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

Internal Antenna (Worst Case)

802.11a 5150~5250 Power Table

Frequency (MHz)	Reading Power (dBm)
5180	**15.14**
5220	14.61
5240	14.57

MPE Prediction (802.11a 5150~5250)

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	15.14	(dBm)
Maximum average output power at antenna input	32.65878322	(mW)
Duty cycle:	97	(%)
Maximum Pav :	31.67901972	(mW)
Antenna gain (typical):	5.5	(dBi)
Maximum antenna gain:	3.548133892	(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)	0.0223729	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0231 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5180MHz.

802.11a 5250~5350 Power Table

Frequency (MHz)	Reading Power (dBm)
5260	**14.60**
5300	14.27
5320	14.26

MPE Prediction (802.11a 5250~5350)

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	14.6	(dBm)
Maximum average output power at antenna input	28.84031503	(mW)
Duty cycle:	97	(%)
Maximum Pav :	27.97510558	(mW)
Antenna gain (typical):	5.5	(dBi)
Maximum antenna gain:	3.548133892	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5260	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0197571	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0204 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 5260MHz.

802.11a 5470~5725 Power Table

Frequency (MHz)	Reading Power (dBm)
5500	**15.32**
5580	14.90
5700	13.13

MPE Prediction (802.11a 5470~5725)

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	15.32	(dBm)
Maximum average output power at antenna input	34.04081897	(mW)
Duty cycle:	97	(%)
Maximum Pav :	33.0195944	(mW)
Antenna gain (typical):	5.5	(dBi)
Maximum antenna gain:	3.548133892	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5580	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0233197	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0240 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 5580MHz.

802.11a 5725~5850 Power Table

Frequency (MHz)	Reading Power (dBm)
5745	11.75
5785	12.10
5825	**14.04**

MPE Prediction (802.11a)

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	14.04	(dBm)
Maximum average output power at antenna input	25.3512863	(mW)
Duty cycle:	97	(%)
Maximum Pav :	24.59074772	(mW)
Antenna gain (typical):	5.5	(dBi)
Maximum antenna gain:	3.548133892	(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)	0.017367	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0179 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 5825.

802.11n HT20 MIMO operation (CH 0 + CH 1)
Power Table

Frequency (MHz)	Reading Power (dBm)
5180	**16.52**
5220	16.47
5240	16.38

MPE Prediction (802.11n HT20 MIMO operation (CH 0 + CH 1) 5150~5250)

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	16.52	(dBm)
Maximum average output power at antenna input	44.87453899	(mW)
Duty cycle:	97	(%)
Maximum Pav :	43.52830282	(mW)
Antenna gain (typical):	8.51	(dBi)
Maximum antenna gain:	7.09577768	(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)	0.0614783	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0634 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5180MHz.

802.11n HT20 MIMO operation (CH 0 + CH 1)
Power Table

Frequency (MHz)	Reading Power (dBm)
5260	**16.57**
5300	16.46
5320	16.16

MPE Prediction (802.11n HT20 MIMO operation (CH 0 + CH 1) 5250~5350)

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	16.57	(dBm)
Maximum average output power at antenna input	45.39416167	(mW)
Duty cycle:	97	(%)
Maximum Pav :	44.03233682	(mW)
Antenna gain (typical):	8.51	(dBi)
Maximum antenna gain:	7.09577768	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5260	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0621902	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0641 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 5260MHz.

802.11n HT20 MIMO operation (CH 0 + CH 1)
Power Table

Frequency (MHz)	Reading Power (dBm)
5500	**18.64**
5580	18.29
5700	16.73

MPE Prediction (802.11n HT20 MIMO operation (CH 0 + CH 1) 5470~5725)

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	18.64	(dBm)
Maximum average output power at antenna input	73.11390835	(mW)
Duty cycle:	97	(%)
Maximum Pav :	70.9204911	(mW)
Antenna gain (typical):	8.51	(dBi)
Maximum antenna gain:	7.09577768	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5500	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.1001664	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.1033 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 5500MHz.

802.11n_20M (5GHz) MIMO Chain 0+ Chain1
Power Table

Frequency (MHz)	Reading Power (dBm)
5745	15.18
5785	15.45
5825	**17.02**

MPE Prediction (802.11n HT20 MIMO operation (CH 0 + CH 1) 5725~5850)

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	17.02	(dBm)
Maximum average output power at antenna input	50.35006088	(mW)
Duty cycle:	97	(%)
Maximum Pav :	48.83955905	(mW)
Antenna gain (typical):	8.51	(dBi)
Maximum antenna gain:	7.09577768	(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)	0.068980	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0711 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 5825.

802.11n HT40 MIMO operation (CH 0 + CH 1)
Power Table

Frequency (MHz)	Reading Power (dBm)
5190	**14.17**
5230	14.07

MPE Prediction (802.11n HT40 MIMO operation (CH 0 + CH 1) 5150~5250)

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	14.17	(dBm)
Maximum average output power at antenna input	26.12161354	(mW)
Duty cycle:	97	(%)
Maximum Pav :	25.33796514	(mW)
Antenna gain (typical):	8.51	(dBi)
Maximum antenna gain:	7.09577768	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5190	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0357867	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0361 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 5190MHz.

802.11n HT40 MIMO operation (CH 0 + CH 1)
Power Table

Frequency (MHz)	Reading Power (dBm)
5270	14.05
5310	**14.34**

MPE Prediction (802.11n HT40 MIMO operation (CH 0 + CH 1) 5250~5350)

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	14.34	(dBm)
Maximum average output power at antenna input	27.16439269	(mW)
Duty cycle:	97	(%)
Maximum Pav :	26.34946091	(mW)
Antenna gain (typical):	8.51	(dBi)
Maximum antenna gain:	7.09577768	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5310	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0372153	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0384 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 5310MHz.

802.11n HT40 MIMO operation (CH 0 + CH 1)
Power Table

Frequency (MHz)	Reading Power (dBm)
5510	14.72
5550	15.19
5670	**17.86**

MPE Prediction (802.11n HT40 MIMO operation (CH 0 + CH 1) 5470~5725)

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	17.86	(dBm)
Maximum average output power at antenna input	61.09420249	(mW)
Duty cycle:	97	(%)
Maximum Pav :	59.26137642	(mW)
Antenna gain (typical):	8.51	(dBi)
Maximum antenna gain:	7.09577768	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5670	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0836994	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0863 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 5670MHz.

802.11n HT40 MIMO operation (CH 0 + CH 1)
Power Table

Frequency (MHz)	Reading Power (dBm)
5755	11.54
5795	**16.76**

MPE Prediction (802.11n_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	16.76	(dBm)
Maximum average output power at antenna input	47.42419853	(mW)
Duty cycle:	97	(%)
Maximum Pav :	46.00147257	(mW)
Antenna gain (typical):	8.51	(dBi)
Maximum antenna gain:	7.09577768	(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)	0.064971	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0670 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 5795.

Remark: For RF exposure potentially generating from Co-located transmitter, please reference to the section of collocated MPE analysis, Report No.: ER/2015/20009.

~ End of Report ~