UHF RFID All-in-one reader

Model：WS-RFIDALL-8 (RS-485、RJ-45)

Version History

Version	Date	Changes
V1.00	06, July, 2023	1st Edition
V1.01	14, July, 2023	1st Edition
V1.02	15, Jan, 2024	1st Edition

Hardware specifications

- **Working frequency：**
  NCC (920~928MHz)、FCC (902~928MHz)、CE (915~921MHz)
- **Antenna type:** circularly polarized 8dBi high gain cavity antenna
  - Circular polarization: The circular polarization antenna can receive and transmit vertical and horizontal polarization signals, which can better handle the polarization problem. For applications such as satellite communications and space communications, circularly polarized signals can reduce multipath interference and polarization distortion and improve signal quality.
  - High gain: the cavity antenna reflects and focuses the signal to improve the antenna gain. Compared to conventional antennas, cavity antennas can provide higher gain, which enhances the strength of received and transmitted signals.
  - Narrow beam: The cavity antenna can produce a narrow beam, which means that it can better focus the signal and reduce the surrounding noise and interference. The narrow beam characteristics of such antennas are useful for applications that require precise positioning or communication in a specific direction.

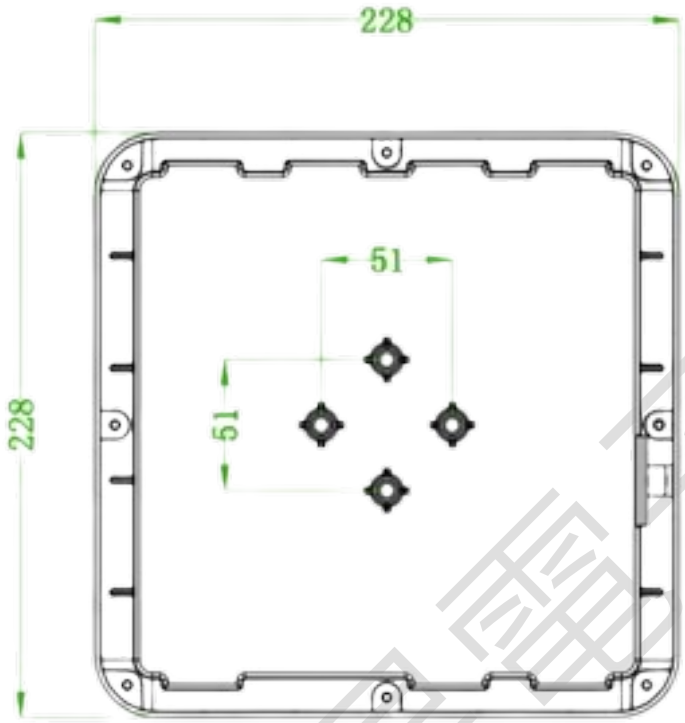
  It can provide better signal quality, higher gain, narrow beams, flexible design, and other features to enhance the performance and reliability of communication systems.
- **Output power:** 1W (adjustable to 2W)
  - Energy saving: Adjust the transmission power can be adjusted according to actual demand to avoid unnecessary energy waste, thereby improving energy utilization
  - Improve efficiency: In some close-range applications, too high transmit power will read too many tags outside the target range, resulting in excessive system load. Therefore, adjusting the transmit power can improve the efficiency and load of the system.

