# 5. RF EXPOSURE EVALUATION

### **5.1 MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

#### 5.1.1 Applicable Standard

FCC §15.247 (i) & §1.1310 & §2.1091

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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Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure									
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)	Averaging Time (minutes)					
0.3–1.34	614	1.63	*(100)	30					
1.34–30	824/f	2.19/f	*(180/f²)	30					
30–300	27.5	0.073	0.2	30					
300–1500	/	/	f/1500	30					
1500-100,000	/	/	1.0	30					

f = frequency in MHz; \* = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

#### 5.1.2 Procedure

Prediction of power density at the distance of the applicable MPE limit

 $S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain; R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_{i} \frac{S_{i}}{S_{Limit,i}} \le 1$$

## **5.1.3** Calculated Result

Modes	Antenna Gain		Conducted output power including Tune- up Tolerance		Evaluation Distance (cm)	Power Density (mW/cm²)	MPE Limit (mW/cm²)
	(dBi)	(numeric)	(dBm)	(mW)			
Lora-DTS 903-914.2 MHz	1.5	1.41	14	25.12	20.00	0.007	0.60
Lora- FHSS 902.3- 914.9MHz	1.5	1.41	14	25.12	20.00	0.007	0.60
WLAN	1.5	1.41	18	63.10	20.00	0.018	1.0
WWAN	1.5	1.41	23.5	223.87	20.00	0.063	0.422

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Note: WWAN limit was used is the worst of all frequency bands(LTE B71).

#### **Simultaneous Transmission:**

The Lora, WLAN and WWAN can transmit simultaneously:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

 $= S_{Lora}/S_{limit\text{-}Lora} + S_{WLAN}/S_{limit\text{-}WLAN} + S_{WWAN}/S_{limit\text{-}WWAN}$ 

=0.007/0.60+0.018/1+0.063/0.422

=0.18

< 1.0

**Result:** The device meet FCC MPE at 20 cm distance

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