

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

Applicable Standard

According to KDB 447498 D04 Interim General RF Exposure Guidance

MPE-Based Exemption:

An alternative to the SAR-based exemption is provided in § 1.1307(b)(3)(i)(C), for a much wider frequency range, from 300 kHz to 100 GHz, applicable for separation distances greater or equal to $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. The MPE-based test exemption condition is in terms of ERP, defined as the product of the maximum antenna gain and the delivered maximum time-averaged power. For this case, a RF source is an RF exempt device if its ERP (watts) is no more than a frequency-dependent value, as detailed tabular form in Appendix B. These limits have been derived based on the basic specifications on Maximum Permissible Exposure (MPE) considered for the FCC rules in § 1.1310(e)(1).

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

| RF Source frequency (MHz) | Threshold ERP (watts) |
|---------------------------|-----------------------|
| 0.3-1.34 | $1,920 R^2$. |
| 1.34-30 | $3,450 R^2/f^2$. |
| 30-300 | $3.83 R^2$. |
| 300-1,500 | $0.0128 R^2 f$. |
| 1,500-100,000 | $19.2 R^2$. |

f = frequency in MHz;

R = minimum separation distance from the body of a nearby person (appropriate units, e.g., m);

For multiple RF sources: Multiple RF sources are exempt if:

in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation:

$$\sum_{l=1}^a \frac{P_l}{P_{th,l}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

Result

For worst case:

| Mode | Frequency (MHz) | Tune up conducted power | Antenna Gain | | ERP | | Evaluation Distance (m) | ERP Limit (W) |
|--------------|--------------------|----------------------------|--------------|-------|-------|---------|-------------------------------|---------------------|
| | | (dBm) | (dBi) | (dBd) | (dBm) | (W) | | |
| BLE | 2402-2480 | -3.0 | 0.58 | -1.57 | -4.57 | 0.00035 | 0.2 | 0.768 |
| WCDMA Band 2 | 1850-1910 | 24.0 | -1.25 | -3.40 | 20.60 | 0.115 | 0.2 | 0.768 |
| WCDMA Band 5 | 824-849 | 25.0 | -0.87 | -3.02 | 21.98 | 0.158 | 0.2 | 0.422 |
| LTE Band 2 | 1850-1910 | 22.5 | -1.25 | -3.40 | 19.10 | 0.081 | 0.2 | 0.768 |
| LTE Band 4 | 1710-1755 | 22.5 | -0.86 | -3.01 | 19.49 | 0.089 | 0.2 | 0.768 |
| LTE Band 12 | 699-716 | 24.0 | -0.72 | -2.87 | 21.13 | 0.130 | 0.2 | 0.358 |

Note 1: The tune-up power and antenna gain was declared by the applicant.

Note 2: 0dBd=2.15dBi.

Simultaneous transmitting consideration (worst case):

The ratio= $ERP_{BLE}/limit_{BLE} + ERP_{WCDMA\ B5}/limit_{WCDMA\ B5} = 0.00035/0.768 + 0.158/0.422 = 0.375 < 1.0$

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

Result: Compliant.