
Title :

PCI Express Half mini card WLAN module

SX-PCEAC-DB R2

Drawing Type :

製品仕様書 Product specifications

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内容

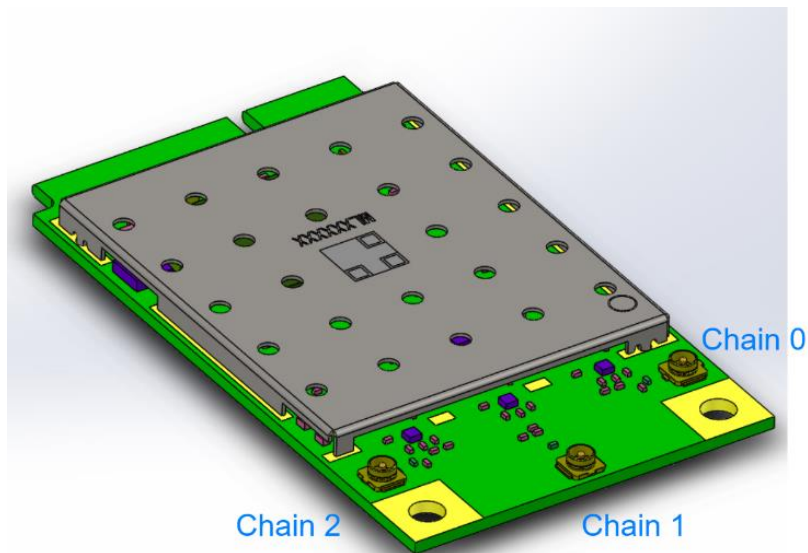
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1. 製品概要 / Product information

SX-PCEAC-DB R2 は Dual Band IEEE802.11ac/a/b/g/n、及び PCI express1.1 準拠の無線 Module です。本モジュールは EU RoHS 指令 2011/65/EC(Lead Free)に適合しています。本モジュールは MAC/BBP, 2.4GHz の RF フロントエンド回路を内蔵したチップセット QCA9880-BR4A (Qualcomm Atheros 社)及び 5GHz の PA と LNA を内蔵した RF フロントエンドモジュール 85717-11 (Skyworks) を採用しています。また、本モジュールは 3x3 SU-MIMO システムで、80MHz 帯域幅モードをサポートしています。

SX-PCEAC-DB R2 is the radio module which supports Dual Band IEEE802.11ac/a/b/g/n and PCI express 1.1. This module complies with EU RoHS Directive 2011/65/EC (Lead Free). This module is made up of an Chipset QCA9880-BR4A (Qualcomm Atheros) which contains a MAC/BBP, 2.4GHz RF front end circuits and a 5GHz RF front end module 85717-11 (Skyworks). Also this module supports high speed 3x3 SU-MIMO and 80MHz bandwidth.



外観図 The appearance

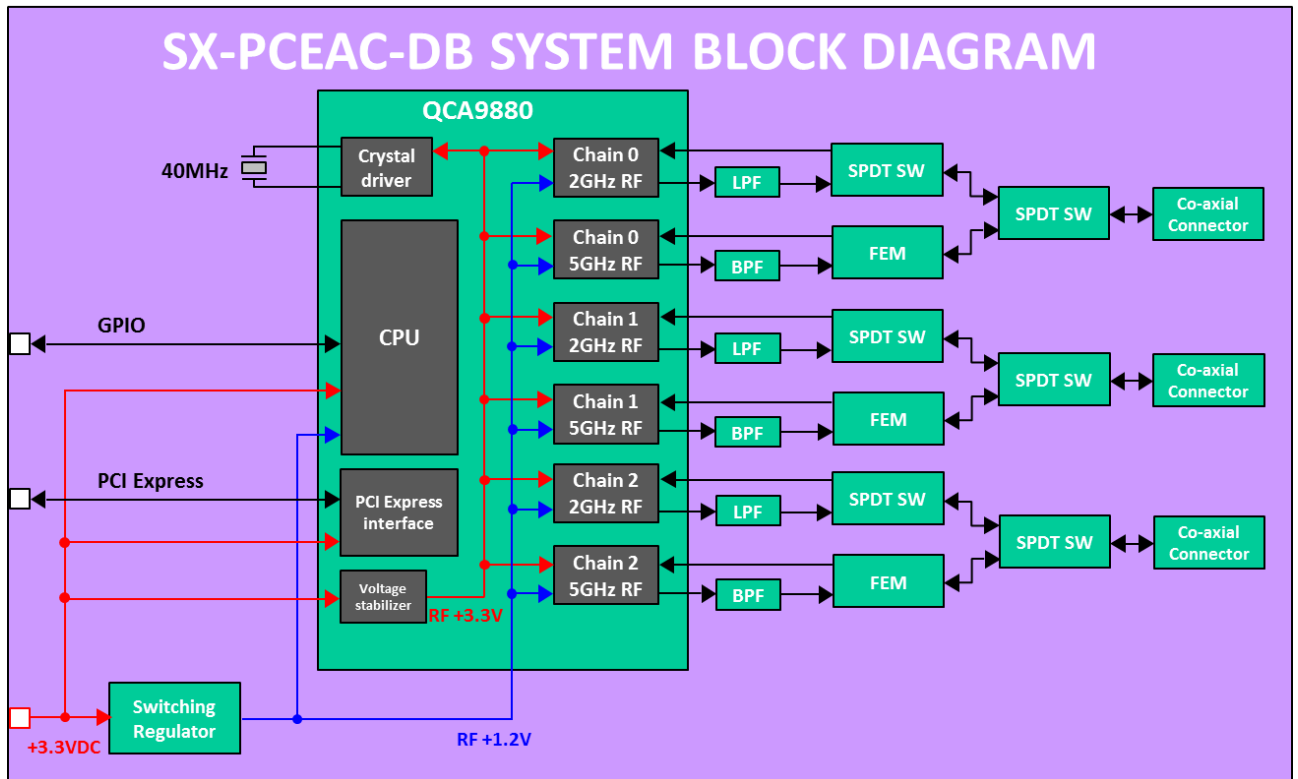
特徴 (Features)

- IEEE802.11a/b/g/n/ac Wave2 準拠 (2.4 GHz, 5 GHz)
IEEE802.11a/b/g/n/ac Wave2 compliant (2.4 GHz, 5 GHz)
- 3 スペーシャルデータストリームシステム (3T3R)
3 spatial data stream system (3T3R)
- 5 GHz : 20/40/80 MHz 帯域幅モード対応 (PHY データレート 1300 Mbps)
2.4 GHz : 20/40 MHz 帯域幅モード対応 (PHY データレート 450 Mbps)

5GHz: Support 20/40/80 MHz bandwidth mode (PHY Data rate 1300 Mbps)
2.4GHz: Support 20/40 MHz bandwidth mode (PHY Data rate 450 Mbps)

PHY Data Rate
 - 802.11b/g 1-54 Mbps
 - 802.11a 6-54 Mbps
 - 802.11n MCS0-7 High Speed mode (HT mode)
 - 802.11ac MCS0-9 Very High Speed mode (VHT mode)
- IEEE802.11e, IEEE802.11h, IEEE802.11i, 対応
Supports IEEE802.11e, IEEE 802.11h and IEEE 802.11i
- Wireless LAN ホスト IF として PCI express 1.1 対応
Supports PCI express 1.1 as the Wireless LAN host interface

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



略語 (Acronyms)

BPF	Band pass filter
LPF	Low pass filter
FEM	Front-end module
SPDT SW	Single pole Double throw switch

3. 基板仕様 / Board specifications

3.1. 一般仕様 / General specifications

Items	Specifications		Units	Remarks
モジュール形状 Module form	PCI Express Mini Card v1.2		—	
アンテナコネクタ Antenna connectors	MHF コネクタ x3 MHF connector x 3		—	
アンテナポートインピーダンス Antenna port impedance	50 +/- 20%		Ω	VSWR < 2.0
インターフェイス Device Interfaces	PCI Express v1.1		—	
無線接続方式 RF Interface	IEEE802.11a/b/g/n/ac/e/h/i		—	IEEE802.11-2012 IEEE802.11ac-2013
重さ Weight	7.2		g	Typ.
寸法 Dimension	29.85 x 50.80 x 4.00		mm	W x H x D 公差 Tolerance W/H +/- 0.15mm D +/- 0.25mm
MTBF	90,000		h	Min.
着脱回数 Mating number	10		Times	PCI Half Mini Card コネクタへの挿入 Insert in PCI Half Mini Card
ESD 耐性 ESD resistance	Antenna pins	+/- 1000	V	Max. Human Body Model at RF Port JS-001-2012 Class 1C device

3.2. 環境条件 Environmental specifications

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
動作周囲温度 Operating ambient temperature	0	—	+60	°C	実装後電源電圧印加時 After assembled with powered
動作ケース温度 Operating case temperature	0	—	+80	°C	実装後電源電圧印加時 After assembled with powered §14 付録 A 参照のこと Refer §14 Appendix A
動作湿度 Operating humidity	15	—	80	%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	-20	—	+85	°C	実装後電源電圧無印加時 After assembled with no-powered
保存湿度 Assembled storage humidity	15	—	85	%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	°C	梱包時 Packaged
保管湿度 Storage humidity	20	—	60	%RH	結露無きこと Non condensing 梱包時 Packaged

3.3. 電気の仕様 / Electrical specifications

絶対最大定格 Absolute Maximum Ratings

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
主電源電圧 Main Power supply voltage	-0.3	—	+3.6	V	

