
Title :

IM-100 User manual

Date :

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本書は IM-100 について説明するものです。

モデル名/ハードウェアバージョン識別番号(HVIN)は「IM-100」です。

This document describes about IM-100.

Model name/Hardware Version Identification Number (HVIN) of this module is “IM-100”.

1. 製品概要 Product information

IM-100 は、NXP 社 RW610 を採用した、2.4GHz/5GHz Dual Band IEEE 802.11 a/b/g/n/ac/ax および Bluetooth LE 5.3 に対応した低消費電力 MCU 無線モジュールです。

IM-100 は 260MHz 動作 MCU と 1.2MB のオンチップ SRAM のサブシステムを有しています。

IM-100 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。また外部アンテナ接続のインターフェイスとして MHF-I コネクタおよび RF パッドを備えています。

The IM-100 with NXP RW610 is a wireless module, low-power Wireless MCU with an integrated MCU and 2.4GHz/5GHz Dual Band IEEE 802.11 a/b/g/n/ac/ax and Bluetooth LE 5.3 radios.

The IM-100 includes a 260MHz MCU with 1.2 MB on-chip SRAM.

The IM-100 highly integrates MAC, Base band, RF, RF front end and peripheral circuitry like power unit, reference clock, etc. And it has a MHF-I connector and a RF PAD as connection interface for an add-on antenna.

特徴 Features

■ MCU およびシステムメモリ MCU and system memory

MCU 260MHz Arm Cortex-M33 with TrustZone-M

1.2MB SRAM, 256kB on-chip ROM

Quad SPI によって外部フラッシュおよび 128MB まで拡張可能な外部 SRAM に接続可能

Connects to external flash and external PSRAM up to 128MB

■ システムインターフェイス System interfaces and connectivity

4 つの FlexComm インターフェイスは、設定変更により USART、SPI、I2C、I2S をサポート
SDIO 3.0 device

OTG 対応 High-Speed USB2.0 ホスト及びデバイスコントローラー

IEEE 1588 準拠 RMII/Ethernet インターフェイスデバッグ用 JTAG

Up to four configurable universal serial interface modules (FlexComm interfaces).

Configurable as UART/SPI/I2C/I2S.

High Speed USB 2.0 Host/Device On-The-Go (OTG) with integrated PHY

Compliant with IEEE 1588 RMII/Fast Ethernet interface

JTAG for debugging

■ Wi-Fi 6 (802.11ax)

IEEE802.11a/b/g/n/ac/ax (2.4 GHz, 5 GHz)

1 ストリーム

チャネル幅 20MHz

1 spatial data stream system (1T1R)

20MHz channel operation

■ Bluetooth LE 5.3

Bluetooth Low Energy 5.3

Bluetooth 4.0, 4.1, 4.2, 5.0, 5.1, 5.2 後方互換

Bluetooth LE 2Mbps および長距離通信(125 / 500kbps)対応

Bluetooth 4.0, 4.1, 4.2, 5.0, 5.1, 5.2 Backward-compatible

Bluetooth LE 2Mbps high speed mode and Long Range operation (125 / 500kbps)

