

M4 P U s e r M a n u a l

File Number:	NQR.CP-M4-2409-001
Product Model:	M4 P
Product Name:	Built-in transceiver digital radio station
Release time:	

File revision record						
Serial number	Amend the chapter / clause	Revision Abstract	Version number	Revision date	Modifier	Approver
1	All	Establish the first draft	V1.0	September 2nd, 2024		
2						
3						
4						

I. Overview

The M4 P is a built-in transceiver LORA radio station, specially developed for the lawnmower market and Internet of Things wireless transmission application scenarios. The product supports the ISM unlicensed frequency bands of 868MHz and 915MHz, and has the characteristics of complying with the radio usage regulations of Europe and the United States, frequency hopping anti-interference, long-distance two-way communication, relay networking, OTA radio firmware upgrade, etc., meeting the wireless communication requirements of the lawnmower market.



Figure 1-1 Appearance of M4

1.1 Product Features

Support the ISM unlicensed frequency band in Europe and the United States: 902 - 928 MHz

Support LBT + AFA and meet the requirements of local radio usage regulations in Europe and the United States

Support point-to-point and point-to-multipoint communication

Integrated transceiver, meeting the requirements of differential data transmission and two-way communication for base station sleep and wake-up.

Fast frequency hopping and strong anti-interference ability

Support relay networking to ensure unimpeded communication between the front and rear yards.

It complies with the requirements of the ISM frequency band for the control of radio power in Europe and the United States. Europe supports 25 mW and the United States supports 1 W.

Open the upgrade protocol and support OTA to upgrade the radio firmware

Support IC, CE and FCC certifications

1.2 Application Fields

Intelligent lawnmower, Internet of Things wireless communication

II. Technical Parameters

2.1 Working Conditions

Parameters	Minimum value	Typical value	Maximum value	Unit	Instruction
Working voltage	3.3	3.3	3.6	V	
Working temperature	-40	-	70	℃	
Work humidity	10	-	90	%RH	
Storage temperature	-45	-	85	℃	
Electrostatic discharge voltage (contact discharge)	-	-	4	KV	
Electrostatic discharge voltage (air discharge)	-	-	6	KV	

2.2 Power consumption parameters

Parameters	Output power	Typical value	Unit	Note
Launching current	1000mW	900	mA	3.3V power supply frequency: 902.5 - 927.49 MHz
	100mW	150	mA	3.3V power supply, 902.5 - 927.49 MHz
	25mW	110	mA	
Receive current	-	22	mA	

2.3 Radio Frequency Characteristics

Project	Content
Working frequency	902.5 - 927.49 MHz
Work mode	Half-duplex

Channel bandwidth	250 kilohertz, 500 kilohertz
Modulation mode	CSS
Carrier power	25mW/100mW/1000mW (902.5 - 927.49 MHz)
Power consumption (typical value)	Emission of high power: 33W @ 3.3V DC (output 1000mW power) Transmit low power: 360 mW @ 3.3 V DC (output 25 mW power) Standby of the whole module: 70mW @ 3.3 V DC
Receiving sensitivity	Better than -118 dBm @ BER 10 ⁻⁵ , 11000 bps
Common channel suppression	>-12dB

2.4 Modem

Airborne rate	11000 bps, 62500 bps
Serial port rate	9600 bps, 19200 bps, 38400 bps, 115200 bps

2.5 Working temperature

Working temperature	-40℃ to +70℃
Storage temperature	-45℃ to +85℃

2.6 Communication interface

Project	Content
Serial port	Standard TTL level Data bits: 8 bits Stop bit: 1 bit Verification: No verification

2.7 Structural Characteristics

Project	Content
Size	25 (length) × 21 (width) × 3.7 (height) mm

Weight	About 3 grams
Antenna interface	IPEX, watermark
Antenna interface impedance	50 Ω
Data interface	30Pin SMT

