UART Wireless FSK Transceiver Module

SPECIFICATION

Model No.: DL-RTM300-B

Version: V1.0

DL-RTM300-B
433/868/915MHz

Before using this module, please pay attention to the following important matters:

This module is an electrostatic sensitive product. Please operate it on an anti-static workbench during installation and testing.

This DL-RTM300-B UART Wireless Module uses an external antenna by default, which is intended to be embedded in your product or application, and does equip with a metal shield itself for a better anti-interference ability. The antenna can be a wire antenna or a standard UHF antenna. You can choose a specific antenna according to the actual situation.

Metal objects and wires should be kept away from the antenna as much as possible. If the product uses a metal shell, be sure to install the antenna outside the metal shell. Otherwise, the RF signal will be seriously attenuated, which will affect the effective distance.

Disclaimer:

This specification is just for your information, all the charts and pictures used in this specification are for reference only. The actual test shall prevail for details. We do not assume any responsibility for personal injury or property loss caused by user's improper operation.

This specification is subject to change due to the continuous improvement and upgrading of the product version, and the latest version specification shall prevail. DREAMLNK reserves the right of final interpretation and modification of all contents in this specification.

Revision History

Date	Version	Formulation / Revision of Contents	Approved by
2023-8-5	V1.0	DL-RTM300-B Standard Version UART Module	Fagan Xu

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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1. Module Overview

1.1 Brief Introduction

DL-RTM300-B RF Module is an UART wireless serial port module with AT commands. It combines an integrated RF Controller with ARM Cortex-M0 32-bit core, 64kB on-chip Flash, 8kB on-chip SRAM, and supports hardware parity check. The Clock Speed of the main frequency can reach up to 48MHz.

The high efficiency of receiving sensitivity enables this RF module to have excellent RF performance and strong anti-interference ability in the 420-510MHz/860-950MHz frequency bands. Meanwhile, this DL-RTM300-B RF Module is equipped with fully functional AT commands that support any serial baud rate of 1920-256000bps, which can improve its communication efficiency.

It also has defaulted low power consumption software, as well as other muti-functions serial port programs when it is manufactured. At the same time, a variety of Wireless Baud Rates and functions can be configured, including Long-range Spread Spectrum Mode and Universal Mode, Wake-on-Radio (eWOR) function, etc. These different configurations can provide simple and efficient solutions for various long-range communication, or battery powered applications.

There are 3 Versions available:

- DL-RTM300-B-433 Freq.: 433MHz
- DL-RTM300-B-868 Freq.: 868MHz
- DL-RTM300-B-915 Freq.: 915MHz

1.2 Features

- Wide voltage range supported: 1.8~3.6V;
- Ultra-low sleep current < 1uA;
- High efficiency receiving performance (RX current @ 9.5mA);
- Transmitting current: 77mA
- Efficient receiver sensitivity: -120dBm @ FSK (433M, 2.4kbps)
- Easily configure and save with AT command, facilitating development and debugging;
- Support transparent transmission mode for data transmission
- Support any serial baud rate of 1920-256000bps;
- Support RSSI acquisition at any time
- Fixed Point, Broadcasting and Monitoring transmissions are all available.

1.3 Typical Application

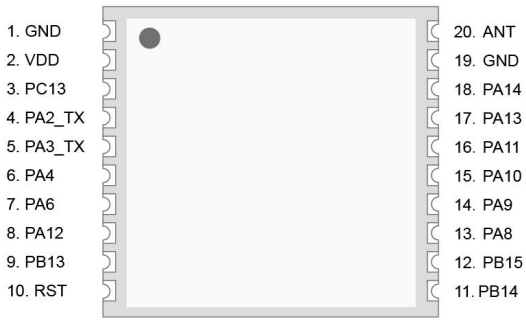
- Smart Grid and Automatic Meter Reading (water meter, electricity meter, gas meter)
- Long-Range Data Communication
- Smart Home Systems
- Wireless Sensor Networks
- Industrial Automation (Data Acquisition)
- Remote Control and Telemetry of Field Data
- Various Transmitter, Intelligent Flow Meter Instrument
- Building Automation and Security
- Monitoring and Control of Petroleum Equipment in Mines
- Environment, Energy Saving, Temperature Monitoring
- Intelligent Transportation, Smart City
- Intelligent Robot
- Home and Building Automation
- Wireless Alarm and Security Systems
- New energy vehicles, intelligent cabins
- Industrial Monitoring and Control
- Wireless M-BUS

