# RFID Reader Data Communication Protocol

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| **Written by:** | **Date:** |
| **Examined by:** | **Date:** |
| **Approved by:** | **Date:** |

## Revised Record

| Version | Contents | Revised by/date |
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# 1 Foreword

## 1.1 Purpose

The data communication interface for the reader and the upper computer (controlling terminal) is standardized in this document. The design of the upper computer (controlling terminal) and the reader must comply with this data communication protocol.

## 1.2 Application Range

This document is applicable to all of our reader models.

The target readers of this document are reader developers, API interface developers, system integration developers and reader technician.

## 1.3 Definition

NRP: RFID Reader Protocol, reader data communication protocol ;

U8: unsigned char ;

S8: signed char ;

U16: unsigned short ;

S16: signed short ;

U32: unsigned long ;

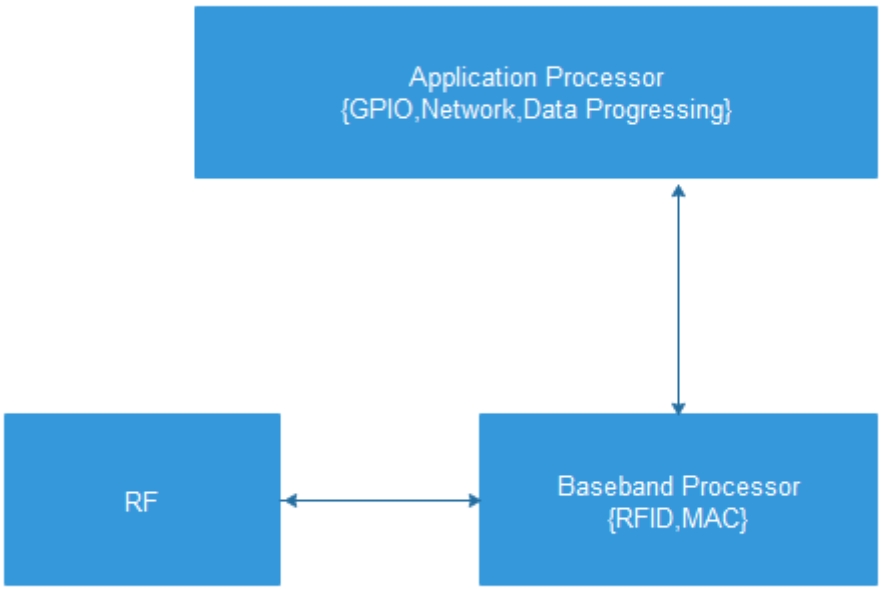
S32: signed long.

## 1.4 Reference

EPC™ Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID Protocol for Communications at 860 MHz–960 MHz Version 1.2.0 .

# 2 Overview

## 2.1 Basic Hardware Frame of the Reader




The basic hardware of reader consists of application processing unit, RFID baseband processing unit and RF hardware circuit unit.

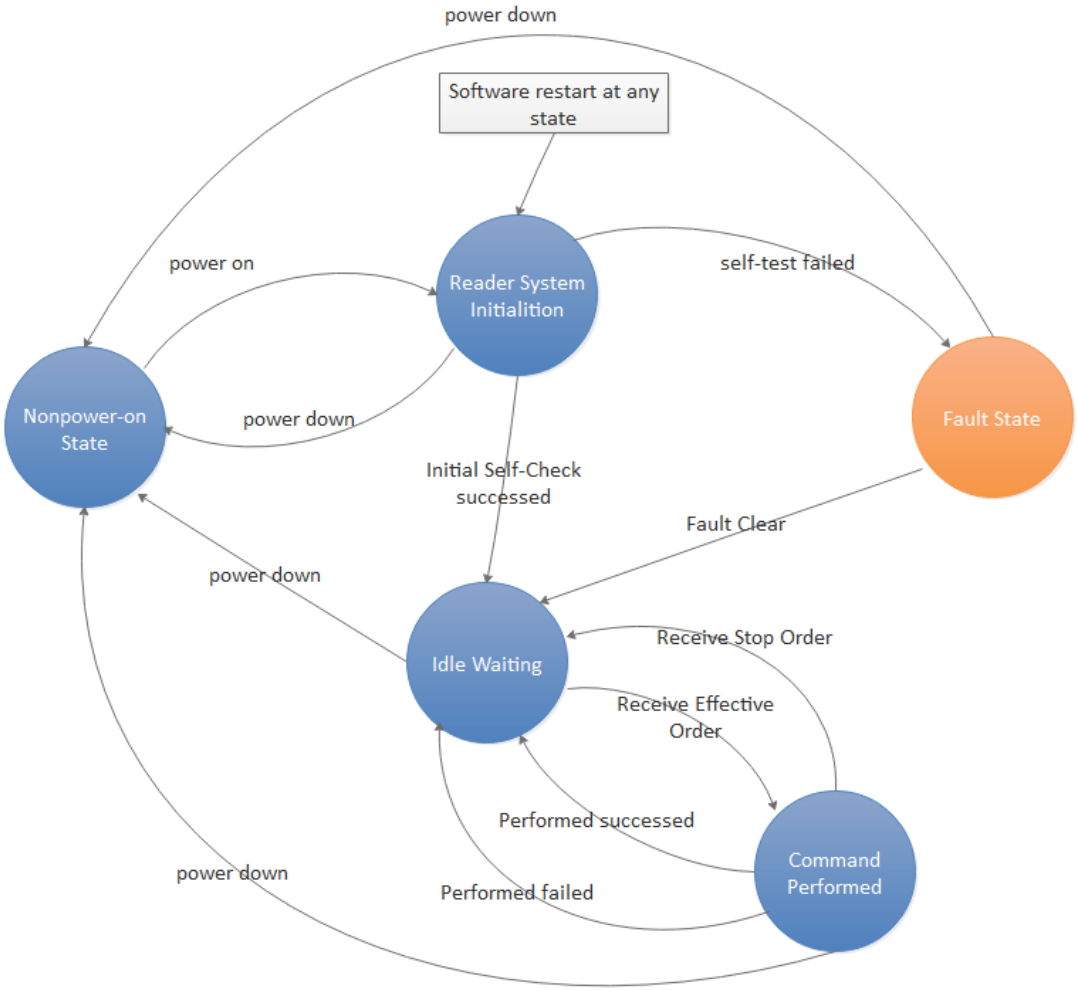
Application Processor: Mainly responsible for network communication, data processing, GPIO and other application-related processing for the reader and The upper computer .

RFID Baseband Processor: Mainly responsible for data exchange and protocol flow control between reader and tag.

RF circuit: responsible for the physical signal transmission between reader and tag

The application processor and baseband processor may work separately as two processors or work together as one processor in the specific reader design.

## 2.2 Basic Operating Mechanism of the Reader



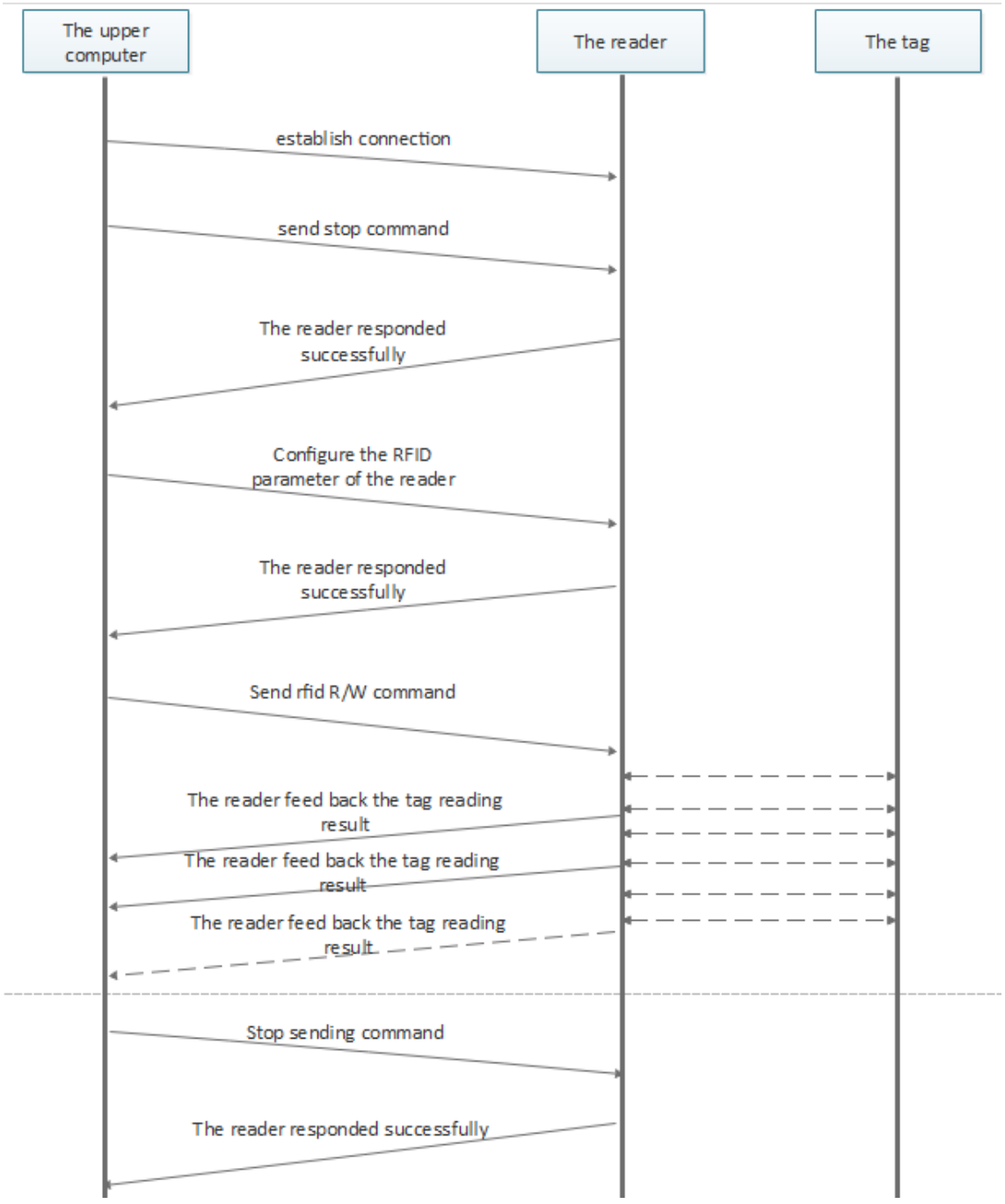

Reader system initialization: start the operating system, and the hardware status of each functional module do self-checking, and the parameters of the reader system are initialized. In this state, the reader cannot receive and execute any instructions from the upper computer .

Idle waiting: the reader finished the initialization and waiting for The upper computer to issue instructions. In this state, the reader can receive any instructions and execute them immediately .

Instruction execution: The reader will switch to the instruction execution state immediately after receiving the complete and legitimate instructions from the upper computer . The reader will only respond to stop operation, GPIO input and output operation and parameter query operation when executing the reading and writing instructions of looping operation .

Breakdown State: When the system broke down during the process of initialization and self-inspection, the system will enter the breakdown state. This state mainly realizes the breakdown alarm and debugging interface of the system, which helps to debug during research and developing and the rapidly tell the breakdown reason .

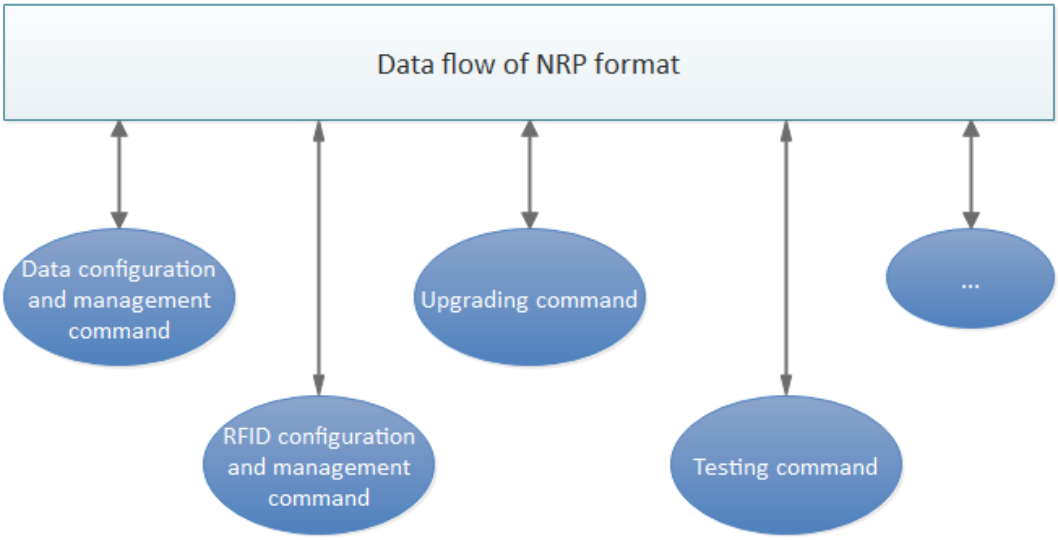
## 2.3 RFID R/W Basic Flow




The upper computer initiates a connection to the reader through a specified port. And The upper computer first sends stop instructions to the reader after the connection. The main purpose of the stop instructions is to: 1. Make the reader switch to the idle state and can respond to the subsequent instructions normally; 2. confirm whether the reader is workable according to the reader's response.

