RF Exposure Evaluation Declaration

FCC ID:	2ALGLM2000
Applicant:	CASSIA NETWORKS INC.
Product:	Cassia Bluetooth Gateway
Model No.:	M2000
Brand Name:	CASSIA
FCC Rule Part(s):	FCC Part 2.1091
Result:	Complies
Evaluation Date:	2024-11-05

Reviewed By: Denise Zhou

Approved By: Robin Wu

Revision History

Report No.	Version	Description	Issue Date	Note
2408RSU011-U3	V01	Initial Report	2024-11-21	Valid

CONTENTS

1. General Information

1.1. Applicant

CASSIA NETWORKS INC.

97 E. Brokaw Road, Suite 130, San Jose, CA 95112

1.2. Manufacturer

CASSIA NETWORKS INC.

97 E. Brokaw Road, Suite 130, San Jose, CA 95112

1.3. Testing Facility

☒	**Test Site – MRT Suzhou Laboratory**				
	Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China **Laboratory Location (Suzhou - SIP)** 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China **Laboratory Location (Suzhou - Wujiang)** Building 1, No.1 Xingdong Road, Wujiang, Suzhou, Jiangsu, People's Republic of China				
	Laboratory Accreditations				
	A2LA: 3628.01		CNAS: L10551		
	FCC: CN1166		ISED: CN0001		
	VCCI:	☐R-20025	☐G-20034	☐C-20020	☐T-20020
		☐R-20141	☐G-20134	☐C-20103	☐T-20104
☐	**Test Site – MRT Shenzhen Laboratory**				
	Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China				
	Laboratory Accreditations				
	A2LA: 3628.02		CNAS: L10551		
	FCC: CN1284		ISED: CN0105		
☐	**Test Site – MRT Taiwan Laboratory**				
	Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)				
	Laboratory Accreditations				
	TAF: 3261				
	FCC: 291082, TW3261		ISED: TW3261		

1.4. Product Information

Product Name	Cassia Bluetooth Gateway
Model No.	M2000
Wi-Fi Specification	802.11b/g/n
Bluetooth Specification	V5.1, BLE only
3GPP Specification	LTE-M1: Band 2, 4, 5, 12, 13, 25, 26, 66, 85 NB-IoT: Band 2, 4, 5, 12, 13, 25, 66, 71, 85
GNSS Specification	GPS, GLONASS, QZSS
Antenna Information	Refer to Section 1.5
Power Type	By AC/DC Adapter
Accessory	
Adapter	Model No.: 6A-121WP05 Input Power: 100 - 240V ~ 50/60Hz, 0.6A Output Power: 5V ⎓ 2.0A, 10W
Integrated Module Information	
Wi-Fi Module	Module Name: Wi-Fi & Bluetooth Internet of Things Module Model No: ESP32-WROVER-E Brand Name: ESPRESSIF
Cellular Module	Module Name: LTE Cat M1 & Cat NB2 Module Model No: BG95-M6 Brand Name: Quectel
Remark: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Antenna Details

Technology	Frequency Range (MHz)	Max Peak Gain (dBi)
LTE-M1 Band 2	1850 ~ 1910	2.36
LTE-M1 Band 4	1710 ~ 1755	3.85
LTE-M1 Band 5	824 ~ 849	2.68
LTE-M1 Band 12	699 ~ 716	2.49
LTE-M1 Band 13	777 ~ 787	2.49
LTE-M1 Band 25	1850 ~ 1915	2.36
LTE-M1 Band 26	814 ~ 849	2.68
LTE-M1 Band 66	1710 ~ 1780	3.85
LTE-M1 Band 85	698 ~ 716	2.49
NB-IoT Band 2	1850 ~ 1910	2.36
NB-IoT Band 4	1710 ~ 1755	3.85
NB-IoT Band 5	824 ~ 849	2.68
NB-IoT Band 12	699 ~ 716	2.49
NB-IoT Band 13	777 ~ 787	2.49
NB-IoT Band 25	1850 ~ 1915	2.36
NB-IoT Band 66	1710 ~ 1780	3.85
NB-IoT Band 71	663 ~ 698	2.49
NB-IoT Band 85	698 ~ 716	2.49
2.4GHz Wi-Fi	2412 ~ 2472	3.40
BLE	2402 ~ 2480	1.00

Note: The antenna gain is from antenna data sheet provided by the manufacturer.

1.6. Device Classification

According to the user manual, this device is classified as a Mobile Device. So, the RF exposure evaluation requirements of § 2.1091 for mobile device exposure conditions subject to MPE limits.

1.7. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 2.1091 & KDB 447498 D04 Interim General RF Exposure Guidance v01

2. RF Exposure Evaluation

2.1. Limits

According to FCC §1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

Limits For Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
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 Exposures				
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
1,500-100,000	--	--	1.0	<30

f= frequency in MHz. * = Plane-wave equivalent power density.

2.2. MPE Exemptions

For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph §1.1307(b)(2) of this section): A single RF source is exempt if:

(Option A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph §1.1307(b)(3)(ii)(A) of this section.
Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(ii)(A);

(Option B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P (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 is given by:

$\mathrm{P\,th(mW)} = \{\mathrm{ERP_{20cm}(d\ /\ 20cm)^{x}}$ d ≤ 20cm

$\mathrm{P\,th(mW)} = \{\mathrm{ERP_{20cm}}$ 20cm < d ≤ 40cm

Where

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

and

$\mathrm{ERP_{20cm}(mW)} = \{2040\mathrm{f}$ 0.3GHz ≤ f < 1.5GHz

$\mathrm{ERP_{20cm}(mW)} = \{3060$ 1.5GHz ≤ f ≤ 6GHz

(Option C) Or 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 λ/2π, 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 λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to §1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1920R^2$
1.34-30	$3450R^2/f^2$
30-300	$3.83R^2$
300-1,500	$0.0128R^2f$
1,500-100,000	$19.2R^2$

For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph §1.1307(b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(i)(A).

