
Title: SX-SDMAH(US)

Drawing Type : Product Specifications

Drawing No.: JW208100XC

Date : January 10, 2024

Rev.	Description	Date	Prepared	Checked	Approved
XX	Draft 1. (初版)	Feb. 17, 23	Y.Shibuya	Y.Kuroda	Y.Shibuya
XA	Draft 2. § 5 Updated Brock diagram § 6.2 Updated pin 2, 44, 56	Jun. 14, 23	H.Nagahama	Y.Kuroda	Y.Shibuya
XB	§ 4.4 Updated Current consumption specifications § 4.6 Updated RF Transmitter specifications § 4.7 Updated RF Receiver specifications § 6.1 Updated Pin Locations § 11 Updated Indication specifications § 12 Updated Packing specifications	Dec. 26, 23	H.Nagahama	Y.Kuroda	Y.Shibuya
XC	§ 4.5 Updated RF function specifications § 4.6 Updated RF Transmitter specifications § 6.1 Updated Pin Locations § 8.3 Updated Recommended Antenna List § 15 Updated Appendix-A Reference land design	Jan. 10, 24	H.Nagahama	Y.Kuroda	Y.Shibuya

1. 適用 / Application	4
2. 概要 / Introduction.....	4
3. 構成表 / Component composition List	5
4. 仕様一覧 / Specifications.....	6
4.1. 一般仕様 / General Specifications	6
4.2. 環境条件 / Environmental Specifications.....	7
4.3. 電気的仕様 / Electrical Specifications.....	9
4.3.1. 絶対最大定格 / Absolute maximum rating.....	9
4.3.2. 推奨動作条件 / Recommended operating conditions	9
4.4. 消費電流仕様 / Current consumption specifications	10
4.5. RF 機能仕様 / RF functional specifications	11
4.6. RF 送信仕様 / RF Transmitter Specifications	12
4.7. RF 受信仕様 / RF Receiver Specifications.....	13
5. ブロック図 / Block Diagram.....	14
6. ホストインターフェイス仕様 / Host Interface Specifications	15
6.1. ピン配置 / Pin Locations	15
6.2. 信号仕様 / Signal Specifications	16
6.3. Boot モード設定 / Boot mode setting	19
7. インターフェイス仕様 / Interface specifications.....	20
7.1. パワーオンシーケンス / Power on sequence.....	20
7.2. SDIO インターフェイス仕様 / SDIO timing.....	21
7.3. SPI インターフェイス仕様 / SPI timing	22
8. 適合規格 / Standards compliance.....	23
8.1. 適合規格 / Standards conformity	23
8.2. 適合法規 / Law Regulation compliance.....	23
8.3. 推奨アンテナリスト / Recommended Antenna List	23
9. RoHS 指令 / RoHS Directive.....	23
10. 外観 / Outside Drawing	24
11. 表示仕様 / Indication specifications.....	25
12. 梱包仕様 / Packing specifications	26
13. 信頼性試験 / Reliability test.....	31
14. 注意事項 / Notifications	34
15. 付録 A 参考ランド設計 / Appendix-A Reference land design.....	42
16. 付録 B SMT リフロー条件 / Appendix -B SMT reflow profiles	43

1. 適用 / Application

本書は SX-SDMAH(US)のハードウェア製品仕様を記したものです。

This document describes the detail of hardware specifications for the SX-SDMAH(US).

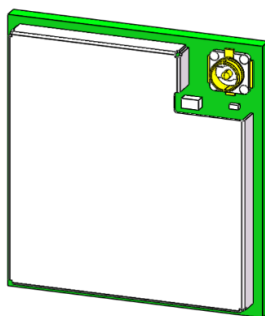
2. 概要 / Introduction

SX-SDMAH(US)は、MM6108 (Morse Micro 社)を採用した、915MHz ISM band IEEE 802.11 ah 準拠の無線モジュールです。本モジュールは、MAC/BBP/RF/RF フロントエンド及び各種電源/クロックなどの外部回路を内蔵しています。SX-SDMAH(US)の製品形状は、表面実装型 (SMT)で、アンテナ接続のインターフェイスは 50 ohm MHF コネクタです。

The SX-SDMAH(US) is a 915MHz ISM band IEEE802.11ah WLAN module based on Morse Micro MM6108 chipset. This module includes MAC/BBP/RF/RF-Front-End, Power regulators and clock sources. Its form-factor is Surface Mount Technology (SMT) type, and it has 50ohm MHF antenna connector.

特徴 (Features)

- IEEE802.11ah 準拠 (915MHz ISM band / Region2)
IEEE802.11ah compliant (915MHz ISM band / Region2)
- 1 スペーシャルデータストリームシステム (1T1R)
1 spatial data stream system (1T1R)
- 変調帯域幅: 1, 2, 4, 8 MHz (PHY データレート 150kbps to 32.5Mbps)
Modulation Bandwidth: 1, 2, 4, 8MHz (PHY data rate 150kbps to 32.5Mbps)
- ホストインターフェイス: SDIO v2.0 / SPI
Host Interface: SDIO v2.0 / SPI



3. 構成表 / Component composition List

Categories	Items	Product No.		Remarks
		ZXE04619	ZXE04620	
		SX-SDMAH(US)	SX-SDMAH-SP(US)	
基板 Board	基板(製品) Main Board	1	10	
ラベル Label	EMI Label	1	1	
	個装箱ラベル Packing Label	1/500	1/10	
	MSL 警告ラベル MSL Caution Label	1/500	1/10	
	集合箱ラベル Carton Label	1/2500	1/50	
付属品 Accessory	湿度表示シート Humidity Indicator	1/500	1/10	
梱包 Packing	個装箱 Packing Box	1/500	1/10	
	集合箱 Carton Box	1/2500	1/50	
	アルミラミネート袋 Aluminum lamination bag	1/500	1/10	
	リール Reel Set	1/500	1/10	
	シリカゲル Silica gel	2/500	2/10	

4. 仕様一覧 / Specifications

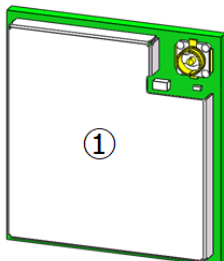
4.1. 一般仕様 / General Specifications

区分/Items	内容/Description	Units	備考/Note
ホストボードへの接続方式 Connection with the host board	60-pin Land Grid Array (Direct solder)	-	
アンテナ端子 Antenna port	MHF1 connector x1	pcs	
アンテナ端子特性 Antenna port characteristics	50	Ω	SWR < 2.0
ホストインターフェイス Host interface	SDIO/SPI	-	
無線接続方式 RF interface	IEEE802.11ah		
重さ Weight	1.6	g	Typ.
寸法 Dimensions	W x H x D : 17.0 x 18.0 x 2.65	mm	
MTTF	90,000	H	Min.
アンテナコネクタ着脱回数 Antenna connector Desorption number of times	10	Times	Max. I-PEX 90224-001 使用時 Use I-PEX 90224-001
リフロー回数 Reflow number of times	2	Times	Max. *NOTE1
ESD 耐性 ESD resistance	+/- 2000	V	Max. Human body model at RF port

NOTE1	<p>解析のためにモジュールをホストボードから取り外す際は、JEDEC J-STD-33 Clause 6 BOARD REWORK に定める方法で取り外してください。</p> <p>実装、取り外しに限らず、リフロー回数としてカウントしますので、取り外したモジュールの再実装や 2 回リフロー後のモジュールの取り外しは 3 回目のリフローとなるため保証しません。</p> <p>In the case of removing the module from the board for the analysis, need to follow JEDEC J-STD-33 Clause 6 BOARD REWORK.</p> <p>Both re-assembling the removed module and removing the module after reflow 2 times won't be guaranteed since above actions may be counted as the number of reflow.</p>
-------	---

4.2. 環境条件 / Environmental Specifications

区分/Items	仕様/Specifications			Units	備考/Note
	Min	Typ	Max		
推奨動作温度 Recommended operating temperature	-40	-	+85	°C	周囲温度 *NOTE1 Ambient temperature *NOTE1 実装後電源電圧印加時 After assembled with powered
推奨動作湿度 Recommended operating humidity	15	-	95	%	結露無きこと No condensing 実装後電源電圧印加時 After assembled with powered
推奨保存温度（実装後） Recommended storage temperature (After assembly)	-40	-	+85	°C	実装後電源電圧無印加時 After assembled with no-powered
推奨保存湿度（実装後） Recommended storage humidity (After assembly)	15	-	95	%	結露無きこと No condensing 実装後電源電圧無印加時 After assembled with no-powered
推奨保管温度 Recommended storage temperature (In the warehouse, before assembly)	+5	-	+35	°C	梱包時。開封後は MSL に従う。 *NOTE2 Packaged. Apply MSL after unpackaged. *NOTE2
推奨保管湿度 Recommended storage humidity (In the warehouse, before assembly)	20	-	60	%	結露無きこと No condensing 梱包時。開封後は MSL に従う。 Packaged. Apply MSL after unpackaged.
Moisture Sensitivity Level (MSL)	3			-	IPC/JEDEC J-STD-020D 取り扱いについては下記を参照。 *NOTE3 See standard for handling IPC/JEDEC J-STD-033C *NOTE3

