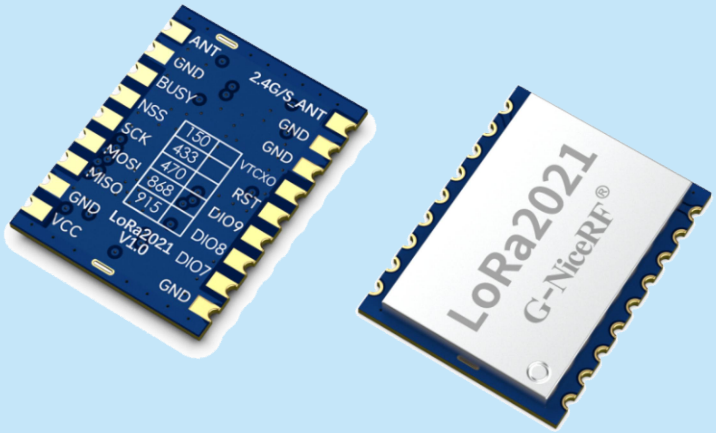
- Dual-band: 150-960MHz and 1.5-2.5GHz
- Up to 2.6 Mbps data rate@FLRC, 125Kbps@LoRa
- Multiple modulations: FSK, LoRa, LR-FHSS, FLRC, O-QPSK, OOK
- Compatible with multiple low-power wireless protocols: Amazon Sidewalk, Wireless M-BUS, Wi-SUN FSK, and Z-Wave
- Supports LoRaWAN protocol
- Supports RTToF ranging

Product Specification



Catalogue

Note: Revision History

Revision	Date	Comment
V1.0	2025-11	First release
V1.1	2025-12	Added power and current data at more frequencies.
V1.2	2025-12	Updated parameters

1. Descriptions

The LoRa2021 is a transceiver module based on SEMTECH's LR2021 chip, which integrates the 4th-generation LoRa IP core and supports operation in the Sub-GHz and 2.4GHz ISM bands, the L-band, and licensed S-band frequencies, making it suitable for both terrestrial and satellite communication (SATCOM) networks.

In addition, the Lora2021 features extended physical-layer modulation capabilities to support Fast Long-Range Communication (FLRC). When integrated with third-party protocol stacks, it is compatible with a wide range of low-power wireless protocols, including Amazon Sidewalk, Wireless M-BUS, Wi-SUN FSK, and Z-Wave. The LoRa2021 is manufactured and tested using strictly lead-free processes and is fully compliant with RoHS and REACH standards.

2. Features

- Sub-GHz Bands: 433/470/868/915MHz
  (Customizable range: 150~960 MHz)
  High frequency band: 1900 / 2400MHz
  (Customizable range: 1500~2500 MHz)
- Transmission distance: >5000 meters at sub-GHz in open area
- Sub-GHz reception sensitivity: up to -143dBm@BW=62.5 KHz, SF=12
- 2.4GHz reception sensitivity: up to-137dBm @ BW=200KHz, SF=12
- Built-in electrostatic protection circuit
- Supports LR-FHSS
- FLRC: modulation rate up to 2.6 Mbps
- LoRa: modulation rate up to 125 kbps
- 4th Generation LoRa IP technology
- Simultaneous reception with multiple Spreading Factors (SF)
- Enhanced CAD (Channel Activity Detection)
- Higher frequency offset tolerance (for harsh RF environments):
- Supports multiple communication protocols:
  LoRa / LoRaWAN® (Sub-GHz + 2.4GHz)
  Bluetooth® LE 5.0
  IEEE® 802.15.4 (Thread®/Zigbee™)
  Amazon Sidewalk, Wireless M-BUS,
  Wi-SUN FSK, and Z-Wave, etc.
- Transmit power is adjustable, up to 22dBm
- Sleep current ≤ 2μA
- Receive current < 7mA
- Small size, stamp hole design

