

XC-RM871 UHF RFID Module User Manual

Welcome to become a user of Invengo RFID products!

We are very glad that you choose the XC-RM871 UHF RFID Module.

We hope that our equipment can bring convenience to your work.



Disclaimer

This manual applies to the following model:

XC-RM871 UHF RFID Module.

 or  **Invengo** logo are owned by Invengo Company.

The introduction and description of product characteristics and functions and other information in this manual are the latest valid information at that time, and all information is accurate at the time of printing. Invengo reserves the right to correct or change the information and instructions in this manual without prior notice and assumes no responsibility for it.

Safety Instructions



Warning sign

Improper operation may do harm to your health.

Improper operation may cause damage to the equipment.



Caution sign

If it is ignored, your operation may not be conducted smoothly.

If it is ignored, it may bring you undesirable results.

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01 Instructions Before Use

XC-RM871 UHF RFID Module



 Before using the XC-RM871 UHF RFID Module (hereinafter referred to as the XC-RM871 Module or Module), please read this document carefully. Improper use may result in serious personal injury or equipment damage.

 To ensure the safety of personnel, please ensure that the location of all antennas complies with the regulatory requirements of the area.

 This manual provides detailed instructions on the features, installation, commissioning, operation, troubleshooting, and other operational steps of the XC-RM871 Module.

 This manual is suitable for personnel installing the XC-RM871 Module, such as engineers or IT personnel with experience in RFID readers or familiarity with basic RFID knowledge.

02 Product Overview

XC-RM871 UHF RFID Module



2.1 Features and Applications

The XC-RM871 module is a single-port UHF RFID module characterized by its small size, integrability, high performance, low power consumption, and ease of use.

This module can be integrated and embedded into different devices, such as high-performance RFID handheld devices, small mobile devices, or other compact-sized equipment. It can be widely applied in fields such as supply chain management, digital warehouse management, and commercial retail. It effectively improves overall work efficiency and reduces error rates. This product complies with UHF RFID standards in China, the United States, Europe, and other countries and regions.

2.2 Applicable Regions and Frequency Points

- **Band (CN): 25 frequency points**
920.625MHz ~ 924.375MHz, with a frequency hopping interval of 250kHz;
- **Band (US): 50 frequency points**
902.75MHz ~ 927.25MHz, with a frequency hopping interval of 500kHz;
- **Band (EU): 4 frequency points**
865.7MHz ~ 867.5MHz, with a frequency hopping interval of 600kHz.

2.3 Environmental Conditions

- Operating Temperature: $-25^{\circ}\text{C} \sim +70^{\circ}\text{C}$;
- Storage Temperature: $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$;
- Humidity Range: 5% ~ 95%RH, no condensation.

2.4 Power Supply

The power supply for the module should have an output DC voltage range of +3.7V to +5.0V, with the ability to provide at least 2.0A of current, and ripple should be less than 100mV.

2.5 Safety and Protective Measures

 During operation (when radiating microwave power), the installation and commissioning personnel should stay at least 20cm away from the antenna to meet the requirements for human exposure to the maximum permissible radio frequency (RF) radiation!

03 Module Introduction

XC-RM871 UHF RFID Module



This section provides information on the module's external interfaces, dimensions, weight, and other relevant details.

3.1 Unpacking Instructions

! After opening the packaging box, please carefully check the accessories against the product's "Packing List" to ensure they are complete. If there are any discrepancies or damages, please contact our company promptly.

3.2 Dimensions and Weight

The external dimensions are shown in Figure 3-1, with specific parameters as follows:

- 1) Volume Parameters: 40.5mm × 36mm × 7.7mm;
- 2) Weight Parameters: 16g.

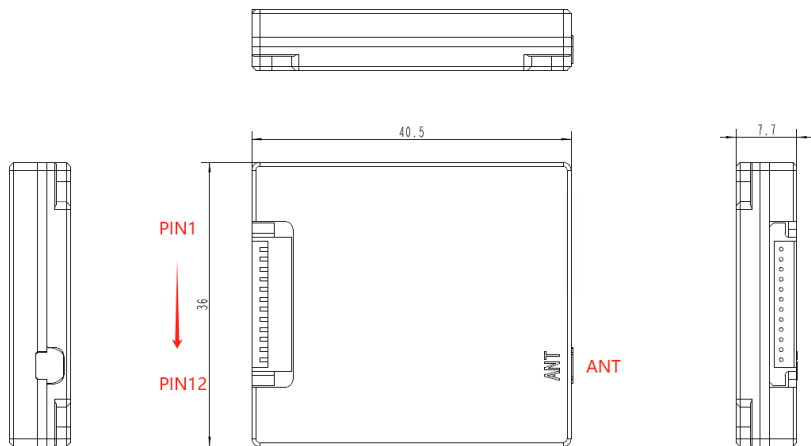


Figure 3-1 Diagram of External Dimensions

3.3 Interface Description

Table 3-1 introduces the interface definitions on the XC-RM871 module.

Table 3-1 Interface Definitions

Num	PIN#	Definition	Description
1	PIN1	VCC(+3.7V~5.0V)	DC Power Positive
2	PIN2	VCC(+3.7V~5.0V)	DC Power Positive
3	PIN3	VCC(+3.7V~5.0V)	DC Power Positive
4	PIN4	GND	DC Power Negative
5	PIN5	GND	DC Power Negative
6	PIN6	GND	DC Power Negative
7	PIN7	UART_TX	TTL Level(3.3V)
8	PIN8	UART_RX	TTL Level(3.3V)
9	PIN9	EN	Reserve
10	PIN10	GPIO	Digital Output1
11	PIN11	GPIO	Digital Output2
12	PIN12	GPIO	Digital Output3
13	ANT	MMCX	RF Head

04 Installation

XC-RM871 UHF RFID Module



4.1 Installation Conditions

Before installing the XC-RM871 module, please check if the following installation conditions are met:

- 1) Meets the requirements of the operating environment;
- 2) The accessories are complete and meet the standards;
- 3) There is an application environment for reading and writing tag information.

4.2 Installation Method

Refer to the connection diagram in Figure 5-1 and connect each component in sequence.

4.3 Installation and Precautions

 The interfaces of the module should correspond one-to-one with the interfaces of the RFID interface board, and the pins should not be bent.

 The output voltage of the power supply should be within the range of +3.7V to +5.0V, and the power supply should be able to provide at least 2.0A of current with ripple less than 100mV.

05 Module Operation

XC-RM871 UHF RFID Module



To quickly verify whether the module is functioning properly, you can operate the module through demo software. Below are explanations of some basic functions. For more information, please refer to the “ User Manual for Invengo Reader Universal Demo Software ”.

5.1 Preliminary Preparations

Before conducting a function demonstration, please prepare at least the following:

① In terms of hardware:

- 1) XC-RM871 module;
- 2) RFID Interface Board (2010000655);
- 3) Communication cables and RF cables;
- 4) UHF antenna;
- 5) RFID UHF tags;
- 6) Computer.

 Excessively long RF cables can cause attenuation of the transmitted signal and the received echo signal, leading to deterioration of read-write performance.

 The RFID interface board can be either self-prepared or optionally configured.

② In terms of software:

- 1) RFID DEMO(V1.5.4.12 or above);
- 2) SDK development kit;
- 3) Computer operating system of Windows 7 or above;
- 4) Microsoft .NET Framework 2.0 or above software execution environment.

③ Physical Connection Method

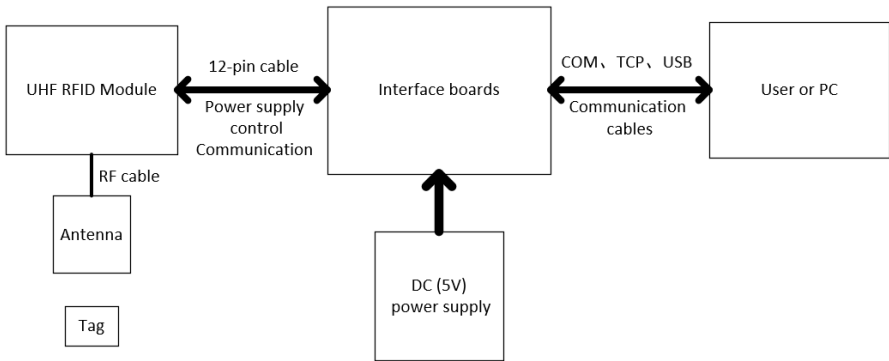


Figure 5-1 Diagram of UHF RFID Module Connection

5.2 Installation of Demo Software

Installation Steps:

- 1) Download the compressed package of “RFID DEMO (v1.5.4.12)” to the computer;
- 2) After decompressing, there is no need for installation. Directly run the “RFID Demo.exe” application software in the folder.

5.3 Connecting and Disconnecting

Figure 5-2 shows the serial port connection interface, Figure 5-3 shows the Ethernet port connection interface, and Figure 5-4 shows the USB connection interface. This document demonstrates the method of connection through the serial port.

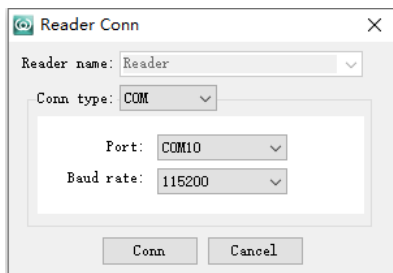


Figure 5-2 Serial Port Connection Interface

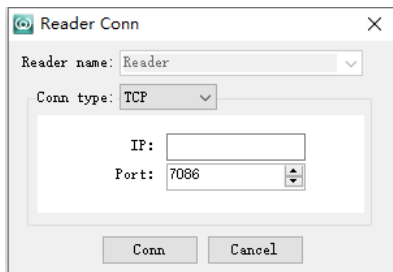


Figure 5-3 Ethernet Port Connection Interface

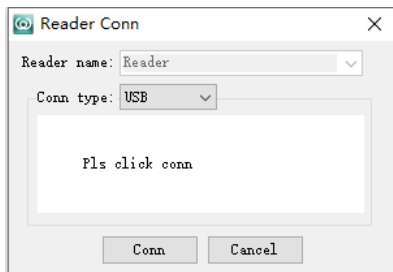


Figure 5-4 USB Connection Interface

The steps are as follows:

- 1) Run the “RFID Demo.exe” program;
- 2) As shown in Figure 5-2, select the correct COM port and baud rate, and click “Connect”;
- 3) Enter the interface shown in Figure 5-5. When the information bar displays “Connected”, the connection is successful;
- 4) Click “Disconn” in the interface shown in Figure 5-5 to disconnect the connection.