	<p>但し次に定義される部品のケース温度(表面接触温度)を超えないこと。 The case temperature (Tc), however, must not exceed below value.</p> <table><tr><th>Point</th><th>Tc (Max.)</th><th>Unit</th></tr><tr><td>①</td><td>110</td><td>°C</td></tr></table> <div></div>	Point	Tc (Max.)	Unit	①	110	°C
Point	Tc (Max.)	Unit					
①	110	°C					
NOTE1							
NOTE2	<p>部品倉庫などで長期間 (弊社出荷後 1 年間)保管する際の推奨条件です。ドライパック未開封状態の場合、この条件下でドライパック内の湿度が 10%RH 未満に保たれます。ドライパック内の湿度が 10%RH 以上となったかどうかの判断は、保管期間に関わらず、§10 に示す湿度表示シートでご確認ください。保管期間 1 年以上経過後や輸送時に保管条件を超えた可能性があった場合は、製造前に湿度表示シートの確認やハンダ濡れ性の確認を実施することを推奨いたします。</p> <p>This is condition to keep the product in the warehouse for long term (1 year after shipping from silex). In case of unpacked of the dry pack, humidity of inside shall be keep less than 10%RH. To know whether humidity in the dry pack is exceed 10%RH or not, please check out the humidity indication card (HIC). After 1 year from shipping or in case it might be exceeded this condition due to transportation, checking HIC or checking solderability before production is strongly recommended.</p>						
NOTE3	<p>推奨ベーキング条件 Recommended baking conditions 基板単独 Board only : 125°C+10/-0°C 24 hours リール状態 With reel : 40°C+5/-0°C ≤5%RH 13 days</p> <p>ドライパック開封後 JEDEC J-STD-033 の取扱い条件下で≤30°C/60%RH でのフロアタイムが 168 時間を超えた場合ベーキングが必要です。ドライパック未開封時でも、§10 に示す湿度表示シートが 10%RH 以上の色に変色している場合ベーキングが必要です。</p> <p>In case ≤30°C/60%RH with handling rule of JEDEC J-STD-033 and floor time is exceeded 168hrs, baking must be necessary. Even before unpacking the dry pack, baking must be necessary if color of HIC is changed to color of 10%RH or more.</p>						

4.3. 電氣的仕様 / Electrical Specifications

4.3.1. 絶対最大定格 / Absolute maximum rating

区分/Items	仕様/Specifications			Units	備考/Note
	Min	Typ	Max		
VDD 主電源電圧 Main power supply	-0.5	-	+3.8	V	
VDDIO IO 電源電圧 IO power supply voltage	-0.5	-	+3.8	V	
VDDFEM RF FEM 電源電圧 RF FEM power supply voltage	-0.3	-	+5.5	V	

4.3.2. 推奨動作条件 / Recommended operating conditions

区分/Items	仕様/Specifications			Units	備考/Note
	Min	Typ	Max		
VDD33 主電源電圧 Main power supply	+3.0	+3.3	+3.6	V	
VDDIO IO 電源電圧 IO power supply voltage	+3.0	-	VDD33	V	※1
VDDFEM RF FEM 電源電圧 RF FEM power supply voltage	+3.0	+5.0	+5.25	V	

※1：VDDIO は VDD33 以下にすること。

VDDIO must be lower than VDD33.

4.4. 消費電流仕様 / Current consumption specifications

Mode: Test Mode

VDD33(3.3V)

modes	MCS	BW(MHz)	Freq(MHz)	TXP(dBm)	Current	
					Typ(mA)	Peak(mA)
Tx	10	1	903.5	24	50	100
	0	2	905	24	60	110
	0	4	910	24	60	110
	0	8	912	24	80	130
	7	1	903.5	16	40	90
	7	2	905	16	50	100
	7	4	910	16	50	100
	7	8	916	16	70	130
Rx	-	-	-	-	40	50

VDDFEM(3.3V)/(5.0V)

modes	MCS	BW(MHz)	Freq(MHz)	TXP(dBm)	Current (3.3V)		Current (5.0V)	
					Typ(mA)	Peak(mA)	Typ(mA)	Peak(mA)
Tx	10	1	903.5	24	340	550	480	950
	0	2	905	24	340	550	480	950
	0	4	910	24	340	550	480	950
	0	8	912	24	340	550	480	950
	7	1	903.5	16	270	330	320	500
	7	2	905	16	270	330	320	500
	7	4	910	16	270	330	320	500
	7	8	916	16	270	330	320	500
Rx	-	-	-	-	0	0	0	0

VDDIO(3.3V)

Modes	MCS	BW(MHz)	Freq(MHz)	TXP(dBm)	VDD33	
					Typ(mA)	Peak(mA)
Tx	10	1	903.5	24	3	10
	0	2	905	24	3	10
	0	4	910	24	3	10
	0	8	912	24	3	10
	7	1	903.5	16	3	10
	7	2	905	16	3	10
	7	4	910	16	3	10
	7	8	916	16	3	10
Rx	-	-	-	-	3	10

4.5. RF 機能仕様 / RF functional specifications

区分/Items	内容/Description	Units	備考/Note
Chipset	MM6108	-	
国/Region	USA/Canada	-	
規格/Standard	IEEE802.11ah	-	
動作周波数 / Operating Frequency	BW1MHz: 903.5, 904.5, 905.5, 906.5, 907.5, 908.5, 909.5, 910.5, 911.5, 912.5, 913.5, 914.5, 915.5, 916.5, 917.5, 918.5, 919.5, 920.5, 921.5, 922.5, 923.5, 924.5, 925.5, 926.5 BW2MHz: 905, 907, 909, 911, 913, 915, 917, 919, 921, 923, 925 BW4MHz: 910, 914, 918, 922 BW8MHz: 908, 916	MHz	
周波数間隔/Channel spacing	1, 2, 4, 8	MHz	
データレート/Data rate	MCS10, 0, 1, 2, 3, 4, 5, 6, 7	-	
変調型/Modulation type	OFDM	-	
暗号化/Encryption	AES-CCMP	-	

4.6. RF 送信仕様 / RF Transmitter Specifications

BW	Freq [MHz]	Data Rates	VDDFEM:5.0V at +25°C			
		MCS	Min	Typical	Max	Units
1MHz	903.5 ~ 926.5	0-2, 10	21.5	24.0	26.5	dBm
		3-4	18.5	21.0	23.5	dBm
		5	17.5	20.0	22.5	dBm
		6	15.5	18.0	20.5	dBm
		7	13.5	16.0	18.5	dBm
2MHz	905 ~ 925	0-2	21.5	24.0	26.5	dBm
		3-4	18.5	21.0	23.5	dBm
		5	17.5	20.0	22.5	dBm
		6	15.5	18.0	20.5	dBm
		7	13.5	16.0	18.5	dBm
4MHz	910 ~ 922	0-2	21.5	24.0	26.5	dBm
		3-4	18.5	21.0	23.5	dBm
		5	17.5	20.0	22.5	dBm
		6	15.5	18.0	20.5	dBm
		7	13.5	16.0	18.5	dBm
8MHz	908	0-5	17.5	20.0	22.5	dBm
		6	15.5	18.0	20.5	dBm
		7	13.5	16.0	18.5	dBm
	916	0-2	21.5	24.0	26.5	dBm
		3-4	18.5	21.0	23.5	dBm
		5	17.5	20.0	22.5	dBm
		6	15.5	18.0	20.5	dBm
		7	13.5	16.0	18.5	dBm

NOTE1

VDDFEM:3.3V の場合、送信仕様は全 rate で-1dB となります。
When VDDFEM:3.3V, the transmission specification is -1dB at all rates.

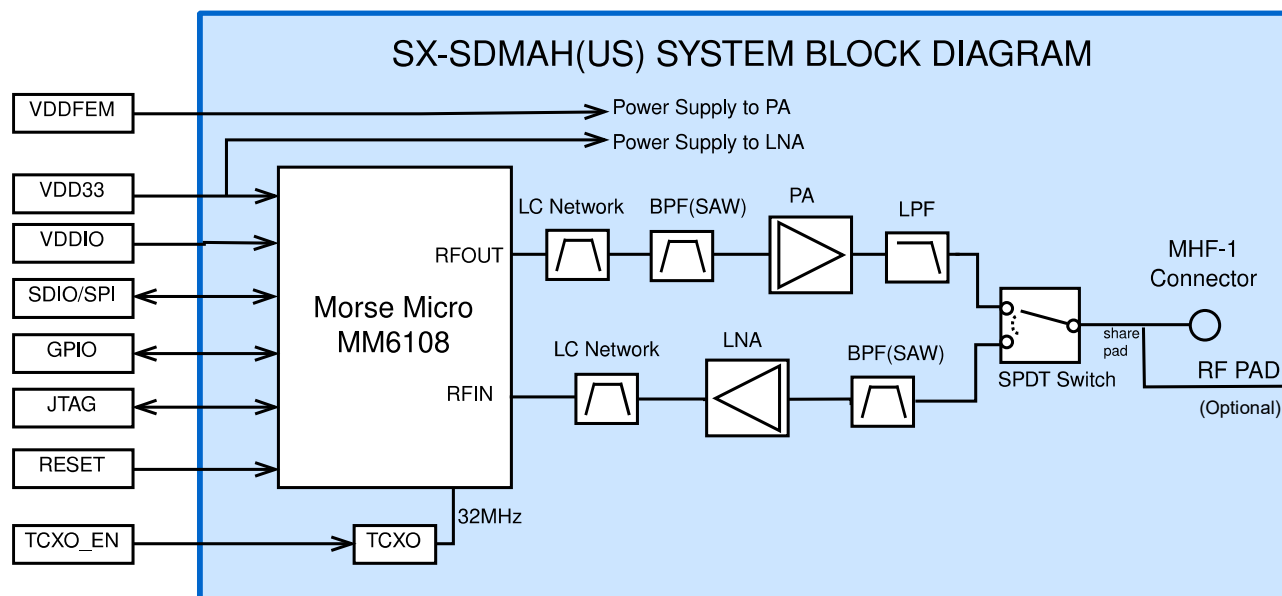
Transmit power uncertainty (Operating temperature)

Items	Specifications					Units	Remarks
	Modes		Min.	Typ.	Max.		
周囲環境条件による 送信パワーの不確かさ Power uncertainty due to environmental conditions ※温度、電源条件 Temperature, Power supply	BW1MHz	MCS0-7,10	-2.0	—	+2.0	dB	
	BW2MHz	MCS0-7	-2.0	—	+2.0	dB	
	BW4MHz	MCS0-7	-2.0	—	+2.0	dB	
	BW8MHz	MCS0-7	-2.0	—	+2.0	dB	

