SJI / SFM20R2
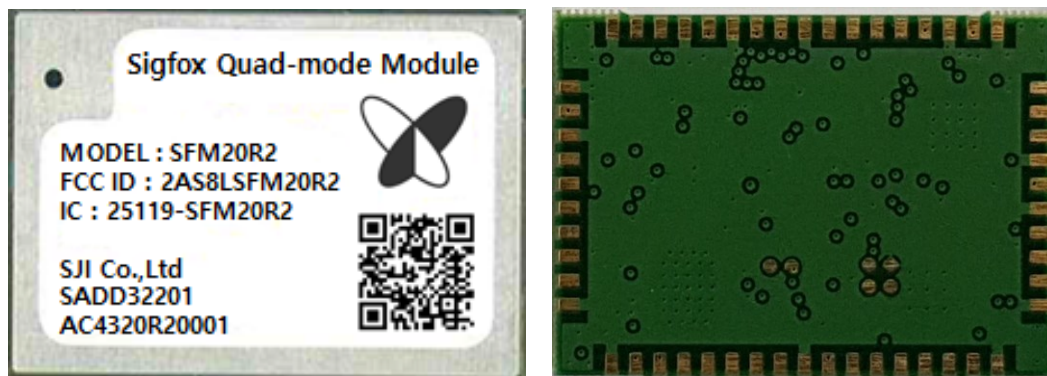
DATA SHEET Rev.07

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1. Approval Revision Record

NO	REASON	RECORD OF REVISION	Date	Remark
1	REV 00	WSSFM20R2 Initial Releases	2017-03-21	-
2	REV 01	Recommend Footprint	2017-04-16	-
		Sigfox Electrical Specification	2017-04-16	-
3	REV 02	Hardware connection for RF regulatory certification	2017-10-12	-
4	REV 03	FCC certification updated of WiFi RF Output Power FCC/IC Warning Statements	2018-02-01	-
5	REV 04	ANATEL certification completed	2018-05-30	-
6	REV 05	Added "ESD Warning"	2018-07-19	-
7	REV 06	Changed manufacture(Wisol → SEONGJI)	2018-08-30	-
8	REV 07	Changed manufacture(SEONGJI → SJI)	2022-08-31	

2. Scope

- Description

  - Sigfox Configuration 2 RC2
  - WIFI (2.4GHz) : Supports 802.11 b/g/n.
  - BLE : Support version BT4.2.
  - NFC : Type 2 near field communication (NFC-A) tag with wakeup-on-field and touch to-pair capabilities.
  - GPS : Supports GPS and GLONASS.
  - Accelerometer : ±2g/±4g±/8g dynamically selectable full-scale.

- Type : SMD Type
- PBA Size : 29mm(W) x 21mm(L) x 2.3mm(H)

  This module has completed SIGFOX P1 verification and FCC, IC RF regulatory certification.

3. Numbering of product

3-1. Product
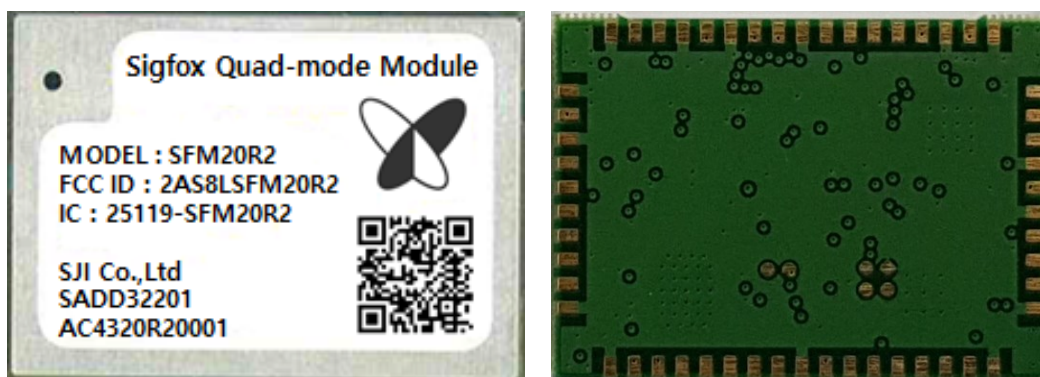
3-2. Part No.

W	S	**S**	**F**	**M**	**2**	**0**	**R**	**2**	A	P
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

No.	EXPLANATION
(1),(2)	Wireless Solution
(3),(4)	Application (SF:Sigfox)
(5)	Type (M:Module)
(6),(7)	Group model numbering
(8), (9)	Region Code
(10), (11)	Application Type(Firm Ware Type) AP(API version)

3-3. Lot. No.

S	A	C	J	A	2	2	0	1
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

①	Sigfox Module
②	Manufacture Area Packing Lot / A / B / C Area / Korea / China / Vietnam
③	Year
④	Month
⑤	Day
⑥⑦	Model Serial Number (10,11,12,13…)
⑧⑨	A Serial Number (1serial: 1,100ea)

② Manufacture Area

Packing Lot	A	B	C
Area	Korea	China	Vietnam

③ Year

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Mark	W	X	Y	Z	A	B	C	D	E	F

④ Month

Month	1	2	3	4	5	6	7	8	9	10	11	12
Mark	A	B	C	D	E	F	G	H	I	J	K	L

⑤ Day

Day	1	2	3	4	5	6	7	8	9	10	
Mark	1	2	3	4	5	6	7	8	9	A	
Day	11	12	13	14	15	16	17	18	19	20	
Mark	B	C	D	E	F	G	H	I	J	K	
Day	21	22	23	24	25	26	27	28	29	30	31
Mark	L	M	N	O	P	Q	R	S	T	U	V

4. Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
VCC	Module input voltage	5.5	V
OT	Operating Temperature	-30 to +85	℃
ST	Storage Temperature	-40 to +125	℃

5. DC Characteristics

Symbol	Parameter	Min	Typ.	Max	Unit
VCC	Module input voltage	3.2	3.3	5.0	V

6. I/O Specifications

Symbol	Parameter	Min	Typ.	Max	Unit
VCC	supply voltage		3.0	3.3	V
VIH	High level input voltage	2.1			V
VIL	Low level input voltage			0.9	V

7. RF Specifications

7-1. Sigfox

7-1-1. Electrical Specification

Symbol	Parameter	Min	Typ.	Max	Unit
Current	Tx Current(@MOD)		150		mA
	Rx Current		25		mA

7-1-2. Receiver, Transmitter Specification

Conditions: VCC=3.3V, Temp=25℃

Parameter		Min	Typ.	Max	Unit
RF Frequency	Tx		902.2		MHz
	Rx		905.2		MHz
Tx output power			22.5		dBm
Frequency Error Tolerance(+25℃)		-2.5	-	+2.5	ppm
2nd Harmonics(conducted)		-	-37	-35	dBm
3nd Harmonics(conducted)		-	-41	-35	dBm
Rx Sensitivity(@600bps, GFSK)		-	-129	-	dBm
Rx Spurious Emission(30MHz~12.75GHz)		-	-	-54	dBm

7-2. BLE

7-2-1. Electrical Specification

Parameter		Min	Typ.	Max	Unit
Target Power for TX					
BLE	Tx mode, Cont.Tx		14		mA
	Rx mode		13		mA

7-2-2. Receiver, Transmitter Specification

Conditions: VCC=3.3V, Temp=25℃

Parameter		Min	Typ.	Max	Unit
RF Characteristics					
RF Frequency Range		2.402	-	2.480	GHz
Output Power [TRM-LE/CA/01/C]		-0.5	3.5	7.5	dBm
In Band Emission[TRM-LE/CA/03/C] ±2MHz offset ±3MHz offset				-20 -30	dBm
Modulation Characteristics [TRM-LE/CA/05/C]	Delta F1 Avg.	225	-	275	KHz
	Delta F2 Max.	185	-	-	KHz
	Delta F2 Avg/F1 Avg	0.8	-	-	-
Carrier Frequency Offset and Drift [TRM-LE/CA/06/C]	Initial Center Frequency Tolerance	-50	-	50	KHz
	|Fn| Max.	-150	-	150	KHz
	|F0 -Fn| Max.	-	-	50	KHz
	|F1 – F0|	-	-	20	KHz
	|Fn = Fn-5| max.	-	-	20	KHz
Receiver Sensitivity [PER<30.8%, 1500packets]		-	-93.5	-70	dBm
Maximum input lever [PER<30.8%, 1500packets]		-10	0		dBm

7-3. WiFi

7-3-1. Electrical Specification

Parameter		Min	Typ.	Max	Unit
Target Power for TX					
2.4GHz	Tx mode, Cont.Tx@11M		203		mA
	Tx mode, Cont.Tx@54M		148		mA
	Tx mode, Cont.Tx@HT20 MCS7		148		mA
	Rx mode, Cont. Rx@11M		77		mA
	Rx mode, Cont. Rx@54M		77		mA
	Rx mode, Cont. Rx@HT20 MCS7		77		mA

Note: The above mentioned values have been obtained according to our own measuring methods and may very depend on the circuit, in which the component is actually incorporated. Therefore, you are kindly requested to test the performance of the component actually in your set.

