Hardware Specification

LoRa Standard Module

Module Type：L-LRNTB25-97UN4

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The Company reserves the right to modify and improve the products described in this manual without prior notice; We reserve the right to revise or withdraw this manual at any time.

Document revision history

Version	Change date	Reviser	Auditor	Change content
Rev1.0	2023-10-19	wfy	lxy	Initial release

catalogue

1 Introduction

This document defines the standard application development specifications for the L-LRNTB25-97UN4 module (hereinafter referred to as the module), and describes its hardware interfaces, electrical characteristics, application methods, and mechanical specifications.

This document can help users quickly understand the hardware interface specifications, electrical, mechanical characteristics and other related information of the module, combined with other relevant documents, you can quickly master the application development method of the module.

2 Product overview

The L-LRNTB25-97UN4 is a LoRaWAN End Node module developed by Lierda Internet of Things Technology Co., LTD. The module uses serial interface to exchange data and instructions with user equipment, which can easily provide users with fast LoRaWAN network access and wireless data transmission functions. The module supports three working modes: sleep, receive and transmit. Users can choose the appropriate working mode according to their own application scenarios. The module has many characteristics, such as wide transmitting power range, low receiving sensitivity and strong anti-interference ability.

2.1 Product features

Main Parameters	Instructions
Operating frequency	860~930MHz
Modulation mode	LoRa
Receiving sensitivity	-124dBm@PER=5%_SF7_BW125
Maximum transmitting power	22dBm@25℃
Communication interface	UART
Supply voltage	DC 3.3V
Transmit current	Avg.120mA@TX power_22dBm Avg.8.5mA@RX
Dimension	17.7×15.8×2.4mm
Operating temperature	-40~+85℃