(B) 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.

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

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for P_{th}, including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

$\boldsymbol{P_i}$ = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source *i* at a distance between 0.5 cm and 40 cm (inclusive).

$\boldsymbol{P_{th,i}}$ = the exemption threshold power (P_{th}) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed, mobile, or portable RF source *i*.

$\boldsymbol{ERP_j}$ = the ERP of fixed, mobile, or portable RF source *j*.

ERP$_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source *j*, at a distance of at least λ/2π according to the applicable formula of paragraph §1.1307(b)(3)(i)(C) of this section.

Evaluated$_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source *k* either in the device or at the transmitter site from an existing evaluation at the location of exposure.

Exposure Limit$_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source *k*, as applicable from §1.1310 of this chapter.

2.3. Calculated Result

Product	Cassia Bluetooth Gateway
Test Item	RF Exposure Evaluation

Test Mode	Frequency Band (MHz)	Tune-up Conducted Power (dBm)	Antenna Gain (dBi)	Tune-up ERP (dBm)	Maximum Power (dBm)
LTE-M1 Band 2	1850 ~ 1910	25.00	2.36	25.21	25.21
LTE-M1 Band 4	1710 ~ 1755	25.00	3.85	26.70	26.70
LTE-M1 Band 5	824 ~ 849	25.00	2.68	25.53	25.53
LTE-M1 Band 12	699 ~ 716	25.00	2.49	25.34	25.34
LTE-M1 Band 13	777 ~ 787	25.00	2.49	25.34	25.34
LTE-M1 Band 25	1850 ~ 1915	25.00	2.36	25.21	25.21
LTE-M1 Band 26	814 ~ 849	25.00	2.68	25.53	25.53
LTE-M1 Band 66	1710 ~ 1780	25.00	3.85	26.70	26.70
LTE-M1 Band 85	698 ~ 716	25.00	2.49	25.34	25.34
NB-IoT Band 2	1850 ~ 1910	25.00	2.36	25.21	25.21
NB-IoT Band 4	1710 ~ 1755	25.00	3.85	26.70	26.70
NB-IoT Band 5	824 ~ 849	25.00	2.68	25.53	25.53
NB-IoT Band 12	699 ~ 716	25.00	2.49	25.34	25.34
NB-IoT Band 13	777 ~ 787	25.00	2.49	25.34	25.34
NB-IoT Band 25	1850 ~ 1915	25.00	2.36	25.21	25.21
NB-IoT Band 66	1710 ~ 1780	25.00	3.85	25.53	25.53
NB-IoT Band 71	663 ~ 698	25.00	2.49	25.34	25.34
NB-IoT Band 85	698 ~ 716	25.00	2.49	25.34	25.34
2.4GHz Wi-Fi	2412 ~ 2472	27.00	3.40	28.25	28.25
BLE	2402 ~ 2480	20.50	1.00	19.35	20.50

Notes:

1. The Tune-up Power was declared by manufacturer.
2. Tune-up ERP = Tune up Conducted Power + Antenna Gain - 2.15.

Option B

Test Mode	Frequency Band (MHz)	Maximum Power (dBm)	R (m)	Maximum Power (mW)	Thresholds ERP (mW)
LTE-M1 Band 2	1850 ~ 1910	25.21	0.2	331.89	3060
LTE-M1 Band 4	1710 ~ 1755	26.70	0.2	467.74	3060
LTE-M1 Band 5	824 ~ 849	25.53	0.2	357.27	1681
LTE-M1 Band 12	699 ~ 716	25.34	0.2	341.98	1426
LTE-M1 Band 13	777 ~ 787	25.34	0.2	341.98	1585
LTE-M1 Band 25	1850 ~ 1915	25.21	0.2	331.89	3060
LTE-M1 Band 26	814 ~ 849	25.53	0.2	357.27	1661
LTE-M1 Band 66	1710 ~ 1780	26.70	0.2	467.74	3060
LTE-M1 Band 85	698 ~ 716	25.34	0.2	341.98	1424
NB-IoT Band 2	1850 ~ 1910	25.21	0.2	331.89	3060
NB-IoT Band 4	1710 ~ 1755	26.70	0.2	467.74	3060
NB-IoT Band 5	824 ~ 849	25.53	0.2	357.27	1681
NB-IoT Band 12	699 ~ 716	25.34	0.2	341.98	1426
NB-IoT Band 13	777 ~ 787	25.34	0.2	341.98	1585
NB-IoT Band 25	1850 ~ 1915	25.21	0.2	331.89	3060
NB-IoT Band 66	1710 ~ 1780	25.53	0.2	357.27	3060
NB-IoT Band 71	663 ~ 698	25.34	0.2	341.98	1353
NB-IoT Band 85	698 ~ 716	25.34	0.2	341.98	1424
2.4GHz Wi-Fi	2412 ~ 2472	28.25	0.2	668.34	3060
BLE	2402 ~ 2480	20.50	0.2	112.20	3060

Notes:

1. R is from user manual.
2. The EUT supports LTE-M1 / NB-IoT+Wi-Fi+BLE simultaneous transmissions, therefore, the worst-case total exposure ratios = 341.98/1353 + 668.34/3060 + 112.20/3060 =0.5078 < 1.

CONCLUSION:

The device qualifies for RF exposure test exemption at 20cm distance.

The End