III. Pin Definitions

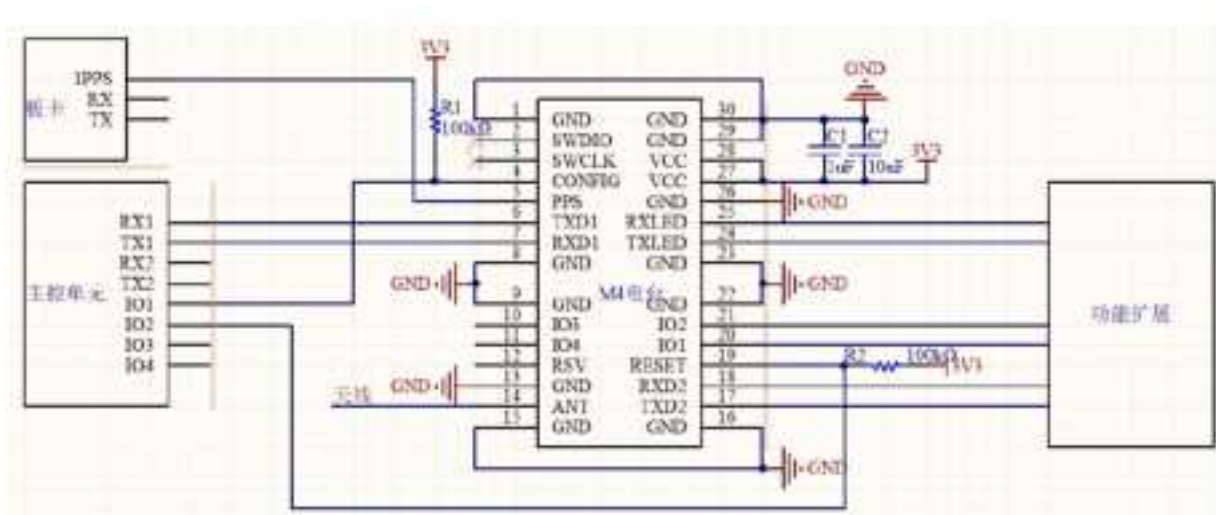
The distribution of the M5 pins is shown in the following figure.

Pin sequence number	Pin name	Pin direction	Pin usage
1	GND		Grounding
2	SWDIO	Input / Output	Suspended (for internal use)
3	SWCLK	Input	Suspended (for internal use)
4	CONFIG	Input	Low level enters the configuration mode, and high level (3.3V) digital transmission mode
5	1PPS	Input	Board card 1 PPS input
6	TXD1	Output	Main serial port 1 TX terminal
7	RXD1	Input	Main serial port 1 RX terminal
8	GND		Grounding
9	GND		Grounding
10	IO3	Input / Output	Functionally expand the IO port
11	IO4	Input / Output	Functionally expand the IO port
12	RSV		Suspended in the air
13	GND		Grounding
14	ANT	Input / Output	Antenna interface
15	GND		Grounding
16	GND		Grounding
17	TXD2	Output	Serial Port 2 TX Terminal
18	RXD2	Input	Serial Port 2 RX Terminal
19	REST	Input	Radio reset (low level valid)
20	IO1	Input / Output	Functionally expand the IO port

21	IO2	Input / Output	Functionally expand the IO port
22	GND		Grounding
23	GND		Grounding
24	LED TX	Output	Transmission signal indicator light (high level valid)
25	LED RX	Output	Receiving signal indicator light (high level valid)
26	GND	Bidirectional	Radio ground wire
27	VCC	Input	Power DC 3 - 3.6V
28	VCC	Input	Power DC 3 - 3.6V
29	GND		Grounding
30	GND		Grounding

IV. Recommended Connection Lines

The recommended connection diagram is shown as follows.



Note:

When the antenna interface uses the 14th pin stamp hole, the impedance of the RF routing line is required to be $50\ \Omega$, and the width should be more than 0.5mm.

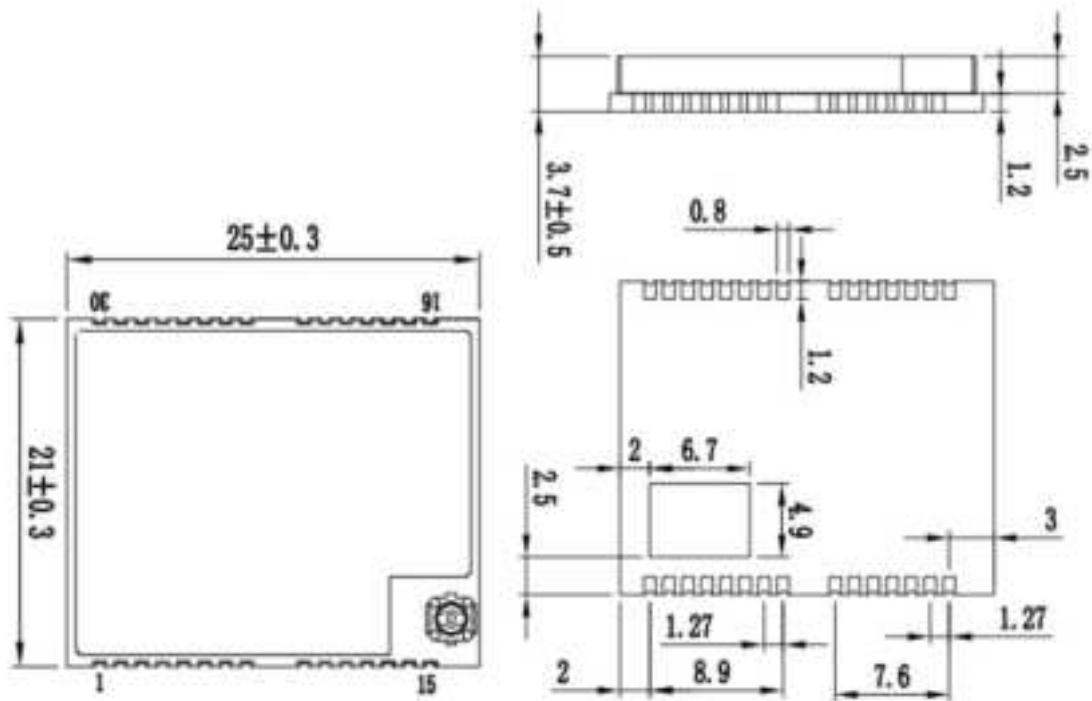
The pads at 13 and 15 need to be arranged close to the vias for connection to the reference ground.

