

**Product Manual
of
MJ001-01
Wi-SUN Module**



Shenzhen Star Instrument Co., Ltd.

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1. Overview

MJ001-01 module is a radio frequency communication module of Wi-SUN protocol developed by Shenzhen Star Instrument Co., LTD. The module consists of the SOC and its peripheral circuit that integrates RF transceiver and Wi-SUN protocol processing, and adopts serial interface for data and instruction interaction with user devices, which can conveniently provide users with fast Wi-SUN protocol wireless terminal communication and other services.

The size of MJ001-01 module is 37mm*18.9mm*4.0mm. It has the features of minimal size, low power consumption, and long transmission distance. It is suitable for automatic meter reading system of interconnection under Wi-SUN protocol framework.

1.1 Electrical parameters

Main Parameters	Performance	Remarks
Operating voltage	1.8~3.8 V	3.3V is recommended.
Operating frequency	902~928MHz	
Initial frequency deviation	± 10 kHz	Frequency deviation at room temperature
TX current	≤150mA	It is recommended that the power supply capacity be more than 300mA.
RX current	≤15mA	
Sleep state	≤3uA	
TX Power	Max 15.95dBm	
RX sensitivity	-106dBm (Average)	Datarate:50 kbps, BER:≤ 0.1%,2GFSK
Modulation mode	OOK, (G)FSK	Programmable
Communication rate	0.1 to 1000 kbps	Programmable
Harmonic characteristic	< -42dBm	
Operating temperature	-40~+85 °C	

2. Interface

When the module is connected to the user mainboard, it mainly includes serial port interfaces, reset, event detection, debug printing, status output, and power supply interfaces, etc.

2.1 Module pin definition

Pin No.	Pin Name	Pin Definition	Description
1	VDD	Reserved module power supply pin	Only 1W high power module is effective
2、16、29、30、31	GND	Ground pins	
3	RESET	Module reset input pin	3.3V TTL level
4	POWER_CHK	Module power failure detection pin	The comparator interrupt is inside the module chip.
5	EVEN_IN	Event trigger signal input pin	
6	UART2_RX	Input pin of serial port UART2	Reserved UART serial port
7	UART2_TX	Output pin of serial port UART2	
8	SWO	DEBUG output pin SWO	Debugging and firmware download ports. SWO is reserved for advanced simulation ports to show simulation process information, which is also optional.
9	SWDIO	DEBUG data input and output	
10	SWCLK	DEBUG clock input	
11	Dout_BER	BER test demodulation data outlet	Only used for receiving sensitivity BER test
12	Flash_CS	External Flash chip selection output	3.3V TTL level signal
13	Flash_CLK	External Flash clock output	
14	Flash_MISO	External Flash data input	
15	Flash_MOSI	External Flash data output	
17	3.3Vp	3.3V power output	Module 3.3V power input pin
18	UART1_RX	Input pin of serial port UART1	Serial port for communication with electricity meter and DCU, 3.3V TTL level
19	UART1_TX	Output pin of serial port UART1	
20	LED_STATE	State indicator control output	3.3V TTL level
21	LED_TX	TX indicator control output	
22	LED_RX	RX indicator control output	
23	UART0_RX	Input pin of serial port	Debug print output serial port,

		UART0	3.3V TTL level
24	UART0_TX	Output pin of serial port UART0	
25	PA0	Reserved data port	
26	PD15	Reserved data port	
27	PD14	Reserved data port	
28	PD13	Reserved data port	
32	ANT	Antenna interface	Pay attention to the 50Ω impedance control for external wiring.

2.2 Hardware interface description

When designing the hardware of the MJ001-01 module, select and design the required interfaces and peripheral circuits according to the actual application. The application interfaces of the MJ001-01 module are as follows:

- External power supply
- Reset
- SPI
- UART
- Module status indicator
- Event detection
- Debug print

2.2.1 External power supply

Before using the module, the user must first ensure that the external power supply has sufficient power load capacity and the power supply range must be strictly controlled between 1.8V and 3.8V. If the value is higher than the power supply range of the module, the main chip of the module will be damaged. If the value is lower than the power supply range of the module, the RF circuit will be affected and the maximum output power cannot be guaranteed.

2.2.2 Reset

The reset pin is a low level reset. The module will be reset if the user provides a low pulse of at least 1ms to the NRST pin (or directly pulling down). It is suggested to add a 4.7kΩ resistance to the power supply in normal mode.

2.2.3 SPI

The SPI interface is a four-wire SPI, which can be used for modules to extend an external FLASH storage or be taken as other communication interfaces.

2.2.4 Module status indicator

The pins of the module status indicator are pin20 LED_STATE, pin21 LED_TX and pin22 LED_RX, which are respectively the module working status indicator, RF signal sending indicator and receiving indicator, and external LED indicator. They are both common-anode connections.

2.2.5 UART

The UART serial port is used for the module to communicate with and exchange data with the external working platform.

2.2.6 Event detection

The event detection interface detects the event output of the external application function circuit, such as the power failure event along with the reporting of other function events.

2.2.7 Debug print

With the Debug interface, you can simulate and burn the firmware of the SOC chip of the module, and the system running information can be output through the print interface, so that you can see the running information directly.

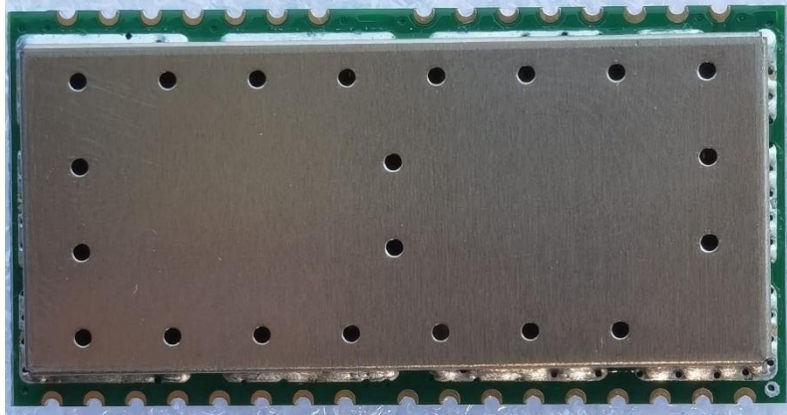
3. Antenna Design Suggestions

Antenna design is directly related to the communication performance of the product. Different types of antennas are selected for different terminals according to the antenna size, cost, and performance. Common short-range antennas include PCB antenna, chip (ceramic) antenna, spring antenna, whip antenna, etc. When selecting an antenna, the following most important parameters should be considered: radiation variation in different directions around the antenna, antenna efficiency, bandwidth required for antenna operation, and power to be provided to the antenna, etc. The typical definition of antenna bandwidth is the frequency range where the reflected wave attenuation is less than -10dB or VSWR is less than 2, that is, the frequency range where the reflected power of the antenna is less than 10%.

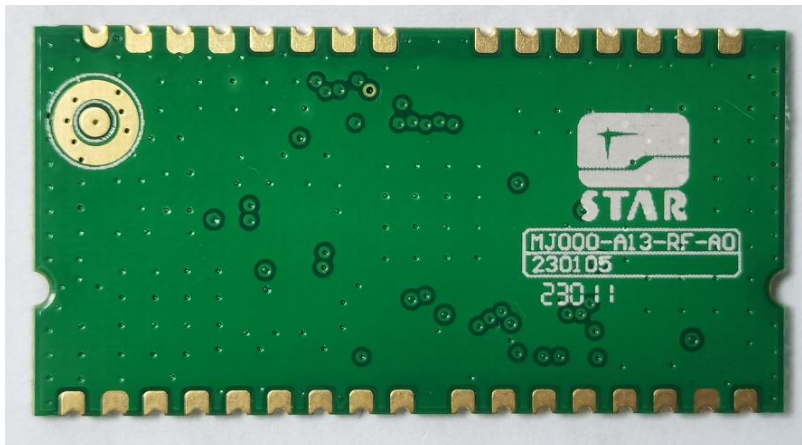
4. Product Material Object

Module size: 37mm*18.9mm*4.0mm, and the actual product is as follows:

The front view:



The back view:



5.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

5.1 List of applicable FCC rules FCC Part 15 Subpart C 15.247

5.2 Specific operational use conditions.

This device is intended only for OEM integrators under the following conditions:

1) The transmitter module may not be co-located with any other transmitter or antenna. As long as the condition above is met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter)

and obtaining a separate FCC authorization. The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

5.3 Limited module procedures.

Additional testing and certification is necessary when specific host originally granted with this module. This module is Limited single modular , host manufacturer have to consult with module manufacturer for the module limiting conditions when integrate the module in the host. module manufacturer should reviews detailed test data or host designs prior to giving the host manufacturer approval.

5.4 Trace antenna designs .Not applicable .

The module may be operated only with the PCB antenna with which it is authorized.

5.5 RF exposure considerations Co-located issue shall be met as mentioned in “Specific operational use conditions”. Product manufacturer shall provide below text in end-product manual “Radiation Exposure Statement: The product comply with the US portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.”

5.6 Antennas Model name: PCB on-board antenna

Antenna type:PCB antenna

Antenna gain:1.71dBi

5.7 Label and compliance information

Product manufacturers need to provide a physical or e-label stating “Contains FCC ID: 2A2X4-MJ001-01” with finished product

5.8 Information on st modes and additional testing requirements

Test tool: SSCOM V5.13.1 shall be used to set the module to transmit continuously

5.9 Additional testing , Part 15 subpart B disclaimer

The module is only FCC authorized for the specific rule parts listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

5.10 FCC Requirement

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

“ CAUTION: Any changes or modifications not expressly approved could void the user’s authority to operate the equipment.”