

1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

| 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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

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 (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

| Frequency (MHz) | Antenna Gain | | Tune up conducted power | | Evaluation Distance (cm) | Power Density (mW/cm ²) | MPE Limit (mW/cm ²) |
|--------------------|--------------|-----------|-------------------------|--------|--------------------------------|---|------------------------------------|
| | (dBi) | (numeric) | (dBm) | (mW) | | | |
| 2412-2462 | 6 | 3.98 | 26.0 | 398.11 | 20 | 0.315 | 1 |
| 5150-5250 | 7 | 5.01 | 22.5 | 177.83 | 20 | 0.177 | 1 |
| 5725-5850 | 7 | 5.01 | 22.5 | 177.83 | 20 | 0.177 | 1 |

Note: The 2.4G Wi-Fi and 5G Wi-Fi can transmit at the same time.
The antenna gain is 3dBi for 2.4GHz Wi-Fi and 4dBi for 5G Wi-Fi.

EUT support beamforming

Directional gain = G_{ANT} + Array Gain

Array Gain=10*log(N_{ant}/N_{ss}) dB

For the worst case, N_{ss}=1, so:

For 2.4GHz Wi-Fi, Directional gain=3dBi+10*log(2/1)dB=6dB

For 5GHz Wi-Fi, Directional gain=4dBi+10*log(2/1)dB=7dB

Simultaneous transmitting consideration:

The ratio=MPE_{DTS}/limit+MPE_{NII}/limit =0.315/1+0.177/1=0.492<1.0

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance