

# 1 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

## 1.1 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

### 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

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## 802.11a Max. output power

### 802.11a\_Main

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	6	<b>16.94</b>	49.431	23.98	PASS
44	5220	6	16.90	48.977	23.98	PASS
48	5240	6	16.72	46.989	23.98	PASS
52	5260	6	<b>16.60</b>	45.708	23.98 or $11+10\log(B) = 25.59$	PASS
60	5300	6	16.54	45.081	23.98 or $11+10\log(B) = 25.63$	PASS
64	5320	6	16.55	45.185	23.98 or $11+10\log(B) = 25.54$	PASS
100	5500	6	14.34	27.185	23.98 or $11+10\log(B) = 23.83$	PASS
116	5580	6	<b>16.78</b>	47.643	23.98 or $11+10\log(B) = 25.77$	PASS
140	5700	6	12.23	16.724	23.98 or $11+10\log(B) = 23.81$	PASS
144	5720(U-NII 2C)	6	15.67	36.898	23.98 or $11+10\log(B) = 24.74$	PASS
144	5720 (U-NII 3)	6	1.11	1.291	30	PASS
149	5745	6	<b>15.94</b>	39.264	30	PASS
157	5785	6	15.78	37.844	30	PASS
165	5825	6	15.72	37.325	30	PASS

### MPE Prediction (802.11a) (Worst case)

Max. output power including tune-up tolerancel:	<b>16.94</b>	(dBm)
Max. output power including tune-up tolerancel:	49.431069	(mW)
Duty cycle:	<b>97.45</b>	(%)
Maximum Pav :	48.170576	(mW)
Peak Antenna gain (Maximum):	<b>4.61</b>	(dBi)
Peak Antenna gain (linear):	2.8906799	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>5180</b>	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm) distance	0.028	(mW/cm <sup>2</sup> )
<b>Measurement Result</b>		
The predicted power density level at 20 cm is 0.028 mW/cm <sup>2</sup> .		
This is below the uncontrolled exposure limit of 1 mW/cm <sup>2</sup> at 5180MHz.		

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## 802.11n\_HT20 Max. output power

### 802.11n\_HT20\_Main

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	MCS0	15.76	37.699	23.98	PASS
44	5220	MCS0	15.71	37.268	23.98	PASS
48	5240	MCS0	15.74	37.526	23.98	PASS
52	5260	MCS0	15.67	36.926	23.98 or $11+10\log(B) = 25.77$	PASS
60	5300	MCS0	15.69	37.097	23.98 or $11+10\log(B) = 25.76$	PASS
64	5320	MCS0	15.68	37.011	23.98 or $11+10\log(B) = 25.77$	PASS
100	5500	MCS0	14.37	27.346	23.98 or $11+10\log(B) = 25.76$	PASS
116	5580	MCS0	15.89	38.845	23.98 or $11+10\log(B) = 25.77$	PASS
140	5700	MCS0	11.01	12.615	23.98 or $11+10\log(B) = 25.77$	PASS
144	5720(U-NII 2C)	MCS0	12.42	17.438	23.98 or $11+10\log(B) = 24.36$	PASS
144	5720 (U-NII 3)	MCS0	3.60	2.290	30	PASS
149	5745	MCS0	15.55	35.920	30	PASS
157	5785	MCS0	15.52	35.673	30	PASS
165	5825	MCS0	15.51	35.590	30	PASS

## MPE Prediction (802.11n\_HT20) (Worst case)

Max. output power including tune-up tolerancel:	15.89	(dBm)
Max. output power including tune-up tolerancel:	38.815037	(mW)
Duty cycle:	97.31	(%)
Maximum Pav :	37.770912	(mW)
Peak Antenna gain (Maximum):	5.08	(dBi)
Peak Antenna gain (linear):	3.2210688	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5580	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm) distance	0.024	(mW/cm <sup>2</sup> )
<b>Measurement Result</b>		
The predicted power density level at 20 cm is 0.024 mW/cm <sup>2</sup> .		
This is below the uncontrolled exposure limit of 1 mW/cm <sup>2</sup> at 5580MHz.		

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## 802.11n\_HT40 Max. output power

### 802.11n\_HT40\_Main

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
38	5190	MCS0	11.94	15.641	23.98	PASS
46	5230	MCS0	<b>15.66</b>	36.783	23.98	PASS
54	5270	MCS0	<b>15.77</b>	37.727	23.98 or $11+10\log(B) = 27.99$	PASS
62	5310	MCS0	12.60	18.209	23.98 or $11+10\log(B) = 27.99$	PASS
102	5510	MCS0	10.98	12.539	23.98 or $11+10\log(B) = 26.98$	PASS
110	5550	MCS0	<b>15.36</b>	34.328	23.98 or $11+10\log(B) = 27.99$	PASS
134	5670	MCS0	12.34	17.150	23.98 or $11+10\log(B) = 27.97$	PASS
142	5710(U-NII 2C)	MCS0	11.89	15.453	23.98 or $11+10\log(B) = 27.37$	PASS
142	5710 (U-NII 3)	MCS0	0.55	1.135	30	PASS
151	5755	MCS0	<b>15.52</b>	35.616	30	PASS
159	5795	MCS0	15.49	35.371	30	PASS

## MPE Prediction (802.11n\_HT40) (Worst case)

Max. output power including tune-up tolerance:	<b>15.77</b>	(dBm)
Max. output power including tune-up tolerance:	37.757219	(mW)
Duty cycle:	<b>94.67</b>	(%)
Maximum Pav :	35.744759	(mW)
Peak Antenna gain (Maximum):	<b>4.73</b>	(dBi)
Peak Antenna gain (linear):	2.971666	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>5270</b>	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm) distance	0.021	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.021 mW/cm<sup>2</sup>.

This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 5270MHz.

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