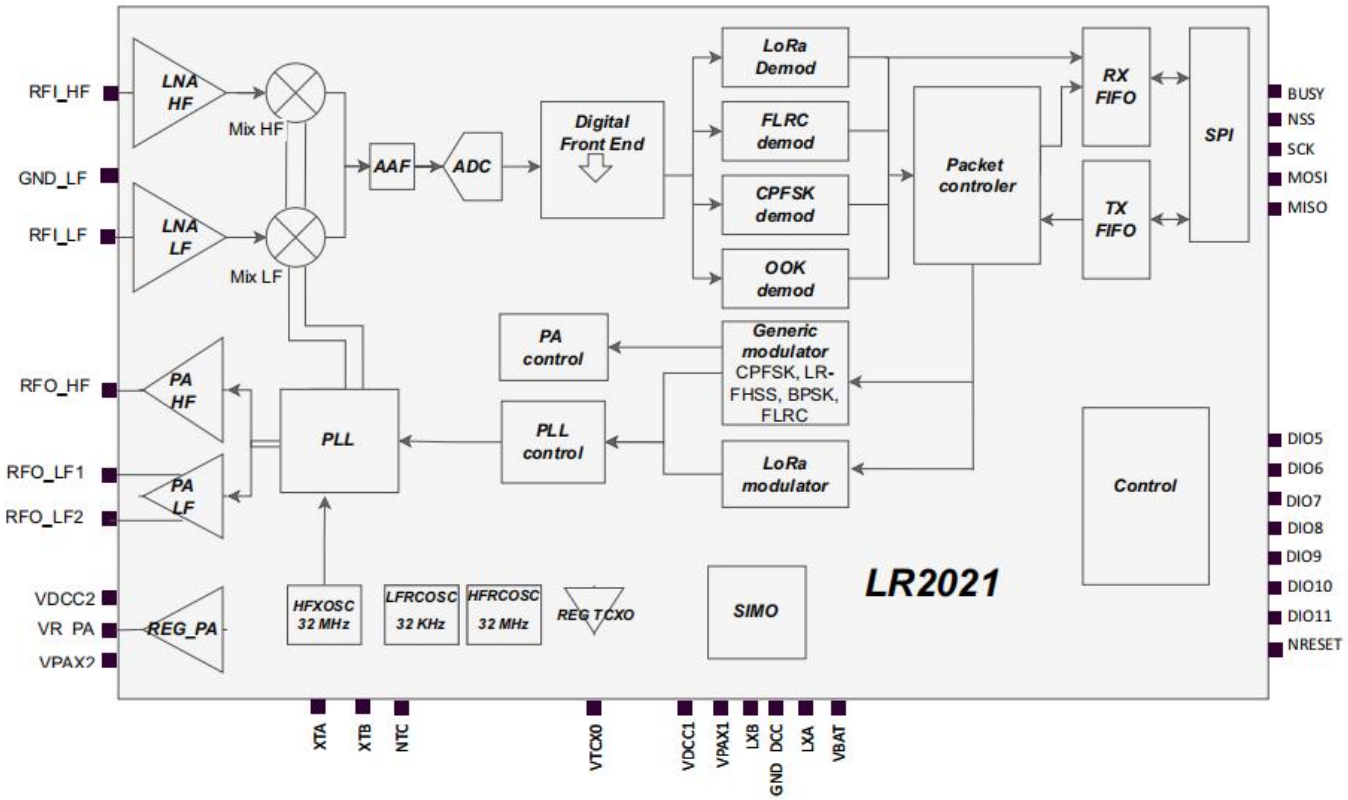
3. Applications

- Drones/UAV Applications
- Smart home/Smart agriculture
- Remote irrigation
- Industrial manufacturing

