

FCC §1.1307& §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/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;

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);

Calculated Data:

Calculation maximum antenna gain based on ERP/EIRP

Mode	Max Tune-up power (dBm)	ERP/EIRP Limit (dBm)	Max Antenna Gain (dBi)
GSM 850/ GPRS 850	33.00	38.45	5.45
GSM 1900/ GPRS 1900	30.00	33.00	3.00

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)	
GSM850/ GPRS 850	824.2-848.8	0.549	27	501.19	20	7.40	5.50	0.548
GSM1900/ GPRS1900	1850.2-1909.8	1.000	25	316.23	20	12.01	15.89	0.999

Note:

The target output power:

GSM 850: 32.5±0.5dBm, Maximum power 33dBm, Max Average Time-base power 24dBm;

GSM 1900: 29±1dBm, Maximum power 30dBm, Max Average Time-base power 21dBm;

GPRS 850: 1 slot 32.5±0.5dBm, 2 slots 31.5±0.5dBm, 3 slots 30.5±0.5dBm, 4 slots 29.5±0.5dBm

Max Average Time-base power 27dBm;

GPRS 1900: 1 slot 29±1dBm, 2slots 28±1dBm, 3 slots 27.5±0.5dBm, 4 slots 27.5±0.5dBm

Max Average Time-base power 25dBm.

Number of Time slot	1	2	3	4
Duty Cycle	1:8	1:4	1:2.67	1:2
Time based Ave. power compared to slotted Ave. power	-9 dB	-6 dB	-4.26 dB	-3 dB

Mode	Max Allow Antenna Gain (dBi)
GSM 850/ GPRS 850	5.45
GSM 1900/ GPRS 1900	3.00

Result: To meet RF exposure & ERP/ERIP, the maximum net gain of antennas allowed are 5.45dBi @ GSM 850/GPRS 850, 3.00 dBi @ GSM 1900/GPRS 1900. 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.