

User manual of SFM10R4

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.

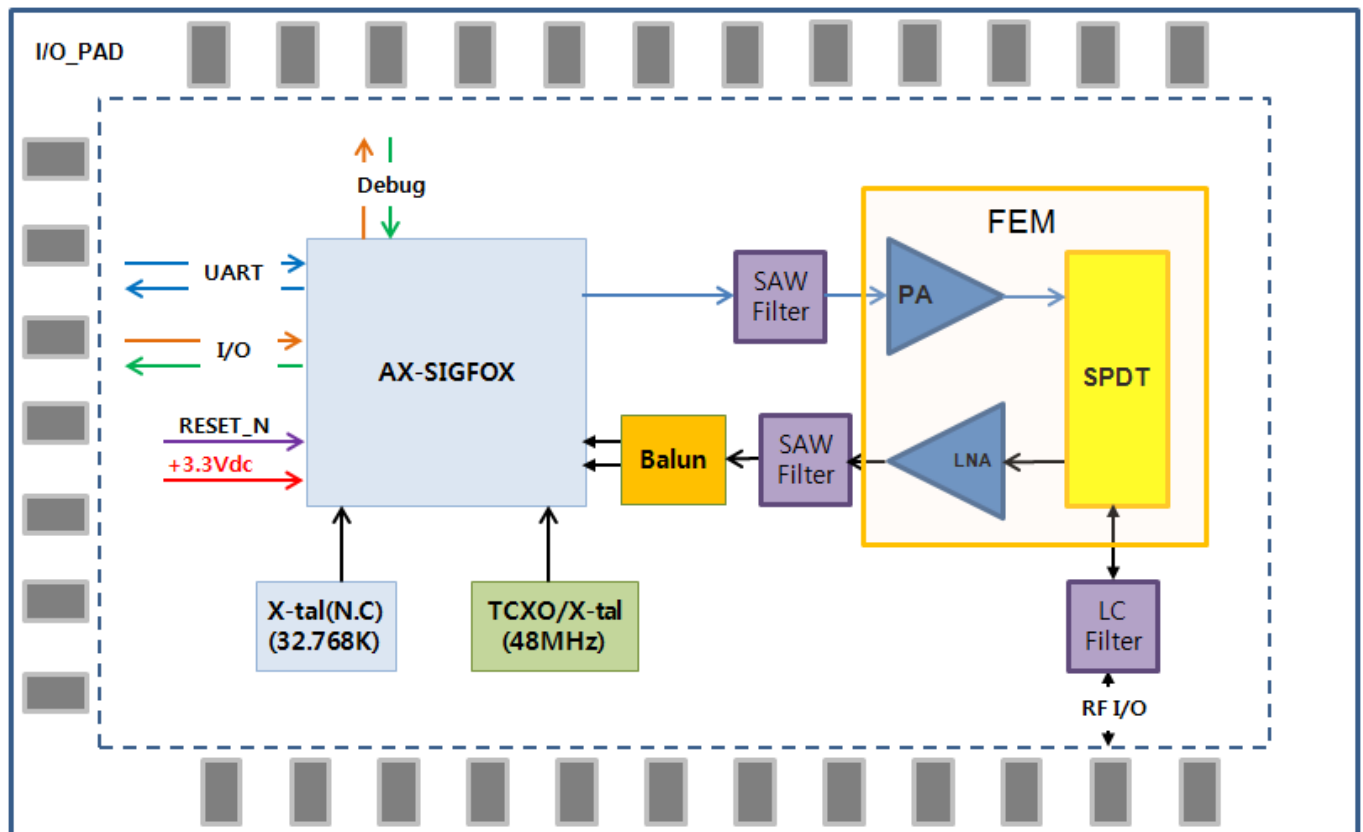


Figure 1-1 Module block diagram and Interface

2.3 Module output power Setting information

Frequency	Power Setting
920.8MHz	24

2.4 Module output power information

Frequency	Output Power
920.8MHz	22.0~24.0dBm

3. Operational Description

This Module able to transmit and receive messages using the SIGFOX network.