7-3-2. Receiver Specification

Conditions: VCC=3.3V, Temp=25℃

Parameter	Conditions	Min	Typ.	Max	Unit
Minimum Receiver Sensitivity in 802.11b mode					
1Mbps	PER<8%, Packet size = 1024bytes	-	-95	-80	dBm
2Mbps		-	-91	-80	dBm
5.5Mbps		-	-84	-76	dBm
11Mbps		-	-84	-76	dBm
Minimum Receiver Sensitivity in 802.11g mode					
6Mbps	PER<10%, Packet size = 1024bytes	-	-89	-82	dBm
9Mbps		-	-88	-81	dBm
12Mbps		-	-87	-79	dBm
18Mbps		-	-85	-77	dBm
24Mbps		-	-82	-74	dBm
36Mbps		-	-79	-70	dBm
48Mbps		-	-74	-66	dBm
54Mbps		-	-72	-65	dBm
Minimum Receiver Sensitivity in 802.11n mode					
HT20, MCS7	PER<10%	-	-70	-64	dBm
Maximum Input Signal Level					
802.11b mode	PER<8%	-10	-	-	dBm
802.11g mode	PER<10%	-20	-	-	dBm
802.11n mode	PER<10%	-20	-	-	dBm
Adjacent channel rejection (ACR) in 802.11b mode					

1Mbps	PER<8%, Packet size = 1024bytes	35	-	-	dB
2Mbps		35	-	-	dB
5.5Mbps		35	-	-	dB
11Mbps		35	-	-	dB
Adjacent channel rejection (ACR) in 802.11g mode					
6Mbps	PER<10%, Packet size = 1024bytes	16	-	-	dB
9Mbps		15	-	-	dB
12Mbps		13	-	-	dB
18Mbps		11	-	-	dB
24Mbps		8	-	-	dB
36Mbps		4	-	-	dB
48Mbps		0	-	-	dB
54Mbps		-1	-	-	dB
Adjacent channel rejection (ACR) in 802.11n mode					
MCS0	PER<10%	16	-	-	dB
MCS7		-2	-	-	dB

7-3-3. Transmitter Specification

The WiFi output power of the SFM20R2 module is set as the below table value.
The output power set in the SFM20R2 module is RF regulatory certification based on the SEONGJI reference board and the external antenna (INNO-LINK: INNO-EWFSWS-151).
Refer to "WiFi RF Output Power Control" for power control method to increase output power by using internal antenna or chip antenna which is lower efficiency than SEONGJI reference antenna.
If the output power set in the SFM20R2 module is changed, WiFi RF regulatory certification of the product is required.

Conditions: VCC=3.3V, Temp=25℃

Parameter	Conditions	Frequency	Min	Typ.	Max	Unit
Output Power in 802.11b mode, CCK						
1~11Mbps	As specified in IEEE802.11	2412	8.5	11.5	13.5	dBm
		2436	10.0	12.5	15.0	dBm
		2462	7.5	10.0	12.5	dBm
Output Power in 802.11g mode, OFDM						
6M~54Mbps	As specified in IEEE802.11	2412	8.5	11.5	13.5	dBm
		2436	10.0	12.5	15.0	dBm
		2462	7.5	10.0	12.5	dBm
Output Power in 802.11n mode, HT20, OFDM						
MCS0~7	As specified in IEEE802.11	2412	8.5	11.5	13.5	dBm
		2436	10.0	12.5	15.0	dBm
		2462	7.5	10.0	12.5	dBm
Spectrum mask						
Margin to 802.11b/g/n all mode	Maximum output power	0	-	-	dBr

Modulation Accuracy in 802.11b mode						
1Mbps	As specified in IEEE802.11	-	-	35	%
2Mbps		-	-	35	%
5.5Mbps		-	-	35	%
11Mbps		-	-	35	%
Modulation Accuracy in 802.11g mode					
6Mbps	As specified in IEEE802.11	-	-	-5	dB
9Mbps		-	-	-8	dB
12Mbps		-	-	-10	dB
18Mbps		-	-	-13	dB
24Mbps		-	-	-16	dB
36Mbps		-	-	-19	dB
48Mbps		-	-	-22	dB
54Mbps		-	-	-25	dB
Modulation Accuracy in 802.11n mode					
HT20, MCS7	Full packet	-	-	-27	dB
Frequency Tolerance					
802.11b/g/n	Operating Temp.	-25	0	25	ppm

   *Output power can be changed according to the antenna characteristics used in mass production but the SEONGJI module is set to the power value shown in the table above.

7-4. GPS

7-4-1. Module Specification

Conditions: VCC=3.3V, Temp=25℃

Frequency	L1, 1575.42MHz
GPS Sensitivity	
Tracking	-158 dBm
Navigation	-157 dBm
Acquisition (Cold start)	-143 dBm
C/N0[2]	- 37
Time To First Fix[2]	
Hot Start	< 1s
Cold Start	< 35s

7-4-2. EVB Specification

-With external GPS LNA module(SAW filter + LNA)

Frequency	L1, 1575.42MHz
GPS Sensitivity[1]	
Tracking	-160 dBm

Navigation	-159 dBm
Acquisition (Cold start)	-145 dBm
C/N0[2]	- 39
Time To First Fix[2]	
Hot Start	< 1s
Cold Start	< 35s

[1] Demonstrated with a SFMG2XAB002 (SAW+LNA)
[2] All satellites at -130 dBm

7-5. NFC

7-5-1.   Electrical Specification

Parameter	Min	Typ.	Max	Unit
RF Input Frequency		13.56		MHz
ISO-14443A				
Carrier modulation index	95			%
Data Rate		106		Kbps
Modulation sub carrier frequency		13.56 /16		MHz
NFC Reader	Min	Typ.	Max	Unit
ACR122U (ACS)[1] reading range	40			mm
Dragon (DUAL I)[2] reading range	50			mm

1.Measurement NFC reader
  [1]ACR122U: http://www.acs.com.hk/en/products/3/acr122u-usb-nfc-reader/
  [2]Dragon: http://duali.com/eng/nfc-product/nfc-reader/nfc-desktop-readers.html
2. Demonstrated with a reference antenna included in the EVK.

