

## 14 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### 14.1 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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SGS Taiwan Ltd.

No.134,WuKungRoad,NewTaipeiIndustrialPark,WukuDistrict,NewTaipeiCity,Taiwan24803/新北市五股區新北產業園區五工路 134 號

台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

[www.tw.sgs.com](http://www.tw.sgs.com)

Member of SGS Group

## Maximum Permissible Exposure (MPE) Evaluation

802.11b Main						
CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	1	19.52	89.54	1 Watt = 30.00 dBm	PASS
6	2437	1	19.36	86.30	1 Watt = 30.00 dBm	PASS
11	2462	1	19.16	82.41	1 Watt = 30.00 dBm	PASS
802.11b Main						
CH	Frequency (MHz)	Data Rate	Max. Output include tune up tolerance Power (dBm)	Max. Output include tune up tolerance Power (mW)	Limit	RESULT
1	2412	1	17.45	55.59	1 Watt = 30.00 dBm	PASS
6	2437	1	17.42	55.21	1 Watt = 30.00 dBm	PASS
11	2462	1	17.25	53.09	1 Watt = 30.00 dBm	PASS

### MPE Prediction (802.11b 2412~2462)

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

Max. output power including tune-up tolerancel:	17.45	(dBm)
Max. output power including tune-up tolerancel:	55.590426	(mW)
Duty cycle:	98.19	(%)
Maximum Pav :	54.584239	(mW)
Peak Antenna gain (Maximum):	0.78	(dBi)
Peak Antenna gain (linear):	1.1967405	(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)	0.013	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.013 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 Main						
CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	6	23.44	220.80	1 Watt = 30.00 dBm	PASS
6	2437	6	23.17	207.49	1 Watt = 30.00 dBm	PASS
11	2462	6	22.9	194.98	1 Watt = 30.00 dBm	PASS

802.11g Main						
CH	Frequency (MHz)	Data Rate	Max. Output include tune up tolerance Power (dBm)	Max. Output include tune up tolerance Power (mW)	Limit	RESULT
1	2412	6	14.46	27.93	1 Watt = 30.00 dBm	PASS
6	2437	6	14.35	27.23	1 Watt = 30.00 dBm	PASS
11	2462	6	14.19	26.24	1 Watt = 30.00 dBm	PASS

### MPE Prediction (802.11g 2412~2462)

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

Max. output power including tune-up tolerancel:	14.46	(dBm)
Max. output power including tune-up tolerancel:	27.925438	(mW)
Duty cycle:	91.25	(%)
Maximum Pav :	25.481963	(mW)
Peak Antenna gain (Maximum):	0.78	(dBi)
Peak Antenna gain (linear):	1.1967405	(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)	0.006	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.006 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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802.11n_HT20M Main						
CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	MCS0	23.4	218.78	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	23.22	209.89	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	23.26	211.84	1 Watt = 30.00 dBm	PASS
802.11n_HT20M Main						
CH	Frequency (MHz)	Data Rate	Max. Output include tune up tolerance Power (dBm)	Max. Output include tune up tolerance Power (mW)	Limit	RESULT
1	2412	MCS0	14.42	27.67	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	14.22	26.42	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	14.48	28.05	1 Watt = 30.00 dBm	PASS

### MPE Prediction (802.11n\_HT20 2412~2462)

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

Max. output power including tune-up tolerancel:	14.48	(dBm)
Max. output power including tune-up tolerancel:	28.054336	(mW)
Duty cycle:	95.5	(%)
Maximum Pav :	26.791891	(mW)
Peak Antenna gain (Maximum):	0.78	(dBi)
Peak Antenna gain (linear):	1.1967405	(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)	0.006	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.006 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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802.11n_HT40M Main						
CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
3	2422	MCS0	23.1	204.17	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	22.98	198.61	1 Watt = 30.00 dBm	PASS
9	2452	MCS0	<b>23.15</b>	<b>206.54</b>	1 Watt = 30.00 dBm	PASS
802.11n_HT40M Main						
CH	Frequency (MHz)	Data Rate	Max. Output include tune up tolerance Power (dBm)	Max. Output include tune up tolerance Power (mW)	Limit	RESULT
3	2422	MCS0	14.26	26.67	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	14.25	26.61	1 Watt = 30.00 dBm	PASS
9	2452	MCS0	<b>14.48</b>	<b>28.05</b>	1 Watt = 30.00 dBm	PASS

### MPE Prediction (802.11n\_HT40 2422~2452)

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

Max. output power including tune-up tolerancel:	<b>14.48</b>	(dBm)
Max. output power including tune-up tolerancel:	28.05433638	(mW)
Duty cycle:	<b>80.92</b>	(%)
Maximum Pav :	22.701569	(mW)
Peak Antenna gain (Maximum):	<b>0.78</b>	(dBi)
Peak Antenna gain (linear):	1.196740531	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>2452</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.005	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.005 mW/cm<sup>2</sup>.

This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2452MHz.

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