

## **FCC §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

### **Applicable Standard**

According to subpart 15.247 (i) and subpart 1.1310, 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

<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

### **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);

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

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

**Calculated Data:**

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	MPE Ratio
		(dBi)	(numeric)	(dBm)	(mW)				
GPRS 850	824~849	2.00	1.58	26.75	473.15	20	0.1492	0.55	0.2712
GPRS 1900	1850~1910	3.01	2.00	25.00	316.23	20	0.1258	1.00	0.1258
BLE	2402-2480	4.56	2.86	7.00	5.01	20	0.0028	1.00	0.0028

Note:

(1) The target output powers are all declared by the Manufacturer.

(2) BLE and GPRS can transmit simultaneously; the worst condition was as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0028/1.00 + 0.1492/0.55 = 0.0028 + 0.2712 = 0.2740 < 1.0$$

(3) For GPRS Mode, the time based average power is relevant, the difference in between depends on the duty cycle of the TDMA signal.

Number of Time slot	1	2	3	4
Duty Cycle	1:8	1:4	1:2.66	1:2
Time based Ave. power compared to slotted Ave. power	-9 dB	-6 dB	-4.25 dB	-3 dB

**Result:** The device meets FCC MPE at 20 cm distance.