推奨動作条件 Recommended Operating Conditions

主電源 Main power supply

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
主電源電圧 [V _{dd}] Main Power supply voltage [V _{dd}]	+3.14	+3.3	+3.46	V	

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

Items	Parameters	Specifications			Units
		Min.	Typ.	Max.	
V _{IH}	Input High Voltage	0.7 x V _{dd}	+3.3	—	V
V _{IL}	Input Low Voltage	—	—	0.3 x V _{dd}	V
V _{OH}	Output High Voltage	0.9 x V _{dd}	—	—	V
V _{OL}	Output Low Voltage	—	—	0.1 x V _{dd}	V

3.4. 消費電流仕様 / Current consumption specifications

Items	Specifications				Units	Remarks
	Modes	Standards	Avg.	Peak		
消費電流 Current consumption 5GHz	Tx	11a (1T1R)	450	490	mA	
		11na HT20 1 chain (1T1R)	450	490	mA	
		11na HT20 2 chain (2T2R)	650	710	mA	
		11na HT20 3 chain (3T3R)	890	990	mA	
		11na HT40 1 chain (1T1R)	450	490	mA	
		11na HT40 2 chain (2T2R)	650	710	mA	
		11na HT40 3 chain (3T3R)	890	990	mA	
		11ac VHT20 1 chain (1T1R)	450	490	mA	
		11ac VHT20 2 chain (2T2R)	650	710	mA	
		11ac VHT20 3 chain (3T3R)	890	990	mA	
		11ac VHT40 1 chain (1T1R)	450	490	mA	
		11ac VHT40 2 chain (2T2R)	650	710	mA	
		11ac VHT40 3 chain (3T3R)	890	990	mA	
		11ac VHT80 1 chain (1T1R)	450	490	mA	
		11ac VHT80 2 chain (2T2R)	650	710	mA	
		11ac VHT80 3 chain (3T3R)	890	990	mA	
	Rx	All mode 1 Chain (1T1R)	220	270	mA	
		All mode 2 Chain (2T2R)	220	270	mA	
		All mode 3 Chain (3T3R)	290	330	mA	

Items	Specifications				Units	Remarks
	Modes	Standards	Avg.	Peak		
消費電流 Current consumption 2.4GHz	Tx	11b (1T1R)	350	390	mA	
		11g (1T1R)	350	390	mA	
		11ng HT20 1 chain (1T1R)	350	390	mA	
		11ng HT20 2 chain (2T2R)	510	630	mA	
		11ng HT20 3 chain (3T3R)	660	730	mA	
		11ng HT40 1 chain (1T1R)	350	390	mA	
		11ng HT40 2 chain (2T2R)	510	630	mA	
		11ng HT40 3 chain (3T3R)	660	730	mA	
	Rx	All mode 1 Chain (1T1R)	210	250	mA	
		All mode 2 Chain (2T2R)	250	290	mA	
		All mode 3 Chain (3T3R)	250	290	mA	

NOTE1:	Avg.はテストモードでの最大 Duty 比通信時の平均消費電流 (連続送信,連続受信モード時)。 Peak の数字は個体バラツキの上限です。 Avg. means the average current consumption (Continuous Tx/Rx Mode) at the max. Duty cycle communication on the test mode. Peak means an upper limit of the individual scatter.
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3.5. 無線 LAN 一般仕様 / Wireless LAN general specifications

Items	Specifications				Units	Remarks
チップセット Chipset	QCA9880-BR4A (Qualcomm Atheros)				—	
国/地域コード Country/Domain code	0x0000				—	NOTE1
動作周波数 Operating Frequency range	Bands	Modes	Min.	Max.		
	2.4GHz	11b	2412	2472	MHz	US : 2412 – 2462MHz EU : 2412 – 2472MHz JP : 2412 – 2472MHz NOTE2
		11g/n/ac 20MHz	2412	2472	MHz	
		11n/ac 40MHz	2422	2462	MHz	
	5GHz	11a/n/ac 20MHz	5180	5825	MHz	US : W52/W53/W56/W58 EU : W52/W53/W56/W58 JP : W52/W53/W56
		11n/ac 40MHz	5190	5795	MHz	
		11ac 80MHz	5210	5775	MHz	
周波数間隔 Frequency step	2.4GHz	11b/g/n/ac 20MHz 11n/ac 40MHz	5		MHz	NOTE2
	5GHz	11a/n/ac 20MHz	20		MHz	
		11n/ac 40MHz	40		MHz	
		11ac 80MHz	80		MHz	

NOTE1:	国/地域コードについて 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。 About Country / Region code 0x0000 as Country / Region code is written on the module by default. You can rewrite as you want by the driver when loading the module.
NOTE2:	2.4GHz 11ac は非サポートです。ただしオプションで動作させることは可能です。 2.4GHz 11ac is not supported. But it does work optionally.

Items	Specifications		Units	Remarks
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 20MHz	MCS 0, 1, 2, 3, 4, 5, 6, 7, 8	—	
	11ac 40MHz	MCS 0, 1, 2, 3, 4, 5, 6, 7, 8, 9	—	
	11ac 80MHz	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)	—	
ハードウェア暗号エンジン Hardware encryption engine	RC4(64-128bit), AES(128-256bit)		—	

利用可能チャネルリスト (Available 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/EU	20MHz	Ch.36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140,149,153,157,161,165
		40MHz	Ch.38,46,54,62,102,110,118,126,134,151,159
		80MHz	Ch.42,58,106,122,155
	CA	20MHz	Ch.36,40,44,48,52,56,60,64,100,104,108,112,116,132,136,140,149,153,157,161,165
		40MHz	Ch.38,46,54,62,102,110,134,151,159
		80MHz	Ch.42,58,106,155
	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

3.6.1. 2.4GHz (+25°C)

Items	Specifications						Units
	Modes			Min.	Typ.	Max.	
送信電力 Transmit Power Typ.=Target Power	11b	US Ch.1-Ch.11	1-11Mbps	+5.5	+8.0	+10.5	dBm
		EU, JP Ch.1-Ch.13	1-11Mbps	+5.0	+7.5	+10.0	
	11g	US Ch.1 - Ch.3	6-54Mbps	+4.5	+7.0	+9.5	
		US Ch.4 - Ch.8	6-24Mbps	+13.0	+15.5	+18.0	
			36Mbps	+11.5	+14.0	+16.5	
			48Mbps	+10.5	+13.0	+15.5	
			54Mbps	+9.0	+11.5	+14.0	
		US Ch.9 - Ch.11	6-54Mbps	+6.5	+9.0	+11.5	
		EU, JP Ch.1-Ch.13	6-54Mbps	+5.0	+7.5	+10.0	
	11n/ac 20MHz NOTE2	US Ch.1 - Ch.3	MCS0-8	+2.0	+4.5	+7.0	
		US Ch.4 - Ch.8	MCS0-4	+11.0	+13.5	+16.0	
			MCS5	+10.0	+12.5	+15.0	
			MCS6	+9.0	+11.5	+14.0	
			MCS7	+7.0	+9.5	+12.0	
			MCS8	+4.5	+7.0	+9.5	
		US Ch.9 - Ch.11	MCS0-7	+6.5	+9.0	+11.5	
			MCS8	+5.0	+7.5	+10.0	
		EU, JP Ch.1-Ch.13	MCS0-8	+5.0	+7.5	+10.0	
	11n/ac 40MHz NOTE2	US Ch.3 - Ch.5	MCS0-9	+1.5	+4.0	+6.5	
		US Ch.6	MCS0-4	+9.5	+12.0	+14.5	
			MCS5	+9.5	+12.0	+14.5	
			MCS6	+8.5	+11.0	+13.5	
			MCS7	+6.0	+8.5	+11.0	
			MCS8	+4.0	+6.5	+9.0	
			MCS9	+2.5	+5.0	+7.5	
		US Ch.7 - Ch.9	MCS0-8	+3.5	+6.0	+8.5	
			MCS9	+2.5	+5.0	+7.5	
		EU, JP Ch.3 - Ch.11	MCS0-7	+5.5	+8.0	+10.5	
			MCS8	+4.0	+6.5	+9.0	
			MCS9	+2.5	+5.0	+7.5	

NOTE1:	送信電力は各アンテナ Chain 単独の値です。3 Data stream 時の総電力は+4.8dB されます。 Transmit power is the value from each single chain. When the device transmits 3 streams of data, total power can be +4.8dB.
NOTE2:	2.4GHz 11ac は非サポートです。ただしオプションで動作させることは可能です。 2.4GHz 11ac is not supported. But it does work optionally.

