E70-400M14S1B

CC1312 410~490MHz Wireless SOC Module



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1 Product Overview

1.1 Brief Introduction

E70-900M14S1B adopts the original imported CC1312R from Texas Instruments (TI). It integrates a single-chip microcomputer and wireless transceiver and uses a 48MHz industrial-grade high-precision low-temperature drift crystal oscillator to ensure its industrial characteristics and stable performance.



The CC1312R chip has a built-in powerful 48MHz Arm Cortex-M4F processor, and has abundant peripheral resources such as UART, I2C, SPI, ADC, DMA, and PWM. The module leads to all the IO ports of the single-chip microcomputer, which can be used for multi-directional development.

Since the E70-900M14S1B is a pure hardware SOC module, there is no program at the factory, and the user needs to develop it again before it can be used.

1.2 Feature

- Developed based on CC1312R, built-in powerful 48MHz Arm Cortex-M4F processor;
- With 48MHz temperature compensated crystal oscillator, industrial-grade standard design
- 352KB system programmable flash memory, 256KB ROM for protocol and library functions;
- 8KB cache SRAM (available as general-purpose RAM), 80KB ultra-low leakage SRAM, SRAM adopts parity check protection to ensure high reliability of operation
- RSSI signal strength reading;
- Air wake-up, that is, low power consumption function, suitable for battery-powered solutions;
- Ultra-low receiving current, its receiving current is only half of similar products;
- The maximum transmit power is 25mW, and the software is multi-level adjustable;
- For European license-free frequency band ISM 868MHz and North America license-free ISM 915MHz frequency band;
- Air transmission rate: 20～1000kbps;
- 2.2～3.8V power supply, power supply greater than or equal to 3.3V can guarantee the best performance;
- Under ideal conditions, the communication distance can reach 1.5km;
- Dual antennas are optional (IPEX/stamp hole), which is convenient for users to develop and integrate.

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1.3 Application

- Home security alarm and remote keyless entry;
- Wireless alarm security system;
- Building automation solutions;
- Wireless industrial-grade remote control;
- Health care products;
- Advanced Meter Reading Architecture(AMI);
- Automotive industry applications.

2 Specification and parameter

2.1 Limit parameter

Main parameter	Performance		Remark
	Min	Max	
Power supply（V）	0	3.8	Voltage over 3.8V will cause permanent damage to module
Blocking power（dBm）	-	10	Chances of burn is slim when modules are used in short distance
Operating temperature（℃）	-40	85	

2.2 Operating parameter

Main parameter		Performance			备注
		Min	Type	Max	
Operating voltage（V）		2.2	3.3	3.8	≥3.3 V ensures output power
Communication level（V）		-	3.3	-	For 5V TTL, it may be at risk of burning down
Operating temperature（℃）		-40	-	+85	Industrial grade
Operating frequency（MHz）		410	-	490	Support ISM band
Power Consump-tion	TX current（mA）	-	24.9	-	Instant power consumption
	RX current（mA）	-	5.8	-	-
	Sleep current （μA）	-	2.0	-	Shut down by software
Max TX power（dBm）		13.5	14	14.5	-
Receiving sensitivity（dBm）		-120	-121	-122	Air data rate is 5 kbps
Air data rate（bps）		20	-	1000k	Controlled via user’s programming

