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^2)	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	*($180/f^2$)	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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13.2 Maximum Permissible Exposure (MPE) Evaluation

802.11b (Aux)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		1	
1	2412	20.72	0.82 Watt = 29.12 dBm
6	2437	25.64	0.82 Watt = 29.12 dBm
11	2462	21.73	0.82 Watt = 29.12 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		1	
1	2412	18.07	0.82 Watt = 29.12 dBm
6	2437	23.55	0.82 Watt = 29.12 dBm
11	2462	19.30	0.82 Watt = 29.12 dBm

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MPE Prediction (802.11b (Aux))

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	25.64	(dBm)
Maximum average output power at antenna input	366.4375746	(mW)
Duty cycle:	100	(%)
Maximum Pav :	366.4375746	(mW)
Antenna gain (Maximum):	6.88	(dBi)
Antenna gain (linear):	4.875284901	(numeric)
Prediction distance:	100	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.014224	(mW/cm^2)

Measurement Result

The predicted power density level at 100 cm is 0.014224mW/cm^2. This is below the uncontrolled exposure limit of 1mW/cm^2 at 2437MHz.

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802.11g (Aux)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		6	
1	2412	18.46	0.82 Watt = 29.12 dBm
6	2437	24.73	0.82 Watt = 29.12 dBm
11	2462	18.50	0.82 Watt = 29.12 dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate	Required Limit
		6	
1	2412	15.57	0.82 Watt = 29.12 dBm
6	2437	21.81	0.82 Watt = 29.12 dBm
11	2462	15.65	0.82 Watt = 29.12 dBm

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MPE Prediction (802.11g (Aux))

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	24.73	(dBm)
Maximum average output power at antenna input	297.1666032	(mW)
Duty cycle:	100	(%)
Maximum Pav :	297.1666032	(mW)
Antenna gain (Maximum):	6.88	(dBi)
Antenna gain (linear):	4.875284901	(numeric)
Prediction distance:	100	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.011535	(mW/cm^2)

Measurement Result

The predicted power density level at 100 cm is 0.011535mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2437MHz.

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802.11n_20M (MIMO Chain 0+1)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2412	21.16	0.41 Watt = 26.11dBm
6	2437	25.46	0.41 Watt = 26.11dBm
11	2462	20.92	0.41 Watt = 26.11dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2412	17.92	0.41 Watt = 26.11dBm
6	2437	22.49	0.41 Watt = 26.11dBm
11	2462	18.19	0.41 Watt = 26.11dBm

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MPE Prediction (802.11 n_20M (MIMO Chain 0+1))

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	25.46	(dBm)
Maximum average output power at antenna input	351.5604405	(mW)
Duty cycle:	100	(%)
Maximum Pav :	351.5604405	(mW)
Antenna gain (Maximum):	6.88	(dBi)
Antenna gain (linear):	4.875284901	(numeric)
Prediction distance:	100	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.013646	(mW/cm^2)

Measurement Result

The predicted power density level at 100 cm is 0.013646mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2437MHz.

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802.11n_40M (MIMO Chain 0+1)

		Peak Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2422	13.85	0.41 Watt = 26.11dBm
6	2437	25.02	0.41 Watt = 26.11dBm
11	2452	14.37	0.41 Watt = 26.11dBm

		Average Power Output (dBm)	
CH	Frequency (MHz)	Data Rate MCS8	Required Limit
1	2422	11.03	0.41 Watt = 26.11dBm
6	2437	22.36	0.41 Watt = 26.11dBm
11	2452	11.59	0.41 Watt = 26.11dBm

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MPE Prediction (802.11 n_40M (MIMO Chain 0+1))

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	25.02	(dBm)
Maximum average output power at antenna input	317.6874071	(mW)
Duty cycle:	100	(%)
Maximum Pav :	317.6874071	(mW)
Antenna gain (Maximum):	6.88	(dBi)
Antenna gain (linear):	4.875284901	(numeric)
Prediction distance:	100	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.012331	(mW/cm^2)

Measurement Result

The predicted power density level at 100 cm is 0.012331mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2437MHz.

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