

1 Overview	3
2 BLOCK DIAGRAM	3
3 PIN DESCRIPTION	4
4 SIZE DESCRIPTION	5
5 SCHEMATIC DESIGN	6
6 Antenna Design	6
7 TECHNICAL SPECIFICATION	8
8 RADIO SPECIFICATION	8
9 FREQUENCY MAPPING	9
10 Hopping Scheme	10
11 TX POWER SPECIFICATION	11
12 RX SENSITIVITY	11

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WSN27-915(B)R

LICENSE-FREE SOLUTION
For Sub-1G Frequency Band
915 MHz Wi-SUN 6LoWPAN RFModule

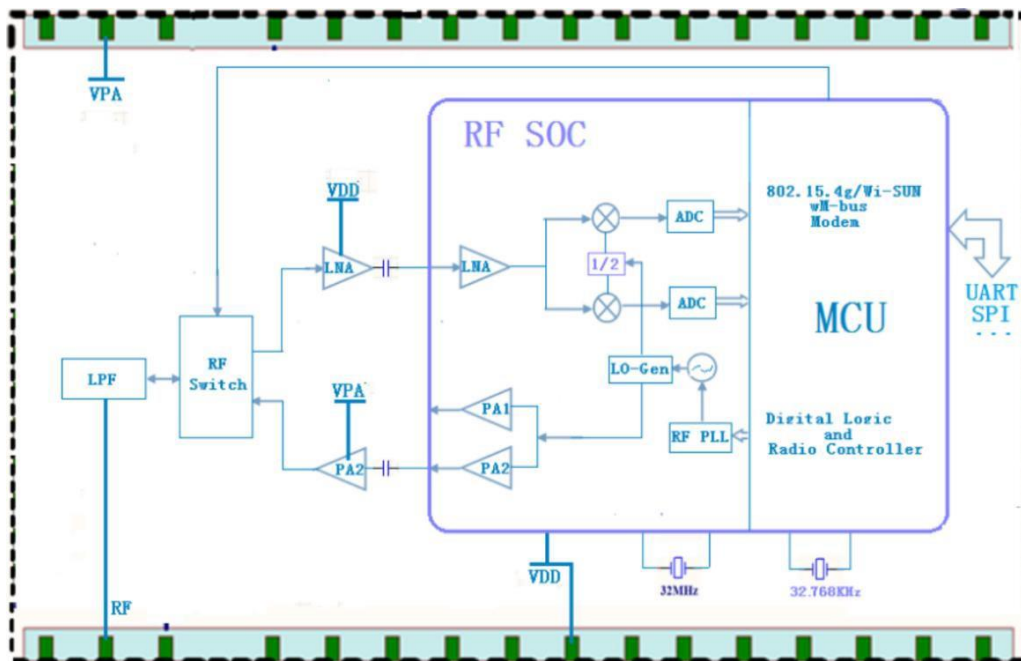
Embedded Module



1 Overview

WSN27-915(B)R is a RF module compliant with interoperable Wireless Smart Ubiquitous IoT Network standard as described by IEEE® 802.15.4g/e. It is ideally suited for use as an embedded RF module in one or two-way data links with electricity meters, DA sensor, devices, terminals and concentrators.

2 BLOCK DIAGRAM



Note: The above block diagram is only used to indicate the internal structure of the module.

1				32
2	GND		GND	31
3	ANT		+5V	30
	GND		GND	
4				29
5	RXD1		IOB8	28
6	TXD1		SPI_CS	27
7	RXD0		SPI_CLK	26
8	TXD0		SPI_MISO	25
9	GND		SPI_MOSI	24
10	+3.3V		SCL	23
11	IOA7		SDA	22
12	IOA6		RXD4	21
13	Boot		TXD4	20
14	RESET		GND	19
15	IOE4		SWCLK	18
16	TXD5		SWIO	17
	RXD5		MODE	

