# UM019180

## RHF0M0E5 User Manual

**V1.3**

## Document information

| Info | Content |
|---|---|
| **Keywords** | *RisingHF, User Manual, Instruction* |
| **Abstract** | RHF0M0E5 module user manual to help users quickly use the module |

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# 1 Preface

RHF0M0E5 is a low-cost, ultra-low power, ultra-small size LoRaWAN® module designed by RisingHF Network (Shenzhen) Co., Ltd. The module uses ST system on chip STM32WLE5, integrated high-performance LoRa® SX126X IP and ultra-low power Consumption of MCU. The target application of this module is wireless sensor networks and other Internet of Things devices, especially battery-powered low power consumption and long-distance occasions.

# 2 Hardware Description

## 2.1 Pin definition

28 pin SMT package for module:

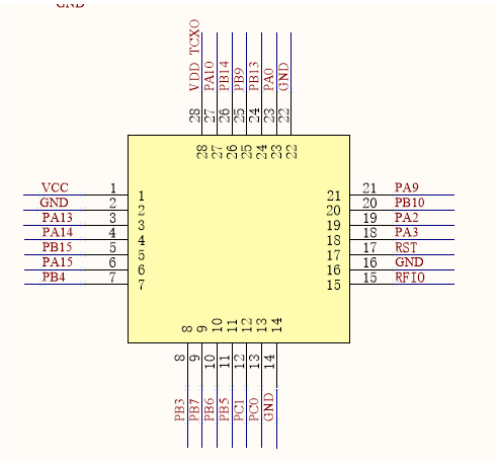



**Figure 2-1 RHF0M0E5 Pin arrangement**

## 2.2 Pin details

PB0 is used for TCXO power supply and should not be used normally.

| Number | Name | Type | Description |
|---|---|---|---|
| 1 | VCC | - | Supply voltage for the module |
| 2 | GND | - | Ground |
| 3 | PA13 | I | SWDIO of SWIM for program download |
| 4 | PA14 | I/O | SWCLK of SWIM for program download |
| 5 | PB15 | I/O | SCL of I2C2 from MCU |
| 6 | PA15 | I/O | SDA of I2C2 from MCU |
| 7 | PB4 | I/O | MCU GPIO |
| 8 | PB3 | I/O | MCU GPIO |
| 9 | PB7 | I/O | UART1_RX from MCU |
| 10 | PB6 | I/O | UART1_TX from MCU |
| 11 | PB5 | I/O | MCU GPIO |

| | | | |
|---|---|---|---|
| 12 | PC1 | I/O | MCU GPIO；LPUART1_TX from MCU |
| 13 | PC0 | I/O | MCU GPIO；LPUART1_RX from MCU |
| 14 | GND | - | Ground |
| 15 | RFIO | I/O | RF input/output |
| 16 | GND | - | Ground |
| 17 | RST | I/O | Reset trigger input for MCU |
| 18 | PA3 | I/O | MCU GPIO；USART2_RX from MCU |
| 19 | PA2 | I/O | MCU GPIO；USART2_TX from MCU |
| 20 | PB10 | I/O | MCU GPIO |
| 21 | PA9 | I/O | MCU GPIO |
| 22 | GND | - | Ground |
| 23 | PA0 | I/O | MCU GPIO |
| 24 | PB13 | I/O | SPI2_SCK from MCU; Boot pin(Active low) |
| 25 | PB9 | I/O | SPI2_NSS from MCU |
| 26 | PB14 | I/O | SPI2_MISO from MCU |
| 27 | PA10 | I/O | SPI2_MOSI from MCU |
| 28 | PB0 | I/O | Unavailable；Suspended treatment |

# 3 quick start

MCU communicates with module through serial port. The default parameter is "9600, 8, N, 1" (9600 baud rate, 8-bit data, no parity, 1-bit stop bit).

The following is the key information entered in the manufacturing, which can be modified by at command, but cannot be read by at command.

AppKey：2B7E151628AED2A6ABF7158809CF4F3C
AppSKey：2B7E151628AED2A6ABF7158809CF4F3C
NwkSKey：2B7E151628AED2A6ABF7158809CF4F3C

## 3.1 ABP mode

Use the AT+ID command to query the module ID information and register the ID information to the server ABP mode device. Follow these steps to configure the node so that it can communicate with the server.

### 3.1.1 ID query

Format：

AT+ID

Return：

+ID: DevAddr, 00:DF:E0:2E

+ID: DevEui, 20:4F:37:50:32:36:50:08
+ID: AppEui, 52:69:73:69:6E:67:48:46

### 3.1.2 Configure band

Set the band of the node according to the working frequency of the gateway.( EU868、US915、US915、HYBRID、CN779 、EU433、AU915、AU915OLD、CN470、AS923、KR920、IN865 、RU864、CN470PREQUEL、STE920)

Format：
AT+DR=CN470
Return：
+DR: CN470

### 3.1.3 Configure channels

Set the channel of the node according to the type of gateway subnet

Format：
AT+CH=NUM,0-7
Return：
+CH: NUM, 0-7

Query whether the channel of the module matches the gateway through the AT+CH command

Format：
AT+CH
Return：
+CH: 8; 0,470300000,DR0,DR5; 1,470500000,DR0,DR5; 2,470700000,DR0,DR5; 3,470900000,DR0,DR5; 4,471100000,DR0,DR5; 5,471300000,DR0,DR5; 6,471500000,DR0,DR5; 7,471700000,DR0,DR5;

### 3.1.4 Configure mode

Format：
AT+MODE=ABP
Return：
+MODE: LWABP

### 3.1.5 Configure class

Format：
AT+CLASS=A
Return：
+CLASS: A

### 3.1.6 Communication

Format：
AT+MSG=123
Return：
+MSG: Start

+MSG: Done

## 3.2 OTAA mode

Use the AT+ID command to query the module ID information and register the ID information to the server OTAA mode device. Follow these steps to configure the node so that it can communicate with the server.

