FCC RF Exposure Evaluation

1. Product Information

FCC ID	:	2ABRU-LE2340RKP
Product name	:	BDE BLE Module Based on CC2340R
Test Model	:	BDE-LE2340R52KPA32
Additional Model No.	:	BDE-LE2340R52KPU32, BDE-LE2340R52KPN32, BDE-LE2340R52KPA0, BDE-LE2340R52KPU0, BDE-LE2340R52KPN0, BDE-LE2340R52KPA32-IN, BDE-LE2340R52KPU32-IN, BDE-LE2340R52KPN32-IN, BDE-LE2340R52KPA0-IN, BDE-LE2340R52KPU0-IN, BDE-LE2340R52KPN0-IN, BDE-LE2340R22KPA32, BDE-LE2340R22KPU32, BDE-LE2340R22KPN32, BDE-LE2340R22KPA0, BDE-LE2340R22KPU0, BDE-LE2340R22KPN0, BDE-LE2340R22KPA32-IN, BDE-LE2340R22KPU32-IN, BDE-LE2340R22KPN32-IN, BDE-LE2340R22KPA0-IN, BDE-LE2340R22KPU0-IN, BDE-LE2340R22KPN0-IN,BDE-LE2340R53KPA32, BDE-LE2340R53KPU32, BDE-LE2340R53KPN32, BDE-LE2340R53KPA0, BDE-LE2340R53KPU0, BDE-LE2340R53KPN0, BDE-LE2340R53KPA32-IN, BDE-LE2340R53KPU32-IN, BDE-LE2340R53KPN32-IN, BDE-LE2340R53KPA0-IN, BDE-LE2340R53KPU0-IN, BDE-LE2340R53KPN0-IN
Model Declaration	:	See model list
Power supply	:	Input: DC 3.3V
Hardware Version	:	V1
Software Version	:	7.40.00
Bluetooth		
Frequency Range	:	2402MHz~2480MHz
Channel Number	:	40 channels for Bluetooth V5.4(125Kbps, 500Kbps, 1Mbps, 2Mbps)
Channel Spacing	:	2MHz for Bluetooth V5.4 (125Kbps, 500Kbps, 1Mbps, 2Mbps)
Modulation Type	:	GFSK for Bluetooth V5.4 (125Kbps, 500Kbps, 1Mbps, 2Mbps)
Bluetooth Version	:	V5.4
Antenna Description	:	Dipole Antenna, 3.0dBi(Max.) PCB Antenna, 0.96dBi(Max.)
Exposure category	:	General population/uncontrolled environment
EUT Type	:	Production Unit
Device Type	:	Moblie Device
Date of Test	:	April 26, 2024 ~ February 12, 2025
Date of Report	:	February 13, 2025

Model list:

Model Number	Orderable Part Number	Chipset	Flash (KB)	SRAM (KB)	Antenna on 2.4G	Operating Temperature (℃)	On-Board SPI Nor Flash Support
BDE-LE2340RKP	BDE-LE2340R52KPA32	CC2340R52KP	512	36	PCB Trace Antenna	-40℃ ~85℃	32Mbit
	BDE-LE2340R52KPU32				U.FL Connector		
	BDE-LE2340R52KPN32				ANT Pin		
	BDE-LE2340R52KPA0				PCB Trace Antenna		Not Included
	BDE-LE2340R52KPU0				U.FL Connector		
	BDE-LE2340R52KPN0				ANT Pin		
	BDE-LE2340R52KPA32-IN				PCB Trace Antenna	-40℃ ~105℃	32Mbit
	BDE-LE2340R52KPU32-IN				U.FL Connector		
	BDE-LE2340R52KPN32-IN				ANT Pin		
	BDE-LE2340R52KPA0-IN				PCB Trace Antenna		Not Included
	BDE-LE2340R52KPU0-IN				U.FL Connector		
	BDE-LE2340R52KPN0-IN				ANT Pin		
	BDE-LE2340R22KPA32	CC2340R22KP	256	36	PCB Trace Antenna	-40℃ ~85℃	32Mbit
	BDE-LE2340R22KPU32				U.FL Connector		
	BDE-LE2340R22KPN32				ANT Pin		
	BDE-LE2340R22KPA0				PCB Trace Antenna		Not Included
	BDE-LE2340R22KPU0				U.FL Connector		
	BDE-LE2340R22KPN0				ANT Pin		
	BDE-LE2340R22KPA32-IN				PCB Trace Antenna	-40℃ ~105℃	32Mbit
	BDE-LE2340R22KPU32-IN				U.FL Connector		
	BDE-LE2340R22KPN32-IN				ANT Pin		
	BDE-LE2340R22KPA0-IN				PCB Trace Antenna		Not Included
	BDE-LE2340R22KPU0-IN				U.FL Connector		
	BDE-LE2340R22KPN0-IN				ANT Pin		
	BDE-LE2340R53KPA32	CC2340R53KP	512	64	PCB Trace Antenna	-40℃ ~85℃	32Mbit
	BDE-LE2340R53KPU32				U.FL Connector		
	BDE-LE2340R53KPN32				ANT Pin		
	BDE-LE2340R53KPA0				PCB Trace Antenna		Not Included
	BDE-LE2340R53KPU0				U.FL Connector		
	BDE-LE2340R53KPN0				ANT Pin		
	BDE-LE2340R53KPA32-IN				PCB Trace Antenna	-40℃ ~105℃	32Mbit
	BDE-LE2340R53KPU32-IN				U.FL Connector		
	BDE-LE2340R53KPN32-IN				ANT Pin		
	BDE-LE2340R53KPA0-IN				PCB Trace Antenna		Not Included
	BDE-LE2340R53KPU0-IN				U.FL Connector		
	BDE-LE2340R53KPN0-IN				ANT Pin		

