Title:

PCI Express Half mini card WLAN module
SX-PCEAC-DB

Drawing Type :	Product Specifications
Drawing No.:	JW202670AX
Date :	July 27, 2016

Revision History

Rev.	Descriptions	Date	Prepared	Checked	Approved
AX	The first edition	July.27,16	Y.Kuroda	K.Yoshikawa	Y.Shibuya

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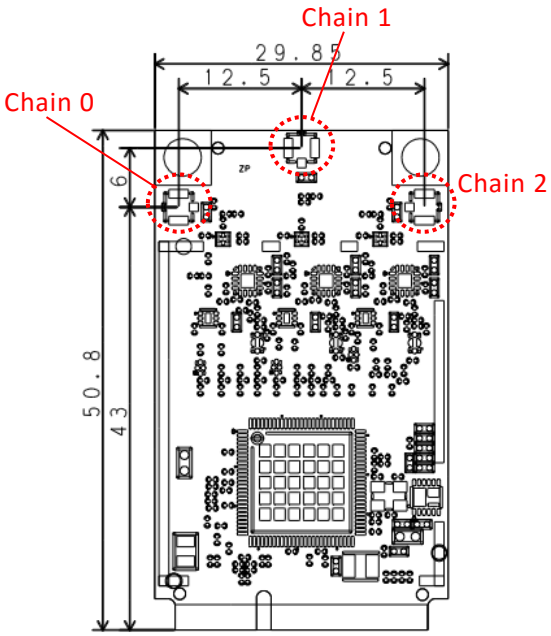
1. Introduction

SX-PCEAC-DB 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 based on the QCA9880-BR4A (Qualcomm Atheros) chipset which contains a MAC/BBP, 2.4GHz RF front end circuit and a 5GHz RF front end module AWL9581(Anadigics). Also this module supports high speed 3x3 SU-MIMO and 80MHz bandwidth.



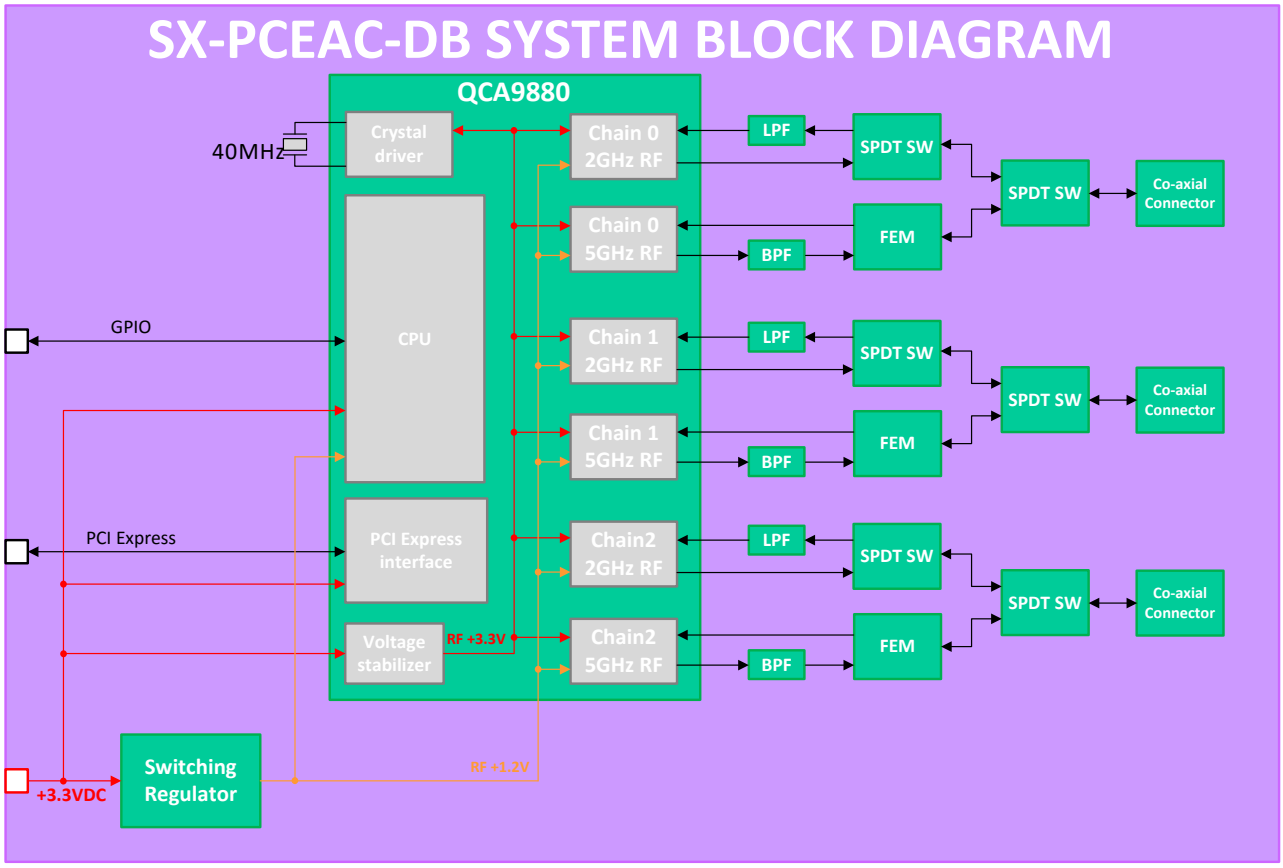
SX-PCEAC-DB

Features

- ❑ IEEE 802.11a/b/g/n/ac conformity (2.4GHz & 5GHz)
- ❑ Supports the 3 streams 3 x 3 SU-MIMO system and 80MHz band width for 5GHz. (Throughput up to 1300Mbps)
- ❑ Supports the 3 streams 3 x 3 SU-MIMO system and 40MHz band width for 2.4GHz. (Throughput up to 600Mbps)
- ❑ Data rates of 1 - 54 Mbps for 802.11b/g, 6 - 54 Mbps for 802.11a, MCS0-7 for 802.11n, 802.11ng HT20 MCS0-8, 802.11ng HT40 MCS0-9 and MCS0-9 for 802.11ac.
- ❑ Supports IEEE802.11e, IEEE 802.11h and IEEE 802.11i.
- ❑ Supports PCI express 1.1 as the host IF of wireless LAN
- ❑ Calibrated TX power per module.

  * MU-MIMO and 160MHz bandwidth not supported.

2. Hardware Block Diagram



Acronyms

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

3. Board Specifications

3.1. General Specifications

Items	Specifications		Units	Remarks
Module form	PCI Express Mini Card v1.2		—	
Antenna connectors	MHF connector x 3		—	
Antenna port impedance	50 +/- 20%		Ω	VSWR < 2.0
Device Interfaces	PCI Express v1.1		—	
RF Interface	IEEE802.11a/b/g/n/ac/e/h/i		—	IEEE802.11-2012 IEEE802.11ac-2013
Weight	7.2		g	Typ.
Dimension	29.85 x 50.80 x 4.00		mm	W x H x D Tolerance W/H +/- 0.15mm D +/- 0.25mm
MTBF	90,000		h	Min.
Mating number	10		Times	Insert in PCI Half Mini Card
ESD resistance	Antenna pins	+/- 1000	V	Max. Human Body Model at RF Port JS-001-2012 Class 1C device

3.2. Environmental Specifications

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
Operating temperature	0	—	+60	℃	Case temperature After assembled with powered
Operating humidity	20	—	80	%RH	Non condensing After assembled with powered
Assembled storage temperature	-20	—	+85	℃	After assembled with no-powered
Assembled storage humidity	20	—	85	%RH	Non condensing After assembled with no-powered
Storage temperature	+5	—	+35	℃	Packaged
Storage humidity	20	—	60	%RH	Non condensing Packaged

3.3. Electrical Specifications

Absolute Maximum Ratings

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

Recommended Operating Conditions

Main power supply

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
Main Power supply voltage [V_{dd}]	+3.14	+3.3	+3.46	V	

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. Current Consumption Specifications

Items	Specifications				Units	Remarks
	Modes	Standards	Avg.	Peak		
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		
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. 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.

