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WM-BAC-AT-49 Wi-Fi/Bluetooth Module

user manual

Revision history

Revision	***Date***	***Change description***
1.0	*2020/12/07*	*First draft of the document.*

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1. Introduction

The WM-BAC-AT-49 combo module is one of the product families in USI's product offering, targeting for system integration requiring a smaller form factor. It also provides the standard migration to high data rate for USI's current SIP customers.

The purpose of this document is defined the product specification for 802.11a/b/g/n/ac Wi-Fi with BT5.1 combo module. All the data in this document is based on Qualcomm QCN7606 datasheet and other documents provided from Qualcomm. The data will be updated after implementing the measurement of the module.

This product is designated for using in embedded applications mainly in the IoT device, which required small size and high data rate wireless connectivity.

1.1 Brief Technology Features

- Full IEEE 802.11a/b/g/n/ac legacy compatibility.
- Support 20, 40 and 80MHz channels for the 2x2 5GHz radio, and 20 MHz channels for the 2x2 2.4GHz radio.
- Lead Free design which supporting Green design requirement, RoHS Compliance, and halogen-free.
- Small size suitable for low volume system integration. Low power consumption & excellent power management performance extend battery life.
- 2.412-2.484 GHz and 5.15 -5.9GHz two SKUs for worldwide market.
- Easy for integrating into IoT device with flexible system configuration and antenna design.

1.2 Wireless Specification

The WM-BAC-AT-49 module complies with the following features and standards;

Features	Description
WLAN Standards	IEEE 802 Part 11a/b/g/n/ac
Bluetooth	Bluetooth TM 5.1 compliance
Antenna Port	Support 2 streaming antennas 1. a single Dual-Band Antenna Port for Wi-Fi on WL_ANT1 2. a single Dual-Band Antenna Port for Wi-Fi on WL_ANT2 3. a single-Band Antenna Port for BT
Frequency band	2.412 to 2.462GHz (1 to 11 channels)
	5.180 to 5.825GHz

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2. OEM Integrators Installation Manual

2.1 Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).

Antenna Installation

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users.
(2) The transmitter module may not be co-located with any other transmitter or antenna.
(3) To comply with FCC/IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile exposure condition must not exceed:

Peak gain of WiFi Antenna:

- 3.18 dBi @ 2.4 GHz Band
- 2.67 dBi @ 5.15GHz – 5.25GHz
- 2.27 dBi @ 5.25GHz – 5.35GHz
- 2.07 dBi @ 5.47GHz – 5.725GHz
- 1.78 dBi @ 5.725GHz – 5.85GHz

Peak gain of Bluetooth Antenna:

- 1.23 dBi @ 2.4 GHz Band

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

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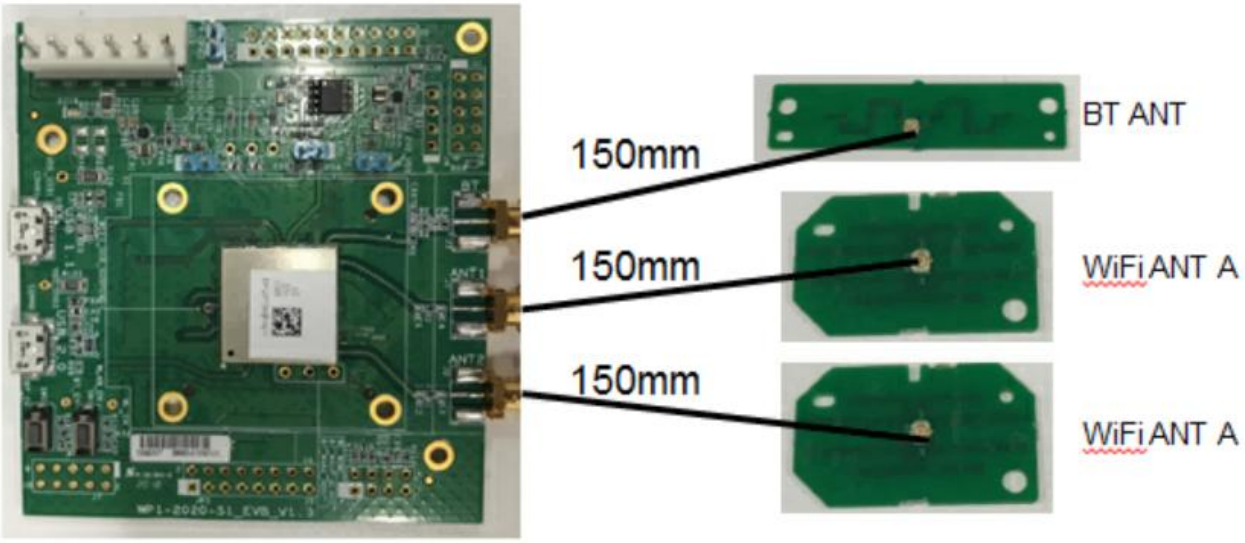
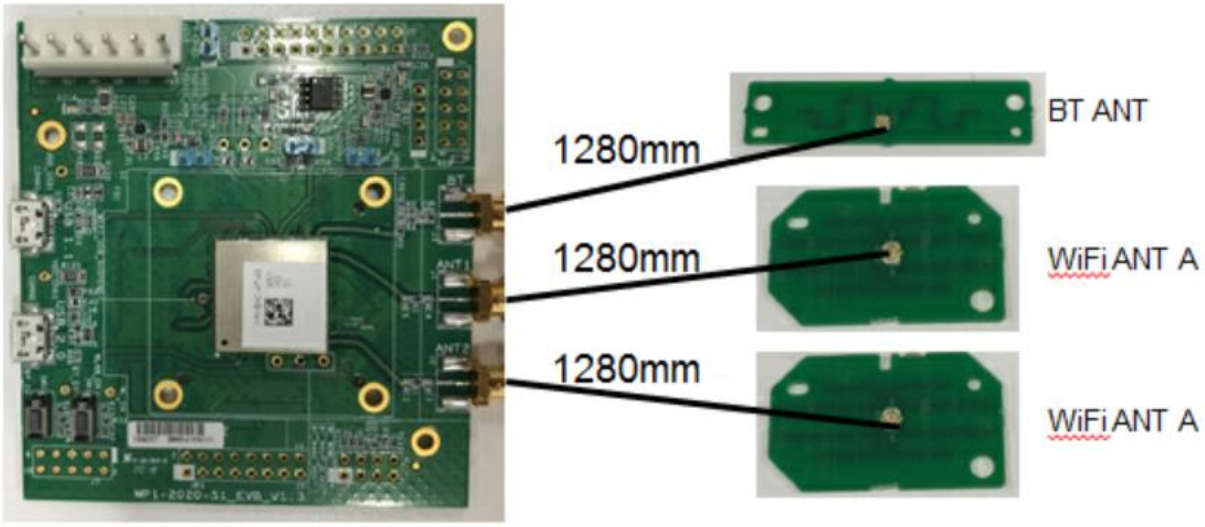
2.2 Antenna Configurations

There are four antenna configurations for WM-BAC-AT-49 module as followings

Configuration 1:



Configuration 2:



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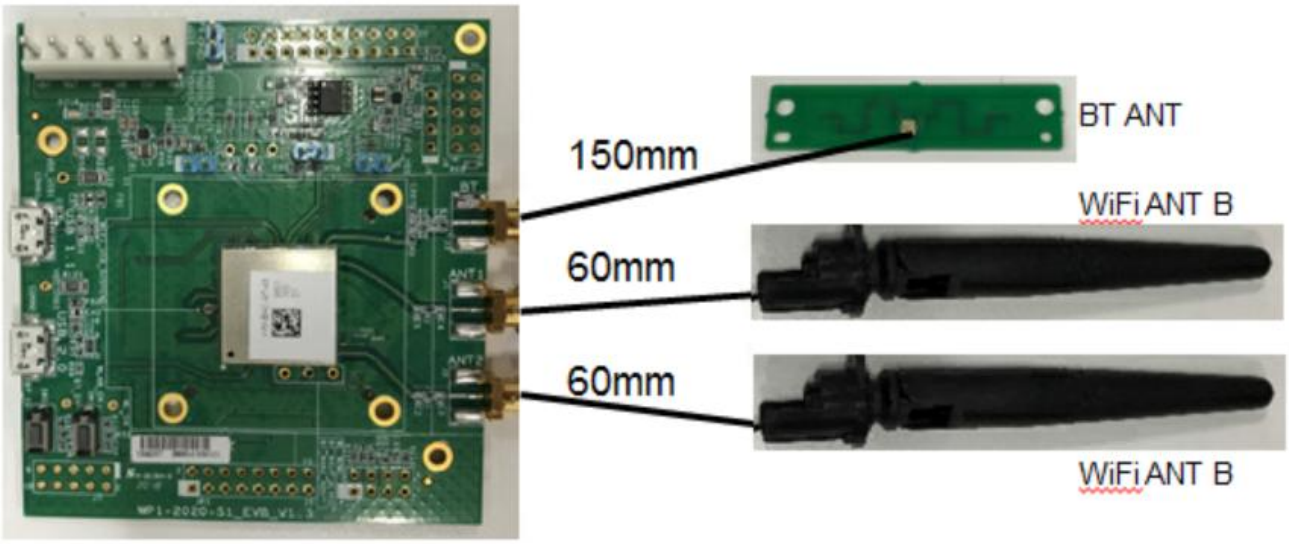
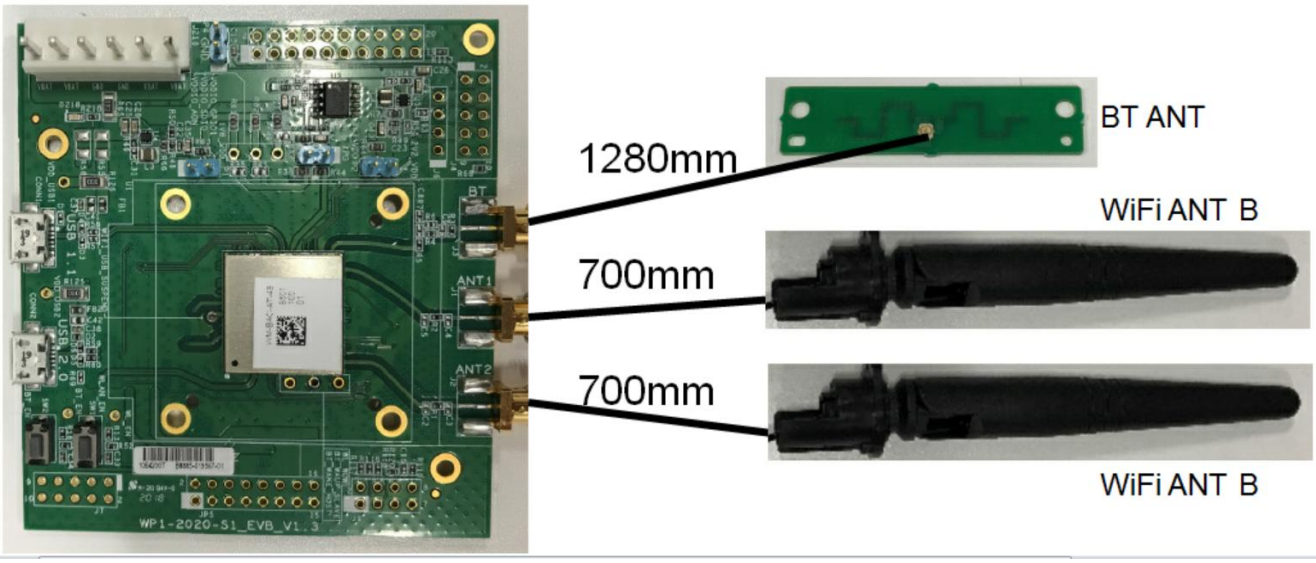
Configuration 3:



Configuration 4:



It can be found there are two different WiFi antennas (WiFi ANT A and B) and only one Bluetooth antenna with different cable lengths could be used among above four configurations. The worst case for AT-49 module will be configuration 3 due to the minimum cable length and maximum antenna gain happened. The OEM integrators should make sure the maximum antenna gain including cable loss must not exceed the list on page 4.

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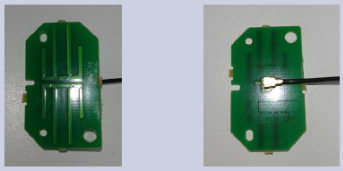
2.3 Antenna Specifications

Below show these antenna specifications for certification test in detail

a. WiFi ANT A Specification with 150mm and 1280mm cable respectively

	WLAN (Same antenna for Both MIMO antenna)		
Photo			
Type	Dipole		
Appearance	Print		
Cable Length	150mm – 1280mm		
5GHz GAIN	Frequency	Peak Gain with min loss	Peak Gain with max loss
	2400MHz	-1.26	-4.77
	2450MHz	-0.30	-3.87
	2500MHz	0.14	-3.44
	5150~5250MHz	1.11	-4.18
	5250~5350MHz	1.11	-4.18
	5470~5725MHz	0.68	-4.77
	5725~5850MHz	0.50	-5.08

b. WiFi ANT B Specification with 60mm and 700mm cable respectively

	WLAN (Same antenna for Both MIMO antenna)		
Photo			
Type	Dipole		
Appearance	Rod		
Cable Length	60mm –700mm		
5GHz GAIN	Frequency	Peak Gain with min loss	Peak Gain with max loss
	2400MHz	1.42	0.59
	2450MHz	2.36	1.38
	2500MHz	3.18	1.84
	5150~5250MHz	2.67	0.11
	5250~5350MHz	2.27	-0.32
	5470~5725MHz	2.07	-0.54
	5725~5850MHz	1.78	-0.94

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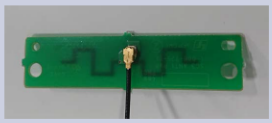
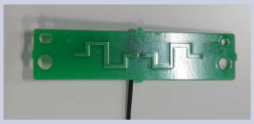
c. BT ANT Specification with 150mm and 1280mm cable respectively

	BT (Same antenna for Both MIMO antenna)		
Photo	 		
Type	Dipole		
Appearance	Print		
Cable Length	150mm – 1280mm		
5GHz GAIN	Frequency	Peak Gain with min loss	Peak Gain with max loss
	2400MHz	0.80	-2.71
	2450MHz	1.23	-2.34
	2500MHz	1.18	-2.40

2.4 Note Information

USI uses various test mode programs for test set up which operate separate from production firmware. Host integrators should contact USI for assistance with test modes needed for module/host compliance test requirements.