### 3.2.1 ID query

Format：

AT+ID

Return：

+ID: DevAddr, 00:DF:E0:2E
+ID: DevEui, 20:4F:37:50:32:36:50:08
+ID: AppEui, 52:69:73:69:6E:67:48:46

### 3.2.2 Configure band

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+DR: CN470

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AT+CH

Return：

+CH: 8; 0,470300000,DR0,DR5; 1,470500000,DR0,DR5; 2,470700000,DR0,DR5; 3,470900000,DR0,DR5; 4,471100000,DR0,DR5; 5,471300000,DR0,DR5; 6,471500000,DR0,DR5; 7,471700000,DR0,DR5;

### 3.2.4 Configure mode

Format：

AT+MODE=OTAA

Return：

+MODE: LWOTAA

### 3.2.5 Configure class

Format：

AT+CLASS=A

Return：

+CLASS: A

### 3.2.6 Join

Use the at + join command to join the network. Start the network access process when the module is not connected to the network

Format：

AT+JOIN

Return：

+JOIN: Start

+JOIN: NORMAL

+JOIN: Network joined

+JOIN: NetID 000000 DevAddr 01:09:BD:8C

+JOIN: Done

Use the at + join command to join the network. Return to network status when the module is connected to the network

Format：

AT+JOIN

Return：

+JOIN: Joined already

Use the AT+JOIN=FORCE command to force joining the network.

Format：

AT+JOIN=FORCE

Return：

JOIN: Start

+JOIN: FORCE

+JOIN: Network joined

+JOIN: NetID 000000 DevAddr 01:09:BD:8C

+JOIN: Done

## 3.3 TEST mode

Test mode is used to evaluate the performance of the module, which helps the user to find the module problems

Use AT+MODE=TEST configuration module to enter test mode

Format：

AT+MODE=TEST

Return：

+MODE: TEST

Use AT+TEST=RFCFG to configure parameters in module test mode

AT+TEST=RFCFG,[FREQUENCY],[SF],[BANDWIDTH],[TX PR],[RX PR],[TX POWER],[CRC],[IQ],[NET]

Format：

AT+TEST=RFCFG,470,7,125,8,8,14,OFF,OFF,OFF

Return：

+TEST: RFCFG F:470000000, SF7, BW125K, TXPR:8, RXPR:8, POW:14dBm, CRC:OFF, IQ:OFF, NET:OFF

### 3.3.1 test noise floor

Parameter 470 is the test frequency (MHz) and parameter 25 is the number of samples.
The return parameters - 98, - 98, - 98 are the average value, the maximum value and the minimum value, respectively.

Format：

AT+TEST=RSSI,470,25

Return：

+TEST: RSSI, -98, -98, -98

### 3.3.2 test TXCW

Format：

AT+TEST=TXCW

Return：

+TEST: TXCW

### 3.3.1 test CLORA

Format：

AT+TEST=TXCLORA

Return：

+TEST: TXCLORA

### 3.3.2 test send LORA packet

Format：

AT+TEST=TXLRPKT,112233

Return：

+TEST: TXLRPKT "112233"
+TEST: TX DONE

### 3.3.3 test receive LORA packet

Format：

AT+TEST=RXLRPKT

Return：

+TEST: RXLRPKT

Display message when LORA packet is received

Return：

+TEST: LEN:3, RSSI:-11, SNR:12

+TEST: RX "AB04BA"

# 4 FAQ

Q：Why does not the baud rate change take effect immediately after setting

A：Restart the module to take effect after baud rate setting

Q：Why there is no response when entering DFU mode

A：In DFU mode, the baud rate of the serial port is 115200. Check whether the baud rate of the serial port tool is correct. RHF0M0x5 module does not need to be restarted

Q:：Node sending data completed, but the server did not receive data

A：

1、Check whether gateway and node devices are registered to the server

2、Check whether the working band of the node and the gateway matches, and whether the working channels matches

3、Check whether the working mode and working type of the node are consistent with the device information registered by the server

4、Check whether the node supports the set working frequency band

5、Check whether the antenna of each node and gateway is correct

ORIGINAL EQUIPMENT MANUFACTURER (OEM) NOTES

The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: 2AJUZ0M0E5". Additionally, the following statement should be included on the label and in the final product's user manual: "This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interferences, and
(2) this device must accept any interference received, including interference that may cause undesired operation."

The module is limited to installation in mobile or fixed applications. Separate approval is required for all other operating configurations, including portable configuration with respect to Part 2.1093 and different antenna configurations.

A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end‐use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.

This Module is full modular approval, it is limited to OEM installation ONLY.
Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable. (OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.

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

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help
- This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.
NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user’s authority to operate the equipment.

# Revision

V1.3 2020-11-18

+ New OEM/FCC warning

V1.2 2020-09-25

+ Update STM32WLE5 description

V1.1 2020-05-08

+ Initial creation

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