2. When the antenna interface uses IPEX, the 14th pin stamp hole cannot be connected to any routing.

3. Mechanical Characteristics

4.1 Module size

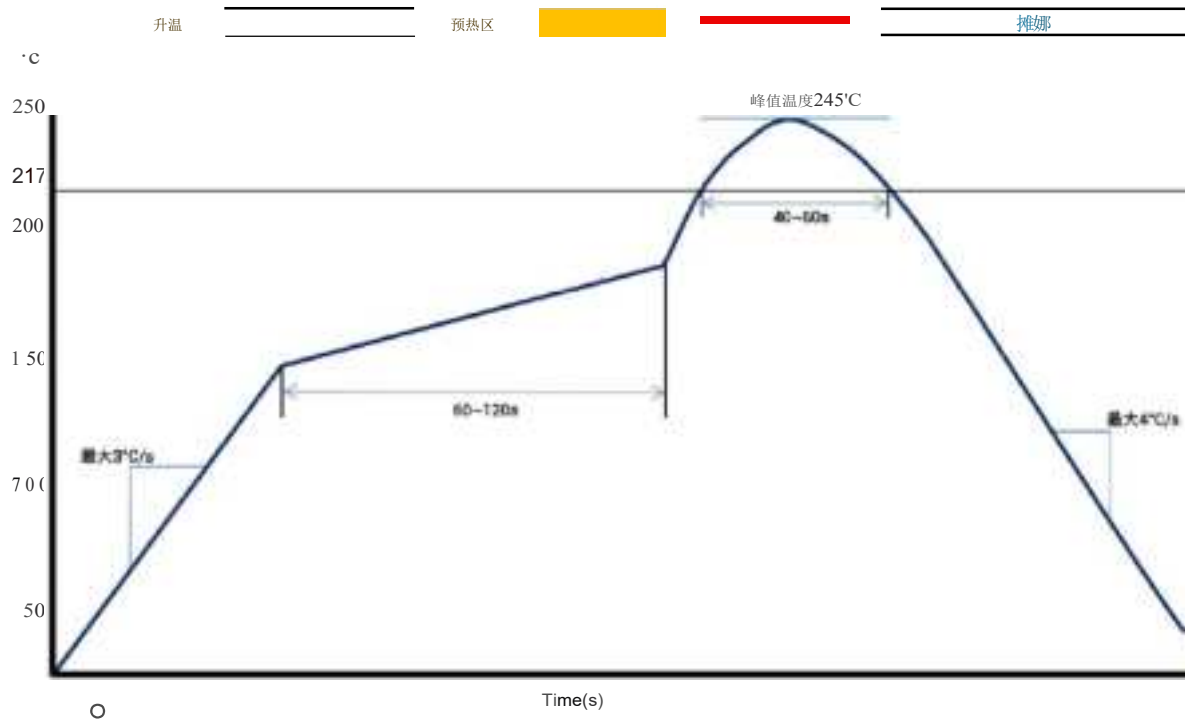
The view and dimensions are shown as follows.



Note: There is a copper-exposed area of 6.7×4.9 mm at the bottom of the radio station, which is used for heat dissipation of the internal PA. When soldering, this area needs to be soldered to the PCBA.

4.2 Requirements for the annealing process

The reference of the furnace temperature zone is shown as follows .



Note: For secondary assembly reflow soldering, we suggest placing the module in the final oven process in the double-sided design application, with the module shielding cover facing up. We recommend that users use the one-time oven process. For the oven temperature curve, please refer to the above picture.

FCC Statement

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.

To assure continued compliance, any changes or modifications not expressly approved by the party.

Responsible for compliance could void the user's authority to operate this equipment. (Example-use only shielded interface cables when connecting to computer or peripheral devices).

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

This equipment 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.