Identities and differences:

The above models have same PCB board and structure, The differences between the above models mainly lie in the main chip model(note: only the Flash and SRAM sizes are different between the main chip models), antenna interface location, operating temperature, and whether an external 32Mbit SPI Flash is configured.

2. Evaluation Method

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modelled or measured field strengths or power density, is ≤ 1.0. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

3. Limit

3. 1 Refer Evaluation Method

ANSI C95.1–2019: IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz

FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: mobile devices.

3. 2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
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 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Uncontrolled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	($180/f^2$)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

F=frequency in MHz

*=Plane-wave equivalent power density

4. MPE Calculation Method

Predication of MPE limit at a given distance
Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$
Where: S=power density
P=power input to antenna
G=power gain of the antenna in the direction of interest relative to an isotropic radiator
R=distance to the center of radiation of the antenna

5. Antenna Information

EUT can only use antennas certificated as follows provided by manufacturer;

Internal/External Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
External	Dipole Antenna	2400-2500 MHz	3.0dBi	Bluetooth Antenna
Internal	PCB Antenna	2400-2500 MHz	0.96dBi	Bluetooth Antenna

6.Conducted Power Results

< BLE_1Mbps >

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	5.48
	19	2440	5.79
	39	2480	5.87

< BLE_2Mbps >

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	5.44
	19	2440	5.74
	39	2480	5.81

< BLE_125Kbps >

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	6.88
	19	2440	7.03
	39	2480	6.99

< BLE_500Kbps >

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	6.88
	19	2440	7.02
	39	2480	7

7.Manufacturing Tolerance

< BLE_1Mbps >

GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	5.0	5.0	5.0
Tolerance ±(dB)	1.0	1.0	1.0

< BLE_2Mbps >

GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	5.0	5.0	5.0
Tolerance ±(dB)	1.0	1.0	1.0

< BLE_125Kbps >

GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	6.0	7.0	6.0
Tolerance ±(dB)	1.0	1.0	1.0

< BLE_500Kbps >

GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	6.0	7.0	7.0
Tolerance ±(dB)	1.0	1.0	1.0

8.Evaluation Results

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, r =20cm, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
BLE_1Mbps	6.0	3.9811	3	1.9953	0.0016	1.0000
BLE_2Mbps	6.0	3.9811	3	1.9953	0.0016	1.0000
BLE_125Kbps	8.0	6.3096	3	1.9953	0.0025	1.0000
BLE_500Kbps	8.0	6.3096	3	1.9953	0.0025	1.0000

Remark:

1. Output power including tune-up tolerance;

2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;

3. MPE evaluate distance is 20cm from user manual provide by manufacturer.

9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

10. Description of Test Facility

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier is CN0071.

CNAS Registration Number is L4595.

Test Firm Registration Number: 254912.

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