

RM-RF10TP-1278

LoRa Transmission Module Specification

V2.01

This specification contains the products

RM-RF10TP-1278(PI)	RM-RF10TP-1278(C)	RM-RF10TP-1278(E)	RM-RF10TP-1278(N)
--------------------	-------------------	-------------------	-------------------

Nanjing Ningyuan Intelligent Instrument Co., Ltd
Focusing on data acquisition, data transmission and data processing.

Contents

I. Product overview	1
1.1 Product Profile	1
1.2 Physical Drawing	1
1.3 Basic Characteristics	1
1.4 Product Application	2
II. Hardware features	2
2.1 Wireless Communication Features	2
2.2 Working Parameters	2
2.3 Electrical Characteristics	3
2.4 Suggested Module Connections	3
2.5 Installation Dimension	3
2.6 PCB package	4
2.7 Package Size	4
III. Mode Configuration	5
IV. Data Communication	6
4.1 Transparent Data	6
4.1.1, Communication data frame	6
4.1.2 Data data transmission characteristics	6
4.2 Communication Mode	7
4.2.1 Point-to-Multi	7
4.2.2 Point-to-Point	8
4.3 Module factory default parameters	9
4.4 Configuration Data(AT instruction)	9
4.4.1 Instruction Brief	9
4.4.2 Instruction Parameter Description	10
4.5 Configuration Data(Hex instruction)	11
4.5.1 Frame Structure	11
4.5.2 Instruction Brief	11
4.5.3 Instruction Parameter Description	12
4.5.4 Response Test(0x01)	13
4.5.5 Restore Factory(0x02)	13
4.5.6 Reset(0x03)	14
4.5.7 Echo Control(0x04)	14
4.5.8 Read Information(0x11)	14
4.5.9 Module Information(0x12)	14
4.5.10 Set Parameters(0x21)	15
4.5.11 Module Parameters(0x22)	15
V. Appendix	16
5.1 Annex 1: Corresponding Frequency band of the Channel	16

I. Product overview

1.1 Product Profile

This LoRa transmission module is a wireless transparent transmission module based on STM32WLE5CB chip. It adopts LoRa spread spectrum modulation frequency hopping technology, has high efficiency receiving sensitivity and super anti-interference performance. The communication distance and the receiving sensitivity is much higher than the current FSK and GFSK modulation. Module can support 433MHz, 868MHz and 915MHz frequency band. The modules are both CE and FCC certified.

1.2 Physical Drawing

Figure 1: Plug-in RM-RF10TP-1278(PI)



1.3 Basic Characteristics

- ◆ Advanced LoRa modulation is supported, which has the advantages of long-range anti-interference;
- ◆ The communication distance can reach 3 km, the transmission distance is better than the traditional GFSK and so on;
- ◆ Support for air wake-up;
- ◆ Maximum transmitting power 500 mW;
- ◆ Optional support for 433MHz, 868MHz, 915MHz frequency band;
- ◆ Supports data transmission rates 0.1 ~ 22 Kbps ;
- ◆ Support 3 ~ 5.2 V power supply, more than 3.3 V power supply can ensure the best performance;
- ◆ Industrial standard design, support -40~+85℃ long time use;
- ◆ SMA-K, RP-SMA-K interface, easy to connect coaxial cable or external antenna;
- ◆ CE certification;
- ◆ FCC certification.

1.4 Product Application

- ◆ Smart outdoor lighting
- ◆ Radioographic electrical instruments
- ◆ Security and alarm
- ◆ Wireless sensor network
- ◆ Smart hotel gateway
- ◆ Industrial communications
- ◆ Railway information equipment
- ◆ Field data is remote control
- ◆ Wireless protocol Converter
- ◆ Mine oil control equipment

II. Hardware features

2.1 Wireless Communication Features

Table 1: Wireless communication features

Project	Minimum	Typical values	Maximum	Unit	Remarks
Working frequency band	433	433	930	MHz	RM-RF10TP-1278(PI) RM-RF10TP-1278(C)
Working frequency band	433	868	930	MHz	RM-RF10TP-1278(E)
Working frequency band	433	915	930	MHz	RM-RF10TP-1278(N)
Transmission power		20	20	dBm	
Receiving sensitivity		-139	-139	dBm	
Air rate		1.8		Kbps	Rate is customizable from 0.1~22 Kbps
Stable transmission interval	0.3		2	S	1Byte: 0.30s;20Byte: 0.40s; 80Byte: 0.80s;160Byte: 1.40s; 200Byte: 1.70s;248Byte: 2.00s.

