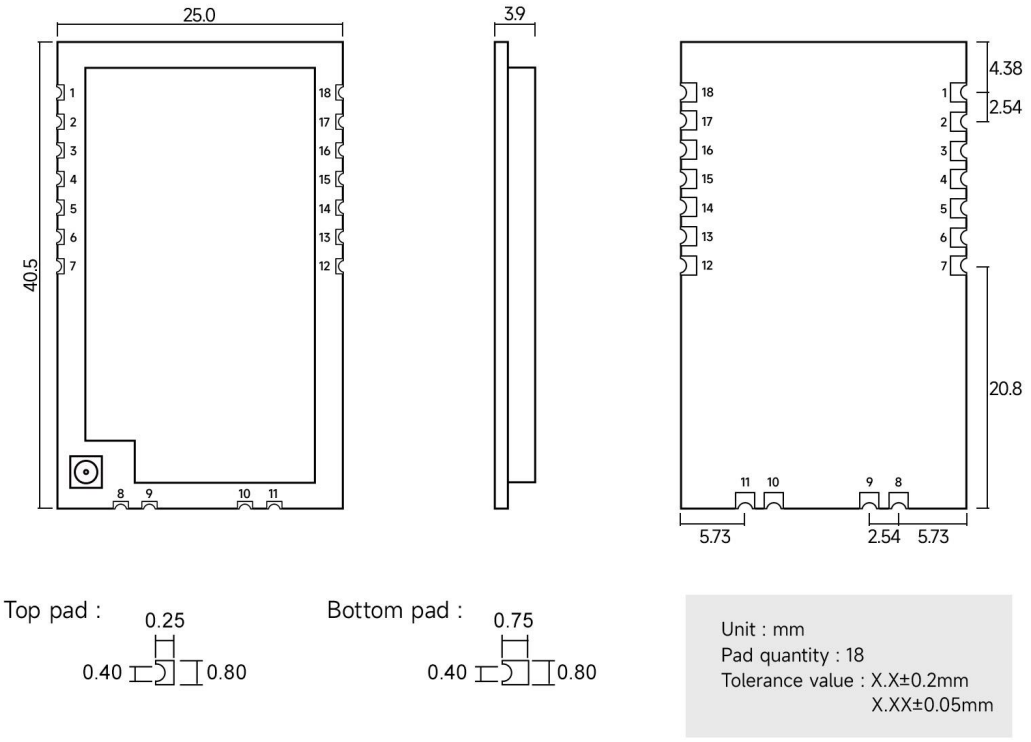
Pin number	Pin Name	Pin Direction	Pin Purpose
1	GND	-	Module ground wire
2	GND	-	Module ground wire
3	GND	-	Module ground wire
4	GND	-	Module ground wire
5	GPIO6	Input/Output	Ordinary GPIO, the default configuration is UART_RTS
6	GPIO7	Input	The default configuration is the Update pin, which needs to be pulled high when burning the firmware; Configured as UART_CTS for hardware flow control
7	RxD	Input	TTL serial port input, connected to external TXD output pin
8	TXD	Output	TTL serial port output, connected to external RXD input pin
9	NC	--	Empty foot (not open for use, users do not need to care)
10	VCC	-	Module power positive reference, voltage range: 1.8~5.5V DC
11	GND	-	Module ground wire
12	NRST	Input	Reset signal input, high effective
13	GND	-	Module ground wire
14	GPIO3	Input/Output	Normal GPIO
15	3.3V	-	3.3V (internal power supply 3.3V, power supply prohibited)

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16	GPIO0	Input/Output	Normal GPIO
17	GPIO2	Output	The default configuration is the RF switch enable pin (RX_EN)
18	GPIO1	Output	The default configuration is the RF switch enable pin (TX_EN)
19	GND	-	Module ground wire
20	GND	-	Module ground wire
21	ANT	-	antenna
22	GND	-	Module ground wire

3.2 EWM293-470T30S mechanical dimensions and pin definition



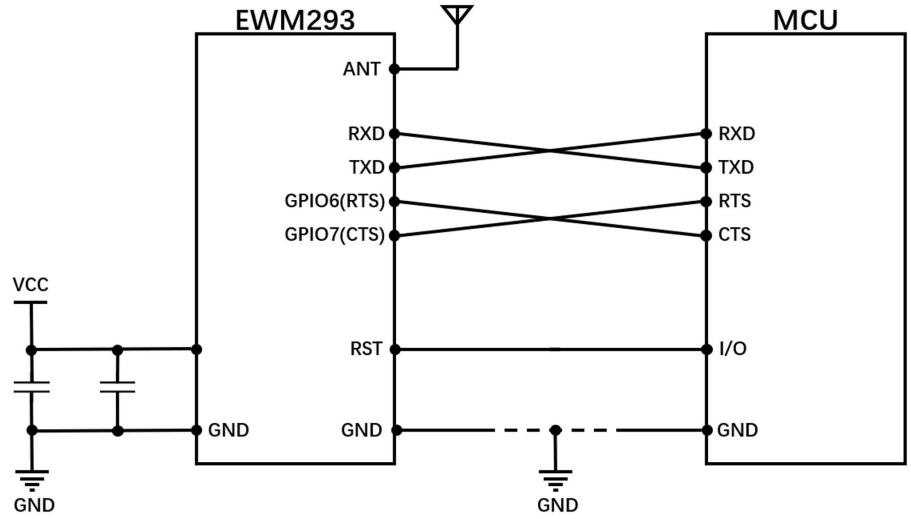
EWM293-470T30S			
Pin number	Pin Name	Pin Direction	Pin Purpose
1	GND	Input	Module ground wire
2	VCC	Input	Module power positive reference, recommended voltage range: 1.8～5.5V DC
3	NC	-	Empty foot (not open for use, users do not need to care)
4	TXD	Output	TTL serial port output, connected to the external RXD input pin;
5	RxD	Input	TTL serial port input, connected to the external TXD output pin;
6	GPIO7	Input/Output	The default configuration is the update pin. This pin needs to be pulled high when burning the firmware. Configured as UART_CTS for hardware flow control
7	GPIO6	Input/Output	Ordinary GPIO, the default configuration is UART_RTS
8	ANT	Output	Antenna interface (high frequency signal output, 50 ohm characteristic impedance)

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9	GND	-	Fixed
10	GND	-	Fixed
11	GND	-	Fixed
12	TXEN	Output	The default configuration is the RF switch enable pin (TX_EN)
13	RXEN	Output	The default configuration is the RF switch enable pin (RX_EN)
14	GPIO0	Input/Output	Normal GPIO
15	NC	-	3.3V (internal power supply 3.3V, power supply prohibited)
16	RST	Input	Module reset pin，high effective
17	GND	Input	Fixed
18	NC	-	Empty foot (not open for use, users do not need to care)

4 Recommended Connection Diagram



Note: If flow control is not used, please ground GPIO7 (CTS).

