
RFID Reader Data Communication Protocol

Written by:	Date:
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Revised Record

Version	Contents	Revised by/date

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 ;

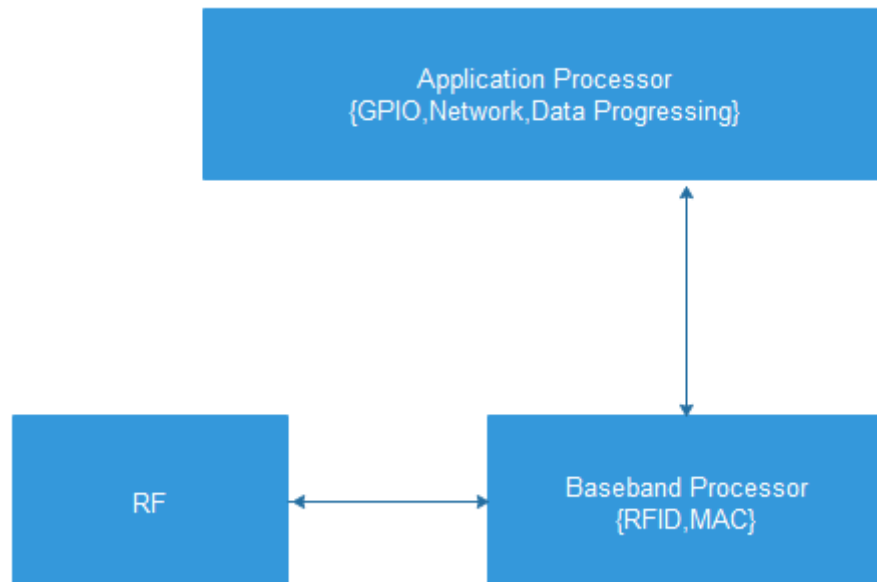
S32: signed long.

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.

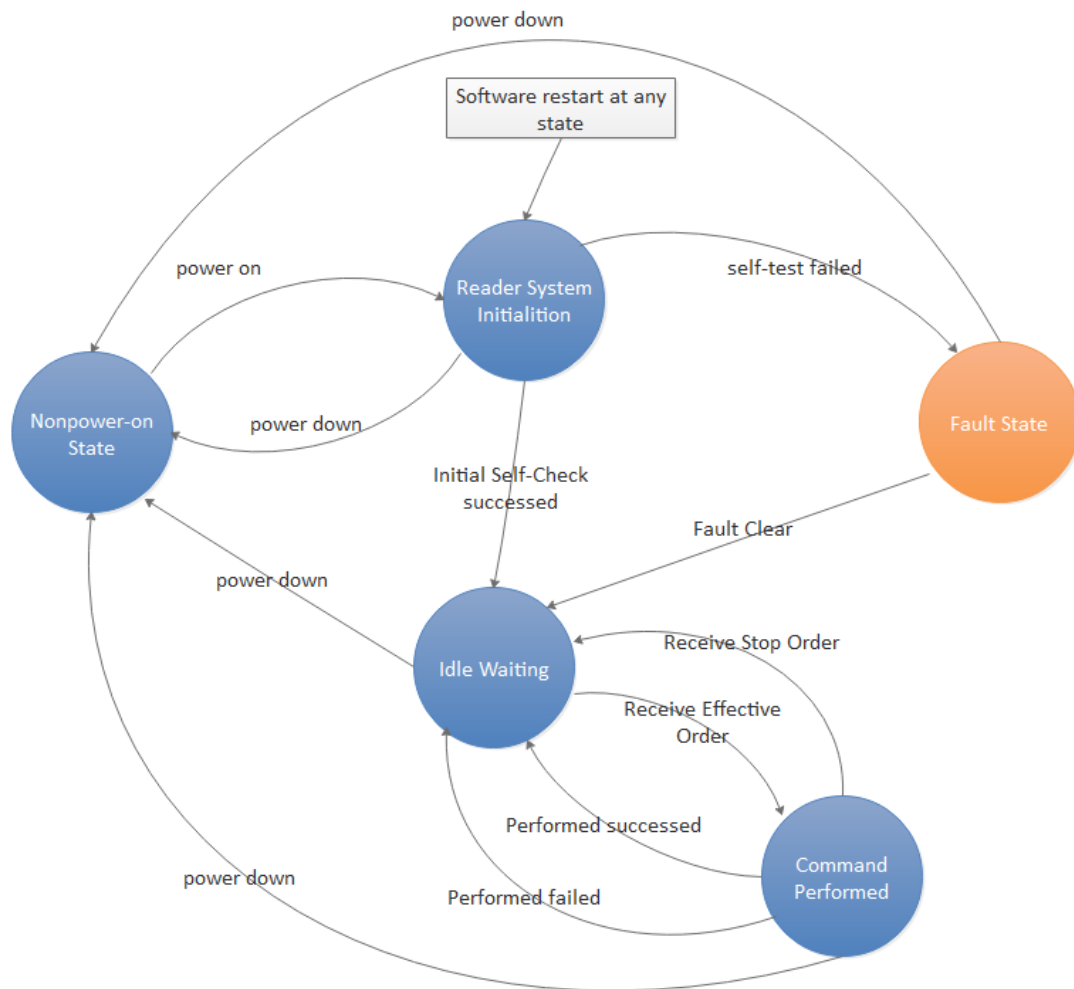
Application Processor: Mainly responsible for network communication, data processing, GPIO and other application-related processing for the reader and The upper computer .

