Model

AL-7651B-WG-A

WF-M651-UWD1

WF-M605-UWD2

User Manual

IEEE 802.11 2x2 WiFi 5 Wireless LAN WIFI Module

[SoC MT7651BUN]

for 802.11a/b/g/n/ac

Version： 1.0

For Private Preview

<Specification may be changed without prior notice>

Sichuan AI-Link Technology Co., Ltd

四川爱联科技股份有限公司

The information and data contained herein is subject to change without notice. While every possible precaution has been taken in the production of this document, it may still contain technical inaccuracies, omissions, and typographical errors, and AI-Link, the document owner, is under no obligation to update or otherwise correct this information. Sichuan AI-Link Technology Co., Ltd. makes no representations or warranties concerning the accuracy or completeness of the contents of this document and assumes no liability of any kind, including the implied warranties of non-infringement, merchantability, or fitness for purposes, concerning the operation or use of AI-Link hardware, software or other products described herein.

No license to any intellectual property rights is granted by this document. Terms and limitations applicable to the purchase or use of AI-Link' s products are outlined in a signed agreement between the parties or AI-Link' s standard terms and conditions of sales.

Any unauthorized copying, alteration, distribution, transmission, performance, display, or other use of this document is strictly prohibited. Reverse engineering or disassembly is also prohibited.

Trademarks

, are trademarks of Sichuan AI-Link Technology Co., Ltd. Other product names used in this document are for identification purposes only and may be trademarks of their respective companies or entities.

Below Space Intentionally Left Blank for Customer Confirmation or Comments		
Typed Name	Signature	Date

Please sign and return this page and the front page to our company by email or fax, or by courier to the following address:

Address: Anzhou Industrial Park, Mianyang, Sichuan, P.R.C
Company: Sichuan AI-Link Technology Co., Ltd.

Module Name		**AL-7651B-WG-A**	
	Designed by	Reviewed by	Approved by
Signature	Qin, Dakai	Fan, Xijun	Feng, Yi
Date	4/12/2022	4/12/2022	4/12/2022

Model AL-7651B-WG-A

- **Compatible WLAN Standards**

  IEEE Std. 802.11 a/b/g/n/ac

- **SoC**

  MT7651BUN

- **Product Size**

  47.0mm×30.0mm×6.0mm

	Sichuan AI-Link Technology Co., Ltd.
	Anzhou Industrial Park, Mianyang, Sichuan, P.R.C
	+86-0816-2438701
	http://www.ailinkiot.com
	ai-link@ailinkiot.com

HSF

Features

WLAN

- IEEE 802.11 a/b/g/n/ac compliant
- Support 20MHz, 40MHz bandwidth in 2.4GHz, Support 20MHz, 40MHz, 80MHz bandwidth in 5GHz band
- Dual bands 2T2R mode
- data rate up to 866.7Mbps with USB2.0
- Support STBC, LDPC, TX Beamformer, and RX Beamformer
- Greenfield, mixed-mode, legacy modes support
- IEEE 802.11 d/e/h/i/j/k/mc/r/v/w support
- Security support for WFA WPA/WPA2/WPA3 personal, WPS2.0
- Qos support of WFA WMM,WMM PS

Revision Record

Revision	Date	Description	Edited by
V1.0	4/12/2022	Premier Release	Qin, Dakai
** Private Preview Only*			

Contents

1 General Description

1.1 System Overview

Model AL-7651B-WG-A is a highly integrated WiFi module by AI-Link, based on the MediaTek SoC MT7651BUN, featuring a 2x2 a/b/g/n/ac dual-band Wi-Fi.

The finely tuned hardware architecture and baseband algorithms provide superlative RF performance, as well as low power consumption. Intelligent MAC design powers a highly efficient offload engine; the hardware supports standard features of higher level of security, performance, and conforms most international regulations, offering the great performance at any time, in any circumstance.