This module addresses the RCZ4 zone (Australia, New Zealand).

- 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-SFUS-1-01.

- Receiver

The Rx path is able to receive 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)
RCZ4 (Australia, New Zealand)	920.1375 ~ 922.6625 MHz	922.3MHz

- Product Spec.

Parameter		Min	Typ.	Max	Unit
RF Characteristics					
RF Frequency	Tx		920.8		MHz
	Rx		922.3		MHz
Tx output power(at "24" setting)		22		24	dBm
Frequency Error Tolerance(+25°C)		-2.5	-	+2.5	ppm
2 nd Harmonics(conducted)		-	-44		dBm
3 rd 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	-	-	230	mA

- Product Temp. Spec.

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

4. Installation Guide**- Contents****- Installation Figure****5.Contact Address**

54-11, Dongtanhana 1(i)-gil, Hwaseong-si, Gyeonggi-do, 18423, Korea (Republic of).

6.Manufacturer

SJIT Co.,Ltd

<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 than 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 and power supply regulation, so the host manufacturer needs to be followed the installation guidance explained below.

1. Antenna Installation Guidance

1) The host device equipped with this transmitter module must be installed by a professional installer who is trained regarding the antenna installation conditions as outlined below:.

- 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.

2. Installation guidance for power supply regulation

This module does not have its own power supply regulation. Therefore, Host product in which this module is installed must be followed module manufacturer's installation guidance to provide the correct input voltages (2.7-3.6 Vdc) to this module from host device's power supply regulation circuitry. Verification testing shall be performed according to the provided test guidance in this documents. This is to ensure that the module, when installed and operated under the host product's operating conditions and voltage regulation range, remains compliant with FCC requirements.

✓ Host Product Test Guidance

: The radiated signal level of the fundamental frequency and radiated spurious emissions measurements shall be performed while varying the hosts supply voltage between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery. At low battery voltage levels, the

module input level may drop to 0V, otherwise shall be maintained within the operating voltage range.

The verification testing results while varying the host operating voltages must be meet the following criteria:

- The radiated signal level of fundamental frequency bands (920.1375MHz~922.6625 MHz) must be lower than 26.1 dBm EIRP (Conducted power 24 dBm + peak Antenna gain 2.1 dBi).
- Radiated spurious emissions measurements must be lower than module's highest value in the harmonic frequencies of fundamental frequency bands.

Trace antenna designs

- This module is using Trace Antenna Design. Module integration guidelines must be closely followed.
Compliance of host integrations of the module is limited to hosts adaptation designs which are identical to SJIT's reference designs explained in this documents.
Host integrations with adaption designs deviating from SJIT's reference design require either class 2 permissive change to this modular approval or a separate host approval with different FCC ID.

Antennas list

The antenna certified with this module is listed following.

- Antenna type: Half Wave dipole (Model name: INNO-EL9SWS-149)
- Max. peak 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 below

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: 2BEK7SFM10R4

Contains IC: 32019-SFM10R4

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 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

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.

Étiquetage du produit final Le module SFM10R4 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 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-SFM10R4

RSS-GEN, Sec. 6.8

This radio transmitter [32019-SFM10R4] 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
- . Max. peak Antenna gain: 2.1 dBi

Le présent émetteur radio [32019-SFM10R4] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

- . Type d'antenne : Dipôle demi-onde
- . Gain d'antenne maximal en crête : 2,1 dBi

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 **must be** SMA Type connector. And Antenna also **must be** dipole antenna manufactured by Inno-Link. Co., Ltd **listed below**.

If difference type of connector other than SMA type or antenna other than the antenna listed below is used, additional authorization through either Class II Permissive change or new authorization procedure is required.

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.

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

Antenna can 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.