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



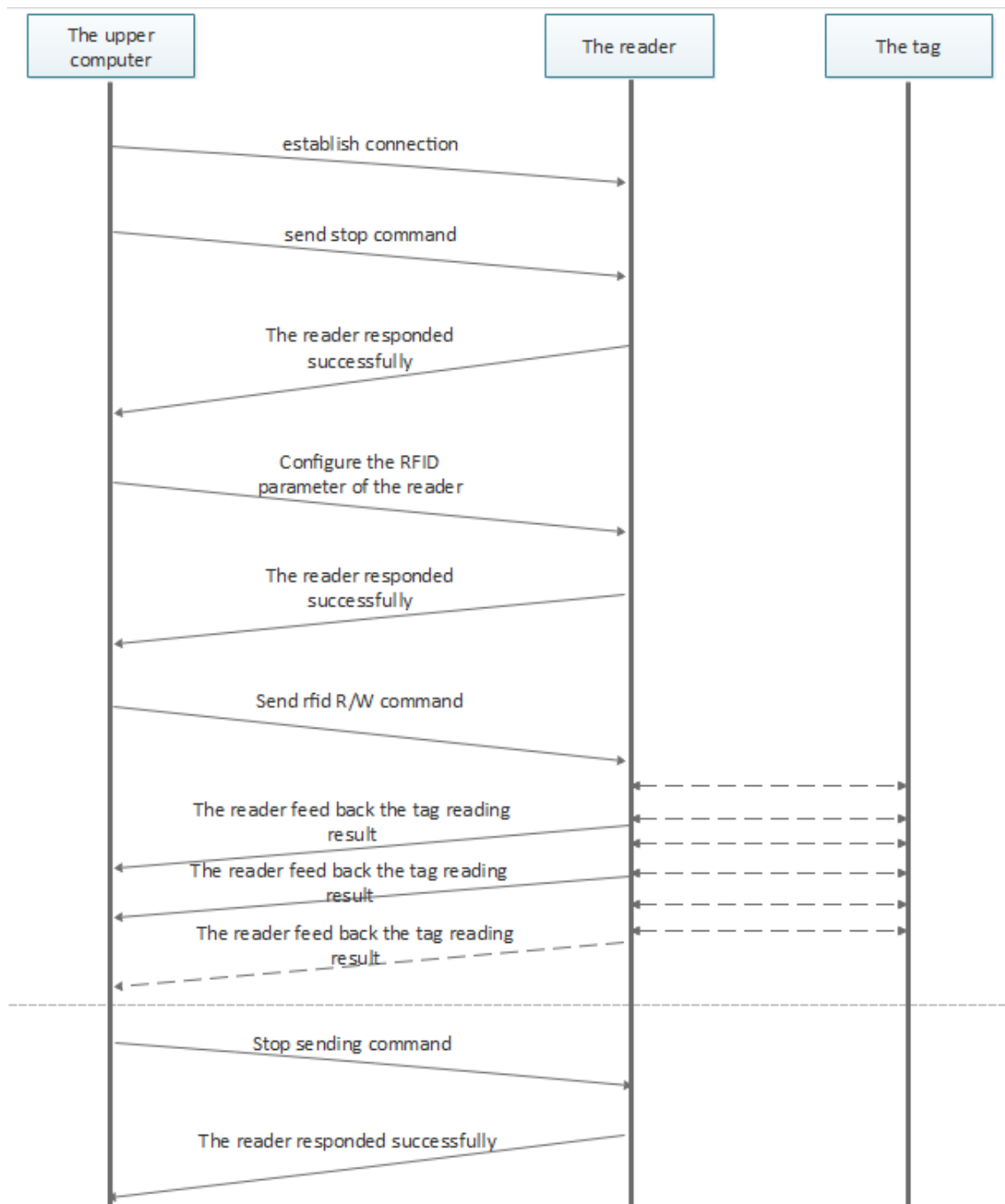
Reader system initialization: start the operating system, and the hardware status of each functional module do self-checking, and the parameters of the reader system are initialized. In this state, the reader cannot receive and execute any instructions from the upper computer .

