Title:	IEEE802.11ac wave2 SDIO wireless LAN module SX-SDMAC-2830 / SX-SDMAC-2831SX-SDCAC-2830
Drawing Type :	Operational description & User manual
Drawing No.:	JW202570AS
Date :	June 20, 2019

改版履歴（Revision History）

Rev.	Description	Date	Prepared	Checked	Approved
AX	The first release. (初版)	Oct.19,16	M.Ieda	K.Yoshikawa	Y.Shibuya
AA	§2 Corrected block diagram §3.6　Corrected typo.	Oct.27,16	M.Ieda	K.Yoshikawa	Y.Shibuya
AB	§1 Added “20/40MHz Co-existence is not supported” §3.9 Corrected Power tolerance to adjust to MIC declared value.	Nov.11,16	M.Ieda	K.Yoshikawa	Y.Shibuya
AC	§4 Corrected typo.(BT_I2S_WS : pull-up > pull-down) §10 Added Specification of Carton Box for SX-SDMAC-2830S	Dec.13,16	T.Minobe	K.Okazaki	Y.Shibuya
AD	§11 Updated the number of thermal shock cycles to 300.	Jan.11,17	M.Ieda	K.Yoshikawa	Y.Shibuya
AE	§16 Corrected reference schematic of SX-SDMAC-2831C.	Feb.01,17	K.Yoshikawa	M.Ieda	Y.Shibuya
AF	§3.8 Deleted packet types. §4 Added the comment to I2S and BT_WKUP_HOST signal. §5.2 Corrected baud rates. §6.2 Corrected part number §16 Modified reference schematics.	Mar.13,17	M.Ieda	K.Yoshikawa	Y.Shibuya
AG	§1 DFS Master 機能追加 §3.5 チャネルリストを追加 §6 DFS Master 機能追加のため、日本電波法認可番号を追加 201-170874 §8 DFS Master 版を追加 §18 参考情報としてパフォーマンスデータを追加. §1 Added DFS Master function. §3.5 Added channel list. §6 Added Japan Certification Number due to DFS Master support. 201-170874 §8 Added DFS Master version §18 Added performance data as reference information.	Aug.28,17	吉川 K.Yoshikawa	家田 M.Ieda	渋谷 Y.Shibuya
AH	§3.6 Remarks にコメントを追加 §3.6 Added comments at Remarks.	Sep.20,17	家田 M.Ieda	渋谷 Y.Shibuya	米谷 T.Kometani
AJ	§3.4 消費電流仕様を更新 §3.4 Updated Current consumption specifications §3.6 備考欄にアプリケーションノートの参照先を追記 §3.6　Added application note number in remarks §5.1 High Speed モード: アウトプット仕様を誤記修正 §5.1 High Speed Mode: Corrected error of output specification §5.1 Ultra High Speed モード: クロック・アウトプット仕様を誤記修正、インプット仕様を追加 §5.1 Ultra High Speed Mode: Corrected error of clock and output specifications. Added input specifications §5.4 リセットタイミング図を更新 §5.4 Updated the picture of reset timing §6.2 Include から Exclude に誤記修正 §6.2 Corrected Include to Exclude §16 pin47,53 の pull-up 先を VDD に変更 §16 change pull-up to VDD of pin47,53 §17 TOP VIEW の記載 §17 Added comments of TOP VIEW.	Jan.29,18	黒田 Y.Kuroda	家田 M.Ieda	渋谷 Y.Shibuya

改版履歴（Revision History）

AK	§1 特徴: FCC DFS Master 未取得の旨を記載 §1 Features: Added comment of FCC DFS Master is unacquired. §6.1 §1 の記載に伴う FCC/IC の内容変更 §6.1 Changed description of FCC/IC according to §1. §6.2 AA258 及び AA222 のアンテナゲイン誤記修正 §6.2 Corrected antenna gain errors of AA258 and AA222.	Jan.31,18	黒田 Y.Kuroda	家田 M.Ieda	渋谷 Y.Shibuya
AL	§3.6 仕向け毎の送信電力から IEEE 802.11 規格に準拠した 最大送信電力値に変更 §3.6 Changed from TX power at each destination to maximum TX power compliant with IEEE 802.11 standard. §4 §4.2 pin53, §4.4 pin38, §4.8 pin14 を NC に変更。 §4 Changed §4.2 pin 53, §4.4 pin38 and §4.8 pin14 to NC. §10 総重量の追加 §10 Added gross weight §16 §4 に伴い変更 §16 Changed along with §4. §19 付録 G 仕向け毎の送信電力を追加 §19 Added Appendix -G TX power at each destination	Mar. 14,18	黒田 Y.Kuroda	渋谷 Y.Shibuya	米谷 T.Kometani
AM	§1 特徴: DFS Master 対応/非対応表を追加 §1 Features: Added Table of DFS Master support/non-support §3.5. 無線 LAN 一般仕様: 利用可能チャネルリスト CA ch145 を削除 §3.5. Wireless LAN general specifications: Deleted ch145 in Operatable channel list CA §3.8, §3.10 誤記修正：8DQPSK ⇒ 8DPSK §3.8, §3.10 Corrected typo :8DQPSK to 8DPSK §6.1 Certification number :認可番号表を追加 §6.1 Certification number :Added table of Certification number §6.2 アメリカ・カナダ・ヨーロッパ のアンテナリストを更新 §6.2 Updated Antenna list of USA・Canada・Europe §8 DFS Master 対応/非対応表を追加 §8 Added Table of DFS Master support/non-support	Jun.28,18	小倉 T.Ogura	渋谷 Y.Shibuya	米谷 T.Kometani
AN	§1 SKU を追加 §1 Added SKU §6.1 SKU を追加 §6.1 Added SKU §8 SKU を追加(MAC アドレス表示モデルを追加) §8 Added SKU(Added MAC address Model) §9 SKU を追加 §9 Added SKU §10 SKU を追加 §10 Added SKU §16 SX-SDMAC-2830S/SX-SDMAC-2831 参考回路図 誤記修正 §16 SX-SDMAC-2830S/SX-SDMAC-2831Ref schematics: corrected an error.	Jul.25,18	美濃部 T.Minobe	渋谷 Y.Shibuya	米谷 T.Kometani
AP	§6.1 ANATEL、Brazil を追加 §6.1 Added ANATEL and Brazil §8 ラベル及び基板表示の変更 §8 Changed marking Label and PCB	Nov.12,18	美濃部 T.Minobe	渋谷 Y.Shibuya	米谷 T.Kometani
AR	§1 §3.1 §3.8 Bluetooth 4.1⇒5.0 に変更 §1 §3.1 §3.8 Change to Bluetooth 4.1 ⇒ 5.0 §6.1 Bluetooth 5.0 の DID 番号追加 §6.1 Added Bluetooth 5.0 DID number	Feb. 25, 19	浜田 K.Hamada	渋谷 Y.Shibuya	米谷 T.Kometani
AS	§3.5, 6.2, 19 Added the antenna (Ethertronics) to US, Canada. US, Canada: Ch.144, Ch.142, Ch.138 Added	Jun. 20, 19	黒田 Y.Kuroda	渋谷 Y.Shibuya	米谷 T.Kometani

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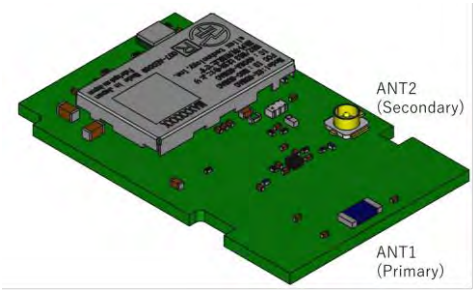
本書は SX-SDMAC-2830S と SX-SDMAC-2831S、SX-SDMAC-2831C、SX-SDCAC-2830 について説明するものです。モジュールのモデル名/ハードウェアバージョン識別番号(HVIN)は「SX-SDMAC」です。

This document describes about “SX-SDMAC-2830S”,“SX-SDMAC-2831S”,“SX-SDMAC-2831C” and “SX-SDCAC-2830”. Model name/Hardware Version Identification Number (HVIN) of this module is “SX-SDMAC”.

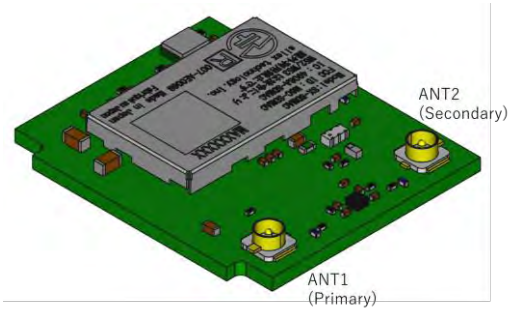
1. 製品概要（Product introduction）

SX-SDMAC は、QCA9377-3 (Qualcomm Atheros 社)を採用した、2.4GHz/5GHz Dual Band IEEE 802.11 a/b/g/n/ac、Bluetooth 5.0 BR/EDR/LE(Class2) 及び SDIO3.0 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-SDMAC の製品形状は、表面実装型 (SMT)の SX-SDMAC-2830S/SX-SDMAC-2831S と Board to Board connector 型(B2B)の SX-SDMAC-2831C があります。主に評価用途目的に SD Card 型の SX-SDCAC-2830 が用意されています。SX-SDMAC は、オンボードチップアンテナ(-2830 型のみ)とアドオンアンテナ接続のインターフェイスとして 50 ohm MHF コネクタを備えています。

The SX-SDMAC is a 2.4 GHz / 5GHz dual band IEEE802.11 a/b/g/n/ac WLAN and Bluetooth 5.0 BR/EDR/LE (Class2) module based on Qualcomm QCA9377-3 chipset. The SX-SDMAC highly integrates MAC, Base band, RF, RF front end and peripheral circuitry like power unit, reference clock, etc. Surface mount type (SMT) SX-SDMAC-2830S/SX-SDMAC-2831S, Board to Board connector type (B2B) SX-SDMAC-2831C. SD Card type SX-SDCAC-2830 is also prepared for mainly as evaluation board. The SX-SDMAC has an On-board chip antenna (only -2830 type) and a 50 ohm MHF connector as connection interface for an add-on antenna.



SX-SDMAC-2830S



SX-SDMAC-2831S

特徴（Features）

- IEEE802.11a/b/g/n/ac 準拠(2.4 GHz, 5 GHz)
  IEEE802.11a/b/g/n/ac compliant (2.4 GHz, 5 GHz)

- 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)

- 5 GHz：20/40/80 MHz 帯域幅モード対応（PHY データレート 433 Mbps）
  2.4 GHz：20/40 MHz 帯域幅モード対応（PHY データレート 150 Mbps,拡張 PHY データレート 200Mbps）
  *20/40MHz Co-existence には非対応。
  5 GHz: Support 20/40/80 MHz bandwidth mode (PHY Data rate 433 Mbps)
  2.4 GHz: Support 20/40 MHz bandwidth mode (PHY Data rate 150 Mbps, Extra PHY Data rate 200Mbps)
  *20/40MHz Co-existence is not supported.

  PHY Data Rate
  - 802.11b/g 1-54 Mbps
  - 802.11a 6-54 Mbps
  - 802.11n MCS0-7
  - 802.11ac MCS0-9

- DFS Master 機能　W53, W56 バンド
  DFS Master function in W53, W56 bands.
  ※SX-SDMAC-2831S、SX-SDMAC-2831C のみ。SX-SDCAC-2830、SX-SDMAC-2830S は非対応。
  SX-SDMAC-2831S, SX-SDMAC-2831C only. SX-SDCAC-2830, SX-SDMAC-2830S are unsupported.

Product No.	Product Name	Certification number	Remarks
ZXE03487	SX-SDMAC-2830S	007-AE0224	DFS Master 非対応 Non DFS Master support
ZXE03493	SX-SDMAC-2830S-SP		
ZXE03491	SX-SDCAC-2830		
ZXE03497	SX-SDCAC-2830-SP		
ZXE04016	SX-SDMAC-2830S-EAL		
ZXE04020	SX-SDMAC-2830S-EAL-SP		
ZXE04019	SX-SDCAC-2830-EAL		
ZXE04023	SX-SDCAC-2830-EAL-SP		
ZXE03490	SX-SDMAC-2831C	201-170874	DFS Master 対応 DFS Master support
ZXE03496	SX-SDMAC-2831C-SP		
ZXE03489	SX-SDMAC-2831S		
ZXE03495	SX-SDMAC-2831S-SP		
ZXE04018	SX-SDMAC-2831C-EAL		
ZXE04017	SX-SDMAC-2831S-EAL		
ZXE04022	SX-SDMAC-2831C-EAL-SP		
ZXE04021	SX-SDMAC-2831S-EAL-SP		

※要 DFS Master 対応ソフトウェア、現時点では FCC DFS Master 未取得
DFS Master software is necessary. FCC DFS Master is not acquired at the moment.

- Bluetooth 5.0 BR/EDR/LE(Class2)。Bluetooth 1.x, 2.x, 3.0, 4.0, 4.1 下位互換
  Bluetooth 5.0 BR/EDR/LE(Class2). Backward-compatible to Bluetooth 1.x, 2.x, 3.0, 4.0, 4.1

- Wireless LAN ホストインターフェイスとして SDIO 3.0 対応
  SDIO3.0 as the Wireless LAN host interface

- Bluetooth ホストインターフェイスとして UART 対応
  UART as the Bluetooth host interface

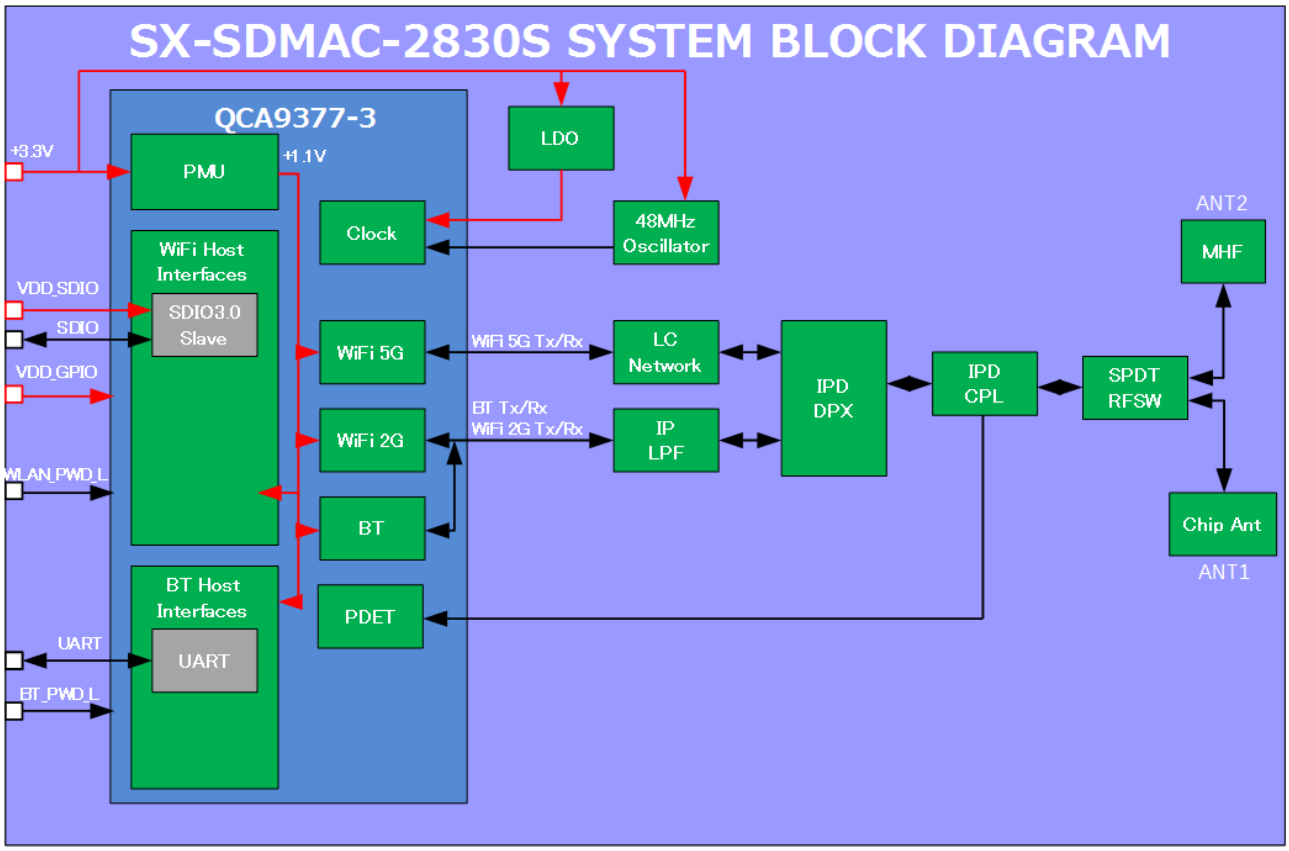
- 主電源+3.3V, IO 電源(VDD_GPIO)+1.8V/+3.3V 選択
  +3.3V main power supply and selectable +1.8V/+3.3V IO power supply (VDD_GPIO)

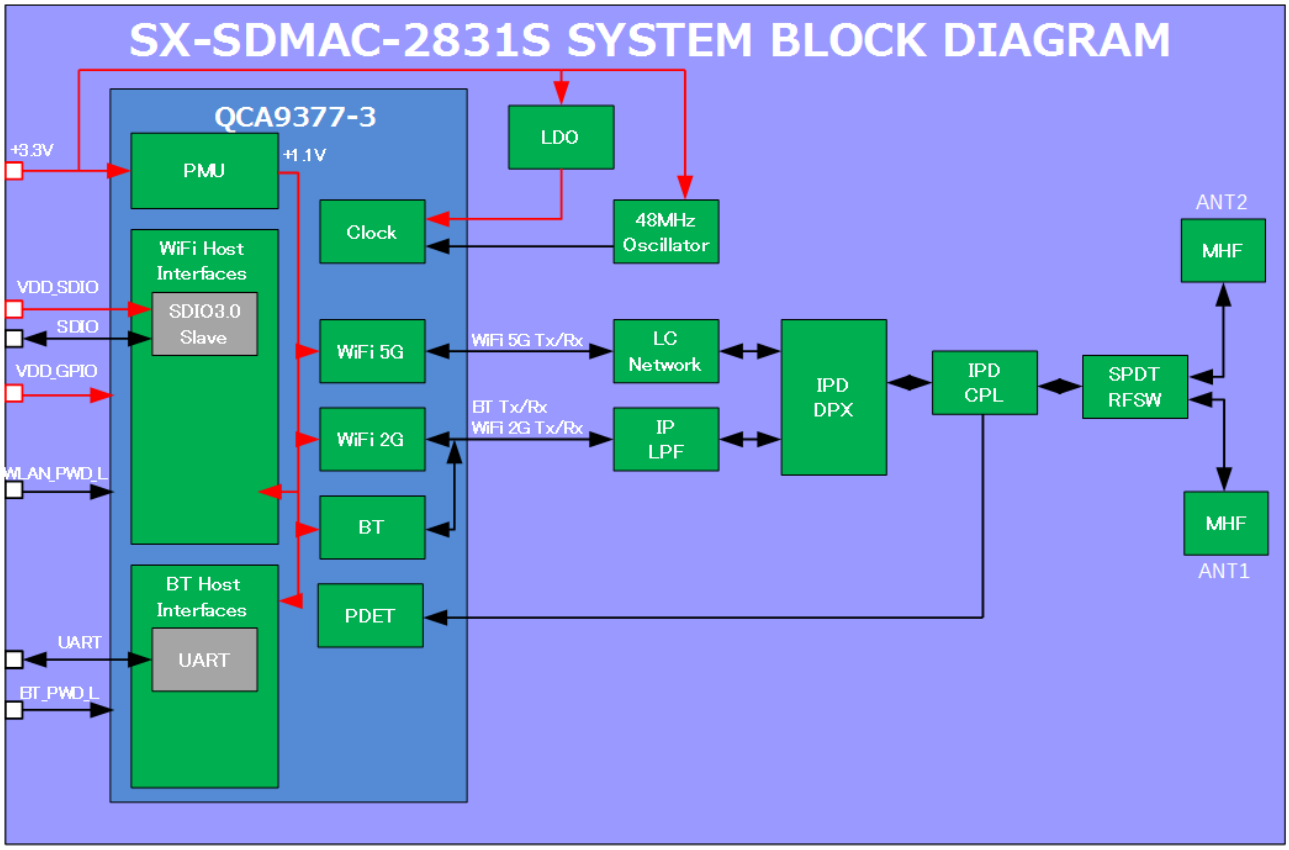
- EU RoHS 指令 2011/65/EC (Lead Free)適合
  EU RoHS directive 2011/65/EC (Lead Free) compliant

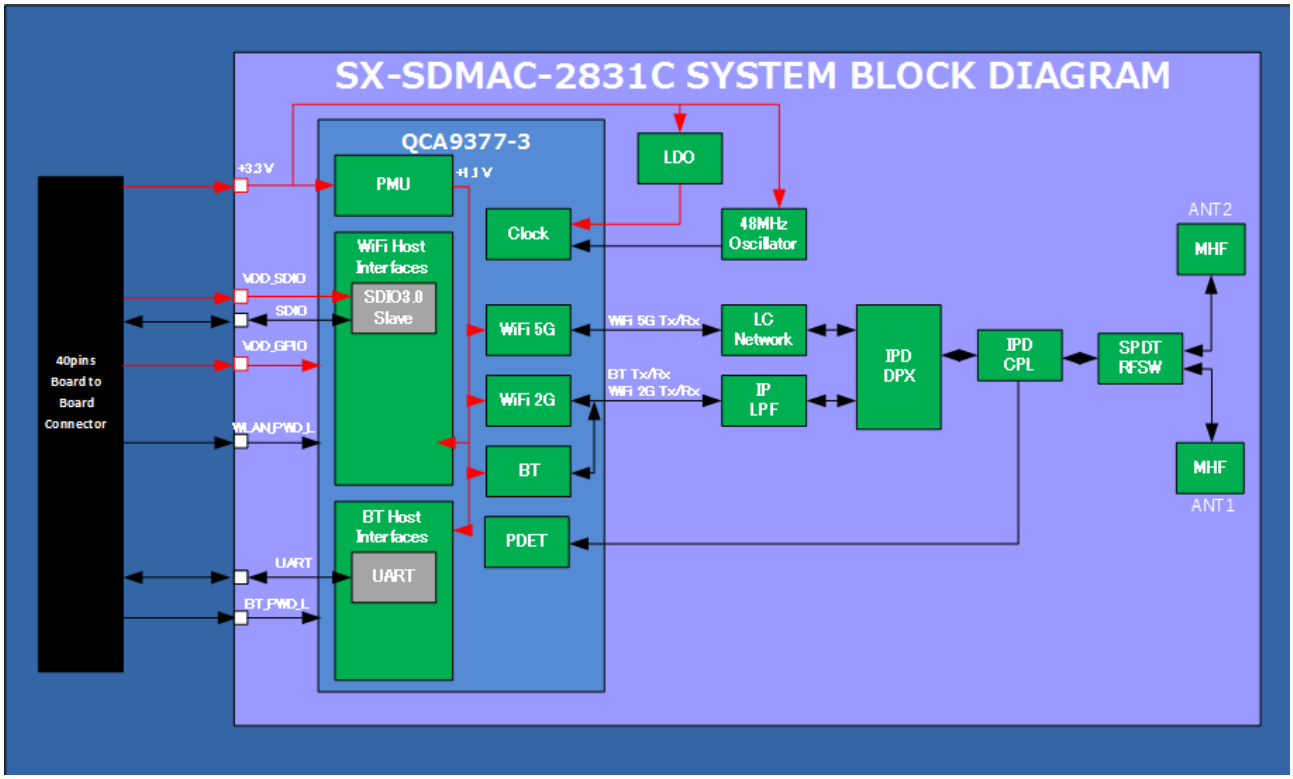
- ~~高速ダイバシティ対応~~（制限機能。将来の SW 更新で対応予定。）
  ~~Fast diversity~~ (Limited function. Supported in the future software update.)

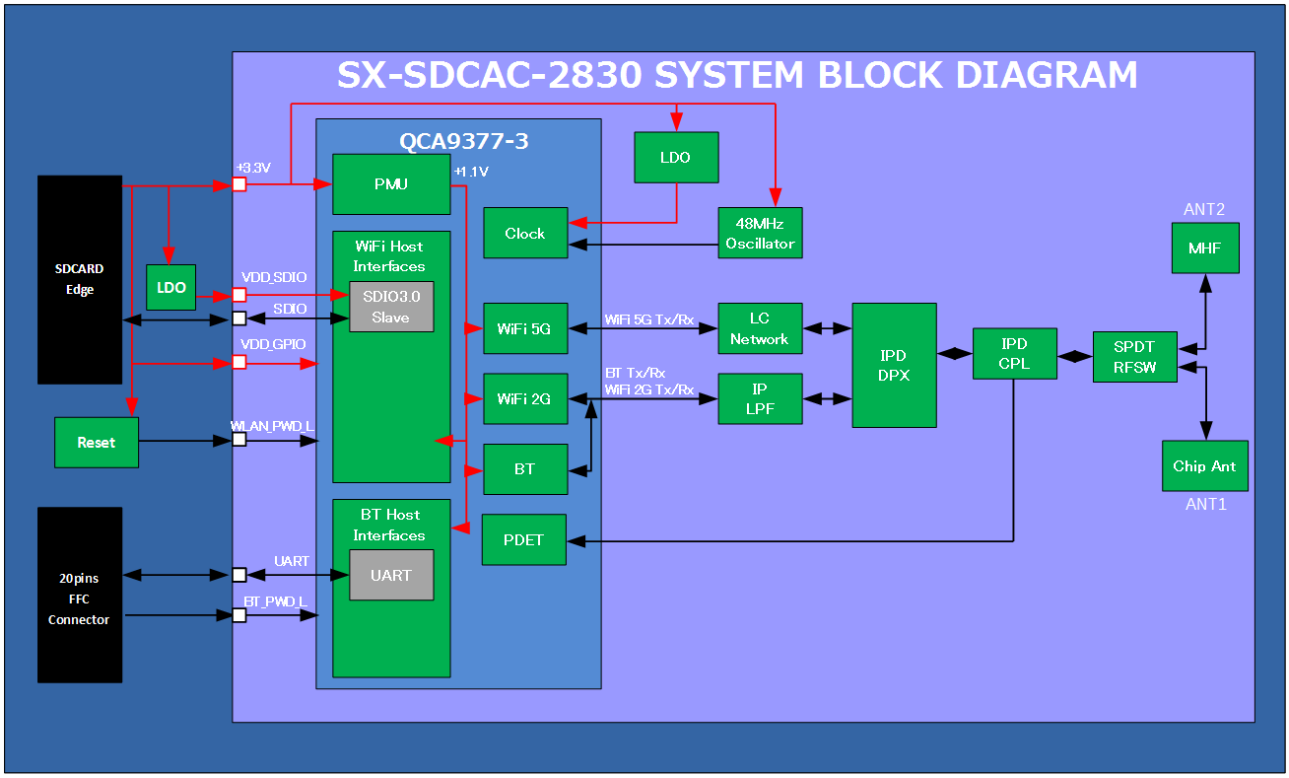
~~※高速ダイバシティ~~
~~Fast diversity~~
~~高速ダイバシティは対向機からの受信信号強度が強いアンテナで送受信するダイバシティです。~~
~~Fast diversity is that SX-SDMAC shall transmit / receive by the antenna whose signal strength of receive packet from opponent is stronger.~~

2. ハードウェアブロック図（Hardware block diagram）






SX-SDMAC-2831C SYSTEM BLOCK DIAGRAM
QCA9377-3
PMU
LDO
Clock
48MHz Oscillator
WiFi Host Interfaces
SDIO3.0 Slave
WiFi 5G
WiFi 2G
BT
PDET
BT Host Interfaces
UART
+3.3V
+1.1V
VDD_SDIO
SDIO
VDD_GPIO
WLAN_PWD_L
UART
BT_PWD_L
40pins Board to Board Connector
WiFi 5G Tx/Rx
BT Tx/Rx
WiFi 2G Tx/Rx
LC Network
IP LPF
IPD DPX
IPD CPL
SPDT RFSW
ANT2
MHF
MHF
ANT1


SX-SDCAC-2830 SYSTEM BLOCK DIAGRAM
QCA9377-3
PMU
LDO
Clock
48MHz Oscillator
WiFi Host Interfaces
SDIO3.0 Slave
WiFi 5G
WiFi 2G
BT
PDET
BT Host Interfaces
UART
+3.3V
+1.1V
SDCARD Edge
LDO
VDD_SDIO
SDIO
VDD_GPIO
Reset
WLAN_PWD_L
20pins FFC Connector
UART
BT_PWD_L
WiFi 5G Tx/Rx
BT Tx/Rx
WiFi 2G Tx/Rx
LC Network
IP LPF
IPD DPX
IPD CPL
SPDT RFSW
ANT2
MHF
Chip Ant
ANT1

略語（Acronyms）

PMU	Power Management Unit
DCDC	DC to DC converter (Switching regulator)
IPD LPF	Integrated Passive Device type Low Pass Filter
IPD DPX	Integrated Passive Device type Diplexer
IPD CPL	Integrated Passive Device type Coupler
SPDT RFSW	Single Pole Double Throw RF switch
MHF	MHF co-axial connector

NOTE1:	ANT1 または ANT2 のどちらか一方を選んで通信を行います。(同時送信はしません) One of antenna (ANT1/ANT2) is chosen to send/receive data. (No concurrent transmission)

3. 基板仕様（Board specifications）

3.1. 一般仕様（General specifications）

Items	Specifications		Units	Remarks
コネクタタイプ Connector Type	SMT：60 pins direct solder pads B2B：40 pins board to board connector SDCARD：WiFi － 9 pins SDCARD Edge BT/Misc. － 20 pins FFC connector		–	B2B connector part number ⇒ 14 5602 040 000 829 H+ FFC connector part number ⇒ 08 6210 020 340 800+ (Kyocera Connector Products)
アンテナポート Antenna port	2830	MHF connector x1 Chip antenna x1	pcs	Chip antenna Unictron H2U84W1H1S (AA077)
	2831	MHF Connector x2		
アンテナポートインピーダンス Antenna port impedance	50		Ω	MHF Connector VSWR < 2.6 (2.4-2.5GHz, 5.18 – 5.825GHz)
インターフェイス Device Interfaces	SDIO v3.0		–	For Wireless LAN
	UART		–	For Bluetooth, up to 4Mbps
無線接続方式 RF Interface	IEEE802.11a/b/g/n/ac		–	IEEE802.11-2012 IEEE802.11ac-2013
	Bluetooth 5.0 BR/EDR/LE		–	Max antenna gain +5dBi@2.4GHz
重さ Weight	SMT type	2830 1.7	g	Typ.
		2831 1.4	g	
	B2B type	2.8	g	Typ.
	SD Card type	6.4	g	Typ.
寸法 Dimensions	SMT W x H x D	2830 19.0 x 30.0 x 2.6	mm	§7 参照。See §7.
		2831 19.0 x 22.0 x 2.6	mm	
	B2B W x H x D	24.0 x 24.0 x 4.8	mm	
	SDCARD	30.00 x 51.00 x 6.15	mm	
MTTF	90,000		h	Min.
コネクタ挿抜回数 Connector mating number of times	10		Times	Max. SX-SDMAC-2831C
	10		Times	Max. SX-SDCAC-2830, FFC
	100		Times	Max. SX-SDCAC-2830, SD edge
リフロー回数 Reflow number of times	2		Times	Max. SX-SDMAC-2830S/2831S
ESD 耐性 ESD resistance	General pins	+/-2000	V	Max. Human Body Model at RF Port. JS-001-2012(JESD22-A114F) Class 2 device 電源無印加。Not powered.
	Antenna pins	+/-2000		

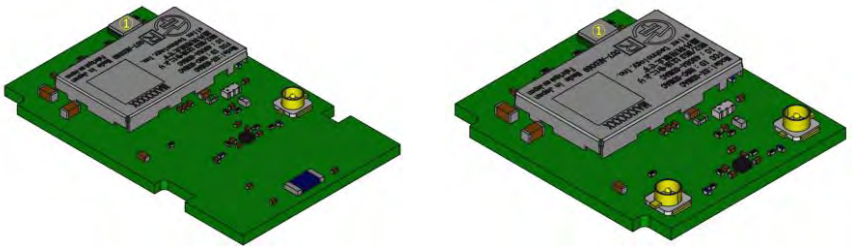
3.2. 環境条件（Environmental specifications）

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
動作温度 Operating Temperature	-40	–	+85	℃	周囲温度 *NOTE 1 Ambient temperature *NOTE 1 実装後電源電圧印加時 After assembled with powered
動作湿度 Operating humidity	15	–	95	%RH	結露無きこと Non condensing 実装後電源電圧印加時 After assembled with powered
保存温度 Assembled storage temperature	-40	–	+105	℃	実装後電源電圧無印加時 After assembled with no-powered
保存湿度 Assembled storage humidity	10	–	95	%RH	結露無きこと Non condensing 実装後電源電圧無印加時 After assembled with no-powered
保管温度 Storage temperature	5	–	+35	℃	梱包時。開封後は MSL に従う。 Packaged. Apply MSL after unpackaged.
保管湿度 Storage humidity	20	–	60	%RH	結露無きこと Non condensing 梱包時。開封後は MSL に従う。 Packaged. Apply MSL after unpackaged.
Moisture Sensitivity Level	3			–	IPC/JEDEC J-STD-020D 取り扱いについては下記を参照。 See below standard for handling. IPC/JEDEC J-STD-033C *SX-SDMAC-2830S/SX-SDMAC-2831S only *NOTE 2

NOTE1 但し、下記で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。

However, case temperature (Tc) must not be higher than temperature defined below.