2.2 Hardware block diagram

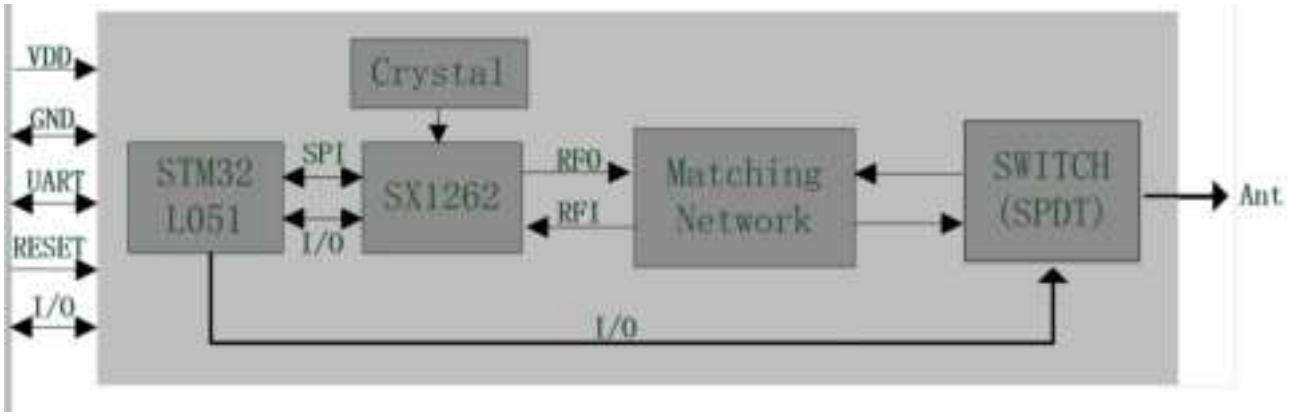

Figure 2 **Hardware block diagram**

2.3 Pin definition

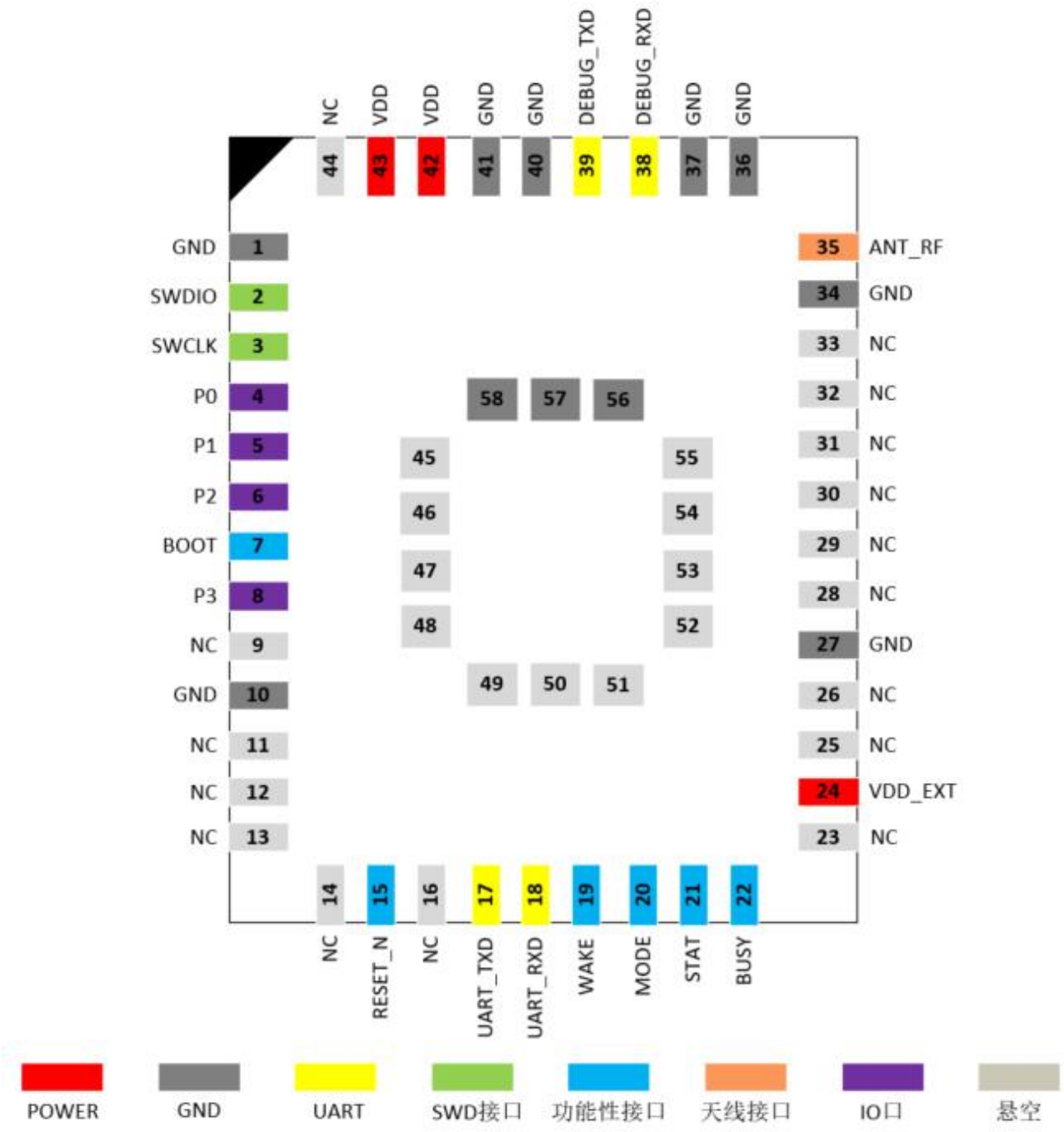

Figure 3　Pin distribution diagram

2.4 Module pin description

2.4.1 UART

Table 1-1 Serial port pin description

Pin Name	Pin No.	Instructions	Pin Type	Dc characteristic	Remarks
UART_TXD	17	UART	O	-	
UART_RXD	18	UART	I	-	
DEBUG_RXD	38	UART	I	-	
DEBUG_TXD	39	UART	O	-	

2.4.2 Power

Table 1-2 Power supply pin description

Pin Name	Pin No.	Instructions	Pin Type	Dc characteristic	Remarks
VDD	42、43	Power	PI	V_{min}= 2V V_{type}= 3.3V V_{max}= 3.7V	
VDD_EXT	24	Power	PO		
GND	1、10、27、34、36、37、40、41、56、57、58	GND	G	-	

2.4.3 SWD

Table 1-3 SWD pin description

Pin Name	Pin No.	Instructions	Pin Type	Dc characteristic	Remarks
SWDIO	2	SWD	I/O	-	

SWCLK	3	SWD	I	-	

2.4.4 Functional Pin Interfaces

Table 1-4 Module function pin description

Pin Name	Pin No.	Instructions	Pin Type	Dc characteristic	Remarks
P0	4	Reserve	I/O	-	Default high resistance state
P1	5	Reserve	I/O	-	
P2	6	Reserve	I/O	-	
BOOT	7	-	I	-	Default low
P3	8	Reserve	I/O	-	Default high resistance state
RESET_N	15	Reset	I	-	Active low
WAKE	19	-	I	-	
MODE	20	-	I	-	
STAT	21	-	O	-	
BUSY	22	-	O	-	Default high
NC	9、11、12、13、14、16、23、25、26、28、29、30、31、32、33、44、45、46、47、48、49、50、51、52、53、54、55	-	-	-	NC