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 .

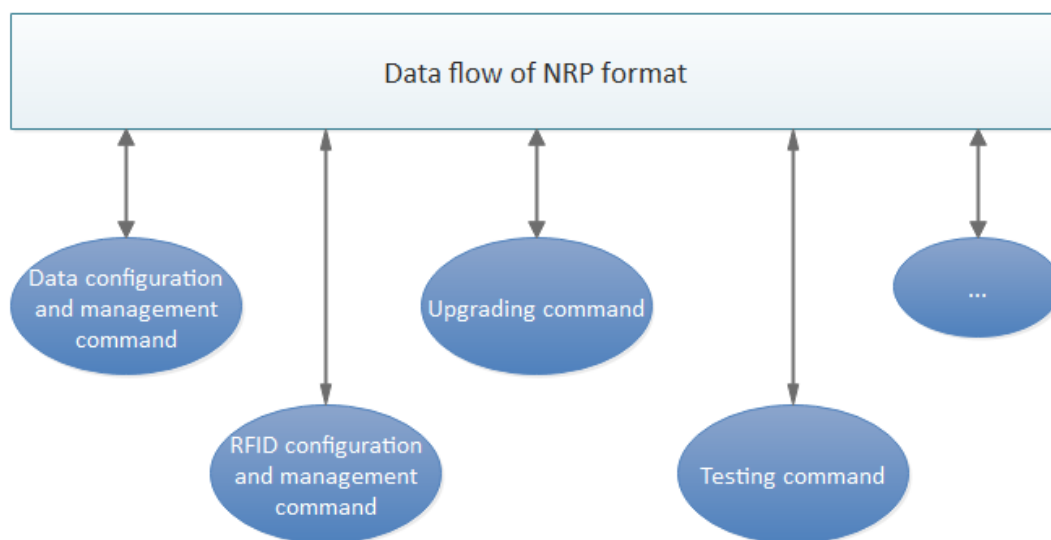
2.3 RFID R/W Basic Flow



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. 1~14,reserve, 15,Antenna Hub Controlling Protocol. 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. 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. 1, Means notification sent by the reader
11-8	Message Category Number	0, reader error or alarm message. 1, Reader configuration and message management. RFID Configuration and operation messages. 2, Reader log messages. Reader application processor software and baseband software upgrade message. 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.

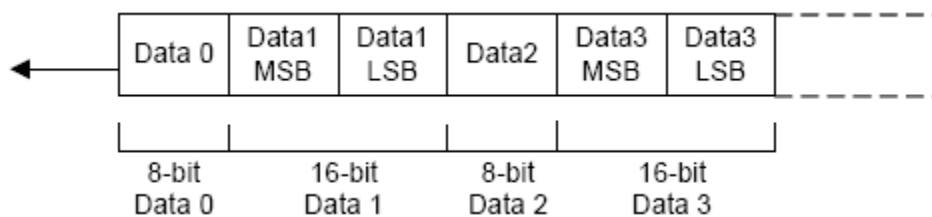
Serial device address: for identifying RS485 address for target reader the value range is 0x00~0xFF. The message will include this field only when the RS485Flag Bit in Protocol Control Word is set to be 1. otherwise, this field should not be included in this message.