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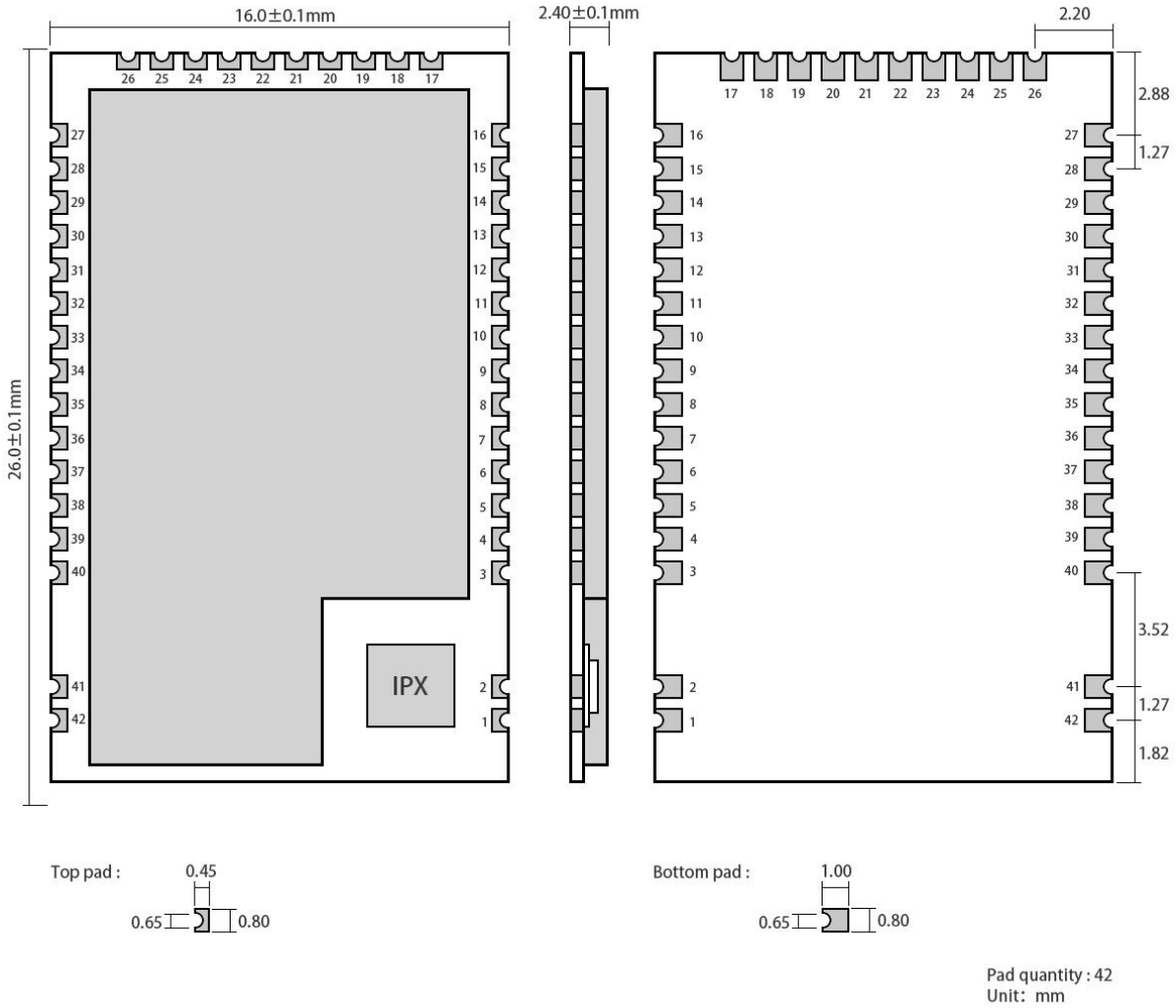
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Main parameter	Description	Remark
Reference distance	1500m	Test condition：clear and open area, antenna gain: 5dBi，antenna height: 2.5m，air data rate: 2.5 kbps
Crystal Oscillator	48MHz	
Modulation	GFSK	
Package	SMD	
Interface	1.27mm	
IC	CC1312R1F3RGZ	
FLASH	352KB	
ROM	256KB	
RAM	8KB+80KB	8KB cache SRAM (available as general-purpose RAM) 80KB ultra-low leakage SRAM.
Core	Arm Cortex-M4F processor	
Size	26*16mm	-
Antenna	IPEX/stamp hole	50 ohm impedance
Weight（g）	2.5	

