

17. MAXIMUM PERMISSIBLE EXPOSURE

RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the Environmental of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
(A) Limits for occupational / Control Exposure				
30 - 300	61.4	0.163	1	6
300 - 1500	...	...	F/300	6
1500 - 100000	...	...	5	6
(B) Limits for General Population / Uncontrolled Exposure				
30 - 300	27.5	0.073	0.2	30
300 - 1500	...	...	F/1500	30
1500 - 100000	...	...	1	30

F = Frequency (MHz)

Fries formula

Fries transmission formula : $Pd = (Pout * G) / (4 * \pi * r^2)$

$$r = \sqrt{((Pout * G) / 4 * \pi * Pd)}$$

Where

Pd = Power density in mW/cm²

Pout = Output power to antenna in mW

G = Gain of antenna in linear scale

$\pi = 3.1416$

r = Distance between observation point center of the radiator in cm

Pd is the limit of MPE, F/1500(GSM850 and WCDMA Band V) or 1 mW/cm²(PCS1900 and WCDMA Band II). If we know the Maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

RF Exposure Distance

GSM 850

Channel	Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Antenna Gain (Numeric)	RF Exposure Distance (cm)
128	824.2	32.13	1633	0.52	11.14
190	836.6	32.11	1626	0.52	11.03
251	848.8	32.01	1589	0.52	10.83

PCS 1900

Channel	Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Antenna Gain (Numeric)	RF Exposure Distance (cm)
512	1850.2	29.07	807	0.69	6.67
661	1880.0	29.13	818	0.69	6.71
810	1909.8	28.98	791	0.69	6.60

WCDMA Band V

Channel	Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Antenna Gain (Numeric)	RF Exposure Distance (cm)
4357	826.4	23.25	211	0.52	4.00
4408	836.6	22.98	199	0.52	3.86
4458	846.6	23.24	211	0.52	3.95

WCDMA Band II

Channel	Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Antenna Gain (Numeric)	RF Exposure Distance (cm)
9262	1852.4	23.43	220	0.69	3.48
9400	1880.0	23.14	206	0.69	3.37
9538	1907.6	23.00	200	0.69	3.31

MPE Safe Distance: 11.14 cm