

§1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to 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/cm ²)	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.

Per 447498 D01 General RF Exposure Guidance v05r01, 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 .

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:

RF module	Frequency band (MHz)	Antenna Gain (dB _i) (numeric)		Conducted Power (dBm) (mW)		Duty cycle (%)	Evaluation distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)	MPE Ratios (%)
		(dB _i)	(numeric)	(dBm)	(mW)					
WIFI	2412-2462	2.5	1.78	20.68	117	100	20	0.041	1	4.14
Zigbee	2405-2480	2.5	1.78	7.99	6.3	100	20	0.002	1	0.22
3G	1850.2-1909.8	2.4	1.74	29.20	832	50	20	0.144	1.00	14.38
Total sum of MPE ratios (%)										18.74

Note:

* For 3G module, the worst case for MPE was chosen.

Result: 18.74 % < 1, the device meet FCC MPE at 20 cm distance.