15. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

15.1 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

Please be noted that 2.4G antenna will not transmit together with 5G antenna.

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802.11a Max. Output Power

802.11a_Main

CH	Frequency (MHz)	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	16.45	44.157	23.98	PASS
44	5220	16.50	44.668	23.98	PASS
48	5240	**16.70**	46.774	23.98	PASS

MPE Prediction (802.11a 5150~5250)

Average output power at antenna input terminal:	16.70	(dBm)
Average output power at antenna input terminal:	46.773514	(mW)
Duty cycle:	100	(%)
Maximum Pav :	46.773514	(mW)
Peak Antenna gain (Maximum):	2.76	(dBi)
Peak Antenna gain (linear):	1.8879913	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5240	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.018	(mW/cm^2)

Measurement Result
The predicted power density level at 20 cm is 0.018 mW/cm2.
This is below the uncontrolled exposure limit of 1 mW/cm2 at 5240MHz.

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802.11n_HT20M Max. Output Power

802.11n_HT20_Main

CH	Frequency (MHz)	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	16.15	41.210	23.98	PASS
44	5220	16.40	43.652	23.98	PASS
48	5240	**16.60**	45.709	23.98	PASS

MPE Prediction (802.11n_HT20 5150~5250)

Average output power at antenna input terminal:	16.60	(dBm)
Average output power at antenna input terminal:	45.708819	(mW)
Duty cycle:	100	(%)
Maximum Pav :	45.708819	(mW)
Peak Antenna gain (Maximum):	2.76	(dBi)
Peak Antenna gain (linear):	1.8879913	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5240	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.017	(mW/cm^2)

Measurement Result
The predicted power density level at 20 cm is 0.017 mW/cm2.
This is below the uncontrolled exposure limit of 1 mW/cm2 at 5240MHz.

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802.11n_HT40M Max. Output Power

802.11n_HT40_Main

CH	Frequency (MHz)	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
38	5190	10.75	11.885	23.98	PASS
46	5230	**12.90**	19.498	23.98	PASS

MPE Prediction (802.11n_HT40 5150~5250)

Average output power at antenna input terminal:	12.90	(dBm)
Average output power at antenna input terminal:	19.498446	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.498446	(mW)
Peak Antenna gain (Maximum):	2.76	(dBi)
Peak Antenna gain (linear):	1.8879913	(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)	0.007	(mW/cm^2)

Measurement Result
The predicted power density level at 20 cm is 0.007 mW/cm2.
This is below the uncontrolled exposure limit of 1 mW/cm2 at 5230MHz.

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802.11ac VHT80M Max. Output Power

802.11ac_VHT80_Main

CH	Frequency (MHz)	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
42	5210	8.10	6.457	23.98	PASS

MPE Prediction (802.11ac_VHT80 5150~5250)

Average output power at antenna input terminal:	8.10	(dBm)
Average output power at antenna input terminal:	6.4565423	(mW)
Duty cycle:	100	(%)
Maximum Pav :	6.4565423	(mW)
Peak Antenna gain (Maximum):	2.76	(dBi)
Peak Antenna gain (linear):	1.8879913	(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)	0.002	(mW/cm^2)

Measurement Result
The predicted power density level at 20 cm is 0.002 mW/cm2.
This is below the uncontrolled exposure limit of 1 mW/cm2 at 5210MHz.

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