

FCC §1.1310, § 2.1091 - Maximum Permissible Exposure (MPE)

Applicable Standard

According to 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.

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);

MPE evaluation:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Output Power		Evaluation Distance (cm)	Power Density (mW/cm²)	MPE Limit (mW/cm²)
		(dBi)	(numeric)	(dBm)	(mW)			
GSM 850	824-249	2	1.585	25.00	316.228	20	0.100	0.55
GPRS 850	824-249	2	1.585	25.00	316.228	20	0.100	0.55
GSM 1900	1850 - 1910	3	1.995	19.50	89.125	20	0.035	1
GPRS 1900	1850 - 1910	3	1.995	20.00	100.000	20	0.040	1

GSM 850: Maximum Tune-up output power with 1 slot is 34.00 dBm, so the max tune-up time based Ave. power compared to slot Ave. power is 25.00 dBm.

GPRS 850: Maximum Tune-up output power with 1 slot is 34.00 dBm, 2 slots is 31.00 dBm, 3 slots is 29.00 dBm, 4 slots is 28.00 dBm, so the max tune-up time based Ave. power compared to slot Ave. power are 25.00 dBm.

GSM 1900: Maximum Tune-up output power with 1 slot is 28.50 dBm, so the max tune-up time based Ave. power compared to slot Ave. power is 19.50 dBm .

GPRS 1900: Maximum Tune-up output power with 1 slot is 28.00 dBm, 2 slots is 26.00 dBm, 3 slots is 24.00 dBm, 4 slots is 23.00 dBm, so the max tune-up time based Ave. power compared to slot Ave. power are 20.00 dBm .

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	-4.26 dB	-3 dB

Result: MPE evaluation meets the requirements of the **20cm** standard.