

**FCC §1.1307 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

**Applicable Standard**

According to subpart §2.1091 and subpart §1.1310, 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.

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

<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
<b>Frequency Range (MHz)</b>	<b>Electric Field Strength (V/m)</b>	<b>Magnetic Field Strength (A/m)</b>	<b>Power Density (mW/cm<sup>2</sup>)</b>	<b>Averaging Time (minutes)</b>
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	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.

Calculated Formulary:

Predication of MPE limit at a given distance

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

**Calculated Data:**

Calculation of maximum antenna gain based on EIRP

<b>Mode</b>	<b>Max Tune-up Power (dBm)</b>	<b>EIRP Limit (dBm)</b>	<b>Max Antenna Gain</b>
NB-IoT Band 4	24.00	30.00	6.0 dBi

Calculation of maximum antenna gain based on MPE

Mode	Frequency Range	Tune-up Conducted Power		Power Density Limit	Maximum Power Density	Evaluation Distance	Maximum Antenna Gain Allowed based on MPE	
	(MHz)	(dBm)	(mW)	(mW/cm <sup>2</sup> )	(mW/cm <sup>2</sup> )	(cm)	(dBi)	(numeric)
NB-IoT Band 4	1710.1-1754.9	24.00	251.19	1.0000	0.9995	20	13.01	20.00

Mode	Max Allowed Antenna Gain
NB-IoT (Band 4) Frequency Range: 1710.1-1754.9MHz	6.0 dBi

**Result: For NB-IoT mode**, to meet RF exposure EIRP, the maximum net gains of antennas allowed is 6.0 dBi @ NB-IoT (Band 4). The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.