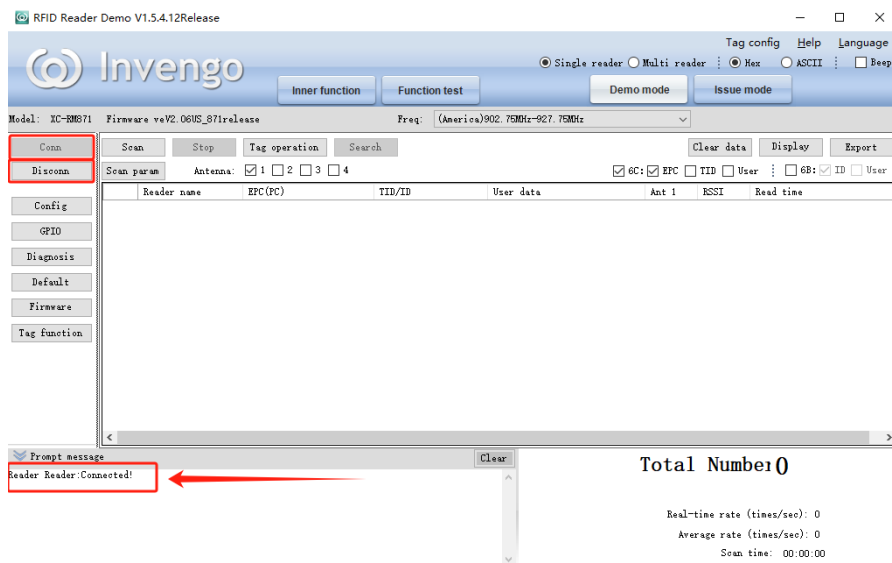


Figure 5-5 Operation Interface

5.4 Module Parameter Configuration

5.4.1 Power Setting

The steps are as follows:

- 1) Click “Config” on the interface shown in Figure 5-6;
- 2) After entering the interface shown in Figure 5-7, select the target power value and click “Config”;
- 3) After the interface shown in Figure 5-8 pops up, click “OK” to complete the process.

