

Maximum Permissible Exposure (MPE)

Related Submittal(s) / Grant (s)

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.

This submittal(s) (test report) is intended to comply with Section Part 22, subpart H and Part 24, subpart E and Part27 subpart C & subpart L of the FCC CFR 47 Rules. And RSS-102 issue 4 For 47 CFR 1.1310 Radio frequency Radiation Exposure requirement.

Special Accessories

Not available for this EUT intended for grant.

Equipment Modifications

Not available for this EUT intended for grant.

Limitation

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

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Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Averaging Time (minutes)
0.003-1	280	2.19	-	6
1-10	280/f	2.19/f	-	6
10-30	28	2.19/f	-	6
30-300	28	0.073	2*	6
300-1500	1.585 f ^{0.5}	0.0042 f ^{0.5}	f/150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/f ^{1.2}
150000-300000	0.158 f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000/f ^{1.2}

Note: f is frequency in MHz.

* Power density limit is applicable at frequencies greater than 100 MHz.

* Please note that R505 supports LTE Multiple Input. But it doesn't support Multiple Output.

The "MIMO" only for LTE receive, not for LTE transmit.

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Maximum Permissible Exposure (MPE) Evaluation

802.11b Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	12.91	0.00	12.91	0.0195	1
2437.00	12.95	0.00	12.95	0.0197	1
2462.00	12.91	0.00	12.91	0.0195	1

MPE Prediction (802.11b)

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 peak output power at antenna input terminal:	12.95	(dBm)
Maximum peak output power at antenna input terminal:	19.72422736	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.72422736	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(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)	0.0074636	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0074636 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2412MHz.

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802.11g Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	12.98	0.00	12.98	0.0199	1
2437.00	12.91	0.00	12.91	0.0195	1
2462.00	12.92	0.00	12.92	0.0196	1

MPE Prediction (802.11g)

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 peak output power at antenna input terminal:	12.98	(dBm)
Maximum peak output power at antenna input terminal:	19.86094917	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.86094917	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(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)	0.0075154	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0075 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2462.

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802.11n_20M (Main)Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	12.99	0.00	12.99	0.0199	1
2437.00	12.95	0.00	12.95	0.0197	1
2462.00	12.93	0.00	12.93	0.0196	1

MPE Prediction (802.11n_20M)

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 peak output power at antenna input terminal:	12.99	(dBm)
Maximum peak output power at antenna input terminal:	19.90673339	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.90673339	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(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)	0.0075327	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0075 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2462.

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802.11n_20M(Aux) Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	12.95	0.00	12.95	0.0197	1
2437.00	12.92	0.00	12.92	0.0196	1
2462.00	12.95	0.00	12.95	0.0197	1

MPE Prediction (802.11n_20M)

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 peak output power at antenna input terminal:	12.95	(dBm)
Maximum peak output power at antenna input terminal:	19.72422736	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.72422736	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(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)	0.0074636	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0074 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2462.

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802.11n_20M(MIMO) Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	15.980	0.00	15.980	0.0396	1
2437.00	15.945	0.00	15.945	0.0393	1
2462.00	15.950	0.00	15.950	0.0394	1

MPE Prediction (802.11n_20M)

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 only for multiple input. (Effect on receiving)

Maximum peak output power at antenna input terminal:	15.98	(dBm)
Maximum peak output power at antenna input terminal:	39.62780343	(mW)
Duty cycle:	100	(%)
Maximum Pav :	39.62780343	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(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)	0.0149951	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.015 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2462.

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802.11n_40M(Main) Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2422.00	12.96	0.00	12.96	0.0198	1
2437.00	12.91	0.00	12.91	0.0195	1
2452.00	12.89	0.00	12.89	0.0195	1

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 peak output power at antenna input terminal:	12.96	(dBm)
Maximum peak output power at antenna input terminal:	19.7696964	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.7696964	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0074808	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0075 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2437.

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802.11n_40M(Aux) Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2422.00	12.95	0.00	12.95	0.0197	1
2437.00	12.95	0.00	12.95	0.0197	1
2452.00	12.91	0.00	12.91	0.0195	1

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 peak output power at antenna input terminal:	12.95	(dBm)
Maximum peak output power at antenna input terminal:	19.72422736	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.72422736	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0074636	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0075 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2437.

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802.11n_40M(MIMO) Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2422.00	15.965	0.00	15.965	0.0395	1
2437.00	15.940	0.00	15.940	0.0393	1
2452.00	15.910	0.00	15.910	0.0390	1

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

MIMO only for multiple input. (Effect on receiving)

Maximum peak output power at antenna input terminal:	15.965	(dBm)
Maximum peak output power at antenna input terminal:	39.49116993	(mW)
Duty cycle:	100	(%)
Maximum Pav :	39.49116993	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0149434	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0149 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2437.

- End of Report -

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