

# 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

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## 1.2 Maximum Permissible Exposure (MPE) Evaluation

### Maximum Permissible Exposure (MPE) Evaluation

802.11b Main						
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	1	14.80	30.20	1 Watt = 30.00 dBm	PASS
6	2437	1	16.50	44.67	1 Watt = 30.00 dBm	PASS
11	2462	1	18.82	76.21	1 Watt = 30.00 dBm	PASS
802.11b Main						
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	1	12.62	18.28	1 Watt = 30.00 dBm	PASS
6	2437	1	14.17	26.12	1 Watt = 30.00 dBm	PASS
11	2462	1	16.6	45.71	1 Watt = 30.00 dBm	PASS

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### 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:	16.60	(dBm)
Max. output power including tune-up tolerancel:	45.708819	(mW)
Duty cycle:	100	(%)
Maximum Pav :	45.708819	(mW)
Peak Antenna gain (Maximum):	4.91	(dBi)
Peak Antenna gain (linear):	3.0974193	(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)	0.028	(mW/cm <sup>2</sup> )

### Measurement Result

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 2462MHz.

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802.11g Main						
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	6	22.41	174.18	1 Watt = 30.00 dBm	PASS
6	2437	6	24.62	289.73	1 Watt = 30.00 dBm	PASS
11	2462	6	23.9	245.47	1 Watt = 30.00 dBm	PASS
802.11g Main						
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	6	11.67	14.69	1 Watt = 30.00 dBm	PASS
6	2437	6	13.97	24.95	1 Watt = 30.00 dBm	PASS
11	2462	6	13.11	20.46	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:	13.97	(dBm)
Max. output power including tune-up tolerancel:	24.945947	(mW)
Duty cycle:	100	(%)
Maximum Pav :	24.945947	(mW)
Peak Antenna gain (Maximum):	4.91	(dBi)
Peak Antenna gain (linear):	3.0974193	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm^2)
Power density at predication frequency at 20 (cm)	0.015	(mW/cm^2)

### Measurement Result

The predicted power density level at 20 cm is 0.015 mW/cm2.

This is below the uncontrolled exposure limit of 1 mW/cm2 at 2437MHz.

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802.11n_HT20M Main						
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	MCS0	23.33	215.28	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	23.35	216.27	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	23.31	214.29	1 Watt = 30.00 dBm	PASS
802.11n_HT20M Main						
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	MCS0	11.68	14.72	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	12.98	19.86	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	12.97	19.82	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:	12.98	(dBm)
Max. output power including tune-up tolerancel:	19.860949	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.860949	(mW)
Peak Antenna gain (Maximum):	4.91	(dBi)
Peak Antenna gain (linear):	3.0974193	(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)	0.012	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.012 mW/cm<sup>2</sup>.

This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2437MHz.

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802.11n_HT40M Main						
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
3	2422	MCS0	23.64	231.21	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	23.52	224.91	1 Watt = 30.00 dBm	PASS
9	2452	MCS0	23.48	222.84	1 Watt = 30.00 dBm	PASS
802.11n_HT40M Main						
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
3	2422	MCS0	12.98	19.86	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	12.92	19.59	1 Watt = 30.00 dBm	PASS
9	2452	MCS0	13.89	24.49	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:	13.89	(dBm)
Max. output power including tune-up tolerancel:	24.490632	(mW)
Duty cycle:	100	(%)
Maximum Pav :	24.490632	(mW)
Peak Antenna gain (Maximum):	4.91	(dBi)
Peak Antenna gain (linear):	3.0974193	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2452	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm^2)
Power density at predication frequency at 20 (cm)	0.015	(mW/cm^2)

### Measurement Result

The predicted power density level at 20 cm is 0.015 mW/cm2.

This is below the uncontrolled exposure limit of 1 mW/cm2 at 2452MHz.

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