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 polynomial 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)	Dat a1	...
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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 1, Unsupported Protocol Version No. 2, Wrong Type Mode CRC check error 3, Wrong MID 4, Protocol Control Word other errors 5, The instruction cannot be executed in current status 6, The instruction queue is full 7, Incomplete message parameters 8, Frame Length Over Limitation 9, Other errors
Reader status	(M)	U8	1	0, idle state 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	configure 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” <u>R</u> : Prefix of Product Model, R means reader, M means module <u>8008</u> : 4-digit product model <u>0000</u> : 4-digit customer code, 0000 is means unspecified customer <u>1901</u> : 4 digit production lot(year & week) <u>0000001</u> : 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

4.2.2 Query 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

4.2.3 Configure 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 1,19200 bps 2,115200 bps 3,230400 bps 4,460800bps others, unsupported 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 1, failed, this baud rate is unsupported

4.2.4 Query 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 1,19200 bps 2,115200 bps

				3,230,400 bps
				4,460,800 bps

4.2.5 Configure 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 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 0xFFFFF00
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 1, Reader IP parameter error

4.2.6 Query Reader's 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 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

4.2.7 Query Reader's 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

4.2.8 Configure 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 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 1, Server IP parameter error

4.2.9 Query 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 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.

4.2.10 Configure 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 1, output high level
GPO2	0x02	U8	1	0, output low level 1, output high level
GPO3	0x03	U8	1	0, output low level 1, output high level
GPO4	0x04	U8	1	0, output low level 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 1, the reader hardware does not support the port parameter

4.2.11 Query 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
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			length	
-	-	-	-	-

Reader response content: MID=0x0A

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

4.2.12 Configure 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 1, GPI2 2, GPI3 3, GPI4 4, GPI5 5, GPI6
Trigger start condition	(M)	U8	1	0, trigger off 1, Low electrical level triggering 2, High electrical level

				triggering 3, Rising edge triggering 4, Falling edge triggering 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 1, Low electrical level triggering 2, High electrical level triggering 3, Rising edge triggering 4, Falling edge triggering 5, Random edge triggering 6, Delay stop 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 1--upload

Reader response content: MID=0x0B

parameter name	PID	data type	parameter length	parameter description
configuration result	(M)	U8	1	0, configured successfully 1, the reader hardware does not support the port parameter 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 1, GP2 2, GP3 3, GP4 4, GP5 5, GP6
GPI port electrical level	(M)	U8	1	0, Low electrical level 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 1, GPI2 2, GPI3 3, GPI4 4, GPI5 5, GPI6
GPI port electrical level	(M)	U8	1	1,Low electrical level 0,High electrical level
Current system seconds	(M)	U32	4	UTC second
Current system microsecond time	(M)	U32	4	UTC microsecond time

4.2.13 Query 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 1, GPI2 2, GPI3 3, GPI4 4, GP5 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 1, Low electrical level triggering 2, High electrical level triggering 3, Rising edge triggering 4, Falling edge triggering 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 1, Low electrical level triggering 2, High electrical level triggering 3, Rising edge triggering 4, Falling edge triggering 5, Random edge triggering 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 1--upload
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4.2.14 Configure 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 1, Enable Wiegand communication port
Wiegand communication format	(M)	U8	1	0, Wiegand 26 1, Wiegand 34 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. 0, Specified transmission of EPC end data 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 1, The reader does not support the Wiegand interface 2, Unsupported Wiegand communication format 3, Unsupported data content

4.2.15 Query 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 1, Enable Wiegand communication port
Wiegand communication format	(M)	U8	1	0, Wiegand 26 1, Wiegand 34 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. 0, Specified transmission of EPC end data 1, Specified transmission of TID end data
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4.2.16 Restart 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.

4.2.17 Configure 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 1, RTC setup failed.

4.2.18 Query 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

4.2.19 Confirm 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 message. And the flag bit is set to be 0 when The upper computer send the confirmation message.

