# Maximum Permissible Exposure

## 1 Applicable standard

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 limit for maximum permissible exposure. IN accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

(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$^2$)* | 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$^2$)* | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | -- | -- | f/1500 | 30 |
| 1500-100000 | -- | -- | 1.0 | 30 |

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

## 2. MPE Calculation Method

$E$ (V/m) = $(30*P*G)^{0.5}/d$     Power Density: $Pd$ (W/m$^2$) =$E^2$/377
E= Electric Field (V/m)
P= Peak RF output power (W)
G= EUT Antenna numeric gain (numeric)
d = Separation distance between radiator and human body (m)
The formula can be changed to
$Pd= (30*P*G)/ (377*d^2)$
From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

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## 3. Calculated Result and Limit

| Test CH (MHz) | | Antenna Gain (Numeric) | Peak Output Power (dBm) | Peak Output Power (mW) | Power Density (S) (mW/cm$^2$) | Limit of Power Density (S) (mW/cm$^2$) | Test Result |
|---|---|---|---|---|---|---|---|
| 802.11b | CH1:2412MHz | 1.5849 | 18.71 | 74.302 | 0.4685[4] | 1.608[1] | Compiles |
| | CH7:2442MHz | 1.5849 | 18.73 | 74.645 | 0.4707[5] | 1.628[2] | Compiles |
| | CH11:2462MHz | 1.5849 | 17.95 | 62.373 | 0.3933[6] | 1.641[3] | Compiles |
| 802.11g | CH1:2412MHz | 1.5849 | 16.24 | 42.073 | 0.2653[7] | 1.608[1] | Compiles |
| | CH7:2442MHz | 1.5849 | 16.32 | 42.855 | 0.2702[8] | 1.628[2] | Compiles |
| | CH11:2462MHz | 1.5849 | 16.25 | 42.170 | 0.2659[9] | 1.641[3] | Compiles |

Note: 1.Antenna gain: 2dBi (1.5849)

2. 1) Limit of Power density S (mW/cm$^2$) for uncontrolled area at 2412.00
   $S=f$ (MHz)$/1500=2412.00/1500=1.608$

   2) Limit of Power density S (mW/cm$^2$) for uncontrolled area at 2442.00
   $S=f$ (MHz)$/1500=2442.00/1500=1.628$

   3) Limit of Power density S (mW/cm$^2$) for uncontrolled area at 2462.00
   $S=f$ (MHz)$/1500=2462/1500=1.641$

3. 4) Power density S (mW/cm$^2$) for uncontrolled area at 2412.00 for 802.11b
   $S= (30*P*G)/ (377*d^2) = (30*74.302mW*1.5849)/ (377*20cm^2) =0.4685$

   5) Power density S (mW/cm$^2$) for uncontrolled area at 2442.00 for 802.11b
   $S= (30*P*G)/ (377*d^2) = (30*74.645mW*1.5849)/ (377*20cm^2) =0.4707$

   6) Power density S (mW/cm$^2$) for uncontrolled area at 2462.00 for 802.11b
   $S= (30*P*G)/ (377*d^2) = (30*62.373mW*1.5849)/ (377*20cm^2) =0.3933$

   7) Power density S (mW/cm$^2$) for uncontrolled area at 2412.00 for 802.11g
   $S= (30*P*G)/ (377*d^2) = (30*42.073mW*1.5849)/ (377*20cm^2) =0.2653$

   8) Power density S (mW/cm$^2$) for uncontrolled area at 2442.00 for 802.11g
   $S= (30*P*G)/ (377*d^2) = (30*42.855mW*1.5849)/ (377*20cm^2) =0.2702$

   9) Power density S (mW/cm$^2$) for uncontrolled area at 2462.00 for 802.11g
   $S= (30*P*G)/ (377*d^2) = (30*42.170mW*1.5849)/ (377*20cm^2) =0.2659$

The S at the position which is 20cm far from the EUT is smaller than the uncontrolled exposure limit line. So the EUT also complies with the limits for Occupational /Controlled Exposure.

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