Operating description LSM110A

1. Introduction

The LSM110A is a compact, low power, bidirectional radio module for the 902MHz ~ 928 MHz frequency band using Semtech's LoRa™ & Sigfox modulation technology. The module provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption.

This LSM110A is a highly-integrated, low power, bi-directional radio transceiver module optimized for use in the sub-1GHz ISM bands.

2. Hardware Architecture:

2.1 Main Chipset Information

Item	Vendor	Part Number
LoRa/ Sigfox	STMicroelectronics	STM32WLE5CC

2.2 Circuit Block Diagram

The major internal and external block diagram of LSM110A is illustrated in Figure 1-1.

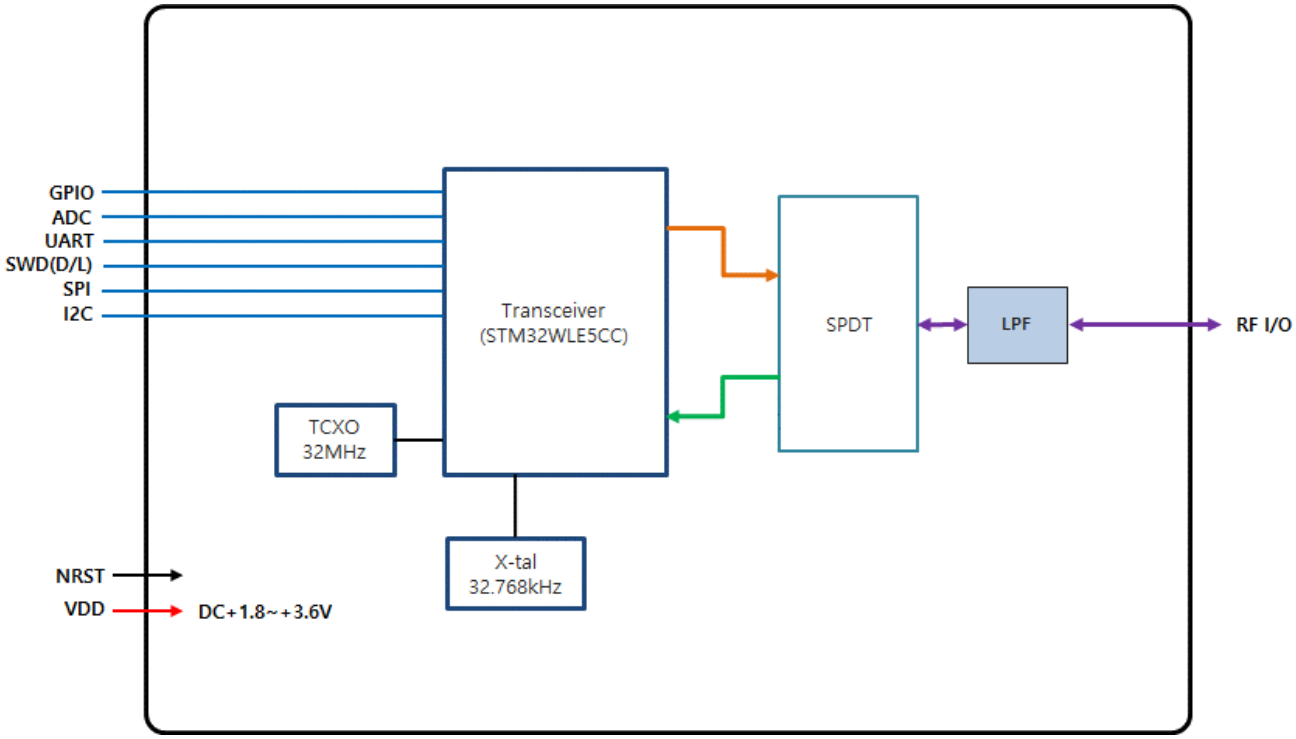


Figure 1-1 LSM110A block diagram and System Interface

3. Operational Description

This Module long-range wireless and ultra-low-power devices embed a powerful and ultra-low-power LPWAN-compliant radio solution, enabling the following modulations: LoRa®, (G)FSK, and BPSK. This Module can use the LoRa® modulation and Sigfox able to transmit and receive messages using the network.
This module address the US902-928, AU915-928 for LoRa and RC2(North America), RC4(Australia, new Zealand) for Sigfox.

3.1 Features

- Compact module 14 x 15 x 2.8mm. (Typ.)
- LoRa™ modulation technology.
- Sigfox modulation technology.
- Sensitivity down to -128dBm@LoRa(BW=500KHz, SF=12)
  -124dBm@Sigfox(0.6Kbps)
- UART interface.
- Low-Power Long Range Transceiver operating in the sub-1GHz ISM band
- Supply voltage range from 1.8 to 3.6V.
- RF interface optimized to 50 Ω.
- Output Power Level up to +22dBm

3.2 Time base of the RF frequency

The reference frequency is 32MHz crystal for LoRa, Sigfox RF frequency.

3.3 Transmission

The transmit chain comprises the modulated output from the modem, that directly modulates the RF-PLL. An optional pre-filtering of the bit stream can be enabled to reduce the power in the adjacent channel also dependent on the selected modulation scheme. The modulated signal from the RF-PLL directly drives the low output power PA (LP PA).

3.4 Receiver

The receive chain comprises a differential low-noise amplifier (LNA), a down-converter to low-IF by mixer operation in quadrature configuration. The I and Q signals are low pass filtered and a ΣΔ ADC converts them into the digital domain. In the digital modem, the signals are decimated, further down converted and channel filtered. The demodulation is done according to the selected modulation scheme.
The receiver supports LoRa, Sigfox modulations.

3.5 Product Details

-Lora

> Data Modulation

LoRa™

> Frequency : US 902.3 ~ 914.9 MHz

AU 915.2 ~ 927.8 MHz

-SIGFOX

> Data Modulation

TX : DBPSK

RX : 2GFSK

> Frequency :

Sigfox zone	Uplink/TX (MHz)	Downlink/RX (MHz)
RC2	902.1375 – 904.6625	905.104 ~ 905.296
RC4	920.1375 – 922.6625	922.204 ~ 922.396

3.6 Output Power tolerance

- Lora Output power : +2/ -2dB
- Sigfox Output power : +2/ -2dB

3.7 LSM110A Category of signal

1) Categorization as Correlated or Completely Uncorrelated

For the purposes of this guidance, transmitter output signals are considered *correlated* if any of the following are true:

- The same digital data are transmitted from two or more antennas in a given symbol period, even with different coding or phase shifts; or,
- Correlation between two transmitted signals exists at any frequency and time delay; or,
- Multiple transmitter outputs serve to focus energy in a given direction or to a given receiver; or,
- The operating mode combines correlated techniques with uncorrelated techniques.

Otherwise, the output signals are considered *completely uncorrelated*.

3.8 Simultaneous transmission

	LoRa	SIGFOX
LoRa		N/A
SIGFOX	N/A	

4. Antenna Trace Design for Host devices

a) Trace layout and dimensions including specific designs for each type:

1) Layout of trace design, parts, antenna, connectors, and isolation requirements;

All RF trace must be 50 ohm line. Connectors are required to use SMA Type connector. And Antenna is required to use EVB_LSM ANT antenna manufactured by Seong Ji Industrial Co., Ltd..

But, you must not give to access to antenna connector to user when you install this module into devices to be compliance with FCC section 15.203.

2) Boundary limits of size, thickness, length, width, shape(s), dielectric constant, and impedance must be clearly described for each type of antenna;

Antenna should be used only PCB pattern type antenna manufactured by Seong Ji Industrial Co., Ltd.. Different antenna type is not acceptable.

3) Different antenna length and shapes affect radiated emissions, and each design shall be considered a different type; e.g., antenna length in multiple(s) of frequency wavelength and antenna shape (traces in phase) can affect antenna gain and must be considered;

Different antenna is unacceptable.

b) Appropriate parts by manufacturer and specifications.

1) For antenna, EVB_LSM ANT or similar part manufactured.

c) Test procedures for design verification.

The manufacturer should verify that the antenna trace design on the PCB board is compliance with this Antenna Trace Design documents.

You connect the antenna connector of the device to the input of a measurement instrument. And you set the measurement instrument to the proper options for each frequency bands and conduct the test to get the output power from the antenna connector. The permissible output power range is in below table to verify the antenna trace design is appropriate for this documents.

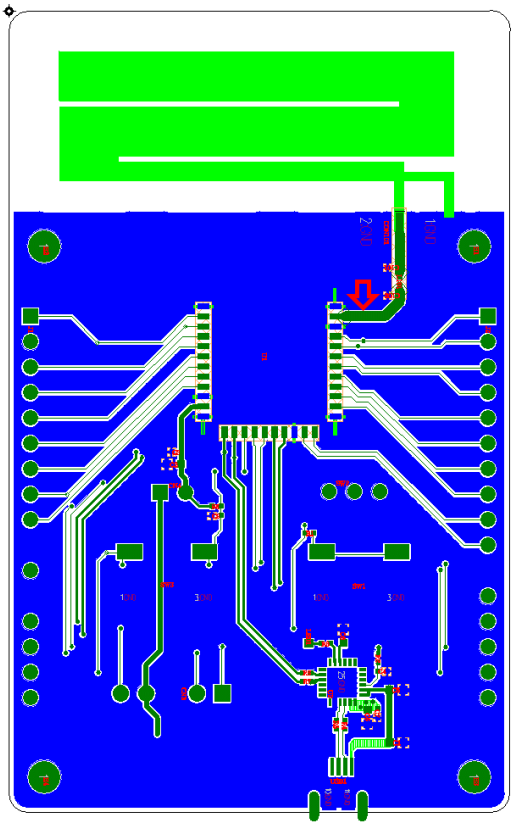
BAND	Output power	Tolerance
LoRa(US/AU)	+21dBm	+2/-2dB
Sigfox(RC2/ RC4)	+21dBm	+2/- 2dB

