E291-400XBX-SC Series Evaluation Kit
User Manual

New generation packaged compatible Sub-1G wireless module kit



Chengdu Ebyte Electronic Technology Co.,Ltd.

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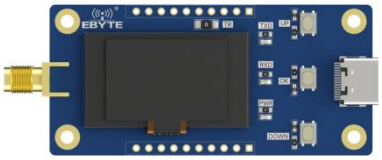
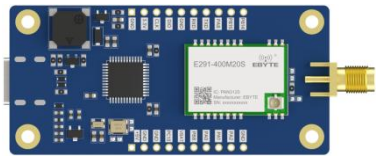
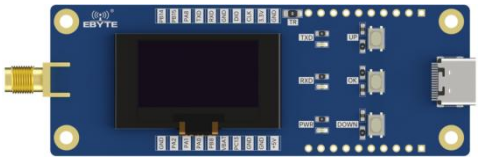
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1.Product Overview

1.1 Product Introduction

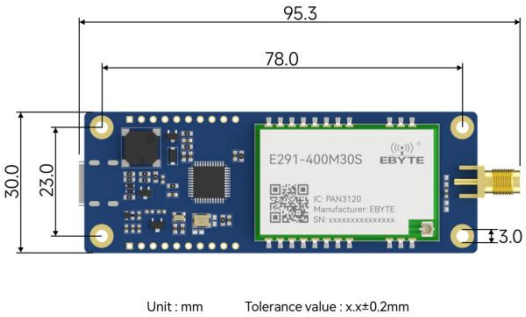
	Model	front	back
Low power kit	E291-400MBL-SC (3120)		
High-power kit	E291-400MBH-SC(3120)		

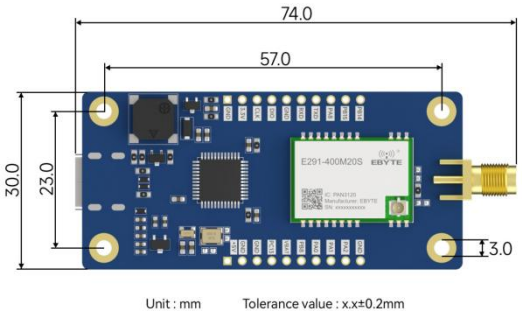
The SC series evaluation kit is designed to help users quickly evaluate EBIRT's next-generation package-compatible wireless modules. The MCU uses the STM32F103C8T6, with all available pins brought out to the side headers. Developers can easily connect various peripheral devices via jumpers according to their needs, facilitating secondary development.

This kit provides complete software application examples to help customers quickly get started with wireless data communication development. Different types of Sub-1G wireless modules can be onboard to meet customer needs. All supported modules have pin-compatible packages for quick replacement.