■ 欧州 RoHS 指令 2011/65/EU , (EU) 2015/863 準拠

Compliant with the EU's RoHS directive 2011/65/EU and (EU) 2015/863

2. 基板仕様 Board specifications

2.1. 一般仕様 General specifications

Items	Specifications		Units	Remarks
ホストボードへの接続方式 Connection with the host board	108-pin Land Grid Array 直接はんだ付け端子 Direct solder		—	
アンテナポート Antenna port	MHF1 connector x 1		pcs	IM-100(MHF)
	RF PAD x 1			IM-100(PAD)
アンテナポート特性 Antenna port characteristics	50		Ω	公称値 Nominal value (2.4-2.5GHz, 5.18-5.85GHz)
周辺インターフェイス Peripheral interface			—	§ 4 参照 See § 4
無線接続方式 RF interface	IEEE802.11a/b/g/n/ac/ax		—	IEEE802.11-2020 IEEE802.11ax-2021
	Bluetooth 5.3 LE		—	
重さ Weight	1.5		g	IM-100(MHF)
				IM-100(PAD)
寸法 Dimensions	17.0 x 18.0 x 2.65		mm	W x H x D § 6 参照 See § 6
MTTF	90,000		h	Min.
アンテナコネクタ着脱回数 Antenna connector Desorption number of times	10		Times	Max. I-PEX 90224-001 使用時 Use I-PEX 90224-001
リフロー回数 Reflow number of times	2		Time	Max.
ESD 耐性 ESD resistance	アンテナピン Antenna connector	+/- 2000	V	§ 10 参照 See § 10

2.2. 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 *NOTE 1 Ambient temperature *NOTE 1 実装後電源電圧印加時 After assembled with powered
動作湿度 Operating humidity	15	—	95	%RH	結露無きこと No condensing 実装後電源電圧印加時 After assembled with powered
保存温度 Assembled storage temperature	-40	—	+90	°C	実装後電源電圧無印加時 After assembled with no-powered
保存湿度 Assembled storage humidity	10	—	95	%RH	結露無きこと No 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。開封後は MSL に従う。 NOTE 2 Packaged. Apply MSL after unpackaged. NOTE 2
保管湿度 Storage humidity	20	—	60	%RH	結露無きこと No condensing 梱包時。開封後は MSL に従う。 Packaged. Apply MSL after unpackaged.
Moisture Sensitivity Level (MSL)	3			—	取り扱いについては下記を参照。 See below standard for handling IPC/JEDEC J-STD-033 *NOTE 3

	但し次に定義される部品のケース温度(表面接触温度)を超えないこと。 The case temperature (Tc), however, must not exceed below value.						
NOTE1	<table><tr><th>Point</th><th>Tc (Max.)</th><th>Unit</th></tr><tr><td>①</td><td>95 (TBD)</td><td>℃</td></tr></table> 	Point	Tc (Max.)	Unit	①	95 (TBD)	℃
Point	Tc (Max.)	Unit					
①	95 (TBD)	℃					
NOTE2	部品倉庫などで長期間 (弊社出荷後 1 年間)保管する際の推奨条件です。ドライパック未開封状態の場合、この条件下でドライパック内の湿度が 10%RH 未満に保たれます。ドライパック内の湿度が 10%RH 以上となったかどうかの判断は、保管期間に関わらず、§ 10 に示す湿度表示シートでご確認ください。保管期間 1 年以上経過後や輸送時に保管条件を超えた可能性があった場合は、製造前に湿度表示シートの確認やハンダ濡れ性の確認を実施することを推奨いたします。 This is condition to keep the product in the warehouse for long term (1 year after shipping from silex). In case of unpacked of the dry pack, humidity of inside shall be keep less than 10%RH. To know whether humidity in the dry pack is exceed 10%RH or not, please check out the humidity indication card (HIC). After 1 year from shipping or in case it might be exceeded this condition due to transportation, checking HIC or checking solderability before production is strongly recommended.						
NOTE3	推奨ベーキング条件 Recommended baking conditions 基板単独 Board only : 125℃+10/-0℃ 24 hours リール状態 With reel : 40℃+5/-0℃ ≤5%RH 13 days ドライパック開封後 JEDEC J-STD-033 の取扱い条件下で≤30℃/60%RH でのフロアタイムが 168 時間を超えた場合ベーキングが必要です。ドライパック未開封時でも、湿度表示シートが 10%RH 以上の色に変色している場合ベーキングが必要です。 In case ≤30℃/60%RH with handling rule of JEDEC J-STD-033 and floor time is exceeded 168hrs, baking must be necessary. Even before unpacking the dry pack, baking must be necessary if color of HIC is changed to color of 10%RH or more.						