2.2 Working Parameters

Table 2: Working parameters

Main parameters	Note	Remarks
Communication distance	3000 m	Clear, empty, with an antenna gain of 3 dbi
Single frame size	248Byte	
Modulation mode	LoRa™	Supports 433MHz, 868MHz, 915MHz frequency band.
Communication interface	UART	TTL, port rate 9600, data bit 8, stop bit 1.
Antenna format	SMA antenna	Use the 3 dbi gain antenna by default.
Number of channels	164	
Working life	20 years	

2.3 Electrical Characteristics

Table 3: Electrical characteristics

Project	Minimum	Typical values	Maximum	Unit	Remarks
Working voltage	3	5	5.2	V	
Emission current		100		mA	
Receiving Current		16		mA	
Working temperature	-40		+85	°C	

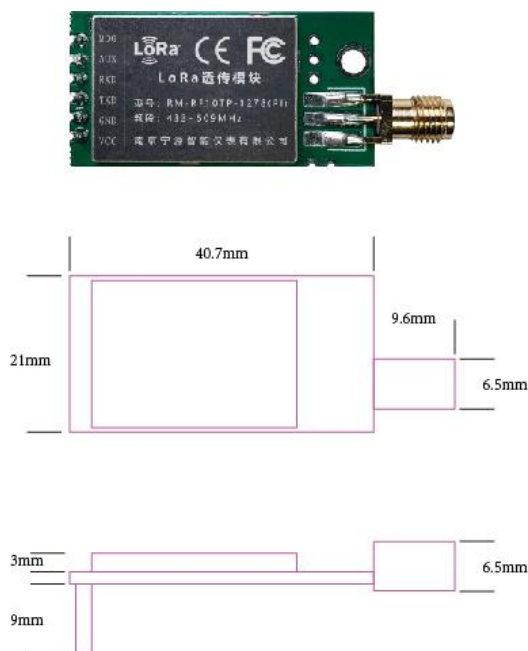
2.4 Suggested Module Connections

Table 4: Recommended Module Connectivity Table

Module pin	Pin direction	Remarks
MD0	Input	With AUX cooperation, determine the module of the three working modes.dangling defaults to high level(MD0=1) .
AUX	Input	With MD0 cooperation, determine the module of the three working modes.dangling defaults to high level(AUX=1) .
RXD	Input	TTL serial port input, connect to MCU RXD input pin.
TXD	Output	TTL serial port output, connect to MCURXD output pin.
GND	Input	Module grounding.
VCC	Input	Module supply pin, voltage range: 3~5.2 V DC.

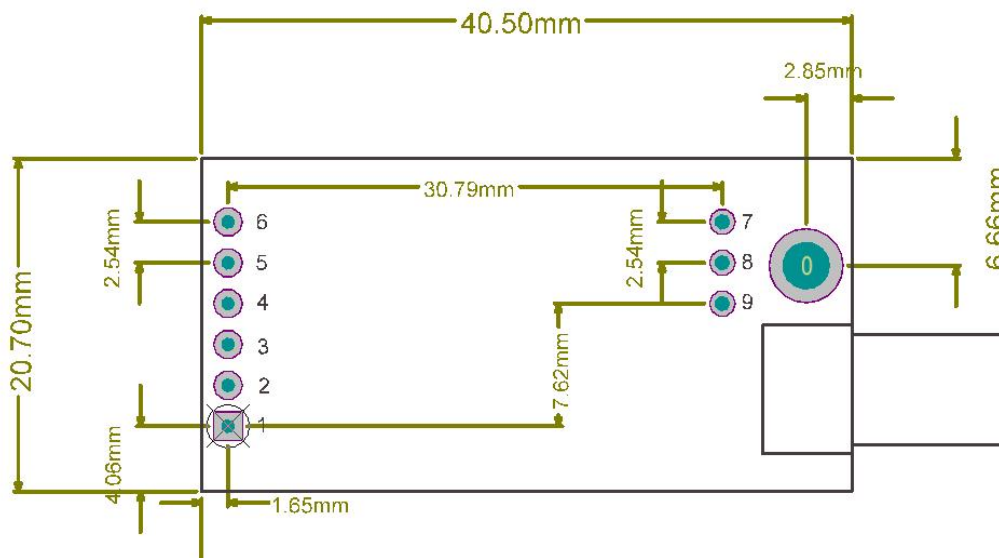
2.5 Installation Dimension

Figure 2: Installation dimension



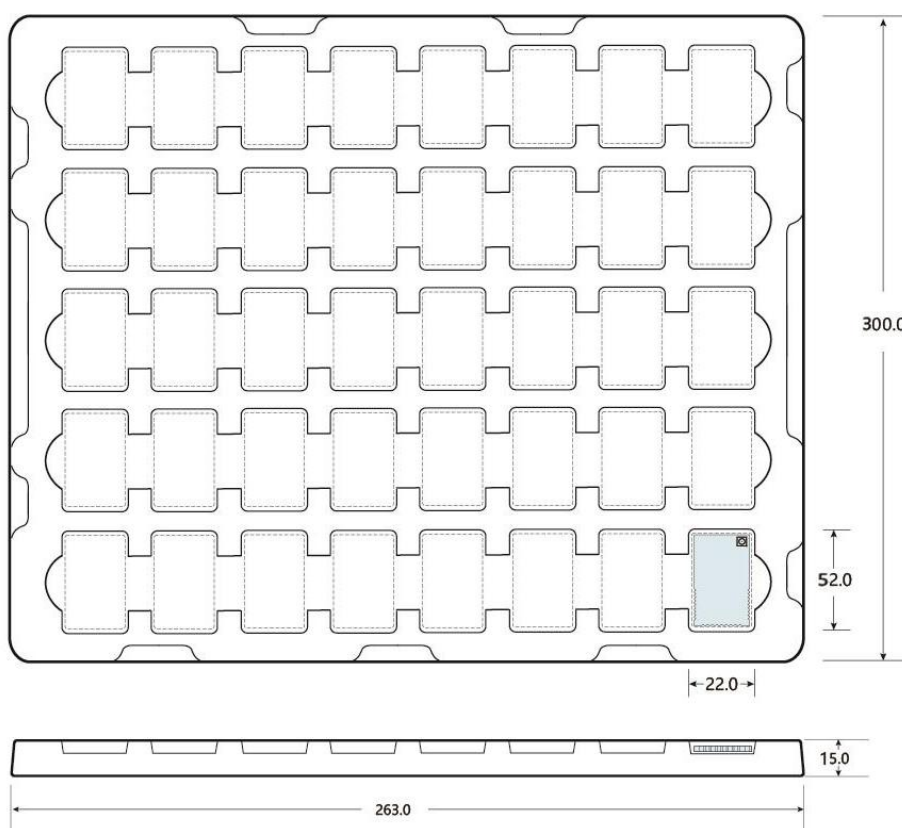
2.6 PCB package

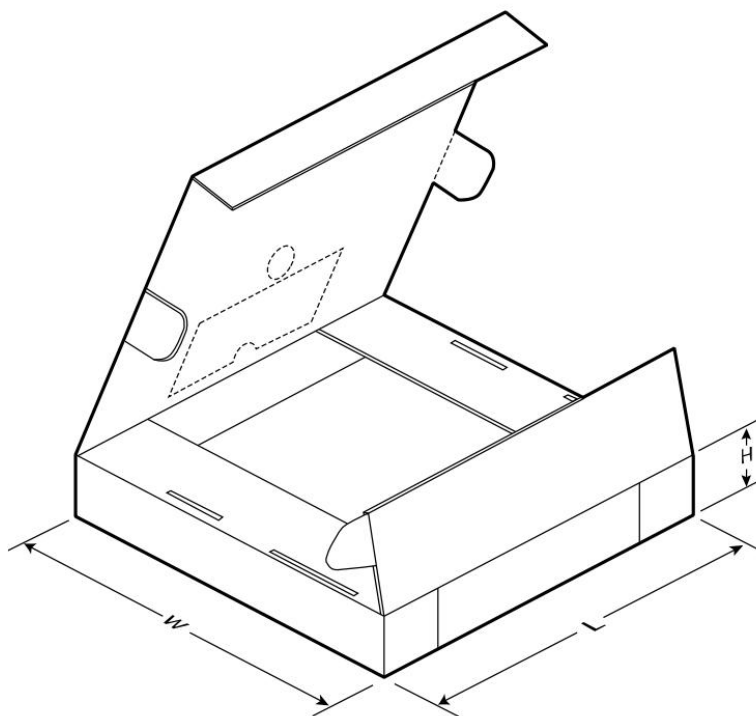
Figure 3: PCB package



2.7 Package Size

Figure 4: Package size





III. Mode Configuration

* Note: The switching mode takes 100ms effective time.

