UM11803

RHF4T003 Handheld Field tester User Manual

V1.0

Items	Content
Keywords	*RisingHF, Handheld Field Tester , User Manual,*
Abstract	This Document is User manual of RHF4T003 Handheld Field Tester, Including how to configure RHF4T003 to work as User expected

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1 Preface

RHF4T003 is a LoRa Handheld Field Tester which integrates GPS, Temperature/Humidity sensor and Full LoRaWAN protocol support. It is a portable device equipped with a 1150mAh rechargeable battery and 2.4” Size LCD display. RHF4T003 field tester is capable in Noise floor scan, Point to point Ping-Pong test and standard LoRaWAN communicating with Gateway. It is very suitable to be used as a tool for LoRa network planning and optimization.

This Manual will introduce how to use and configure RHF4T003 in detail, including:

- General Description
  - Power On/Off
  - Home Page Introduction
  - Keyboard Description
  - How to charge battery
  - PC Driver
  - PC Configure tool
- Hardware Function
  - Parameter Configure
  - Function Test
- LoRaWAN Function
  - Parameter Configure
  - Function Test
- NoiseScan Function
  - Parameter Configure
  - Function Test
- Ping-Pong Function
  - Parameter Configure
  - Function Test
- Firmware Upgradation
  - LoRa Module Firmware Update
  - System Firmware Upgradation
- Frequent Q&A
- Special Attention

2 General Description

2.1 Device Appearance

Each part of RHF4T003 appearance is listed below:

① : Esc/Return to upper layer[1]

② : Confirm/Enter[2]

③ : Direction Key

④ : Delete/Backspace

⑤ : Number Input Area

⑥ : Power Key

⑦ : LCD Display

⑧ : LED Indication

⑨ : Antenna Port

⑩ : Battery Cover

2.2 Power On/Off

- **Power On**

  Press and Hold the Power Key until LCD display is on.

- **Power Off**

  Press and Hold the Power Key until LCD display is off.

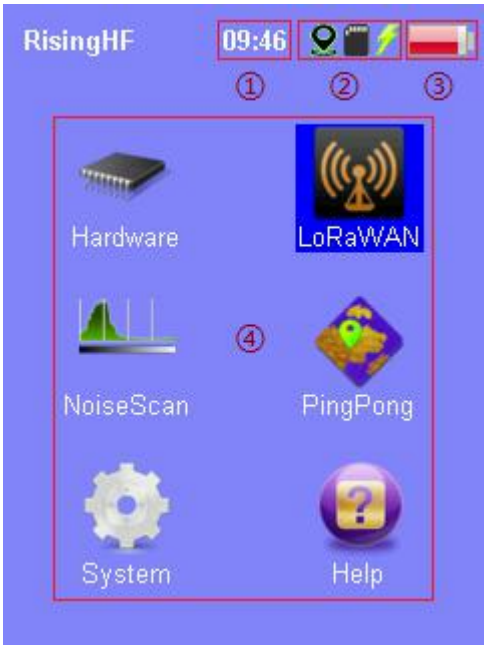
For power saving purpose, RHF4T003 will power off if no function test actived more than 30 minutes.

[1] Esc/Return to upper layer, both of the two Keys have the same function.

[2] Confirm/Enter, both of the two Keys have the same function.

2.3 Home Page

Home Page after power on：



① System Time
② Status bar，including GPS，Micro SD card and Charging status.
③ Battery Capacity
④ Function menu

2.4 Keyboard Description

- Direction Key
  Including up, down, left, right keys, used to move the cursor and Menu selection.

- Confirm/Enter
  Press to confirm to execute.

- Esc/Return to upper layer
  Press to exit current page.

- Delete/Backspace
  Use to delete the character of current cursor when editing text.

- Number Input Area
  Including 0~9 number，use to input number when editing text.

- Power key

The Red key to Power on/off the device.

2.5 LED 指示

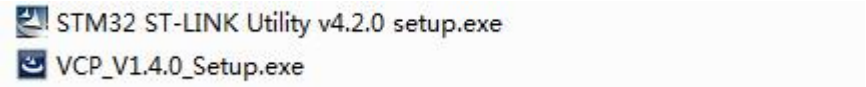
There are two LED for indication, one for Battery charge, one the left side of front panel, the other one is for LoRa event (TX or RX).

Battery charge indication: Red LED indicates the battery is charging, the battery is charged by USB 5V power, when USB power is plugged, the charging icon will appear in the status bar, shows the charging is processing[3]. When battery is full charged, the Red LED will be off.

LoRa event indication: This is a Bi-color LED, Red will be on when LoRa TX, And Green LED will on when LoRa received on packet.

2.6 PC Driver Installation

RHF4T003 handheld field tester is a recombination USB device，it need necessary driver before connecting with PC，select default installation.



[3] When charging is on-going, the battery capacity percentage is not readable.

3 Hardware

Hardware function is used to test the LoRa hardware performance of this Device.
Select Hardware menu and Press Enter key, to start hardware function.

3.1 Parameter configure

3.1.1 Procedure

1. Select Hardware Test Setting，Press ENTER.

2. After parameter input，Move the cursor to “Save” button, then press Enter Key to confirm. Press Esc/Return to upper layer to cancel.

3.1.2 Parameter Explanation

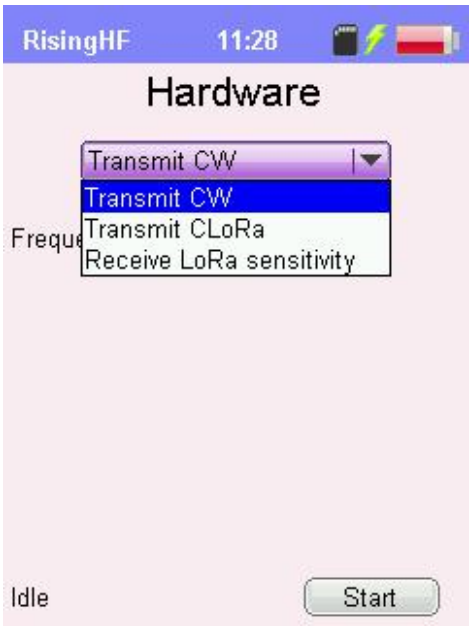
- Configurable Parameter:
  - RF frequency(RF Freq): frequency range is 410M~525M, 779M~999M
  - RF TX power(RF Power): 0~20dBm
  - LoRa Spreading factor(SF): SF7~SF12
  - LoRa Bandwidth(BW): 125/250/500KHz

- Default setting by RHF4T003, Un-configurable:
  - TX Preamble Length: 8
  - Rx Preamble Length: 8
  - CRC: ON
  - IQ: OFF
  - Net: OFF
  - Low Data rate Optimization ON for SF11 and SF12

3.2 Hardware Function test

3.2.1 Procedure

After parameter is set, return to Hardware menu, and select Hardware Test, press ENTER key.



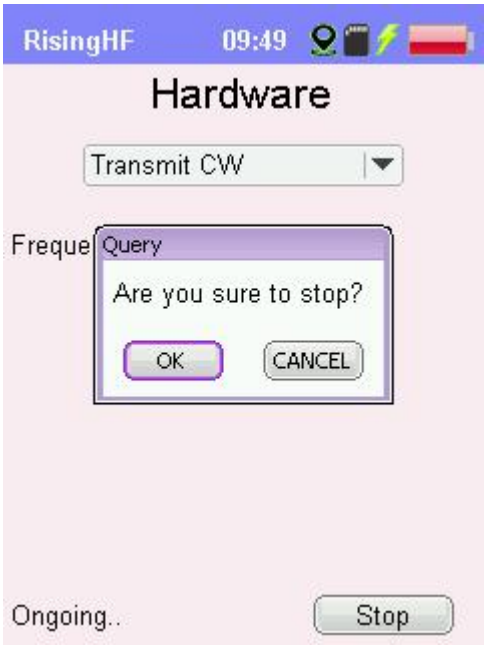
Transmit CW: to transmit unmodulated CW.
Transmit CLoRa: to transmit continuous LoRa packets.
Receive LoRa sensitivity: LoRa continuous receiving mode.

3.2.2 Start Test

Move the cursor to “Start” button，Press ENTER key to start hardware test. Then the testing is on progress, and the “Start” button will change to ”Stop” button.

