

LDT43B000A Zigbee + BLE Module Specification

Module ID: 2064700281



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Note: This document is for LEEDARSON and development partners only.

Revision History

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1. Introduction

1.1 Overview

LDT43B000A is a LEEDARSON self-developed, small size, and low-power ZigBee + BLE module. It integrates TLSR8258F1KAT32 solution from Telink Semiconductor Inc., supports ZigBee and Bluetooth low Energy 5.0.

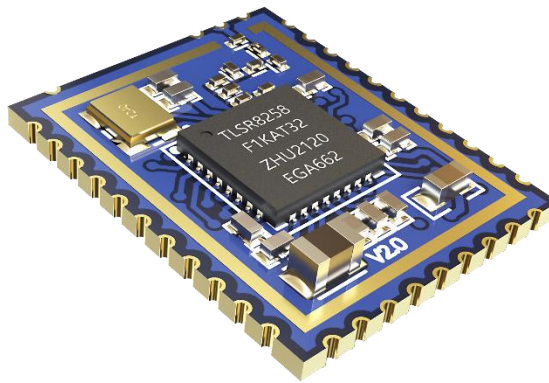


Chart 1.LDT43B000A Module

1.2 Key Features

- ◆ Support ZigBee and BLE 5.0
- ◆ Embedded a 32-bit ARM M0, with clock up to 48MHz
- ◆ Data Memory: 64KB internal SRAM and 1MB internal Flash
- ◆ Frequency of crystal oscillator: 24MHz;
- ◆ Interface: 4 PWMs/I2C/5 GPIOs/1 UARTs/3 ADCs
- ◆ Wide power supply voltage range: 1.8V~3.6V
- ◆ Wide operating temperature range: -40℃~125℃;
- ◆ Operating frequency: 2400~2483.5MHz
- ◆ Modulation: O-QPSK(ZigBee); GFSK(BLE5.0);
- ◆ Data Rate: ZigBee: 250Kbps
BLE:1Mbps, 2Mbps, 125Kbps, 500Kbps
- ◆ ZigBee TX output power:10dBm (Typical)
- ◆ ZigBee Receiving sensitivity:-97dBm
- ◆ ZigBee Transmitting mode current(peak): 52mA@10dBm
- ◆ ZigBee Receiving mode current(average):8.7mA
- ◆ BLE TX output power:10dBm(Typical)
- ◆ BLE Receiving sensitivity:
-93dBm @1Mbit/s;-89dBm @2Mbit/s;-97dBm @125Kbit/s;-95dBm @500Kbit/s
- ◆ BLE Transmitting mode current(peak): 52mA@10dBm 1Mbps
- ◆ BLE Receiving mode current(average):7.3mA@10dBm 1Mbps
- ◆ Deep sleep mode current: 0.4uA

