

## 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 <sup>2</sup> )	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 <sup>2</sup> )	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/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.0213772	(mW/cm <sup>2</sup> )

### Measurement Result

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

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### 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/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.0129405	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.0129405 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2462.

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### 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/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.0106157	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.0106157 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2412.

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### 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/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.0106402	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.0106402 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2437.