12 Maximum Permissible Exposure (MPE)

12.1 Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

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
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

12.2 Maximum Permissible Exposure (MPE) Evaluation

802.11b Power Table

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)
2412	16.07	0	16.07	0.040
2437	15.45	0	15.45	0.035
2462	15.08	0	15.08	0.032

MPE Prediction (802.11b)

Prediction 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

Maximum peak output power at antenna input terminal:	16.07	(dBm)
Maximum peak output power at antenna input terminal:	40.45758917	(mW)
Duty cycle:	100	(%)
Maximum Pav :	40.45758917	(mW)
Antenna gain (typical):	3.7	(dBi)
Maximum antenna gain:	2.344228815	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0188778	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.018 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 2412MHz.

802.11g Power Table

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)
2412	22.32	0	22.32	0.171
2437	22.53	0	22.53	0.179
2462	22.28	0	22.28	0.169

MPE Prediction (802.11g)

Prediction 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

Maximum peak output power at antenna input terminal:	22.53	(dBm)
Maximum peak output power at antenna input terminal:	179.0605854	(mW)
Duty cycle:	100	(%)
Maximum Pav :	179.0605854	(mW)
Antenna gain (typical):	3.7	(dBi)
Maximum antenna gain:	2.344228815	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0835508	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.083 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 2437.

802.11n_20M Power Table

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)
2412	23.54	0	23.54	0.226
2437	23.77	0	23.77	0.238
2462	23.54	0	23.54	0.226

MPE Prediction (802.11n_20M)

Prediction 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

Maximum peak output power at antenna input terminal:	23.77	(dBm)
Maximum peak output power at antenna input terminal:	238.2319469	(mW)
Duty cycle:	100	(%)
Maximum Pav :	238.2319469	(mW)
Antenna gain (typical):	3.7	(dBi)
Maximum antenna gain:	2.344228815	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.1111605	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.11 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 2437.

802.11n_40M Power Table

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)
2422	23.15	0	23.15	0.207
2437	23.28	0	23.28	0.213
2452	23.12	0	23.12	0.205

MPE Prediction (802.11n_40M)

Prediction 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

Maximum peak output power at antenna input terminal:	23.28	(dBm)
Maximum peak output power at antenna input terminal:	212.8139046	(mW)
Duty cycle:	100	(%)
Maximum Pav :	212.8139046	(mW)
Antenna gain (typical):	3.7	(dBi)
Maximum antenna gain:	2.344228815	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0993003	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.099 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 2437.