## 2.4 Basic Frame of Protocol

The basic framework of reader protocol is shown in the figure below. Reader instructions mainly include the following categories: reader parameters and configuration, RFID R/W instructions, stop instructions, and GPIO instructions.




# 3 Data Format

## 3.1 Frame Structure

| frame header | Protocol Control Word | Serial device address | data Length | Data parameters | Check Code |
|---|---|---|---|---|---|
| 0x5A | 4 bytes | 1 bytes | 2 bytes (U16) | N bytes | 2 bytes |

**Frame Header:** The hexadecimal "0x5A" is used as the starting identifier of a frame of data.

**Protocol Control Word:** Used to identify the current message type. Specific bits are defined as follows:

| Bit field | Definition | Description |
|---|---|---|
| 31-24 | Protocol Type Number | 0，UHF RFID reader protocol.<br>1~14,reserve,<br>15,Antenna Hub Controlling Protocol.<br>Others, reserve. |

| | | |
|---|---|---|
| 23-16 | Protocol Version No. | such as, 0x01 represent version No.1 |
| 15-14 | Reserve bit | Keep it 0 |
| 13 | RS485 Flag Bit | 0， This message is not used for RS485 communication.<br>1， This message is used for RS485 communication. |
| 12 | Reader notification Flag Bit | 0， Means this message is the instruction of The upper computer or the reader response for The upper computer instruction instead of the notification sent by the reader.<br>1， Means notification sent by the reader |
| 11-8 | Message Category Number | 0， reader error or alarm message.<br>1， Reader configuration and message management. RFID Configuration and operation messages.<br>2， Reader log messages. Reader application processor software and baseband software upgrade message.<br>Test instructions.0x6~0xF,reserve. |
| 7-0 | Message ID | 0x00~0xFF, Distinguish specific messages under the same category of messages, hereinafter referred to as MID. |

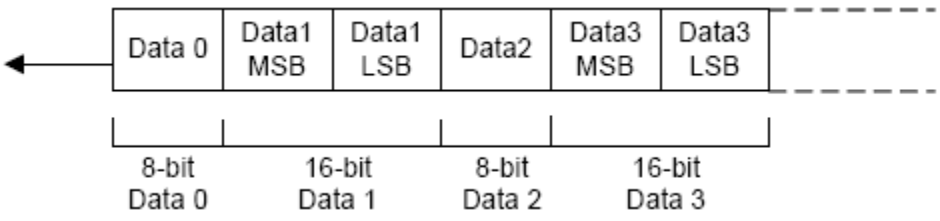
**Serial device address: for identifying RS485 address for target reader the value range is** 0x00~0xFF. The message will include this field only when the RS485Flag Bit in Protocol Control Word is set to be 1. otherwise, this field should not be included in this message.

**data Length:** Indicates the total length of the data content bytes. Currently, the maximum data content length supported by the reader is 1024 bytes.

**Data parameters:** Instruction or parameter of the upper computer . Or information uploaded by the reader.

**Check Code:** Use CCITT-16 as calibration algorithm, except for CRC16 data checksum of frame header. The check polynomia is $X^{16} + X^{15} + X^2 + 1$. Set the initial value to be 0. See Appendix 1 for the implementation of the specific verification algorithm.

transmitting data, byte order is in big-endian format. As shown in the following figure:



## 3.2 Data parameters Format

Data content in frame format can be divided into two categories according to content: one is the parameter content that must be included in the instructions, which is represented in the following description table as (M). And such parameter has no parameter ID. The other one is optional parameter content, which has parameter ID (PID).

When the parameter has variable length data, the data format is: parameter length + parameter content, in which the parameter length is 2bytes data, and the length unit is byte. For parameters of fixed length, there is no parameter length field. The basic format is shown in the following table:

| (M)Data0 | (M)Data1 length(U16) | (M)Data1 | … | PID0 | Data0 | PID1 | Data1 length(U16) | Data1 | … |
|---|---|---|---|---|---|---|---|---|---|

## 3.3 Illegal Instruction Response

The reader may receive instructions or error frames that cannot be executed, in the meanwhile the reader will initiatively report an error message to the upper computer .

Message content: MID=0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Error Type | (M) | U8 | 1 | 0，Unsupported Protocol Type Number<br>1，Unsupported Protocol Version No.<br>2，Wrong Type Mode CRC check error<br>3，Wrong MID<br>4，Protocol Control Word other errors<br>5，The instruction cannot be executed in current status<br>6，The instruction queue is full<br>7，Incomplete message parameters<br>8，Frame Length Over Limitation<br>9，Other errors |
| Reader status | (M) | U8 | 1 | 0，idle state<br>1，Execution status |

| | | | | |
|---|---|---|---|---|
| | | | | 2， Failure status |
| Protocol Control Word received | (M) | U16 | 2 | Protocol Control Word Current Illegal Instructions Received |
| Length of message content received | (M) | U16 | 2 | The message content length of the current illegal instruction received |

# 4 Reader Configuration Management

## 4.1 Reader Configuration Management Instructions

Such type of instruction is mainly used to obtain and manage the version information of reader name, communication port parameters of reader, and GPIO status.

## 4.2 Message List of Reader Configuration and Management

Instruction List of Reader Configuration Management

| Command ID(MID) | Command Description | Command executable status |
|---|---|---|
| 0x00 | Query Reader Information | any state |
| 0x01 | Query Baseband Software Version | any state |
| 0x02 | Configure serial port parameters | Idle state |
| 0x03 | Query serial port parameters | any state |
| 0x04 | Configure the reader IP | Idle state |
| 0x05 | Query the reader IP | any state |
| 0x06 | Query the reader MAC | any state |
| 0x07 | Configure server/client mode parameters | Idle state |
| 0x08 | Query Server/Client Mode Parameters | any state |
| 0x09 | configure GPO state | any state |
| 0x0A | query GPI state | any state |
| 0x0B | Configure GPI triggering parameters | Idle state |
| 0x0C | Query GPI triggering | any state |

| | | |
|---|---|---|
| | parameters | |
| 0x0D | Configure Wiegand Communication Parameters | Idle state |
| 0x0E | Query Wiegand Communication Parameters | any state |
| 0x0F | restart the reader | any state |
| 0x10 | coufigure the system time of the reader | Idle state |
| 0x11 | query the system time of the reader | any state |
| 0x12 | confirm the connection state | any state |
| 0x13 | configure the MAC of the reader | Idle state |
| 0x14 | restore the default configuration of the reader | Idle state |
| 0x15 | Configure RS485 device address of the reader | Idle state |
| 0x16 | query RS485 device address of the reader | any state |

List of notification Configured and Managed by the Reader

| Command ID(MID) | Command Description |
|---|---|
| 0x00 | Trigger start message |
| 0x01 | Trigger stop message |
| 0x12 | confirm the connection state |

### 4.2.1 Query Reader Information

This instruction is used to acquire basic information such as the software version of the reader and the name of the reader and the time of power-on.

The upper computer Instruction Content: MID = 0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Reader sequential number | (M) | U8 | variable length | ASCII Code Example :“R8008000019010 |

| | | | | |
|---|---|---|---|---|
| | | | | 000001”<br>R: Prefix of Product Model, R means reader, M means module<br>8008: 4-digit product model<br>0000: 4-digit customer code, 0000 is means unspecified customer<br>1901: 4 digit production lot(year & week)<br>0000001: 7 digit serial number |
| power on time of the reader | (M) | U32 | 4 | The elapsed seconds from power-on time to the current time of the reader |
| Baseband compilation time | (M) | U8 | variable length | ASCII code |
| Application software version | 0x01 | U32 | 4 | Version V0.1.0.0 is expressed as 0x00010000 |
| Operating System Version | 0x02 | U8 | variable length | Normally it is character string(Ascii) of “V1.00_20190101” |
| Compilation time of application software | 0x03 | U8 | variable length | ASCII code |

### 4.2.2Query Baseband Software Version

This instruction is used for The upper computer to acquire the version number of baseband software.

The upper computer Instruction Content: MID = 0x01

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x01

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Baseband Software Version | (M) | U32 | 4 | Version V1.0.0 is expressed as 0x00010000 |

### 4.2.3Configure serial port parameters

This instruction is used to configure the communication baud rate of the reader COM .

The upper computer Instruction Content: MID = 0x02

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| baud rate of the COM | (M) | U8 | 1 | 0,9600 bps<br>1,19200 bps<br>2,115200 bps<br>3,230400 bps<br>4,460800bps<br>others, unsupported<br>The reader is defaulted to be 115200 bps. |

Reader response content: MID=0x02

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0，configured successfully<br>1，failed, this baud rate is unsupported |

### 4.2.4Query serial port parameters

This instruction is used for The upper computer acquire baud rate parameters of COM communication of reader.

The upper computer Instruction Content: MID = 0x03

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x03

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| baud rate of the COM | (M) | U8 | 1 | 0,9600bps<br>1,19200 bps<br>2,115200 bps |

| | | | | |
|---|---|---|---|---|
| | | | | 3,230400 bps<br>4,460800 bps |

### 4.2.5Configuration for the Reader's Ethernet IP

This instruction is used for Configure the reader IP address parameter.

The upper computer Instruction Content: MID = 0x04

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Automatic Acquisition/Static IP | (M) | U8 | 1 | 0, Automatic Acquisition<br>1, Static IP |
| Reader IP | 0x01 | U32 | 4 | 192.168.1.100 is expressed as 0xC0A80164. |
| Reader Subnet Mask | 0x02 | U32 | 4 | Ditto, 255.255.255.0 is expressed as 0xFFFFFF00 |
| Reader default gateway | 0x03 | U32 | 4 | Ditto, 192.168.1.1 is expressed as 0xC0A80101. |
| Dns1 | 0x04 | U32 | 4 | Ditto, 0.0.0.0 is expressed as 0x00000000. |
| Dns2 | 0x05 | U32 | 4 | Ditto, 0.0.0.0 is expressed as 0x00000000. |

Reader response content: MID=0x04

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0， configured successfully<br>1， Reader IP parameter error |

### 4.2.6Query Reader Ethernet IP

This instruction is used for The upper computer acquire baud rate parameters of COM communication of reader.

The upper computer Instruction Content: MID = 0x05

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x05

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Automatic Acquisition/Static IP | (M) | U8 | 1 | 0,Automatic Acquisition<br>1, Static IP |
| Reader IP | (M) | U32 | 4 | 192.168.1.100 is expressed as 0xC0A80164 |
| Reader Subnet Mask | (M) | U32 | 4 | Ditto, 255.255.255.0 is expressed as 0xFFFFFF00 |
| Reader default gateway | (M) | U32 | 4 | Ditto, 192.168.1.1 is expressed as 0xC0A80101 |
| Dns1 | (M) | U32 | 4 | Ditto, 0.0.0.0 is expressed as 0x00000000. |
| Dns2 | (M) | U32 | 4 | Ditto, 0.0.0.0 is expressed as 0x00000000 |

### 4.2.7Query Reader Ethernet MAC

This instruction is used for The upper computer acquire the MAC address of the reader.

The upper computer Instruction Content: MID = 0x06

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x06

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| MAC address | (M) | U8 | 6 | standard MAC address format |

### 4.2.8Configure Server/client Mode Parameters

This instruction is used to configure the server/client mode and related parameters of the reader network interface.

