

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Standard Applicable

According to § 1.1307(b)(1), system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

(a) Limits for Occupational / Controlled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100000			5	6

(b) Limits for General Population / Uncontrolled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100000			1	30

Note: f = frequency in MHz: * = Plane-wave equivalents power density

MPE Calculation Method

$$S = (P \cdot G) / (4 \cdot \pi \cdot R^2)$$

S = 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 (in appropriate units, e.g., cm)

MPE Calculation Result

Maximum peak output power at antenna input terminal: 23.17(mW)

Prediction distance: 20 (cm)

Prediction frequency: 2412 (MHz)

Antenna gain (typical): 0 (dBi)

Antenna gain (numeric): 1 (numeric)

The worst case is power density at prediction frequency at 20cm: 0.00461 (mw/cm²)

MPE limit for general population exposure at prediction frequency: 1 (mw/cm²)

$$0.00461 \text{ (mw/cm}^2\text{)} < 1 \text{ (mw/cm}^2\text{)}$$

And:

RF Output Power

Tx frequency range: 2412~2462MHz

Antenna-to-tissue separation: 20 cm

Maximum Output Power: 13.65dBm(23.17mW)

Maximum Duty Factor: 100%

$$60/f(\text{GHz}) \text{ mW} = 24.37 \text{ mW}$$

Source-based time-averaged conducted output power is 23.17 mW =< 60/f

So the transmitter is comply the RF exposure requirements and the SAR in not required.