3 PIN DESCRIPTION

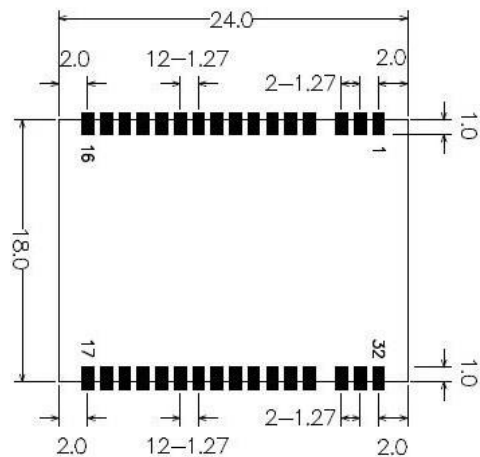
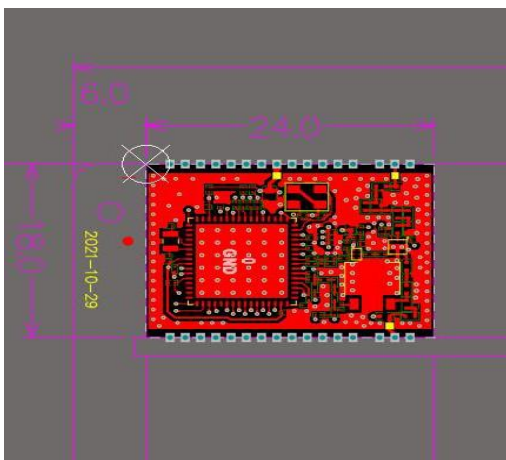
INTERFACE PINS DEFINITION

Pin	Symbol	Name	Definition
1	GND	RF Gnd	Connected to power ground
2	ANT	RF Port	Module RF output, external antenna
3	GND	RF Gnd	Connected to power ground
4	RXD1	Debug UART1	Module debug serial port data receiving end, connecting user data sending end, RSTTL level, 3.3V
5	TXD1`	Debug UART1	Module debug serial port data sending end, connecting user data receiving end, RSTTL level, 3.3V
6	RXD0	APP UART0	The module communicates with the data receiving end of the serial port of the external device and connects with the user data sending end, with RSTTL level of 3.3V
7	TXD0	APP UART0	The module communicates with the data sending end of the serial port of the external device and connects with the user data receiving end, with RSTTL level of 3.3V
8	GND	Power Gnd	External power supply cathode
9	+3.3V	Power supply	External power supply positive pole, voltage 3.3V, power supply load current at least 1A
10	IOA7	Communication Indicator	Low level when sending data, external LED indicator
11	IOA6	Communication Indicator	Low level when receiving data, external LED indicator
12	Boot	Startup control	Start mode selection, internal is pulled down, embedded flash boot when Boot=0, Boot=1 internal ROM boot,
13	RESET	Reset	Reset RF module at low level
14	IOE4	Communication	Network indication, output low level, external LED indicator

		Indicator	
15	TXD5	IO Port	Expansion port, connecting SRAM HOLD pin of external equipment
16	RXD5	IO Port	Expansion port, connecting SRAM WP pin of external equipment
17	MODE	Mode Select	Internal pull-up, MODE=0: Debug mode MODE=1: Normal mode
18	SWIO	IO Port	Data signal of debug port
19	SWCLK	IO Port	Clock signal of debug port
20	GND	Power Gnd	Connect to power ground
21	TXD4	IO Port	NC, extended standby
22	RXD4	IO Port	NC, extended standby
23	SDA	IO Port	NC, extended standby
24	SCL	IO Port	NC, extended standby
25	SPI_MOSI	IO Port	Connect SPI of external equipment_ MOSI pin
26	SPI_MISO	IO Port	Connect SPI of external equipment_ MISO pin
27	SPI_CLK	IO Port	Connecting SPI of external equipment_ CLK foot
28	SPI_CSN	IO Port	Connecting SPI of external equipment_ CSN pin
29	IOB8	IO Port	SRAM CSN, connect CS pin of external SRAM
30	GND	Power Gnd	Power supply ground
31	+5V	Power Supply	Positive pole of power supply, PA power supply, the load current of power supply is required to be at least 1A
32	GND	Power Gnd	Power supply ground