The upper computer Instruction Content: MID = 0x07

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Server/client mode | (M) | U8 | 1 | 0， server mode<br>1， client mode |

| | | | | |
|---|---|---|---|---|
| TCP port number in server mode | 0x01 | U16 | 2 | Reader TCP service port number, which is recommended between 1024 and 65535, and defaulted to be 8160. |
| Server IP in client mode | 0x02 | U32 | 4 | 192.168.1.1 is expressed as 0xC0A80101. |
| Server Port in Client Mode | 0x03 | U16 | 2 | The TCP service port number of The upper computer is recommended to be between 1024 and 65535, and it is defaulted to be 8160. |

Reader response content: MID=0x07

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0，configured successfully<br>1，Server IP parameter error |

## 4.2.9Query Server/Client Mode Parameters

This instruction is used to configure the Server/client mode and related parameters of the reader's network interface.

The upper computer Instruction Content: MID = 0x08

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x08

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Server/client mode | (M) | U8 | 1 | 0，server mode<br>1，client mode |
| TCP port number in server mode | (M) | U16 | 2 | Reader TCP service port number, |

| | | | | |
|---|---|---|---|---|
| | | | | defaulted as 8160. |
| Server IP in client mode | (M) | U32 | 4 | 192.168.1.1 is expressed as 0xC0A80101. |
| Server Port in Client Mode | (M) | U16 | 2 | The upper computer TCP service port number, which is defaulted as 8160. |

### 4.2.10Configure GPO state

This instruction is used to configure the electrical level of the output port of the reader GPIO.

The upper computer Instruction Content: MID = 0x09

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| GPO1 | 0x01 | U8 | 1 | 0，output low level<br>1，output high level |
| GPO2 | 0x02 | U8 | 1 | 0，output low level<br>1，output high level |
| GPO3 | 0x03 | U8 | 1 | 0，output low level<br>1，output high level |
| GPO4 | 0x04 | U8 | 1 | 0，output low level<br>1，output high level |

Reader response content: MID=0x09

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0, configured successfully<br>1, the reader hardware does not support the port parameter |

### 4.2.11Query GPI state

This instruction is used for the upper computer to acquire the input port level state of GPIO reader.

The upper computer Instruction Content: MID = 0x0A

| parameter name | PID | data type | parameter | parameter description |
|---|---|---|---|---|

| | | | length | |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x0A

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| GPI1electrical level | 0x01 | U8 | 1 | 0， Low electrical level<br>1， High electrical level |
| GPI2electrical level | 0x02 | U8 | 1 | 0， Low electrical level<br>1， High electrical level |
| GPI3electrical level | 0x03 | U8 | 1 | 0， Low electrical level<br>1， High electrical level |
| GPI4electrical level | 0x04 | U8 | 1 | 0， Low electrical level<br>1， High electrical level |

### 4.2.12Configure GPI triggering parameters

This instruction is used to configure the trigger parameters of GPI input port of reader.

The upper computer Instruction Content: MID = 0x0B

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Trigger GPI port number | (M) | U8 | 1 | 0， GPI1<br>1， GPI2<br>2， GPI3<br>3， GPI4<br>4， GPI5<br>5， GPI6 |
| Trigger start condition | (M) | U8 | 1 | 0， trigger off<br>1， Low electrical level triggering<br>2， High electrical level |

| | | | | |
|---|---|---|---|---|
| | | | | triggering<br>3， Rising edge triggering<br>4， Falling edge triggering<br>5， Random edge triggering |
| Instructions to trigger binding | (M) | U8 | variable length | The instruction triggering the binding does not contain the frame header and CRC 16 check fields. |
| Trigger stop condition | (M) | U8 | 1 | 0， Do not stop<br>1， Low electrical level triggering<br>2， High electrical level triggering<br>3， Rising edge triggering<br>4， Falling edge triggering<br>5， Random edge triggering<br>6， Delay stop<br>When the trigger stop condition is satisfied, the reader will execute the stop instruction. |
| Stop Delay Time | 0x01 | U16 | 2 | The unit is 10ms. 0 means the delay time is infinite. The parameter make sense Only when the stopping condition is the delay stopping. |
| Uploading Switch of IO Electrical Level Changes When Triggering Do not Stop | 0x02 | U8 | 1 | 0--do not upload<br>1--upload |

Reader response content: MID=0x0B

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0， configured successfully<br>1， the reader hardware does not support the port parameter<br>2， parameter missing |

When the trigger start condition is satisfied, the reader will send a notification to

inform The upper computer that the trigger operation has started, and then the reader will send notification, whose Flag Bit is 1.

Trigger start message content: MID=0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Trigger GPI port number | (M) | U8 | 1 | 0， GPI1<br>1， GP2<br>2， GP3<br>3， GP4<br>4， GP5<br>5， GP6 |
| GPI port electrical level | (M) | U8 | 1 | 0， Low electrical level<br>1， High electrical level |
| Current system seconds | (M) | U32 | 4 | UTC second |
| Current system microsecond time | (M) | U32 | 4 | UTC microsecond time |

When the Trigger stop condition is satisfied, the reader will send a notification to inform The upper computer that the trigger operation has started. In the meanwhile, the reader will send notification , whose Flag Bit is 1.

Trigger stop message content: MID=0x01

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Trigger GPI port number | (M) | U8 | 1 | 0， GPI1<br>1， GPI2<br>2， GPI3<br>3， GPI4<br>4， GPI5<br>5， GPI6 |
| GPI port electrical level | (M) | U8 | 1 | 1,Low electrical level<br>0,High electrical level |
| Current system seconds | (M) | U32 | 4 | UTC second |
| Current system microsecond time | (M) | U32 | 4 | UTC microsecond time |

### 4.2.13Query GPI triggering parameters

This instruction is used for the upper computer to acquire the GPI trigger parameters

of the inputting port specified by the reader.

The upper computer Instruction Content: MID = 0x0C

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| GPI port No. | (M) | U8 | 1 | 0，GPI1<br>1，GPI2<br>2，GPI3<br>3，GPI4<br>4，GP5<br>5，GP6 |

The upper computer Instruction Content: MID = 0x0C

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Trigger start condition | (M) | U8 | 1 | 0，trigger off<br>1，Low electrical level triggering<br>2，High electrical level triggering<br>3，Rising edge triggering<br>4，Falling edge triggering<br>5，Random edge triggering |
| Instructions to trigger binding | (M) | U8 | variable length | The instruction triggering the binding does not contain the frame header and CRC 16 check fields. |
| Trigger stop condition | (M) | U8 | 1 | 0，Do not stop<br>1，Low electrical level triggering<br>2，High electrical level triggering<br>3，Rising edge triggering<br>4，Falling edge triggering<br>5，Random edge triggering<br>6，Delay stop |
| Delay stop time | (M) | U16 | 2 | In 10ms, 0 means the delay time is infinite. Only when the stopping condition is the delay stopping, can this parameter make sense. |

| | | | | |
|---|---|---|---|---|
| Uploading Switch of IO Electrical Level Changes when the triggering conditions don't stop | (M) | U8 | 1 | 0--do not upload<br>1--upload |

### 4.2.14Configure Wiegand Communication Parameters

This instruction is used to configure the Wiegand communication parameters of Reader.

The upper computer Instruction Content: MID = 0x0D

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Wiegand communication switch | (M) | U8 | 1 | 0， switch off Wiegand communication port<br>1， Enable Wiegand communication port |
| Wiegand communication format | (M) | U8 | 1 | 0， Wiegand 26<br>1， Wiegand 34<br>2， Wiegand 66 |
| Wiegand data transmitting content | (M) | U8 | 1 | The reader intercepts the end data of EPC code or TID code according to Wiegand communication format and outputs it through Wiegand signal. It intercepts the last 3 bytes of specified data for Wiegand 26 format, the last 4 bytes of specified data for Wiegand 34 format, and the last 8 bytes of the specified data for Wiegand 66 format.<br>0， Specified transmission of EPC end data<br>1， Specified transmission of TID end data |

Reader response content: MID=0x0D

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0，configured successfully<br>1，The reader does not support the Wiegand interface<br>2，Unsupported Wiegand communication format<br>3，Unsupported data content |

### 4.2.15Query Wiegand Communication Parameters

This instruction is used for the upper computer to acquire the Wiegand communication parameters of the reader.

The upper computer Instruction Content: MID = 0x0E

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0x0E

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Wiegand communication switch | (M) | U8 | 1 | 0，switch off Wiegand communication port<br>1，Enable Wiegand communication port |
| Wiegand communication format | (M) | U8 | 1 | 0，Wiegand 26<br>1，Wiegand 34<br>2，Wiegand 66 |
| Wiegand data transmitting content | (M) | U8 | 1 | The reader intercepts the end data of EPC code or TID code according to Wiegand communication format and outputs it through Wiegand signal. It intercepts the last 3 bytes of specified data for Wiegand 26 format, the last 4 bytes of specified data for Wiegand 34 |

| | | | | |
|---|---|---|---|---|
| | | | | format ,and the last 8 bytes of the specified data for Wiegand 66 format.<br>0， Specified transmission of EPC end data<br>1， Specified transmission of TID end data |

### 4.2.16restart the reader

This instruction is used for upper computer to restart the reader through software.

The upper computer Instruction Content: MID = 0x0F

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

The reader will restart automatically when it receives this information.

### 4.2.17configure the system time of the reader

This instruction is used for the upper computer to configure the system time of the reader.

The upper computer Instruction Content: MID = 0x10

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| UTC second | (M) | S32 | 4 | UTC standard seconds time format |
| UTC microsecond time | (M) | S32 | 4 | UTC standard microsecond time format |

Reader response content: MID=0x10

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0， configured successfully<br>1， RTC setup failed. |

### 4.2.18query the system time of the reader

This instruction is used for the upper computer to query the system time of the reader.

The upper computer Instruction Content: MID = 0x11

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x11

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Reader UTC second | (M) | S32 | 4 | UTC standard seconds time format |
| Reader UTC microsecond time | (M) | S32 | 4 | UTC standard microsecond time format |

### 4.2.19Confirm the Connection State

This message is used to confirm the connection state between the reader and the upper computer. Both of the reader and The upper computer can send connection state confirming message. The one receive it must rely immediately. The connection will be taken as failed if the sender didn't receive any reply. The flag bit is set to be 1 when the reader send confirmation massage. And the flag bit is set to be 0 when The upper computer send the confirmation massage.

Message content of the sender: MID = 0x12

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Message No. | (M) | U32 | 4 | Message No. Of the connection confirmation The seed is one. |

Confirming party response content: MID=0x12

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Confirming massage No. | (M) | U32 | 4 | Message No. of the connection confirmation. This number should be equal to the sender's message No. |

### 4.2.20configure the MAC of the reader

This instruction is used for the upper computer to configure the MAC of the reader

The upper computer Instruction Content: MID = 0x13

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Reader MAC | (M) | U8 | 6 | MAC standard format |

Reader response content: MID=0x13

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0,configured successfully<br>1,reader MAC parameter error |

### 4.2.21restore the default configuration of the reader

This instruction is used for The upper computer software to restore the reader default configuration. Except for system time and MAC address. This operation restores all parameters of the reader to factory default settings, including RFID configuration parameters.

The upper computer Instruction Content: MID = 0x14

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Confirmation cod | (M) | U32 | 4 | This parameter is fixed and always 0X5AA5A55A. |

Reader response content: MID=0x14

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0,configured successfully<br>1,Other errors |

### 4.2.22Configure Reader RS485 Parameters

This instruction is used for the upper computer software to set RS485 communication parameters of reader, including communication baud rate and 485 address. When restoring factory settings, the baud rate is defaulted to be 115200 and 485 address is defaulted to be 1.

The upper computer Instruction Content: MID = 0x15

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| reader RS485 address | (M) | U8 | 1 | 0~255,Reader RS485 Bus Device Address |

| | | | | |
|---|---|---|---|---|
| communication baud rate | 0x01 | U8 | 1 | 0,9600bps<br>1,19200 bps<br>2,115200 bps<br>3,230400 bps<br>4,460800 bps |

Reader response content: MID=0x15

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0,configured successfully<br>1,Other errors |

### 4.2.23Query RS485 Parameters of the Reader

This instruction is used for The upper computer software to query theRS485 communication parameter for the reader, including the baud rate and 485 address.

