

FCC §1.1310 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart § 2.1051 and subpart §1.1310, 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.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	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;

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

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain

factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Mode	Max Turn-up power (dBm)	ERP/EIRP Limit (dBm)	Max Allowed Ant Gain (dBi)
LTE (Band 4)	23.5	30	6.5
(Band 13)	23.5	34.77	13.77

Note: The maximum allowed antenna gains are calculated based on the ERP/EIRP output power limits.

Mode	Frequency (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
LTE (Band 4)	1755.0	13.50	22.39	23.5	223.87	20	1.0	1.0
LTE (Band 13)	777	10.65	11.61	23.5	223.87	20	0.518	0.518

Mode	Max Allowed Antenna Gain (dBi)
LTE (Band 4) uplink Frequency 1710-1755 (MHz)	6.5
LTE (Band 13) uplink Frequency 777-787 (MHz)	10.65

Note:

- (1) Target Power = the max power including the tune-up tolerance, the tuned up power declared by manufacture as:
FDD Band 4 = 22.5 ± 1 dBm, FDD Band 13 = 22.5 ± 1 dBm
- (2) Maximum allowed antenna gains are calculated based on MPE limits @ 20 cm distance.

Result: The device meets FCC MPE at 20 cm distance, the maximum allowed antenna gain are 6.5 dBi @ Band 4 and 10.65 dBi @ Band 13.