

Maximum Permissible Exposure

Applicable Standard According to §1.1307(b)(5), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20cm, even if the calculation indicate that the MPE distance would be lesser.

Calculation

$$\text{Given } E = \sqrt{\frac{30 \times P \times G}{d}} \quad \& \quad S = \frac{E^2}{3770}$$

Where E - Field Strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts / square centimeter

For 2.4G

1) The maximum output power is -0.102dBm (0.98mW) at 2402MHz, (with 0dBi antenna gain (1.0 numeric antenna gain))

Maximum Permissible Exposure

Output power=0.98mW

Numeric Antenna gain=1.0 Substituting the MPE safe distance using $d=20\text{cm}$ into above equation.

Yields: $S=0.000199 \times P \times G$

Where P = Power in mW

G = Numeric antenna gain

S = Power density in mW/cm²

Power density=0.0002mW/cm²

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm even if the calculation indicates that the power density would be larger.)

For 13.56 NFC

Maximum Field Strength is 65.12 dBμV/m = -30.08dBm

Note: $E(\text{dB}\mu\text{V/m}) = \text{EIRP(mW)} + 95.2$, for $d=3\text{m}$,

So $\text{EIRP} = 65.12\text{dB}\mu\text{V/m} - 95.2 = -30.08\text{dBm}$

Antenna gain is 5dBi (3.16 numeric antenna gain)

$P = -30.08 - 5 = -35.08\text{dBm} = 0.00003\text{mW}$

Power density = 0.0000002mW/cm² < 0.9789 mW/cm

(For frequency range 1.34-30MHz Power density limit is $180/f^2 = 0.9789 \text{ mW/cm}$)