Num	Device name	Tc (Max)	Unit
①	Oscillator	+100	℃



NOTE2	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有った場合は、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。 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.
NOTE3	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 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。 In case ≦30°C/60%RH with handling rule of JEDEC-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.

3.3. 電気的仕様（Electrical specifications）

絶対最大定格（Absolute Maximum Ratings）

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
主電源電圧（VDD） Main Power supply voltage	-0.30	–	+3.65	V	
IO 電源電圧（VDD_GPIO） IO Power supply voltage	-0.30	–	+4.00	V	
SDIO 電源電圧(VDD_SDIO) SDIO Power supply voltage	-0.30	–	+4.00	V	

推奨動作条件（Recommended Operating Conditions）

主電源 / Bluetooth 電源(Main power supply/Bluetooth power supply)

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
主電源電圧（VDD） Main Power supply voltage	+3.135	+3.30	+3.465	V	

IO 電源/SDIO 電源 +3.3V 動作（IO power supply/SDIO power supply, +3.3V operation）

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
IO 電源電圧（VDD_GPIO） IO Power supply voltage	+3.14	+3.30	+3.46	V	
SDIO 電源電圧(VDD_SDIO) SDIO Power supply voltage	+3.14	+3.30	+3.46	V	

IO 電源/SDIO 電源 +1.8V 動作（IO power supply/SDIO power supply, +1.8V operation）

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
IO 電源電圧（VDD_GPIO） IO Power supply voltage	+1.71	+1.80	+1.89	V	
SDIO 電源電圧(VDD_SDIO) SDIO Power supply voltage	+1.71	+1.80	+1.89	V	

デジタル論理信号レベル（Digital logic signal level）

1) V_{IO} (VDD_GPIO, VDD_SDIO) = +3.3V operation

Items	Parameters	Specifications				Units	Remarks
		Output/Input current	Min.	Typ.	Max.		
V_{IH}	入力 High レベル電圧 Input High Voltage	–	0.7 x V_{IO}	+3.3	V_{IO} + 0.3	V	
V_{IL}	入力 Low レベル電圧 Input Low Voltage	–	-0.3	–	0.3 x V_{IO}	V	
V_{OH}	出力 High レベル電圧 Output High Voltage	I_{OH} = 3mA	V_{IO} - 0.4	–	–	V	
V_{OL}	出力 Low レベル電圧 Output Low Voltage	I_{OL} = -11mA	–	–	0.1 x V_{IO}	V	

2) V_{IO} (VDD_GPIO, VDD_SDIO) = +1.8V operation

Items	Parameters	Specifications				Units	Remarks
		Output/Input current	Min.	Typ.	Max.		
V_{IH}	入力 High レベル電圧 Input High Voltage	–	0.7 x V_{IO}	+1.8	V_{IO} + 0.2	V	
V_{IL}	入力 Low レベル電圧 Input Low Voltage	–	-0.3	–	0.3 x V_{IO}	V	
V_{OH}	出力 High レベル電圧 Output High Voltage	I_{OH} = 3mA	V_{IO} - 0.4	–	V_{IO}	V	
V_{OL}	出力 Low レベル電圧 Output Low Voltage	I_{OL} = -11mA	–	–	0.1 x V_{IO}	V	

NOTE1	全ての I/O ピンにはシュミットトリガ回路が入っています。 シュミットヒステリシスは +1.8V IO：375mV (Typ.), +3.3V IO：645mV (Typ.)です。 Schmitt trigger is prepared for all I/O pins. Schmitt hysteresis is +1.8V IO：375mV (Typ.), +3.3V IO：645mV (Typ.).
NOTE2	UHS-I(Ultra High Speed)モードでは VDD_SDIO は+1.8V のみ対応となります。 HS(High Speed)/DS(Default Speed)モードでは VDD_SDIO は+3.3V / +1.8V 対応となります。 Supported only VDD_SDIO=+1.8V as UHS-I (Ultra High Speed) mode. Supported only VDD_SDIO=+1.8V/+3.3V as HS (High Speed) and DS (Default Speed) mode.

3.4. 消費電流仕様（Current consumption specifications）

VDD (WLAN operating)

Items	Specifications				Units	Remarks
	Modes	Standards	Typ.	Max.		
消費電流 Current consumption 2.4GHz	Tx	11b	350	400	mA	
		11g	320	390	mA	
		11ng HT20	320	380	mA	
		11ng HT40	320	380	mA	
	Rx	All mode	70	110	mA	
消費電流 Current consumption 5GHz	Tx	11a	430	570	mA	
		11na HT20	440	570	mA	
		11na HT40	430	550	mA	
		11ac VHT80	430	530	mA	
	Rx	All mode	90	140	mA	

VDD (BT operating)

Items	Specifications			Units	Remarks
	Modes	Typ.	Max.		
消費電流 Current consumption	Tx	20	30	mA	
	Rx	20	40	mA	

VDD_GPIO

Items	Specifications				Units	Remarks
	Modes		Typ.	Max.		
消費電流 Current consumption	Tx	+1.8V operation	7	15	mA	
		+3.3V operation	7	15	mA	
	Rx	+1.8V operation	7	15	mA	
		+3.3V operation	7	15	mA	

VDD_SDIO

Items	Specifications				Units	Remarks
	Modes		Typ.	Max.		
消費電流 Current consumption	Tx	+1.8V operation	3	10	mA	
		+3.3V operation	3	10	mA	
	Rx	+1.8V operation	3	10	mA	
		+3.3V operation	3	10	mA	

NOTE1:	Typ.: テストツールの連続送信/受信時における平均電流の個体バラつきの平均値。 Average value of unevenness of average current per unit with continuous transmit/receive mode of the test tool. Max.: テストツールの連続送信/受信時におけるピーク電流の個体バラつきの最大値。 Maximum value of unevenness of peak current per unit with continuous transmit/receive mode of the test tool.
NOTE2：	総電力は VDD(WLAN operating)と VDD_SDIO、VDD_GPIO の総和になります。モードによる組合せにご注意ください。 Total power consumption is total of VDD (WLAN operating), VDD_SDIO and VDD_GPIO. Note that combination of each mode.

3.5. 無線 LAN 一般仕様（Wireless LAN general specifications）

Items	Specifications				Units	Remarks
チップセット Chipset	QCA9377-3 (Qualcomm Atheros)				–	
国/地域コード Country/Domain code	0x0000				–	NOTE1
動作周波数 Operating Frequency range	Band	Modes	Min	Max		
	2.4GHz	11b	2412	2472	MHz	
		11g/n/ac 20MHz	2412	2472	MHz	
		11g/n/ac 40MHz	2422	2462	MHz	
	5GHz	11a/n/ac 20MHz	5180	5825	MHz	
		11n/ac 40MHz	5190	5795	MHz	
		11ac 80MHz	5210	5775	MHz	
周波数間隔 Frequency step	2.4GHz	11b/g/n	5		MHz	
	5GHz	11a/n/ac 20MHz	20		MHz	
		11n/ac 40MHz	40		MHz	
		11ac 80MHz	80		MHz	
リンクデータレート Link Data Rate	11b	1,2,5.5L,5.5S,11L,11S			Mbps	
	11a/g	6,9,12,18,24,36,48,54			Mbps	
	11n	MCS 0,1,2,3,4,5,6,7			–	
	11ac	MCS 0,1,2,3,4,5,6,7,8,9			–	
変調型 Modulation type	11b	DSSS(DBPSK,DQPSK,CCK)			–	
	11a/g/n	OFDM(BPSK,QPSK,16QAM,64QAM)			–	
	11ac	OFDM(BPSK,QPSK,16QAM,64QAM,256QAM)			–	
暗号化 Encryption	RC4	128			bits	
	AES	128			bits	

NOTE	国/地域コードについて（Country/Region code） モジュールにはデフォルトで国/地域コードとして 0x0000 が書かれています。 モジュールのロード時にドライバにより任意のコードに書き換えてご使用ください。 0x0000 is programed into the memory of the module as the default value. This code is assumed to be changed to the other code by driver when the module is loaded.

利用可能チャネルリスト（Operatable channel list）

2.4GHz	US/CA	20MHz	Ch.1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
		40MHz	Ch.3, 4, 5, 6, 7, 8, 9
	EU/JP	20MHz	Ch.1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
		40MHz	Ch.3, 4, 5, 6, 7, 8, 9, 10, 11
5GHz	US	20MHz	Ch.36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140,144,149,153,157,161,165
		40MHz	Ch.38,46,54,62,102,110,118,126,134,142,151,159
		80MHz	Ch.42,58,106,122,138,155
	CA	20MHz	Ch.36,40,44,48,52,56,60,64,100,104,108,112,116,132,136,140,144,149,153,157,161,165
		40MHz	Ch.38,46,54,62,102,110,134,142,151,159
		80MHz	Ch.42,58,106,138,155
	EU/JP	20MHz	Ch.36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140
		40MHz	Ch.38,46,54,62,102,110,118,126,134
		80MHz	Ch.42,58,106,122

3.6. 無線 LAN 送信仕様（Wireless LAN Transmitter specifications）

IEEE 802.11 規格に準拠した最大送信電力値を示すものです。
ただし、各チャネルの最終的な送信電力値は、各国の電波法認証により制限を受けます。

There is maximum TX power which is compliant with IEEE 802.11 standard.
Actual TX Power value of each channel is limited by the regulatory certification of each country, however.

2.4GHz (+25℃)

Standard	Modulation	Data Rates	2.4 GHz TX Power with IEEE 802.11 EVM and Spectral Mask at +25°C			
		Index	802.11b/g	802.11n/ac 20 MHz	802.11n/ac 40 MHz	Units
			Typical	Typical	Typical	
802.11b	BPSK	1Mbps	21.5	-	-	dBm
	QPSK	2 Mbps	21.5	-	-	dBm
	CCK	5.5 Mbps	21.5	-	-	dBm
	CCK	11 Mbps	21.5	-	-	dBm
802.11g	BPSK	6 Mbps	21.0	-	-	dBm
	BPSK	9 Mbps	21.0	-	-	dBm
	QPSK	12 Mbps	21.0	-	-	dBm
	QPSK	18 Mbps	21.0	-	-	dBm
	16 QAM	24 Mbps	19.0	-	-	dBm
	16 QAM	36 Mbps	18.5	-	-	dBm
	64 QAM	48 Mbps	17.0	-	-	dBm
	64 QAM	54 Mbps	16.0	-	-	dBm
802.11n/ac	BPSK	MCS0	-	21.0	19.0	dBm
	QPSK	MCS1	-	21.0	19.0	dBm
	QPSK	MCS2	-	21.0	19.0	dBm
	16 QAM	MCS3	-	19.5	18.0	dBm
	16 QAM	MCS4	-	18.5	17.0	dBm
	64 QAM	MCS5	-	16.5	17.0	dBm
	64 QAM	MCS6	-	16.0	16.0	dBm
	64 QAM	MCS7	-	15.5	15.5	dBm
802.11ac (optional)	256 QAM	MCS8	-	14.5	14.5	dBm
	256 QAM	MCS9	-	-	13.0	dBm

5GHz (+25℃)

Standard	Modulation	Data Rates	5 GHZ TX Power with IEEE 802.11 EVM and Spectral Mask at +25°C				
		Index	802.11a	802.11n/ac 20 MHz	802.11n/ac 40 MHz	802.11n/ac 80 MHz	Units
			Typical	Typical	Typical	Typical	
802.11a	BPSK	6 Mbps	13.5	-	-	-	dBm
	BPSK	9 Mbps	13.5	-	-	-	dBm
	QPSK	12 Mbps	13.5	-	-	-	dBm
	QPSK	18 Mbps	13.0	-	-	-	dBm
	16 QAM	24 Mbps	12.5	-	-	-	dBm
	16 QAM	36 Mbps	10.5	-	-	-	dBm
	64 QAM	48 Mbps	10.5	-	-	-	dBm
	64 QAM	54 Mbps	9.0	-	-	-	dBm
802.11n/ac	BPSK	MCS0	-	13.5	12.5	12.0	dBm
	QPSK	MCS1	-	13.5	12.5	12.0	dBm
	QPSK	MCS2	-	13.5	12.5	12.0	dBm
	16 QAM	MCS3	-	12.0	12.5	12.0	dBm
	16 QAM	MCS4	-	12.0	11.5	12.0	dBm
	64 QAM	MCS5	-	10.5	10.0	10.5	dBm
	64 QAM	MCS6	-	9.5	10.0	9.5	dBm
	64 QAM	MCS7	-	9.0	9.0	9.5	dBm
802.11ac (optional)	256 QAM	MCS8	-	8.0	8.0	7.5	dBm
	256 QAM	MCS9	-	-	5.5	7.5	dBm

NOTE1	各チャネルの最終的な送信電力値は、認証により制限を受けます。FCC/CE および MIC により制限された送信電力値は §19 に記載されています。 Actual TX Power value of each channel is limited by the regulatory certification. Please refer to the product specifications §19 regarding limited TX Power by FCC/CE and MIC.
NOTE2	ノーマルモード(非テストモード)で測定する際は Green Tx などの送信電力を動的に変える機能は無効として測定してください。 The function that changes transmit power dynamically such as Green Tx must be disabled when measure transmit power in normal mode (Non-test mode).

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	802.11a	6-54Mbps	-2.0	−	+2.0	dB	
	802.11b	1-11Mbps	-2.0	−	+2.0	dB	
	802.11g	6-54Mbps	-2.0	−	+2.0	dB	
	802.11n/ac	MSC0-9	-2.0	−	+2.0	dB	

Frequency accuracy (Operating temperature)

Items	Specifications				Units	Remarks
	Standards	Min.	Typ.	Max.		
周波数精度 Frequency accuracy	11a/11b/11g/11n/11ac	-20	0	+20	ppm	

3.7. 無線 LAN 受信仕様（Wireless LAN Receiver specifications）

2.4GHz 動作温度（Operating temperature）

Items	Specifications					Units	Remarks
	Modes		Min.	Typ.	Max.		
最小受信感度 Receiver minimum sensitivity	11b (FER<8%)	1Mbps	–	-95	-80	dBm	
		2Mbps	–	-93	-80	dBm	
		5.5Mbps	–	-92	-76	dBm	
		11Mbps	–	-91	-76	dBm	
	11g (PER<10%)	6Mbps	–	-90	-82	dBm	
		9Mbps	–	-89	-81	dBm	
		12Mbps	–	-88	-79	dBm	
		18Mbps	–	-87	-77	dBm	
		24Mbps	–	-86	-74	dBm	
		36Mbps	–	-83	-70	dBm	
		48Mbps	–	-79	-66	dBm	
		54Mbps	–	-78	-65	dBm	
	11n/ac 20MHz (PER<10%)	MCS0	–	-90	-82	dBm	HT/VHT
		MCS1	–	-88	-79	dBm	HT/VHT
		MCS2	–	-87	-77	dBm	HT/VHT
		MCS3	–	-84	-74	dBm	HT/VHT
		MCS4	–	-81	-70	dBm	HT/VHT
		MCS5	–	-78	-66	dBm	HT/VHT
		MCS6	–	-76	-65	dBm	HT/VHT
		MCS7	–	-74	-64	dBm	HT/VHT
		MCS8	–	-69	-59	dBm	VHT
	11n/ac 40MHz (PER<10%)	MCS0	–	-87	-79	dBm	HT/VHT
		MCS1	–	-86	-76	dBm	HT/VHT
		MCS2	–	-84	-74	dBm	HT/VHT
		MCS3	–	-81	-71	dBm	HT/VHT
		MCS4	–	-78	-67	dBm	HT/VHT
		MCS5	–	-74	-63	dBm	HT/VHT
		MCS6	–	-73	-62	dBm	HT/VHT
		MCS7	–	-72	-61	dBm	HT/VHT
		MCS8	–	-67	-56	dBm	VHT
		MCS9	–	-65	-54	dBm	VHT

5GHz 動作温度（Operating temperature）

Items	Specifications					Units	Remarks
	Modes		Min.	Typ.	Max.		
最小受信感度 Receiver minimum sensitivity	11a (PER<10%)	6Mbps	–	-85	-82	dBm	
		9Mbps	–	-84	-81	dBm	
		12Mbps	–	-83	-79	dBm	
		18Mbps	–	-82	-77	dBm	
		24Mbps	–	-81	-74	dBm	
		36Mbps	–	-78	-70	dBm	
		48Mbps	–	-74	-66	dBm	
		54Mbps	–	-73	-65	dBm	
	11n/ac 20MHz (PER<10%)	MCS0	–	-85	-82	dBm	HT/VHT
		MCS1	–	-83	-79	dBm	HT/VHT
		MCS2	–	-81	-77	dBm	HT/VHT
		MCS3	–	-79	-74	dBm	HT/VHT
		MCS4	–	-75	-70	dBm	HT/VHT
		MCS5	–	-72	-66	dBm	HT/VHT
		MCS6	–	-71	-65	dBm	HT/VHT
		MCS7	–	-70	-64	dBm	HT/VHT
		MCS8	–	-65	-59	dBm	VHT
	11n/ac 40MHz (PER<10%)	MCS0	–	-82	-79	dBm	HT/VHT
		MCS1	–	-81	-76	dBm	HT/VHT
		MCS2	–	-79	-74	dBm	HT/VHT
		MCS3	–	-76	-71	dBm	HT/VHT
		MCS4	–	-73	-67	dBm	HT/VHT
		MCS5	–	-70	-63	dBm	HT/VHT
		MCS6	–	-68	-62	dBm	HT/VHT
		MCS7	–	-67	-61	dBm	HT/VHT
		MCS8	–	-63	-56	dBm	VHT
		MCS9	–	-61	-54	dBm	VHT
	11ac 80MHz (PER<10%)	MCS0	–	-80	-76	dBm	HT/VHT
		MCS1	–	-78	-73	dBm	HT/VHT
		MCS2	–	-76	-71	dBm	HT/VHT
		MCS3	–	-74	-68	dBm	HT/VHT
		MCS4	–	-70	-64	dBm	HT/VHT
		MCS5	–	-67	-60	dBm	HT/VHT
		MCS6	–	-65	-59	dBm	HT/VHT
		MCS7	–	-64	-58	dBm	HT/VHT
		MCS8	–	-60	-53	dBm	VHT
		MCS9	–	-59	-51	dBm	VHT

3.8. Bluetooth 一般仕様（Bluetooth general specifications）

Items	Specifications			Units	Remarks
チップセット Chipset	QCA9377-3 (Qualcomm Atheros)			–	
コア仕様 Core specification	Bluetooth 5.0			–	Max antenna gain +5.0dBi@2.4GHz
動作周波数 Operating Frequency range	Mode	Min	Max		
	BR/EDR/LE	2402	2480	MHz	
周波数間隔 Frequency step	BR/EDR	1		MHz	Ch.1-Ch.79
	LE	2		MHz	Ch.0-Ch.39
変調方式 Modulation type	GFSK(1Mbps),Π/4 DQPSK(2Mbps),8DPSK(3Mbps)			–	
暗号化 Encryption	E0	128		bits	BR/EDR
	AES	128		bits	LE

3.9. Bluetooth 送信仕様（Bluetooth Transmitter specifications）

Bluetooth BR/EDR/LE (+25℃)

Items	Specifications						Units	Remarks
	Standards			Min.	Typ.	Max.		
最大送信電力 Maximum TX power	BR	Class 2	Ch.1-Ch.79	-3.7	+0.5	+4.0	dBm	Class 2
	EDR	Class 2	Ch.1-Ch.79	-6.7	-2.5	+1.0	dBm	Class 2
	LE		Ch.0-Ch.39	-4.2	+1.5	+3.5	dBm	
送信電力ステップ Tx power step	BR/EDR		Ch.1-Ch.79	2.0	–	8.0	dB	8 steps

Frequency accuracy (Operating temperature)

Items	Specifications				Units	Remarks
	Standards	Min.	Typ.	Max.		
中心周波数精度 Center frequency accuracy	BR/EDR/LE	-20	–	+20	ppm	

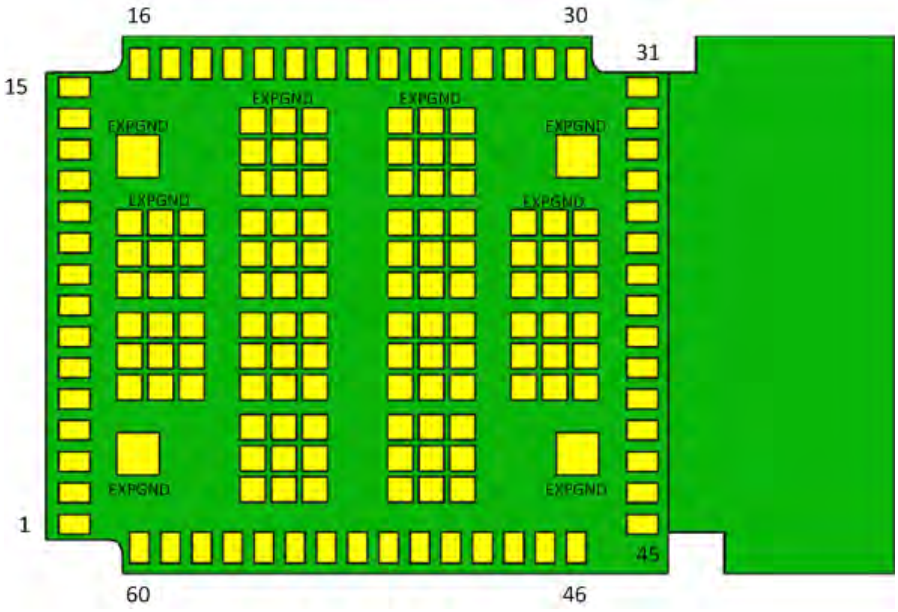
3.10. Bluetooth 受信仕様（Bluetooth Receiver specifications）

Bluetooth BR/EDR/LE (Operating temperature)

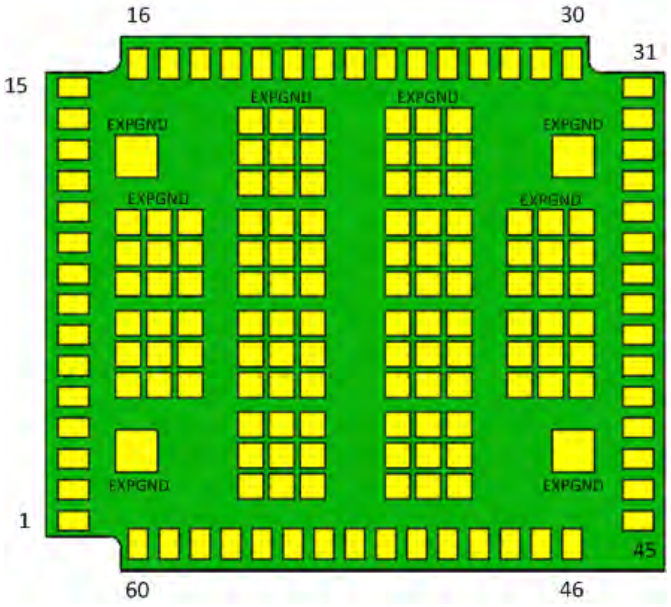
Items	Specifications					Units	Remarks
最小受信感度 Receiver minimum Sensitivity	Standards	Packet Types	Min.	Typ.	Max.		
	BR (BER<0.1%)	GFSK (1Mbps)	–	-90	-70	dBm	
	EDR (BER<0.01%)	Π/4 DQPSK (2Mbps)	–	-89	-70	dBm	
		8DPSK (3Mbps)	–	-84	-70	dBm	
	LE (PER<30%)	GFSK (1Mbps)	–	-94	-70	dBm	

4. 信号仕様（Signal pin specifications）

4.1. SMT type ピン配置（SMT type pin locations）



SX-SDMAC-2830S (Bottom view)



SX-SDMAC-2831S (Bottom view)

4.2. SMT type 信号仕様（SMT type signal descriptions）

Pin Number	Pin Name	Type	I/O Domain	Descriptions
1	RESERVED	DI	VDD_GPIO	未使用信号。未接続処理(Open)とする。 Un-used signal. Keep Open.
2	RESERVED	DO	VDD_GPIO	未使用信号。未接続処理(Open)とする。 Un-used signal. Keep Open.
3	GND	GND	GND	Ground
4	NC	NC	NC	NC pin
5	NC	NC	NC	NC pin
6	VDD	P	P	主電源 +3.135～+3.465V。 Main Power Supply +3.135V to +3.465V
7	WLAN_PWD_L	PD	VDD_GPIO	WLAN HW リセット信号。(0=Disable, 1=Enable)内部 Pull-down。 WLAN reset. (0=Disable, 1=Enable) Internal Pull-down.
8	RESERVED	DO	VDD_SDIO	未使用信号。未接続処理(Open)とする。Bootstrap option に使用されているため、Reset 解除まではドライブしないください。内部 Pull-up Un-used signal. Keep Open. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Internal Pull-up.
9	GND	GND	GND	Ground
10	VDD_GPIO	P	P	IO 電源。+1.71 ～ +3.46V。 IO power supply +1.71 to +3.46V.
11	VDD_SDIO	P	P	WLAN SDIO 電源 +1.71～+3.46V。 WLAN SDIO Power supply +1.71 to +3.46V.
12	VDD_SDIO	P	P	WLAN SDIO 電源 +1.71～+3.46V。 WLAN SDIO Power supply +1.71 to +3.46V.
13	VDD	P	P	主電源 +3.135～+3.465V。 Main Power Supply +3.135V to +3.465V
14	VDD	P	P	主電源 +3.135～+3.465V。 Main Power Supply +3.135V to +3.465V
15	VDD	P	P	主電源 +3.135～+3.465V。 Main Power Supply +3.135V to +3.465V

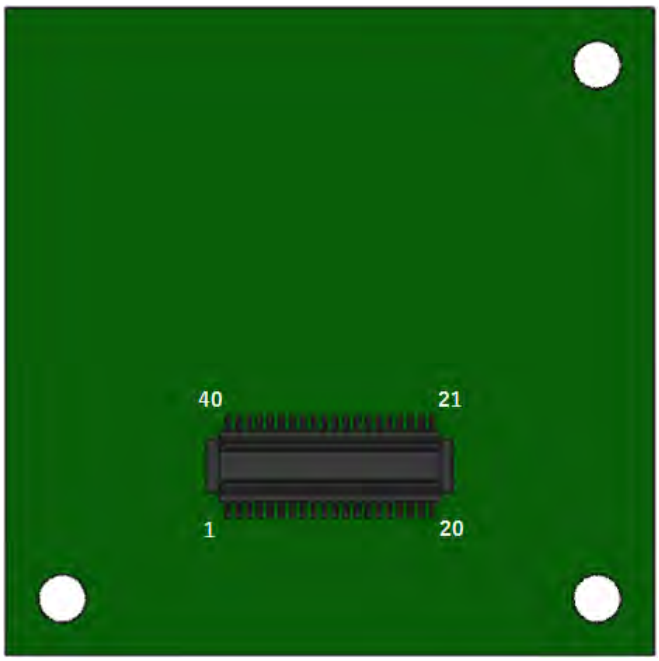
Pin Number	Pin Name	Type	I/O Domain	Descriptions
16	SD_CMD	B	VDD_SDIO	WLAN 用 SDIO Command 信号。 SDIO command for WLAN.
17	SD_D3	B	VDD_SDIO	WLAN 用 SDIO Data[3]信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。内部 Pull-up。 SDIO Data[3] for WLAN. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Internal Pull-up.
18	SD_D2	B	VDD_SDIO	WLAN 用 SDIO Data[2]信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。内部 Pull-up。 SDIO Data[2] for WLAN. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Internal Pull-up
19	SD_D1	B	VDD_SDIO	WLAN 用 SDIO Data[1]信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。内部 Pull-up。 SDIO Data[1] for WLAN. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Internal Pull-up
20	SD_D0	B	VDD_SDIO	WLAN 用 SDIO Data[0]信号。 SDIO Data[0] for WLAN.
21	GND	GND	GND	Ground
22	SD_CLK	DI	VDD_SDIO	WLAN 用 SDIO clock 信号。 SDIO Clock for WLAN.
23	GND	GND	GND	Ground
24	BT_UART_RXD	DI	VDD_GPIO	BT 用 UART RXD 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT 未使用時は未接続処理(Open)とする。内部 Pull-up。 UART RXD for BT. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT is not used. Internal Pull-up.
25	BT_UART_CTS	DI	VDD_GPIO	BT 用 UART CTS 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT 未使用時は未接続処理(Open)とする。内部 Pull-up。 UART CTS for BT. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT is not used. Internal Pull-up.
26	BT_UART_TXD	DO	VDD_GPIO	BT 用 UART TXD 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT 未使用時は未接続処理(Open)とする。内部 Pull-up。 UART TXD for BT. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT is not used. Internal Pull-up.
27	BT_UART_RTS	DO	VDD_GPIO	BT 用 UART RTS 信号。BT 未使用時は未接続処理(Open)とする。 UART RTS for BT. Keep Open if BT is not used.
28	VDD	P	P	主電源 +3.135～+3.465V。 Main Power Supply +3.135V to +3.465V
29	VDD	P	P	主電源 +3.135～+3.465V。 Main Power Supply +3.135V to +3.465V
30	VDD	P	P	主電源 +3.135～+3.465V。 Main Power Supply +3.135V to +3.465V

Pin Number	Pin Name	Type	I/O Domain	Descriptions
31	RESERVED	DI	VDD	未使用信号。未接続処理(Open)とする。 Un-used signal. Keep Open.
32	GND	GND	GND	Ground
33	GND	GND	GND	Ground
34	GND	GND	GND	Ground
35	GND	GND	GND	Ground
36	GND	GND	GND	Ground
37	GND	GND	GND	Ground
38	GND	GND	GND	Ground
39	GND	GND	GND	Ground
40	GND	GND	GND	Ground
41	GND	GND	GND	Ground
42	GND	GND	GND	Ground
43	GND	GND	GND	Ground
44	GND	GND	GND	Ground
45	GND	GND	GND	Ground

Pin Number	Pin Name	Type	I/O Domain	Descriptions
46	RESERVED	OD	Open drain	未使用信号。VDD_GPIO へ外部 Pull-up、Test pad への接続を推奨。(もしくは Open とする。) オープンドレイン出力。 Un-used signal. Recommended to connect to a test pad and Pull-up by VDD_GPIO. (or keep Open) Open drain output.
47	WOW	OD	Open drain	Wake on wireless 信号。アクティブ High。オープンドレイン出力。要 VDD への外部 Pull-up。 Wake on wireless signal. Active High. Open drain output. Need external pull-up to VDD.
48	BT_I2S_WS	B	VDD_GPIO	BT PCM SYNC 信号。BT Audio 未使用時は未接続処理(Open)とする。 内部 Pull-down. *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM SYNC. Keep Open if BT Audio is not used. Internal pull-down. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
49	BT_I2S_SCK	PD	VDD_GPIO	BT PCM BCK 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT Audio 未使用時は未接続処理(Open)とする。内部 Pull-down. *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM BCK. Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT Audio is not used. Internal Pull-down. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
50	BT_I2S_SDI	DI	VDD_GPIO	BT PCM IN 信号。BT Audio 未使用時は未接続処理(Open)とする。 *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM IN. Keep Open if BT Audio is not used. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
51	BT_I2S_SDO	DO	VDD_GPIO	BT PCM OUT 信号。BT Audio 未使用時は未接続処理(Open)とする。 *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM OUT. Keep Open if BT Audio is not used. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
52	GND	GND	GND	Ground

Pin Number	Pin Name	Type	I/O Domain	Descriptions
53	RESERVED	PD	VDD	未使用信号。OPEN とする。内部 Pull-down Un-used signal. Keep Open. Internal Pull-down
54	GND	GND	GND	Ground
55	RESERVED	PD	VDD	未使用信号。OPEN とする。内部 Pull-down Un-used signal. Keep Open. Internal Pull-down.
56	NC	NA	NA	NC pin
57	GND	GND	GND	Ground
58	BT_PWD_L	PD	VDD_GPIO	BT の HW リセット信号。(0=Disable, 1=Enable) 内部 Pull-down。 BT HW reset. (0=Disable, 1=Enable) Internal Pull-down.
59	NC	NA	NA	NC pin
60	NC	NA	NA	NC pin

4.3. B2B type ピン配置（B2B type pin locations）



BOTTOM VIEW

4.4. B2B type 信号仕様（B2B type signal descriptions）

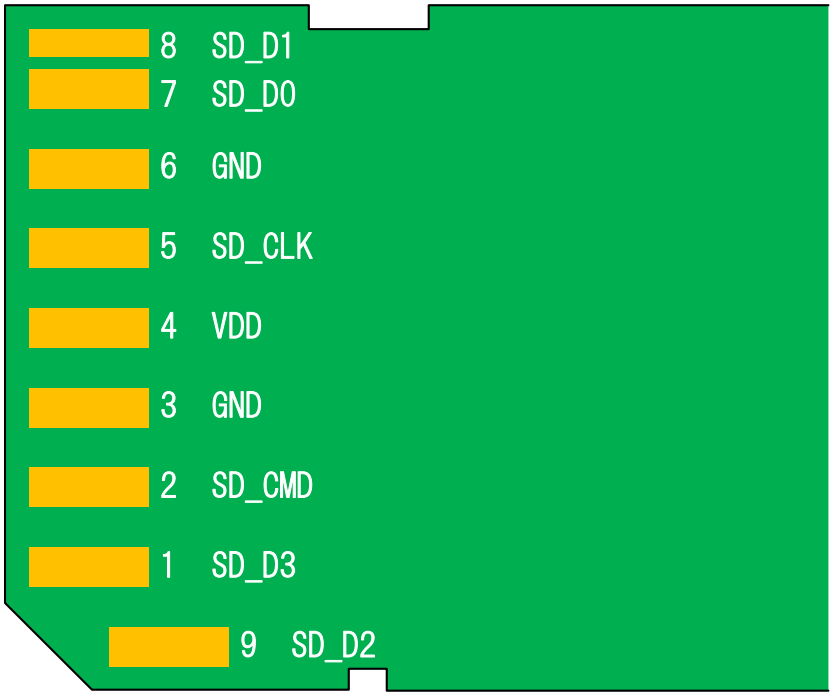
Pin Number	Pin Name	Type	I/O Domain	Descriptions
1	VDD	P	P	主電源 +3.135～+3.465V。 Main Power Supply +3.135V to +3.465V
2	VDD	P	P	主電源 +3.135～+3.465V。 Main Power Supply +3.135V to +3.465V
3	VDD	P	P	主電源 +3.135～+3.465V。 Main Power Supply +3.135V to +3.465V
4	BT_UART_RTS	DO	VDD_GPIO	BT 用 UART RTS 信号。BT 未使用時は未接続処理(Open)とする。 UART RTS for BT. Keep Open if BT is not used.
5	BT_UART_TXD	DO	VDD_GPIO	BT 用 UART TXD 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT 未使用時は未接続処理(Open)とする。内部 Pull-up。 UART TXD for BT. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT is not used. Internal Pull-up.
6	BT_UART_CTS	DI	VDD_GPIO	BT 用 UART CTS 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT 未使用時は未接続処理(Open)とする。内部 Pull-up。 UART CTS for BT. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT is not used. Internal Pull-up.
7	BT_UART_RXD	DI	VDD_GPIO	BT 用 UART RXD 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT 未使用時は未接続処理(Open)とする。内部 Pull-up。 UART RXD for BT. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT is not used. Internal Pull-up.
8	GND	GND	GND	Ground
9	SD_CLK	DI	VDD_SDIO	WLAN 用 SDIO clock 信号。 SDIO Clock for WLAN.
10	GND	GND	GND	Ground

Pin Number	Pin Name	Type	I/O Domain	Descriptions
11	SD_D0	B	VDD_SDIO	WLAN 用 SDIO Data[0]信号。 SDIO Data[0] for WLAN.
12	SD_D1	B	VDD_SDIO	WLAN 用 SDIO Data[1]信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。内部 Pull-up。 SDIO Data[1] for WLAN. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Internal Pull-up
13	SD_D2	B	VDD_SDIO	WLAN 用 SDIO Data[2]信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。内部 Pull-up。 SDIO Data[2] for WLAN. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Internal Pull-up
14	SD_D3	B	VDD_SDIO	WLAN 用 SDIO Data[3]信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。内部 Pull-up。 SDIO Data[3] for WLAN. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Internal Pull-up.
15	SD_CMD	B	VDD_SDIO	WLAN 用 SDIO Command 信号。 SDIO command for WLAN.
16	GND	GND	GND	Ground
17	RESERVED	NA	NA	未使用信号。未接続処理(Open)とする。 Un-used signal. Keep Open.
18	BT_I2S_SDO	DO	VDD_GPIO	BT PCM OUT 信号。BT Audio 未使用時は未接続処理(Open)とする。 *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM OUT. Keep Open if BT Audio is not used. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
19	NC	NA	NA	NC pin
20	VDD_SDIO	P	P	WLAN SDIO 電源 +1.71～+3.46V。 WLAN SDIO Power supply +1.71 to +3.46V.