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 message No.	(M)	U32	4	Message No. of the connection confirmation. This number should be equal to the sender's message No.

4.2.20 Configure 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
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Reader MAC	(M)	U8	6	MAC standard format
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Reader response content: MID=0x13

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

4.2.21 Restore 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 1,Other errors

4.2.22 Configure 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 1,19200 bps 2,115200 bps 3,230400 bps 4,460800 bps
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Reader response content: MID=0x15

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

4.2.23 Query RS485 Parameters of the Reader

This instruction is used for The upper computer software to query the RS485 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 1,19200 bps 2,115200 bps 3,230400 bps 4,460800 bps

4.2.24 Buzzer 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 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 1. Set-up failed

4.2.25 Buzzer 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 1.buzzer ring Byte1:0.buzzer ring for once 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 1.Set-up failed

4.2.26 Acquire 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 0xFFFFFFFF 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 0xFFFFFFFF.
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 1,fail
--	-----	----	---	---------------------

4.2.28 Delete 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 1. Delete failed

4.2.29 Set 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 2. 2# relay 3. 3# relay 4. 4# relay
relay close time	(M)	U16	1	unit: second 0001-- relay close for 1 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 1.Set-up failed
--	-----	----	---	-------------------------------------

4.2.30 Acquire 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 2. 2# relay 3. 3# relay 4. 4# relay
relay close time	(M)	U16	1	unit: second 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 message
0x01	EPC reading end message
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

5.2.1 Query 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: 0, National standard 920~925MHz 1, National standard 840~845MHz 2, National standard 840~845MHz and 920~925MHz 3, FCC,902~928MHz 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: 0, ISO18000-6C/EPC C1G2 1, ISO18000-6B 2, National standard GB/T 29768-2013 3, National army standard GJB 7383.1-2011

5.2.2 Configure 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
Parameter persistence	0xFF	U8	1	0, power down not save 1, power down save If this parameter is not specified, it is saved after power down by default.

Reader response content: MID=0x01

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

5.2.3 Query 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
------------------------------	------	----	---	---------------------------------------

5.2.4 Configure 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 1, National standard 840~845MHz 2, National standard 840~845MHz and 920~925MHz 3, FCC, 902~928MHz 4, ETSI, 866~868MHz 5, JP, 916.8~920.4 MHz 6, TW, 922.25~927.75 MHz 7, ID, 923.125~925.125 MHz 8, RUS, 866.6~867.4 MHz
Parameter persistence	0x01	U8	1	0, power down not save 1, power down save If this parameter is not specified, it is saved after power down by default.

Reader response content: MID=0x03

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

5.2.5 Query 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	parameter description
----------------	-----	-----------	-----------	-----------------------

			length	
-	-	-	-	-

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

5.2.6 Configure 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. 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.
Parameter persistence	0x02	U8	1	0, power down not save 1, power down save If this parameter is not specified, it is saved after power down by default.

Reader response content: MID=0x05

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

5.2.7 Query 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

				<p>points according to the specified Frequency List.</p> <p>1, The reader automatically selects frequency points within the RF frequency range.</p>
Frequency List	(M)	U8	variable length	<p>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.</p>

5.2.8 Configure 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	<p>Enabling mask of hub extended antenna of antenna 1</p> <p>Bit0:Enabling Hub Port 1</p> <p>Bit1:Enabling Hub Port 2</p> <p>Bit2:Enabling Hub Port 3</p> <p>Bit3: Enabling Hub Port 4</p> <p>Bit4:Enabling Hub Port 5</p> <p>Bit5:Enabling Hub Port 6</p> <p>Bit6:Enabling Hub Port 7</p> <p>Bit7:Enabling Hub Port 8</p> <p>...</p>

				Bit15:Enabling Hub Port 16 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 1, antenna port does not exist 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.

message 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.

