

## 15. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### 15.1 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

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## 15.2 Maximum Permissible Exposure (MPE) Evaluation

Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5180	9.79	9.528	23.98
5220	8.26	6.699	23.98
5240	7.62	5.781	23.98

### MPE Prediction (802.11a 5150~5250)

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 average output power at antenna input	9.79	(dBm)
Maximum average output power at antenna input	9.5279616	(mW)
Duty cycle:	98.2	(%)
Maximum Pav :	9.3564583	(mW)
Antenna gain (Maximum):	3.71	(dBi)
Antenna gain (linear):	2.3496328	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5180	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.0043758	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.0043758mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 5180MHz.

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Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5180	12.68	18.555	23.26
5220	13.15	20.675	23.26
5240	11.94	15.614	23.26

### MPE Prediction (802.11n HT20 5150~5250)

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 average output power at antenna input	12.68	(dBm)
Maximum average output power at antenna input	18.535316	(mW)
Duty cycle:	96.4	(%)
Maximum Pav :	17.868045	(mW)
Antenna gain (Maximum):	6.72	(dBi)
Antenna gain (linear):	4.6989411	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5180	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.0167120	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.0167120mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 5180MHz.

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Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5190	13.71	23.484	23.26
5230	<b>12.26</b>	<b>16.808</b>	23.26

### MPE Prediction (802.11n HT40 5150~5250)

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 average output power at antenna input	<b>12.26</b>	(dBm)
Maximum average output power at antenna input	16.826741	(mW)
Duty cycle:	<b>78.8</b>	(%)
Maximum Pav :	13.259472	(mW)
Antenna gain (Maximum):	<b>6.72</b>	(dBi)
Antenna gain (linear):	4.6989411	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>5230</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.0124016	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.0124016mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 5230MHz.

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Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5745	7.52	5.649	30
5785	8.63	7.295	30
5825	<b>9.27</b>	<b>8.453</b>	30

**MPE Prediction (802.11a 5725~5850)**

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 average output power at antenna input	9.27	(dBm)
Maximum average output power at antenna input	8.4527885	(mW)
Duty cycle:	98.2	(%)
Maximum Pav :	8.3006383	(mW)
Antenna gain (Maximum):	5.02	(dBi)
Antenna gain (linear):	3.1768741	(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)	0.0052488	(mW/cm <sup>2</sup> )

**Measurement Result**

The predicted power density level at 20 cm is 0.052488mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 5825MHz.

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Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5745	11.67	14.694	27.97
5785	<b>12.53</b>	<b>17.920</b>	27.97
5825	13.22	21.004	27.97

### MPE Prediction (802.11n HT20 5725~5850)

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 average output power at antenna input	<b>12.53</b>	(dBm)
Maximum average output power at antenna input	17.906059	(mW)
Duty cycle:	<b>96.4</b>	(%)
Maximum Pav :	17.26144	(mW)
Antenna gain (Maximum):	<b>8.03</b>	(dBi)
Antenna gain (linear):	6.3533093	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>5785</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.0218287	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.0218287mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 5785MHz.

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Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5755	11.66	14.649	27.97
5795	<b>12.01</b>	<b>15.886</b>	27.97

### MPE Prediction (802.11n HT40 5725~5850)

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 average output power at antenna input	<b>12.01</b>	(dBm)
Maximum average output power at antenna input	15.885467	(mW)
Duty cycle:	<b>78.8</b>	(%)
Maximum Pav :	12.517748	(mW)
Antenna gain (Maximum):	<b>8.03</b>	(dBi)
Antenna gain (linear):	6.3533093	(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)	0.0158298	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.0158298mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 5795MHz.

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