4.7. RF 受信仕様/ RF Receiver Specifications

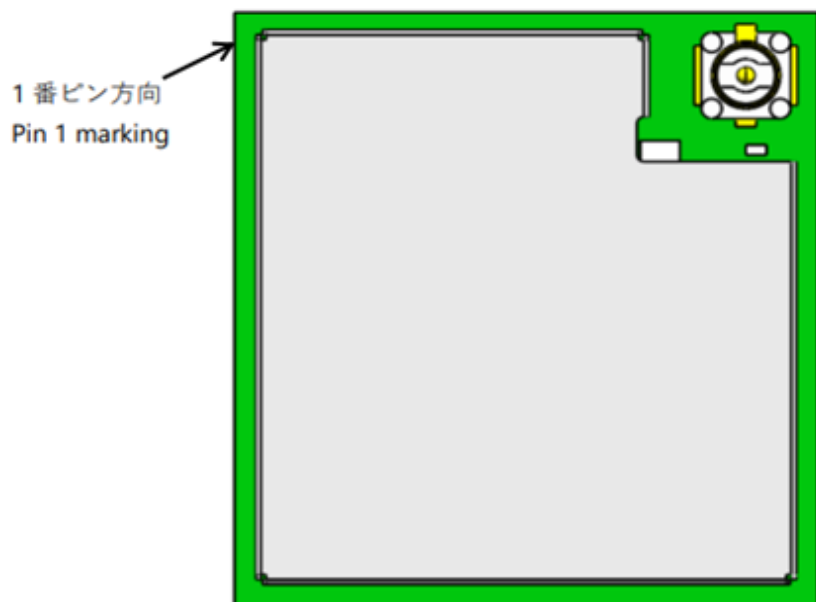
BW	Modulation	Data Rates	Rx input with IEEE 802.11 Rx Minimum Sensitivity at -40°C ~ +85°C			
		Index	Min	Typical	Max	Units
1MHz	BPSK	MCS10	-	-105	-98	dBm
	BPSK	MCS0	-	-103	-95	dBm
	QPSK	MCS1	-	-101	-92	dBm
	QPSK	MCS2	-	-98	-90	dBm
	16 QAM	MCS3	-	-96	-87	dBm
	16 QAM	MCS4	-	-92	-83	dBm
	64 QAM	MCS5	-	-88	-79	dBm
	64 QAM	MCS6	-	-86	-78	dBm
2MHz	64 QAM	MCS7	-	-85	-77	dBm
	BPSK	MCS0	-	-101	-92	dBm
	QPSK	MCS1	-	-98	-89	dBm
	QPSK	MCS2	-	-96	-87	dBm
	16 QAM	MCS3	-	-92	-84	dBm
	16 QAM	MCS4	-	-90	-80	dBm
	64 QAM	MCS5	-	-86	-76	dBm
	64 QAM	MCS6	-	-84	-75	dBm
4MHz	64 QAM	MCS7	-	-83	-74	dBm
	BPSK	MCS0	-	-100	-89	dBm
	QPSK	MCS1	-	-97	-86	dBm
	QPSK	MCS2	-	-94	-84	dBm
	16 QAM	MCS3	-	-92	-81	dBm
	16 QAM	MCS4	-	-88	-77	dBm
	64 QAM	MCS5	-	-84	-73	dBm
	64 QAM	MCS6	-	-83	-72	dBm
8MHz	64 QAM	MCS7	-	-81	-71	dBm
	BPSK	MCS0	-	-96	-86	dBm
	QPSK	MCS1	-	-93	-83	dBm
	QPSK	MCS2	-	-90	-81	dBm
	16 QAM	MCS3	-	-87	-78	dBm
	16 QAM	MCS4	-	-84	-74	dBm
	64 QAM	MCS5	-	-79	-70	dBm
	64 QAM	MCS6	-	-78	-69	dBm
	64 QAM	MCS7	-	-76	-68	dBm

5. ブロック図 / Block Diagram

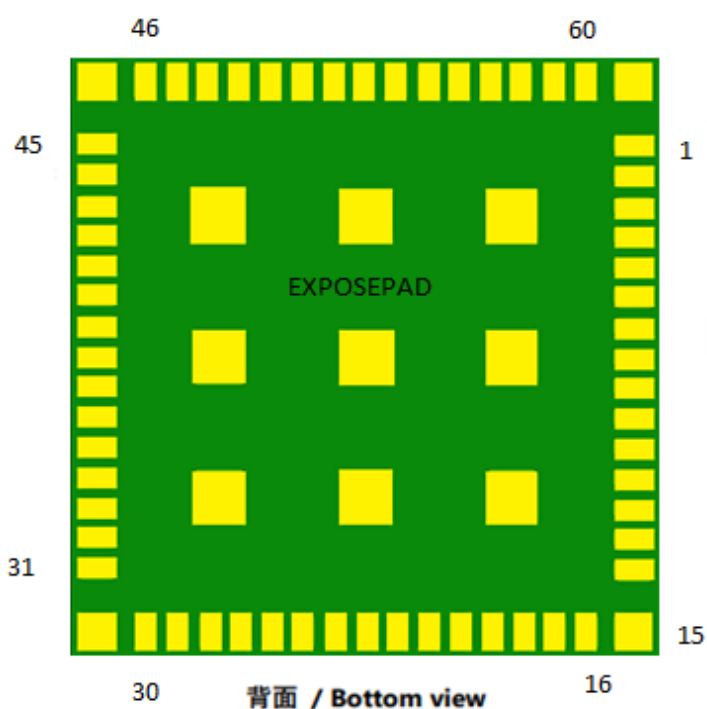


6. ホストインターフェイス仕様 / Host Interface Specifications

6.1. ピン配置 / Pin Locations



表面 / Top view



6.2. 信号仕様 / Signal Specifications

Pin	Signal	I/O	Description
1	GND	G	
2	GND	G	
3	GND	G	
4	RESET_N	DI	Reset signal. Active low.
5	WAKE	DI	Wake on wireless. This pin needs pulled up 10k ohm when not in use.
6	GND	G	
7	BUSY	DIO	Wi-Fi busy
8	GPIO1	DIO	This pin needs pulled down 10k ohm when not in use.
9	GND	G	
10	VDD_3V3	P	
11	GPIO2	DIO	This pin needs pulled down 10k ohm when not in use.
12	GND	G	
13	GPIO3	DIO	This pin needs pulled down 10k ohm when not in use.
14	GPIO4	DIO	This pin needs pulled down 10k ohm when not in use.
15	GPIO5	DIO	This pin needs pulled down 10k ohm when not in use.
16	SD_D3 / SPI_CS	DIO	SDIO data3 signal. SPI Chip Select.
17	SD_D2	DIO	SDIO data2 signal.
18	SD_D1 / SPI_INT	DIO	SDIO data1 signal. SPI Interrupt signal.
19	GND	G	
20	SD_D0 / SPI_MISO	DIO	SDIO data0 signal. SPI Master In Slave Out.
21	SD_CMD / SPI_MOSI	DIO	SDIO CMD signal. SPI Master Out Slave In.
22	GND	G	
23	SD_CLK / SPI_CLK	DI	SDIO Clock signal. SPI Clock signal.
24	GND	G	
25	GPIO7	DIO	This pin needs pulled down 10k ohm when not in use.
26	GPIO6	DIO	This pin needs pulled down 10k ohm when not in use.
27	GND	G	
28	VDDIO	P	
29	GPIO8	DIO	This pin needs pulled down 10k ohm when not in use.
30	GPIO9	DIO	This pin needs pulled down 10k ohm when not in use.
31	GPIO10	DIO	This pin needs pulled down 10k ohm when not in use.
32	GPIO11	DIO	This pin needs pulled down 10k ohm when not in use.
33	GND	G	
34	JTAG_TDO	DIO	JTAG Data Out

			This pin needs pulled down 10k ohm when not in use.
35	JTAG_TMS	DIO	JTAG Mode Select This pin needs pulled down 10k ohm when not in use.
36	GND	G	
37	JTAG_TDI	DIO	JTAG Data In This pin needs pulled down 10k ohm when not in use.
38	JTAG_TRST	DIO	JTAG Reset This pin needs pulled down 10k ohm when not in use.
39	GND	G	
40	JTAG_TCK	DIO	JTAG Clock This pin needs pulled down 10k ohm when not in use.
41	TCXO_EN	DI	TCXO Enable
42	GND	G	
43	GND	G	
44	Reserved	-	
45	GND	G	
46	GND	G	
47	GND	G	
48	GND	G	
49	GND	G	
50	GND	G	
51	GND	G	
52	GND	G	
53	GND	G	
54	GND	G	
55	GND	G	
56	VDD_FEM	P	
57	GND	G	
58	GND	G	
59	GND	G	
60	GND	G	
E		G	For exposed pad

Symbols	Descriptions
DIO	CMOS 双方向デジタル信号 CMOS bidirectional digital signal
DI	CMOS デジタルインプット CMOS digital input
DO	CMOS デジタルアウトプット CMOS digital output
AI	アナログインプット Analog input
RF	RF ポート RF port

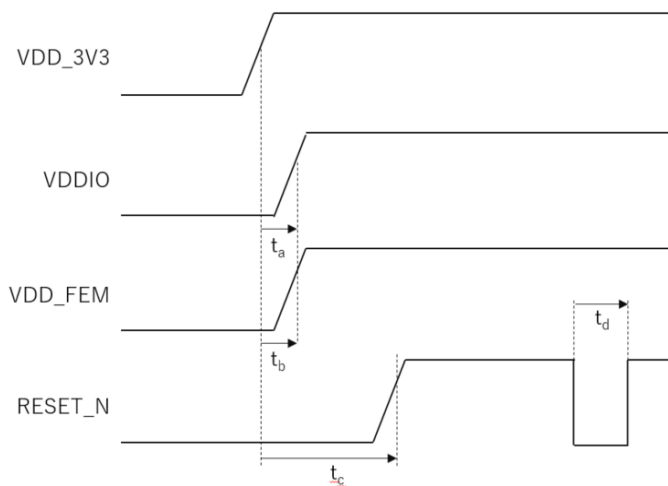
P	電源 Voltage supply
G	グラウンド Ground

6.3. Boot モード設定 / Boot mode setting

No specifications for boot settings.

