
Title:

SX-PCEBE

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1. 製品概要 Product overview

SX-PCEBE は、QCC2076 (Qualcomm Atheros 社) SoC を採用した、2.4GHz/5GHz/6GHz Tri-Band IEEE 802.11 a/b/g/n/ac/ax/be、Bluetooth 5.3 BR/EDR/LE/2LE 準拠、PCI Express 3.0 with L1SS function 対応の無線モジュールです。本モジュールは、2.4 GHz + 5 GHz、または 2.4GHz + 6 GHz でのデュアルバンド同時動作をサポートしています。

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-PCEBE の製品形状は表面実装型 (SMT) の SX-PCEBE-SMT と M.2 Card Key E Type 型の SX-PCEBE-M2 があります。

SX-PCEBE is a wireless module that adopts the QCC2076 (Qualcomm Atheros) SoC, supporting 2.4GHz/5GHz/6GHz Tri-Band IEEE 802.11 a/b/g/n/ac/ax/be, Bluetooth 5.3 BR/EDR/LE/2LE compliance, and PCI Express 3.0 with L1SS function. This module supports simultaneous operation on 2.4 GHz + 5 GHz or 2.4GHz + 6 GHz.

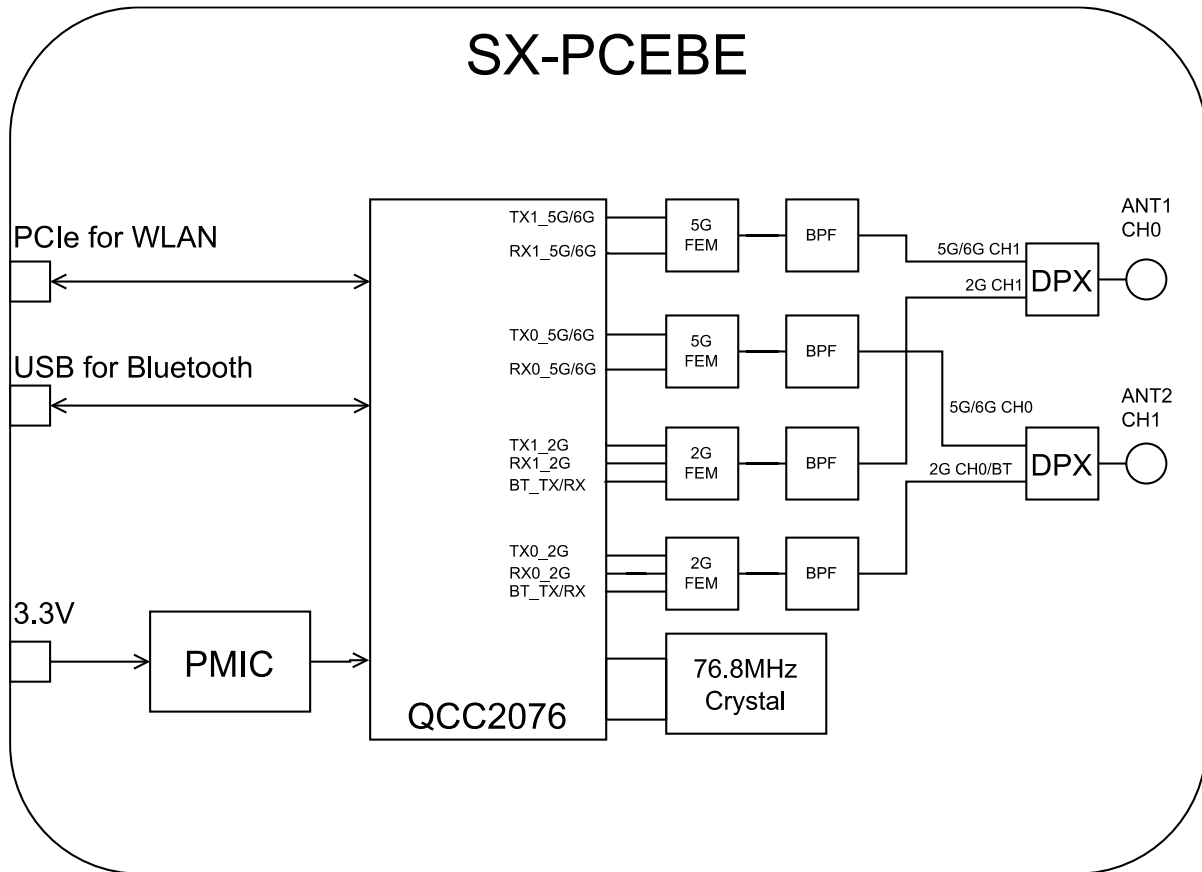
This module integrates external circuits such as MAC/BBP/RF/RF front end and various power/clock circuits. The product form factors for SX-PCEBE include Surface Mount Type (SMT) SX-PCEBE-SMT and M.2 Card Key E Type SX-PCEBE-M2.