8. Pin Description

8-1. Interface PIN(SMD Type : 60 Pin) Top view
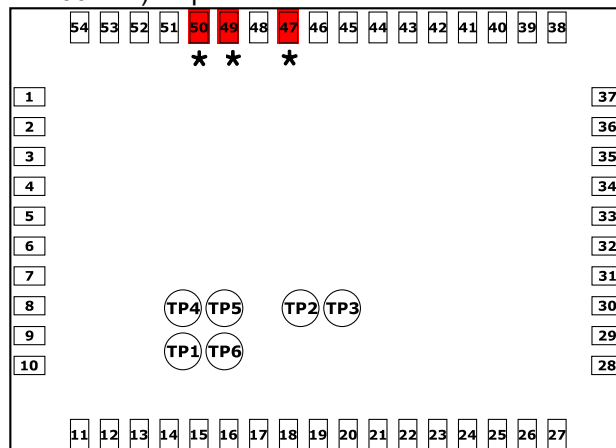
NO	PIN NAME	NO	PIN NAME	NO	PIN NAME
1	STATE_LINK_WIFI	22	I2C0_SCL_DBG	43	GND
2	STATE_WORK_WIFI	23	STATE0	44	NFC2
3	VDD_WIFI_EN	24	WKUP	45	NFC1
4	GND	25	STATE_CPU_SFX	46	GND
5	GPS_RF	26	STATE_RF_SFX	47	DL_EN/INT_WIFI *
6	GND	27	GND	48	NRST_WIFI
7	VDD_MAIN_3P0	28	GND	49	UART0_RX_WIFI *
8	V_BCKP_GPS	29	VDD_SFX_EN	50	UART0_TX_WIFI *
9	VDD_GPS	30	NRST_SFX	51	VDD_WIFI
10	GND	31	SWDCLK	52	GND
11	GND	32	SWDIO	53	WIFI_RF
12	NRST_GPS	33	VDD_SFX	54	GND
13	I2C1_SDA_ACC	34	NRST	TP1	NC (VDD USB For GPS)
14	I2C1_SCL_ACC	35	GND	TP2	NC (USB DM For GPS)
15	I2C1_SCL_BLE	36	SIGFOX_RF	TP3	NC (USB DP For GPS)
16	I2C_SDA_BLE	37	GND	TP4	NC (GND for GPS)
17	VDD_GPS_EN	38	GND	TP5	NC
18	BATT	39	AIN1	TP6	NC
19	GND	40	AIN0		
20	2ND_POW_EN	41	GND		
21	I2C0_SDA_DBG	42	BLE_RF		

* In case of RF regulatory certification, connect to external connector or Test-point to download WiFi test firmware. For details, refer to "8-2-1 Hardware connection for RF Regulatory Certification".

8-2. Interface PIN description

NO.	PIN NAME	TYPE	DESCRIPTION
1	STATE_LINK_WIFI	O	WiFi Link state, 0: unlinked 1: linked
2	STATE_WORK_WIFI	O	WiFi working state, 0: not working 1: working
3	VDD_WIFI_EN	O	WiFi power enable
4,6,10,11,19, 27,28,35,37,38, 41,43,46,52,54	GND	P	Ground
5	GPS_RF	RF	GPS RF Input
7	VDD_MAIN_3P0	P/O	3.0V Main power
8	V_BCKP_GPS	P/I	GPS backup power
9	VDD_GPS	P/O	GPS Power
12	NRST_GPS	I	GPS Reset , do not connect
13	I2C1_SDA_ACC*		Accelerometer Side, connect pin16(I2C1_SDA_BLE)
14	I2C1_SCL_ACC*		Accelerometer Side, connect pin15(I2C1_SCL_BLE)
15	I2C1_SCL_BLE*		BLE(CPU) Side, connect to pin14(I2C1_SCL_ACC)
16	I2C1_SDA_BLE*		BLE(CPU) Side, connect to pin13(I2C1_SDA_ACC)
17	VDD_GPS_EN	O	GPS power enable
18	BATT	P/I	Supply 3.3V ~ 5.0V
20	2ND_POW_EN	O	Secondary DCDC power enable
21	I2C0_SDA_DBG		Module Debugging port for I2C **It must be connected to an external connector or TP for use in RF regulatory certifications.**
22	I2C0_SCL_DBG		Module Debugging port for I2C **It must be connected to an external connector or TP for use in RF regulatory certifications.**
23	STATE0	O	Indicate module(BLE) state
24	WKUP	I	Module Wake-up from sleep state
25	STATE_CPU_SFX	O	Sigfox CPU state
26	STATE_RF_SFX	O	Sigfox RF state
29	VDD_SFX_EN	O	Sigfox power enable
30	NRST_SFX	I	Sigfox Reset , do not connect
31	SWDCLK	I	BLE SWD clock input for debug and programming **It must be connected to an external connector or TP for use in RF regulatory certifications.**
32	SWDIO	I/O	BLE SWD I/O for debug and programming **It must be connected to an external connector or TP for use in RF regulatory certifications.**
33	VDD_SFX	P/O	Sigfox Power output

34	NRST	I	BLE Reset , Main reset , active low
36	SIGFOX_RF	RF	Sigfox RF In/Out
39	AIN1	I/O	Analog input, General purpose I/O
40	AIN0	I/O	Analog input, General purpose I/O
42	BLE_RF	RF	BLE RF In/Out
44	NFC2	I/O	NFC antenna connection , General purpose I/O
45	NFC1	I/O	NFC antenna connection , General purpose I/O
47	DL_EN/INT_WIFI	I	WiFi Download enable , active high **It must be connected to an external connector or TP for use in RF regulatory certifications.**
48	NRST_WIFI	I	WiFi Reset , do not connect
49	UART0_RX_WIFI	I	WiFi Download **It must be connected to an external connector or TP for use in RF regulatory certifications.**
50	UART0_TX_WIFI	O	WiFi Download **It must be connected to an external connector or TP for use in RF regulatory certifications.**
51	VDD_WIFI	P/O	WiFi Power output
53	WIFI_RF	RF	WiFi RF In/Out
TP1	NC		Internal connection
TP2	NC		Internal connection
TP3	NC		Internal connection
TP4	NC		Internal connection
TP5	NC		Internal connection
TP6	NC		Internal connection

- To use internal accelerometer sensor, connect pin 13 to pin 16 and pin 14 to pin 15.
- Slave address of internal accelerometer is 0x18(7bit)
- External I^2C devices can be connected to pin 15 and 16.

8-2-1. Hardware connection for RF Regulatory Certification

When performing RF certification on products using the SFM20R module, you must have the following hardware connections to control each RF block and download the test-firmware.

- **WiFi control and firmware download**

The specified test-firmware must be downloaded to the internal flash memory of the SFM20R module and controlled using the AT command to RF certification proceed. Hardware pin47, pin49 and pin50 must be connected to an external connector or test-point.

- **Sigfox, BLE, GPS control**

There is no need to download a test-firmware, and one of the two below must be connected to an external connector or test-point to control the RF block.

[Case 1]
    The SWD(pin31 and pin32) port can be used to control Sigfox, BLE and GPS.

However, JTAG equipment such as J-link is required.
[Case 2]
　　The I2C(pin21 and pin22) port can be used to control Sigfox, BLE and GPS.
　　However, I2C to USB converter is required.

8-2-2. WIFI status PIN
● STATE_LINK_WIFI : TBD
● STATE_WORK_WIFI : WIFI Scan State (0: not working 1: working)

8-2-3. Sigfox status PIN
● STATE_CPU_SFX : Sigfox CPU activity indicator
● STATE_RF_SFX : Sigfox Radio activity indicator

8-2-4. I2C Master for external sensors
● The TWI master is compatible with I2C operating at 100 kHz and 400 kHz.

Symbol	Description	Min.	Typ.	Max.	Units
$f_{TWI,SCL,100k}$	SCL clock frequency, 100 kbps		100		kHz
$f_{TWI,SCL,400k}$	SCL clock frequency, 400 kbps		400		kHz
t_{TWI,SU_DAT}	Data setup time before positive edge on SCL – all modes	300			ns
t_{TWI,HD_DAT}	Data hold time after negative edge on SCL – all modes	500			ns
$t_{TWI,HD\_STA,100k}$	TWI master hold time for START and repeated START condition, 100k	10000			ns
$t_{TWI,HD\_STA,400k}$	TWI master hold time for START and repeated START condition, 400k	2500			ns
$t_{TWI,SU\_STO,100k}$	TWI master setup time from SCL high to STOP condition, 100k	5000			ns
$t_{TWI,SU\_STO,400k}$	TWI master setup time from SCL high to STOP condition, 400k	1250			ns
$t_{TWI,BUF,100k}$	TWI master bus free time between STOP and START conditions, 100k	5800			ns
$t_{TWI,BUF,400k}$	TWI master bus free time between STOP and START conditions, 400k	2100			ns
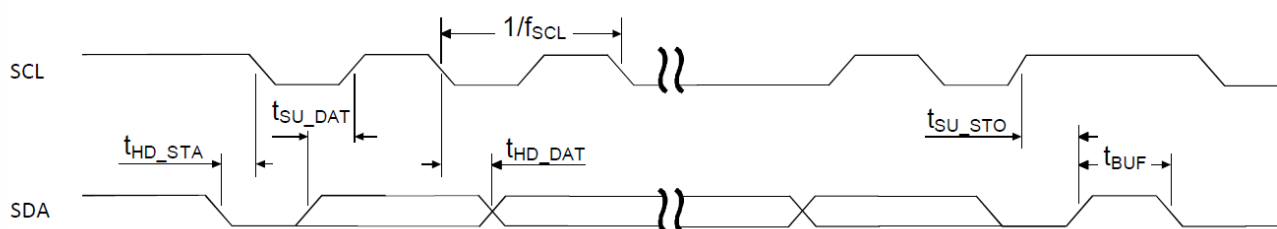
TWI timing diagram, 1 byte transaction

8-2-5. I2C Slave for debug
● upto 400Khz

8-2-6. Two-pin Serial Wire Debug (SWD) interface
● The debug and trace system offers a flexible and powerful mechanism for non-intrusive debugging.
　The main features of the debug and trace system are:
　　. Two-pin Serial Wire Debug (SWD) interface
　　. Flash Patch and Breakpoint Unit (FPB) supports:
　　　. Two literal comparators
　　　. Six instruction comparators
　　. Data Watchpoint and Trace Unit (DWT)
　　　. Four comparators
　　. Instrumentation Trace Macrocell (ITM)

. Embedded Trace Macrocell (ETM)

8-2-7. GPIOs
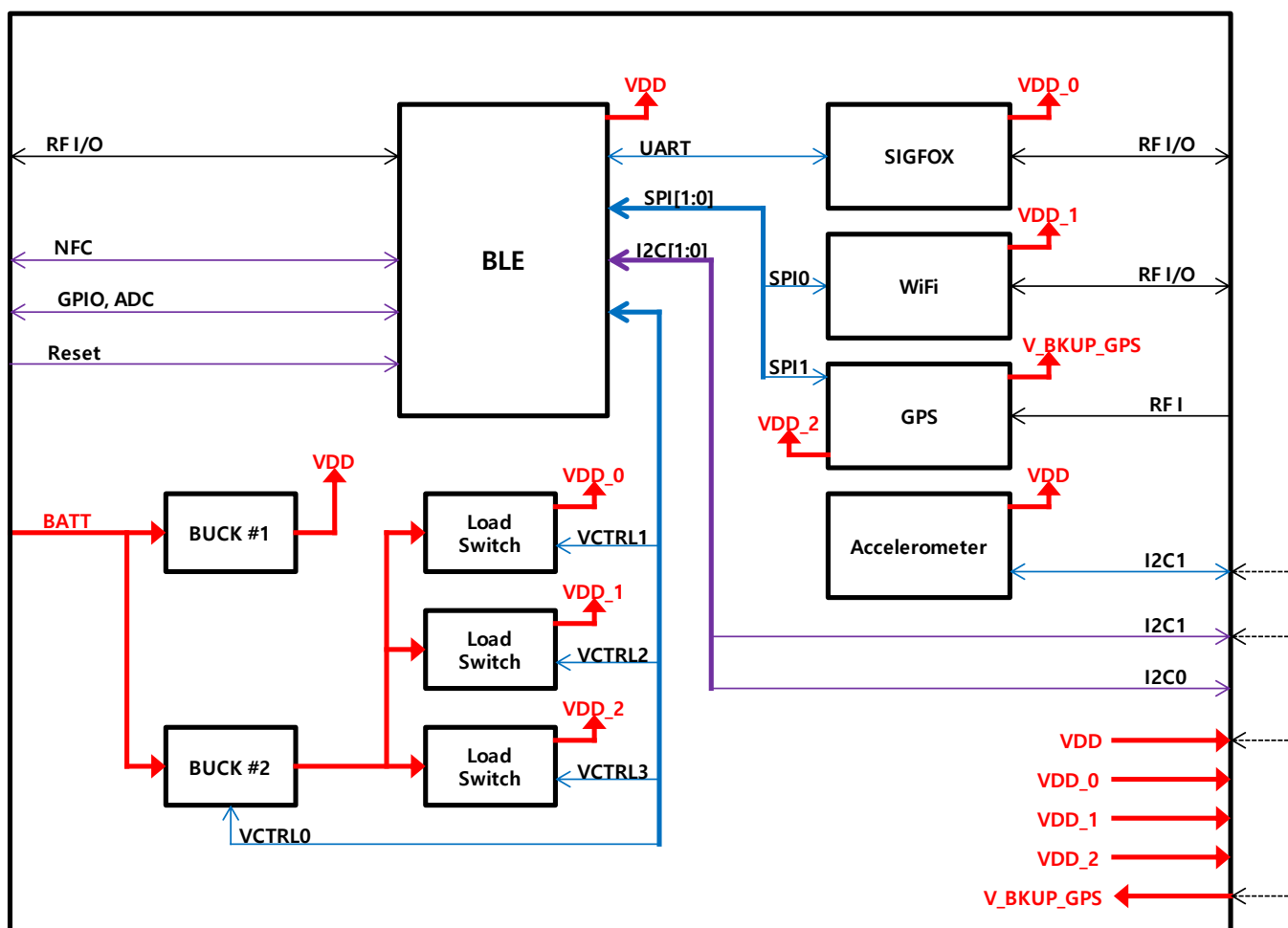● support 4 GPIO
   STATE0
   WKUP
   AIN1
   AIN0

8-2-8. NFC
● Type 2 near field communication (NFC-A) tag with wakeup-on-field and touch to-pair capabilities

8-2-9. Reset Pin
● Chip reset input. Active low.
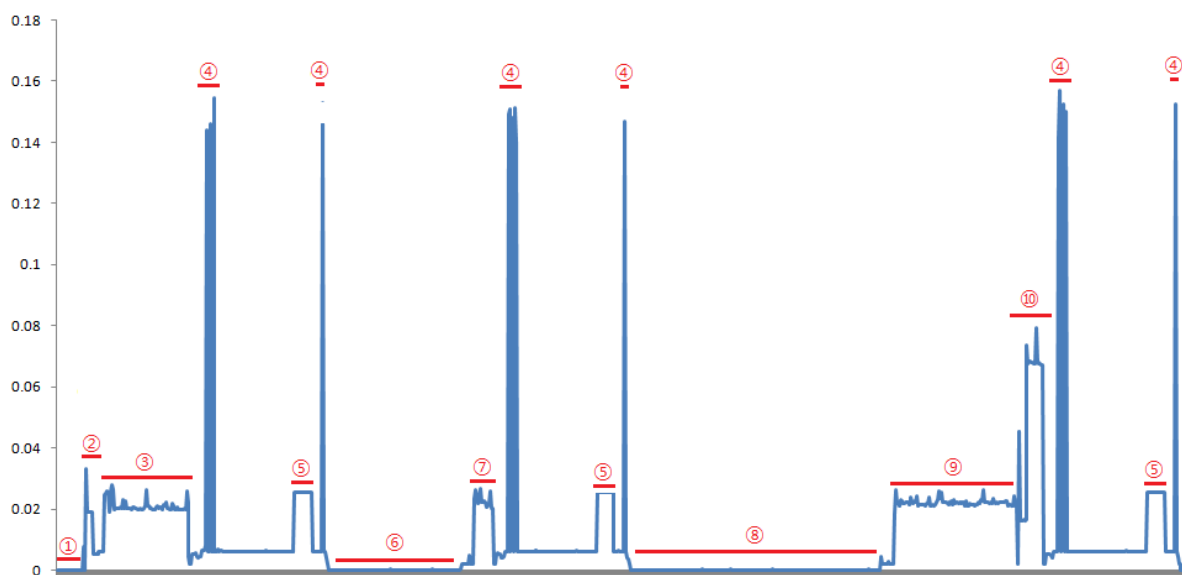
9. Block Diagram

10. Power Modes

10-1. Test condition

Time Interval : 250ms
Measurement : DC Current
Range(Adc) : 0.1A

Power Off (Deep Sleep)	Power On	GPS (ublox)	WIFI	Sigfox Tx		BLE
				Tx	Rx	
avg 5uA	8mA~37mA	avg 22mA	avg 75mA	140mA~155mA	avg 23mA	avg 40uA
①	②	③ ⑦ ⑨	⑩	④	⑤	⑥ ⑧

11. FCC/IC Warning Statements

FCC Part 15.19 / RSS-GEN Sec.8.4 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.