1.2 Dimensions and Pin Definitions

1.2.1 Product Dimensions

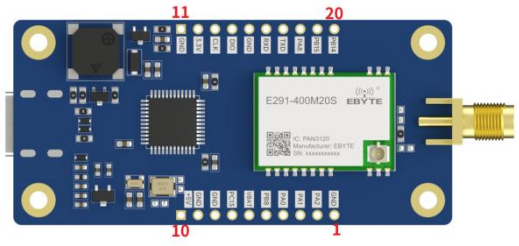




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1.2.1 Pin Definitions



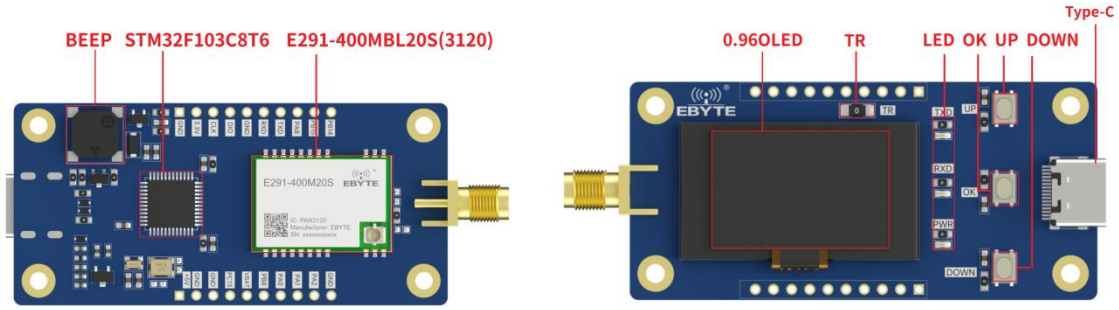


E291 - 400 MBL/MBH-SC (3120)		
Pin number	definition	Function Description
1	GND	Base plate ground wire
2	PA2	MCU_PA2 pin
3	PA1	MCU_PA1 pin
4	PA0	MCU_PA0 pin
5	PB8	MCU_PB8 pin
6	VBAT	MCU_VBAT pin
7	PC13	MCU_PC13 pin
8	GND	Base plate ground wire
9	GND	Base plate ground wire
10	+5V	5V power supply interface
11	GND	Base plate ground wire
12	3.3V	3.3V power supply interface
13	CLK	SWCLK
14	DIO	SWDIO
15	GND	Base plate ground wire
16	RXD	MCU_RXD data input pin
17	TXD	MCU_TXD data output pin
18	PA8	MCU_PA8 pin
19	PB15	MCU_PB15 pin
20	PB14	MCU_PB14 pin

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1.3 Function Introduction



Referring to the above image E290-400MBH-SC(3060), the hardware functions of other models in the SC series are the same.

Display screen	0.96 OLED	Displays current configuration, test parameters, and version information, etc.
button	Up	The up arrow key is used to select or add points; continuous clicking is supported when setting frequency and power.
	Confirm/OK	Press the confirmation button to proceed to the next page or exit to the last page.
	Down	The down arrow key is used to select or decrease the frequency; continuous clicking is supported when setting frequency and power.
indicator lights	TXD	The transmit indicator light flashes once for each transmission.
	RXD	The receiver indicator light flashes once for each received signal.
	PWR	The power indicator light stays on when the power is on.
Test resistance	TR	Remove the test resistor and connect an ammeter in series to test the module current.
buzzer	BEEP	A beep sounds once when the button is pressed.

1.4 Parameter Introduction

Serial Number	Parameter name	Parameter value		Notes
		MBL-SC	MBH-SC	
1	Test board size	30 * 7.4mm	30 * 95.3 mm	-
2	Production process	Lead-free process, machine mounting		Machine-applied stamping ensures batch consistency and reliability.
3	Antenna Interface	SMA		-

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3	Power interface	Type-C	USB to Type-C
4	Operating temperature	-40 ~ +85℃	-
5	Operating humidity	10% ~ 90%	-
6	Storage temperature	-40 ~ +125℃	-

1.5 Compatibility List

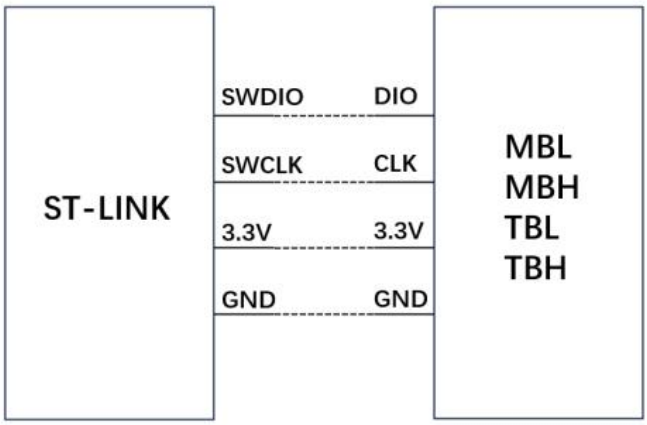
Low power module	SPI	1	E22-400M22S	E22-400/900MBL-SC
		2	E22-900M22S	
		3	E32-400M20S	E32-400/900MBL-SC
		4	E32-900M20S	
		5	E220-400M22S	E220-400/900MBL-SC
		6	E220-900M22S	
		7	E290-400M20S(3060)	E290-400MB L -SC (3060)
		8	E290-400M20S(3029)	E290-400MB L -SC (3029)
		9	E29 1 -400M20S(3 120)	E290-400MB L -SC (3120)
	UART	10	E22-400T22S	E22-400/900TBL-SC
		11	E22-900T22S	
		12	E32-433T20S	E32-433/900TBL-SC
		13	E32-900T20S	
		14	E220-400T22S	E220-400/900TBL-SC
		15	E220-900T22S	
High power module	SPI	16	E22-400M30S	E22-400/900MBH-SC
		17	E22-900M30S	
		18	E32-400M30S	E32-400/900MBH-SC
		19	E32-900M30S	
		20	E220-400M30S	E220-400/900MBH-SC
		twenty one	E220-900M30S	
		twenty two	E290-400M30S(3029)	E290-400MBH-SC (3029)
		twenty three	E290-400M30S(3060)	E290-400MBH-SC (3060)
		twenty four	E290-400M30S(3120)	E290-400MBH-SC (3120)
	UART	25	E22-400T30S	E22-400/900TBH-SC
		26	E22-900T30S	
		27	E32-433T30S	E32-433/900TBH-SC