特徴 Features

- ◆ IEEE 802.11a/b/g/n/ac/ax/be 準拠
IEEE 802.11a/b/g/n/ac/ax/be compliant
- ◆ 2 スペーシャルデータストリームシステム (2T2R)
2 spatial data stream system (2T2R)
- ◆ 5 GHz, 6GHz : 20/40/80/160 MHz 帯域幅モード対応
2.4 GHz : 20/40 MHz 帯域幅モード対応
5 GHz, 6GHz: Support 20/40/80/160 MHz bandwidth mode
2.4 GHz: Support 20/40 MHz bandwidth mode

PHY Data Rate
 - 802.11b/g 1-54 Mbps
 - 802.11a 6-54 Mbps
 - 802.11n 1Stream MCS0-7
 - 802.11n 2Stream MCS8-15
 - 802.11ac MCS0-9
 - 802.11ax MCS0-11
 - 802.11be MCS0-13
- ◆ Bluetooth 5.3 BR/EDR/LE 準拠。
Bluetooth 1.x, 2.x, 3.0, 4.0, 4.1, 4.2, 5.0, 5.1, 5.2 後方互換
Bluetooth 5.3 BR/EDR/LE/2LE compatible.
Backward compatible to Bluetooth 1.x, 2.x, 3.0, 4.0, 4.1, 4.2, 5.0, 5.1, 5.2
- ◆ Wireless LAN ホストインターフェイスとして PCI Express 3.0 with L1SS function 対応
PCI Express 3.0 with L1SS function as the Wireless LAN host interface
- ◆ Bluetooth ホストインターフェイスとして USB 1.1 対応
USB 1.1 as the Bluetooth host interface
- ◆ 主電源+3.3V
+3.3V main power supply
- ◆ 本製品は、欧州の RoHS 指令 2011/65/EU ,(EU) 2015/863 に準拠しています。
This product is compliant with the EU's RoHS directive 2011/65/EU and (EU) 2015/863.

2. ハードウェアブロック図 Hardware Block Diagram



3. 基板仕様 Board specifications

3.1. 一般仕様 General specifications

Items	Specifications	Units	Remarks
Package Type	QM.2 LGA Type 1620	—	
Antenna ports	2	pcs	MHF4 connector
Antenna port's impedance	50	Ω	Nominal value
Interfaces	PCI Express 3.0 with L1SS function	—	For Wireless LAN
	USB 1.1	—	For Bluetooth
RF Interfaces	IEEE802.11a/b/g/n/ac/ax/be	—	IEEE802.11-2012 IEEE802.11ac-2013 IEEE802.11ax IEEE802.11be
	Bluetooth 5.3 BR/EDR/LE/2LE	—	
Dimensions	See §7.		
Weight	3.0	g	
ESD resistance	+/- 2000	V	See §11.

3.2. 環境条件 Environmental specifications

Items	Specifications			Units	Remarks
	Min.	Typ.	Max.		
動作温度 Operating Temperature	-40	—	+85	°C	周囲温度 Ambient temperature 実装後電源電圧印加時 After assembled with powered NOTE 1,
動作湿度 Operating humidity	+5	—	+85	%RH	結露無きこと Non condensation 実装後電源電圧印加時 After assembled with powered
保存温度 Assembled storage temperature	-40	—	+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	+5	—	+60	%RH	結露無きこと Non condensation 実装後電源電圧無印加時 After assembled with no-powered
保管温度 Storage temperature	+5	—	+85	°C	梱包時。開封後は MSL に従う。 Packaged. Apply MSL after unpackaged. NOTE2
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			—	取り扱いについては下記を参照。 IPC/JEDEC J-STD-033 See below standard for handling. IPC/JEDEC J-STD-033 NOTE3

3.3. 電気の仕様 Electrical specifications

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 VDD (3.3V) Main Power supply voltage	+2.97	+3.300	+3.63	V	

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

Parameters		Min.	Typ.	Max.	Units	Remarks
V _{IH}	High-level input voltage (hihys_en=HIGH)	2.145	—	VDD	V	
V _{IL}	Low-level input voltage (hihys_en=HIGH)	-0.3	—	0.99	V	
V _{OH}	High-level output voltage, CMOS	2.85	—	VDD	V	
V _{OL}	Low-level output voltage, CMOS	0.0	—	0.45	V	

3.4. 無線 LAN 一般仕様 Wireless LAN general specifications

Items	Specifications				Units	Remarks
Chipset	QCC2076(Qualcomm)				—	
Country/Domain Code	Select by software				—	
Operating Center Frequency	Band	Modes	Min	Max		
	2.4GHz	11b	2412	2472	MHz	
		11g/n/ac/ax 20MHz	2412	2472	MHz	
		11n/ac/ax 40MHz	2422	2462	MHz	
	5GHz	11a/n/ac/ax 20MHz	5180	5885	MHz	
		11n/ac/ax 40MHz	5190	5875	MHz	
		11ac/ax 80MHz	5210	5855	MHz	
		11ac/ax 160MHz	5250	5815	MHz	
	6GHz	11ax 20MHz	5955	7115	MHz	Disabled 320MHz operation
		11ax 40MHz	5965	7085	MHz	
		11ax 80MHz	5985	7025	MHz	
		11ax 160MHz	6025	6985	MHz	
		11ax 320MHz	6105	6905	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			—	1Stream
		MCS 8,9,10,11,12,13,14,15			—	2Stream
	11ac	MCS 0,1,2,3,4,5,6,7,8,9			—	
	11ax	MCS 0,1,2,3,4,5,6,7,8,9,10,11			—	
	11be	MCS 0,1,2,3,4,5,6,7,8,9,10,11,12,13			—	
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)			—	
	11ax	OFDM (BPSK,QPSK,16QAM,64QAM,256QAM,1024QAM)			—	
	11be	OFDM(BPSK,QPSK,16QAM,64QAM, 256QAM,1024QAM,4096QAM)			—	
暗号化 Encryption	RC4	128			bits	
	AES	192			bits	