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.

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.

RF Exposure Statement
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. This device must not be co-located or operating 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.

End Product Labeling
The module is labeled with its own FCC ID. If the FCC ID is 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: 2AS8LSFM20R2
" Contains IC: 25119-SFM20R2

Étiquetage du produit final Le module BT111 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 identification FCC ID : FCC ID: 2AS8LSFM20R2
« Contient module émetteur IC : 25119-SFM20R2

OEM Responsibilities to comply with FCC Regulations
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 20cm 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.

As long as the two conditions above is met, further transmitter testing may 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 (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions can ' t be met (for certain configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can't 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 authorization.

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.

RSS-GEN, Sec. 8.3
This radio transmitter (IC: 25119-SFM20R2, Model: SFM20R2) has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

- List of approved antennas
1) For Sigfox antenna, INNO-EL9SWS-149 or similar part manufactured by Inno-Link. Co., Ltd. (Highest permitted antenna gain: 2.01 dBi)
2) For Wi-Fi 2.4 GHz antenna, INNO-EL9SWS-151 or similar part manufactured by Inno-Link. Co., Ltd. (Highest permitted antenna gain: 4.15 dBi)
3) For BT LE antenna, INNO-EL9SWS-151 or similar part manufactured by Inno-Link. Co., Ltd.(Highest permitted antenna gain: 4.15 dBi)

Le présent émetteur radio (IC: 25119-SFM20R2, Model: SFM20R2) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

- Liste des antennes approuvées
1) Pour l'antenne Sigfox, INNO-EL9SWS-149 ou une pièce similaire fabriquée par Inno-Link. Co., Ltd. (Plus haut gain d'antenne autorisé: 2,01 dBi)
2) Pour antenne Wi-Fi 2,4 GHz, INNO-EL9SWS-151 ou une pièce similaire fabriquée par Inno-Link. Co., Ltd. (Plus haut gain d'antenne autorisé: 4.15 dBi)
3) Pour l'antenne BT LE, INNO-EL9SWS-151 ou une pièce similaire fabriquée par Inno-Link. Co., Ltd. (Plus haut gain d'antenne autorisé: 4.15 dBi)

Antenna Installation Requirement
The host manufacturer must meet the antenna requirements stated in operational description and 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.

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

2) For Wi-Fi 2.4 GHz antenna, INNO-EL9SWS-151 or similar part manufactured by Inno-Link. Co., Ltd.

3) For BT LE antenna, INNO-EL9SWS-151 or similar part 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 document.

Band	Output power	Tolerance
WIFi	19.5 dBm	+/- 2.5 dB
Sigfox	22.1385 dBm	+/- 1.5 dB
BT LE	3.48 dBm	+/- 4.0 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.
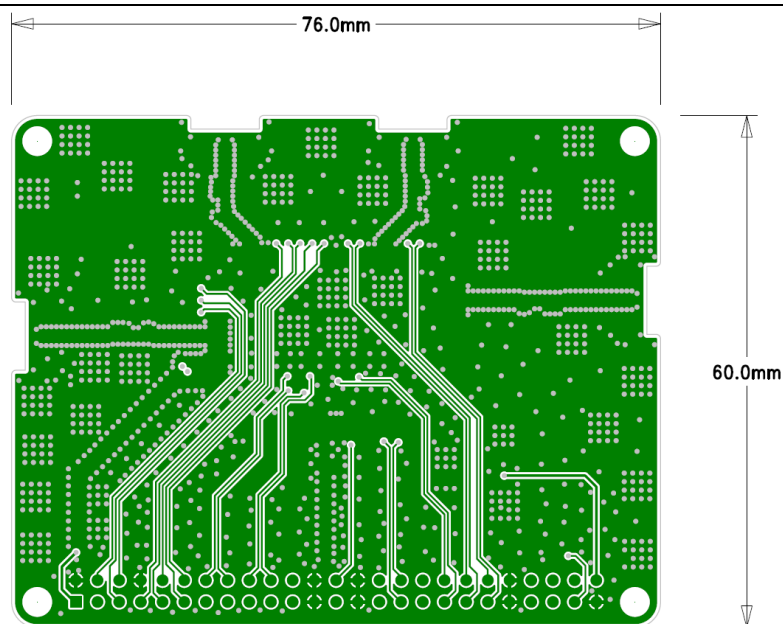
So, the host device should be tested for unintentional radiators under Part 15 subpart B for non-transmitter functions on the transmitter module as appropriate.

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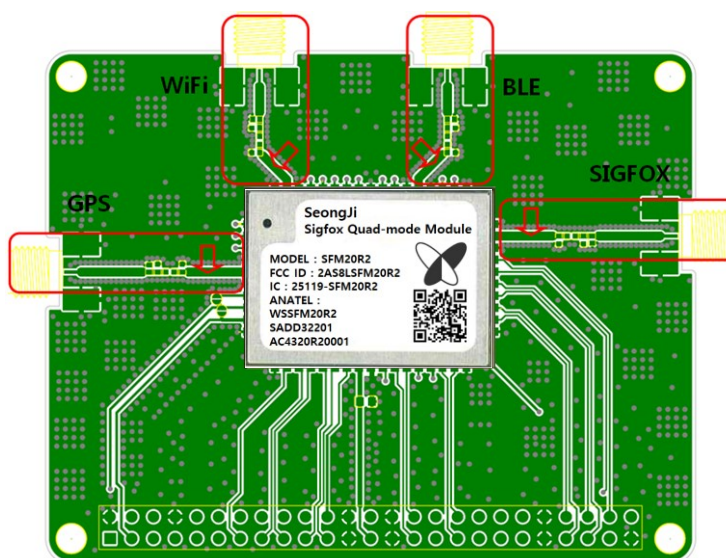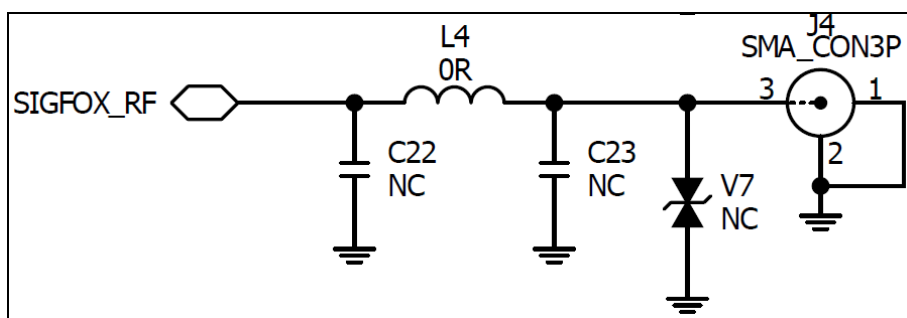

⇨ : 50 ohm matching pattern

[PCB Top]

[PCB Bottom]

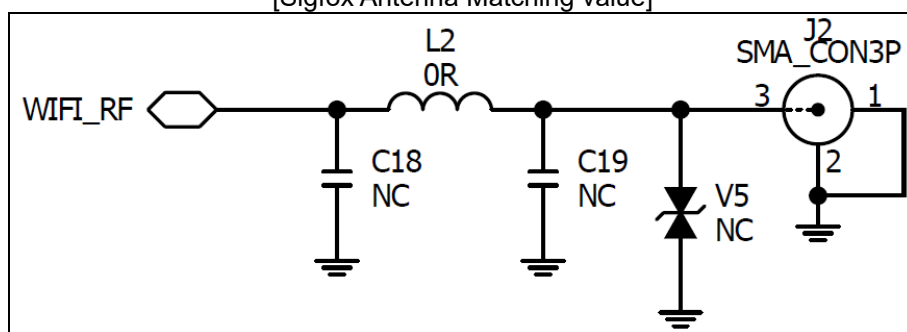[Antenna application PCB information]