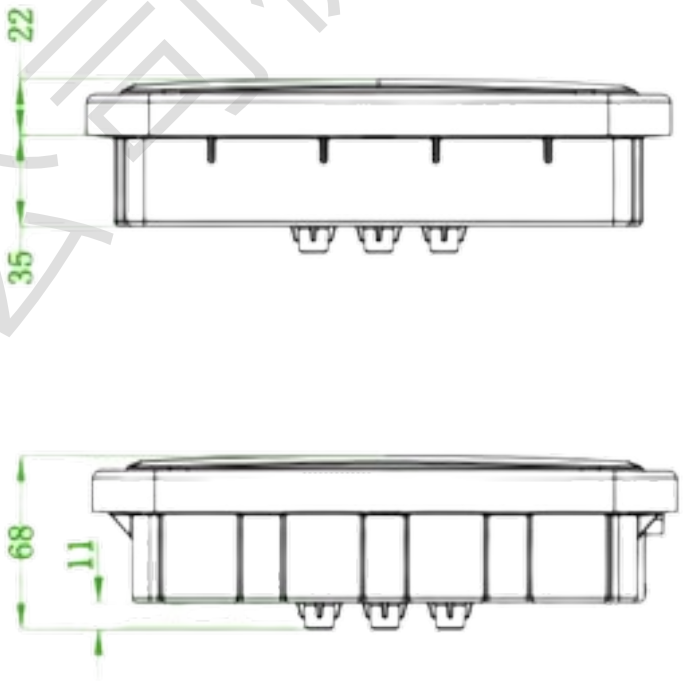
- **Security Protocol**：ISO18000-6C (EPC GEN2)
  - High performance: It has high reliability and stability, can quickly and accurately identify and track items, and supports high-speed reading and writing data.
  - Large capacity: support large-capacity data transmission, realize multi-tag simultaneous reading and writing, and improve data processing efficiency.
  - Wireless long-distance identification: the use of wireless technology for identification, can realize the remote identification of untouchable items, convenient and efficient.
  - Low cost: wireless communication mode is adopted, no physical contact is required, thereby shortening deployment and maintenance time, and reducing overall cost.
  - Global standards: Seamless interoperability between different countries and regions improves application flexibility and scalability.
- **Communication Protocol**：ModbusRTU、AT Command
- **Operating Voltage**：12Vdc ~ 24Vdc 2A
- **Wireless communication interface**：BLE 5.1、WiFi (Mesh Support)、NB-Iot
  - The advantages of BLE 5.1 for communicating between readers and smartphones or computers include low power consumption, high speed, long range and low latency.
  - WiFi (Optional Mesh) is used to communicate with other devices, including high speed, long distance, and scalability. Due to its high-speed characteristics, it allows users to obtain reader data more quickly. Due to its long-range characteristics, it can be used in different environments, indoors or outdoors. Its extensibility allows users to extend the communication range to cover more devices.
  - NB-IoT is a low-power, wide-coverage, large-connection wireless communication technology, suitable for the connection of many low-power devices such as the Internet of Things, used in UHF RFID systems. Compared with other communication interfaces, NB-IoT technology can provide more stable connection, lower power

consumption, and can achieve longer-distance data transmission, meeting the needs of long-distance connection and low power consumption in UHF RFID systems.