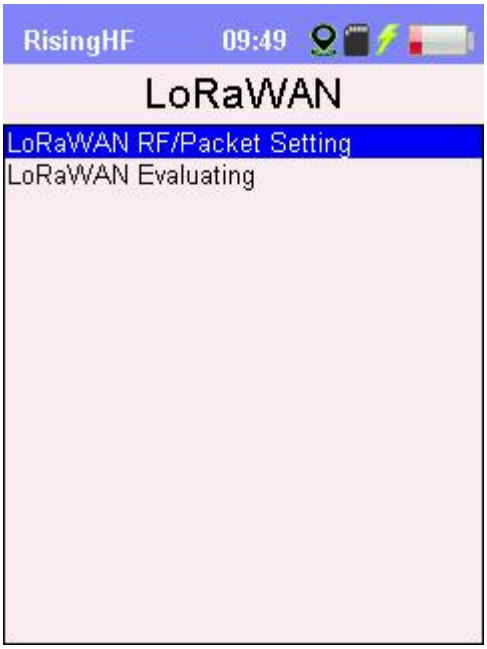
3.2.3 Stop testing

Move cursor to “Stop” button，Press ENTER key, Then a dialog box will pop out, Select wanted actions according to needs.



4 LoRaWAN

Select LoRaWAN menu in home page, Press ENTER key to confirm.



4.1 Parameter configure

4.1.1 Procedure

1. Select LoRaWAN RF/Packet Setting，Press ENTER key.

2. After parameter input，Move the cursor to “Save” button, then press Enter Key to confirm. Press Esc/Return to upper layer to cancel.

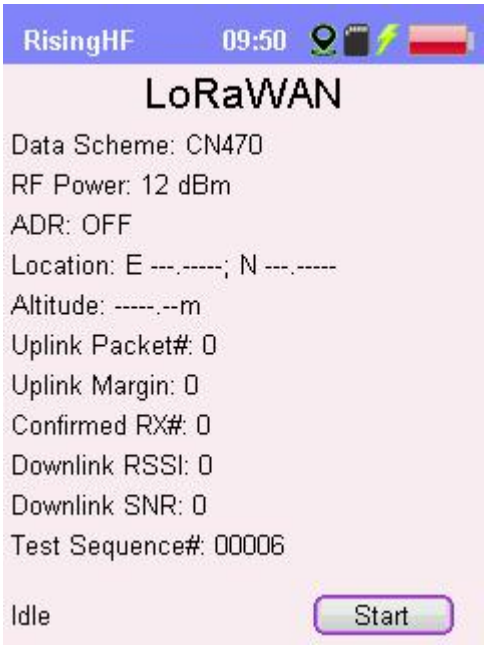
4.1.2 Parameter Explanation

- RHF4T003 configurable parameter in LoRaWAN function:
  - RF TX power(RF Power): 0~20dBm
  - Uplink packet interval(TX Interval): 5~999s
  - Confirm Packet retry number: 1~3(1means only transmit one time every uplink, no retry.)
  - ADR(adaptive data rate): ON or OFF
  - LoRaWAN activation mode: ABP or OTAA
  - Band: LoRaWAN frequency band plan. The default value of channel, DR, RXWIND1, RXWIN2 will set to match with the Band plan selected.
    - ✓ EU433
    - ✓ CN470
    - ✓ CN470PREQUEL
    - ✓ CN779
    - ✓ IN865
    - ✓ EU868
    - ✓ US915
    - ✓ US915HYBRID
    - ✓ AU915
    - ✓ AU915OLD
    - ✓ JP920
    - ✓ KR920
    - ✓ STE920
    - ✓ AS923
  - DR: The data rate to LoRa Packet, when ADR is on, the data rate may be changed by Server.

4.2 LoRaWAN test

4.2.1 Procedure

Return to LoRaWAN menu，select LoRaWAN Evaluating，Press ENTER key to confirm.



4.2.2 Parameter Explanation

- **Uplink Margin**

Uplink Margin is Link Margin of Uplink (Handheld field tester Transmit to Gateway), The value is obtained from Network server by Mac Command.

Link margin represent the signal quality to uplink, it is related to the Uplink SNR (signal noise ratio), and the relation is different by different Network server.

Take RisingHF Lorasever as an example:

Link Margin=Uplink SNR+20.

Some other network server manage the uplink Margin as below:

- Loriot

  Link Margin=uplink SNR (SNR>0, max SNR=10)
  Link Margin=0 (SNR< 0, min SNR=-20)

- Aisenz

  Link Margin=SNR+20 (10>SNR>-20)

- TTN

  Link Margin=SNR+20 (10>SNR>-20)

- **Test Sequence**

Every test will have a distinction Test Sequence, The Log file saved in the Memory will also use this Test sequence as a part of its file name.

The Test sequence will auto increase every time the test is executed, to distinguish each individual test, the uplink packets will also carry this Test sequence.

4.2.3 Startup test

1. Move the cursor to “Start” button, Press ENTER key to start.
2. RHF4T003 will send the uplink packets according to the configured interval, its type is confirmed packets, and payload length is 10 bytes.

Byte0	Battery status, 0:charging, 1~99:capacity
Byte1~2	Altitude (Little endian)，16 bits Signed integer
Byte3~5	Longitude(Little endian), 24 bits Signed integer, [bit0~22] = (uint)(abs(Long) *4000)
Byte6~8	Latitude (Little endian)，24 bits Signed integer, [bit0~22] = (uint)(abs(Lat) *4000)
Byte9	Test sequence number

3. Every time the Test is started, a Log file will generated to save data in the Memory：
   - File name

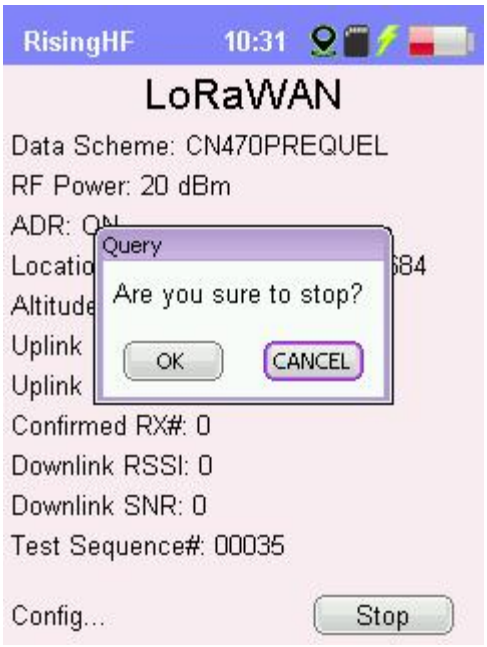
LWxxxxx.CSV， Here xxxxx is the test sequence number。

   - File content including
     - Uplink count (TX Cnt)
     - Date and time(Time)
     - RF power(Power)
     - Test sequence(Test No)
     - BAND plan
     - LoRa Bandwidth(BW)
     - LoRa Spreading factor(SF)
     - ADR
     - Longitude
     - Latitude
     - Altitude
     - Uplink Margin
     - Downlink RSSI
     - Downlink SNR
     - TX Data
     - RX Data

TX Cnt	Time	Power	Test No	Band	BW	SF	ADR	Long	Lat	Alt	Margin	Rssi	Snr	Tx Data	Rx Data
6	2018/09/04 09:14:21	20	13	CN470PREQUEL	BW125	SF12	ON	113.94338	22.5468	34.5	9	-86	6	80F15D0D008105000208F43CF189C9AA38B3118E0B3D64BC	60F15D0D00A305000209013EA1DC54
7	2018/09/04 09:14:31	20	13	CN470PREQUEL	BW125	SF12	ON	113.94337	22.54682	32.1	9	-85	5	80F15D0D008106000208F464FB0E6C320D78252C9CEA6839	60F15D0D00A306000209013F1CACA06
8	2018/09/04 09:14:41	20	13	CN470PREQUEL	BW125	SF12	ON	113.94337	22.54683	30.7	8	-86	5	80F15D0D008107000208266C7F857CF04B0463794EDCAE3F	60F15D0D00A307000208018099AB34

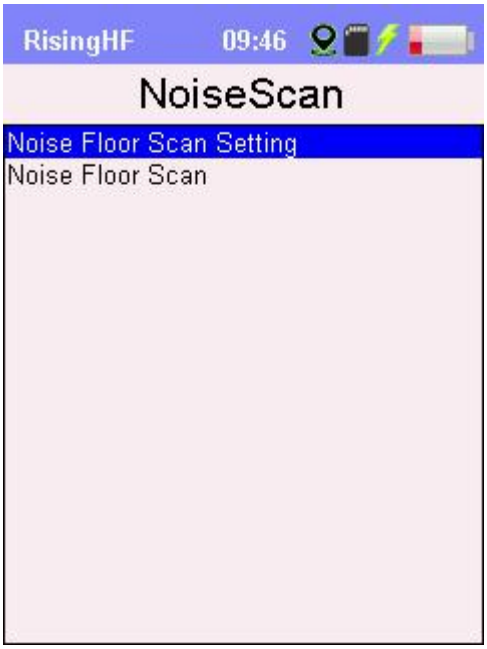
4.2.4 Stop test

Move the cursor to “Stop” button, Press ENTER key, then a dialog box will pop out, Select wanted actions according to needs.