3.6.2. 5GHz (+25°C)

Items	Specifications						Units
	Modes			Min.	Typ.	Max.	
送信電力 Transmit Power Typ.=Target Power	11a	US Ch.36 - Ch.48	6-54Mbps	+5.0	+7.5	+10.0	dBm
		US Ch.52 - Ch.64	6-54Mbps	+9.5	+12.0	+14.5	
		US Ch.100 - Ch.140	6-48Mbps	+11.0	+13.5	+16.0	
			54Mbps	+9.5	+12.0	+14.5	
		US Ch.149	6-36Mbps	+12.0	+14.5	+17.0	
			48Mbps	+11.5	+14.0	+16.5	
			54Mbps	+10.5	+13.0	+15.5	
		US Ch.153 - Ch.165	6-24Mbps	+13.5	+16.0	+18.5	
			36Mbps	+12.0	+14.5	+17.0	
			48Mbps	+11.5	+14.0	+16.5	
			54Mbps	+10.5	+13.0	+15.5	
		EU Ch.36 - Ch.48	6-54Mbps	+2.5	+5.0	+7.5	
		EU Ch.52 - Ch.64	6-54Mbps	+5.0	+7.5	+10.0	
		EU Ch.100 - Ch.140	6-24Mbps	+12.5	+15.0	+17.5	
			36Mbps	+12.0	+14.5	+17.0	
			48Mbps	+11.5	+14.0	+16.5	
			54Mbps	+10.0	+12.5	+15.0	
		EU Ch.149 - Ch.165	6-54Mbps	-2.0	+0.5	+3.0	
		JP Ch.36 - Ch.64	6-54Mbps	+5.0	+7.5	+10.0	
		JP Ch.100 - Ch.140	6-24Mbps	+13.0	+15.5	+18.0	
			36Mbps	+12.0	+14.5	+17.0	
			48Mbps	+11.5	+14.0	+16.5	
			54Mbps	+10.0	+12.5	+15.0	
	11n/ac 20MHz	US Ch.36 - Ch.64	MCS0-8	+5.0	+7.5	+10.0	
		US Ch.100 - Ch.140	MCS0-8	+8.5	+11.0	+13.5	
		US Ch.149	MCS0-5	+12.0	+14.5	+17.0	
			MCS6	+11.0	+13.5	+16.0	
			MCS7-8	+9.5	+12.0	+14.5	
		US Ch.153 - Ch.165	MCS0-4	+13.5	+16.0	+18.5	
			MCS5	+12.5	+15.0	+17.5	
			MCS6	+11.0	+13.5	+16.0	
			MCS7-8	+9.5	+12.0	+14.5	
		EU Ch.36 - Ch.48	MCS0-8	+4.5	+7.0	+9.5	
		EU Ch.52 - Ch.64	MCS0-8	+5.0	+7.5	+10.0	
		EU Ch.100 - Ch.140	MCS0-5	+11.5	+14.0	+16.5	
			MCS6	+10.5	+13.0	+15.5	
			MCS7	+9.5	+12.0	+14.5	
			MCS8	+9.0	+11.5	+14.0	
		EU Ch.149 - Ch.165	MCS0-8	-2.0	+0.5	+3.0	
		JP Ch.36 - Ch.64	MCS0-8	+5.0	+7.5	+10.0	
		JP Ch.100 - Ch.140	MCS0-4	+13.0	+15.5	+18.0	
			MCS5	+11.5	+14.0	+16.5	
			MCS6	+10.5	+13.0	+15.5	
			MCS7	+9.5	+12.0	+14.5	
			MCS8	+9.0	+11.5	+14.0	

Items	Specifications						Units
	Modes			Min.	Typ.	Max.	
送信電力 Transmit Power Typ.=Target Power	11n/ac 40MHz	US Ch.36 - Ch.62	MCS0-9	+5.0	+7.5	+10.0	dBm
		US Ch.102 - Ch.134	MCS0-7	+9.0	+11.5	+14.0	
			MCS8	+8.5	+11.0	+13.5	
			MCS9	+6.5	+9.0	+11.5	
		US Ch.151	MCS0-8	+9.5	+12.0	+14.5	
			MCS9	+7.5	+10.0	+12.5	
		US Ch.159	MCS0-5	+12.5	+15.0	+17.5	
			MCS6	+10.5	+13.0	+15.5	
			MCS7	+10.0	+12.5	+15.0	
			MCS8	+9.5	+12.0	+14.5	
			MCS9	+7.5	+10.0	+12.5	
		EU Ch.38 - Ch.62	MCS0-9	+5.0	+7.5	+10.0	
		EU Ch.102 - Ch.134	MCS0-4	+12.0	+14.5	+17.0	
			MCS5	+11.5	+14.0	+16.5	
			MCS6	+10.5	+12.5	+15.0	
			MCS7	+9.5	+12.0	+14.5	
			MCS8	+8.5	+11.0	+13.5	
			MCS9	+6.5	+9.0	+11.5	
		EU Ch.151 - Ch.159	MCS0-9	-2.0	+0.5	+3.0	
		JP Ch.38 - Ch.62	MCS0-9	+5.5	+8.0	+10.5	
		JP Ch.102 - Ch.134	MCS0-2	+12.5	+15.0	+17.5	
			MCS3-4	+12.0	+14.5	+17.0	
			MCS5	+11.5	+14.0	+16.5	
			MCS6	+10.5	+12.5	+15.0	
			MCS7	+9.5	+12.0	+14.5	
			MCS8	+8.5	+11.0	+13.5	
			MCS9	+6.5	+9.0	+11.5	
	11n/ac 80MHz	US Ch.42	MCS0-9	+5.5	+8.0	+10.5	
		US Ch.58	MCS0-9	+5.0	+7.5	+10.0	
		US Ch.106	MCS0-9	+5.0	+7.5	+10.0	
		US Ch.122	MCS0-6	+9.5	+12.0	+14.5	
			MCS7	+9.0	+11.5	+14.0	
			MCS8	+8.5	+11.0	+13.5	
			MCS9	+6.5	+9.0	+11.5	
		US Ch.155	MCS0-9	+4.0	+6.5	+9.0	
		EU Ch.42, Ch.58	MCS0-9	+4.5	+7.0	+9.5	
		EU Ch.106 - Ch.122	MCS0-5	+11.5	+14.0	+16.5	
			MCS6	+11.0	+13.5	+16.0	
			MCS7	+9.0	+11.5	+14.0	
			MCS8	+8.5	+11.0	+13.5	
			MCS9	+6.5	+9.0	+11.5	
		EU Ch.155	MCS0-9	-2.0	+0.5	+3.0	
		JP Ch.42, Ch.58	MCS0-9	+5.5	+8.0	+10.5	
		JP Ch.106 - Ch.122	MCS0-5	+12.0	+14.5	+17.0	
			MCS6	+11.0	+13.5	+16.0	
			MCS7	+9.0	+11.5	+14.0	
			MCS8	+8.5	+11.0	+13.5	
			MCS9	+6.5	+9.0	+11.5	

NOTE1:	送信電力は各アンテナ Chain 単独の値です。3 Data stream 時の総電力は+4.8dB されます。 Transmit power is the value from each single chain. When the device transmits 3 streams of data, total power can be +4.8dB.
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3.6.3. Misc

送信パワーの不確かさ / Transmit power uncertainty (0°C~+60°C)

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	-2.5	—	+2.5	dB	
	802.11b	1-11Mbps	-2.5	—	+2.5	dB	
	802.11g	6-54Mbps	-2.5	—	+2.5	dB	
	802.11n/ac	MSC0-9	-2.5	—	+2.5	dB	

周波数精度 / Frequency accuracy (0°C~+60°C)

Item	Specifications					Unit	Remark
	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

3.7.1. 2.4GHz (0°C~+60°C)

Items	Specifications					Units
	Modes		Min.	Typ.	Max.	
最小受信感度 Receiver minimum sensitivity	11b (FER<8%)	1Mbps	—	-85	-76	dBm
		2Mbps	—	-85	-76	
		5.5Mbps	—	-85	-76	
		11Mbps	—	-85	-76	
	11g (PER<10%)	6Mbps	—	-86	-82	
		9Mbps	—	-86	-81	
		12Mbps	—	-86	-79	
		18Mbps	—	-85	-77	
		24Mbps	—	-81	-74	
		36Mbps	—	-78	-70	
		48Mbps	—	-74	-66	
		54Mbps	—	-73	-65	
	11n/ac 20MHz (PER<10%) NOTE1	MCS0	—	-86	-82	
		MCS1	—	-86	-79	
		MCS2	—	-84	-77	
		MCS3	—	-80	-74	
		MCS4	—	-77	-70	
		MCS5	—	-73	-66	
		MCS6	—	-71	-65	
		MCS7	—	-70	-64	
	11n/ac 40MHz (PER<10%) NOTE1	MCS8	—	-66	-59	
		MCS0	—	-85	-79	
		MCS1	—	-85	-76	
		MCS2	—	-82	-74	
		MCS3	—	-78	-71	
		MCS4	—	-75	-67	
		MCS5	—	-71	-63	
		MCS6	—	-69	-62	
		MCS7	—	-68	-61	
		MCS8	—	-64	-56	
		MCS9	—	-62	-54	

NOTE1:

2.4GHz 11ac は非サポートです。ただしオプションで動作させることは可能です。
2.4GHz 11ac is not supported. But it does work optionally.