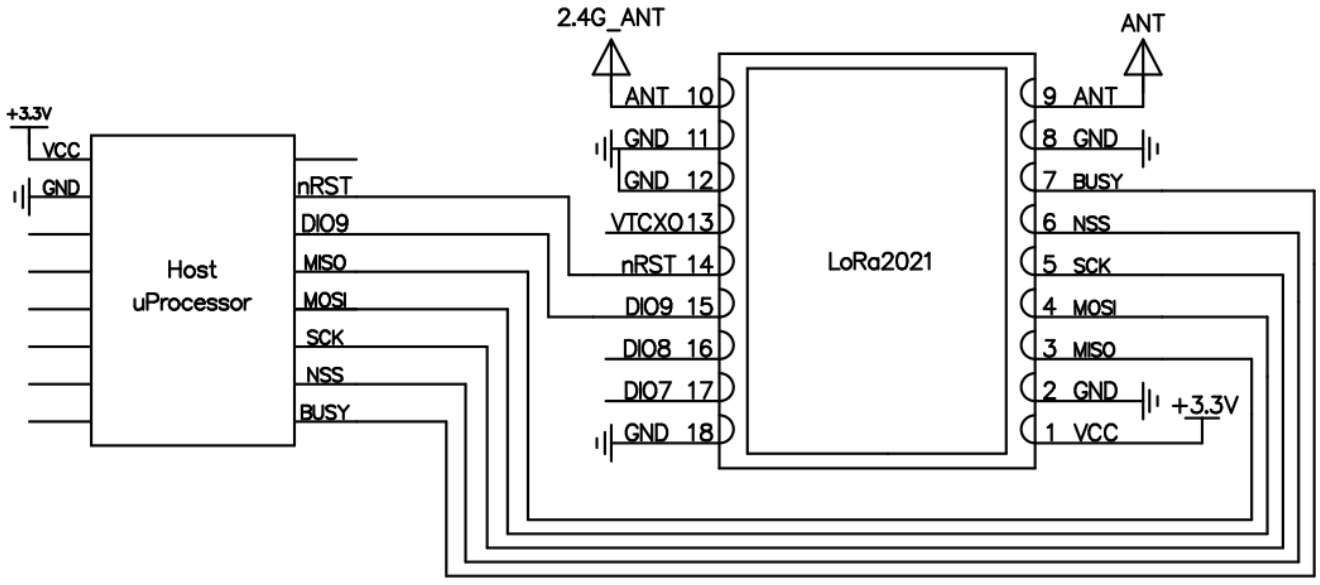
4. Electrical Characteristics

Parameters	Test condition	Min.	Typ.	Max	Unit
Voltage range		1.8	3.3	3.6	V
Operating Temperature		-40	25	85	℃
Maximum Input Signal			10		dBm
Current Consumption					
Transmit Current	@433MHz		< 120		mA
	@2.4GHz		< 35		mA
Receive Current	@3.3V,@DCDC,2.4GHz		< 7		mA
	@3.3V,@LDO,2.4GHz		< 11		mA
	@3.3V,@DCDC, Sub-GHz		< 6		mA
	@3.3v,@LDO, Sub-GHz		< 9.3		mA
Sleep Current	@3.3V		≤2		uA
RF Parameters					
Frequency Range	@433MHz	400		460	MHz
	@470MHz	470		510	MHz
	@868MHz	850		890	MHz
	@915MHz	900		940	MHz
Transmit Power	@Sub-GHz	19	21	22	dBm
	2.4GHz	10	11	12	dBm
Receive Sensitivity	BW=62.5KHz, SF=12 @Sub-GHz		-143		dBm
	BW=125KHz, SF=10 @Sub-GHz		-136		
	BW=125KHz, SF=10 @S frequency band		-131		dBm
	BW=406KHz, SF=12 @2.4GHz		-134		dBm
Frequency Error	@Crystal		10		ppm
	@TCXO		0.5		ppm
Modulation Rate (@sub-GHz)	@LoRa	0.0458		125	Kbps
	@FRLC	260		2600	Kbps
	@FSK,@863-2.5GHz	0.5		2000	Kbps
Modulation Rate (@S Frequency bands)	@LoRa	0.0458		125	Kbps
Modulation Rate (@2.4GHz)	@LoRa	0.476		101.5	Kbps

