

OM802S

LoRa Module with Open Source

OM802S is a highly integrated low-power half-duplex RF transceiver module embedding high-speed low-power MCU and high-performance RF chip with LORA modem which is capable of achieving significant longer range than existing RF transceiver based on FSK or OOK modulation. OM802S can support secondary development to realize an application of LoRaWAN with the SDK supplied by ManThink, OM802S have abundant hardware resource to realize different function which include SPI, IIC, AD and DIO.

This module uses LoRa modem to improve the sensitivity up to -137dBm, significantly extending the transmission distance under a low power. Under LoRaWAN protocol, the start network can solve the problem of collision and low power consumption through gateway solution.

OM802S module's interface voltage 2.6-3.6 V with consuming only 13 mA at the receiving mode. If there is no packet to transmit, the module consumption is only 3uA which is very suitable for a battery-powered system.

Using the OM802S module in an application minimize the need or an expensive and time-consuming RF development. Fast time to market is possible with this pre-qualified module.

Apply

- Wireless water/heat/gas meter reading
- Wireless sensor
- Intelligent instrument and meter
- Intelligent lighting control
- Auto data collection
- Remote control and sensing
- Smart building and security
- Robot control
- Power system monitoring
- Wireless warehousing, logistics management

Feature

- LoRaWAN class-A compliant
- Globally unique 64-bit identifier
- Four band and 16 channels support
- Transmission distance > 5000 m
- Frequency AS915
- High sensitivity -137dBm
- Maximum transmission power 20dBm
- Low sleep current 3uA
- Receiving mode current 13mA
- Super small size 17.8mm*13mm*2.0mm

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1. Module Overview

The OM802S is an ultra-long range, high-performance module for wireless communication. It operates in the license free frequency band .

The OM802S uses Semtech's patented LoRa modulation technique which combines Spread spectrum modulation and forward error correction techniques to increase the range and spectrum modulation and forward error correction techniques to increase the range and robustness of radio communication links compared with traditional FSK or OOK based modulation. Typically examples of OM802S receive performances are given in the following table.

Table 1 : performance of LoRa with different parameters

Signal Bandwidth/[kHz]	Spreading Factor	Sensitivity/[dBm]
125	7	-123
125	12	-138
250	7	-121
250	12	-135
500	7	-116
500	12	-130

The module is solderable like a SMD component and can easily be mounted on a simple carrier board with a minimum of required external connections.

2. Global Electrical Characteristics

Table 2 : Global Electrical Characteristics

Radio Frequency	923.2~924.6 MHz
Step Frequency	1KHz
Transmission Power	5~20dBm,
Receiving Sensitivity	-138dBm@292bps
Air Transfer Rate	292bps~5.4kbps
Working Humidity	10%~90% (no condensation)
Working Temperature	-45°C~85°C
The power Supply	2.6~ 3.6V
ESD(Human Body Model)	2000V
Transmission Current (typical)	120mA@100mW
Harmonic Suppression	≤1GHz: <-36dBm, >1GHz: < -30dBm
CAD/ Receives Current(typical)	13mA
Sleep Current(typical)	3uA
Size	17.8mm x 13.0mm x 2.0mm
Antenna Impedance	50Ω

3. Module Package

3.1 Pin Definition

1	S1MOSI/PD6	GND	23
2	S1MISO/PD7	VCC	22
3	S1SS/PD4	RESET	21
4	PC7	SWCLK	20
5	S1SCK/PD5	SWDIO	19
6	NC5	GND	18
7	NC4	UART1-TX/PC4	17
8	NC3	UART1_RX/PC3	16
9	NC2	I1SDA/PC2	15
10	NC1	I1SCL/PC1	14
		GND	13
		ANT	12
		GND	11

Figure 1 : description of pins and top view

OM802S module has nine pins, specific definitions as the following table:

Table 3 : description of the pin

Pin	Name	Direction	Function
1	S1MOSI/PD6	Input/output	Refer the datasheet of KL17x
2	S1MISO/PD7	Input/output	Refer the datasheet of KL17x
3	S1SS/PD4	Input/output	Refer the datasheet of KL17x
4	PC7	Input/output	Refer the datasheet of KL17x
5	S1SCK/PD5	Input/output	Refer the datasheet of KL17x
6	NC5	-	Keep the Pin float
7	NC4	-	Keep the Pin float
8	NC3	-	Keep the Pin float
9	NC2	-	Keep the Pin float
10	NC1	-	Keep the Pin float
11	GND	-	Digital GND
12	ANT	-	Should be connected to antenna
13	GND	-	Digital GND
14	I1SCL/PC1	-	Refer the datasheet of KL17x
15	I1SDA/PC2	Input/output	Refer the datasheet of KL17x
16	UART1_RX/PC3	Input/output	Refer the datasheet of KL17x

