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

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

802.11a Max. output power

802.11a_Main

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	MCS0	14.81	30.269	23.98	PASS
44	5220	MCS0	**14.87**	**30.690**	23.98	PASS
48	5240	MCS0	14.80	30.200	23.98	PASS
149	5745	MCS0	14.84	30.479	30	PASS
157	5785	MCS0	14.81	30.269	30	PASS
165	5825	MCS0	**14.85**	**30.549**	30	PASS

MPE Prediction (802.11a 5150~5250)

Max. output power including tune-up tolerancel:	14.87	(dBm)
Max. output power including tune-up tolerancel:	30.69022	(mW)
Duty cycle:	95.16	(%)
Maximum Pav :	29.204813	(mW)
Peak Antenna gain (Maximum):	5.53	(dBi)
Peak Antenna gain (linear):	3.5727284	(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)	0.021	(mW/cm^2)

Measurement Result
The predicted power density level at 20 cm is 0.021 mW/cm2.
This is below the uncontrolled exposure limit of 1 mW/cm2 at 5220MHz.

MPE Prediction (802.11a 5725~5850)

Max. output power including tune-up tolerancel:	14.85	(dBm)
Max. output power including tune-up tolerancel:	30.549211	(mW)
Duty cycle:	95.16	(%)
Maximum Pav :	29.070629	(mW)
Peak Antenna gain (Maximum):	5.5	(dBi)
Peak Antenna gain (linear):	3.5481339	(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)	0.021	(mW/cm^2)

Measurement Result
The predicted power density level at 20 cm is 0.021 mW/cm2.
This is below the uncontrolled exposure limit of 1 mW/cm2 at 5825MHz.

802.11n_HT20M Max. output power

802.11n_HT20_MIMO

CH	Frequency (MHz)	Data Rate	AVERAGE POWER (dBm)			TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1	CH 2				
36	5180	MCS16	10.44	9.81	10.09	14.89	30.848	19.68	PASS
44	5220	MCS16	10.49	9.94	10.13	**14.96**	**31.361**	19.68	PASS
48	5240	MCS16	10.44	9.9	10.14	14.94	31.166	19.68	PASS
149	5745	MCS16	10.93	9.36	9.84	**14.87**	**30.656**	25.73	PASS
157	5785	MCS16	10.76	9.26	9.82	14.76	29.940	25.73	PASS
165	5825	MCS16	10.79	9.27	9.9	14.80	30.220	25.73	PASS

MPE Prediction (802.11n_HT20 5150~5250)

MIMO gain= G+(10 logN)= 5.53+4.77= 10.3dBm

Max. output power including tune-up tolerancel:	14.96	(dBm)
Max. output power including tune-up tolerancel:	31.332857	(mW)
Duty cycle:	87.08	(%)
Maximum Pav :	27.284652	(mW)
Peak Antenna gain (Maximum):	10.3	(dBi)
Peak Antenna gain (linear):	10.715193	(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)	0.058	(mW/cm^2)

Measurement Result
The predicted power density level at 20 cm is 0.058 mW/cm2.
This is below the uncontrolled exposure limit of 1 mW/cm2 at 5220MHz.

MPE Prediction (802.11n_HT20 5725~5850)

MIMO gain= G+(10 logN)= 5.50+4.77= 10.27dBm

Max. output power including tune-up tolerancel:	14.87	(dBm)
Max. output power including tune-up tolerancel:	30.69022	(mW)
Duty cycle:	87.08	(%)
Maximum Pav :	26.725043	(mW)
Peak Antenna gain (Maximum):	10.27	(dBi)
Peak Antenna gain (linear):	10.64143	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5745	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.057	(mW/cm^2)

Measurement Result
The predicted power density level at 20 cm is 0.057 mW/cm2.
This is below the uncontrolled exposure limit of 1 mW/cm2 at 5745MHz.

802.11n_HT40M Max. output power

802.11n_HT40_MIMO

CH	Frequency (MHz)	Data Rate	AVERAGE POWER (dBm)			TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1	CH 2				
38	5190	MCS16	10.11	9.51	10.59	14.86	30.645	19.68	PASS
46	5230	MCS16	10.31	9.69	10.6	**14.99**	**31.533**	19.68	PASS
151	5755	MCS16	10.65	9.61	10.31	**14.98**	**31.496**	25.73	PASS
159	5795	MCS16	10.58	9.37	10.32	14.89	30.843	25.73	PASS

MPE Prediction (802.11n_HT40 5150~5250)

MIMO gain= G+(10 logN)= 5.53+4.77= 10.3dBm

Max. output power including tune-up tolerancel:	14.99	(dBm)
Max. output power including tune-up tolerancel:	31.550046	(mW)
Duty cycle:	78.22	(%)
Maximum Pav :	24.678446	(mW)
Peak Antenna gain (Maximum):	10.3	(dBi)
Peak Antenna gain (linear):	10.715193	(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)	0.053	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.053 mW/cm2.

This is below the uncontrolled exposure limit of 1 mW/cm2 at 5230MHz.

MPE Prediction (802.11n_HT40 5725~5850)

MIMO gain= G+(10 logN)= 5.50+4.77= 10.27dBm

Average output power at antenna input terminal:	14.98	(dBm)
Average output power at antenna input terminal:	31.477483	(mW)
Duty cycle:	78.22	(%)
Maximum Pav :	24.621687	(mW)
Peak Antenna gain (Maximum):	10.27	(dBi)
Peak Antenna gain (linear):	10.64143	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5755	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.052	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.052 mW/cm2.

This is below the uncontrolled exposure limit of 1 mW/cm2 at 5755MHz.

802.11ac VHT80M Max. output power

802.11ac_VHT80_MIMO

CH	Frequency (MHz)	Data Rate	AVERAGE POWER (dBm)			TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1	CH 2				
42	5210	MCS0	10.63	9.57	10.35	14.98	31.458	19.68	PASS
155	5775	MCS0	10.45	9.38	10.37	14.86	30.651	25.73	PASS

MPE Prediction (802.11ac_VHT80 5150~5250)

MIMO gain= G+(10 logN)= 5.53+4.77= 10.3dBm

Average output power at antenna input terminal:	14.98	(dBm)
Average output power at antenna input terminal:	31.477483	(mW)
Duty cycle:	92.45	(%)
Maximum Pav :	29.100933	(mW)
Peak Antenna gain (Maximum):	10.3	(dBi)
Peak Antenna gain (linear):	10.715193	(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)	0.062	(mW/cm^2)

Measurement Result
The predicted power density level at 20 cm is 0.062 mW/cm2.
This is below the uncontrolled exposure limit of 1 mW/cm2 at 5210MHz.

MPE Prediction (802.11ac_VHT80 5725~5850)

MIMO gain= G+(10 logN)= 5.50+4.77= 10.27dBm

Average output power at antenna input terminal:	14.86	(dBm)
Average output power at antenna input terminal:	30.619634	(mW)
Duty cycle:	92.45	(%)
Maximum Pav :	28.307852	(mW)
Peak Antenna gain (Maximum):	10.27	(dBi)
Peak Antenna gain (linear):	10.64143	(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)	0.060	(mW/cm^2)

Measurement Result
The predicted power density level at 20 cm is 0.06 mW/cm2.
This is below the uncontrolled exposure limit of 1 mW/cm2 at 5775MHz.