利用可能チャネルリスト Available channel list

2.4GHz

Channel	Fc (MHz)	20MHz	US/CA	EU/UK	JP
1	2412	20	Yes	Yes	Yes
2	2417	20	Yes	Yes	Yes
3	2422	20	Yes	Yes	Yes
4	2427	20	Yes	Yes	Yes
5	2432	20	Yes	Yes	Yes
6	2437	20	Yes	Yes	Yes
7	2442	20	Yes	Yes	Yes
8	2447	20	Yes	Yes	Yes
9	2452	20	Yes	Yes	Yes
10	2457	20	Yes	Yes	Yes
11	2462	20	Yes	Yes	Yes
12	2467	20	No	Yes	Yes
13	2472	20	No	Yes	Yes

Channel	Fc (MHz)	40MHz	US/CA	EU/UK	JP
3	2422	40	Yes	Yes	Yes
4	2427	40	Yes	Yes	Yes
5	2432	40	Yes	Yes	Yes
6	2437	40	Yes	Yes	Yes
7	2442	40	Yes	Yes	Yes
8	2447	40	Yes	Yes	Yes
9	2452	40	Yes	Yes	Yes
10	2457	40	No	Yes	Yes
11	2462	40	No	Yes	Yes

NOTE	日本、Canada、EU、United Kingdom では法令により 5.15-5.35GHz 帯域 (W52, W53) を屋外で利用することは禁止されています。本製品を屋外で利用される場合は予め該当の電波を出さない様に設定してください。
	In Japan, Canada, the EU, and the United Kingdom, it is prohibited by law to use the 5.15-5.35GHz band (W52, W53) outdoors. If you intend to use this product outdoors, please ensure that it is configured not to emit signals in the corresponding frequency bands.

5GHz

Channel	Fc (MHz)	20MHz	40MHz	80MHz	160MHz	US	CA	EU	UK	JP
36	5180	20	40	80	160	Yes	Yes	Yes	Yes	Yes
40	5200	20				Yes	Yes	Yes	Yes	Yes
44	5220	20	40			Yes	Yes	Yes	Yes	Yes
48	5240	20				Yes	Yes	Yes	Yes	Yes
52	5260	20	40	80		Yes	Yes	Yes	Yes	Yes
56	5280	20				Yes	Yes	Yes	Yes	Yes
60	5300	20	40			Yes	Yes	Yes	Yes	Yes
64	5320	20				Yes	Yes	Yes	Yes	Yes
100	5500	20	40	80	160	Yes	Yes	Yes	Yes	Yes
104	5520	20				Yes	Yes	Yes	Yes	Yes
108	5540	20	40			Yes	Yes	Yes	Yes	Yes
112	5560	20				Yes	Yes	Yes	Yes	Yes
116	5580	20	40	80		Yes	Yes	Yes	Yes	Yes
120	5600	20				Yes	No	Yes	Yes	Yes
124	5620	20	40			Yes	No	Yes	Yes	Yes
128	5640	20				Yes	No	Yes	Yes	Yes
132	5660	20	40	80	X	Yes	Yes	Yes	Yes	Yes
136	5680	20				Yes	Yes	Yes	Yes	Yes
140	5700	20	40			Yes	Yes	Yes	Yes	Yes
144	5720	20				Yes	Yes	No	Yes	Yes
149	5745	20	40	80	160	Yes	Yes	Yes	Yes	No
153	5765	20				Yes	Yes	Yes	Yes	No
157	5785	20	40			Yes	Yes	Yes	Yes	No
161	5805	20				Yes	Yes	Yes	Yes	No
165	5825	20	40	80		Yes	Yes	Yes	Yes	No
169	5845	20				Yes	No	No	No	No
173	5865	20	40			Yes	No	No	No	No
177	5885	20				Yes	No	No	No	No

NOTE	日本(LPI)、US、Canada、EU(LPI)、United Kingdom(LPI)では 6GHz 帯域を屋外で利用することは禁止されています。本製品を屋外で利用される場合は予め該当の電波を出さない様に設定してください。 In Japan (LPI), the US, Canada, the EU (LPI), and the United Kingdom (LPI), the use of the 6GHz band outdoors is prohibited. If you intend to use this product outdoors, please ensure that it is configured not to emit signals in the corresponding frequency bands.
NOTE	6GHz WLAN の 320MHz 帯域動作は QCC2076 ではサポートされていません。 320MHz bandwidth operation is not supported for 6GHz WLAN in the chip QCC2076.