The upper computer Instruction Content: MID = 0x16

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x16

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| reader RS485 address | (M) | U8 | 1 | 0~255,Reader RS485 Bus Device Address. |
| communication baud rate | (M) | U8 | 1 | 0,9600bps<br>1,19200 bps<br>2,115200 bps<br>3,230400 bps<br>4,460800 bps |

### 4.2.24Buzzer Switch

This instruction is used for The upper computer software to set up buzzer switch.

The upper computer Instruction Content: MID = 0x1E

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Buzzer controlling switch | - | - | 1- | 0. Reader control<br>1. upper computer control |

Reader response content: MID=0x1E

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Set up buzzer controlling switch | (M) | U8 | 1 | 0. Set-up succeed<br>1. Set-up failed |

### 4.2.25Buzzer controlling

This instruction is used for The upper computer software to setup the buzzer.

The upper computer Instruction Content: MID = 0x1F

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| buzzer controlling | - | - | 2 | Byte0:0.buzzer stop<br>1.buzzer ring<br>Byte1:0.buzzer ring for once<br>1.buzzer keep ringing |

Reader response content: MID=0x1F

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| buzzer controlling | (M) | U8 | 1 | 0.Set-up succeed<br>1.Set-up failed |

### 4.2.26Acquire White list

This instruction is used for The upper computer software to acquire the white list of internal storage of Reader.

The upper computer Instruction Content: MID = 0x20

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Sequential Number of the White List Data Packet | (M) | U32 | 4 | Sequential Number of the White List Data |

| | | | | |
|---|---|---|---|---|
| | | | | Packet |

Reader response

Instruction content of the reader response: MID = 0x20

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Sequential Number of the White List Data Packet | (M) | U32 | 4 | The white list data package serial number starts with 0x00000000. The upper computer responds with 0xFFFFFFFFFFFF when the acquired package serial number of The upper computer is greater than the maximum package serial number of the file. |
| content of the White List Data Packet | (M) | U8 | variable length | content of the White List Data Packet |

### 4.2.27 Import the White List

This instruction is used to import whitelist into reader.

The upper computer Instruction Content: MID = 0x21

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Sequential Number of the White List Data Packet | (M) | U32 | 4 | Sequential Number of the White List Data Package starts with 0x00000000 and 0xFFFFFFFFFFFF. |
| content of the White List Data Packet | (M) | U8 | variable length | content of the White List Data Packet |

Reader response content: MID = 0x21

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Sequential Number of the White List Data Packet | (M) | U32 | 4 | White List Package Number Sent by the upper computer. |

| | | | | |
|---|---|---|---|---|
| White List Package Confirmation Results | (M) | U8 | 1 | 0,success<br>1,fail |

### 4.2.28Delete the White List

This instruction is used to delete the white list of the internal storage of the reader.

The upper computer Instruction Content: MID = 0x22

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x22

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Delete operation execution results | (M) | U8 | 1 | 0. Delete succeed<br>1. Delete failed |

### 4.2.29Set the Action Parameters of the White List Label

This instruction is used for the upper computer software to set the action parameter for the tags.

The upper computer Instruction Content: MID = 0x23

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Relay No. | (M) | U8 | 1- | 1.1# relay<br>2. 2# relay<br>3. 3# relay<br>4. 4# relay |
| relay close time | (M) | U16 | 1 | unit: second 0001--<br>relay close for 1<br>second and then open. |

Reader response content: MID=0x23

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| set the action parameter of the white list tag | (M) | U8 | 1 | 0.Set-up succeed<br>1.Set-up failed |

### 4.2.30Acquire the action parameter of the white list tag

This instruction is used for the upper computer software to acquire the action parameter of the white list tag.

Reader response content: MID=0x24

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| | | | | |

Reader response content: MID=0x24

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| relay No. | (M) | U8 | 1- | 1.1# relay<br>2. 2# relay<br>3. 3# relay<br>4. 4# relay |
| relay close time | (M) | U16 | 1 | unit: second<br>0001--relay close for 1 second and then open. |

# 5 RFID Configuration and Operation

## 5.1 Instruction for the RFID Configuration and Operation

This instruction set is used for RFID related configuration and operation.

## 5.2 RFID configuration and operation message list

RFID configuration and operation instruction list

| Command ID(MID) | Command Description | Command executable status |
|---|---|---|
| 0x00 | Query Reader's RFID Ability | any state |
| 0x01 | Configure the Reader Power | any state |

| | | |
|---|---|---|
| 0x02 | Query the Reader Power | Idle state |
| 0x03 | Configure the RF Band of the Reader | any state |
| 0x04 | Query the RF Band of the Reader | Idle state |
| 0x05 | Configure the Working Frequency of the Reader | any state |
| 0x06 | Query the Working Frequency of the Reader | any state |
| 0x07 | Configure the antenna of the reader | Idle state |
| 0x08 | query the antenna of the reader | any state |
| 0x09 | configure the uploading parameter of the tag | Idle state |
| 0x0A | query the uploading parameter of the tag | any state |
| 0x0B | configure the EPC baseband parameter | Idle state |
| 0x0C | query the EPC baseband parameter | any state |
| 0x0D | Configure Auto-idle Mode for the Reader | Idle state |
| 0x0E | Query Auto-idle Mode for the Reader | any state |
| 0x0F | reserve | NA |
| 0x10 | read EPC tag | Idle state |
| 0x11 | write EPC tag | Idle state |
| 0x12 | lock EPC tag | Idle state |
| 0x13 | inactivate EPC tag | Idle state |
| 0x14~0x3F | reserve | NA |
| 0x40 | read 6B tag | Idle state |
| 0x41 | write 6B tag | Idle state |
| 0x42 | Lock 6B tag | Idle state |
| 0x43 | 6B tag locking query | Idle state |
| 0x44~0x4F | reserve | NA |
| 0x50 | read national standard tag | Idle state |
| 0x51 | Write national standard tag | Idle state |
| 0x52 | Lock national standard tag | Idle state |

| | | |
|---|---|---|
| 0x53 | Inactivate national standard tag | Idle state |
| 0x54~0xFE | reserve | NA |
| 0xFF | Stop command | any state |

RFID notification list

| 命令 ID(MID) | Command Description |
|---|---|
| 0x00 | EPC tag data uploading massage |
| 0x01 | EPC reading end massage |
| 0x20 | 6B tag data uploading message |
| 0x21 | 6B tag reading stop message |
| 0x30 | national standard tag data uploading message |
| 0x31 | national standard tag reading stop message |

### 5.2.1Query Reader's RFID Ability

This instruction is used for the upper computer to acquire the power range of the reader, the number of antennas, the list of supported bands, and the list of supported RFID air interface protocols.

The upper computer Instruction Content: MID = 0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Minimum transmit power | (M) | U8 | 1 | 0~36,the unit is dBm, stepping 1dB |
| Maximum transmit power | (M) | U8 | 1 | 0~36,the unit is dBm, stepping 1dB |
| Antenna quantity | (M) | U8 | 1 | Number of the port that the reader supported |

| | | | | |
|---|---|---|---|---|
| Frequency range list | (M) | U8 | variable length | List of the frequency band that the reader supported. The frequency band code is defined as below:<br>0， National standard 920~925MHz<br>1， National standard 840~845MHz<br>2， National standard 840~845MHz and 920~925MHz<br>3， FCC,902~928MHz<br>4,ETSI,866~868MHz |
| RFID protocol list | (M) | U8 | variable length | The RFID air interface protocol that the reader supported. The protocol code is defined as below:<br>0， ISO18000-6C/EPC C1G2<br>1， ISO18000-6B<br>2， National standard GB/T 29768-2013<br>3， National army standard GJB 7383.1-2011 |

### 5.2.2Configure the Reader Power

This instruction is used to configure the power of all of the antenna port.

The upper computer Instruction Content: MID = 0x01

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| The power of antenna port 1 | 0x01 | U8 | 1 | 0~36, the unit is dBm, stepping 1 dbm |
| The power of antenna port 2 | 0x02 | U8 | 1 | 0~36, the unit is dBm, stepping 1 dbm |
| The power of antenna port 3 | 0x03 | U8 | 1 | 0~36, the unit is dBm, stepping 1 dbm |
| The power of antenna port 4 | 0x04 | U8 | 1 | 0~36, the unit is dBm, stepping 1 dbm |

| | | | | |
|---|---|---|---|---|
| … | … | … | … | … |
| The power of antenna port 64 | 0x40 | U8 | 1 | 0~36, the unit is dBm, stepping 1 dbm |

Reader response content: MID=0x01

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0，configured successfully<br>1，the reader hardware does not support the port parameter<br>2，The reader does not support the power parameter<br>3，Save failed |

### 5.2.3Query the Reader Power

This instruction is used for the upper computer to acquire the parameter of all of the antenna port of the reader.

The upper computer Instruction Content: MID = 0x02

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0x02

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| the power of antenna port 1 | 0x01 | U8 | 1 | 0~36, the unit is dBm, stepping 1 dbm |
| the power of antenna port 2 | 0x02 | U8 | 1 | 0~36, the unit is dBm, stepping 1 dbm |
| the power of antenna port 3 | 0x03 | U8 | 1 | 0~36, the unit is dBm, stepping 1 dbm |
| the power of antenna port 4 | 0x04 | U8 | 1 | 0~36, the unit is dBm, stepping 1 dbm |
| … | … | … | … | … |
| the power of antenna port 64 | 0x40 | U8 | 1 | 0~36, the unit is dBm, stepping 1 dbm |

## 5.2.4Configure the RF frequency band of the Reader

This instruction is used to configure the current working frequency of the reader.

The upper computer Instruction Content: MID = 0x03

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| RF Frequency Range | (M) | U8 | 1 | 0， National standard 920~925MHz<br>1， National standard 840~845MHz<br>2， National standard 840~845MHz and 920~925MHz<br>3， FCC, 902~928MHz<br>4， ETSI, 866~868MHz<br>5， JP, 916.8~920.4 MHz<br>6， TW, 922.25~927.75 MHz<br>7， ID, 923.125~925.125 MHz<br>8， RUS, 866.6~867.4 MHz |

Reader response content: MID=0x03

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0， configured successfully<br>1， the reader hardware does not support the frequency parameter<br>2， save failed |

## 5.2.5Query the RF frequency band of the Reader

This instruction is used for the upper computer to acquire the current working frequency of the reader.

The upper computer Instruction Content: MID = 0x04

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0x04

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| RF frequency band | (M) | U8 | 1 | 0， national standard 920~925MHz<br>1， national standard |

| | | | | |
|---|---|---|---|---|
| | | | | 840~845MHz<br>2， national standard 840~845MHz and 920~925MHz<br>3， FCC,902~928MHz<br>4， ETSI,866~868MHz<br>5， JP, 916.8~920.4MHz<br>6， TW,922.25~927.75MHz<br>7， ID,923.125~925.125MHz<br>8， RUS, 866.6~867.4MHz |

### 5.2.6Configure the Working Frequency of the Reader

This instruction is used to configure the frequency used by the reader.

The upper computer Instruction Content: MID = 0x05

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Automatic frequency setting | (M) | U8 | 1 | 0， The reader does not automatically select frequency points, but only uses frequency points according to the specified Frequency List.<br>1， The reader automatically selects frequency points within the RF frequency range. |
| Frequency List | 0x01 | U8 | variable length | It is used to specify the working frequency of the reader in Non-automatic Frequency Selection Mode. Frequency List is a list of channel numbers in the current working frequency band. For example, 920.625、922.375、924.375MHz are three points that need to be specified under the 920~925MHz national standard. Then the Frequency List should be {0,7,15}. The quantity of the |

| | | | | |
|---|---|---|---|---|
| | | | | frequency points should not be less than 1 and not more than 50. |

Reader response content: MID=0x05

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0， configured successfully<br>1， The channel number is not in the current frequency band.<br>2， Invalid frequency number.<br>3， Other parameter errors<br>4， Save failed |

### 5.2.7Query the Working Frequency of the Reader

This instruction is used for the upper computer to acquire the frequency configuration of the reader.

The upper computer Instruction Content: MID = 0x06

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0x06

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Automatic frequency setting | (M) | U8 | 1 | 0， The reader does not automatically select frequency points, but only uses frequency points according to the specified Frequency List.<br>1， The reader automatically selects frequency points within the RF frequency range. |
| Frequency List | (M) | U8 | variable length | It is used to specify the working frequency of the reader in Non-automatic Frequency Selection Mode. Frequency List is a list of channel numbers in the current working frequency band. For example, 920.625、922.375、924.375MHz are three points that need to be specified under the |

| | | | | |
|---|---|---|---|---|
| | | | | 920~925MHz national standard. Then the Frequency List should be {0,7,15}. The quantity of the frequency points should not be less than 1 and not more than 50. |

### 5.2.8Configure the Extended Parameter of the Hub of Reader Antenna

This instruction is used to configure the extended parameter of the antenna hub of the reader.

