

RF Exposure evaluation

FCC ID: 2A25ICS-PEBBLETRKR

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

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

CS-PEBBLETRKR-01 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:
LTE	/	Internal antenna	1.06dBi for Band 2:1850~1910MHz Band 4:1710~1755MHz Band 26:814~849MHz Band 66:1710~1780MHz	

5. Manufacturing Tolerance

NB-IOT

Mode	Target Power
LTE Band 2	24.0 ± 1
LTE Band 4	24.0 ± 1
LTE Band 26(part 22)	24.0 ± 1
LTE Band 26(part 90)	23.0 ± 1
LTE Band 66	24.0 ± 1

Cat-M

Mode	Target Power		
QPSK	1RB	50%RB	100%RB
LTE Band 2	23.5 ± 2	23.5 ± 2	23.5 ± 2
LTE Band 4	22.5 ± 2	22.5 ± 2	22.5 ± 2
LTE Band 26(part 22)	23.0 ± 2	23.0 ± 2	23.0 ± 2
LTE Band 26(part 90)	23.0 ± 2	23.0 ± 2	23.0 ± 2
LTE Band 66	23.0 ± 2	23.0 ± 2	23.0 ± 2

Cat-M

Mode	Target Power		
16-QAM	1RB	50%RB	100%RB
LTE Band 2	23.5 ± 2	23.5 ± 2	23.5 ± 2
LTE Band 4	22.5 ± 2	22.5 ± 2	22.5 ± 2
LTE Band 26(part 22)	23.0 ± 2	23.0 ± 2	23.0 ± 2
LTE Band 26(part 90)	23.0 ± 2	23.0 ± 2	23.0 ± 2
LTE Band 66	23.0 ± 2	23.0 ± 2	23.0 ± 2

6. Standalone MPE Result

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 25 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r=25\text{cm}$, as well as the gain of the used antenna is 1.06dBi, the RF power density can be obtained.

Modulation Type NB-IOT	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
LTE Band 2	25.0	316.2278	1.06	1.2764	0.0514	1.0000
LTE Band 4	25.0	316.2278	1.06	1.2764	0.0514	1.0000
LTE Band 26(part 22)	25.0	316.2278	1.06	1.2764	0.0514	0.5493
LTE Band 26(part 90)	24.0	251.1886	1.06	1.2764	0.0408	0.5427
LTE Band 66	25.0	316.2278	1.06	1.2764	0.0514	1.0000

Modulation Type Cat-M	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
LTE Band 2	25.5	354.8134	1.06	1.2764	0.0577	1.0000
LTE Band 4	24.5	281.8383	1.06	1.2764	0.0458	1.0000
LTE Band 26(part 22)	25.0	316.2278	1.06	1.2764	0.0514	0.5493
LTE Band 26(part 90)	25.0	316.2278	1.06	1.2764	0.0514	0.5427
LTE Band 66	25.0	316.2278	1.06	1.2764	0.0514	1.0000

Remark:

1. Output power (Peak) including turn-up tolerance;
2. MPE evaluate distance is 25cm from user manual provide by manufacturer.

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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