PCB Thickness: 1.6mm
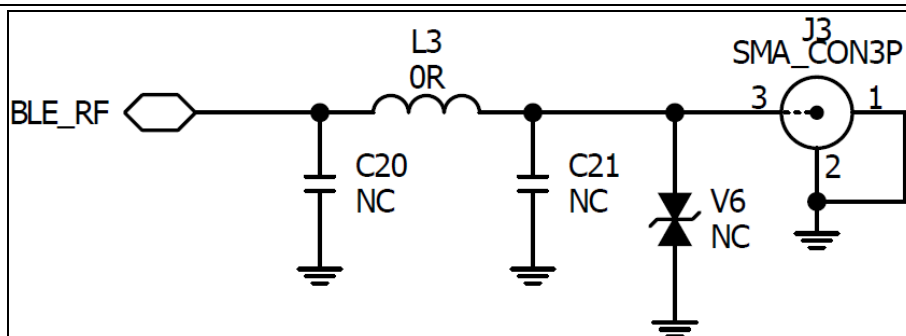
Impedance line width : 1.2mm

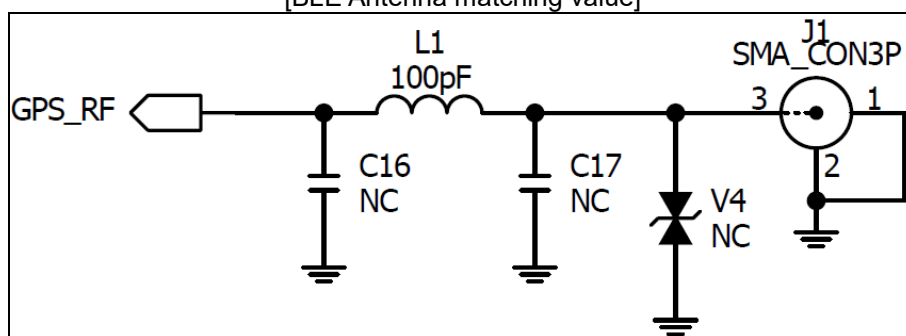Clearance : 0.2mm

FR4 PCB ε_r = 4.6

[Sigfox Antenna Matching value]

[WiFi Antenna matching value]

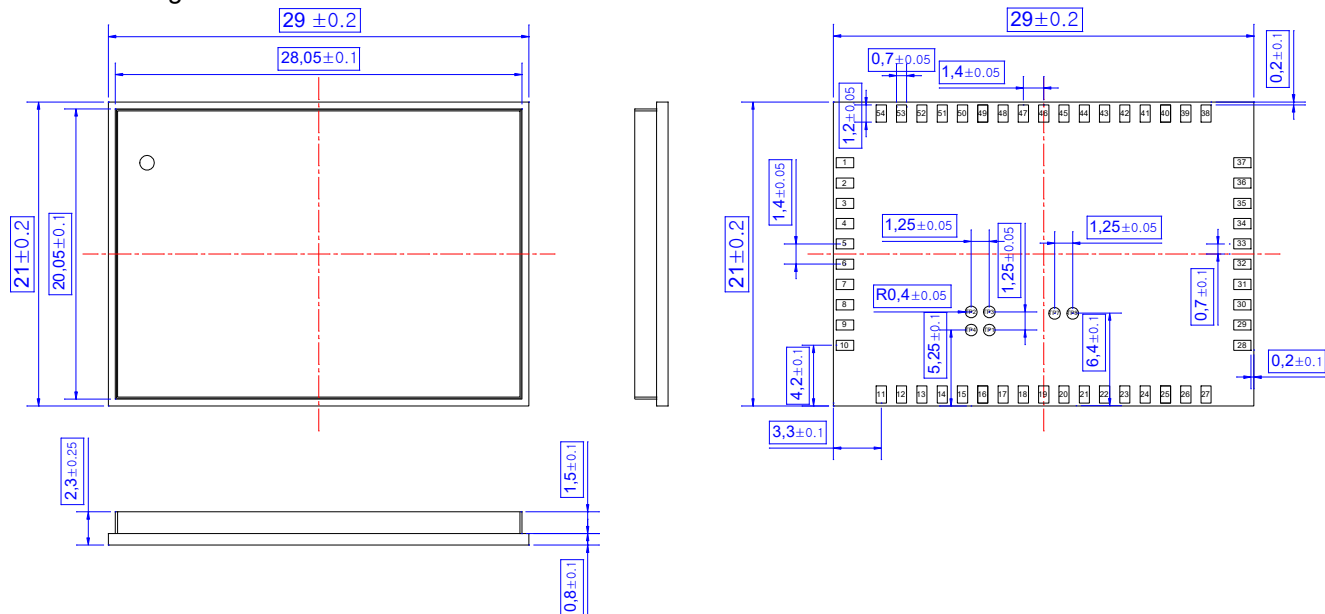[BLE Antenna matching value]

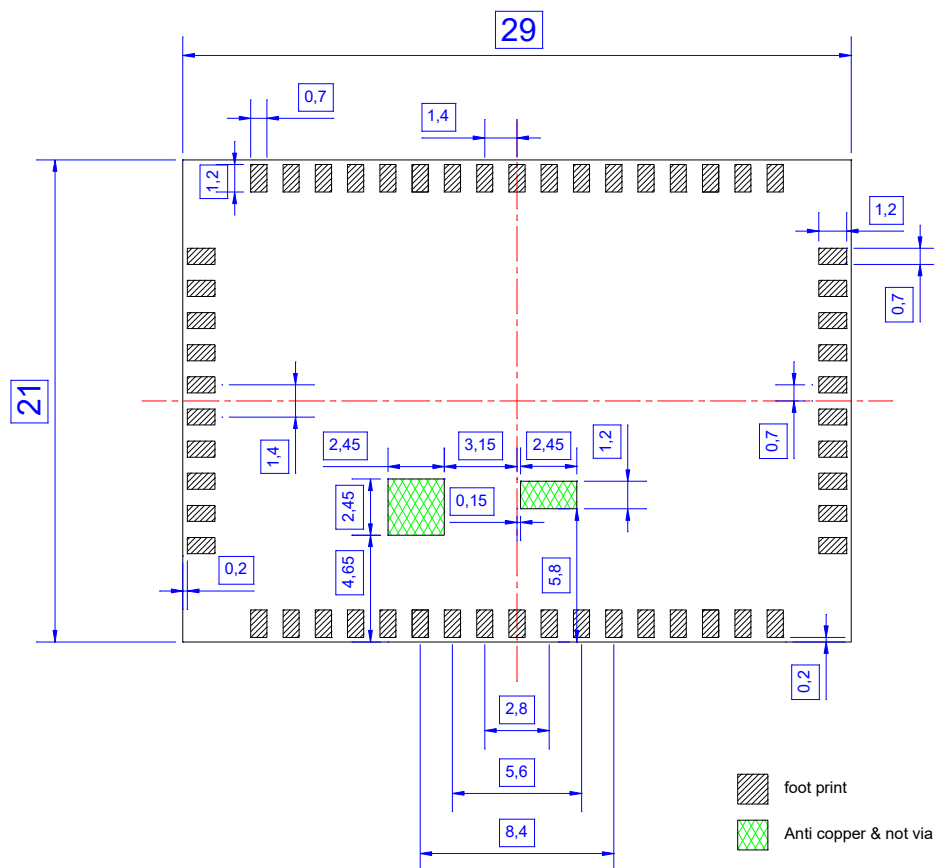[GPS Antenna matching value]

12. Dimensions & drawing

12-1. Design dimension

12-2. Recommend Foot print


foot print

Anti copper & not via

- **X-ray by Foot print size**

The foot print size was designed 0.7x1.2mm and 0.9x1.8mm then the SMD was performed.
It is not a big difference, but it can be seen that the design with 0.7x1.2mm has better soldering performance with less Void as seen in the X-ray below. The disadvantage is that manual soldering is not possible, so it may be better to design 0.9x1.8mm for development stage. However, we recommend a foot print of 0.7 x 1.2mm for mass production.
Please don't use a bigger PAD like as 0.9x1.8mm than recommended PAD except for the development stage.