The upper computer Instruction Content: MID = 0x07

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Extended antenna list of Main Antenna1 | 0x01 | U16 | 2 | Enabling mask of hub extended antenna of antenna 1<br>Bit0:Enabling Hub Port 1<br>Bit1:Enabling Hub Port 2<br>Bit2:Enabling Hub Port 3<br>Bit3: Enabling Hub Port 4<br>Bit4:Enabling Hub Port 5<br>Bit5:Enabling Hub Port 6<br>Bit6:Enabling Hub Port 7<br>Bit7:Enabling Hub Port 8<br>...<br>Bit15:Enabling Hub Port 16<br>If the extended external hub ports of antenna 1 is 1~16, this parameter should be 0xFF. |
| Extended antenna list of Main Antenna 2 | 0x02 | U16 | 2 | Definition ditto |
| Extended antenna list of Main Antenna 3 | 0x03 | U16 | 2 | Definition ditto |
| Extended antenna list of Main Antenna 4 | 0x04 | U16 | 2 | Definition ditto |

| | | | | |
|---|---|---|---|---|
| Extended antenna list of Main Antenna 5 | 0x05 | U16 | 2 | Definition ditto |
| Extended antenna list of Main Antenna 6 | 0x06 | U16 | 2 | Definition ditto |
| Extended antenna list of Main Antenna 7 | 0x07 | U16 | 2 | Definition ditto |
| Extended antenna list of Main Antenna 8 | 0x08 | U16 | 2 | Definition ditto |
| ... | ... | ... | ... | ... |
| Extended antenna list of Main Antenna 32 | 0x20 | U16 | 2 | Definition ditto |

*Main antenna: refers to the original antenna port of the reader.

Reader response content: MID = 0x07

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0， configured successfully<br>1， antenna port does not exit<br>2， save failed |

The antenna hub help with the reader antenna extending. The reader send a notification through RS 485 port to control the antenna hub for antenna port switching. In the meanwhile the flag bit of the reader notification should be set to be 1.

Serial device address: it is corresponding to the reader's main antenna ID.

massage data content: MID=0x03

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| hub antenna ID | (M) | U8 | 1 | 1~16,which is corresponding to the antenna port 1~16 of the antenna hub switch for. |

## 5.2.9Query the Extended Parameter of the Reader Antenna

This instruction is used to query the current antenna using by reader.

The upper computer Instruction Content: MID = 0x08

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0x08

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Extended antenna list of the main antenna 1 | 0x01 | U16 | 2 | Enabling Mask of the Hub Extended Antenna of Antenna 1 Bit0: Enabling Hub port 1<br>Bit1: Enabling Hub port 2<br>Bit2: Enabling Hub port 3<br>Bit3: Enabling Hub port 4<br>Bit4: Enabling Hub port 5<br>Bit5: Enabling Hub port 6<br>Bit6: Enabling Hub port 7<br>Bit7: Enabling Hub port 8<br>...<br>Bit15: Enabling Hub port 16.<br>If the extended external hub ports of antenna 1 is 1~16, this parameter should be 0xFF. |
| Extended antenna list of the main antenna 2 | 0x02 | U16 | 2 | Definition ditto |
| Extended antenna list of the main antenna 3 | 0x03 | U16 | 2 | Definition ditto |
| Extended antenna list of the main antenna 4 | 0x04 | U16 | 2 | Definition ditto |
| Extended antenna list of the main antenna 5 | 0x05 | U16 | 2 | Definition ditto |
| Extended antenna list of the main antenna 6 | 0x06 | U16 | 2 | Definition ditto |
| Extended antenna list of the main antenna 7 | 0x07 | U16 | 2 | Definition ditto |
| Extended antenna list of the main antenna 8 | 0x08 | U16 | 2 | Definition ditto |

| | | | | |
|---|---|---|---|---|
| ... | ... | ... | ... | ... |
| Extended antenna list of the main antenna 32 | 0x20 | U16 | 2 | Definition ditto |

### 5.2.10Configure the tag uploading parameter

This instruction is used to configure the data uploading rule of the reader after reading the tag.

The upper computer Instruction Content: MID = 0x09

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| repeated tag filtering time | 0x01 | U16 | 2 | means during a reading instruction execution period, the same tag content can only be uploaded once in a specified repeated tag filtering time, 0~65535,time units,10ms . |
| RSSI threshold | 0x02 | U8 | 1 | The tag data will be gave up uploading and discarded when the RSSI value of the tag is lower than the threshold value. |

Reader response content: MID = 0x09

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0， configured successfully<br>1， parameter error<br>2， save failed |

### 5.2.11Query the Tag Uploading Parameter

This instruction is used to query the current give up uploading and discard when the RSSI value of the tag is lower than the threshold value uploading parameter of the reader

The upper computer Instruction Content: MID = 0x0A

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0x0A

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| repeated tag filtering time | (M) | U16 | 2 | means during a reading instruction execution period, the same tag content can only be uploaded once in a specified repeated tag filtering time, 0~65535,time units,10ms . |
| RSSI threshold | (M) | U8 | 1 | The tag data will be gave up uploading and discarded when the RSSI value of the tag is lower than the threshold value. |

## 5.2.12Configure EPC Baseband Parameter

This instruction is used to configure the baseband parameter the reader is using.

The upper computer Instruction Content: MID = 0x0B

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| EPC baseband speed | 0x01 | U8 | 1 | 0， Tari=25us,FM0,LHF =40KHz.<br>1， Tari=25us,Miller4, LHF=250KHz.<br>2， Tari=25us,Miller4, LHF=300KHz.<br>3， Tari=6.25us,FM0,L HF=400KHz.<br>4， Tari=25us,Miller4, LHF=320KHz.<br>5~254,reserve. |

| | | | | |
|---|---|---|---|---|
| | | | | 255,reader automatic setup |
| default Q value | 0x02 | U8 | 1 | 0~15,the starting Q value the reader is using |
| Session | 0x03 | U8 | 1 | 0， Session0<br>1， Session1<br>2， Session2<br>3， Session3 |
| inventory taking marking parameter | 0x04 | U8 | 1 | 0， use only flag A to take inventory<br>1， use only flag B to take inventory<br>2， use Flag A and Flag B alternately for double sides inventory taking |

Reader response content: MID = 0x0B

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0， configured successfully<br>1， baseband that unsupported by the reader<br>2， Q value parameter error<br>3， Session parameter error<br>4， Inventory taking parameter error<br>5， Other parameter errors<br>6， save failed |

## 5.2.13Query for EPC baseband Parameter

This instruction is used to query the baseband parameter the reader is using.

The upper computer Instruction Content: MID = 0x0C

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0x0C

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| EPC baseband speed | (M) | U8 | 1 | 0， Tari=25us,FM0,LHF=4 |

| | | | | |
|---|---|---|---|---|
| | | | | 0KHz.<br>1， Tari=25us,Miller4,LHF=250KHz.<br>2， Tari=25us,Miller4,LHF=300KHz.<br>3， Tari=6.25us,FM0,LHF=400KHz.<br>4~254,reserve.<br>255,reader automatic setup |
| default Q value | (M) | U8 | 1 | 0~15,the starting Q value the reader is using |
| Session | (M) | U8 | 1 | 0， Session0<br>1， Session1<br>2， Session2<br>3， Session3 |
| inventory taking marking parameter | (M) | U8 | 1 | 0， use only flag A to take inventory<br>1， use only flag B to take inventory<br>2， use Flag A and Flag B alternately for double sides inventory taking |

## 5.2.14Configure the Intermittent Reading Mode of the Reader

This instruction is used to Configure the reading mode of the reader.

The upper computer Instruction Content: MID = 0x0D

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Intermittent mode enablement | (M) | U8 | 1 | Intermittent reading mode means the reader enter idle state after a constant reading period for power saving. And the reader start reading again when the idle time is over.<br>0， Off the intermittent reading mode. |

| | | | | |
|---|---|---|---|---|
| | | | | 1， Enable the intermittent reading mode. |
| Working time | (M) | | | |
| Idle time | 0x01 | U16 | 2 | Means the time that the automatically-on idle time of the reader. 0~65535, time unit: 10ms |

Reader response content: MID = 0x0D

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0, configured successfully<br>1, mode parameter error<br>2, other parameter errors<br>3, save failed |

## 5.2.15Query the Automatically-on Idle Mode of the Reader

This instruction is used for the configuration to query the automatically-on idle mode.

The upper computer Instruction Content: MID = 0x0E

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0x0E

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| automatically-on idle mode enablement | (M) | U8 | 1 | 0, off the automatically-on idle mode.<br>1, enable the automatically-on idle mode |
| automatically-on Idle time | (M) | U16 | 2 | Means the time that the automatically-on idle time of the reader. 0~65535, time unit: 10ms |

## 5.2.16Read EPC Tag

This instruction is used for the configuration of the tag parameters and start card reading. The tag EPC code need to be acquired before and tag reading, so tag reading operation will get the EPC code.

The upper computer Instruction Content: MID = 0x10

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1<br>Bit1: enabling antenna 2<br>Bit2: enabling antenna 3<br>Bit3: enabling antenna 4<br>Bit4: enabling antenna 5<br>Bit5: enabling antenna 6<br>Bit6: enabling antenna 7<br>Bit7: enabling antenna 8<br>...<br>Bit32: enabling antenna 32<br>One or multiple antennas can be designated. |
| constant/single reading | (M) | U8 | 1 | 0， single read, the reader read one time on each enabling antenna then stop reading and automatically enter idle state.<br>1， continuous read, the reader keeps reading and stop reading after receiving a stop command. |
| choose reading parameters | 0x01 | U8 | variable length | Byte 0:data area to be matched; 1, EPC area; 2, TID area;3, user data area.<br>Byte1+byte 2: starting address of the matching data. byte 1 is the high 8-bit of the starting address, and byte 2 is the low 8-bit of the starting address. byte 3: bit length of the data to be matched .<br>byte 4~ byte N: data content to be matched. |

| | | | | |
|---|---|---|---|---|
| TID reading parameters | 0x02 | U8 | 2 | byte 0:TID reading mode configuration. 0, the length of the TID is self-adaptable, but the maximum length should not be more than the length defined by byte 1.1, read TID according to the length that byte 1 defined.<br>byte 1: length of the TID data word(word, 16bits, similarly hereinafter) need to be read by the reader. |
| reading parameters for the user data area | 0x03 | U8 | 3 | byte 0+byte 1:starting address of the matching data. byte 0 is the high 8-bit of the starting address, and byte 1 is the low 8-bit of the starting address.<br>Byte 2: The word length of the user data that need to be read |
| reserve area reading parameter | 0x04 | U8 | 3 | byte 0+byte 1:starting address of the matching data. byte 0 is the high 8-bit of the starting address, and byte 1 is the low 8-bit of the starting address.<br>Byte 2: the word length of the reserve area that need to be read |
| tag access password | 0x05 | U32 | 4 | Access password for tag checking. |
| MONZA QT PEEK reading | 0x06 | U8 | 1 | It is fixed to be 1. And it is used for QT PEEK reading for MONZA QT tag. |
| Read RFMICRON chip temperature sensor data. | 0x07 | U8 | 1 | It is fixed to be 1. It is used for temperature acquiring for RFMICRON Magnus-S3 tag. |
| Read EM chip Sensor Data | 0x08 | U8 | 1 | It is fixed to be 1. It is used for the Sensor Data acquiring for EM tag. |

Reader response content: MID = 0x10

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Read configuration result | (M) | U8 | 1 | 0，configured successfully antenna port parameter error<br>1，Choosing reading parameter error<br>2，TID reading parameter error<br>3，User data area reading parameter error<br>4，Reserve area reading parameter error<br>5，Other parameter errors. |

The reader start reading after receiving correct reading command. And then it uploads the content of the tag data user area. At the same time, the reader notification Flag Bit should be set to be 1.