5.2.9 Query 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	<p>Enabling Mask of the Hub Extended Antenna of Antenna 1</p> <p>Bit0: Enabling Hub port 1</p> <p>Bit1: Enabling Hub port 2</p> <p>Bit2: Enabling Hub port 3</p> <p>Bit3: Enabling Hub port 4</p> <p>Bit4: Enabling Hub port 5</p> <p>Bit5: Enabling Hub port 6</p> <p>Bit6: Enabling Hub port 7</p> <p>Bit7: Enabling Hub port 8</p> <p>...</p> <p>Bit15: Enabling Hub port 16.</p> <p>If the extended external hub ports of antenna 1 is 1~16, this parameter should be 0xFF.</p>

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

5.2.10 Configure 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 1, parameter error 2, save failed

5.2.11 Query 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.

5.2.12 Configure 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. 1, Tari=25us,Miller4,LHF=250KHz. 2, Tari=25us,Miller4,LHF=300KHz. 3, Tari=6.25us,FM0,LHF=400KHz. 4, Tari=25us,Miller4,LHF=320KHz. 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 1, Session1 2, Session2 3, Session3
inventory taking marking parameter	0x04	U8	1	0, use only flag A to take inventory 1, use only flag B to take inventory 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
----------------	-----	-----------	------------------	-----------------------

configurati on result	(M)	U8	1	0, configured successfully 1, baseband that unsupported by the reader 2, Q value parameter error 3, Session parameter error 4, Inventory taking parameter error 5, Other parameter errors 6, save failed
--------------------------	-----	----	---	--

5.2.13 Query 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=40KHz. 1, Tari=25us,Miller4,LHF=250KHz. 2, Tari=25us,Miller4,LHF=300KHz. 3, Tari=6.25us,FM0,LHF=400KHz. 4~254,reserve. 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 1, Session1 2, Session2 3, Session3
inventory taking marking parameter	(M)	U8	1	0, use only flag A to take inventory 1, use only flag B to take inventory

				2, use Flag A and Flag B alternately for double sides inventory taking
--	--	--	--	--

5.2.14 Configure 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. 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 1, mode parameter error 2, other parameter errors 3, save failed

5.2.15 Query 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. 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

5.2.16 Read 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 Bit1: enabling antenna 2 Bit2: enabling antenna 3 Bit3: enabling antenna 4 Bit4: enabling antenna 5 Bit5: enabling antenna 6 Bit6: enabling antenna 7 Bit7: enabling antenna 8 ... Bit32: enabling antenna 32 One or multiple antennas can be designated.

constant/single reading	(M)	U8	1	<p>0, single read, the reader read one time on each enabling antenna then stop reading and automatically enter idle state.</p> <p>1, continuous read, the reader keeps reading and stop reading after receiving a stop command.</p>
choose reading parameters	0x01	U8	variable length	<p>Byte 0:data area to be matched; 1, EPC area; 2, TID area;3, user data area.</p> <p>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 .</p> <p>byte 4~ byte N: data content to be matched.</p>
TID reading parameters	0x02	U8	2	<p>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.</p> <p>byte 1: length of the TID data word(word, 16bits, similarly hereinafter) need to be read by the reader.</p>
reading parameters for the user data area	0x03	U8	3	<p>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.</p> <p>Byte 2: The word length of the user data that need to be read</p>

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. 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 1, Choosing reading parameter error 2, TID reading parameter error 3, User data area reading parameter error 4, Reserve area reading parameter error 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 1, antenna 1 2, antenna 2 3, antenna 3 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, 0, read succeeded 1, no tag response 2, CRC error 3, data area locked 4, Data area overflow. 5, access password error 6, Other tag errors 7, Other reader errors
tag TID data	0x03	U16	variable length	tag TID data read by the reader
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. 1~16
UTC reading time of the tag	0x07	U32	8	BYTE0~BYTE3:UTC time second 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, computation for tag phase: $:(\text{phase value} / 128) * 2\pi$

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	parameter description
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			length	
end reason for the reading	(M)	U8	1	0, single operation finished 1, receive stopping command 2, hardware error caused reading interruption

5.2.17 Write 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. Bit1: enabling antenna 2. Bit2: enabling antenna 3. Bit3: enabling antenna 4. Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. one or multiple antennas can be designated at the same time
data area	(M)	U8	1	data area of the tag to be written: 0, Reserve are 1, EPC area 2, TID area 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 . 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 1, antenna port parameter error 2, Choosing parameter error 3, Writing parameter error 4, CRC check error 5, Insufficient power 6, data area overflow 7, data area locked 8, access password error 9, Other tag errors 10, tag lost 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.