7. インターフェイス仕様 / Interface specifications

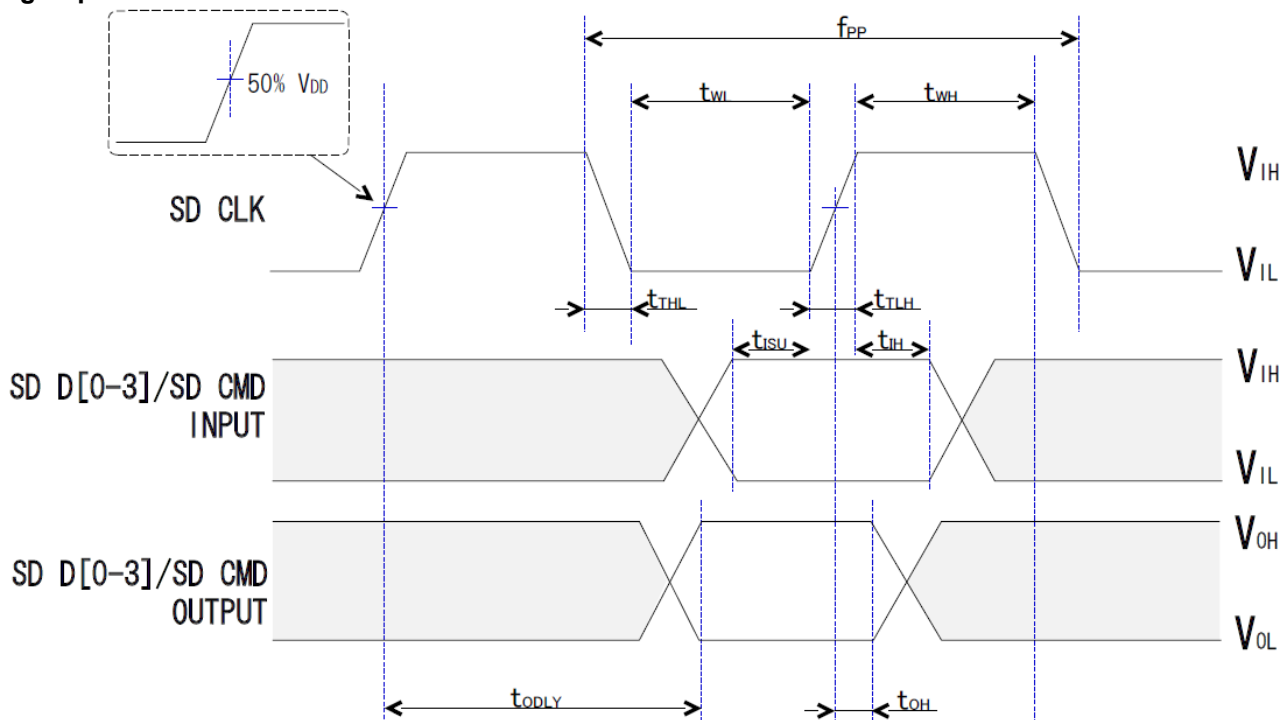
7.1. パワーオンシーケンス / Power on sequence



Symbol	Parameter	Min	Typ	Max	Unit
t_a	Time from VDD33 reaches high level to VDDIO reaches high level	0	-	-	ms
t_b	Time from VDD33 reaches high level to VDDFEM reaches high level	0	-	-	ms
t_c	Time from VDD33 reaches high level to RESET_N reaches high level	0.05	-	-	ms
t_d	Duration of RESET_N signal level < VIL_nRST to reset the chip	1.0	-	-	ms

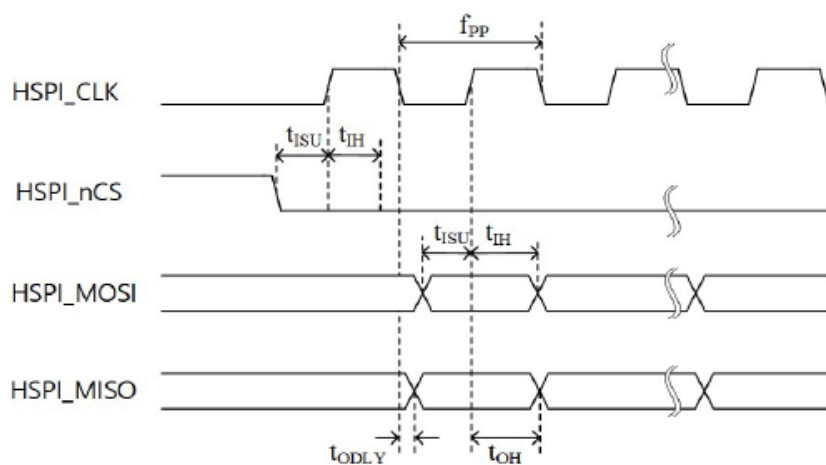
7.2. SDIO インターフェイス仕様 / SDIO timing

High Speed



Symbols	Items	Specifications		Units	Remarks
		Min.	Max.		
f_{PP}	Clock frequency Data Transfer Mode	0	50	MHz	
t_{WL}	Clock low time	7	—	nsec	
t_{WH}	Clock high time	7	—	nsec	
t_{TLH}	Clock rise time	—	3	nsec	
t_{THL}	Clock fall time	—	3	nsec	
t_{ISU}	Input setup time	6	—	nsec	
t_{IH}	Input hold time	2	—	nsec	
t_{ODLY}	Output Delay time	—	14	nsec	
t_{OH}	Output Hold time	2.5	—	nsec	

7.3. SPI インターフェイス仕様 / SPI timing



Symbol	Parameter	Min	Typ	Max	Unit
f_{pp}	Frequency	-	-	50	MHz
t_{ODLY}	Output delay time	6	-	-	ns
t_{OH}	Output hold time	2	-	-	ns
t_{ISU}	Input setup time	14	-	-	ns
t_{IH}	Input hold time	2.5	-	-	ns

8. 適合規格 / Standards compliance

8.1. 適合規格 / Standards conformity

- IEEE802.11ah

8.2. 適合法規 / Law Regulation compliance

- FCC Part 15.247
ID: N6C-SDMAH
- ISSED RSS-247
ID: 4908A-SDMAH

8.3. 推奨アンテナリスト / Recommended Antenna List

Vender	Model No.	Antenna Type	Antenna Gain [dBi]
Kyocera	X9000984-4GDSMB	Rod	3.4

NOTE1	<p>適合している認証は silex 推奨アンテナでのみ有効です。 但し、silex の推奨アンテナを使用していたとしても最終製品の形態によっては再認証試験が必要になる可能性があります。</p> <p>The above certification is effective only with the silex recommended antennas. However, the re-certification might be required in the case of the final product form even if the silex recommended antennas are used.</p>
NOTE2	<p>各国の EMC 認証は最終製品形態での試験が必要です。</p> <p>EMC certification of each country might be required as the final product.</p>

9. RoHS 指令 / RoHS Directive

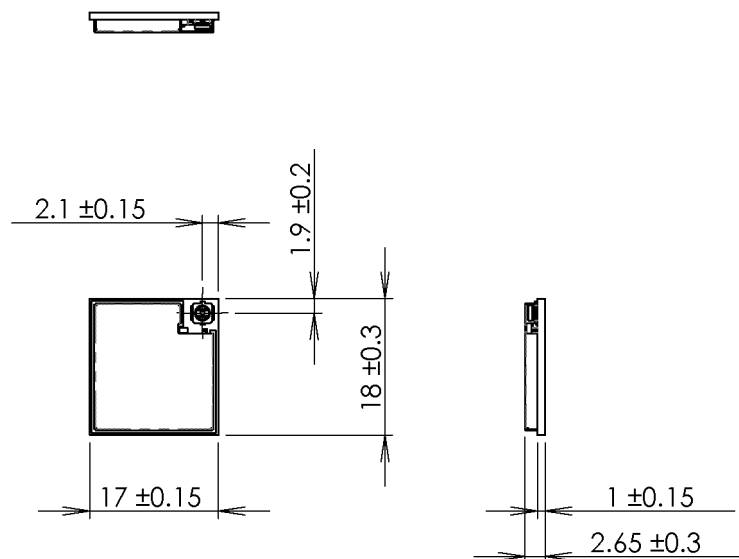
本製品は欧州の RoHS 指令(2011/65/EU) ,(EU) 2015/863 に準拠しています。

This product is compliant with the EU's RoHS directive (2011/65/EU) and (EU) 2015/863

本製品は英国の RoHS 規則 2012 (S.I.2012/3032)に準拠しています。

This product is compliant with the UK's RoHS regulations 2012 (S.I.2012/3032)

