

USER'S MANUAL

**QCS403YA44 with WCN3980 1x1 11ac/BT5.1 connectivity LGA
System-on-Module (SOM)**

QCS403YA44

Memory Configuration: MCP 512MB+512MB

Version 1.7



**Internet Communication Module S.B.U
LITE-ON Technology Corporation
11F, 392, Ruey Kuang Road,
Neihu, Taipei 11492, Taiwan, R.O.C.**

1.2 INTRODUCTION

The QCS403YA device is an Audi/Wi-Fi SoC for use in the smart Speaker, Smart Assistant, Mesh router and Soundbar markets. It includes a 64-bit ARM Cortex-A53 dual-core application processor.

1.3 QCS403YA FEATURES

- MCP Memory Support (1x32 LPDDR2 32-bit wide memory support for up to 533MHz + SLC NAND Flash)
- 12 channel/384kHz; 32 channel/192kHz; DSD support
- Direct 8x PDM DMIC support
- Support for UART, I2C, SPI, USB2.0 interface
- Support for high fidelity CSRA6620/6640 amplifiers (optional)

1.4 QCS403YA SPECIFICATIONS

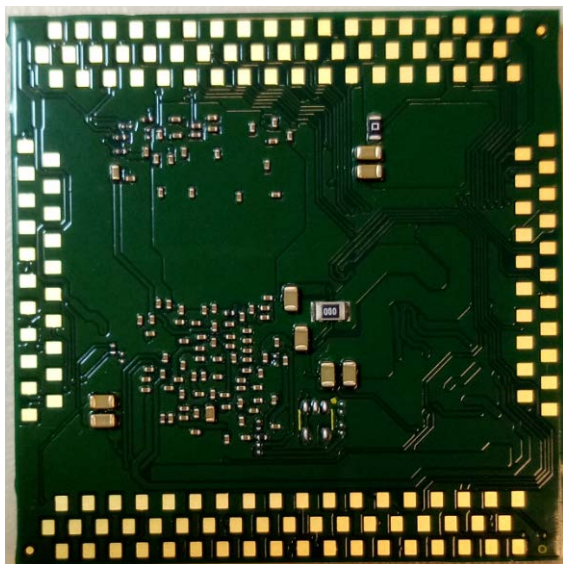
Feature	Specification
Processor	QCS403-0 ARM Cortex-A53 microprocessor cores ■ 64bit processor ■ Dual core 1.4GHz ■ Primary boot processor
Memory	● Nanya MCP(512MB LPDDR2 + NAND 512MB) MFG P/N: NM1484KSLAXAJ-3B ● ESMT MCP(512MB LPDDR2 + NAND 512MB) MFG P/N: FM6BD4G4GXB-1.8BLCGE2X Nanya(PVL) and ESMT(Under Qualification) are the alternates each other
DSP	Audio DSP (800MHz, Quad MAC) 1.5MB Compute DSP(700MHz, Dual MAC), 256K
Wireless	WCN3980 - 802.11a/b/g/n/ac - 1x1 MU-MIMO - 2.4/5GHz - Bluetooth 5.1; aptX <u>See Appendix for detail</u>
Machine Learning	HVX accelerator for improved ECNS, wake-word detection and local ASR
Audio Decode	MP3, AAC, ALAC, FLAC, He-AAC v1/v2, WMA 9/Pro
Voice	6-mic Fluence PRO w/Linear Echo Cancellation(LEC) CNN based SVA; Hexagon Vector Extension(HVX)
Audio Interface	1x SLIMbus interface to WCD9335(optional) 3x I2S TDM (384kHz/32bit) 8x DMIC
Power Management	Power management (PMS405)
I/O	1x USB2.0 interface, 1x SPDIF, 2x UART, 2x SPI, 3x I2C
OS Support	Linux based
SOM Dimension	37x37mm
Antenna Type	1x I-PEX antenna connector; Wi-Fi&BT share the same antenna
Operating Environment	Power Input: 3.6V Operating Temperature: 0 ⁰ C to +65 ⁰ C