6GHz

X: Not Supported

Channel	Fc (MHz)	20MHz	40MHz	80MHz	160MHz	320MHz		US (SP)	CA (SP)	US/CA (LPI)	EU/UK (LPI, VLP)	JP (LPI, VLP)
1	5955	20	40	80	160	X	X	Yes	Yes	Yes	Yes	Yes
5	5975	20						Yes	Yes	Yes	Yes	Yes
9	5995	20	40					Yes	Yes	Yes	Yes	Yes
13	6015	20						Yes	Yes	Yes	Yes	Yes
17	6035	20	40	80				Yes	Yes	Yes	Yes	Yes
21	6055	20						Yes	Yes	Yes	Yes	Yes
25	6075	20	40					Yes	Yes	Yes	Yes	Yes
29	6095	20						Yes	Yes	Yes	Yes	Yes
33	6115	20	40	80	160	X	X	Yes	Yes	Yes	Yes	Yes
37	6135	20						Yes	Yes	Yes	Yes	Yes
41	6155	20	40					Yes	Yes	Yes	Yes	Yes
45	6175	20						Yes	Yes	Yes	Yes	Yes
49	6195	20	40	80				Yes	Yes	Yes	Yes	Yes
53	6215	20						Yes	Yes	Yes	Yes	Yes
57	6235	20	40					Yes	Yes	Yes	Yes	Yes
61	6255	20						Yes	Yes	Yes	Yes	Yes
65	6275	20	40	80	160	X	X	Yes	Yes	Yes	Yes	Yes
69	6295	20						Yes	Yes	Yes	Yes	Yes
73	6315	20	40					Yes	Yes	Yes	Yes	Yes
77	6335	20						Yes	Yes	Yes	Yes	Yes
81	6355	20	40	80				Yes	Yes	Yes	Yes	Yes
85	6375	20						Yes	Yes	Yes	Yes	Yes
89	6395	20	40					Yes	Yes	Yes	Yes	Yes
93	6415	20						Yes	Yes	Yes	Yes	Yes
97	6435	20	40	80	160	X	X	No	Yes	Yes	No	No
101	6455	20						No	Yes	Yes	No	No
105	6475	20	40					No	Yes	Yes	No	No
109	6495	20						No	Yes	Yes	No	No
113	6515	20	40	80				Yes	Yes	Yes	No	No
117	6535	20						Yes	Yes	Yes	No	No
121	6555	20	40					Yes	Yes	Yes	No	No
125	6575	20						Yes	Yes	Yes	No	No

Channel	Fc (MHz)	20MHz	40MHz	80MHz	160MHz	320MHz		US (SP)	CA (SP)	US/CA (LPI)	EU/UK (LPI. VLP)	JP (LPI. VLP)			
129	6595	20	40	80	160	X	X	Yes	Yes	Yes	No	No			
133	6615	20						Yes	Yes	Yes	No	No			
137	6635	20	40					Yes	Yes	Yes	No	No			
141	6655	20						Yes	Yes	Yes	No	No			
145	6675	20	40					Yes	Yes	Yes	No	No			
149	6695	20		80				Yes	Yes	Yes	No	No			
153	6715	20	40					Yes	Yes	Yes	No	No			
157	6735	20						Yes	Yes	Yes	No	No			
161	6755	20	40		80	160	X	X	Yes	Yes	Yes	No	No		
165	6775	20							Yes	Yes	Yes	No	No		
169	6795	20	40	Yes					Yes	Yes	No	No			
173	6815	20		Yes					Yes	Yes	No	No			
177	6835	20	40	80					Yes	Yes	Yes	No	No		
181	6855	20			Yes				Yes	Yes	No	No			
185	6875	20	40		160				X	X	No	No	Yes	No	No
189	6895	20									No	No	Yes	No	No
193	6915	20	40			80	160	X			X	No	No	Yes	No
197	6935	20		No								No	Yes	No	No
201	6955	20	40	No								No	Yes	No	No
205	6975	20		No								No	Yes	No	No
209	6995	20	40	80								No	No	Yes	No
213	7015	20				No						No	Yes	No	No
217	7035	20	40		No	No			Yes	No		No			
221	7055	20			No	No			Yes	No		No			
225	7075	20	40		X	X			X	No		No	Yes	No	No
229	7095	20		No			No	Yes		No	No				
233	7115	20	X							No	No	Yes	No	No	

3.5. Bluetooth 一般仕様 Bluetooth general specifications

Items	Specifications			Units	Remarks
チップセット Chipset	QCC2076(Qualcomm Atheros)			—	
コア仕様 Core specification	Bluetooth 5.3			—	
動作周波数 Operating Frequency range	Mode	Min	Max		
	BR/EDR/LE/2LE	2402	2480	MHz	
周波数間隔 Frequency step	BR/EDR	1		MHz	Ch.0-Ch.78
	LE/2LE	2		MHz	Ch.0-Ch.39
変調方式 Modulation type	BR 1Mbps	GFSK		—	
	EDR 2Mbps	π/4 DQPSK		—	
	EDR 3Mbps	8DPSK		—	
	LE 1Mbps	GFSK		—	
	LE 2Mbps	GFSK		—	
暗号化 Encryption	E0	128		bits	BR/EDR
	AES	128		bits	LE/2LE

