

Maximum Permissible Exposure Report

1. Product Information

FCC ID	:	2ASKHDL01
EUT	:	Battery Operated LTE Cellular GPS Tracker
Test Model	:	Dagger67
Additional Model No.:	:	AssetTrac
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, so no additional models were tested.
Power Supply	:	DC 12V By External Power 3.6V/8.1Ah By Lithium Battery
Hardware Version	:	A
Software Version	:	2.8.0_B13
Bluetooth	:	
Frequency Range	:	2402-2480MHz
Channel Number	:	40 channels
Channel Spacing	:	2MHz
Modulation Type	:	GFSK
Bluetooth Version	:	V4.2 (Support Only BT LE)
Antenna Description	:	Multi-layer chip antenna, 4dBi (Max.)
WCDMA	:	
UMTS Operation Frequency Band	:	UMTS FDD Band II/ V
WCDMA Release Version	:	R8
HSDPA Release Version	:	Release 8
HSUPA Release Version	:	Release 8
DC-HSUPA Release Version	:	Not Supported
Modulation Type	:	QPSK for UMTS
Antenna Gain	:	PIFA Antenna, 2dBi(WCDMA II) / -1.5dBi(WCDMA V)
LTE	:	
LTE Operation Frequency Band	:	LTE Band 2, 4, 12
LTE Release Version	:	Release 9
LTE/UMTS Power Class	:	Class 3
Modulation Type	:	QPSK, 16QAM for LTE
Antenna Gain	:	PIFA Antenna, 2dBi(LTE B2&B4) / -1.5dBi(LTE B12)
Extreme temp. Tolerance	:	-20°C to +55°C
Extreme vol. Limits	:	
GPS	:	
Receive Frequency	:	1575.42MHz

Channel Number : 1
Antenna Description : PCB Antenna, 5dBi(max.)
Exposure category : General population/uncontrolled environment
EUT Type : Production Unit
Device Type : Mobile 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

Battery Operated LTE Cellular GPS Tracker can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
Multi-layer chip antenna	2400 MHz – 2500 MHz	4.0 dBi	WLAN ANT
PIFA Antenna	1850MHz~1910MHz 1710MHz~1755MHz	2.0 dBi	WCDMA/LTE Main ANT
PIFA Antenna	699MHz~716MHz 824MHz~849MHz	-1.5dBi	WCDMA/LTE Main ANT

6. Conducted Power

[BT Max Peak Conducted Power]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
BT	0	2402	2.68
	19	2440	2.777
	39	2480	2.763

[WCDMA Max Average Power]

Test Mode	Channel	Frequency (MHz)	Max Average Power (dBm)
WCDMA Band II	Low	1852.4	23.49
	Middle	1880.0	23.55
	High	1907.6	23.43
WCDMA Band V	Low	826.4	23.57
	Middle	836.4	23.53
	High	846.6	23.56

[LTE Max Average Power]

Test Mode		Channel	Max Average Power (dBm)
LTE	Band 2	LCH	23.36
		MCH	24.01
		HCH	23.40
	Band 4	LCH	23.22
		MCH	23.66
		HCH	24.17
	Band 12	LCH	24.81
		MCH	24.81

		HCH	24.45
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7. Manufacturing Tolerance

[BT Max Conducted Power]

Test Mode	Channel	Max Conducted Power (dBm)	ANT Max. Tune Up Power (dBm)
BT	LCH	2.68	2.0±1.0
	MCH	2.777	2.0±1.0
	HCH	2.763	2.0±1.0

[WCDMA Max Average Power]

Test Mode	Channel	Max Average Power (dBm)	ANT Max. Tune Up Power (dBm)
WCDMA	Band II	LCH	23.49
		MCH	23.55
		HCH	23.43
	Band V	LCH	23.57
		MCH	23.53
		HCH	23.56

<LTE Max Average Power>

Test Mode	Channel	Max Average Power (dBm)	ANT Max. Tune Up Power (dBm)
LTE	Band 2	LCH	23.36
		MCH	24.01
		HCH	23.40
	Band 4	LCH	23.22
		MCH	23.66
		HCH	24.17
	Band 12	LCH	24.81
		MCH	24.81
		HCH	24.45

8. Measurement Results

8.1 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, $r=20\text{cm}$, 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/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
BT	3.0	2.00	4.0	2.512	0.001	1.0

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
WCDMA Band II	24.0	251.19	2.0	1.585	0.079	1.0
WCDMA Band V	24.0	251.19	-1.5	0.7079	0.035	0.55
LTE Band 2	25.0	316.23	2.0	1.585	0.100	1.0
LTE Band 4	25.0	316.23	2.0	1.585	0.100	1.0
LTE Band 12	25.0	316.23	-1.5	0.7079	0.045	0.47

Remark:

1. Output power including turn-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;
3. We choose the lowest frequency operate to calculate MPE limit as higher frequency will have higher MPE limits;
4. MPE values = $PG/4\pi R^2$.

8.2 Simultaneous Transmission MPE

The sample support one BT and another one LTE&WCDMA transmit antenna, so need consider simultaneous transmission;

Simultaneous transmission MPE

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

$\sum$ of MPE ratios ≤ 1.0

Mode	$\sum$ MPE max ratios	Limit	Results
BLE + WCDMA	0.080	1.0	Pass
BLE + LTE	0.101	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.

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