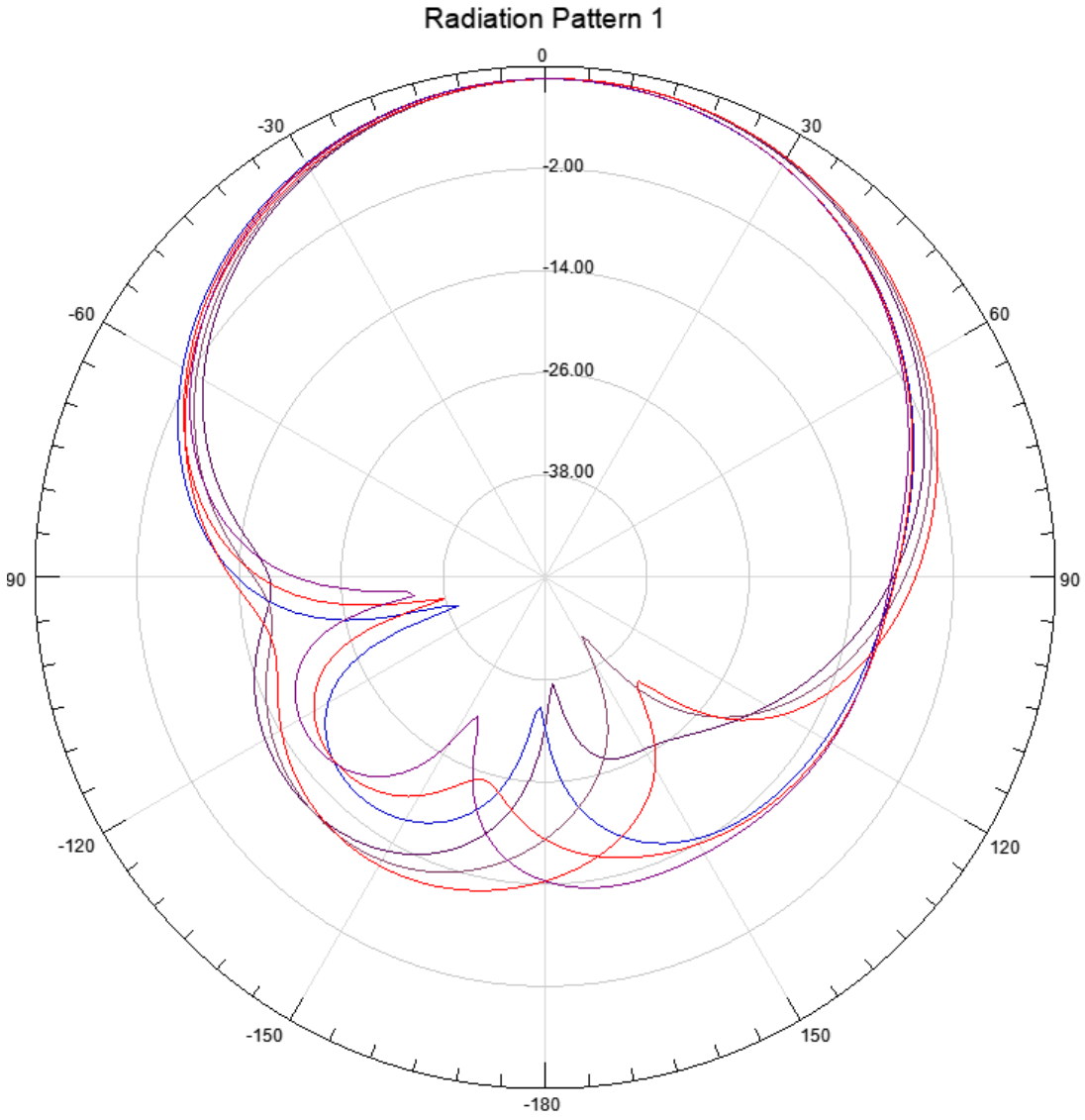
- **Communication interface**：RS-485、RJ45
  - RS-485 is a differential signal communication interface, which can realize multi-point communication and reduce signal attenuation when transmitting over long distances. Multiple access readers can be connected to increase system scalability while reducing the possibility of signal interference and data errors.
  - RJ45 can be connected to multiple access control readers through the network, which can achieve higher data transmission rate and convenient management system.
  - Both RS-485 and RJ45 communication interfaces have their advantages in applications. According to different application scenarios, different communication interfaces can be selected to meet system requirements.
- **Built-in sensor**：built-in temperature sensor
  - The built-in temperature sensor can monitor the working temperature of the reader in real time, monitor the temperature of the equipment under the high load operation of the system, and automatically slow down when the temperature reaches the set monitoring value to avoid the system abnormality due to high temperature.
- **Trigger reading mode:** external trigger (5Vdc~30Vdc optocoupler input contact) communication control
  - In the external trigger mode, the reader detects that the external trigger contact has a voltage input and starts to find the card.
  - Data packets can be sent through various communication interfaces to control the reader's card search.
- **Output control**：4 Relay outputs (5A 250Vac, 5A 30Vdc).
- **Prompt mode**：voice prompt, buzzer
- **Storage temperature**：-40℃~+70℃
- **Size**：228*228*68mm

Dimensions (unit : mm)