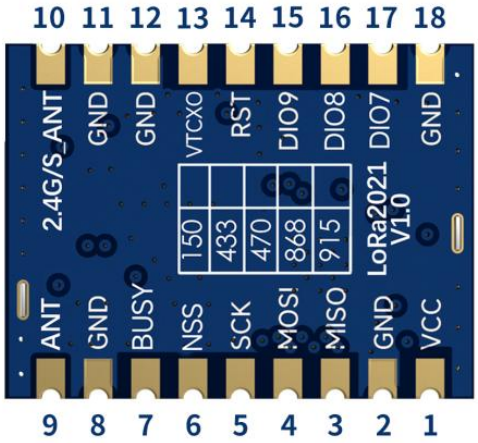
5. Block Diagram



6. Typical Schematic Circuit:



7. Pin definition



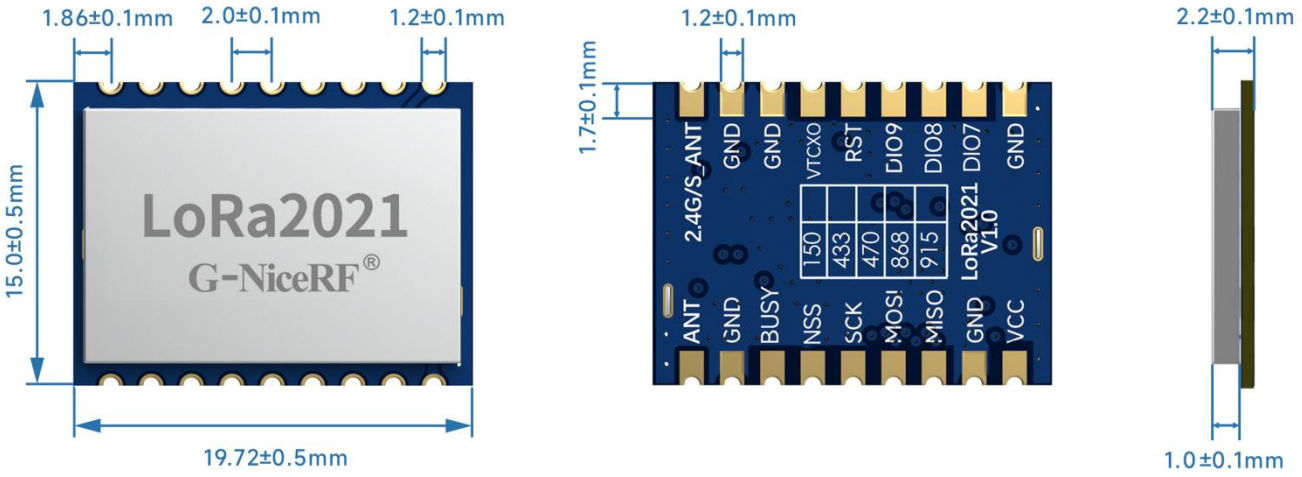
Pin NO.	Pin name	I/0	Description
1	VCC		Connect to the positive power supply.
2,8,11,12,18	GND		Connect to the negative power supply.
3	MISO	O	SPI data output
4	MOSI	I	SPI data input
5	SCK	I	SPI clock input
6	NSS	I	SPI chip select input
7	BUSY	O	Used for status indication, refer to the chip datasheet for details.
9	ANTA ANT		@sub-GHz band antenna interface, external 50-ohm antenna.
10	2.4/S_ANTA		2.4G and S band antenna interface, external 50-ohm antenna.
13	VTCXO	O	Can provide power for an external TCXO.
14	RST	I	Reset trigger input, refer to the chip datasheet for details.
15	DIO9	IO	Multipurpose digital interface, refer to the chip datasheet for details.
16	DIO8	IO	Multipurpose digital interface, refer to the chip datasheet for details.
17	DIO7	IO	Multipurpose digital interface, refer to the chip datasheet for details.