RisingHF
10:31
LoRaWAN
Data Scheme: CN470PREQUEL
RF Power: 20 dBm
ADR: ON
Locatio
84
Altitude
Uplink
Uplink
Query
Are you sure to stop?
OK
CANCEL
Confirmed RX#: 0
Downlink RSSI: 0
Downlink SNR: 0
Test Sequence#: 00035
Config...
Stop

5 NoiseScan

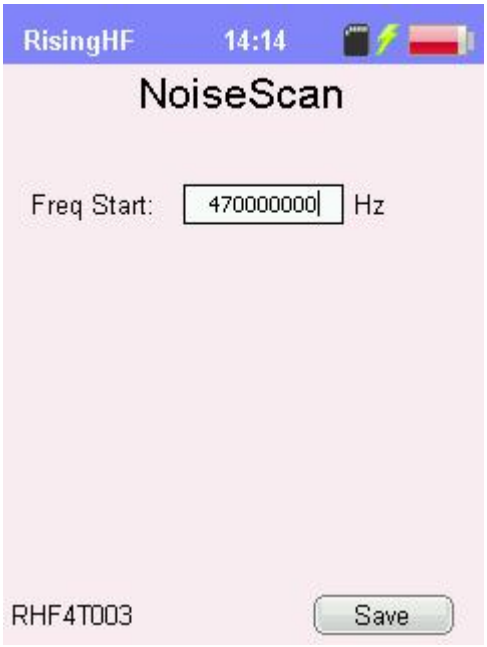
NoiseScan is used to scan environment noise floor



5.1 Parameter configure

5.1.1 Procedure

1. Select Noise Floor Scan Setting, press ENTER key, there is only start frequency need to set.



2. After parameter input，Move the cursor to “Save” button, then press Enter Key to confirm. Press Esc/Return to upper layer to cancel.

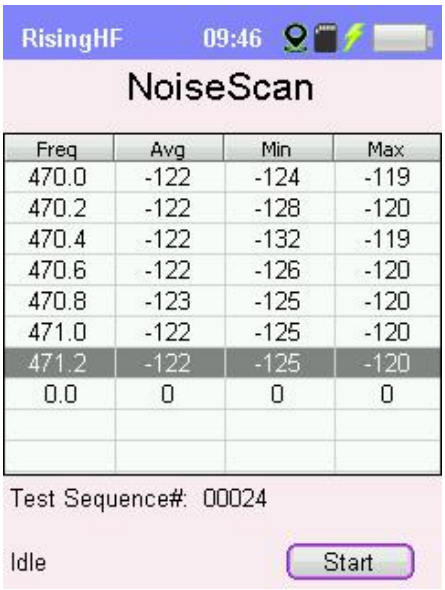
5.1.2 Parameter Explanation

- There is only start frequency need to set:
  - Freq Start: the noise scan will sweep 8 channels after the start frequency is set, the channel interval is 200KHz, channel bandwidth is 125KHz.

5.2 NoiseScan test

5.2.1 Procedure

In NoiseScan menu，select Noise Floor Scan, Press ENTER key to enter into test page, move cursor to “Start” button and Press ENTER key to start.



5.2.2 Parameter Explanation

- **Test Sequence**

Every test will have a distinction Test Sequence, The Log file saved in the Memory will also use this Test sequence as a part of its file name.
The Test sequence will auto increase every time the test is executed, to distinguish each individual test.

5.2.3 Start Test

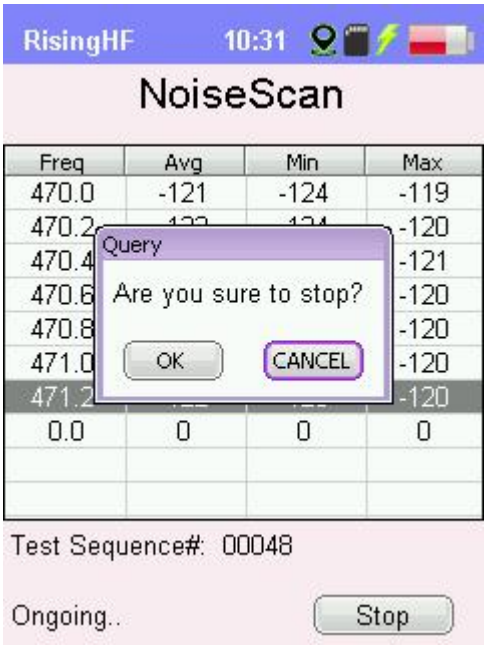
1. Move cursor to “Start” button and Press ENTER key to start.
2. RHF4T003 will scan the noise floor on the 8 channels and give the Average/Min/Max value of every 500 times scan
3. Every time the Test is started, a Log file will generated to save data in the Memory：
   - File name

NSxxxxx.CSV, Here xxxxx is test sequence.

   - File content
     - Date and time
     - Longitude
     - Latitude
     - Altitude
     - Channel 1 noise floor (Average，min，max)
     - Channel 2 noise floor (Average，min，max)
     - Channel 3 noise floor (Average，min，max)
     - Channel 4 noise floor (Average，min，max)
     - Channel 5 noise floor (Average，min，max)
     - Channel 6 noise floor (Average，min，max)
     - Channel 7 noise floor (Average，min，max)
     - Channel 8 noise floor (Average，min，max)

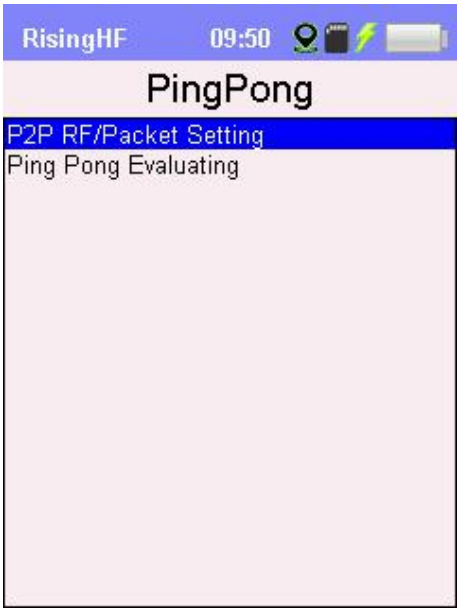
5.2.4 Stop Test

Move cursor to “Stop” button，Press ENTER key, Then a dialog box will pop out, Select wanted actions according to needs.



6 Ping-Pong

Ping-Pong test is the LoRa communication between one pair of RHF4T003 handheld field tester.



6.1 Parameter configure

6.1.1 Procedure

1. In Ping-Pong page, select P2P RF/Packet Setting，Press ENTER key to configure the parameters.

2. After parameter input，Move the cursor to “Save” button, then press Enter Key to confirm. Press Esc/Return to upper layer to cancel.

6.1.2 Parameter Explanation

- The configurable parameter in Ping-Pong test is:
  - RF Freq: 410M~525M, 779M~999M
  - RF Power: 0~20dBm
  - Antenna Gain: it aim is to simulate the actual antenna Gain of user end device, this is not the Gain of antenna in this Handheld field tester, If this is not applicable, Please set it to 0 by default. The RHF4T003 actual TX power is defined to be:

    TX power= RF Power-Ant Gain-handheld field tester antenna gain
  - Kit ID: the device identifier of one pair of Ping-Pong device, Devices with same Kit ID will communicate normally, otherwise, Ping-Pong Communication will be fail.
  - Spreading factor(SF)
  - Bandwidth (BW)
  - Role: Master/Slave, please configure one Master and other one Slave for one pair of device.

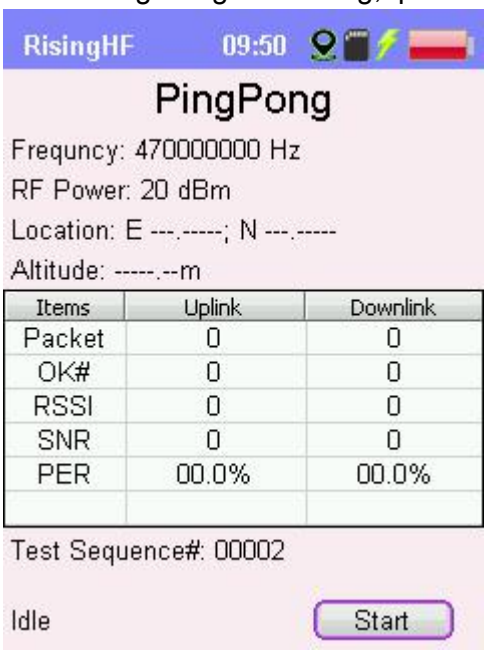
- Default parameter, un-configurable:
  - Tx Preamble Length: 8
  - Rx Preamble Length: 8
  - CRC: ON
  - IQ: OFF
  - Net: OFF
  - Low Data rate Optimization ON for SF11 and SF12

Note: Please make sure the RF parameter (Frequency, SF, BW) and KIT ID is same between one pair of Devices, one Role set as Master and the other as Slave.