Pin Number	Pin Name	Type	I/O Domain	Descriptions
21	WLAN_PWD_L	PD	VDD_GPIO	WLAN HW リセット信号。(0=Disable, 1=Enable)内部 Pull-down。 WLAN reset. (0=Disable, 1=Enable) Internal Pull-down.
22	NC	NA	NA	NC pin
23	RESERVED	DO	VDD_GPIO	未使用信号。未接続処理(Open)とする。 Un-used signal. Keep Open.
24	RESERVED	DI	VDD_GPIO	未使用信号。未接続処理(Open)とする。 Un-used signal. Keep Open.
25	NC	NA	NA	NC pin
26	GND	GND	GND	Ground
27	BT_I2S_SDI	DI	VDD_GPIO	BT PCM IN 信号。BT Audio 未使用時は未接続処理(Open)とする。 *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM IN. Keep Open if BT Audio is not used. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
28	BT_I2S_SCK	PD	VDD_GPIO	BT PCM BCK 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT Audio 未使用時は未接続処理(Open)とする。内部 Pull-down. *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM BCK. Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT Audio is not used. Internal Pull-down. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
29	GND	GND	GND	Ground
30	NC	NA	NA	NC pin

Pin Number	Pin Name	Type	I/O Domain	Descriptions
31	BT_I2S_WS	B	VDD_GPIO	BT PCM SYNC 信号。BT Audio 未使用時は未接続処理(Open)とする。 内部 Pull-down. *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM SYNC. Keep Open if BT Audio is not used. Internal pull-down. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
32	GND	GND	GND	Ground
33	NC	NA	NA	NC pin
34	NC	NA	NA	NC pin
35	GND	GND	GND	Ground
36	BT_PWD_L	PD	VDD_GPIO	BT の HW リセット信号。(0=Disable, 1=Enable) 内部 Pull-down。 BT HW reset. (0=Disable, 1=Enable) Internal Pull-down.
37	NC	NA	NA	NC pin
38	RESERVED	PD	VDD	未使用信号。OPEN とする。内部 Pull-down Un-used signal. Keep Open. Internal Pull-down
39	WOW	OD	Open drain	Wake on wireless 信号。アクティブ High。オープンドレイン出力。要 VDD への外部 Pull-up。 Wake on wireless signal. Active High. Open drain output. Need external pull-up to VDD.
40	VDD_GPIO	P	P	IO 電源。+1.71 ～ +3.46V。 IO power supply +1.71 to +3.46V.

4.5. SDCARD type edge ピン配置（SD Card type edge pin locations）

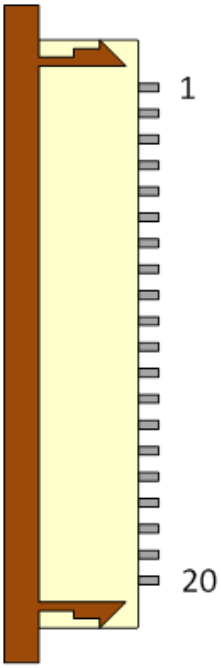


SD Card Edge (BOTTOM VIEW)

4.6. SDCARD type エッジ信号仕様（SDCARD type edge signal descriptions）

Pin Number	Pin Name	Type	I/O Domain	Descriptions
1	SD_D3	B	Internal +1.8V LDO	WLAN 用 SDIO Data[3]信号。+1.8V 動作のみ対応。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。内部 Pull-up。 SDIO Data[3] for WLAN. Only +1.8V operation is supported. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Internal Pull-up.
2	SD_CMD	DI	Internal +1.8V LDO	WLAN 用 SDIO Command 信号。+1.8V 動作のみ対応。 SDIO command for WLAN. Only +1.8V operation is supported.
3	GND	GND	NA	Ground
4	VDD	P	NA	主電源 +3.14～+3.46V。Main Power Supply +3.14V to +3.46V
5	SD_CLK	DI	Internal +1.8V LDO	WLAN 用 SDIO clock 信号。+1.8V 動作のみ対応。 SDIO Clock for WLAN. Only +1.8V operation is supported.
6	GND	GND	NA	Ground
7	SD_D0	B	Internal +1.8V LDO	WLAN 用 SDIO Data[0]信号。+1.8V 動作のみ対応。 SDIO Data[0] for WLAN. Only +1.8V operation is supported.
8	SD_D1	B	Internal +1.8V LDO	WLAN 用 SDIO Data[1]信号。+1.8V 動作のみ対応。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。内部 Pull-up。 SDIO Data[1] for WLAN. Only +1.8V operation is supported. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Internal Pull-up
9	SD_D2	B	Internal +1.8V LDO	WLAN 用 SDIO Data[2]信号。+1.8V 動作のみ対応。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。内部 Pull-up。 SDIO Data[2] for WLAN. Only +1.8V operation is supported. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Internal Pull-up

4.7. SDCARD type FFC ピン配置（SD Card type FFC pin locations）



FFC Connector（BOTTOM VIEW）

4.8. SDCARD type FFC 信号仕様（SDCARD type FFC signal descriptions）

Pin Number	Pin Name	Type	I/O Domain	Descriptions
1	GND	GND	NA	Ground
2	BT_UART_RTS	DO	VDD_GPIO	BT 用 UART RTS 信号。BT 未使用時は未接続処理(Open)とする。 UART RTS for BT. Keep Open if BT is not used.
3	BT_UART_TXD	DO	VDD_GPIO	BT 用 UART TXD 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT 未使用時は未接続処理(Open)とする。内部 Pull-up。 UART TXD for BT. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT is not used. Internal Pull-up.
4	BT_UART_CTS	DI	VDD_GPIO	BT 用 UART CTS 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT 未使用時は未接続処理(Open)とする。内部 Pull-up。 UART CTS for BT. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT is not used. Internal Pull-up.
5	BT_UART_RXD	DI	VDD_GPIO	BT 用 UART RXD 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT 未使用時は未接続処理(Open)とする。内部 Pull-up。 UART RXD for BT. Since this pin is used for Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT is not used. Internal Pull-up.
6	VDD	P	NA	主電源 +3.14～+3.46V。 Main Power Supply +3.14V to +3.46V
7	VDD	P	NA	主電源 +3.14～+3.46V。 Main Power Supply +3.14V to +3.46V
8	WOW	OD	Open drain	Wake on wireless 信号。アクティブ High。オープンドレイン出力。要 VDD への外部 Pull-up。 Wake on wireless signal. Active High. Open drain output. Need external pull-up to VDD.
9	BT_I2S_WS	B	VDD_GPIO	BT PCM SYNC 信号。BT Audio 未使用時は未接続処理(Open)とする。 内部 Pull-down. *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM SYNC. Keep Open if BT Audio is not used. Internal pull-down. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
10	BT_I2S_SCK	PD	VDD_GPIO	BT PCM BCK 信号。Bootstrap option に使用されているため、Reset 解除まではドライブしないでください。BT Audio 未使用時は未接続処理(Open)とする。内部 Pull-down. *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM BCK. Bootstrap option, you must not drive this pin until releasing the reset signal. Keep Open if BT Audio is not used. Internal Pull-down. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.

Pin Number	Pin Name	Type	I/O Domain	Descriptions
11	BT_I2S_SDI	DI	VDD_GPIO	BT PCM IN 信号。BT Audio 未使用時は未接続処理(Open)とする。 *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM IN. Keep Open if BT Audio is not used. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
12	BT_I2S_SDO	DO	VDD_GPIO	BT PCM OUT 信号。BT Audio 未使用時は未接続処理(Open)とする。 *動作未検証機能。接続する I2S デバイスまたは CODEC との組み合わせで別途検証が必要となります。使用する場合はお問い合わせください。 BT PCM OUT. Keep Open if BT Audio is not used. *No testing function. Need to verify with your I2S device or CODEC. If you need this function please contact silex support.
13	GND	GND	NA	Ground
14	RESERVED	PD	VDD	未使用信号。OPEN とする。内部 Pull-down Un-used signal. Keep Open. Internal Pull-down
15	BT_PWD_L	PD	VDD_GPIO	BT の HW リセット信号。(0=Disable, 1=Enable) 内部 Pull-down。 BT HW reset. (0=Disable, 1=Enable) Internal Pull-down.
16	NC	NA	NA	NC pin
17	NC	NA	NA	NC pin
18	NC	NA	NA	NC pin
19	NC	NA	NA	NC pin
20	NC	NA	NA	NC pin

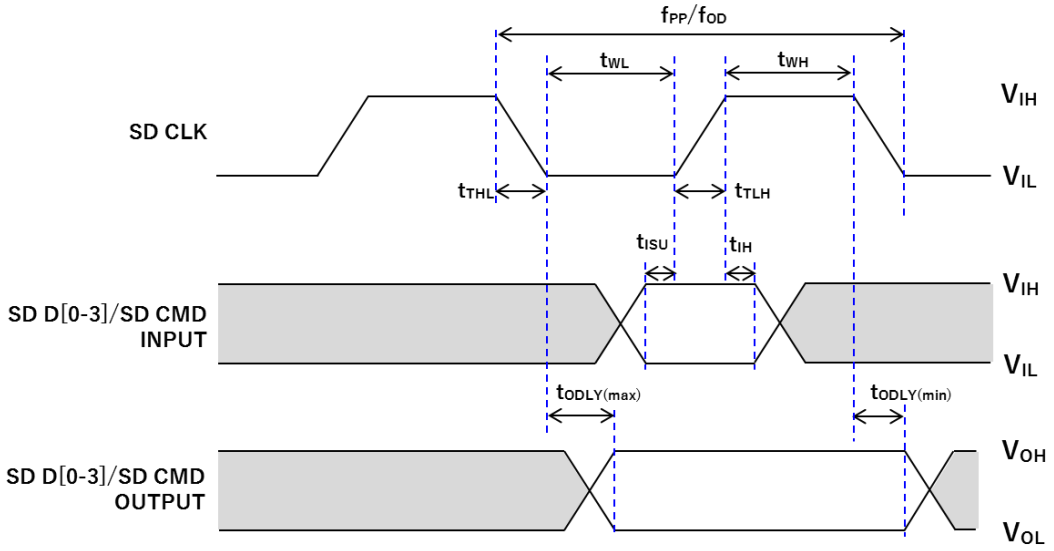
4.9. 信号定義（Signal definitions）

Symbols	Descriptions
AI	アナログインプット Analog input
AO	アナログアウトプット Analog output
B	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
OD	オープンドレインデジタルアウトプット Open drain digital output
PU	ウィークプルアップインプット信号（+1.8V IO：120kohm, +3.3V IO：70kohm） Input signal with weak pull-up. (+1.8V IO：120kohm, +3.3V IO：70kohm)
PD	ウィークプルダウンインプット信号（+1.8V IO：120kohm, +3.3V IO：70kohm） Input signal with weak pull-down. (+1.8V IO：120kohm, +3.3V IO：70kohm)
P	電源 Voltage supply
GND	グランド Ground
NC	モジュール上未接続 No connection
NA	未定義 Not applicable
Internal +1.8V LDO	VDD 電源から内部の LDO で作られた+1.8V。 +1.8V generated from VDD by the internal LDO.

5. インターフェイス/タイミング仕様（Interface / timing specifications）

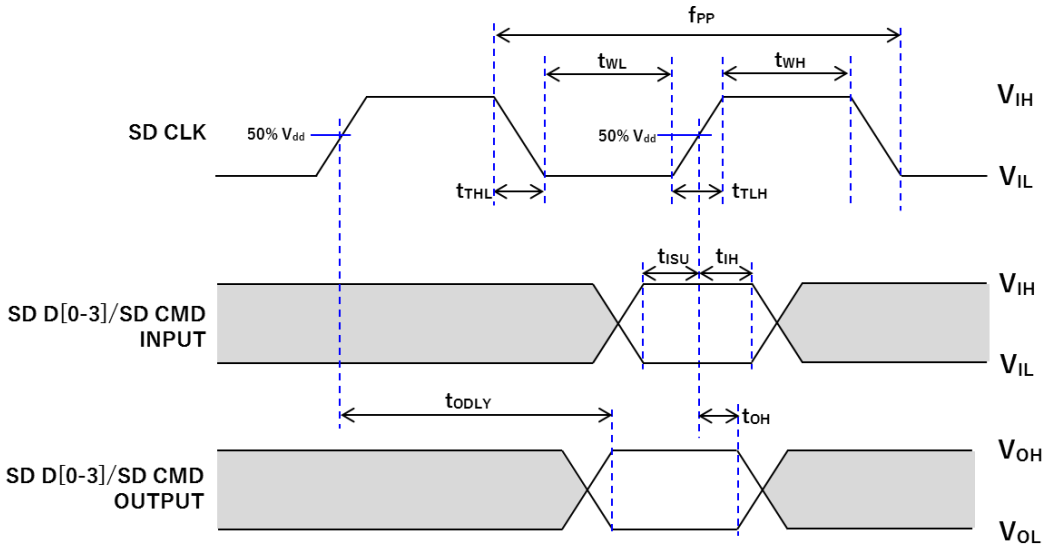
5.1. WLAN SDIO AC タイミング仕様（WLAN SDIO AC timing specifications）

Default Speed



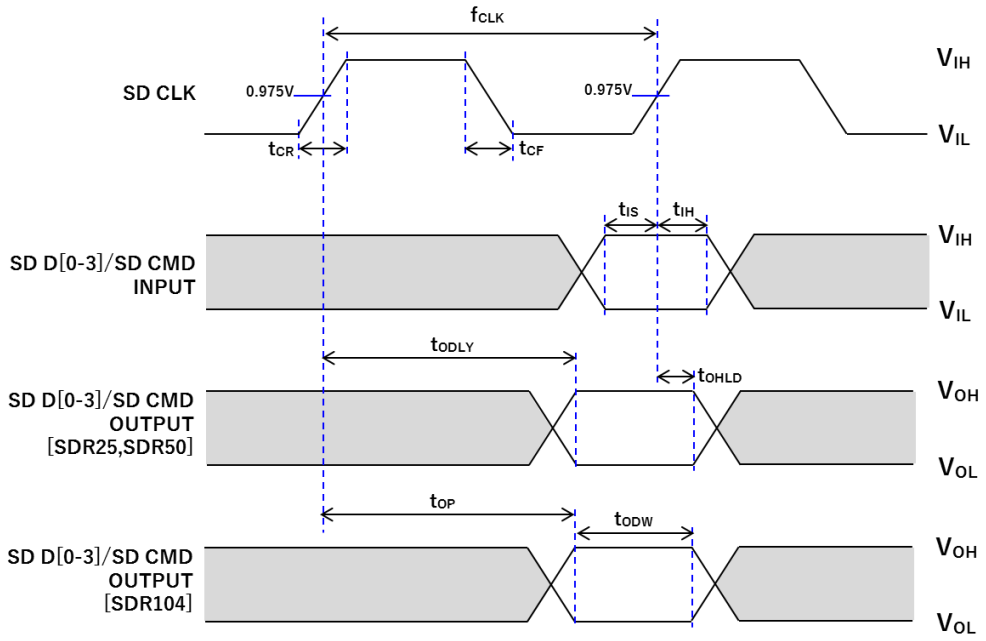
Symbols	Items	Specifications		Units	Remarks
		Min.	Max.		
f_{PP}	Clock frequency Data Transfer Mode	0	25	MHz	
f_{OD}	Clock frequency Identification Mode	100	400	kHz	Stop:0Hz
t_{WL}	Clock low time	10	–	nsec	
t_{WH}	Clock high time	10	–	nsec	
t_{TLH}	Clock rise time	–	10	nsec	
t_{THL}	Clock fall time	–	10	nsec	
t_{ISU}	Input setup time	5	–	nsec	
t_{IH}	Input hold time	5	–	nsec	
t_{ODLY}	Output Delay time during Data Transfer Mode	0	14	nsec	
t_{ODLY}	Output Delay time during Identification Mode	0	50	nsec	

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 during Identification Mode	–	14	nsec	
t_{OH}	Output Hold time	2.5	–	nsec	

Ultra-High Speed (UHS/SDR mode)



Symbols	Items	Specifications		Units	Remarks
		Min.	Max.		
f_{CLK}	Clock frequency Data Transfer Mode	0	208	MHz	
t_{CR}	Clock rise time	–	0.2*1/ f_{CLK}	nsec	NOTE1
t_{CF}	Clock fall time	–	0.2*1/ f_{CLK}	nsec	NOTE1
t_{IS}	Input setup time	1.4	–	nsec	SDR104
t_{IH}	Input hold time	0.8	–	nsec	SDR104
t_{IS}	Input setup time	3.0	–	nsec	SDR50
t_{IH}	Input hold time	0.8	–	nsec	SDR50
t_{ODLY}	Output Delay time during Identification Mode	–	7.5	nsec	SDR50
t_{ODLY}	Output Delay time during Identification Mode	–	14	nsec	SDR25
t_{OHLD}	Output Hold time	1.5	–	nsec	
t_{OP}	Card Output phase	0	9.6	nsec	SDR104
t_{ODW}	Output valid data window	2.88	–	nsec	SDR104

NOTE1:	0.96 nsec(Max.) at SDR104 (208MHz) 2.00 nsec(Max.) at SDR50 (100MHz) 40.00 nsec(Max.) at SDR25 (50MHz)

SDIO 信号の配線について（SDIO signal length）

SDIO 信号は SD_CLK を基準に外部回路等遅延配線としてください。

Skew of SDIO signal lines are recommended on the host board..

SX-SDMAC-2830S/SX-SDMAC-2831S

Signals	QCA9377-3	SMT PCB	Total length (Chip+PCB)	Difference from SD_CLK signal	Units
SD_CLK	0.951	10.478	11.429	0	mm
SD_CMD	0.368	14.825	15.193	+3.764	mm
SD_DATA3	0.101	10.808	10.909	-0.520	mm
SD_DATA2	0.264	11.090	11.354	-0.075	mm
SD_DATA1	0.112	11.010	11.122	-0.307	mm
SD_DATA0	0.425	11.325	11.750	+0.321	mm

SX-SDMAC-2831C

Signals	QCA9377-3	SMT PCB	B2B PCB	Total length (Chip+2PCBs)	Difference from SD_CLK signal	Units
SD_CLK	0.951	10.478	5.897	17.326	0	mm
SD_CMD	0.368	14.825	9.629	24.822	+7.496	mm
SD_DATA3	0.101	10.808	8.958	19.867	+2.541	mm
SD_DATA2	0.264	11.090	8.287	19.641	+2.315	mm
SD_DATA1	0.112	11.010	7.616	18.738	+1.412	mm
SD_DATA0	0.425	11.325	6.946	18.696	+1.370	mm

SX-SDCAC-2830

Signals	QCA9377-3	SMT PCB	SD Card PCB	Total length (Chip+2PCBs)	Difference from SD_CLK signal	Units
SD_CLK	0.951	10.478	31.677	43.106	0	mm
SD_CMD	0.368	14.825	27.992	43.185	+0.079	mm
SD_DATA3	0.101	10.808	32.245	43.154	+0.048	mm
SD_DATA2	0.264	11.090	31.869	43.223	+0.117	mm
SD_DATA1	0.112	11.010	32.725	43.847	+0.741	mm
SD_DATA0	0.425	11.325	31.389	43.139	+0.033	mm

表内の各数値はモジュール上での各信号配線長を、Diff from CLK の数値は SD_CLK との配線長差を示しています。Diff from CLK の値が”+”の場合は SD_CLK より短く、”-”の場合は SD_CLK より長くホストボード上で配線することで等遅等長配線となるようにしてください。

The value of tables means the length of SDIO signals on the module, and Diff from CLK means the difference of each SD signal's length from SD_CLK. “+” means the length of SD signal should be shorter from SD_CLK, “-” means the length of SD signal should be longer from SD_CLK on your board to equate the length of SD signals.

5.2. Bluetooth UART 仕様（Bluetooth UART interface specifications）

本モジュールは HCI 上位レイヤーBluetooth スタック互換の HCI-UART 規格をサポートしています。
This module supports standard HCI-UART interface so it's compatible with HCI upper layer Bluetooth stacks.

Items	Specifications		Units	Remarks
	設定値 Setting values	実効値 Actual values		
Baud rates	115200	114000	bps	
	230400	229000	bps	
	460800	476000	bps	
	500000	495000	bps	
	921600	943000	bps	
	1000000	1000000	bps	
	2000000	2000000	bps	
	3000000	3040000	bps	
	3500000	3490000	bps	
	4000000	3960000	bps	
Number of data bits	8		bits	
Parity bit	None		–	
Stop bit	1		bit	
Flow control	RTS/CTS		–	

※フロー制御が必要です。
Flow control is necessary.

※詳しくは Bluetooth SIG の最新の Bluetooth Core 仕様書を参照してください。
See Bluetooth core specifications from Bluetooth SIG for further information.

https://www.bluetooth.com/specifications/

リンク URL は予告なく変更または削除される可能性がございます。
The Link URL might be changed or be removed without notification.

5.3. Bluetooth 音声インターフェイス仕様(Bluetooth audio interface specifications)

本モジュールの Bluetooth オーディオインターフェイスは、ソフトウェアによるレジスタ設定によって PCM と I2S のプロトコルを切り替えて使用することができます。

The audio interface of this module is configurable either PCM or I2S protocol by top-level register setting of software.

CODEC types

Items	Specifications	Remarks
Codec	CVSD, SBC	Over PCM/I2S or HCI

Synchronous audio interface (SCO profile)

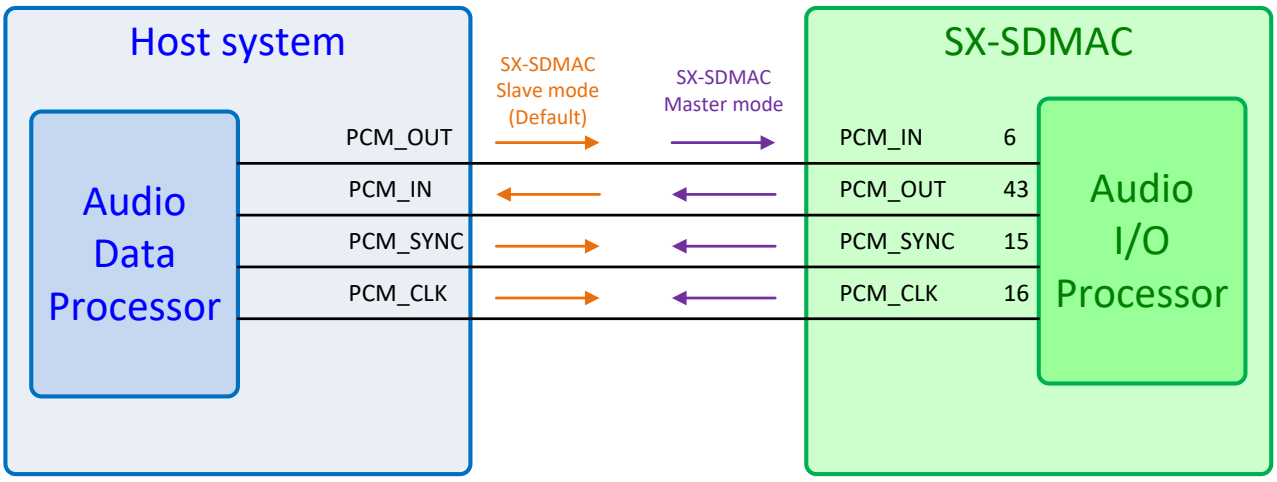
Items	Specifications		Units	Remarks
インターフェイスモード Interface modes	PCM/I2S Master/Slave(Default)		–	ソフトウェアで切り替え Switch by Software
サンプリング周波数 Sampling frequencies	8kHz / 16 kHz サンプリング動作 8kHz / 16 kHz Sample-based operations		–	
PCM データフォーマット PCM data formats	A-law, μ -law	8-bit,13-bit,14-bit,16-bit	–	
	Linear mono	8K,16K,32K,48K,96K Samples		
PCM クロック周波数 PCM clock frequencies	64,96,128,192,256,384,512,768,1024,1536, 1544,2048,3072,4096		kHz	
I2S クロック周波数 I2S clock frequencies	2.4		MHz	Max.

Asynchronous audio interface (A2DP profile)

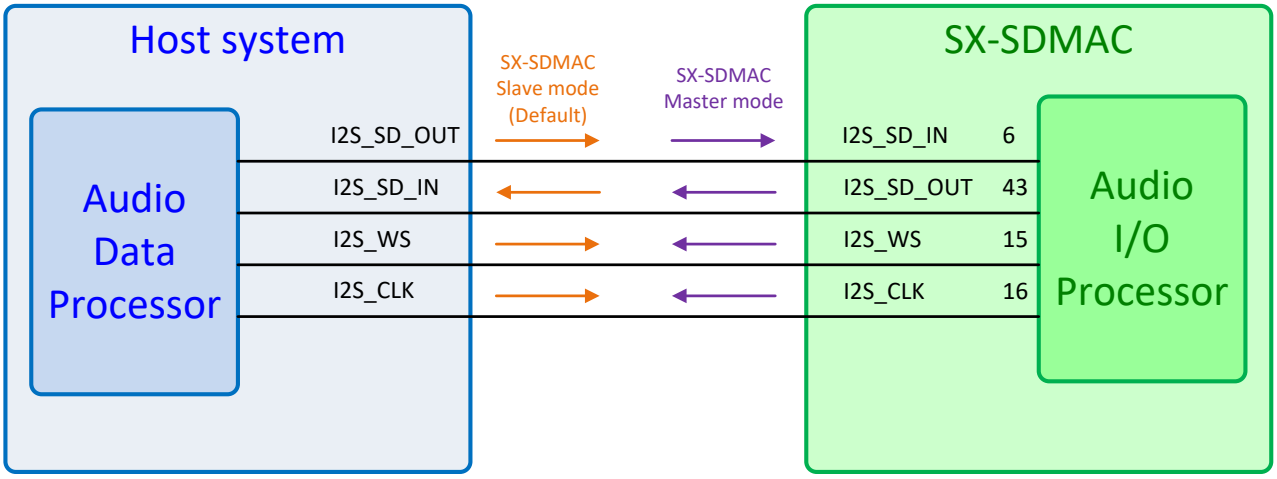
Items	Specifications	Units	Remarks
モード Mode	HCI UART	–	

接続図（Connection）

PCM mode

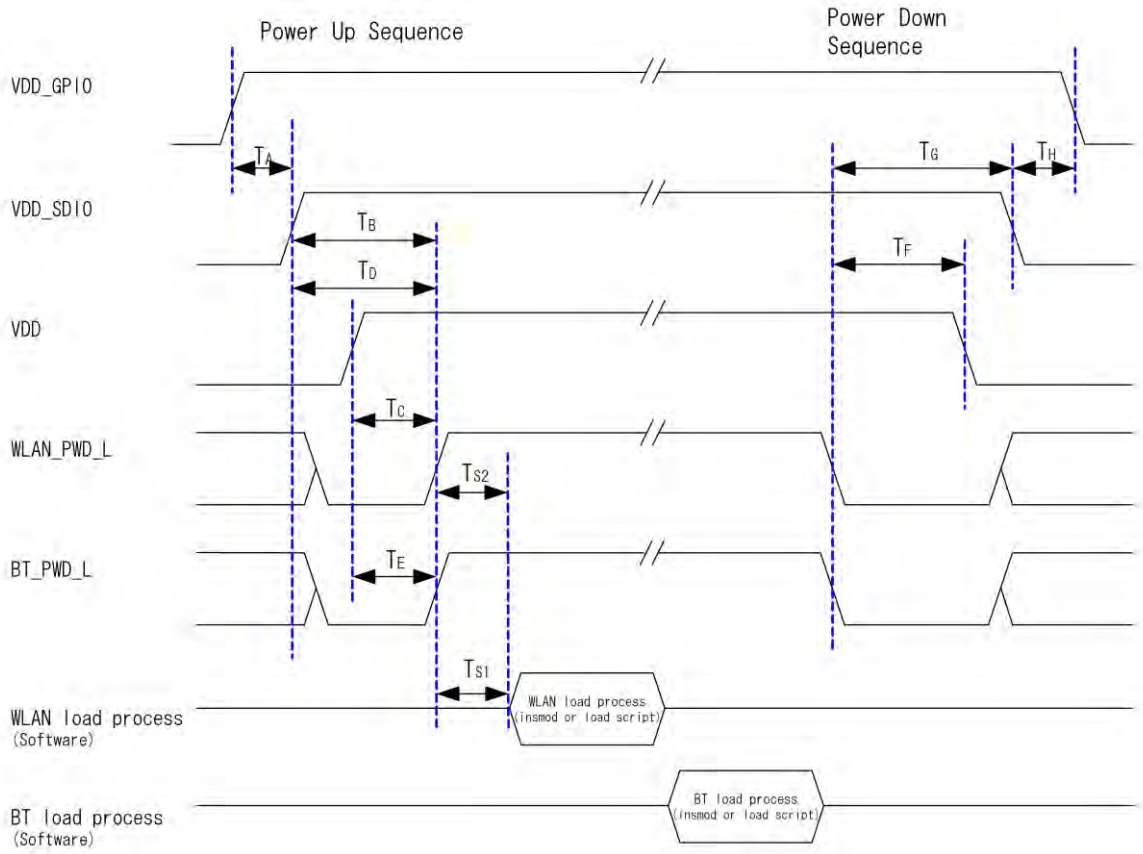


I2S mode

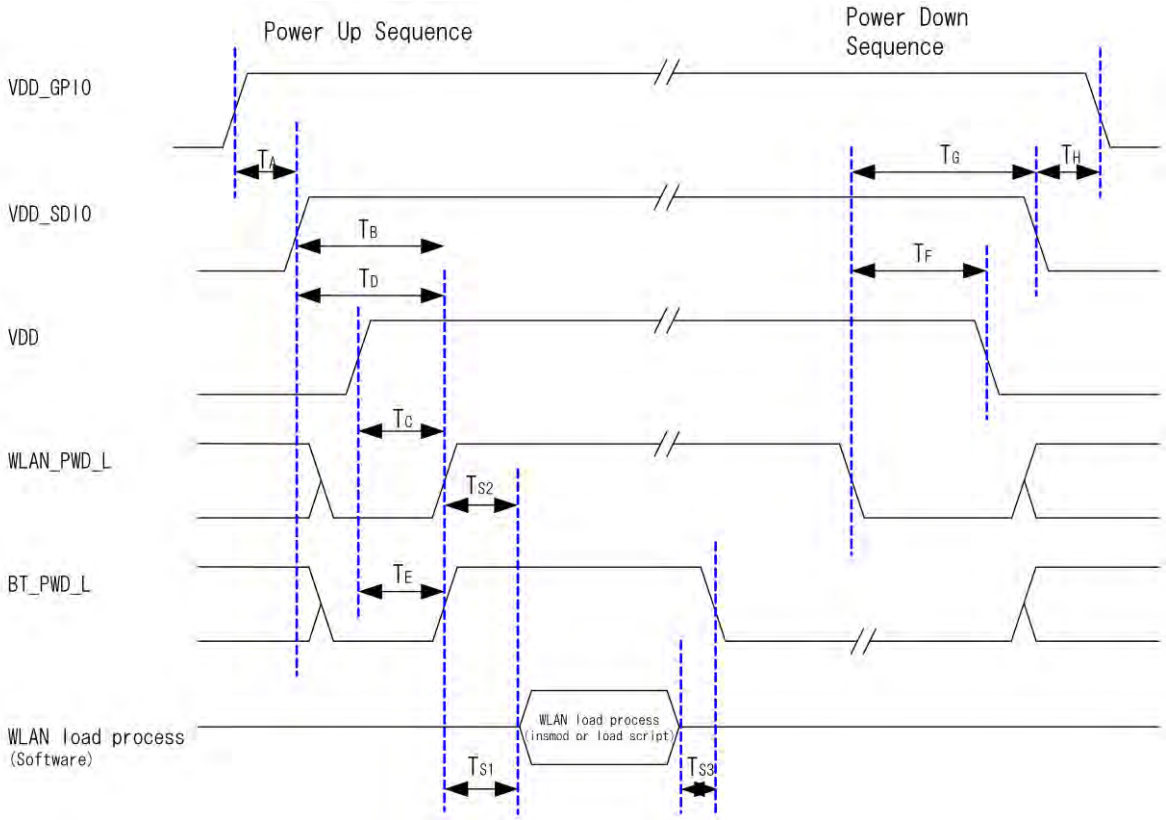


5.4. パワーON/OFF, リセットタイミング（Power on/off and reset timing）

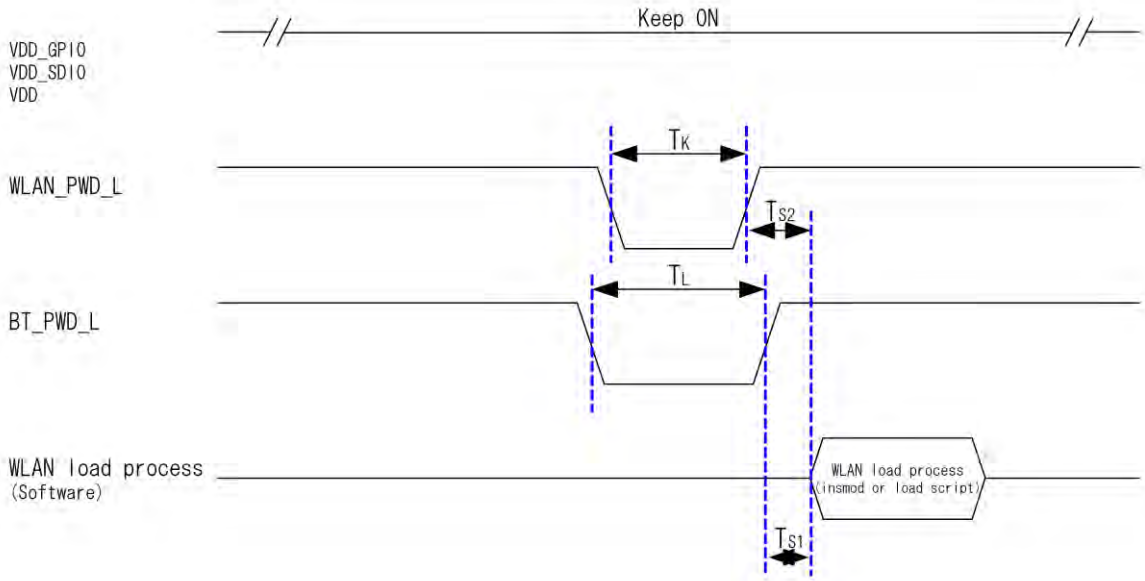
- **BT_PWD_L を常時 High(De-assert)で使用する場合**
  In case BT_PWD_L is always High (De-assert).