3.7.2. 5GHz (0°C~+60°C)

Items	Specifications					Units
	Modes		Min.	Typ.	Max.	
最小受信感度 Receiver minimum sensitivity	11a (PER<10%)	6Mbps	—	-86	-82	dBm
		9Mbps	—	-86	-81	
		12Mbps	—	-86	-79	
		18Mbps	—	-84	-77	
		24Mbps	—	-80	-74	
		36Mbps	—	-77	-70	
		48Mbps	—	-73	-66	
		54Mbps	—	-71	-65	
	11n/ac 20MHz (PER<10%)	MCS0	—	-86	-82	
		MCS1	—	-86	-79	
		MCS2	—	-83	-77	
		MCS3	—	-79	-74	
		MCS4	—	-75	-70	
		MCS5	—	-71	-66	
		MCS6	—	-70	-65	
		MCS7	—	-68	-64	
		MCS8	—	-64	-59	
	11n/ac 40MHz (PER<10%)	MCS0	—	-85	-79	
		MCS1	—	-83	-76	
		MCS2	—	-80	-74	
		MCS3	—	-76	-71	
		MCS4	—	-73	-67	
		MCS5	—	-69	-63	
		MCS6	—	-67	-62	
		MCS7	—	-66	-61	
		MCS8	—	-62	-56	
		MCS9	—	-60	-54	
	11ac 80MHz (PER<10%)	MCS0	—	-82	-76	
		MCS1	—	-80	-73	
		MCS2	—	-77	-71	
		MCS3	—	-73	-68	
		MCS4	—	-70	-64	
		MCS5	—	-66	-60	
		MCS6	—	-65	-59	
		MCS7	—	-63	-58	
		MCS8	—	-59	-53	
		MCS9	—	-57	-51	

4. 信号仕様 / Signal pins specifications

4.1. PCI Express Mini Card エッジピン配置 / PCI Express Card Edge Pin Assignments

Top side

Pin Number	Pin Name	Type	Description
1	RESERVED	OD	WAKE_L
3	RESERVED	IO	GPIO に接続 Connected to GPIO.
5	RESERVED	IO	GPIO に接続 Connected to GPIO.
7	RESERVED	OD	CLKREQ_L
9	GND	GND	
11	REFCLK-	IA	PCI Express 差動リファレンスクロック (100MHz) PCI Express differential reference clock (100MHz)
13	REFCLK+	IA	PCI Express 差動リファレンスクロック (100MHz) PCI Express differential reference clock (100MHz)
15	GND	GND	
			Mechanical key
17	RESERVED	NA	NC
19	RESERVED	NA	NC
21	GND	GND	
23	PERn0	OA	モジュール側 : 差動送信データ信号 Module : Differential data transmit
25	PERp0	OA	モジュール側 : 差動送信データ信号 Module : Differential data transmit
27	GND	GND	
29	GND	GND	
31	PETn0	IA	モジュール側 : 差動受信データ信号 Module : Differential data receive
33	PETp0	IA	モジュール側 : 差動受信データ信号 Module : Differential data receive
35	GND	GND	
37	RESERVED	NA	NC
39	RESERVED	NA	モジュール内部で 41 ピンと短絡: Connected to pin 41 internally
41	RESERVED	NA	モジュール内部で 39 ピンと短絡: Connected to pin 39 internally
43	RESERVED	GND	GND 端子として使用 Connected to GND
45	RESERVED	IO	GPIO に接続 Connected to GPIO
47	RESERVED	IO	GPIO に接続 Connected to GPIO.
49	RESERVED	NA	NC
51	RESERVED	NA	NC

Bottom side

Pin Number	Pin Name	Type	Description
2	+3.3Vaux	PWR	
4	GND	GND	
6	RESERVED	NA	NC
8	RESERVED	NC	NC
10	RESERVED	NA	NC
12	RESERVED	NA	NC
14	RESERVED	NA	NC
16	RESERVED	NA	NC
			Mechanical key
18	GND	GND	
20	RESERVED	IO	GPIO に接続 Connected to GPIO. Disable wireless module. On board Pull-up(10kohm)
22	PERST_L	IL	PCI Express リセット信号 PCI Express reset. Internal weak pull-down
24	+3.3Vaux	PWR	
26	GND	GND	
28	RESERVED	NA	NC
30	RESERVED	NA	NC
32	RESERVED	NA	NC
34	GND	GND	
36	RESERVED	NA	NC
38	RESERVED	NA	NC
40	GND	GND	
42	RESERVED	NA	NC
44	RESERVED	IO	GPIO に接続 Connected to GPIO.
46	RESERVED	NA	NC
48	RESERVED	NA	NC
50	GND	GND	
52	+3.3V	PWR	

略語 (Acronyms)

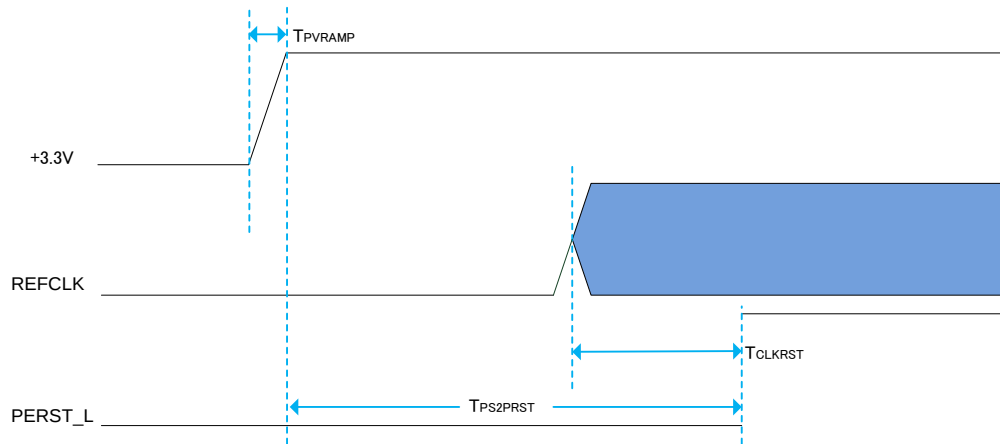
Symbols	Descriptions
NC	No connection
IO	Digital bidirectional pin
IA	Analog input signal
OA	Analog output signal
OD	Digital output signal with open drain
IL	Input signal with weak internal pull-down
PWR	Power signal
GND	Ground

4.2. PCI Express Configuration Registers

Offset	Name	Description	Value(hex)
0x00	Vendor ID	Manufacturer Identification	168C
0x02	Device ID	Device Type Identification	
0x04	Command	Device Accessibility Control	
0x06	Status	Device Functionality Status	
0x08	Revision ID	Identification of Device Revision.	
0x09	Class Code	Device Basic Function Identification.	
0x0C	Cache Line Size	System Cache Line Size	
0x0D	Latency Timer	Defines Minimum Time (in bus cycles)	
0x0E	Header Type	Device Configuration Header Format	
0x10	Base Address	Base Address to Access WLAN Memory Mapped Registers	
0x2C	Sub Vender ID	Subsystem manufacturer Identification	
0x2E	Subsystem ID	Subsystem device type Identification	
0x34	Capabilities Pointer	Device Capability List Pointer	
0x3D	Interrupt Line	Interrupt Line Value	
0x40	Power Management Capability	Power Management Capability	
0x44	Power Management Status/Control	Power Management Status/Control	
0x50	Message Capability ID	Message Capability ID	
0x51	Message Capability Next Pointer	Message Capability Next Pointer	
0x52	Message Control	Message Control	
0x54	Message Address	Message Address	
0x58	Message Data	Message Data	
0x70	PCI Express Capabilities List	PCI Express Capabilities List	
0x72	PCI Express Capabilities	PCI Express Capabilities	
0x74	Device Capabilities	Device Capabilities	
0x78	Device Control	Device Control	
0x7A	Device Status	Device Status	
0x7C	Link Capabilities	Link Capabilities	
0x80	Link Control	Link Control	
0x82	Link Status	Link Status	

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

5.1. パワーON & OFF, リセットタイミング / Power ON & OFF, reset timing

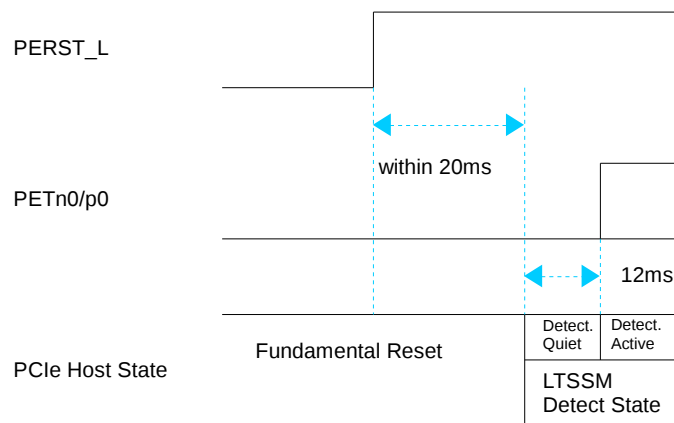


Timing	Description	Min	Max	Unit
TPVRAMP	Power Supply Ramp on 3.3V	—	25	msec
TCLKRST	PCIE_REFCLK_N and PCIE_REFCLK_P stable to PCIE_RST_L de-asserted	100	—	μsec
TPS2PRST	Power Supply Stable to PCIE_RST_L de-assert	10	—	msec

*PCI ホストは PERST_L リリース時（Fundamental Reset リリース時）、PCI ホストは 20msec 以内に LTSSM の Detect State に遷移しなければなりません。

PCI ホストステートの詳細は PCI Express v1.1 規格を参照ください。

*When a PCI host de-assert PERST_L (Fundamental Reset is de-asserted), a PCI host must be in the LTSSM Detect State within 20msec. Refer to PCI Express v1.1 standard for detail about a PCI host state.