6.2 Ping-Pong test

6.2.1 Procedure

Select Ping Pong Evaluating, press ENTER key to enter into Ping-Pong test page.



6.2.2 Parameter Explanation

- **Test Sequence**

Every test will have a distinction Test Sequence, The Log file saved in the Memory will also use this Test sequence as a part of its file name.

The Test sequence will auto increase every time the test is executed, to distinguish each individual test, the Ping-Pong packets will also carry this Test sequence。

6.2.3 Start Test

1. In Ping-Pong test page, Move cursor to “Start” button，start test.
2. Master will TX packet every 5s, Slave will send packet back after receive.
3. Every time the Test is started, a Log file will generated to save data in the Memory：
   - File name

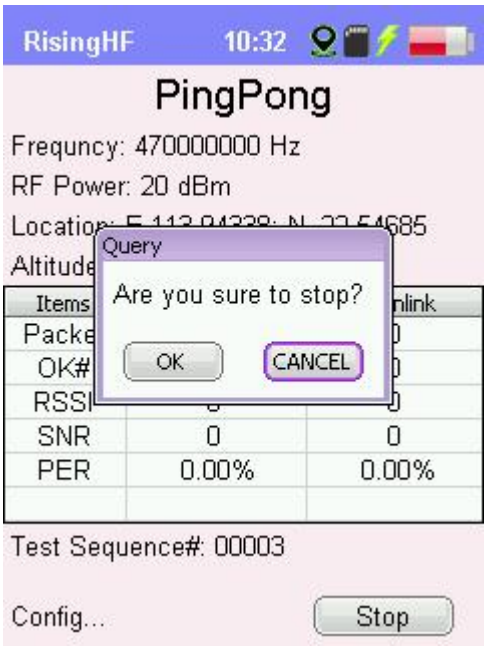
P2Pxxxx.CSV, here xxxxx is test sequence。

   - File content
     - Date and time
     - RF TX Power
     - Frequency
     - LoRa Spreading factor
     - LoRa bandwidth
     - Master Longitude
     - Master Latitude

- Master Altitude
- Slave Longitude
- Slave Latitude
- Slave Altitude
- Uplink Packet count
- Uplink OK Packet count
- Uplink RSSI
- Uplink SNR
- Uplink PER
- Downlink Packet count
- Downlink OK Packet count
- Downlink RSSI
- Downlink SNR
- Downlink PER

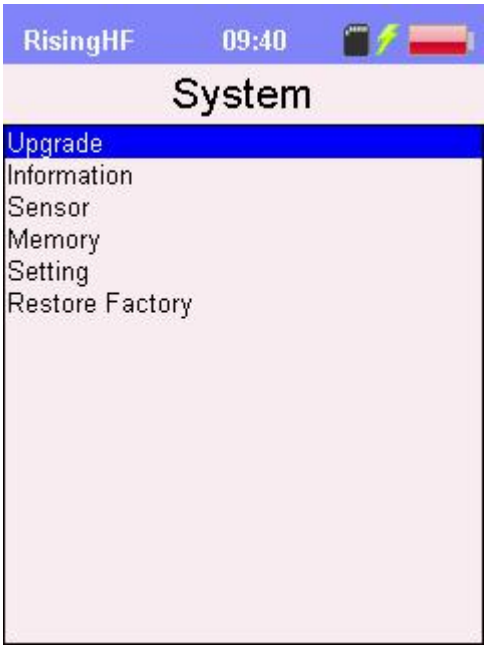
6.2.4 结束测试

Move cursor to “Stop” button，Press ENTER key, Then a dialog box will pop out, Select wanted actions according to needs 点.



7 System

In home page，select System menu，Press ENTER key，enter into System page.



7.1 Upgrade

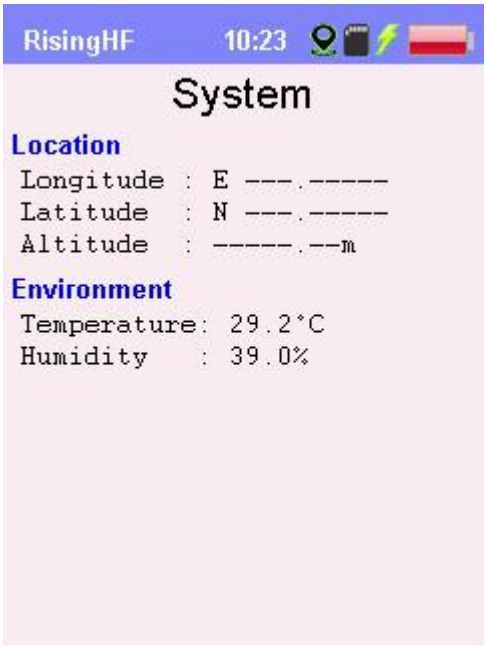
See chapter 8 for detail.

7.2 Information

The system information such as data and time, firmware version, battery status, LoRaWAN parameters。

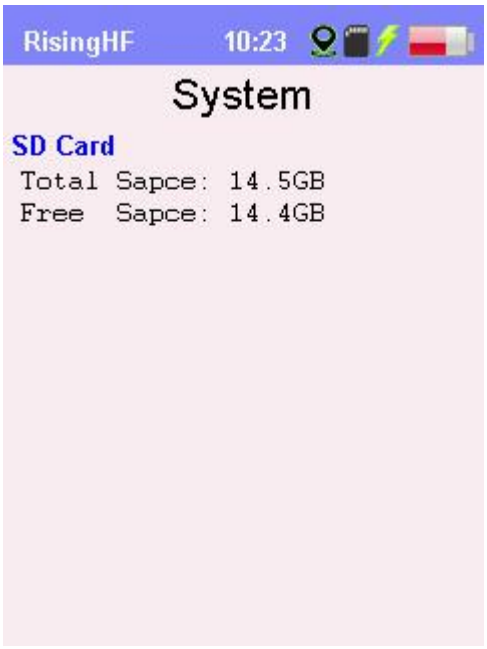
7.3 Sensor

GPS Location and T&H sensor results.

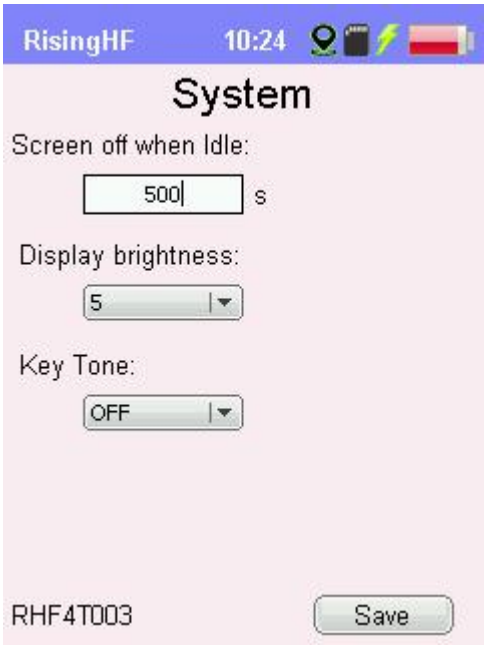


7.4 Memory

To check the TF card (Micro SD card) status.



7.5 Setting

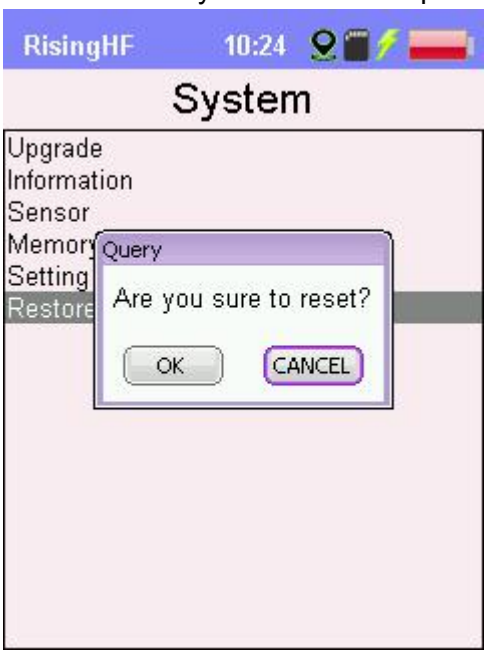


7.5.1 Parameter explanation

- System setting allow user to configure below parameter:
  - Screen off when idle, to save power
  - Display brightness
  - Key Tone to Enable/disable the buzzer when Operation keys.

