



Project No: TM-2411000242P
Report No.: TMWK2411004019KS

FCC ID: COF-WMBACBM25

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RF Exposure Evaluation Report

FCC 47 CFR § 2.1091

for

802.11a/b/g/n/ac 1x1 + BT 5.0 Module

**Model: WM-BAC-BM-25-FF4, WM-BAC-BM-25,
WM-BAC-BM-25_FF2, WM-BAC-BM-25-FF3**

Prepared for:

Universal Global Scientific Industrial Co., Ltd.

No. 141, Lane 351, Sec. 1, Taiping Road, Tsao-tuen, Nantou County 542007, Taiwan

Prepared by

Compliance Certification Services Inc.

Wugu Laboratory

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New Taipei City, Taiwan**

Issued Date: December 24, 2024

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	December 24, 2024	Initial Issue	ALL	Peggy Tsai

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1 Attestation of Test Results

Applicant	Universal Global Scientific Industrial Co., Ltd. No. 141, Lane 351, Sec. 1, Taiping Road, Tsao-tuen, Nantou County 542007, Taiwan
Manufacturer	Universal Global Scientific Industrial Co., Ltd. No. 141, Lane 351, Sec. 1, Taiping Road, Tsao-tuen, Nantou County 542007, Taiwan
Model Name	WM-BAC-BM-25-FF4, WM-BAC-BM-25, WM-BAC-BM-25_FF2, WM-BAC-BM-25-FF3
Applicable Standards	FCC 47 CFR § 2.1091 FCC 47 CFR § 1.1307 FCC 47 CFR § 1.1310 Published RF exposure KDB procedures
Receive EUT Date:	November 15, 2024
Compliance Certification Services Inc. , tested the above equipment in accordance with the requirements set forth in the above standards. Determination of compliance is based on the results of the compliance measurement,not taking into account measurement instrumentation uncertainty.All indications of Pass/Fail in this report are opinions expressed by Compliance Certification Services Inc, based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.	
Approved & Released By: 	
Sky Zhou Asst. Section Manager	

2 Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1091, the following FCC Published RF exposure [KDB](#) procedures:

- 447498 D04 Interim General RF Exposure Guidance v01
- 865664 D02 RF Exposure Reporting v01r02



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3 Device Under Test (DUT) Information

3.1 DUT Description

Product	802.11a/b/g/n/ac 1x1 + BT 5.0 Module
Trade Name	USI
Test model	WM-BAC-BM-25-FF4
Series model	WM-BAC-BM-25, WM-BAC-BM-25_FF2, WM-BAC-BM-25-FF3
Model Discrepancy	WM-BAC-BM-25-FF4, Change Antenna matching.
EUT Serial #	88850195490224110480039
Software Version	dhd-100.10.65.0
Hardware Version	V30
Sample Stage	Identical prototype