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3 Size and pin definition



Pin No.	Item	Direction	Description
1	GND	Reference ground	Ground
2	ANT		Antenna（50 ohm impedance）
3	X32K_Q1	Input/Output	Connect with pin 4 to 32.768K quartz crystal
4	X32K_Q2	Input/Output	Connect with pin 3 to 32.768K quartz crystal
5	DIO_1	Input/Output	MCU GPIO
6	DIO_2	Input/Output	MCU GPIO
7	DIO_3	Input/Output	MCU GPIO
8	DIO_4	Input/Output	MCU GPIO
9	DIO_5	Input/Output	MCU GPIO
10	DIO_6	Input/Output	MCU GPIO
11	DIO_7	Input/Output	MCU GPIO
12	DIO_8	Input/Output	MCU GPIO
13	DIO_9	Input/Output	MCU GPIO

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14	DIO_10	Input/Output	MCU GPIO
15	DIO_11	Input/Output	MCU GPIO
16	GND	Reference ground	Ground
17	DIO_12	Input/Output	MCU GPIO
18	DIO_13	Input/Output	MCU GPIO
19	DIO_14	Input/Output	MCU GPIO
20	DIO_15	Input/Output	MCU GPIO
21	TMSC	Input	JTAG TMSC
22	TCKC	Input	JTAG TCKC
23	DIO_16	Input/Output	MCU GPIO
24	DIO_17	Input/Output	MCU GPIO
25	DIO_18	Input/Output	MCU GPIO
26	VCC		Power supply：2.2～3.8V DC
27	GND	Reference ground	Ground
28	DIO_19	Input/Output	MCU GPIO
29	DIO_20	Input/Output	MCU GPIO
30	DIO_21	Input/Output	MCU GPIO
31	DIO_22	Input/Output	MCU GPIO
32	RESET	Input	Module reset
33	DIO_23	Input/Output	MCU GPIO
34	DIO_24	Input/Output	MCU GPIO
35	DIO_25	Input/Output	MCU GPIO
36	DIO_26	Input/Output	MCU GPIO
37	DIO_27	Input/Output	MCU GPIO
38	DIO_28	Input/Output	MCU GPIO
39	DIO_29	Input/Output	MCU GPIO
40	DIO_30	Input/Output	MCU GPIO
41	GND	Reference ground	Ground
42	GND	Reference ground	Ground

4 Basic operation

4.1 Hardware design

- It is recommended to use a DC stabilized power supply. The power supply ripple factor is as small as possible and the module needs to be reliably grounded;
- Please pay attention to the correct connection of the positive and negative poles of the power supply, reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure that between the recommended supply voltage, if exceeding the maximum, the module will be permanently damaged;

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- Please check the stability of the power supply. Voltage can not fluctuate greatly and frequently;
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so the whole machine is beneficial for long-term stable operation;
- The module should be as far away as possible from the power supply, transformers, high-frequency wiring and other parts with large electromagnetic interference;
- Bottom Layer High-frequency digital routing, high-frequency analog routing, and power routing must be avoided under the module. If it is necessary to pass through the module, assume that the module is soldered to the Top Layer, and the copper is spread on the Top Layer of the module contact part(well grounded), it must be close to the digital part of the module and routed in the Bottom Layer;
- Assuming the module is soldered or placed over the Top Layer, it is wrong to randomly route over the Bottom Layer or other layers, which will affect the module's spurs and receiving sensitivity to varying degrees;
- It is assumed that there are devices with large electromagnetic interference around the module that will greatly affect the performance. It is recommended to keep them away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done;
- Assume that there are traces with large electromagnetic interference (high-frequency digital, high-frequency analog, power traces) around the module that will greatly affect the performance of the module. It is recommended to stay away from the module according to the strength of the interference.If necessary, appropriate isolation and shielding can be done;
- If the communication line uses a 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage);
- Try to stay away from some physical layers such as TTL protocol at 2.4GHz , for example: USB3.0;
- The mounting structure of antenna has a great influence on the performance of the module. It is necessary to ensure that the antenna is exposed, preferably vertically upward. When the module is mounted inside the case, use a good antenna extension cable to extend the antenna to the outside;
- The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.

