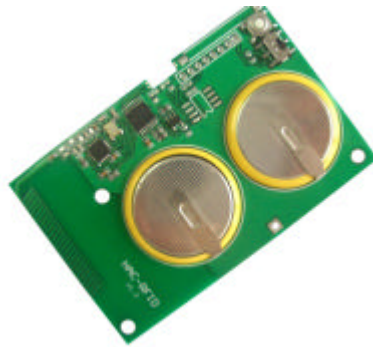


HAC-AID
HAC-USR
Active RFID Specification



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I. The type definition HAC active RFID

HAC active RFID can be divided into two parts, i.e. RFID and reader. Our RFID is a wireless short-distance active transmitter, its type is HAC-AID. And the reader is a wireless passive receiver, its type is HAC-USR.

II. The features of HAC active RFID

RFID is a non-contact automatic identification method, it can identify aim object automatically and obtain some correlative information by using RF signal. It doesn't require any manual intervention. It can be applied to various harsh environments.

Combining active RFID technology and sensors, we develop a new product, i.e. HAC active RFID. Based on traditional active tags, it increases monitoring for temperature, voltage and RSSI signal strength. And it also realized the sensor, identification, and other wireless transmission in one whole, so that it greatly expands the traditional applications field of RFID technology.

1. Ultra low power transmission

The maximum transmission is 10mw.

2. ISM frequency band with no require of applying frequency

The carrier frequency is 433.516MHz, it is a fixed frequency. (The other frequencies are available if needed. If you need to choose setting channel, you should customize the products in quantity.)

3. High anti-interference and Low BER (Bit error Rate)

Based on the Minimum Shift Keying (MSK) modulation, the high-efficiency forward error correction channel encoding technology is used to enhance data's resistance to both transient interference and random interference.

4. Long Transmission Distance

Within the visible range, the reliable transmission distance for the module with

PCB antenna is more than 120m.

5. Temperature measure

Measure range: -20 ~ 60

Precision of temperature: ± 2

6. Battery voltage detection

Detect the state of battery voltage in RFID, so that you can change the battery in time.

7. RSSI signal query

RSSI signal is Received Signal Strength Indication. According to the signal, you can know the effect of receiving or the distance at that time.

8. Low power consumption

When the power is 10mW, the moment receiving current is less than 35mA, and the sleeping current is less than 1 μ A. It is low power consumption, so that it is much better for the environment.

According to one transmission every 10 seconds, and transmitting time is 2ms. The total electric quantity of two batteries is 540mAh. The continuous working time is calculated as follows:

The average current consumption of one transmission: $35\text{mA} * 0.002\text{s}/10\text{s} = 0.007\text{mA}$

The total consumption of average current: $0.007\text{mA} + 0.001\text{mA} = 0.008\text{mA}$

The theoretical value of time for 540mAh battery: $540\text{mAh}/0.008\text{mA} = 67500\text{h} = 7.7$ years

Actually, you only can use 60% electric quantity of battery, so the actual battery life is up to four years.

9. High reliability, small and light

By using monolithic radio-frequency integrated circuit and single-chip MCU, the transceivers have less peripheral circuits, higher reliability, and lower failure rate.

III. Application of HAC active RFID

Today, the use of RFID is very extensive. Our products join sensors and other technology, it can be used in more extensive field, for example some projects that temperature information is needed. The application of HAC active RFID is as follow:

Logistics, including cargo tracking, automatic collecting information, storage management and temperature monitoring

Manufacturing, used in the monitoring of data in the process of production and automated production

Medical, used in the management of hospital equipment and patient identification.

Food, used in the food processing, preservation and transportation monitoring

Cars, traffic and many other industries

IV. The using methods for HAC-AID

HAC-AID works in active transmission mode. The interval for transmitting can be adjusted to meet users' need. Commonly, its average is 10s. In order to avoid the collision caused by the use of multiple readers at the same time, the timing for HAC-AID is random timing manner. For example when users' requirement for average reading interval is 10s, and the timing is a random number between 8.000s with 12.000s.

