

5 FCC §15.407(f), § 1.1307(b)(3)(i) – RF Exposure

5.1 Applicable Standard

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

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:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or 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

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

5.2 RF Exposure Evaluation Result

The EUT can be used in the following modes, selecting the worst mode for evaluation.

Mode 1: 2.4G XOR + 5G Regular + 2.4G Aux + BLE

Mode 2: 2.4G XOR + 5G Regular + 5G Aux + BLE

Mode 3: 5G XOR + 5G Regular + 2.4G Aux + BLE

Mode 4: 5G XOR + 5G Regular + 5G Aux + BLE

Worst case is Mode 1 :

Project info

Band	Freq (MHz)	Tune-up Power (dBm)	Ant Gain (dBi)	Distances (mm)	Duty (%)	Tune-up Power (mW)	ERP (dBm)	ERP (mW)
BLE	2480	5	13	300	100%	3.16	15.85	38.46
do0 2.4GHz XOR	2462	22	13	300	100%	158.49	32.85	1927.52
d01 5GHz Regular	5850	23	13	300	100%	199.53	33.85	2426.61
do4 2.4G Aux	2462	16	13	300	100%	39.81	26.85	484.17

Option A

The available maximum time-averaged power is no more than 1 mW

Band	Freq (MHz)	Result Option A
BLE	2480	not exempt
do0 2.4GHz XOR	2462	not exempt
d01 5GHz Regular	5850	not exempt
do4 2.4G Aux	2462	not exempt

Option B

The available maximum time-averaged power or effective radiated power (ERP), whichever is greater.

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).

Band	Freq (MHz)	Pth (mW)	X	ERP 20cm (mW)	Ratio	Result Option B
BLE	2480	3060.00	1.905	3060	0.01	exempt
do0 2.4GHz XOR	2462	3060.00	1.903	3060	0.63	exempt
d01 5GHz Regular	5850	3060.00	2.091	3060	0.79	exempt
do4 2.4G Aux	2462	3060.00	1.903	3060	0.16	exempt

Simultaneous Analysis :

Band	Freq (MHz)	PSD Require	PSD (mW/cm ²)	PSD Limit (mW/cm ²)	Simultaneous TX	Ratio
BLE	2480	exempt	0.006	1.000	O	0.006
do0 2.4GHz XOR	2462	exempt	0.280	1.000	O	0.280
d01 5GHz Regular	5850	exempt	0.352	1.000	O	0.352
do4 2.4G Aux	2462	exempt	0.070	1.000	O	0.070
Simultaneous Analysis (Limit 1)						0.708

Result: The EUT meets exemption requirement- RF exposure evaluation greater than **30cm** distance.