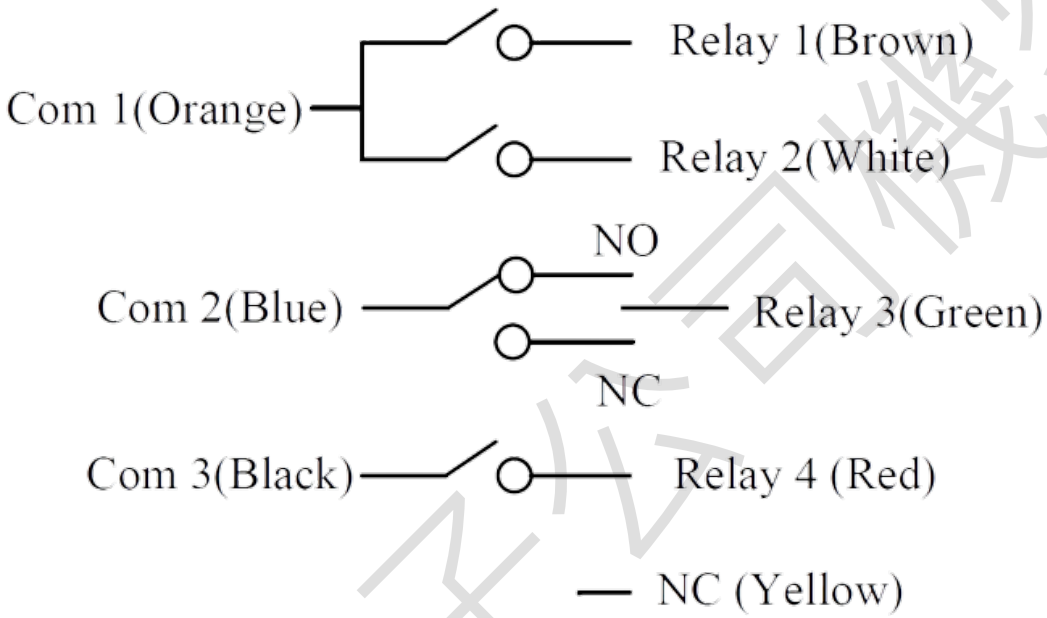
Field diagram



c9

Curve Info	max	xdb10Beamwidth(3)
dB(RealizedGainLHCP) Setup2 : Sweep Freq='0.905GHz' Phi='0deg'	8.5211	63.5081
dB(RealizedGainLHCP) Setup2 : Sweep Freq='0.905GHz' Phi='90deg'	8.5656	68.8966
dB(RealizedGainLHCP) Setup2 : Sweep Freq='0.915GHz' Phi='0deg'	8.5155	64.6651
dB(RealizedGainLHCP) Setup2 : Sweep Freq='0.915GHz' Phi='90deg'	8.5623	66.5430
dB(RealizedGainLHCP) Setup2 : Sweep Freq='0.925GHz' Phi='0deg'	8.5103	65.7062
dB(RealizedGainLHCP) Setup2 : Sweep Freq='0.925GHz' Phi='90deg'	8.5561	64.3761

Wiring



Communication interface	Pin 1	Pin 2	Pin 3	Pin 4
RS-485	B	A	GND	external trigger
RS-232	RX	TX	GND	external trigger

Connection setting method

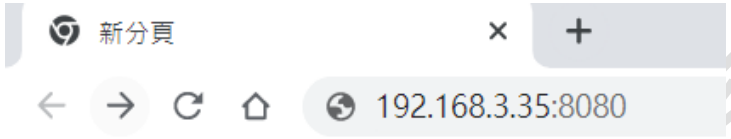
Power on, the hardware self-test will send out the voice "boot successful", after assigning to the IP position,

the IP location of the unit will be sent through the voice, and the exception code is as follows:

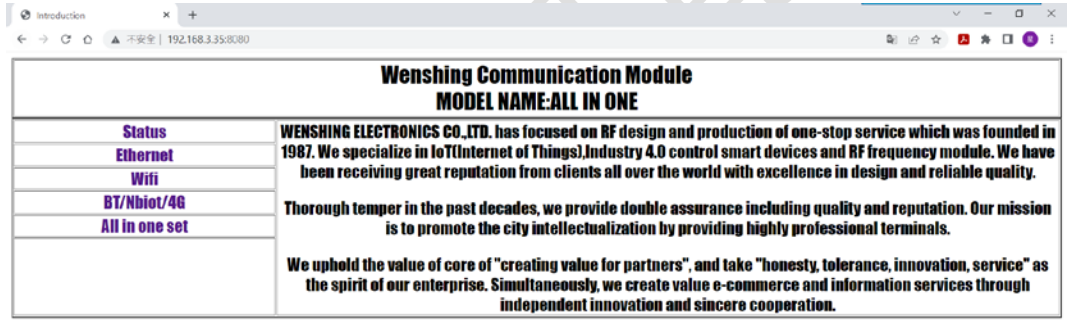
"Exception 1": RFID communication abnormality, "Exception 2": RJ45 communication abnormality,

