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)

		Peak Power Output (dBm)	
CH	**Frequency (MHz)**	**Data Rate**	**Required Limit**
		1	
1	**2412**	**23.13**	**1 Watt = 30 dBm**
6	**2437**	22.77	**1 Watt = 30 dBm**
11	**2462**	22.18	**1 Watt = 30 dBm**

		Average Power Output (dBm)	
CH	**Frequency (MHz)**	**Data Rate**	**Required Limit**
		1	
1	**2412**	**20.88**	**1 Watt = 30 dBm**
6	**2437**	20.34	**1 Watt = 30 dBm**
11	**2462**	19.89	**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	20.88	(dBm)
Maximum average output power at antenna input	122.4616199	(mW)
Duty cycle:	100	(%)
Maximum Pav :	122.4616199	(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)	0.034431	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.034431mW/cm^2. This is below the uncontrolled exposure limit of 1mW/cm^2 at 2412MHz.

802.11g (Main)

		Peak Power Output (dBm)	
CH	**Frequency (MHz)**	**Data Rate**	**Required Limit**
		6	
1	**2412**	**23.99**	**1 Watt = 30 dBm**
6	**2437**	23.83	**1 Watt = 30 dBm**
11	**2462**	23.82	**1 Watt = 30 dBm**

		Average Power Output (dBm)	
CH	**Frequency (MHz)**	**Data Rate**	**Required Limit**
		6	
1	**2412**	14.27	**1 Watt = 30 dBm**
6	**2437**	14.02	**1 Watt = 30 dBm**
11	**2462**	13.98	**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	14.27	(dBm)
Maximum average output power at antenna input	26.73006409	(mW)
Duty cycle:	100	(%)
Maximum Pav :	26.73006409	(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)	0.007515	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.007515mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2412MHz.

802.11n_20M (MIMO Chain 0+1)

		Peak Power Output (dBm)	
CH	**Frequency (MHz)**	**Data Rate**	**Required Limit**
		MCS8	
1	**2412**	**26.86**	**1 Watt = 30 dBm**
6	**2437**	26.57	**1 Watt = 30 dBm**
11	**2462**	26.54	**1 Watt = 30 dBm**

		Average Power Output (dBm)	
CH	**Frequency (MHz)**	**Data Rate**	**Required Limit**
		MCS8	
1	**2412**	16.65	**1 Watt = 30 dBm**
6	**2437**	16.42	**1 Watt = 30 dBm**
11	**2462**	16.31	**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	16.65	(dBm)
Maximum average output power at antenna input	46.23810214	(mW)
Duty cycle:	100	(%)
Maximum Pav :	46.23810214	(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)	0.018363	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.018363mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2412MHz.

802.11n_40M (MIMO Chain 0+1)

		Peak Power Output (dBm)	
CH	**Frequency (MHz)**	**Data Rate**	**Required Limit**
		MCS8	
1	**2422**	26.55	**1 Watt = 30 dBm**
6	**2437**	26.65	**1 Watt = 30 dBm**
11	**2452**	**26.97**	**1 Watt = 30 dBm**

		Average Power Output (dBm)	
CH	**Frequency (MHz)**	**Data Rate**	**Required Limit**
		MCS8	
1	**2422**	16.29	**1 Watt = 30 dBm**
6	**2437**	16.42	**1 Watt = 30 dBm**
11	**2452**	16.54	**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	16.54	(dBm)
Maximum average output power at antenna input	45.08167045	(mW)
Duty cycle:	100	(%)
Maximum Pav :	45.08167045	(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)	0.017904	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.017904mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2452MHz.