4. 適合規格 Standards compliance

4.1. 規格一覧 Standards list

適合規格 Standards conformity

- ◆ IEEE802.11-2012 (a/b/g/n)
- ◆ IEEE802.11ac-2013
- ◆ IEEE802.11ax
- ◆ IEEE802.11be
- ◆ Bluetooth 5.3 BR/EDR/LE
Reference information: QDID: 179074 [Qualcomm Technologies, Inc.]
- ◆ PCI Express 3.0 with L1SS function
- ◆ USB 1.1

適合法規制 Law regulation compliance

- ◆ 日本電波法 (MIC) ^{NOTE4}
証明規則第 2 条第 1 項 第 19 号 (WLAN, Bluetooth)
証明規則第 2 条第 1 項 第 19 号の 3 (W52/W53/W56 DFS master 対応) ^{NOTE3}
証明規則第 2 条第 1 項第 79 号(VLP 子局)
証明規則第 2 条第 1 項第 80 号(LPI 子局)
Article 2 paragraph 1 item (19) (WLAN, Bluetooth)
Article 2 paragraph 1 item (19)-3 (W52/W53/W56 with DFS master) ^{NOTE3}
Article 2 paragraph 1 item (79) (VLP Client)
Article 2 paragraph 1 item (80) (LPI Client)
認証番号 Certification number: **003-240192**
- ◆ FCC Part15
Subpart C (2.4GHz WLAN, Bluetooth)
Subpart E (U-NII-1/2A/2C/3/4 without DFS master, 6G Dual Client) ^{NOTE1}
ID: **N6C-PCEBE**
- ◆ ISED
RSS-247 (2.4GHz WLAN, Bluetooth)
RSS-247 (U-NII-1/2A/2C/3 without DFS master)
RSS-248 (6G Client) ^{NOTE1}
ID: **4908A-PCEBE**

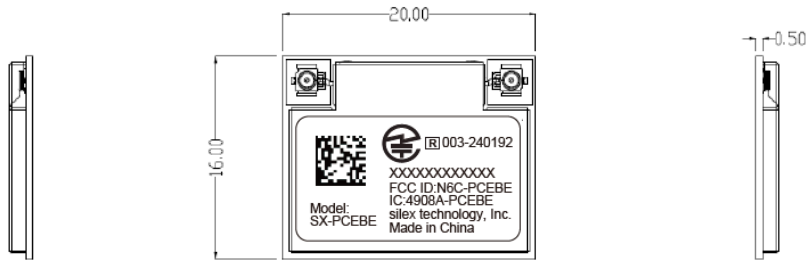
- ◆ ETSI
 - EN 300 328 (2.4GHz WLAN, Bluetooth)
 - EN 301 893 (W52/W53/W56 without DFS master)
 - EN 300 440 (5.8GHz)
 - EN 303 687(Draft) (6G Client) ^{NOTE2}
- ◆ Ofcom
 - EN 300 328 (2.4GHz WLAN, Bluetooth)
 - EN 301 893 (W52/W53/W56 without DFS master)
 - VNS 2030/8/3 (5.8GHz)
 - EN 303 687(Draft) (6G Client) ^{NOTE2}
- ◆ CE RoHS Directive
- ◆ EN 62311
- ◆ IEC 62368-1:2014 (EN 62368-1:2014+A11:2017)

対応国 Supported countries

- ◆ Asia
 - Japan
- ◆ North America
 - US
 - Canada
- ◆ EU ^{NOTE2}
- ◆ United Kingdom ^{NOTE2}

NOTE1	本製品の 6GHz 帯の認証取得クラス/カテゴリは US では 6CD (Dual Client)、Canada では Client Device です。他のクラス/カテゴリは未取得のため、6GHz 帯の Access Point としては使えません。 The certification class/category for the 6GHz band of this product is 6CD (Dual Client) in the US and Client Device in Canada. As other classes/categories are not acquired, it cannot be used as an Access Point in the 6GHz band.
NOTE2	EU で 6GHz 帯を使用する場合、EU の NB 検証を取得する必要があります。 United Kingdom で 6GHz 帯を使用する場合、United Kingdom の NB 検証を取得する必要があります。 If you intend to use the 6GHz band in the EU, you need to obtain EU's NB verification. If you plan to use the 6GHz band in the United Kingdom, you need to obtain United Kingdom's NB verification.
NOTE3	DFS の制限：Host の追加申請が必要 DFS restrictions: Additional application by the host is required.
NOTE4	日本電波法の認証番号は、最終製品に表示してください。 Please make sure to display the certification number of the Japanese Radio Law on the final product.
	その他、各国の法令に従って使用してください。 Additionally, please use the product in accordance with the regulations of each country.
用語説明 Further Note of Glossary	
Access Point	これは 6GHz 帯域での定義です。以下のいずれかに該当するものを指します。 - ピアツーピアのブリッジ接続をするもの - 優先と無線、それぞれのネットワークセグメント間を接続するもの - 無線ネットワークセグメント間のリレーをするもの This is a definition for the 6GHz band, referring to any of the following: - Devices that establish point-to-point bridge connections. - Devices that connect priority and wireless segments. - Devices that relay between wireless network segments.
Client	これは 6GHz 帯域での定義です。 クライアントデバイスは、送信がアクセスポイントか室内で従属する機器の制御下におかれている機器です。クライアントデバイスはネットワークを開始できません。 クライアントデバイスとは固定クライアントデバイス、ローパワークライアントデバイス、スタンダードクライアントデバイスを含みます。 This is a definition for the 6GHz band. A client device is a device that is under the control of either an access point or an indoor unit for transmission. A client device cannot initiate a network. A client device includes fixed client devices, low-power client devices, and standard client devices.

