

## 13 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### 13.1 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

Note: Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4 R^2$$

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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### 13.2 Maximum Permissible Exposure (MPE) Evaluation 802.11b (Main)

CH	Frequency (MHz)	Average Power Output (dBm)	
		Data Rate 1	Required Limit
1	2412	18.11	0.79 Watt = 28.98 dBm
6	2437	19.89	0.79 Watt = 28.98 dBm
11	2462	19.27	0.79 Watt = 28.98 dBm

#### MPE Prediction (802.11b (Main) )

Maximum average output power at antenna input	19.89	(dBm)
Maximum average output power at antenna input	97.49896377	(mW)
Duty cycle:	99.3	(%)
Maximum Pav :	96.81647103	(mW)
Antenna gain (Maximum):	7.02	(dBi)
Antenna gain (linear):	5.035006088	(numeric)
Prediction distance:	100	(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)	0.003881	(mW/cm <sup>2</sup> )

#### Measurement Result

The predicted power density level at 100 cm is 0.003881mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 2437MHz.

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## 802.11g (Main)

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		6	
1	2412	15.40	0.79 Watt = 28.98 dBm
6	2437	20.94	0.79 Watt = 28.98 dBm
11	2462	13.94	0.79 Watt = 28.98 dBm

## MPE Prediction (802.11g (Main) )

Maximum average output power at antenna input	20.94	(dBm)
Maximum average output power at antenna input	124.1652308	(mW)
Duty cycle:	96.1	(%)
Maximum Pav :	119.3227868	(mW)
Antenna gain (Maximum):	7.02	(dBi)
Antenna gain (linear):	5.035006088	(numeric)
Prediction distance:	100	(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)	0.004783	(mW/cm <sup>2</sup> )

## Measurement Result

The predicted power density level at 100 cm is 0.004783mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 2437MHz.

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## 802.11n\_20M (MIMO Chain 0+1)

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		MCS8	
1	2412	15.07	0.40 Watt = 25.97dBm
6	2437	20.22	0.40 Watt = 25.97dBm
11	2462	16.05	0.40 Watt = 25.97dBm

## MPE Prediction (802.11 n\_20M (MIMO Chain 0+1) )

Maximum average output power at antenna input	20.22	(dBm)
Maximum average output power at antenna input	105.1961874	(mW)
Duty cycle:	92.7	(%)
Maximum Pav :	97.5168657	(mW)
Antenna gain (Maximum):	7.02	(dBi)
Antenna gain (linear):	5.035006088	(numeric)
Prediction distance:	100	(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)	0.003909	(mW/cm <sup>2</sup> )

## Measurement Result

The predicted power density level at 100 cm is 0.003909mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 2437MHz.

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## 802.11n\_40M (MIMO Chain 0+1)

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		MCS8	
1	2422	13.93	0.41 Watt = 26.11dBm
6	2437	20.30	0.41 Watt = 26.11dBm
11	2452	13.68	0.41 Watt = 26.11dBm

## MPE Prediction (802.11 n\_40M (MIMO Chain 0+1) )

Maximum average output power at antenna input	20.3	(dBm)
Maximum average output power at antenna input	107.1519305	(mW)
Duty cycle:	89.9	(%)
Maximum Pav :	96.32958554	(mW)
Antenna gain (Maximum):	7.02	(dBi)
Antenna gain (linear):	5.035006088	(numeric)
Prediction distance:	100	(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)	0.003862	(mW/cm <sup>2</sup> )

## Measurement Result

The predicted power density level at 100 cm is 0.003862mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 2437MHz.

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