13 Maximum Permissible Exposure (MPE)

13.1 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 §2.1093 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

13.2 Maximum Permissible Exposure (MPE) Evaluation

802.11b Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	16.62	0.00	16.62	0.04592	1
2437.00	16.62	0.00	16.62	0.04592	1
2462.00	16.66	0.00	16.66	0.04634	1

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:	16.66	(dBm)
Maximum peak output power at antenna input terminal:	46.34469197	(mW)
Duty cycle:	100	(%)
Maximum Pav :	46.34469197	(mW)
Antenna gain (typical):	3.65	(dBi)
Maximum antenna gain:	2.31739465	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0213772	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0213772 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 2462MHz.

802.11g Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	14.10	0.00	14.10	0.02570	1
2437.00	14.47	0.00	14.47	0.02799	1
2462.00	14.48	0.00	14.48	0.02805	1

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:	14.48	(dBm)
Maximum peak output power at antenna input terminal:	28.05433638	(mW)
Duty cycle:	100	(%)
Maximum Pav :	28.05433638	(mW)
Antenna gain (typical):	3.65	(dBi)
Maximum antenna gain:	2.31739465	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0129405	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0129405 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2462.

802.11n_20M Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	13.62	0.00	13.62	0.02301	1
2437.00	13.61	0.00	13.61	0.02296	1
2462.00	13.60	0.00	13.60	0.02291	1

MPE Prediction (802.11n_20M, Comp) (Worset Case)

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:	13.62	(dBm)
Maximum peak output power at antenna input terminal:	23.01441817	(mW)
Duty cycle:	100	(%)
Maximum Pav :	23.01441817	(mW)
Antenna gain (typical):	3.65	(dBi)
Maximum antenna gain:	2.31739465	(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)	0.0106157	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0106157 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2412.

802.11n_40M Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2422.00	13.60	0.00	13.60	0.02291	1
2437.00	13.63	0.00	13.63	0.02307	1
2452.00	13.53	0.00	13.53	0.02254	1

MPE Prediction (802.11n_40M, Comp) (Worset case)

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:	13.63	(dBm)
Maximum peak output power at antenna input terminal:	23.06747189	(mW)
Duty cycle:	100	(%)
Maximum Pav :	23.06747189	(mW)
Antenna gain (typical):	3.65	(dBi)
Maximum antenna gain:	2.31739465	(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)	0.0106402	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0106402 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2437.