5. 機械的仕様 Mechanical specifications

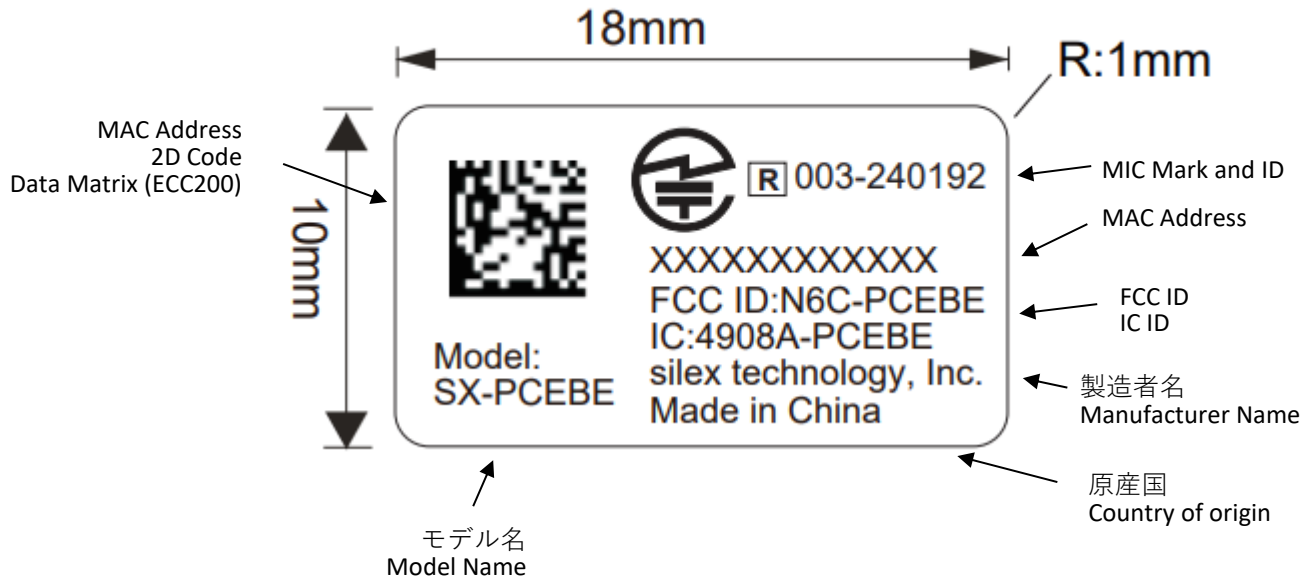


Tolerance: C

DEG	A	B	C	D	ANGLE
0-5	± 0.05	± 0.05	± 0.10		$0^\circ - 30^\circ$ $\pm 0.1^\circ$
5-10	± 0.05	± 0.10	± 0.15		$31^\circ - 60^\circ$ $\pm 0.5^\circ$
10-50	± 0.10	± 0.15	± 0.20		$61^\circ - 90^\circ$ $\pm 0.5^\circ$
50-100	± 0.15	± 0.20	± 0.25		
100+	$\pm 0.15\%$	$\pm 0.20\%$	$\pm 0.25\%$		

Unit: mm

6. 銘板仕様 Label specifications



7. 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。

The specifications of this product comply with the regulations listed in §6. However, there is a possibility of specification changes in the following cases.

- 1) §6.1 に掲げる国以外で使う場合。
If used in countries other than those listed in §6.1.
- 2) 認可されたアンテナ以外を使う場合。
If used other antenna than approved.
- 3) 認可の更新が必要な場合。
If renewal of certification is required.

- ◇ 本製品は一般電子機器への組み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み込みを意図した物ではありません。**医療機器に組み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 product is designed for incorporation into general electronic equipment and is not intended for incorporation into equipment that requires extremely high levels of reliability and quality, such as aircraft equipment, nuclear control systems, high-reliability medical devices, and high-reliability security equipment. **If you intend to incorporate it into medical devices, please contact our sales department regardless of the medical device 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。

Since this product communicates using radio waves, we strongly recommend implementing security settings to prevent information leakage to third parties.

- ◇ 本製品の機能、特性をご理解の上、組み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。

Upon understanding the functions and characteristics of this product, we kindly request evaluation in the final embedded product. Additionally, EMC testing has not been conducted on this standalone wireless device. Therefore, it is necessary to conduct EMC testing and certification application for products incorporating this wireless device.

- ◇ 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。

In the wireless band used by this product, there may be cases where it is affected by or affects devices using the same frequency band. Prior to installation, please conduct an environmental survey.

- ◇ 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。

Disassembly or modification of this product may result in penalties under the 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 product is an embedded module with exposed terminals and components. When integrating the product, please exercise caution regarding static electricity (as high-frequency devices sensitive to static electricity are used in this product), water droplets, and other dust particles.