The WN-BAC-AT-49 module is only verified for FCC/IC/CE compliance by using the dipole antennas list in above section 2.2 and 2.3. And the antenna shall not be modified or exceed the maximum gain list in section 2.3. A separate approval is required for all other operating configurations, including different antenna configurations.

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3. Federal Communication Commission Compliance Statement

WM-BAC-AT-49

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.

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 20cm between the radiator & your body.

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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 15.247 and 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 design: 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 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.

WiFi Antenna type A:

Antenna Type	Dipole
Antenna connector	IPEX
Peak gain	-1.26 dBi @ 2.4 GHz -0.3 dBi @ 2.45 GHz 0.14 dBi @ 2.5 GHz 1.11 dBi @ 5.15GHz – 5.25GHz 1.11 dBi @ 5.25GHz – 5.35GHz 0.68 dBi @ 5.47GHz – 5.725GHz 0.5 dBi @ 5.725GHz – 5.85GHz

WiFi Antenna type B:

Antenna Type	Dipole
Antenna connector	IPEX

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Peak gain	1.42 dBi @ 2.4 GHz 2.36 dBi @ 2.45 GHz 3.18 dBi @ 2.5 GHz 2.67 dBi @ 5.15GHz – 5.25GHz 2.27 dBi @ 5.25GHz – 5.35GHz 2.07 dBi @ 5.47GHz – 5.725GHz 1.78 dBi @ 5.725GHz – 5.85GHz

Bluetooth Antenna:

Antenna Type	Dipole
Antenna connector	IPEX
Peak gain	0.8 dBi @ 2.4 GHz 1.23 dBi @ 2.45 GHz 1.18 dBi @ 2.5 GHz

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following: "Contains FCC ID: COF-WMBACAT49". 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.

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

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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.

List of applicable FCC rules

This module has been tested and found to comply with 15.247 and 15.407 requirements for Modular Approval.

US Information

Name of the company: USI America, Inc
Address of the company: 2000 Regency Parkway, Suite 420, Cary, NC 27518
Phone number: 919-466-8688 Ext. 109

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4. ISED Compliance Statement

This device complies with ISED'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:
This equipment complies with ISED 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.

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 avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

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

1) The antenna must be installed such that 20 cm is maintained 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 de telle sorte qu'une distance de 20 cm est respectée 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
This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains IC: 10293A-WMBACAT49”.

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Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 20cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 10293A- WMBACAT49".

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.

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RSS-247 Section 6.4 (5) (6) (for local area network devices, 5GHz)

The device could automatically discontinue transmission in case of absence of information to transmit, or operational failure. Note that this is not intended to prohibit transmission of control or signaling information or the use of repetitive codes where required by the technology.

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) 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.

L'appareil peut interrompre automatiquement la transmission en cas d'absence d'informations à transmettre ou de panne opérationnelle. Notez que ceci n'est pas destiné à interdire la transmission d'informations de contrôle ou de signalisation ou l'utilisation de codes répétitifs lorsque cela est requis par la technologie.

Avertissement:

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) 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.

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5. CE RF Exposure Information

This device has been tested and meets applicable limits for Radio Frequency (RF) exposure. To comply with the RF exposure requirements, this module must be installed in a host platform that is intended to be operated in a minimum of 20 cm separation distance to the user.

Hereby, **USI** declares that the radio equipment type WiFi/BT Module is in compliance with Directive 2014/53/EU.
The full text of the EU declaration of conformity is available at the following internet address:
https://www.usiglobal.com/tw/WM-BAC-AT-49/DoC.pdf

In all cases assessment of the final product must be met against the Essential requirements of the RE Directive Articles 3.1(a) and (b), safety and EMC respectively, as well as any relevant Article 3.3 requirements.
1. The Dipole antennas (WiFi maximum gain: 3.18dBi@2.4GHz, 2.67dBi@5GHz; BT maximum gain: 1.23dBi@2.4GHz) were verified in the conformity testing, and for compliance the antenna shall not be modified. A separate approval is required for all other operating configurations, including different antenna configurations.
2. If any other simultaneous transmission radio is installed in the host platform together with this module, or above restrictions cannot be kept, a separate RF exposure assessment and CE equipment certification is required.

The device is restricted to indoor use only when operating in the 5150 to 5350 MHz frequency range.

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