2.4.5 ANT

Table 1-5 ANT function pin description

Pin Name	Pin No.	Instructions	Pin Type	Dc characteristic	Remarks
ANT_RF	35	ANT	I/O	-	

Remarks

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

3 Operating characteristics

3.1 Working mode

Table 3-1 working mode

Working mode	Module state
Normal working mode	Networking status，Users can initiate communication through serial port commands
Sleep mode	In low-power state, the user needs to wake up the module and then initiate communication through the serial port command

3.2 Power supply circuit

VDD is the input end of the whole module power supply, and the power supply directly affects the performance of the module. During the design, a power supply capable of providing at least 0.3A current must be selected to ensure that the input voltage to the VDD is not lower than the minimum operating voltage to prevent abnormal operation of the module due to voltage drop.

If the pressure difference between the input voltage and the power supply voltage of the module is not very large, it is recommended to choose LDO as the power supply. If there is a relatively large pressure difference between the input and output, DC-DC is used for power conversion, and EMI problems caused by DC/DC should be paid attention to.

The power wiring is as short as possible and the GND plane of the power supply part should be as complete as possible and have more ground holes, and the capacitor should be as close as possible to the VDD pin of the module.

3.3 RESET

The reset pin of the module remains at a low level of 100 subtle or above, and the module is reset

4 Typical reference design circuit

The following is the typical design circuit of the module, and the use of other pins should be adjusted according to the actual application requirements.

When the VDD of the module is 3.3V, if the terminal serial port is not 3.3V level, the serial port level conversion circuit needs to be added.

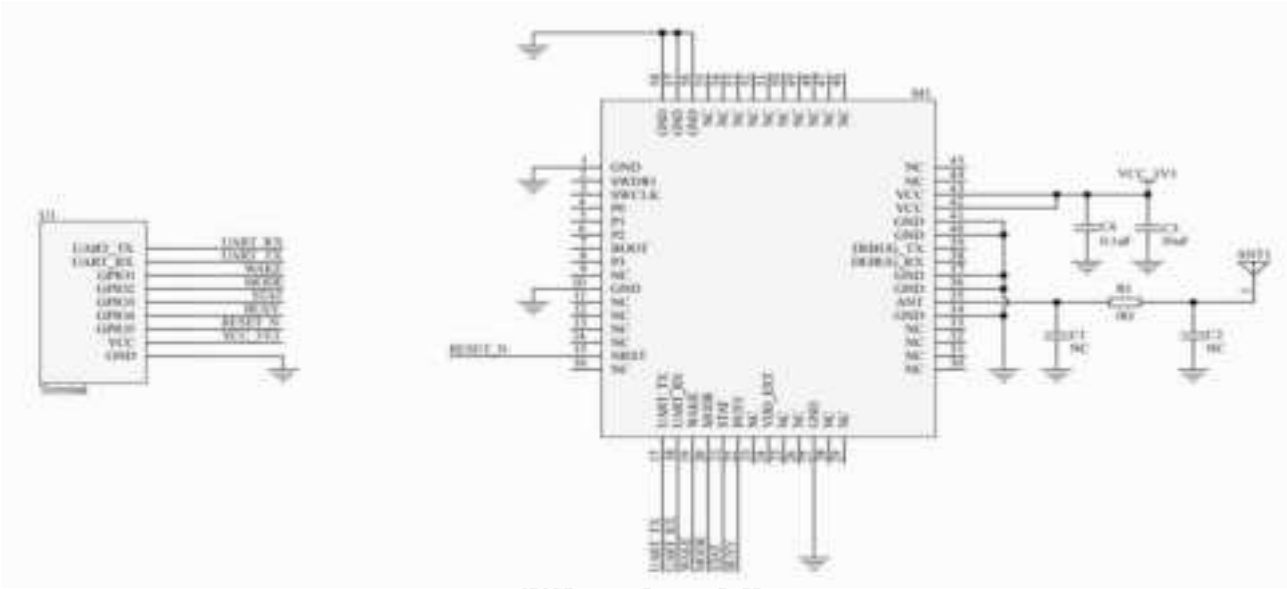

Figure 4 **Typical reference design circuit**

5 Specification parameter

5.1 Absolute maximum ratings

Only the maximum load that can be borne is given here, and it does not mean that the functional operation of the device under these conditions is correct. The reliability of the device may be affected if the device works at the maximum value for a long time.

