



USB & 4G Card Reader WE-USBRCSS04

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I. Overview

The WE-USBRCS04 Reader is a USB-based long-range label reader. When connected to a computer, it can read standard labels as well as audio-visual labels within a range of 50 meters; it can also establish a transparent data transmission channel with certain specialized labels (e.g., barcode audio-visual labels equipped with a screen) to exchange data (allowing item information to be displayed on the label screen). Additionally, it supports 4G-based card reading data reporting.

The following features can be implemented through web-based configuration and commands:

- Supports TCP/UDP sockets; supports common passthrough and non-passthrough modes such as HTTP and MQTT.

- Supports common public cloud providers such as OneNET, Alibaba Cloud, Baidu Cloud, and Tencent Cloud.

- Supports RTU Master Control Mode

- Supports data stream templates and tasks

- Supports message push notifications (phone calls, SMS, and network alerts)

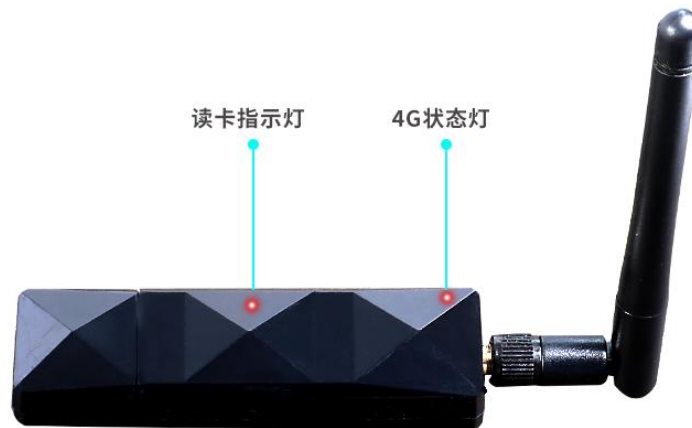
- Supports over-the-air (OTA) updates

The system provides open protocols and sample source code for card reading, call handling, and data transmission; users can leverage these resources to develop their own application software for tasks such as object location, inventory management, and data collection.

Positioning RFID tags have been widely adopted across a variety of application domains, including smart warehouse management, logistics tracking, indoor navigation, personnel management, and smart construction sites.

II. Main Features

- ◆ Operates in various modes—including card reading, call handling, and data transmission—with a communication range of no less than 50 meters.
- ◆ Can read up to 1,000 tags simultaneously and activate up to 80 audio-visual tags at the same time.
- ◆ Full-duplex transparent data transmission in data transmission mode, with a maximum rate of up to 2000 bytes/second.
- ◆ The USB interface supports Windows, Linux, Android, and macOS operating systems.
- ◆ Provides open protocols for card reading, call handling, and data transmission, along with sample source code.
- ◆ Can be used as a card issuer for the WE-TLED20 barcode audio-visual label, along with accompanying card issuance software.
- ◆ Operates within an industrial-grade temperature range of -40°C to +85°C
- ◆ Supports remote web-based management and configuration
- ◆ Universal Network Compatibility 4G CAT-1 Communication Module



III. Technical Specifications

project	specifications	parameter
Card reader antenna	carrier frequency	2.4GHz
	modulation mode	QPSK (Quadrature Phase Shift Keying)
	control protocol	IEEE 802.15.4
	receiving	-118dBm
	antenna gain	3dBm
4g	Supporting	LTE-TDD:B34/B38/B39/B40/B41LTE-FDD:B1/B3/B5/B8
	protocol stack	TCP/UDP/PPP/HTTP/NITZ/NDIS/NTP/HTTPS/MQTT
	SIM card	China Mobile / China Unicom / China Telecom
USB port	Chip	Use the Qinheng Microelectronics CH340 USB-to-Serial Port Conversion Chip
	Baud rate	115200bps
	data format	8 data bits, 1 stop bit, no parity check
	interface type	USB-A
pilot lamp	Operating light	Flash once per second.
	Card reader light	The label data flashes once for each reception.
source	voltage	5V
	Current	Recommended drive current: $\geq 1A$
External Structure	size	84mm×25mm×15mm
	hull	ABS engineering plastic, transparent black
	weight	50 g
work environment	temperature	-40℃~ 85℃,
	humidity	Less than 95% (no condensation)

IV. Card Reading and Call Serial Port Protocol

The controller (typically a computer) operates the card reader via a USB interface, receives the tag information reported by the card reader, and sends various control commands to the card reader.