2. Technical Parameter

Parameter	Min.	Typical	Max.	Unit	Remarks
Operating Conditions					
Working Voltage	2.0	3.3	3.6	V	Voltage above range may damage the RF module
I/O Voltage Range	1.8	3.3	3.6	V	Recommended Operating voltage is +3.3V
Working Temperature	-40	25	85	℃	
Current Consumption					
Receiving Current	8	8.5	8.8	mA	@ Radio Frequency Receiving Current (MCU sleep)
Receiver Working Current	8.3	9.5	10.5	mA	@ Overall Receiving Current
Transmitting Current	55	64	77	mA	@433M 20dBm Peak value
	43	57	71	mA	@868M 20dBm Peak value
	43	57	71	mA	@915M 20dBm Peak value
Standby Current	1	1.8	3	mA	@ RF Receive Function Disable
Sleep Current	0.7	1	2	uA	@M1=0,RXGAS=0
RF Parameters					
Recommended Frequency (Ensure best performance))	420	433.92	510	MHz	@433Mh RF module
	840	868 915	930	MHz	@868Mhz/915Mhz RF module
Transmitting Power Range	-4	20	20	dBm	@Please refer to the *Frequency* command for details
Max. Receiver Sensitivity @ FSK		-117		dBm	@868Mhz/915Mhz @2400bps
		-120		dBm	@433Mhz @2400bps
FSK Rate Range		2.4		Kbps	@Please refer to the *Rate* command for details