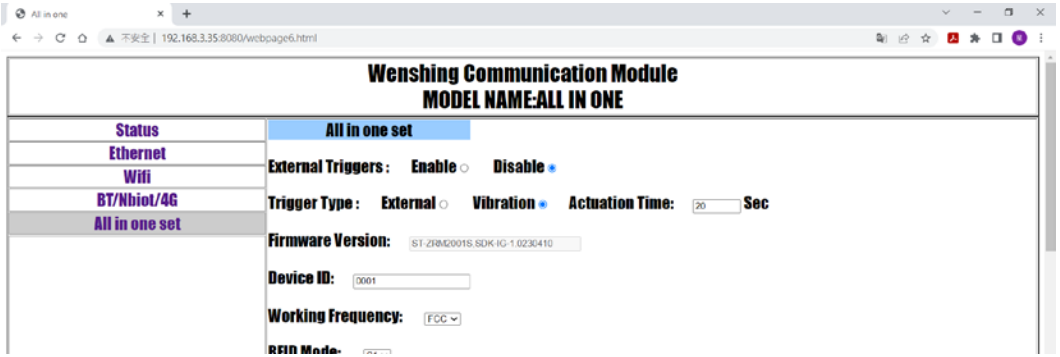
"Exception 3": WiFi communication abnormality, "Exception 4": NB-Iot communication abnormality

1. Open the browser and enter the local IP location into the browser according to the format 192.168.1.100 :8080, you can open the web page for setting.
   Example of using Chrome: After booting, the voice sends 192.168.3.35 (representing the IP location assigned to the device) enter 192.168.3.35:8080 in the browser, and then press Enter:



2. After opening the web page, click "All in one set" to enter the RFID function settings:





Output Data Format (HEX & ASCII)

Byte1 = 0x53 Suggesting output data is TAG TID；Data format reference as below

Byte 0	Byte 1	Byte 2	Byte 3~N	Byte N+1
0x02	0x53	Length of data being read	TAG TID	0x03

Byte1 =0x54 Suggesting output data is TAG EPC；Data format reference as below

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4~6	Byte 7	Byte 8~9	Byte 10~N	Byte N+1
0x02	0x54	Length of data being read	RSSI value being received	Frequency being received and Antenna port	PC+EPC Length	PC (Tag assortment)	TAG EPC	0x03

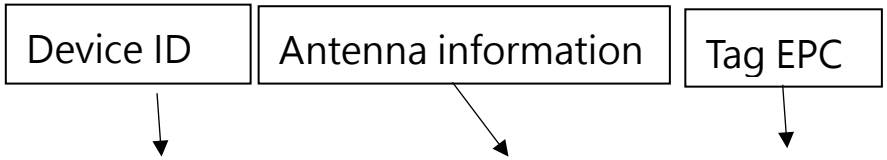
Byte 4 is frequency low byte

Byte 5 is frequency middle byte

Byte 6 is frequency high byte and antenna port

When bit 7=1 the frequency value is 0E, bit 7=0 the frequency value is 0D

Bit 0~5 is received antenna port , antenna 1=0 0000、antenna 2=0 0001



+EPC+0001-000000000000000: E2002019770402251691726 8:00000

The red part of the information transmitted back above represents which antenna is output

0 = right antenna = main antenna = AT+0001-antenna: 1

l = left antenna = secondary antenna = AT+0001-antenna: 2

AT Command

"Newline" for each command (Please note: You must stop scanning before sending all commands.)