5 Quick Test of Instructions

5. 1 Asynchronous working mode + data transmission

AT+WORKMODE=21 // Set asynchronous working mode

AT+FREQ=485125000 // Set frequency

AT+RATE=6 // Set the rate

AT+TXP=15 // Set the transmit power

AT+DEST=04:03:02:01 // Set the destination device address

AT+SENDB=0102030405060708090A // Send hexadecimal format data

5. 2 Asynchronous working mode + data reception

AT+WORKMODE=21 // Set asynchronous working mode

AT+FREQ=485125000 // Set frequency

AT+RATE=6 // Set the rate

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AT+TXP=15 // Set the transmit power

AT+ADDR=04:03:02:01 // Set terminal address

AT+ADDRFILTER=1 // Open address filtering

5. 3 synchronous main working mode + data transmission and reception

AT+WORKMODE=31 // Set the synchronous main working mode

AT+FRAMECFG=7,30,8,40 // Set the time slot structure to 3 time slots , namely BCN time slot (no configuration required), send data time slot, receive data time slot, and the data time slot length is 30 bytes and 40 bytes respectively

AT+FREQ=485125000 // Set the sending frequency, receiving frequency and BCN frequency

AT+RATE=6 // Set the rate

AT+TXP=15 // Set the transmit power

AT+SENDB=0102030405060708090A // Send hexadecimal format data

5. 4 synchronous slave working mode + data transmission and reception

AT+WORKMODE=32 // Set the synchronous slave working mode

AT+FRAMECFG=8,30,7,40 // Set the time slot structure to 3 time slots, namely BCN time slot (no configuration required), receive data time slot, send data time slot, and the data time slot length is 30 bytes and 40 bytes respectively

AT+FREQ=485125000 // Set the sending frequency, receiving frequency and BCN frequency

AT+RATE=6 // Set the rate

AT+TXP=15 // Set the transmit power

AT+SENDB=0102030405060708090A // Send hexadecimal format data

5. 5 wake-up + data sending

AT+WORKMODE=21 // Set asynchronous working mode

AT+FREQ=485125000 // Set the sending frequency, receiving frequency and BCN frequency

AT+RATE=6 // Set the rate

AT+TXP=15 // Set the transmit power

AT+DEST=04:03:02:01 // Set the destination device address

AT+WAKEUPCFG=9,1,1000,470125000 // Set carrier sleep wake-up parameters

AT+SENDB=0102030405060708090A // Carrier wakes up the peer end and sends hexadecimal format data

5. 6 Sleep + Data Receiving

AT+WORKMODE=21 // Set asynchronous working mode

AT+FREQ=485125000 // Set the sending frequency, receiving frequency and BCN frequency

AT+RATE=6 // Set the rate

AT+TXP=15 // Set the transmit power

AT+ADDR=04:03:02:01 // Set terminal address

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AT+ADDRFILTER=0 // Disable address filtering

AT+WAKEUPCFG=9,1,1000,470125000 // Set carrier sleep wake-up parameters

AT+ENTERSLEEP // Set the terminal to sleep mode

5. 7. One master and four slaves data concurrency example

5.7.1 Main Terminal

AT+WORKMODE=31 // Set the synchronous main working mode

AT+FRAMECFG=7,50,8,50,8,50,8,50,8,50 // Set the time slot structure. The first data time slot is the sending time slot, and the other data time slots are receiving time slots.

AT+FREQ=485125000 // Set the sending frequency, receiving frequency and BCN frequency

AT+RATE=6 // Set the rate

AT+TXP=15 // Set the transmit power

AT+SENDB=0102030405060708090A // Send hexadecimal format data

5.7.2 From Terminal 1

AT+WORKMODE=32 // Set the synchronous slave working mode

5.7.3 From Terminal 2

AT+WORKMODE=32 // Set the synchronous slave working mode

AT+FRAMECFG=8,50,8,50,7,50,8,50,8,50 // Set the time slot structure. The third data time slot is the sending time slot, and the other data time slots are receiving time slots.

The following four steps are the same as the main terminal

5.7.4 From Terminal 3

AT+WORKMODE=32 // Set the synchronous slave working mode

AT+FRAMECFG=8,50,8,50,8,50,7,50,8,50 // Set the time slot structure. The fourth data time slot is the sending time slot, and the other data time slots are receiving time slots.

The following four steps are the same as the main terminal

5.7.5 From Terminal 4

AT+WORKMODE=32 // Set the synchronous slave working mode

AT+FRAMECFG=8,50,8,50,8,50,8,50,7,50 // Set the time slot structure. The fifth data time slot is the sending time slot, and the other data time slots are receiving time slots.

The following four steps are the same as the main terminal

6 Instructions and Factory Parameters

6.1 Instruction format

The module supports parameter reading and writing . The default baud rate supported by the module serial port is 921600bps and 8N1 format .

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The AT command ends with <CR>< LF > , which will not be repeated in the following description. <CR>: carriage return; <LF>: line feed.

Instruction Format	describe	Example
AT+XXX	Run Instructions	AT+RST
AT+XXX ?	Query command	AT+TXP?
AT+XXX =?	Query command parameter range	AT+TXP=?
AT+XXX =YYYY	Setting Instructions	AT+TXP=15

6.2 Return value description

AT command return value	illustrate
AT _OK	correct
+ERROR: Error code	+ERROR: Error code

Error Code	illustrate
-1	Middleware interface call failed
-2	Middleware interface call timeout
-3	The middleware interface call parameter is incorrect.
-50	PHY interface call failed
-51	PHY interface call parameter error
-52	The length of the PHY interface call parameter is incorrect.
-53	PHY interface call timeout
-54	PHY interface invokes wake-up mode
-55	PHY interface calls IO wake-up level error
-56	The PHY interface calls the scheduled wake-up time incorrectly
-57	PHY interface calls air signal wake-up ID error
-58	The PHY interface calls the air signal wake-up frequency incorrectly
-59	PHY interface calls the air signal wake-up cycle error
-60	PHY interface calls air signal to wake up master-slave mode error
-150	P2P interface call error
-151	P2P interface call initialization failed
-152	P2P interface calls the radio non- idle state
-153	P2P interface call parameter error
-154	P2P interface call check sends data exceeding limit
-155	P2P interface call does not join the network

6.3 AT command table

Instruction Type	instruction	describe
Basic	AT	AT link check

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instructions	AT+VER	Query the firmware version number
	AT+UID	Query FLASH ID
	AT+RST	Reset MCU
	AT+RSTPARA	Restore default parameters
Configuration directives	AT+BAUDRATE	Set/query baud rate
	AT+WORKMODE	Set/query working mode
	AT+FRAMECFG	Set/query the time slot structure of synchronous working mode
	AT+FREQ	Set/query data sending frequency, data receiving frequency, BCN sending frequency, and BCN receiving frequency
	AT+TXP	Set/query the transmit power level
	AT+RATE	Set/query the wireless transmission rate mode
	AT+WAKEUPCFG	Set/query sleep/wake-up parameters
	AT+WAKEUPCB	Set/query the pin that outputs the high level after wake-up
	AT+ENTERSLEEP	Entering sleep mode
	AT+LISTEN	Channel Listening
	AT+TSSYNC	TS synchronization control
	AT+TDET	Temperature detection
	AT+VDET	Voltage detection
	AT+GPIO	Set GPIO input or output high or low level
	AT+WREG	Write register
	AT+RREG	Read Register
	AT+RFSW	Set RF on/off
Sending instructions	AT+ADDR	Set/query the device address in asynchronous working mode
	AT+ADDRFILTER	Set/query the address filtering switch in asynchronous working mode
	AT+DEST	Set/query the destination device address in asynchronous working mode
	AT+SEND	Send character format data
	AT+SENDB	Send hexadecimal format data