2.3. 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 VDD33	—	—	+3.96	V	
IO 電源電圧 IO power supply voltage VIO_1, VIO_2, VIO_SD	—	—	+3.96	V	

推奨動作条件 Recommended Operating Conditions

主電源 Main power supply

Items	Specifications	Units	Remarks
	Typ.		
主電源電圧 Main power supply VDD33	+3.30	V	

IO 電源 IO power supply

Items	Specifications	Units	Remarks
	Min.		
IO 電源電圧 IO power supply voltage VIO_1, VIO_2, VIO_SD	+3.30	V	+3.3V 動作 +3.3V operation
IO 電源電圧 IO power supply voltage VIO_1, VIO_2, VIO_SD	+1.80	V	+1.8V 動作 +1.8V operation

2.4. 消費電流仕様 Current consumption specifications

Mode	VDD33		Unit
	Typ.	Max.	
2.4GHz WLAN transmit mode + BLE idle mode			
11b / 1Mbps	240	260	mA
11g / 6Mbps	240	260	mA
11n HT20, 11ax HE20 / MCS0	230	250	mA
5GHz WLAN transmit mode + BLE idle mode			
11a / 6Mbps	370	400	mA
11n HT20, 11ac VHT20, 11ax HE20 / MCS0	370	400	mA
BLE transmit mode + WLAN idle mode			
BLE / 1Mbps	100	120	mA
BLE / 2Mbps	100	120	mA
BLR / S = 8	100	120	mA
BLR / S = 2	100	120	mA
2.4GHz WLAN receive idle mode + BLE receive idle mode			
All mode	80	100	mA
5GHz WLAN receive idle mode + BLE receive idle mode			
All mode	100	110	mA

NOTE1	Typ.: テストツールの連続送信/受信時における平均電流の個体バラツキの平均値。 Average value of unevenness of average current per unit with continuous transmit/receive mode of the test tool.
	Max.: テストツールの連続送信/受信時におけるピーク電流の個体バラツキの最大値。 Maximum value of unevenness of peak current per unit with continuous transmit/receive mode of the test tool.
NOTE2	消費電流値は MCU アクティブ時。 Current consumption values are with MCU in active state

2.5. 無線 LAN 一般仕様 Wireless LAN general specifications

Items	Specifications				Units	Remarks
国/地域コード Country/Region code	ソフトウェアにより設定 Set by software				—	NOTE1
動作周波数 Operating frequencies	Band	Modes	Min	Max		
	2.4GHz	11b 20MHz	2412	2472	MHz	
		11g/n/ax 20MHz	2412	2472	MHz	
	5GHz	11a/n/ac/ax 20MHz	5180	5825	MHz	
周波数間隔 Frequency steps	2.4GHz	11b/g/n/ax	5		MHz	
	5GHz	11a/n/ac/ax	20		MHz	
データレート Data rates	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/ax	MCS 0,1,2,3,4,5,6,7,8,9			—	
変調型 Modulation types	11b	DSSS(DBPSK,DQPSK,CCK)			—	
	11a/g/n	OFDM(BPSK,QPSK,16QAM,64QAM)			—	
	11ac/ax	OFDM(BPSK,QPSK,16QAM,64QAM,256QAM)			—	
暗号化 Encryptions	RC4	128			bits	
	AES	128			bits	

NOTE1	国/地域コードについて About Country/Region code モジュールにはデフォルトで国/地域コードとして 0x0000 が書かれています。 モジュールのロード時にドライバにより任意のコードに書き換えてご使用ください。 0x0000 is programed into the memory of the module as the default value. This code is assumed to be changed to the other code by driver when the module is loaded.
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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