8. Power and Current Comparison Table

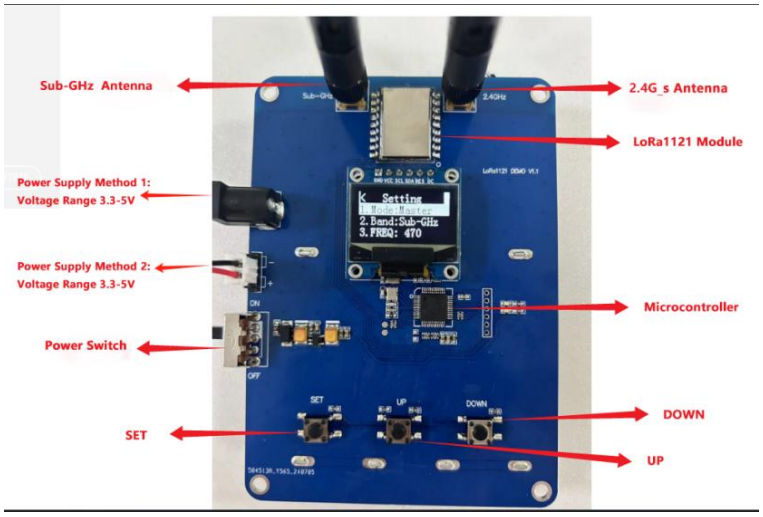
Power Levels of the DEMO Board		0	1	2	3	4	5	6	7	8	9
SubGHz Register Values		-11	-5	1	7	13	19	25	31	37	44
@915MHz @3.3V	Power(dBm)	-4.3	-1.4	1.5	4.4	7.3	10.3	13.4	16.5	19.5	21.9
	Current(mA)	12.5	13.7	15.2	17.9	21.1	29.6	36.5	47.7	80.3	140
@868MHz @3.3V	Power(dBm)	-4.2	-1.4	1.5	4.4	7.3	10.2	13.3	16.3	19.3	22
	Current(mA)	12.4	13.8	15.3	17.9	21.5	30.5	37.2	47.8	79.2	142.4
@490MHz @3.3V	Power(dBm)	-6	-3	-0.1	2.8	5.7	8.7	12	15.1	18.1	21.3
	Current(mA)	9.8	10.9	11.8	13.4	15.7	21	26	33.9	56.7	113
@433MHz @3.3V	Power(dBm)	-5.4	-2.4	0.6	3.6	6.3	9.4	12.6	15.7	18.6	21.4
	Current(mA)	9.6	10.8	11.8	13.8	16.2	21.2	27	36.6	62	128
@340MHz @3.3V	Power(dBm)	-5.9	-3.1	-0.3	2.5	5.3	8.7	11.7	14.9	17.7	21.1
	Current(mA)	9.5	10.6	11.6	13.4	15.8	21.5	26	33.8	54.7	121
1.9GHz/2.4GHz Register Values		-12	-8	-4	0	4	8	12	16	20	24
@1.9GHz @3.3V	Power(dBm)	-6.2	-4.1	-2.3	0	1.5	3.6	5.6	7.7	9.8	12.0
	Current(mA)	9.0	9.5	10.1	10.9	11.2	12.2	13.5	15.1	17.1	21.0
@2.4GHz @3.3V	Power(dBm)	-5.0	-3.0	-1.4	0.6	2.4	4.5	6.4	8.4	10.3	12.2
	Current(mA)	11.4	12.3	13.3	14.4	15.3	17.2	19.3	21.9	25	31.3

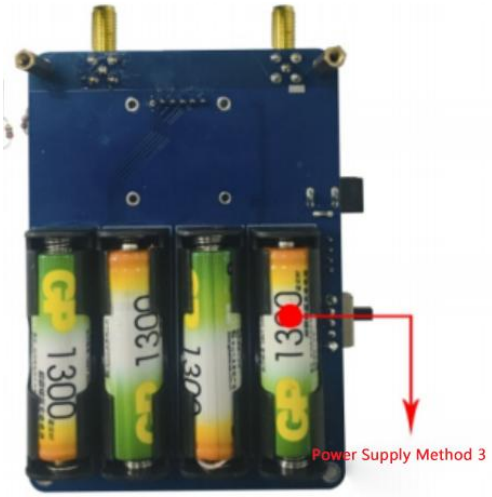
Register Value 1: TxPower in the SetTxParams(0x0203) Command

9. Mechanism Dimension (Unit: mm)



Appendix 1: Function Demonstration Board





Note: Only one power supply method can be selected

1. Function Description

The LoRa2021 wireless module demo board primarily implements bidirectional communication (Master and Slave) in LoRa mode, along with sleep (Sleep), transmit power (TxTest), and receiver sensitivity (RxTest) testing functions at the modulations of FLRC and LoRa.

Note: Transmit power and receiver sensitivity must be tested with instruments.

2. Key Functions

The demo board has three buttons: SET, UP, and DOWN. Their functions are as follows:

Buttons	Functions
SET Key Short Press	Confirm or enter the next level of the interface
SET Key Long Press	Return to the previous interface
UP Key Short Press	Move cursor up or increase parameter by 1
UP Key Long Press	Increase parameter
DOWN Key Short Press	Move cursor down or decrease parameter by 1
DOWN Key Long Press	Decrease parameter

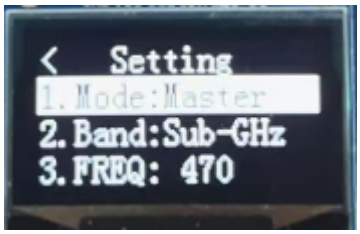
Operation Method:

With normal power supply, toggle the power switch to turn on the device. The LCD screen on the demo board will display the "Setting" interface. Briefly press the UP or DOWN key to move the cursor. When the cursor is on the parameter you wish to modify, press the SET key briefly to make the cursor flash. Then, use the UP or DOWN key to adjust the parameter. Press the SET key again to confirm the modification.

