

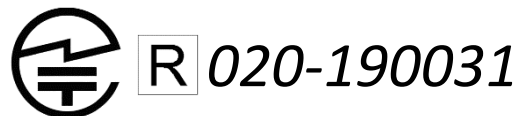


WM-BAC-BM-25-FF4

Wi-Fi/Bluetooth Module

user manual

FCC ID: COF-WMBACBM25
IC: 10293A-WMBACBM25



Revision history

<i>Revision</i>	<i>Date</i>	<i>Change description</i>
<i>1.0</i>	<i>2024/12/13</i>	<i>First draft of the document.</i>



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1. Introduction

The WM-BAC-BM-25-FF4 SiP 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 BT5.0 combo module. All the data in this document is based on Broadcom BCM43455 datasheet and other documents provided from Broadcom.

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 1x1 5GHz radio, and 20 MHz channels for the 1x1 2.4GHz radio.
- Supports standard SDIO v3.0 (including DDR50 mode at 50MHz and SDR104 mode at 208 MHz, 4-bit and 1-bit) interfaces for WiFi control.
- Supports UART/I2S/PCM interfaces for BT control.
- 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.
- Easy for integrating into IoT device with flexible system configuration and antenna design.

1.2 Technical Specification

The WM-BAC-BM-25-FF4 module complies with the following features and standards;

Features	Description
WLAN Standards	- IEEE 802 Part 11a/b/g/n/ac - Single-stream spatial multiplexing up to 433.3 Mbps data rate
Bluetooth	Bluetooth TM 5.0 compliance
Antenna Port	Support single streaming antenna shared between Bluetooth and WLAN
Frequency band	2.412 to 2.472GHz (1 to 13 channels) 5.180 to 5.825GHz
Temperature	-40°C - +85°C
Operating Voltage	Max. 4.8V, Typ. 3.6V, Min. 3.2V

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2. OEM Integrators Installation Manual

2.1 Important Notice to OEM integrators

- This module is limited to OEM installation ONLY.
- This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
- The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
- 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

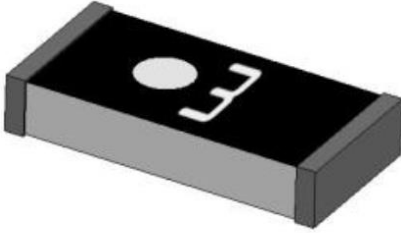
- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users.
- 2) The transmitter module may not be co-located with any other transmitter or antenna.
- 3) To comply with FCC/IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile exposure condition must not exceed the values in section 2.2.

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.



2.2 Antenna Specifications

Below shows antenna specification for certification test in detail

Brand	YAGEO	
Model (PN)	ANT3216A063R2455A	
Photo		
Type	Ceramic Chip Antenna	
Peak Gain	2.4GHz band	5GHz band
	1.59dBi @ 2.40 GHz – 2.4835GHz	2.23dBi @ 5.15GHz – 5.85GHz

2.3 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.



3. Federal Communication Commission Compliance Statement

WM-BAC-BM-25-FF4

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.

The final end product must be labeled in a visible area with the following: "Contains FCC ID: COF-WMBACBM25". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

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.

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 v01r01 guidance, the following conditions must be strictly followed when using this certified module:

KDB 996369 D03 OEM Manual v01r01 rule sections:

2.2 List of applicable FCC rules:

This module has been verified for compliance to

- §15.203 Antenna Requirement
- §15.204 External radio frequency power amplifiers and antenna modifications.
- §15.212 Modular Transmitters §15.207 Conducted Limits
- §15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz (digitally modulated)
- §15.407 General technical requirements
- §15.19 Labeling requirements
- §15.21 Information to user

2.3 Summarize the specific operational use conditions:

The module, WM-BAC-BM-25-FF4, has been approved for use in the US, Canada and Japan. Any changes or modifications to the module not expressly approved by the party responsible for compliance could void the user's authority to operate the module.

The host product operating conditions must be such that there is a minimum separation distance of 20 cm between the antenna and nearby persons.

2.4 Limited module procedures: The module, WM-BAC-BM-25-FF4, is full modular approval.

2.5 Trace antenna design: The module, WM-BAC-BM-25-FF4, does not require Micro-Strip antennas or traces on the host device. All traces and antennas are contained on the module.

2.6 RF exposure considerations:

The host product operating conditions must be such that there is a minimum separation distance of 20 cm between the antenna radiating structures and nearby persons. The host manufacturer is obligated to confirm the use conditions of the host product to ensure that the distance specified in the instructions is met.

The following statement must be included as a CAUTION statement in manuals and OEM products to alert end users of FCC RF Exposure compliance:

“To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.”

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2.7 Antenna:

The antenna listed in section 2.2 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.

2.8 Label and compliance information:

Host product manufacturer must provide a physical label stating, Contains “FCC ID: COF-WMBACBM25” and “IC: 10293A-WMBACBM25” in a visible location on the finished product. The module host shall bear the following statement in a conspicuous location on the host and in the manual:

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 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.”

2.9 Information on test modes and additional testing requirements:

Host manufacturer should confirm proper operation using a known good module to link to the installed module. Test procedure for the host will require a particular setting to address the good module and proper operational response will be checked.

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:

Host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties. For standalone mode, reference the guidance in D04 Module Integration Guide and for simultaneous mode7; see D02 Module Q&A Question 12, which permits the host manufacturer to confirm compliance.

2.12 How to make changes:

Only Grantees are permitted to make permissive changes, need any support please use below information:

<https://www.usiglobal.com/en/enquiry-form>

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.

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.

CAN ICES-3(B)/ NMB-3(B)

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

The County Code Selection feature is disabled for products marketed in the US/ Canada.

This radio transmitter (IC: 10293A-WMBACBM25 / Model: WM-BAC-BM-25-FF4) has been approved by ISED to operate with the antenna type listed in section 2.2 with maximum permissible gain 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.

Cet appareil et son antenne ne doivent pas être situés ou fonctionner en conjonction avec une autre antenne ou un autre émetteur, exception faites des radios intégrées qui ont été testées.

La fonction de sélection de l'indicatif du pays est désactivée pour les produits commercialisés aux États-Unis et au Canada.

Le présent émetteur radio (IC: 10293A-WMBACBM25 / Model: WM-BAC-BM-25-FF4) a été approuvé par ISED 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, sont strictement interdits pour l'exploitation de l'émetteur.

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.

Label and compliance information

The final end product must be labeled in a visible area with the following: "Contains IC: 10293A-WMBACBM25". The grantee's IC ID can be used only when all IC compliance requirements are met.

Étiquette et informations de conformité

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC:

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10293A-WMBACBM25". L'identifiant IC du bénéficiaire ne peut être utilisé que lorsque toutes les exigences de conformité IC sont remplies.

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.



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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