5.2.18 Lock EPC 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. Bit1: enabling antenna 2. Bit2: enabling antenna 3. Bit3: enabling antenna 4.

				Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. one or multiple antennas can be designated at the same time
locking operation area	(M)	U8	1	tag area to be locked: 0, inactivation password area 1, Access password area 2, EPC area 3, TID area 4, user data area
locking operation type	(M)	U8	1	type locking operation to be done: 0, Unlock 1, Lock 2, Unlock permanently 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 . 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 1, antenna port error 2, Choosing parameter error 3, Locking parameter error 4, CRC check error

				5, Insufficient power 6, data area overflow 7, data area locked 8, access password error 9, Other tag errors 10,tag lost reader sending command error
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5.2.19 Kill EPC Tag

This instruction is used for the reader to kill 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 Bit1: enabling antenna 2. Bit2: enabling antenna 3. Bit3: enabling antenna 4. Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. 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. 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 . 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 1, antenna port parameter error 2, Choosing parameter error 3, CRC check error 4, Insufficient power 5, inactivation password errors 6, Other tag errors 7, tag lost reader sending command error

5.2.20 MONZA 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. Bit1: enabling antenna 2. Bit2: enabling antenna 3. Bit3: enabling antenna 4. Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. one or multiple antennas can be designated at the same time
QT operation type	(M)	U8	1	0, Query QT configurate 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 . 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. Bit14:0,the tag enters private mode;1,the tag enters public mode 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 1, antenna port parameter error 2, Choosing parameter error 3, QT parameter error 4, CRC check error 5, Insufficient power 6, access password error 7, Other tag errors 8, tag lost 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 Bit14:0, the tag enters private mode;1, the tag enters public mode reserve other bits

5.2.21 Read 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 Bit1: enabling antenna 2 Bit2: enabling antenna 3 Bit3: enabling antenna 4 Bit4: enabling antenna 5 Bit5: enabling antenna 6 Bit6: enabling antenna 7 Bit7: enabling antenna 8 ... Bit32: enabling antenna 32 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, continuous read, the reader keeps reading and stop reading after receiving a stop command.
Read content	(M)	U8	1	0, read only 6B TID 1, read 6B TID + user data 2, read only user data
user data reading parameter	0x01	U8	2	byte 0: starting word address of the user data 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 configuratio	(M)	U8	1	0, configured successfully 1, antenna port parameter error 2, Read content parameter error

n result				3, user data area reading parameter error 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 1, antenna 1 2, antenna 2 3, antenna 3 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 1, read succeeded 2, no tag response 3, CRC error 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 1, hardware error caused reading interruption

5.2.22 Write 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. Bit1: enabling antenna 2. Bit2: enabling antenna 3. Bit3: enabling antenna 4. Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. 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 1, Writing parameter error 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

5.2.23 Lock 6B Tag

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.

				Bit1: enabling antenna 2. Bit2: enabling antenna 3. Bit3: enabling antenna 4. Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. 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 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

5.2.24 Lock Query 6B Tag

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. Bit1: enabling antenna 2. Bit2: enabling antenna 3. Bit3: enabling antenna 4. Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32.

				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 1,Other errors
data locking state	0x01	U8	1	0,unlocked 1,locked

5.2.25 Read 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. Bit1: enabling antenna 2. Bit2: enabling antenna 3. Bit3: enabling antenna 4. Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. 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	<p>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.</p> <p>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 .</p> <p>byte 4~ byte N:data content to be matched.</p>
tag information area (TID) reading parameter	0x02	U8	2	<p>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.</p> <p>byte 1: length of the TID data word(word, 16bits, similarly hereinafter) need to be read by the reader.</p>
user area reading parameter	0x03	U8	4	<p>byte 0: sub-user area ,0x30~0x3F.</p> <p>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.</p> <p>Byte 2: The word length of the user data that need to be read</p>
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 configuratio	(M)	U8	1	<p>0, configured successfully</p> <p>1, antenna port parameter error</p>

n result				2, Choosing reading parameter error tag information area (TID) reading parameter error 3, User area reading parameter error 4, Other parameter errors
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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 1, antenna 1 2, antenna 2 3, antenna 3 4, antenna 4 ...
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 1, read succeeded 2, no tag response 3, CRC error 4, data area locked 5, Data area overflow 6, Reading password error 7, Insufficient authority 8, Checking failed 9, Other tag errors 10, Other reader errors
tag information(TID)	0x03	U16	variable length	tag information area (TID) have been read

data				
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 message 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 1, receive stopping command 2, hardware error caused reading interruption