EPC tag data uploading content: MID=0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Tag EPC code | (M) | U16 | variable length | tag EPC code data read by the reader. |
| Tag PC | (M) | U16 | 2 | tag PC value read by the reader |
| Antenna ID | (M) | U8 | 1 | refer to the tag antenna ID number read by the reader<br>1，antenna 1<br>2，antenna 2<br>3，antenna 3<br>4，antenna 4 |
| RSSI | 0x01 | U8 | 1 | the tag RSSI value received |
| reading result of the tag data | 0x02 | U8 | 1 | If the reading command includes reading the Data parameters of TID, user data area or reserve area,<br>0，read succeeded<br>1，no tag response<br>2，CRC error<br>3，data area locked<br>4，Data area overflow.<br>5，access password error<br>6，Other tag errors<br>7，Other reader errors |
| tag TID data | 0x03 | U16 | variable | tag TID data read by the reader |

| | | | | |
|---|---|---|---|---|
| | | | length | |
| data of the tag data area | 0x04 | U16 | variable length | data of the tag data area read by the reader |
| data of the tag reserve area | 0x05 | U16 | variable length | data of the tag reserve area read by the reader |
| Sub-antenna No. | 0x06 | U8 | 1 | Sub-antenna No. On the concentrator after expansion.<br>1~16 |
| UTC reading time of the tag | 0x07 | U32 | 8 | BYTE0~BYTE3:UTC time second<br>BYTE4~BYTE7:UTC time microsecond |
| current frequency | 0x08 | U32 | 4 | current reading tag frequency, unit: KHz |
| current tag phase | 0x09 | U8 | 1 | current reading tag phase value, range: 0~128,<br>computation for tag phase: :(phase value /128)*2π |

The reader will automatically upload a ending operation massage when the reading is end. And in the meanwhile, the flag bit of the notification should be set to be 1.

EPC reading end notification: MID=0x01

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| end reason for the reading | (M) | U8 | 1 | 0， single operation finished<br>1， receive stopping command<br>2， hardware error caused reading interruption |

## 5.2.17Write EPC Tag

This instruction is used for the reader to write the EPC tag. The writing operation defined by this command is single.

The upper computer Instruction Content: MID = 0x11

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1.<br>Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3.<br>Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5. |

| | | | | |
|---|---|---|---|---|
| | | | | Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| data area | (M) | U8 | 1 | data area of the tag to be written:<br>0， Reserve are<br>1， EPC area<br>2， TID area<br>3， User data area |
| word starting address | (M) | U16 | 2 | starting address of the data area of the tag to be written |
| Data content | (M) | U16 | variable length | data content to be written |
| choose writing parameters | 0x01 | U8 | variable length | byte 0: data area to be matched; 1,EPC area; 2, TID area; 3, user data area. byte1+byte 2: starting address of the matching data. byte 1 is the high 8-bit of the starting address, and byte 2 is the low 8-bit of the starting address. byte 3: bit length of the data to be matched .<br>byte 4~ byte N:data content to be matched. |
| tag accessing password | 0x02 | U32 | 4 | Access password for tag checking. |
| Block write parameter | 0x03 | U8 | 1 | Word length of the single block write data content. 0 means do not take block write. |

Reader response content: MID = 0x11

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| writing result | (M) | U8 | 1 | 0, write successfully<br>1, antenna port parameter error<br>2, Choosing parameter error<br>3, Writing parameter error<br>4, CRC check error |

| | | | | |
|---|---|---|---|---|
| | | | | 5, Insufficient power<br>6, data area overflow<br>7, data area locked<br>8, access password error<br>9, Other tag errors<br>10, tag lost<br>11, reader sending command error |
| write failed word address | 0x01 | U16 | 2 | if the writing fail, the reader need to upload the failed tag address. |

### 5.2.18Lock PEC Tag

This instruction is used for the reader to lock or unlock the tag. The operation this command defined is single.

The upper computer Instruction Content: MID = 0x12

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1.<br>Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3.<br>Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5.<br>Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| locking operation area | (M) | U8 | 1 | tag area to be locked:<br>0，inactivation password area<br>1，Access password area<br>2， EPC area<br>3，TID area<br>4， user data area |
| locking operation type | (M) | U8 | 1 | type locking operation to be done:<br>0，Unlock<br>1，Lock<br>2，Unlock permanently<br>3，Lock permanently |

| | | | | |
|---|---|---|---|---|
| choose locking parameter | 0x01 | U8 | variable length | byte 0: data area to be matched; 1,EPC area; 2, TID area; 3, user data area. byte1+byte 2: starting address of the matching data. byte 1 is the high 8-bit of the starting address, and byte 2 is the low 8-bit of the starting address. byte 3: bit length of the data to be matched .<br>byte 4 ~ byte N: data content to be matched. |
| tag accessing password | 0x02 | U32 | 4 | Access password for tag checking. |

Reader response content: MID = 0x12

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| locking result | (M) | U8 | 1 | 0， Lock successful<br>1， antenna port error<br>2， Choosing parameter error<br>3， Locking parameter error<br>4， CRC check error<br>5， Insufficient power<br>6， data area overflow<br>7， data area locked<br>8， access password error<br>9， Other tag errors<br>10,tag lost reader sending command error |

## 5.2.19Inactivate EPC Tag

This instruction is used for the reader to inactivate the tag. The tag inactivated will be in permanent failure and this operation is irreversible. The operation this command defined is single.

The upper computer Instruction Content: MID = 0x13

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1<br>Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3. |

| | | | | |
|---|---|---|---|---|
| | | | | Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5.<br>Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| inactivation password | (M) | U32 | 4 | Access password for tag checking. |
| choose inactivation parameter | 0x01 | U8 | variable length | byte 0: data area to be matched; 1,EPC area; 2, TID area; 3, user data area.<br>byte1+byte 2: starting address of the matching data. byte 1 is the high 8-bit of the starting address, and byte 2 is the low 8-bit of the starting address. byte 3: bit length of the data to be matched .<br>byte 4 ~ byte N:data content to be matched. |

Reader response content: MID = 0x13

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| inactivation result | (M) | U8 | 1 | 0， Inactivated successful<br>1， antenna port parameter error<br>2， Choosing parameter error<br>3， CRC check error<br>4， Insufficient power<br>5， inactivation password errors<br>6， Other tag errors<br>7， tag lost reader sending command error |

## 5.2.20MONZA QT Tag Operation

This instruction is used for the reader to performs QT operation on Impinj MONZA tag chip with QT function. This function is only valid for tags with QT function. The operation this command defined is single.

The upper computer Instruction Content: MID = 0x14

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1.<br>Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3.<br>Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5.<br>Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| QT operation type | (M) | U8 | 1 | 0, Query QT configurate<br>1, Set QT configurate |
| tag choosing parameter | 0x01 | U8 | variable length | byte 0: data area to be matched; 1,EPC area; 2, TID area; 3, user data area. byte1+byte 2: starting address of the matching data. byte 1 is the high 8-bit of the starting address, and byte 2 is the low 8-bit of the starting address. byte 3: bit length of the data to be matched .<br>byte 4~ byte N:data content to be matched. |
| tag accessing password | 0x02 | U32 | 4 | Access password for tag checking. |
| QT parameter | 0x03 | U16 | 2 | Bit15:1,reduce the response distance in OPEN and SECURED states.;0,do not reduce the response distance in OPEN and SECURED states.<br>Bit14:0,the tag enters private mode;1,the tag enters public mode<br>Reserve other bits. |

Reader response content: MID = 0x14

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| QT result | (M) | U8 | 1 | 0， write successfully<br>1， antenna port parameter error<br>2， Choosing parameter error<br>3， QT parameter error<br>4， CRC check error<br>5， Insufficient power<br>6， access password error<br>7， Other tag errors<br>8， tag lost<br>9， The reader failed to send instructions |
| QT parameter query result | 0x01 | U16 | 2 | Bit15:1, reduce the response distance in OPEN and SECURED states;0,do not reduce the response distance in OPEN and SECURED states<br>Bit14:0, the tag enters private mode;1, the tag enters public mode<br>reserve other bits |

### 5.2.21Read 6B Tag

This instruction is used to read ISO18000-6B tag.

The upper computer Instruction Content: MID = 0x40

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1<br>Bit1: enabling antenna 2<br>Bit2: enabling antenna 3<br>Bit3: enabling antenna 4<br>Bit4: enabling antenna 5<br>Bit5: enabling antenna 6<br>Bit6: enabling antenna 7<br>Bit7: enabling antenna 8<br>...<br>Bit32: enabling antenna 32<br>one or multiple antennas can be designated at the same time |
| constant/single reading | (M) | U8 | 1 | 0， single read, the reader read one time on each enabling antenna |

| | | | | |
|---|---|---|---|---|
| | | | | then stop reading and automatically enter idle state.<br>1， continuous read, the reader keeps reading and stop reading after receiving a stop command. |
| Read content | (M) | U8 | 1 | 0， read only 6B TID<br>1， read 6B TID + user data<br>2， read only user data |
| user data reading parameter | 0x01 | U8 | 2 | byte 0: starting word address of the user data<br>byte 1: word length of the user data |
| TID to be matched | 0x02 | U8 | 8 | TID code of the 6B tag to be matched |

Reader response content: MID = 0x40

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Reading operation configuration result | (M) | U8 | 1 | 0， configured successfully<br>1， antenna port parameter error<br>2， Read content parameter error<br>3， user data area reading parameter error<br>4， Other errors |

The reader begin reading after receiving the reading command and it will upload the data content proactively after reading. And at the same time the flag bit of the notification should be set to be 1.

6B tag uploading content: MID=0x20

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| 6B tag TID | (M) | U8 | 8 | 6B tag TID have been read |
| Antenna ID | (M) | U8 | 1 | refer to the tag antenna ID number read by the reader<br>1, antenna 1<br>2, antenna 2<br>3, antenna 3<br>4, antenna 4 |
| RSSI | 0x01 | U8 | 1 | the tag RSSI value received |
| user reading result | 0x02 | U8 | 1 | 0， If the reading command includes |

| | | | | |
|---|---|---|---|---|
| | | | | reading TID, user data area parameter<br>1， read succeeded<br>2， no tag response<br>3， CRC error<br>4， Other reader errors |
| tag user data | 0x03 | U8 | variable length | tag user data have been read |

The reader will send a notification when the reading is end. And at the same time the flag bit of the notification should be set to be 1.

6B reading end notification: MID=0x21

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| end reason for the reading | (M) | U8 | 1 | 0， single operation finished receive stopping command<br>1， hardware error caused reading interruption |

### 5.2.22Write 6B Tag

This instruction is used for the reader to write 6B tag . The writing operation defined by this command is single.

The upper computer Instruction Content: MID = 0x41

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1.<br>Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3.<br>Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5.<br>Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| TID of the tag to be written | (M) | U8 | 8 | TID code of the tag to be written |
| starting address | (M) | U8 | 1 | word starting address of the data |

| | | | | |
|---|---|---|---|---|
| | | | | area of the tag to be written |
| data content | (M) | U8 | variable length | data content to be written. |

Reader response content: MID = 0x41

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| writing result | (M) | U8 | 1 | 0， write successfully antenna port parameter error<br>1， Writing parameter error<br>2， Other errors |
| byte address that failed to write | 0x01 | U8 | 1 | the reader need to upload the failed tag word address if the writing fail |

### 5.2.236B Tag Locking

This instruction is used for the reader to lock 6B tag. This operation is irreversible. And the operation this command defined is single.

The upper computer Instruction Content: MID = 0x42

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1.<br>Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3.<br>Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5.<br>Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| tag TID to be locked | (M) | U8 | 8 | TID code of the tag to be locked |
| locking address | (M) | U8 | 1 | byte address of the data to be locked |

Reader response content: MID = 0x42

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Locking result | (M) | U8 | 1 | 0， Lock successful<br>1， Other errors |
| byte address that failed to write | 0x01 | U8 | 1 | the reader need to upload the failed tag word address if the writing fail |

### 5.2.246B Tag Locking Query

This instruction is used for the reader to query the data of 6B tag. The operation this command defined is single.

\The upper computer Instruction Content: MID = 0x43

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1.<br>Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3.<br>Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5.<br>Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| tag TID to be locked | (M) | U8 | 8 | TID code of the tag to be written |
| Data address | (M) | U8 | 1 | Means byte address whose data locking state is to be queried. |

Reader response content: MID = 0x43

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| query result | (M) | U8 | 1 | 0,query successful<br>1,Other errors |
| data locking state | 0x01 | U8 | 1 | 0,unlocked<br>1,locked |

### 5.2.25Read National-standard Tag

This instruction is used for the configuration of the tag parameters and start card reading. The tag EPC code need to be acquired before and tag reading, so tag reading operation will get the EPC code.

