

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.