1. SOM PHOTO

TOP SIDE



BOTTOM SIDE



2. ELECTRICAL SPECIFICATIONS

10.1 Absolute maximum ratings

Table 10-1 Absolute maximum ratings

Power supply	Description	Min	Typ	Max	Units
VPH_PWR	Prime Power	-0.5	-	5.25	V
VDD_CH0_3P3	Power supply for WCN3980 from system	-0.3	-	3.63	V
VREG_L4_1P2	Linear regulator L4 output for QCS403	-0.3	-	1.7	V
VREG_L6_1P8	Linear regulator L6 output for QCS403, WCN3980, Memory	-0.3	-	2.3	V
VREG_L12_3P3	Linear regulator L12 output for QCS403	-0.3	-	3.8	V
VREG_L11_SDC2	Linear regulator L11 output for QCS403	-0.3	-	3.4	V
VREG_S4_1P8	Linear regulator S4 output	-0.3	-	2.3	V

10.2 Operation Conditions

Table 10-2 Recommended Operation Conditions

Symbol	Parameter	Min	Typ	Max	Units
VPH_PWR	Prime Power	2.5	3.6	5.25	V
VDD_CH0_3P3	Power supply for WCN3980 from system	2.97	3.3	3.63	V
VREG_L4_1P2	Linear regulator L4 output for QCS403	1.144	1.2	1.256	V
VREG_L6_1P8	Linear regulator L6 output for QCS403, WCN3980, Memory	1.704	1.8	1.896	V
VREG_L12_3P3	Linear regulator L12 output for QCS403	2.97	3.3	3.63	V
VREG_L11_SDC2	Linear regulator L11 output for QCS403	2.7	2.95	3.05	V
VREG_S4_1P8	Linear regulator S4 output	1.704	1.8	1.896	V
T _A	Ambient operating temperature	0	25	65	°C
T _S	Storage temperature	-20	25	80	°C

APPENDIX – WCN3980 1x1 WIRELESS CONNECTIVITY SPECIFICATIONS

Table A-1 Bluetooth specifications

BT Function	
Standard	Bluetooth V5.1LE
Data Rate	1 Mbps, 2Mbps and Up to 3Mbps
Modulation Scheme	GFSK, $\pi/4$ -DQPSK and 8-DPSK
Frequency Range	2.402~2.480 GHz
Transmit Output Power	$+4 \leq \text{Output Power} \leq +10\text{dBm}$; Class I Device
Receiver Sensitivity	$< 0.1\%$ BER at -94dBm

Table A-2 Wi-Fi specifications

Wi-Fi Function	
Standard	IEEE802.11a; IEEE802.11b; IEEE 802.11g; IEEE 802.11n; IEEE802.11ac
Data Rate	802.11a: 54, 48, 36, 24, 18, 12, 9, 6 Mbps 802.11b: 11, 5.5, 2, 1 Mbps 802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps 802.11n: MCS 0 to 7 for HT20MHz MCS 0 to 7 for HT40MHz 802.11ac: MCS 0 to 8 for HT20MHz MCS 0 to 9 for HT40MHz MCS 0 to 9 for HT80MHz
Media Access Control	CSMA/CA with ACK
Modulation Technique	802.11a: 64QAM, 16QAM, QPSK, BPSK 802.11b: CCK, DQPSK, DBPSK 802.11g: 64QAM, 16QAM, QPSK, BPSK 802.11n: 64QAM, 16QAM, QPSK, BPSK 802.11ac: 256QAM, 64QAM, 16QAM, QPSK, BPSK
Network Architecture	Infrastructure mode

Operation Channel	2.4GHz 11: (Ch. 1-11) – United States 13: (Ch. 1-13) – Europe 14: (Ch. 1-14) – Japan
	5GHz 21: USA 19: EU 8: Japan
Frequency Range	802.11bg 2.400 ~ 2.4835 GHz
	802.11a 5.15 ~ 5.85 GHz
Security	WPS, WPA, WPA2, WEP 64bit & 128bit, IEEE 802.1X, IEEE 802.11i

Table A-3 Transmit Output Power specifications
2.4GHz
Transmit Output Power Tolerance: $\pm 1.5\text{dBm}$

802.11b	1Mbps	2Mbps	5.5Mbps	11Mbps
Tgtpwr (dBm)	16	16	16	16

802.11g	6~24Mbps	36Mbps	48Mbps	54Mbps
Tgtpwr (dBm)	16.5	16	15	13.5

802.11n HT20	MCS0	MCS1	MCS2	MCS3	MCS4
Tgtpwr (dBm)	16.5	16.5	16.5	16	16
	MCS5	MCS6	MCS7		
	15	14	13.5		