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		28	E32-900T30S	
		29	E220-400T30S	E220-400/900TBH-SC
		30	E220-900T30S	

1.6 Program Download Interface



Taking E29 1-400MBH -SC(3 120) as an example



The MCU can be programmed via ST-LINK. Please compile the program before programming.



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2.Software Introduction

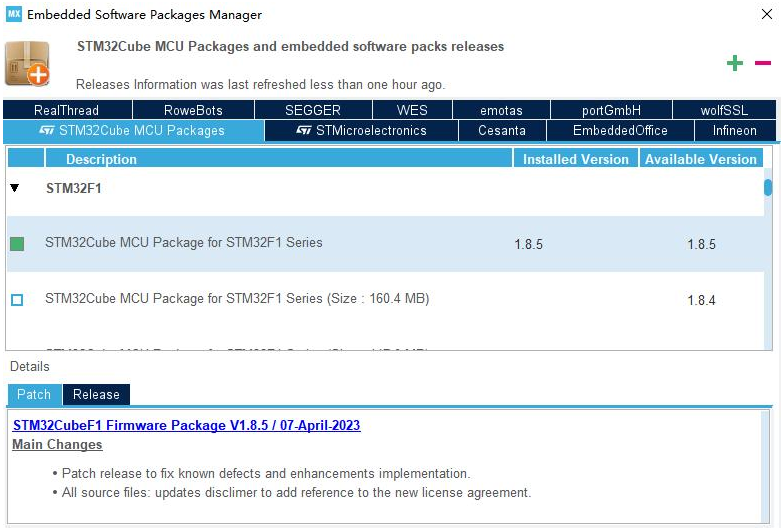
2.1 Development Environment

2.1.1 STM32CubeMX

Recommended tool version: ≥v6.9.2



STM32 firmware version ≥ v1.8.5



2.1.2 MDK-ARM

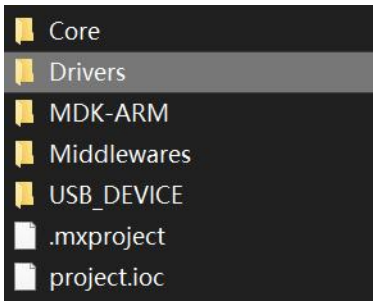
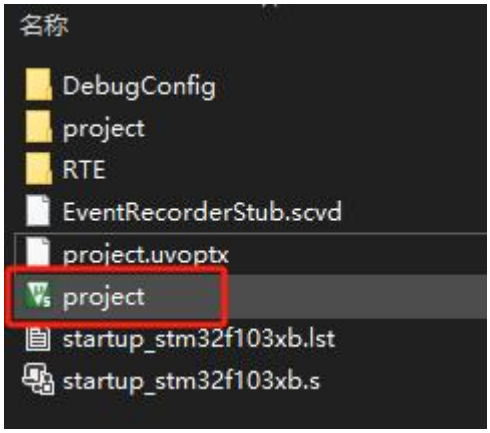
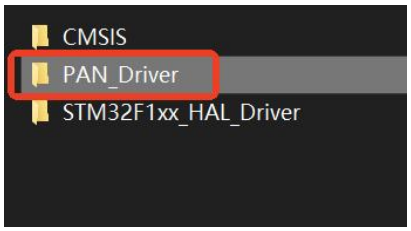
Keil version ≥ v5.31.0

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2.2 Directory Structure

	Matter	illustrate
1	File Directory	The sample project can be downloaded from the official website. The directory is shown in the image below.
2	Project Launch	The MDK-ARM folder contains the startup files.
3	Module driver	The corresponding RF chip driver is located in the Drivers folder.
4	Module application	The Core/Src folder contains the corresponding exx_demo example.

