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 (5150~5250MHz)

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
5180	**18.21**	0.0662	1
5220	18.15	0.0653	1
5240	18.12	0.0649	1

MPE Prediction (802.11a, 5150~5250MHz)

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

Average output power at antenna input terminal:	18.21	(dBm)
Average output power at antenna input terminal:	66.22165	(mW)
Duty cycle:	95.2	(%)
Maximum Pav :	63.043011	(mW)
Antenna gain (Maximum):	5.72	(dBi)
Antenna gain (linear):	3.7325016	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5180	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0468368	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0468 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5180MHz.

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
5180	21.60	0.1445	0.533
5220	**21.64**	0.1460	0.533
5240	21.55	0.1429	0.533

MPE Prediction (802.11n_HT20 MIMO, 5150~5250MHz)

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

MIMO gain= G+(10 logN)= 5.72+3.01= 8.73dBm

Average output power at antenna input terminal:	21.64	(dBm)
Average output power at antenna input terminal:	145.88143	(mW)
Duty cycle:	95.2	(%)
Maximum Pav :	138.87912	(mW)
Antenna gain (Maximum):	8.73	(dBi)
Antenna gain (linear):	7.4644876	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5220	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.2063418	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.2063 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5220MHz.

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
5190	16.79	0.0478	0.533
5230	**16.80**	0.0478	0.533

MPE Prediction (802.11n_HT40 MIMO, 5150~5250MHz)

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

MIMO gain= G+(10 logN)= 5.72+3.01= 8.73dBm

Average output power at antenna input terminal:	16.80	(dBm)
Average output power at antenna input terminal:	47.86300923	(mW)
Duty cycle:	78.3	(%)
Maximum Pav :	37.47673623	(mW)
Antenna gain (Maximum):	8.73	(dBi)
Antenna gain (linear):	7.464487584	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5230	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0556817	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0557 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5230MHz.

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
5210	17.00	0.0501	0.533

MPE Prediction (802.11n_HT80 MIMO, 5150~5250MHz)

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

MIMO gain= G+(10 logN)= 5.72+3.01= 8.73dBm

Average output power at antenna input terminal:	17.00	(dBm)
Average output power at antenna input terminal:	50.118723	(mW)
Duty cycle:	87.2	(%)
Maximum Pav :	43.703527	(mW)
Antenna gain (Maximum):	8.73	(dBi)
Antenna gain (linear):	7.4644876	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5210	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0649332	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0649 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5210MHz.

1.3 Maximum Permissible Exposure (MPE) Evaluation (5725~5850MHz)

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
5745	15.38	0.0345	1
5785	**18.71**	0.0743	1
5825	18.66	0.0735	1

MPE Prediction (802.11a, 5725~5850MHz)

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

Average output power at antenna input terminal:	18.71	(dBm)
Average output power at antenna input terminal:	74.301914	(mW)
Duty cycle:	95.2	(%)
Maximum Pav :	70.735422	(mW)
Antenna gain (Maximum):	5.75	(dBi)
Antenna gain (linear):	3.758374	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5785	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0529160	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0529 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5785MHz.

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
5745	17.72	0.0592	0.530
5785	21.14	0.1300	0.530
5825	**21.18**	0.1313	0.530

MPE Prediction (802.11n_HT20 MIMO, 5725 5850MHz)

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

MIMO gain= G+(10 logN)= 5.75+3.01= 8.76dBm

Average output power at antenna input terminal:	21.18	(dBm)
Average output power at antenna input terminal:	131.21999	(mW)
Duty cycle:	95.2	(%)
Maximum Pav :	124.92143	(mW)
Antenna gain (Maximum):	8.76	(dBi)
Antenna gain (linear):	7.5162289	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5825	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.1868905	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.1869 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5825MHz.

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
5755	15.69	0.0371	0.530
5795	**19.08**	0.0809	0.530

MPE Prediction (802.11n_HT40 MIMO, 5725~5850MHz)

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

MIMO gain= G+(10 logN)= 5.75+3.01= 8.76dBm

Average output power at antenna input terminal:	19.08	(dBm)
Average output power at antenna input terminal:	80.90959	(mW)
Duty cycle:	78.3	(%)
Maximum Pav :	63.352209	(mW)
Antenna gain (Maximum):	8.76	(dBi)
Antenna gain (linear):	7.5162289	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5795	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0947790	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0948 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5795MHz.

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
5775	15.46	0.0351	0.530

MPE Prediction (802.11n_HT80 MIMO, 5725~5850MHz)

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

MIMO gain= G+(10 logN)= 5.75+3.01= 8.76dBm

Average output power at antenna input terminal:	17.00	(dBm)
Average output power at antenna input terminal:	50.118723	(mW)
Duty cycle:	87.2	(%)
Maximum Pav :	43.703527	(mW)
Antenna gain (Maximum):	8.76	(dBi)
Antenna gain (linear):	7.5162289	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5775	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0653833	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0654 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5775MHz.