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

13.2 Maximum Permissible Exposure (MPE) Evaluation

802.11b

CH	Frequency (MHz)	Average Power Output (dBm)				
		Data Rate				Required Limit
		1	2	5.5	11	
1	2412	14.89	14.65	14.49	14.32	1 Watt = 30 dBm
6	2437	**14.95**	14.74	14.52	14.36	1 Watt = 30 dBm
11	2462	14.90	14.71	14.50	14.35	1 Watt = 30 dBm

MPE Prediction (802.11b)

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	14.95	(dBm)
Maximum average output power at antenna input	31.26079367	(mW)
Duty cycle:	100	(%)
Maximum Pav :	31.26079367	(mW)
Antenna gain (typical):	3	(dBi)
Maximum antenna gain:	1.995262315	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.012415	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.012415mW/cm^2. This is below the uncontrolled exposure limit of 1mW/cm^2 at 2437MHz.

802.11g

CH	Frequency (MHz)	Average Power Output(dBm)								
		Data Rate								Required Limit
		6	9	12	18	24	36	48	54	
1	2412	12.90	12.84	12.79	12.75	12.69	12.62	12.57	12.51	1 Watt = 30 dBm
6	2437	**12.98**	12.89	12.84	12.79	12.72	12.65	12.60	12.54	1 Watt = 30 dBm
11	2462	12.91	12.86	12.81	12.78	12.71	12.63	12.59	12.53	1 Watt = 30 dBm

MPE Prediction (802.11g)

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	12.98	(dBm)
Maximum average output power at antenna input	19.86094917	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.86094917	(mW)
Antenna gain (typical):	3	(dBi)
Maximum antenna gain:	1.995262315	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.007888	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.007888mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2437MHz.

802.11n_20M (MIMO CH0+CH1)

CH	Frequency (MHz)	Average Power Output(dBm)								
		Data Rate								Required Limit
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	
1	2412	13.62	13.55	13.49	13.43	13.39	13.34	13.30	13.23	1 Watt = 30 dBm
6	2437	**13.91**	13.85	13.78	13.73	13.69	13.65	13.62	13.59	1 Watt = 30 dBm
11	2462	13.75	13.71	13.70	13.67	13.64	13.61	13.59	13.57	1 Watt = 30 dBm

MPE Prediction (802.11 n_20M)

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	13.91	(dBm)
Maximum average output power at antenna input	24.60367604	(mW)
Duty cycle:	100	(%)
Maximum Pav :	24.60367604	(mW)
Antenna gain (typical):	3	(dBi)
Maximum antenna gain:	1.995262315	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.009771	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.009771mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2437MHz.

802.11n_40M (MIMO CH0+CH1)

CH	Frequency (MHz)	Average Power Output(dBm)								
		Data Rate								Required Limit
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	
1	2422	13.74	13.69	13.65	13.62	13.57	13.52	13.49	13.45	1 Watt = 30 dBm
6	2437	**13.95**	13.89	14.12	14.02	13.91	13.84	14.00	13.68	1 Watt = 30 dBm
11	2452	13.84	13.81	13.78	13.74	13.71	13.65	13.61	13.58	1 Watt = 30 dBm

MPE Prediction (802.11 n_40M)

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	13.95	(dBm)
Maximum average output power at antenna input	24.83133105	(mW)
Duty cycle:	100	(%)
Maximum Pav :	24.83133105	(mW)
Antenna gain (typical):	3	(dBi)
Maximum antenna gain:	1.995262315	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.009862	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.009862mW/cm2. This is below the uncontrolled exposure limit of 1mW/cm2 at 2437MHz.