10. 外観 / Outside Drawing



厚み Thickness

Item	Thickness	Description
SMT (単体) SMT (A simple substance)	2.65mm +/- 0.3mm	

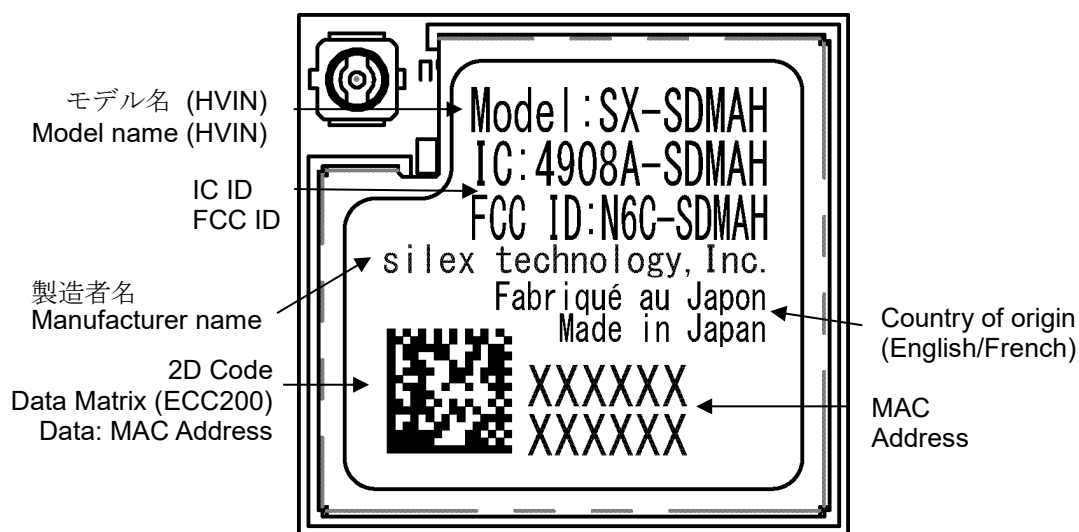
PCB 厚 PCB Thickness

Item	Thickness	Description
SMT (PCB)	1.00 mm +/- 0.15 mm	

特に記載が無い場合、寸法公差は ± 0.15 mm

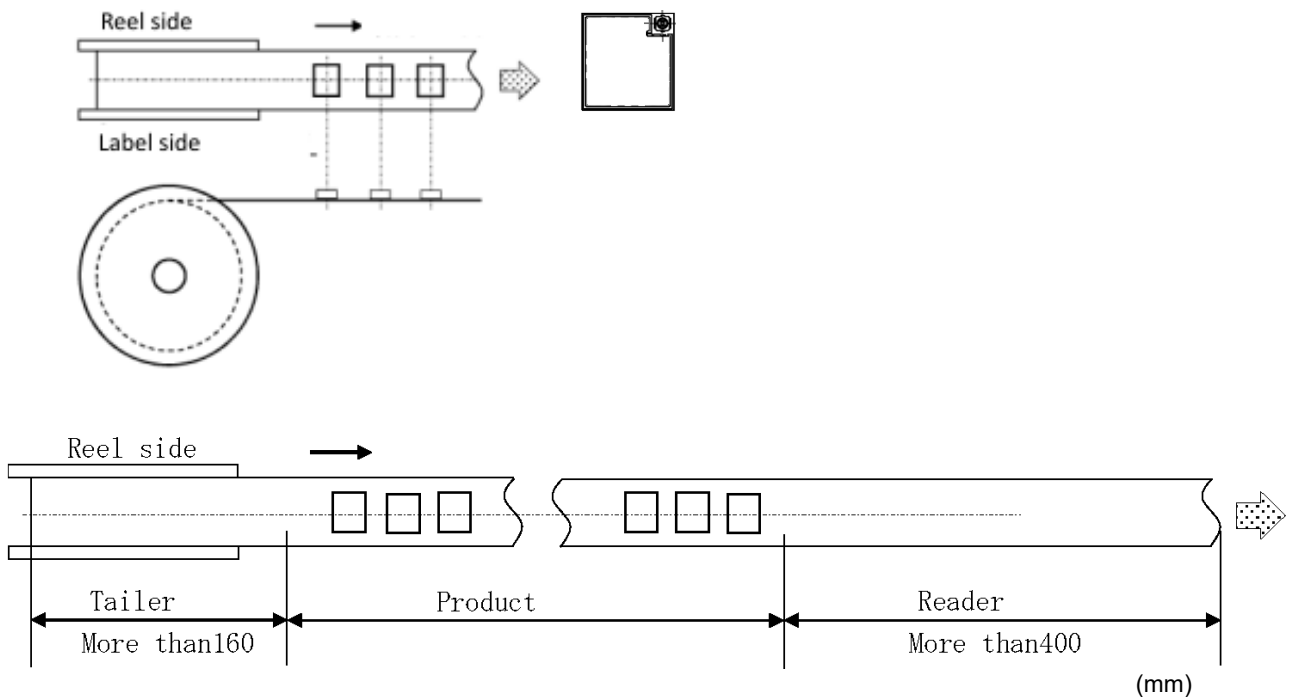
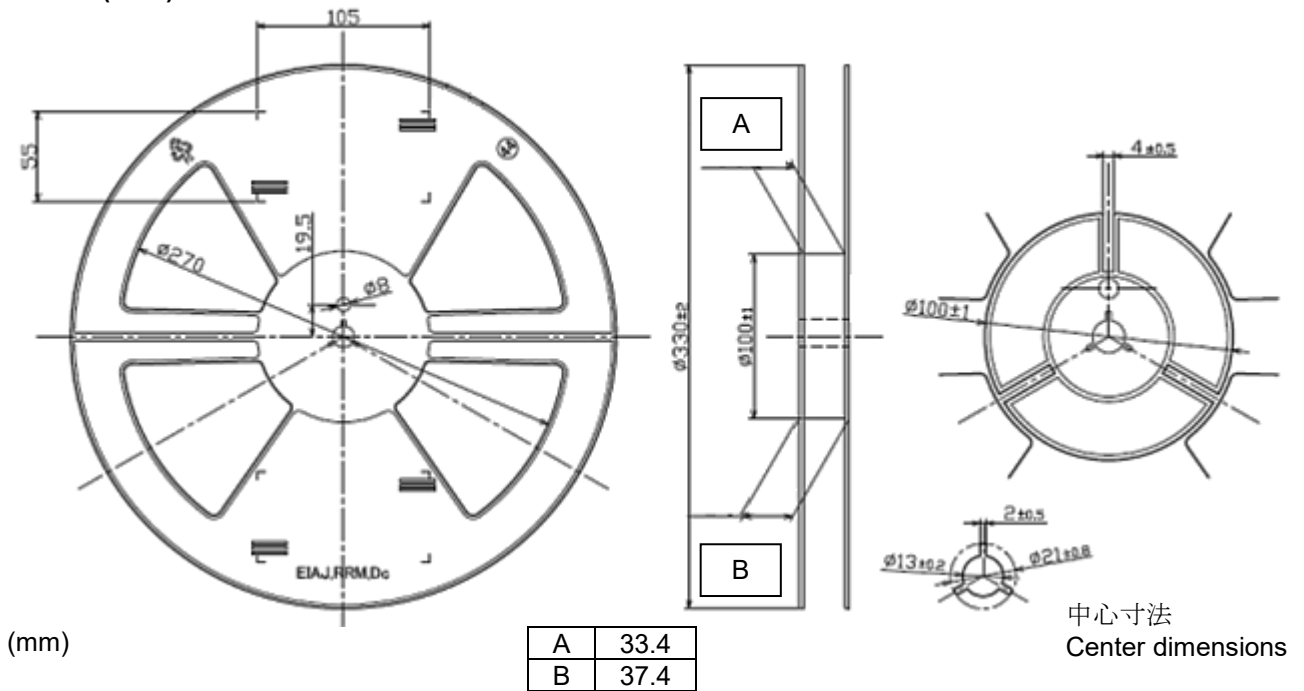
All dimension tolerances are ± 0.15 mm, unless otherwise specified.

