

FCC §15.247 (i) & §1.1307 (b) (3) & §2.1091- MPE-BASED EXEMPTION

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:

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

Result**For worst case:**

Mode	Frequency (MHz)	Tune up conducted power [#]	Antenna Gain [#]		ERP		Evaluation Distance (m)	ERP Limit (mW)
		(dBm)	(dBi)	(dBd)	(dBm)	(mW)		
BLE	2402-2480	-2.00	0.37	-1.78	-3.78	0.42	0.2	768
NB-IoT Band 2	1850-1910	25.00	0.45	-1.70	23.3	213.80	0.2	768
NB-IoT Band 4	1710-1755	25.00	0.45	-1.70	23.3	213.80	0.2	768
NB-IoT Band 5	824-849	25.00	0.18	-1.97	23.03	200.91	0.2	422
NB-IoT Band 12	699-716	25.00	0.23	-1.92	23.08	203.24	0.2	358
NB-IoT Band 13	777-787	25.00	0.23	-1.92	23.08	203.24	0.2	398
NB-IoT Band 17	704-716	25.00	0.23	-1.92	23.08	203.24	0.2	360
NB-IoT Band 25	1850-1915	25.00	0.45	-1.70	23.3	213.80	0.2	768
NB-IoT Band 66	1710-1780	25.00	0.45	-1.70	23.3	213.80	0.2	768
NB-IoT Band 85	698-716	25.00	0.23	-1.92	23.08	203.24	0.2	357

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= $ERP_{BLE} / \text{limit} + ERP_{NB-IoT \text{ Band } 85} / \text{limit} = 0.42/768 + 203.24/357 = 0.570 < 1.0$

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

Result: Compliant