To enter the test function corresponding to the "Mode" parameter, long-press the SET key. Briefly press the SET key to return to the "Setting" interface.

3. Setting Interface Description

Parameter Name	Description	LoRa Mode	FLRC Mode
Mod	Modulation	LoRa	FLRC
Mode	Function	Master, Slave, TXTEST, RXTEST, SLEEP	
Band	Frequency Band	LF: 150-960MHz, HF: 1500-2500MHz	
FREQ	Frequency(MHz)	Set value(MHz)	
POWER	TX Power	0-9 Levels	
SF(LoRa)	Spreading Factor	5-12	N/A
BW(LoRa)	Bandwidth	62.5/125/250/500/1000(Sub-GHz) 203/406/812(2.4G)	N/A
CR(LoRa)	Coding Rate	4/5-4/8	N/A
DR_BW(FLRC)	Data rate, Bandwidth(Mbps)	N/A	0.26/0.32/0.52/0.65 /1.04/1.3/2.08/2.6
CR(FLRC)	Coding Rate	N/A	1/2, 3/4, 1, 2/3
Shape(FLRC)	Pulse shape	N/A	BT_05, BT_1, OFF

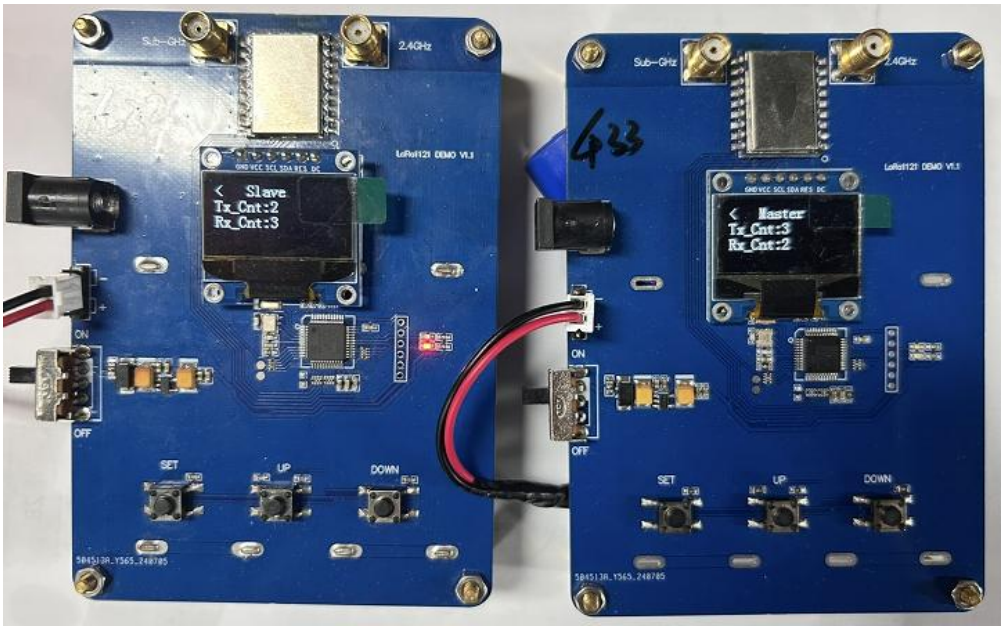


4. Communication Test

Prepare two LoRa2021 demo boards, and select the modulation: LoRa or FLRC. Set one to Master mode as the communication host, and the other to Slave mode as the communication slave. (Set the LoRa or FLRC communication parameters: FREQ, SF, BW, and CR to be the same; otherwise, communication will fail.)

On the communication interface screen, the Tx_cnt and Rx_cnt values will keep increasing. (The

red indicator light represents a successful transmission, and the blue indicator light represents a successful reception.)



Appendix 2: SMD Reflow Chart

Below reflow profile is recommended for SMT technology: