



RF Exposure evaluation

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1. Applicable Standard

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 v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

2. Limit

FCC:

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 modeled 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.

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

FCC:

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. Result

Mode	Minimum Separation Distance	Output Power (Turn-up Procedure)		Antenna Gain	Antenna Gain (Numerical)	Power Density At 20 cm	Power Density Limit	Test Results
	(cm)	dBm	mW	dBi		mW/cm ²	mW/cm ²	
LTE Band 2	20.00	24.0	251.19	2.9	1.95	0.09749	1.0	PASS
LTE Band 4	20.00	24.0	251.19	3.5	2.24	0.11193	1.0	PASS
LTE Band 5	20.00	25.0	316.23	-3.5	0.45	0.02812	0.558	PASS
LTE Band 12	20.00	25.0	316.23	-3.3	0.47	0.02944	0.469	PASS
LTE Band 13	20.00	25.0	316.23	-1.4	0.72	0.04560	0.521	PASS
LTE Band 14	20.00	25.0	316.23	-1.4	0.72	0.04560	0.529	PASS
LTE Band 66	20.00	24.0	251.19	3.5	2.24	0.11193	1.0	PASS
LTE Band 71	20.00	25.0	316.23	-2.4	0.58	0.03622	0.454	PASS

Note: 300-1500MHz Power Density Limit = $F/1500$ (F=frequency in MHz)

Band 5: Power Density Limit (mW/cm²) = $836.5/1500 = 0.558$ mW/cm²

Band 12: Power Density Limit (mW/cm²) = $704/1500 = 0.469$ mW/cm²

Band 13: Power Density Limit (mW/cm²) = $782/1500 = 0.521$ mW/cm²

Band 14: Power Density Limit (mW/cm²) = $793/1500 = 0.529$ mW/cm²

Band 71: Power Density Limit (mW/cm²) = $680.5/1500 = 0.454$ mW/cm²

5. Simultaneous transmission MPE Considerations

According to KDB447498: For mobile exposure host platform to qualify for simultaneous transmission MPE test exclusion, all transmitters and antennas in the host must be either evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in section 7.1.

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 modeled or measured field strengths or power density, is ≤ 1.0 .

This means that:

Σ of MPE ratios ≤ 1.0

6. Conclusion

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.