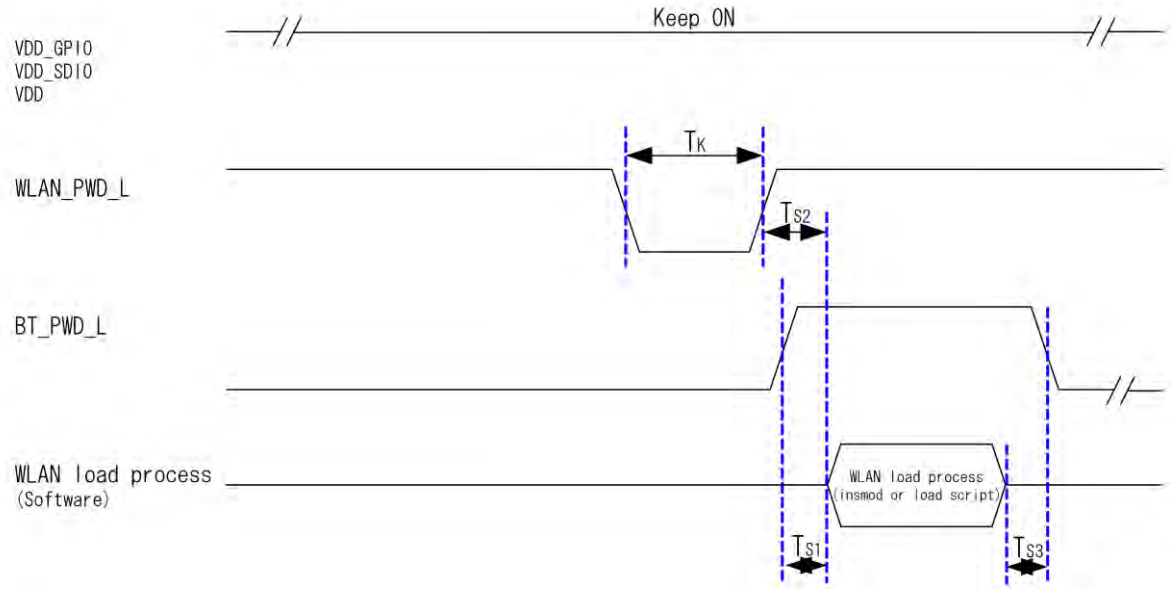
- **BT_PWD_L を常時 Low(Assert)で使用する場合**
  In case BT_PWD_L is always Low (Assert).



- **BT_PWD_L を常時 High(De-assert)で使用する場合のホットリセットタイミング**
  Hot reset timing in case BT_PWD_L is always High (De-assert).



- **BT_PWD_L を常時 Low(Assert)で使用する場合のホットリセットタイミング**
  Hot reset timing in case BT_PWD_L is always Low (Assert).



Symbols	Descriptions	Specifications		Units	Remarks
		Min.	Max.		
T_A	VDD_GPIO 電源が 90%に達してからその他の電源が 90%に達するまでの時間。 Time from VDD_GPIO reaches 90% to other power sources reach 90%.	0	–	μ sec	
T_B	VDD_SDIO が 90%に達してから WLAN のリセット解除(De-assert)までの時間 Time from VDD_SDIO reaches 90% to WLAN reset release (De-assert).	5	–	μ sec	
T_C	VDD が 90%に達してから WLAN のリセット解除(De-assert)までの時間 Time from VDD reaches 90% to WLAN reset release (De-assert).	5	–	μ sec	
T_D	VDD_SDIO が 90%に達してから BT のリセット解除(De-assert)までの時間 Time from VDD_SDIO reaches 90% to WLAN reset release (De-assert).	5	–	μ sec	
T_E	VDD が 90%に達してから BT のリセット解除までの時間(De-assert) Time from VDD reaches 90% to WLAN reset release (De-assert).	5	–	μ sec	
T_F	WLAN/BT のリセットが Low(Assert)になってから VDD が OFF になるまでの時間 Time from WLAN/BT reset = Low to VDD = OFF.	5	–	μ sec	
T_G	WLAN/BT のリセットが Low(Assert)になってから VDD_SDIO が OFF になるまでの時間 Time from WLAN/BT reset = Low to VDD_SDIO = OFF.	5	–	μ sec	
T_H	その他の電源が OFF になってから VDD_GPIO が OFF になるまでの時間 Time from other power source = OFF to VDD_GPIO = OFF.	0	–	μ sec	
T_K	WLAN ホットリセット時間 WLAN hot reset time.	5	–	msec	
T_L	BT ホットリセット時間 BT hot reset time.	5	–	msec	
T_{S1}	BT_PWD_L=High(De-assert)から WLAN load process を開始するまでの時間 Time from BT_PWD_L = High(De-assert) to WLAN load process start	0	–	msec	
T_{S2}	WLAN_PWD_L=High(De-assert)から WLAN load process を開始するまでの時間 Time from BT_PWD_L = High(De-assert) to WLAN load process start	0	–	msec	
T_{S3}	WLAN load process の処理完了から BT_PWD_L を Low(Assert)にするまでの時間 Time from WLAN load process finish to BT_PWD_L = Low(Assert)	0	–	msec	

6. 適合規格（Standards Compliance）

6.1. 規格一覧（Standard list）

適合規格 ：
Standards conformity

- IEEE802.11-2012 (a/b/g/n)
- IEEE802.11ac-2013
- Bluetooth 4.1 BR/EDR/LE (DID:**D032832**)
- Bluetooth 5.0 BR/EDR/LE (DID:**D043700**)
- SDIO v3.0

適合法規制 ：
Law regulation compliance

- 日本電波法（MIC）
  証明規則第 2 条第 1 項第 19 （親機/子機）
  証明規則第 2 条第 1 項第 19 の 3 （親機/子機）
  証明規則第 2 条第 1 項第 19 の 3 の 2 （親機/子機）
  Japan Radio Law (MIC)
  Article 2 Section 1 Number 19 (Master/Station mode)
  Article 2 Section 1 Number 19-3 (Master/Station mode)
  Article 2 Section 1 Number 19-3-2 (Master/Station mode)

  Certification number:

Product No.	Product Name	Certification number	Remarks
ZXE03487	SX-SDMAC-2830S	007-AE0224	DFS Master 非対応 Non DFS Master support
ZXE03493	SX-SDMAC-2830S-SP		
ZXE03491	SX-SDCAC-2830		
ZXE03497	SX-SDCAC-2830-SP		
ZXE04016	SX-SDMAC-2830S-EAL		
ZXE04020	SX-SDMAC-2830S-EAL-SP		
ZXE04019	SX-SDCAC-2830-EAL		
ZXE04023	SX-SDCAC-2830-EAL-SP		
ZXE03490	SX-SDMAC-2831C	201-170874	DFS Master 対応 DFS Master support
ZXE03496	SX-SDMAC-2831C-SP		
ZXE03489	SX-SDMAC-2831S		
ZXE03495	SX-SDMAC-2831S-SP		
ZXE04018	SX-SDMAC-2831C-EAL		
ZXE04017	SX-SDMAC-2831S-EAL		
ZXE04022	SX-SDMAC-2831C-EAL-SP		
ZXE04021	SX-SDMAC-2831S-EAL-SP		

- FCC Part15 (Subpart C, Subpart E (UNII-1/2/2Ext/3))
  (2.4GHz, 5GHz 子機, Station mode)
  ID: **N6C-SDMAC**
- IC RSS (UNII-1/2/2Ext/3)
  (2.4GHz, 5GHz 子機, Station mode)
  ID: **4908A-SDMAC**
- CE ETSI (EN 300 328, EN 301 893)
  (2.4GHz, 5GHz 親機/子機, Master/Station mode)
- CE RoHS Directive

- ANATEL（only EAL Model）
  ID: **05593-18-09143**

対応国　　：
Countries

- Asia
  - Japan
- North America
  - United States
  - Canada
- South America
  - Brazil（only EAL Model）
- EU

Regulatory notice

Channel Selection

For product available in the USA/Canada market, only channel 1~11 can be operated. Selection of other channels is not possible.

Fcc Rules Part 15

FCC CAUTION

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

FCC Rules, Part 15　§15.19(a)(3) / IC RSS Gen　§8.4

Below sentences must be indicated on the final product which contains this module inside.

This device complies with part 15 of FCC Rules and Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and(2) thisdevice 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; 2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

FCC Rules Part 15 Subpart C　§15.247 and Subpart E / IC RSS-102　§2.6

This equipment complies with FCC/IC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the IC 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.

Cet équipement est conforme aux limites d'exposition aux rayonnement énoncées pour un environnement non contrôlé et respecte les règles les radioélectriques (RF) de la FCC lignes directrices d'exposition et d 'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC. Cet équipement doit être installé et utilisé en gardant une distance de 20 cm ou plus entre le radiateur et le corps humain.

FCC Rules Part 15 Subpart E § 15.407(c)

Compliance with FCC requirement 15.407(c)

Data transmission is always initiated by software, which is the 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 discontinue transmission in case of either absence of information to transmit or operational failure.

FCC Rules Part 15 Subpart E § 15.407(g)

Frequency Tolerance: +/-20 ppm

FCC Rules Part 15 Subpart C § 15.247(g) / Subpart E

This device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

RSS-Gen § 8.3

This radio transmitter 4908A-SDMAC has been approved by Industry Canada to operate with the antenna types listed § 6.2 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.

Le numéro IC du présent émetteur radio 4908A-SDMAC 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 pour ce type, sont strictement interdits pour l'exploitation avec cet appareil.

RSS-247 Issue 1 May 2015

Radio Standards Specification RSS-247, Issue 1, Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, is a new standard to replace annexes 8 and 9 of RSS-210, Issue 8, Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.

At the date of publication of this standard, devices covered under the scope of this document will no longer be certified under RSS-210, Issue 8.

Le Cahier des normes radioélectriques 247, 1re édition, Les systèmes de transmission numérique (STN), les systèmes à sauts de fréquence (SSF) et les dispositifs de réseaux locaux exempts de licence (RL-EL), remplace les annexes 8 et 9 du CNR-210, 8e édition, Appareils radio exempts de licence (pour toutes les bandes de fréquences) : matériel de catégorie I.

À la date de publication de la présente norme, les dispositifs visés par ce document ne seront plus certifiés conformément au CNR-210, 8e édition.

Frequency Band 5150 – 5250 MHz

LE-LAN devices are restricted to indoor operation only in the band 5150-5250 MHz.

Les dispositifs LAN-EL sont restreints à une utilisation à l'intérieur, dans la bande 5150-5250MHz.

High-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

Les radars de haute puissance sont désignés comme utilisateurs principaux (c'est-à dire utilisateurs prioritaires) pour les bandes 5250-5350 MHz et 5650-5850 MHz, et que ces radars peuvent rovoquer du brouillage et/ou es dommages auxdispositifs LAN-EL.

WARNING :

The FCC / The Industry Canadaregulations provide that changes or modifications not expressly approved by the party responsible for compliance could void the user'sauthority to operate the equipment.

Manual and Product Labeling information To The End User

The end user manual shall include all required regulatory information/warning as show in this manual.And when this module is installed in the host product, you must include a "Contain FCC ID : N6C-SDMAC"and a "Contain IC: 4908A-SDMAC" in the label of the host product.

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, high reliability security instruments or any other devices required extremely high reliability and quality.

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

- 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.

- 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.

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

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

- "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."

IMPORTANT NOTE: In the event that these conditions cannot be met (for example co-location with another transmitter), then the FCC / IC authorization is no longer considered valid and the FCC / IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC / IC authorization. As long as a condition above is 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 (for example, digital device emissions, PC peripheral requirements, etc.

6.2. 推奨アンテナリスト（Recommended Antenna List）

日本（Japan）MIC

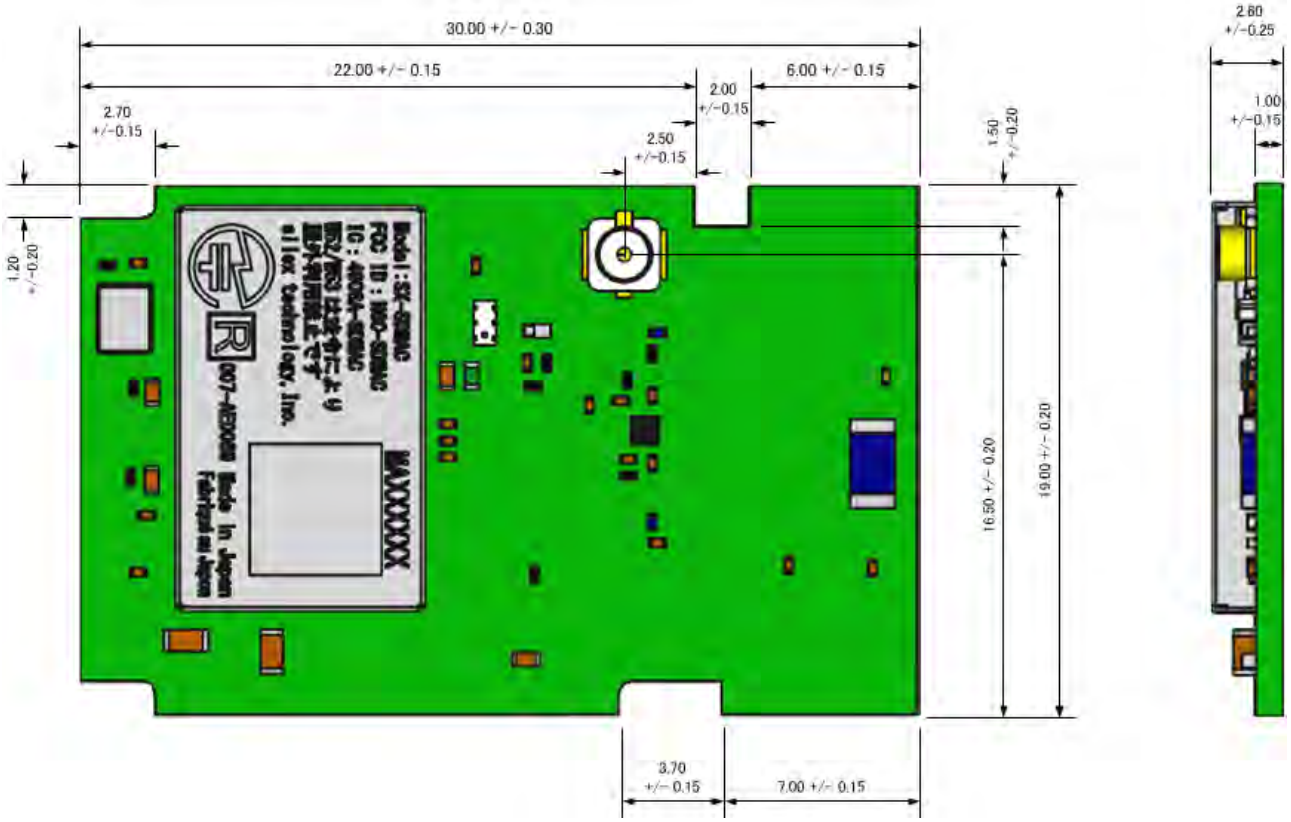
Antennas	Vendors	Antenna Type	2.4GHz Gain	5GHz Gain	No.19 2.4GHz	No.19-2 2.484GHz	No.19-3 W52/53	No.19-3-2 W56
AA258 (H2B1PC1A1C) (Exclude cable loss)	Unictron	PCB	+2.9dBi	+4.4dBi	✓	–	✓	✓
AA222 (H2B1PD1A1C) (Exclude cable loss)	Unictron	PCB	+2.8dBi	+4.2dBi	✓	–	✓	✓
146153 (Exclude cable loss)	Molex	PCB	+3.25dBi	+5.0dBi	✓	–	✓	✓
1000418 (Exclude cable loss)	Ethertronics	PIFA	+2.5dBi	+3.5dBi	✓	–	✓	✓
GRF1762/GRF1802 (Exclude cable loss)	VSO	Rod	+2.0dBi	+2.0dBi	✓	–	✓	✓
GRF1763 (Exclude cable loss)	VSO	Rod	+1.5dBi	+2.1dBi	✓	–	✓	✓
ANTDC-081A0/B0 (Exclude cable loss)	Sansei-Denki	Rod	+2.0dBi	+2.0dBi	✓	–	✓	✓
ANTDP-027A0 (Exclude cable loss)	Sansei-Denki	Rod	+1.5dBi	+2.1dBi	✓	–	✓	✓

アメリカ・カナダ・ヨーロッパ（USA・Canada・Europe）FCC/IC/ETSI

Antennas	Vendors	Antenna Type	2.4GHz Gain	5GHz Gain	FCC Subpart-C 2.4GHz)	FCC Subpart-E W52/53/56/58	ETSI EN300329 2.4GHz	ETSI EN300329 W52/53/56
AA258 (H2B1PC1A1C) (Exclude cable loss)	Unictron	PCB	+2.9dBi	+4.4dBi	✓	✓	✓	✓
AA222 (H2B1PD1A1C) (Exclude cable loss)	Unictron	PCB	+2.8dBi	+4.2dBi	✓	✓	✓	✓
146153 (Exclude cable loss)	Molex	PCB	+3.25dBi	+5.0dBi	✓	✓	✓	✓
1000418 (Exclude cable loss)	Ethertronics	PIFA	+2.5dBi	+3.5dBi	✓	✓	–	–
GRF1762/GRF1802 (Exclude cable loss)	VSO	Rod	+2.0dBi	+2.0dBi	✓	✓	✓	✓
GRF1763 (Exclude cable loss)	VSO	Rod	+1.5dBi	+2.1dBi	✓	✓	✓	✓
ANTDC-081A0/B0 (Exclude cable loss)	Sansei-Denki	Rod	+2.0dBi	+2.0dBi	✓	✓	✓	✓
ANTDP-027A0 (Exclude cable loss)	Sansei-Denki	Rod	+1.5dBi	+2.1dBi	✓	✓	✓	✓

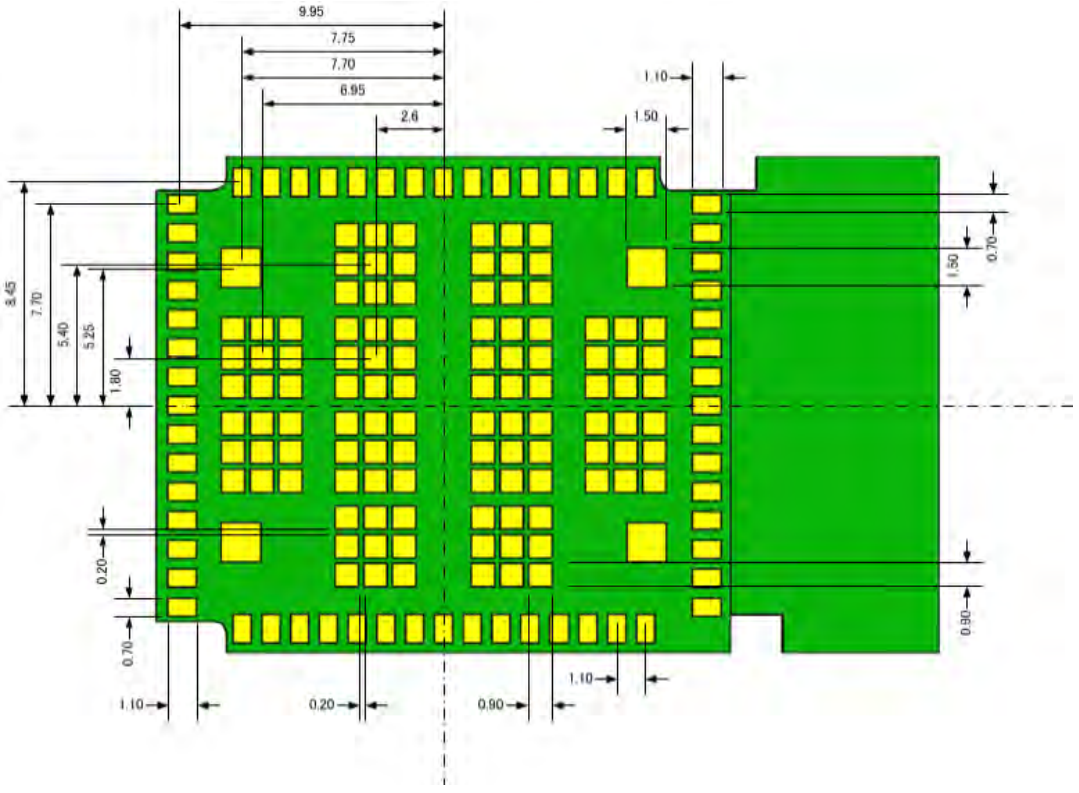
NOTE1	これらの認証は silex 推奨アンテナ、silex 製ボードデータファイルと silex 製ドライバでのみ有効です。 但し、silex の推奨アンテナを使用していたとしても最終製品の形態、または silex 製ドライバ以外を使う場合は再認証試験が必要になる可能性があります。 The above certification is effective only with the silex recommended antennas, silex recommended board data file and driver. However, the re-certification might be required in the case of the final product form even if the silex recommended antennas are used or no use of the silex driver.
NOTE2	各国の EMC 認証は最終製品形態での試験が必要です。 EMC certification of each country might be required as the final product.
NOTE3	三省電機 Rod アンテナは認可済みですが、非推奨です。VSO 互換品が推奨です。 The rod antenna of Sansei-Denki's been certified, but not recommended. VSO's compatible one is recommended

7. 機械的仕様（Mechanical Specifications）



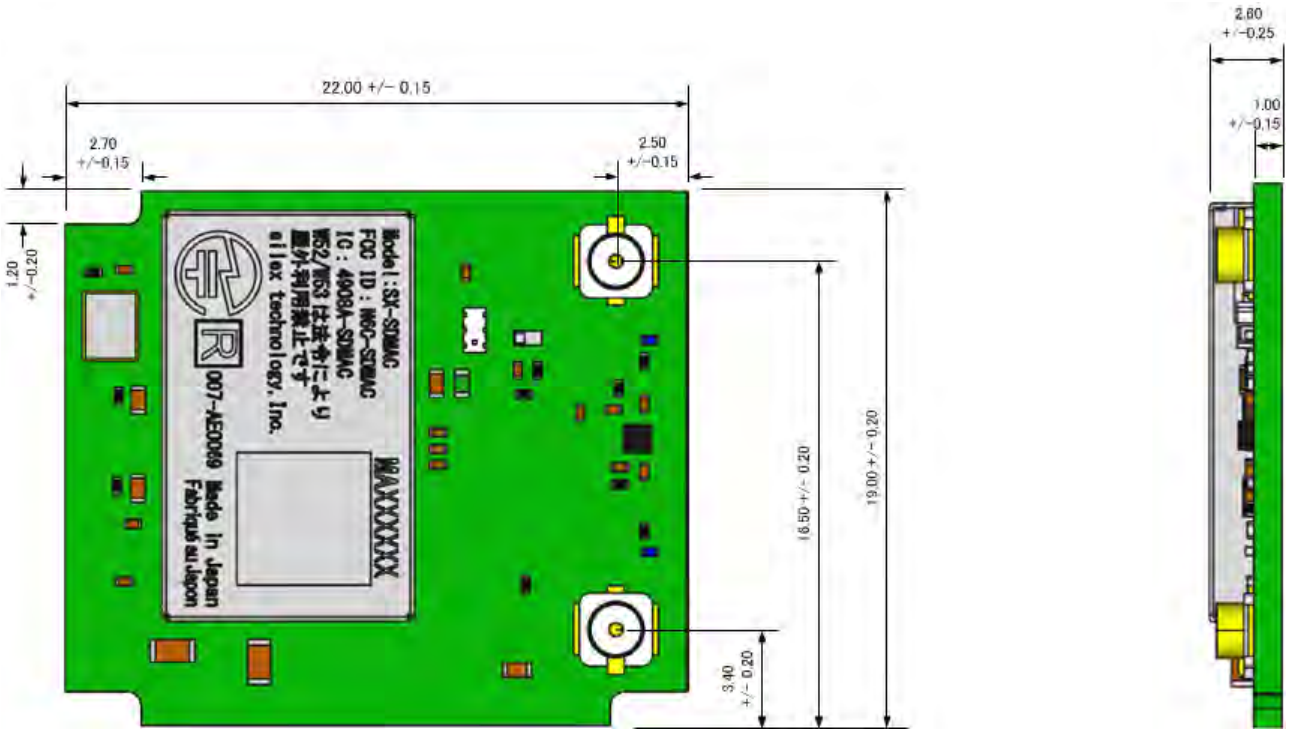
(mm)

SX-SDMAC-2830S (Top view)



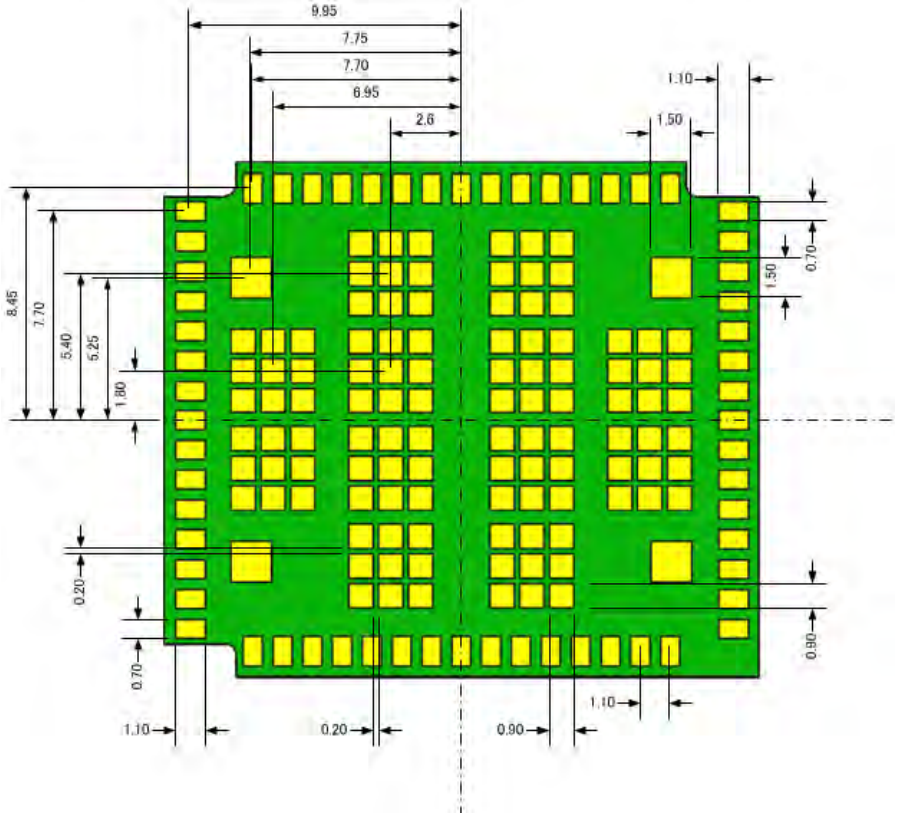
(mm)

SX-SDMAC-2830S (Bottom view)



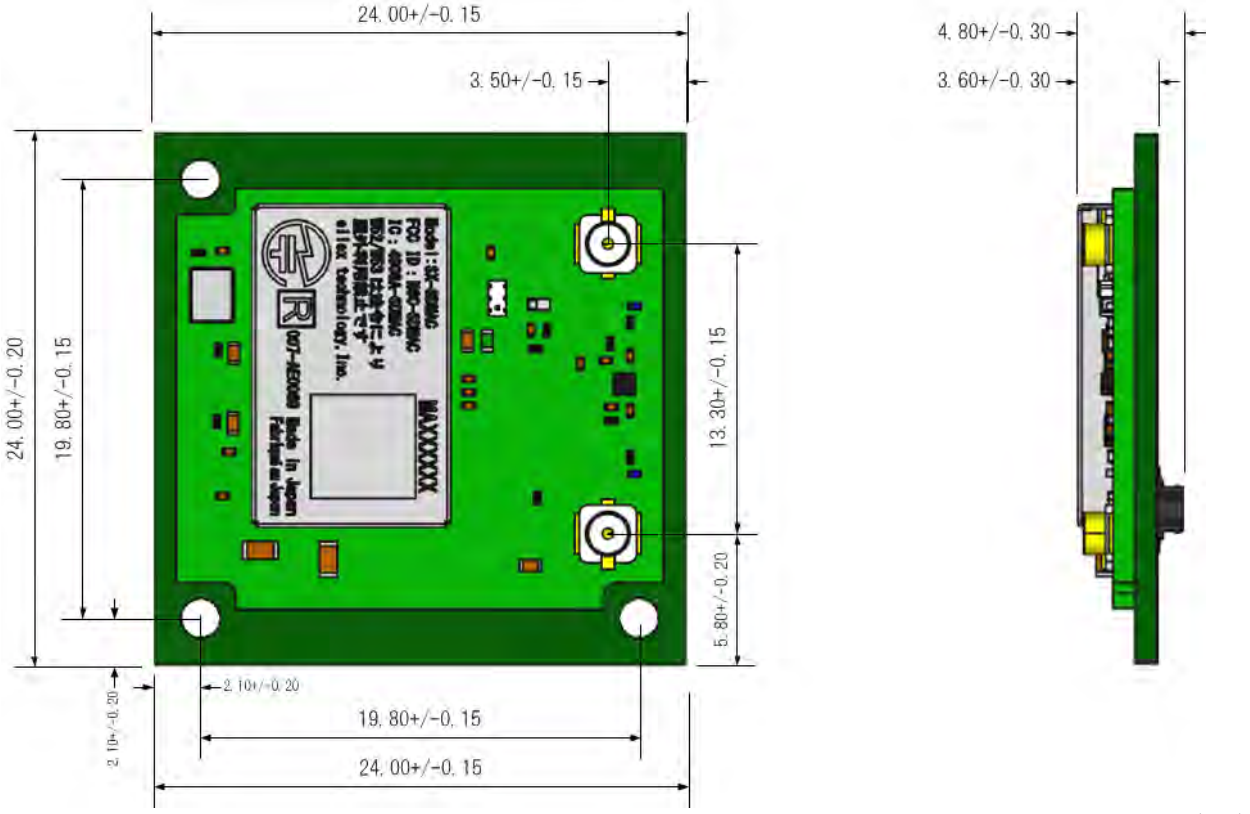
(mm)