	AT COMMAND	RFID Reader Return	Function Explanation
1	AT+0001-Linking		Heartbeat packet, if the device does not receive any instructions from the remote end for more than 10 seconds, or the heartbeat packet determines that the network is abnormal 0001 stands for device ID number, from which the ID number specifies the data transmitted back by the device
		+0001-Linking_0	0001 stands for the device ID number, from which ID number can determine which device sent back the data The parameter 1:0 indicates that there is no entry and exit record on the device side 1 indicates that there are entry and exit records on the device side

2	AT+0001-Reset		Reset Device 0001 stands for device ID number, from which the ID number specifies the data transmitted back by the device
		+0001-Reset	0001 stands for the device ID number, from which ID number can determine which device sent back the data The instruction succeeded
3	AT+0001-ReadVer		Read the version number of the device 0001 stands for device ID number, from which the ID number specifies the data transmitted back by the device
		+0001-ReadVer:MainFw V0.10;RF ST-ZRM2001S,SDK-IG-1.0230406	0001 stands for the device ID number, from which ID number can determine which device sent back the data Device name and firmware version
4	AT+0001-MainCtrl:1		Sets the data output format 0001stands for device ID number, from which the ID number specifies the data transmitted back by the device 0:The received EPC number is uploaded to the remote in character format: +EPC:0001-000000000000000:EPC:000000 1:The received EPC number is uploaded to the remote in HEX format: 0254... EPC03 (refer to Output data format).
		+0001-MainCtrl:1	0001stands for the device ID number, from which ID number can determine which device sent back the data The instruction succeeded

5	AT+0001-Scan:0		Set the working mode of RFID 0001stands for device ID number, from which the ID number specifies the data transmitted back by the device Parameter 1: 0 - Stop scanning 1- Start scanning (the device is disconnected from the wire to the connection, does not actively scan, must be remotely placed the scan instruction)
		+0001-Scan:0	0001 stands for the device ID number, from which ID number can determine which device sent back the data The instruction succeeded
6	AT+0001-Mode:S0		0001 stands for device ID number, from which the ID number specifies the data transmitted back by the device S0: Scan multiple TAG, if there is RFID to scan TAG will respond (more used in the test environment) S1: Scan multiple TAG, after scanning TAG response, it takes 1 second TAG to respond,andthe application is in inventory,lanes, logisticsare used more
		+0001-Mode:S0	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful

7	This feature is not yet complete AT+0001- Read:0,00,00000000,00,EPC		0001 represents the device ID number. This ID number can specify the device to return data. Read the information of the specified Tag Parameter 1: =0 - Read the password area of the specified Tag (starting at position 00) =1 - Read the EPC area of the specified Tag (starting at position 02) =2 - Read the number area of the specified TID (read only, starting at position 02) =3 - Read the user area of the specified Tag Parameter 2: 00 – Read all subsequent data starting from address 00 (in words (2Byte)), range 00~FF Parameter 3: 00000000: Access password parameter Parameter 4: How many words to read (Word=2Byte) Parameter 5: EPC number
	AT+0001- Read:1,02,00000000,06,20131124 8725010001020023	+0001- Read:1,02,00000000,06,20131124 8725010001020023<00> ->2013112487250100010200 23	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. <00>: indicates that the reading is correct, otherwise it indicates that the reading is incorrect (please refer to the Error code comparison table) <09>: Description tag no longer exists <A3>: Description parameter 4 exceeds the storage area size
8	This feature is not yet complete AT+0001- Write:0,00,00000000,EPC,String		0001 represents the device ID number. This ID number can specify the device to return data. Write information about the specified Tag Parameter 1: – Write String to the password area of the specified Tag (String will be converted to Hex format and written) =0 – Write the password area of the specified Tag (starting at position 00) =1 – Write the EPC area of the specified Tag (starting at position 02)

			=3 – Write the user area of the specified Tag Parameter 2:00 – Write starting from address 00 Parameter 3: 00000000: Access password Parameter 4: EPC number String: Its length must be a multiple of 4, otherwise it will be padded with 0s
	AT+0001-Write:3,00,00000000,2013112487250100010200 23,0987654321098 7654321	+0001-Write:3,00,00000000,2013112487250100010200 23,0987654321098 7654321<00>	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. <00>: The description is written correctly, and other descriptions are written incorrectly (please refer to the Error code comparison table) <10>: The label no longer exists or the EPC number is incorrect.
9	AT+0001-SetPower:30dBm		Set/query the power of UHF Reader: the range is 19-33 0001 represents the device ID number. This ID number can specify the device to return data.
		+0001-SetPower:30dBm	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
10	AT+0001-SetFreq:902~928		Set the working frequency band of RFID Reader 0001 represents the device ID number. This ID number can specify the device to return data.
		+0001-SetFreq:902~928	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
11	AT+0001-Antenna:1		Set/query the mode in which the UHF Reader antenna works: 0001 represents the device ID. From this ID, you can set the data of the specified device or specify the device to return data (if the device ID is 0000, it is a broadcast command) parameter