Table 5-1 Absolute maximum ratings

Main Parameters	Minimum	Maximum	Uints	Remarks
Supply voltage	-0.3	+3.9	V	
Max RF input power	-	+10	dBm	ANT port

5.2 Operating Range

Table 5-2 Operating Range

Main Parameters	Minimum	Typical	Maximum	Uints	Remarks
Supply voltage	+2	+3.3	+3.7	V	
Operating temperature	-40	-	+85	℃	
Storage temperature	-40	-	+85	℃	

Table 5-3 Digital logic level characteristics

Main Parameters	Minimum	Typical	Maximum	Remarks
V_{IH}(V)	0.7*VDD	-	-	
V_{IL}(V)	-	-	0.3*VDD	
V_{OH}(V)	VDD-0.45	-	-	2V≤VDD≤3.7V
V_{OL}(V)	-	-	0.4	

Table 5-4 Radio-frequency parameter

Main Parameters	Minimum	Typical	Maximum	Uints	Remarks
Operating frequency	860	-	930	MHz	The module hardware supports the 860-930MHz band. The specific operating band is selected according to the user's software configuration.
TX power	20.5	21	22	dBm	VDD=+3.3V@25℃; At 25℃, the operating voltage VDD ≥ 3.2V, the maximum transmitting power ≥20.5dBm; When 2.7V ≤ VDD < 3.2V, the maximum transmit power ≥ 17.5dBm; When 2V ≤ VDD < 2.7V, the maximum transmitting power is ≥14.5dBm;
Transmit current	-	120	135	mA	TX power@22dBm
	-	8.5	10.5	mA	RX
Sleep current	-	2	3	uA	
Receiving sensitivity	-125	-124	-123	dBm	SF7_BW125

Note

(1) The test conditions are: temperature: 25℃, center frequency: 863.1MHz/902.1MHz, working voltage: 3.3V; Unless otherwise specified, all test temperatures are 25℃, the same below.

(2) The user can configure the working frequency band according to the local regulations of the terminal market, and must comply with the local regulations. If the frequency band is not allowed by the regulations, our company does not assume any responsibility.For domestic terminal market applications, please refer to *the Catalogue and Technical Requirements of Micro-power Short-range Radio Transmission Equipment.*

6 Mechanical dimension

6.1 Dimension drawing

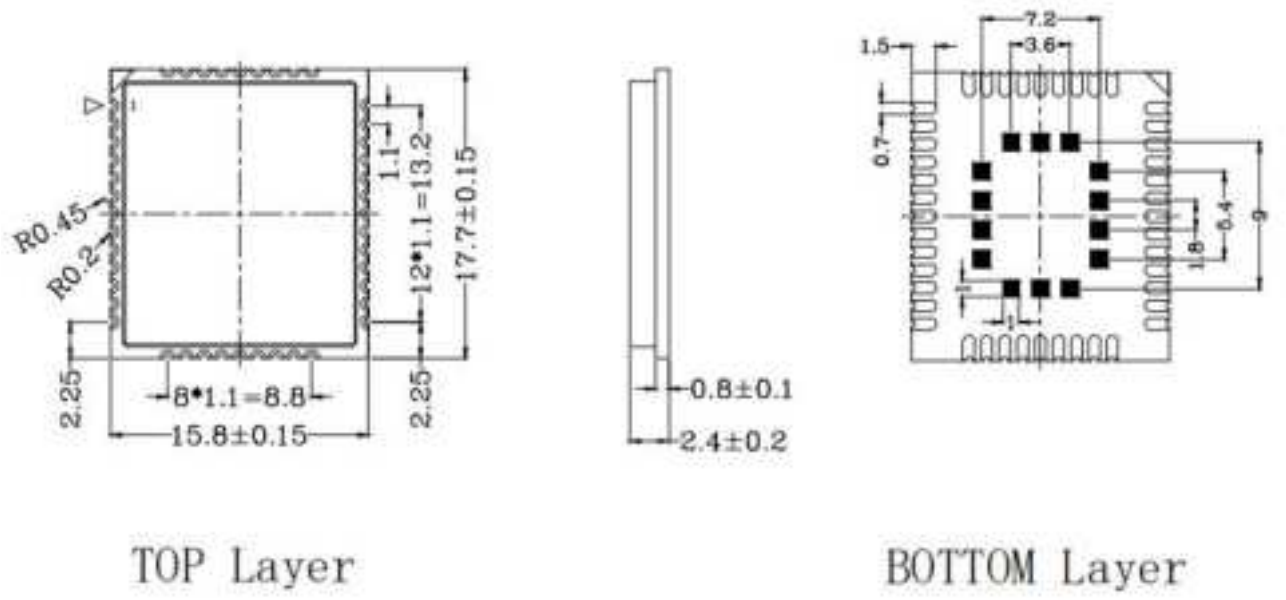

Figure 5 Dimension drawing

7 operation instruction

7.1 Steel mesh opening design

In principle, the thickness selection of the steel network on the bottom plate is selected according to the comprehensive consideration of the packaging type of the devices in the plate, and the following requirements should be focused on:

The module pad position can be locally thickened to 0.15~0.20mm to avoid air welding.