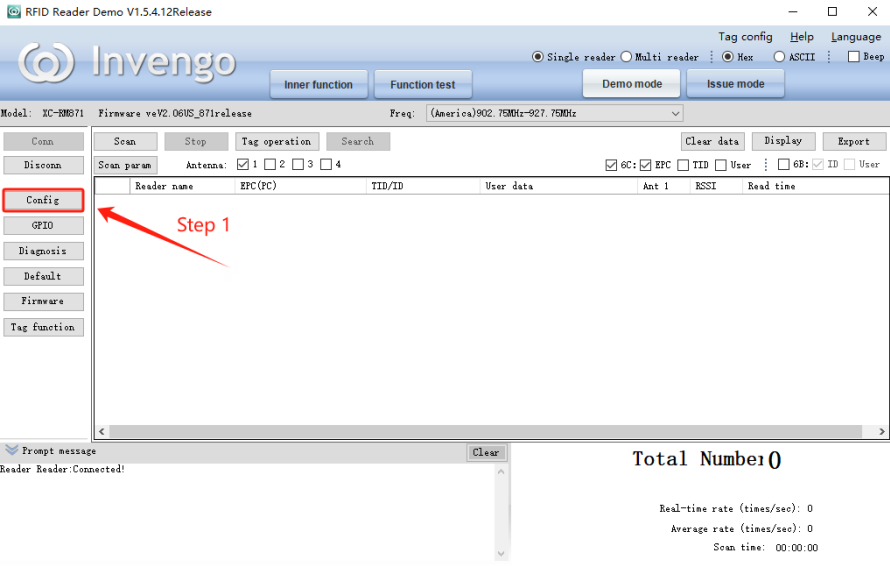


Figure 5-6 Power Setting Diagram 1

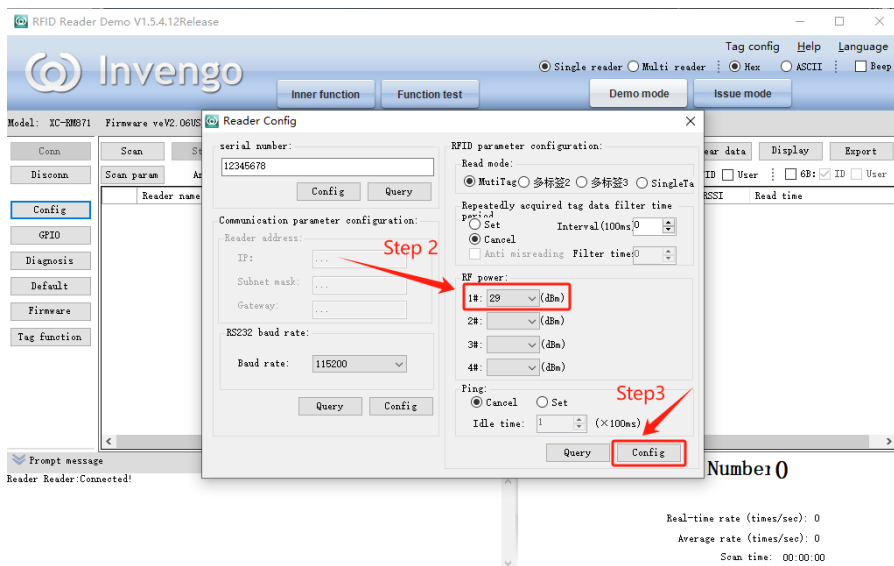


Figure 5-7 Power Setting Diagram 2

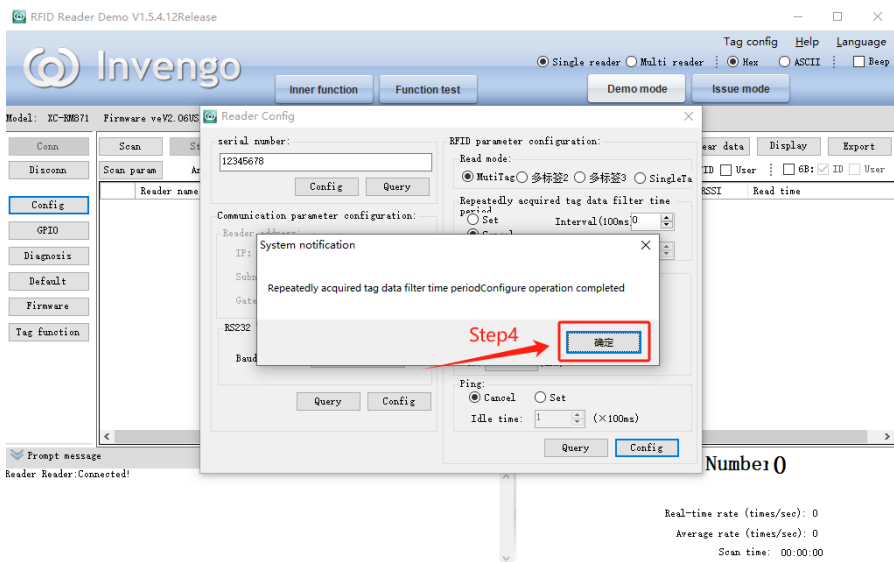


Figure 5-8 Power Setting Diagram 3

5.4.2 Frequency Band Setting

The steps are as follows:

- 1) As shown in Figure 5-9, click the “Freq” dropdown menu;
- 2) As shown in Figure 5-10, select the frequency band that complies with the regulations of the region where the device is located.