3.5. Wireless LAN General Specifications

Items	Specifications				Units	Remarks
Chipset	QCA9880-BR4A (Qualcomm Atheros)				—	
Country/Domain code	0x0000				—	NOTE1
Operating Frequency range	Bands	Modes	Min.	Max.		
	2.4GHz	11b	2412	2472	MHz	US : 2412 – 2462MHz EU : 2412 – 2472MHz JP : 2412 – 2472MHz
		11g/n 20MHz	2412	2472	MHz	
		11n 40MHz	2422	2462	MHz	
	5GHz	11a/n/ac 20MHz	5180	5825	MHz	US : W52/W53/W56/W58 EU : W52/W53/W56 JP : W52/W53/W56
		11n/ac 40MHz	5190	5795	MHz	
		11ac 80MHz	5210	5775	MHz	
Frequency step	2.4GHz	11b/g /ng 20MHz /ng 40MHz	5		MHz	
	5GHz	11a /na 20MHz /ac 20MHz	20		MHz	
		11na /ac 40MHz	40		MHz	
		11ac 80MHz	80		MHz	

NOTE1: 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.

Items	Specifications		Units	Remarks
Link Data Rate	11b	1, 2, 5.5L, 5.5S, 11L, 11S	Mbps	
	11a/g	6, 9, 12, 18, 24, 36, 48, 54	Mbps	
	11na	MCS 0, 1, 2, 3, 4, 5, 6, 7	—	
	11ng/11ac 20MHz	MCS 0, 1, 2, 3, 4, 5, 6, 7, 8	—	
	11ng/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	—	
Modulation Type	11b	DSSS(DBPSK,DQPSK,CCK)	—	
	11a/g/na	OFDM(BPSK,QPSK,16QAM,64QAM)	—	
	11ng/ac	OFDM(BPSK,QPSK,16QAM,64QAM,256QAM)	—	
Hardware Encryption Engine	RC4(64-128bit) AES(128-256bit)		—	

3.6. Wireless LAN Transmitter Specifications

2.4GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
TX power Japan Typ. = Target Power	11b	Ch.1 - Ch.13	1-11Mbps	+5.0	+7.5	+10.0	dBm	NOTE1
	11g	Ch.1 - Ch.13	6-54Mbps	+5.0	+7.5	+10.0	dBm	NOTE1
	11ng HT20	Ch.1 - Ch.13	MCS0-8	+5.0	+7.5	+10.0	dBm	NOTE1
	11ng HT40	Ch.3 - Ch.11	MCS0-7	+5.5	+8.0	+10.5	dBm	NOTE1
			MCS8	+4.0	+6.5	+9.0	dBm	NOTE1
			MCS9	+2.5	+5.0	+7.5	dBm	NOTE1

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

5GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
TX power Japan Typ. = Target Power	11a	Ch.36 - Ch.64 W52/53	6-54Mbps	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.100 - Ch.140 W56	6-24Mbps	+13.0	+15.5	+18.0	dBm	NOTE1
			36Mbps	+12.0	+14.5	+17.0	dBm	NOTE1
			48Mbps	+11.5	+14.0	+16.5	dBm	NOTE1
			54Mbps	+10.0	+12.5	+15.0	dBm	NOTE1
	11na HT20	Ch.36 - Ch.64 W52/53	MCS0-7	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.100 - Ch.140 W56	MCS0-4	+13.0	+15.5	+18.0	dBm	NOTE1
			MCS5	+11.5	+14.0	+16.5	dBm	NOTE1
			MCS6	+10.5	+13.0	+15.5	dBm	NOTE1
			MCS7	+9.5	+12.0	+14.5	dBm	NOTE1
	11na HT40	Ch.38 - Ch.62 W52/53	MCS0-7	+5.5	+8.0	+10.5	dBm	NOTE1
		Ch.102 - Ch.134 W56	MCS0-2	+12.5	+15.0	+17.5	dBm	NOTE1
			MCS3-4	+12.0	+14.5	+17.0	dBm	NOTE1
			MCS5	+11.5	+14.0	+16.5	dBm	NOTE1
			MCS6	+10.5	+12.5	+15.0	dBm	NOTE1
			MCS7	+9.5	+12.0	+14.5	dBm	NOTE1

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

5GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
TX power Japan Typ. = Target Power	11ac VHT20	Ch.36 - Ch.64 W52/53	MCS0-8	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.100 - Ch.140 W56	MCS0-4	+13.0	+15.5	+18.0	dBm	NOTE1
			MCS5	+11.5	+14.0	+16.5	dBm	NOTE1
			MCS6	+10.5	+13.0	+15.5	dBm	NOTE1
			MCS7	+9.5	+12.0	+14.5	dBm	NOTE1
			MCS8	+9.0	+11.5	+14.0	dBm	NOTE1
	11ac VHT40	Ch.38 - Ch.62 W52/53	MCS0-9	+5.5	+8.0	+10.5	dBm	NOTE1
		Ch.102 - Ch.134 W56	MCS0-2	+12.5	+15.0	+17.5	dBm	NOTE1
			MCS3-4	+12.0	+14.5	+17.0	dBm	NOTE1
			MCS5	+11.5	+14.0	+16.5	dBm	NOTE1
			MCS6	+10.5	+12.5	+15.0	dBm	NOTE1
			MCS7	+9.5	+12.0	+14.5	dBm	NOTE1
			MCS8	+8.5	+11.0	+13.5	dBm	NOTE1
			MCS9	+6.5	+9.0	+11.5	dBm	NOTE1
	11ac VHT80	Ch.42, Ch.58 W52/53	MCS0-9	+5.5	+8.0	+10.5	dBm	NOTE1
		Ch.106 - Ch.122 W56	MCS0-5	+12.0	+14.5	+17.0	dBm	NOTE1
			MCS6	+11.0	+13.5	+16.0	dBm	NOTE1
			MCS7	+9.0	+11.5	+14.0	dBm	NOTE1
			MCS8	+8.5	+11.0	+13.5	dBm	NOTE1
			MCS9	+6.5	+9.0	+11.5	dBm	NOTE1

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

2.4GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
送信電力	11b	Ch.1 - Ch.13	1-11Mbps	+5.0	+7.5	+9.5	dBm	NOTE1
EU	11g	Ch.1 - Ch.13	6-54Mbps	+5.0	+7.5	+9.5	dBm	NOTE1
TX power	11ng HT20	Ch.1 - Ch.13	MCS0-8	+5.0	+7.5	+9.5	dBm	NOTE1
EU	11ng HT40	Ch.3 - Ch.11	MCS0-7	+5.5	+8.0	+10.5	dBm	NOTE1
Typ. = Target Power			MCS8	+4.0	+6.5	+9.0	dBm	NOTE1
			MCS9	+2.5	+5.0	+7.5	dBm	NOTE1

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

5GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
EU TX power EU Typ. = Target Power	11a	Ch.36 - Ch.48 W52	6-54Mbps	+2.5	+5.0	+7.5	dBm	NOTE1
		Ch.52 - Ch.64 W53	6-54Mbps	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.100- Ch.140 W56	6-24Mbps	+12.5	+15.0	+17.5	dBm	NOTE1
			36Mbps	+12.0	+14.5	+17.0	dBm	NOTE1
			48Mbps	+11.5	+14.0	+16.5	dBm	NOTE1
			54Mbps	+10.0	+12.5	+15.0	dBm	NOTE1
	11na HT20	Ch.36 - Ch.48 W52	MCS0-7	+4.5	+7.0	+9.5	dBm	NOTE1
		Ch.52 - Ch.64 W53	MCS0-7	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.100 - Ch.140 W56	MCS0-5	+11.5	+14.0	+16.5	dBm	NOTE1
			MCS6	+10.5	+13.0	+15.5	dBm	NOTE1
			MCS7	+9.5	+12.0	+14.5	dBm	NOTE1
	11na HT40	Ch.38 - Ch.62 W52/53	MCS0-7	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.102 - Ch.134 W56	MCS0-4	+12.0	+14.5	+17.0	dBm	NOTE1
			MCS5	+11.5	+14.0	+16.5	dBm	NOTE1
			MCS6	+10.5	+12.5	+15.0	dBm	NOTE1
			MCS7	+9.5	+12.0	+14.5	dBm	NOTE1

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

5GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
EU TX power EU Typ. = Target Power	11ac VHT20	Ch.36 - Ch.48 W52	MCS0-8	+4.5	+7.0	+9.5	dBm	NOTE1
		Ch.52 - Ch.64 W53	MCS0-8	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.100 - Ch.140 W56	MCS0-5	+11.5	+14.0	+16.5	dBm	NOTE1
			MCS6	+10.5	+13.0	+15.5	dBm	NOTE1
			MCS7	+9.5	+12.0	+14.5	dBm	NOTE1
			MCS8	+9.0	+11.5	+14.0	dBm	NOTE1
	11ac VHT40	Ch.38 - Ch.62 W52/53	MCS0-9	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.102 - Ch.134 W56	MCS0-4	+12.0	+14.5	+17.0	dBm	NOTE1
			MCS5	+11.5	+14.0	+16.5	dBm	NOTE1
			MCS6	+10.5	+12.5	+15.0	dBm	NOTE1
			MCS7	+9.5	+12.0	+14.5	dBm	NOTE1
			MCS8	+8.5	+11.0	+13.5	dBm	NOTE1
			MCS9	+6.5	+9.0	+11.5	dBm	NOTE1
	11ac VHT80	Ch.42, Ch.58 W52/53	MCS0-9	+4.5	+7.0	+9.5	dBm	NOTE1
		Ch.106 - Ch.122 W56	MCS0-5	+11.5	+14.0	+16.5	dBm	NOTE1
			MCS6	+11.0	+13.5	+16.0	dBm	NOTE1
			MCS7	+9.0	+11.5	+14.0	dBm	NOTE1
			MCS8	+8.5	+11.0	+13.5	dBm	NOTE1
			MCS9	+6.5	+9.0	+11.5	dBm	NOTE1