			1 – Right antenna = main antenna 2 – Left Antenna = Secondary Antenna 3 – Dual Antenna Mode
		+0001-Antenna:1	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
12	AT+0001-BuzzTime:5		Buzz sound number control, the buzzer will sound 5 times when this command is given. 0001 represents the device ID number. This ID number can specify the device action. The range of parameter 1 is 1~9
		+0001-BuzzTime:5	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
13	AT+0001-ONOFFRelay1:L,3	(optional) Scanning the tag number stored in the flash will start opening the door (the number of seconds for suction and absorption is the time set by set relay1 plus 1 second)	Control the door lock action. When the remote end receives the EPC number, it must return whether to open the door within 3 seconds. Otherwise, it will determine whether to open the door according to the EPC number stored in the device. 0001 represents the device ID number. This ID number can specify the device action. Parameter 1 represents the action mode, H means opening the door, L means not opening the door. Parameter 2 represents the duration of the action in seconds, ranging from 1 to 9
		+0001-ONOFFRelay1:L,3	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
14	AT+0001-ONOFFRelay2:L,3	(optional) After opening the door, it will automatically close the door after an interval of 10 seconds (the number of seconds	Control the door lock action. When the remote end receives the EPC number, it must return whether to open the door within 3 seconds. Otherwise, it will determine whether to open the door according to the EPC number stored in the device. 0001 represents the device ID number. This ID number can specify the device action.

		for suction and closing is the time set by set relay2)	Parameter 1 represents the action mode, H means opening the door, L means not opening the door. Parameter 2 represents the duration of the action in seconds, ranging from 1 to 9
		+0001-ONOFFRelay2:L,3	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
15	AT+0001-ONOFFRelay3:L,3	(optional)	Control the door lock action. When the remote end receives the EPC number, it must return whether to open the door within 3 seconds. Otherwise, it will determine whether to open the door according to the EPC number stored in the device. 0001 represents the device ID number. This ID number can specify the device action. Parameter 1 represents the action mode, H means opening the door, L means not opening the door. Parameter 2 represents the duration of the action in seconds, ranging from 1 to 9
		+0001-ONOFFRelay3:L,3	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
16	AT+0001-ONOFFRelay4:L,3	(optional)	Control the door lock action. When the remote end receives the EPC number, it must return whether to open the door within 3 seconds. Otherwise, it will determine whether to open the door according to the EPC number stored in the device. 0001 represents the device ID number. This ID number can specify the device action. Parameter 1 represents the action mode, H means opening the door, L means not opening the door. Parameter 2 represents the duration of the action in seconds, ranging from 1 to 9
		+0001-ONOFFRelay4:L,3	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
17	AT+0001-SetRelay1:L,3	(optional)	Set whether the relay is NC or NO

			0001 represents the device ID number. This ID number can specify the device action. Parameter 1 represents the action mode, L is NO, H is NC Parameter 2 represents the length of time for action after reading the correct Tag, ranging from 1 to 8
		+0001-SetRelay1:L,3	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
18	AT+0001-SetRelay2:L,3	(optional)	Set whether the relay is NC or NO 0001 represents the device ID number. This ID number can specify the device action. Parameter 1 represents the action mode, L is NO, H is NC Parameter 2 represents the length of time for action after reading the correct Tag, ranging from 1 to 8
		+0001-SetRelay2:L,3	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
19	AT+0001-SetRelay3:L,3	(optional)	Set whether the relay is NC or NO 0001 represents the device ID number. This ID number can specify the device action. Parameter 1 represents the action mode, L is NO, H is NC Parameter 2 represents the length of time for action after reading the correct Tag, ranging from 1 to 8
		+0001-SetRelay3:L,3	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
20	AT+0001-SetRelay4:L,3	(optional)	Set whether the relay is NC or NO 0001 represents the device ID number. This ID number can specify the device action. Parameter 1 represents the action mode, L is NO, H is NC

			Parameter 2 represents the length of time for action after reading the correct Tag, ranging from 1 to 8
		+0001-SetRelay4:L,3	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
21	AT+0000-FindDeviceID		Query the ID Address of all devices in the local network 0001 represents the device ID number. This ID number can specify the device to return data.
		+0000-FindDeviceID:0001	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful
22	AT+0001-DeviceID:0002		Set device ID 0001 represents the device ID number, from which the device can be set. The range of parameter 1 is 0001~9999
		+0001-SetDeviceID:0002	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful This device ID changed from 0001 to 0002
23	AT+0001-NoMatchEPC:0		Prompt sound that does not comply with Flash memory EPC 0001 represents the device ID number. This ID number can specify the device to return data.
		+0001-NoMatchEPC:0	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful The range of parameters is 0~2 0 means no prompt 1 means 1 sound

			2 means 2 sounds in a row
24	AT+0001-MatchEPC:1		Flash memory EPC compliant prompt sound 0001 represents the device ID number. This ID number can specify the device to return data.
		+0001-MatchEPC:1	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful The range of parameters is 0~2 0 means no prompt 1 means 1 sound 2 means 2 sounds in a row
25	AT+0001-ReadEPCList		Read the EPC list in the device memory 0001 represents the device ID number, from which the device can be queried
		+0001-ReadEPCList File Size is 156Byte 20130924872603000101C0C4 20130924872603000102AAA7 20130924872603000102AAE8 323241000000000000000000 E2002019770402251691726	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful Each EPC number has a total of 24 codes plus newline characters, a total of 26 bytes. The example on the left has a total of 6 EPC numbers, so the file size is 156byte
26	AT+0001-UpdataEPCList		Update the EPC list in device memory 0001 represents the device ID number. This ID number can specify the device to return data.
		+0001-UpdataEPCList	0001 represents the device ID number. From this ID number, you can determine which device the data is returned from. Command successful

	20130924872603000101C0C4 20130924872603000102002 2 20130924872603000102AAA7 20130924872603000102AAE8 32324100000000000000000 E2002019770402251691726 8		The EPC list must be sorted from small to large Each line contains 24 digits and line feed characters, and a maximum of 16 lines of lists can be sent each time. For example, there are 109 EPC numbers to be updated. The first 16 lines were sent and an OK response was received. Send 16 lines for the second time and receive OK reply The third transaction sent 16 lines and received an OK reply. The seventh transaction sent line 13 and received an OK reply.
		OK	
	AT+UpdataEPCList End		End of updating EPC list
		+UpdataEPCList End	
27	Read the information returned by Tag		Read the information returned by Tag
		+EPC+0001- 000000000000000:2013092487260 30001020022:00000 或 025413000000000E3000E200302 8630C0245175064AB03	The data are equipment ID number, entry and exit time (fill in 0 for all reservations), EPC number, and entry and exit statistics (fill in 0 for all reservations) +EPC+0001-000000000000000:20130924872603000102002 2:00000 or 025413000000000E3000E2003028630C0245175064AB03 The red part of the information returned above represents which antenna outputs it. 0=Right Antenna=Main Antenna=AT+0001-Antenna:1 1=Left Antenna=Secondary Antenna=AT+0001-Antenna:2
28	AT+0001-WhiteList:?		Query whitelist inventory 0001 represents the device ID number, from which the device can be set.
		+0001- WhiteList:001,E200201977040225 16917268	The first parameter 0001 = how many Tags follow The second parameter starts with Tag EPC
29	AT+0001-		Add whitelist inventory

	WhiteList:001,E200201977040225 16917268		0001 represents the device ID number, from which the device can be set. The first parameter 0001 = how many tags to add later The second parameter starts with Tag EPC
		+0001-WhiteList:1	
30	AT+0001- WhiteDel:001,E200201977040225 16917268		Delete whitelist inventory 0001 represents the device ID number, from which the device can be set. The first parameter 0001 = how many tags to delete later The second parameter starts with Tag EPC
		+0001-WhiteDel:1	