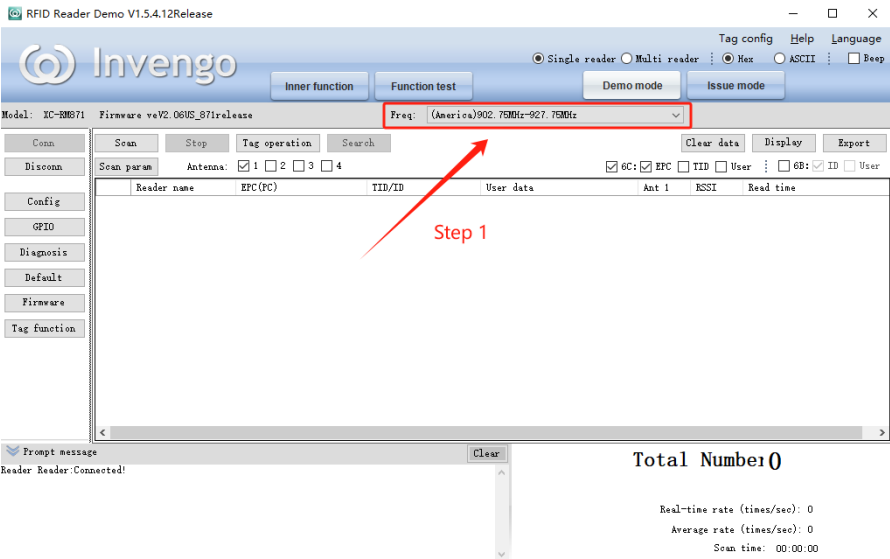


Figure 5-9 Frequency Band Setting Diagram 1

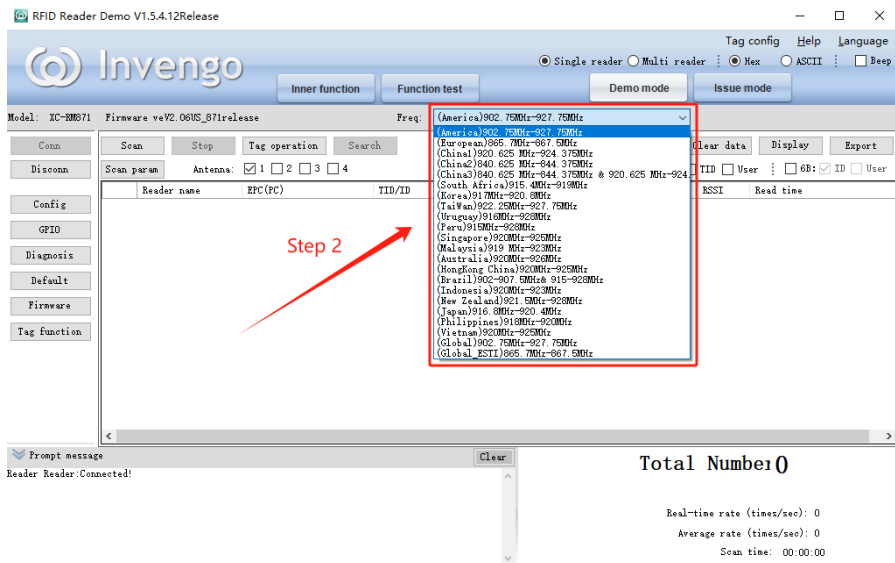


Figure 5-10 Frequency Band Setting Diagram 2

5.5 Reading Tags

The steps are as follows:

- 1) As shown in Figure 5-11, select the correct antenna port. For XC-RM871, select “1”;
- 2) Set the tag’s type parameters;
- 3) Click “Scan” to start reading;
- 4) Figure 5-12 shows the interface for inventorying tag information. Click “Stop” to halt the inventory process.