5GHz

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

2.6. 無線 LAN 受信仕様 Wireless LAN receiver specifications

2.4GHz 動作温度 Operating temperature -40°C ~ +85°C

Items	Specifications					Units	Remarks
	Modes		Min.	Typ.	Max.		
最小受信感度 Receiver minimum Sensitivity	11b	1Mbps	—	-87.0	-76.0	dBm	FER<8%
		2Mbps	—	-87.0	-76.0	dBm	
		5.5Mbps	—	-87.0	-76.0	dBm	
		11Mbps	—	-87.0	-76.0	dBm	
	11g	6Mbps	—	-90.0	-82.0	dBm	PER<10%
		9Mbps	—	-88.0	-81.0	dBm	
		12Mbps	—	-87.0	-79.0	dBm	
		18Mbps	—	-85.0	-77.0	dBm	
		24Mbps	—	-82.0	-74.0	dBm	
		36Mbps	—	-78.0	-70.0	dBm	
		48Mbps	—	-74.0	-66.0	dBm	
		54Mbps	—	-72.0	-65.0	dBm	
	11n/ax	MCS0	—	-86.0	-82.0	dBm	
		MCS1	—	-86.0	-79.0	dBm	
		MCS2	—	-83.0	-77.0	dBm	
		MCS3	—	-80.0	-74.0	dBm	
		MCS4	—	-77.0	-70.0	dBm	
		MCS5	—	-72.0	-66.0	dBm	
		MCS6	—	-71.0	-65.0	dBm	
		MCS7	—	-69.0	-64.0	dBm	
	11ax	MCS8	—	-64.0	-59.0	dBm	
		MCS9	—	-63.0	-57.0	dBm	

5GHz 動作温度 Operating temperature -40°C ~ +85°C

Items	Specifications					Units	Remarks
	Modes		Min.	Typ.	Max.		
最小受信感度 Receiver minimum Sensitivity	11a	6Mbps	—	-89.0	-82.0	dBm	PER<10%
		9Mbps	—	-88.0	-81.0	dBm	
		12Mbps	—	-85.0	-79.0	dBm	
		18Mbps	—	-83.0	-77.0	dBm	
		24Mbps	—	-80.0	-74.0	dBm	
		36Mbps	—	-77.0	-70.0	dBm	
		48Mbps	—	-73.0	-66.0	dBm	
		54Mbps	—	-71.0	-65.0	dBm	
	11n/ac/ax	MCS0	—	-88.0	-82.0	dBm	
		MCS1	—	-85.0	-79.0	dBm	
		MCS2	—	-83.0	-77.0	dBm	
		MCS3	—	-79.0	-74.0	dBm	
		MCS4	—	-76.0	-70.0	dBm	
		MCS5	—	-72.0	-66.0	dBm	
		MCS6	—	-70.0	-65.0	dBm	
		MCS7	—	-68.0	-64.0	dBm	
	11ac/ax	MCS8	—	-65.0	-59.0	dBm	
	11ax	MCS9	—	-62.0	-57.0	dBm	

2.7. Bluetooth 一般仕様 Bluetooth general specifications

Items	Specifications			Units	Remarks
コア仕様 Core specification	Bluetooth LE 5.3			—	
動作周波数 Operating Frequency range	Mode	Min	Max		
	LE/2LE/LR	2402	2480	MHz	
周波数間隔 Frequency step	LE/2LE/LR	2		MHz	Ch.0-Ch.39
データレート Data rates	LE	1		Mbps	
	2LE	2			
	LR S=8	125		kbps	
	LR S=2	500			
変調型 Modulation types	LE/2LE/LR	GFSK		—	

2.8. Bluetooth 送信仕様 Bluetooth transmitter specifications

動作温度 Operating temperature +25°C

Items	Specifications					Units	Remarks
	Standards		Min.	Typ.	Max.		
最大送信電力 Maximum TX power	All modes	Ch.0-Ch.39	0.0	+3.0	+6.0	dBm	

送信パワーの不確かさ Transmit power uncertainty

動作温度 Operating temperature -40°C ~ +85°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	All modes		-2.0	—	+2.0	dB	