7.6 Restore Factory

Restore Factory will recover all parameter to Default value.



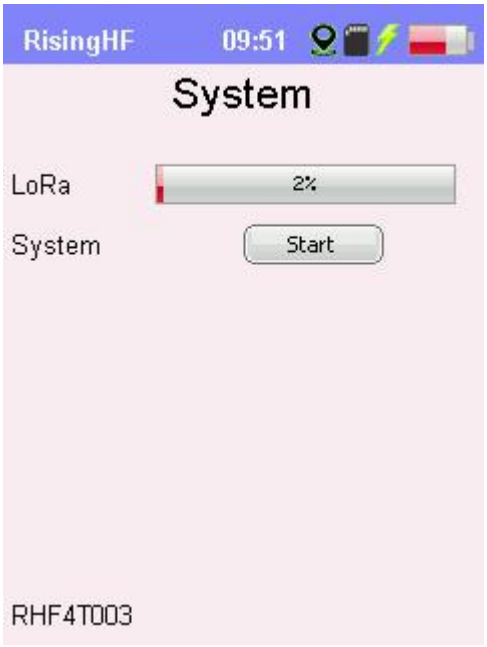
8 Firmware Upgrade

In system page, select Upgrade, enter into Firmware upgrade page.

8.1 LoRa Module Firmware update

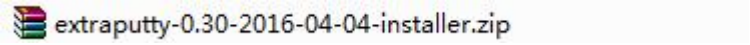
1. LoRaWAN module Firmware will update from micro SD card, Connect USB port to PC, Copy the firmware into SD card, Rename as “lw_sw.bin”.

2. Move the cursor to LoRa menu, Press ”Start” button，Wait until it is finished.

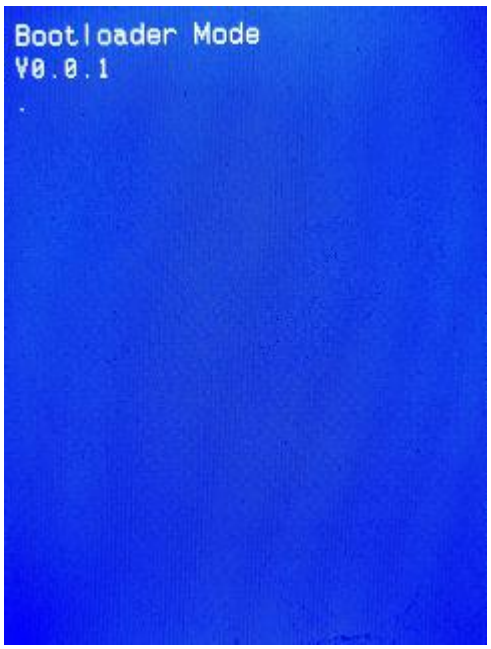


8.2 System Firmware upgrade

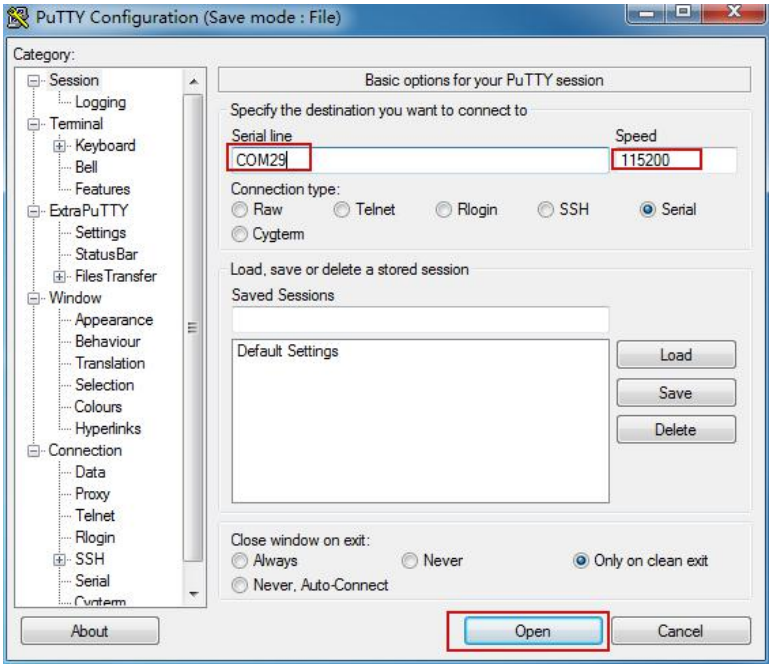
1. We use ExtraPuTTY to upgrade System firmware, please install before upgrade.



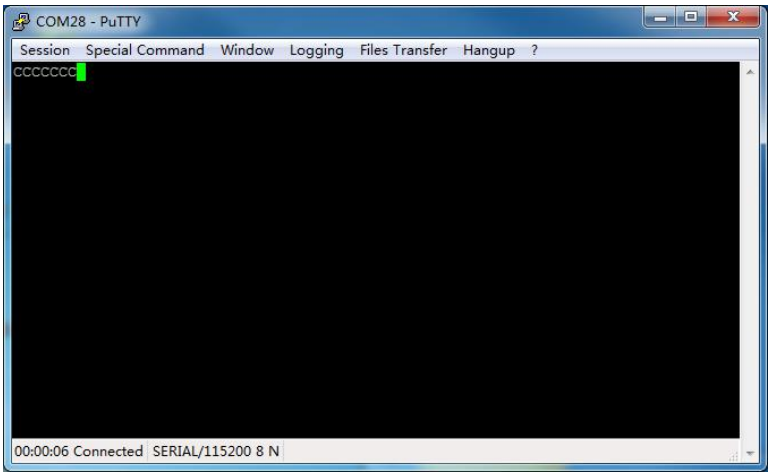
2. Move the cursor to System menu, Press ”Start” button，The RHF4T003 will shut down, and enter into Bootloader Mode after next Power ON.



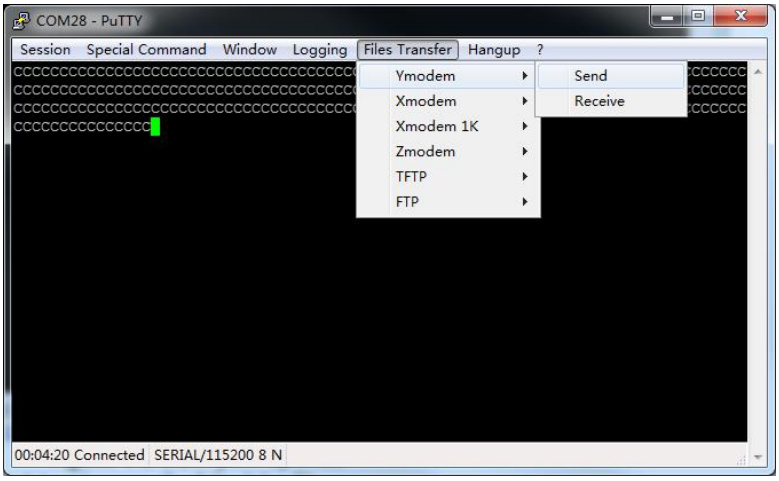
3. Open ExtraPuTTY, Input Serial COM port，and baud rate 115200, click open.

