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Figure 1-1 Module block diagram and Interface

SJIT SFM11R2D SIGFOX Module User Manual

Contents

SJIT SFM11R2D SIGFOX Module

USER MANUAL

1. Introduction

The module is a SIGFOX only module able to transmit and receive messages using the SIGFOX network. The Sigfox chipset is from ON semiconductor, part number AX-SFUS-1-01.

2. Hardware Architecture:

2.1 Main Chipset Information

Item	Vendor	Part Number
Sigfox	ON semiconductor	AX-SFUS-1-01

2.2 Circuit Block Diagram

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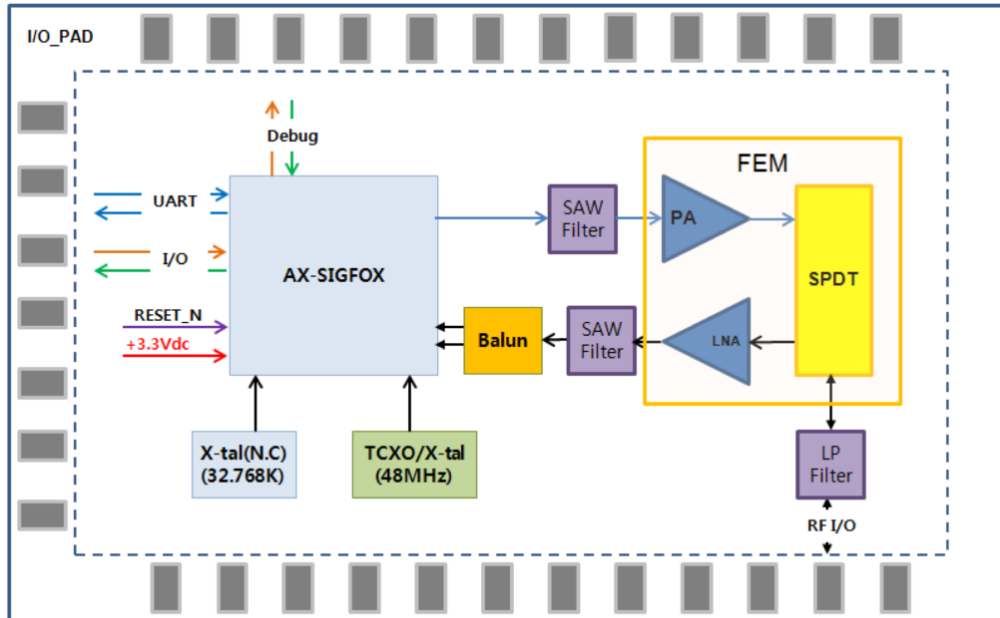

Figure 1-1 Module block diagram and Interface

3. Operational Description

This Module able to transmit and receive messages using the SIGFOX network.
This module addresses the RC2 and RC4 zone (North America and Australia).

– Features
> Sigfox up-link and down-link functionality controlled by AT commands
> Temperature sensor
> Ultra-low power consumption
> High performance narrow-band Sigfox

– Time base of the RF frequency
For Sigfox RF frequency, a TCXO(48MHz) is a clock reference.

– Transmission
The Tx path produces a DBPSK-modulated signal. modulate RF signal generated by the synthesizer. The modulated RF signal is fed to the integrated RX/TX switch and antenna interface and then out of the AX-SFEU-1-01.

– Receiver
The Rx path is able to receive 905.2MHz, 922.3MHz signal and the noise amplifier is built in the inside of the chip, it amplifies the received signal by the low noise amplifier according to the receiving intensity, and the amplified signal is converted into the digital signal through the ADC, Packets will be interpreted

– Product Details
> Data Modulation
Sigfox : TX- DBPSK
RX- 2GFSK

> Frequency :

Sigfox zone	Uplink(TX)	Downlink(RX)
RC2(North America)	902.1375 ~ 904.6625 MHz	905.2MHz
RC4(Australia)	920.1375 ~ 922.6625 MHz	922.3MHz

– Product Spec.

Parameter			Min	Typ.	Max	Unit
RF Frequency	RC2	Tx		902.2		MHz
		Rx		905.2		MHz
	RC4	Tx		920.8		MHz
		Rx		922.3		MHz
Tx output power(at "24" setting)			–	+22.5	+24	dBm
Frequency Error Tolerance(+25°C)			-2.5	–	+2.5	ppm
2nd Harmonics(conducted)			–	-44	–	dBm
3nd Harmonics(conducted)			–	-44	–	dBm
Rx Sensitivity(@600bps, GFSK)			–	-129	–	dBm
Rx Spurious Emission(30MHz~12.75GHz)					-54	dBm

– Product pwr Spec.