The message format is as follows:

地址	0	1	2	3	4	5	6	7	...	N	N+1	N+2
字段	前导字节		命令	长度	消息内容						CRC校验	
示例	55	AA	02	06	00	19	F0	A0	...	01	32	54

[Leading Byte]: A fixed value of two bytes (0X55 or 0XAA) serves as an identification marker for a new data packet.

[Command]: 1 byte that specifies the exact meaning of the message; examples are as follows:

Command	name	direction	explain
1	Read label	Controller (Card	The reader reads the tag ID and sends it to the
2	Call Label	Controller (Card	The controller triggers a designated tag
3	Transparent	Controller (Card	The controller requests the reader and the tag
4	Direct	Controller (Card	Card reader feedback data transmission status

The call function must be used in conjunction with an audio-visual tag; the passthrough function must be used in conjunction with a tag equipped with data transmission capability.

[Length]1 byte: The length of the subsequent field "Message Content".

[Message Content]To be determined by each individual message.

[CRC Checksum]The result of calculating the CRC16 for the message (excluding the preamble bytes). Used to ensure message integrity.

(1) Read Label Message (0X01)

Message Content:

卡号 4字节	属性 1字节	扩展数据 0~7字节	RSSI值 1字节
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[Card Number]4 bytes: the card identifier.

[Attribute]1 byte, used to store information such as tag type, under-voltage flag, and extended data length.

位 : 7	6	5	4	3	2	1	0
扩展数据长度	运动标志	标签类型	欠压标志				

Bit 0: Under-voltage indicator. 1: Under-voltage; 0: Normal.

Bits 1–3: Label type. 0: Standard label; 1: Audio-visual label; 7: Empty label (Note 1)

Bit 4 – Motion Flag. This bit is only valid for the motion detection tag. 0: Tag is stationary; 1: Tag is moving.

Bits 5–7: Extended data length. When necessary, the tag can upload additional extended data (e.g., humidity, temperature, etc.); this extended data field follows immediately after the attribute byte and can span between 0 and 7 bytes.

Note 1: An empty tag message is sent to the controller every 3 seconds when the card reader fails to detect any electronic tag; this is done to indicate to the controller that the reader is functioning normally. If the controller does not receive either valid tag information or an empty tag message for an extended period, it indicates that the card reader is experiencing a malfunction.

[Extended Data]0–7 bytes: The length of the extended data is specified within the attribute byte; it can carry data specific to the tag (e.g., temperature, humidity, etc.). The extended data may consist of up to 7 bytes or be absent.

[RSSI Value]: A 1-byte value representing the signal strength received by the positioning antenna from the tag; this signal strength value can be used to calculate the distance between the tag and the positioning antenna.

(2) Call Tag Message (0X02)

The controller sends a call-tag command to the card reader via the serial port, causing the specified tag to light up and emit sound, making it easy for users to quickly locate the tag.

Message Content:

地址	0	1	2	3	4
字段	标签ID				参数
示例	00	19	F0	A0	01

[Parameter]Byte: Call Mode.

The general definition is as follows (the definitions for individual sound and light labels may vary slightly).

Call Mode	explain
0	Only the green light is flashing.
1	Green light flashing + buzzer sound
2	Only the red light is flashing.
3	Red light flashing + buzzer sound
4	Only alternating red and green
5	Alternating red and green flashing +
255	Stop Reminder

Upon receiving a startup command from the controller, the reader will maintain the alert operation for the specified tag for up to 5 seconds. If the controller requires continuous tag calling, it should continuously send calling commands (recommended: once per second). If the reader does not receive a calling command for 5 consecutive seconds, it will automatically stop the audio-visual alert operation for that tag. This ensures that, in the event of an unexpected communication interruption between the controller and the reader, the audio-visual tag will promptly cease its alert operation.