The using methods for HAC-AID are very simple. As long as you fix battery, HAC-AID will work automatically and transmit the information that includes ID, temperature, voltage of battery forwardly.

The operating voltage range for HAC-AID is 2.6~4.3V, so you can use many types of battery for it.

The transmission power for HAC-AID can be adjusted to meet users' need, its range is -20~10dBm.

V. The using methods for HAC-USR

The using methods for the reader HAC-USR are also very simple. When HAC-USR receives the information from HAC-AID, it will output the information to the main

equipment through UART interface by 9600bps and no-parity format.

1. Data format

The data is expressed by hexadecimal number.

24 09 xx xx xx xx xx xx xx xx FF xx

- : Data header
- : Effective data length
- : ID number , compressed BCD code
- : Celsius temperature
- : Battery voltage
- : Serial number
- : RSSI , Received Signal Strength Indication
- : Reservations bytes
- : Checksum, from to

2. Calculating formula

Calculate temperature:

$$T = \text{ } - 60 \text{ ()}$$

If you want to convert the temperature to Fahrenheit, the formula is as follow:

$$F = ((\text{ } - 60) \div 5) * 9 - 76$$

Calculate battery voltage:

$$V = \text{ } * 3 \div 256 \text{ (V)}$$

Calculate RSSI:

If is more than and equal to 128, $RSSI = \text{ } \div 2 - 207 \text{ dBm}$

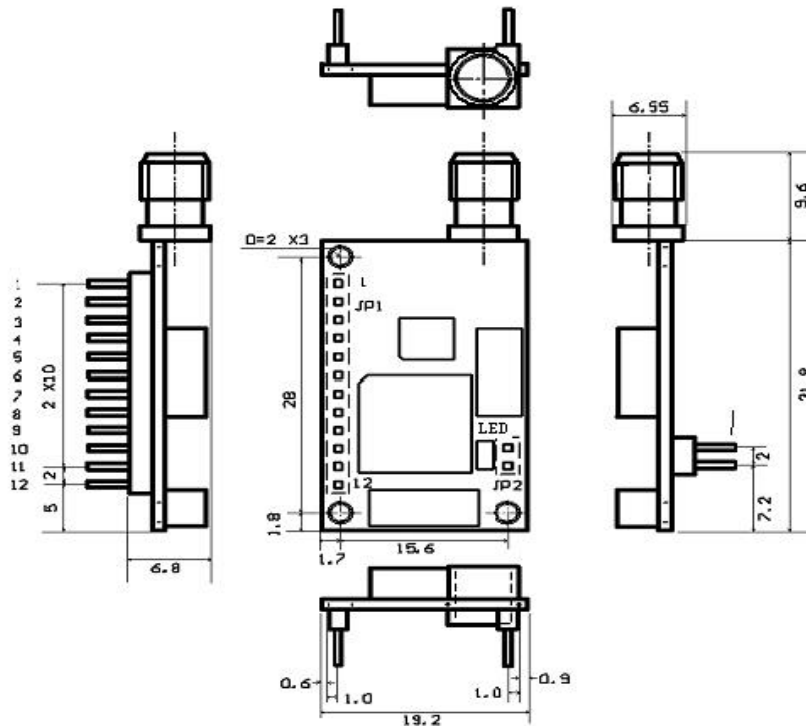
Otherwise $RSSI = \text{ } \div 2 - 79 \text{ dBm}$

3. The using methods for the receiver HAC-USR

HAC-USR works with supply voltage +3.3~5.25 DC.

The following picture is structure dimension of our standard product. To meet the needs of different users, we can design smaller dimension or different shapes for users.

(Unit: mm)



HAC-USR offers a connector of twelve pins (i.e. JP1). Its definition and connection with terminal can be seen in the table 1. It is shown as follow.