Symbol	Parameter	Min	Typ.	Max	Unit
VDD	Power supply	2.7	3.3	3.6	V
Idd	current	–	170	–	mA

– Product Temp. Spec.

Symbol	Parameter	Rating	Unit
Temp	Operating	-30 to +85	°C
TSTG	Storage Temperature	-40 to +125	°C

4. Installation Guide

– Contents
– Installation Figure

5. Notice

<Warning Statements>
<Warning Statements>

FCC Part 15.19 Statements:
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.

FCC Part 15.21 statement
Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment

Modular Approval Statement
Regulatory notice to host manufacturer according to KDB 996369 D03 OEM Manual
This module has been granted modular approval as below listed FCC rule parts.

-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 below this instruction manual.

Limited module Procedures
This module is certified as limited modular approval because of lack of both conditions of SMA type connector antenna, so the host manufacturer needs to be followed the installation guidance explained below.

1. Antenna Installation Guidance
1) The antenna used must be used in the specified antenna type and maximum antenna gain as listed below:
-. Antenna type: Half Wave dipole
-. Max. peak Antenna gain: 2.1 dBi
If a different type or higher gain antenna is used, additional authorization is required.
2) The OEM manufacturer, responsible for installing this module into the host device, must ensure that end-users do not have access to the antenna and connector, in compliance with FCC Section 15.203.
3) the antenna connector must not be accessible to the end-user when installed into the host device and the host device must ensure the module and antenna are installed in accordance with the installation guidance.

Antennas list
The antenna certified with this module is listed following.
-. Antenna type: Half Wave dipole
-. INNO-EL9SWS-149 manufactured by Inno-Link. Co., Ltd. (Highest permitted antenna gain: 2.1 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.

End Product Labeling

The module is labeled with its own FCC ID. If the FCC ID 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: 2BEK7SFM11R2D

Contains IC: 32019-SFM11R2D

Information on test modes and additional testing requirements

-OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, additional transmitter in the host, etc.).

Additional testing, Part 15 Subpart B disclaimer

-The final host product also requires Part 15 subpart B compliance testing with the modular transmitter installed to be properly authorized for operation as a Part 15 digital device.

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 noncompliant 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
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.
É tiquetage du produit final Le module SFM11R2D est étiqueté avec sa propre identification ISED et son propre numéro de certification IC. Si l'identification ISED et le numéro de certification ISED ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre dispositif, la partie externe du dispositive 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-SFM11R2D

RSS-GEN, Sec. 6.8
This radio transmitter [32019-SFM11R2D] 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.
-. Antenna type: Half Wave dipole
-. INNO-EL9SWS-149 manufactured by Inno-Link. Co., Ltd. (Highest permitted antenna gain: 2.1 dBi)

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 dipole antenna manufactured by Inno-Link. 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 SMA type antenna manufactured by Inno-Link 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 Sigfox antenna, INNO-EL9SWS-149 manufactured by Inno-Link. Co., Ltd.

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
Sigfox	22.5 dBm	+/- 1.5 dB

d) Production test procedures for ensuring compliance.

The host product itself is required to comply with all other applicable FCC equipment authorization regulations, requirements.
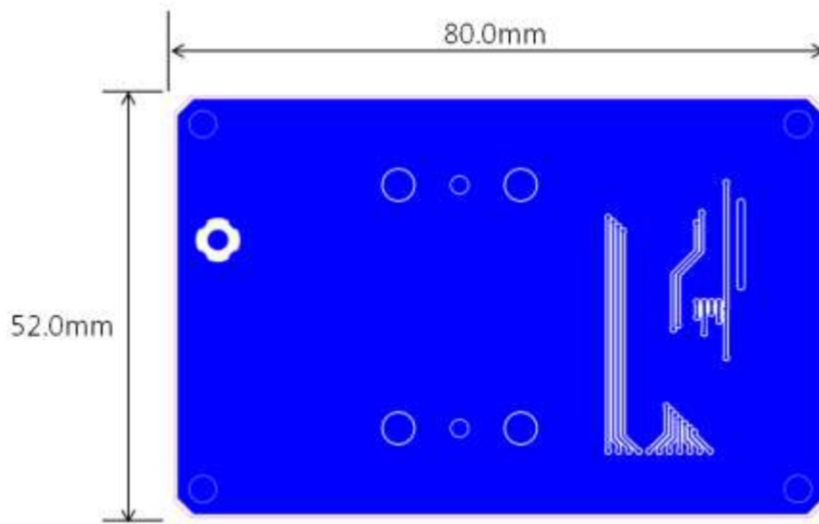
So, the host device should be tested for unintentional radiators under Part 15 subpart B for nontransmitter functions on the transmitter module as appropriate.

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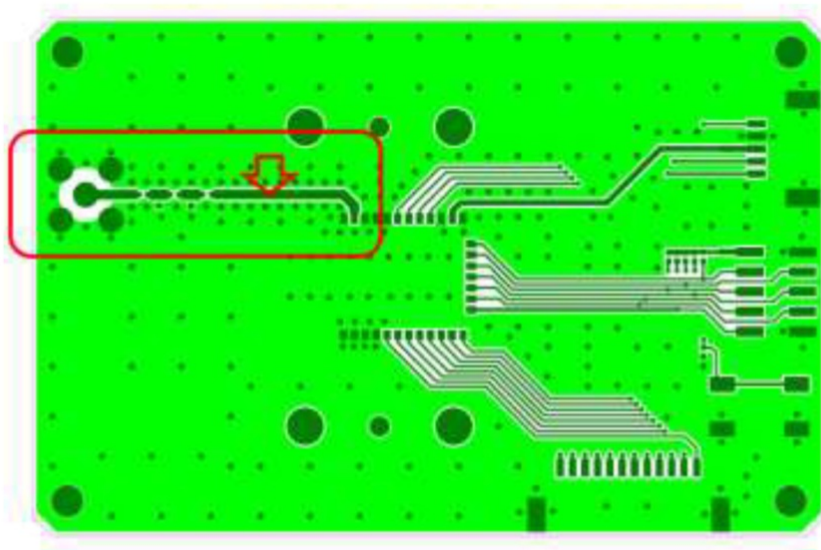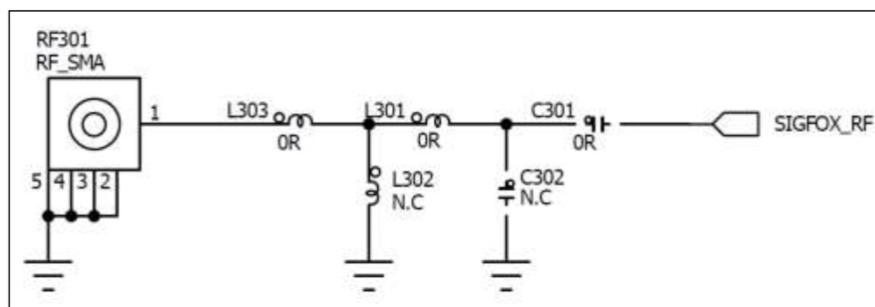

⇩ : 50 ohm matching pattern

[PCB Top]

[PCB Bottom]

[PCB Bottom] [Antenna application PCB information] PCB Thickness: 1.6mm
Impedance line width : 1.0mm
Clearance : 0.23mm
FR4 PCB εr = 4.6
[Sigfox Antenna Matching value]

[Sigfox Antenna Matching value]

Specifications

- **RF Frequency:** 902.2 MHz to 905.2 MHz (Tx RC2),

  920.8 MHz to 922.3 MHz (Rx Tx RC4 Rx)

- **Tx Output Power:** +22.5 dBm to +24 dBm

- **Frequency Error Tolerance:** -2.5 ppm to +2.5 ppm

- **2nd Harmonics (conducted):** -44 dBm

- **3rd Harmonics (conducted):** -44 dBm

- **Rx Sensitivity:** -129 dBm (@600bps, GFSK)

- **Rx Spurious Emission:** -54 dBm (30MHz~12.75GHz)

- **Power Supply:** 2.7 V to 3.6 V

- **Current:** 170 mA

- **Operating Temperature:** -30°C to +85°C

- **Storage Temperature:** -40°C to +125°C

Frequently Asked Questions (FAQ)

Q: What are the operational zones supported by the module?

A: The module supports the RC2 (North America) and RC4 (Australia) zones for SIGFOX network communication.

Q: What is the power supply requirement for the module?

A: The module requires a power supply voltage between 2.7V to 3.6V.

Q: How can I control the functionality of the module?

A: The SIGFOX up-link and down-link functionality can be controlled using AT commands.

Documents / Resources
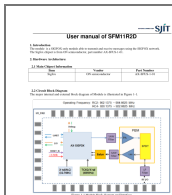
SJIT SFM11R2D SIGFOX Module [pdf] User Manual
2BEK7SFM11R2D, sfm11r2d, SFM11R2D SIGFOX Module, SFM11R2D, SIGFOX Module, Module

References

- **User Manual**