SX-SDMAC-2831S (Top view)



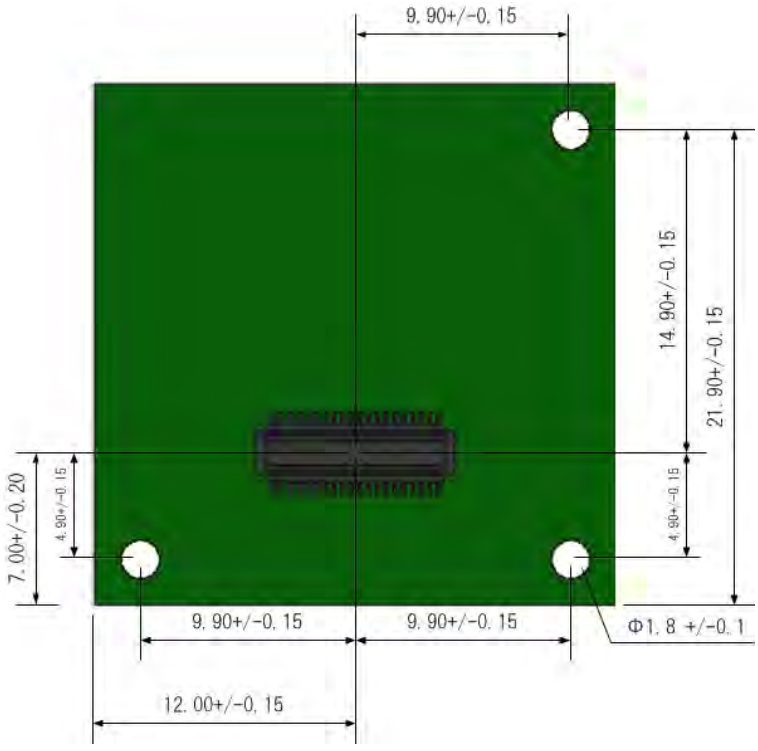
(mm)

SX-SDMAC-2831S (Bottom view)



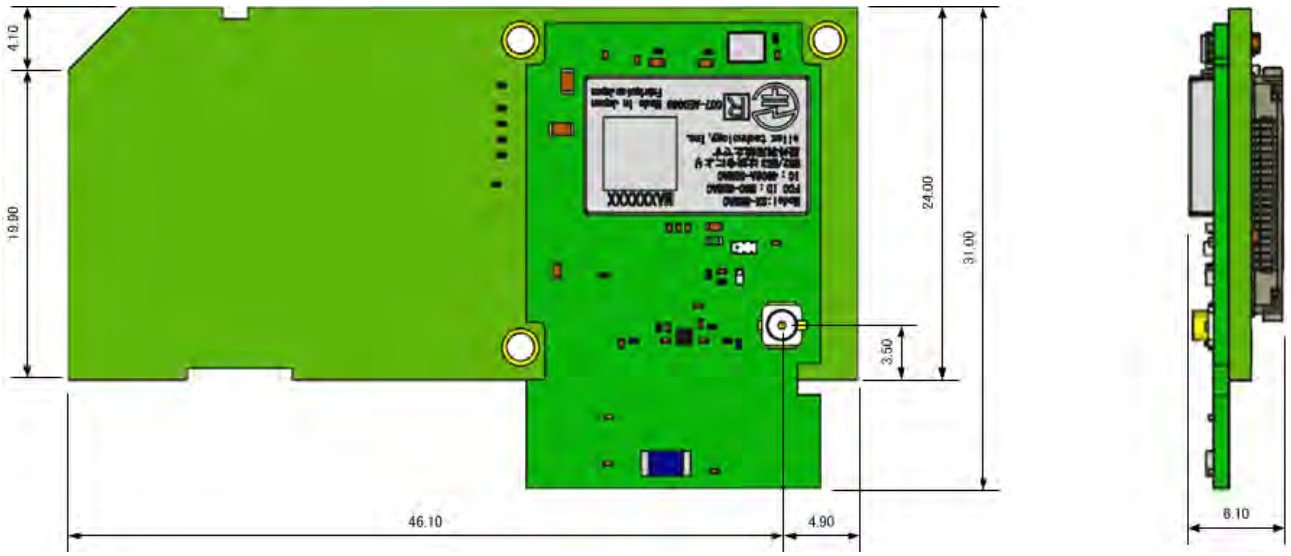
(mm)

SX-SDMAC-2831C (Top view)



(mm)

SX-SDMAC-2831C (Bottom view)



(mm)

SX-SDCAC-2830 (Top view)

(mm)

SX-SDCAC-2830 (Bottom view)

厚み（Thickness）

Item	Thickness	Remarks
SMT (単体) SMT (A simple substance)	2.6mm	
SMT (コネクタ嵌合時) SMT (Connector mating)	2.9mm, 3.4mm, 4.1mm (Max.)	アンテナケーブル側の MHF コネクタにより 3 パターン有り。 3 patterns depend on MHF connector of antenna cable. H2B1PC1A1C (Unictron)との嵌合時: 3.4mm Max In case mating with H2B1PC1A1C (Unictron) : 3.4mm Max
B2B (単体) B2B (A simple substance)	4.8mm	推奨固定ねじサイズ M1.7 Recommended screw/washer is M1.7
B2B (コネクタ嵌合時) B2B (Connector mating)	5.4mm, 5.9mm, 6.6mm (Max.)	アンテナケーブル側の MHF コネクタにより 3 パターン有り。 3 patterns depend on MHF connector of antenna cable. H2B1PC1A1C (Unictron)との嵌合時: 5.4mm Max In case mating with H2B1PC1A1C (Unictron) : 5.4mm Max
SDCARD (単体) SDCARD (A simple substance)	6.1mm	推奨固定ねじサイズ M1.7 Recommended screw/washer is M1.7
SDCARD (コネクタ嵌合時) SDCARD (Connector mating)	6.4mm, 6.9mm, 7.6mm (Max.)	アンテナケーブル側の MHF コネクタにより 3 パターン有り。 3 patterns depend on MHF connector of antenna cable. H2B1PC1A1C (Unictron)との嵌合時: 5.4mm Max In case mating with H2B1PC1A1C (Unictron) : 6.4mm Max

PCB 厚（PCB Thickness）

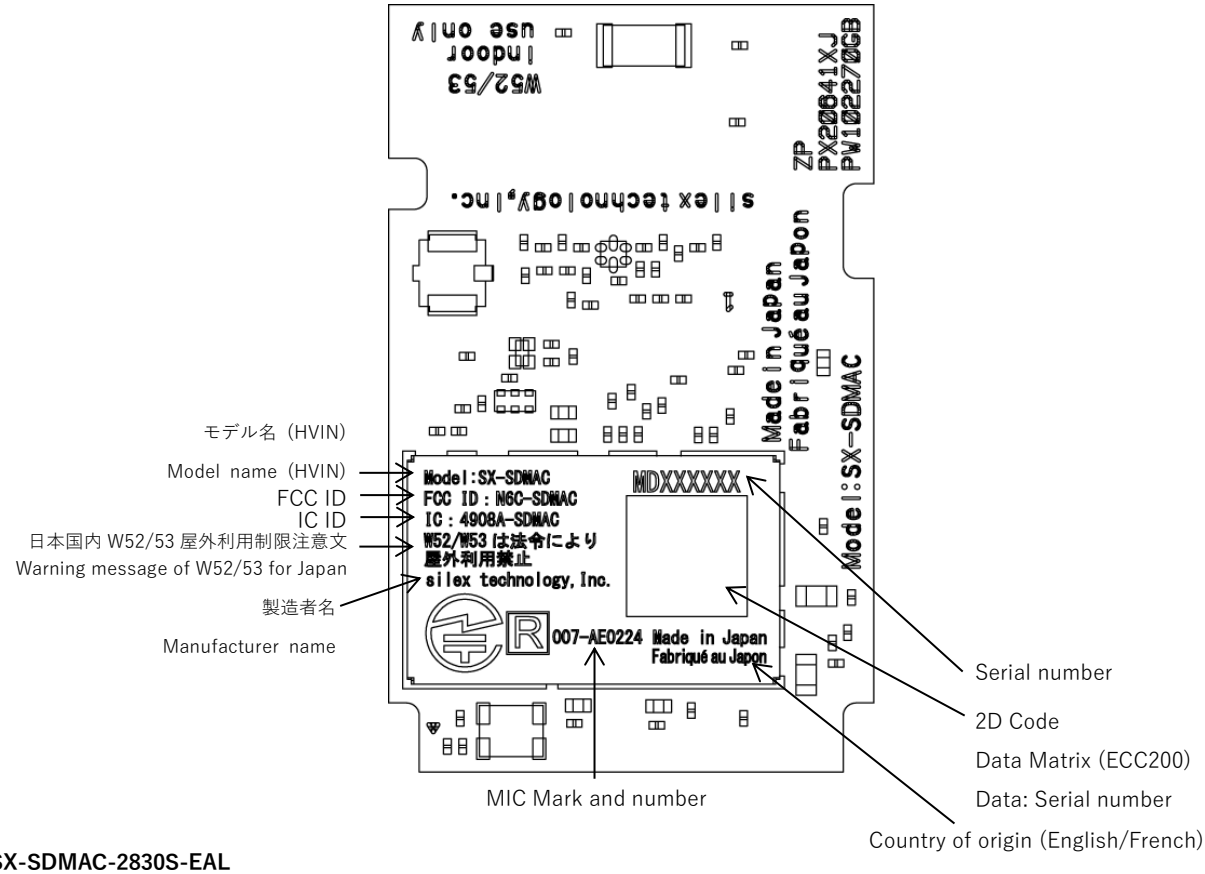
Item	Thickness	Remarks
SMT PCB	1.00 mm +/- 0.15 mm	
B2B PCB	1.00 mm +/- 0.30 mm	
SD CARD PCB	1.50 mm +/- 0.15 mm	

特に記載が無い場合、寸法公差は±0.15 mm

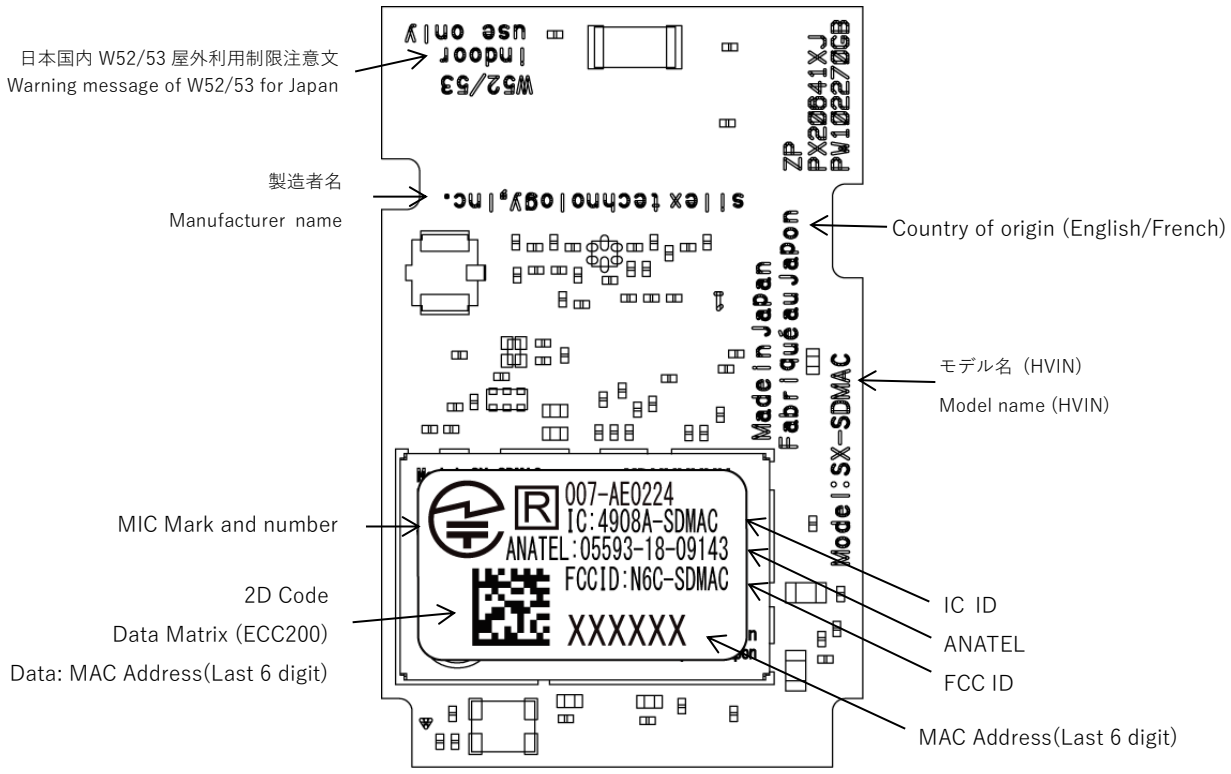
All dimension tolerances are ±0.15mm, unless otherwise specified.

8. 表示仕様(Indication specifications)

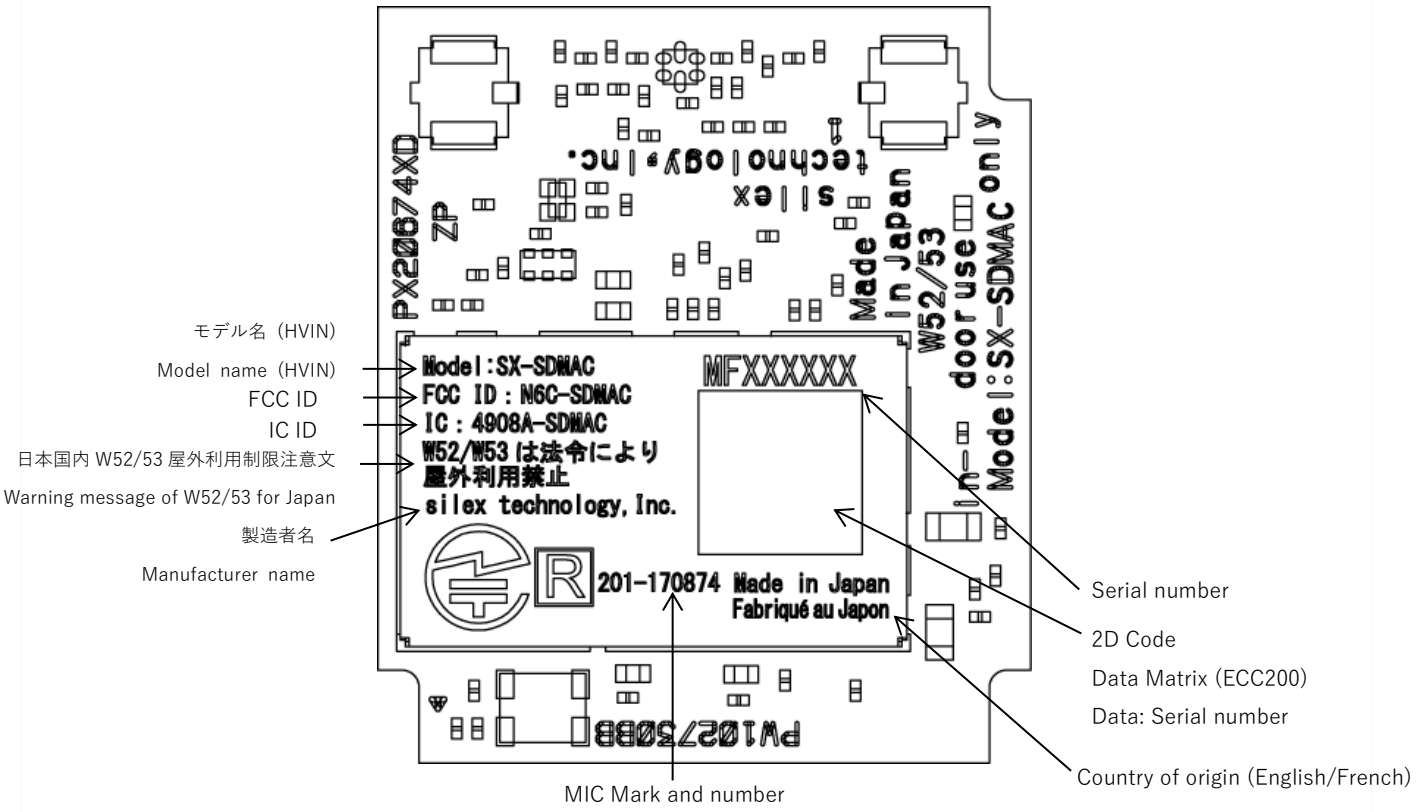
DFS Master 非対応（Non DFS Master support）
SX-SDMAC-2830S/SX-SDCAC-2830



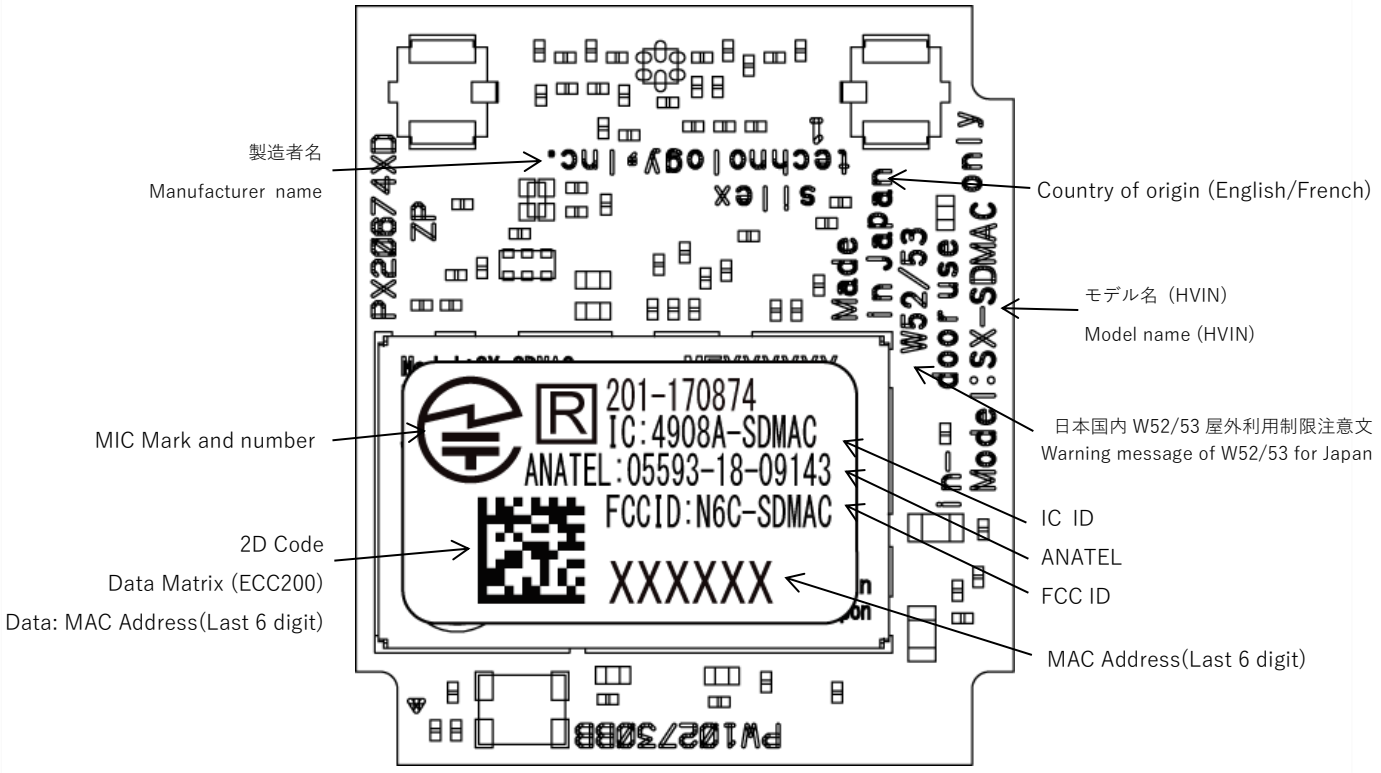
SX-SDMAC-2830S-EAL



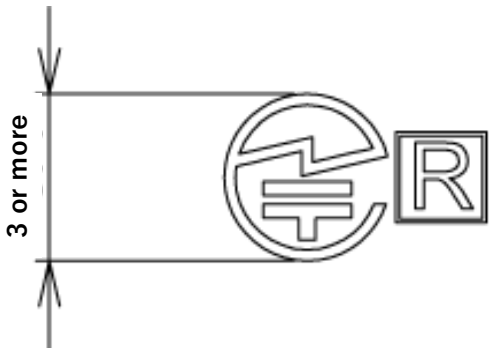
DFS Master 対応（DFS Master support）
SX-SDMAC-2831C/SX-SDMAC-2831S



SX-SDMAC-2831C-EAL/SX-SDMAC-2831S-EAL



MIC Mark dimension



(mm)

DFS Master 対応/非対応表（Table of DFS Master support/non-support）

Product No.	Product Name	Certification number	Remarks
ZXE03487	SX-SDMAC-2830S	007-AE0224	DFS Master 非対応 Non DFS Master support
ZXE03493	SX-SDMAC-2830S-SP		
ZXE03491	SX-SDCAC-2830		
ZXE03497	SX-SDCAC-2830-SP		
ZXE04016	SX-SDMAC-2830S-EAL		
ZXE04020	SX-SDMAC-2830S-EAL-SP		
ZXE04019	SX-SDCAC-2830-EAL		
ZXE04023	SX-SDCAC-2830-EAL-SP		
ZXE03490	SX-SDMAC-2831C	201-170874	DFS Master 対応 DFS Master support
ZXE03496	SX-SDMAC-2831C-SP		
ZXE03489	SX-SDMAC-2831S		
ZXE03495	SX-SDMAC-2831S-SP		
ZXE04018	SX-SDMAC-2831C-EAL		
ZXE04017	SX-SDMAC-2831S-EAL		
ZXE04022	SX-SDMAC-2831C-EAL-SP		
ZXE04021	SX-SDMAC-2831S-EAL-SP		

9. 構成リスト（Components composition List）

SX-SDMAC-2830S/SX-SDMAC-2830C/SX-SDCAC-2830

Categories	Items	Product No.								Remarks
		ZXE 03487 SX-SDMAC-2830S	ZXE 03493 SX-SDMAC-2830S-SP	ZXE 04016 SX-SDMAC-2830S-EAL	ZXE 04020 SX-SDMAC-2830S-EAL-SP	ZXE 03491 SX-SDCAC-2830	ZXE 03497 SX-SDCAC-2830-SP	ZXE 04019 SX-SDCAC-2830-EAL	ZXE 04023 SX-SDCAC-2830-EAL-SP	
Board	Main board	1	1	1	1	1	1	1	1	
Label	EMI Label	–	–	1	1	–	–	1	1	
	Packing Label	1/500	1/10	1/500	1/10	–	1	–	1	
	MSL Caution Label	1/500	1/10	1/500	1/10	–	–	–	–	
	Carton Label	1/2500	1/50	1/2500	1/50	1/100	1/20	1/100	1/20	
Accessory	Humidity Indicator	1/500	1/10	1/500	1/10	–	–	–	–	For Reel
	Antenna	–	–	–	–	–	1	–	1	
Packing	Packing Box	1/500	1/10	1/500	1/10	–	1	–	1	
	Carton Box	1/2500	1/50	1/2500	1/50	–	1/20	–	1/20	
	Bulk Packing Box	–	–	–	–	1/100	–	1/100	–	
	Antistatic air-cap bag	–	–	–	–	1	2	1	2	
	Aluminum lamination bag	1/500	1/10	1/500	1/10	–	–	–	–	For Reel
	Reel Set	1/500	1/10	1/500	1/10	–	–	–	–	
	Silicagel	1/500	1/10	1/500	1/10	–	–	–	–	For Reel

(pcs)

1 台当たり。Per 1 unit.

*ZXE03488 SX-SDMAC-2830C は未製品化
This product is not defined

* ZXE03494 SX-SDMAC-2830C-SP は未製品化
This product is not defined

*アンテナとアンテナケーブルはオプションです。
Antenna and Antenna Cable are optional.

SX-SDMAC-2831S/SX-SDMAC-2831C/SX-SDCAC-2831

Categories	Items	Product No.								Remarks
		ZXE 03490 SX-SDMAC-2831C	ZXE 03489 SX-SDMAC-2831S	ZXE 03496 SX-SDMAC-2831C-SP	ZXE 03495 SX-SDMAC-2831S-SP	ZXE 04018 SX-SDMAC-2831C-EAL	ZXE 04017 SX-SDMAC-2831S-EAL	ZXE 04022 SX-SDMAC-2831C-EAL-SP	ZXE 04021 SX-SDMAC-2831S-EAL-SP	
Board	Main board	1	1	1	1	1	1	1	1	
Label	EMI Label	–	–	–	–	1	1	1	1	
	Packing Label	–	1/500	1	1/10	–	1/500	1	1/10	
	MSL Caution Label	–	1/500	–	1/10	–	1/500	–	1/10	
	Carton Label	1/100	1/2500	1/20	1/50	1/100	1/2500	1/20	1/50	
Accessory	Humidity Indicator	–	1/500	–	1/10	–	1/500	–	1/10	For Reel
	Antenna	–	–	–	–	–	–	–	–	
Packing	Packing Box	–	1/500	1	1/10	–	1/500	1	1/10	
	Carton Box	–	1/2500	1/20	1/50	–	1/2500	1/20	1/50	
	Bulk Packing Box	1/100	–	–	–	1/100	–	–	–	
	Antistatic air-cap bag	1	–	1	–	1	–	1	–	
	Aluminum lamination bag	–	1/500	–	1/10	–	1/500	–	1/10	For Reel
	Reel Set	–	1/500	–	1/10	–	1/500	–	1/10	
	Silicagel	–	1/500	–	1/10	–	1/500	–	1/10	For Reel

(pcs)

1 台当たり。Per 1 unit.

*ZXE03492 SX-SDCAC-2831 は未製品化
This product is not defined

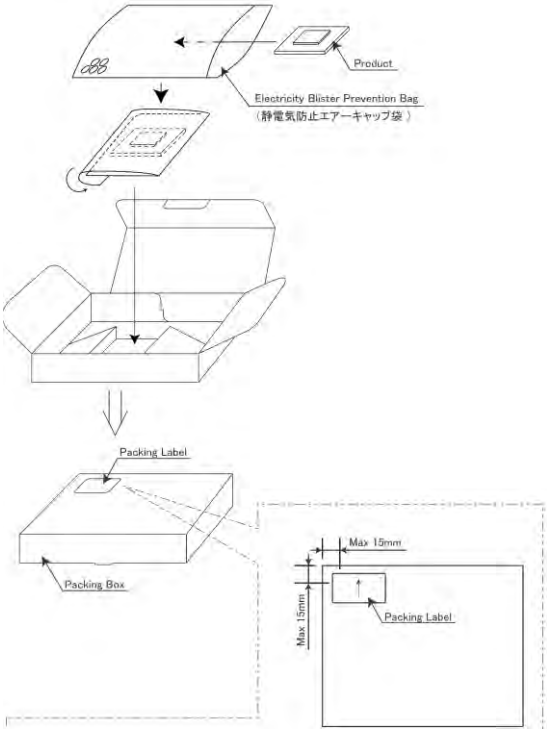
* ZXE03498 SX-SDCAC-2831-SP は未製品化
This product is not defined

*アンテナとアンテナケーブルはオプションです。
Antenna and Antenna Cable are optional.

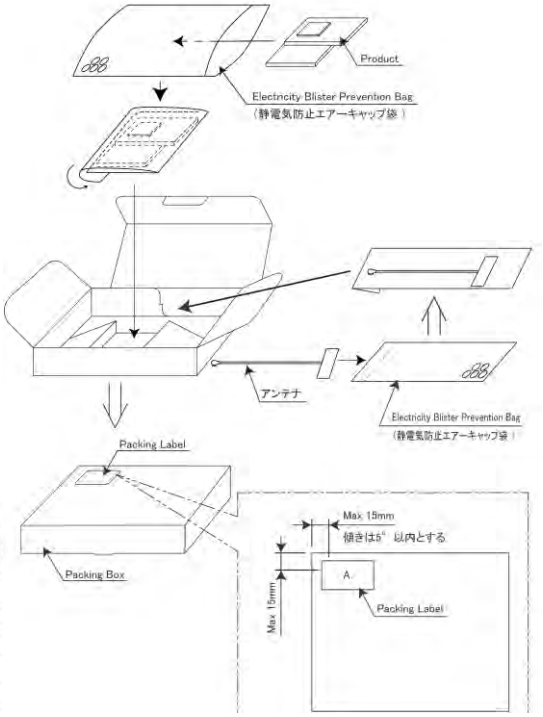
10. 梱包仕様（Packing specifications）

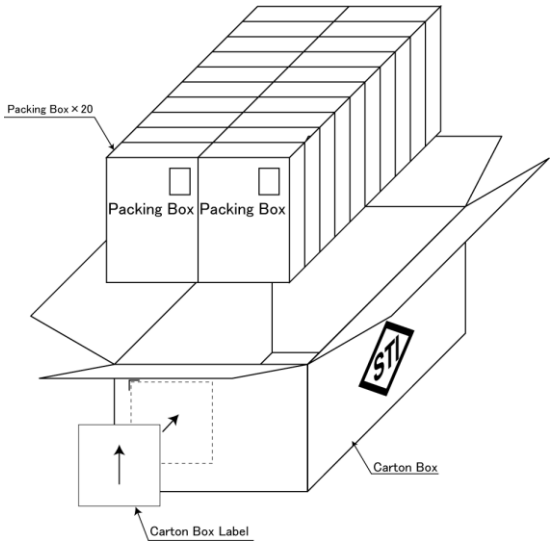
サンプルパック（Sample pack）

SX-SDMAC-2831C-SP/SX-SDMAC-2831C-EAL-SP



SX-SDCAC-2830-SP/SX-SDCAC-2830-EAL-SP

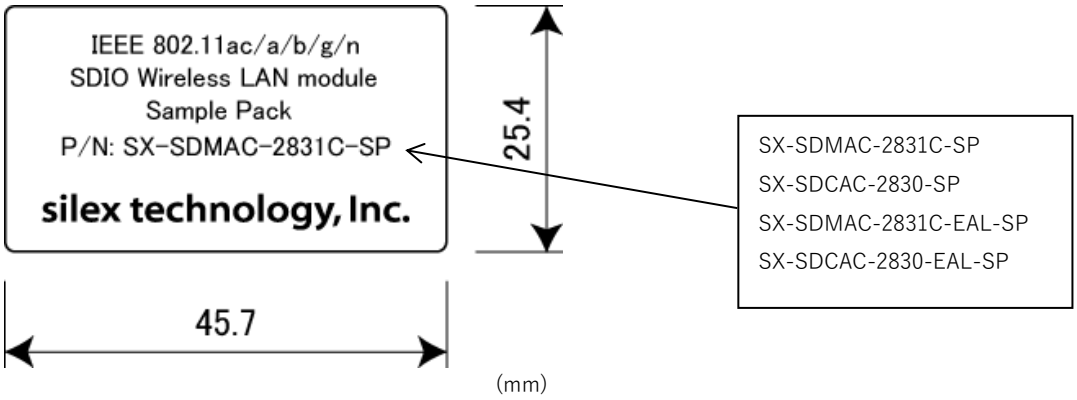




総重量 Gross weight

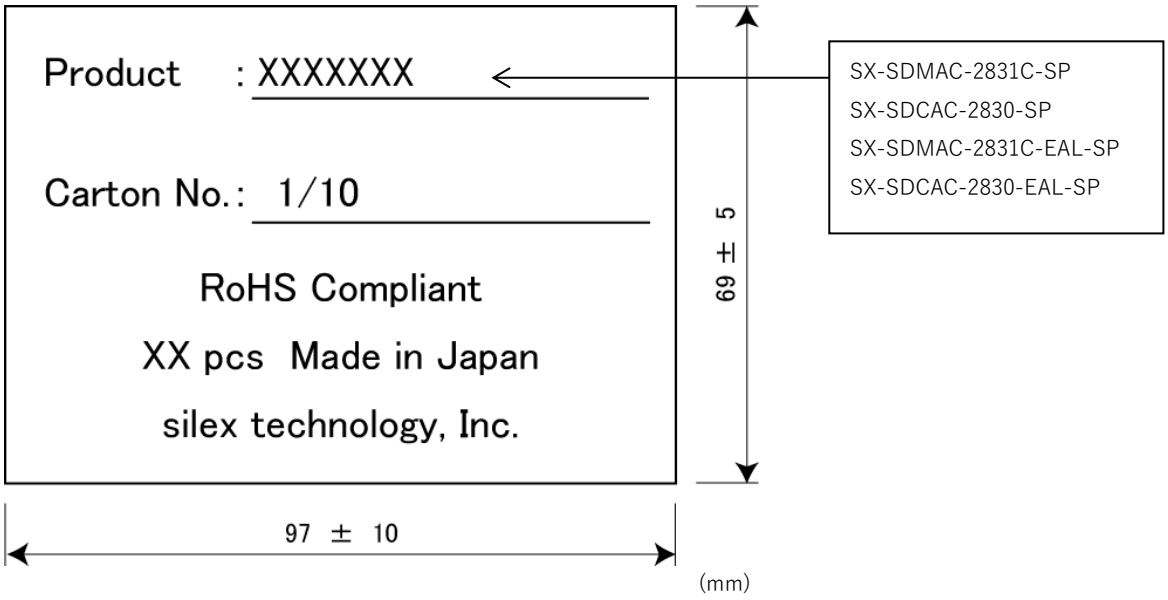
SX-SDMAC-2831C-SP/SX-SDMAC-2831C-EAL-SP	SX-SDCAC-2830-SP/SX-SDCAC-2830-EAL-SP
1.6kg	1.7kg

