

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

Applicable Standard

According to 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.

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit

$S = PG/4\pi R^2$ = 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);

Maximum Antenna Gain per MPE Calculation:

Mode	Frequency (MHz)	Conducted output power including Tune-up Tolerance		Evaluation Distance (cm)	MPE Limit (mW/cm²)	Maximum Antenna Gain (dBi)
		(dBm)	(mW)			
GSM850	824-849	32	1584.89	20.00	0.55	2.41
PCS1900	1850-1910	29	794.33	20.00	1.00	8.01
LTE Band 2	1850-1910	24	251.19	20.00	1.00	13.01
LTE Band 4	1710-1755	24	251.19	20.00	1.00	13.01
LTE Band 5	824-849	24	251.19	20.00	0.55	10.41
LTE Band 7	2500-2570	24	251.19	20.00	1.00	13.01
LTE Band 38	2570-2620	24	251.19	20.00	1.00	13.01
LTE Band 40	2305-2315 & 2350-2360	24	251.19	20.00	1.00	13.01
LTE Band 41	2535-2655	24	251.19	20.00	1.00	13.01
LTE Band 66	1710-1780	24	251.19	20.00	1.00	13.01

Maximum Antenna Gain per ERP/EIRP Calculation:

Mode	Frequency (MHz)	Conducted output power including Tune-up Tolerance (dBm)	ERP/EIRP Limit (dBm)	Maximum Antenna Gain (dBi/dBd)
GSM850	824-849	32	38.45	6.45
PCS1900	1850-1910	29	33	4
LTE Band 2	1850-1910	24	33	9
LTE Band 4	1710-1755	24	30	6
LTE Band 5	824-849	24	38.45	14.45
LTE Band 7	2500-2570	24	33	9
LTE Band 38	2570-2620	24	33	9
LTE Band 40	2305-2315 & 2350-2360	24	24	0
LTE Band 41	2535-2655	24	33	9
LTE Band 66	1710-1780	24	30	6

Therefore:

The maximum Antenna gain:

Mode	Frequency (MHz)	Maximum Antenna Gain (dBi/dBd)
GSM850/ LTE Band 5	824-849	2.41
PCS1900/ LTE Band 2	1850-1910	4
LTE Band 4/66	1710-1780	6
LTE Band 7	2500-2570	9
LTE Band 38	2570-2620	9
LTE Band 40	2305-2315 & 2350-2360	0
LTE Band 41	2535-2655	9

Note: Antenna gain listed is dBd for operation below 1 GHz and dBi for operation above 1 GHz.

This device is to be used in mobile or fixed applications only. Antenna gain including cable loss must not exceed above value for the purpose of satisfying the requirements of 2.1043 and 2.1091. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operated in conjunction with any antenna or transmitter not described under this FCC ID. The final product operating with this transmitter must include operating instructions and antenna installation instructions, for end-users and installers to satisfy RF exposure compliance requirements. Compliance of this device in all final product configurations is the responsibility of the Grantee. Installation of this device into specific final products may require the submission of a Class II permissive change application containing data pertinent to RF Exposure, spurious emissions, ERP/EIRP, and host/module authentication, or new application if appropriate. Installation of this device into specific final products may require the submission of a Class II permissive change application containing data pertinent to RF Exposure, spurious emissions, ERP/EIRP, and host/module authentication, or new application if appropriate.