# FCC §1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

## Applicable Standard

According to subpart 1.1307 (b)(1), 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.

| Limits for General Population/Uncontrolled Exposure | | | | |
|---|---|---|---|---|
| **Frequency Range (MHz)** | **Electric Field Strength (V/m)** | **Magnetic Field Strength (A/m)** | **Power Density ($mW/cm^2$)** | **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

## Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. $mW/cm^2$);
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 maximum antenna gain based on ERP/EIRP

| Mode | Max Tune-up power (dBm) | ERP/EIRP Limit (dBm) | Max Antenna Gain (dBi) |
|---|---|---|---|
| GPRS 850 | 33.50 | 38.45 | 4.95 |
| GPRS 1900 | 31.00 | 33.00 | 2.00 |

Calculation maximum antenna gain based on MPE

| Mode | Frequency Range (MHz) | MPE Limit ($mW/cm^2$) | Tune-up Power Source Based Time Average Power | | Evaluation Distance (cm) | Antenna Gain | | Power Density ($mW/cm^2$) |
|---|---|---|---|---|---|---|---|---|
| | | | (dBm) | (mW) | | (dBi) | (numeric) | |
| GPRS 850 | 824.2-848.8 | 0.55 | 26.00 | 398.11 | 20 | 8.45 | 7.00 | 0.55 |
| GPRS 1900 | 1850.2-1909.8 | 1.00 | 23.00 | 199.53 | 20 | 14.00 | 25.12 | 1.00 |

**Note:**

1. Tune-up power:

GPRS 850: 1 slot 33±0.5dBm, 2 slots 31.5±0.5dBm, max average power 26dBm;
GPRS 1900: 1 slot 30.5±0.5dBm, 2slots 28.5±0.5dBm, max average power 23dBm.

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

| Mode | Max Allow Antenna Gain (dBi) |
|---|---|
| GPRS 850 | 4.95 |
| GPRS 1900 | 2.00 |

**Result:** To meet RF exposure & ERP/ERIP, the maximum net gain of antennas allowed are 4.95 dBi @ GPRS 850 and 2.00 @ GPRS1900. 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.