802.11n HT40	MCS0	MCS1	MCS2	MCS3	MCS4
Tgtpwr (dBm)	15.5	15.5	15.5	15	15
	MCS5	MCS6	MCS7		
	14	13	12.5		

5GHz
Transmit Output Power Tolerance: ± 2 dBm

802.11a	6~24Mbps	36Mbps	48Mbps	54Mbps
Tgtpwr (dBm)	15.5	14	13	12

802.11n HT20	MCS0	MCS1	MCS2	MCS3	MCS4
Tgtpwr (dBm)	15.5	15.5	15.5	15	15
	MCS5	MCS6	MCS7		
	14	13	12		

802.11n HT40	MCS0	MCS1	MCS2	MCS3	MCS4
Tgtpwr (dBm)	14.5	14.5	14.5	14	14
	MCS5	MCS6	MCS7		
	13	12	11		

802.11ac VHT80	MCS0	MCS1	MCS2	MCS3	MCS4
Tgtpwr (dBm)	13.5	13.5	13.5	13	13
	MCS5	MCS6	MCS7	MCS8	MCS9
	12	11	10	9	8

Table A-4 Receiver Sensitivity specifications

Frequency Band	Rate	Condition	1x1(1SS) (dBm)
2.4G	11b-1M	PER < 8%	-95
	11b-11M	PER < 8%	-87
	11g-6M	PER < 10%	-90
	11g-54M	PER < 10%	-72
	11ac-VHT20MCS0	PER < 10%	-89
	11ac-VHT20MCS7	PER < 10%	-70
	11ac-VHT20MCS8	PER < 10%	-68
	11ac-VHT40MCS0	PER < 10%	-87
	11ac-VHT40MCS7	PER < 10%	-67
	11ac-VHT40MCS8	PER < 10%	-65
	11ac-VHT40MCS9	PER < 10%	-63
5G	11a-6M	PER < 10%	-87
	11a-54M	PER < 10%	-71
	11ac-VHT20MCS0	PER < 10%	-87

	11ac-VHT20MCS7	PER < 10%	-70
	11ac-VHT20MCS8	PER < 10%	-66
	11ac-VHT40MCS0	PER < 10%	-84
	11ac-VHT40MCS7	PER < 10%	-67
	11ac-VHT40MCS9	PER < 10%	-61
	11ac-VHT80MCS0	PER < 10%	-81
	11ac-VHT80MCS7	PER < 10%	-65
	11ac-VHT80MCS9	PER < 10%	-57

WARNINGS**FCC Statement:****Federal Communication Commission Interference Statement**

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 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.

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

This device and its antenna(s) must not be co-located with any other transmitters except in accordance with FCC multi-transmitter product procedures.

Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without C2P.

This device is restricted for indoor use.

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

IMPORTANT NOTE:**FCC 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.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated.

Additional testing and certification may be necessary when multiple modules are used.

20 cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20 cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

This device is restricted to indoor use.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains FCC ID: PPQ-QCS403YA ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

This module is certified pursuant to Part 15 rules section 15.247, 15.407 and RSS-247.

This module has been approved to operate with the antenna types listed below, with the maximum permissible gain indicated.

Antenna	Frequency Band	Antenna Type	Brand	Model Number	Gain(dBi)
1	2400-2483.5MHz; BT	PIFA	INPAQ	RFPCA370808IMLB302	2.55
	5150-5850MHz				4.87
2	2400-2483.5MHz; BT	PIFA	INPAQ	RFPCA370811IMLB301	2.4
	5150-5850MHz				4.56
3	2400-2483.5MHz; BT	PIFA	INPAQ	RFPCA370838IMLB302	2.02
	5150-5850MHz				5.46
4	2400-2483.5MHz; BT	PIFA	INPAQ	RFPCA320808IMAB301	2.5
5	2400-2483.5MHz; BT	PIFA	INPAQ	RFPCA320806IMAB302	2.5

Information on test modes and additional testing requirements

This module has been approved under stand-alone configuration.

OEM integrator has be limited the operation channels in channel 1-11 for 2.4GHz band.

The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093/RSS-102 and different antenna configurations

The information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host can be found at KDB Publication 996369 D04.