周波数精度 Frequency accuracy

動作温度 Operating temperature -40°C ~ +85°C

Items	Specifications					Units	Remarks
	Standards		Min.	Typ.	Max.		
中心周波数精度 Center frequency accuracy	All modes		-20	—	+20	ppm	

2.9. Bluetooth 受信仕様 Bluetooth receiver specifications

動作温度 Operating temperature -40°C ~ +85°C

Items	Specifications					Units	Remarks
	Standards	Data rate	Min.	Typ.	Max.		
最小受信感度 Receiver Minimum Sensitivity	LE	1Mbps	—	-96.0	-70.0	dBm	PER<30%
	2LE	2Mbps	—	-96.0	-70.0	dBm	
	LR S=8	125kbps	—	-100.4	-70.0	dBm	
	LR S=2	500kbps	—	-100.0	-70.0	dBm	

3. 適合規格 Standards compliance

3.1. 規格一覧 Standards list

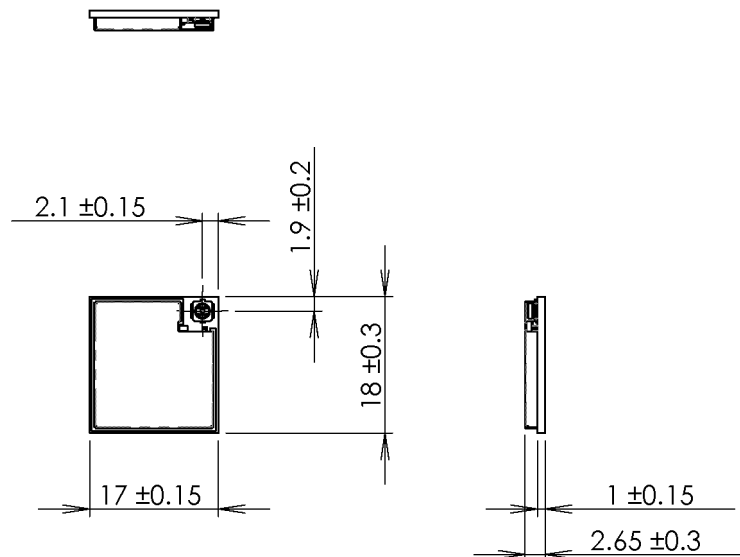
適合法規制 Law regulation compliance

- ◇ Bluetooth 5.3 LE (DID : **TBD**)
- ◇ 日本電波法 (MIC)
 - 証明規則第 2 項第 1 条 第 19 号 (2.4GHz WLAN, Bluetooth)
 - 証明規則第 2 項第 1 条 第 19 号の 3 (W52/W53/W56 WLAN without DFS master)
 - Article 2 paragraph 1 item (19) (2.4GHz WLAN, Bluetooth)
 - Article 2 paragraph 1 item (19)-3 (W52/W53/W56 WLAN without DFS master)
 - 認証番号 Certification number: **003-230334**
- ◇ FCC Part15
 - Subpart C (2.4GHz WLAN, Bluetooth)
 - Subpart E (U-NII-1/2A/2C/3 WLAN without DFS master)
 - ID: **N6C-IM100**
- ◇ ISSED
 - RSS-247 (2.4GHz WLAN, Bluetooth)
 - RSS-247 (U-NII-1/2A/2C/3 WLAN without DFS master)
 - ID: **4908A-IM100**
- ◇ ETSI
 - ETSI EN 300 328 (2.4GHz WLAN, Bluetooth.)
 - ETSI EN 301 893 (5GHz WLAN without DFS master)
 - ETSI EN 300 440 (5.8GHz WLAN)
- ◇ Ofcom
 - ETSI EN 300 328 (2.4GHz WLAN, Bluetooth.)
 - ETSI EN 301 893 (5GHz WLAN without DFS master)
 - VNS 2030/8/3 (5.8GHz WLAN)
- ◇ CE RoHS Directive
- ◇ EN 62311
- ◇ EN 62368-1 : 2014 (EN 62368-1 : 2014 + A11 : 2017)

