

CP18 series 2.4G transmission module Hardware design manual

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1 Foreword

This document defines the standard application development specification for the Lilda CP18 series 2.4G transmission modules, describing their hardware interfaces, electrical characteristics, application methods and mechanical specifications. This document can help users to quickly understand the hardware interface specifications, electrical, mechanical characteristics and other relevant information of the module. Combined with other corresponding documents, they can quickly master the application development method of CP18 series modules.

2 Product Review

CP18 series 2.4G transtransmission module internal integrated LoRa RF transceiver SX1280 and MCU, support LoRa and FSK modulation, maximum transmission power up to + 28 dBm, sensitivity up to -132 dBm, frequency range 2.4-2.5GHz, its unique modulation mode makes it strong anti-interference ability.

2.1 Features

Parameter	Describe
frequency	2.4-2.5GHz
modulation mode	◆ LoRa modulation ◆ FSK modulation
receiving sensitivity	-110dBm@SF7_BW1625KHz
transmitting power	Typ.28dBm
interface	UART
rate	1.6 kbps~2Mbps (Typ. 20kbps,40kbps,80kbps)
supply voltage	DC2.6V~5.5V(Typ.5V)
Transmit current	Avg.550mA(@27dBm)
Receive current	Avg.28.5mA
size	40.5mm*25mm*3mm
applicable scene	Smart micro-inverter, smart electricity meter, smart home, sensor network, smart street lamp, etc

2.2 Functional Block Diagram



2.4 Module pin instructions

2.4.1 UART

Pin Name	Pin No.	explain	Pin Type	remark
RXD	14	Data serial port	I	
TXD	12		O	

2.4.2 POWER

Pin Name	Pin No.	explain	Pin Type	remark
VCC	13	power supply	PI	5V
GND	1,2,6,20,21	GND	G	-

2.4.3 SWD Interface

Pin Name	Pin No.	explain	Pin Type	remark
SWCLK	10	CLOCK	I	-
SWDIO	9	DATA	I/O	-

2.4.4 Functional interface

Pin Name	Pin No.	explain	Pin Type	remark
NRST	5	Reset	I	Low level is effective
STAT	12	status indicator	O	-
BUSY	15	Line-up indicator	O	-
MODE	16	status switching	I	-
WAKE	17	Module wake up	I	-
GPIO	2,3,4,22	GPIO	-	NC

2.4.5 ANT

Pin Name	Pin No.	explain	Pin Type	remark
ANT	22	Antenna pin	I/O	The impedance of customer antenna input is 50 Ω

remark

Pin type: "O"=Output, "I"= Input, "P"=Power, "G"=Ground

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3 performance characteristics

3.1 Operational Modes

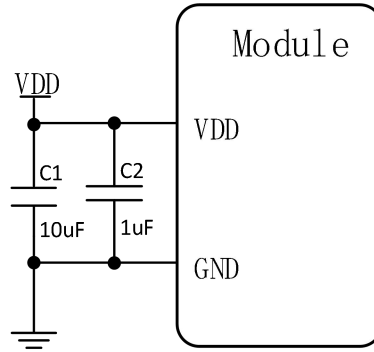
Operational Modes	Enable module
SLEEP	Optional registers, backup regulator, RC64k oscillator, data RAM
STDBY_RC	Top regulator (LDO), RC13M oscillator
STDBY_XOSC	Top regulator (DC-DC or LDO), XOSC
FS	All of the above + Frequency synthesizer at Tx frequency
TX	Frequency synthesizer and transmitter, Modem
RX	Frequency synthesizer and receiver, Modem

3.2 reset

The RESET pin maintains a low level 100us reset chip.