Radiation Exposure Statement:

The equipment complies with FCC Radiation exposure limits set forth for uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

ISED Statement

This device contains licence-exempt transmitter(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Radiation exposure statement:

The device complies with the RSS radiation exposure limits set for uncontrolled environments. The device must be installed and used with a minimum distance of 20cm between the radiator and the body

Le present appareil est conforme aux CNR ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisee aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioelectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement.

Déclaration d'exposition aux rayonnements:

L'équipement est conforme aux limites d'exposition au rayonnement RSS établies pour les environnements non contrôlés. Cet équipement doit être installé et utilisé avec une distance minimale de 20cm entre le radiateur et votre corps

RSS-Gen clause 4.3 statement:

If the IC Certification Number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be

labeled in a visible area with the following:

"Contains IC: 33426-M4P"

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter.

2.3 Summarize the specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

This radio transmitter 2BM2K-M4P have been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

The concrete contents to check are the following three points.

- 1) Must use an antenna such as Dipole Antenna with a gain not exceeding 1.34 dBi
- 2) Should be installed so that the end user cannot modify the antenna;

Fine-tuning of return loss etc. can be performed using a matching network. The antenna shall not be accessible for modification or change by the end user. A modification to the antenna is required FCC/ISED Class II permissive change.

This device has been approved as mobile device in accordance with FCC and ISED Canada RF exposure requirements. This means that a restricted minimum separation distance of 20cm between the antenna and any person.

A change in use that involves a separation distance $\leq 20\text{cm}$ (Portable usage) between the Module's antenna and any persons is a change in the RF exposure of the module and, hence, is subject to a FCC Class 2 Permissive Change and a ISED Canada Class 4 Permissive Change policy in accordance with FCC KDB 996396 D01 and ISED Canada RSP-100.

2.4 Limited module procedures

The module is a single module, not applicable.

2.5 Trace antenna designs

The module has no tracking antenna be used, not applicable.

2.6 RF exposure considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

The host product shall show the same or similar statement to the end users in the end-product manuals.

If the module is installed to a host / end product with a used distance <20cm, additional SAR evaluation or measurement must be followed according to FCC KDB 447498 and RSS-102.

If the module is installed to a host / end product with multiple transmitters, additional RF exposure evaluation must be performed for the simultaneous transmission condition per FCC KDB 447498 and RSS-102. A Formula is also showed below:

The procedure rules are provided in 2.3 in this document. As the module manufacturer is still taking responsibility for the compliance of this module, if you have any changes mentioned above, you must advise and get the help from us with the contact information as shown below 2.12.

2.7 Antennas

This radio transmitter has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. FCC ID: 2BM2K-M4P

Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Radios	Dipole Antenna
LoRa	1.34dBi

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains FCC ID: 2BM2K-M4P

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

Additional testing requirements should be taking into account for different operating conditions for the transmitter function.

If this module is operated as a stand-alone modular in a host:

Radiated spurious emission per FCC Part 15.247, RSS247

The host should be operated in all its normal mode with the modular transmitter active.

Please follow 2.11 in this document to obtain a best radio engineer design.

If this module is operated as multiple simultaneously transmitting modules in a host:

Foundation frequency power, Radiated spurious emission per FCC Part 15.247 and RSS-247.

Conducted spurious emission and conducted power per FCC part 15.247 and

RSS-247.

Please contact the modular manufacturer through the contact information shown below 2.12 to get the test software.

This module should be operated in transmitter mode with other transmitter for the simultaneous condition.

Please follow 2.11 in this document to obtain a best radio engineer design.

The procedure rules are provided in 2.3 in this document. As the module manufacturer is still taking responsibility for the compliance of this module, if you have any changes mentioned above, you must advise and get the help from us with the contact information as shown below 2.12.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

2.11 Note EMI Considerations

EMI consideration for transmitting simultaneously:

This module is stand-alone modular. If the end product has multiple certified modules integrated in a host and transmitting simultaneously: When after radiated emission testing, if there are no additional emissions generated due to simultaneous-transmission operations compared to single transmitter operations testing, it is not necessary to file the additional simultaneous transmission test data. FCC class II permissive changes is no necessary.

However, RF exposure for transmitting simultaneously also needed, please refer to 2.6 in this document.

To obtain better engineer design while installing this module:

It is recommended to place the module as close as possible to the edge of the baseplate. If conditions permit, make the antenna feed point closest to the edge of the baseplate. Please ensure that the module is not covered by any metal shell. Do not lay copper, wire, or place components in the antenna area of the module PCB.

2.12 How to make changes

Only the module grantee is permitted to make permissive changes. If the host integrator is expected to install the module in a way different from this manual or want to change the module, please contact:

Company: Shenzhen Navynav Technology Co., Ltd.

Address: Room 502, Han's Laser Technology Centre Shennan Ave No.9988, Nanshan District, Shenzhen, Guangdong Province, China

Email: 157381769@qq.com