- ◇ 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)

When using other wireless devices in the vicinity that operate on the same frequency band, please pay special attention to the following: 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。

In the 2.4GHz band, it is recommended to use a frequency spacing of more than $\pm 25\text{MHz}$ (5 channels) from the center frequency of this module.

- 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。

Please pay close attention to signals from adjacent and non-adjacent channels, and set up an environment to avoid interference.

□ 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)

□ 5/6GHz 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

5/6GHz HT20: Center frequency $\pm 20\text{MHz}$ (4Ch), Non Adjacent channel: Further than Center frequency $\pm 40\text{MHz}$ (8Ch)

□ 5/6GHz 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

5/6GHz HT40 Adjacent channel: Center frequency $\pm 40\text{MHz}$ (8Ch), Non Adjacent channel: Further than Center frequency $\pm 80\text{MHz}$ (16Ch)

□ 5/6GHz 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

5/6GHz HT80 Adjacent channel: Center frequency $\pm 80\text{MHz}$ (16Ch), Non Adjacent channel: Further than Center frequency $\pm 160\text{MHz}$ (32Ch)

□ 5/6GHz HT160 隣接チャネル：中心周波数 $\pm 160\text{MHz}$ (32Ch), 非隣接チャネル：中心周波数 $\pm 320\text{MHz}$ (64Ch)以上

5/6GHz HT160 Adjacent channel: Center frequency $\pm 160\text{MHz}$ (32Ch), Non Adjacent channel: Further than Center frequency $\pm 160\text{MHz}$ (64Ch)

※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 outside the above conditions, there is a possibility of interference if there is strong radio frequency input. Therefore, please use wireless devices in the vicinity at a sufficient distance.

- ◇ 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、5/6GHz 帯で -30dBm 以下としてください。

The input from the opposing device, including antenna gain, should be -20dBm or lower at 2.4GHz and -30dBm or lower at 5/6GHz.

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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

This device meets all the other requirements specified in Part 15E, Section 15.407 of the FCC Rules.

Radiation Exposure Statement:

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 must be installed and operated keeping the radiator at least 20cm or more away from person's body.

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

KDB 996369 D03 OEM Manual v01 rule sections:**2.2 List of applicable FCC rules**

This module has been tested for compliance to FCC Part 15

2.3 Summarize the specific operational use conditions

The module is tested for standalone mobile RF exposure use condition. Any other usage conditions such as co-location with other transmitter(s) or being used in a portable condition will need a separate reassessment through a class II permissive change application or new certification.

2.4 Limited module procedures

Not applicable.

2.5 Trace antenna designs

Not applicable.

2.6 RF exposure considerations

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

2.7 Antennas

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

Brand	Model	Antenna Type	Peak Gain				
			2.4-2.5GHz	5.15-5.25GHz	5.25-5.35GHz	5.47-5.725GHz	5.725-5.85GHz
HONGBO	260-25094	PIFA	+3.53dBi	+3.06dBi	+3.07dBi	+4.81dBi	+4.20dBi
HONGBO	260-25084	Monopole	+3.22dBi	+3.35dBi	+3.42dBi	+4.77dBi	+4.72dBi

Brand	Model	Antenna Type	Peak Gain				
			5.850-5.925GHz	5.925-6.425GHz	6.425-6.525GHz	6.525-6.875GHz	6.875-7.125GHz
HONGBO	260-25083	PIFA	+5.09dBi	+5.14dBi	+5.09dBi	+5.16dBi	+5.12dBi
HONGBO	260-25084	Monopole	+4.71dBi	+4.75dBi	+4.29dBi	+4.81dBi	+4.74dBi

2.8 Label and compliance information

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

2.9 Information on test modes and additional testing requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) or portable use will require a separate class II permissive change re-evaluation or new certification.

2.10 Additional testing, Part 15 Subpart B disclaimer

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

2.11 Note EMI Considerations

Note that a host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties

For standalone mode, reference the guidance in D04 Module Integration Guide and for simultaneous mode⁷; see D02 Module Q&A Question 12, which permits the host manufacturer to confirm compliance.

2.12 How to make changes

Only Grantees are permitted to make permissive changes. Please contact us should the host integrator expect the module to be used differently than as granted:

Yukinari Shibuya/ Manager
Silex Technology, Inc.
Tel.: + 81-774-98-3878 / Fax: + 81-774-98-3878
E-mail: shibuya@silex.jp

As long as all conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

OEM/Host manufacturer responsibilities

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

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

Industry Canada statement:

This device complies with ISSED's licence-exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Radiation Exposure Statement:

The product comply with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

Déclaration d'exposition aux radiations:

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé.

Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

This device is intended only for OEM integrators under the following conditions: (For module device use)

1) The transmitter module may not be co-located with any other transmitter or antenna.

As long as **1** conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

1) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 1 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed and operated with greater than 20cm between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC: 4908A-PCEBE".

Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un appareil où l'antenne peut être installée et utilisée à plus de 20 cm entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 4908A-PCEBE".

