

11 FCC §1.1307(b), §27.52 & §2.1091 - RF EXPOSURE

11.1 Applicable Standard

According to §1.1310 and §2.1091 (Mobile Devices) RF exposure is calculated.

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 (minute)
Limits for General Population/Uncontrolled Exposure				
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

11.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

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

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

DL: 746-757 MHz

Worst Case: LTE-QPSK

Maximum peak output power at antenna input terminal (dBm): 11.19
Maximum peak output power at antenna input terminal (mW): 13.15
Prediction distance (cm): 20
Prediction frequency (MHz): 752
Antenna Gain, typical (dBi): 8.39
Maximum Antenna Gain (numeric): 6.902
Power density at predication frequency and distance (mW/cm²): 0.01806
MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.5013

UL: 776-787 MHz

Worst Case: LTE-QPSK

Maximum peak output power at antenna input terminal (dBm): -21.56
Maximum peak output power at antenna input terminal (mW): 0.007
Prediction distance (cm): 20
Prediction frequency (MHz): 782
Antenna Gain, typical (dBi): 8.39
Maximum Antenna Gain (numeric): 6.902
Power density at predication frequency and distance (mW/cm²): 0.00000959
MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.5213

DL: 728-746 MHz

Worst Case: LTE-QPSK

Maximum peak output power at antenna input terminal (dBm): 10.98
Maximum peak output power at antenna input terminal (mW): 12.53
Prediction distance (cm): 20
Prediction frequency (MHz): 733
Antenna Gain, typical (dBi): 8.39
Maximum Antenna Gain (numeric): 6.902
Power density at predication frequency and distance (mW/cm²): 0.01721
MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.4887

UL: 698-716 MHz

Worst Case: WCDMA

Maximum peak output power at antenna input terminal (dBm): -19.43
Maximum peak output power at antenna input terminal (mW): 0.011
Prediction distance (cm): 20
Prediction frequency (MHz): 707
Antenna Gain, typical (dBi): 8.39
Maximum Antenna Gain (numeric): 6.902
Power density at predication frequency and distance (mW/cm²): 0.0000157
MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.4317

DL: 2110-2155 MHz

Worst Case: LTE-16QAM

Maximum peak output power at antenna input terminal (dBm):	<u>15.34</u>
Maximum peak output power at antenna input terminal (mW):	<u>34.20</u>
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>2125</u>
Antenna Gain, typical (dBi):	<u>8.39</u>
Maximum Antenna Gain (numeric):	<u>6.902</u>
Power density at predication frequency and distance (mW/cm ²):	<u>0.04696</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>1.0</u>

UL: 1710-1755 MHz

Worst Case: WCDMA

Maximum peak output power at antenna input terminal (dBm):	<u>-19.85</u>
Maximum peak output power at antenna input terminal (mW):	<u>0.0103</u>
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>1732.4</u>
Antenna Gain, typical (dBi):	<u>8.39</u>
Maximum Antenna Gain (numeric):	<u>6.902</u>
Power density at predication frequency and distance (mW/cm ²):	<u>0.00001421</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>1.0</u>

Test Result

For DL 746-757 MHz Band, the highest power density level at 20 cm is 0.01806 mW/cm², which is below the uncontrolled exposure limit of 0.5013 mW/cm² at 752 MHz.

For UL 776-787 MHz Band, the highest power density level at 20 cm is 0.00000959 mW/cm², which is below the uncontrolled exposure limit of 0.5213 mW/cm² at 782 MHz.

For DL 728-746 MHz Band, the highest power density level at 20 cm is 0.01721 mW/cm², which is below the uncontrolled exposure limit of 0.4887 mW/cm² at 733 MHz.

For UL 698-716 MHz Band, the highest power density level at 20 cm is 0.0000157 mW/cm², which is below the uncontrolled exposure limit of 0.4317 mW/cm² at 707 MHz.

For DL 2110-2155 MHz Band, the highest power density level at 20 cm is 0.04696 mW/cm², which is below the uncontrolled exposure limit of 1.0 mW/cm² at 2125 MHz.

For UL 1710-1755 MHz Band, the highest power density level at 20 cm is 0.00001421 mW/cm², which is below the uncontrolled exposure limit of 1.0 mW/cm² at 1732.4 MHz.

Note:

Antenna gain is restricted to 1.5 Watt ERP (2.49 Watt EIRP) in order to satisfy RF exposure compliance requirements. If higher than 1.5 Watt ERP, routine MPE evaluation is needed. The antennas should be installed to provide at least 20 cm from all persons to satisfy MPE requirements of FCC Part 2, 2.1091.