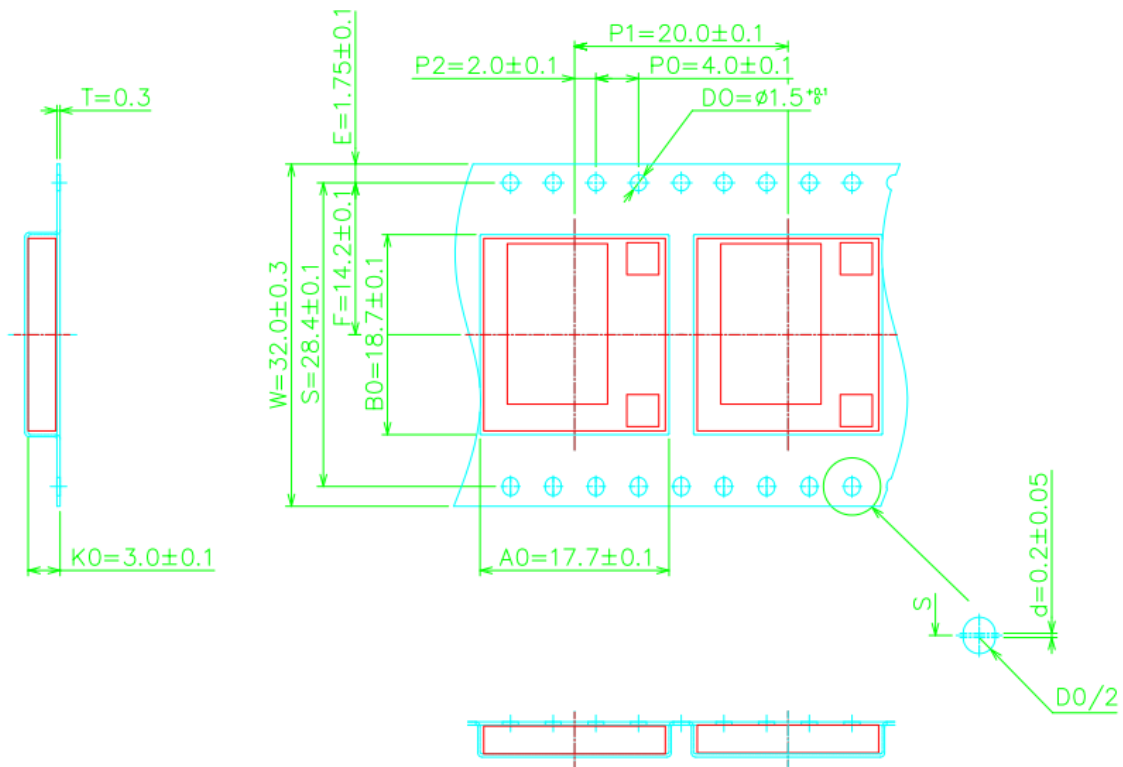
11. 表示仕様 / Indication specifications



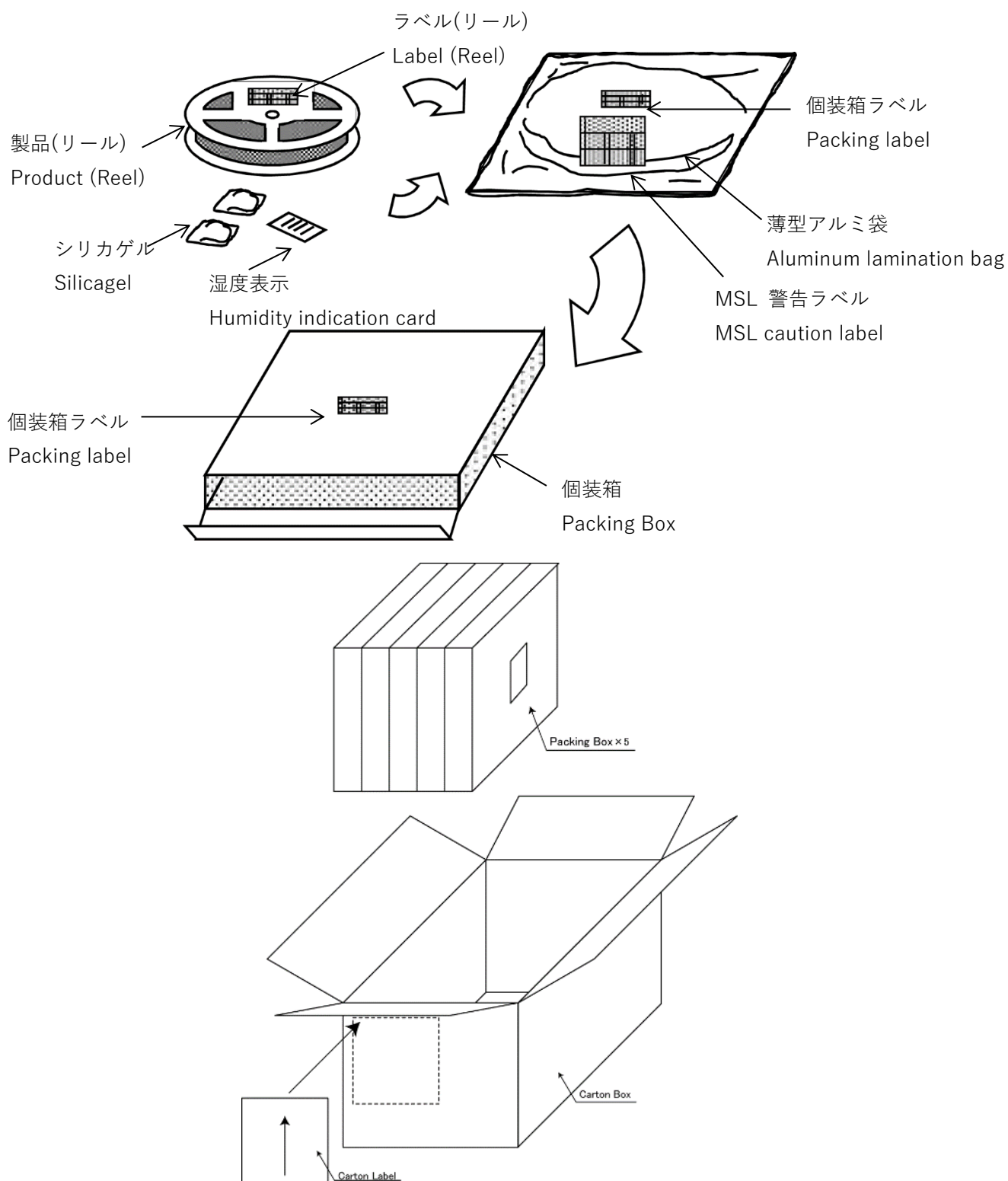
12. 梱包仕様 / Packing specifications

リール (Reel)





(mm)



SX-SDMAH	SX-SDMAH-SP
8.0kg	3.5kg

Packing label


品名: AN*****/SZ****

型名: ****

数量: ****

ロットNo.:

完了日: YYYY/MM/DD

巻き方: 

担当者: ****


Part No

Product Name

ラ

TRT: *XXXXXXX*

テープ幅: 32 送りピッチ: 20
リール外径: 330



項目	表示内容
リール	リ
ラミネート袋	ラ
内箱	内

Product Name	Part No
SX-SDMAH(US)	ZXE04619
SX-SDMAH-SP(US)	ZXE04620





集合ラベル (Carton label)

Product : ***** <


Type : _____

Carton No.: */*

Quantity : ** pcs

RoHS Compliant
Made in Japan / Fabriqué au Japon
silex technology, Inc.



SX-SDMAH(US)
SX-SDMAH-SP(US)

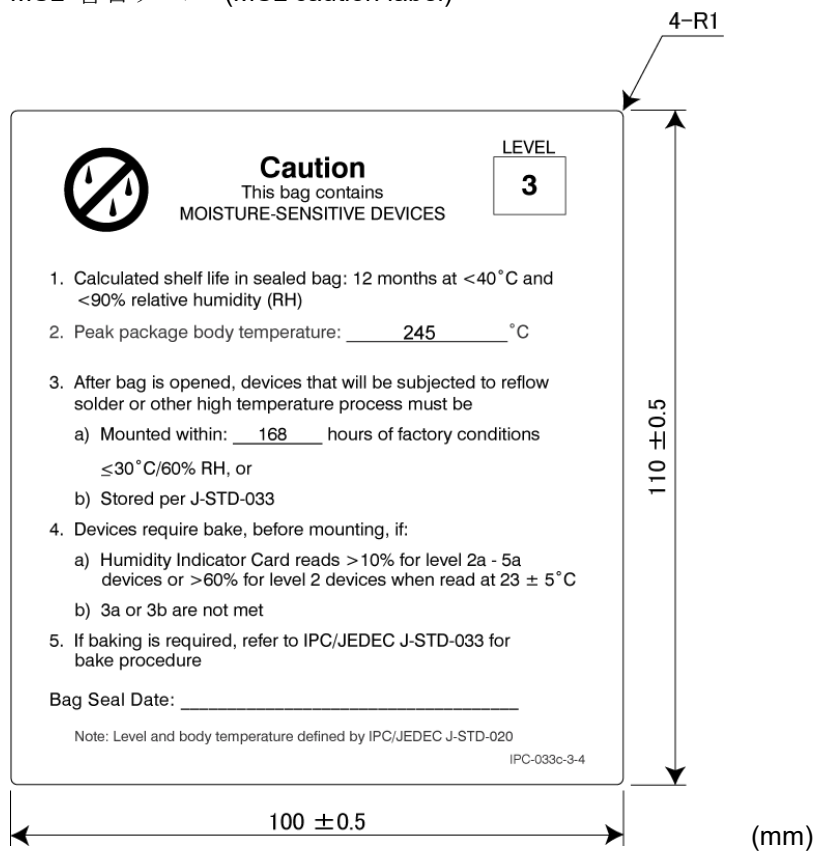
69 ± 5

(mm)

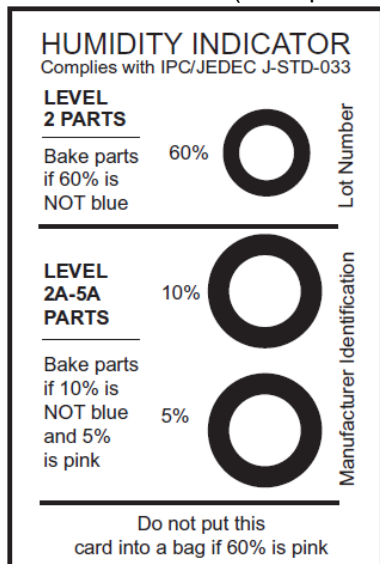
97 ± 10

(mm)

MSL 警告ラベル (MSL caution label)



湿度表示カード例 (Example of humidity indication card)