Table 5: Module Mode Configuration

Module mode	Pin configuration	Remarks
Upgrade mode (Custom required)	MD0=0, AUX=0	The MD0 foot is low level, the AUX foot is low level, and the module enters firmware upgrade mode after 1 s. In this mode, the module can be upgraded by serial port and configuration tool software.
Configuration mode	MD0=1, AUX=0	The MD0 foot is high level(suspended) , the AUX foot is low level, and the module enters the configuration mode after 1 s. In this mode, the module can be configured by serial port.
Transmission mode	MD0=1, AUX=1	The MD0 foot is high level(suspended) , the AUX foot is high level(suspended) , the module enters the transmission mode; All the data received by the serial ports will be encapsulated and sent using a radio broadcast. All received legitimate wireless packets will be released and sent through the serial port.

IV. Data Communication

4.1 Transparent Data

When the module is in transmission mode, wireless data transmission can be received through the module serial port.

4.1.1, Communication data frame

Serial Communication Frame Structure: Send

Name of name	Target address	Channel	Data domain
Symbol	Target	Channel	Data
bytes	2	1	Maximum 248

- ◆ Target address: address number of Target: data target, Hex code 2 bytes.
When the target address is 0xFF 0xFF, it is a point-to-multimode; if the target address is not 0xFF 0xFF, it is a point-to-point mode.
- ◆ Channel: Channel: data target communication channel, Hex code 1 byte.
- ◆ Data domain: Data: transparent data, Hex code, maximum length of 248 bytes.

Serial Communication Frame Structure: Receiving

Name of name	Data domain
Symbol	Data
bytes	Maximum 248
Value	

- ◆ Data domain: Data: transparent data, Hex code, maximum length of 248 bytes.

4.1.2 Data data transmission characteristics

- ◆ After sending a channel data with a serial port under [Transmission mode], the transmission and receiving channel of the module will be temporarily changed to the channel, and the module will be restored to the channel configured under [Configuration mode] after power off or restart.
- ◆ The serial port cache size of the module is 260 bytes. If the serial port sends more than 260 bytes of data to the module, the first 3 bytes will cycle over the data domain data automatically since the first 3 bytes are the target address and channel.
- ◆ The module currently supports a maximum of 255 bytes of data communication, of which 248 bytes are valid data. If the valid data sent to the module exceeds 248 bytes, only the valid data of the first 248 bytes will be kept and sent externally.

4.2 Communication Mode

4.2.1 Point-to-Multi

Data can be sent to the specified channel.

Figure 4: Point-to-Multi



Example:

Module A: Sending Module, Address: 4369(0x11 0x11) , channel: 05(0x05) ;

Module B: Receiving Module, Address: 8738(0x22 0x22) , channel: 30(0x1E) ;

Module C: Receiving Module, Address: 13107(0x33 0x33) , channel: 30(0x1E) ;

Module D: Receiving Module, Address: 17476(0x44 0x44) , channel: 31(0x1F) ;

Data sent: 00x12x34 0x56 0x78 0x90;

If you need to send data to all modules with channel 30, the serial port needs to send data to the module A as follows:

[0xFF 0xFF 0x1E 0x12 0x34 0x56 0x78 0x90]

- ◆ [0xFF 0xFF]: point-to-multi;
- ◆ [0x1E]: Channels requiring data reception;
- ◆ [00x12x34 0x56 0x78 0x90]: Data to be sent;

Modules B, C receive the data and send it to the serial port: [0x12 x34 0x56 0x78 0x90];

Module D can not receive data.

4.2.2 Point-to-Point

You can send data to the module with the specified module.

Figure 5: Point-to-Point



Example:

Module A: Sending Module, Address: 4369(0x11 0x11) , channel: 05(0x05) ;

Module B: Receiving Module, Address: 8738(0x22 0x22) , channel: 30(0x1E) ;

Module C: Receiving Module, Address: 13107(0x33 0x33) , channel: 30(0x1E) ;

Module D: Receiving Module, Address: 17476(0x44 0x44) , channel: 31(0x1F) ;

Data sent: 00x12x34 0x56 0x78 0x90;

Now need to send data to module B separately, then serial port needs to send data to module A as follows:

[00x22 0x22 0x1E 00x12x34 0x56 0x78 0x90];

- ◆ [0x22 0x22]: point-to-point mode, module B address;
- ◆ [0x1E]: Module B channel;
- ◆ [0x12 0x34 0x56 0x78 0x90]: Data to be sent.

Module B receives the data and sends it to the serial port: [0x12 0x34 0x56 0x78 0x90];

Module C receives the data and does not send the data to the serial port;

Module D can not receive data.

4.3 Module factory default parameters

Table 6: Factory default parameters of the module

project	parameter	numeric value	unit	explain
Module address	00 01	1		
communication channel	00	0		

4.4 Configuration Data(AT instruction)

When the module is in configuration mode, the module can be configured through the module serial port.