6.4 AT command description

6.4.1 AT link check

instruction	response	Example
AT	AT_OK	**Send** : AT **Return** : AT_OK //Command successful response

6.4.2 Query the firmware version number

instruction	response	Example
AT+VER?	<version number> AT_OK	**Send** : AT+VER? **Return** : +VER: xxxxxxxxxxxx //Return the

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		current version number AT_OK //Command successful response

6.4.3 Query FLASH ID

instruction	response	Example
AT+UID?	<FLASH ID> AT_OK	**Send** : AT+ UID? **Return** : +UID:343734323005E88A343734323005E88A AT_OK

6.4.4 Reset MCU

instruction	response	Example
AT+RST	AT_OK P2P AT CMD!	**Send** : AT+RST **Return** : AT_OK P2P AT CMD! // Chip reset completed

6.4.5 Restore default parameters

instruction	response	Example
AT+RSTPARA	AT_OK	**Send** : AT+RSTPARA **Return** : AT_OK // Command successfully responded, restore default parameters

P2P mode default parameter table:

Parameter name	Default parameter values
Working Mode	21, namely P2P burst mode
Sending rate	6
Receiving rate	6
BCN sending frequency	473200000Hz
BCN receiving frequency	473200000Hz
Data sending frequency	473200000Hz
Data receiving frequency	473200000Hz
Transmit power index	15, i.e. 20dBm/30dBm
Slotted Mode Terminal Address	00:00:00:01, for asynchronous mode

6.4.6 Set / Query baud rate

instruction	response	Example
AT+BAUDRATE=<baud rate>	AT_OK	**Send** : AT+BAUDRATE=921600 // Set the baud rate to 921600 **Return** : AT_OK //Command successful response
AT+BAUDRATE?	< baud rate > AT_OK	**Send** : AT+BAUDRATE? // Query the baud rate **Return** : +BAUDRATE:921600 //The baud rate is

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		921600 AT_OK //Command successful response
<baud rate>	2400; 4800; 9600; 19200; 38400; 57600; 115200; 230400; 460800; 921600; 1000000; 2000000	

6.4.7 Setting/Querying the Working Mode

instruction	response	Example
AT+WORKMODE=< working mode >	AT_OK	**Send** : AT+WORKMODE=21 //Set to P2P burst mode **Return** : AT_OK //Command successful response
AT+WORKMODE?	<Working Mode> AT_OK	**Send** : AT+WORKMODE? // Query working mode **Return** : +WORKMODE:21 //Return current working mode AT_OK //Command successful response
<Working Mode>	20 : Asynchronous send-only working mode (this mode can only send data but not receive data) 21: Asynchronous working mode; 31: Synchronous main working mode; 32: Synchronous slave working mode; 71: Single TONE test mode, the frequency uses the BCN transmission frequency; 72: Sensitivity test mode, the frequency uses the BCN receiving frequency, and the rate uses the receiving rate; 81: Enable transparent transmission mode ; 82: Turn off transparent transmission mode , namely AT command mode ; AT command mode is a communication protocol, in which devices communicate and control each other by sending AT commands; transparent transmission mode is another communication working mode, in which devices can directly transmit data through the data channel without sending and receiving AT commands in a specific format.	
illustrate: Asynchronous working mode: data transmission is temporary and short-lived. After transmission is completed, the sender immediately returns to the receiving state. This mode is often used in application scenarios that have requirements for power consumption and response speed, but low communication frequency. Synchronous working mode: In this mode, the data interaction between multiple devices is continuous and the devices can achieve time synchronization through beacon transmission and reception. This mode is often used in application scenarios with periodic, frequent, and two-way communication. In the synchronous mode, the device that actively sends beacons is called the synchronous master working mode, and the device that passively receives beacons is called the synchronous slave working mode. Single Tone test mode: reserved for RF performance testing; Sensitivity test mode: reserved for RF performance testing;		

6.4.8 Setting/querying the time slot structure of synchronous working mode

The first time slot is the BCN time slot and does not need to be configured.

instruction	response	Example

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AT+FRAMECFG=<time slot type>,<time slot length>,<time slot type>,<time slot length> time slot type>, <time slot length>, ...	AT_OK	**Send** : AT+FRAMECFG=7,30,6,2000,8,40 //Set the time slot structure to 4 time slots, namely BCN time slot, send data time slot, idle time slot and receive data time slot, and the time slot length is 30 bytes, 2000 microseconds, 40 bytes respectively **Return** : AT_OK //Command successful response
AT+FRAMECFG?	<Time slot type>,<Time slot length>,<Time slot type>,<Time slot length>,<Time slot type>,<Time slot length>,… AT_OK	**Send** : AT+FRAMECFG? // Query the custom time slot structure **Return** : +FRAMECFG:7,30,6,2000,7,40 //Return time slot structure AT_OK //Command successful response
<Time slot type>	6: idle time slot; 7: Send data time slot; 8: Receive data time slot	
<Time slot length>	The range of idle time slot length is: 1024~4294967295 --- represents microseconds The data slot length range is 1~600, indicating the number of bytes.	

Time slot description:

As the smallest processing unit, time slots can be divided into four types according to their functions: beacon slots (BCN slots), data slots (Dataslot), and idle slots (IDLEslot). Data slots can be divided into transmit data slots (TX Data) and receive data slots (RXData).

Serial number	Timing Type	illustrate
1	IDLE slot	Idle time slot, the chip is in idle state
2	BCN slot	Beacon time slot, the chip is in the beacon sending or receiving processing state RX BCN means receiving beacon, TX BCN means sending beacon
3	RX Data	Data receiving time slot, the chip is in the data receiving processing state
4	TX Data	Data sending time slot, the chip is in data sending processing state

6.4.9 Set/query data sending frequency, data receiving frequency, BCN sending frequency and BCN receiving frequency.

instruction	response	Example
AT+FREQ=<data and BCN transmission frequency>	AT_OK	**Send** : AT+FREQ=485125000 //Set the data and BCN sending and receiving frequencies. The data sending frequency, data receiving frequency, BCN sending frequency and BCN receiving frequency are all 485125000 **Return** : AT_OK // Command successful response