3.3 Power design

VDD is the power supply input of the whole module, and the quality of the power supply directly affects the performance of the module. The design must select a power supply that can provide at least 1A current capacity to ensure that the input voltage to the VDD is not lower than the minimum operating voltage to prevent abnormal module operation due to voltage sag. If the voltage difference between the input voltage and the supply voltage of the module is not very large, it is recommended to choose LDO as the power supply. If there is a large pressure difference between the input and output, use DC-DC for power conversion, and pay attention to the EMI problem caused by DCDC. To ensure better power supply performance, the VBAT input reference circuit is as below:



In the PCB design, the longer the VDD line, the wider the line width. It is recommended that the wire width should not be less than 0.7mm. The GND plane of the power supply part should be as complete as possible and drilled in the ground, and the capacitor should be as close as possible to the VDD pin of the module.

4 Specification parameters

4.1 Absolute Maximum Ratings

parameter	Min	Max	unit	remark
supply voltage	-0.5	+5.5	V	
Maximum RF input power	-	+10	dBm	
ESD		±4	KV	ANT

4.2 Operating Range

parameter	Min	Tpy	Max	unit	remark
supply voltage	2.6	+5	+5.5	V	
Temperature under bias	-40	-	85	°C	
Storage temperature	-40	-	125	°C	

parameter	Min	Tpy	Max	unit	remark
Input high level	0.7*VDD	-	VDD	V	
Input low level	0	-	0.3VDD	V	
Output high level	-	3.8	-	V	VDD=5V Isink=10mA
Output low level	-	1.05	-	V	
Reset low level	-	-	0.3VDD	V	
leakage current	-1	-	1	uA	

pull resistance		100		KΩ	
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模式	测试条件	Tpy	unit	remark
SLEEP mode	Hot start, register retention	3	uA	
STANDBY mode	XOSC ON	0.9	mA	
Receive mode	DCDC mode	28.5	mA	

4.3 General Specifications

parameter	Min	Tpy	Max	unit	remark
Frequency range	2.4	-	2.5	GHz	
Maximum RF output power	-	27	28	dBm	
Transmit current	500	550	600	mA	27dBm
Receiving sensitivity	-109	-110	-111	dBm	BW1625/SF7
Receive current		28.5	30	mA	

remark

(1) The upper test conditions are, temperature: 25℃, center frequency: 2.45GHz, working voltage: 5V;

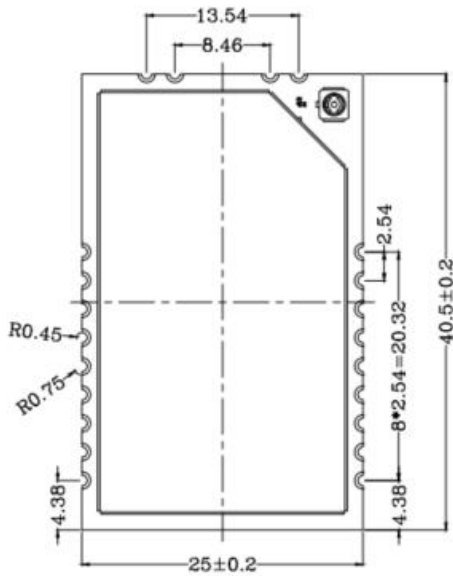
(2) Use the working frequency band according to the local regulations of the terminal market, please comply with the local regulations. If the application is not allowed, we will not assume any responsibility; please refer to the Catalogue and Technical Requirements for the domestic terminal market application.

4.4 reference design

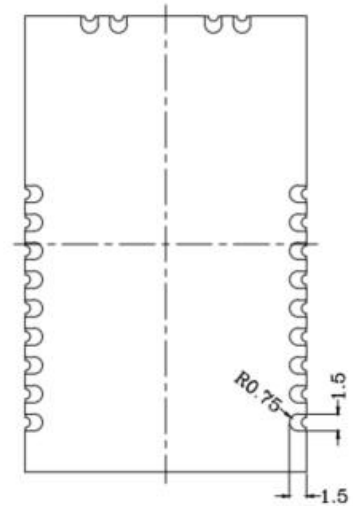
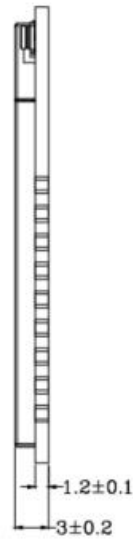
See CP18 Series 2.4G Transmission Module _ Hardware Reference Design Manual.

