



LE250-LA

Hardware Guide

V1.3

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Applicable Models

No.	Applicable Model	Description
1	LE250-LA	CAT1, 4MB FLASH, 2MB RAM, LTE FDD/TDD, WIFI-SCAN, GNSS

1 Foreword

1.1 Description

This document describes information on electrical characteristics, RF performance, structural dimensions and application environment of the LE250 module. With the help of this document and other related documents, the application developer can quickly understand the hardware functions of the LE250 module and develop the hardware of the product.

1.2 Reference Standards

This product is designed with reference to the following standards:

- 3GPP TS 51.010-1 V10.5.0: Mobile Station (MS) conformance specification; Part 1: Conformance specification
- 3GPP TS 34.121-1 V10.8.0: User Equipment (UE) conformance specification; Radio transmission and reception (FDD) ; Part 1: Conformance specification
- 3GPP TS 36.521-1 V15.0.0: User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing
- 3GPP TS 36.124V10.3.0: Electro Magnetic Compatibility (EMC) requirements for mobile terminals and ancillary equipment
- 3GPP TS 21.111 V10.0.0: USIM and IC card requirements
- 3GPP TS 51.011 V4.15.0: Specification of the Subscriber Identity Module -Mobile Equipment (SIM-ME) interface
- 3GPP TS 31.102 V10.11.0: Characteristics of the Universal Subscriber Identity Module (USIM) application
- 3GPP TS 31.11 V10.16.0: Universal Subscriber Identity Module (USIM) Application Toolkit (USAT)
- 3GPP TS 27.007 V10.0.8: AT command set for User Equipment (UE)
- 3GPP TS 27.005 V10.0.1: Use of Data Terminal Equipment -Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
- Universal Serial Bus Specification 2.0

1.3 Important Notice to OEM Integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band

emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are compliant with the transmitter(s) rule(s).

The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed. Important Note 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 to XXXX 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 USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

1.3.1 End Product Labeling

When the module is installed in the host device, the FCC/IC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: ZMOLE250LA" The FCC ID/IC ID can be used only when all FCC/IC compliance requirements are met.

1.3.2 Antenna Installation

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
- (2) The transmitter module may not be co-located with any other transmitter or antenna.
- (3) Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/IC authorization is no longer considered valid and the FCC ID/IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC/IC authorization.

1.3.3 Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

1.3.4 Federal Communication Commission Interference 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.

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 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.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

1.3.5 List of applicable FCC rules

This module has been tested and found to comply with part 22, part 24, part 27, part 90, 15.247 and 15.407 requirements for Modular Approval.

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.

This device is intended only for OEM integrators under the following conditions: (For module device use)

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

1.3.6 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 20 cm between the radiator & your body.

2 Product Overview

2.1 Product Introduction

LE250 series module is a highly integrated wireless communication module that uses a baseband processor built on the ARM CORTEX-M3 core. The main frequency can reach up to 306 MHz. This module supports the LTE network standard.

Table 1. Product sub-model

Item	LE250-LA-1D3GW6
LTE TDD	Band 38/40/41
LTE FDD	Band 2/3/4/5/7/8/28/66
WIFI-SCAN	Supported
GNSS	Supported
BLE	Not supported
SIM	Single
Codec	Not supported
Memory	4MB Flash+4MB RAM

2.2 Key Features

Table 2. Baseband features

Category	Function Description
Power supply	DC: 3.4V–4.5V, typical voltage: 3.8V
Processor	ARM CORTEX-M3
PC operating system	Linux/Android/Windows
Network protocol	Support IPv4/IPv6
SMS	Supported
Function interface	USB × 1: USB2.0. It can be used for AT communication, log capture, and software version upgrade
	I2C × 1: Support standard mode 100 KHz, fast mode 400 KHz
	ADC × 4: Support 12-bit ADC, voltage range 0~1.6V
	UART × 2: Main serial port: Used for AT command, data transmission or software upgrade. The baud rate is 115200 bps by default. It supports RTS and CTS hardware flow control.