Table 1: Connector's definition and connection method

Pin	Definition	Instruction	Level	Connect to terminal	Remark
1	GND	Power ground		Power ground	
2	VCC	Power DC	+3.3-5.5V		
3	NC				
4	NC				
5	NC				
6	RESET	Reset signal (input)	TTL		Negative pulse reset
7	NC				
8	TxD	Transmitter for serial data	TTL	RxD	
9	RxD	Receiver for serial data	TTL	TxD	
10	SGND	Signal ground			
11	NC				
12	NC				

Note: When HAC-USR connects with computer, signal must be converted into RS232 level, so that it can communicate.

The standard antenna is 80mm helical SMA antenna, it is high gain and low cost. And it can transmit long distance. If users have special needs, we can customize various specs of antenna for users.

HAC-USR can be embedded in user's equipment or terminal, and it uses with external antenna. If you need to use embedded antenna, you should put it in plastic shell. Pay attention to that the antenna is far from copper clad plate and power circuit.

User also can customize our Smart series which has metal shell. HAC-USR/M1 offers standard RS-232 or RS-485 interface. If users need USB interface, we also can offer it.



4. DEMO testing

You can use our testing board and RFID testing software for simple testing. You can see the working process and actual operating results of RFID directly, so that you can know and use it quickly.

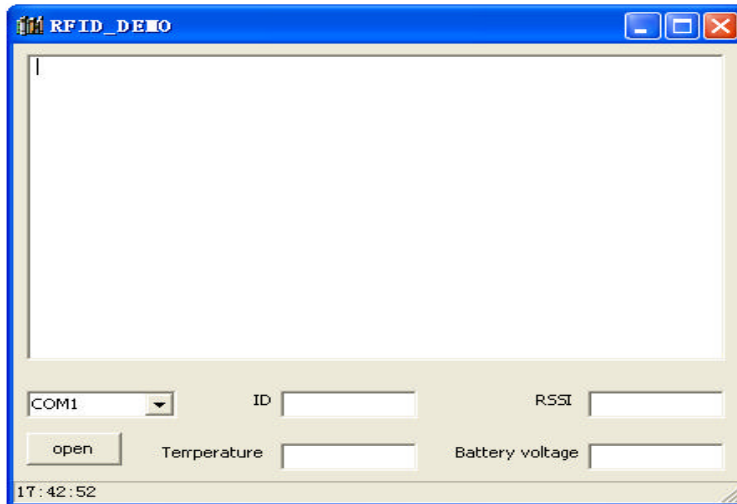
Testing board used to connect HAC-USR and computer. You can send the data to terminal, and it can be processed and displayed by testing software.

The testing board uses three seven-size AA battery to supply power, you also can use external power 5V DC.

HAC-USR places in a fixed position of testing board. You can use serial wire to connect DB9 of testing board and serial port of computer. Open power switch of testing board, the power LED light.

Open the testing software, the interface is shown as follow. Choose the right corresponding serial port for computer, click "open" button. Turn on HAC-AID , it will send a data every 10 seconds. When the receiver has received a data, the signal LED (D10) in testing board will glitter once.

All of the receiving data in hexadecimal form and receiving time are displayed in the software window. At the same time, they will be explained according to the data format of active RFID, and the results will be displayed in the corresponding area.



VI. Technology specification of HAC-AID

Working frequency:	433.516MHz
Transmitting interval:	10s
Time tolerance:	$\pm 2s$
Transmitting power:	-20~10dBm
Transmitting current:	<35mA (10dBm)
Visible transmission distance:	>120m (10dBm)
Sleep current:	<1 μ A
Working voltage:	+2.5~4.3V DC
Battery:	CR2430 270mAh (two pieces)
Measure range of temperature:	-20 ~ 60
Precision of temperature:	± 2
Continuous working time:	more than four years
Dimension :	45 × 70 × 3.5mm

VII. Technology specification of HAC-USR

Working frequency:	433.516MHz
Receiving sensitivity:	< -105dBm
Working current:	<40mA
Working voltage:	+3.3~5.25VDC