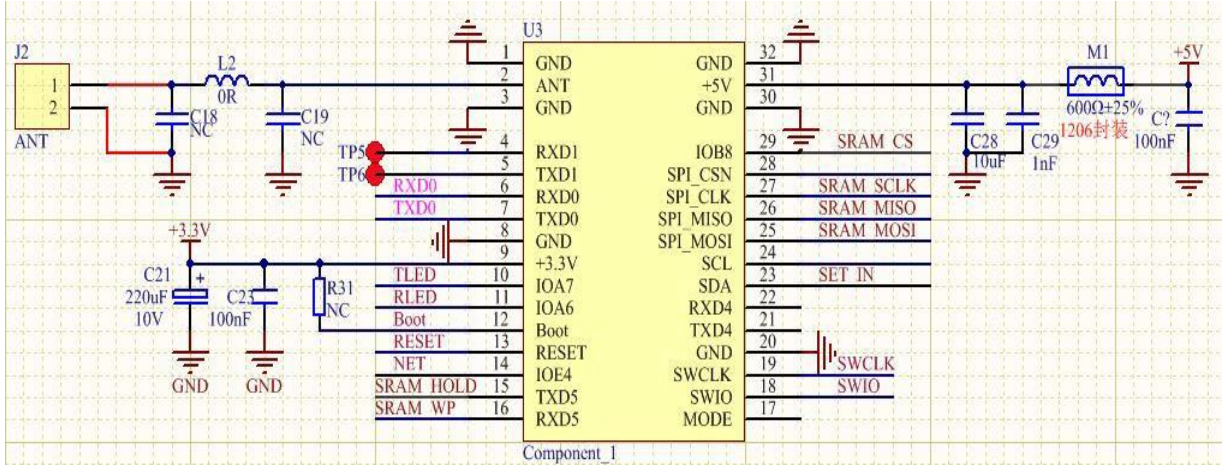
4 SIZE DESCRIPTION

The specific dimensions of the module are shown in the figure below:

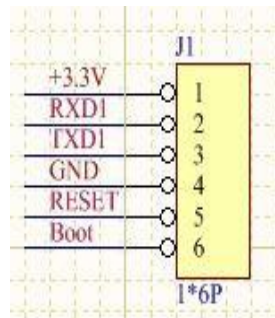


5 SCHEMATIC DESIGN

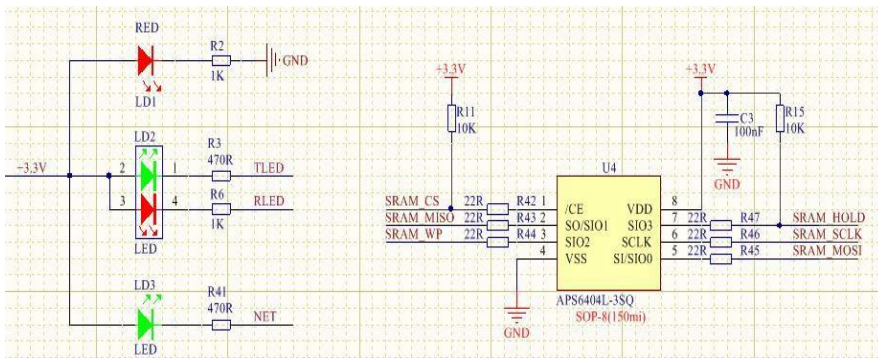
At the periphery of RF module, a 1206 packaged magnetic bead M1 and filter capacitor shall be connected in series to the 5 V power supply interface, and L2, C18 and C19 constitute the antenna port matching circuit.



5.1 Debug Interface as follows.



5.2 LED indication, plus PSRAM (increase node capacity) schematic diagram is as follows.



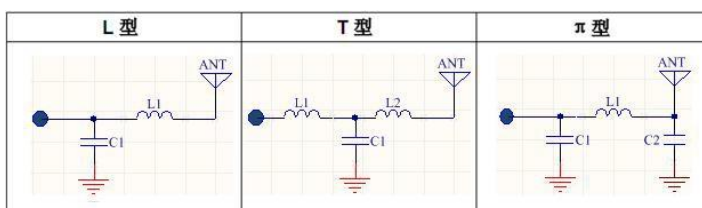
5.3 Antenna port

The WSN27-915(B)R communication module is encapsulated by the patch. The user PCB board should leave an antenna port. The user configures the appropriate antenna according to the actual application. The antenna port is impedance of 50Ohm and connected to the external antenna of 50 Ohm.

6 Antenna Design

The Wi-SUN RF module is packaged in a stamp hole patch. All I/O ports and antenna ports need to be led out from the user board. Suggested RF signal routing: PCB Layout RF routing between the module and the antenna is required to be 50Ω Impedance rule design, and trace length as short as possible. Since the impedance cannot be controlled, it is recommended that the impedance line width be 0.8-1mm when routing the PCB Layout, and the distance between the surrounding grounding copper foil be 1-1.5 times the line width. Ground vias to ensure that the grounding impedance is as small as possible. Keep the RF port away from all sources of interference, especially high-speed digital signals and switching power supplies, otherwise the receiving sensitivity of the module will be reduced.