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AT+FREQ=<data and BCN sending frequency>,<data and BCN receiving frequency>	AT_OK	**Send** : AT+FREQ=485125000,485250000 //Set the data and BCN sending frequency, data and BCN receiving frequency. The data and BCN sending frequency are both 485125000, and the data and BCN receiving frequency are both 485250000 **Return** : AT_OK // Command successful response
AT+FREQ=<data sending frequency>,<data receiving frequency>,<BCN sending and receiving frequency>	AT_OK	**Send** : AT+FREQ=485125000,485250000,485375000 // Set the data sending frequency, data receiving frequency and BCN sending and receiving frequency. The BCN sending frequency and BCN receiving frequency are both 485375000 **Return** : AT_OK // Command successful response
AT+FREQ=<data sending frequency>,<data receiving frequency>,<BCN sending frequency>,<BCN receiving frequency>	AT_OK	**Send** : +FREQ:485125000,485250000,485375000, 485375000 // Return the current data sending frequency and number According to the receiving frequency, BCN sending frequency and BCN receiving frequency **Return** : AT_OK // Command successful response
AT+FREQ?	<Data sending frequency>, <Data receiving frequency> rate>,<BCN sending frequency>,<BCN receiving frequency > AT_OK	**Send** : AT+FREQ? // Query data sending frequency, data receiving frequency, BCN sending frequency and BCN receiving frequency **Return** : +FREQ:485125000,485125000,485125000, 485125000 // Return the current data sending frequency, data receiving frequency, BCN sending frequency and BCN receiving frequency AT_OK // Command successful response

Remark:

<Data and BCN transmit and receive frequencies> Set the data transmit frequency, data receive frequency, BCN transmit frequency and BCN receive frequency at the same time, in Hz

<Data and BCN sending frequency> Set the data sending frequency and BCN sending frequency at the same time, the unit is Hz

<Data and BCN receiving frequency> Set the data receiving frequency and BCN receiving frequency at the same time, the unit is Hz

<Data transmission frequency> The frequency of sending data, in Hz

<Data receiving frequency> The frequency of receiving data, in Hz

<BCN transmit and receive frequency> Set both the BCN transmit frequency and the BCN receive frequency, in Hz

<BCN sending frequency> The frequency of sending BCN, in Hz

<BCN receiving frequency> The frequency of receiving BCN, in Hz

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Note: One parameter, two parameters, three parameters, and four parameters are supported. One parameter indicates that the data transmission and reception frequency is the same as the BCN transmission and reception frequency; The two parameters indicate that the data sending frequency is the same as the BCN sending frequency, and the data receiving frequency is the same as the BCN receiving frequency; The three parameters indicate that the frequency of sending and receiving BCN is the same; The four parameters represent the configuration of data sending frequency, data receiving frequency, BCN sending frequency and BCN receiving frequency respectively.

6.4.10 Set/Query Transmit Power Level

instruction	response	Example
AT+TXP=<power index>	AT_OK	**Send** : AT+TXP=15 // Set the transmit power index to 15, i.e. 20dBm **Return** : AT_OK //Command successful response
AT+TXP?	<Power Index> AT_OK	Send: AT+TXP? // Query the transmit power Return: +TXP:15 //The returned power index is 15, i.e. 20dBm AT_OK //Command successful response
<Power Index> Range 0-15	EWM293-470T20S	EWM293-470T20S
	0 --- Transmit power -25dBm 1 --- Transmit power -22dBm 2 --- Transmit power -19dBm 3 --- Transmit power -16dBm 4 --- Transmit power -13dBm 5 --- Transmit power -10dBm 6 --- Transmit power - 6 dBm 7 --- Transmit power - 3 dBm 8 --- Transmit power -1dBm 9 --- Transmit power 3 dBm 10 --- Transmit power 5dBm 11 --- Transmit power 8dBm 12 --- Transmit power 11dBm 13 --- Transmit power 14dBm 14 --- Transmit power 17dBm 15 --- Transmit power 20dBm	0 --- Transmit power - 10 dBm 1 --- Transmit power - 7 dBm 2 --- Transmit power - 5 dBm 3 --- Transmit power - 2 dBm 4 --- Transmit power 2 dBm 5 --- Transmit power 4 dBm 6 --- Transmit power 7 dBm 7 --- Transmit power 11 dBm 8 --- Transmit power 13 dBm 9 --- Transmit power 17 dBm 10 --- Transmit power 19 dBm 11 --- Transmit power 22 dBm 12 --- Transmit power 26 dBm 13 --- Transmit power 29 dBm 14 --- Transmit power 30 dBm 15 --- Transmit power 30 dBm

6.4.11 Set / query wireless transmission rate mode

instruction	response	Example
AT+RATE=<data and BCN sending and receiving rate mode>	AT_OK	**Send** : AT+RATE=6 / // Set the data and BCN transmission and reception rate modes. The data transmission rate mode, data reception rate mode, BCN transmission rate mode and BCN reception rate mode are all 6 **Return** : AT_OK

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AT+RATE=<data and BCN sending rate mode>,<data and BCN receiving rate mode>	AT_OK	**Send** : AT+RATE=6,7 // Set the data and BCN sending rate mode, data and BCN receiving rate mode. The data and BCN sending rate modes are both 6, and the data and BCN receiving rate modes are both 7 **Return** : AT_OK
AT+RATE=<data sending rate mode>,<data receiving rate mode>,<BCN sending and receiving rate mode>	AT_OK	**Send** : AT+RATE=6,7,8 //Set the data transmission rate mode, data reception rate mode and BCN transmission and reception rate mode . The data transmission rate mode is 6 , the data reception rate mode is 7 , the BCN transmission rate mode and the BCN reception rate mode are both 8 **Return** : AT_OK
AT+RATE= <data sending rate mode>,<data receiving rate mode>,<BCN sending rate mode><BCN receiving rate mode>	AT_OK	**Send** : AT+RATE=6,7,8,9 // Set the data transmission rate mode, data reception rate mode, BCN transmission rate mode, and BCN reception rate mode . The data transmission rate mode is 6 , the data reception rate mode is 7 , the BCN transmission rate mode is 8, and the BCN reception rate mode is 9 **Return** : AT_OK
AT+RATE?	<Data transmission rate mode>,<Data reception rate mode>,<BCN transmission rate mode><BCN reception rate mode> AT_OK	**Send** : AT+RATE? // Query data sending rate mode, data receiving rate mode, BCN sending rate mode and BCN receiving rate mode **Return** : +RATE:6,7 ,6,7 //Return the current data sending rate mode, data receiving rate mode, BCN sending rate mode and BCN receiving rate mode AT_OK //Command successful response
<Rate Mode>	4 --- rate 441bps; 5 --- rate 934bps; 6 --- rate 1868bps; 7 --- rate 3736bps; 8 --- rate 7472bps; 9 --- rate 14946bps; 10 --- rate 29891bps; 11 --- rate 59783bps 18 --- Rate 85106 bps	
Parameter Description: < Data and BCN transmission and reception rate mode > : Set the data transmission rate mode, data reception rate mode, BCN transmission rate mode and BCN reception rate mode at the same time < Data and BCN transmission rate mode > : Set the data transmission rate mode and BCN transmission rate mode at the same time < Data and BCN receiving rate mode > : Set the data receiving rate mode and BCN receiving rate mode at the same time < Data transmission rate mode > : The rate mode of sending data < Data receiving rate mode > : The rate mode of receiving data <BCN send/receive rate mode > : Set both BCN send rate mode and BCN receive rate mode <BCN sending rate mode > : rate mode for sending BCN <BCN receiving rate mode > : rate mode for receiving BCN		
Note: One parameter, two parameters, three parameters, and four parameters are supported. One parameter indicates that the data receiving and sending rate mode is the same as the BCN receiving and sending rate		

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mode; The two parameters indicate that the data transmission rate mode is the same as the BCN transmission rate mode, and the data reception rate mode is the same as the BCN reception rate mode; The three parameters indicate that the sending and receiving BCN rate modes are the same; The four parameters represent the configuration of data sending rate mode, data receiving rate mode, BCN sending rate mode and BCN receiving rate mode respectively .