5 Mechanical size

5.1 Mechanical size



TOP Layer



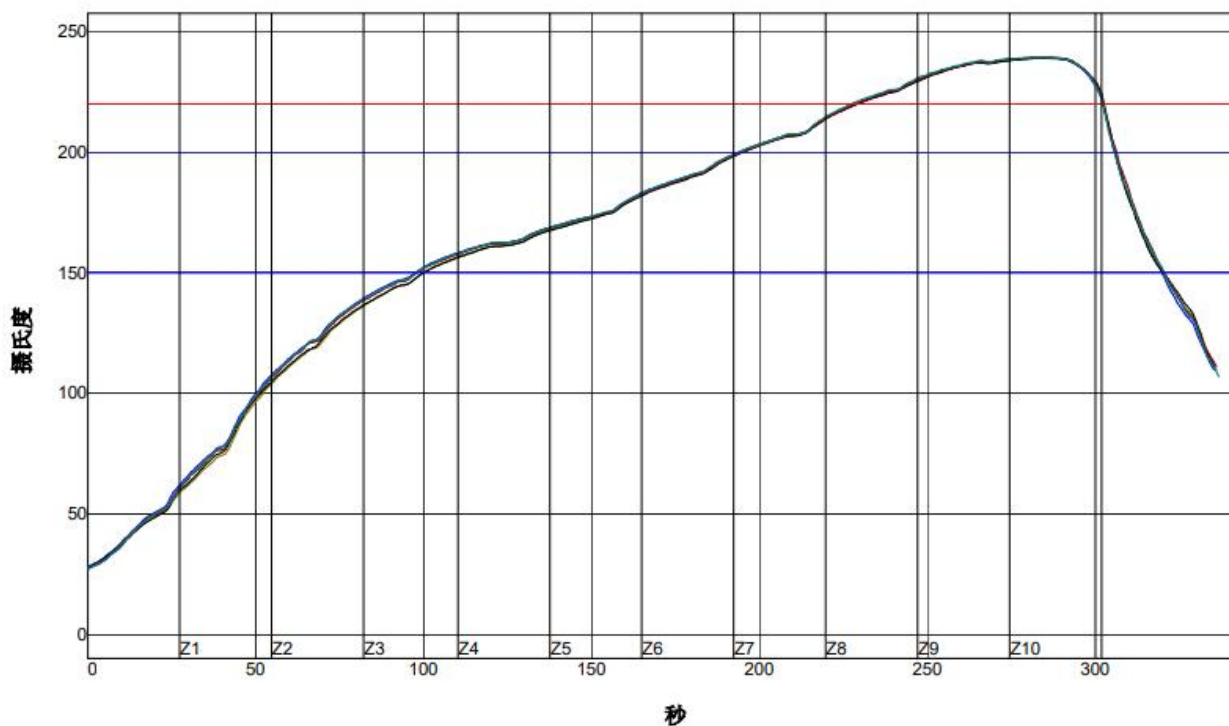
BOTTOM Layer

6 Production and packaging information

6.1 Production welding

Steel mesh opening design In principle, the thickness selection of the steel mesh on the bottom plate is selected according to the packaging type of the devices in the plate, and the following requirements should be emphasized: The position of the module pad can be locally thickened to 0.15~0.20mm to avoid air welding. Reflow-welding operation instruction Note: This operation instruction is only suitable for lead-free operation and is for reference only.

