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^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

1.2 Maximum Permissible Exposure (MPE) Evaluation

802.11b (Main)

CH	Frequency (MHz)	Peak Power Output (dBm)	
		Data Rate	Required Limit
		1	
1	2412	18.98	1 Watt = 30 dBm
6	2437	18.80	1 Watt = 30 dBm
11	2462	18.85	1 Watt = 30 dBm

CH	Frequency (MHz)	Average Power Output (dBm)	
		Data Rate	Required Limit
		1	
1	2412	16.59	1 Watt = 30 dBm
6	2437	16.40	1 Watt = 30 dBm
11	2462	16.39	1 Watt = 30 dBm

Note: Measured by power meter, cable loss as 11dB that offsets on the power meter.

MPE Prediction (802.11b (Main))

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	16.59	(dBm)
Maximum average output power at antenna input	45.6036916	(mW)
Duty cycle:	100	(%)
Maximum Pav :	45.6036916	(mW)
Antenna gain (typical):	1.5	(dBi)
Maximum antenna gain:	1.412537545	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.012822	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.012822mW/cm^2. This is below the uncontrolled exposure limit of 1mW/cm^2 at 2412MHz.

802.11g (Main)

CH	Frequency (MHz)	Peak Power Output (dBm)	
		Data Rate	Required Limit
		6	
1	2412	18.74	1 Watt = 30 dBm
6	2437	18.85	1 Watt = 30 dBm
11	2462	**18.93**	1 Watt = 30 dBm

CH	Frequency (MHz)	Average Power Output (dBm)	
		Data Rate	Required Limit
		6	
1	2412	8.79	1 Watt = 30 dBm
6	2437	8.97	1 Watt = 30 dBm
11	2462	**9.13**	1 Watt = 30 dBm

Note: Measured by power meter, cable loss as 11dB that offsets on the power meter.

MPE Prediction (802.11g (Main))

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	9.13	(dBm)
Maximum average output power at antenna input	8.184647881	(mW)
Duty cycle:	100	(%)
Maximum Pav :	8.184647881	(mW)
Antenna gain (typical):	1.5	(dBi)
Maximum antenna gain:	1.412537545	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.002301	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.002301mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2462MHz.

802.11n_20M (MIMO Chain 0+1)

CH	Frequency (MHz)	Peak Power Output (dBm)	
		Data Rate	Required Limit
		MCS8	
1	2412	21.96	1 Watt = 30 dBm
6	2437	21.63	1 Watt = 30 dBm
11	2462	21.93	1 Watt = 30 dBm

CH	Frequency (MHz)	Average Power Output (dBm)	
		Data Rate	Required Limit
		MCS8	
1	2412	11.60	1 Watt = 30 dBm
6	2437	11.17	1 Watt = 30 dBm
11	2462	11.35	1 Watt = 30 dBm

Note: Measured by power meter, cable loss as 14dB that offsets on the power meter.

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	11.60	(dBm)
Maximum average output power at antenna input	14.45439771	(mW)
Duty cycle:	100	(%)
Maximum Pav :	14.45439771	(mW)
Antenna gain (typical):	3	(dBi)
Maximum antenna gain:	1.995262315	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.005741	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.005741mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2412MHz.

802.11n_40M (MIMO Chain 0+1)

CH	Frequency (MHz)	Peak Power Output (dBm)	
		Data Rate	**Required Limit**
		MCS8	
1	**2422**	21.77	**1 Watt = 30 dBm**
6	**2437**	21.68	**1 Watt = 30 dBm**
11	**2452**	**21.96**	**1 Watt = 30 dBm**

CH	Frequency (MHz)	Average Power Output (dBm)	
		Data Rate	**Required Limit**
		MCS8	
1	**2422**	11.08	**1 Watt = 30 dBm**
6	**2437**	11.21	**1 Watt = 30 dBm**
11	**2452**	11.36	**1 Watt = 30 dBm**

Note: Measured by power meter, cable loss as 14dB that offsets on the power meter.

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	11.36	(dBm)
Maximum average output power at antenna input	13.67728826	(mW)
Duty cycle:	100	(%)
Maximum Pav :	13.67728826	(mW)
Antenna gain (typical):	3	(dBi)
Maximum antenna gain:	1.995262315	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2452	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.005432	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.005432mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2452MHz.