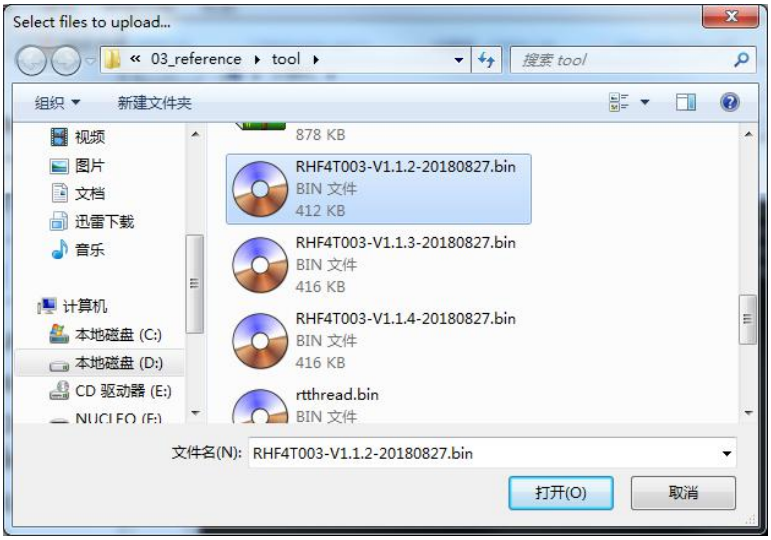


4. Character “C” will print in command console, indicating it is in Bootloader Mode.

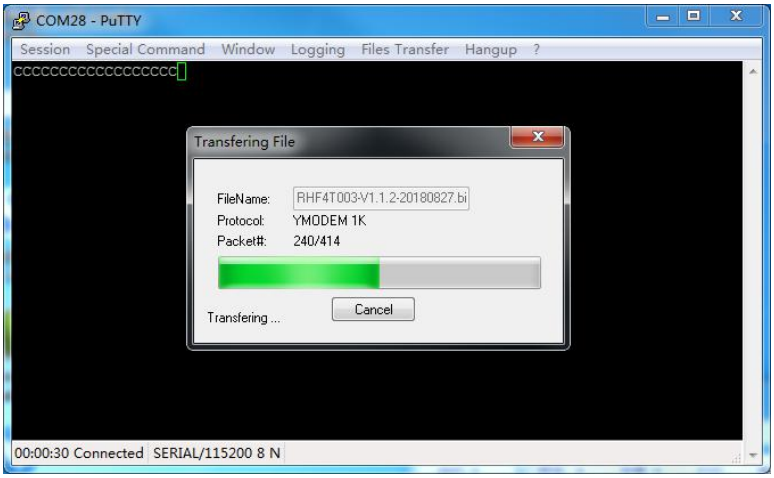


5. Select Ymodem->Send, Load firmware to upgrade. We use YModem protocol to upgrade.

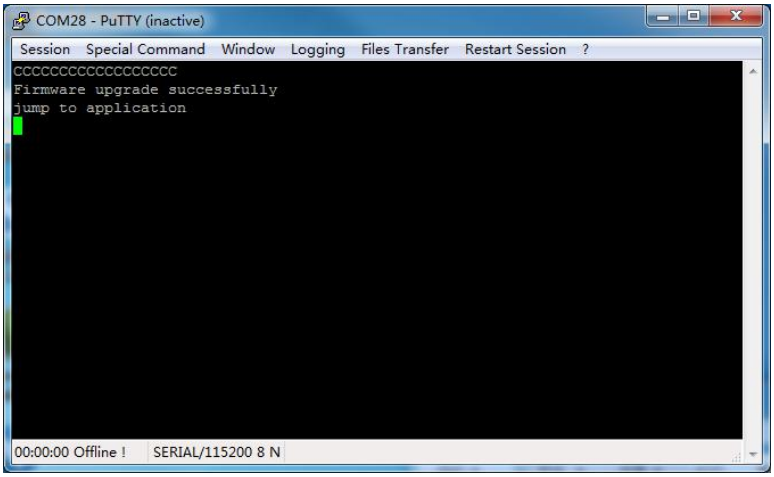




6. Wait for the upgrade processing.



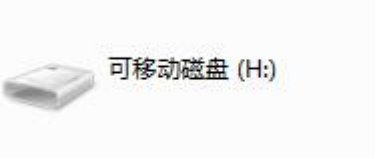
7. After finished, RHF4T003 will power off automatically. Just need Power on again next time before use it.



9 Test data Log file

All the test data is stored in Micro SD card as the format of .CSV, when connecting USB port to PC，PC can identify it as a USB storage device，it is easy to export file, open the file with excel or other text edit tool.

Note: When Function test is on-going, RHF4T003 will protect the file system，and the micro SD card is Inaccessible through PC，it will be shown as below:



9.1 Micro SD Card File system

RHF4T003 only support FAT32 file system，File name support DOS 8.3 short name.

9.2 9 Test data file sequence

Every time the Device power on, RHF4T003 will search the documents whose name starts with LW,NS and P2P, and rank the maximum test sequence number，and use this sequence number as the current sequence number.

Example：

Micro SD card contains documents below:

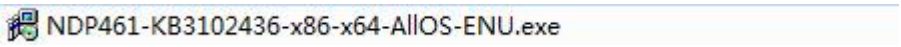
LW00003.CSV
LW00005.CSV
NS00001.CSV
P2P000010.CSV

Then LoRaWAN，NoiseScan and Ping-Pong test sequence number will start with 00005, 00001, 00010 respectively.

10 PC Configure Tool

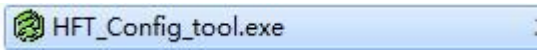
10.1 Installation

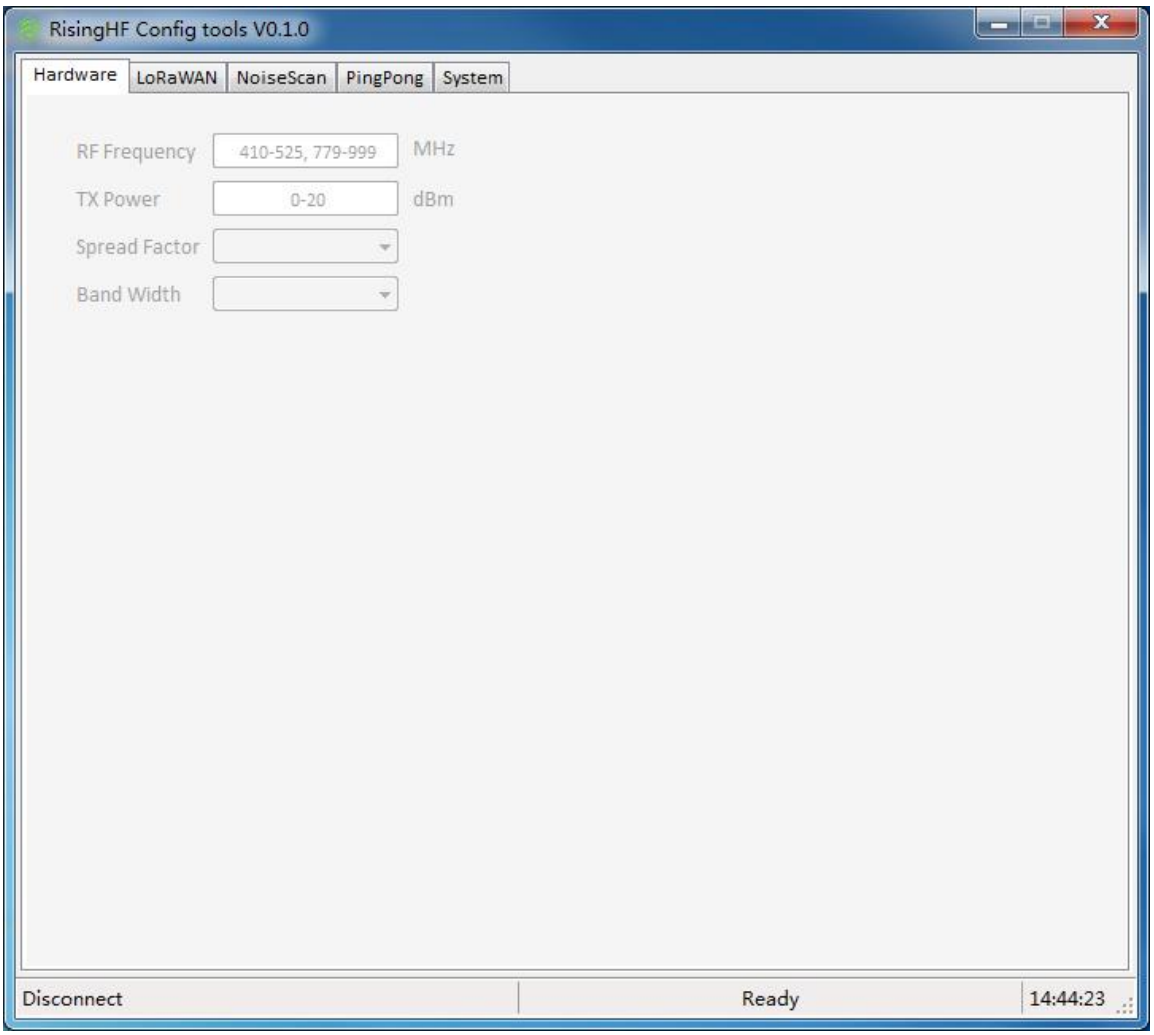
RHF4T003 PC Configure Tool support Windows 7/8/10 Operation system, Need Microsoft .NET Framework 4.6.1 Platform and above，No or lower version Microsoft.NET Framework can't make the PC configure Tool run normally. Please install the Framework first and Restart the PC.