* **Note 1: After all configuration settings, 100ms takes required.**

Note 2: AT instruction is capital, all in return, change line character ending: [\r\n]

Note 3: Under AT command, the port rate is 9600, 1 bit stop bit, no check bit.

4.4.1 Instruction Brief

Table 7: Brief Description of AT Instruction

Instruction description	Instruction format	Examples of instructions	Example Description
Response of test modules	Sent: AT return: OK	Sent: AT return: OK	Send a response test instruction to the module, The module responded: OK: module working normally
Type of equipment	Sent: AT + MD0EL? Return: + MD0EL: <Type> OK	Sent: AT + MD0EL? Return: + MD0EL: RZ-LORA-V1.1 OK	Send to moduleType of equipmentInstructions, The module responded: Type: Module Type OK: query success
Get firmware version number	Sent: AT + CGMR? Return: + VERSION: <Ver.> OK	Sent: AT + CGMR? Return: + VERSION: 109 OK	Send to moduleGet firmware version numberInstructions, The module responded: Ver: firmware version: 1.09 OK: query success
Turn off echo	Sent: AT + NORESP Return: No return	Sent: AT + NORESP Return: No return	Send to moduleCancel echo instructions The module will not respond
Open echo	Sent: AT + RESP return: OK	Sent: AT + RESP return: OK	Send to moduleTurn off the echo command The module responded: OK: echo open
Query whether the device is in firmware upgrade mode (Customizable and	Sent: AT + UPDATE return: OK	Sent: AT + UPDATE return: OK	Send a query to the modules the device in firmware upgrade modeInstructions, The module responded:

on-demand)			OK: in upgrade mode
Module reset(restart)	Send: AT + RESET return: OK	Send: AT + RESET return: OK	Send module reset(restart) instructions to the module, The module responded: OK: reset successfully
Restoration of factory settings	Send: AT + DEFAULT return: OK	Send: AT + DEFAULT return: OK	Send recovery factory setup instructions to the module, The module responded: OK: recovery success
Query device address	Send: AT + ADDR? Return: + ADDR: <Addr> OK	Send: AT + ADDR? Return: + ADDR: B1, B2 OK	Send to moduleQuery device addressInstructions, The module responded: Addr: address: 45490 OK: query success
Configuration Device Address	Send: AT + ADDR= <Addr> return: OK	Send: AT + ADDR=B1, B2 return: OK	Send the device address setting instruction to the module and set the address to: Addr: address: 45490 The module responded: OK: set up successfully
Query wireless rates and channels	Send: AT + WLRATE? return: +WLRATE(<Channel>, <Speed>) OK	Send: AT + WLRATE? Return: + WLRATE(0, 7) OK	Send to moduleQuery wireless rates and channelsInstructions, The module responded: Channel: channel: 0(433 MHz) Speed: 7(1.8 Kbps)
Configure wireless rates and channels (Current version of wireless rate is unconfigurable and customized on demand)	Sent: AT+WLRATE=<Channel>, <Speed> return: OK	Send: AT + WLRATE=0, 7 return: OK	Send to moduleConfigure wireless rates and channelsInstruction, willWireless Rate and Channel SettingsTo: Channel: channel: 0(433 MHz) Speed: 7(1.8 Kbps) The module responded: OK: set up successfully

4.4.2 Instruction Parameter Description

Address: Addr: module address number, Hex code 2 bytes.

Set address: 0000~65535: [0x00 0x00]~[0xFF 0xFF];

Among them [0x00 0x01] is factory default address , [0xFF 0xFF] is broadcast default address, do not recommend equipment use;

Rate: Speed: module communication air rate, Hex code 1 byte.

The following is the corresponding relationship between the Wireless rate and the Value:

* **Note: [0x07]: 1.8Kbps is the most stable test rate, the current version is not configurable and can be customized on demand.**

Rate	0.1 Kbps	0.14 Kbps	0.21 Kbps	0.3 Kbps	0.45 Kbps	0.6 Kbps
Values	0x00	0x01	0x02	0x03	0x04	0x05
Rate	0.9 Kbps	1.8 Kbps	3.5 Kbps	7.0 Kbps		
Values	0x06	0x07	0x08	0x09		

Channel: Channel: module communication channel, Hex code 1 byte.

The different channel modules will automatically use different communication frequencies:

RM-RF10TP-1278(PI) , RM-RF10TP-1278(C) : 433 MHz~509 MHz;

RM-RF10TP-1278(E) , RM-RF10TP-1278(N) : 850MHz~930 MHz;

The corresponding frequency band of the wireless communication channel refers to **Annex 1: Corresponding Frequency band of the Channel**.