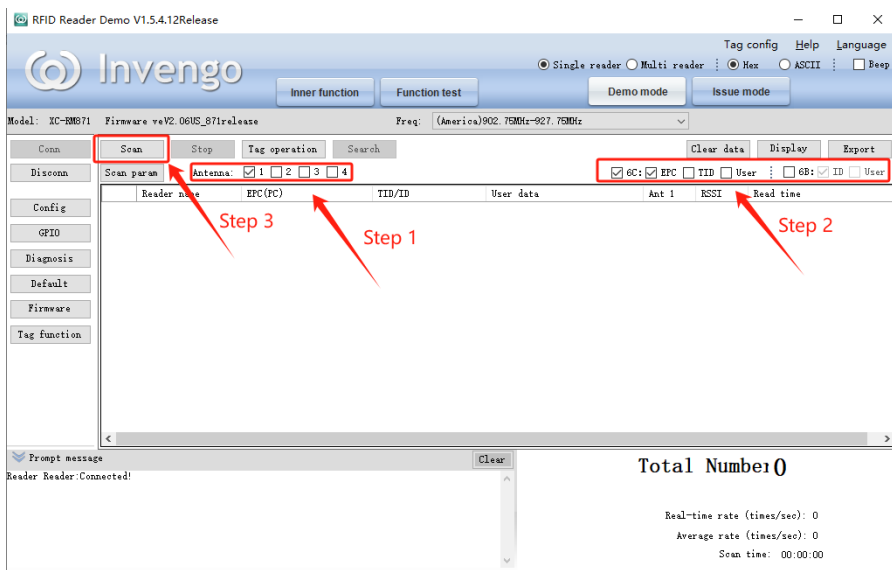


Figure 5-11 Inventory Operation Diagram 1

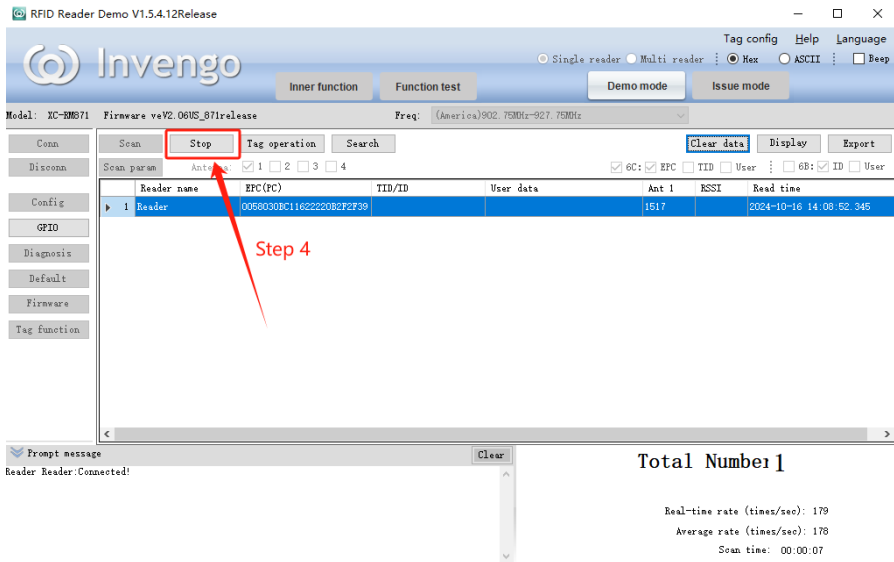
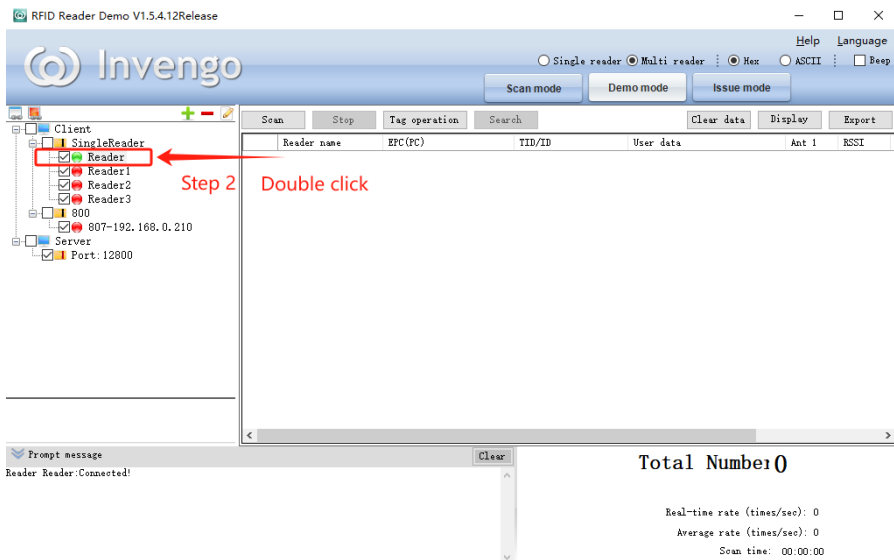
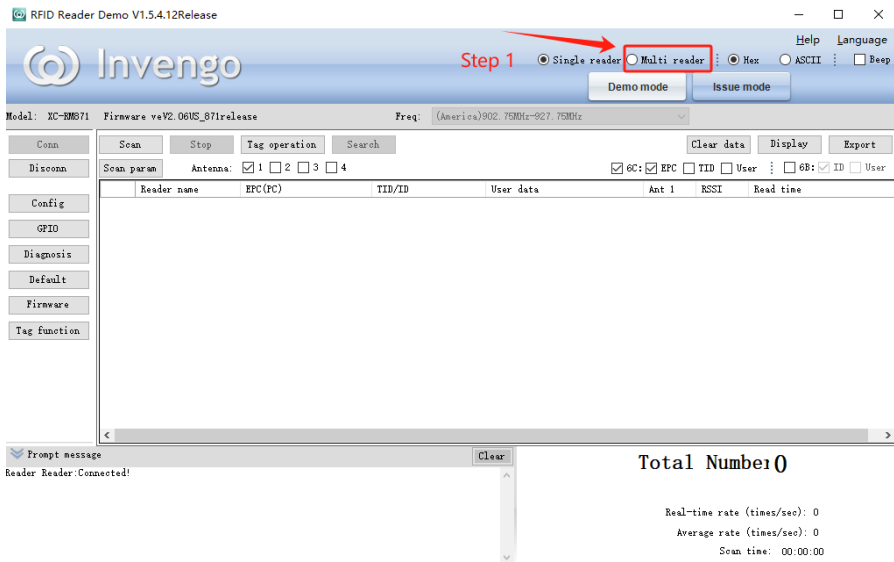


Figure 5-12 Inventory Operation Diagram 2

5.6 Writing Tags

The steps are as follows:

- 1) As shown in Figure 5-13, click “Multi reader”;
- 2) After the interface shown in Figure 5-14 appears, double-click the green “Reader”;
- 3) As shown in Figure 5-15, click “Basic test”;
- 4) As shown in Figure 5-16, select “Repeat R/W”;
- 5) As shown in Figure 5-17, click “Scan” to lock the tag, and then click “Stop”;
- 6) Set the “Write Address”, “Write Data Length”, and “Test Times”;
- 7) Click “Start” to begin writing information.;
- 8) The process will automatically stop after the specified number of tests has been reached. The writing process is complete.