6.4.1 2 Set/query sleep/wake-up parameters

For wireless wake-up, after setting the wake-up parameters, you need to use the AT+SEND command or AT+SENDB command to trigger the wake-up signal first and then send the data.

instruction	response	Example
AT+WAKEUPCFG?	<wake-up source>,<wake-up signal ID/high and low level/timing time>,<carrier sense cycle>,<wake-up frequency>,<wake-up rate> AT_OK	**Send** : AT+WAKEUPCFG? // Query sleep wakeup parameters **return** : +WAKEUPCFG: 0,1;8,10000; 9,1,1000,473200000,4 // Return the current sleep wakeup configuration as pin + timer sleep + wireless wakeup mode, pin is GPIO0 and high level, timing time is 10000ms , wakeup ID is 1 , listening period is 1000ms , wakeup frequency is 470.125MHz , wakeup rate is 4 AT_OK
AT+WAKEUPCFG=<pin wakeup source>,<high and low level>	AT_OK	**Send** : AT+WAKEUPCFG=0,1 //Set pin GPIO0 and high level sleep wake-up mode **Return** : AT_OK // Command successful response
AT+WAKEUPCFG=<timer wakeup source>,<timing time>	AT_OK	**Send** : AT+WAKEUPCFG=8,10000 //Set the timer sleep wake-up mode, and the timing time is 10000ms **Return** : AT_OK // Command successful response
AT+WAKEUPCFG=<wireless wakeup source>,<wireless wakeup ID>,<wireless listening period>,<wireless wakeup frequency>, < wireless wakeup rate >	AT_OK	**Send** : AT+WAKEUPCFG=9,1,1000,470125000,4 //Set the wireless sleep wake-up mode, the wake-up ID is 1 , the listening period is 1000ms, the wake-up frequency is 470.125MHz, and the wake-up rate is 4 **Return** : AT_OK //Command successful response
AT+WAKEUPCFG=<pin wakeup source>,<high and low level>;<wireless wakeup source>,<wireless wakeup ID>,<wireless listening period>,<wireless wakeup frequency>,<wireless wakeup rate>	AT_OK	**Send** : AT+WAKEUPCFG=0,1;9,1,1000,470125000,4 // Set the pin + wireless sleep wake-up mode, the pin is GPIO0 and high level, the wake-up ID is 1 , the listening period is 1000ms, the wake-up frequency is 470.125MHz, and the wake-up rate is 4 **Return** : AT_OK // Command successful response
AT+WAKEUPCFG=<timer wakeup source>,<timing time>;<wireless wakeup	AT_OK	**Send** : AT+WAKEUPCFG=8,10000;9,1,1000,470125000 // Set the timer + wireless sleep wake-up mode, the timer

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source>,<wireless wakeup ID>,<wireless listening period>,<wireless wakeup frequency>,<wireless wakeup rate>		is 10000ms, the wake-up ID is 1 , the listening period is 1000ms, the wake-up frequency is 470.125MHz, and the wake-up rate is 4 **Return** : AT_OK // Command successful response
AT+WAKEUPCFG=<pin wakeup source>,<high and low level>;<timer wakeup source>,<timing time>	AT_OK	**Send** : AT+WAKEUPCFG=0,1;8,10000 // Set the pin + timer sleep wake-up mode, the pin is GPIO0 and high level, the timing time is 10000ms **Return** : AT_OK // Command successful response
AT+WAKEUPCFG=<pin wakeup source>,<high and low level>;<timer wakeup source>,<timing time>;<wireless wakeup source>,<wireless wakeup ID>,<wireless listening period>,<wireless wakeup frequency>, < Wireless wake-up rate >	AT_OK	**send** : AT+WAKEUPCFG=0,1;8,10000;9,1,1000,470125000,4 //Set pin + timer sleep + wireless wake-up mode, pin is GPIO0 and high level, timing time is 10000ms, wake-up ID is 1 , listening period is 1000ms, wake-up frequency is 470.125MHz, wake-up rate is 4 **Return:** AT_OK // Command successful response
<Wake-up source>	0 --- The wake-up source is the chip pin GPIO0 3 --- Wake-up source is chip pin GPIO3 8 --- Wake-up source is timer 9 --- Wake-up source is wireless carrier	
< Wireless Wake-up ID>	Wake-up ID, value range is 0~127. It is divided into 4 groups, 0~31, 32~63, 64~95 and 96~127. Among them, 0, 32, 64 and 96 are group wake-up IDs, which can wake up all IDs in their respective groups; other IDs are individual wake-up IDs, which can only be successfully woken up when the wake-up end and the wake-up end are configured with the same ID.	
<Wireless listening period>	Value range: 1~86400000ms	
<Wireless wake-up frequency>	Frequency of wireless wake-up signal, in Hz	
< Wireless wake-up rate >	Value range: 1~4; different rate modes have different sensitivities, as follows: 1 --- -131dBm 2 --- -128dBm 3 --- -125dBm 4 --- -122dBm	
<High and Low Level>	0 --- indicates low level wake-up 1 --- indicates high level wake-up	
<Timer Time>	Timer setting time, value range: 1~86400000ms	

6.4.13 Set/query the pin that outputs high level after wake-up

instruction	response	Example
AT+WAKEUPCB=<enable><pin number>	AT_OK	**Send** : AT+WAKEUPCB=1,0 // Set the output level of GPIO0 to high after wake-up

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		Return : AT_OK //Command successful response
AT+WAKEUPCB?	<enable> , < pin number > AT_OK	**Send** : AT+WAKEUPCB? // Query the pin whose output level is pulled high after wake-up **Return** : +WAKEUPCB:1, 0 // Return the current setting to pull up the output level of GPIO0 after wake-up AT_OK //Command successful response
<Enable>	0: Close ; 1: Open	
<Pin Number>	0: The wakeup source is the chip pin GPIO0; 3: The wakeup source is the chip pin GPIO3	

6.4.14 Set the device to sleep

instruction	response	Example
AT+ENTERSLEEP	AT_OK	**Send** : A T+ENTERSLEEP // Set the device to sleep mode **Return** : AT_OK //Command successful response

6.4.15 Channel Monitoring

instruction	response	Example
AT+LISTEN=<listening frequency> ,< listening accuracy >	AT_OK	**Send** : AT+LISTEN=485125000,4 // Enable listening and set the listening frequency to 485.125MHz and the listening precision to 4 **Return** : +LISTEN:-90 // Return the signal strength value (RSSI) on the listening frequency as -90, in dBm AT_OK //Command successful response
<Listening frequency>	The listening frequency in Hz	
< Listening Accuracy>	0, // Detection bandwidth 6.25kHz 1, // Detection bandwidth 12.5kHz 2, // Detection bandwidth 25kHz 3, // Detection bandwidth 50kHz 4, // Detection bandwidth 100kHz 5, // Detection bandwidth 200kHz	
Description : The return value of the channel listening AT command refers to the in-band signal strength value (in dBm) detected at the set frequency point. It reflects the result at the current moment. Due to the burst and discontinuity of the signal, in order to more accurately measure the in-band signal strength of the frequency point, it is recommended to use the statistical average of multiple listenings; the channel listening function is often used for channel quality assessment, conflict detection and avoidance, and it needs to be implemented in conjunction with the corresponding algorithm or protocol.		