Table 1: Technical Parameter

3. Pin Definitions



Front Side

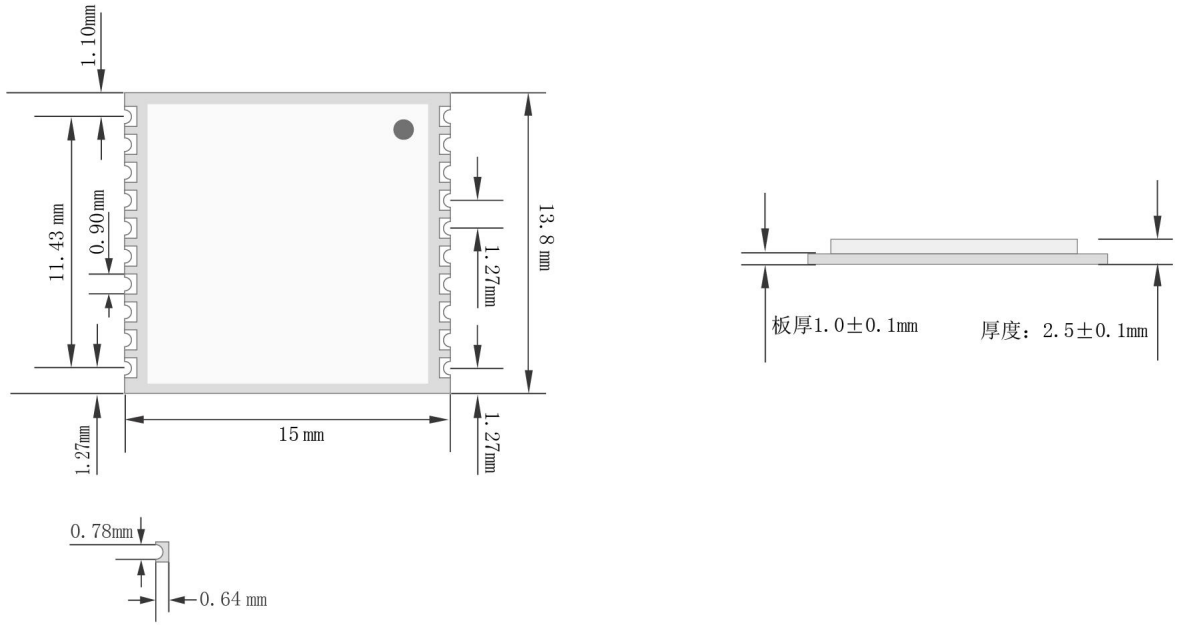
Back Side

No.	Pin Name	I/O type	Function Description
1	GND	PWR	Reliable Ground
2	VDD	PWR	To maximize the chip function, ≥3V stable voltage is recommended
3	PC13	Out	AUX
4	PA2	Out	(AT UART TX) TTL serial port output, connect to external RXD input pin
5	PA3	In	(AT UART RX) TTL serial port input, connect to external TXD output pin
6	PA4	In	Mode selection pins: high-level normal mode, low-level LP mode
7	PA6	IO	I2C2_SCL, ADC_IN6, TIM3_CH1, EVENT_OUT
8	PA12	IO	I2C2_SDA, COMP_OUT, EVENT_OUT
9	PB13	IO	I2C2_SCL, TIM1_CH1N
10	RESET	In	Reset pin, effective at low level
11	PB14	IO	I2C2_SDA, TIM1_CH2N, OPAMP_VINP
12	PB15	IO	TIM1_CH3N, RTC_REFIN
13	PA8	IO	TIM1_CH1, EVENT_OUT, SPI2_NSS
14	PA9	IO	USART1_TX, TIM1_CH2, SPI2_SCK
15	PA10	IO	USART1_RX, SPI2_MISO
16	PA11	IO	EVENT_OUT, SPI2_MOSI
17	SWDIO	I	SWD debugging interface, serial data signal
18	SWDCLK	I	SWD debugging interface, serial clock signal
19	GND	PWR	Reliable Ground

20	ANT	AI/AO	RF signal input/output port, π-matching circuit must be reserved; Adopt 50Ω impedance matching for RF routing, route the ground and add via holes around it

Table 2: Pin Definitions

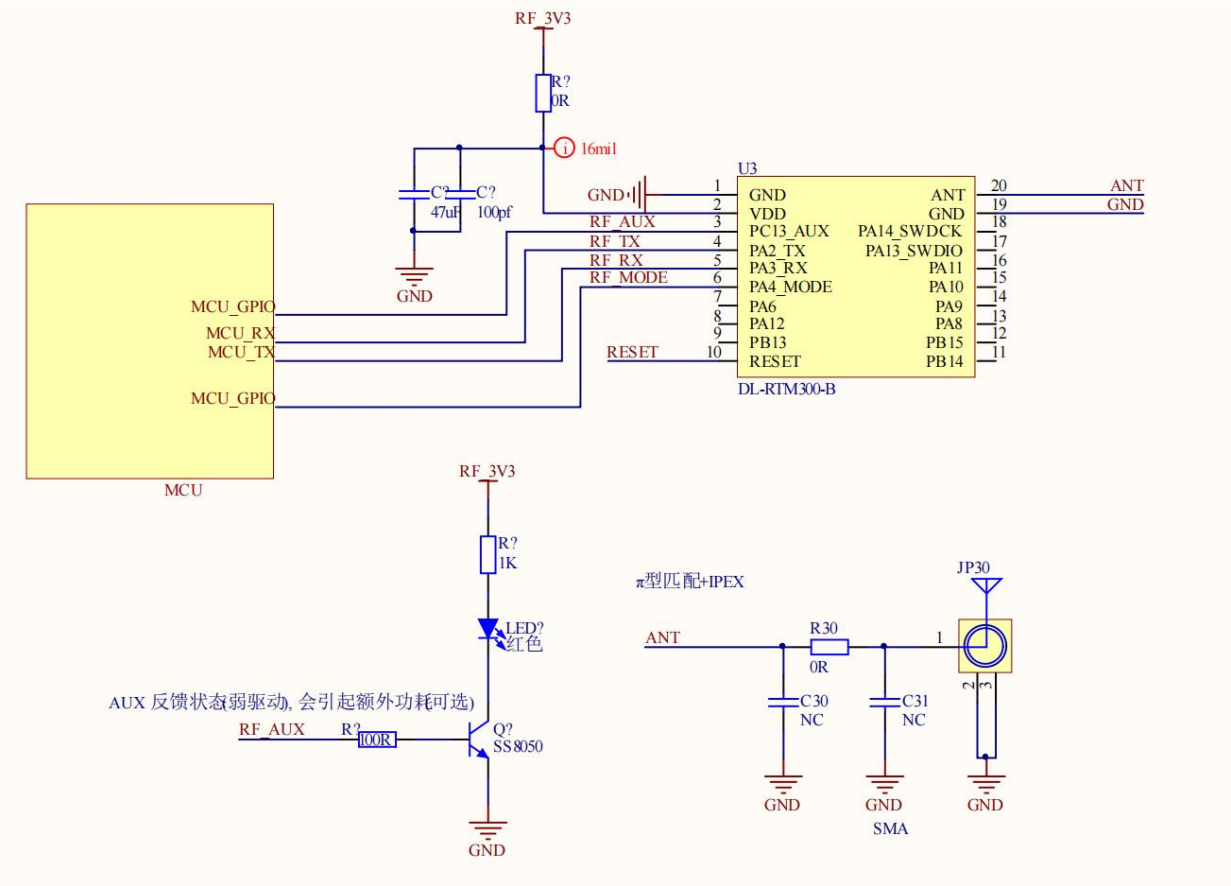
4. Module Dimension



DL-RTM300-B Module Dimension

5. Application Connection Diagram

AT Command Development Circuit Reference:



Notice for Pin Connection:

1. The voltage range of power supply should be 2V~3.6V, and cannot be exceed this range. If it exceeds 3.6V, the module will be burned out. The recommended working voltage is 3.3V.

2. The interface can be directly connected to a 3.3V powered MCU, without the need for series resistors;

3. AUX: RF module's status indicator pin

4. RX and TX are used for data transmission, and they should be reversed with the external MCU UART pins.

5. MODE: RF module's mode control pin

(1) It has two high-level modes:

Mode 1: Normal mode, can transmit and receive data

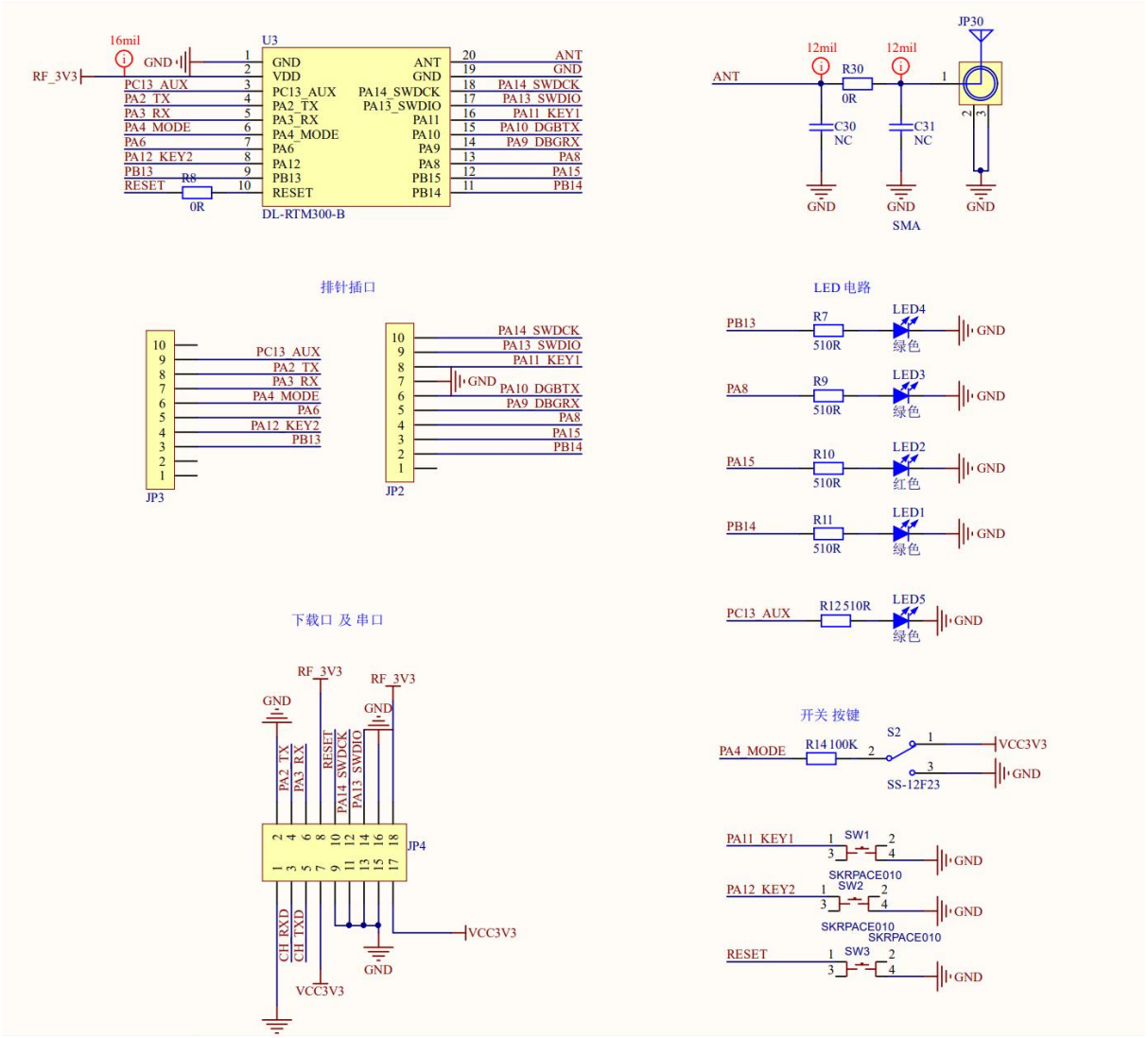
Mode 2: When receiving "+++" in a high-level state, it will enter AT mode