The card reader supports concurrent reminder operations for up to 80 tags; when it is necessary to call multiple tags simultaneously, multiple commands can be issued, or a single command can contain information for multiple tags (due to packet length limitations, a single data packet can contain up to 25 tag IDs).

For example, when simultaneously calling two electronic tags (1805100,1904212), the following call command can be issued:

55 AA 02 0A 00 1B 8B 2C 01 00 1D 0E 54 01 82 3F

55 AA : 前导字节

02 : 命令 (呼叫标签)

0A : 长度 (10字节)

00 1B 8B 2C : 标签ID (1805100)

01 : 模式 (发光发声)

00 1D 0E 54 : 标签ID (1904212)

01 : 模式 (发光发声)

82 3F : CRC校验

V. Data Direct Transmission Serial Port Protocol

(1) Transparent Request Message (0X03)

The controller sends a data forwarding switch command to the reader via the serial port; upon successful switching, the reader and the tag establish a point-to-point transparent data transmission channel. The data transmitted by the controller (microcontroller) to the reader is then wirelessly forwarded by the tag to the remote controller, and the reverse process also occurs.

After establishing a passthrough channel, the length of data transmitted by the controller each time should be limited to 110 bytes; if it is necessary to transmit excessively long data packets, the controller should wait for a short period (greater than 5 milliseconds) after completing the transmission of a partial data segment (less than 110 bytes) before continuing the transmission.

Message Content:

地址	0	1	2	3	4	5	6
字段	标签ID				无线 频道	创建 超时	退出 超时
示例	00	01	E2	40	01	05	0A

[Tag ID]: 4 bytes – applicable to tag cards requiring direct transmission.

[Wireless Channel] 1 byte; Channel (0–7); Total of 8 channels. This wireless channel is used for data transmission directly, preventing mutual interference when transmitting data within the same frequency band.

[Creation Timeout] 1 byte – maximum waiting time before attempting to create a data transmission channel; unit: seconds. If the creation fails, the controller should issue another handover command to attempt establishing the channel. Valid range: 3–60 seconds.

[Exit Timeout] 1 byte: The timeout duration for exiting the data transmission channel (unit: seconds). When the data transmission mode is activated, if the channel remains idle (no incoming or outgoing data packets) for the specified timeout period, the system will automatically exit the data transmission mode and revert to Card Reader/Tag Mode. Valid range: 1–60 seconds.

As a typical example, the instruction sequence for establishing a data transmission channel between a card reader and a tag with ID "123456" is as follows:

55 AA 03 07 00 01 E2 40 01 05 0A 0D 5B

Each field is explained as follows:

55 AA	前导字节
03	消息命令 (切换到透传)
07	消息内容长度 (有7个字节的消息内容)
00 01 E2 40	消息内容/ 标签ID (123456)
01	消息内容/ 无线频道 (使用1号频道)
05	消息内容/ 创建超时 (最多等待5秒)
0A	消息内容/ 退出超时 (10秒没有数据退出)
0D 5B	CRC校验

Serial port transparent data packets, each up to 110 bytes in size with a minimum packet interval of 10 ms. Extremely long packets will have their excess data automatically truncated.

(2) Transparent Response Message (0X04)

Return the result of the passthrough operation (success or failure) to the controller.

Message Content:

地址	0	1	2	3	4
字段	标签ID				结果
示例	00	19	F0	A0	01

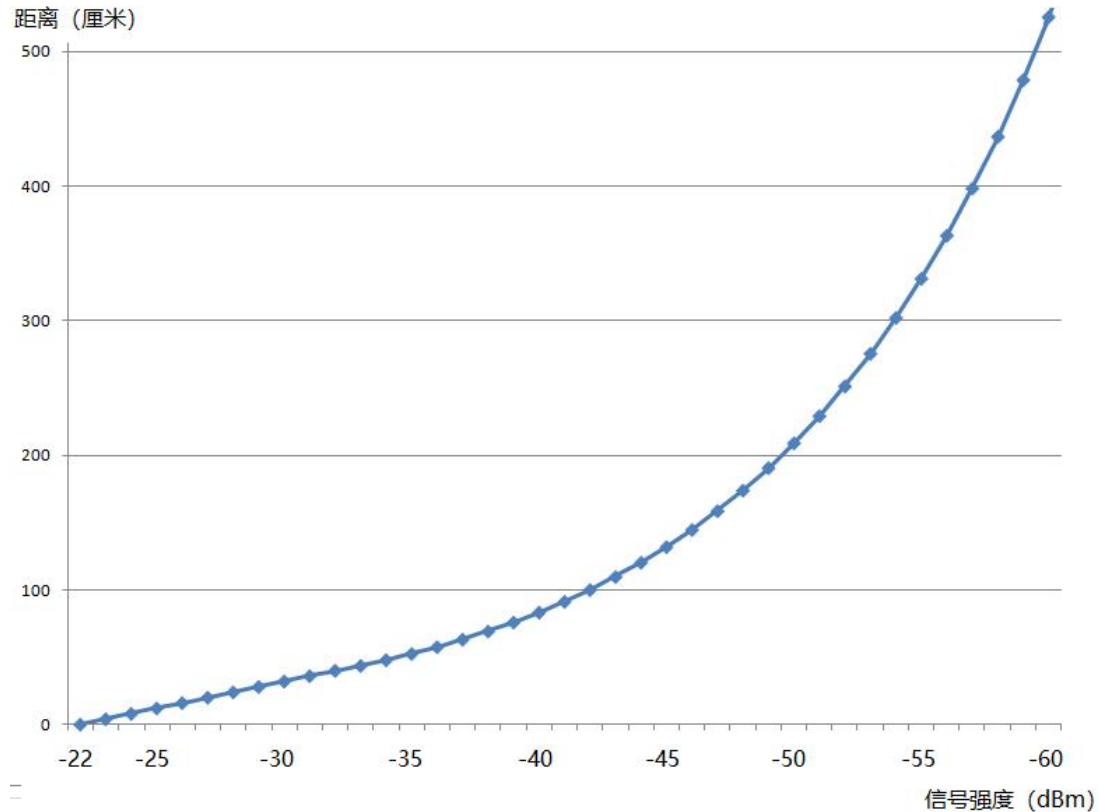
[Result]The return value indicates whether a transparent transmission channel was successfully created: 0 – Success; 1 – Failure.

Example: 55 AA 04 05 00 1B 8B 2C 00 9B 34

55 AA : 前导字节
04 : 命令 (呼叫标签)
05 : 长度 (5字节)
00 1B 8B 2C : 标签ID (1805100)
00 : 结果 (创建透传通道成功)
9B 34 : CRC校验

VI. Distance Measurement Formula

This product calculates the distance between the electronic tag and the antenna by measuring the wireless signal field strength; the relationship between this distance and the wireless signal strength follows an exponential curve, as shown below:



Due to chart size limitations, only the correspondence for distances within 6 meters is displayed.

In the above figure, there are three values that require repeated measurement and calibration.

- 1、 L0: Signal strength when the distance between the tag and the reader is 0 cm; measured value: -22 dBm.
- 2、 L1: Signal strength when the tag is 40 cm away from the card reader; measured value: -32 dBm.
- 3、 L2: Signal strength when the tag is 100 cm away from the card reader; measured value: -42 dBm.

The derived formula based on these three values is as follows:

- 1、信号强度大于等于L0，距离直接判定为0厘米。
- 2、信号强度大于等于L1，距离可以根据线性运算。
距离 = $\left[\frac{L0 - \text{信号强度}}{L0 - L1} \right] * 40$
- 3、信号强度小于L1，距离可以根据指数曲线运算。
距离 = $10^{\left[\frac{L2 - \text{信号强度}}{25} \right]} * 100$

For the specific algorithm implementation, please refer to the source code of our DEMO software.