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

Caution :

- (i) the device for 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;
- (ii) for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit;
- (iii) for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits as appropriate;
- (iv) where applicable, antenna type(s), antenna models(s), and worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in section 6.2.2.3 shall be clearly indicated.

Avertissement:

Le guide d'utilisation des dispositifs pour réseaux locaux doit inclure des instructions précises sur les restrictions susmentionnées, notamment :

- (i) les dispositifs fonctionnant dans la bande 5150-5250 MHz sont 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;
- (ii) pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis pour les dispositifs utilisant les bandes de 5 250 à 5 350 MHz et de 5 470 à 5 725 MHz doit être conforme à la limite de la p.i.r.e.;
- (iii) pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis (pour les dispositifs utilisant la bande de 5 725 à 5 850 MHz) doit être conforme à la limite de la p.i.r.e. spécifiée, selon le cas;
- (iv) lorsqu'il y a lieu, les types d'antennes (s'il y en a plusieurs), les numéros de modèle de l'antenne et les pires angles d'inclinaison nécessaires pour rester conforme à l'exigence de la p.i.r.e. applicable au masque d'élévation, énoncée à la section 6.2.2.3, doivent être clairement indiqués

For 6G statement

- a. Operation shall be limited to indoor use only; and
- b. Operation on oil platforms, cars, trains, boats and aircraft shall be prohibited except for on large aircraft flying above 10,000 ft.
- a. Utilisation limitée à l'intérieur seulement;
- b. Utilisation interdite à bord de plateformes de forage pétrolier, de voitures, de trains, de bateaux et d'aéronefs, sauf à bord d'un gros aéronef volant à plus de 10 000 pieds d'altitude.

DETACHABLE ANTENNA USAGE

This radio transmitter [IC: **4908A-PCEBE**] 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.

Le présent émetteur radio [IC: **4908A-PCEBE**] 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.

Brand	Model	Antenna Type	Peak Gain				
			2.4-2.5GHz	5.15-5.25GHz	5.25-5.35GHz	5.47-5.725GHz	5.725-5.85GHz
HONGBO	260-25094	PIFA	+3.53dBi	+3.06dBi	+3.07dBi	+4.81dBi	+4.20dBi
HONGBO	260-25084	Monopole	+3.22dBi	+3.35dBi	+3.42dBi	+4.77dBi	+4.72dBi

Brand	Model	Antenna Type	Peak Gain				
			5.850-5.925GHz	5.925-6.425GHz	6.425-6.525GHz	6.525-6.875GHz	6.875-7.125GHz
HONGBO	260-25083	PIFA	+5.09dBi	+5.14dBi	+5.09dBi	+5.16dBi	+5.12dBi
HONGBO	260-25084	Monopole	+4.71dBi	+4.75dBi	+4.29dBi	+4.81dBi	+4.74dBi

Impedance: 50 Ω

The antenna-to-user separation distance must be greater than 15 mm.
La distance de séparation antenne-utilisateur doit être supérieure à 15 mm.

To ensure compliance with the Radio Frequency (RF) exposure guidelines, this device must be used at least 15 mm away from your body or nearby persons. Failure to observe this warning could result in the RF exposure levels exceeding the applicable limits.

Pour garantir la conformité aux directives d'exposition aux radiofréquences (RF), cet appareil doit être utilisé à au moins 15 mm de votre corps ou des personnes à proximité. Le non-respect de cet avertissement peut entraîner des niveaux d'exposition RF dépassant les limites applicables.

The distance between each antenna should more than 50 mm when integrated in the host to ensure the simultaneous transmission compliance.

La distance entre chaque antenne doit être supérieure à 50 mm lorsqu'elle est intégrée à l'hôte pour assurer la conformité de la transmission si

RSS-248 Issue 3 General statement (all equipment class)

- Devices shall not be used for control of or communications with unmanned aircraft systems.
- Devices shall not be used on oil platforms.
- Devices shall not be used on aircraft, except for the low-power indoor access points, indoor subordinate devices, low-power client devices, and very low-power devices operating in the 5925-6425 MHz band, that may be used on large aircraft as defined in the Canadian Aviation Regulations, while flying above 3,048 metres (10,000 feet).
- Devices shall not be used on automobiles.
- Devices shall not be used on trains.
- Devices shall not be used on maritime vessels.

- Les dispositifs ne doivent pas être utilisés pour commander des systèmes d'aéronef sans pilote ni pour communiquer avec de tels systèmes;
- Les dispositifs ne doivent pas être utilisés sur les plateformes de forage pétrolier;
- Les dispositifs ne doivent pas être utilisés dans les aéronefs, à l'exception des points d'accès intérieurs de faible puissance, des dispositifs subordonnés intérieurs, des dispositifs clients de faible puissance et des dispositifs de très faible puissance fonctionnant dans la bande de 5 925 à 6 425 MHz, qui peuvent être utilisés dans les gros aéronefs tel qu'il est défini dans le Règlement de l'aviation canadien, et ce, lorsqu'ils volent à une altitude supérieure à 3 048 mètres (10 000 pieds).
- Les dispositifs ne doivent pas être utilisés dans les automobiles;
- Les dispositifs ne doivent pas être utilisés dans les trains;
- Les dispositifs ne doivent pas être utilisés sur les navires maritimes.