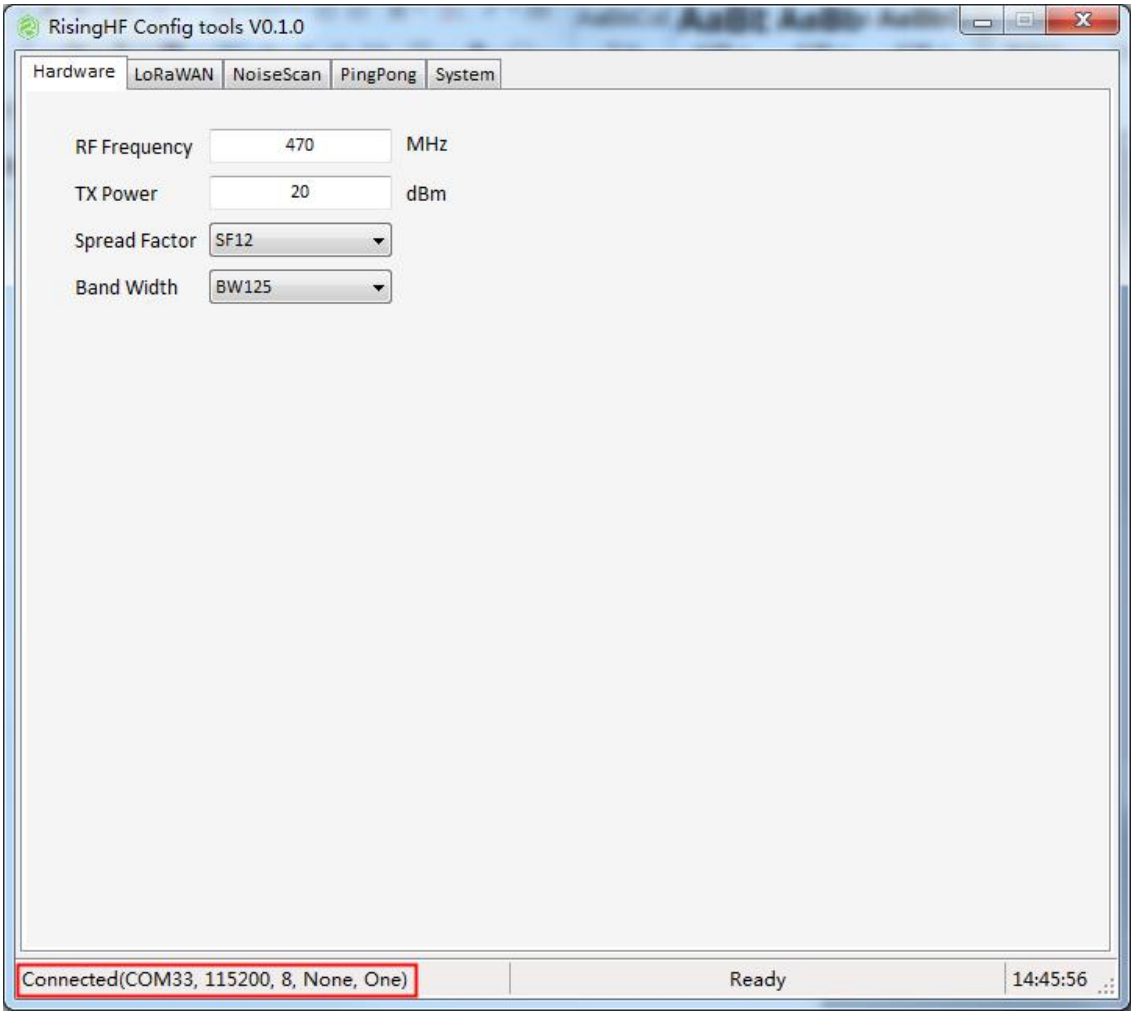
10.2 How to use

1. Double click to open.

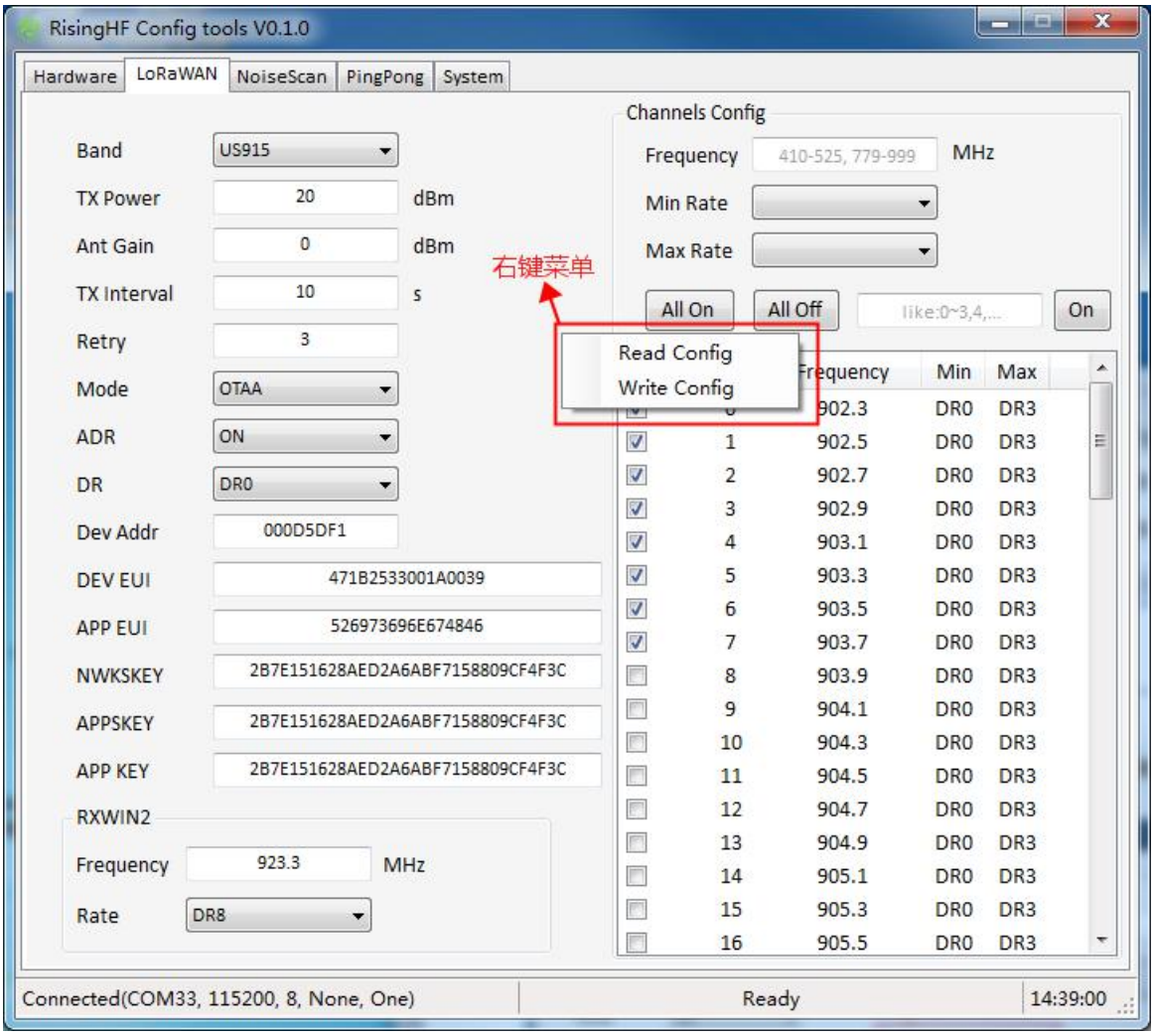


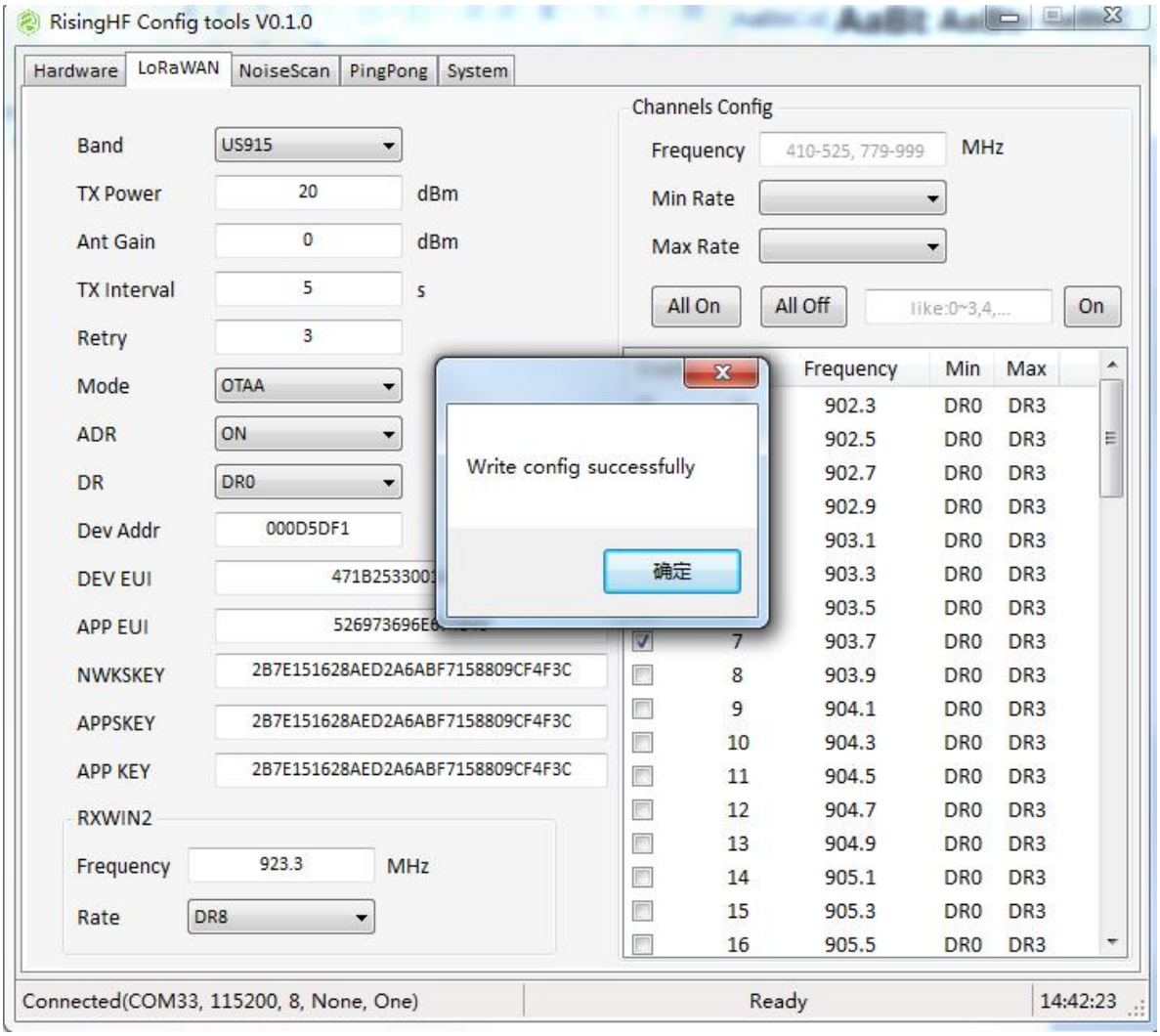


2. Connect USB port to PC, PC configure tool will identify the device automatically, and Read the current configuration. The status will be shown at the left bottom side.



3. Right Click the Mouse at any open area，a menu will pop out, two actions is available, Read config and Write config.
   - Click “Read Config”，Read all the current parameter configuration (Hardware, LoRaWAN,NoiseScan,Ping-Pong,System)，after read out a dialog box will pop out.
   - Click “Write Config”, the PC configure tool will write the all the new parameter (Hardware, LoRaWAN,NoiseScan,Ping-Pong,System) into RHF4T003，a dialog box will also pop out after that.



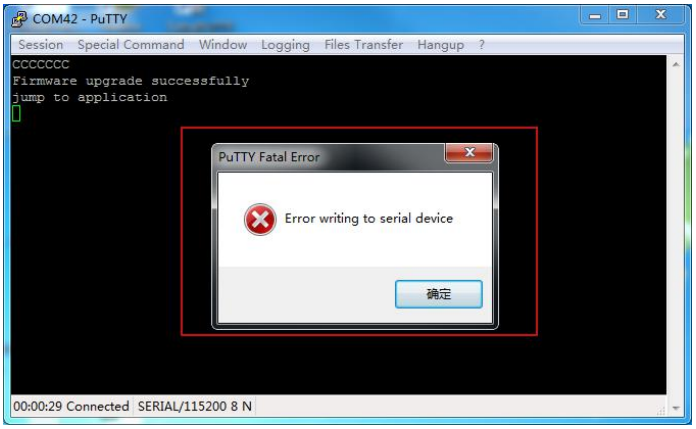

RisingHF Config tools V0.1.0
Hardware
LoRaWAN
NoiseScan
PingPong
System
Band
US915
TX Power
20
dBm
Ant Gain
0
dBm
TX Interval
5
s
Retry
3
Mode
OTAA
ADR
ON
DR
DR0
Dev Addr
000D5DF1
DEV EUI
APP EUI
NWKSKEY
2B7E151628AED2A6ABF7158809CF4F3C
APPSKEY
2B7E151628AED2A6ABF7158809CF4F3C
APP KEY
2B7E151628AED2A6ABF7158809CF4F3C
RXWIN2
Frequency
923.3
MHz
Rate
DR8
Channels Config
Frequency
410-525, 779-999
MHz
Min Rate
Max Rate
All On
All Off
like:0~3,4,...
On
Frequency
Min
Max
902.3 DR0 DR3
902.5 DR0 DR3
902.7 DR0 DR3
902.9 DR0 DR3
903.1 DR0 DR3
903.3 DR0 DR3
903.5 DR0 DR3
7 903.7 DR0 DR3
8 903.9 DR0 DR3
9 904.1 DR0 DR3
10 904.3 DR0 DR3
11 904.5 DR0 DR3
12 904.7 DR0 DR3
13 904.9 DR0 DR3
14 905.1 DR0 DR3
15 905.3 DR0 DR3
16 905.5 DR0 DR3
Write config successfully
确定
Connected(COM33, 115200, 8, None, One)
Ready
14:42:23

11 Frequent Question and Answer

Q: Enter into Bootloader Mode by accident，and I don't want to upgrade firmware?
A: Power off the device, then Power on to exit the Bootloader Mode.

Q: How to enter into Bootloader by shortcut key.
A: Press and Hold F1 and F2 Key before Power on，then after device power on，it is in Bootloader mode.

Q: After System Firmware upgrade finished，An error dialog box will pop out.

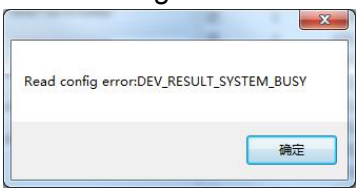