温度设置 (摄氏度)										
温区	1	2	3	4	5	6	7	8	9	10
上温区	120	140	160	170	180	200	220	240	255	250
下温区	120	140	160	170	180	200	220	240	255	250
传送带速度 (公分/分): 80.0										



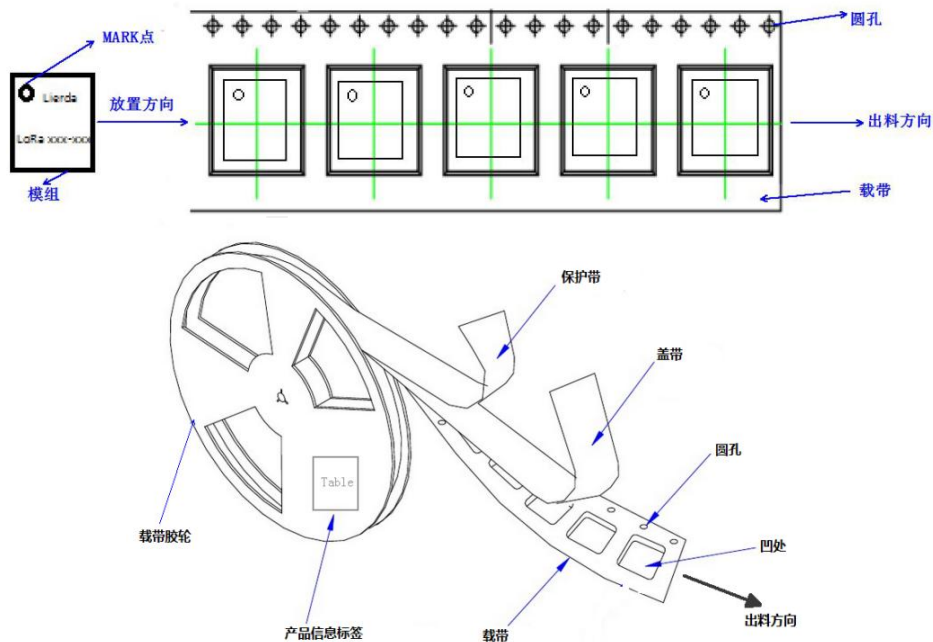
PWI= 65%	最高上升斜率		最高下降斜率		恒温时间150至200°C		回流时间 /220°C		最高温度		斜率1 (215-225°C)	
<TC3>	1.74	-22%	-3.42	-21%	96.27	21%	74.21	21%	238.95	-47%	0.58	-61%
<TC4>	1.69	-26%	-3.37	-18%	94.04	13%	74.36	22%	239.33	-42%	0.57	-62%
<TC5>	1.71	-24%	-3.38	-19%	95.01	17%	73.01	15%	238.98	-47%	0.52	-65%
<TC6>	1.72	-23%	-3.39	-19%	96.90	23%	73.61	18%	239.27	-43%	0.58	-61%
<TC7>	1.75	-21%	-3.40	-20%	96.33	21%	75.12	26%	239.23	-44%	0.58	-61%
温差	0.06		0.05		2.86		2.11		0.38		0.06	

制程界限:

制程界限:	SAC305		
统计数名称	最低界限	最高界限	单位
最高温度上升斜率 (目标=2.0) (计算斜率的时间距离= 30 秒)	0.8	3.0	度/秒
斜率1 (目标=1.5) 介于 215.0 和 225.0 (计算斜率的时间距离= 20 秒)	0.0	3.0	度/秒
最高温度下降斜率 (计算斜率的时间距离= 30 秒)	-5.0	-1.0	度/秒
恒温时间 150-200°C	60	120	秒
回流以上时间 - 220°C	50	90	秒
最高温度	235	250	摄氏度