Packing Label



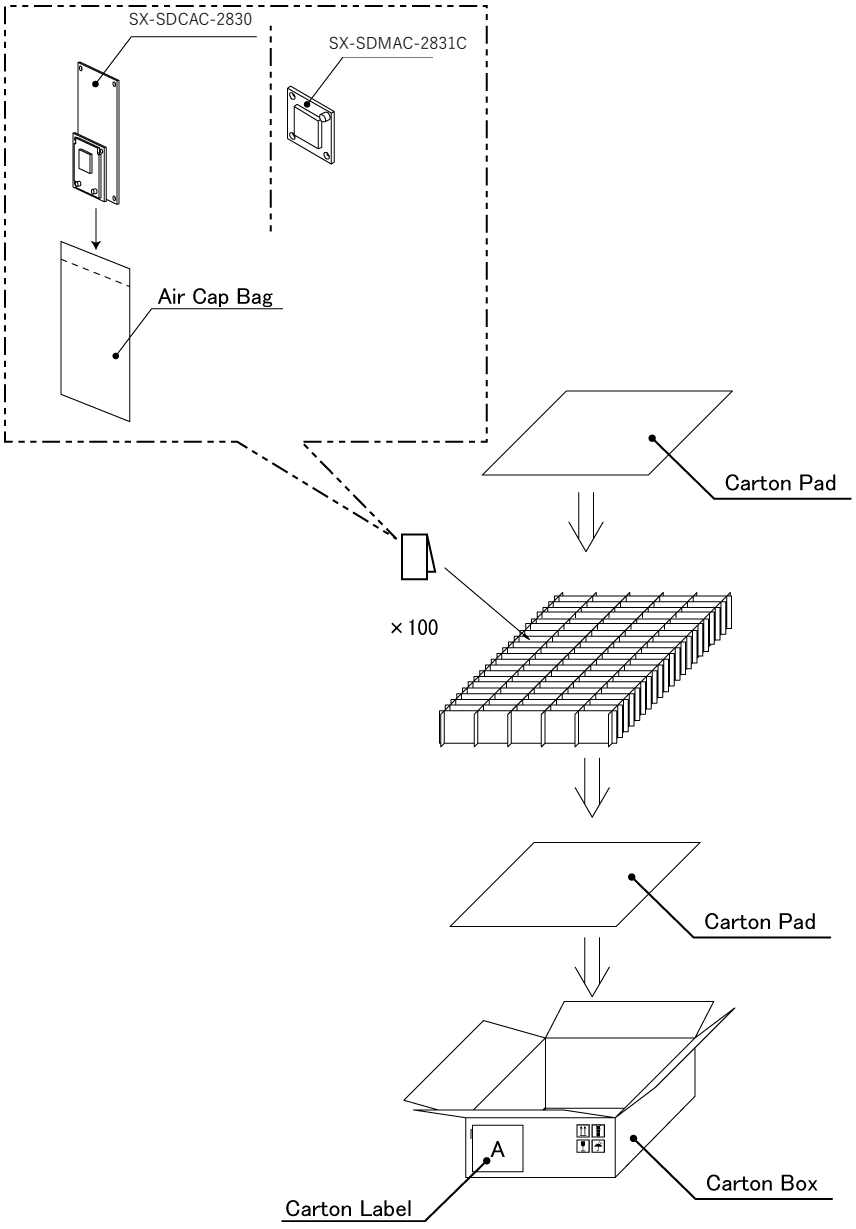
(mm)

Carton Label



(mm)

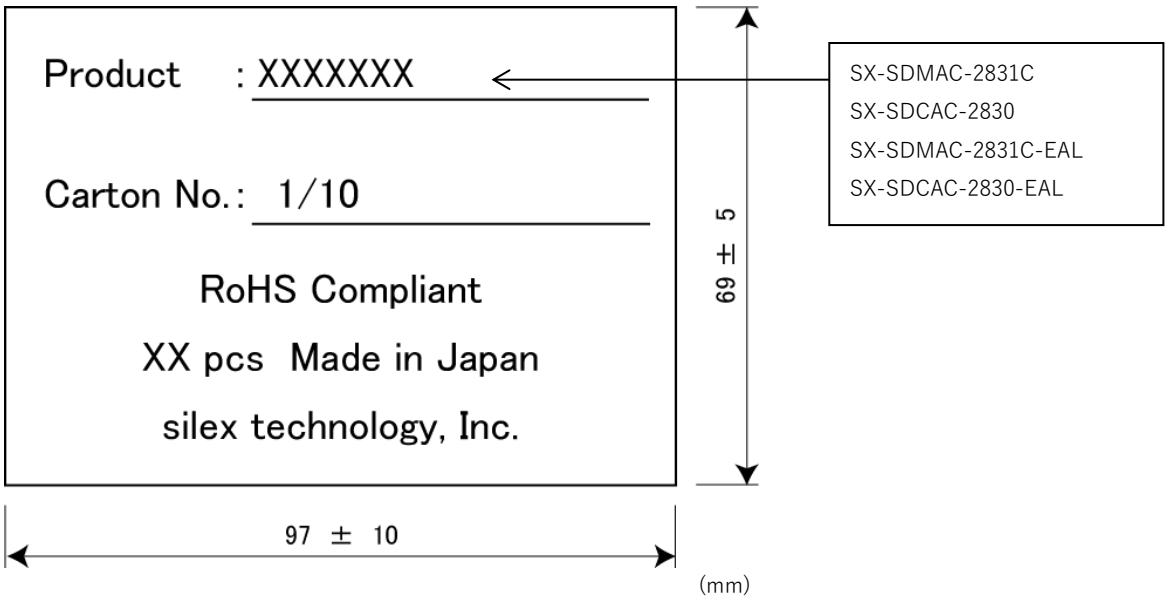
バルクパック（Bulk packing）



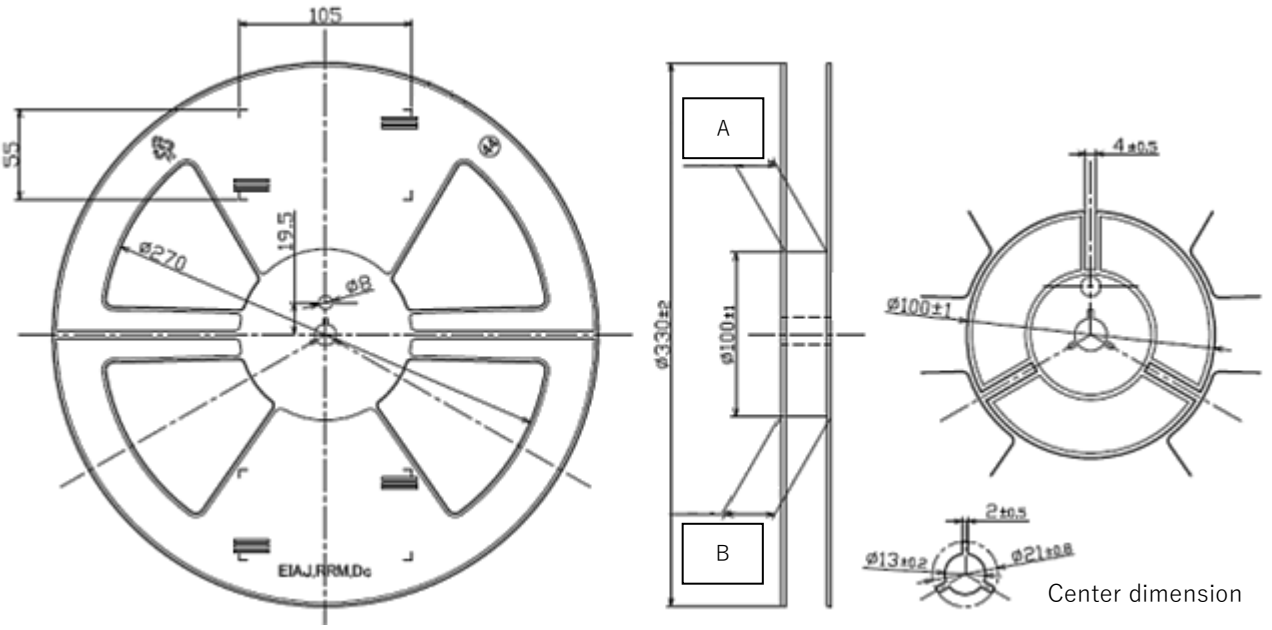
総重量 Gross weight

SX-SDMAC-2831C/SX-SDMAC-2831C-EAL	SX-SDCAC-2830/SX-SDCAC-2830-EAL
1.5kg	1.9kg

Carton Label

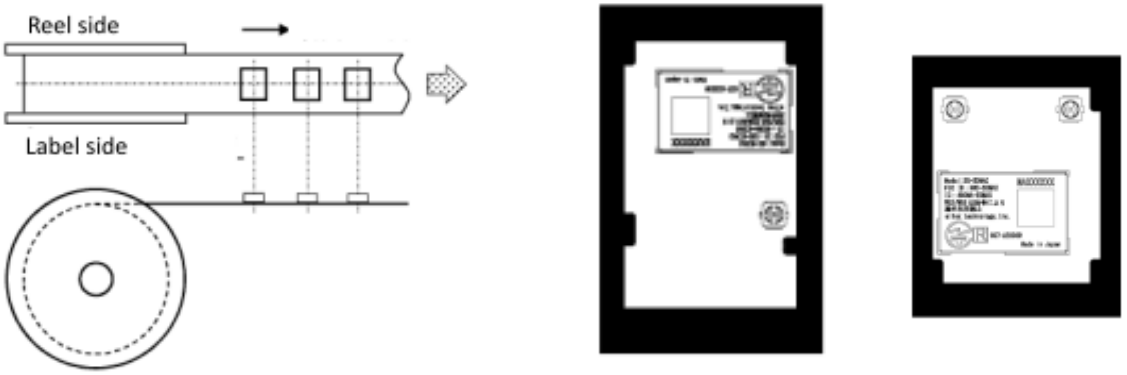


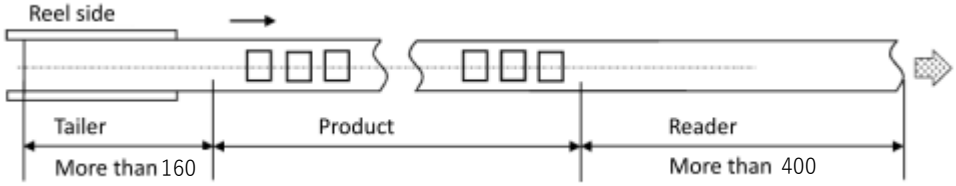
リール (Reel)



(mm)

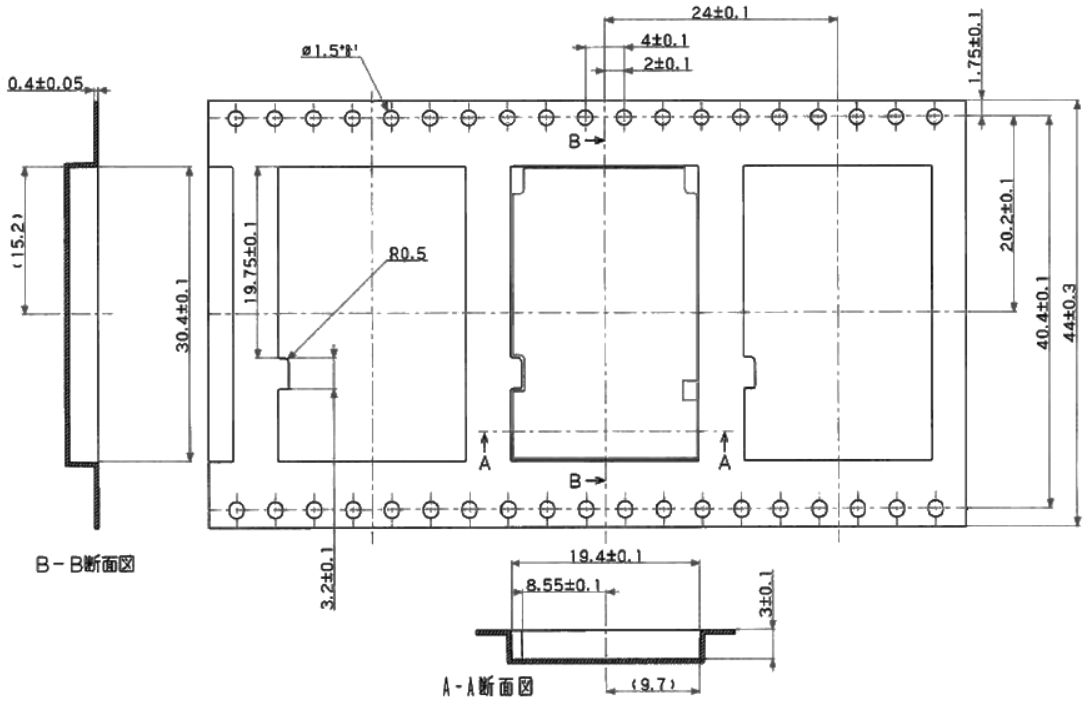
	SX-SDMAC-2830S SX-SDMAC-2830S-EAL	SX-SDMAC-2831S SX-SDMAC-2831S-EAL
A	45.4±1	33.4±1
B	49.4±1	37.4±1





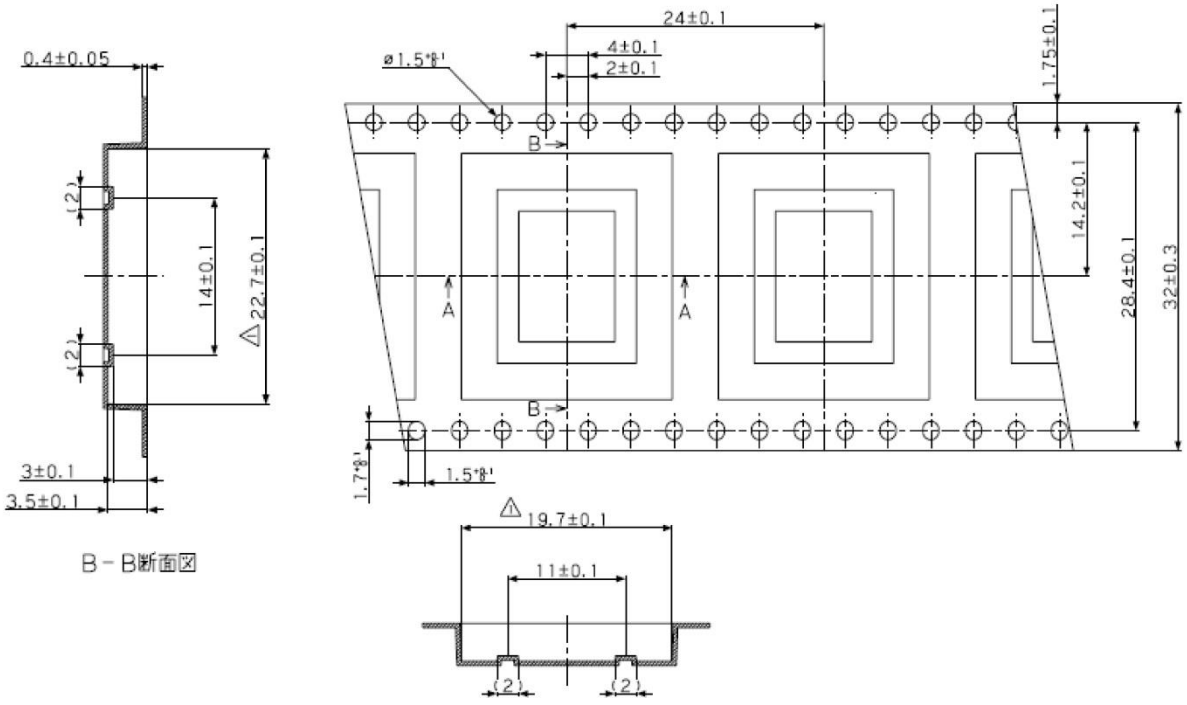
(mm)

SX-SDMAC-2830S/SX-SDMAC-2830S-EAL

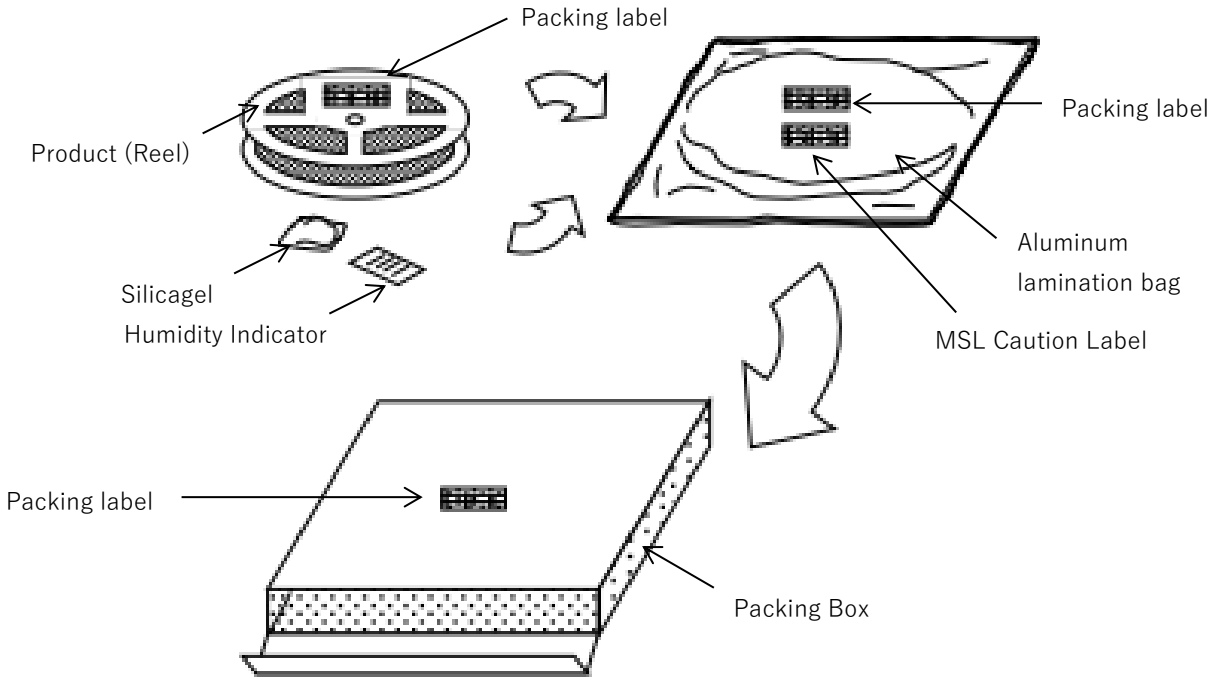


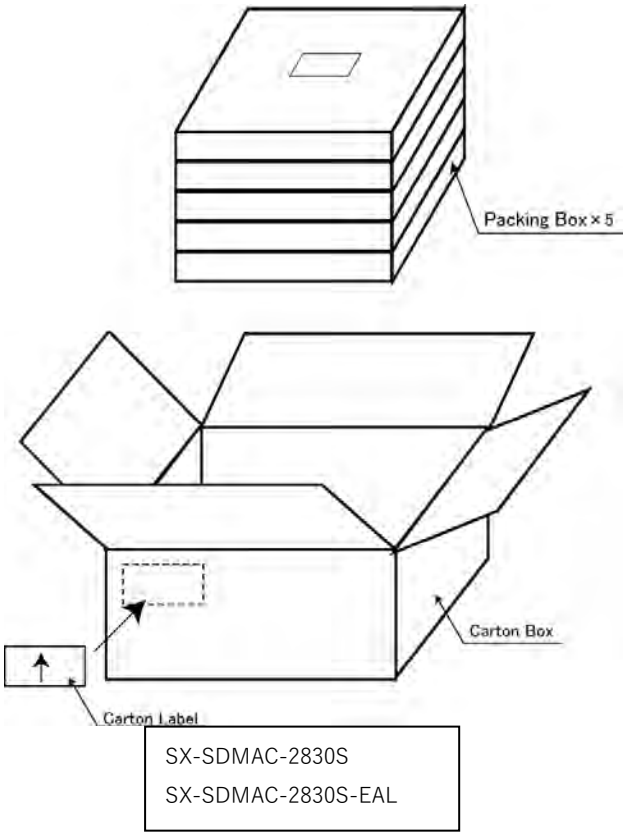
(mm)

SX-SDMAC-2831S/SX-SDMAC-2831S-EAL

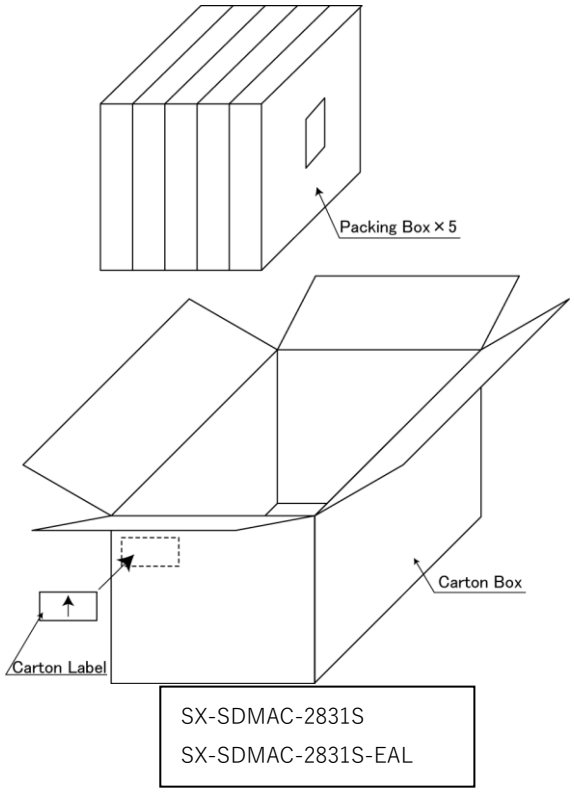


(mm)





SX-SDMAC-2830S
SX-SDMAC-2830S-EAL

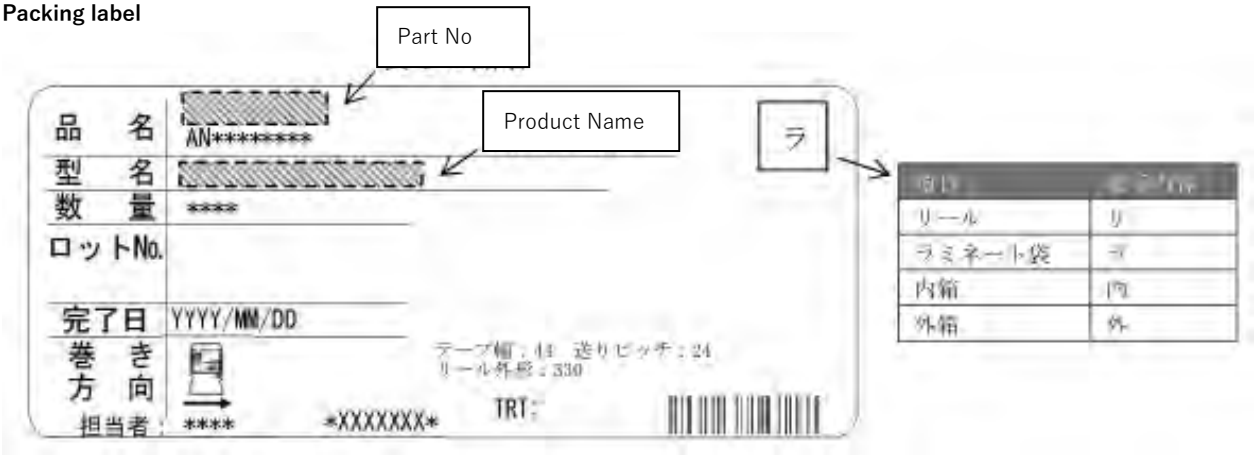


SX-SDMAC-2831S
SX-SDMAC-2831S-EAL

総重量 Gross weight

SX-SDMAC-2830S/SX-SDMAC-2830S-EAL	SX-SDMAC-2831S/SX-SDMAC-2831S-EAL
9.7kg	7.6kg

Packing label



Product Name	Part No
SX-SDMAC-2830S	ZXE03487
SX-SDMAC-2830S-SP	ZXE03493
SX-SDMAC-2830S-EAL	ZXE04016
SX-SDMAC-2830S-EAL-SP	ZXE04020

Product Name	Part No
SX-SDMAC-2831S	ZXE03489
SX-SDMAC-2831S-SP	ZXE03495
SX-SDMAC-2831S-EAL	ZXE04017
SX-SDMAC-2831S-EAL-SP	ZXE04021

集合ラベル（Carton label）

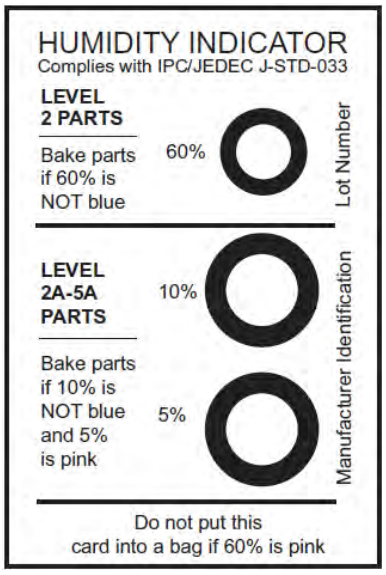
(mm)

SX-SDMAC-2830S
SX-SDMAC-2830S-SP
SX-SDMAC-2831S
SX-SDMAC-2831S-SP
SX-SDMAC-2830S-EAL
SX-SDMAC-2831S-EAL
SX-SDMAC-2830S-EAL-SP
SX-SDMAC-2831S-EAL-SP

MSL 警告ラベル（MSL caution label）

(mm)

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



11. 信頼性試験（Reliability test）

<table>
<tr><th rowspan="2">Test items</th><th rowspan="2">Standards</th><th rowspan="2">Description</th><th colspan="2">Requirements</th></tr>
<tr><th>Electricity</th><th>Appearance</th></tr>
<tr><td>DC 電圧試験
DC voltage test</td><td>－</td><td>電源電圧+3.0 V ~ +3.6 Vで動作確認を行う。
・通信の停止や通信速度の異常が起こらないことを確認する。
Check to work with +3.0 - +3.6V voltage range.
・Check no transaction stop or no throughput drop.</td><td>動作可能
Workable</td><td>NA</td></tr>
<tr><td>温湿度電圧
サイクル試験
Temperature/
Humidity cycle
test</td><td>－</td><td>下記条件で動作確認を行う。
・通信の停止や通信速度の異常が起こらないことを確認する。
Check to work with below conditions.
・Check no transaction stop or no throughput drop.
Standard test[⇨: Ramp] (Hr:Min)
<table>
<tr><td>Step</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>℃</td><td>+25</td><td>⇨</td><td>-40</td><td>⇨</td><td>+90</td><td>⇨</td><td>-40</td><td>⇨</td><td>+90</td><td>+90</td></tr>
<tr><td>%RH</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>20</td><td>20</td><td>85</td></tr>
<tr><td>Time</td><td>0:05</td><td>1:00</td><td>2:00</td><td>1:00</td><td>2:00</td><td>1:00</td><td>4:00</td><td>1:00</td><td>2:00</td><td>6:00</td></tr>
<tr><td>Power</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><td>ON</td></tr>
<tr><td>Step</td><td>11</td><td>12</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td></tr>
<tr><td>℃</td><td>⇨</td><td>+25</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td></tr>
<tr><td>%RH</td><td>30</td><td>OFF</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td></tr>
<tr><td>Time</td><td>1:00</td><td>0:10</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td></tr>
<tr><td>Power</td><td>⇨</td><td>+25</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td><td>－</td></tr>
</table>
Extended test[⇨: Ramp] (Hr:Min)
<table>
<tr><td>Step</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>℃</td><td>-</td><td>⇨</td><td>-40</td><td>⇨</td><td>0</td><td>⇨</td><td>+20</td><td>⇨</td><td>+40</td><td>+40</td></tr>
<tr><td>%RH</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>⇨</td><td>10</td><td>⇨</td><td>10</td><td>⇨</td></tr>
<tr><td>Time</td><td>0:00</td><td>2:00</td><td>2:00</td><td>1:00</td><td>2:00</td><td>1:00</td><td>3:00</td><td>1:00</td><td>4:00</td><td>0:45</td></tr>
<tr><td>Power</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><td>ON</td></tr>
<tr><td>Step</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>－</td><td>－</td><td>－</td></tr>
<tr><td>℃</td><td>+40</td><td>⇨</td><td>+85</td><td>⇨</td><td>+40</td><td>⇨</td><td>+25</td><td>－</td><td>－</td><td>－</td></tr>
<tr><td>%RH</td><td>95</td><td>⇨</td><td>95</td><td>⇨</td><td>95</td><td>⇨</td><td>50</td><td>－</td><td>－</td><td>－</td></tr>
<tr><td>Time</td><td>24:15</td><td>1:00</td><td>12:00</td><td>1:00</td><td>4:00</td><td>1:00</td><td>2:00</td><td>－</td><td>－</td><td>－</td></tr>
<tr><td>Power</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>－</td><td>－</td><td>－</td></tr>
</table></td><td>動作可能
Workable</td><td>NA</td></tr>
<tr><td>高温動作試験
Functional hot temp</td><td>－</td><td>+90°Cの環境下で動作すること。
Workable at +90°C</td><td>動作可能
Workable</td><td>NA</td></tr>
<tr><td>低温動作試験
Functional cold temp</td><td>－</td><td>-40°Cの環境下で動作すること。
Workable at -40°C</td><td>動作可能
Workable</td><td>NA</td></tr>
</table>

<table>
<tr><th rowspan="2">Test items</th><th rowspan="2">Standards</th><th rowspan="2">Description</th><th colspan="2">Requirements</th></tr>
<tr><th>Electricity</th><th>Appearance</th></tr>
<tr><td>衝撃試験
Mechanical shock test</td><td>MIL-STD-202
Method 213B
Condition A</td><td>衝撃を加えた後、動作確認を行う。
・方向と回数：X1/2 (+ /-), Y1/2 (+ /-), Z1/2 (+ /-) 各5回（計30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.
・Axis and number of times： X1/2 (+ /-), Y1/2 (+ /-), Z1/2 (+ /-)
5 times per direction (Total 30 times)
・Damage/Defect/RF degradation is not observed after shock.
<table><tr><th>Test condition</th><th>Peak value (g's)</th><th>Normal duration (D) (ms)</th><th>Waveform</th><th>Velocity change (Vi) ft/sec</th></tr><tr><td>A</td><td>50</td><td>11</td><td>Half-sine</td><td>11.3</td></tr></table></td><td>検査仕様適合
Test spec in</td><td>損傷無し
No damage</td></tr>
<tr><td>振動試験
Mechanical vibration test</td><td>MIL-STD-202
Method 204D
Condition D</td><td>振動を加えた後、動作確認を行う。
・最大加速：20g, 周波数：10 <> 2000Hz
・方向と回数：X-Y-Z 各20分 各4回（計12回）
・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.
・Peak g's：20g, Frequency： 10 <> 2000Hz
・Axis and number of times： X-Y-Z
4 times per direction (Total 12 times)
・Damage/Defect/RF degradation is not observed after vibration.</td><td>検査仕様適合
Test spec in</td><td>損傷無し
No damage</td></tr>
<tr><td>温度衝撃試験
Thermal shock test</td><td>JEDEC
JESD22-A106B
Test Condition C
(Fluid Air)</td><td>本製品をLxWxT=50x18x1.6mmの基板に実装後に試験を実施する。
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。
・100 Cycleで動作確認を実施する。
Perform after soldering this module down on the LxWxT=50x18x1.6mm.
Check to work after heat shocking
・Repeat Step 1 (High temp.) / Step 3 (Low temp.)
・Check to work after 100 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>+125
+10/-0°C</td><td>⇨</td><td>-55
+0/-10°C</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></td><td>検査仕様適合
Test spec in</td><td>損傷無し
No damage</td></tr>
<tr><td>静電気試験
ESD test</td><td>JEDEC
JESD22-A114F</td><td>アンテナ芯線とGND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 and GND ring 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.</td><td>動作可能
Workable</td><td>NA</td></tr>
</table>

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

NOTE1	以下を除く全ての項目のサンプル数は 3 台 ・温度衝撃試験：10 台 Sample numbers for all test except below is 3 units. ・Thermal shock test：10 units

12. 使用上の注意（Notifications）

- 本製品の仕様は、§6. 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 compliant to law regulations of §6. Standards Compliance, but this shall not apply to following cases.
  1) §6. に掲げるアンテナ以外を使う場合。
     In case this module is used with different antenna from the antenna list of §6.
  2) §6. 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 §6
  3) 認可の更新が必要な場合。
     In case the certification must be renewed.

- 本製品は 2.4GHz 帯と 5GHz 帯の電波を媒体とする無線通信機です。法令により 5.15-5.35GHz 帯域（W52, W53）を屋外で利用する事は禁止されております。本製品を屋外で利用される場合は予め W52 / W53 帯域の電波を出さない様に設定してください。
  This module is the wireless device using 2.4GHz / 5GHz band. You have to disable 5.15-5.35GHz band (W52, W53) before use at outdoor in Japan because these band are prohibited to use at outdoor by low restriction.

- 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以下に特に注意してください。(IEEE802.11-2012 及び IEEE802.11ac-2013 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 and IEEE802.11ac-2013)

  1) 2.4GHz 帯では、本モジュールの中心周波数から+/- 25MHz (5Ch) 以上の間隔をあけて使用することが推奨されます。
     +/-25MHz (+/-25MHz) or more frequency separation from the center frequency of this module is recommended in 2.4GHz.

