5. RF EXPOSURE EVALUATION

5.1 RF Exposure Evaluation - MPE-Based Exemption

5.1.1 Applicable Standard

FCC §15.247 (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 levels in excess of the Commission's guidelines. See §1.1307(b)(1) of this chapter.

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5.1.2 Procedure

According to §1.1307(b)(3)(ii)(B)

Simultaneous Transmission with both SAR-based and MPE-Based Test Exemptions

This case is described in detail in § 1.1307(b)(3)(ii)(B) and covers the situations where both SAR-based and MPE-based exemption may be considered for test exemption in fixed, mobile, or portable device exposure conditions. For these cases, a device with multiple RF sources transmitting simultaneously will be considered an RF exempt device if the condition of Formula (1) is satisfied.

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	$1,920 \text{ R}^2.$		
1.34-30	$3,450 \text{ R}^2/\text{f}^2.$		
30-300	3.83 R^2 .		
300-1,500	$0.0128 \text{ R}^2\text{f}.$		
1,500-100,000	19.2R ² .		

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

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Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for P_{th} , 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_i = 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.

5.1.3 Measurement Result

Radio	Frequency (MHz)	λ/2 Π (mm)	Distance (mm)	Exemption ERP (mW)	Maximum Conducted Power including Tune-up	Antenna Gain (dBi)	ERP	
		()		(,)	Tolerance (dBm)	(==)	dBm	mW
WiFi	2412-2462	19.80	200	768	15	2.07	14.92	31.05
BLE	2402-2480	19.88	200	768	5	2.07	4.92	3.10
ZigBee	2405-2480	19.85	200	768	12	2.38	12.23	16.71

Note:

- 1. The Value of Maximum Conducted Power including Tune-up Tolerance was declared by the customer.
- 2. The WiFi or BLE and ZigBee can transmit simultaneously.

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

 $=\!\!ERP_{WiFi}\,/\,ERP_{th}+ERP_{ZigBee}\,/\,ERP_{th}$

=31.05/768 + 16.71/768

=0.622

< 1.0

Result: The device compliant the MPE-Based Exemption at 20cm distances.