



Project No.: TM-2406000276P
Report No.: TMWK2407002346KS

FCC ID: PANBM3086

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RF Exposure Evaluation Report

FCC 47 CFR § 2.1091

for

Bluetooth v5.4 APTX LE Audio TX Module

Model: BM-3086, BM-3086E

Prepared for:

CC&C Technologies, Inc.

8F, No.150, Jian Yi Rd, Zhonghe District, New Taipei City, 235, Taiwan

Prepared by

Compliance Certification Services Inc.

Wugu Laboratory

No.11, Wugong 6th Rd., Wugu Dist.,

New Taipei City, Taiwan

Issued Date: December 23, 2024

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	August 08, 2024	Initial Issue	ALL	Allison Chen
01	August 22, 2024	See the following Note Rev.(01)	P.6-8	Allison Chen
02	September 16, 2024	See the following Note Rev.(02)	P.6-7	Allison Chen
03	September 24, 2024	See the following Note Rev.(03)	P.14	Allison Chen
04	December 23, 2024	See the following Note Rev.(04)	P.14	Allison Chen

- Note:**
- Rev.(01)**
1. Modify antenna information and reference report number in section 3.1 and 3.2.
- Rev.(02)**
1. Modify antenna type in section 3.1 and 3.2.
- Rev.(03)**
1. Added simultaneous transmission analysis in section 6.
- Rev.(04)**
1. Modify mode description in section 6.1.


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1 Attestation of Test Results

Applicant	CC&C Technologies, Inc. 8F, No.150, Jian Yi Rd, Zhonghe District, New Taipei City, 235, Taiwan
Model Name	BM-3086, BM-3086E
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:	June 24, 2024
<p>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.</p>	
<p>Approved & Released By:</p> 	
<p>Sky Zhou Asst. Section Manager</p>	

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

3 Device Under Test (DUT) Information

3.1 DUT Description

Product	Bluetooth v5.4 APTX LE Audio TX Module	
Trade Name	CC&C	
Model No.	BM-3086, BM-3086E	
Model Discrepancy	For detailed description of the differences between series models, please see the table below:	
	Model name	Difference
	BM-3086	Chip antenna
	BM-3086E	embedded antenna
Software Version	01	
Hardware Version	0B	
Sample Stage	Identical prototype	

3.2 Wireless Technologies

Frequency bands	<input checked="" type="checkbox"/> Bluetooth: 2402MHz-2480MHz <input type="checkbox"/> 802.11b/g/n HT20: 2412MHz ~ 2462 MHz <input type="checkbox"/> 802.11n HT40/ac VHT40/ax HE40: 2422MHz ~ 2452MHz <input type="checkbox"/> 802.11a/n HT20: 5180MHz ~ 5240MHz / 5260MHz ~ 5320MHz / 5500MHz ~ 5700MHz / 5745MHz ~ 5825MHz <input type="checkbox"/> 802.11ac VHT20: 5180MHz ~ 5240MHz / 5260MHz ~ 5320MHz / 5500MHz ~ 5700MHz / 5745MHz ~ 5825MHz <input type="checkbox"/> 802.11ax HE20: 5180MHz ~ 5240MHz / 5260MHz ~ 5320MHz / 5500MHz ~ 5700MHz / 5745MHz ~ 5825MHz <input type="checkbox"/> 802.11n HT40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz / 5510MHz ~ 5670MHz / 5755MHz ~ 5795MHz <input type="checkbox"/> 802.11ac VHT40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz / 5510MHz ~ 5670MHz / 5755MHz ~ 5795MHz <input type="checkbox"/> 802.11ax HE40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz / 5510MHz ~ 5670MHz / 5755MHz ~ 5795MHz <input type="checkbox"/> 802.11ac VHT80: 5210MHz / 5290MHz / 5530MHz ~ 5610MHz / 5775MHz <input type="checkbox"/> 802.11ax HE80: 5210MHz / 5290MHz / 5530MHz ~ 5610MHz / 5775MHz <input type="checkbox"/> 802.11ac VHT160: 5250 MHz / 5570 MHz <input type="checkbox"/> 802.11ac VHT160: 5250 MHz / 5570 MHz <input type="checkbox"/> 802.11ax HE160: 5250 MHz / 5570 MHz <input type="checkbox"/> Others: Zigbee: 2405MHz-2480MHz
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure <input checked="" type="checkbox"/> General Population/Uncontrolled exposure
Antenna Specification	<p>(1) Type: Chip Antenna Brand / Model: ACX / AT3216-B2R7HAAT/LF Gain: 0.5 dBi</p> <p>(2) Type: embedded antenna Brand / Model: LYNwave / ALA120-051026-00 Gain: 3.2 dBi</p> <p>Antenna Gain: BT&BLE 3.20 dBi (Numeric gain: 2.09) worst</p>

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Maximum Measurement Average Power	BT	6.89 dBm	(4.89 mW)
	BLE	6.87 dBm	(4.86 mW)
Maximum Tune up power	BT	7.50 dBm	(5.62 mW)
	BLE	7.50 dBm	(5.62 mW)

Notes:

1. For more details, please refer to the User's manual of the EUT.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
3. The tune up power referred the AVG power of the test report TMWK2406002056KR and TMWK2407002365KR 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

Bluetooth

Mode	Frequency (MHz)	R(m)	Max Tune-up power (dBm)	G(dBi)	Max Tune-up EIRP (dBm)	Max Tune-up ERP (dBm)	Max Tune-up ERP (mW)	ERP Threshold (mW)	MPE Exemption
BT	2480.00	0.2	7.5	3.20	10.70	8.55	7.161	3060	Complies
BLE	2480.00	0.2	7.5	3.20	10.70	8.55	7.161	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	BLE	+ Bluetooth

6.1 Sum of the BLE & Bluetooth

BLE & Bluetooth

Mode	Frequency (MHz)	Max Tune-up ERP(mW)	ERP Threshold(mW)	simultaneous Transmission	simultaneous Transmission Limit
BT	2480.00	6.383	3060	0.004	≤1
BLE	2480.00	6.383	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.

--End of Test Report--