

FCC§15.247 (i), §1.1307 (b) (3) – RF EXPOSURE

Applicable Standard

According to FCC §15.247(i) and §1.1307(b) (3), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission’s guideline.

According to KDB 447498 D04 Interim General RF Exposure Guidance

SAR-Based Exemption:

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum timeaveraged power or maximum time-averaged ERP, whichever is greater.

Per § 1.1307(b)(3)(i)(B), for single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

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:

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

Result

For worst case:

Mode	Frequency (MHz)	Tune up conducted power	Antenna Gain		ERP		Evaluation Distance (m)	Pth (mW)
		(dBm)	(dBi)	(dBd)	(dBm)	(mW)		
BT	2402-2480	7.0	4.5	2.35	9.35	8.61	0.20	3060
BLE	2402-2480	6.5	4.5	2.35	8.85	7.67	0.20	3060
SRD	2402-2480	4.0	3.5	1.35	5.35	3.43	0.20	3060
2.4GHz Wi-Fi	2412-2462	26.0	6.0	3.85	29.85	966.05	0.20	3060
5GHz Wi-Fi	5180-5240	19.5	5.0	2.85	22.35	171.79	0.20	3060
	5260-5280	18.5	5.0	2.85	21.35	136.46	0.20	3060
	5500-5700	17.5	5.0	2.85	20.35	108.39	0.20	3060
	5745-5825	20.0	5.0	2.85	22.85	192.75	0.20	3060

Note: 1. The tune up conducted power was declared by the applicant.

2. BT/SRD can transmit at same time with Wi-Fi, the 2.4G Wi-Fi cannot transmit at the same time with the 5G Wi-Fi, the BT cannot transmit at the same time with the SRD.

Simultaneous transmitting consideration (worst case):

The ratio= $P_{BT}/P_{th_{BT}} + P_{Wi-Fi}/P_{th_{Wi-Fi}} = 8.61/3060 + 966.05/3060 = 0.319 < 1.0$, 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.