

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.

Remark:

- 1) The GSM850 maximum output power for antenna is 32.72dBm (1870.7mW) at 848.8MHz, 2.1dBi antenna gain (with 1.62 numeric antenna gain.)
 - 2) The PCS1900 maximum output power for antenna is 28.56dBm (717.79mW) at 1909.8MHz, 2.5dBi antenna gain (with 1.78 numeric antenna gain.)
 - 3) The WCDMA Band 5 maximum output power for antenna is 23.09dBm (203.7mW) at 826.4MHz, 2.3dBi antenna gain (with 1.70 numeric antenna gain.)
 - 4) The WCDMA Band 2 maximum output power for antenna is 23.39dBm (218.27mW) at 1880MHz, 2.1dBi antenna gain (with 1.62 numeric antenna gain.)
 - 5) The LTE Band 2 maximum output power for antenna is 24.97dBm (314.05mW) at 1900MHz, 2.0dBi antenna gain (with 1.58 numeric antenna gain.)
 - 6) The LTE Band 4 maximum output power for antenna is 24.23dBm (264.85mW) at 1907.5MHz, 2.5dBi antenna gain (with 1.78 numeric antenna gain.)
 - 7) The LTE Band 5 maximum output power for antenna is 25.67dBm (368.98mW) at 1852.5MHz, 2.1dBi antenna gain (with 1.62 numeric antenna gain.)
 - 8) The WIFI maximum output power for antenna is 17.08dBm (51.05mW) at 2412MHz, 2.5dBi antenna gain (with 1.78 numeric antenna gain.)
- 2) 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

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

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

Maximum Permissible Exposure

GSM 850 output power=1870.7mW

Numeric Antenna gain=1.62

PCS 1900 output power=717.79mW

Numeric Antenna gain=1.78

WCDMA Band 5 output power=203.7mW

Numeric Antenna gain=1.70

WCDMA Band 2 output power=218.27mW

Numeric Antenna gain=1.62

LTE Band 2 output power=314.05mW
 Numeric Antenna gain=1.58
 LTE Band 4 output power=264.85mW
 Numeric Antenna gain=1.78
 LTE Band 5 output power=368.98mW
 Numeric Antenna gain=1.62
 WIFI output power=51.05mW
 Numeric Antenna gain=1.78

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

Yields:

$$S=0.000199 \cdot P \cdot G$$

Where P =Power in mW

G =Numeric antenna gain

S =Power density in mW/cm^2

$$\text{GSM 850 Power density} = 0.6031 \text{mW}/\text{cm}^2$$

$$\text{PCS 1900 Power density} = 0.2543 \text{mW}/\text{cm}^2$$

$$\text{WCDMA Band 5 Power density} = 0.0689 \text{mW}/\text{cm}^2$$

$$\text{WCDMA Band 2 Power density} = 0.0704 \text{mW}/\text{cm}^2$$

$$\text{LTE Band 2 Power density} = 0.0987 \text{mW}/\text{cm}^2$$

$$\text{LTE Band 4 Power density} = 0.0938 \text{mW}/\text{cm}^2$$

$$\text{LTE Band 5 Power density} = 0.1190 \text{mW}/\text{cm}^2$$

$$\text{WIFI Power density} = 0.0181 \text{mW}/\text{cm}^2$$

GSM and GSM, WCDMA, LTE can be launched simultaneously, but

$$\text{Maximum Permissible Exposure} = \text{GSM 850 Power density} + \text{WIFI Power density} = 0.6212 \text{mW}/\text{cm}^2$$

(For mobile or fixed location transmitters, the maximum power density is $1.0 \text{mW}/\text{cm}^2$ even if the calculation indicates that the power density would be larger.)

Result: Because the result of power density is lower than the limit, so the device is exempt from SAR.