Maximum Permissible Exposure Report

1. Product Information

FCC ID	:	2A4FR-LS4G-4-C
EUT	:	Stick Logger(4G)
Test Model	:	LS4G-4-C
Additional Model No.	:	LS4G-4
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power Supply	:	Input: DC 5-12V
Hardware Version	:	/
Software Version	:	/
Bluetooth		
Frequency Range	:	2402MHz~2480MHz
Channel Number	:	40 channels for Bluetooth V5.0 (DTS)
Channel Spacing	:	2MHz for Bluetooth V5.0 (DTS)
Modulation Type	:	GFSK for Bluetooth V5.0 (DTS)
Bluetooth Version	:	V5.0
Antenna Description	:	PCB Antenna, 3.97dBi(Max.)
LTE		
Support Band	:	☒ E-UTRA Band 2(U.S.-Band) ☒ E-UTRA Band 4(U.S.-Band) ☒ E-UTRA Band 5(U.S.-Band) ☒ E-UTRA Band 12(U.S.-Band) ☒ E-UTRA Band 13(U.S.-Band) ☒ E-UTRA Band 14(U.S.-Band) ☒ E-UTRA Band 66(U.S.-Band)
LTE Release Version	:	R9
Type Of Modulation	:	QPSK/16QAM
Antenna Description	:	External Antenna 2.9dBi (max.) For E-UTRA Band 2 3.5dBi (max.) For E-UTRA Band 4 1.8dBi (max.) For E-UTRA Band 5 -0.06dBi (max.) For E-UTRA Band 12 1.91dBi (max.) For E-UTRA Band 13 1.29dBi (max.) For E-UTRA Band 14 2.59dBi (max.) For E-UTRA Band 66
Power Class	:	Class 3
Exposure category	:	General population/uncontrolled environment
EUT Type	:	Production Unit
Device Type	:	Mobile Devices

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/cm²)	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/f2)*	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/cm²)	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/f2)*	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	External Antenna	2400-6000MHz	BT: 5.20dBi(Max.) 2.9dBi (max.) For E-UTRA Band 2 3.5dBi (max.) For E-UTRA Band 4 1.8dBi (max.) For E-UTRA Band 5 -0.06dBi (max.) For E-UTRA Band 12 1.91dBi (max.) For E-UTRA Band 13 1.29dBi (max.) For E-UTRA Band 14 2.59dBi (max.) For E-UTRA Band 66	BT/LTE Antenna

6. Conducted Power

[BLE]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	ANT Max. Tune Up Power (dBm)
GFSK	0	2402	0.05	0±1.0
	19	2440	0.02	0±1.0
	39	2480	0.39	0±1.0

[LTE Max Average Power]

Test Mode		Channel	Max Average Power (dBm)	ANT Max. Tune Up Power (dBm)
LTE	Band 2	LCH	23.40	23.0±1.0
		MCH	23.20	23.0±1.0
		HCH	23.26	23.0±1.0
	Band 4	LCH	22.86	22.0±1.0
		MCH	23.06	23.0±1.0
		HCH	22.92	22.0±1.0
	Band 5	LCH	23.82	23.0±1.0
		MCH	23.86	23.0±1.0
		HCH	23.82	23.0±1.0
	Band 12	LCH	23.64	23.0±1.0
		MCH	23.90	23.0±1.0
		HCH	24.00	24.0±1.0
	Band 13	LCH	23.34	23.0±1.0
		MCH	23.73	23.0±1.0
		HCH	23.73	23.0±1.0
	Band 14	LCH	23.68	23.0±1.0
		MCH	24.01	24.0±1.0
		HCH	23.75	23.0±1.0
	Band 66	LCH	23.21	23.0±1.0
		MCH	23.17	23.0±1.0
		HCH	23.55	23.0±1.0

7. Measurement Results

7.1 Standalone MPE Evaluation

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.

[BT LE]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
BT LE	1.0	1.2589	3.97	3.3113	0.0006	1.0000

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
LTE Band 2	24.00	251.1886	2.9	1.9498	0.0974	1.0000
LTE Band 4	24.00	251.1886	3.5	2.2387	0.1119	1.0000
LTE Band 5	24.00	251.1886	1.8	1.5136	0.0756	0.5493
LTE Band 12	25.00	316.2278	-0.06	0.9863	0.0620	0.4660
LTE Band 13	24.00	251.1886	1.91	1.5524	0.0776	0.4973
LTE Band 14	25.00	316.2278	1.29	1.3459	0.0847	0.5053
LTE Band 66	24.00	251.1886	2.59	1.8155	0.0907	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.

8.2 Simultaneous Transmission MPE Evaluation

The EUT support one BE modular and one LTE modular, BLE modular and LTE modular share difference antenna, so need consider simultaneous transmission;
According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;
∑∑of MPE ratios ≤ 1.0

BLE MPE ratios	LTE MPE ratios	∑ MPE ratios	Limit	Results
0.0006	0.1676	0.1682	1.0	Pass

9. Conclusion

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

----------THE END OF REPORT----------