1.2 System Properties

Dimension	Typically, 47.0mm×30.0mm×6.0mm
Chipset	MT7651BUN
Operating Frequency	2.4GHz:2.412~2.484 GHz 5 GHz：5.180~5.825GHz
Antenna	IPEX Connector and Internal Antenna
Operating Voltage	3.3V±10%
PCB Information	4-layers design (1.0+/-0.15mm)
Peripheral Interface	USB 2.0
Rate	11b: 1, 2, 5.5 and 11Mbps 11a/g: 6, 9, 12, 18, 24, 36, 48 and 54 Mbps 11n: MCS0~15, up to 300Mbps 11ac: MCS0~9, Nss=2, up to 866.7Mbps
Operating Temperature	-0℃ to +70℃

Storage Temperature	-40℃ to +80℃
ESD Protection	HBM：2000V MM：±100V IEC(Contact discharge)：±4000V IEC(Air discharge)：±8000V

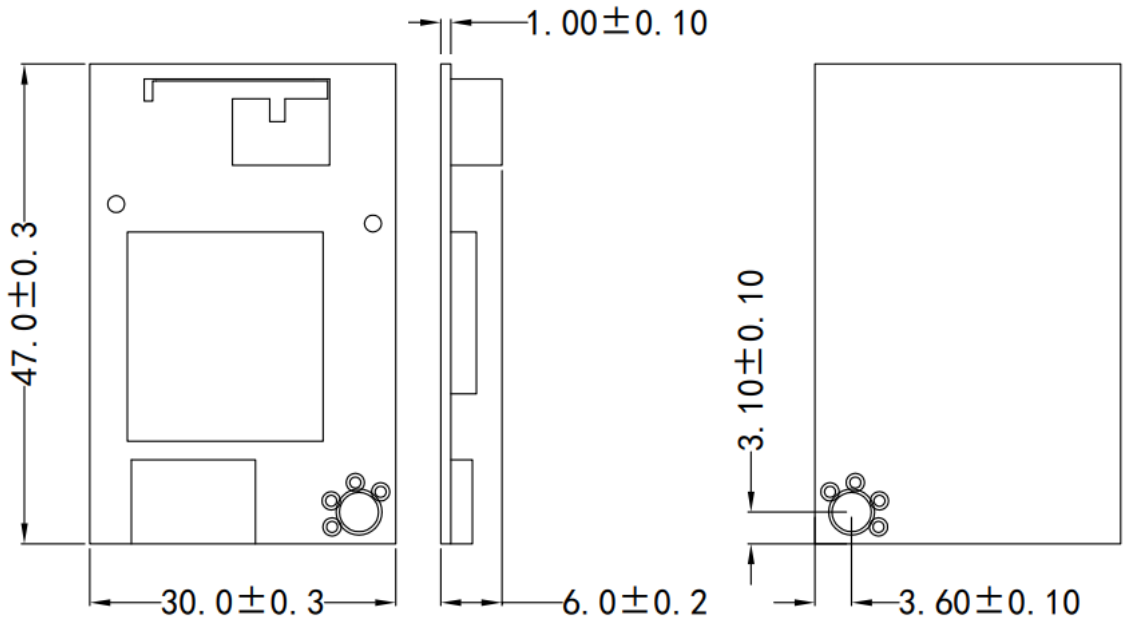
1.3 Diagram

The hardware architecture for the module is shown in Figure 1. The AI-Link’s AL-7651B-WG-A module Complies with IEEE standards 802.11a/b/g/n/ac; it also supports 2x2 Multi-User Multiple-Input Multiple-Output and could reach up to data rate of 866.7 Mbps.

2 Mechanical Dimensions

2.1 Mechanical Outline Drawing

- Typical Dimension (W x L x T): 47.0mmx 30.0mm x 6.0mm
- PCB Thickness: 1.0mm (+/-0.15mm)



Top View *Bottom View*

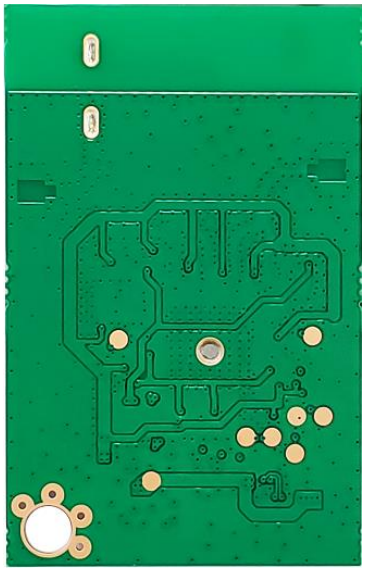
2.2 Pin definitions

Pin	Define	Description
1	GND	GND
2	HSDP	HSDP
3	HSDM	HSDM
4	VIN	+3.3V
5	VIN	+3.3V
6	VIN	+3.3V
7	WL_WAKE_HOST	Wlan WAKE Host
8	HOST_WAKE_WL	Host WAKE Wlan
9	RESET	RESET
10	GND	GND