対応国 Countries

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

4. 機械的仕様 Mechanical specifications



ラベルの厚みは含まず。

IM-100 表面 Top view

NOTE1	LGA パッド設計を CAD にインポートする必要がある場合は、TBD.dxf をご利用ください。 In case LGA pad design need to be imported to CAD system, please use TBD.dxf
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製品厚み Product thickness

Items	Thickness	Remarks
IM-100	2.65mm+/- 0.3 mm	

PCB 厚 PCB thickness

Items	Thickness	Remark
IM-100	1.0mm +/- 0.15 mm	

ラベルの厚み(0.05mm)は含まない。

The label thickness (0.05 mm) is not included.

5. 使用上の注意 Notifications

- ◇ 本製品の仕様は、§ 5. に掲げる法規制に適合していますが、以下の場合は仕様が変更になる可能性があります。
This module is compliant to the law regulations mentioning § 5. But the contents may change at below conditions.
 - 1) § 5.1 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 § 5.1
 - 2) § 5.2 に掲げるアンテナ以外を使う場合。
In case this module is used with different antenna from the antenna list of § 5.2
 - 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, IEEE802.11ac-2013 及び IEEE802.11ax 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, IEEE802.11ac-2013 and IEEE802.11ax)
 - 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。
 $\pm 25\text{MHz}$ (5Ch) 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 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: Center frequency $\pm 20\text{MHz}$ (4Ch), Non Adjacent channel: Further than Center frequency $\pm 40\text{MHz}$ (8Ch)
- ※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、アンテナゲインを含み 2.4GHz 帯で -20dBm 以下、5GHz 帯で -30dBm 以下としてください。
The input level from the opponent device must be -20dBm or less at 2.4GHz, -30dBm or less at 5GHz with including antenna gain.

6. 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.

Operations in the 5.15-5.25GHz band are restricted to indoor usage only. 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. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

FCC Notice;

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

KDB 996369 D03 OEM Manual v01 rule sections:

2.2 List of applicable FCC rules

This module has been tested for compliance to Part 15.247, Part 15.407.

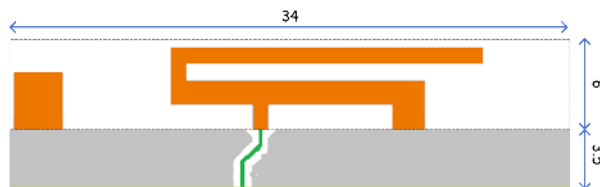
2.3 Summarize the specific operational use conditions

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



Top Layer (Antenna Layer)

Use FR-4 ($D_k = 4.3$ @1GHz) PCB material

Resist thickness : 30um

Metal thickness : 42um

Any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

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 equal or lower gain may also be used with this module. The antenna must be installed such that 20 cm can be maintained between the antenna and users.

Antenna No.	Brand	Model	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable Length
1	Molex	146153	3.175	2.4-2.4835GHz	Dipole	ipex(MHF)	50mm
			3.175	5.15-5.25GHz			
			2.975	5.25-5.35GHz			
			4.275	5.47-5.725GHz			
			3.775	5.725-5.80GHz			
2	Unictron	AA258 (H2B1PC1A1C)	2.67	2.4-2.4835GHz	Dipole	ipex(MHF)	50mm
			3.22	5.15-5.25GHz			
			3.91	5.25-5.35GHz			
			2.77	5.47-5.725GHz			
			3.92	5.725-5.80GHz			
3	Silex Technology	SXANTFDB24A55-03	2.75	2.4-2.4835GHz	Folded inverted-L	None (On-board)	-
			1.82	5.15-5.25GHz			
			1.82	5.25-5.35GHz			
			2.82	5.47-5.725GHz			
			2.99	5.725-5.80GHz			

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following: “Contains FCC ID: **N6C-IM100**”. The grantee’s FCC ID can be used only when all FCC compliance requirements are met.

