

## MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### 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

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## Maximum Permissible Exposure (MPE) Evaluation

### Internal Antenna

#### 802.11b Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	16.51	0.00	16.51	0.04477	1
2437.00	16.35	0.00	16.35	0.04315	1
2462.00	16.36	0.00	16.36	0.04325	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:	16.51	(dBm)
Maximum peak output power at antenna input terminal:	44.77133042	(mW)
Duty cycle:	100	(%)
Maximum Pav :	44.77133042	(mW)
Antenna gain (typical):	1.8	(dBi)
Maximum antenna gain:	1.513561248	(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)	0.013488	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.01349 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2412MHz.

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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	<b>16.97</b>	0.00	16.97	0.04977	1
2437.00	16.68	0.00	16.68	0.04656	1
2462.00	15.67	0.00	15.67	0.03690	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:	<b>16.97</b>	(dBm)
Maximum peak output power at antenna input terminal:	49.7737085	(mW)
Duty cycle:	<b>100</b>	(%)
Maximum Pav :	49.7737085	(mW)
Antenna gain (typical):	<b>1.8</b>	(dBi)
Maximum antenna gain:	1.513561248	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>2412</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.014995	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.01500 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\_20M (2.4G) MIMO Chain 0+Chain 1 Power Table**

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	15.08	0.00	15.08	0.03221	1
2437.00	<b>18.16</b>	0.00	18.16	0.06546	1
2462.00	15.13	0.00	15.13	0.03258	1

**MPE Prediction (802.11n\_20M (2.4G))**

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:	<b>18.16</b>	(dBm)
Maximum peak output power at antenna input terminal:	65.46361741	(mW)
Duty cycle:	<b>100</b>	(%)
Maximum Pav :	65.46361741	(mW)
Antenna gain (typical):	<b>4.8</b>	(dBi)
Maximum antenna gain:	3.01995172	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>2437</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.039351	(mW/cm <sup>2</sup> )

**Measurement Result**

The predicted power density level at 20 cm is 0.03935 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2437.

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**802.11n\_40M (2.4G) MIMO Chain 0+Chain 1 Power Table**

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2422.00	13.20	0.00	13.20	0.02089	1
2437.00	<b>13.72</b>	0.00	13.72	0.02355	1
2452.00	12.91	0.00	12.91	0.01954	1

**MPE Prediction (802.11n\_40M (2.4G))**

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:	<b>13.72</b>	(dBm)
Maximum peak output power at antenna input terminal:	23.55049284	(mW)
Duty cycle:	<b>100</b>	(%)
Maximum Pav :	23.55049284	(mW)
Antenna gain (typical):	<b>4.8</b>	(dBi)
Maximum antenna gain:	3.01995172	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>2437</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.014156	(mW/cm <sup>2</sup> )

**Measurement Result**

The predicted power density level at 20 cm is 0.01416 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2437.

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### 802.11a Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
5745.00	14.20	0.00	14.20	0.02630	1
5785.00	13.98	0.00	13.98	0.02500	1
5825.00	<b>14.52</b>	0.00	14.52	0.02831	1

### MPE Prediction (802.11a)

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:	14.52	(dBm)
Maximum peak output power at antenna input terminal:	28.31391996	(mW)
Duty cycle:	100	(%)
Maximum Pav :	28.31391996	(mW)
Antenna gain (typical):	4.97	(dBi)
Maximum antenna gain:	3.140508694	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5825	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.017699	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.01770 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 5825.

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**802.11n\_20M (5GHz) MIMO Chain 0+ Chain1 Power Table**

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
5745.00	16.87	0.00	16.87	0.04864	1
5785.00	17.02	0.00	17.02	0.05035	1
5825.00	<b>17.08</b>	0.00	17.08	0.05105	1

**MPE Prediction (802.11a)**

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:	17.08	(dBm)
Maximum peak output power at antenna input terminal:	51.0505	(mW)
Duty cycle:	100	(%)
Maximum Pav :	51.0505	(mW)
Antenna gain (typical):	6.82	(dBi)
Maximum antenna gain:	4.808393484	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5825	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.048860	(mW/cm <sup>2</sup> )

**Measurement Result**

The predicted power density level at 20 cm is 0.04886 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 5825.

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**802.11n\_40M (5GHz) MIMO Chain 0+ Chain1 Power Table**

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
5755.00	15.56	0.00	15.56	0.03597	1
5795.00	<b>15.62</b>	0.00	15.62	0.03648	1

**MPE Prediction (802.11a)**

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:	<b>15.62</b>	(dBm)
Maximum peak output power at antenna input terminal:	36.47539469	(mW)
Duty cycle:	<b>100</b>	(%)
Maximum Pav :	36.47539469	(mW)
Antenna gain (typical):	<b>6.82</b>	(dBi)
Maximum antenna gain:	4.808393484	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>5795</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.034910	(mW/cm <sup>2</sup> )

**Measurement Result**

The predicted power density level at 20 cm is 0.03491 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 5795.