A: Because after System Firmware upgrade finished, the Device will power off, and the Serial Com Port is not usable, ExtraPuTTY will out of connection with this Port, this is normal.

Q: When handheld field tester connecting to PC，the LCD display will lag and slow response.
A: The Handheld field tester MCU will interact with PC, and this will occupy much MCU resource, And at this time, when LCD switch display content, The picture may appear some lag, this act as expected and will not affect the normal use.

Q: Open PC configure tool, but can't do anything.
A: PC configure tool is activated only after connected with a Handheld field tester.

Q: PC configure tool occur DEV_RESULT_SYSTEM_BUSY error



A:It is because the Handheld field tester is doing function test and protect the file system, the Micro SD card is only accessable when No function test is on-going.

Q: Handheld can't identify the Micro SD card file system.
A: Check the file system Format is FAT32, if not, please format it.
Q:After system firmware up gradation, will the previous configure parameter still be kept?

A: If only Patch change, All the previous parameter will be kept. While MAJOR or MINOR changed，only DevAddr, DevEui, AppEui, AppsKey, NwksKey,AppKey will be kept.[4]

[4] Firmware version format:V$MAJOR.$MINOR.$PATCH, e.g. V1.2.0

12 Special Attention

a) When RHF4T003 doing LoRaWAN function test, the packet type is confirmed packet, every uplink will request Downlink, this will take most of the network capacity of Gateway, Suggest use a dedicated Gateway for RHF4T003, and don't share with other deployed end nodes.
b) When RHF4T003 doing LoRaWAN function test RHF4T003, if there are more than one RHF4T003 devices connecting with one gateway, PER may affect and bigger than normal.
c) RHF4T003 support Full LoRa frequency band of Sub-GHz, but need select suitable antenna to match the frequency, one antenna always can't cover full frequency band.
d) When System firmware upgrade, Suggest don't contain any Space or Chinese character in the file path，ExtraPuTTY may fail to open the file and can't upgrade the system firmware successfully.

Revision History

V1.0 2018-08-30

+ Initial Create

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