Category	Function Description
	Debug serial port: Used to capture log output.
	SIM × 2: SIM1 supports 1.8 V and 3 V card self-adaptation, and supports hot swap detection. By default, SIM2 supports only 1.8V SIM cards and does not support hot swap detection
	I2S/PCM × 1: For external audio Codec
	LCD/CAMERA × 1: Partial model support
Antenna interface	Main antenna × 1 (shared antenna with WIFI-SCAN) GNSS antenna × 1 (Partial model support)
LTE features	Modulation system Uplink: QPSK/16QAM Downlink: QPSK/16QAM/64QAM Peak rate LTE FDD: 10.3 Mbps DL/5.1 Mbps UL (Cat 1) LTE TDD: 9.1 Mbps DL/3.1 Mbps UL (Cat 1)
Physical features	Dimensions: (22.2±0.15) mm × (20.2±0.15) mm × (2.3±0.2) mm Package: 101 Pin LCC + LGA Weight: about 2g
Temperature features	Operating temperature: -30°C to +75°C. The module can work normally and meet the requirements of 3GPP standard. Expansion temperature: -40°C to +85°C. The module works normally, and some indexes may exceed 3GPP standards. Storage temperature: -45°C to +90°C. The temperature range for normal storage when the module is not powered on.

3 Antenna Interfaces

3.1 Operating Bands

Tables 4. RF operating band and frequency range

System	Band	Tx (MHz)	Rx (MHz)
LTE FDD	Band 2	1850-1910	1930-1990
	Band 3	1710-1785	1805-1880
	Band 4	1710-1755	2110-2155
	Band 5	824-849	869-894
	Band 7	2500-2570	2620-2690
	Band 8	880-915	925-960
	Band 28	703-748	758-803
	Band 66	1710-1780	2110-2180
LTE TDD	Band 38	2570-2620	2570-2620
	Band 40	2300-2400	2300-2400
	Band 41	2496-2690	2496-2690

4 Electrical Characteristics

4.1 Maximum Transmit Power

The maximum transmit power is the transmit power measured at the antenna pin at an ambient temperature of 25°C. Users should fully consider the insertion loss on the RF path when designing, so as to avoid excessive insertion loss affecting TRP indicators. The maximum transmit power of the LE250 module is as follows:

Table 5. Maximum transmit power of each frequency band

System	Band	Tx Power (dBm)	Description
LTE FDD	Band 2	23.5±2	10MHz Bandwidth, 1 RB
	Band 3	23.5±2	10MHz Bandwidth, 1 RB
	Band 4	23.5±2	10MHz Bandwidth, 1 RB
	Band 5	23.5±2	10MHz Bandwidth, 1 RB
	Band 7	23.5±2	10MHz Bandwidth, 1 RB
	Band 8	23.5±2	10MHz Bandwidth, 1 RB
	Band 28	23.5±2	10MHz Bandwidth, 1 RB
	Band 66	23.5±2	10MHz Bandwidth, 1 RB
LTE TDD	Band 38	23.5±2	10MHz Bandwidth, 1 RB
	Band 40	23.5±2	10MHz Bandwidth, 1 RB
	Band 41	23.5±2	10MHz Bandwidth, 1 RB

4.2 GNSS

Some sub-models of LE250 products support GNSS functions, and the indicators are as follows:

Table 7. GNSS performance

Parameter	Condition	Typical Result	Unit
Power consumption	Location@-130 dBm	55	mA
	Tracking@-130 dBm	55	mA
C/N0	Cold Start @-130dBm	39	dB-Hz
TTFF	Cold Start@-130dBm	40	S
	Hot Start@-130dBm	5	S
Static accuracy	CEP (50% @-130dBm)	3	m

Parameter	Condition	Typical Result	Unit
Sensitivity	Tracking	-156	dBm
	Acquisition	-145	dBm