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

2.4GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
TX power US / Canada Typ. = Target Power	11b	Ch.1 - Ch.11	1-11Mbps	+5.5	+8.0	+10.5	dBm	NOTE1
	11g	Ch.1 - Ch.3	6-54Mbps	+4.5	+7.0	+9.5	dBm	NOTE1
		Ch.4 - Ch.8	6-24Mbps	+13.0	+15.5	+18.0	dBm	NOTE1
			36Mbps	+11.5	+14.0	+16.5	dBm	NOTE1
			48Mbps	+10.5	+13.0	+15.5	dBm	NOTE1
			54Mbps	+9.0	+11.5	+14.0	dBm	NOTE1
		Ch.9 - Ch.11	6-54Mbps	+6.5	+9.0	+11.5	dBm	NOTE1
	11ng HT20	Ch.1 - Ch.3	MCS0-8	+2.0	+4.5	+7.0	dBm	NOTE1
		Ch.4 - Ch.8	MCS0-4	+11.0	+13.5	+16.0	dBm	NOTE1
			MCS5	+10.0	+12.5	+15.0	dBm	NOTE1
			MCS6	+9.0	+11.5	+14.0	dBm	NOTE1
			MCS7	+7.0	+9.5	+12.0	dBm	NOTE1
			MCS8	+4.5	+7.0	+9.5	dBm	NOTE1
		Ch.9 - Ch.11	MCS0-7	+6.5	+9.0	+11.5	dBm	NOTE1
			MCS8	+5.0	+7.5	+10.0	dBm	NOTE1
	11ng HT40	Ch.3 - Ch.5	MCS0-9	+1.5	+4.0	+6.5	dBm	NOTE1
		Ch.6	MCS0-4	+11.5	+14.0	+16.5	dBm	NOTE1
			MCS5	+11.0	+13.5	+16.0	dBm	NOTE1
			MCS6	+8.5	+11.0	+13.5	dBm	NOTE1
			MCS7	+6.0	+8.5	+11.0	dBm	NOTE1
			MCS8	+4.0	+6.5	+9.0	dBm	NOTE1
			MCS9	+2.5	+5.0	+7.5	dBm	NOTE1
		Ch.7 - Ch.9	MCS0-8	+3.5	+6.0	+8.5	dBm	NOTE1
			MCS9	+2.5	+5.0	+7.5	dBm	NOTE1

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

5GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
TX power US / Canada Typ. = Target Power	11a	Ch.36 - Ch.48 W52/53	6-54Mbps	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.52 - Ch.64 W52/53	6-54Mbps	+9.5	+12.0	+14.5	dBm	NOTE1
		Ch.100 - Ch.140	6-48Mbps	+11.5	+14.0	+16.5	dBm	NOTE1
		W56	54Mbps	+9.5	+12.0	+14.5	dBm	NOTE1
		Ch.149	6-36Mbps	+12.0	+14.5	+17.0	dBm	NOTE1
		W58	48Mbps	+11.5	+14.0	+16.5	dBm	NOTE1
			54Mbps	+10.5	+13.0	+15.5	dBm	NOTE1
		Ch.153 - Ch.165	6-24Mbps	+13.5	+16.0	+18.5	dBm	NOTE1
		W58	36Mbps	+12.0	+14.5	+17.0	dBm	NOTE1
			48Mbps	+11.5	+14.0	+16.5	dBm	NOTE1
			54Mbps	+10.5	+13.0	+15.5	dBm	NOTE1
	11na HT20	Ch.36 - Ch.64 W52/53	MCS0-7	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.100 - Ch.140 W56	MCS0-7	+8.5	+11.0	+13.5	dBm	NOTE1
		Ch.149	MCS0-5	+12.0	+14.5	+17.0	dBm	NOTE1
		W58	MCS6	+11.0	+13.5	+16.0	dBm	NOTE1
			MCS7	+9.5	+12.0	+14.5	dBm	NOTE1
		Ch.153 - Ch.165	MCS0-4	+13.5	+16.0	+18.5	dBm	NOTE1
		W58	MCS5	+12.5	+15.0	+17.5	dBm	NOTE1
			MCS6	+11.0	+13.5	+16.0	dBm	NOTE1
			MCS7	+9.5	+12.0	+14.5	dBm	NOTE1

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

5GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
TX power (US, Canada) (Typ.=Target Power)	11na HT40	Ch.36 - Ch.62 W52/53	MCS0-7	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.102 - Ch.134 W56	MCS0-7	+9.0	+11.5	+14.0	dBm	NOTE1
		Ch.151 W58	MCS0-7	+9.5	+12.0	+14.5	dBm	NOTE1
		Ch.159 W58	MCS0-5	+12.5	+15.0	+17.5	dBm	NOTE1
			MCS6	+10.5	+13.0	+15.5	dBm	NOTE1
			MCS7	+10.0	+12.5	+15.0	dBm	NOTE1
	11ac VHT20	Ch.36 - Ch.64 W52/53	MCS0-8	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.100 - Ch.140 W56	MCS0-8	+8.5	+11.0	+13.5	dBm	NOTE1
		Ch.149 W58	MCS0-5	+12.0	+14.5	+17.0	dBm	NOTE1
			MCS6	+11.0	+13.5	+16.0	dBm	NOTE1
			MCS7-8	+9.5	+12.0	+14.5	dBm	NOTE1
		Ch.153 - Ch.165 W58	MCS0-4	+13.5	+16.0	+18.5	dBm	NOTE1
			MCS5	+12.5	+15.0	+17.5	dBm	NOTE1
			MCS6	+11.0	+13.5	+16.0	dBm	NOTE1
			MCS7-8	+9.5	+12.0	+14.5	dBm	NOTE1
	11ac VHT40	Ch.36 - Ch.62 W52/53	MCS0-9	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.102 - Ch.134 W56	MCS0-7	+9.0	+11.5	+14.0	dBm	NOTE1
			MCS8	+8.5	+11.0	+13.5	dBm	NOTE1
			MCS9	+6.5	+9.0	+11.5	dBm	NOTE1
		Ch.151 W58	MCS0-8	+9.5	+12.0	+14.5	dBm	NOTE1
			MCS9	+7.5	+10.0	+12.5	dBm	NOTE1
		Ch.159 W58	MCS0-5	+12.5	+15.0	+17.5	dBm	NOTE1
			MCS6	+10.5	+13.0	+15.5	dBm	NOTE1
			MCS7	+10.0	+12.5	+15.0	dBm	NOTE1
			MCS8	+9.5	+12.0	+14.5	dBm	NOTE1
			MCS9	+7.5	+10.0	+12.5	dBm	NOTE1

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

5GHz (+25℃)

Items	Specifications						Units	Remarks
	Modes			Min.	Typ.	Max.		
TX power (US, Canada) (Typ.=Target Power)	11ac VHT80	Ch.42 W52	MCS0-9	+5.5	+8.0	+10.5	dBm	NOTE1
		Ch.58 W53	MCS0-9	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.106 W56	MCS0-9	+5.0	+7.5	+10.0	dBm	NOTE1
		Ch.122 W58	MCS0-6	+9.5	+12.0	+14.5	dBm	NOTE1
			MCS7	+9.0	+11.5	+14.0	dBm	NOTE1
			MCS8	+8.5	+11.0	+13.5	dBm	NOTE1
			MCS9	+6.5	+9.0	+11.5	dBm	NOTE1
		Ch.155 W58	MCS0-9	+4.0	+6.5	+9.0	dBm	NOTE1

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

Power uncertainly due to environmental conditions (Operating temperature)