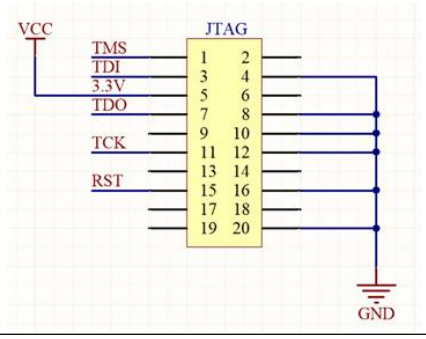
4.2 Software program

- The chip scheme of this module is the CC1312R of Texas Instruments (Texas Instruments), and the user can operate according to the CC1312R chip book provided by TI's official website;
- Users can download the CC1312R software development kit on TI's official website to effectively shorten the development cycle;
- If you encounter problems during the development process, you can log in to TI’s E2E community to ask questions, and TI’s technical staff will answer them;

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4.3 Program burn

	Description
Program burn	The module is a SoC module with its own GPIO port. Program download uses the CC series dedicated downloader: JTAG downloader (or TI's official CC1312 supporting development board). Serial ports or any other ISP or ICP tools cannot be used. The figure below is a schematic diagram of the JTAG connection (XDS100). For the specific development method, please refer to the relevant Ti official documents (the TDI and TDO pins may not be connected). 

5 FAQ

5.1 Communication range is too short

- The communication distance will be affected when obstacle exists;
- Data lose rate will be affected by temperature, humidity and co-channel interference;
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing near ground;
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea;
- The signal will be affected when the antenna is near metal object or put in a metal case;
- Power register was set incorrectly, air data rate is set as too high (the higher the air data rate, the shorter the distance);
- The power supply low voltage under room temperature is lower than 2.5V, the lower the voltage, the lower the transmitting power;
- Due to antenna quality or poor matching between antenna and module.

5.2 Module is easy to damage

- Please check the power supply source, ensure it is in right range, or the module will be damaged;
- Please check the stability of power source, the voltage cannot fluctuate too much;
- Please make sure antistatic measure are taken when installing and using, high frequency devices have electrostatic susceptibility;
- Please ensure the humidity is within limited range, some parts are sensitive to humidity;

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- Please avoid using modules under too high or too low temperature.

5.3 BER(Bit Error Rate) is high

- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- Poor power supply may cause messy code. Make sure that the power supply is reliable;
- The extension line and feeder quality are poor or too long, so the bit error rate is high.

6 Production guidance

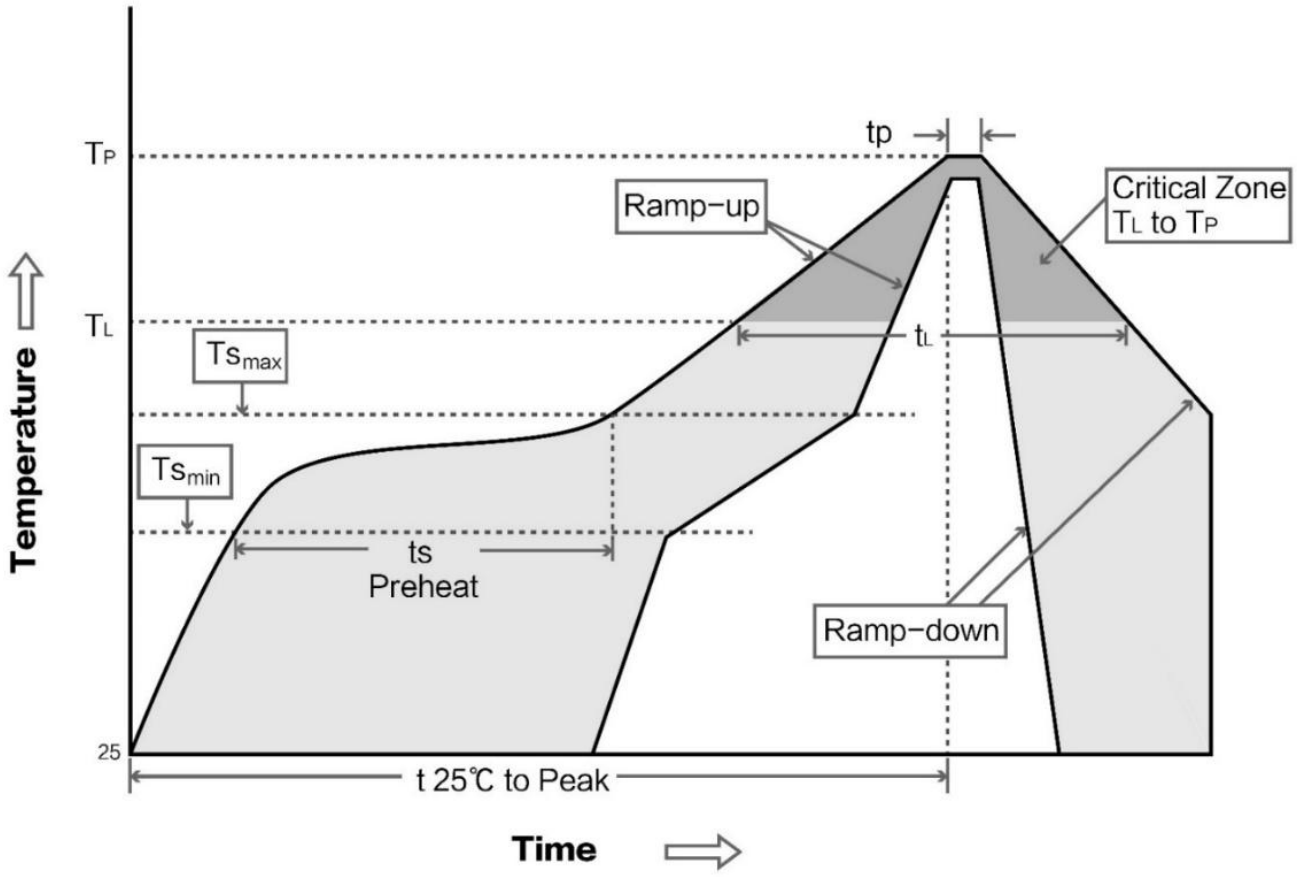
6.1 Reflow soldering temperature

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	100℃	150℃
Preheat temperature max (Tsmax)	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	3℃/second max	3℃/second max
Liquidous Temperature (TL)	183℃	217℃
Time（tL）Maintained Above（TL）	60-90 sec	30-90 sec
Peak temperature（Tp）	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	6℃/second max	6℃/second max
Time 25℃ to peak temperature	6 minutes max	8 minutes max

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6.2 Reflow soldering curve



7 E70 series

Model No.	Chip	Frequency	TX power	Distance	Size	Package	Communication Connector
		Hz	dBm	km	mm		
E70-433T14S	CC1310	433M	14	1.5	2.5k～168k	SMD	16 * 26
E70-868T14S	CC1310	868M	14	1.5	2.5k～168k	SMD	16 * 26
E70-915T14S	CC1310	915M	14	1.5	2.5k～168k	SMD	16 * 26
E70-433T30S	CC1310	433M	30	6.0	2.5k～168k	SMD	24 * 38.5
E70-915T30S	CC1310	915M	30	6.0	2.5k～168k	SMD	24 * 38.5
E70-868T30S	CC1310	868M	30	6.0	2.5k～168k	SMD	24 * 38.5
E70-433T14S2	CC1310	433M	14	1.5	2.5k～168k	SMD	14 * 20
E70-868T14S2	CC1310	868M	14	1.5	2.5k～168k	SMD	14 * 20
E70-915T14S2	CC1310	915M	14	1.5	2.5k～168k	SMD	14 * 20
E70-900M14S1B	CC1312R	868M/915M	14	1.5	20-1000k	SMD	16 * 26

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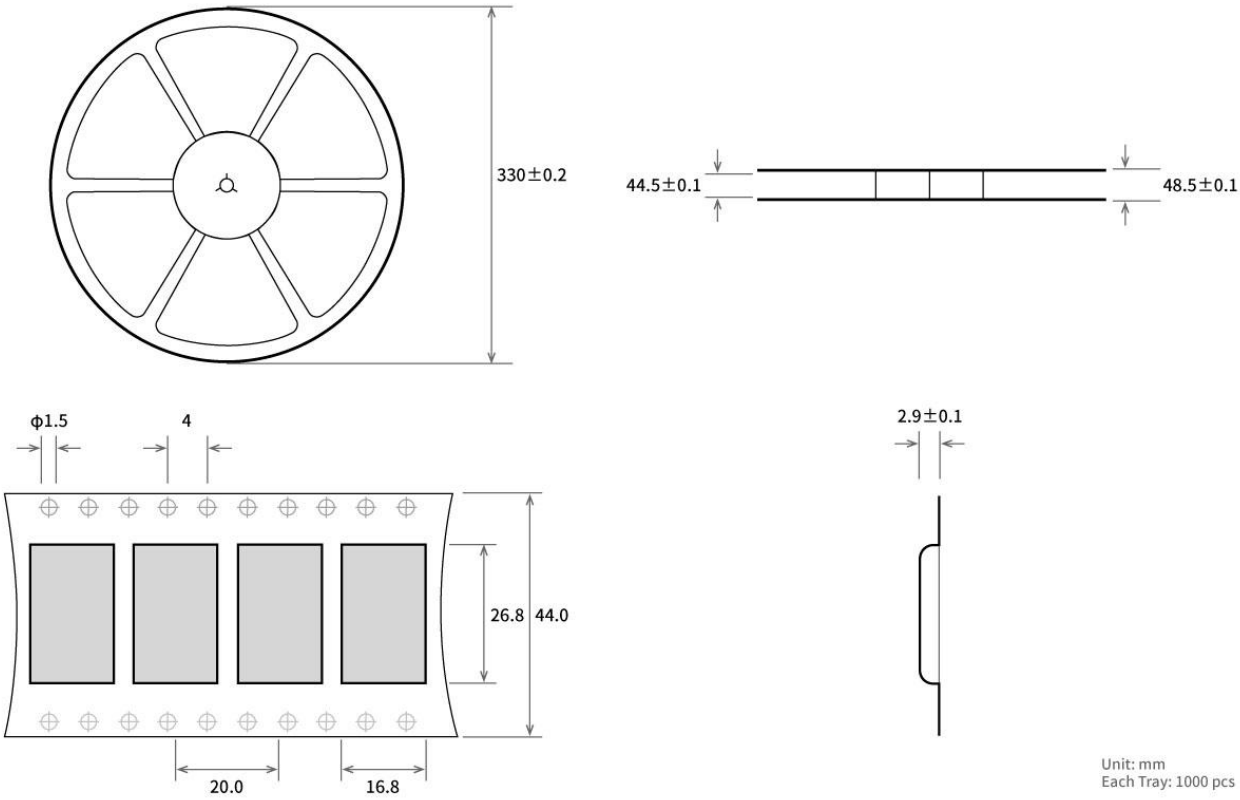
8 Antenna recommendation

8.1 Recommendation

The antenna is an important role in the communication process. A good antenna can largely improve the communication system. Therefore, we recommend some antennas for wireless modules with excellent performance and reasonable price.

Model No.	Type	Frequency	Gain	Size	Length	Feeder	Feature
		Hz	dBi	mm	cm		
TX915-XPL-100	Sucker antenna	915M	SMA-J	3.5	250	100	High gain small sucker antenna
TX915-JK-20	Rubber antenna	915M	SMA-J	3.0	210	-	Flexible &omnidirectional
TX915-JK-11	Rubber antenna	915M	SMA-J	2.5	110	-	Flexible &omnidirectional
TX915-JZ-5	Rubber antenna	915M	SMA-J	2.0	50	-	Short straight &omnidirectional

9 Package for bulk order



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Revision history

Version	Date	Description	Issued by
1.0	2023-07-4	Initial version	Linson

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