VII. Card Reading, Call and Data Transmission Testing

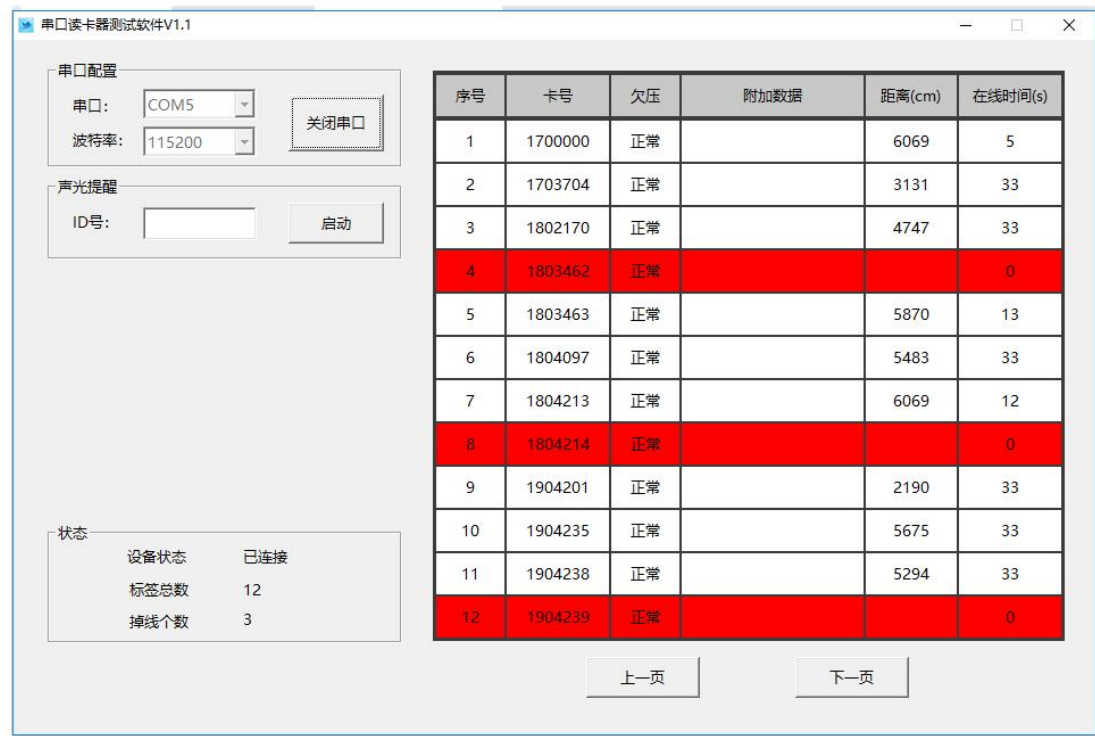
Connect the card reader to your computer using a USB adapter board.

Open Device Manager to check whether the USB adapter board has been successfully connected; if not, install the appropriate driver. In Device Manager, locate the "USB-SERIAL CH340" device under the "Ports" category and note down its COM port number.



Card reader and call transmission function testing

Run the card reader testing software and initiate the test.



Select the serial port connected to the card reader antenna, set the baud rate to 115,200 bps, and then initiate the test.

The software displays the total number of electronic tags detected by the card reader antenna, along with detailed information for each tag—including the tag number, battery level, distance, online duration, and other relevant data. Red tags indicate electronic tags that have lost connection (due to unstable signal).

The status bar in the lower-left corner displays device status, total number of tabs, and number of disconnections.

Enter the tag ID into the "Sound and Light Alert" section on the left, then click the "Start" button to trigger the specified sound-and-light tag.

Data Transmission Function Testing

This functional test requires a DSM-81 Tag Module Evaluation Board. If possible, connect the DSM-81 Tag Module Evaluation Board to another computer.

On both computers, launch the "Electronic Tag Data Transfer Test Software." In the test software corresponding to the reader, enter the tag ID and the transmission channel that need to be used for direct transmission, then click the [Direct Transmission Switch] button to initiate the creation of the direct transmission channel.



Wait for 1–3 seconds; when the "Data" light on the card reader turns on, it indicates that the passthrough channel has been successfully created. At this point, any data sent via the "HEX Send" button – whether from the card reader or the tag – will be received by the other party. The exchanged passthrough data can be viewed in the information bar on the left.



After a period of time without data transmission, the device exits the data forwarding state; the "Data" indicator light turns off, and the card reading function is restored.