Device type: Type: current device type, Ascii code.

DDevice type: RM-RF10TP-1278(PI) , RM-RF10TP-1278(C) , RM-RF10TP-1278(E) , RM-RF10TP-1278(N) : lora transmission module.

Firmware version: Ver: firmware version of the current device, Hex code 2 bytes.

Example: firmware version: [00x01x09]: Represents the current firmware version 1.09

4.5 Configuration Data(Hex instruction)

When the module is in configuration mode, the module can be configured through the module serial port.

*** Note 1: After all configuration settings, 100ms takes required.**

Note 2: Under Hex command, the port rate is 9600, 1 bit stop bit, no check bit.

4.5.1 Frame Structure

Name of name	Data Head	Command code	Data domain	Package tail
Symbol	Head	Cmd	Data	End
bytes	1	1	Change	1
Value	0x68			0x16

- ◆ Data Head: Head: data frame header, fixed to 0x68, Hex code 1 byte.
- ◆ Command code: Cmd: used to identify command content.Hex code , 1 byte.
- ◆ Data domain: Data: configuration command contains relevant data, Hex code, maximum length of 251 bytes.
- ◆ Package tail: End: data frame package tail, fixed to 0x16, Hex code 1 byte.

4.5.2 Instruction Brief

Table 8: Brief Description of Hex Instruction

Instruction description	Instruction format	Examples of instructions	Example Description
Module Response Test	Send: 68 01 16 Return: 68 22 <Addr> <Speed> <Channel> 16	Send: 68 01 16 Return: 68 22 12 34 07 00 16	Send the response test instruction to the module, the module reply is: Addr: address: 4660 Speed: rate: 07(1.8 Kbps)

			Channel: channel: 00(433 MHz)
Restoration of factory settings	Send: 68 02 16 Return: 68 22 00 01 03 00 16	Send: 68 02 16 Return: 68 22 00 01 07 00 16	Send the recovery factory instruction to the module, the module will reset all parameters and reply. The default parameters of the module are: Addr: address: 0001 Speed: rate: 07(1.8 Kbps) Channel: channel: 00(433 MHz)
Module Reset	Send: 68 03 16 Return: 68 22 <Addr> <Speed> <Channel> 16	Send: 68 03 16 Return: 68 22 12 34 07 00 16	Send module reset instruction to module, module will restart, and reply. The module responded: Addr: address: 4660 Speed: rate: 07(1.8 Kbps) Channel: channel: 00(433 MHz)
Turn off echo	Send: 68 04 00 16 Return: No return	Send: 68 04 00 16 Return: No return	Send to moduleTurn off the echo command The module will not make any reply.
Open echo	Send: 68 04 01 16 Return: 68 22 <Addr> <Speed> <Channel> 16	Send: 68 04 01 16 Return: 68 22 12 34 07 00 16	Send open to moduleEcho command The module returns to the latest parameters: Addr: address: 4660 Speed: rate: 07(1.8 Kbps) Channel: channel: 00(433 MHz)
Read device information	Send: 68 11 16 Return: 68 12 <Type> <Ver.> 16	Send: 68 11 16 Return: 68 12 01 02 01 09 16	Send instructions to the module to read device information, The module responded: Type: equipment type: 0102 Ver.: firmware version: 1.09
Setting device parameters (Current version of wireless rate is unconfigurable and customized on demand)	Send: 68 21 <Addr> <Speed> <Channel> 16 Return: 68 22 <Addr> <Speed> <Channel> 16	Send: 68 21 12 34 07 00 16 Return: 68 22 12 34 07 00 16	Send the set device parameter instruction to the module and set the parameter to: Addr: address: 4660 Speed: rate: 07(1.8 Kbps) Channel: channel: 00(433 MHz) The module returns to the latest parameters: Addr: address: 4660 Speed: rate: 07(1.8 Kbps) Channel: channel: 00(433 MHz)

4.5.3 Instruction Parameter Description

Address: Addr: module address number, Hex code 2 bytes.

Set address: 0000~65535: [0x00 0x00]~[0xFF 0xFF];

Among them [0x00 0x01] is factory default address , [0xFF 0xFF] is broadcast default address, do not recommend equipment use;

Rate: Speed: module communication air rate, Hex code 1 byte.

The following is the corresponding relationship between the Wireless rate and the Value:

* Note: [0x07]: 1.8Kbps is the most stable test rate, the current version is not configurable and can be customized on demand.