6.4.16 TS synchronization control

instruction	response	Example

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AT+TSSYNC= <status>	AT_OK	**Send** : AT+TSSYNC=1 //Control TS signal input enable **Return** : AT_OK //Command successful response
<Status>	1 --- Indicates TS signal input is enabled 2 --- Indicates that TS signal output is enabled 3 --- Indicates that TS signal input is disabled 4 --- Indicates that TS signal output is disabled	

6.4.17 Temperature detection

instruction	response	Example
AT+TDET?	<Temperature value> AT_OK	**Send** : A T+TDET? // Temperature detection **Return** : +TDET:25 // Temperature 25°C
<Temperature value>	Temperature value, accuracy: ±2℃	

6.4.18 Voltage detection

instruction	response	Example
AT+VDET?	<Voltage value> AT_OK	**Send** : AT+VDET? // voltage detection **Return** : +VDET:3.3 // voltage 3.3V
<Voltage value>	Voltage value	

6.4.19 Setting GPIO

instruction	response	Example
AT+GPIO=<pin number>,<direction>,<pull-up /pull-down status >,<level status>	AT_OK	**Send** : AT+GPIO=0,1,0,0 // Set GPIO 0 to output pull-up low level **Return** : AT_OK // Command successful response
<Pin Number>	0~7	
<Direction>	0 : input ; 1 : output	
< Pull-up and pull-down status >	0 : Pull up ; 1 : Pull down	
<Level Status>	0: low level ; 1: high level ; 2: floating	

6.4.20 Writing to registers

instruction	response	Example
AT+RREG=< register address >,< register value >	AT_OK	**Send** : AT+WREG=C30E0084,081C0A0A **Return** : AT_OK // Command successful response

6.4.21 Read Register

instruction	response	Example
AT+RREG=< register address >	<Register>	**Send** : AT+RREG=C30E0084

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	AT_OK	**Return** : +RREG:081C0A0A AT_OK // Command successful response
<Voltage value>	Voltage value	

6.4.22 Setting RF On/Off

instruction	response	Example
AT+RFSW=< GPIO number of pin 1 >< GPIO number of pin 2 >< level status of pin 1 during transmission >	AT_OK	**Send** : AT+RFSW=1,2,1 // Set pin 1 to GPIO1, pin 2 to GPIO2, and pin 1 to high level during transmission **Return** : AT_OK // Command successful response
< GPIO number of pin 1 >	Value range: 0~7	
< GPIO number of pin 2 >	Value range: 0~7	
< Level status of pin 1 during transmission >	0 --- indicates low level 1 --- indicates high level	
Note: Setting the RF switch is only used when the control level logic of the RF switch is inconsistent with the reference design. Under normal circumstances, customers are advised not to modify this setting.		

6.4.23 Set/query the device address in asynchronous working mode

instruction	response	Example
AT+ADDR=<device address>	AT_OK	**Send** : AT+ADDR=01:02:03:04 // Set the device address to 01:02:03:04 **Return** : AT_OK // Command successful response
AT+ADDR?	<Device Address> AT_OK	**Send** : AT+ADDR? // Query device address **Return** : +ADDR:01:02:03:04 // Return the current device address AT_OK //Command successful response
<Device Address>	Four hexadecimal numbers separated by colons in the format of xx:xx:xx:xx .	

6.4.24 Set/query the address filter switch in asynchronous working mode

instruction	response	Example
AT+ADDRFILTER=<filter switch>	AT_OK	**Send** : AT+ADDRFILTER=1 // Set the address filter switch to on **Return** : AT_OK // Command successful response
AT+ADDRFILTER?	<Filter switch> AT_OK	**Send** : AT+ADDRFILTER? // Query address filter switch **Return** : +ADDRFILTER:1 // Return the current address filter switch AT_OK // Command successful response
Note: <Filter switch> 0 means to turn off filtering ; 1 means to turn on filtering. In this case, data received with a destination address that is not the local device address will be discarded.		

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6.4.25 Set/query the destination device address in asynchronous working mode

instruction	response	Example
AT+DEST=<destination device address>	AT_OK	**Send** : AT+DEST=04:03:02:01 // Set the destination device address **Return** : AT_OK // Command successful response
AT+DEST?	<destination device address> AT_OK	**Send** : AT+DEST? // Query the destination device address **Return** : +DEST:04:03:02:01 // Return the current destination device address AT_OK // Command successful response
Note: <destination device address> consists of four hexadecimal numbers separated by colons in the format of xx:xx:xx:xx . It is only applicable to asynchronous working mode.		

6.4.26 Sending character format data

instruction	response	Example
AT+SEND=<character format data>	AT_OK	**Send** : AT+SEND=hello world // Send character format data immediately, the data is hello world **Return** : AT_OK // Command successful response
AT+SEND=<time slot index>,<character format data>	AT_OK	**Send** : AT+SEND=1,hello world // Send character format data in the first sending time slot, the data is hello world **Return** : AT_OK // Command successful response
AT+SEND?	< Number of remaining send buffers > AT_OK	**Send** : AT+SENDB? //Query the remaining cache number **Return** : +SEND:7 //7 send buffers remaining AT_OK //Command successful response
<Character format data>	Character format data	
<Time Slot Index>	Data is sent in a specified time slot, and the time slot index starts from 1, indicating the first sending time slot. For example, if there are 3 sending time slots in a frame , the time slot indexes are 1, 2, and 3 respectively. This parameter is used in synchronous working mode and has no effect in asynchronous working mode.	
Note: supports one parameter and two parameters; One parameter indicates that the data is sent immediately, using the nearest sending time slot to send the data; The two parameters indicate that data is sent in the specified transmission time slot. If the current frame has missed the specified transmission time slot, data will be sent in the specified time slot of the next frame;		

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The maximum number of bytes supported for sending in different rate modes is as follows (AT+SENDB same):

Rate Mode	Synchronous Mode (Bytes)	Asynchronous Mode (Bytes)
4	44	40
5	92	88
6	188	184
7	380	376
8~11,18	600	596

6.4.27 Sending hexadecimal format data

instruction	response	Example
AT+SENDB=<hexadecimal format data>	AT_OK	**Send** : AT+SENDB=01020304 // Send hexadecimal format data immediately, the data is 01020304 **Return** : AT_OK // Command successful response
AT+SENDB=<time slot index>,<hexadecimal format data>	AT_OK	**Send** : AT+SENDB=1,01020304 // Send hexadecimal format data in the first sending time slot, the data is 01020304 **Return** : AT_OK // Command successful response
AT+SENDB?	< Number of remaining send buffers > AT_OK	**Send** : AT+SENDB? //Query the remaining cache number **Return** : +SENDB:7 //7 send buffers remaining AT_OK //Command successful response
<Hexadecimal format data>	Hexadecimal format data.	
<Time Slot Index>	Send data in the specified time slot. The time slot index starts from 1, indicating the first sending time slot. For example, if there are 3 sending time slots in a frame, the time slot indexes are 1, 2, and 3. This parameter is used in synchronous working mode and does not work in asynchronous working mode.	
< Number of remaining send buffers >	The number of remaining send buffers. The total number of asynchronous mode buffers is 7 ; the synchronous mode is determined by the longest data slot length, specifically: total number of buffers = 4000 bytes / longest data slot bytes	
Note: supports one parameter and two parameters; One parameter indicates that the data is sent immediately, using the nearest sending time slot to send the data; The two parameters indicate that data is sent in the specified transmission time slot. If the current frame has missed the specified transmission time slot, data will be sent in the specified time slot of the next frame;		

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7 Notes

7.1 Half-duplex working mode

The module adopts half-duplex communication mode, which allows only one module to transmit data into the air at the same time and at the same frequency. Multiple modules sending data at the same time are prone to collision, resulting in data loss.

7.2 Network structure

The module supports point-to-point or point-to-multipoint communication. Data transmission between multiple users can be achieved by competition or time slot polling.

7.3 On-site network layout

Considering the complexity and unpredictability of the wireless environment, users should conduct on-site surveys before planning solutions. For example, use modules to conduct communication tests on site, and gradually select and optimize node locations. Reasonable early deployment will greatly improve the communication quality of the network, speed up construction progress, reduce debugging difficulties, and reduce later maintenance costs.

7.4 Module Integration and Installation

Compatibility design is an issue that users need to consider during integrated design, including structural dimensions, electromagnetic compatibility, etc. Antenna factors must also be taken into consideration .

- Space should be reserved around the external antenna, and it should not be close to the structural parts ;
- The internal antenna requires impedance matching ;
- Under the premise that construction permits, the installation of on-site antennas should try to follow the principles of height, openness and unobstructedness .

8 Hardware Design

- It is recommended to use a DC regulated power supply to power the module. The power supply ripple coefficient should be as small as possible and the module should be reliably grounded.
- Please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent damage to the module.
- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged.
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently.
- When designing the power supply circuit for the module, it is often recommended to retain more than 30% margin, which is conducive to long-term stable operation of the whole machine;
- The module should be kept as far away as possible from power supplies, transformers, high-frequency wiring and other parts with large electromagnetic interference;
- High-frequency digital routing, high-frequency analog routing, and power routing must avoid the bottom of the module. If it is necessary to pass under the module, assuming that the module is soldered on the Top Layer,

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ground copper should be laid on the Top Layer of the module contact part (all copper should be laid and well grounded), and it must be close to the digital part of the module and routed on the Bottom Layer ;

- Assuming the module is soldered or placed on the Top Layer, it is also wrong to randomly route the wires on the Bottom Layer or other layers, which will affect the module's spurious signal and receiving sensitivity to varying degrees ;
- If there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.
- If there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.
- If the communication line uses 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage) ;
- The antenna installation structure has a great impact on the module performance. Make sure the antenna is exposed and preferably vertically upward;
- When the module is installed inside the case, you can use a high-quality antenna extension cable to extend the antenna to the outside of the case;
- The antenna must not be installed inside a metal shell, as this will greatly reduce the transmission distance.

9 FAQ

9.1 No response after power on module

- When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly ;
- Temperature, humidity, and co-channel interference can increase the communication packet loss rate ;
- The ground absorbs and reflects radio waves, so the test results are poor when close to the ground ;
- Seawater has a strong ability to absorb radio waves, so the test effect at the seaside is poor ;
- If there are metal objects near the antenna, or the antenna is placed in a metal shell, the signal attenuation will be very serious ;
- The power register is set incorrectly, or the air rate is set too high (the higher the air rate, the closer the distance) ;
- The power supply voltage is lower than the recommended value at room temperature. The lower the voltage, the lower the power output .
- The antenna used does not match the module well or the antenna itself has quality issues.

9.2 Module is easily damaged

- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged .
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently .
- Please ensure anti-static operation during installation and use, as high-frequency components are sensitive to

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static electricity ;

- Please ensure that the humidity is not too high during installation and use, as some components are humidity sensitive devices ;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

9.3 Transmission distance is short/getting closer

- The module transmission performance deteriorates (low transmission power, decreased receiving sensitivity) , the module is damaged, and needs to be returned to the factory for repair ;
- The antenna is loose, corroded or damaged . Tighten the antenna connection or replace the antenna .
- When a new interference source is added , give priority to changing the channel and adjusting/ upgrading the antenna;

10 Welding Operation Instructions

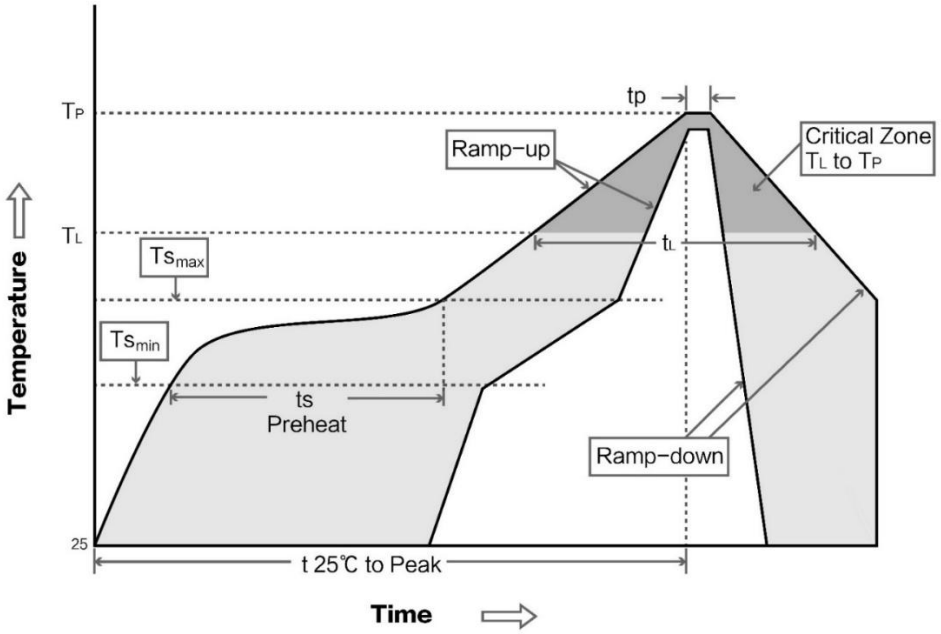
10.1 Reflow Temperature

Profile Feature	Curve characteristics	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (Tsmin)	Minimum preheating temperature	100 ℃	150 ℃
Preheat temperature max (Tsmax)	Maximum preheating temperature	150 ℃	200 ℃
Preheat Time (Tsmin to Tsmax)(ts)	Warm-up time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average ascent rate	3 ℃ /second max	3 ℃ /second max
Liquid Temperature (TL)	Liquidus temperature	183 ℃	217 ℃
Time(tL)Maintained Above(TL)	Time above liquidus	60-90 sec	30-90 sec
Peak temperature (Tp)	Peak temperature	220-235 ℃	230-250 ℃
Aveage ramp-down rate (Tp to Tsmax)	Average descent rate	6 ℃ /second max	6 ℃ /second max
Time 25 ℃ to peak temperature	Time from 25 ℃ to peak temperature	6 minutes max	8 minutes max

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10.2 Reflow Oven Curve



11 Related Models

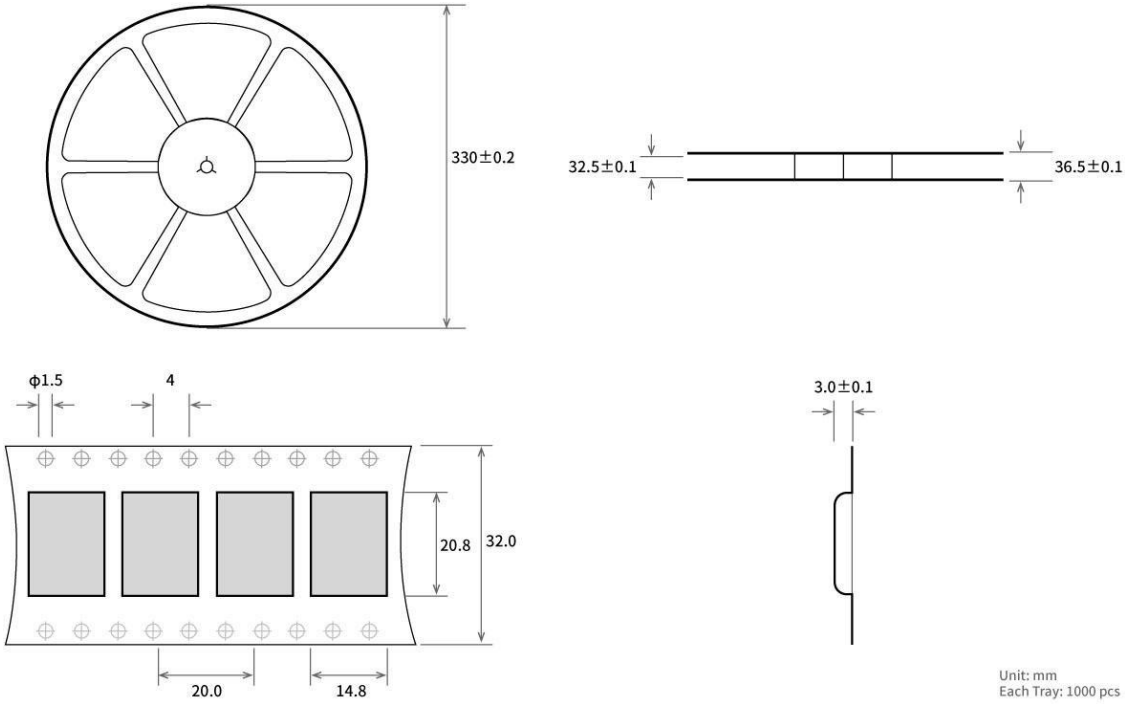
Product Model	Carrier frequency Hz	Transmit power dBm	Test distance km	Package	Product size mm	Communication interface
EWM293-470T20 S	470M -510M	20±1	3.5	Patches	16 * 26	UART
EWM293-470T30 S	470M -510M	30±1	5	Patches	26.5 * 33	UART

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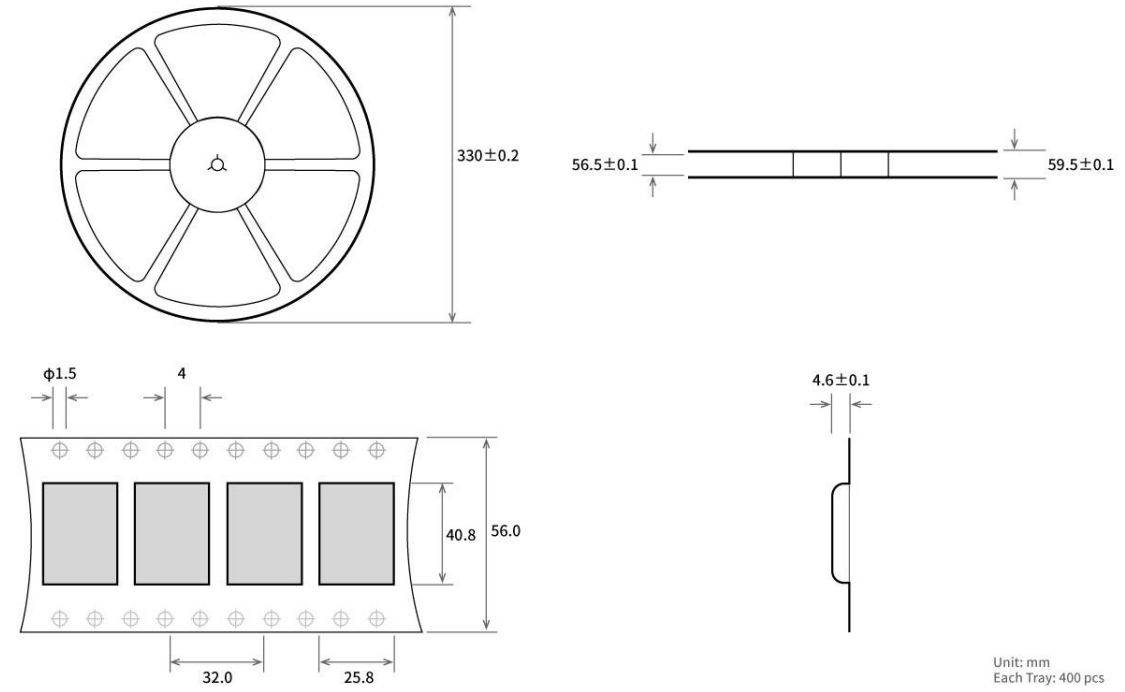
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12 Bulk Packaging Methods

12.1 EWM293-470T20S



12.2 EWM293-470T30S



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Revision History

Version	Revision Date	Revision Notes	Maintainer
1.0	2025-01-07	Initial release	Lei
1.1	2025-08-20	Modify recommended connection diagram	Lei
1.2	2026-03-06	Add pin description and revise the recommended connection diagram.	Lei

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