[Foot print size : 0.7 x 1.2mm]	[Foot print size : 0.9 x 1.8mm]

13. Reflow profile

<Reflow profile of Module>
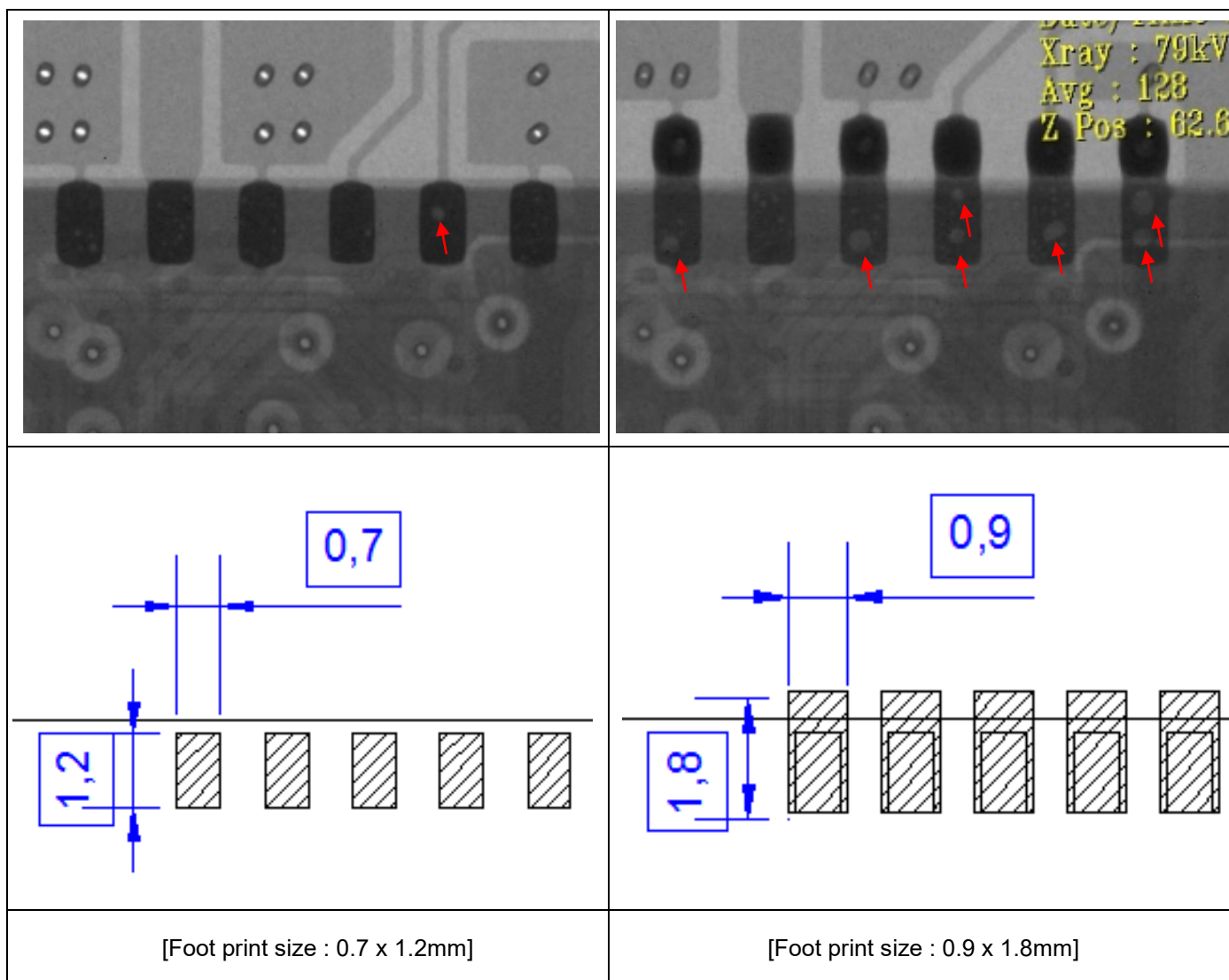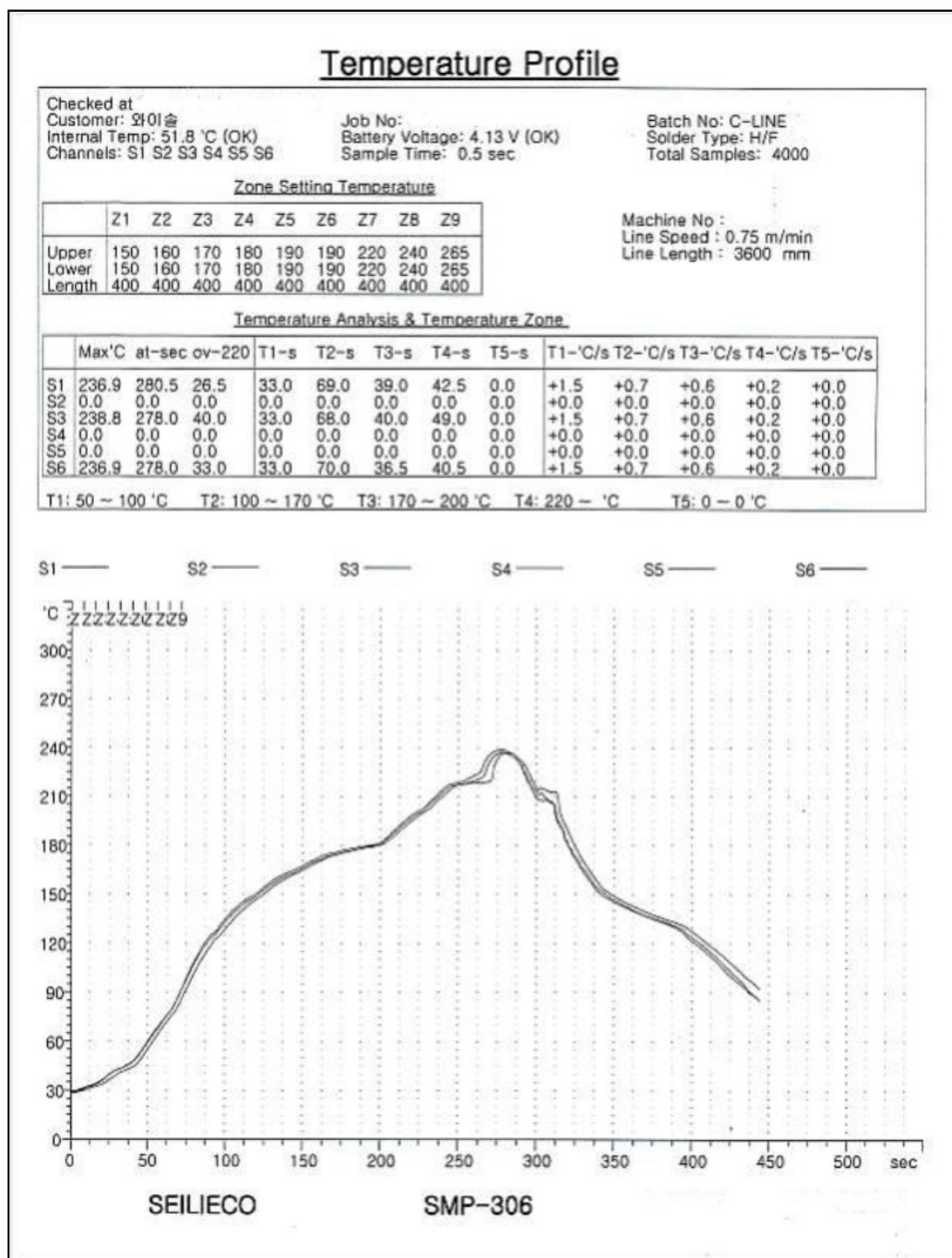
	Preheat	Soak	Ramp	PEAK
SPEC	50~100℃	100~170℃	220℃ ↑	240℃
	1~2℃/sec	60~100sec	30~50sec	±5℃
result of measurement	1.5	69	44	237.5
	OK	OK	OK	OK