Rate	0.1 Kbps	0.14 Kbps	0.21 Kbps	0.3 Kbps	0.45 Kbps	0.6 Kbps
------	----------	-----------	-----------	----------	-----------	----------

Values	0x00	0x01	0x02	0x03	0x04	0x05
Rate	0.9 Kbps	1.8 Kbps	3.5 Kbps	7.0 Kbps		
Values	0x06	0x07	0x08	0x09		

Channel: Channel: module communication channel, Hex code 1 byte.

The different channel modules will automatically use different communication frequencies:

RM-RF10TP-1278(PI) , RM-RF10TP-1278(C) : 433 MHz~509 MHz;

RM-RF10TP-1278(E) , RM-RF10TP-1278(N) : 850MHz~930 MHz;

The corresponding frequency band of the wireless communication channel refers to **Annex 1: Corresponding Frequency of the Channel**.

Device type: Type: the type of the current device, Hex code 2 bytes.

Device type 1: [0x01 0x02]: RM-RF10TP-1278(PI) transmission module;

Device Type 2: [0x01 0x03]: RM-RF10TP-1278(C) transmission module;

Device Type 3: [0x01 0x04]: RM-RF10TP-1278(E) transmission module;

Device Type 4: [0x01 0x05]: RM-RF10TP-1278(N) transmission module.

Firmware version: Ver.: firmware version of the current device, Hex code 2 bytes.

Example: Firmware version: [00x01 0x09]: The current firmware version 1.09

4.5.4 Response Test(0x01)

Name of name	Data Head	Command code	Data domain	Package tail
Symbol	Head	Cmd	Data	End
bytes	1	1	0	1
Value	0x68	0x01		0x16

Module received in configuration mode: [0x68 0x01 0x16] Returns device parameter information [0x22]command frame.

4.5.5 Restore Factory(0x02)

Name of name	Data Head	Command code	Data domain	Package tail
Symbol	Head	Cmd	Data	End
bytes	1	1	0	1
Value	0x68	0x02		0x16

Module received in configuration mode: [0x68 0x02 0x16] command frame, all parameters are reset to factory status and the recovered device parameter information [0x22], is returned.

Note: factory default equipment parameter information is:

- ◆ Device address: [0x00 0x01]: 1;
- ◆ Wireless rate: [0x07]: 1.8Kbps;
- ◆ Channel: [0x00]: 0 channel 433 MHz communication band.

4.5.6 Reset(0x03)

Name of name	Data Head	Command code	Data domain	Package tail
Symbol	Head	Cmd	Data	End
bytes	1	1	0	1
Value	0x68	0x03		0x16

Module received in configuration mode: [0x68 0x03 0x16] command frame is automatically restarted and the device parameter information [0x22]. is returned after the restart is successful.

4.5.7 Echo Control(0x04)

Name of name	Data Head	Command code	Data domain	Package tail
Symbol	Head	Cmd	Data	End
bytes	1	1	0	1
Value	0x68	0x04		0x16

Data domain(Data)

Name of name	Echo type
Symbol	Type
bytes	1

◆ Echo type: Type: Set the flag bit to open or close the echo, HEX code 1 byte.

Echo type 1: [0x00]: turn off the echo, will no longer reply to the settings command, but directly effective.

Echo type 2: [0x01]: Turn on the echo and will reply to all setup commands.

4.5.8 Read Information(0x11)

Name of name	Data Head	Command code	Data domain	Package tail
Symbol	Head	Cmd	Data	End
bytes	1	1	0	1
Value	0x68	x11 0		0x16

Module received in configuration mode: [0x68 0x11 0x16] , Returns device information [0x12], after command frame.

4.5.9 Module Information(0x12)

Name of name	Data Head	Command code	Data domain	Package tail
Symbol	Head	Cmd	Data	End
bytes	1	1	4	1
Value	0x68	0x12		0x16

Data domain(Data)

Name of name	Type of equipment	Firmware version
Symbol	Type	Ver.
bytes	2	2

Device type: Type: current device type, Hex code 2 bytes;

- ◆ Firmware version: Ver.: firmware version of the current device, Hex code 2 bytes.

Example: firmware version: [00x01 0x07]: Represents current firmware version 1.07.

4.5.10 Set Parameters(0x21)

Module received in configuration mode: [0x68 00x21 0xXX 0xXX 0xXX 0xXX 0x16] command frame, save what needs to be set and return the device's latest parameter information [0x22].