If a long trace is used, a matching network needs to be added in the middle, as shown in the figure below.



In order to reduce the reduction of the antenna performance caused by the parasitic capacitor caused by the RF pad, the first and second layers of the module radio frequency port pads are recommended to be hollowed out, as shown in the figure below.



The method of outer radiation frequency feed cable or IPEX welding is connected to the module, but it is necessary to ensure the sufficientness of the welding and prevent excessive cable damage from affecting the radio frequency performance of the module. The effect diagram of the two connection methods is shown in the figure below.



The antenna used in the module must meet the equipment standards. The Bobby should be between 1.1 and 1.5, the input impedance is 50Ω, the use environment is different, and the gain requirements for the antenna are also different. Generally, the greater the internal gain, the more foreign gain, the gain of the external gain, The smaller, the better the antenna performance

Notice: Check the stick external antenna specification for details.

7 TECHNICAL SPECIFICATION

No.	Parameters Index	Value Description
1	Chip set	Cortex-M3 MCU, 512 KB Flash, 128 KB SRAM, sub-GHz radio
2	Operating Frequency	902-928MHz
3	Data Modulation	GMSK
4	Operating Mode	RF channel hopping
5	Number of Channels (50 Kbps)	129
6	Interfaces	Application UART & Debug UART,115200-8-n-1
7	Main Host Operating Voltage	3.3V ±10%
8	Radio PA Operating Voltage	5V±10% or 3.3V ±10%
9	RF Receive Current	40mA
10	Operating Temperature Range	-40°C ~ +70°C
11	Mechanical Dimension	24×18×3 mm

8 RADIO SPECIFICATION

Frequency (MHz)	Wi-SUN PHY Mode	Data Rate	Modulation	Modulation Index	No. of Channels	Channel Spacing(KHz)
902-928MHz	3	50kbps	2GFSK	1	129	200

9 FREQUENCY MAPPING

Channel Definitions is as the following table:

No.	Frequency Center (MHz)	No.	Frequency Center (MHz)	No.	Frequency Center (MHz)	No.	Frequency Center (MHz)
1	902.2	16	905.2	31	908.2	46	911.2
2	902.4	17	905.4	32	908.4	47	911.4
3	902.6	18	905.6	33	908.6	48	911.6
4	902.8	19	905.8	34	908.8	49	911.8
5	903.0	20	906.0	35	909.0	50	912.0
6	903.2	21	906.2	36	909.2	51	912.2
7	903.4	22	906.4	37	909.4	52	912.4
8	903.6	23	906.6	38	909.6	53	912.6
9	903.8	24	906.8	39	909.8	54	912.8
10	904.0	25	907.0	40	910.0	55	913.0
11	904.2	26	907.2	41	910.2	56	913.2
12	904.4	27	907.4	42	910.4	57	913.4
13	904.6	28	907.6	43	910.6	58	913.6
14	904,8	29	907,8	44	910,8	59	913,8
15	905.0	30	908.0	45	911.0	60	914.0
No.	Frequency Center (MHz)	No.	Frequency Center (MHz)	No.	Frequency Center (MHz)	No.	Frequency Center (MHz)
61	914.2	76	917.2	91	920.2	106	923.2
62	914.4	77	917.4	92	920.4	107	923.4
63	914.6	78	917.6	93	920.6	108	923.6
64	914.8	79	917.8	94	920.8	109	923.8
65	915.0	80	918.0	95	921.0	110	924.0
66	915.2	81	918.2	96	921.2	111	924.2
67	915.4	82	918.4	97	921.4	112	924.4
68	915.6	83	918.6	98	921.6	113	924.6
69	915.8	84	918.8	99	921.8	114	924.8
70	916.0	85	919.0	100	922.0	115	925.0
71	916.2	86	919.2	101	922.2	116	925.2
72	916.4	87	919.4	102	922.4	117	925.4
73	916.6	88	919.6	103	922.6	118	925.6
74	916,8	89	919,8	104	922,8	119	925,8
75	917.0	90	920.0	105	923.0	120	926.0

No.	Frequency Center (MHz)	No.	Frequency Center (MHz)	No.	Frequency Center (MHz)	No.	Frequency Center (MHz)
121	926.2						
122	926.4						
123	926.6						
124	926.8						
125	927.0						
126	927.2						
127	927.4						
128	927.6						
129	927.8						

10 Hopping Scheme

Each module will receive at its channel according to channel order table(Channel1--Channel2 -channels--....Channel 129).If module A transmits RF frame to module B module A first know the receiving channel of module B.