OEM integrator is still responsible for testing their end product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/ISED authorization is no longer considered valid and the FCC/IC No. cannot 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/ISED authorization.

Additional testing, Part 15 Subpart B and ICES-003 disclaimer

Appropriate measurements (e.g. Part 15 Subpart B compliance) and if applicable additional equipment authorizations (e.g. SDoC) of the host product to be addressed by the integrator/manufacturer.

This module is only FCC/ISED authorized for the specific rule parts 15.247, 15.407/RSS-247 listed on the grant, and the host product manufacturer is responsible for compliance to any other FCC/ISED rules that apply to the host product as being Part 15 Subpart B/ICES-003 compliant.

IC 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;

L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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

Pour les produits disponibles aux États-Unis / Canada du marché, seul le canal 1 à 11 peuvent être exploités. Sélection d'autres canaux n'est pas possible.

This device and its antenna(s) must not be co-located with any other transmitters except in accordance with IC multi-transmitter product procedures.

Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without reassessment permissive change.

Cet appareil et son antenne (s) ne doit pas être co-localisés ou fonctionnement en association avec une autre antenne ou transmetteur.

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.

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.

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 specified for point-to-point and non-point-to-point operation as appropriate.

le gain maximal d'antenne permis (pour les dispositifs utilisant la bande 5725-5850 MHz)

doit se conformer à la limite de p.i.r.e. spécifiée pour l'exploitation point à point et non point à point, selon le cas.

Dynamic Frequency Selection (DFS) for devices operating in the bands 5250- 5350 MHz, 5470-5600 MHz and 5650-5725 MHz.

Sélection dynamique de fréquences (DFS) pour les dispositifs fonctionnant dans les bandes 5250-5350 MHz, 5470-5600 MHz et 5650-5725 MHz.

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.

le gain maximal d'antenne permis pour les dispositifs utilisant les bandes 5250-5350 MHz et 5470-5725 MHz doit se conformer à la limite de p.i.r.e.

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

De plus, les utilisateurs devraient aussi être avisés que les utilisateurs de radars de haute puissance sont désignés utilisateurs principaux (c.-à-d., qu'ils ont la priorité) pour les bandes 5250-5350 MHz et 5650-5850 MHz et que ces radars pourraient causer du brouillage et/ou des dommages aux dispositifs LAN-EL.

For indoor use only.

Pour une utilisation en intérieur uniquement.

IMPORTANT NOTE:

IC Radiation Exposure Statement:

This equipment complies with IC RSS-102 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.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

This radio transmitter (IC: 4491A-QCS403YA) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (IC: 4491A-QCS403YA) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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

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

This module is intended for OEM integrator. The OEM integrator is still responsible for the IC compliance requirement of the end product, which integrates this module.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20 cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the IC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. 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.

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

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

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains IC : 4491A-QCS403YA".

The user manual of the end product should include:

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.

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.

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.

ISED Radiation Exposure Statement:

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20cm de distance entre la source de rayonnement et votre corps.

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

Pour les produits disponibles aux États-Unis / Canada du marché, seul le canal 1 à 11 peuvent être exploités. Sélection d'autres canaux n'est pas possible.

Table for Filed Antenna

Antenna	Frequency Band	Antenna Type	Brand	Model Number	Gain(dBi)
1	2400-2483.5MHz; BT	PIFA	INPAQ	RFPCA370808IMLB302	2.55
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	5150-5850MHz				4.56
3	2400-2483.5MHz; BT	PIFA	INPAQ	RFPCA370838IMLB302	2.02
	5150-5850MHz				5.46
4	2400-2483.5MHz; BT	PIFA	INPAQ	RFPCA320808IMAB301	2.5
5	2400-2483.5MHz; BT	PIFA	INPAQ	RFPCA320806IMAB302	2.5

CE Statement:

This equipment complies with EU 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.

Japan Statement:

5GHz product for indoor use only.

NCC 警語:

- 1.取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。
- 2.無線資訊傳輸設備應避免影響附近雷達系統之操作。
- 3.本器材須經專業工程人員安裝及設定，始得設置使用，且不得直接販售給一般消費者。
- 4.最終產品內含已認證過之射頻模組(組件)，應於最終產品本體明顯處標示「本產品內含射頻模組 CCXXxxLPyyZz 」