注：Wlan WAKE Host、Host WAKE Wlan 及 RESET 引脚模块内部无上拉电阻。

2.3 Product Photos

Bottom View



Top View

2.5 Label Information

- WIFI MAC information QR code
- Model：AL-7651B-WG-A
- WIFI Mac:FFFFFFFFFFFF（Example）
- FCC ID：
- IC ID：

3 RF Characteristics

3.1 Wi-Fi Subsystem

Items	Contents	
WLAN Standard	IEEE 802.11a/b/g/n/ac	
Frequency Range	2.400 GHz ~ 2.497 GHz (2.4 GHz)	
	5.1 GHz~5.9 GHz (5 GHz)	
Channels	CH1 to CH13 @ 2.4G	
	CH36 to CH165 @ 5G	
Modulation Mode	802.11b: DBPSK, DQPSK ,CCK	
	802.11 a/g/n: BPSK, QPSK, 16QAM, 64QAM	
	802.11 ac: BPSK, QPSK, 16QAM, 64QAM, 256QAM	
Output Power & EVM	Power Value	EVM
	802.11b /11Mbps: 21.5dBm ± 2.0dBm	≤ -10dB
	802.11g /54Mbps: 18.5dBm ± 2.0dBm	≤ -25dB
	802.11a /54Mbps: 17.0dBm ± 2.0dBm	≤ -25dB
	802.11n HT20 /MCS7: @2.4G 18 dBm ± 2.0dBm	≤ -28dB
	802.11n HT20 /MCS7: @5G 16.0 dBm ± 2.0dBm	≤ -28dB
	802.11n HT40 /MCS7: @2.4G 17.5 dBm ± 2.0dBm	≤ -28dB
	802.11n HT40 /MCS7: @5G 16.0 dBm ± 2.0dBm	≤ -28dB
	802.11ac HT80 /MCS9: @5G 15.0 dBm ± 2.0dBm	≤ -32dB
Receiver Sensitivity @2.4G PER≤ 10% @5G PER≤ 10%	Rate Type	Max
	802.11b /11Mbps @2.4G PER≤8%	-82dBm
	802.11g /54Mbps @2.4G	-73dBm
	802.11a /54Mbps @5G	-73dBm
	802.11n HT20 /MCS7 @2.4G	-70dBm

Items	Contents	
	802.11n HT20 /MCS7 @5G	-70dBm
	802.11n HT40 /MCS7 @2.4G	-66dBm
	802.11n HT40 /MCS7 @5G	-66dBm
	802.11ac HT80 /MCS9 @5G	-56dBm

4 Interface

4.1 USB Interface

The module supports the USB (USB v2.0 specification) device port, Use USB as the host interface for Bluetooth.

5 Electrical Current Consumption

5.1 WLAN Current Consumption

Description	Value	Unit
2.4GHz-Band TX CCK, 1Mbps	514	mA
2.4GHz-Band TX OFDM, 6Mbps	487	mA
2.4GHz-Band TX HT20, MCS0	845	mA
2.4GHz-Band TX HT40, MCS0	811	mA
5GHz-Band TX OFDM, 6Mbps	582	mA
5GHz-Band TX HT20, MCS0	913	mA
5GHz-Band TX HT40, MCS0	894	mA

**Note:*

[1] Results are measured provided VDD33 is 3.3V. TX power is measured at the antenna port. The temperature is 25℃.

[2] The duty cycle for TX/RX measurement is 100%.

[3] The chip variation is +/- 25%.

6 Software Information

6.1 RF Driver

customer_package_UIv2.06_DLLv4.09_E2-20200506_WinDriverV.0.0.2.5_FWv.67c4fb6a

6.2 Normal Driver

MT76x3_MP1.4.1_20200929125502-GOOD

**Note: The software (driver) package version is subject to change without notice because it may encounter several updates. It is advised to consult with AI-Link for the best right driver package.*

