5   FCC §2.1091, FCC §15.247(i) & ISEDC RSS-102 – RF Exposure

5.1   Applicable Standards

According to FCC §15.247(i), Radio frequency devices operating under the provisions of this part are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b), 1.1310, 2.1091, and 2.1093 of this chapter, as appropriate. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements. Technical information showing the basis for this statement must be submitted to the Commission upon request.

According to FCC §2.1091 and §1.1310(e)(1), 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.

<div align="center">Limits for General Population/Uncontrolled Exposure</div>

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* (180/f^2)	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 ISEDC RSS-102 Issue 6 Section 6.6: Field reference level exposure exemption limits

Field reference level (FRL) exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm (i.e. mobile devices), except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 1 W (adjusted for tune-up tolerance)

- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $4.49/f^{0.5}W$ (adjusted for tune-up tolerance), where f is in MHz

- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance)

- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} W$ (adjusted for tune-up tolerance), where f is in MHz

- at or above 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 5 W (adjusted for tune-up tolerance)

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the EIRP was derived.

5.2   MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
        P = power input to antenna
        G = power gain of the antenna in the direction of interest relative to an isotropic radiator
        R = distance to the center of radiation of the antenna

5.3   MPE Result

Note: The Maximum power measurements and Antenna gain for Iridium were referenced from the test report: Document 75926443 Report 10 Issue 2 by TÜV SÜD Product Service, issued on 2014-08-06.

Radio	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)
LoRa	915	-1.3	17.53	16.23	41.98	0.008	1.0
Iridium	1626.5	3	21.34	24.34	271.64	0.054	1.0

Worst Case Sum of Ratios:

LoRa + Iridium: 0.008/1.0 + 0.054/1.0 = 0.062 < 1

For the different combination of transmitters, a separation distance of 20 cm complies with the MPE simultaneous transmission limit of ≤ 1.0.

5.4   IC Exemption

LoRa:

The EIRP of this device is 16.23 dBm (41.98 mW) which is less than the exemption threshold, i.e., $1.31*10^{-2} * f^{0.6834}=1.38W$. Therefore, the RF exposure evaluation is exempt.

Iridium:

The EIRP of this device is 24.34 dBm (271.64 mW) which is less than the exemption threshold, i.e., $1.31*10^{-2} * f^{0.6834}=2.05W$. Therefore, the RF exposure evaluation is exempt.

Worst Case Sum of Ratios:

LoRa + Iridium +: 0.04198/1.38 + 0.27164/2.05 = 0.1629 < 1