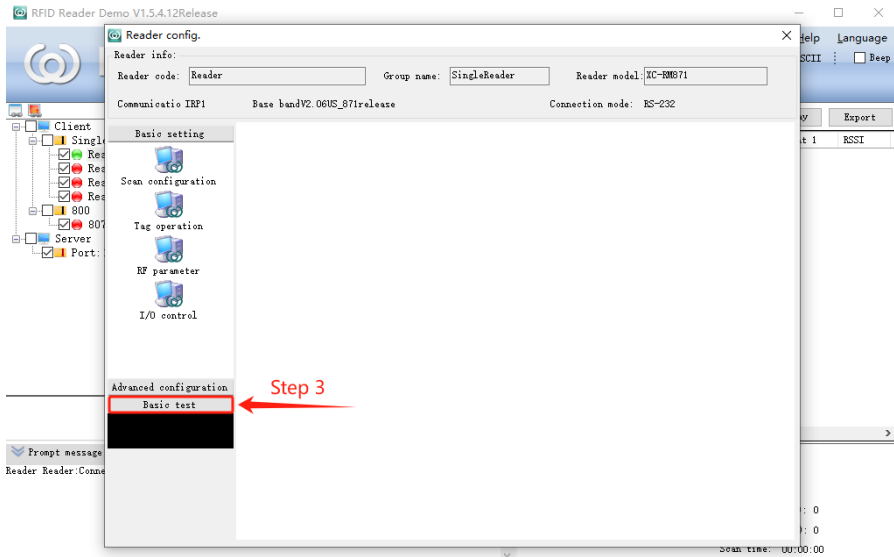


Figure 5-15 Write Tags Diagram 3

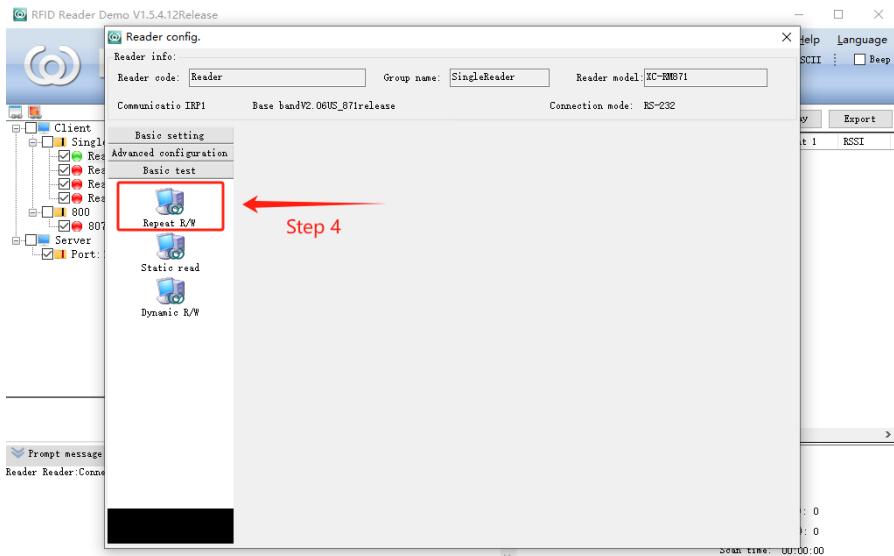


Figure 5-16 Write Tags Diagram 4

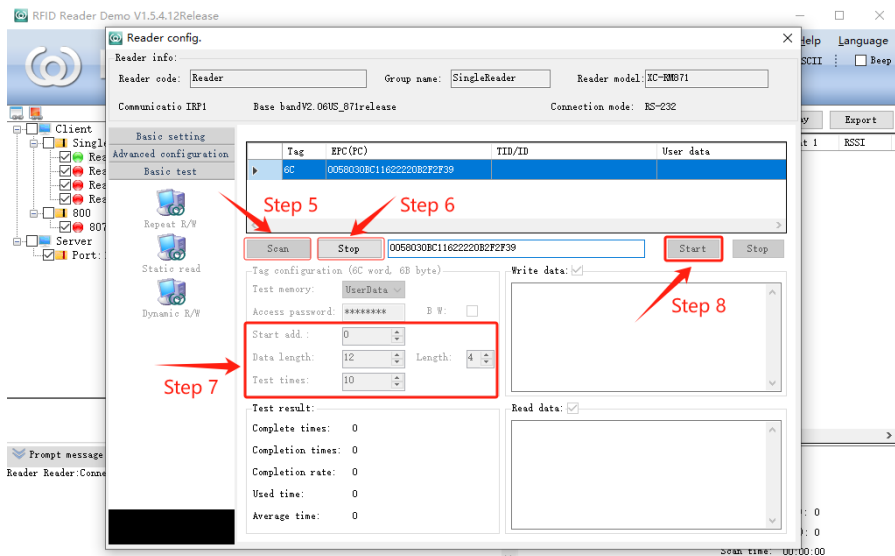


Figure 5-17 Write Tags Diagram 5

06 Technical Specifications

XC-RM871 UHF RFID Module



6.1 RFID Parameters

Table 6-1 RFID Parameters

Type	Description
Interface Protocol	EPC Global UHF Class1 Gen2
Transmission Power	0~32 dBm (Step: 1dB)
Frequency Range	CN: 920.625 MHz~924.375 MHz
	FCC: 902.75 MHz~927.25 MHz
	EU: 865.7 MHz~867.5 MHz
Read Rate	Up to 200 pieces per second
Read Distance	0~10 m
Write Distance	0~5 m
Reception Sensitivity	-84 dBm
Antenna Impedance	50 ohm

6.2 Interface Parameters

Table 6-2 Interface Parameters

Type	Description
TTL UART Interface	Default Baud Rate: 115200 bps
Antenna Interface	MMCX RF Connector

07 Routine Maintenance and Repair

XC-RM871 UHF RFID Module



7.1 Daily Maintenance

The main maintenance points during the daily use of the module are as follows:

- 1) Check if the RF connectors are tightened;
- 2) Check if the screws on the module and antenna are tightened;
- 3) Check if the grounding shield at the RF cable connector is intact;
- 4) Check if the power cord connection of the module is secure;
- 5) Avoid contact with corrosive substances and keep away from fire and heat sources;
- 6) The environment should be kept dry, with a temperature range of -10°C to 40°C .