7 RF Connector Dimension

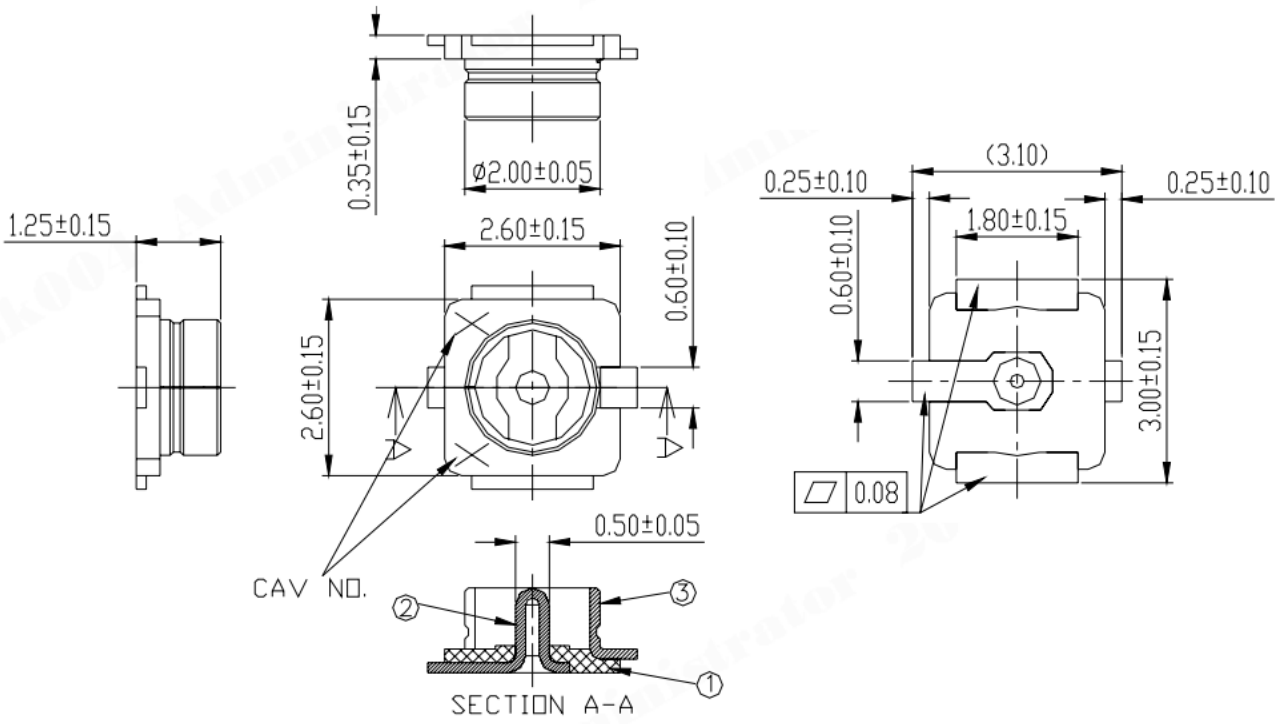


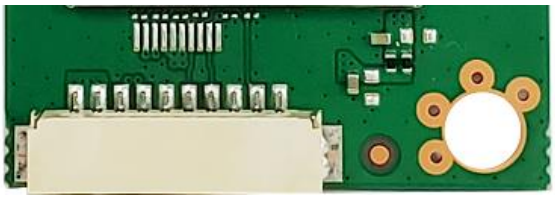
Figure 2: The dimensions of the connector
I-PEX, P/N: 818000368 (Unit: mm)

8 Order

订单料号	规格	备注
AL-7651B-WG-A	2.4G,5G;802.11n;ffc connector;	
WF-M651B-UWD1	2.4G,5G;802.11n;ffc connectpr;	
WF-M651B-UWD2	2.4G,5G;802.11n;	

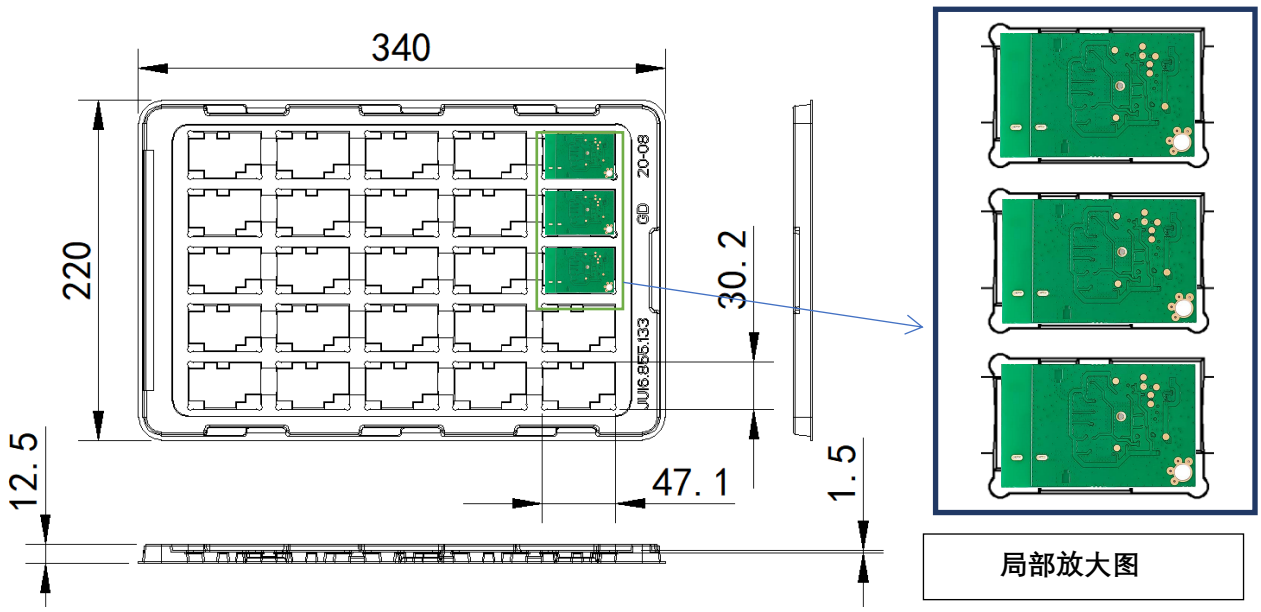
AL-7651B-WG-A and WF-M651B-UWD1：

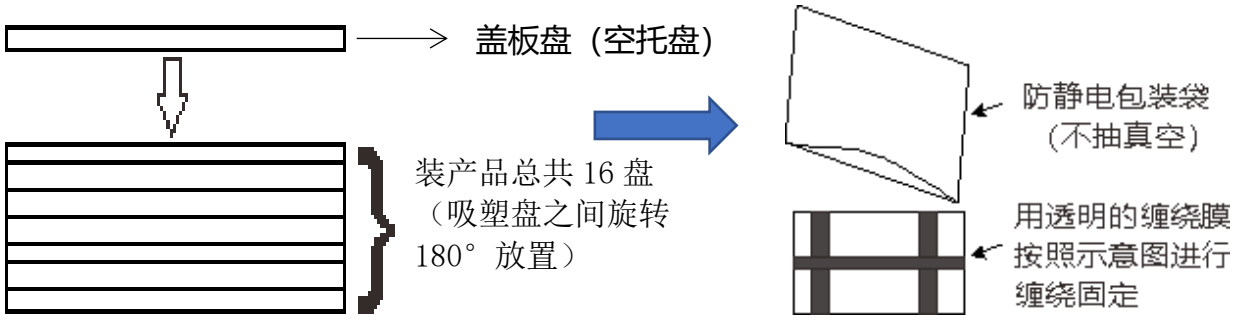
WF-M651B-UWD2：

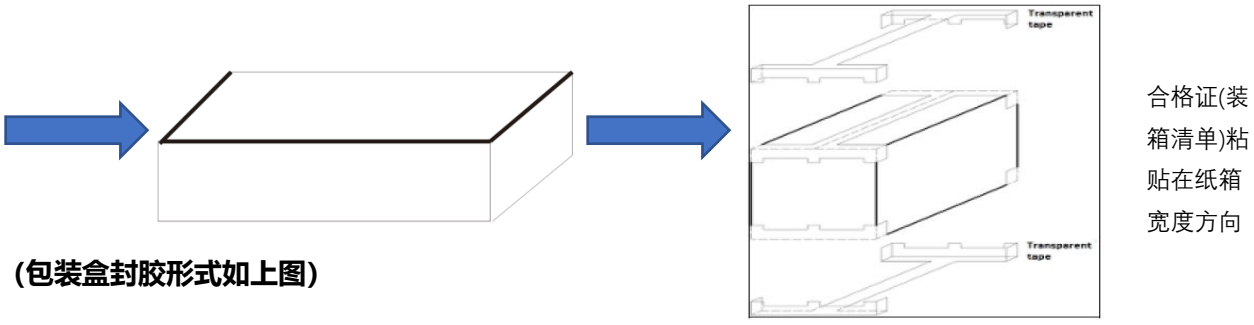


9 Package, Storage & Disposal

9.1 Package







（包装盒封胶形式如上图）

1. The product placement direction, label pasting position and packaging shall be carried out according to the schematic diagram;

2. Put 2 bags of 2G desiccant and a humidity card in the packing box;

3. The number of products is 25 in each layer, with an empty tray on the upper layer. Each box contains 4 boxes, totaling 1600pcs, and each box contains 400pcs products;

4. Outer box size: 499mm * 394mm * 298mm;

5. Other matters not covered shall be implemented according to the customer's packaging requirements.

9.2 Storage

All electronic components must be stored in a clean, well-ventilated place free of corrosive gas. Unless otherwise specified, the temperature and humidity of the storage place must meet below requirements:

- Temperature：-30~85℃;
- Humidity：20%~75%;
- Humidity sensitivity grade： MSL 3
- Container Requirement: products shall be placed in a container well-functioning as an electrostatic shielding.