Channel hopping average interval is 25 S. The maximum time of each transmission is 200ms.

11 TX POWER SPECIFICATION

Power ±1dB	3.3V	5V
20dBm	<150mA	
23dBm	<450mA	
27dBm	<150mA	<600mA

12 RX SENSITIVITY


-108dBm@50Kbps, PER=10%

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 www.friendcom.com

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

FCC Statement

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.

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

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.

FCC Radiation Exposure Statement

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

Shenzhen Friendcom Technology Development Co., Ltd./ADS-BLEnRF1-ANT902 MHz - 928 MHz:

2dBi(declare by Applicant)

Compliance list INTEGRATION INSTRUCTIONS for 996369 D03 OEM the and 996369 D03 OEM by Sections 2.2 through 2.12.

Requirement	Yes	N/A	Comment
<p>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</p>	YES		FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247
<p>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.</p>	YES		Glue stick antenna with antenna gain 2dBi
<p>2.4 Limited module procedures If a modular transmitter is approved as a “limited module,” then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions. A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum</p>		N/A	Not applicable

<p>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.</p> <p>This limited module 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.</p>			
<p>2.5 Trace antenna designs</p> <p>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.⁴</p> <p>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);</p> <p>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);</p> <p>c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;</p> <p>d) Appropriate parts by manufacturer and specifications;</p> <p>e) Test procedures for design verification; and</p>		N/A	Not applicable

<p>compliance.</p> <p>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.</p>			
<p>2.6 RF exposure considerations</p> <p>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).</p>	<p>YES</p>		<p>This modular complies with FCC RF 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.</p>
<p>2.7 Antennas</p> <p>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”)).</p> <p>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</p>	<p>YES</p>		<p>Glue stick antenna with antenna gain 2dBi</p>

<p>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.</p>		
<p>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.</p>	<p>YES</p>	<p>If the FCC identification 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. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: UU3FC-3902-915 Or Contains FCC ID: UU3FC-3902-915</p>
<p>2.9 Information on test modes and additional testing requirements</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p>YES</p>	<p>The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings.</p>
<p>2.10 Additional testing, Part 15 Subpart B disclaimer</p> <p>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</p>	<p>YES</p>	<p>Refer to instruction</p> <p>Any company of the host device which install this modular with limit modular approval should perform the test of radiated & conducted emission and spurious emission, etc. according to FCC part 15B : 15.107 and 15.109, 15B Class B requirement, Only if the test result comply with FCC part 15B : 15.107 and 15.109, 15B Class B requirement, then the host can be sold legally.</p>

<p>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.</p>		<p>When the module is installed inside another device, the user manual of the host must contain below warning statements;</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> —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.
<p>2.11 Note EMI Considerations</p> <p>Note that a host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties</p> <p>For standalone mode, reference the guidance in D04 Module Integration Guide and for simultaneous mode7; see D02 Module Q&A Question 12, which permits the host manufacturer to confirm compliance.</p>	<p>YES</p>	<p>Note: host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties</p> <p>For standalone mode, reference the guidance in D04 Module Integration Guide and for simultaneous mode7; see D02 Module Q&A Question 12, which permits the host manufacturer to confirm compliance.</p>

<p>2.12 How to make changes Since . only Grantees are permitted to make permissive changes, it is recommended that module manufactures provide contact information and some guidance to host providers in the integration instructions if they expect their module will be used differently than granted.</p>	YES	only Grantees are permitted to make permissive changes.
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IC STATEMENT

This device contains licence-exempt transmitter(s)/receiver(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

Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux RSS (RSS) d'Innovation, Sciences

et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes :

- (1) Cet appareil ne doit pas causer d'interférences.
- (2) Cet appareil doit accepter toutes les interférences, y compris celles susceptibles de provoquer un fonctionnement indésirable de l'appareil.

IC Radiation Exposure Statement

This modular complies with IC RF 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.

If the IC 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. This exterior label can

use wording such as the following: "Contains IC: 11418A-BLENRF1"

when the module is installed inside another device, the user manual of this device must contain below warning

statements;

1. This device contains licence-exempt transmitter(s)/receiver(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.

2. Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux RSS (RSS) d'Innovation,

Sciences et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes :

- (1) Cet appareil ne doit pas causer d'interférences.
- (2) Cet appareil doit accepter toutes les interférences, y compris celles susceptibles de provoquer un fonctionnement indésirable de l'appareil.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.