13. 信頼性試験 / Reliability test

Test items	Standards	Description	Requirements																																																																																										
			Electricity	Appearance																																																																																									
温湿度電圧 サイクル試験 Temperature/ Humidity cycle test	—	下記条件で動作確認を行う。 ・通信の停止が起こらないことを確認する。 Check to work with below conditions. ・Check no transaction stop. <table><tr><th colspan="10">《Humidity and temperature chamber setup》</th></tr><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th></tr><tr><td>温度</td><td>25</td><td>-40</td><td>-40</td><td>-40</td><td>-40</td><td>85</td><td>85</td><td>85</td><td>25</td></tr><tr><td>湿度</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>温度の配</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>湿度の配</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>OFF</td><td>OFF</td></tr><tr><td>time[h:m]</td><td>0:05</td><td>0:30</td><td>1:00</td><td>1:00</td><td>2:00</td><td>1:00</td><td>2:00</td><td>6:00</td><td>1:00</td></tr><tr><td rowspan="2">retry</td><td>number</td><td>start</td><td>finish</td><td colspan="6"></td></tr><tr><td>1</td><td>4</td><td>7</td><td colspan="6"></td></tr></table>	《Humidity and temperature chamber setup》										Step	1	2	3	4	5	6	7	8	9	温度	25	-40	-40	-40	-40	85	85	85	25	湿度	-	-	-	-	-	-	-	-	-	温度の配	ON	ON	ON	ON	ON	ON	ON	ON	ON	湿度の配	-	-	-	-	-	-	-	OFF	OFF	time[h:m]	0:05	0:30	1:00	1:00	2:00	1:00	2:00	6:00	1:00	retry	number	start	finish							1	4	7							動作可能 Workable	NA
《Humidity and temperature chamber setup》																																																																																													
Step	1	2	3	4	5	6	7	8	9																																																																																				
温度	25	-40	-40	-40	-40	85	85	85	25																																																																																				
湿度	-	-	-	-	-	-	-	-	-																																																																																				
温度の配	ON	ON	ON	ON	ON	ON	ON	ON	ON																																																																																				
湿度の配	-	-	-	-	-	-	-	OFF	OFF																																																																																				
time[h:m]	0:05	0:30	1:00	1:00	2:00	1:00	2:00	6:00	1:00																																																																																				
retry	number	start	finish																																																																																										
	1	4	7																																																																																										
高温連続試験 Functional hot temp	—	+85℃の環境下で8H以上動作すること。 Workable at +85℃ over 8 hours	動作可能 Workable	NA																																																																																									
低温連続試験 Functional cold temp	—	-40℃の環境下で4H以上動作すること。 Workable at -40℃ over 4 hours	動作可能 Workable	NA																																																																																									
低温・高温起 動試験 Low temp and High tem start-up test	—	下記条件で動作確認を行う ・電源起動を行い、通信ができること Check to work with below conditions. ・Power on and check no transaction stop. Temp: -40℃/+90℃ Standing time: 2H(No electricity) 30 minutes after the second Number of times: 5 times each	動作確認 Workable	NA																																																																																									
温度衝撃試験 Thermal shock test	JEDEC JESD22- A106B Test Condition C (Fluid Air)	熱衝撃を加えた後、動作確認を行う。 ・Step 1 (高温) / Step 3 (低温)を繰り返す。 ・500 Cycleで動作確認を実施する。 Check to work after heat shocking ・Repeat Step 1 (High temp.) / Step 3 (Low temp.) ・Check to work after 500 Cycles Steps per 1 Cycle [⇒: Ramp] <table><tr><th>Steps</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temperature</td><td>+100 +10/- 0℃</td><td>⇒</td><td>-20 +0/- 10℃</td><td>⇒</td></tr><tr><td>Time</td><td>5min</td><td>< 10sec</td><td>5min</td><td>< 10sec</td></tr><tr><td>Power</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr></table>	Steps	1	2	3	4	Temperature	+100 +10/- 0℃	⇒	-20 +0/- 10℃	⇒	Time	5min	< 10sec	5min	< 10sec	Power	OFF	OFF	OFF	OFF	動作可能 Workable	損傷無し No damage																																																																					
Steps	1	2	3	4																																																																																									
Temperature	+100 +10/- 0℃	⇒	-20 +0/- 10℃	⇒																																																																																									
Time	5min	< 10sec	5min	< 10sec																																																																																									
Power	OFF	OFF	OFF	OFF																																																																																									

Test items	Standards	Description	Requirements	
			Electricity	Appearance
衝撃試験 Mechanical shock test	JIS C60068-2-27	衝撃を加えた後、動作確認を行う。 10G / 6msec / vertical / half sine pulse ・方向と回数：X1/2 (+ /-), Y1/2 (+ /-), Z1/2 (+ /-) 各1000回 (計6000回) 30G / 11msec / vertical ・方向と回数：X1/2 (+ /-), Y1/2 (+ /-), Z1/2 (+ /-) 各10回 (計60回) ・衝撃を加えた後も破損/故障/RF性能が劣化しないことを確認する。 Check to work after shocking. 10G / 6msec / vertical / half sine pulse ・Axis and number of times : X1/2 (+ /-), Y1/2 (+ /-), Z1/2 (+ /-) 1000 times per direction (Total 6000 times) 30G / 11msec / vertical ・Axis and number of times : X1/2 (+ /-), Y1/2 (+ /-), Z1/2 (+ /-) 10 times per direction (Total 60 times) ・Damage/Defect/RF degradation is not observed after shock.	動作可能 Workable	損傷無し No damage
振動試験 Mechanical vibration test	JIS C600678-2-6	振動を加えた後、動作確認を行う。 10~150Hz / 2G / sine ・方向と回数：X-Y-Z 各10サイクル (計30サイクル) ・振動を加えた後も破損/故障/RF性能が劣化しないことを確認する。 Check to work after vibrating. 10~150Hz / 2G / sine ・Axis and number of times : X-Y-Z 10 cycles (Total 30 cycles) ・Damage/Defect/RF degradation is not observed after vibration.	検査仕様適合 Test spec in	損傷無し No damage
静電気放電試験 Electrostatic discharge test	JEDEC JESD22-A114F	アンテナ芯線へのESD印加試験を行う。 ・放電容量=100pF/放電抵抗=1.5kΩ ・アンテナコネクタ芯線：+/-2kV ・正極、負極各3回ずつの印加。 ・印加した後も故障/RF性能が劣化しないことを確認する。 Add ESD to the center pin of antenna connector. ・Discharging capacitance=100pF, Discharging resistance=1.5kΩ ・ESD level for the center pin : +/-2kV ・3 times per each plus pulse and minus pulse. ・Check no damage and no RF performance degradation after testing.	動作可能 Workable	NA

Criteria	Description
<div> <div>損傷無し</div> <div>No damage</div> </div>	<div>試験後外観に損傷が無いこと。</div> <div>No damage on the appearance after test.</div>
<div> <div>検査仕様適合</div> <div>Test spec in</div> </div>	<div>RF 検査仕様を満たすこと。</div> <div>Meet to RF test specifications</div>
<div> <div>動作可能</div> <div>Workable</div> </div>	<div>試験中動作が確認できること。</div> <div>Can confirm to work during test.</div>

NOTE1	<div>以下を除く全ての項目のサンプル数は 3 台</div> <div>・ 温度衝撃試験：20 台</div> <div>Sample numbers for all test except below is 3 units.</div> <div>・ Thermal shock test：20 units</div>
-------	--

14. 注意事項 / Notifications

■本製品の仕様は § 8. Standards compliance に掲げる法規制に適合していますが、以下の場合は仕様が変更になる可能性があります。
Specifications of this module are compliant to law regulations of § 8. Standards Compliance, but this shall not apply with below cases.

- ・ § 8. Standards Compliance に掲げる国以外で使う場合。

In case this module is used in the different country from the list of § 8. Standards Compliance.

- ・ 認可の更新が必要な場合。

In case the certification must be renewed.

■本製品は915MHz 帯の電波を媒体とする無線通信機です。

This module uses 915MHz band radio.

■本製品は一般電子機器への組込みを目的に設計された物であり、航空機器、原子力制御、高信頼性医療器、高信頼性セキュリティ器等、極めて高い水準の信頼性・品質を要求される機器への組込みを意図した物ではありません。**医療機器に組込む際は医療機器クラスに関係なく弊社営業までお問い合わせください。**

This module is designed for embedded purpose into the general electric devices, and is not designed for high reliability demands like aircraft instruments, nuclear control instruments, high reliability medical instruments (Class III, IV), high reliability security instruments or any other devices required extremely high reliability and quality.

In the case embedded into the medical instrument, please ask to silex despite the medical class.

■本製品は電波を媒体として通信を行いますので、第三者への情報漏洩を防ぐ為にもセキュリティに関する設定を実施いただく事を強く推奨します。

As this module communicates by radio wave, it is strongly recommended to use some security system to prevent unexpected information leakage to others.

■本製品は組込みを意図した無線装置です。本製品の機能、特性をご理解の上、組込み最終製品での評価をお願いいたします。又、本無線装置単品でのEMC 測定は実施しておりませんので、本無線装置を組み込んだ製品形態でのEMC 試験の実施、及び認可申請を行う必要があります。

This module is a radio module for embedded purpose. Please understand functions and features of this module, and evaluate as the final product which has this module embedded. Also, as evaluation of EMC conformity of this module has not been performed, EMC conformity evaluation and application must be performed with the final product which this module is embedded.

- 本製品が使用する無線帯域において、同一周波数帯を利用する装置への影響又は装置からの影響を受ける場合があります。設置においては事前に環境の調査を実施してください。

This module will effect to some other device or be affected by the some other device using the same frequency band.

Please investigate the environment to use this module beforehand.

- 本製品について分解や改造を行うと電波法に基づいた処罰を受ける事があります。

Disassembling or modifying the radio module leads to punishment based on radio law.

- 本製品は端子や部品が露出した組込み用モジュールです。製品組込み時には静電気（本製品には静電気に弱い高周波デバイスを使用しております）や水滴、その他粉塵等には十分注意願います。

This module is the embedded module that has the exposed connectors or some devices. Please be careful for electro static, condensing, and other dusts.

- 周辺で同一周波数帯を使う他の無線機器を使う場合、特に注意してください。(IEEE802.11-2012 参照)

In the case using the other wireless devices using same frequency band around this product, please take care below.

(See IEEE802.11-2012)

- 強い電波入力がある場合は混信する可能性があるので、周辺の無線機器は十分距離を離してご使用ください。

The module is possibly interfered when strong signal is input. The other wireless system should be enough far from this module

- 対向機からの入力、アンテナゲインを含み-10dBm 以下としてください。

Input level from the opponnet device must be -10dBm or less with including antenna gain.

- 本製品のファームウェアは事前通知の上更新されることが有ります。ファームウェアの更新についてご要望がございました場合、購買契約前に弊社までお問い合わせください。

Firmware of this product shall be updated with the advance notice. If you have special request on firmware updating, you can contact to silex before purchase contracting.

Federal Communication Commission Interference Statement

The following statements must be described on the user manual of the host device of this module;

This device complies with Part 15 of 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 Notice;

This module is intended for OEM integrators only. Per FCC KDB 996369 D03 OEM Manual v01 guidance, the following conditions must be strictly followed when using this certified module:

KDB 996369 D03 OEM Manual v01 rule sections:

2.2 List of applicable FCC rules

This module has been tested for compliance to FCC Part 15

2.3 Summarize the specific operational use conditions

This module designed for mounting inside of the end product by end product manufacturer professionally.

Therefore, it complies with the antenna and transmission system requirements of § 15.203.