6. 適合規格 / Standards compliance

6.1. 規格一覧 / Standards list

適合規格 (Standards conformity)

- IEEE802.11-2012 (a/b/g/n)
- IEEE802.11ac-2013
- PCI Express v1.1

適合法規制 (Law regulation compliance)

- ◇ 日本電波法 (MIC)
 - 証明規則第 2 項第 1 条 第 19 号 (Infra 親機/子機, Wi-Fi Direct)
 - 証明規則第 2 項第 1 条 第 19 号の 3 (W52 Infra 親機/子機、W53 Infra 子機)
 - 証明規則第 2 項第 1 条 第 19 号の 3 の 2 (Infra 子機)
 - Article 2 paragraph 1 item (19) (Infra Master/Slave mode, Wi-Fi Direct)
 - Article 2 paragraph 1 item (19)-3 (W52 Infra Master/Slave mode、W53 Infra Slave mode)
 - Article 2 paragraph 1 item (19)-3-2 (Infra Slave mode)
 - 認証番号 (Certification number): **201-191012**
- ◇ FCC Part15 (Subpart C, Subpart E)
 - Subpart C (2.4GHz Master device & Client device, Wi-Fi Direct)
 - Subpart E (W52 Master mode and Slave mode, Wi-Fi Direct W53/W56 Slave mode, W58 Master mode and Slave mode.)
 - ID: **N6C-PCEACDBR2**
- ◇ ISSED RSS-247
 - Subpart C (2.4GHz Mater device & Client device, Wi-Fi Direct)
 - Subpart E (W52 Master mode and Slave mode, Wi-Fi Direct W53/W56 Slave mode, W58 Master mode and Slave mode.)
 - ID: **4908A-PCEACDBR2**
- ◇ ETSI (EN 300 328, EN 301 893)
 - EN 300 328 (2.4GHz Master & Slave, Wi-Fi Direct)
 - EN 301 893 (W52 Master & Slave, Wi-Fi Direct W53/W56 Slave.)
 - EN 300 440 (W58)
 - EN 62311

- CE RoHS Directive

対応国 (Countries)

- Asia
 - ・ Japan
- North America
 - ・ US
 - ・ Canada
- EU

6.2. 推奨アンテナリスト / Recommended antenna list

日本 (Japan) MIC

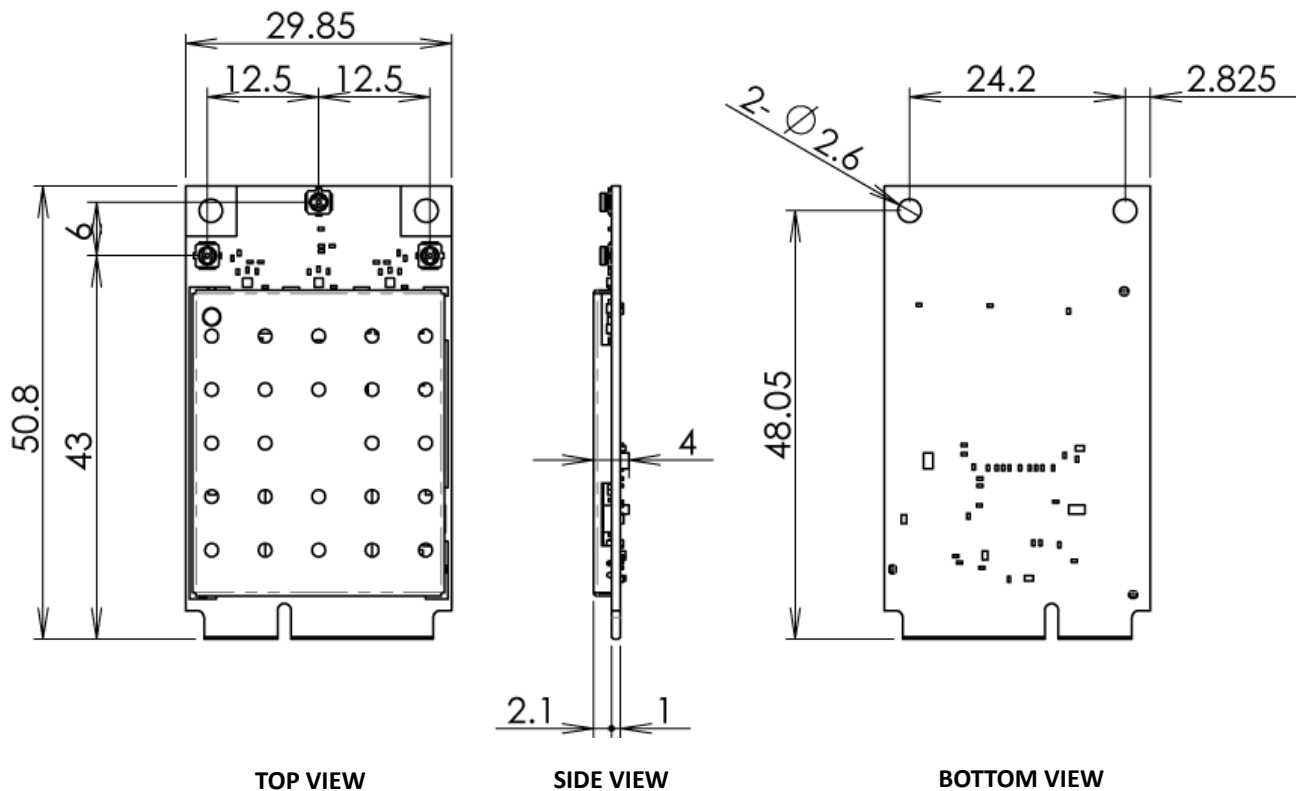
Antennas	Vendors	Antenna Type	2.4GHz Gain	5GHz Gain	No.19 2.4GHz	No.19-2 2.484GHz	No.19-3 W52/53	No.19-3-2 W56
H2B1PC1A1C (AA258) (Include cable loss)	Unictron	PCB	+2.9dBi	+4.4dBi	✓	—	✓	✓
H2B1PD1A1C (AA222) (Include cable loss)	Unictron	PCB	+2.8dBi	+4.2dBi	✓	—	✓	✓
146153 (Include cable loss)	Molex	PCB	+3.25dBi	+5.0dBi	✓	—	✓	✓
ANTDC-081A0/B0 (Include cable loss)	Sansei-Denki	Rod	+2.0dBi	+2.0dBi	✓	—	✓	✓
ANTDP-027A0 (Not include 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 EN300328 2.4GHz	ETSI EN301893 W52/53/56	ETSI EN300440 W58
H2B1PC1A1C (AA258) (Include cable loss)	Unictron	PCB	+2.9dBi	+4.4dBi	✓	✓	✓	✓	✓
H2B1PD1A1C (AA222) (Include cable loss)	Unictron	PCB	+2.8dBi	+4.2dBi	✓	✓	✓	✓	✓
146153 (Include cable loss)	Molex	PCB	+3.25dBi	+5.0dBi	✓	✓	✓	✓	✓
ANTDC-081A0/B0 (Include cable loss)	Sansei-Denki	Rod	+2.0dBi	+2.0dBi	✓	✓	✓	✓	✓
ANTDP-027A0 (Not include 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。 <u>EMC certification of each country might be required as the final product.</u>

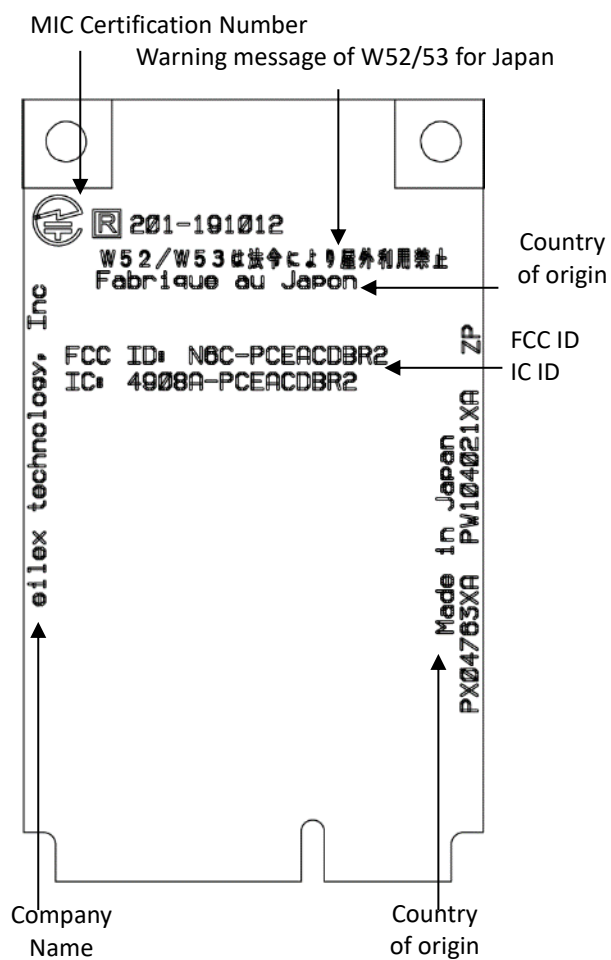
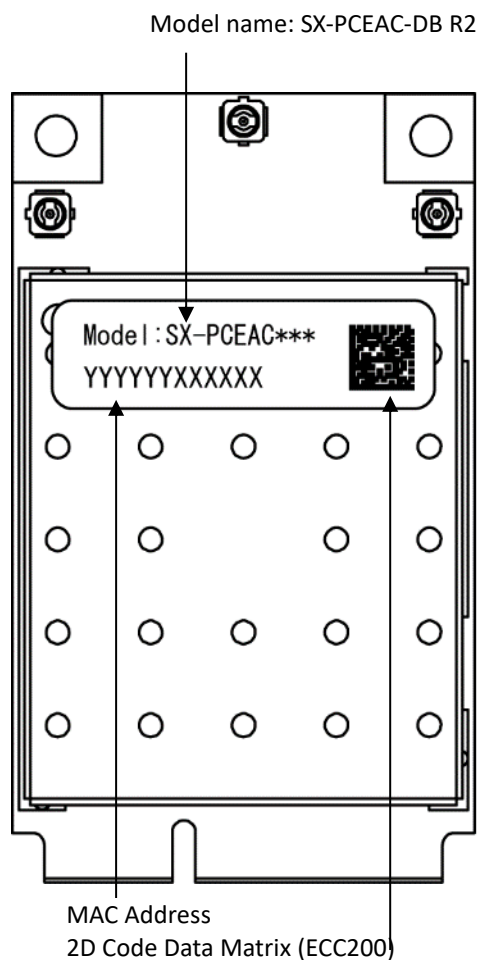
7. 機械的仕様 / Mechanical specifications