7.2 Reflux welding operation instruction

Note: This operation instruction is only suitable for lead-free operations and is for reference only.

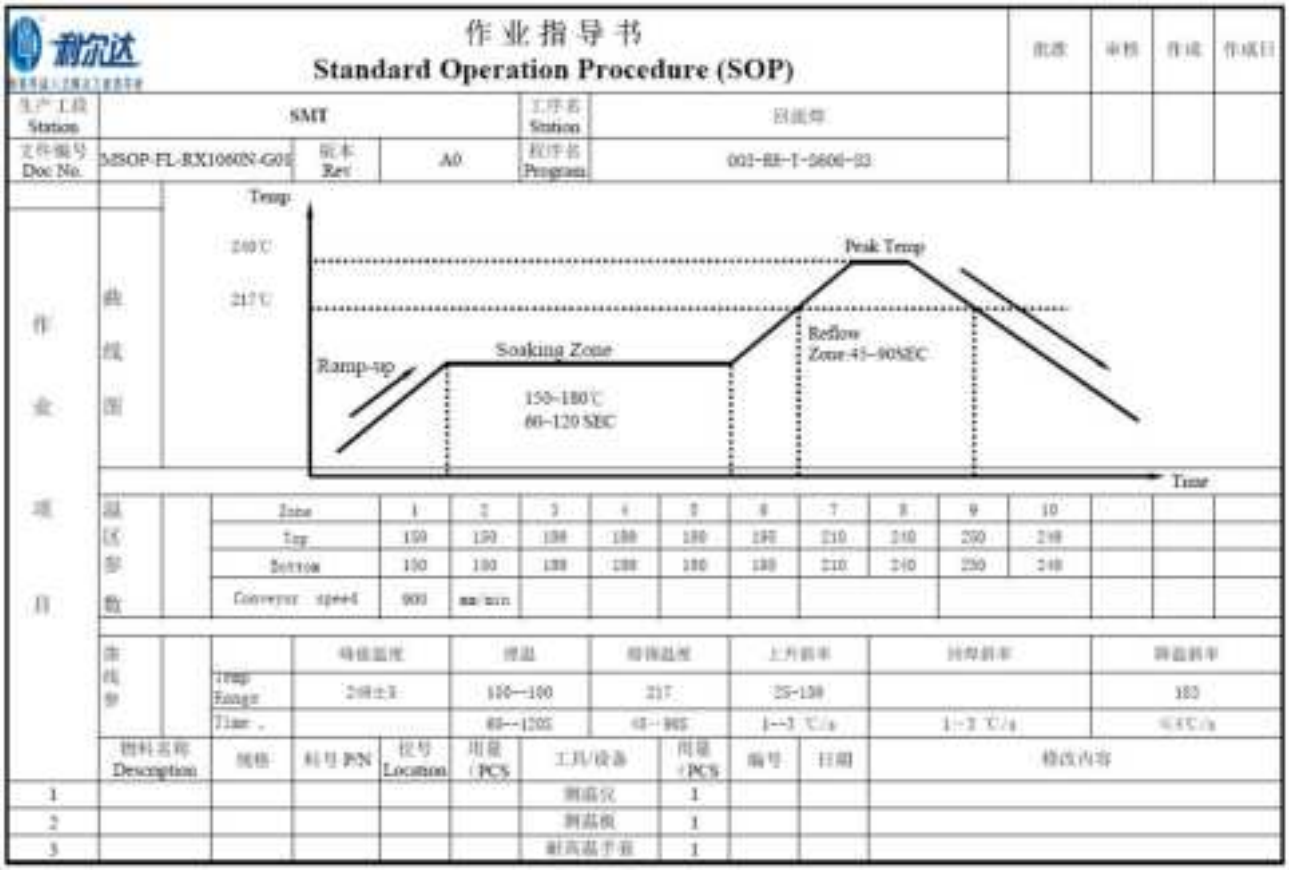

Figure 6 Reflux welding operation instruction

Federal Communication Commission (FCC) Radiation Exposure Statement

When using the product, maintain a distance of 20cm from the body to ensure compliance with RF exposure requirements.

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.

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

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-LRNTB25. 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 allowed to be installed in mobile and portable applications 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 FCCapplication 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.