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External Antenna

802.11b Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	16.51	0.00	16.51	0.04477	1
2437.00	16.35	0.00	16.35	0.04315	1
2462.00	16.36	0.00	16.36	0.04325	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:	16.51	(dBm)
Maximum peak output power at antenna input terminal:	44.77133042	(mW)
Duty cycle:	100	(%)
Maximum Pav :	44.77133042	(mW)
Antenna gain (typical):	2.98	(dBi)
Maximum antenna gain:	1.986094917	(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)	0.017699	(mW/cm <sup>2</sup> )

Measurement Result

The predicted power density level at 20 cm is 0.00177 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2412MHz.

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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	16.97	0.00	16.97	0.04977	1
2437.00	16.68	0.00	16.68	0.04656	1
2462.00	15.67	0.00	15.67	0.03690	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:	16.97	(dBm)
Maximum peak output power at antenna input terminal:	49.7737085	(mW)
Duty cycle:	100	(%)
Maximum Pav :	49.7737085	(mW)
Antenna gain (typical):	2.98	(dBi)
Maximum antenna gain:	1.986094917	(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)	0.019677	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.01968mW/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\_20M (2.4G) MIMO Chain 0+Chain 1Power Table**

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	15.08	0.00	15.08	0.03221	1
2437.00	<b>18.16</b>	0.00	18.16	0.06546	1
2462.00	15.13	0.00	15.13	0.03258	1

**MPE Prediction (802.11n\_20M (2.4G))**

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:	<b>18.16</b>	(dBm)
Maximum peak output power at antenna input terminal:	65.46361741	(mW)
Duty cycle:	<b>100</b>	(%)
Maximum Pav :	65.46361741	(mW)
Antenna gain (typical):	<b>5.98</b>	(dBi)
Maximum antenna gain:	3.962780343	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>2437</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.051636	(mW/cm <sup>2</sup> )

**Measurement Result**

The predicted power density level at 20 cm is 0.05164 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2437.

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**802.11n\_40M (2.4G) MIMO Chain 0+Chain 1 Power Table**

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2422.00	13.20	0.00	13.20	0.02089	1
2437.00	<b>13.72</b>	0.00	13.72	0.02355	1
2452.00	12.91	0.00	12.91	0.01954	1

**MPE Prediction (802.11n\_40M (2.4G))**

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:	<b>13.72</b>	(dBm)
Maximum peak output power at antenna input terminal:	23.55049284	(mW)
Duty cycle:	<b>100</b>	(%)
Maximum Pav :	23.55049284	(mW)
Antenna gain (typical):	<b>5.98</b>	(dBi)
Maximum antenna gain:	3.962780343	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>2437</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.018576	(mW/cm <sup>2</sup> )

**Measurement Result**

The predicted power density level at 20 cm is 0.01858 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2437.

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### 802.11a Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
5745.00	14.20	0.00	14.20	0.02630	1
5785.00	13.98	0.00	13.98	0.02500	1
5825.00	<b>14.52</b>	0.00	14.52	0.02831	1

### MPE Prediction (802.11a)

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:	14.52	(dBm)
Maximum peak output power at antenna input terminal:	28.31391996	(mW)
Duty cycle:	100	(%)
Maximum Pav :	28.31391996	(mW)
Antenna gain (typical):	4.85	(dBi)
Maximum antenna gain:	3.054921113	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5825	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.017217	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.01722 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 5825.

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**802.11n\_20M (5GHz) MIMO Chain 0+ Chain1 Power Table**

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
5745.00	16.87	0.00	16.87	0.04864	1
5785.00	17.02	0.00	17.02	0.05035	1
5825.00	<b>17.08</b>	0.00	17.08	0.05105	1

**MPE Prediction (802.11a)**

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:	17.08	(dBm)
Maximum peak output power at antenna input terminal:	51.0505	(mW)
Duty cycle:	100	(%)
Maximum Pav :	51.0505	(mW)
Antenna gain (typical):	7.85	(dBi)
Maximum antenna gain:	6.095368972	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5825	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.061937	(mW/cm <sup>2</sup> )

**Measurement Result**

The predicted power density level at 20 cm is 0.06194 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 5825.

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**802.11n\_40M (5GHz) MIMO Chain 0+ Chain1 Power Table**

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
5755.00	15.56	0.00	15.56	0.03597	1
5795.00	<b>15.62</b>	0.00	15.62	0.03648	1

**MPE Prediction (802.11a)**

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:	<b>15.62</b>	(dBm)
Maximum peak output power at antenna input terminal:	36.47539469	(mW)
Duty cycle:	<b>100</b>	(%)
Maximum Pav :	36.47539469	(mW)
Antenna gain (typical):	<b>7.85</b>	(dBi)
Maximum antenna gain:	6.095368972	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>5795</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.044254	(mW/cm <sup>2</sup> )

**Measurement Result**

The predicted power density level at 20 cm is 0.04425 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 5795.

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