The upper computer Instruction Content: MID = 0x50

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1.<br>Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3.<br>Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5.<br>Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| constant/single reading | (M) | U8 | 1 | 0, single read, the reader read one time on each enabling antenna then stop reading and automatically enter idle state. 1, constant read, the reader keeps reading and stop reading after receiving a stop command. |
| choose reading parameters | 0x01 | U8 | variable length | byte 0: data area to be matched, 0x00, tag information area ; 0x10,tag coding area; 0x20, tag secure area ; 0x30~0x3F,sub-user area 0~15.<br>Byte1+byte 2: starting address of the matching data. byte 1 is the high 8-bit of the starting address, and byte 2 is the low 8-bit of the starting address. byte 3: bit length of the data to be matched .<br>byte 4~ byte N:data content to be matched. |
| tag information area (TID) reading parameter | 0x02 | U8 | 2 | byte 0:TID reading mode configuration 0, the length of the TID is self-adaptable, but the maximum length should not be more than the length defined by byte 1.1, read TID |

| | | | | |
|---|---|---|---|---|
| | | | | according to the length that byte 1 defined.<br>byte 1: length of the TID data word(word, 16bits, similarly hereinafter) need to be read by the reader. |
| user area reading parameter | 0x03 | U8 | 4 | byte 0: sub-user area ,0x30~0x3F.<br>byte 0+byte 1:starting address of the matching data. byte 0 is the high 8-bit of the starting address, and byte 1 is the low 8-bit of the starting address.<br>Byte 2: The word length of the user data that need to be read |
| tag reading password | 0x05 | U32 | 4 | reading password for tag checking . |

Reader response content: MID = 0x50

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Reading configuration result | (M) | U8 | 1 | 0， configured successfully<br>1， antenna port parameter error<br>2， Choosing reading parameter error tag information area (TID) reading parameter error<br>3， User area reading parameter error<br>4， Other parameter errors |

The reader begin reading after receiving the reading command and it will upload the data content proactively after reading. And at the same time the flag bit of the notification should be set to be 1.

National-standard tag data content uploading content: MID=0x30

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Tag coding | (M) | U16 | variable length | tag coding data have been read |
| tag length | (M) | U16 | 2 | tag coding length have been read |
| Antenna ID | (M) | U8 | 1 | refer to the tag antenna ID number read by the reader<br>1, antenna 1 |

| | | | | |
|---|---|---|---|---|
| | | | | 2, antenna 2<br>3,antenna 3<br>4, antenna 4<br>… |
| RSSI | 0x01 | U8 | 1 | the tag RSSI value received |
| reading result of the tag data | 0x02 | U8 | 1 | 0， If the reading command includes tag information area (TID) and user data<br>1， read succeeded<br>2， no tag response<br>3， CRC error<br>4， data area locked<br>5， Data area overflow<br>6， Reading password error<br>7， Insufficient authority<br>8， Checking failed<br>9， Other tag errors<br>10, Other reader errors |
| tag information(TID) data | 0x03 | U16 | variable length | tag information area (TID) have been read |
| tag user area data | 0x04 | U16 | variable length | data of the tag data area have been read |

The reader will automatically upload a ending operation massage when the reading is end. And in the meanwhile, the flag bit of the notification should be set to be 1.

National-standard tag reading end notification: MID=0x31

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| end reason for the reading | (M) | U8 | 1 | 0， single operation finished<br>1， receive stopping command<br>2， hardware error caused reading interruption |

## 5.2.26Write National-standard Tag

This instruction is used for the reader to write the national-standard tag. The writing operation defined by this command is single.

The upper computer Instruction Content: MID = 0x51

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1.<br>Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3.<br>Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5.<br>Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| data area | (M) | U8 | 1 | data area to be written:<br>0x10,tag coding area<br>0x20,tag secure area<br>0x30~0x3F,sub-user area 0~15 |
| word starting address | (M) | U16 | 2 | word starting address of the tag data area to be written. |
| data content | (M) | U16 | variable length | data content to be written. |
| choose writing parameters | 0x01 | U8 | variable length | byte 0: data area to be matched, 0x00,tag information area ;0x10,tag coding area ;0x20,tag secure area ;0x30~0x3F,sub-user area 0~15.<br>Byte1+byte 2: starting address of the matching data. byte 1 is the high 8-bit of the starting address, and byte 2 is the low 8-bit of the starting address. byte 3: bit length of the data to be matched .<br>byte 4~ byte N:data content to be matched. |
| tag writing password | 0x02 | U32 | 4 | It is used for the writing password for tag checking. |

Reader response content: MID = 0x51

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| writing result | (M) | U8 | 1 | 0， write successfully<br>1， antenna port parameter error<br>2， choosing parameter error<br>3， writing parameter error<br>4， CRC check error<br>5， Insufficient power<br>6， data area overflow<br>7， data area locked<br>8， writing password error<br>9， Insufficient authority<br>10， checking failed<br>11， Other tag errors<br>12， tag lost<br>13， reader sending command error |
| write failed word address | 0x01 | U16 | 2 | if the writing fail, the reader need to upload the failed tag address |

### 5.2.27Lock National-standard Tag

This instruction is used for the reader to lock or unlock the tag. The operation this command defined is single.

The upper computer Instruction Content: MID = 0x52

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1<br>Bit1: enabling antenna 2<br>Bit2: enabling antenna 3<br>Bit3: enabling antenna 4<br>Bit4: enabling antenna 5<br>Bit5: enabling antenna 6<br>Bit6: enabling antenna 7<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| locking operation area | (M) | U8 | 1 | tag area to be locked<br>0x00,tag information area<br>0x10,tag coding area |

| | | | | |
|---|---|---|---|---|
| | | | | 0x20,tag secure area<br>0x30~0x3F,sub-user area 0~15 |
| 锁参数 | (M) | U8 | 1 | locking parameter to be performed:<br>0x00,Readable and writable.<br>0x01,Readable but not writable.<br>0x02,not readable but writable.<br>0x03,not readable and not writable.<br>0x11,Set no identification is required under secure mode The operation area must be tag secure area.0x12,Set identification is required but no secure communications is required under secure mode. The operation area must be tag secure area.<br>0x13,Set identification and secure communications are required under secure mode ; The operation area must be tag secure area. |
| choose locking parameter | 0x01 | U8 | variable length | byte 0: data area to be matched, 0x00,tag information area ;0x10,tag coding area ;0x20,tag secure area ;0x30~0x3F,sub-user area 0~15.<br>Byte1+byte 2: starting address of the matching data. byte 1 is the high 8-bit of the starting address, and byte 2 is the low 8-bit of the starting address. byte 3: bit length of the data to be matched .<br>byte 4~ byte N:data content to be matched. |
| tag locking password | 0x02 | U32 | 4 | locking password for tag checking |

Reader response content: MID = 0x52

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| locking result | (M) | U8 | 1 | 0， lock successfully<br>1， antenna port error<br>2， choosing parameter error |

| | | | | |
|---|---|---|---|---|
| | | | | 3，locking operation parameter error<br>4，CRC check error<br>5，Insufficient power<br>6，data area overflow<br>7，data area locked<br>8，locking password error<br>9，Insufficient authority<br>10，checking failed<br>11，Other tag errors<br>12，tag lost<br>13，reader sending command error |

### 5.2.28Inactivate National-standard Tag

This instruction is used for the reader to inactivate national-standard tag. The inactivated tag will be invalid permanently. This operation is irreversible. And the operation this command defined is single.

The upper computer Instruction Content: MID = 0x53

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1.<br>Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3.<br>Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5.<br>Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>one or multiple antennas can be designated at the same time |
| choose inactivation parameter | 0x01 | U8 | variable length | byte 0: data area to be matched,<br>0x00,tag information area ;0x10,tag coding area ;0x20,tag secure area ;0x30~0x3F,sub-user area |

| | | | | |
|---|---|---|---|---|
| | | | | 0~15.<br>Byte1+byte 2: starting address of the matching data. byte 1 is the high 8-bit of the starting address, and byte 2 is the low 8-bit of the starting address. byte 3: bit length of the data to be matched .<br>byte 4~ byte N:data content to be matched. |

Reader response content: MID = 0x53

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| inactivation result | (M) | U8 | 1 | 0， Inactivate successfully<br>1， antenna port parameter error<br>2， choosing parameter error<br>3， CRC check error<br>4， Insufficient power<br>5， inactivation password error<br>6， Insufficient authority<br>7， checking failed<br>8， Other tag errors<br>9， tag lost reader sending command error |

## 5.2.29Antenna Switching Notification

This instruction is used for the reader to upload antenna number and notify the concentrator to switch to the correct antenna number when the reader switch antenna. The command will be transmitted to the concentrator via 485. The 485 address should keep the same as its port number. For example, the 485 address of the concentrator connected with antenna 1 should be set to be 1.

Command content: MID = 0x54

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna NO. | (M) | U8 | 1 | 0~15 |

### 5.2.30Stop Command

This instruction is used for the reader to stop all RFID operation and enter idle state.

The upper computer Instruction Content: MID = 0xFF

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID = 0xFF

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| query result | (M) | U8 | 1 | 0， Stop successfully<br>1， system error |

# 6 Upgrade

## 6.1 Upgrade function description

This command is used for the application software and baseband software upgrading. During the upgrading process, the upper computer divides the upgrading files into a certain number of bytes. The upper computer send a data package whose serial number is 0x00000000 to start the upgrading and send data package numbered 0xFFFFFFFF as an end. The reader must confirm every upgrading package for the upper computer. And the upper computer must send next upgrading data package after confirming the current data package.

## 6.2 Upgrade Messages List

Reader Configuring Management Command List

| Command ID(MID) | Command Description | Command executable status |
|---|---|---|
| 0x00 | Reader application software upgrading | Idle state |
| 0x01 | baseband software upgrading | Idle state |

### 6.2.1Reader Application Software Upgrading

This instruction is used for the upgrading for the reader application software.

The upper computer Instruction Content: MID = 0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Upgrading package sequential NO. | (M) | U32 | 4 | Sequential number of the upgrading package begins with 0x00000000 and end with0xFFFFFFFF. |
| Upgrading package sequential content | (M) | U8 | variable length | Upgrading data content |

Reader response content: MID = 0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Upgrading package sequential NO. | (M) | U32 | 4 | Upgrading package sequential number sent by the upper computer |
| Upgrading package confirming result | (M) | U8 | 1 | 0,succeeded<br>1,failed |

### 6.2.2Baseband Software Upgrading

This instruction is used for the upgrading for the reader baseband software.

The upper computer Instruction Content: MID = 0x01

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Upgrading package sequential NO. | (M) | U32 | 4 | Sequential number of the upgrading package begins with 0x00000000 and end with 0xFFFFFFFF. |
| Upgrading package sequential content | (M) | U8 | variable length | Upgrading data content. |

Reader response content: MID = 0x01

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Upgrading package sequential NO. | (M) | U32 | 4 | Upgrading package sequential number sent by the upper computer |
| Upgrading package confirming result | (M) | U8 | 1 | 0,succeeded<br>1,failed |

# 7 Testing Command

## 7.1 Instruction for Testing Function

This command is used for the debugging and testing for the reader, including power calibration and carrier radio frequency index testing.

## 7.2 Reader Testing Command List

Reader Testing Command List

| Command | Command Description | Command executable status |
|---|---|---|
| 0x00 | transmit carrier instructions | Idle state |
| 0x01 | R2000 DC bias calibration | Idle state |
| 0x02 | parameter query for R2000 DC bias calibration | any state |
| 0x03 | reader power calibration | Idle state |
| 0x04 | Parameter query for reader power calibration | any state |
| 0x05 | Reader standing wave detection for antenna port | Idle state |

### 7.2.1Send Carrier Command

This instruction is used for designating the reader frequency and for the antenna port to send RF carrier signal.