INNO-EL9SWS-149 or similar part manufactured by Inno-Link. Co., Ltd.

c) Test procedures for design verification.

Host product is recommended to test below test items according to KDB 996369 D04 guidance.

Measure the fundamental and unwanted/spurious emissions with the modular transmitter(s) operating in a normal mode.

And specifically, below testing should be focused on during testing.

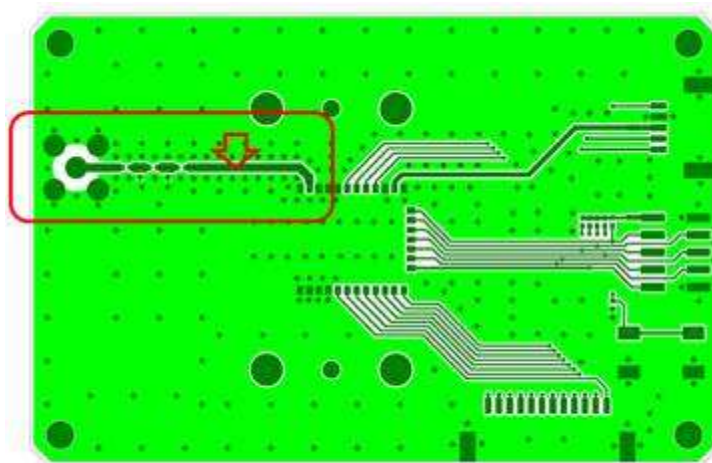
Test items	Channel	Modulation	
Worst case radiated spurious emission in restricted band	Low/Mid	DBPSK	Specifically 4 th , 8 th and 9 th harmonic of fundamental

Please refer to the testing guidance under KDB 558074 D01 and test report of FCC ID: 2BEK7SFM10R4.

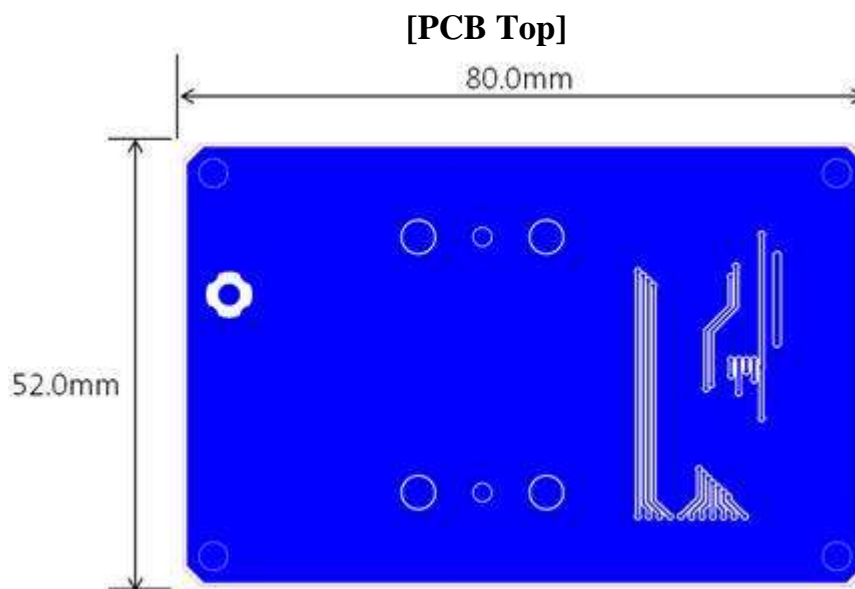
d) Production test procedures for ensuring compliance.

As same as above section c)

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



↓ : 50 ohm matching pattern



[PCB Bottom]

[Antenna application PCB information]

PCB Thickness: 1.6mm

Impedance line width : 1.0mm

Clearance : 0.23mm

FR4 PCB $\epsilon_r = 4.6$

Connector type: SMA type

[Sigfox Antenna Matching value]

