

11 §1.1307(b) (1) & §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 page 18 of 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

Operation Frequency Band – 762 to 776 MHz

Maximum peak output power at antenna input terminal (dBm): 36.43
Maximum peak output power at antenna input terminal (mW): 4395.4
Prediction distance (cm): 100
Prediction frequency (MHz): 769
Antenna Gain, typical (dBi): 10
Maximum Antenna Gain (numeric): 10
Power density at predication frequency and distance (mW/cm²): 0.3498
MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.5127

Operation Frequency Band – 792 to 806 MHz

Maximum peak output power at antenna input terminal (dBm): 36.79
Maximum peak output power at antenna input terminal (mW): 4775.3
Prediction distance (cm): 40
Prediction frequency (MHz): 799
Antenna Gain, typical (dBi): 2
Maximum Antenna Gain (numeric): 1.585
Power density at predication frequency and distance (mW/cm²): 0.3764
MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.5327

Operation Frequency Band – 806 to 824 MHz

Maximum peak output power at antenna input terminal (dBm): 37.86
Maximum peak output power at antenna input terminal (mW): 6109.4
Prediction distance (cm): 100
Prediction frequency (MHz): 815
Antenna Gain, typical (dBi): 10
Maximum Antenna Gain (numeric): 10
Power density at predication frequency and distance (mW/cm²): 0.4862
MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.5433

Operation Frequency Band – 851 to 869 MHz

Maximum peak output power at antenna input terminal (dBm): 37.96
Maximum peak output power at antenna input terminal (mW): 6251.7
Prediction distance (cm): 40
Prediction frequency (MHz): 860
Antenna Gain, typical (dBi): 2
Maximum Antenna Gain (numeric): 1.585
Power density at predication frequency and distance (mW/cm²): 0.4928
MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.5734

Operation Frequency Band – 896 to 901MHz

Maximum peak output power at antenna input terminal (dBm):	<u>37.60</u>
Maximum peak output power at antenna input terminal (mW):	<u>5754.4</u>
Prediction distance (cm):	<u>100</u>
Prediction frequency (MHz):	<u>898.5</u>
Antenna Gain, typical (dBi):	<u>10</u>
Maximum Antenna Gain (numeric):	<u>10</u>
Power density at predication frequency and distance (mW/cm ²):	<u>0.4579</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>0.5990</u>

Operation Frequency Band – 935 to 940 MHz

Maximum peak output power at antenna input terminal (dBm):	<u>35.82</u>
Maximum peak output power at antenna input terminal (mW):	<u>3819.4</u>
Prediction distance (cm):	<u>40</u>
Prediction frequency (MHz):	<u>937.5</u>
Antenna Gain, typical (dBi):	<u>2</u>
Maximum Antenna Gain (numeric):	<u>1.585</u>
Power density at predication frequency and distance (mW/cm ²):	<u>0.3011</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>0.6250</u>

11.3 Test Results

The device is compliant with the requirement MPE limit for uncontrolled exposure.

The indoor antenna prediction distance should be greater then 40 cm, and outdoor antenna prediction distance should be greater then 100 cm.

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300-1500	/	/	f/1500	30
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f = frequency in MHz

* = Plane-wave equivalent power density

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Predication of MPE limit at a given distance

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Uplink:

CDMA:

Maximum peak output power at antenna input terminal (dBm):	<u>37.10</u>
Maximum peak output power at antenna input terminal (mW):	<u>51.29</u>
Prediction distance (cm):	<u>100</u>
Prediction frequency (MHz):	<u>836.52</u>
Antenna Gain, typical (dBi):	<u>10</u>
Maximum Antenna Gain (numeric):	<u>10</u>
Power density at predication frequency and distance (mW/cm ²):	<u>0.4082</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>0.57</u>

GSM:

Maximum peak output power at antenna input terminal (dBm):	<u>37.06</u>
Maximum peak output power at antenna input terminal (mW):	<u>5082</u>
Prediction distance (cm):	<u>100</u>
Prediction frequency (MHz):	<u>836.6</u>
Antenna Gain, typical (dBi):	<u>10</u>
Maximum Antenna Gain (numeric):	<u>10</u>
Power density at predication frequency and distance (mW/cm ²):	<u>0.40443</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>0.57</u>

Downlink:**CDMA:**

Maximum peak output power at antenna input terminal (dBm):	<u>37.54</u>
Maximum peak output power at antenna input terminal (mW):	<u>5675</u>
Prediction distance (cm):	<u>40</u>
Prediction frequency (MHz):	<u>881.52</u>
Antenna Gain, typical (dBi):	<u>2</u>
Maximum Antenna Gain (numeric):	<u>1.585</u>
Power density at predication frequency and distance (mW/cm ²):	<u>0.4474</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>0.587</u>

GSM:

Maximum peak output power at antenna input terminal (dBm):	<u>37.41</u>
Maximum peak output power at antenna input terminal (mW):	<u>5508</u>
Prediction distance (cm):	<u>40</u>
Prediction frequency (MHz):	<u>881.6</u>
Antenna Gain, typical (dBi):	<u>2</u>
Maximum Antenna Gain (numeric):	<u>1.585</u>
Power density at predication frequency and distance (mW/cm ²):	<u>0.4342</u>
MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>0.587</u>

Test Result

For Uplink, the highest power density level at 100 cm is 0.4082mW/cm², which is below the uncontrolled exposure limit of 0.57 mW/cm² at 836.52 MHz.

For Downlink, the highest power density level at 40 cm is 0.4474mW/cm², which is below the uncontrolled exposure limit of 0.587 mW/cm² at 881.52 MHz.

So the indoor antenna prediction distance should be greater then 40 cm, and outdoor antenna prediction distance should be greater then 100 cm.