Maximum Permissible Exposure Report

1. Product Information

FCC ID	: 2AXZU-STRONBAT
EUT	: Starlink OnBatt 4G cat1 SF iRF
Test Model	: Starlink OnBatt 4G cat1 SF iRF
Power Supply	: Input: DC 9-32V DC 3.7V by Rechargeable Li-ion Battery(350mAh)
Hardware Version	: /
Software Version	: /
Bluetooth	
Frequency Range	: 2402MHz ~ 2480MHz
Bluetooth Version	: V4.0
Bluetooth Channel Number	: 40 channels for Bluetooth V4.0(DTS)
Bluetooth Channel Spacing	: 2MHz for Bluetooth V4.0 (DTS)
Bluetooth Modulation Type	: GFSK for Bluetooth V4.0(DTS)
Antenna Description	: PCB Antenna, 0dBi(Max.)
GSM Frequency Band	: GSM 850, GSM 1900
LTE Frequency Band	: LTE FDD Band 2, Band 4, Band 5, Band 7
GSM And LTE Antenna Description	: PCB Antenna, 4dBi(Max.)
GPS function	: Support and only RX
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 KDB447498 D01 General RF Exposure Guidance v06 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 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

Electronic Lock can only use an antenna certificated as follows provided by manufacturer;

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

6. Conducted Power of BLE

[BLE Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	5.726
	19	2440	5.653
	39	2480	5.032

7. Manufacturing tolerance of BLE

BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	5	5	5
Tolerance ±(dB)	1	1	1

8. Measurement 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.

Mode	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
BLE	6	3.98	0	1.0	0.0008	1.0

Mode	PG(mW)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
GSM 850	993.116	0.198	0.57
GSM 1900	497.737	0.099	1.0
LTE Band 2	794.328	0.158	1.0
LTE Band 4	794.328	0.158	1.0
LTE Band 5	933.254	0.186	0.55
LTE Band 7	794.328	0.158	1.0

Remark:
1. Output power including turn-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/cm^2*, for 1500~100,000MHz is 1.0* mW/cm^2*.*

The transmit antennas of BLE and GSM/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

Mode	∑ MPE max ratios	Limit	Results
BLE & GSM	0.348	1.0	Pass
BLE & LTE	0.339	1.0	Pass

9. Conclusion

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

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