

**FCC§1.1307 (b) (1) & §2.1091& RSS-102 - 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.

**FCC Limits for Maximum Permissible Exposure (MPE)**

(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 <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|---|---|
| 0.3-3.0               | 614                               | 1.63                              | (100)*                                  | 6   |
| 3.0-30                | 1842/f                            | 4.89/f                            | (900/f <sup>2</sup> )*                  | 6   |
| 30-300                | 61.4                              | 0.163                             | 1.0                                     | 6   |
| 300-1500              | --                                | --                                | f/300                                   | 6   |
| 1500-100,000          | --                                | --                                | 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 <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|---|---|
| 0.3-1.34              | 614                               | 1.63                              | (100)*                                  | 30  |
| 1.34-30               | 824/f                             | 2.19/f                            | (180/f <sup>2</sup> )*                  | 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

According to RSS-102:

#### 4.2 RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

| Frequency Range (MHz) | Electric Field (V/m rms)      | Magnetic Field (A/m rms)                        | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes)        |
|-----------------------|-------------------------------|---|-----------------------------------|---------------------------------|
| 0.003-1               | 280                           | 2.19  | -                                 | 6                               |
| 1-10                  | 280/ <i>f</i>                 | 2.19/ <i>f</i>                                  | -                                 | 6                               |
| 10-30                 | 28                            | 2.19/ <i>f</i>                                  | -                                 | 6                               |
| 30-300                | 28                            | 0.073   | 2*                                | 6                               |
| 300-1500              | 1.585 <i>f</i> <sup>0.5</sup> | 0.0042 <i>f</i> <sup>0.5</sup>                  | <i>f</i> /150                     | 6                               |
| 1500-15000            | 61.4                          | 0.163   | 10                                | 6                               |
| 15000-150000          | 61.4                          | 0.163   | 10                                | 616000/ <i>f</i> <sup>1.2</sup> |
| 150000-300000         | 0.158 <i>f</i> <sup>0.5</sup> | 4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup> | 6.67 x 10 <sup>-5</sup> <i>f</i>  | 616000/ <i>f</i> <sup>1.2</sup> |

Note: *f* is frequency in MHz.

\* Power density limit is applicable at frequencies greater than 100 MHz.

#### 4.4 RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

| Frequency Range (MHz) | Electric Field (V/m rms)      | Magnetic Field (A/m rms)                       | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes)        |
|-----------------------|-------------------------------|--|-----------------------------------|---------------------------------|
| 0.003-1               | 600                           | 4.9  | -                                 | 6                               |
| 1-10                  | 600/ <i>f</i>                 | 4.9/ <i>f</i>                                  | -                                 | 6                               |
| 10-30                 | 60                            | 4.9/ <i>f</i>                                  | -                                 | 6                               |
| 30-300                | 60                            | 0.163  | 10*                               | 6                               |
| 300-1500              | 3.54 <i>f</i> <sup>0.5</sup>  | 0.0094 <i>f</i> <sup>0.5</sup>                 | <i>f</i> /30                      | 6                               |
| 1500-15000            | 137                           | 0.364  | 50                                | 6                               |
| 15000-150000          | 137                           | 0.364  | 50                                | 616000/ <i>f</i> <sup>1.2</sup> |
| 150000-300000         | 0.354 <i>f</i> <sup>0.5</sup> | 9.4 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup> | 3.33 x 10 <sup>-4</sup> <i>f</i>  | 616000/ <i>f</i> <sup>1.2</sup> |

Note: *f* is frequency in MHz.

\*Power density limit is applicable at frequencies greater than 100 MHz.

**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/cm<sup>2</sup> for FCC, and W/m<sup>2</sup> for IC)

P = power input to the antenna (in appropriate units, e.g., mW for FCC, and W for IC).

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 FCC, and m for IC)

For FCC calculation:

| Frequency (MHz) | Antenna Gain |           | Conducted Power (W) | The minimum Distance (m) | Calculated RF Exposure (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Note                     |
|-----------------|--------------|-----------|---------------------|--------------------------|--|---------------------------------|--------------------------|
|                 | (dBi)        | (numeric) |                     |                          |  |                                 |                          |
| 156.8           | 3            | 2         | 25                  | 1.5                      | 0.1769                                       | 1.0                             | Controlled Environment   |
| 156.8           | 3            | 2         | 25                  | 1.5                      | 0.1769                                       | 0.2                             | UnControlled Environment |

For IC calculation:

| Frequency (MHz) | Antenna Gain |           | Conducted Power (W) | The minimum Distance (m) | Calculated RF Exposure (W/m <sup>2</sup> ) | MPE Limit (W/m <sup>2</sup> ) | Note                     |
|-----------------|--------------|-----------|---------------------|--------------------------|--|-------------------------------|--------------------------|
|                 | (dBi)        | (numeric) |                     |                          |  |                               |                          |
| 156.8           | 3            | 2         | 25                  | 1.5                      | 1.769                                      | 10                            | Controlled Environment   |
| 156.8           | 3            | 2         | 25                  | 1.5                      | 1.769                                      | 2.0                           | UnControlled Environment |

Note: The Maximum power is 25 W which declared by manufacture

**Radiation Exposure Statement:**

To comply with RF exposure requirements, the minimum permissible distance is 1.5 m required between the antenna and the body of the user or nearby persons.

**Result: Compliance**