Item	Specification						Unit	Note
	Mode			Min.	Typ.	Max.		
Power uncertainty due to environmental conditions	802.11a	6-54Mbps	W52	-2.5	—	+2.5	dB	Chain[NOTE1]
			W53	-2.5	—	+2.5	dB	Chain[NOTE1]
			W56,W58	-2.5	—	+2.5	dB	Chain[NOTE1]
	802.11na	MSC0-7	W52	-2.5	—	+2.5	dB	Chain[NOTE1]
			W53	-2.5	—	+2.5	dB	Chain[NOTE1]
			W56,W58	-2.5	—	+2.5	dB	Chain[NOTE1]
	802.11ac VHT20	MSC0-8	W52	-2.5	—	+2.5	dB	Chain[NOTE1]
			W53	-2.5	—	+2.5	dB	Chain[NOTE1]
			W56,W58	-2.5	—	+2.5	dB	Chain[NOTE1]
	802.11ac VHT40/80	MSC0-9	W52	-2.5	—	+2.5	dB	Chain[NOTE1]
			W53	-2.5	—	+2.5	dB	Chain[NOTE1]
			W56,W58	-2.5	—	+2.5	dB	Chain[NOTE1]
	802.11b	1-11Mbps		-2.5	—	+2.5	dB	Chain[NOTE1]
	802.11g	6-54Mbps		-2.5	—	+2.5	dB	Chain[NOTE1]
	802.11ng HT20	MSC0-8		-2.5	—	+2.5	dB	Chain[NOTE1]
	802.11ng HT40	MSC0-9		-2.5	—	+2.5	dB	Chain[NOTE1]

NOTE1: Transmit power is the value from each single chain.
When the device transmits 3 streams of data, total power can be +4.8dB.

Frequency Accuracy (Operating Temperature)

Items	Specifications				Units	Remarks
	Standards	Min.	Typ.	Max.		
Frequency Accuracy	11a/11b/11g/11n/11ac	-20	0	+20	ppm	

3.7. Wireless LAN Receiver Specifications

2.4GHz (Operating Temperature)

Items	Specifications					Units	Remarks
	Modes		Min.	Typ.	Max.		
Receiver Minimum Sensitivity 2.4GHz	11b (FER<8%)	1Mbps	—	-85	-76	dBm	
		2Mbps	—	-85	-76	dBm	
		5.5Mbps	—	-85	-76	dBm	
		11Mbps	—	-85	-76	dBm	
	11g (PER<10%)	6Mbps	—	-86	-82	dBm	
		9Mbps	—	-86	-81	dBm	
		12Mbps	—	-86	-79	dBm	
		18Mbps	—	-85	-77	dBm	
		24Mbps	—	-81	-74	dBm	
		36Mbps	—	-78	-70	dBm	
		48Mbps	—	-74	-66	dBm	
		54Mbps	—	-73	-65	dBm	
	11ng HT20 (PER<10%)	MCS0	—	-86	-82	dBm	
		MCS1	—	-86	-79	dBm	
		MCS2	—	-84	-77	dBm	
		MCS3	—	-80	-74	dBm	
		MCS4	—	-77	-70	dBm	
		MCS5	—	-73	-66	dBm	
		MCS6	—	-71	-65	dBm	
		MCS7	—	-70	-64	dBm	
		MCS8	—	-66	-59	dBm	
	11ng HT40 (PER<10%)	MCS0	—	-85	-79	dBm	
		MCS1	—	-85	-76	dBm	
		MCS2	—	-82	-74	dBm	
		MCS3	—	-78	-71	dBm	
		MCS4	—	-75	-67	dBm	
		MCS5	—	-71	-63	dBm	
		MCS6	—	-69	-62	dBm	
		MCS7	—	-68	-61	dBm	
		MCS8	—	-64	-56	dBm	
		MCS9	—	-62	-54	dBm	

5GHz (Operating Temperature)

Items	Specifications					Units	Remarks
	Modes		Min.	Typ.	Max.		
Receiver Minimum Sensitivity 5GHz	11a (PER<10%)	6Mbps	—	-86	-82	dBm	
		9Mbps	—	-86	-81	dBm	
		12Mbps	—	-86	-79	dBm	
		18Mbps	—	-84	-77	dBm	
		24Mbps	—	-80	-74	dBm	
		36Mbps	—	-77	-70	dBm	
		48Mbps	—	-73	-66	dBm	
		54Mbps	—	-71	-65	dBm	
	11na HT20 (PER<10%)	MCS0	—	-86	-82	dBm	
		MCS1	—	-85	-79	dBm	
		MCS2	—	-83	-77	dBm	
		MCS3	—	-79	-74	dBm	
		MCS4	—	-75	-70	dBm	
		MCS5	—	-71	-66	dBm	
		MCS6	—	-70	-65	dBm	
		MCS7	—	-69	-64	dBm	
	11na HT40 (PER<10%)	MCS0	—	-85	-79	dBm	
		MCS1	—	-83	-76	dBm	
		MCS2	—	-80	-74	dBm	
		MCS3	—	-76	-71	dBm	
		MCS4	—	-73	-67	dBm	
		MCS5	—	-69	-63	dBm	
		MCS6	—	-67	-62	dBm	
		MCS7	—	-66	-61	dBm	

5GHz (Operating Temperature)

Items	Specifications					Units	Remarks
	Modes		Min.	Avg.	Max.		
Receiver Minimum Sensitivity 5GHz	11ac VHT20 (PER<10%)	MCS0	—	-86	-82	dBm	
		MCS1	—	-86	-79	dBm	
		MCS2	—	-83	-77	dBm	
		MCS3	—	-79	-74	dBm	
		MCS4	—	-75	-70	dBm	
		MCS5	—	-71	-66	dBm	
		MCS6	—	-70	-65	dBm	
		MCS7	—	-68	-64	dBm	
		MCS8	—	-64	-59	dBm	
	11ac VHT40 (PER<10%)	MCS0	—	-85	-79	dBm	
		MCS1	—	-83	-76	dBm	
		MCS2	—	-80	-74	dBm	
		MCS3	—	-76	-71	dBm	
		MCS4	—	-73	-67	dBm	
		MCS5	—	-69	-63	dBm	
		MCS6	—	-67	-62	dBm	
		MCS7	—	-66	-61	dBm	
		MCS8	—	-62	-56	dBm	
		MCS9	—	-60	-54	dBm	
	11ac VHT80 (PER<10%)	MCS0	—	-82	-76	dBm	
		MCS1	—	-80	-73	dBm	
		MCS2	—	-77	-71	dBm	
		MCS3	—	-73	-68	dBm	
		MCS4	—	-70	-64	dBm	
		MCS5	—	-66	-60	dBm	
		MCS6	—	-65	-59	dBm	
		MCS7	—	-63	-58	dBm	
		MCS8	—	-59	-53	dBm	
		MCS9	—	-57	-51	dBm	

4. Signal Specifications

4.1. PCI Express Mini Card Edge Pin Assignments

Top Side

Pin Number	Pin Name	Type	Description
1	RESERVED	OD	WAKE_L
3	RESERVED	IO	Connected to GPIO.
5	RESERVED	IO	Connected to GPIO.
7	RESERVED	OD	CLKREQ_L
9	GND	GND	
11	REFCLK-	IA	PCI Express differential reference clock (100MHz)
13	REFCLK+	IA	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	Module: Differential data transmit
25	PERp0	OA	Module: Differential data transmit
27	GND	GND	
29	GND	GND	
31	PETn0	IA	Module: Differential data receive
33	PETp0	IA	Module: Differential data receive
35	GND	GND	
37	RESERVED	NA	NC
39	RESERVED	NA	Connected to pin 41 internally
41	RESERVED	NA	Connected to pin 39 internally
43	RESERVED	GND	Connected to GND
45	RESERVED	IO	Connected to GPIO
47	RESERVED	IO	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	Connected to GPIO. Disable wireless module. On board Pull-up(10kohm)
22	PERST_L	IL	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	Connected to GPIO.
46	RESERVED	NA	NC
48	RESERVED	NA	NC
50	GND	GND	
52	+3.3V	PWR	

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 signal.