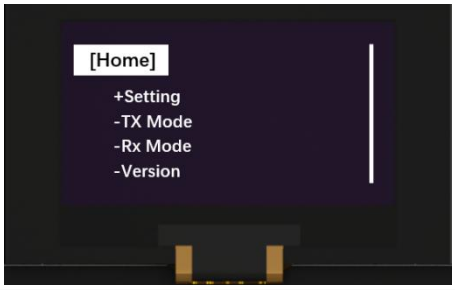
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		e291_demo e291_hal gpio i2c key main spi stm32f1xx_hal_msp stm32f1xx_it system_stm32f1xx tim u8g2_hal

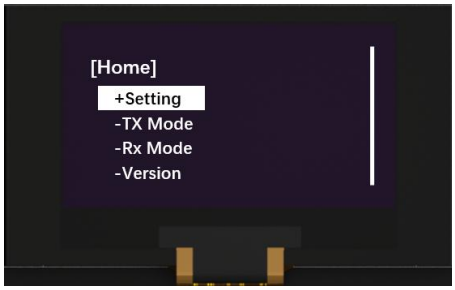
3.Function Demonstration

3.1 Quick Start

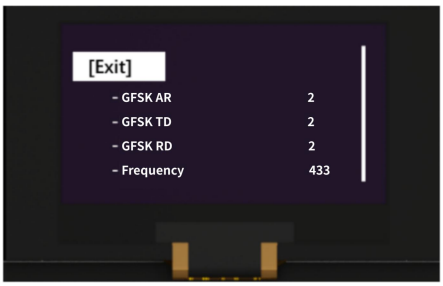
	Matter	illustrate
1	front page	Upon power-on, the system will default to the home page, and all configuration parameters will be restored to their default settings. 
2	Enter page	Clicking the physical confirmation button will take you to the corresponding options page. 
3	Basic parameter settings	The M series Setting page offers a variety of parameters that can be adjusted to suit different needs . The only difference between the T-series and M-series is the airspeed configuration. After configuration, select [Exit] to confirm and return to the previous page.

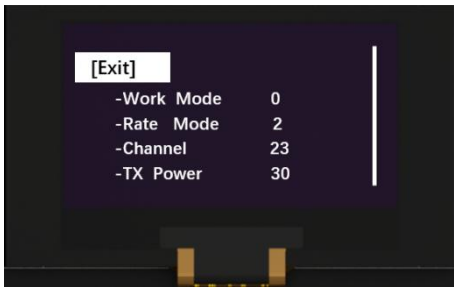
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The M series configuration is as follows: The T series configuration is as follows:





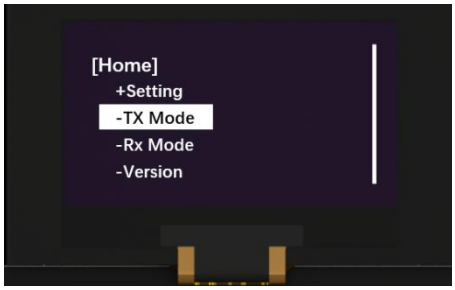
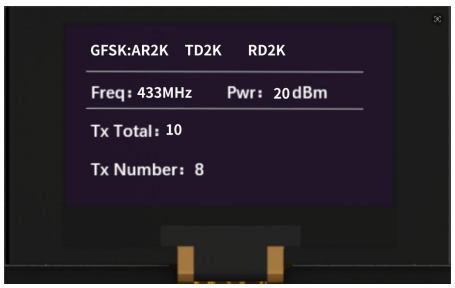
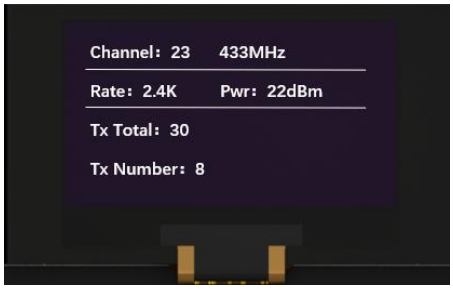
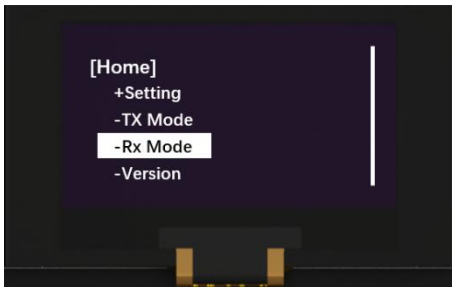
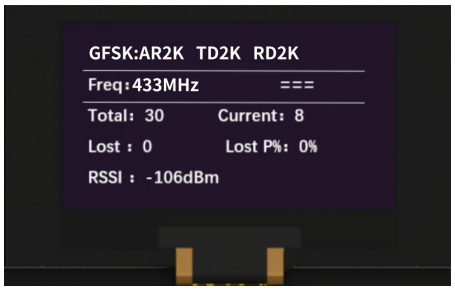
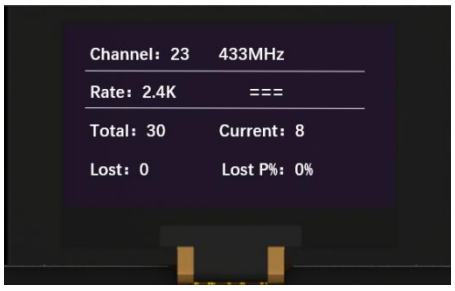
Functional explanation:

M series			T series		
GFSK AR	air speed	Configure air speed	Work Mode	Work mode	Select module working mode
GFSK TD	TX deviation	Transmission frequency offset	Rate Mode	Rate mode	Select airspeed
GFSK RD	RX deviation	Receive frequency offset	Channel	Working Channel	Select Channel
Frequency	Operating frequency	Select frequency point	TX Power	Transmit power	Configure transmission power
TX Power	Transmit power	Configure transmit power	TX Count	Number of times sent	Configure the number of sends
TX Count	Number of times sent	Configure the number of sends	Back Color	Background color	Reverse display screen background color
Back Color	Background color	Reverse display screen background color			

4	Send test	Once Tx Mode is entered, it will automatically start sending data packets according to the user-defined parameters (default 10 bytes per packet).

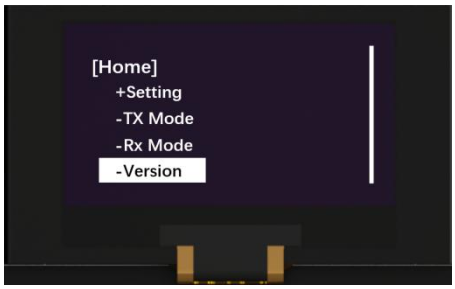
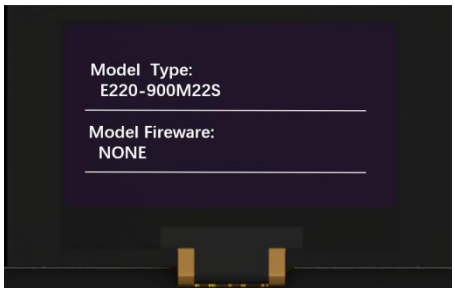
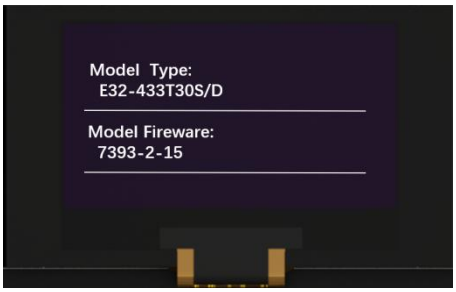
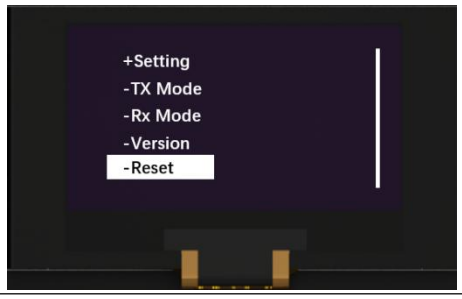
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		Press the "OK" button on the page to exit and return to the previous page. After sending, press the "down" key to resend.  The M-series TX sending interface is shown below: The T-series TX sending interface is shown below:  
5	Receive test	After entering Rx Mode, it will automatically begin waiting to receive wireless data according to the user-defined parameters. Press the "OK" button on the page to exit and return to the previous page. After sending, press the "down" key to restart receiving.  The M-series RX receiver interface is shown below: The T-series RX receiver interface is shown below:  
6	Version information	Displays basic information such as module model; if the M series module has no internal firmware, it displays NONE.