1.3 Functional Block Diagram

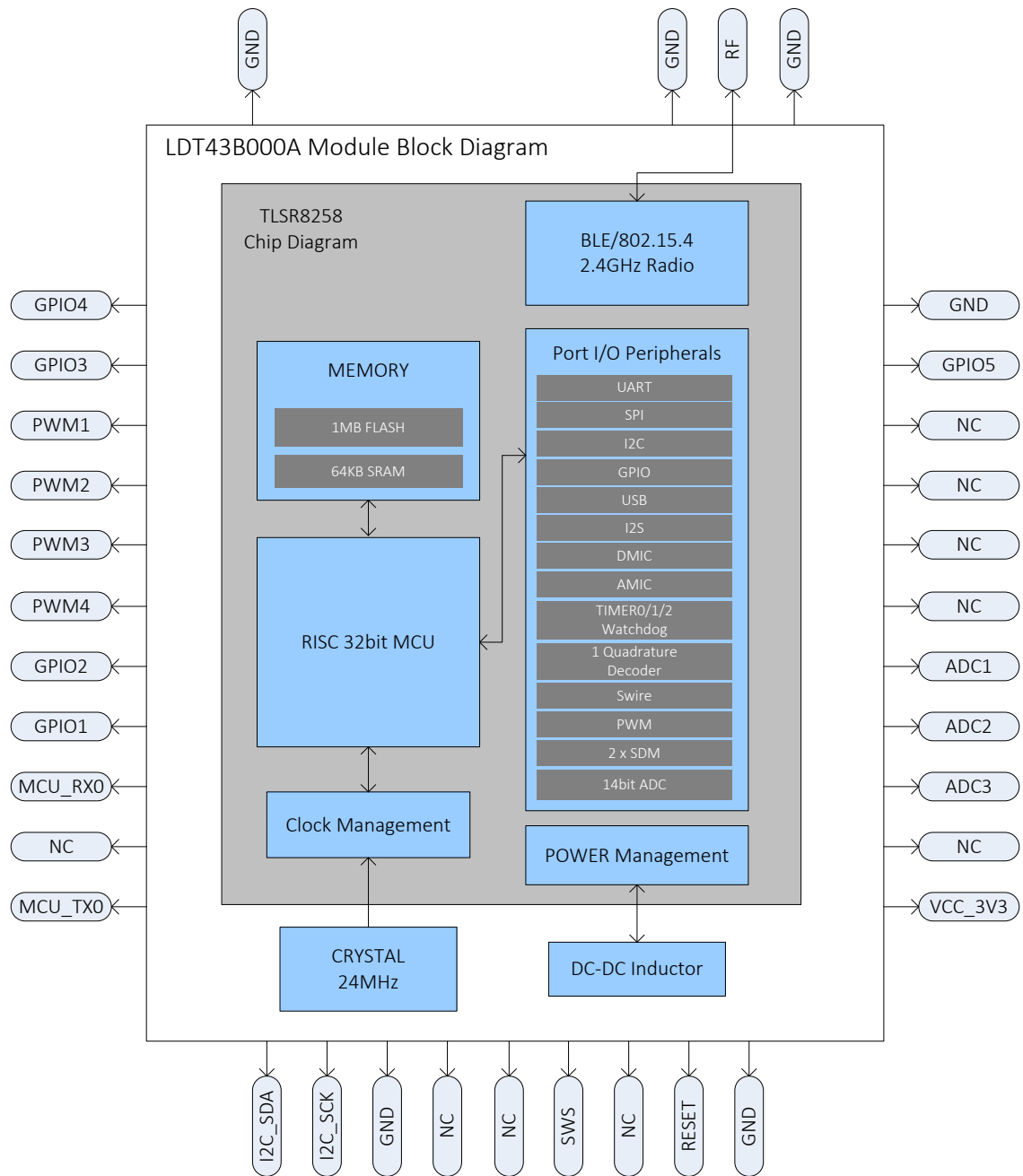


Chart 2.Functional Block Diagram

1.4 Product Application

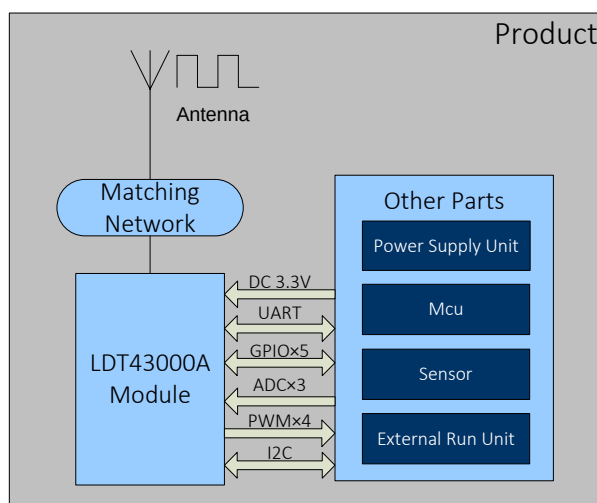


Chart 3.Application Block Diagram

LDT43B000A module is mainly used for smart products as following:

- ◆ Lighting
- ◆ Plug
- ◆ Sensor
- ◆ Switch
- ◆ Gateway



The module need to design A 2.4GHz antenna, worked in the ISM band(2400-2483.5MHz). The different structure parts and driving schemes of different products need to be designed to make certain space for avoidance so as to ensure the optimal wireless communication performance of each product.