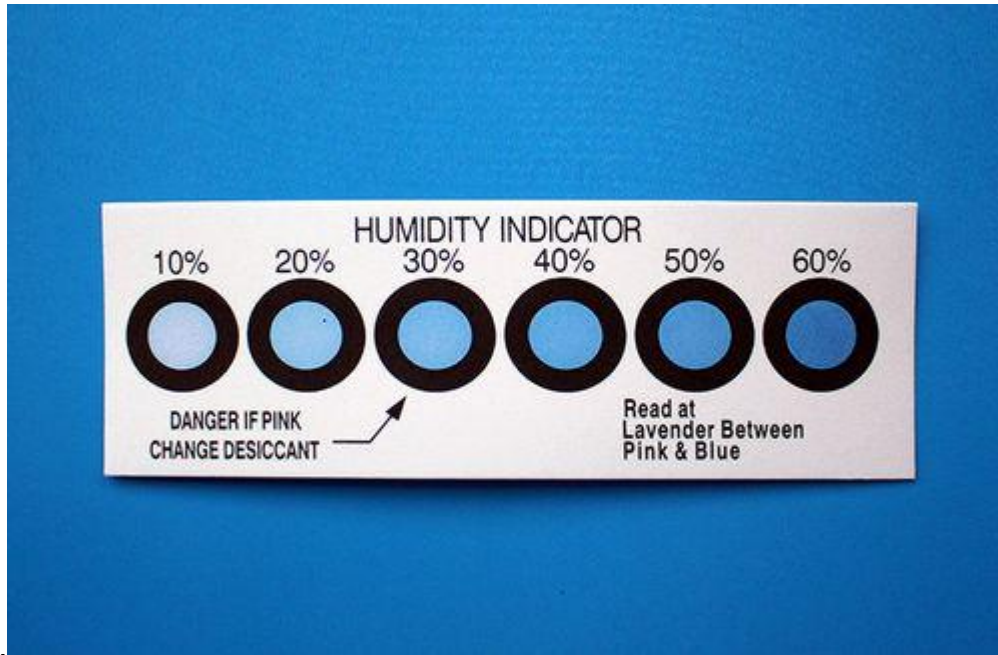
6.2 product packaging

The product is packaged in tape packaging, and the packaging diagram and explain are as follows



6.3 Humidity indicator card

Represents: the relative humidity is 10%, 20%, 30%, 40%, 50% and 60% respectively.



During the package, when the 10% humidity indicator card is pink, the device is damp, please bake before the SMT patch, baking condition is 125°C / 12 hours, use within 168 hours after baking; when the 30% or above gear is pink, the products in the package are not allowed.

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Conformity

FCC regulatory conformance :

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.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

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

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement:

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 & your body.

- English: "

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device."

- French:"

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil n' doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

ORIGINAL EQUIPMENT MANUFACTURER (OEM) NOTES

The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID:2AOFDL-LRNCP18". Additionally, the following statement should be included on the label and in the final product's user manual: "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 interferences, and
- (2) this device must accept any interference received, including interference that may cause undesired operation."

The module is limited to installation in mobile or fixed applications. Separate approval is required for all other operating configurations, including portable configuration with respect to Part 2.1093 and different antenna configurations.

A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end - use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.

This Module is full modular approval, it is limited to OEM installation ONLY.

Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable. (OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user

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).

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 EUT has a Dipole Antenna, and the antenna use a permanently attached antenna which is not replaceable.

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 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 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.

Explanation: The module is not a limited 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.

Explanation: Yes, The module with trace antenna designs, and This manual has been shown the layout of trace design, antenna, connectors, and isolation requirements.

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: This module 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 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is:2AOFDL-LRNCP18.

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 EUT has a Dipole Antenna, and the antenna use a permanently attached antenna which is unique.

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: 2AOFDL-LRNCP18, Contains IC:25210-LLRNCP18”

2.9 Information on test modes and additional testing requirements⁵

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: Top band 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.

IC labeling requirement for the final end product:

The final end product must be labeled in a visible area with the following "Contains IC: 25210-LLRNCP18 "

The Host Marketing Name (HMN) must be indicated at any location on the exterior of the host product or product packaging or product literature, which shall be available with the host product or online.

This radio transmitter [IC:25210-LLRNCP18] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Frequency range	Manufacturer	Peak gain	Impedance	Antenna type
2400-2483.5MHz	DONGGUAN SLEing INTEL-TECH CO.,LTD	4.76dBi	50Ω	Dipole