

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 1 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

$S = 0.467 \text{ mW/cm}^2$, for uncontrolled exposure

$S = 2.333 \text{ mW/cm}^2$, for controlled exposure

The table below shows the EIRP for each mode of operation of the EM7355 module¹.

Technology	Frequency (MHz)	Max. Cond. Power (W)	duty cycle	Actual Antenna gain (dBi)	Avg EIRP (mW)
LTE	1850-1910	0.3	1	3.4	656
	1710-1755	0.3	1	3.4	656
	824-849	0.3	1	2.9	585
	777-787	0.3	1	2.9	585
	704-716	0.3	1	2.9	585
	1850-1915	0.3	1	3.4	656
UMTS	1850-1910	0.251	1	3.4	549
	1710-1755	0.251	1	3.4	549
	824-849	0.251	1	2.9	489
GSM	824-849	2	0.25	2.9	975
	1850-1910	1	0.25	3.4	547
CDMA	824-849	0.3	1	2.9	585
	1850-1910	0.3	1	3.4	656
	817-824	0.3	1	2.9	585

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

The table below shows the EIRP value for LoRa radio both 1 channel and in 2 channels transmission mode. This mode was determined by measurement to be the worst case scenario for EIRP.

Ant port0	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)
One Channel operation	923.3	27.11	.514	1	27.11	.7	8	34.41	2760.6
	925.1	28.41	.693	1	28.41	.7	8	35.71	3723.9
	927.5	27.49	.561	1	27.49	.7	8	34.79	3013.0
Two Channel operation	923.3 + 923.9	28.35	.684	1	28.35	2	8	34.35	2722.7
	924.5 + 925.1	29.29	.85	1	29.29	2	8	35.29	3380.6
	926.7 + 927.5	28.33	.681	1	28.33	2	8	34.33	2710.2

For worst case scenario, the highest measured EIRP value was rounded up to 3723.9 mW.

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

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

Where: S, power density in 'mW/cm²'

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.

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

R = 28.3 cm, for uncontrolled exposure (rounded up to the first decimal)

R = 12.7 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.

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