4.2. Signal Pin Specifications

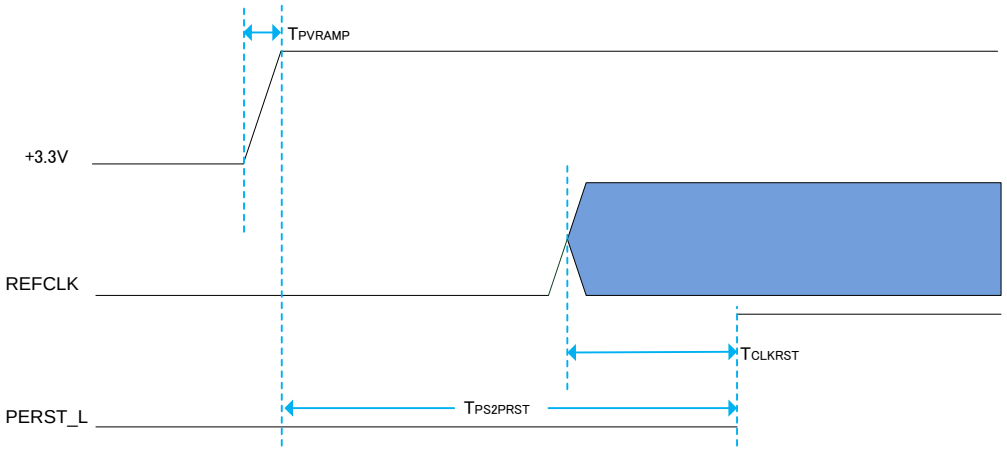
Signal Name	Pin#	QCA9880 Pin#	Type	Drive	PU/PD Resistance
PERST_L	22	26	IL	-	150k ohm
REFCLK-	11	29	IA	-	
REFCLK+	13	30	IA	-	
PERn0	23	31	OA	-	
PERp0	25	32	OA	-	
PETn0	31	34	IA	-	
PETp0	33	33	IA	-	

4.3. 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	Massage Capability ID	Massage 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	

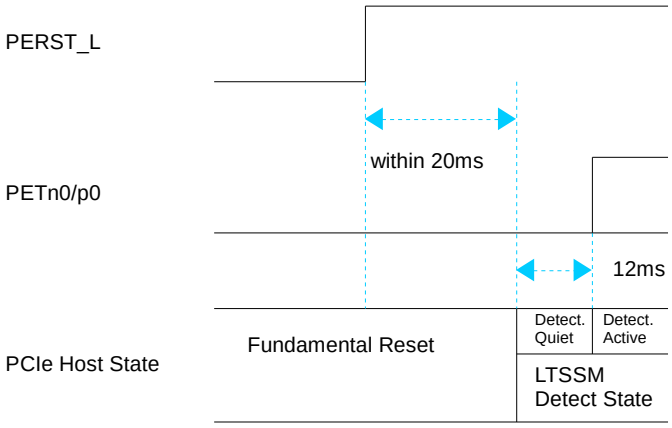
5. Interface / Timing Specifications

5.1. 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

* 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. Standards Compliance

6.1. Standard List

Standards Conformity:

- IEEE802.11a/b/g/n/ac
- PCI Express v1.1

Law regulation compliance (Master/Slave mode):

- Japan Radio Law (MIC)
  Article 2 Section 1 Number 19
  Article 2 Section 1 Number 19-3
  Article 2 Section 1 Number 19-3-2

  Certification number: **201-160190**

- FCC Part15 (Subpart C, Subpart E (UNII-1/2/2Ext/3))
  ID: **N6C-SXPCEACDB**

- IC RSS
  ID: **4908A-SXPCEACDB**

- ETSI R&TTE EN 300 328

- ETSI R&TTE EN 301 893

- CE RoHS Directive 2011/65/EC (Lead Free)

Countries:

- Asia
  - Japan

- North America
  - United States
  - Canada

- EU

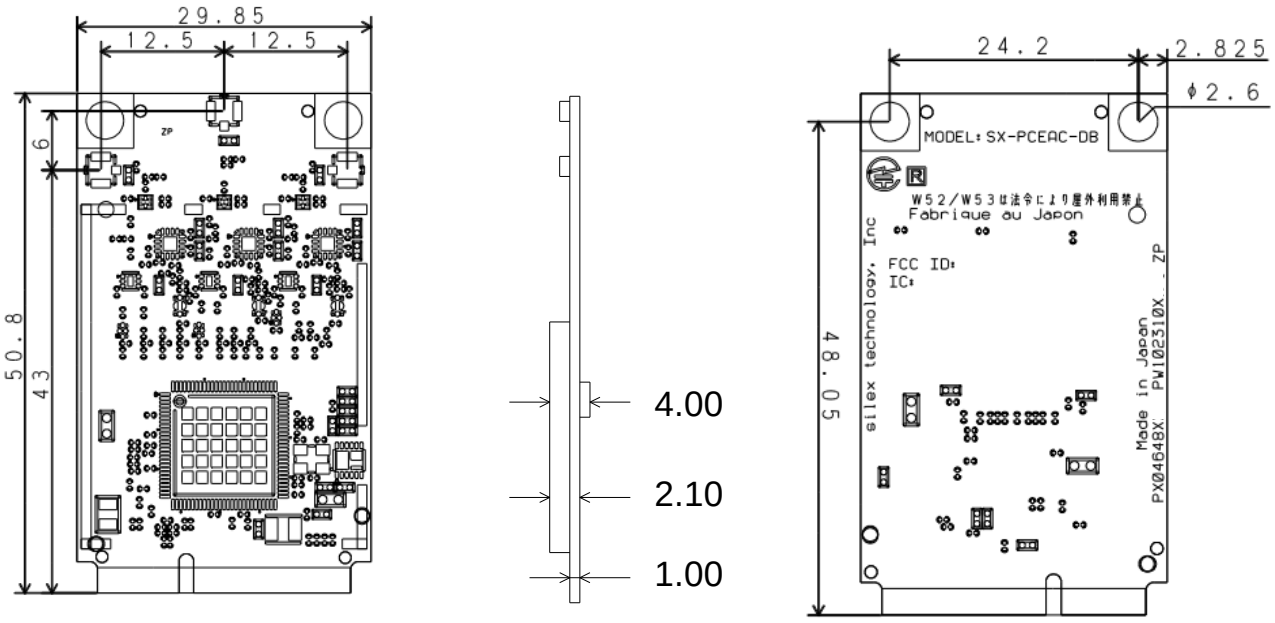
※ EMC certification of each country might be required as the final product.

6.2. Recommended Antenna List

Antennas	Vendors	2.4GHz Gain	5GHz Gain	MIC No.19	MIC No.19-3	MIC 19-3-2	FCC Subpart-C	FCC Subpart-E	ETSI EN300329	ETSI EN301893
H2B1PC1A1C100 (AA258) (Include cable loss)	Unictron	+2.9dBi	+4.4dBi	✔	✔	✔	✔	✔	✔	✔
H2B1PD1A1C100 (AA222) (Include cable loss)	Unictron	+2.8dBi	+4.2dBi	✔	✔	✔	✔	✔	✔	✔
AS-146153-100 (Include cable loss)	molex	+3.25dBi	+5.0dBi	✔	✔	✔	✔	✔	✔	✔
ANTDC-081A0/B0 (Include cable loss)	Sansei-Denki	+2.0dBi	+2.0dBi	✔	✔	✔	–	–	–	–
ANTDP-027A0 (Not include cable loss)	Sansei-Denki	+1.5dBi	+2.1dBi	✔	✔	✔	–	–	–	–

NOTE1: The above certification is only effective with the silex recommended antennas 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.

7. Mechanical Specifications



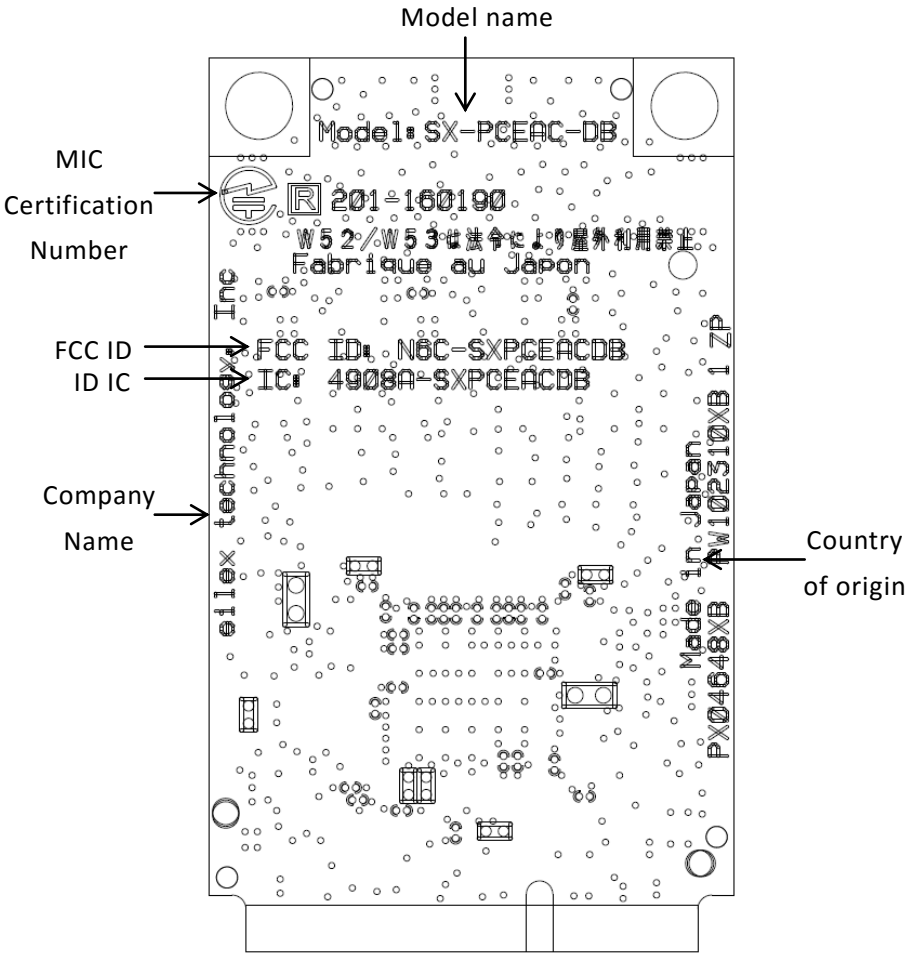
TOP VIEW **SIDE VIEW** **BOTTOM VIEW**

(mm)

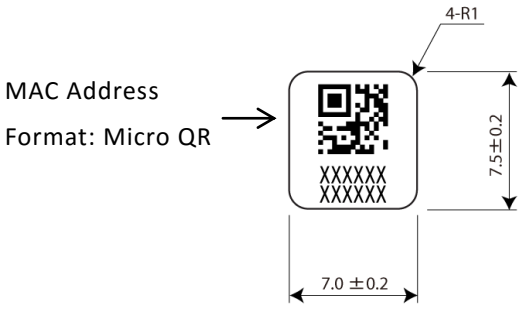
NOTE1: The thickness of dimension tolerance is +/-0.25 mm, other than that +/-0.15mm

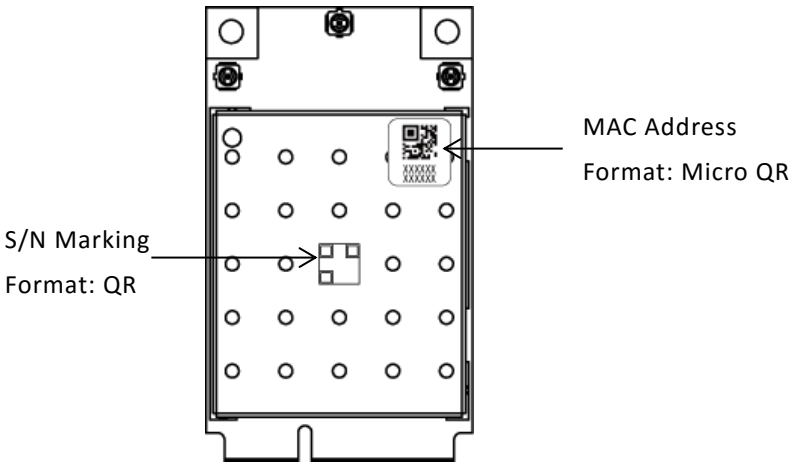
NOTE2: Solder thickness = 0.1mm

8. Marking Specifications



9. Label Specifications

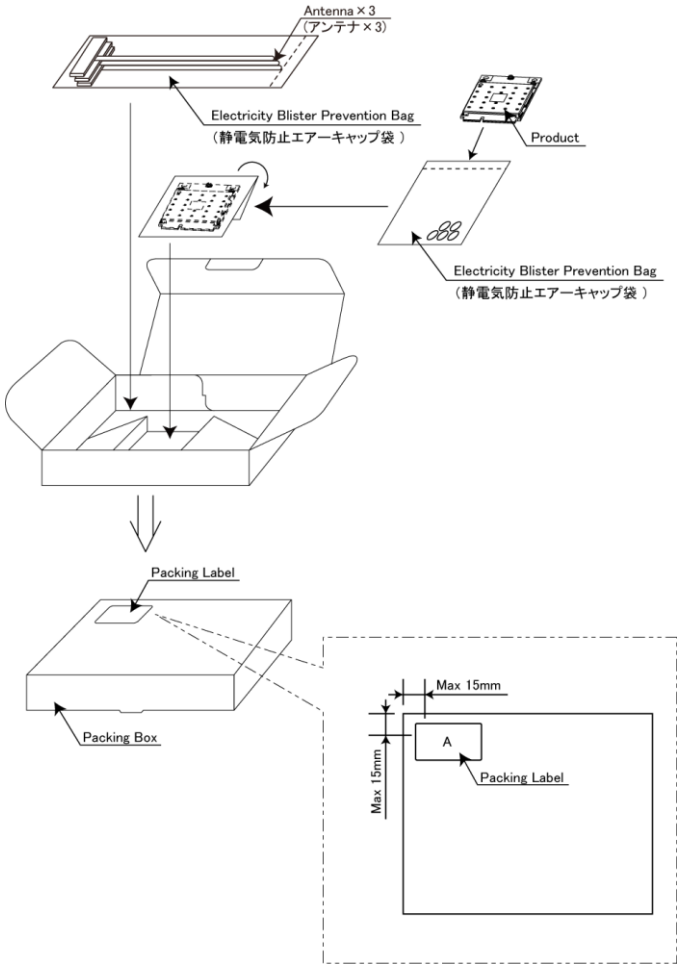


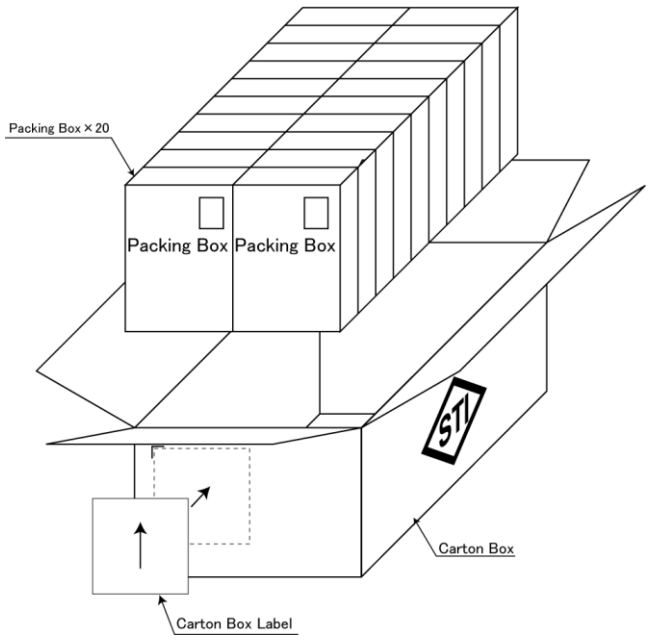


10. Components Composition List

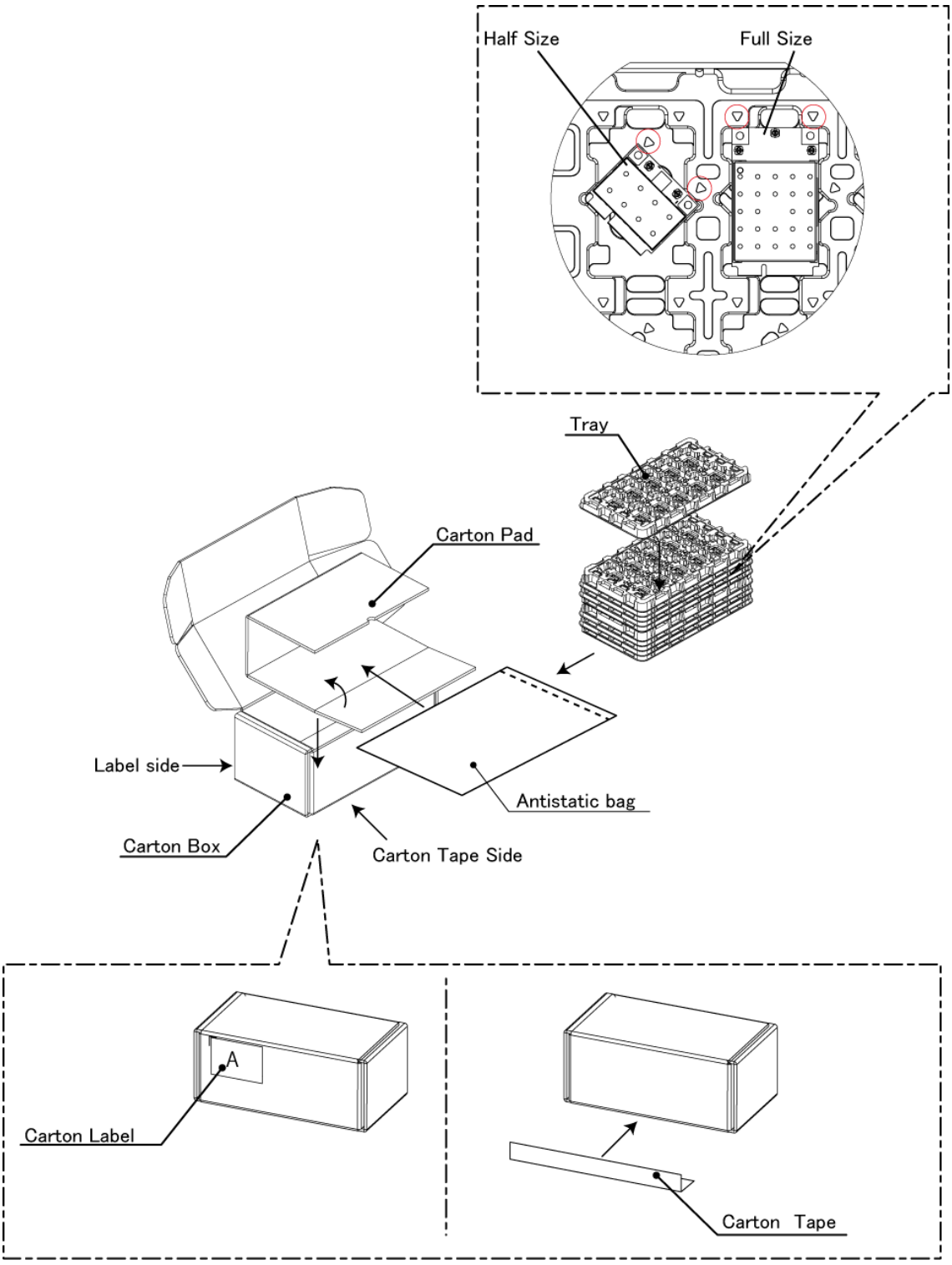
Categories	Items	Product No.		Remarks
		ZXE03507	ZXE03558	
		SX-PCEAC-DB	SX-PCEAC-DB SP	
Board	Main board	1	1	
Label	E/A Label	1	1	
	Packing Label	—	1	
	Carton Label	1/100	1/20	
Accessory	Antenna	—	3	H2B1PC1A1C100 (AA258)
Packing	Packing Box	—	1	
	Carton Box	1/100	1/20	
	Carton Pad	1/100	—	
	Tray	11/100	—	
	Antistatic bag	1/100	—	
	Antistatic air-cap bag	—	2	For Board and Accerrory

11. Packing Specifications

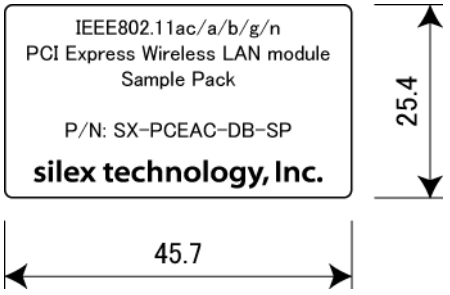




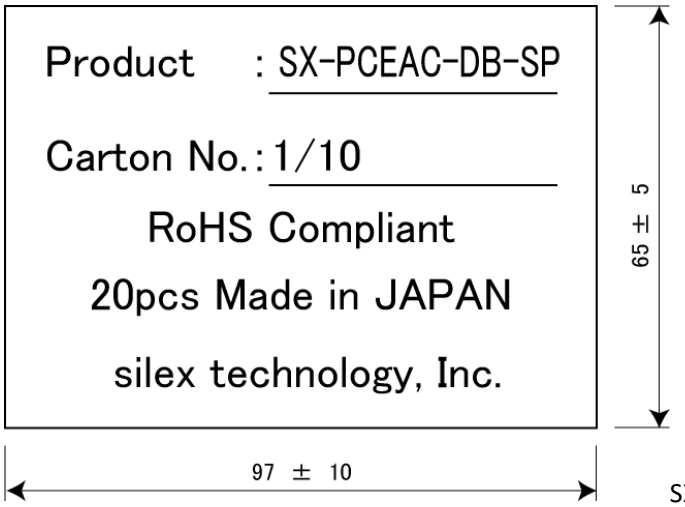
Bulk Specifications



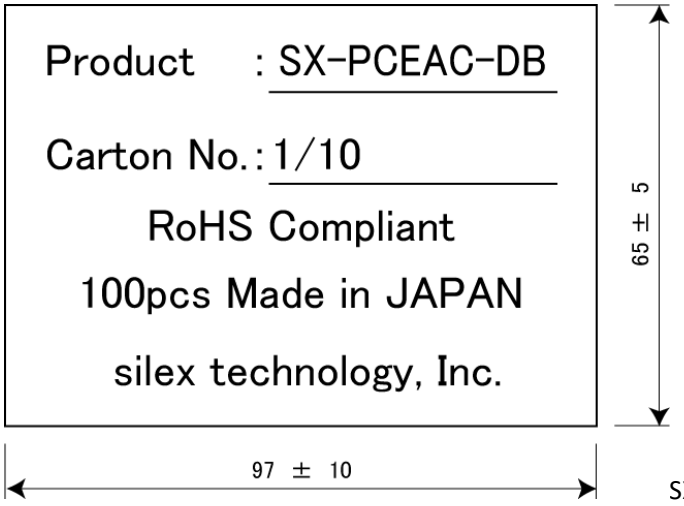
Packing Box label



SX-PCEAC-DB-SP Packing Label



SX-PCEAC-DB-SP Carton Label



SX-PCEAC-DB Carton Label

12. Reliability Test

<table>
<tr><th rowspan="2">Test Items</th><th rowspan="2">Standards</th><th rowspan="2">Descriptions</th><th colspan="2">Requirements</th></tr>
<tr><th>Electricity</th><th>Appearance</th></tr>
<tr><td>DC voltage</td><td>-</td><td>Expose to 3.0 V to 3.6 V and confirm DUT is working.</td><td>Workable</td><td>NA</td></tr>
<tr><td>Temperature Rise</td><td>-</td><td>Change temperature 20℃/ H or more and confirm DUT is working.</td><td>Workable</td><td>NA</td></tr>
<tr><td>Temperature Humidity Cycle</td><td>IEC60601-1-11</td><td>Exposed to the following conditions [Time Hr:min]
Condition 1
<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></tr>
<tr><td>℃</td><td>+25</td><td>→</td><td>-5</td><td>→</td><td>+65</td><td>→</td><td>-5</td></tr>
<tr><td>%RH</td><td>OFF</td><td>→</td><td>OFF</td><td>→</td><td>+95</td><td>→</td><td>OFF</td></tr>
<tr><td>Time</td><td>0:05</td><td>→</td><td>3:00</td><td>→</td><td>3:00</td><td>→</td><td>5:00</td></tr>
