FCC §15.247(i) & §1.1307(b) – RF EXPOSURE

Applicable Standard

According to FCC §1.1307(b), 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 v01, clause 2.1.3.1-SAR-Based Exemption:

A more comprehensive exemption, considering a variable power threshold that depends on both the separation distance and power, is provided in § 1.1307(b)(3)(i)(B). This exemption is applicable to the frequency range between 300 MHz and 6 GHz, with test separation distances between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions.

Accordingly, a RF source is considered an RF exempt device if its available maximum time-averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold. This exemption threshold was derived based on general population 1-g SAR requirements and is detailed in Appendix C.

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

Where

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

and

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

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.

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

Where:
a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for Pth, including existing exempt transmitters and those being added.
b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.
c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.
P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

$P_{th,i}$ = the exemption threshold power (P_{th}) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i.
ERP_j = the ERP of fixed, mobile, or portable RF source j.
$ERP_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least $\lambda/2\pi$ according to the applicable formula of paragraph (b)(3)(i)(C) of this section.
$Evaluated_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.
Exposure $Limit_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from § 1.1310 of this chapter.

Test Result

For worst case:

Mode	Frequency	Maximum Tune-up Conducted Power	Antenna Gain		ERP		Distance	SAR-Based Exclusion Threshold P_{th}	SAR-Based Exclusion
	MHz	dBm	dBi	dBd	dBm	mW	(mm)	mW	
2.4G Wi-Fi	2412-2472	14.5	6.0	3.85	18.35	68.39	200	3060	Yes
WCDMA B2	1850-1910	25	4.5	2.35	27.35	543.25	200	3060	Yes
WCDMA B4	1710-1755	25	4.5	2.35	27.35	543.25	200	3060	Yes
WCDMA B5	824-849	25	4.5	2.35	27.35	543.25	200	1681	Yes
LTE B2	1850-1910	25	4.5	2.35	27.35	543.25	200	3060	Yes
LTE B4	1710-1755	25	4.5	2.35	27.35	543.25	200	3060	Yes
LTE B5	824-849	25	4.5	2.35	27.35	543.25	200	1681	Yes
LTE B12	699-716	25	4.5	2.35	27.35	543.25	200	1426	Yes
LTE B13	777-787	25	4.5	2.35	27.35	543.25	200	1585	Yes
LTE B14	788-798	25	4.5	2.35	27.35	543.25	200	1607	Yes
LTE B66	1710-1780	25	4.5	2.35	27.35	543.25	200	3060	Yes
LTE B71	663-698	25	4.5	2.35	27.35	543.25	200	1352	Yes

Note 1: The tune-up power was declared by the applicant.
Note 2: 0dBd=2.15dBi.
Note 3: The power of WWAN can refer to the FCC ID: XMR201909EC25AFX.
Note 4: The Wi-Fi can transmit at the same time with the WWAN.

Simultaneous transmitting consideration (worst case):

The ratio= $EEPE_{2.4G\ Wi\text{-}Fi}$ /limit + $EPE_{LTE\ B71}$/limit=68.39/3060+543.25/1352=0.424＜1.0

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

Result: Compliant.