3.2 Wireless Technologies

Frequency bands	☒ Bluetooth: 2402MHz-2480MHz ☒ 802.11b/g/n HT20: 2412MHz ~ 2462 MHz ☒ 802.11n HT40: 2422MHz ~ 2452MHz ☒ 802.11a/n HT20: 5180MHz ~ 5240MHz / 5260MHz ~ 5320MHz / 5500MHz ~ 5720MHz / 5745MHz ~ 5825MHz ☒ 802.11ac VHT20: 5180MHz ~ 5240MHz / 5260MHz ~ 5320MHz / 5500MHz ~ 5720MHz / 5745MHz ~ 5825MHz ☐ 802.11ax HE20: 5180MHz ~ 5240MHz / 5260MHz ~ 5320MHz / 5500MHz ~ 5720MHz / 5745MHz ~ 5825MHz ☒ 802.11n HT40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz / 5510MHz ~ 5710MHz / 5755MHz ~ 5795MHz ☒ 802.11ac VHT40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz / 5510MHz ~ 5710MHz / 5755MHz ~ 5795MHz ☐ 802.11ax HE40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz / 5510MHz ~ 5710MHz / 5755MHz ~ 5795MHz ☒ 802.11ac VHT80: 5210MHz / 5290MHz / 5530MHz ~ 5690MHz / 5775MHz ☐ 802.11ac VHT160: 5250 MHz / 5570 MHz ☐ Others																												
Exposure classification	☐ Occupational/Controlled exposure ☒ General Population/Uncontrolled exposure																												
Maximum Tune up power	<table border="1"> <tr> <td>BT</td> <td>2402-2480 MHz</td> <td>10.02 dBm</td> <td>(10.046 mW)</td> </tr> <tr> <td>BLE</td> <td>2402-2480 MHz</td> <td>7.17 dBm</td> <td>(5.21 mW)</td> </tr> <tr> <td>WIFI 2.4GHz</td> <td>2412-2462 MHz</td> <td>20.28 dBm</td> <td>(106.66 mW)</td> </tr> <tr> <td>WIFI 5GHz (Band 1)</td> <td>5180-5240 MHz</td> <td>19.65 dBm</td> <td>(92.257 mW)</td> </tr> <tr> <td>WIFI 5GHz (Band 2)</td> <td>5260-5320 MHz</td> <td>19.17 dBm</td> <td>(82.604 mW)</td> </tr> <tr> <td>WIFI 5GHz (Band 3)</td> <td>5500-5700 MHz</td> <td>19.31 dBm</td> <td>(85.31 mW)</td> </tr> <tr> <td>WIFI 5GHz (Band 4)</td> <td>5745-5825 MHz</td> <td>21.77 dBm</td> <td>(150.31 mW)</td> </tr> </table>	BT	2402-2480 MHz	10.02 dBm	(10.046 mW)	BLE	2402-2480 MHz	7.17 dBm	(5.21 mW)	WIFI 2.4GHz	2412-2462 MHz	20.28 dBm	(106.66 mW)	WIFI 5GHz (Band 1)	5180-5240 MHz	19.65 dBm	(92.257 mW)	WIFI 5GHz (Band 2)	5260-5320 MHz	19.17 dBm	(82.604 mW)	WIFI 5GHz (Band 3)	5500-5700 MHz	19.31 dBm	(85.31 mW)	WIFI 5GHz (Band 4)	5745-5825 MHz	21.77 dBm	(150.31 mW)
BT	2402-2480 MHz	10.02 dBm	(10.046 mW)																										
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Antenna Specification	Type: Ceramic Chip Antenna Brand / Model: YAGEO / ANT3216A063R2455A (1) Bluetooth: Gain: 1.59 dBi (2) WIFI 2.4GHz: Gain: 1.59 dBi (3) WIFI 5GHz: Band1: Gain: 2.23 dBi Band2: Gain: 2.23 dBi Band3: Gain: 2.23 dBi Band4: Gain: 2.23 dBi Antenna Gain: <table><tr><td>Bluetooth</td><td>1.59 dBi</td><td>(Numeric gain: 1.44)</td><td>Worst</td></tr><tr><td>2.4GHz:</td><td>1.59 dBi</td><td>(Numeric gain: 1.44)</td><td>Worst</td></tr><tr><td>5GHz(Band 1)</td><td>2.23 dBi</td><td>(Numeric gain: 1.67)</td><td>Worst</td></tr><tr><td>5GHz(Band 2)</td><td>2.23 dBi</td><td>(Numeric gain: 1.67)</td><td>Worst</td></tr><tr><td>5GHz(Band 3)</td><td>2.23 dBi</td><td>(Numeric gain: 1.67)</td><td>Worst</td></tr><tr><td>5GHz(Band 4)</td><td>2.23 dBi</td><td>(Numeric gain: 1.67)</td><td>Worst</td></tr></table>	Bluetooth	1.59 dBi	(Numeric gain: 1.44)	Worst	2.4GHz:	1.59 dBi	(Numeric gain: 1.44)	Worst	5GHz(Band 1)	2.23 dBi	(Numeric gain: 1.67)	Worst	5GHz(Band 2)	2.23 dBi	(Numeric gain: 1.67)	Worst	5GHz(Band 3)	2.23 dBi	(Numeric gain: 1.67)	Worst	5GHz(Band 4)	2.23 dBi	(Numeric gain: 1.67)	Worst
Bluetooth	1.59 dBi	(Numeric gain: 1.44)	Worst																						
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5GHz(Band 3)	2.23 dBi	(Numeric gain: 1.67)	Worst																						
5GHz(Band 4)	2.23 dBi	(Numeric gain: 1.67)	Worst																						
Class II Permissive Change	1. Modify Product Name: 802.11a/b/g/n/ac 1x1 + BT 5.0 Module 2. Add one Model Name: WM-BAC-BM-25-FF4 3. Change Antenna Matching. 4. Update Firmware.																								

