The Device is a carrier grade gateway designed for IoT applications. The device is intended to be installed in controlled area like tower or roof top building with restricted access to general public. The installation and maintenance must be performed by professional trained RF technician.

The device has 3 antenna ports, which must be used with antenna respecting the requirement specified in the technical documentation.

Per OET Bulletin 65 Edition 97-01, Appendix A Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	**Controlled Exposure (table 1 A) Power Density 'S' (mW/cm^2)**	**Uncontrolled Exposure (table 1 B) Power Density 'S' (mW/cm^2)**
300-1500	f/300	f/1500

We are using the lowest transmitter frequency of all possible on-board radio (module radio EM7355) for worst case calculation: 704 MHz (EM7355 module, LTE band 17)

We will also use the Uncontrolled Exposure Limit: f/1500

$S = 0.467$ mW/cm^2, for uncontrolled exposure

$S = 2.333$ mW/cm^2, for controlled exposure

The table below shows the EIRP for each mode of operation of the EM7355 module[1].

Technology	**Frequency (MHz)**	**Max. Cond. Power (W)**	**duty cycle**	**Max. Antenna gain (dBi)**	**Avg EIRP (mW)**
LTE	1850-1910	0.3	1	3	501.187
	1710-1755	0.3	1	6	1000
	824-849	0.3	1	3	501.187
	777-787	0.3	1	6	1000
	704-716	**0.3**	**1**	**6**	**1000**
	1850-1915	0.3	1	3	501.187
UMTS	1850-1910	0.251	1	3	501.187
	1710-1755	0.251	1	6	1000
	824-849	0.251	1	3	501.187
GSM	824-849	2	0.25	3	995.268
	1850-1910	1	0.25	3	498.816
CDMA	824-849	0.3	1	3	630.957
	1850-1910	0.3	1	3	630.957
	817-824	0.3	1	3	630.957

[1] Sierra Wireless, MPE Evaluation for EM7355 Radio Module, February 5, 2013

The table below shows the EIRP value for both LoRa radio in 2 channels transmission mode. This mode was determined by measurement to be the worst case scenario for EIRP.

LoRa ID	Frequency (MHz)	Corrected Reading (dBm)	RF Output (Watts)	Duty cycle (ratio)	Avg Power (dBm)	Cable loss (dB)	Max. antenna gain (dBi)	Avg EIRP (dBm)	Avg EIRP (mW)
	923.3 + 923.9	29.78	0.95	1	29.78	2	8	35.78	3782.02
	923.9 + 924.5	29.83	0.96	1	29.82	2	8	35.82	3821.83
LoRa 0	924.5 + 925.1	29.9	0.98	1	29.91	2	8	35.91	**3901.45**
	925.7 + 926.3	29.61	0.91	1	29.59	2	8	35.59	3622.78
	926.3 + 926.9	29.63	0.92	1	29.64	2	8	35.64	3662.59
LoRa 1	926.9 + 927.5	29.64	0.92	1	29.64	2	8	35.64	3662.59

For worst case scenario, the highest measured EIRP value was rounded up to 4000 mW.

To determine the minimum safe distance, the sum of all transmitted power is used with the equation (4) from the OET bulletin 65,

$$S = EIRP / (4 \pi R^2)$$

Where: S, power density in 'mW/cm^2'
EIRP, Effective Isotropic Radiated Power in 'mW'
R, distance to the center of the radiation of the antenna in 'cm'

and then re-arrange to determine the minimum safe distance.

$$R = \sqrt{[EIRP / (4 \pi S)]}$$

R = 39.2 cm, for uncontrolled exposure (rounded up to the first decimal)

R = 17.6 cm, for controlled exposure (rounded up to the first decimal)

The manufacturer manual specified a minimum safe distance of **80 cm**. An additional safety factor of 2 is provided to consider phenomenon like reflection from ground or adjacent structures.

The device is intended to be installed in controlled area like tower or roof top building with restricted access to general public. The installation and maintenance must be performed by professional trained RF technician.