14. Package

14-1. Dimension of Tape
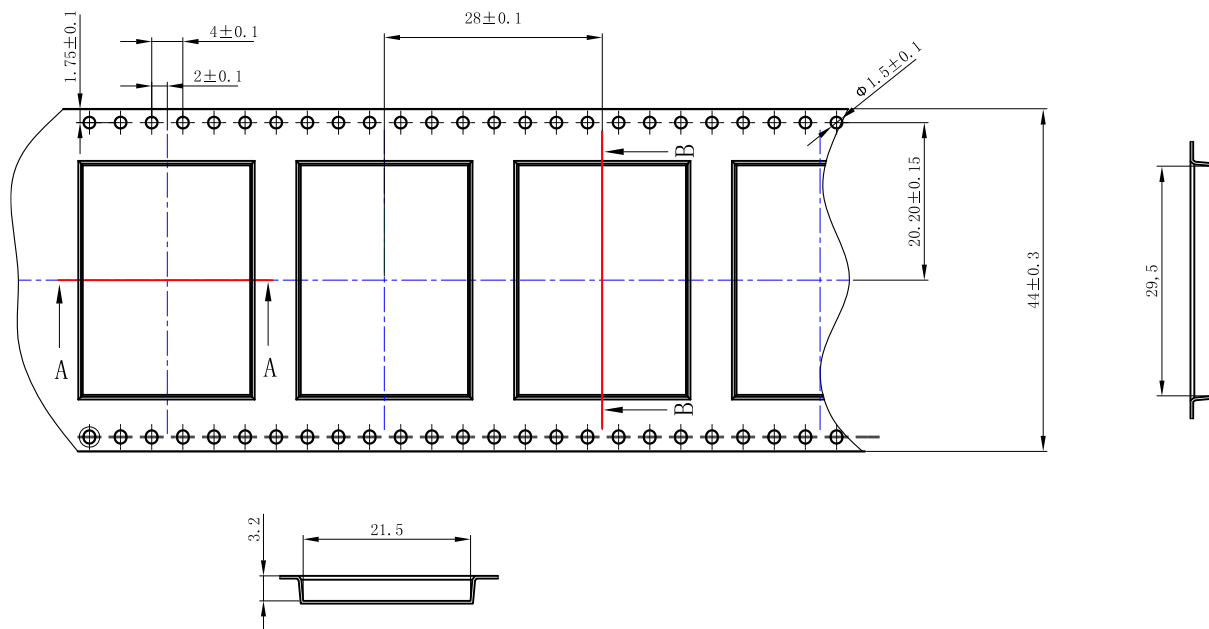
14-2. Dimension of Reel

a: ⌀13.4±1
b: 2.0±1
c: ⌀210±1

DETAL A
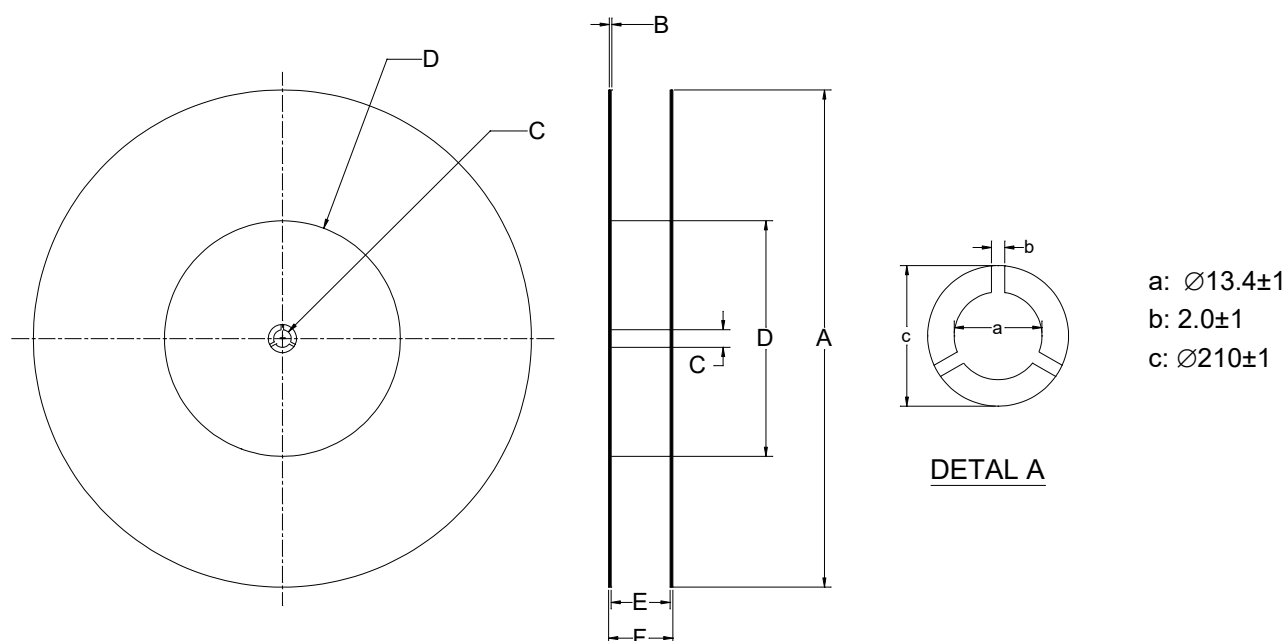
A	B	C	D	E	F
380 ± 1 mm	2 ± 1 mm	13.4 ± 1 mm	180 ± 1 mm	45 ± 1 mm	49 ± 1 mm

14-3. IN BOX

823.5

25.0   345.0   55.0   345.0   53.5

480.0

350.0

SJI Co .,Ltd

MODEL
Q'TY   EA
USER
DATE   .   .

SJI Co .,Ltd

Module Ass'y

1reel/ 1 In-BOX

14-4. OUT BOX

365 mm   **320 mm**   **365 mm**   **320 mm**

375 mm

SJI Co .,Ltd

ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

SJI Co .,Ltd

L/C NO:
C/T NO:

Module Ass'y

MODEL
Q'TY   EA
USER
DATE   .   .

Module Ass'y

MADE IN VIET NAM

5 In-BOX/ 1 Out-BOX

14-5. IN BOX Label

Model   Name : Sigfox Quad-mode Module → (2) Model Name

SFM20R2000600 → (1) Vendor Barcode

Model   Name : Sigfox Quad-mode Module
Assy Code : SFM20R2
Vendor : SJI(HWASEONG)
Quantity : 600

Vendor P/N : WSSFM20R2
Vendor Lot : SACH122I01

(1) Vendor Barcode
(2) Model Name
(3) Assy Code
(4) Vendor
(5) Quantity
(6) Vendor P/N
(7) Vendor Lot

75mm
100mm

14-6. OUT BOX Label

SFM20R2003000

Model   Name : Sigfox Quad-mode Module
Assy Code : SFM20R2
Vendor : SJI(HWASEONG)
Quantity : 3000

Vendor P/N : WSSFM20R2
Vendor Lot : SACH122P01

(1) Vendor Barcode
(2) Model Name
(3) Assy Code
(4) Vendor
(5) Quantity
(6) Vendor P/N
(7) Vendor Lot

75mm
100mm

ESD Warning

This modules are ESD sensitive devices, appropriate precautions should be taken during the module assembly in the final product.
Mechanical impact and harsh tools must be avoided during the module assembly in the final product.

Product ESD specification:
• HBM ±2kV

The following precautions must be taken:

• Do not open the protective conductive packaging until you have use the following, and are at an approved anti-static work station.

• Use a conductive wrist strap attached to a good earth ground.

• If working on a prototyping board, use a soldering iron or station that is marked as ESD-safe.
• If possible, use SMT equipment(reflow) when making prototype boards.
• Use an approved anti-static mat to cover your work surface.
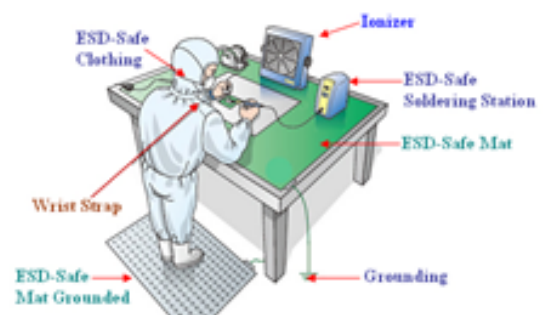
• Always discharge yourself by touching a grounded bare metal surface or approved anti-static mat before picking up an ESD - sensitive electronic component.