Notes:

- For more details, please refer to the User's manual of the EUT.
- Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
- Disclaimer: Variant information between/among trademarks is provided by the applicant, test results of this report are applicable to the sample EUT received of main test model name.
- The power referred the Tune up power of the test report RFBERD-WTW-P21100651A, RFBERD-WTW-P21100651A-1, RFBERD-WTW-P21100651A-2 and RFBERD-WTW-P21100651A-3 for RF Exposure assessment purpose.

4 Maximum Permissible Exposure

4.1 Limits for Maximum Permissible Exposure (MPE)

Table 1 - Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	* 100	6
3.0-30	1842/f	4.89/f	* 900/f ²	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* 100	30
1.34-30	824/f	2.19/f	* 180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
<u>1,500-100,000</u>			1.0	30

4.2 MPE Calculation Method

Calculation

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{377}$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{377 d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{377 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \text{ Equation 1}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

If, Substituting the MPE safe distance using d = 20 cm into Equation 1:

$$S = 0.000199 \times P \times G$$

4.3 MPE EXEMPTION

- (A) The available maximum time-averaged power is no more than 1 mW
- (B) The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

- (C) Using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$.
1.34-30	$3,450 R^2/f^2$.
30-300	$3.83 R^2$.
300-1,500	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.
Note: R is in meters, f is in MHz.	

4.4 Multiple RF sources

In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation),

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

5 MPE Exemption Option B

Band	Frequency (MHz)	R(m)	Max. power (dBm)	G(dBi)	Max. EIRP (dBm)	Max. ERP (dBm)	Max. ERP (mW)	ERP Threshold (mW)	MPE Exemption
BT	2402-2480	0.2	10.02	1.59	11.61	9.46	8.831	3060	Complies
BLE	2402-2480	0.2	7.17	1.59	8.76	6.61	4.581	3060	Complies
WLAN	2412-2462	0.2	20.28	1.59	21.87	19.72	93.756	3060	Complies
	5180-5240	0.2	19.65	2.23	21.88	19.73	93.972	3060	Complies
	5260-5320	0.2	19.17	2.23	21.40	19.25	84.140	3060	Complies
	5500-5700	0.2	19.31	2.23	21.54	19.39	86.896	3060	Complies
	5745-5825	0.2	21.77	2.23	24.00	21.85	153.109	3060	Complies

6 Simultaneous Transmission Analysis

In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation),

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations		
	1	DTS	+	BT
	2	U-NII	+	BT

6.1 Sum of the WiFi 2.4GHz + Bluetooth

Mode	Frequency (MHz)	Max ERP(mW)	ERP Threshold(mW)	simultaneous Transmission	simultaneous Transmission Limit
WiFi 2.4GHz	2412-2462	93.756	3060	0.034	≤1
Bluetooth	2402-2480	8.831	3060		

6.2 Sum of the WiFi 5GHz + Bluetooth

Mode	Frequency (MHz)	Max ERP(mW)	ERP Threshold(mW)	simultaneous Transmission	simultaneous Transmission Limit
WiFi 5GHz	5745-5825	153.109	3060	0.053	≤1
Bluetooth	2402-2480	8.831	3060		

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7 Facilities

All measurement facilities used to collect the measurement data are located at

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan.

☐ No. 12, Ln. 116, Wugong 3rd Rd., Wugu Dist., New Taipei City, Taiwan.

--End of Test Report--