9.3 Disposal

The waste disposal of this product and the package should comply with the applicable local/regional /state/ international regulations.

10 Appendix

10.1Key Components List

NO.	Name	Model	Specification	Manufacturer
1	IC	MT7651BUN		MediaTek
2	PCB	JUI7.820.1011 series	FR-4, 4-lay 1.0mm	科翔 顺络 英创立 联坤
3	DPX		2.4G@5G	佳利 华科 ACX

10.2 Antenna specification

NO.	Type	Antenna Project Code	Part No.	Gain
Ant 1	Onboard PIFA Antenna	Metal Antenna	RFMTA170900NNLB003	2.4GWIFI:3.79dBi 5GWIFI:3.68dBi
Ant 2	External PIFA Antenna	PIFA Antenna	TX-DM*BD113B63M	2.4GWIFI: 2.32dBi 5GWIFI:4.13dBi
Ant 3			TX-DM1*BD113Y63M	2.4GWIFI:3.93dBi 5GWIFI:5.19dBi

Note：

1.ANT 3 is another antenna of ANT 2 port using by the clients.

2. AL-7651B-WG-A, WF-M651-UWD1, WF-M651-UWD2 all use these three antennas.

11 Authentication

	ID	note
FCC	**2AOKI-AL7651B**	
IC	**23460-AL7651B**	

A、FCC Radiation Exposure 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.

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

This Module complies with FCC 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 and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Labelling Instruction for Host Product Integrator

Please notice that if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains *FCC ID:* **2AOKI-AL7651B**" any similar wording that expresses the same meaning may be used.

Installation Notice to Host Product Manufacturer

The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module. The module is limited to installation in mobile application, a separate approval is required for all other operating configurations, including portable configurations with respect to §*2.1093* and difference antenna configurations.

Antenna Change Notice to Host manufacturer

If you desire to increase antenna gain and either change antenna type or use same antenna type certified, a Class II permissive change application is required to be filed by us, or you (host manufacturer) can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

FCC other Parts, Part 15B Compliance Requirements for Host product manufacturer

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

Host manufacturer in any case shall ensure host product which is installed and operating with the module is in compliant with Part 15B requirements.

Note: 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 or more 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.

B、ISED Regulatory Compliance

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.

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 and your body.

Cet équipement est conforme aux limites d'exposition aux radiations IC CNR-102 établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20cm entre le radiateur et votre corps.

Please notice that if the IC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains IC: **23460-AL7651B**" any similar wording that expresses the same meaning may be used.

L'étiquette d'homologation d'un module d'Innovation, Sciences et Développement économique Canada devra être posée sur le produit hôte à un endroit bien en vue, en tout temps. En l'absence d'étiquette, le produit hôte doit porter une étiquette sur laquelle figure le numéro d'homologation du module d'Innovation, Sciences et Développement économique Canada, précédé du mot « contient », ou d'une formulation similaire allant dans le même sens et qui va comme suit : Contient IC: **23460-AL7651B** est le numéro d'homologation du module.

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; and

i. le dispositif utilisé dans la bande 5150-5250 MHz est réservé à une utilisation en intérieur afin de réduire le risque de brouillage préjudiciable aux systèmes mobiles par satellite dans le même canal;

ii. pour les dispositifs à antenne (s) détachable (s), le gain d'antenne maximal autorisé pour les dispositifs dans les bandes 5250-5350 MHz et 5470-5725 MHz doit être tel que l'équipement soit toujours conforme à la norme e.i.r.p. limite;

iii. pour les dispositifs à antenne (s) détachable (s), le gain d'antenne maximal autorisé pour les dispositifs de la bande 5725-5850 MHz doit être tel que l'équipement soit toujours conforme à la norme e.i.r.p. les limites, le cas échéant; et

- Below Space Intentionally Left Blank -