<tr><td>Step</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr>
<tr><td>℃</td><td>→</td><td>+65</td><td>→</td><td>+18</td><td>→</td><td>+25</td></tr>
<tr><td>%RH</td><td>→</td><td>+95</td><td>→</td><td>+10</td><td>→</td><td>+30</td></tr>
<tr><td>Time</td><td>→</td><td>8:05</td><td>→</td><td>8:05</td><td>→</td><td>1:00</td></tr>
</table>
Condition 2
<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></tr>
<tr><td>℃</td><td>+25</td><td>→</td><td>-5</td><td>→</td><td>+65</td><td>→</td><td>-5</td><td>-5</td><td>→</td></tr>
<tr><td>%RH</td><td>OFF</td><td>→</td><td>OFF</td><td>→</td><td>95</td><td>→</td><td>OFF</td><td>OFF</td><td>→</td></tr>
<tr><td>Time</td><td>0:05</td><td>→</td><td>3:00</td><td>→</td><td>3:00</td><td>→</td><td>2:00</td><td>3:00</td><td>→</td></tr>
<tr><td>Step</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td></tr>
<tr><td>℃</td><td>+65</td><td>+65</td><td>+65</td><td>→</td><td>+5</td><td>+5</td><td>+5</td><td>→</td><td>+25</td></tr>
<tr><td>%RH</td><td>95</td><td>95</td><td>95</td><td>→</td><td>10</td><td>10</td><td>10</td><td>→</td><td>30</td></tr>
<tr><td>Time</td><td>2:00</td><td>0:05</td><td>6:00</td><td>→</td><td>2:00</td><td>0:05</td><td>6:00</td><td>→</td><td>1:00</td></tr>
</table></td><td>Workable</td><td>NA</td></tr>
<tr><td>Cold Temp</td><td>-</td><td>Boot up and work at -5℃</td><td>Workable</td><td>NA</td></tr>
<tr><td>Heat Resistance</td><td>-</td><td>Expose at +65℃for 8 hours. Leave at room temp for 2 hours after taking out from chamber.</td><td>Meet to spec.</td><td>No damage</td></tr>
<tr><td>Cold Resistance</td><td>-</td><td>Expose at -5℃for 8 hours. Leave at room temp for 2 hours after r taking out from chamber.</td><td>Meet to spec.</td><td>No damage</td></tr>
<tr><td>Device Temp rise</td><td>-</td><td>Measure temperature on each device with exposing at +60℃.</td><td>Meet to Device's spec.</td><td>NA</td></tr>
<tr><td>Drop with Package</td><td>ISO 4180
JIS Z0200 Level II</td><td>Drop with the package from 60cm height to the wood board. (6 faces, 3 edges, 1 corner).</td><td>Meet to spec.</td><td>No damage</td></tr>
</table>