17	UART1-TX/PC4	Input/output	Refer the datasheet of KL17x
18	GND	Input/output	Refer the datasheet of STM32L051C8T6
19	SWDIO	Input/output	Refer the datasheet of KL17x
20	SWCLK	Input/output	Refer the datasheet of KL17x
21	RESET	Input/output	Refer the datasheet of KL17x
22	VCC	Input/output	Connect to the power supply(2.6V-3.6V)
23	GND	Input/output	Digital GND

3.2 Module Dimensions

Figure 2 : Dimensions of the module



4. Typical Application Schematic

Maximum system

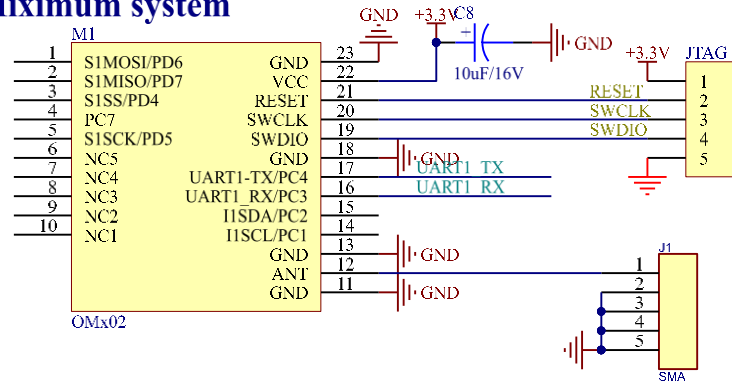


Figure 3 : Typical design

6. Other

6.1 Contact

For more support, please contact with Beijing Manthink technology co., Ltd:

Contact number: +86-010-56229170

E-mail: info@manthink.cn

Address: Room601 Ronghua International Building No.5, Ronghua South Road No.10, Beijing

E-Town (BDA)



7. FCC STATEMENT

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.

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

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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 5mm between the radiator & your body.

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

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.249 & 15.207 & 15.209

2.3 Specific operational use conditions

The module is a LoRa module with LoRa function.

Operation Frequency: 923.2~924.6 MHz

Number of Channel: 8

Modulation: LoRa

Type: Cylindrical antenna

Gain: 1 dBi Max.

The module can be used for mobile or portable applications with a maximum 1dBi antenna. The host manufacturer installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer 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 shown in this manual.

2.4 Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs

Not applicable. The module has its own antenna, and doesn't need a host's printed board microstrip trace antenna etc.

2.6 RF exposure considerations

The module must be installed in the host equipment such that at least 5mm is maintained between the antenna and users' body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.7 Antennas

Antenna Specification are as follows:

Type: Cylindrical antenna

Gain: 1 dBi

This device is intended only for host manufacturers under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the External antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique' antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating “Contains FCC ID: **2ATLH-OM802S**” with their finished product.

2.9 Information on test modes and additional testing requirements

Operation Frequency: 923.2~924.6 MHz

Number of Channel: 8

Modulation: LoRa

Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is **only** FCC authorized for FCC Part 15 Subpart C 15.249 & 15.207 & 15.209 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. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

General

Sections 2.2 through 2.10 of KDB 996369 D03 describe the items that must be provided in the integration instructions for host product manufacturers (e.g., OEM instruction manual) to use when integrating a module in a host product. Modular transmitter applicants should include information in their instructions for all these items indicating clearly when they are not applicable. For example, information on trace antenna designs could indicate “not applicable.”

If the modular transmitter is only approved for use by the grantee in its own products and not intended for sale to third parties, the integration instructions may not be detailed but this must be declared in the filing. In that case, it is permitted to place the instructions in the theory-of-operation exhibit folder using long-term confidentiality. The applicant must include a statement in the filing that the module is not for sale and the user manual integration instructions are internal confidential manufacturing documents. The grant of certification for such a modular transmitter must be limited.

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

2.4 Limited module procedures

If a modular transmitter is approved as a “limited module,” then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an "omni-directional antenna" is not considered to be a specific "antenna type")).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating "Contains FCC ID" with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

2.9 Information on test modes and additional testing requirements

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer's determination that a module as installed in a host complies with FCC requirements.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is **only** FCC authorized for the specific rule parts (i.e., FCC transmitter rules) 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. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.