RF Exposure evaluation

FCC ID: 2AQSK-KG-04

1. Reference

According to §1.1307(b)(1), systems operating under the provisions of this 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.

According to §1.1310 and §2.1091 RF exposure is calculated.

KDB447498 D01: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

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

3. 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

4. Antenna Information

KG-04 can only use antennas certificated as follows provided by manufacturer;

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
LORA	/	FPC ANT	2.27dBi for 922MHz	
GPRS	/	FPC ANT	0.39 dBi for 824.2MHz-848.8MHz	
			2.35 dBi for 1850.2MHz-1909.8MHz	
LTE	/	FPC ANT	0.39 dBi for 824 MHz -849MHz	
			2.14 dBi for 2570 MHz -2620MHz	
			1.75 dBi for 2305 MHz - 2315MHz	
			2.14 dBi for 2557MHz -2655MHz	

5. Manufacturing Tolerance

(Peak)

LORA	
Channel	922MHz
Target (dBm)	10.0
Tolerance ±(dB)	1.0

Operating Band	Max Conducted Average Output Power (dBm)	Max Tune-up
GPRS 850	33.87	34.0
GPRS 1900	31.00	32.0
LTE Band 5	23.13	24.0
LTE Band 38	23.52	24.0
LTE Band 40	23.82	24.0
LTE Band 41	22.82	23.0

6. Standalone MPE Result

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/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
LORA	11.0	12.5893	2.27	1.6866	0.0042	0.6147
GPRS 850	34.0	2511.8864	0.39	1.0940	0.5467	0.5495
GPRS 1900	32.0	1584.8932	2.35	1.7179	0.5417	1.0000
LTE Band 5	24.0	251.1886	0.39	1.0940	0.0547	0.5493
LTE Band 38	24.0	251.1886	2.14	1.6368	0.0818	1.0000
LTE Band 40	24.0	251.1886	1.75	1.4962	0.0748	1.0000
LTE Band 41	23.0	199.5262	2.14	1.6368	0.0650	1.0000

Remark:

1. Output power including turn-up tolerance;

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

Simultaneous Evaluation

LORA MPE (mW/cm^2)	GPRS MPE (mW/cm^2)	MPE	MPE Limits
0.0042	0.5467	0.5509	1.0000

7. 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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