MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

Maximum Permissible Exposure (MPE) Evaluation

802.11b_MIMO											
CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)				Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit		RESULT
			CH 0	CH 1	CH 2	CH3					
1	2412	1	19.26	19.88	19.51	19.60	**25.59**	362.14	1 Watt =	30.00 dBm	PASS
6	2437	1	19.12	19.77	19.25	19.49	25.44	349.56	1 Watt =	30.00 dBm	PASS
11	2462	1	19.12	19.88	19.45	19.64	25.55	359.08	1 Watt =	30.00 dBm	PASS

802.11b_MIMO											
CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)				Max. Output include tune up tolerance Power (dBm)	Max. Output include tune up tolerance Power (mW)	Limit		RESULT
			CH 0	CH 1	CH 2	CH3					
1	2412	1	17.19	17.70	17.39	17.44	**23.45**	221.53	1 Watt =	30.00 dBm	PASS
6	2437	1	16.74	17.49	16.93	17.22	23.12	205.35	1 Watt =	30.00 dBm	PASS
11	2462	1	16.89	17.59	16.93	17.26	23.20	208.81	1 Watt =	30.00 dBm	PASS

MPE Prediction (802.11b 2412~2462)

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

Max. output power including tune-up tolerancel:	23.45	(dBm)
Max. output power including tune-up tolerancel:	221.30947	(mW)
Duty cycle:	99.99	(%)
Maximum Pav :	221.28734	(mW)
Peak Antenna gain (Maximum):	5.61	(dBi)
Peak Antenna gain (linear):	3.6391504	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm^2)
Power density at predication frequency at 20 (cm)	0.160	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.16 mW/cm2.

This is below the uncontrolled exposure limit of 1 mW/cm2 at 2412MHz.

802.11g_MIMO										
CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)				Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CH 0	CH 1	CH 2	CH3				
1	2412	6	22.89	24.24	24.65	23.63	29.92	982.41	1 Watt = 30.00 dBm	PASS
6	2437	6	23.22	24.06	24.56	23.78	**29.95**	989.12	1 Watt = 30.00 dBm	PASS
11	2462	6	23.57	24.01	24.34	23.76	29.95	988.61	1 Watt = 30.00 dBm	PASS
802.11g_MIMO										
CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)				Max. Output include tune up tolerance Power (dBm)	Max. Output include tune up tolerance Power (mW)	Limit	RESULT
			CH 0	CH 1	CH 2	CH3				
1	2412	6	17.87	20.49	20.41	20.12	**25.86**	385.88	1 Watt = 30.00 dBm	PASS
6	2437	6	18.33	20.29	20.27	20.19	25.86	385.87	1 Watt = 30.00 dBm	PASS
11	2462	6	17.29	18.26	17.94	17.79	23.85	242.92	1 Watt = 30.00 dBm	PASS

MPE Prediction (802.11g 2412~2462)

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

Max. output power including tune-up tolerancel:	25.86	(dBm)
Max. output power including tune-up tolerancel:	385.47836	(mW)
Duty cycle:	99.99	(%)
Maximum Pav :	385.43981	(mW)
Peak Antenna gain (Maximum):	5.61	(dBi)
Peak Antenna gain (linear):	3.6391504	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm^2)
Power density at predication frequency at 20 (cm)	0.279	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.279 mW/cm2.

This is below the uncontrolled exposure limit of 1 mW/cm2 at 2412MHz.

802.11n_HT20M MIMO										
CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)				Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CH 0	CH 1	CH 2	CH3				
1	2412	MCS24	19.04	19.76	18.96	19.98	25.48	353.04	1 Watt = 25.69 dBm	PASS
6	2437	MCS24	19.22	19.55	19.04	20.16	25.53	357.64	1 Watt = 25.69 dBm	PASS
11	2462	MCS24	19.18	19.51	18.92	20.38	**25.55**	359.25	1 Watt = 25.69 dBm	PASS
802.11n_HT20M MIMO										
CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)				Max. Output include tune up tolerance Power (dBm)	Max. Output include tune up tolerance Power (mW)	Limit	RESULT
			CH 0	CH 1	CH 2	CH3				
1	2412	MCS24	7.39	7.82	7.73	7.87	13.73	23.59	1 Watt = 25.69 dBm	PASS
6	2437	MCS24	7.19	8.08	7.60	8.16	13.80	23.96	1 Watt = 25.69 dBm	PASS
11	2462	MCS24	7.13	8.11	7.75	8.20	**13.84**	24.20	1 Watt = 25.69 dBm	PASS

MPE Prediction (802.11n20 2412~2462)

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= Directional gain = 10 log $[(10^{(G1/20)}+10^{(G2/20)}+\ldots+10^{(GN/20)})^2/N_{ANT}]$ = 8.62dBi

Max. output power including tune-up tolerancel:	13.84	(dBm)
Max. output power including tune-up tolerancel:	24.21029	(mW)
Duty cycle:	99.99	(%)
Maximum Pav :	24.207869	(mW)
Peak Antenna gain (Maximum):	8.62	(dBi)
Peak Antenna gain (linear):	7.277798	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm^2)
Power density at predication frequency at 20 (cm)	0.035	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.035 mW/cm2.

This is below the uncontrolled exposure limit of 1 mW/cm2 at 2462MHz.

802.11n_HT40M MIMO										
CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)				Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CH 0	CH 1	CH 2	CH3				
3	2422	MCS24	19.12	19.85	18.93	19.33	25.34	342.13	1 Watt = 25.69 dBm	PASS
6	2437	MCS24	19.09	19.71	19.58	19.17	25.42	348.02	1 Watt = 25.69 dBm	PASS
9	2452	MCS24	19.07	19.77	19.26	19.86	**25.52**	356.73	1 Watt = 25.69 dBm	PASS
802.11n_HT40M MIMO										
CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)				Max. Output include tune up tolerance Power (dBm)	Max. Output include tune up tolerance Power (mW)	Limit	RESULT
			CH 0	CH 1	CH 2	CH3				
3	2422	MCS24	6.16	6.65	6.37	7.01	12.58	18.11	1 Watt = 25.69 dBm	PASS
6	2437	MCS24	6.18	6.71	6.44	7.21	12.67	18.50	1 Watt = 25.69 dBm	PASS
9	2452	MCS24	6.28	6.90	6.51	7.15	**12.74**	18.81	1 Watt = 25.69 dBm	PASS

MPE Prediction (802.11n40 2412~2452)

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= Directional gain = 10 log $[(10^{(G1/20)}+10^{(G2/20)}+\ldots+10^{(GN/20)})^2/N_{ANT}]$ = 8.62dBi

Max. output power including tune-up tolerancel:	12.74	(dBm)
Max. output power including tune-up tolerancel:	18.793168	(mW)
Duty cycle:	99.99	(%)
Maximum Pav :	18.791289	(mW)
Peak Antenna gain (Maximum):	8.62	(dBi)
Peak Antenna gain (linear):	7.277798	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2452	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm^2)
Power density at predication frequency at 20 (cm)	0.027	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.027 mW/cm2.

This is below the uncontrolled exposure limit of 1 mW/cm2 at 2452MHz.