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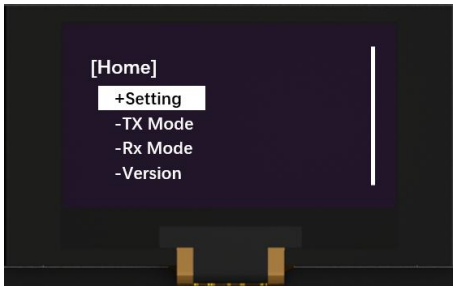
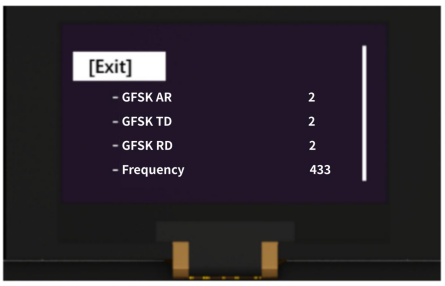
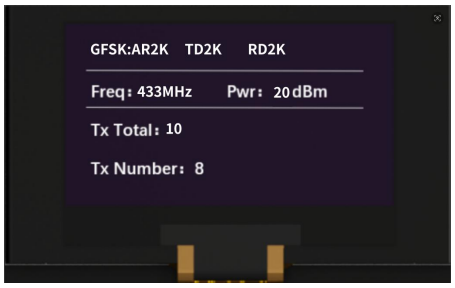
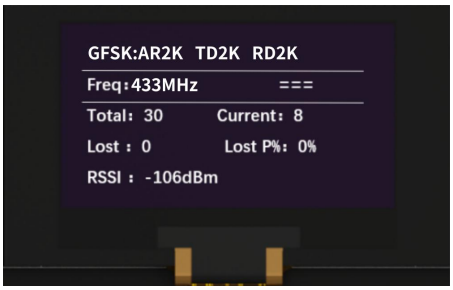
		 The M-series version information interface is shown below: The T-series version information interface is shown below:  
7	Reset	Select Reset, click OK to confirm, reset the configuration and return to the homepage.  

3.2 Implementing Pass-through Function via USB Serial Port

	Matter	illustrate
1	front page	Upon power-on, the system will default to the home page, and all configuration parameters will be restored to their default settings. 
2	menu	Press any key to enter the menu page, then press the "DOWN" key to select "Setting", and then press the "OK" key to enter the settings mode.

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3	set up	In the settings, press the "DOWN" key to select the parameters to be configured , and then press the "OK" key to complete the settings. Communication is possible as long as the GFSK AR, GFSK TD, GFSK RD, and Frequency parameters of the sender and receiver are consistent. 
4	Implement pass-through function via USB serial port	To enable transparent transmission with modules of the same model, open the serial port tool. Set the sender to TX Mode and the receiver to RX Mode. Note: The kit's configuration parameters are at their default values at this time.   TX mode RX mode

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4.Frequently Asked Questions

4.1 Transmission distance is not ideal

- When there are obstacles in line-of-sight communication, the communication distance will be reduced accordingly;
- Temperature, humidity, and co-channel interference can all lead to increased packet loss rates in communications.
- The ground absorbs and reflects radio waves, and the test results are poor when the ground is close to the ground.
- Seawater has a strong ability to absorb radio waves, so testing results are poor at the seaside.
- If there are metal objects near the antenna, or if it is placed inside a metal casing, the signal attenuation will be very severe.
- Power register settings are incorrect; air speed is set too high (the higher the air speed, the shorter the distance).
- At room temperature, the power supply voltage is lower than the recommended value; the lower the voltage, the lower the power output.
- The antenna may be poorly matched with the module or have quality issues.

4.2 The module is easily damaged.

- Please check the power supply and ensure it is within the recommended voltage range. Exceeding the maximum value will cause permanent damage to the module.
- Please check the power supply stability; the voltage should not fluctuate significantly or frequently.
- Please ensure anti-static operation during installation and use, as high-frequency devices are sensitive to electrostatic discharge.
- Please ensure that the humidity is not too high during installation and use, as some components are humidity-sensitive.
- Unless there are special requirements, it is not recommended to use it at excessively high or low temperatures.

4.3 The error rate is too high.

- If there is interference from a co-channel signal nearby, move away from the source of interference or change the frequency or channel to avoid the interference.
- An inadequate power supply can also cause garbled characters, so it is essential to ensure the reliability of the power supply.
- Poor quality or excessive length of extension lines or feeders can also lead to a high bit error rate.

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Revision History

Version	Revision Date	Revision Notes	maintainer
1.0	2026-06-08	Initial version	Bin

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