7.2 Common Issues and Troubleshooting

Users may encounter various types of faults when using the module. Here, based on daily applications, we list common fault phenomena and their troubleshooting methods.

7.2.1 Unable to Connect

- 1) Please check if the module is powered as required;
- 2) Check if the communication cable is loose;
- 3) Check the correctness of the port number and baud rate.

7.2.2 Unable to read electronic tags

- 1) Check if the tag is damaged;
- 2) Check the accuracy of the antenna port setting;
- 3) Check if the tag type (6B/6C) matches the type selected in the software;

- 4) Check if the tag placement is within the module's reading range;
- 5) Check if there is electromagnetic interference.

7.2.3 Short reading distance of the module for tags

- 1) Check if the module's frequency setting is correct;
- 2) Check if the module's RF output power is low and adjust the output power accordingly;
- 3) Check if the polarization direction of the tag matches the antenna. If the antenna is vertically polarized, the tag needs to be placed vertically;
- 4) Check if the tag is a special type, such as an anti-metal tag, which may require placement on a metal surface to achieve optimal reading performance;
- 5) Check if the RF cable connector connecting the module to the antenna is loose;
- 6) The tag's performance may have normally degraded over time.

7.2.4 Slow Tag Reading Speed or Poor Multi-Tag Performance

- 1) Check if there are any tags with poor performance;
- 2) The "Operating Mode" in the RFID settings may be selected incorrectly;
- 3) Check the module's RF output power setting.

For issues that users cannot resolve on their own, please contact the company's customer service center or technical support department.

7.3 Maintenance during Long-term Storage

If the module is not to be used for a long time, please disconnect the power supply, remove all cables, package the module and related accessories properly, and store them in a relatively dry and well-ventilated place.

08 Transportation and Storage

XC-RM871 UHF RFID Module



8.1 Transportation Requirements

Precautions during transportation include:

- 1) It should not be bumped;
- 2) It should not be exposed to rain;
- 3) It should not be exposed to direct sunlight for a long time;
- 4) It should not come into contact with harmful chemicals;
- 5) It should not be corroded by harmful gases.

8.2 Storage Requirements

The warehouse for long-term storage of XC-RM871 modules should meet the following conditions:

- 1) Ambient temperature: -10°C to 40°C ;
- 2) Relative humidity: not exceeding 80%;
- 3) No sudden temperature changes;
- 4) The air should be free of acidic and other harmful gases.

09 After-Sales Service

XC-RM871 UHF RFID Module



9.1 After-Sales Service

When users encounter issues that cannot be resolved with the module equipment, please contact our customer service center.

9.2 Other Notes

If our customer service personnel determine that the user needs to return the module for repair, the customer service representative will provide you with a Return Merchandise Authorization (RMA) number. Please write this number on the outside of the return shipping box and also include a note with the number inside the box. This will ensure that your returned item is processed quickly.

When returning a module for repair service, please follow these steps:

- 1) Properly pack the module and its accessories in their original packaging;
- 2) Use filling material to cover the items inside the box;
- 3) Include a note with the RMA number inside the packaging box;
- 4) Write the RMA number and the word “Fragile” on the outside of the packaging box.

FCC Warning

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 1: 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.

NOTE 2: Any changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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V1.0

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FCC WARNING

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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 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. Radiation Exposure Statement:

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

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

antenna or transmitter.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The final end product must be labelled in a visible area with the following:

“Contains Transmitter Module “FCC ID: TQ4-XC-RM871”

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.³

Explanation: This module meets the requirements of FCC part 15C (15.247). It specifically identified AC Power Line Conducted Emission, Radiated Spurious emissions, Band edge and RF Conducted Spurious Emissions, Conducted Peak Output Power, Bandwidth, Power Spectral Density, Antenna Requirement.

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The product antenna uses an irreplaceable antenna with a gain of 5dBi

2.4 Single Modular

If a modular transmitter is approved as a "Single Modular," then the module manufacturer is responsible for approving the host environment that the Single Modular is used with. The manufacturer of a Single Modular must describe, both in the filing and in the installation instructions, the alternative means that the Single Modular manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions. A Single Modular manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited

module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This Single Modular procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited

module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is a single module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna); b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered); c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout; d) Appropriate parts by manufacturer and specifications; e) Test procedures for design verification; and f) Production test procedures for ensuring compliance. The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: The module complies with FCC radiofrequency radiation exposure limits for uncontrolled environments. The device is installed and operated with a distance of more than 20 cm between the radiator and your body." This module follows FCC statement design, FCC ID: TQ4-XC-RM871

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an "omni-directional antenna" is not considered to be a specific "antenna type").

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product.

The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The product antenna uses an irreplaceable antenna with a gain of 5dBi

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This

includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: TQ4-XC-RM871

2.9 Information on test modes and additional testing requirements⁵

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Invengo Information Technology Co., Ltd. can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product

as being Part 15

Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.