FCC RF Exposure Evaluation

1. Product Information

FCC ID	2ASKH-FLAT01
Product name	Battery Operated LTE Cellular GPS Tracker
Test Model	77-6811
Additional Model No.	Smart-7-LA, Smart-7 Lid, 77-6800 A, SBR-4LA, 77-MB-ARLA, Sabre LA, 77-MB-02, 77-6900
Model Declaration	PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Power supply	Input: DC 12V DC 3.65V by Li-ion Battery(10.6Ah)
Modulation Type	GFSK for Bluetooth V5.0(DTS)
Antenna Type	PIFA Antenna
Antenna Gain	0dBi(Max.)
Hardware version	P1
Software version	2.8.211_b1
FCC Operation frequency	2402MHz ~ 2480MHz
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Fixed Device

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 C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz 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/Controlled 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

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

Antenna Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
BLE ANT	PIFA Antenna	2400MHz – 2500MHz	0 dBi(Max.)
WCDMA&LTE ANT	PIFA Antenna	600MHz – 3000MHz	4 dBi(Max.)

6. Conducted Power

<BLE Max Conducted Power >

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	6.358
	19	2440	7.701
	39	2480	6.178

7. Manufacturing Tolerance

<BLE>

BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	7	7	7
Tolerance ±(dB)	1	1	1

8. Measurement Results

8.1 Standalone MPE

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.

Mode	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)	MPE ratios
	dBm	mW					
BLE	8	6.31	0	1.0	0.0013	1.0	0.0013

Mode	Max Conducted Power (dBm)		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)	MPE ratios
	dBm	mW					
WCDMA II	23.5	223.872	4.0	2.512	0.112	1.0	0.112
WCDMA IV	23.5	223.872	4.0	2.512	0.112	1.0	0.112
WCDMA V	23.5	223.872	4.0	2.512	0.112	0.55	0.204
LTE Band 2	23.5	223.872	4.0	2.512	0.112	1.0	0.112
LTE Band 4	23.5	223.872	4.0	2.512	0.112	1.0	0.112
LTE Band 12	23.5	223.872	4.0	2.512	0.112	0.47	0.238

Remark:
1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;
3. MPE values = $PG/4\pi R^2$;
4. The maximum permissible exposure for 300~1500MHz is f/1500 mW/cm2, for 1500~100,000MHz is 1.0 mW/cm2.
5. MPE ratios = MPE values / MPE Limits

8.2 Simultaneous Transmission MPE

The transmit antennas of BLE and WCDMA/LTE aren't the same one, they can transmit at the same time. According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

$\sum$of MPE ratios ≤ 1.0

Worst Mode	∑ MPE max ratios	Limit	Results
BLE & LTE Band 12	0.239	1.0	Pass

Remark: Only report the worst mode.

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.....