Name of name	Data Head	Command code	Data domain	Package tail
Symbol	Head	Cmd	Data	End
bytes	1	1	4	1
Value	0x68	0x21		0x16

Data domain(Data)

Name of name	Device address	Wireless rate	Channel
Symbol	Addr	Speed	Channel
bytes	2	1	1

- ◆ Device address: Addr: to set the device new address, Hex code 2 bytes;
- ◆ Wireless rate: Speed: wireless rate to be set, Hex code 1 byte;
- ◆ Channel: Channel: wireless channel to be set, Hex code 1 byte.

4.5.11 Module Parameters(0x22)

Name of name	Data Head	Command code	Data domain	Package tail
Symbol	Head	Cmd	Data	End
bytes	1	1	4	1
Value	0x68	0x22		0x16

Data domain(Data)

Name of name	Device address	Wireless rate	Channel
Symbol	Addr	Speed	Channel
bytes	2	1	1

- ◆ Device address: Addr: device current address, Hex code 2 bytes;
- ◆ Wireless rate: Speed: device current wireless rate, Hex code 1 byte;
- ◆ Channel: Channel: device's current wireless channel, Hex code 1 byte.

V. Appendix

5.1 Annex 1: Corresponding Frequency band of the Channel

Note: FR - Frequency range; FB - Frequency band; Ch - Channel.

FR	Ch	FB MHz	Ch	FB MHz	Ch	FB MHz	Ch	FB MHz	Ch	FB MHz	Ch	FB MHz
433 MHz	00	433.06	20	463.06	40	493.06	60	863.00	80	895.00	A0	927.00
	01	434.00	21	464.00	41	494.00	61	864.00	81	896.00	A1	928.00
	02	434.94	22	464.94	42	494.94	62	865.00	82	897.00	A2	929.00
	03	435.88	23	465.88	43	495.88	63	866.00	83	898.00	A3	930.00
	04	436.81	24	466.81	44	496.81	64	867.00	84	899.00		
	05	437.75	25	467.75	45	497.75	65	868.00	85	900.00		
	06	438.69	26	468.69	46	498.69	66	869.00	86	901.00		
	07	439.63	27	469.63	47	499.63	67	870.00	87	902.00		
	08	440.56	28	470.56	48	500.56	68	871.00	88	903.00		
	09	441.50	29	471.50	49	501.50	69	872.00	89	904.00		
	0A	442.44	2A	472.44	4A	502.44	6A	873.00	8A	905.00		
	0B	443.38	2B	473.38	4B	503.38	6B	874.00	8B	906.00		
	0C	444.31	2C	474.31	4C	504.31	6C	875.00	8C	907.00		
	0D	445.25	2D	475.25	4D	505.25	6D	876.00	8D	908.00		
	0E	446.19	2E	476.19	4E	506.19	6E	877.00	8E	909.00		
	0F	447.13	2F	477.13	4F	507.13	6F	878.00	8F	910.00		
868 MHz	10	448.06	30	478.06	50	508.06	70	879.00	90	911.00		
	11	449.00	31	479.00	51	509.00	71	880.00	91	912.00		
915 MHz	12	449.94	32	479.94	52	509.94	72	881.00	92	913.00		
	13	450.88	33	480.88	53	510.00	73	882.00	93	914.00		
	14	451.81	34	481.81	54	511.00	74	883.00	94	915.00		
	15	452.75	35	482.75	55	512.00	75	884.00	95	916.00		
	16	453.69	36	483.69	56	513.00	76	885.00	96	917.00		
	17	454.63	37	484.63	57	514.00	77	886.00	97	918.00		
	18	455.56	38	485.56	58	515.00	78	887.00	98	919.00		
	19	456.50	39	486.50	59	516.00	79	888.00	99	920.00		
	1A	457.44	3A	487.44	5A	517.00	7A	889.00	9A	921.00		
	1B	458.38	3B	488.38	5B	518.00	7B	890.00	9B	922.00		
	1C	459.31	3C	489.31	5C	519.00	7C	891.00	9C	923.00		
	1D	460.25	3D	490.25	5D	520.00	7D	892.00	9D	924.00		
	1E	461.19	3E	491.19	5E	521.00	7E	893.00	9E	925.00		
	1F	462.13	3F	492.13	5F	522.00	7F	894.00	9F	926.00		

FCC Statement

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 important announcement

Important Note:

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 and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/Canada.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be co-located with any other transmitter or antenna,

As long as the three conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following" Contains FCC ID: **2A884-RMRF10TP**"

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

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.

2.7 Antennas

This radio transmitter **FCC ID:2A884-RMRF10TP** has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Type of antenna:	Gain of the antenna (Max.)	Frequency range:
External antenna	-0.74dBi (430-510MHZ) -1.71dBi (850-930MHZ)	

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains **FCC ID:2A884-RMRF10TP**".

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.