2.4 Limited module procedures

This module is certified as limited modular approval as it does not have its own power supply regulator, therefore regulated 3.3V and 5.0V must be supplied by a host device using voltage regulator, e.g. NCV1117STAT3G or equivalent.

The antenna must be installed inside the host device by a professional installer. Also, the antenna connector must be installed in such a way that it cannot be touched by the general public.

2.5 Trace antenna designs

Not applicable.

2.6 RF exposure considerations

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter except for SX-SDMAX.

The following statements must be described on the user manual of the host device of this module;

This equipment complies with FCC mobile radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. If the module is installed in a portable host, a separate SAR evaluation is required to confirm compliance with relevant FCC portable RF exposure rules.

2.7 Antennas

The following antennas have been certified for use with this module; antennas of the same type with equal or lower gain may also be used with this module. The antenna must be installed such that 20 cm can be maintained between the antenna and users.

Antenna Type	Antenna Gain
Rod	+3.4dBi

The antenna must be installed inside the host device by a professional installer. Also, the antenna connector must be installed in such a way that it cannot be touched by the general public.

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following: “Contains FCC ID: **N6C-SDMAH**”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

FCC CAUTION

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

2.9 Information on test modes and additional testing requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) not allowed or portable use will require a separate class II permissive change re-evaluation or new certification.

2.10 Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.

2.11 Note EMI Considerations

We recommend to use "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. The host manufacturer is responsible for ensuring compliance with the applicable FCC rules for the transmitters operating individually and simultaneously. This includes compliance for the summation of all emissions from all outputs occupying the same or overlapping frequency ranges, as defined by the applicable rules.

2.12 How to make changes

Only the grantee is permitted to make permissive changes. Please contact us at Silex Technology, Inc.

As long as all 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.

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

OEM/Host manufacturer responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment

Prohibited for control of or communications with unmanned aircraft systems, including drones.

Innovation, Science and Economic Development Canada statement:

The following statements must be described on the user manual of the host device of this module;

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Les déclarations suivantes doivent être décrites dans le manuel d'utilisation de l'appareil hôte de ce module ;

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation,

Sciences et Développement économique 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**
- 2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.**

Limited module procedures

This module is certified as limited modular approval as it does not have its own power supply regulator, therefore regulated 3.3V and 5.0V must be supplied by a host device using voltage regulator, e.g. NCV1117STAT3G or equivalent.

The antenna must be installed inside the host device by a professional installer. Also, the antenna connector must be installed in such a way that it cannot be touched by the general public.

Ce module est certifié en tant qu'approbation modulaire limitée car il n'a pas son propre régulateur d'alimentation, donc le 3.3V et 5.0V régulé doit être fourni par un dispositif hôte utilisant un régulateur de tension, par exemple NCV1117STAT3G ou équivalent.

L'antenne doit être installée à l'intérieur du dispositif hôte par un installateur professionnel. De plus, le connecteur de l'antenne doit être installé de manière à ce qu'il ne puisse pas être touché par le grand public.

Label and compliance information

The following information must be indicated on the host device of this module.

Les informations suivantes doivent être indiquées sur le périphérique hôte de ce module.

Contains Transmitter Module IC: 4908A-SDMAH

Or

Contains IC: 4908A-SDMAH

Data transmission

Data transmission is always initiated by software, which is then passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet.

Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinues transmission in case of either absence of information to transmit or operational failure.

La transmission des données est toujours initiée par le logiciel, puis les données sont transmises par l'intermédiaire du MAC, par la bande de base numérique et analogique et, enfin, à la puce RF. Plusieurs paquets spéciaux sont initiés par le MAC. Ce sont les seuls moyens pour qu'une partie de la bande de base numérique active l'émetteur RF, puis désactive celui-ci à la fin du paquet. En conséquence, l'émetteur reste uniquement activé lors de la transmission d'un des paquets susmentionnés. En d'autres termes, ce dispositif interrompt automatiquement toute transmission en cas d'absence d'information à transmettre ou de défaillance.

RF exposure considerations

The following statements must be described on the user manual of the host device of this module;

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the ISED radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

Les déclarations suivantes doivent être décrites dans le manuel d'utilisation de l'appareil hôte de ce module ;

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'ISDE. Cet équipement doit être installé et utilisé en gardant une distance de

20 cm ou plus entre le radiateur et le corps humain.

Antenna Type

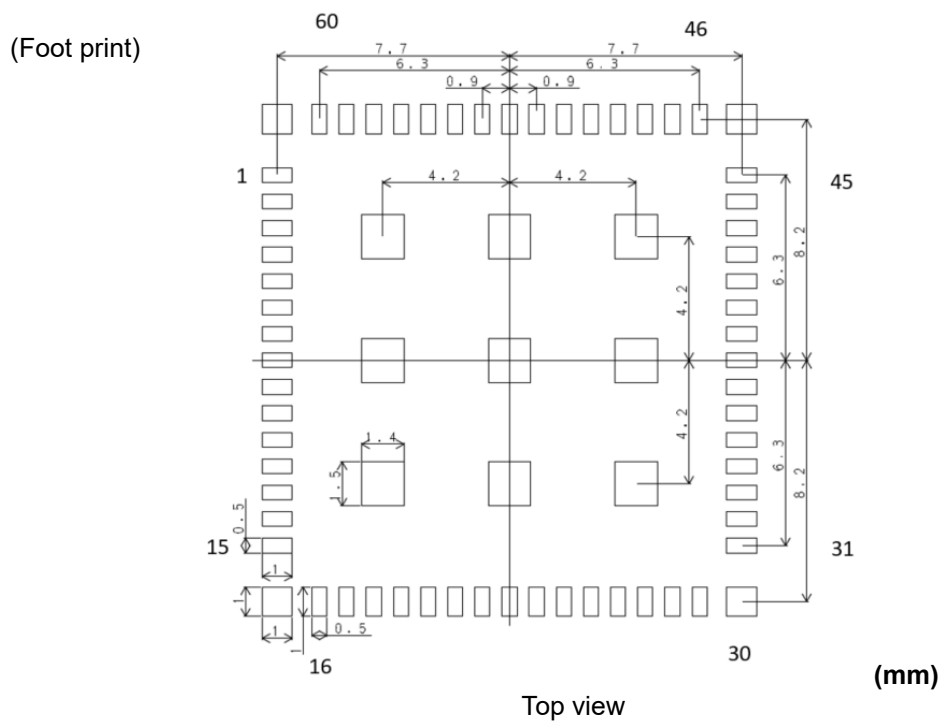
This radio transmitter (4908A-SDMAH) has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna Type	Antenna Gain	Impedance
Rod Antenna	+3.4dBi	50ohms

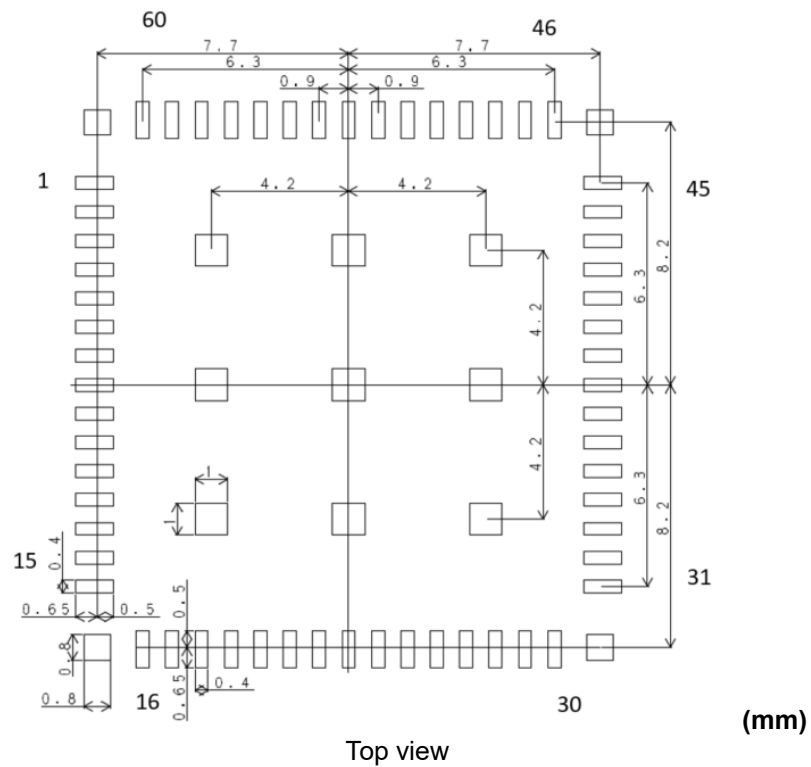
Le présent émetteur radio (4908A-SDMAH) a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

Type d'antenne	Antenna Gain	Impedance
Antenne Rod	+3.4Bi	50ohms

15. 付録 A 参考ランド設計 / Appendix-A Reference land design



(reference stencil design)



16. 付録 B SMT リフロー条件 / Appendix -B SMT reflow profiles

本推奨条件は、Sn/Ag/Cu Pb-フリーハンダを使用した場合のものです。使用するハンダの種類によって最適化することを推奨します。

This recommended condition assumes Sn/Ag/Cu/Pb-free solder. This condition should be optimized per using solder type.

Sn/Ag/Cu Pb-Free Assembly

Profile Feature	Parametric	Conditions			
		Min.	Typ.	Max.	Units
Average ramp-up rate	T_L to T_p	0	—	3.0	°C/Sec
Preheat	Temperature T_{smin}	150	—	—	°C
	Temperature T_{smax}	—	—	200	°C
	Time t_s	60	—	120	Sec
Time maintained above	Temperature T_L	220	—	—	°C
	Time t_L	60	—	150	Sec
Peak Temperature	T_p	230	—	250	°C
Time within 5°C of Actual Peak Temperature	t_p	—	—	20	Sec
Average ramp-down rate	—	0	—	6	°C/Sec
Time 25°C to Peak Temperature	—	—	—	6	Min