(mm)

NOTE1:	厚みの寸法公差は+/-0.25mm それ以外は+/-0.15mm The thickness of dimension tolerance is +/-0.25 mm, other than that +/-0.15 mm
NOTE2:	はんだ厚み = 0.1mm Solder thickness = 0.1mm

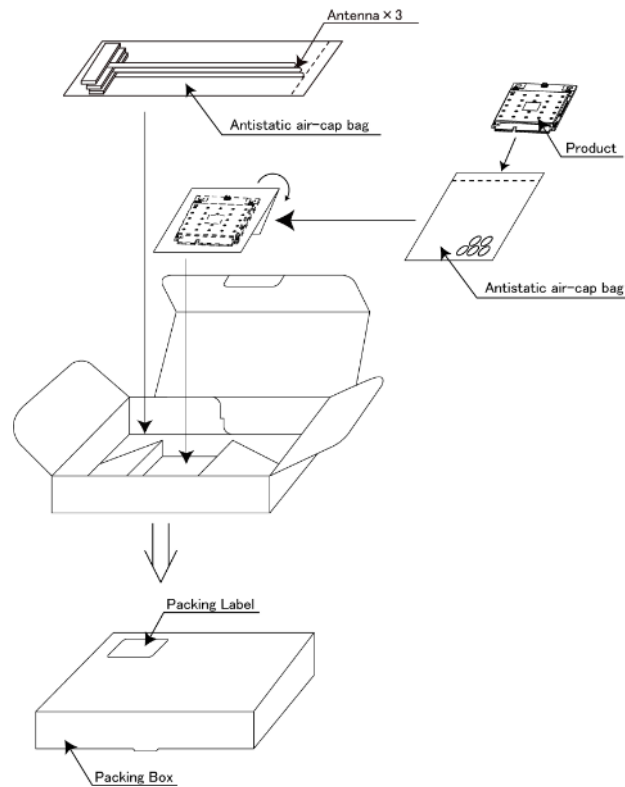
8. マーキング仕様 / Marking specifications



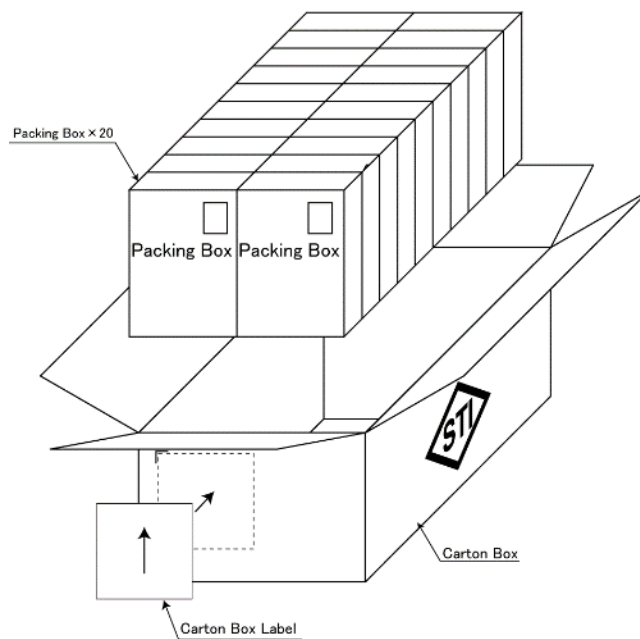
9. 構成リスト / Components composition list

Categories	Items	Product No.	
		ZXE04250	ZXE04251
		SX-PCEAC-DB R2	SX-PCEAC-DB R2 SP
Board	Main board	1	1
Label	E/A Label	1	1
	Packing Label	—	1
	Carton Label	1/100	1/20
Accessory	Antenna	—	3
	Antenna Cable	—	—
Packing	Packing Box	—	1
	Carton Box	1/100	1/20
	Carton Pad	1/100	—
	Tray	11/100	—
	Antistatic bag	1/100	—
	Antistatic air-cap bag	—	2

