

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

Applicable Standard

According to subpart 15.247(i) 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) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)	Averaging Time (minutes)
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 §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/cm²);

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 ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
BLE	2402~2480	1.92	1.56	6.50	4.47	20	0.0014	1.00
GPRS 850	824~849	0.41	1.10	21.00	125.89	20	0.0275	0.55
GPRS 1900	1850~1910	2.69	1.86	21.00	125.89	20	0.0465	1.00

Note:

- 1) For the above tune up power were declared by the manufacturer.
- 2) BLE and GPRS can transmit simultaneously, the worst condition was as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0014/1.00 + 0.0275/0.55 = 0.0014 + 0.0500 = 0.0514 < 1.0$$

- (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
Duty Cycle	1:8
Time based Ave. power compared to slotted Ave. power	-9 dB

GPRS 850: Tune-up maximum output power is 30.00dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 21.00dBm.

GPRS 1900: Tune-up Maximum output power is 30.00dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 21.00dBm.

Result: The device meet FCC MPE at 20 cm distance.