

FCC §15.247 (i) & §1.1307 (b) (3) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 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.

According to KDB 447498 D04 Interim General RF Exposure Guidance

MPE-Based Exemption:

General frequency and separation-distance dependent MPE-based effective radiated power(ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

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	$0.0128 R^2f$.
1,500-100,000	$19.2 R^2$.

R is the minimum separation distance in meters

f = frequency in MHz

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

Mode	Frequency (MHz)	Tune up conducted power	Antenna Gain		ERP		Evaluation Distance (m)	ERP Limit (W)
		(dBm)	(dBi)	(dBd)	(dBm)	(W)		
BLE	2402-2480	6.5	1.1	-1.05	5.45	0.004	0.2	0.768
NFC	13.56	/	/	/	/	0.00045	0.2	0.751
GSM850	824-849	25.97	1.0	-1.15	24.82	0.303	0.2	0.422
GSM1900	1850-1910	22.97	1.5	-0.65	22.32	0.171	0.2	0.768
Cat-M B2	1850-1910	22.0	1.5	-0.65	21.35	0.136	0.2	0.768
Cat-M B4	1710-1755	22.0	1.7	-0.45	21.55	0.143	0.2	0.768
Cat-M B5	824-849	22.0	1.0	-1.15	20.85	0.122	0.2	0.422
Cat-M B12	699-716	22.0	0.8	-1.35	20.65	0.116	0.2	0.358
Cat-M B13	777-787	22.0	0.8	-1.35	20.65	0.116	0.2	0.398
Cat-M B25	1850-1915	22.0	1.5	-0.65	21.35	0.136	0.2	0.768
Cat-M B26	814-849	22.0	1.0	-1.15	20.85	0.122	0.2	0.417
Cat-M B66	1710-1780	22.0	1.7	-0.45	21.55	0.143	0.2	0.768
Cat-M B85	698-716	22.0	0.8	-1.35	20.65	0.116	0.2	0.357
NB-IOT B2	1850-1910	22.0	1.5	-0.65	21.35	0.136	0.2	0.768
NB-IOT B4	1710-1755	22.0	1.7	-0.45	21.55	0.143	0.2	0.768
NB-IOT B5	824-849	22.0	1.0	-1.15	20.85	0.122	0.2	0.422
NB-IOT B12	699-716	22.0	0.8	-1.35	20.65	0.116	0.2	0.358
NB-IOT B13	777-787	22.0	0.8	-1.35	20.65	0.116	0.2	0.398
NB-IOT B25	1850-1915	22.0	1.5	-0.65	21.35	0.136	0.2	0.768
NB-IOT B66	1710-1780	22.0	1.7	-0.45	21.55	0.143	0.2	0.768
NB-IOT B71	663-698	22.0	0.8	-1.35	20.65	0.116	0.2	0.339
NB-IOT B85	698-716	22.0	0.8	-1.35	20.65	0.116	0.2	0.357

- Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
 2. The device contain a WWAN module (FCC ID: XMR201910BG95M3) granted on 07/17/2020.
 3. The BLE, NFC and WWAN can transmit at same time.
 4. For NFC, the max E-field strength is 93.64dBuV/m@3m

$$EIRP = P_t \times g_t = (E \times d)^2 / 30$$

where

P_t is the transmitter output power in watts
 g_t is the numeric gain of the transmitting antenna (dimensionless)
 E is the electric field strength in V/m
 d is the measurement distance in meters (m)

$$ERP = EIRP/1.64 = (E \times d)^2 / (30 \times 1.64) = (E \times d)^2 / 49.2$$

$$\text{So, } ERP = (0.048 \times 3)^2 / 49.2 = 0.00042W = 0.42mW$$

The tune-up ERP=0.45mW

Simultaneous transmitting consideration (worst case):

The ratio= $ERP_{BLE}/limit + ERP_{NFC}/limit + ERP_{WWAN}/limit$
 $=0.004/0.768+0.00045/0.751+0.303/0.422=0.724 < 1.0$, so simultaneous exposure is compliant.

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

Result: Compliant.