1.5 Ordering Information

Ordering Code	Protocol Stack	IC Solution	Operating Temperature	Dimension	Version
LDT43B000A	Zigbee+BLE5.0	TLSR8258F1K	-40~125℃	12mm*15mm	A

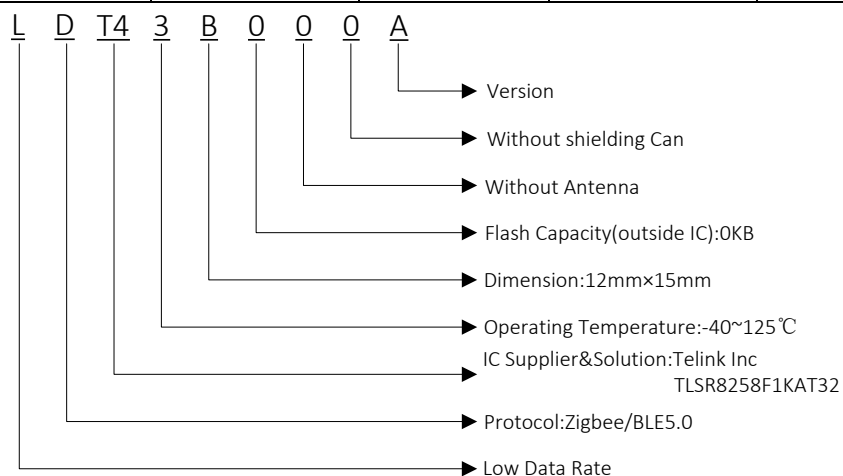


Chart 4.Ordering Information

2. Technical Specification

2.1 Radio Frequency Parameters

Parameter	Value			
Protocol	ZigBee and BLE 5.0			
Modulation	ZigBee: O-QPSK BLE:GFSK			
Channel Number	ZigBee:16 BLE:40			
Channel Bandwidth	Zigbee:5MHz BLE:2MHz			
Basic Transmitting Rate	Zigbee:250Kbps BLE:1Mbps/2Mbps/125Kbps/500Kbps			
Parameter	Min.	Typ.	Max.	Unit
Frequency	2400	--	2483.5	MHz
Frequency Offset	-10	--	10	KHz
Power Level of Software Setting	-25	--	10	dBm
ZigBee TX Power	--	10	--	dBm
ZigBee Receiving Sensitivity	--	--	-97	dBm
BLE TX Power	--	10	--	dBm
BLE Receiving Sensitivity@1Mbit/s	--	--	-93	dBm
BLE Receiving Sensitivity@2Mbit/s	--	--	-89	dBm
BLE Receiving Sensitivity@125Kbit/s	--	--	-97	dBm
BLE Receiving Sensitivity@500Kbit/s	--	--	-95	dBm
Remark: Above data are based on 25℃ ambient temperature and 3.3V supply voltage;				

Chart 5.RF Parameters

2.2 Pin Definition

2.2.1 Default and Multiplexing Pin Definition

There are 35 pins in LDT43B000A module, refer to below chart 6 & chart 7 for pin definition. "Default Pin Definition" in Chart 7 means the recommended pin function definition. Usually, customers need to choose target pins according to the pin definition in this column of Chart 7. In some special projects, if "default pin definition" can't meet the needs of products, then "Multiplexing Pin Definition" function can be chosen. However, when choosing this multiplexing function, need to consider whether other modules that have the same package, also have the same multiplexing function.

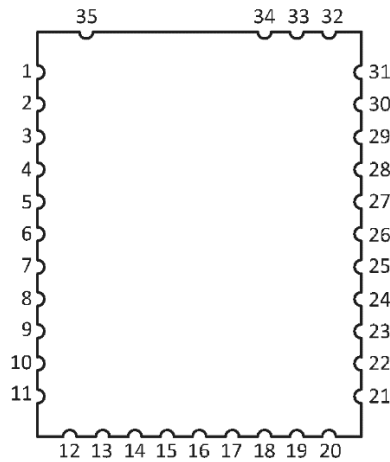


Chart 6.Module Pin Number

Module Pin NO.	Type	Default Pin Definition	Pin of IC	Multiplexing Pin Definition of IC
1	I/O	GPIO4	32. PD3	PWM1_N/I2S_SDI/7816_TRX/PD<3>
2	I/O	GPIO3	1. PD4	SWM/I2S_SDO/PWM2_N/PD<4>
3	I/O	PWM1	14. PB4	SDM_P0/PWM4/lc_comp_ain<4>/sar_aio<4>/PB<4>
4	I/O	PWM2	15. PB5	SDM_N0/PWM5/lc_comp_ain<5>/sar_aio<5>/PB<5>
5	I/O	PWM3	23. PC3	PWM1/UART_RX/I2C_SCK/XC32K_I/PGA_N1/PC<3>
6	I/O	PWM4	31. PD2	SPI_CN/I2S_LR/PWM3/PD<2>
7	I/O	GPIO2	2. PD7	SPI_CK/I2S_BCK/7816_TRX(UART_TX)/PD<7>
8	I/O	GPIO1	4. PA1	DMIC_CLK/7816_CLK/I2C_CLK/PA<1>
9	--	UART_RX	3. PA0	DMIC_DI/PWM0_N/UART_RX/PA<0>
10	--	NC	--	--
11	--	UART_TX	6. PB1	PWM4/UART_TX/ATSEL2/lc_comp_ain<1>/sar_aio<1>/PB<1>
12	I/O	I2C-SDA	20. PC0	I2C_SDA/PWM4_N/UART_RTS/PGA_P0/PC<0>
13	I/O	I2C-SCK	21. PC1	I2C_SCK/PWM1_N/PWM0/PGA_N0/PC<1>
14	--	GND	--	Ground
15	--	NC	--	--
16	--	NC	--	--
17	--	SWS	5. PA7	SWS/UART_RTS/PA<7>
18	--	NC	--	--
19	RESET	RESET	25.RESETB	Chip Reset
20	--	GND	--	Ground
21	PWR	VCC	9.VDDIO 18.VDD3 19.VDDIO_AMS	Power supply, DC 3.3V
22	--	NC	--	--
23	I/O	ADC3	16.PB6	SDM_PI/SPI_DI/UART_RTS/lc_comp_ain<6>/sar_aio<6>/PB<6>
24	I/O	ADC2	17.PB7	SDM_N1/SPI_DO/UART_RX/lc_comp_ain<7>/sar_aio<7>/PB<7>
25	I/O	ADC1	24.PC4	PWM2/UART_CTS/PWM0_N/sar_aio<8>/PC<4>
26	--	NC	--	--
27	--	NC	--	--
28	--	NC	--	--
29	--	NC	--	--
30	I/O	GPIO5	22.PC2	PWM0/7816_TRX/I2C_SDA/XC32K_O/PGA_P1/PC<2>

31	--	GND	--	Ground
32	--	GND	--	Ground
33	--	RF	27_ANT	RF signal transmission and reception
34	--	GND	--	Ground
35	--	GND	--	Ground

Chart 7. Default Pin Definition

2.2.2 “Pin to Pin” Module Replacement Introduction

“Pin to Pin” module means different modules with same default pin definition function which have same package, except for burning and NC pins. When choosing “Multiplexing Pin Definition” function, should ensure that other same package modules have the same multiplexing function. We already have “Pin to Pin” modules, such as “LBS61B000A”, “LDS31B000A”, and “LWK32B500A”; and tend to add more in the future. Below chart is a comparison of default pin definitions for the “Pin to Pin” module.

Module Pin Number	Definition of Default Pin				
	LDT43B000A TLSR8258	LDS53B000A EFR32MG22	LBS61B000A EFR32BG13	LDS31B000A EFR32MG13	TBD
1	GPIO4	GPIO7	GPIO7	GPIO7	--
2	GPIO3	GPIO6	GPIO6	GPIO6	--
3	PWM1	PWM1	PWM1	PWM1	--
4	PWM2	PWM2	PWM2	PWM2	--
5	PWM3	PWM3	PWM3	PWM3	--
6	PWM4	PWM4	PWM4	PWM4	--
7	GPIO2	GPIO8	GPIO8	GPIO8	--
8	GPIO1	GPIO9	GPIO9	GPIO9	--
9	RX0 (Debug)	RX0 (Debug)	RX0 (Debug)	RX0 (Debug)	--
10	NC	GPIO10	GPIO10	GPIO10	--
11	TX0 (Debug)	TX0 (Debug)	TX0 (Debug)	TX0 (Debug)	--
12	I2C-SDA	I ² C_SDA	I ² C_SDA	I ² C_SDA	--
13	I2C-SCK	I ² C_SCL	I ² C_SCL	I ² C_SCL	--
14	GND	GND	GND	GND	--
15	NC	GPIO11	GPIO11	GPIO11	--
16	NC	GPIO12	GPIO12	GPIO12	--
17	SWS (Burning)	SW_CLK (Burning)	SW_CLK (Burning)	SW_CLK (Burning)	--
18	NC	SW_TMS (Burning)	SW_TMS (Burning)	SW_TMS (Burning)	--
19	RESET	RESET	RESET	RESET	--
20	GND	GND	GND	GND	--
21	VCC	VCC	VCC	VCC	--
22	NC	ADC4	ADC4	ADC4	--
23	ADC3	ADC3	ADC3	ADC3	--
24	ADC2	RX/ADC2	RX/ADC2	RX/ADC2	--
25	ADC1	TX/ADC1	TX/ADC1	TX/ADC1	--
26	NC	GPIO5	GPIO5	GPIO5	--

27	NC	GPIO4	GPIO4	GPIO4	--
28	NC	GPIO3	GPIO3	GPIO3	--
29	NC	GPIO2	GPIO2	GPIO2	--
30	GPIO5	GPIO1	GPIO1	GPIO1	--
31	GND	GND	GND	GND	--
32	GND	GND	GND	GND	--
33	RF	RF	RF	RF	--
34	GND	GND	GND	GND	--
35	GND	GND	GND	GND	--

Chart 8.Comparison of Default Pin Definitions for "Pin to Pin" Module

2.3 Electrical Performance

Parameter	Unit	Min.	Typ.	Max.	Remark
Power Supply Voltage	V	1.8	3.3	3.6	Ripple voltage of power supply should be less than 250mV.
Deep Sleep Current	uA	--	0.4	--	Deep sleep mode.
ZigBee TX Peak Current	mA	--	41.6	52	TX test mode @10dBm
ZigBee RX Current	mA	--	8.72	10.9	Average current in RX test mode.
BLE TX Peak Current	mA	--	41.6	52	TX test mode @10dBm
BLE 1M RX Current	mA	--	7.36	9.2	Average current in RX test mode.
Remark: 1. Suggested that driving current should not be less than 100mA; 2. Above data are based on ambient temperature of 25°C and supply voltage of 3.3V.					

Chart 9.Electrical performance parameters

2.4 Operating Condition

Parameter	Unit	Min.	Typ.	Max.	Remark
Operating Temperature	°C	-40	--	125	The temperature on components of LDT43B000A when the module is working.
Storage Temperature	°C	-40	25	150	Recommend to store it in antistatic vacuum bag at 25°C.
Operating Humidity	%	10	--	90	Relative humidity.
Storage Humidity	°C	10	--	90	Relative humidity.

Chart 10.Operating Condition

4. Application Notes

4.1 Suggestion on Backplane Design

4.1.1 Antenna matching network reserved

A 2.4GHz antenna is needed in the driver backplane and the antenna is designed according to different product structures and driving schemes, to ensure the best wireless communication performance of each kind of product. Here are the suggestions for antenna design as below:

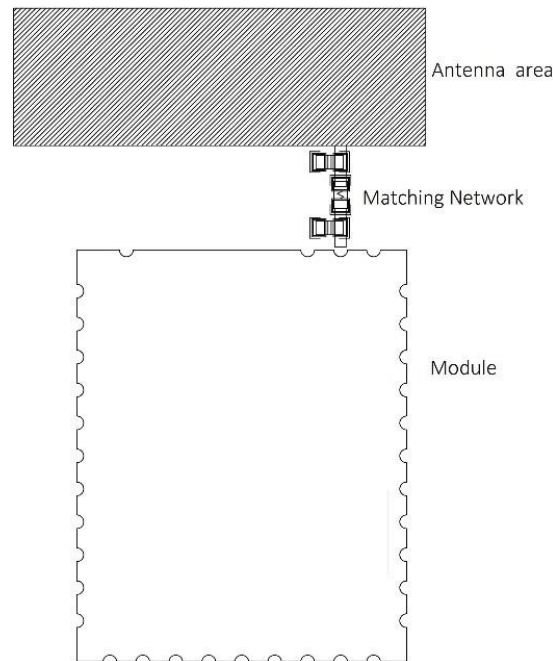


Chart 14. Module Application Diagram

1. An avoidance area is recommended to be reserved for antenna design, and it should be as close as possible to the edge of the backplane; See more details in chapter 4.1.2;
2. It is necessary to reserve a ' π ' matching network for antenna impedance matching.
3. The path of ' π ' network components must be designed to be 50Ω impedance.

4.1.2 Antenna design recommendation

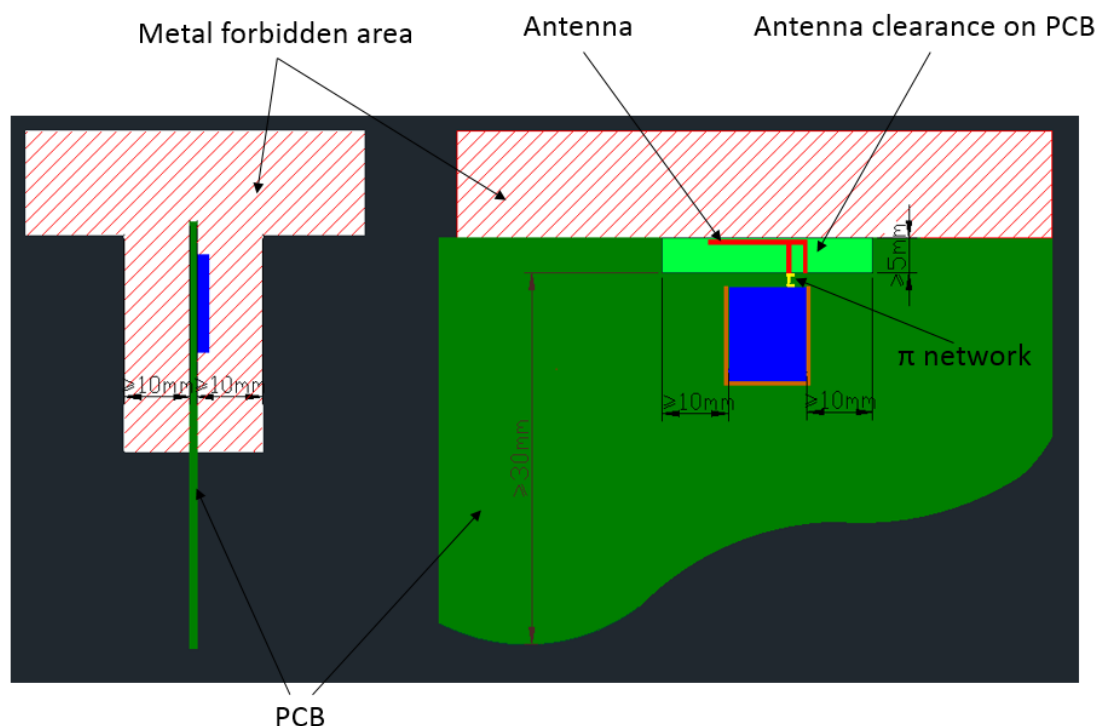


Chart 15.Recommended antenna design

The 2.4 GHz antenna which used cooperatively with the LDT43B000A module is to be designed according to the whole product environment. Different antenna performance would cause wireless communication distance difference.

Below are the antenna parameters typical value recommended.

Parameter	Value
Frequency Range	2.4 ~ 2.5GHz
Impedance	50 Ohm
VSWR	2.0(Max.)
Return Loss	-10 dB (Max.)
Antenna Gain	0~2dBi peak gain
Antenna Type	Integrated PCB antenna
Efficiency	>30%

Chart 16.Recommended Antenna Parameters

In addition, there are some guidelines that need to be taken into consideration.

1. Make sure that antenna is not in contact with any kind of metal.
2. The antenna should be places as far away from any metal structures as possible. At least 10 mm away is needed.
3. Antenna types having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this module. Under **FCC/CE/ISED** regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by **FCC/CE/ISED**. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropic radiated power (e.i.r.p.) is not more than that necessary for successful communication.

4.2 Suggestions on SMT Temperature Setting

The picture below shows a typical setup which has been used at the module production site. It is provided here for reference only.

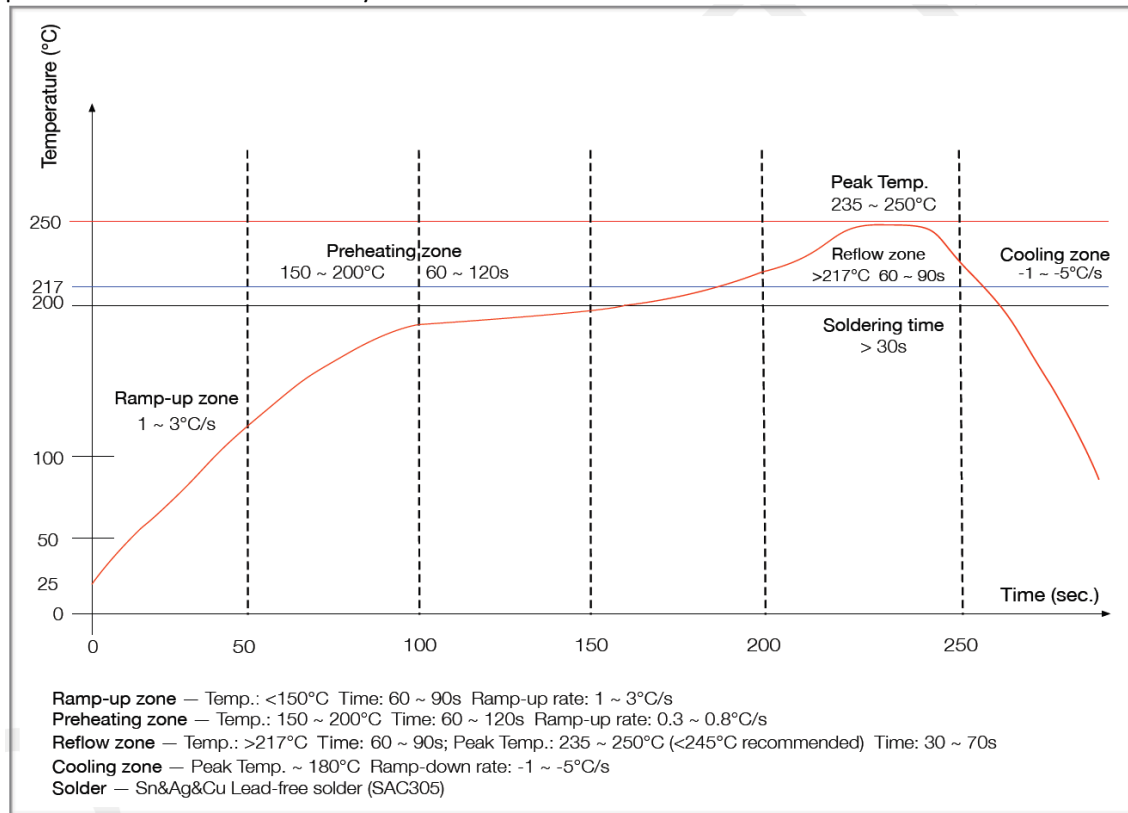


Chart 18.SMT Temperature Setting

5. Package Information

5.1 Package Specification

TBD.

5.2 Weight

Weight of single module is 0.51g±15% (0.44g—0.61g).

FCC WARNING

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

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 and your body. Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This transmitter must not be co-located or operating in conjunction with any other

antenna or transmitter.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The final end product must be labelled in a visible area with the following:

“Contains Transmitter Module “FCC ID: 2AW95NIN230829”

Requirement per KDB996369 D03

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.³

Explanation: This module meets the requirements of FCC part 15C (15.247). It specifically identified AC Power Line Conducted Emission, Radiated Spurious emissions, Band edge and RF Conducted Spurious Emissions, Conducted Peak Output Power, Bandwidth, Power Spectral Density, Antenna Requirement.

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.

Explanation: The product antenna uses an irreplaceable antenna with a gain of 1.67dBi

2.4 Single Modular

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

Explanation: The module is a single 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).

Explanation: The module complies with FCC radiofrequency radiation exposure limits for uncontrolled environments. The device is installed and operated with a distance of more than 20 cm between the radiator and your body." This module follows FCC statement design, FCC ID :2AW95NIN230829

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.

Explanation: The product antenna uses an irreplaceable antenna with a gain of 1.67dBi

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.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2AW95NIN230829

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.

Explanation: SPRING SUNSHINE TECHNOLOGY CO., LIMITED can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

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.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.