(2) It has two low-level modes:

Mode 1: Sleep mode, requires AT command to configure "RXGAS=0"

Mode 2: WOR mode, requires AT command to configure "RXGAS>0"

Secondary Development, Development Board Circuit Reference:



This is a secondary development test board circuit connection, and a switch is used for the MODE pin, which makes it convenient to switch between different modes. There are 4 LED lights connected to AUX, which can be used to indicate the status or display information of the device, for an easily development and debugging.

At the same time, there are two buttons on the board that can be used for user input or device control. There is a USB interface on the development board, which can be used for serial port debugging and log printing. With the help of this resources above, you can make the development easily.

6. Circuit Design

6.1 Power Supply Design

● Please pay attention to the power supply voltage of the device, exceeding the recommended voltage range may cause function abnormally and permanently damage;

● Try to use a DC stabilized power supply, and the power ripple coefficient should be as small as possible; the power load when transmitting the maximum power needs to be also considered;

● The module needs to be grounded reliably, and a good grounding can achieve better performance output and reduce the impact of RF on other sensitive devices.

6.2 RF Routing Design

● The module should be far away from RF interference sources, such as high-frequency circuit transformer, and please do not directly route at the lower layer of the RF module. Otherwise, the receiving sensitivity may be affected;

● When using the on-board antenna, the antenna needs to be clear on both sides, and the ground should not be too close to the antenna at the same time, otherwise it will absorb the radiated energy;

● Route 50Ω impedance line, lay the ground and add more via holes around it

● If there is enough space on your PCBA, please reserve a π-type matching circuit, and it needs to be placed as close to the chip end as possible, please make it grounded and add via holes around it. Do remember to connect it through a 0R resistor, otherwise the antenna will open circuit; SMA ANT circular through-hole requires clearance treatment

6.3 Antenna Design

● There are many types of antennas, please choose the appropriate antenna according to your needs;

● Choose a suitable position to place the antenna, according to the antenna polarity. And it is recommended to be vertically upward;

● There should be no metal objects in the antenna radiation path, otherwise the transmission distance will be affected (such as a closed metal casing).

7. Command Format

Query a Command: AT+<x>? Query the current value in the command.

Set the Command: AT+<x>=<...> To set user-defined parameter values.

Execute the Command: AT+<x> To perform certain immutable functions.

How to enter AT Command mode: please use serial port to send "+++", when command received and returned OK, it successfully enters AT Command mode for parameter configuration

Note: when entering AT Command mode, "\r\n" cannot be followed after "+++"

When sending an AT command, the command needs to be followed by "\r\n"

Type	Command Format	Command Response
Set Command	AT+<cmd>=<p1>,<p2>,...	OK\r\n AT ERR! = 1\r\n
Query Command	AT+<cmd>?	Return query parameters AT ERR! = 1\r\n

Table 3

8. AT Command

8.1 AT Command List

Basic Commands

Command	Description	Command Format Response/Default Parameters	Savable (Y/N)
AT	Testing response	AT\r\n OK	No
AT+DEFAULT	Restoring factory settings; For the default parameters of each command, see "Default Parameters" in the AT Command table.	AT+DEFAULT\r\n OK	No
AT+UART=	Set/Query serial port transmission properties. For details, please refer to: Serial Port Baud Rate Setting	AT+UART=<baudrate>,<databits>,<stopbits>,<parity>\r\n	Yes
AT+UART?		+UART:115200,8,0,0 OK	
AT+ENTM	Quit AT Command Mode	AT+ENTM\r\n OK	No

Table 4

8.2 RF Command

Command	Description	Command Format Response/Default Parameters	Savable (Y/N)
AT+RADIO=	Set/Query RF Machine Configuration. Different rates are detailed in: Setting Frequency and Communication Rate	AT+UART=<datarate>\r\n	Yes
AT+RADIO?		+RADIO:9600 OK	
AT+FREQ=	Quickly set/query the current wireless frequency. Can be used to achieve channel switching and avoid co-frequency interference	AT+FREQ=<frequency>\r\n	Yes
AT+FREQ?		+FREQ:433920000 OK	
AT+RFPOWER=	Set/Query the transmission power. It can be set to reduce the power consumption, but it will short the communication distance. (Max. Power is defaulted) Power: 433: Min.@ -4, Max.@ 20 868/915: Max.@ 20 Unit: dBm	AT=RFPOWER=<power>\r\n	Yes
AT+RFPOWER?			
AT+RFSADDR=	Set/Query Module Address Addr: Addr1: 1-65535 Addr2: 1-254 Addr1(0): Do not configure address Addr2(255): Broadcast address	AT+RFSADDR=<Addr1>,<Addr2>\r\n	Yes
AT+RFSADDR?		+RFSADDR:255,255 OK	
AT+PREAMBLE=	Set/Query the preamble duration, which is used to wake up the device in periodic wake up reception. Note: the duration of transmitting preamble will cause the delay of each transmission a little bit.	AT+PREAMBLE=<PreambleTime>\r\n	Yes
AT+PREAMBLE?		+PREAMBLE:0 OK	
AT+RXGAS=	Set the receiving interval. It can effectively reduce the power consumption of receiving. The receiving interval is RXGasTime (mS); In this mode,	AT+RXGAS=<RXGasTime>\r\n	Yes

AT+RXGAS?	the transmitter needs to configure the corresponding preamble duration. RXGasTime:(Effective in LP mode) Range: 100-2000 Unit: mS	+RXGAS:0 OK	
AT+RSSI?	Query the RSSI signal strength of the last packet. Usually, a negative number is returned	+RSSI:-110 OK	No

Table 5

9. Detailed Explanation of AT Commands

9.1 Serial Baud Rate Setting

Command Format: AT+UART=<baudrate>,<databits>,<stopbits>, <parity>\r\n

Factory default settings: AT+UART=115200,8,0,0

Parameters	Description
<baudrate>: UART Baud Rate	Range: 1920 ~ 2560000 1920 ~ 2560000
<databits>: data bits	8 : 8 data bits 9 : 9 data bits
<stopbits>: stop bits	0 : 1 stop bit 1 : 0.5 stop bits 2 : 2 stop bits 3 : 1.5 stop bits
<parity>: parity bits	0: No verification 1: Even parity check 2: Odd check

Table 6

Description	AT Command	Command Response
115200 Baud Rate 8 Data Bits NO Stop Bits NO Parity Bits	AT+UART=115200,8,0, 0	OK\r\n
Query Command	AT+UART?	+UART: 115200,8,0,0 OK\r\n

Table 7

9.2 Data Rate Setting

Command Format: AT+RADIO=<datarate>\r\n

Factory default settings: AT+RADIO=433920000

Parameters	Description
<datarate> : data rate The rate between each terminal must be the same	Current supported rates : 1.2Kbps , 2.4Kbps , 4.8Kbps , 9.6Kbps , 20Kbps , 50Kbps , 100Kbps

Table 8

9.3 Frequency Setting

Command Format: AT+FREQ=<frequency>\r\n

Only under the same frequency, wireless modules can communicate with each other, but frequencies within the same range will cause co-channel interference. This problem can be avoided by changing the current communication channel by setting the frequency.

Please note that the interval between the minimum channels is related to the rate. In order to avoid-channel interference, this command cannot set frequencies across frequency bands.

Parameters	Description
<frequency>: Communication Frequency The frequency must be the same between devices	Recommended range for 433Mhz: 420000000-510000000 Recommended range for 868Mhz/915Mhz: 840000000-930000000 (Unit: Hz)

Table 9

9.4 Power Setting

Command Format: AT+RFPOWER=<power>\r\n

Parameters	Description
<power>: the power of the transmitter determines the propagation range of the signal	Current supported scope: -4dB~20dB

Table 10

9.5 Address Setting

Command Format: AT+RFSADDR=<Addr1>,<Addr2>\r\n

1. Communication can only be carried out if the address Addr1 is the same. If the two modules are configured with a different address Addr1, then these two RF modules cannot communicate with each other.

2. Address Addr2 (1-254) is used to set the module's own address. After the Addr2 of a transmitter has been set, it is necessary to write the sending address and use a space to separate the following data before sending the data out.

For example, in 215 AFGgg5689K, **215** is the address to which data needs to be sent, and **AFGgg5689K** is the data being sent. When the address Addr2 is 255, it is under Broadcast Monitoring Mode.

Note: Addr2 configured only takes effect when Addr1 is not 0, and address configuration is not performed when Addr1 is 0.

Description	AT Command	Command Response
Set Address	AT+RFSADDR=256 , 125	OK\r\n
Query Address	AT+RFSADDR?	+RFSADDR : 256 , 125 OK\r\n

Table 11

9.6 Receiving Mode and WOR

Two modes of receiving:

Supported Receiving Modes	Description	Condition
Normal Receive Mode	Always in a receiving state even when the module is idle, which consumes more energy, but has good real-time performance	MODE = 1 (AT+RXGAS=0)
Low Power Receive Mode (eWOR)	The module enters the sleep state, and the serial port function is closed. The receiving interval can be set through AT+RXGAS, which will greatly reduce the current consumption. Since the transmitter also needs to set the AT+PREAMBLE time, the communication delay will be increased	MODE =0 (AT+RXGAS>0)

Table 12

9.7 Set the Preamble Duration: AT+PREAMBLE

Description	AT Command	Command Response
Command Format	AT+PREAMBLE=<PreambleTime>\r\n Unit: ms	OK\r\n ERROR:<erron>\r\n
Set the preamble duration 1s	AT+PREAMBLE=1000	OK\r\n
Query the duration of the preamble	AT+PREAMBLE?	+AT+PREAMBLE: 1000 OK\r\n

Table 13

9.8 Set Receiving Wake-up Time: AT+RXGAS

Description	AT Command	Command Response
Command Format	AT+RXGAS=<RXGasTime>\r\n Range: 100-2000 Unit: ms	OK\r\n ERROR:<erron>\r\n
Set the Wake-up Time 1s	AT+RXGAS=1000	OK\r\n
Query the duration of Wake-up	AT+RXGAS?	+RXGAS=1000 OK\r\n

Table 14

9.9 Resume Default Setting: AT+DEFAULT

Description	AT Command	Command Response
Command Format	AT+DEFAULT\r\n	OK\r\n
Resume Factory Setting	AT+DEFAULT	OK\r\n

Table 15

10. Working Modes

Name	Description	Condition
AT Command Mode	Carry out AT Command interactive configuration, and the module can be in the receiving state in the idle state;	MODE=1
Transparent Transmission Mode	After entering the transparent transmission mode, the module will send out the data exactly as what the host send to it; The module is always in the receiving state under normal conditions. The received data will be sent out through the serial port;	MODE=1
Pure Sleep Mode	After entering sleep mode, the MCU and RF stop working. To wake up, the module needs to be pull high externally. After waking up, the module works normally	MODE=0 AT+RXGAS=0
WOR Mode	After entering WOR mode, the module will periodically wake up and detect the RF preamble in the air according to the set time interval. It will automatically wake up and detect wireless signals. If a valid wireless signal is detected, it will enter receiving mode until it is received completely	MODE=0 AT+RXGAS>0

Table 16

11. AUX Description

Logic of serial port data from external MCU, under transparent transmission mode:

AUX high level indicates that the FIFO buffer is not empty and enters the TX state. After all transmission is completed, AUX low level indicates that there is no data in FIFO (used to judge the status of sending).

Serial port data output indication (used to wake up the external sleep MCU)

12. Notice for Module Application

(1) This module is an electrostatic sensitive product. Please operate on an anti-static workbench during installation and testing;
(2) When installing the module, make sure that nearby objects keep a sufficient safe distance from the module to prevent short-circuit damage;
(3) Liquid substance is not allowed to come into contact with this module, and this module should be used in a dry environment;
(4) Please use an independent voltage stabilizing circuit to supply power to this module, and avoid sharing with other circuits. The tolerance of the power supply should not be less than 5%.
(5) The indicators of this module are accord to commonly used international standard. If special certifications needed, we can adjust certain indicators according to your needs.

13. Contact us

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★ Data collection, Smart home, Internet of Things applications, Wireless remote control technology, Remote active RFID, Antennas ★

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