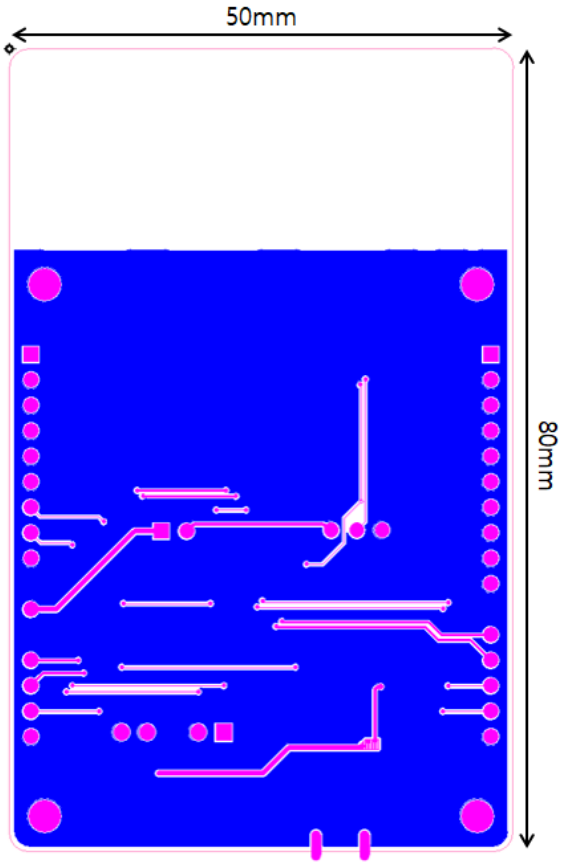
d) Production test procedures for ensuring compliance.

The host product itself is required to comply with all other applicable FCC equipment authorization regulations, requirements.

So, the host device should be tested for unintentional radiators under Part 15 subpart B for non-transmitter functions on the transmitter module as appropriate.

4) The above data is to be provided by a Gerber file (or equivalent) for PCB layout.





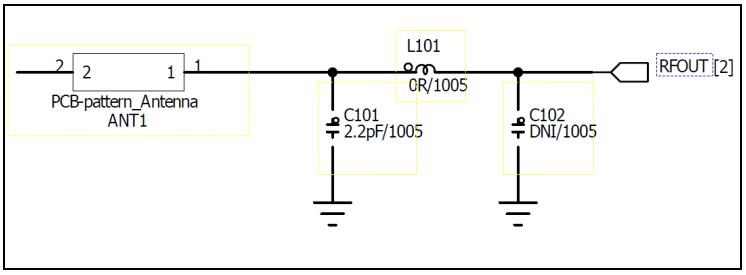
: 50 ohm matching parrern

[PCB Top] [PCB Bottom]

[application PCB information]

- **PCB : 2-layer, 1.6mm**
- **Impedance line width : 1.0mm**
- **Clearance : 0.15mm**
- **FR4 PCB εr = 4.3**

[Antenna Matching value]

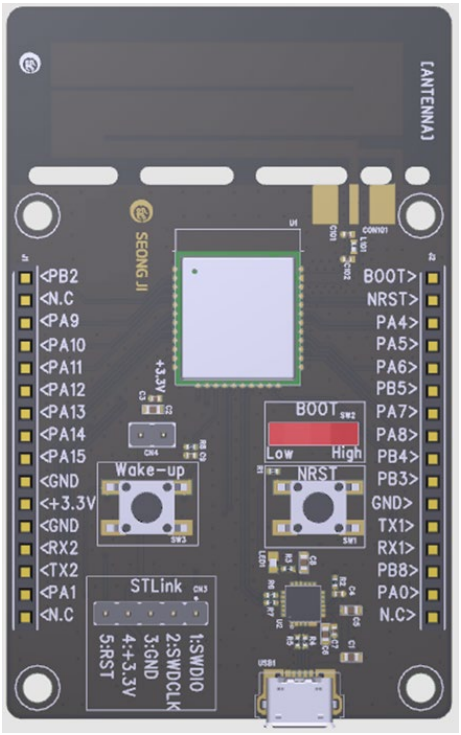


5. I stallation Guide

- Contents

This module is used by mounting on the main board that included antenna.

- InstallationFigure



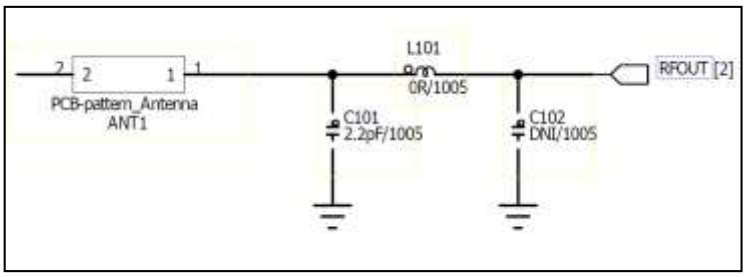
6.Contact Address

54-33, Dongtanhana 1(i)-gil, Hwaseong-si, Gyeonggi-do, 18423, Republic of Korea.

7.Manufacturer

SJI CO.,LTD

[Antenna Matching value]



FCC approval

Supplier's Declaration of Conformity 47 CFR § 2.1077 Compliance Information
Unique Identifier: (e.g., Trade Name, Model Number)

Responsible Party – U.S. Contact Information
1. Company Name: Sea Slug Labs LLC
Street Address Sea Slug Labs 19806 Maverick Creek Ln Cypress
City, State: Texas
Zip Code: 77433
Telephone number or internet contact information: +6827778293 / jorge@seasluglabs.io

2. Company Name: Treetop Technical Products LLC
Street Address 1776 Broadway, Unit 7 Raynham Massachusetts
City, State: Massachusetts
Zip Code: 02767
Telephone number or internet contact information: +15082383133/ sales@treetoptech.com

This device complies with Part 15 of the FCC`s 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 undesirable operation.
To satisfy FCC exterior labeling requirements, the following text must be placed on the exterior of the end product.

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.
−The OEM integrator is responsible for ensuring the end-user has no manual instruction to remove or install module.
−The module is limited to installation in mobile or fixed applications.

Regulatory notice to host manufacturer according to KDB 996369 D03 OEM Manual v01

List of applicable FCC rules
This module has been granted modular approval as FCC Rule parts 15C(15.247).

Summarize the specific operational use conditions
-The OEM integrator should use equivalent antennas which is the same type and equal or less gain then an antenna listed in this instruction manual.

Limited module Procedures
This module is single modular approval.

Antennas list
The antenna certified with this module is listed following.
-Type: Pattern antenna / Max. peak Antenna gain : 1.9 dBi

A host manufacturer must not use the other types of antenna and an antenna with a gain that exceeds the values listed in this documents.

RF exposure considerations

The module has been certified for integration into products only by OEM integrators under the following condition:

-The antenna(s) must be installed such that a minimum separation distance of at least **20** cm is maintained between the radiator (antenna) and all persons at all times.

-The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

-Mobile use

As long as the three conditions above are met, further transmitter testing will not be required.
OEM integrators should provide the minimum separation distance to end users in their end-product manuals.

Label and compliance information

End Product Labeling

The module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are 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. In that case, the final end product must be labeled in a visible area with the following:
“Contains FCC ID: 2BEK7LSM110A
“Contains IC: 32019-LSM110A

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 or change RF related parameters in the user manual of the end product.

Note EMI Considerations

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
For standalone mode, reference the guidance in D04 Module Integration Guide and for simultaneous mode; see

D02 Module Q&A Question 12, which permits the host manufacturer to confirm compliance.

How to make changes

Since only Grantees are permitted to make permissive changes, when the module will be used differently than granted, please contact the module manufacture on below contact information.
-. Contact information: wskim@seongji.co.kr/ +82-31-223-7048

ISED approval

RSS-GEN, Sec. 7.1.3–(licence-exempt radio apparatus)

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.
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 ne 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.

RF Exposure

The antenna (or antennas) must be installed so as to maintain at all times a distance minimum of at least **20 cm** between the radiation source (antenna) and any individual. This device may not be installed or used in conjunction with any other antenna or transmitter.

l'exposition aux RF

L'antenne (ou les antennes) doit être installée de façon à maintenir à tout instant une distance minimum de au moins **20 cm** entre la source de radiation (l'antenne) et toute personne physique.
Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment. Attention:
Les changements ou modifications de cet appareil non expressément approuvé par le fabricant peuvent annuler votre droit à utiliser cet équipement.

Étiquetage du produit final (IC)

Le module LSM110A est étiqueté avec sa propre identification FCC et son propre numéro de certification IC. Si l'identification FCC et le numéro de certification IC ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre dispositif, la partie externe du dispositif dans lequel le module est installé devra également présenter une étiquette faisant référence au module inclus. Dans ce cas, le produit final devra être étiqueté sur une zone visible avec les informations suivantes :
« Contient module émetteur IC : 32019-LSM110A