5. RF EXPOSURE EVALUATION

5.1 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.

5.2 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.

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

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_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.

5.3 Measurement Result

MPE-based

Radio	Frequency (MHz)	λ /2Π (mm)	Distance (mm)	Exemption ERP_{th} (mW)	Maximum ERP including Tune-up Tolerance	
					(dBm)	(mW)
Lora-FHSS	902.3-914.9	52.92	200	462	24	251.19
Lora-DTS	923.3-927.5	51.71	200	473	28	630.96
BLE	2402-2480	19.88	200	768	-5	0.32

SAR-based

Radio	Frequency (MHz)	Distance (mm)	P_{th} (mW)	Maximum Conducted Power including Tune-up Tolerance	
				(dBm)	(mW)
Lora-DTS	923.3-927.5	200	1884	28	630.96

Note:
The BLE and Lora can transmit simultaneously
Antenna Gain is 2dBi(-0.15dBd), So Conducted power was used for evaluation.

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

$=ERP_{Lora\text{-}FHSS} / ERP_{th} + ERP_{BLE} / ERP_{th}$

=251.19/462 + 0.32/768

=0.544

< 1.0

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

===== END OF REPORT =====