The upper computer Instruction Content: MID = 0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| antenna port | (M) | U32 | 4 | Bit0: enabling antenna 1. |

| | | | | |
|---|---|---|---|---|
| | | | | Bit1: enabling antenna 2.<br>Bit2: enabling antenna 3.<br>Bit3: enabling antenna 4.<br>Bit4: enabling antenna 5.<br>Bit5: enabling antenna 6.<br>Bit6: enabling antenna 7.<br>Bit7: enabling antenna 8.<br>...<br>Bit32: enabling antenna 32.<br>Only can be designated at the same time. |
| Frequency number | (M) | U8 | 1 | It is used to designate the sending channel number in the current frequency. For example, in 920~925MHz , channel 0 means 920.625;channel 8 menas922.875;channel 15 menas924.375 |

Reader response content: MID=0x00

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Carrier sending result | (M) | U8 | 1 | 0， Carrier sent successfully<br>1， the hardware does not support the frequency parameter<br>2， the reader hardware does not support the port parameter<br>3， phase-locked loop locking failed<br>4， other errors |

## 7.2.2R2000 DC bias calibration

This instruction is used to calibrate R2000 DC bias parameters. The designated antenna port carrier should be on before calibration. Save the current calibration value and end the calibration operation when the calibration parameters are adjusted to the minimum carrier transmission power.

The upper computer Instruction Content: MID = 0x01

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| calibration parameters | (M) | S8 | 1 | -127~+127 |
| operation type | (M) | U8 | 1 | 0，Calibration<br>1，Calibration end and save the current calibration value. |

Reader response content: MID=0x01

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Calibration result | (M) | U8 | 1 | 0，Operation parameter<br>1，save failed<br>2，Other errors |

### 7.2.3Parameter Query for R2000 DC Bias Calibration

This instruction is used to parameter query for R2000 DC bias calibration.The designated antenna port carrier should be on before calibration. Save the current calibration value and end the calibration operation when the calibration parameters are adjusted to the minimum carrier transmission power.

The upper computer Instruction Content: MID = 0x02

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x02

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| calibration parameter | (M) | S8 | 1 | -127~+127 |

### 7.2.4Reader Power Calibration

This instruction is used to calibrate the reader power. The designated antenna port carrier should be on before calibration. When the calibration parameter is adjusted to a specified power, the current power level is calibrated. When all the power saves the current calibration value, the calibration operation is end.

The upper computer Instruction Content: MID = 0x03

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| sub-frequency range to be calibrated | (M) | U8 | 1 | 0~4,according to the difference of hardware implementation, in order to meet the requirement of power flatness, it may need to be calibrated in several sub-frequency range under the current range setting. And this parameter is used to specify the sub-frequency range. |
| Power level to be calibrated | (M) | U8 | 1 | 0~36,the unit being dBm, stepping 1 dbm |
| Power calibration parameter | (M) | U8 | 1 | 0~255,is used for power fine-tuning calibration. Calibration value 0 means the power of the current power scale is not calibrated. |
| operation type | (M) | U8 | 1 | 0， Calibration<br>1， Calibration end. Save the calibration values of all power levels in the power-off preservation parameter area. |

Reader response content: MID=0x03

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Calibration result | (M) | U8 | 1 | 0， Operation succeeded<br>1， Parameter save failed<br>2， Other errors |

## 7.2.5Calibration Parameter Query for the Reader Power.

This instruction is used for the upper computer to query the power calibration parameter of the reader.

The upper computer Instruction Content: MID = 0x04

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| calibrated sub-frequency range | (M) | U8 | 1 | 0~4,according to the difference of hardware implementation, in order to meet the requirement of power flatness, it may need to be calibrated in several sub-frequency range under the current range setting. And this parameter is used to specify the sub-frequency range. |
| power scale | (M) | U8 | 1 | 0~36,the unit being dBm, stepping 1 dbm |

Reader response content: MID=0x04

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| calibrated sub-frequenc y range | (M) | U8 | 1 | 0~4,according to the difference of hardware implementation, in order to meet the requirement of power flatness, it may need to be calibrated in several sub-frequency range under the current range setting. And this parameter is used to specify the sub-frequency range. |
| power scale | (M) | U8 | 1 | 0~36,the unit being dBm, stepping 1 dbm, should be equal to the power scale parameter sent by the upper computer. |
| Power calibration parameter | (M) | U8 | 1 | 0~255,is used for power fine-tuning calibration. Calibration value 0 means the power of the current power scale is not calibrated |

## 7.2.6Standing Wave Detection for the Reader Antenna Port

This instruction is used for the standing wave detection for the reader antenna port.

The designated antenna port carrier should be on before calibration. At this time, the standing wave detection value obtained through the query is the forward and backward power detection value of the current port.

The upper computer Instruction Content: MID = 0x05

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| - | - | - | - | - |

Reader response content: MID=0x05

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Forward power detection value | (M) | U8 | 1 | Normalized value of forward power detection |
| Backward power detection value | (M) | U8 | 1 | Normalized value of backward power detection |

### 7.2.7Reader Sequential Number Burning

This instruction is used for the burning for the reader production sequential number. And it cannot be repeat burned.

The upper computer Instruction Content: MID = 0x10

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| Reader sequential number | (M) | U8 | variable length | ASCII Code<br>Example :“R8008000019010 000001”<br>R: Prefix of Product Model, R means reader, M means module.<br>8008:4-digit product model<br>0000:4-digit client number<br>0000 means non-specified client<br>1901:4-digit production batch number (year and week)<br>0000001:7-digit production serial number. |

Reader response content: MID=0x10

| parameter name | PID | data type | parameter length | parameter description |
|---|---|---|---|---|
| configuration result | (M) | U8 | 1 | 0，configured successfully<br>1,Other errors. |

# 8 Appendix 1

*Note：The CRC16 calculation does not include frame headers#define U8 unsigned char
#define U16 unsigned short
#define CRC_16_CCITT 0x1021
static const U16 CRC_CCITT_table[256] = {

0x0000, 0x1021, 0x2042, 0x3063, 0x4084, 0x50a5, 0x60c6, 0x70e7, 0x8108, 0x9129, 0xa14a, 0xb16b, 0xc18c, 0xd1ad, 0xe1ce, 0xf1ef,

0x1231, 0x0210, 0x3273, 0x2252, 0x52b5, 0x4294, 0x72f7, 0x62d6, 0x9339, 0x8318, 0xb37b, 0xa35a, 0xd3bd, 0xc39c, 0xf3ff, 0xe3de,

0x2462, 0x3443, 0x0420, 0x1401, 0x64e6, 0x74c7, 0x44a4, 0x5485, 0xa56a, 0xb54b, 0x8528, 0x9509, 0xe5ee, 0xf5cf, 0xc5ac, 0xd58d,

0x3653, 0x2672, 0x1611, 0x0630, 0x76d7, 0x66f6, 0x5695, 0x46b4, 0xb75b, 0xa77a, 0x9719, 0x8738, 0xf7df, 0xe7fe, 0xd79d, 0xc7bc,

0x48c4, 0x58e5, 0x6886, 0x78a7, 0x0840, 0x1861, 0x2802, 0x3823, 0xc9cc, 0xd9ed, 0xe98e, 0xf9af, 0x8948, 0x9969, 0xa90a, 0xb92b,

0x5af5, 0x4ad4, 0x7ab7, 0x6a96, 0x1a71, 0x0a50, 0x3a33, 0x2a12, 0xdbfd, 0xcbdc, 0xfbbf, 0xeb9e, 0x9b79, 0x8b58, 0xbb3b, 0xab1a,

0x6ca6, 0x7c87, 0x4ce4, 0x5cc5, 0x2c22, 0x3c03, 0x0c60, 0x1c41, 0xedae, 0xfd8f, 0xcdec, 0xddcd, 0xad2a, 0xbd0b, 0x8d68, 0x9d49,

0x7e97, 0x6eb6, 0x5ed5, 0x4ef4, 0x3e13, 0x2e32, 0x1e51, 0x0e70, 0xff9f, 0xefbe, 0xdfdd, 0xcffc, 0xbf1b, 0xaf3a, 0x9f59, 0x8f78,

0x9188, 0x81a9, 0xb1ca, 0xa1eb, 0xd10c, 0xc12d, 0xf14e, 0xe16f, 0x1080, 0x00a1, 0x30c2, 0x20e3, 0x5004, 0x4025, 0x7046, 0x6067,

0x83b9, 0x9398, 0xa3fb, 0xb3da, 0xc33d, 0xd31c, 0xe37f, 0xf35e, 0x02b1, 0x1290, 0x22f3, 0x32d2, 0x4235, 0x5214, 0x6277, 0x7256,

0xb5ea, 0xa5cb, 0x95a8, 0x8589, 0xf56e, 0xe54f, 0xd52c, 0xc50d, 0x34e2, 0x24c3, 0x14a0, 0x0481, 0x7466, 0x6447, 0x5424, 0x4405,

0xa7db, 0xb7fa, 0x8799, 0x97b8, 0xe75f, 0xf77e, 0xc71d, 0xd73c, 0x26d3, 0x36f2, 0x0691, 0x16b0, 0x6657, 0x7676, 0x4615, 0x5634,

0xd94c, 0xc96d, 0xf90e, 0xe92f, 0x99c8, 0x89e9, 0xb98a, 0xa9ab, 0x5844, 0x4865, 0x7806, 0x6827, 0x18c0, 0x08e1, 0x3882, 0x28a3,

```
    0xcb7d, 0xdb5c, 0xeb3f, 0xfb1e, 0x8bf9, 0x9bd8, 0xabbb, 0xbb9a, 0x4a75, 0x5a54, 0x6a37, 0x7a16, 0x0af1, 0x1ad0, 0x2ab3, 0x3a92,
    0xfd2e, 0xed0f, 0xdd6c, 0xcd4d, 0xbdaa, 0xad8b, 0x9de8, 0x8dc9, 0x7c26, 0x6c07, 0x5c64, 0x4c45, 0x3ca2, 0x2c83, 0x1ce0, 0x0cc1,
    0xef1f, 0xff3e, 0xcf5d, 0xdf7c, 0xaf9b, 0xbfba, 0x8fd9, 0x9ff8, 0x6e17, 0x7e36, 0x4e55, 0x5e74, 0x2e93, 0x3eb2, 0x0ed1, 0x1ef0
};


#define CRC_16_CCITT                0x1021
/****** The function name:CRC16_CCITT() **********************
*
* Function description:
* This function is the system's CRC16 calculation function, will be given the CRC value and * the data to be calculated to do the CRC calculation and give the calculation result to the *previous given CRC value.
* Calculation formula:
*                 CRC_16= x^16 + x^12 + x^5 + 1
*
*     Call parameters:
*           pchMsg            Data pointer to be evaluated
*           wDataLen          The length of the data
*     Return value:
*           wCRC              The newly computed CRC value of the function
*     Function code:
*/
unsigned short CRC16_CCITT(unsigned char* pchMsg, unsigned short wDataLen) // 1. MSB first; 2. Initial value is 0000;
{
    unsigned char i, chChar;
    unsigned short wCRC = 0;
    while (wDataLen--)
    {
        chChar = *pchMsg++;
        wCRC ^= (((unsigned short)chChar) << 8);
        for (i = 0; i < 8; i++)
        {
            if (wCRC & 0x8000)
                wCRC = (wCRC << 1) ^ CRC_16_CCITT;
            else
```

```
                    wCRC <<= 1;
                }
            }

            return wCRC;
}


/******Function Name: CRC16_CCITT_CalateByte() *********************
*
* Function description:
* This function is the system's CRC16 calculation function, will be given the CRC value and *
the data to be calculated to do the CRC calculation and give the calculation result to        *
the previous given CRC value.
*     Calculation formula:
*                CRC_16= x^16 + x^12 + x^5 + 1
*
*     Call parameters:
*           CRC_byte            Data to calculate
*           last_CRC_value    The CRC value calculated last time
*     Return value
*          The newly computed CRC value of the function
*   Function code:
*/

U16 CRC16_CCITT_CalateByte(U8 CheckByte, U16 LastCRC)
{
      return (LastCRC << 8) ^ CRC_CCITT_table[(LastCRC >> 8) ^ CheckByte];
}

/******Function Name:CRC16_CalculateBuf() *********************
*
* Function description:
* This function is the calculation function of the system CRC16, calculating the check value *
of CRC_16 for the specified address and number of data.
* Calculation formula:
*                CRC_16= x^16 + x^15 + x^2 + 1
*
*     Call parameters:
*           ptr        Calculated data starting address
```

```
*          len          Calculated data length
*     Return value:
*           CRC value calculated by the function
*     Function code:
*/

U16 CRC16_CCITT_CalculateBuf(U8 *ptr, U16 len)
{

    U16 crc_result = 0x0000;

    while (len--)
    {
        crc_result = CRC16_CCITT_CalateByte(*ptr, crc_result);
        ptr++;
    }


    return crc_result;
}
```