FCC CAUTION

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

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

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

2.9 Information on test modes and additional testing requirements

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

2.10 Additional testing, Part 15 Subpart B disclaimer

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

2.11 Note EMI Considerations

We recommend to use “best practice” RF design engineering testing and

evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties. The host manufacturer is responsible for ensuring compliance with the applicable FCC rules for the transmitters operating individually and simultaneously. This includes compliance for the summation of all emissions from all outputs occupying the same or overlapping frequency ranges, as defined by the applicable rules.

2.12 How to make changes

Only 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 : 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.

7. Innovation, Science and Economic Development Canada statement:

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

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

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.**

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; (detachable antenna only)
- (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; (detachable antenna only)
- (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; (detachable antenna only)

(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; (detachable antenna only)

(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

Radiation Exposure Statement:

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with greater than 20 cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à plus de 20 cm entre le radiateur et votre corps.

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

- 1) The antenna must be installed and operated with greater than 20cm between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 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) L'antenne doit être installée et exploitée avec plus de 20 cm entre l'antenne et les utilisateurs, et

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

Tant que les 2 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 FOR MOBILE DEVICE USAGE (>20cm/low power)

This transmitter module is authorized only for use in device where the antenna may be installed and operated with greater than 20 cm between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC:4908A-IM100".

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-IM100".

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.

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-IM100

Or

Contains IC: 4908A-IM100

Operation in the band 5150-5350 MHz

Operation in the band 5150-5350 MHz is only for indoor use to reduce the potential for harmful interference to cochannel mobile satellite systems.

La bande 5150-5350 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.

Data transmission

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

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

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

RF exposure considerations

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-IM100) 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 No.	Brand	Model	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable Length	Impedance
1	Molex	146153	3.175	2.4-2.4835GHz	Dipole	ipex(MHF)	50mm	50ohms
			3.175	5.15-5.25GHz				
			2.975	5.25-5.35GHz				
			4.275	5.47-5.725GHz				
			3.775	5.725-5.80GHz				
2	Unictron	AA258 (H2B1PC1A1C)	2.67	2.4-2.4835GHz	Dipole	ipex(MHF)	50mm	50ohms
			3.22	5.15-5.25GHz				
			3.91	5.25-5.35GHz				
			2.77	5.47-5.725GHz				
			3.92	5.725-5.80GHz				
3	Silex Technology	SXANTFDB24A55-03	2.75	2.4-2.4835GHz	Folded inverted-L	None (On-board)	-	50ohms
			1.82	5.15-5.25GHz				
			1.82	5.25-5.35GHz				
			2.82	5.47-5.725GHz				
			2.99	5.725-5.80GHz				

Le présent émetteur radio (4908A-IM100) 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.

Numéro d'antenne	Marque	Modèle	Antenne Gain net (dBi)	Gamme de fréquences	Type d'antenne	Type de connecteur	Longueur du câble	Impedance
1	Molex	146153	3.175	2.4-2.4835GHz	Dipole	ipex(MHF)	50mm	50ohms
			3.175	5.15-5.25GHz				
			2.975	5.25-5.35GHz				
			4.275	5.47-5.725GHz				
			3.775	5.725-5.80GHz				
2	Unictron	AA258 (H2B1PC1A1C)	2.67	2.4-2.4835GHz	Dipole	ipex(MHF)	50mm	50ohms
			3.22	5.15-5.25GHz				
			3.91	5.25-5.35GHz				
			2.77	5.47-5.725GHz				
			3.92	5.725-5.80GHz				
3	Silex Technology	SXANTFDB24A55-03	2.75	2.4-2.4835GHz	Folded inverted-L	None (On-board)	-	50ohms
			1.82	5.15-5.25GHz				
			1.82	5.25-5.35GHz				
			2.82	5.47-5.725GHz				
			2.99	5.725-5.80GHz				