  2) 隣接チャネル及び非隣接チャネルの信号入力には十分注意して、混信を避ける環境を設定してください。
     Appropriate environment to avoid interference from the adjacent channels or the non-adjacent channels is necessary.

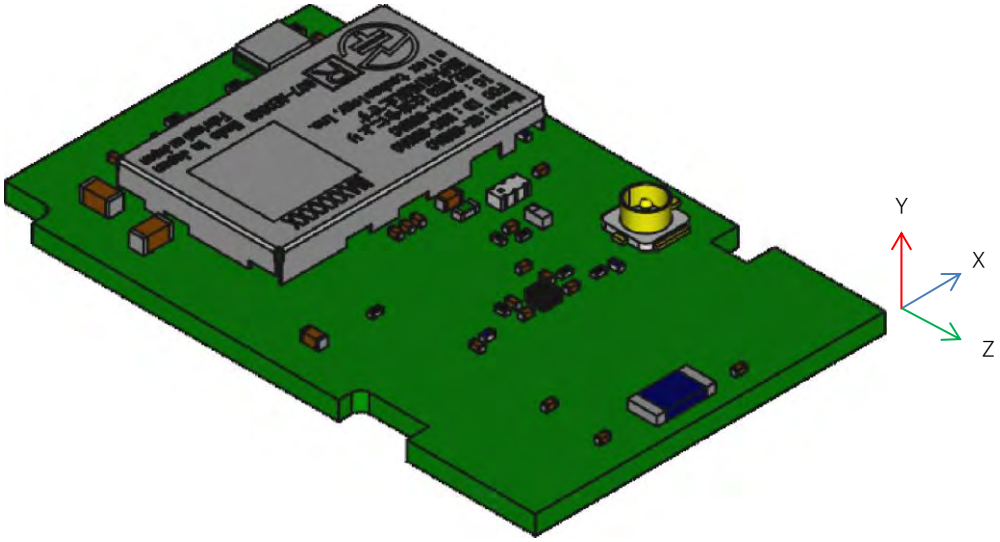
     - 2.4GHz 隣接チャネル：中心周波数+/-25MHz(5Ch), 非隣接チャネル：中心周波数 +/-25MHz(5Ch)以上
       2.4GHz: Center frequency +/-25MHz (5Ch), Non Adjacent channel: Further than Center frequency +/-25MHz (5Ch)
     - 5GHz HT20 隣接チャネル：中心周波数+/-20MHz(4Ch), 非隣接チャネル：中心周波数 +/-20MHz(4Ch)以上
       5GHz HT20: Center frequency +/-20MHz (4Ch), Non Adjacent channel: Further than Center frequency +/-20MHz (4Ch)
     - 5GHz HT40 隣接チャネル：中心周波数+/-40MHz(8Ch), 非隣接チャネル：中心周波数 +/-40MHz(8Ch)以上
       5GHz HT40 Adjacent channel: Center frequency +/-40MHz (8Ch), Non Adjacent channel: Further than Center frequency +/-40MHz (8Ch)

  ※上記の条件外であっても、強い電波入力が有る場合は混信する可能性が有るため、周辺の無線機器は十分距離を離してご使用ください。
  Even if these conditions are satisfied, the module is possibly interfered when strong signal is input. The other wireless system should be enough far from this module

- 対向機からの入力は、アンテナゲインを含み 2.4GHz 帯で-20dBm 以下、5GHz 帯で-30dBm 以下としてください。
  The input level from the opponent device must be -20dBm or less at 2.4GHz, -30dBm or less at 5GHz with including antenna gain.

13. 付録 A アンテナ性能（Appendix -A Antenna performance）

SX-SDMAC On board chip antenna performance.



XY

	2450	5100	5500	5800
	XY	XY	XY	XY
Peak Gain (dBi)	-1.67	-2.43	0.95	-1.37
AveGain (dBi)	-3.21	-7.05	-3.80	-5.05

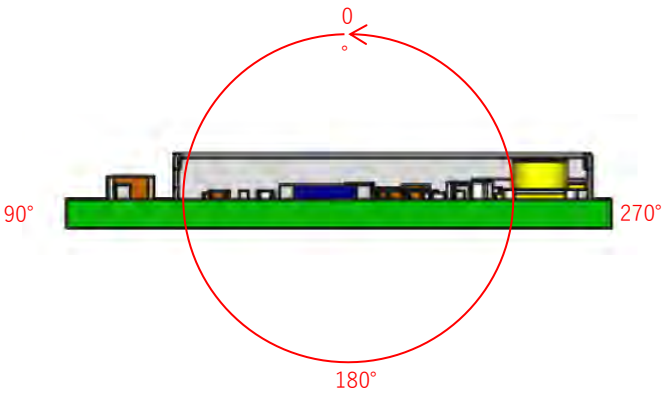
YZ

	2450	5100	5500	5800
	YZ	YZ	YZ	YZ
Peak Gain (dBi)	-2.72	-7.67	-3.19	-1.92
AveGain (dBi)	-3.93	-10.86	-5.19	-4.93

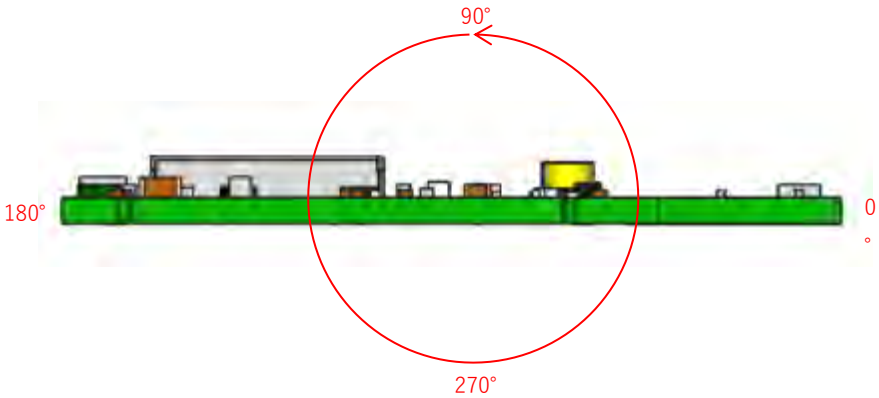
ZX

	2450	5100	5500	5800
	ZX	ZX	ZX	ZX
Peak Gain (dBi)	-1.62	-3.26	0.33	0.07
AveGain (dBi)	-5.85	-7.94	-4.88	-5.32

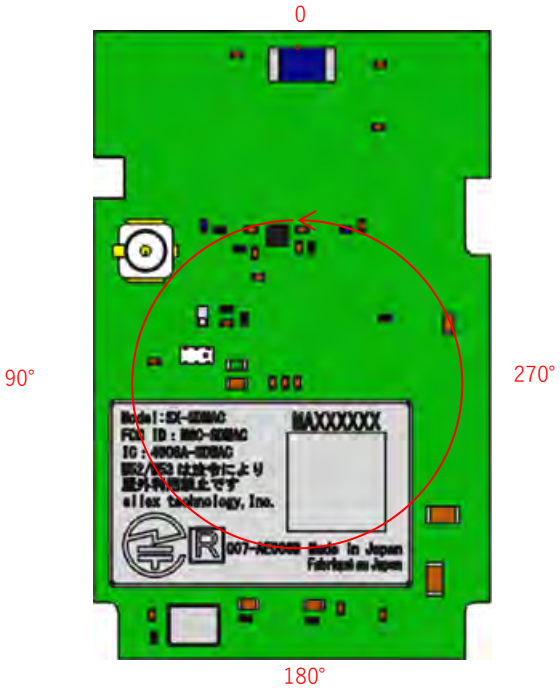
XY

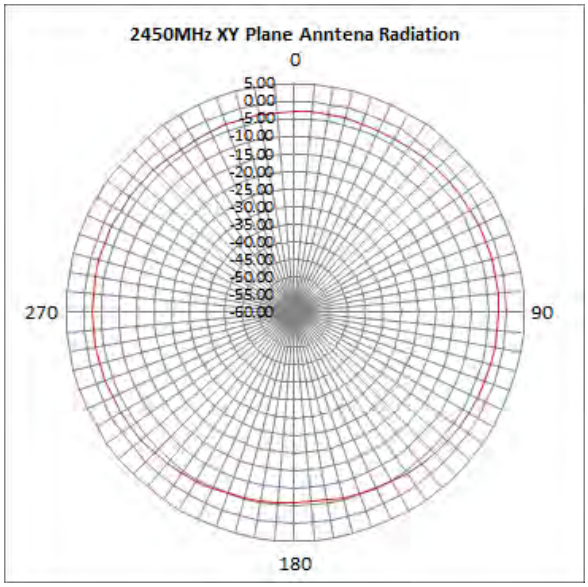

0
°
90°
270°
180°

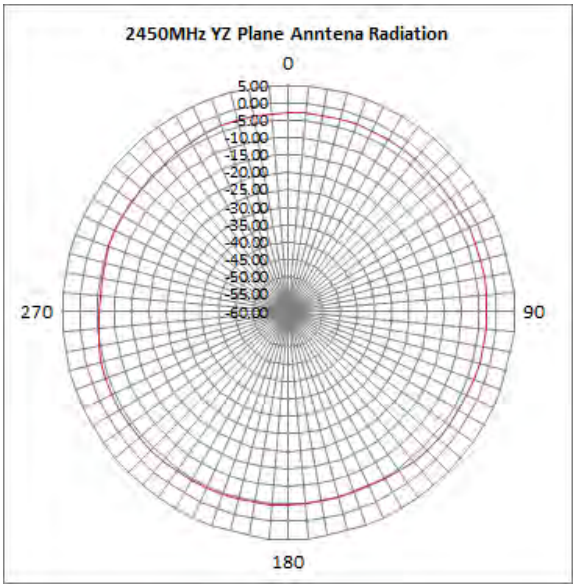
YZ

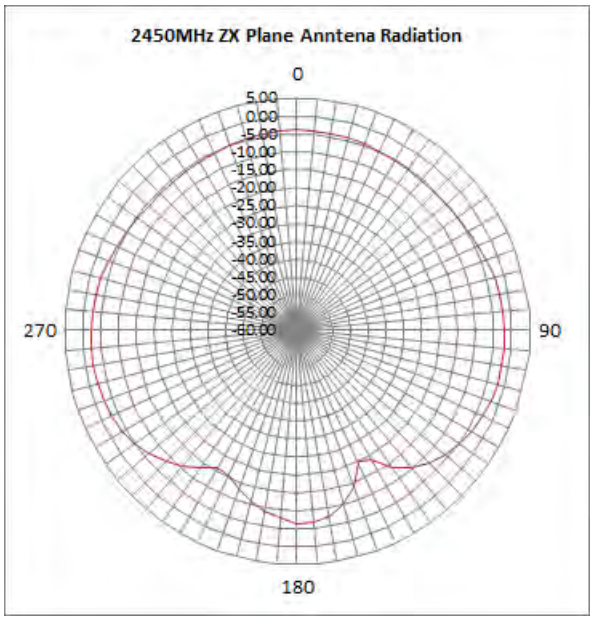

90°
180°
0
°
270°

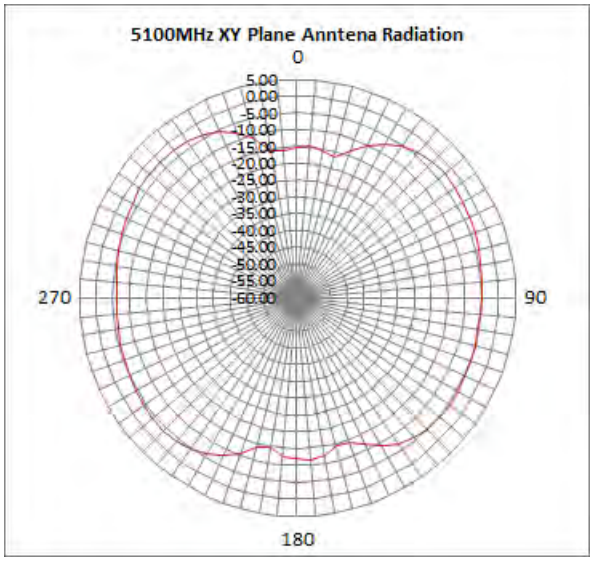
ZX

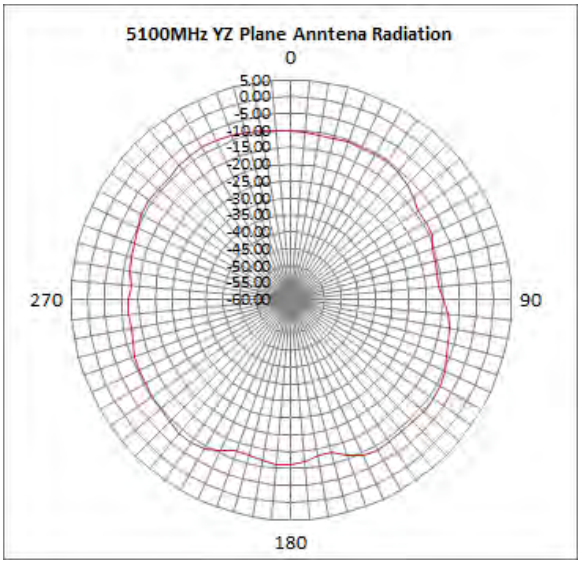

0
°
90°
270°
180°
MAXXXXXX
silex technology, Inc.
Made in Japan
Fabriqué au Japon

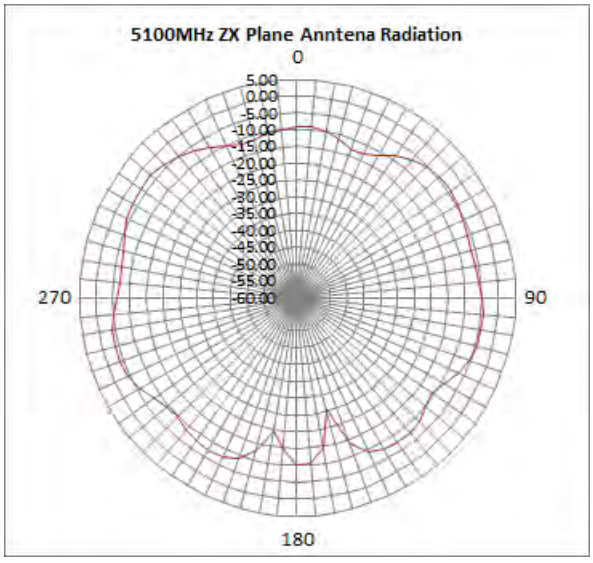


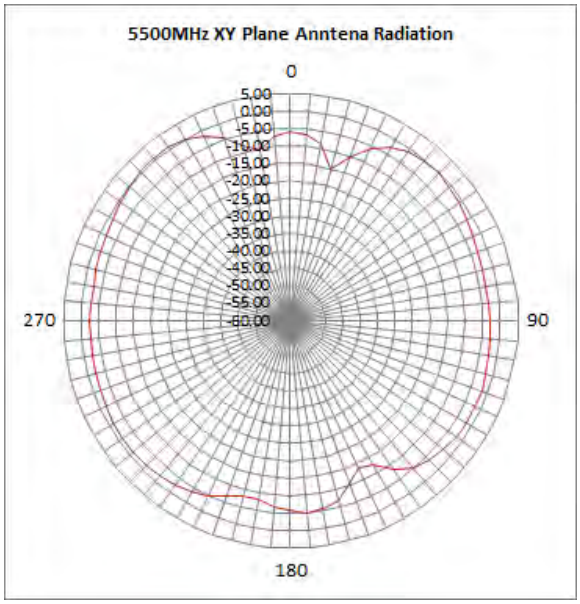


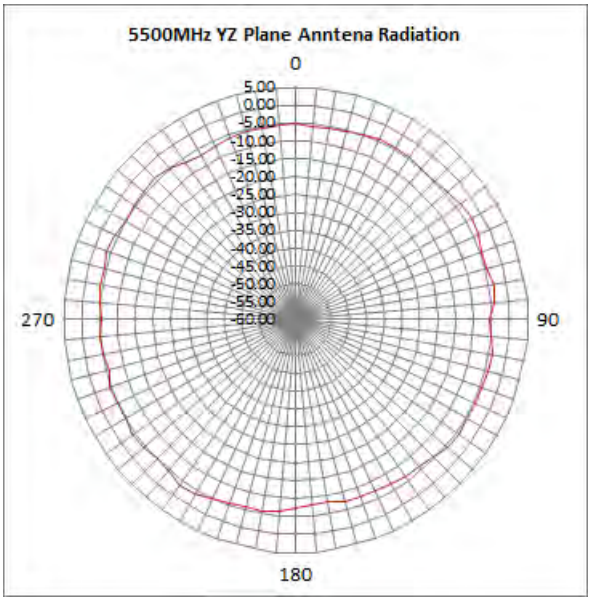


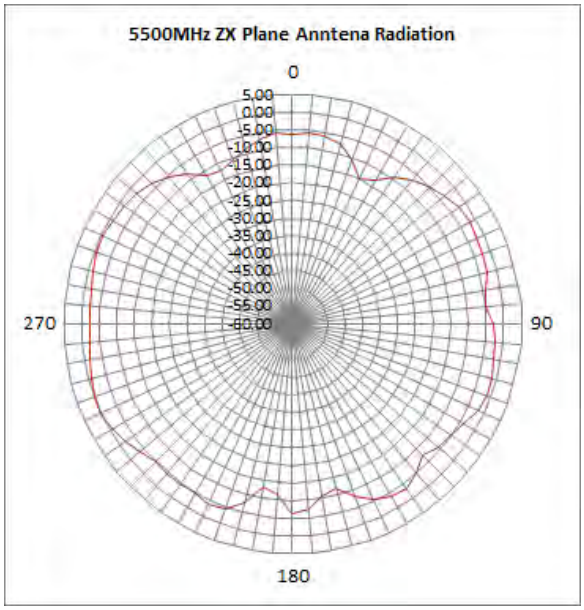


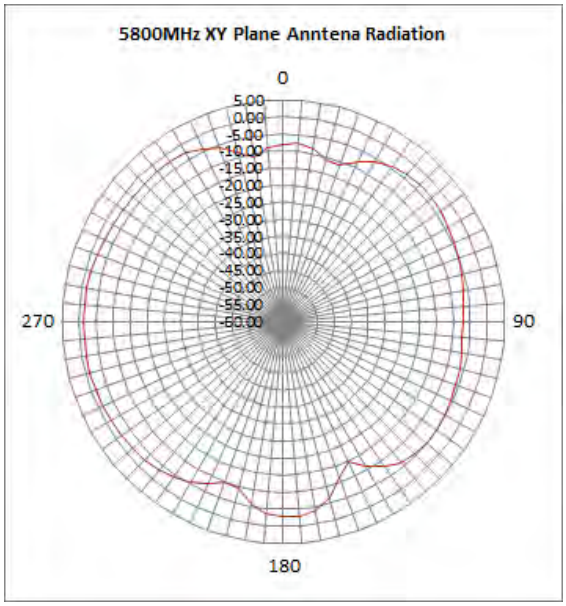


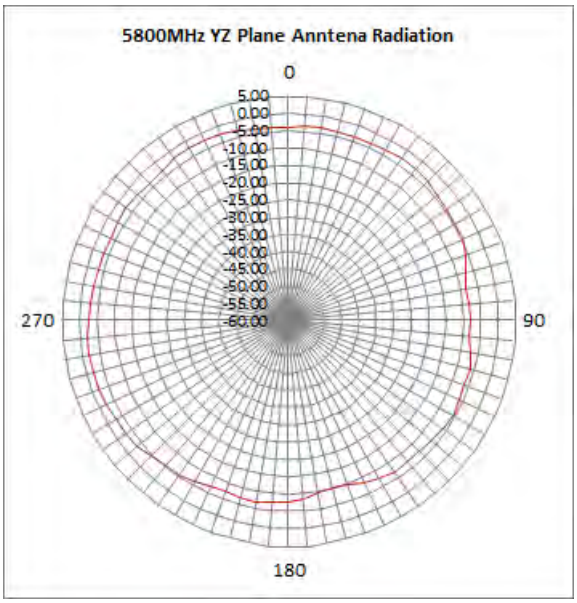


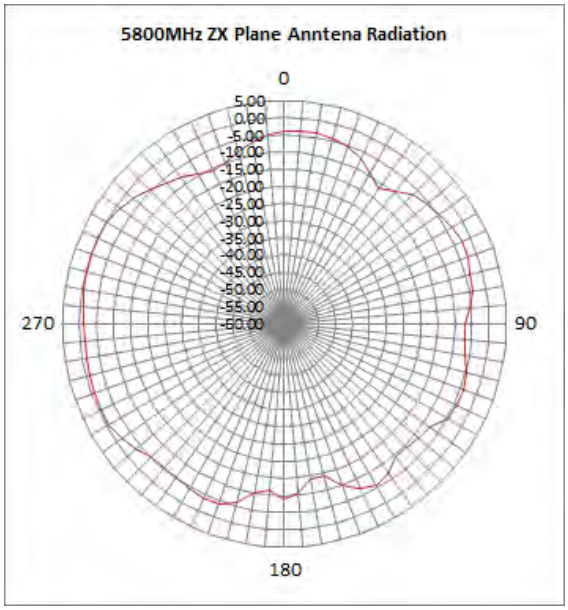










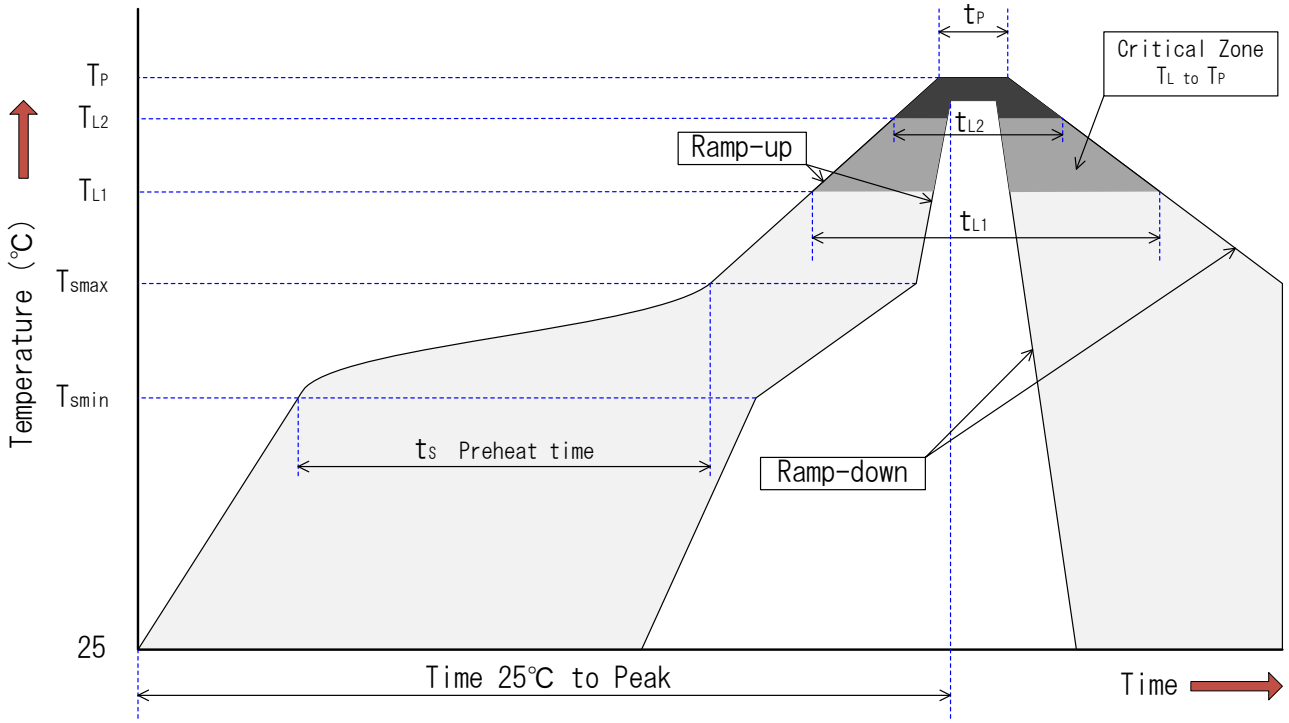


14. 付録 B SMT リフロー条件（Appendix -B SMT reflow profiles）

本推奨条件は、Sn/Ag/Cu Pb-Free 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 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	1.5	–	3.0	°C/Sec
Preheat	Temperature Ts_{min}	160	–	–	°C
	Temperature Ts_{max}	–	–	170	°C
	Time t_s	60	–	120	Sec
Time maintained above	Temperature T_{L1}	217	–	–	°C
	Time t_{L1}	–	–	60	Sec
	Temperature T_{L2}	230	–	–	°C
	Time t_{L2}	–	–	40	Sec
Peak Temperature	T_p	245	–	250	°C
Time within 5°C of Actual Peak Temperature	t_p	–	–	10	Sec
Average ramp-down rate	–	1.5	–	6	°C/Sec
Time 25°C to Peak Temperature	–	–	–	8	Min

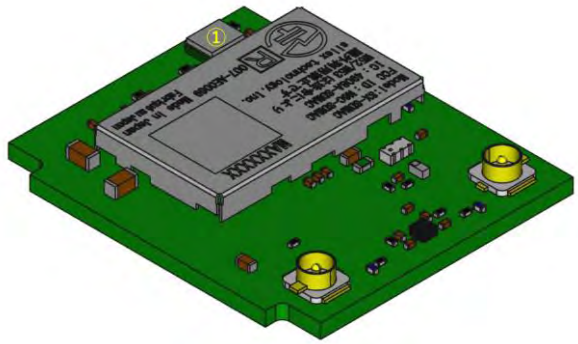


Profile Data

15. 付録 C 動作温度定義条件（Appendix -C Conditions of operating temperature definition）

SX-SDMAC の温度上昇と周囲温度について参考情報として記載致します。
使用温度についてはお客様のシステムにて十分にご検証ください。

This data of temperature rise and ambient temperature is the reference information.
Customers need to evaluate to temperature in your products.



温度上昇データ

Temperature rise data

Device	Temp. rise (˚C)	Throughput (Mbps)
①	9.7	280

Mode : 5GHz 11ac VHT80
TCP/UDP: UDP Tx.

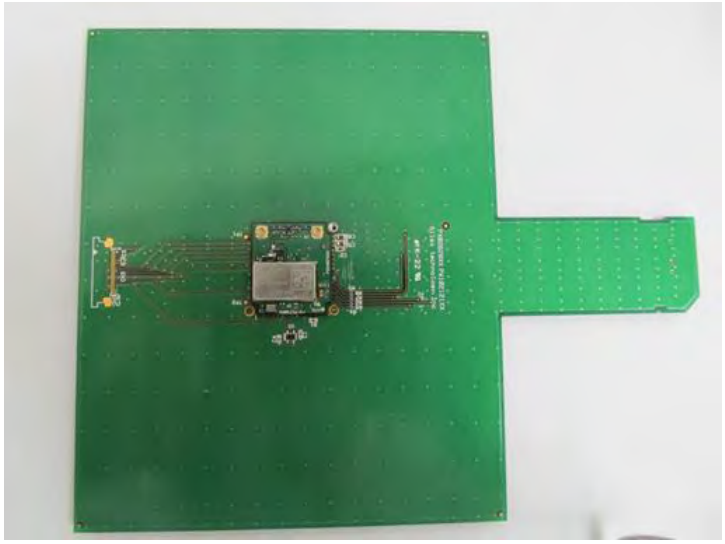
Conditions

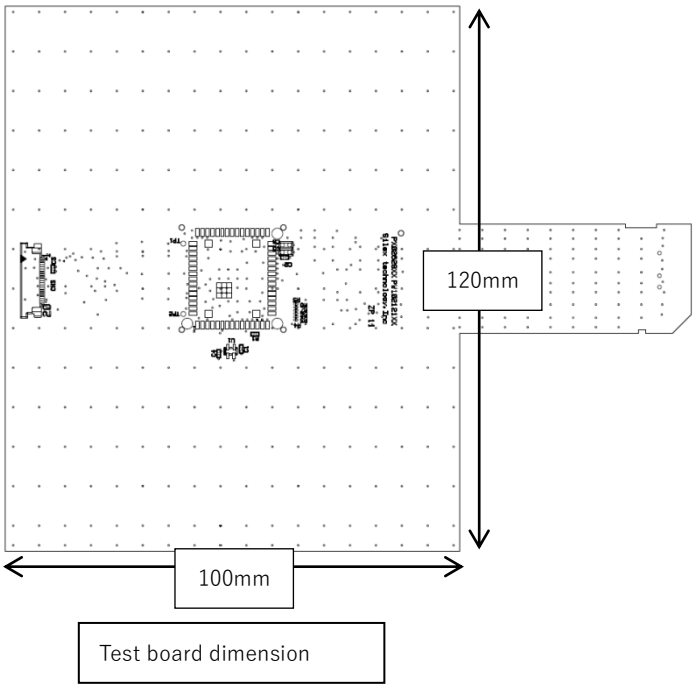
以下に測定時の条件を記載します。

The following is the condition when we measured.

試験基板条件

DUT conditions

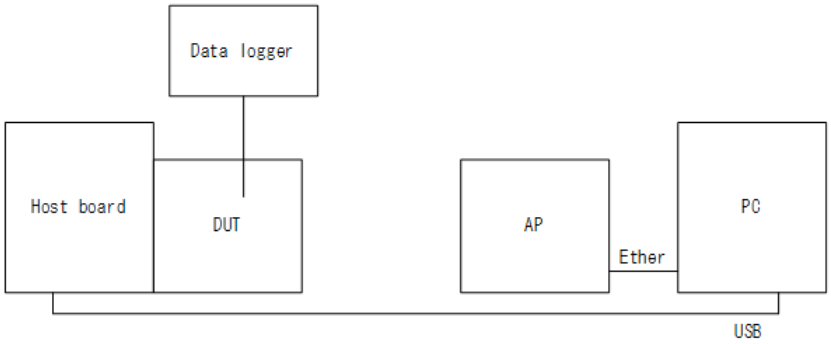




Test board dimension

構成図

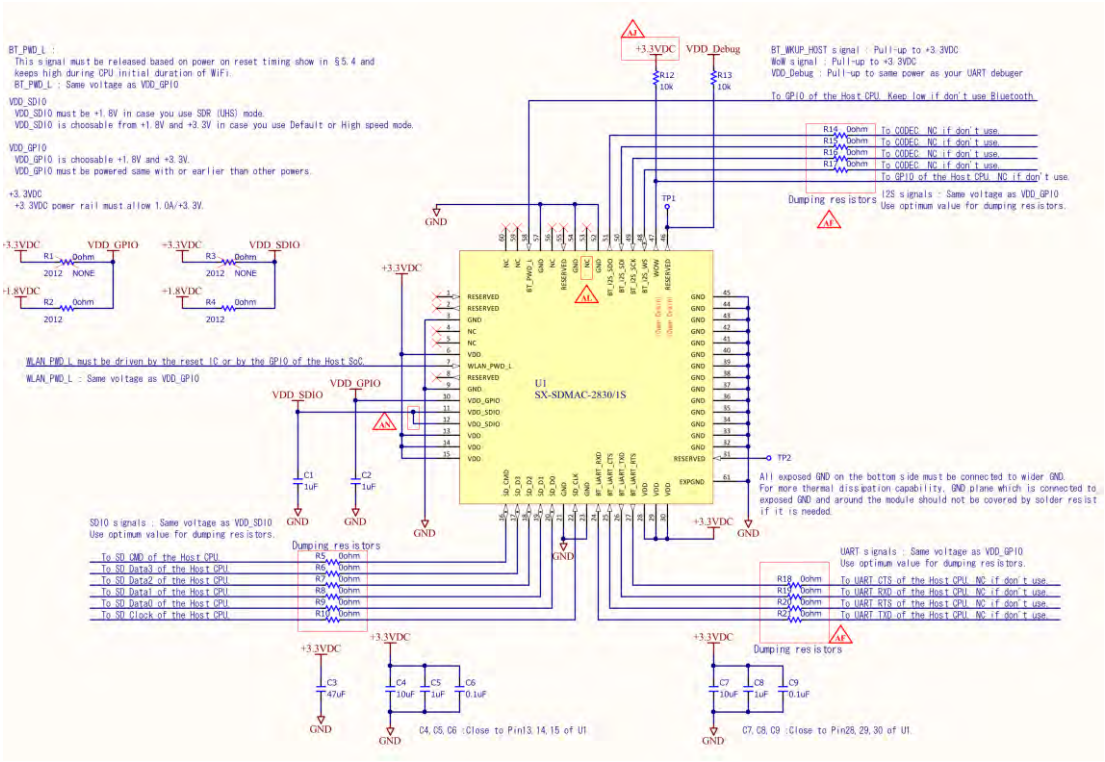
Block diagram



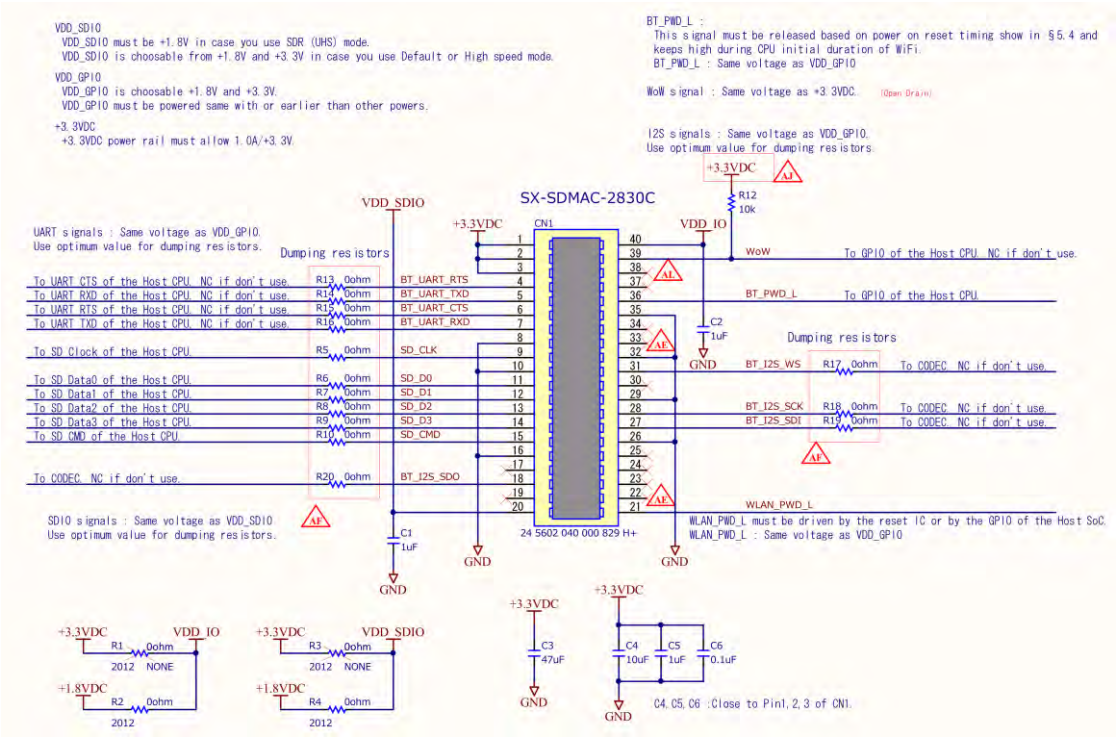
DUT	SX-SDMAC	PW102730BA	–
	Test board	PW102121XX	–
Host board	MCIMX6Q-SDB		NXP
AP	WXR-2533DHP		Buffalo
PC	Probook		HP
Data logger	LR8400+LR8500		Hioki
Software	Driver: Version 4.5.20.020		–
	iperf Version 1.7.0 for Windows iperf 2.0.5 for Linux		–

16. 付録 D 参考回路図（Appendix-D Reference schematic）

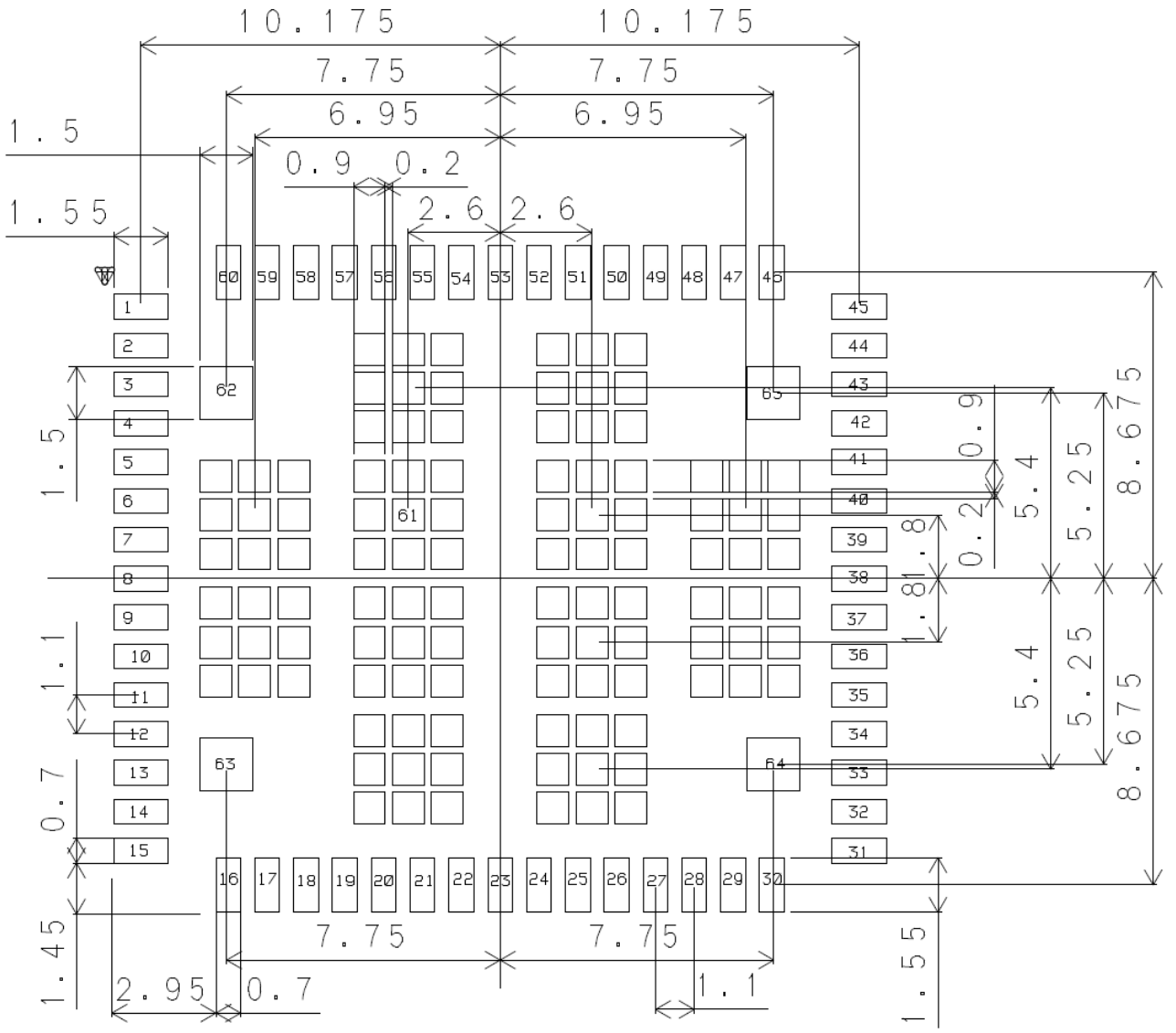
SX-SDMAC-2830S/SX-SDMAC-2831S



SX-SDMAC-2831C



17. 付録 E 参考ランド設計（Appendix-E Reference land design）



(mm)

SX-SDMAC-2830S/SX-SDMAC-2831S Exposed PAD (Top View)

NOTE1	ランド設計を CAD にインポートする必要が有る場合は、PW102270GX_land_design.dxf をご利用ください。 In case LGA pad design need to be imported to CAD system, please use PW102890CX_land_design.dxf. PW102270GX_land_design.dxf MD5 CHECK SUM : 78E48705BD35162B91CEBA61BF59329D

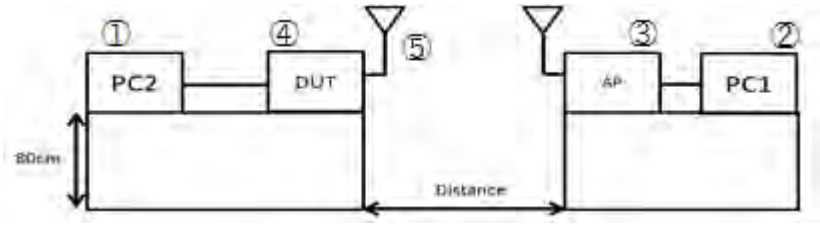
18. 付録 F 参考性能（Appendix-F Performance data）

18.1. 距離対スループット（Distance vs Throughput）

SX-SDMAC の各距離におけるスループットを示します。

The following is SX-SDMAC throughput performance.

(セットアップと環境 / Setup and Environment)



Number	Name	Product name	Vendor	Serial#	Note
1	PC2	E5540	DELL	CU02565	
2	PC1	E6540	DELL	CU02096	
3	AP	AP-500AC	silex	-	MAC:84253F-0109AE. Board rev.: PW1102110AX
4	Host board	i.MX6 SoloX	NXP	-	
5	PCB antenna	146153	Molex	-	ANT2 (Secondary)

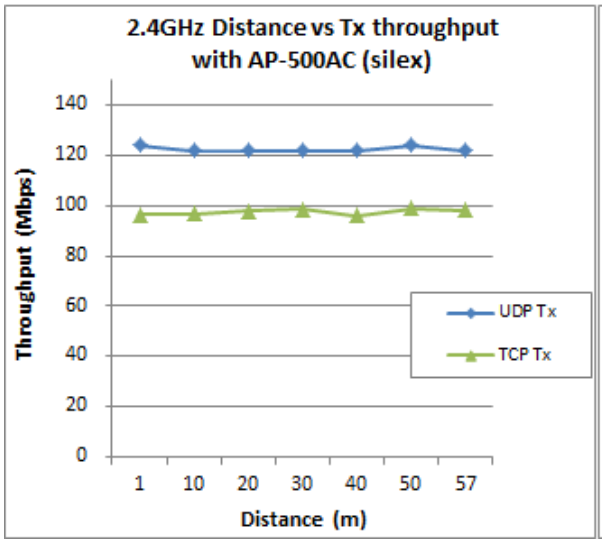
(パフォーマンス / Performance)

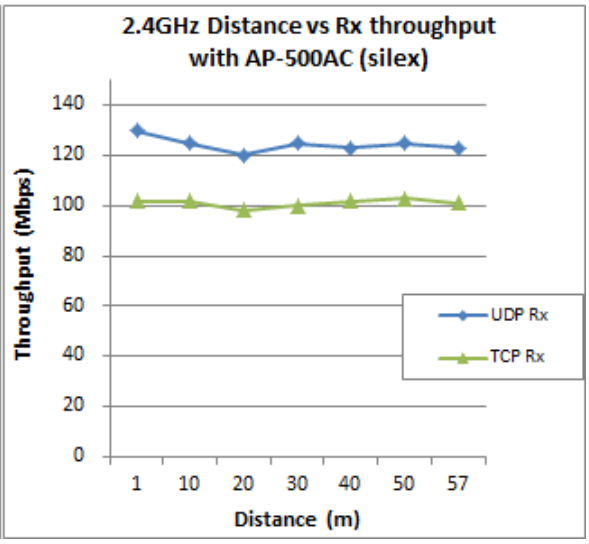
2.4GHz

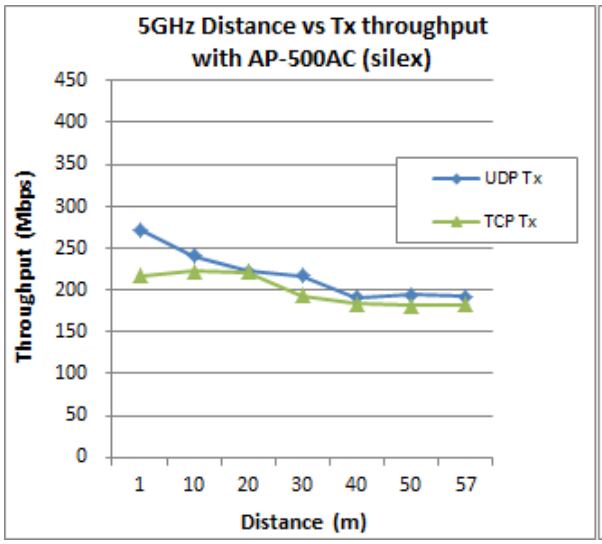
	Distance (m)	UDP(Mbps)		TCP(Mbps)	
		Tx	Rx	Tx	Rx
2422MHz HT40	1	124.0	130.0	96.3	102.0
	10	122.0	125.0	96.7	102.0
	20	122.0	120.0	97.7	98.3
	30	122.0	125.0	98.5	100.0
	40	122.0	123.0	96.0	102.0
	50	124.0	125.0	98.8	103.0
	57	122.0	123.0	98.2	101.0

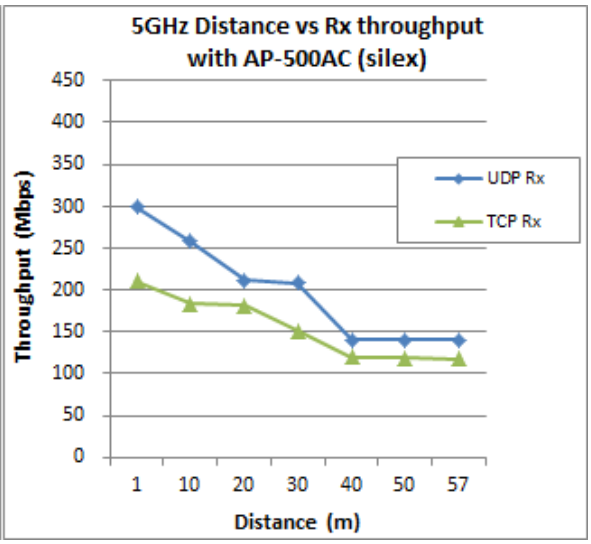
5GHz

	Distance (m)	UDP(Mbps)		TCP(Mbps)	
		Tx	Rx	Tx	Rx
5210MHz VHT80	1	272.0	299.0	217.0	210.0
	10	241.0	258.0	222.0	183.0
	20	222.0	212.0	221.0	181.0
	30	217.0	208.0	193.0	151.0
	40	191.0	140.0	184.0	120.0
	50	194.0	140.0	181.0	119.0
	57	192.0	140.0	182.0	118.0







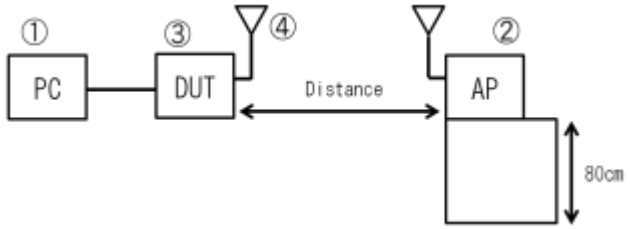


18.2. カバレッジ（Coverage）

SX-SDMAC の屋外での限界通信距離を示します

The following is SX-SDMAC Maximum rage in outside.

(セットアップと環境 / Setup and Environment)



Number	Name	Product name	Vendor	Serial#	Note
1	PC	E5540	DELL	CU02565	
2	AP	AP-500AC	silex	SX04696	MAC: 84253F-0109AE. Board rev.: PW1102110AX
3	Host board	i.MX6 SoloX	NXP	-	
4	PCB antenna	146153	Molex	-	ANT2 (Secondary)

(パフォーマンス / Performance)

2.4GHz

	Size(Byte)	Distance(m)	Signal level(dBm)
2422MHz HT40	32	403.0	-89.0
	1500	407.0	-90.0

5GHz

	Size(Byte)	Distance(m)	Signal level(dBm)
5210MHz VHT80	32	413.0	-90.0
	1500	413.0	-90.0

19. 付録 G 仕向け毎の送信電力（Appendix -G TX power at each destination）

日本/Japan 2.4GHz (+25℃)

Items	Specifications						Units	Remarks
	モード			Min.	Typ.	Max.		
送信電力	11b	Ch.1-Ch.13	1-11Mbps	+10.0	+12.5	+15.0	dBm	Regulation compliant
Transmit Power	11g	Ch.1-Ch.13	6-24Mbps	+14.0	+16.5	+19.0	dBm	Regulation compliant
日本			36Mbps	+12.5	+15.0	+17.5	dBm	EVM compliant
Japan			48Mbps	+11.5	+14.0	+16.5	dBm	EVM compliant
			54Mbps	+10.5	+13.0	+15.5	dBm	EVM compliant
	11n/ac 20MHz	Ch.1-Ch.13	MCS0-2	+14.0	+16.5	+19.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+12.5	+15.0	+17.5	dBm	EVM compliant, HT/VHT
			MCS5	+11.5	+14.0	+16.5	dBm	EVM compliant, HT/VHT
			MCS6	+10.5	+13.0	+15.5	dBm	EVM compliant, HT/VHT
			MCS7	+9.5	+12.0	+14.5	dBm	EVM compliant, HT/VHT
			MCS8	+8.5	+11.0	+13.5	dBm	EVM compliant, VHT
	11n/ac 40MHz	Ch.3-Ch.11	MCS0-2	+14.0	+16.5	+19.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+11.5	+14.0	+16.5	dBm	EVM compliant, HT/VHT
			MCS5	+11.0	+13.5	+16.0	dBm	EVM compliant, HT/VHT
			MCS6	+10.5	+13.0	+15.5	dBm	EVM compliant, HT/VHT
			MCS7	+10.0	+12.5	+15.0	dBm	EVM compliant, HT/VHT
			MCS8	+8.5	+11.0	+13.5	dBm	EVM compliant, VHT
			MCS9	+7.0	+9.5	+12.0	dBm	EVM compliant, VHT

日本/Japan　5GHz (+25℃)

Items	Specifications						Units	Remarks
	モード			Min.	Typ.	Max.		
送信電力 Transmit Power 日本 Japan	11a	Ch.36-Ch.64	6-24Mbps	+7.5	+10.0	+12.5	dBm	EVM compliant
			36Mbps	+5.5	+8.0	+10.5	dBm	EVM compliant
			48Mbps	+5.0	+7.5	+10.0	dBm	EVM compliant
			54Mbps	+4.0	+6.5	+9.0	dBm	EVM compliant
		Ch.100-Ch.140	6-24Mbps	+7.5	+10.0	+12.5	dBm	EVM compliant
			36Mbps	+5.5	+8.0	+10.5	dBm	EVM compliant
			48Mbps	+5.0	+7.5	+10.0	dBm	EVM compliant
			54Mbps	+4.0	+6.5	+9.0	dBm	EVM compliant
	11n/ac 20MHz	Ch.36-Ch.64	MCS0-2	+8.5	+11.0	+13.5	dBm	Mask compliant HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
		Ch.100-Ch.140	MCS0-2	+8.5	+11.0	+13.5	dBm	Mask compliant HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
	11n/ac 40MHz	Ch.38-Ch.62	MCS0-2	+7.5	+10.0	+12.5	dBm	Mask compliant HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+0.0	+2.5	+5.0	dBm	EVM compliant, VHT
		Ch.102-Ch.134	MCS0-2	+7.5	+10.0	+12.5	dBm	Mask compliant HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+0.0	+2.5	+5.0	dBm	EVM compliant, VHT

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力 Transmit Power 日本 Japan	11ac 80MHz	Ch.38-Ch.62	MCS0-2	+6.5	+9.0	+11.5	dBm	Mask compliant HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	Mask compliant HT/VHT
			MCS5	+5.5	+8.0	+10.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+1.5	+4.0	+6.5	dBm	EVM compliant, VHT
		Ch.102-Ch.134	MCS0-2	+6.5	+9.0	+11.5	dBm	Mask compliant HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	Mask compliant HT/VHT
			MCS5	+5.5	+8.0	+10.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+1.5	+4.0	+6.5	dBm	EVM compliant, VHT

US 2.4GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力 Transmit Power アメリカ US	11b	Ch.1	1-11Mbps	+15.0	+17.5	+20.0	dBm	Regulation compliant
		Ch.2-Ch.10	1-11Mbps	+15.5	+18.0	+20.5	dBm	Mask compliant
		Ch.11	1-11Mbps	+15.0	+17.5	+20.0	dBm	Regulation compliant
	11g	Ch.1	6-24Mbps	+10.5	+13.0	+15.5	dBm	Regulation compliant
			36Mbps	+10.5	+13.0	+15.5	dBm	Regulation compliant
			48Mbps	+10.5	+13.0	+15.5	dBm	Regulation compliant
			54Mbps	+10.5	+13.0	+15.5	dBm	EVM compliant
		Ch.2-Ch.10	6-24Mbps	+12.5	+15.0	+17.5	dBm	Regulation compliant
			36Mbps	+12.5	+15.0	+17.5	dBm	EVM compliant
			48Mbps	+11.5	+14.0	+16.5	dBm	EVM compliant
			54Mbps	+10.5	+13.0	+15.5	dBm	EVM compliant
		Ch.11	6-24Mbps	+9.5	+12.0	+14.5	dBm	Regulation compliant
			36Mbps	+9.5	+12.0	+14.5	dBm	Regulation compliant
			48Mbps	+9.5	+12.0	+14.5	dBm	Regulation compliant
			54Mbps	+9.5	+12.0	+14.5	dBm	Regulation compliant
	11n/ac 20MHz	Ch.1	MCS0-2	+9.5	+12.0	+14.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+9.5	+12.0	+14.5	dBm	Regulation compliant, HT/VHT
			MCS5	+9.5	+12.0	+14.5	dBm	Regulation compliant, HT/VHT
			MCS6	+9.5	+12.0	+14.5	dBm	Regulation compliant, HT/VHT
			MCS7	+9.5	+12.0	+14.5	dBm	EVM compliant, HT/VHT
			MCS8	+8.5	+11.0	+13.5	dBm	EVM compliant, VHT
		Ch.2-Ch.10	MCS0-2	+12.5	+15.0	+17.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+12.5	+15.0	+17.5	dBm	EVM compliant, HT/VHT
			MCS5	+11.5	+14.0	+16.5	dBm	EVM compliant, HT/VHT
			MCS6	+10.5	+13.0	+15.5	dBm	EVM compliant, HT/VHT
			MCS7	+9.5	+12.0	+14.5	dBm	EVM compliant, HT/VHT
			MCS8	+8.5	+11.0	+13.5	dBm	EVM compliant, VHT
		Ch.11	MCS0-2	+9.0	+11.5	+14.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+9.0	+11.5	+14.0	dBm	Regulation compliant, HT/VHT
			MCS5	+9.0	+11.5	+14.0	dBm	Regulation compliant, HT/VHT
			MCS6	+9.0	+11.5	+14.0	dBm	Regulation compliant, HT/VHT
			MCS7	+9.0	+11.5	+14.0	dBm	Regulation compliant, HT/VHT
			MCS8	+8.5	+11.0	+13.5	dBm	EVM compliant, VHT

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力 Transmit Power アメリカ US	11n/ac 40MHz	Ch.3	MCS0-2	+6.5	+9.0	+11.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	Regulation compliant, HT/VHT
			MCS5	+6.5	+9.0	+11.5	dBm	Regulation compliant, HT/VHT
			MCS6	+6.5	+9.0	+11.5	dBm	Regulation compliant, HT/VHT
			MCS7	+6.5	+9.0	+11.5	dBm	Regulation compliant, HT/VHT
			MCS8	+6.5	+9.0	+11.5	dBm	Regulation compliant, VHT
			MCS9	+6.5	+9.0	+11.5	dBm	Regulation compliant, VHT
		Ch.4	MCS0-2	+7.0	+9.5	+12.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+7.0	+9.5	+12.0	dBm	Regulation compliant, HT/VHT
			MCS5	+7.0	+9.5	+12.0	dBm	Regulation compliant, HT/VHT
			MCS6	+7.0	+9.5	+12.0	dBm	Regulation compliant, HT/VHT
			MCS7	+7.0	+9.5	+12.0	dBm	Regulation compliant, HT/VHT
			MCS8	+7.0	+9.5	+12.0	dBm	Regulation compliant, VHT
			MCS9	+7.0	+9.5	+12.0	dBm	EVM compliant, VHT
		Ch.5-Ch.8	MCS0-2	+8.0	+10.5	+13.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+8.0	+10.5	+13.0	dBm	Regulation compliant, HT/VHT
			MCS5	+8.0	+10.5	+13.0	dBm	Regulation compliant, HT/VHT
			MCS6	+8.0	+10.5	+13.0	dBm	Regulation compliant, HT/VHT
			MCS7	+8.0	+10.5	+13.0	dBm	Regulation compliant, HT/VHT
			MCS8	+8.0	+10.5	+13.0	dBm	Regulation compliant, VHT
			MCS9	+7.0	+9.5	+12.0	dBm	EVM compliant, VHT
		Ch.9	MCS0-2	+7.0	+9.5	+12.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+7.0	+9.5	+12.0	dBm	Regulation compliant, HT/VHT
			MCS5	+7.0	+9.5	+12.0	dBm	Regulation compliant, HT/VHT
			MCS6	+7.0	+9.5	+12.0	dBm	Regulation compliant, HT/VHT
			MCS7	+7.0	+9.5	+12.0	dBm	Regulation compliant, HT/VHT
			MCS8	+7.0	+9.5	+12.0	dBm	Regulation compliant, VHT
			MCS9	+7.0	+9.5	+12.0	dBm	EVM compliant, VHT

US 5GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力 Transmit Power アメリカ US	11a	Ch.36	6-24Mbps	+6.5	+9.0	+11.5	dBm	Regulation compliant
			36Mbps	+5.5	+8.0	+10.5	dBm	EVM compliant
			48Mbps	+5.0	+7.5	+10.0	dBm	EVM compliant
			54Mbps	+4.0	+6.5	+9.0	dBm	EVM compliant
		Ch.40-Ch.60	6-24Mbps	+7.5	+10.0	+12.5	dBm	EVM compliant
			36Mbps	+5.5	+8.0	+10.5	dBm	EVM compliant
			48Mbps	+5.0	+7.5	+10.0	dBm	EVM compliant
			54Mbps	+4.0	+6.5	+9.0	dBm	EVM compliant
		Ch.64	6-24Mbps	+6.0	+8.5	+11.0	dBm	Regulation compliant
			36Mbps	+5.5	+8.0	+10.5	dBm	EVM compliant
			48Mbps	+5.0	+7.5	+10.0	dBm	EVM compliant
			54Mbps	+4.0	+6.5	+9.0	dBm	EVM compliant
		Ch.100-Ch.136	6-24Mbps	+5.5	+8.0	+10.5	dBm	Regulation compliant
			36Mbps	+5.5	+8.0	+10.5	dBm	EVM compliant
			48Mbps	+5.0	+7.5	+10.0	dBm	EVM compliant
			54Mbps	+4.0	+6.5	+9.0	dBm	EVM compliant
		Ch.140-Ch.144	6-24Mbps	+6.0	+8.5	+11.0	dBm	Regulation compliant
			36Mbps	+5.5	+8.0	+10.5	dBm	EVM compliant
			48Mbps	+5.0	+7.5	+10.0	dBm	EVM compliant
			54Mbps	+4.0	+6.5	+9.0	dBm	EVM compliant
		Ch.149-Ch.165	6-24Mbps	+6.5	+9.0	+11.5	dBm	Mask compliant
			36Mbps	+5.5	+8.0	+10.5	dBm	EVM compliant
			48Mbps	+5.0	+7.5	+10.0	dBm	EVM compliant
			54Mbps	+4.0	+6.5	+9.0	dBm	EVM compliant

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力 Transmit Power アメリカ US	11n/ac 20MHz	Ch.36	MCS0-2	+6.5	+9.0	+11.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
		Ch.40-Ch.60	MCS0-2	+8.5	+11.0	+13.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
		Ch.64	MCS0-2	+6.0	+8.5	+11.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+6.0	+8.5	+11.0	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
		Ch.100-Ch.136	MCS0-2	+5.5	+8.0	+10.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+5.5	+8.0	+10.5	dBm	Regulation compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
		Ch.140-Ch.144	MCS0-2	+6.0	+8.5	+11.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+6.0	+8.5	+11.0	dBm	Regulation compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
		Ch.149-Ch.165	MCS0-2	+6.5	+9.0	+11.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力 Transmit Power アメリカ US	11n/ac 40MHz	Ch.38	MCS0-2	+5.0	+7.5	+10.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+5.0	+7.5	+10.0	dBm	Regulation compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+0.0	+2.5	+5.0	dBm	EVM compliant, VHT
		Ch.46-Ch.54	MCS0-2	+7.5	+10.0	+12.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+0.0	+2.5	+5.0	dBm	EVM compliant, VHT
		Ch.62	MCS0-2	+6.0	+8.5	+11.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+6.0	+8.5	+11.0	dBm	Regulation compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+0.0	+2.5	+5.0	dBm	EVM compliant, VHT
		Ch.102	MCS0-2	+5.5	+8.0	+10.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+5.5	+8.0	+10.5	dBm	Regulation compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+0.0	+2.5	+5.0	dBm	EVM compliant, VHT
		Ch.110-Ch.142	MCS0-2	+6.0	+8.5	+11.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+6.0	+8.5	+11.0	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+0.0	+2.5	+5.0	dBm	EVM compliant, VHT
		Ch.151-Ch.159	MCS0-2	+5.5	+8.0	+10.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+5.5	+8.0	+10.5	dBm	Regulation compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+0.0	+2.5	+5.0	dBm	EVM compliant, VHT

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力 Transmit Power アメリカ US	11ac 80MHz	Ch.42	MCS0-2	+5.0	+7.5	+10.0	dBm	Regulation compliant, HT/VHT
			MCS3-4	+5.0	+7.5	+10.0	dBm	Regulation compliant, HT/VHT
			MCS5	+5.0	+7.5	+10.0	dBm	Regulation compliant, HT/VHT
			MCS6	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+1.5	+4.0	+6.5	dBm	EVM compliant, VHT
		Ch.58	MCS0-2	+5.5	+8.0	+10.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+5.5	+8.0	+10.5	dBm	Regulation compliant, HT/VHT
			MCS5	+5.5	+8.0	+10.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+1.5	+4.0	+6.5	dBm	EVM compliant, VHT
		Ch.106	MCS0-2	+5.5	+8.0	+10.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+5.5	+8.0	+10.5	dBm	Regulation compliant, HT/VHT
			MCS5	+5.5	+8.0	+10.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+1.5	+4.0	+6.5	dBm	EVM compliant, VHT
		Ch.122-Ch.138	MCS0-2	+6.5	+9.0	+11.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	Mask compliant, HT/VHT
			MCS5	+5.5	+8.0	+10.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+1.5	+4.0	+6.5	dBm	EVM compliant, VHT
		Ch.155	MCS0-2	+6.5	+9.0	+11.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	Mask compliant, HT/VHT
			MCS5	+5.5	+8.0	+10.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+1.5	+4.0	+6.5	dBm	EVM compliant, VHT

EU 2.4GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力 TX power EU	11b	Ch.1-Ch.13	1-11Mbps	+11.0	+13.5	+16.0	dBm	Regulation compliant
	11g	Ch.1-Ch.13	6-24Mbps	+12.5	+15.0	+17.5	dBm	Regulation compliant
			36Mbps	+12.5	+15.0	+17.5	dBm	EVM compliant
			48Mbps	+11.5	+14.0	+16.5	dBm	EVM compliant
			54Mbps	+10.5	+13.0	+15.5	dBm	EVM compliant
	11n/ac 20MHz	Ch.1-Ch.13	MCS0-2	+12.5	+15.0	+17.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+12.5	+15.0	+17.5	dBm	EVM compliant, HT/VHT
			MCS5	+11.5	+14.0	+16.5	dBm	EVM compliant, HT/VHT
			MCS6	+10.5	+13.0	+15.5	dBm	EVM compliant, HT/VHT
			MCS7	+9.5	+12.0	+14.5	dBm	EVM compliant, HT/VHT
			MCS8	+8.5	+11.0	+13.5	dBm	EVM compliant, VHT
	11n/ac 40MHz	Ch.3-Ch.11	MCS0-2	+12.5	+15.0	+17.5	dBm	Regulation compliant, HT/VHT
			MCS3-4	+11.5	+14.0	+16.5	dBm	EVM compliant, HT/VHT
			MCS5	+11.0	+13.5	+16.0	dBm	EVM compliant, HT/VHT
			MCS6	+10.5	+13.0	+15.5	dBm	EVM compliant, HT/VHT
			MCS7	+10.0	+12.5	+15.0	dBm	EVM compliant, HT/VHT
			MCS8	+8.5	+11.0	+13.5	dBm	EVM compliant, VHT
			MCS9	+7.0	+9.5	+12.0	dBm	EVM compliant, VHT

EU 5GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力 Transmit Power ヨーロッパ EU	11a	Ch.36-Ch.64	6-24Mbps	+7.5	+10.0	+12.5	dBm	EVM compliant
			36Mbps	+5.5	+8.0	+10.5	dBm	EVM compliant
			48Mbps	+5.0	+7.5	+10.0	dBm	EVM compliant
			54Mbps	+4.0	+6.5	+9.0	dBm	EVM compliant
		Ch.100-Ch.140	6-24Mbps	+7.5	+10.0	+12.5	dBm	EVM compliant
			36Mbps	+5.5	+8.0	+10.5	dBm	EVM compliant
			48Mbps	+5.0	+7.5	+10.0	dBm	EVM compliant
			54Mbps	+4.0	+6.5	+9.0	dBm	EVM compliant
	11n/ac 20MHz	Ch.36-Ch.64	MCS0-2	+8.5	+11.0	+13.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
		Ch.100-Ch.140	MCS0-2	+8.5	+11.0	+13.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
	11n/ac 40MHz	Ch.38-Ch.62	MCS0-2	+7.5	+10.0	+12.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+0.0	+2.5	+5.0	dBm	EVM compliant, VHT
		Ch.102-Ch.134	MCS0-2	+7.5	+10.0	+12.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	EVM compliant, HT/VHT
			MCS5	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+0.0	+2.5	+5.0	dBm	EVM compliant, VHT

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力 Transmit Power ヨーロッパ EU	11ac 80MHz	Ch.42-Ch.58	MCS0-2	+6.5	+9.0	+11.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	Mask compliant, HT/VHT
			MCS5	+5.5	+8.0	+10.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+1.5	+4.0	+6.5	dBm	EVM compliant, VHT
		Ch.106-Ch.122	MCS0-2	+6.5	+9.0	+11.5	dBm	Mask compliant, HT/VHT
			MCS3-4	+6.5	+9.0	+11.5	dBm	Mask compliant, HT/VHT
			MCS5	+5.5	+8.0	+10.5	dBm	EVM compliant, HT/VHT
			MCS6	+4.5	+7.0	+9.5	dBm	EVM compliant, HT/VHT
			MCS7	+4.0	+6.5	+9.0	dBm	EVM compliant, HT/VHT
			MCS8	+2.5	+5.0	+7.5	dBm	EVM compliant, VHT
			MCS9	+1.5	+4.0	+6.5	dBm	EVM compliant, VHT