<table>
<tr><th rowspan="2">Test Items</th><th rowspan="2">Standards</th><th rowspan="2">Descriptions</th><th colspan="2">Requirements</th></tr>
<tr><th>Electricity</th><th>Appearance</th></tr>
<tr><td>Shock</td><td>MIL-STD-202
Method 213B
Condition A</td><td>Peak g's = 50g, Duration = 11ms, Waveform = Half-sine, Vi = 11.3ft/sec</td><td>Meet to spec.</td><td>No damage</td></tr>
<tr><td>Vibration</td><td>MIL-STD-202
Method 204D
Condition D</td><td>Peak g's = 20g, 10 <> 2000Hz at 20min/cycle for each X/Y/Z axis, Perform 12 times</td><td>Meet to spec.</td><td>No damage</td></tr>
<tr><td>Thermal Shock</td><td>MIL-STD-833J
Method 1011.9</td><td>Step1 (High Temp) ⇒ Step 2 (Low Temp) Repeat
10 Cycle, 200 Cycle, 1000 Cycle [Check operation for each]
Step per cycle [⇨: Ramp]
<table>
<tr><th>Steps</th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>degC</td><td>+100
+10/-2℃</td><td>⇨</td><td>0
+2/-10℃</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>
</table></td><td>Meet to spec.</td><td>No damage</td></tr>
</table>

Criteria	Descriptions
No damage	No damage on the appearance after test.
Meet to spec	Meet to specifications in §3.
Workable	Can confirm working during test.
Meet to device's spec	Meet to operation temperature range of each device.

13. Notifications

- Specifications of this module compliant to law regulations of Standards Compliance §6, will not apply to the following cases.

  1) In the case this module is used with a different antenna from the antenna list. (Standards Compliance §6).
  2) In the case this module is used in a different country from the list. (Standards Compliance §6).
  3) In case the certification is renewed.

- This module is a wireless device using the 2.4GHz / 5GHz band. The 5.15-5.35GHz band (W52, W53) must be disabled for outdoor use in Japan because these bands are prohibited to be used by law.

- This module is designed to be embedded into general electronic devices. It is not designed for high reliability demands like aircraft instruments, atom control, artificial life support or any other devices requiring extremely high reliability and quality. **If embedding into a medical instrument, please contact Silex regardless of what medical class it belongs to.**

- As this module communicates by radio wave, it is strongly recommended to use some type of security to prevent unexpected information leakage to other wireless modules.

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

- The radio module can affect or be affected by other devices using the same frequency band. Please investigate the environment prior to using this module.

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

- The radio module is an embedded module that has exposed connectors and components. Please be cautious of electro static, condensing and dust.

- When being used with other wireless devices using the same frequency band around this product, please consider the recommendations below. (See IEEE802.11-2012, IEEE802.11ac-2013)

  1) +/-25MHz (+/-25MHz) or more frequency separation from the center frequency of this module is recommended in 2.4GHz.
  2) Appropriate environment to avoid interference from the adjacent channels or the non -adjacent channels is necessary.
     - ✧ 2.4GHz: Center frequency +/-25MHz(5Ch), Non Adjacent channel : Further than Center frequency +/-30MHz(6Ch)
     - ✧ 5GHz HT20: Center frequency +/-20MHz(4Ch), Non Adjacent channel : Further than Center frequency +/-40MHz(8Ch)
     - ✧ 5GHz HT40 Adjacent channel: Center frequency +/-40MHz(8Ch), Non Adjacent channel : Further than Center frequency +/-80MHz(16Ch)
     - ✧ 5GHz HT80 Adjacent channel: Center frequency +/-80MHz(16Ch), Non Adjacent channel : Further than Center frequency +/-160MHz(32Ch)

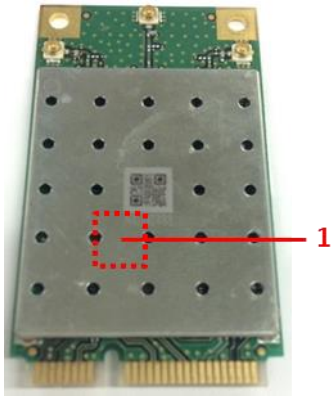
※ Even if these conditions are satisfied, the module is possibly interfered when strong signal is input. The other wireless system should be enough far from this module

- The input level from the opponent device must be -20dBm or less at 2.4GHz, -30dBm or less at 5GHz with including antenna gain.

14. Appendix A—Thermal Design

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.

The measurement point / The device operational temperature specification



#	Name	Temperature upper limits [℃]
1	SX-PCEAC-DB Tc	+80

The condition of device temp rise test

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

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

1. The specification of the baseboard AP-500AC by silex

- PCB size : 180mm X 130mm (refer Fig.1)
- Thermal dissipation pad size : 43mm X 16mm (refer Fig.1)

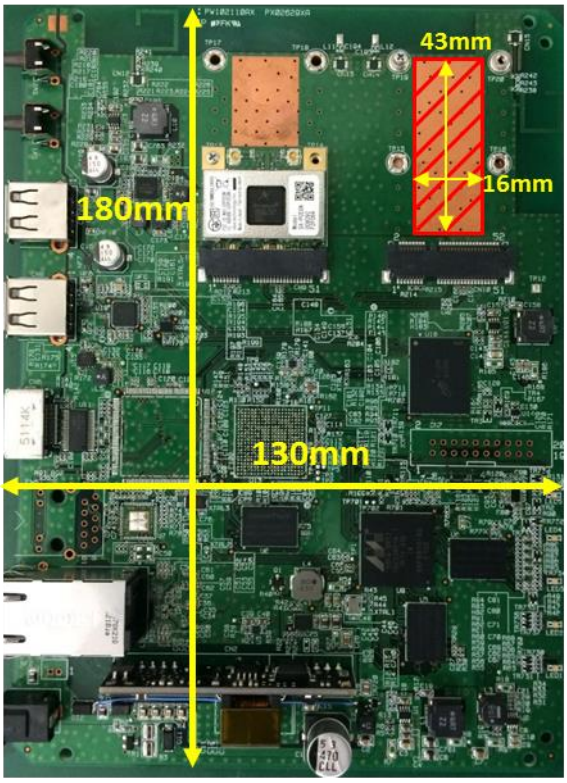


Fig 1 The baseboard AP-500AC

2. The specification of the thermal dissipation sheet

- Part # : TG-X (T-GLOBAL Technology) / Thickness: 2.0mm
- Thermal Conductivity : 12.0W/mK
- Size : 43mm X 16mm

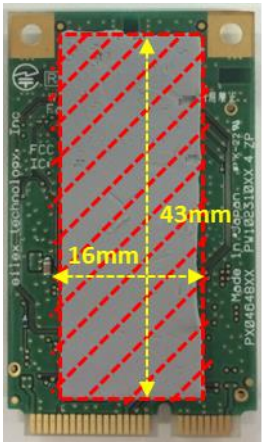


Fig.2 The position of thermal dissipation sheet against the module

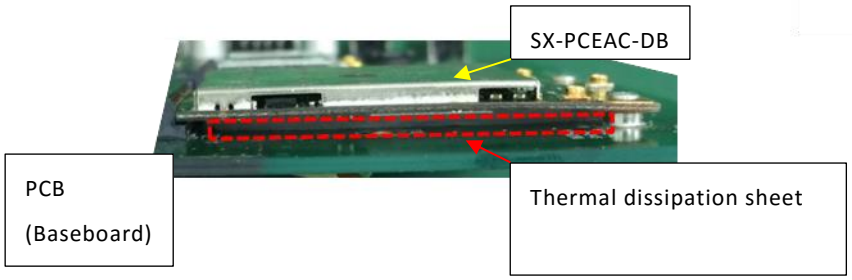


Fig.3 The situation the module with thermal dissipation sheet is mounted on the baseboard