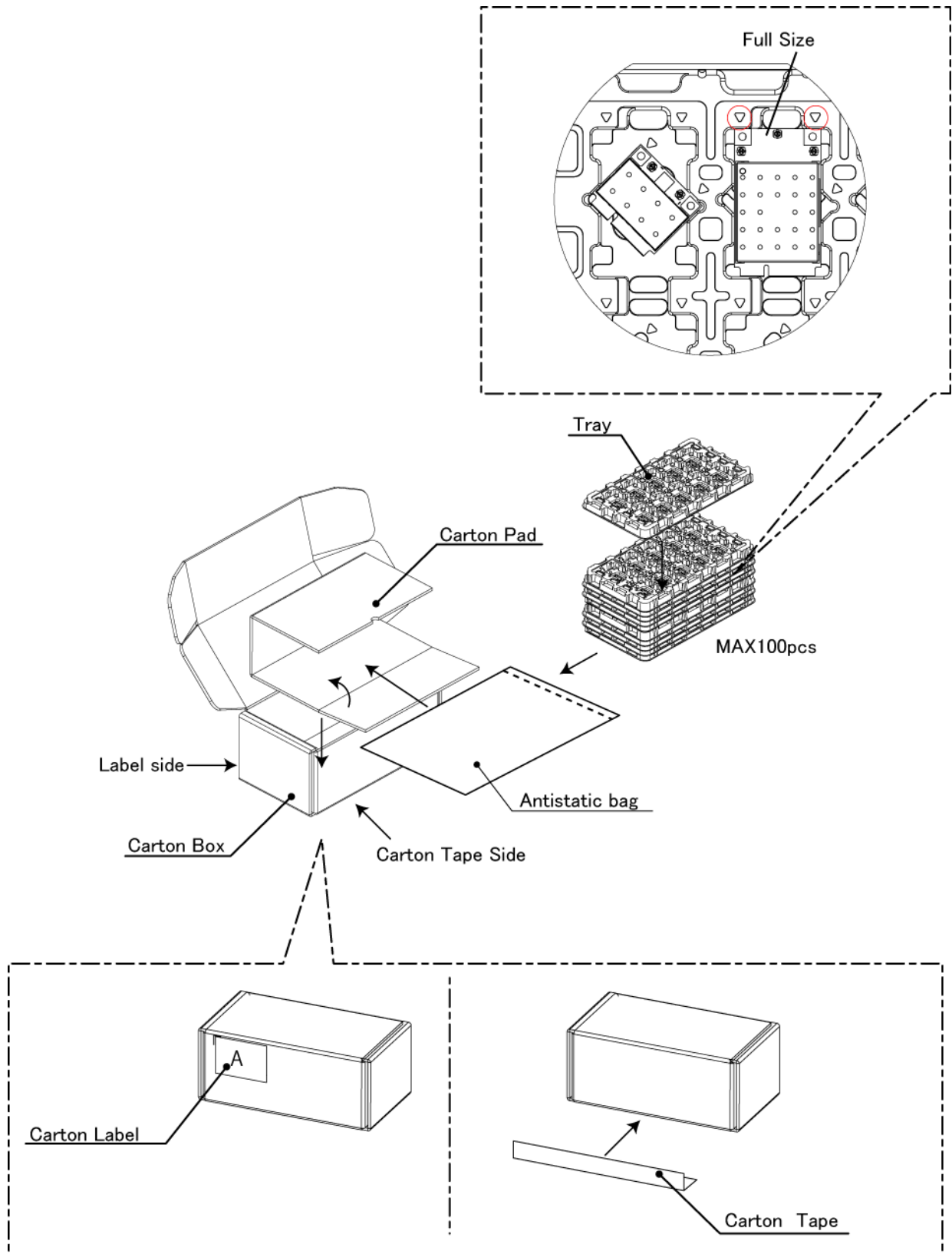
10. 梱包仕様 / Packing specifications



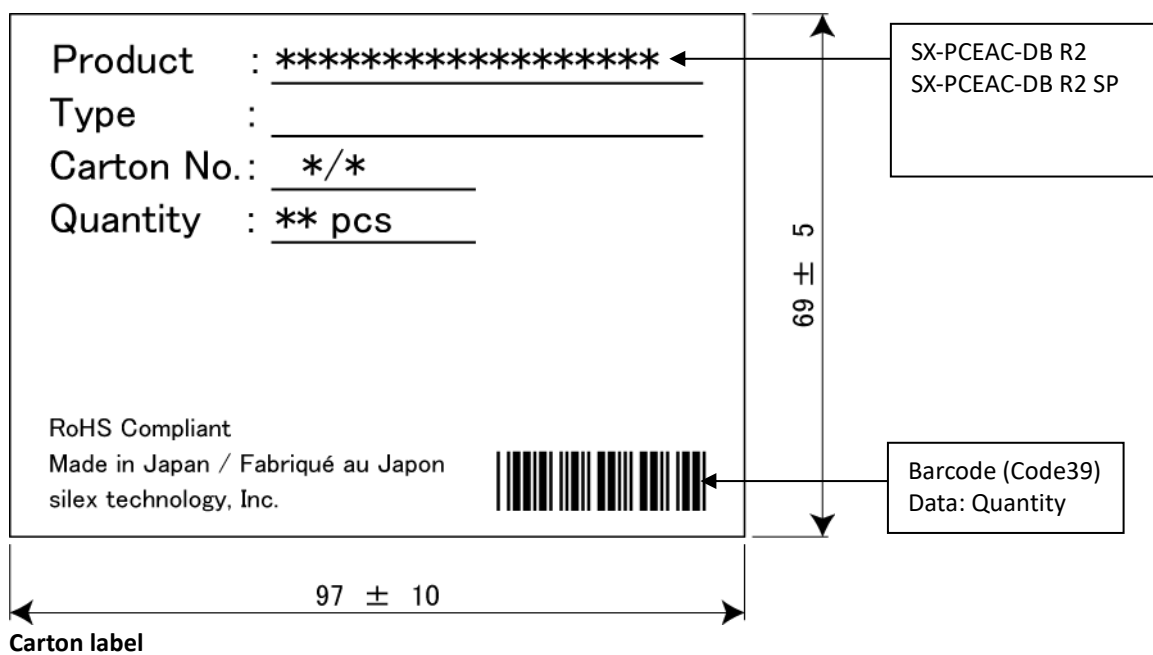
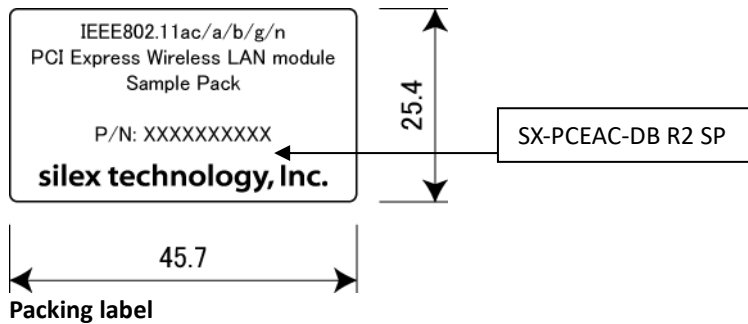
SX-PCEAC-DB R2 SP



バルク仕様 Bulk specifications



梱包箱ラベル図



11. 信頼性試験 / Reliability test

Test items	Standards	Description	Requirements											
			Electricity	Appearance										
DC 電圧試験 DC voltage test	—	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.	Workable	NA										
温湿度電圧 サイクル試験 Temperature/ Humidity cycle test	IEC60601-1-11	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.	Workable	NA										
		Condition 1 (Hr:Min)												
		Step			1	2	3	4	5	6	7	8	9	10
		°C			+25	⇄	-5	⇄	+65	⇄	-5	⇄	+65	⇄
		%RH			OFF	⇄	OFF	⇄	95	⇄	OFF	⇄	95	⇄
		Time			0:05	⇄	3:00	⇄	3:00	⇄	5:00	⇄	8:05	⇄
		Power			ON	⇄	ON	⇄	ON	⇄	ON	⇄	ON	⇄
		Step			11	12	13	—	—	—	—	—	—	—
		°C			+18	⇄	+25	—	—	—	—	—	—	—
		%RH			10	⇄	30	—	—	—	—	—	—	—
		Time			8:05	⇄	1:00	—	—	—	—	—	—	—
		Power			ON	⇄	—	—	—	—	—	—	—	—
		Condition 2 (Hr:Min)												
		Step			1	2	3	4	5	6	7	8	9	10
		°C			+25	⇄	-5	⇄	+65	⇄	-5	-5	⇄	+65
		%RH			OFF	⇄	OFF	⇄	95	⇄	OFF	OFF	⇄	95
		Time			0:05	⇄	3:00	⇄	3:00	⇄	2:00	3:00	⇄	2:00
		Power			ON	⇄	ON	⇄	ON	⇄	ON	ON	⇄	ON
		Step			11	12	13	14	15	16	17	18	—	—
		°C			+65	+65	⇄	+5	+5	+5	⇄	+25	—	—
		%RH			95	95	⇄	10	10	10	⇄	30	—	—
Time	0:05	6:00	⇄	2:00	2:00	2:00	⇄	1:00	—	—				
Power	ON	ON	⇄	ON	ON	ON	⇄	ON	—	—				

Test items	Standards	Description	Requirements	
			Electricity	Appearance
高温起動試験 High temperature boot-up test	—	高温状態での起動を確認する。 ・ 1回目は+65°Cで2時間放置後に電源をONにし、起動することを確認する。 ・ 2回目以降は30分放置し電源をONとし、起動することを確認する。 ・ 試行回数計5回。 Check to boot-up with high temperature. ・ 1st boot-up check is performed after 2 hours exposure at +65°C. ・ 2nd boot-up or later boot-up check is performed after 30 minutes exposure at +65°C. ・ Total number of checking times are 5 times.	Workable	NA
低温起動試験 Low temperature boot-up test	—	低温状態での起動を確認する。 ・ 1回目は-5°Cで2時間放置後に電源をONにし、起動することを確認する。 ・ 2回目以降は30分放置し電源をONとし、起動することを確認する。 ・ 試行回数5回。 Check to boot-up with low temperature. ・ 1st boot-up check is performed after 2 hours exposure at -5°C. ・ 2nd boot-up or later boot-up check is performed after 30 minutes exposure at -5°C. ・ Total number of checking times are 5 times.	Workable	NA
衝撃試験 Mechanical shock test	MIL-STD-202 Method 213B Condition A	最大加速度 = 50g, 期間 = 11ms, 波形 = ハーフサイン波, 速度変化 = 11.3ft/sec Peak g's = 50g, Duration = 11ms, Waveform = Half-sine, Vi = 11.3ft/sec	Meet to spec.	No damage
振動試験 Mechanical vibration test	MIL-STD-202 Method 204D Condition D	最大加速度 = 20g, 10 <> 2000HzでX/Y/Z軸方向に各20分、12回実施。 Peak g's = 20g, 10 <> 2000Hz at 20min/cycle for each X/Y/Z axis, Perform 12 times	Meet to spec.	No damage

Test items	Standards	Description	Requirements																					
			Electricity	Appearance																				
温度衝撃試験 Thermal shock test	MIL-STD-883J Method 1011.9	Step1 (高温) ⇒ Step 2 (低温)を繰り返す。 10 Cycle, 200 Cycle, 1000 Cycle 毎に動作を確認。 1サイクル辺りのステップ[⇒: Ramp] <table border="1"> <thead> <tr> <th>Steps</th><th>1</th><th>2</th><th>3</th><th>4</th></tr> </thead> <tbody> <tr> <td>degC</td><td>+100 +10/-2°C</td><td>⇒</td><td>0 +2/-10°C</td><td>⇒</td></tr> <tr> <td>Time</td><td>2 - 5min</td><td>< 10sec</td><td>2 - 5min</td><td>< 10sec</td></tr> <tr> <td>Power</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr> </tbody> </table>	Steps	1	2	3	4	degC	+100 +10/-2°C	⇒	0 +2/-10°C	⇒	Time	2 - 5min	< 10sec	2 - 5min	< 10sec	Power	OFF	OFF	OFF	OFF	Meet to spec.	No damage
Steps	1	2	3	4																				
degC	+100 +10/-2°C	⇒	0 +2/-10°C	⇒																				
Time	2 - 5min	< 10sec	2 - 5min	< 10sec																				
Power	OFF	OFF	OFF	OFF																				
高温耐性試験 Heat resistance	-	+65°C環境下で8時間放置する。その後、室温で2時間放置する。 Expose at +65°C for 8 hours. Leave at room temp for 2 hours after taking out from chamber.	Meet to spec.	No damage																				
低温耐性試験 Cold resistance	-	-5°C環境下で8時間放置する。その後、室温で2時間放置する。 Expose at -5°C for 8 hours. Leave at room temp for 2 hours after r taking out from chamber.	Meet to spec.	No damage																				
部品温度上昇試験 Device temp rise	-	+60°Cでの各主要部品の温度を測定する。 Measure temperature on each device with exposing at +60°C.	Meet to Device's spec.	NA																				
梱包落下試験 Drop with package	ISO 4180 JIS Z0200 Level II	梱包箱状態で60cmの高さより木の板に落下させる。(6面、3辺、1稜) Drop with the package from 60cm height to the wood board. (6 faces, 3 edges, 1 corner).	Meet to spec.	No damage																				

Criteria	Description
No damage	試験後外観に損傷が無いこと。 No damage on the appearance after test.
Meet to spec	§3 に掲げる仕様を満たすこと。 Meet to specifications in §3.
Workable	試験中動作が確認できること。 Can confirm working during test.
Meet to device's spec	各デバイス仕様書の動作温度を満たすこと。 Meet to operation temperature range of each device.

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、以下の場合には仕様が変更になる可能性があります。
This module is compliant to the law regulations mentioning § 6. But the contents may change at below conditions.

 - 1) § 6.1 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 § 6.1
 - 2) § 6.2 に掲げるアンテナ以外で使う場合。
In case this module is used with different antenna from the antenna list of § 6.2
 - 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.
Do not use 5.15-5.35GHz band (W52, W53) outdoors due to the law restriction.
When use this modules outdoors, need to disable it from using such band in advance.
- ◇ 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 has been designed for being embedded in the general electric devices, not in the extremely reliable demands like aircraft instruments, nuclear control instruments, high reliable medical instruments (Class III, IV), high reliable security instruments or any other such devices.
In the case of being embedded in the medical instruments, please ask our sales reps regardless of 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。
Because this module communicates through radio waves, it is highly recommended to set security system in order to prevent the information leak to third parties.
- ◇ 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。
The wireless bands this module is using may affect the peripheral devices which use same bands and vice versa. When install them, please check the use environment in advance.