5.2.26 Write 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. Bit1: enabling antenna 2. Bit2: enabling antenna 3. Bit3: enabling antenna 4. Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. one or multiple antennas can be designated at the same time
data area	(M)	U8	1	data area to be written: 0x10,tag coding area 0x20,tag secure area 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. 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 . 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 1, antenna port parameter error 2, choosing parameter error 3, writing parameter error 4, CRC check error 5, Insufficient power 6, data area overflow 7, data area locked 8, writing password error 9, Insufficient authority 10, checking failed 11, Other tag errors 12, tag lost 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

5.2.27 Lock 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 Bit1: enabling antenna 2 Bit2: enabling antenna 3 Bit3: enabling antenna 4 Bit4: enabling antenna 5 Bit5: enabling antenna 6 Bit6: enabling antenna 7 Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. one or multiple antennas can be designated at the same time
locking operation area	(M)	U8	1	tag area to be locked 0x00,tag information area 0x10,tag coding area 0x20,tag secure area 0x30~0x3F,sub-user area 0~15
锁参数	(M)	U8	1	locking parameter to be performed: 0x00,Readable and writable. 0x01,Readable but not writable. 0x02,not readable but writable. 0x03,not readable and not writable. 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. 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. 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 . 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 1, antenna port error 2, choosing parameter error 3, locking operation parameter error 4, CRC check error 5, Insufficient power 6, data area overflow 7, data area locked 8, locking password error 9, Insufficient authority 10, checking failed 11, Other tag errors 12, tag lost 13, reader sending command error

5.2.28 Kill National-standard Tag

This instruction is used for the reader to kill 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	PID	data type	parameter	parameter description
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name			length	
antenna port	(M)	U32	4	Bit0: enabling antenna 1. Bit1: enabling antenna 2. Bit2: enabling antenna 3. Bit3: enabling antenna 4. Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. 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, 0x00,tag information area ;0x10,tag coding area ;0x20,tag secure area ;0x30~0x3F,sub-user area 0~15. 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 . 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 1, antenna port parameter error 2, choosing parameter error 3, CRC check error 4, Insufficient power 5, inactivation password error 6, Insufficient authority 7, checking failed 8, Other tag errors

				9, tag lost reader sending command error
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5.2.29 Antenna 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

5.2.30 Stop 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 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	<u>Reader application software upgrading</u>	Idle state
0x01	<u>baseband software upgrading</u>	Idle state

6.2.1 Reader 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 with 0xFFFFFFFF.
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 1,failed

6.2.2 Baseband 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 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

7.2.1 Send 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. Bit2: enabling antenna 3. Bit3: enabling antenna 4. Bit4: enabling antenna 5. Bit5: enabling antenna 6. Bit6: enabling antenna 7. Bit7: enabling antenna 8. ... Bit32: enabling antenna 32. 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 means922.875;channel 15 means924.375

Reader response content: MID=0x00

parameter name	PID	data type	parameter length	parameter description
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Carrier sending result	(M)	U8	1	0, Carrier sent successfully 1, the hardware does not support the frequency parameter 2, the reader hardware does not support the port parameter 3, phase-locked loop locking failed 4, other errors
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7.2.2 R2000 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 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 1, save failed 2, Other errors

7.2.3 Parameter 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	parameter description
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			length	
-	-	-	-	-

Reader response content: MID=0x02

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

7.2.4 Reader 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

				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 1, Parameter save failed 2, Other errors

7.2.5 Calibration 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-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, 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

7.2.6 Standing 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

7.2.7 Reader 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 Example :“R800800001901000001” <u>R</u> : Prefix of Product Model, R means reader, M means module. <u>8008</u> :4-digit product model <u>0000</u> :4-digit client number 0000 means non-specified client <u>1901</u> :4-digit production batch number (year and week) <u>0000001</u> :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 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;
```

```
}
```