

# FCC MPE Report

FCC §15.247 (i), §2.1091 – RF Exposure

**FCC ID: 2BB29-RUBLMAX**

## Applied procedures / limit

According to FCC §15.247(i) and §1.1307(b)(1), 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 of the Commission's guidelines.

## 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)*                               | 6                                                                |
| 30-300                | 61.4                              | 0.163                             | 1.0                                      | 6                                                                |
| 300-1500              |                                   |                                   | F/300                                    | 6                                                                |
| 1500-100,000          |                                   |                                   | 5                                        | 6                                                                |

Note:  $f$  is frequency in MHz

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

## 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)*                                 | 30                                                               |
| 30-300                | 27.5                              | 0.073                             | 0.2                                      | 30                                                               |
| 300-1500              |                                   |                                   | F/1500                                   | 30                                                               |
| 1500-100,000          |                                   |                                   | 1.0                                      | 30                                                               |

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## 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> )  | Reference Period (minutes)      |
|-------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------|------------------------------------|---------------------------------|
| 0.003-10 <sup>21</sup>                                                                                                  | 83                               | 90                                              | -                                  | Instantaneous*                  |
| 0.1-10                                                                                                                  | -                                | 0.73/ <i>f</i>                                  | -                                  | 6**                             |
| 1.1-10                                                                                                                  | 87/ <i>f</i> <sup>0.5</sup>      | -                                               | -                                  | 6**                             |
| 10-20                                                                                                                   | 27.46                            | 0.0728                                          | 2                                  | 6                               |
| 20-48                                                                                                                   | 58.07/ <i>f</i> <sup>0.25</sup>  | 0.1540/ <i>f</i> <sup>0.25</sup>                | 8.944/ <i>f</i> <sup>0.5</sup>     | 6                               |
| 48-300                                                                                                                  | 22.06                            | 0.05852                                         | 1.291                              | 6                               |
| 300-6000                                                                                                                | 3.142 <i>f</i> <sup>0.3417</sup> | 0.008335 <i>f</i> <sup>0.3417</sup>             | 0.02619 <i>f</i> <sup>0.6834</sup> | 6                               |
| 6000-15000                                                                                                              | 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: <i>f</i> is frequency in MHz.<br>*Based on nerve stimulation (NS).<br>** Based on specific absorption rate (SAR). |                                  |                                                 |                                    |                                 |

Note: *f* = frequency in MHz

\* = Plane-wave equivalent power density

## MPE PREDICTION

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna, R=0.2m

## TEST RESULTS

| Mode | tune up power tolerance (dBm) | max. output power(mW) | Directional Gain (numeric) | Power Density at R=20cm (mW/cm2) | Limit (mW/cm <sup>2</sup> ) | Result |
|------|-------------------------------|-----------------------|----------------------------|----------------------------------|-----------------------------|--------|
| 2402 | 0±1                           | 1.259                 | 3.63                       | 0.0006                           | 1.0                         | PASS   |
| 2440 | 0±1                           | 1.259                 | 3.63                       | 0.0006                           | 1.0                         | PASS   |
| 2480 | 0±1                           | 1.259                 | 3.63                       | 0.0006                           | 1.0                         | PASS   |

## Conclusion:

For the max result: 0.0006 mW/cm<sup>2</sup> ≤ 1.0 mW/cm<sup>2</sup> , No SAR is required.