- ◇ 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。
There are cases in which you will be punished by the radio law if this module is disassembled or modified.
 - ◇ 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。
Some terminals and electric parts of this module are exposed. When embed this module in your products, should attract attention to ESD, 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 $\pm 25\text{MHz}$ (5Ch) 以上の間隔をあけて使用することが推奨されます。
 $\pm 25\text{MHz}$ ($\pm 25\text{MHz}$) 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 $\pm 25\text{MHz}$ (5Ch), 非隣接チャネル：中心周波数 $\pm 30\text{MHz}$ (6Ch)以上
2.4GHz: Center frequency $\pm 25\text{MHz}$ (5Ch), Non Adjacent channel: Further than Center frequency $\pm 30\text{MHz}$ (6Ch)
 - ☐ 5GHz HT20 隣接チャネル：中心周波数 $\pm 20\text{MHz}$ (4Ch), 非隣接チャネル：中心周波数 $\pm 40\text{MHz}$ (8Ch)以上
5GHz HT20: Center frequency $\pm 20\text{MHz}$ (4Ch), Non Adjacent channel: Further than Center frequency $\pm 40\text{MHz}$ (8Ch)
 - ☐ 5GHz HT40 隣接チャネル：中心周波数 $\pm 40\text{MHz}$ (8Ch), 非隣接チャネル：中心周波数 $\pm 80\text{MHz}$ (16Ch)以上
5GHz HT40 Adjacent channel: Center frequency $\pm 40\text{MHz}$ (8Ch), Non Adjacent channel: Further than Center frequency $\pm 80\text{MHz}$ (16Ch)
 - ☐ 5GHz HT80 隣接チャネル：中心周波数 $\pm 80\text{MHz}$ (16Ch), 非隣接チャネル：中心周波数 $\pm 160\text{MHz}$ (32Ch)以上
5GHz HT80 Adjacent channel: Center frequency $\pm 80\text{MHz}$ (16Ch), Non Adjacent channel: Further than Center frequency $\pm 160\text{MHz}$ (32Ch)
- ※上記の条件外であっても、強い電波入力がある場合は混信する可能性があるので、周辺の無線機器は十分距離を離してご使用ください。
Even if these conditions is 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 GHz with including antenna gain.

FCC Notice

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

List of applicable FCC rules

This device complies with below part 15 of the FCC Rules.

Part 15 Subpart C

Part 15 Subpart E

Test Modes

silex technology, Inc. uses various test mode programs for test set up which operate separate from production firmware. Host integrators should contact silex technology, Inc. for assistance with test modes needed for module/host compliance test requirements.

Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Summarize the specific operational use conditions

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

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

RF exposure considerations

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

Co-Location Rule

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

Label and compliance information

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

Contains Transmitter Module FCC ID : N6C-PCEACDBR2

Or

Contains FCC ID : N6C-PCEACDBR2

FCC CAUTION

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

FCC CAUTION

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

ISED Notice

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

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

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Operation in the band 5150-5250 MHz

Operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.

La bande 5 150-5 250 MHz est réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux.

Label and compliance information

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

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

Contains Transmitter Module IC: 4908A-PCEACDBR2
--

Or

Contains IC: 4908A-PCEACDBR2

RF exposure considerations

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

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

Antenna Type

This radio transmitter (4908A- PCEACDBR2) has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list, that have a gain greater than the maximum gain indicated for any type listed, are strictly prohibited for use with this device.

Antenna Type	Gain		Impedance
	2.4GHz	5GHz	
Rod Antenna	2.14dBi	4dBi	50ohms
PCB Antenna	3.25dBi	5dBi	50ohms

Le présent émetteur radio (4908A- PCEACDBR2) a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

Type d'antenne	Gain		Impedance
	2.4GHz	5GHz	
Antenne à tige	2.14dBi	4dBi	50ohms
Antenne PCB	3.25dBi	5dBi	50ohms

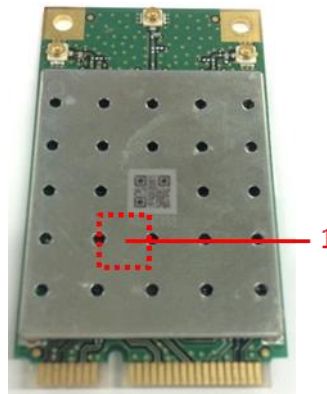
13. 付録 A 放熱設計 / Appendix A Thermal design

本モジュールは放熱対策を行った上で使用してください。本モジュールの部品温度上昇信頼性試験は次頁に示す放熱条件のもとで実施しています。また、次頁の放熱設計仕様は性能を完全に保証するものではありません。そのため、ご使用に際しては使用環境にて放熱設計を行い、十分な評価を行ってください。放熱設計については、以下に示すデバイス箇所にて温度上昇がデバイス仕様を満たすように設計を行ってください。

You should use this module to take measures of thermal dissipation. The device temperature rise test was done at the following condition. The following specification of thermal dissipation perfectly guarantees the performance. Thus you should enough evaluate the design of thermal dissipation to an actual use environment. As for the design, you should satisfy the device operational temperature specification at the following point.

測定ポイント / デバイスの動作温度仕様

A measurement point / A device operational temperature specification



#	名称 Name	温度範囲上限 Temperature upper limits [°C]
1	The module ケース温度 Tc	+80

部品温度上昇試験条件

The condition of device temp rise test

ベースボードと本モジュールとの間に放熱用シートを使用し、連続通信時における部品温度上昇試験を実施。

The device temperature rise test was done at continuous communication using the thermal dissipation sheet between the baseboard and the module.

ベースボードの基板仕様については第 1 項を、

放熱用シリコンシート仕様及び取付け位置については第 2 項を参照してください。

Please refer item 1 showing the baseboard specifications and item 2 showing the thermal dissipation sheet specification and the mounting position.

1. ベースボード（弊社 AP-500AC 基板）仕様

The specification of the baseboard AP-500AC by silex

- ・ PCB サイズ PCB size : 180mm X 130mm (図 1 参照 refer Fig.1)
- ・ 放熱パッドサイズ Thermal dissipation pad size : 43mm X 16mm (図 1 参照 refer Fig.1)

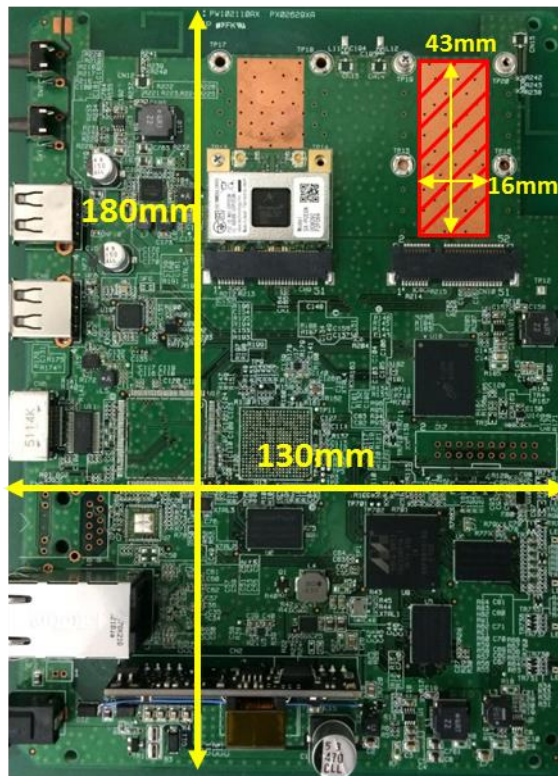


図 1 ベースボード AP-500AC Fig 1 The baseboard AP-500AC

2. 放熱用シート仕様

The specification of the thermal dissipation sheet

- ・ 型番 Part # : TG-X (T-GLOBAL Technology) / 厚み Thickness: 2.0mm
- ・ 熱伝導率 Thermal conductivity : 12.0W/mK
- ・ サイズ Size : 43mm X 16mm

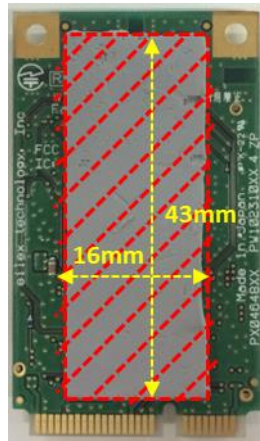


図 2 モジュールに対する放熱シート位置

Fig.2 The position of thermal dissipation sheet against the module

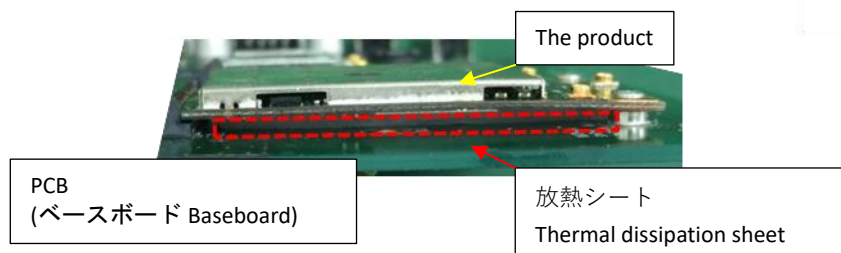


図 3 放熱シート付きモジュール実装図

Fig.3 The situation the module with thermal dissipation sheet is mounted on the baseboard