

14 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

14.1 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 Permissible 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

MPE Prediction (802.11a (Aux))

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

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14.2 Maximum Permissible Exposure (MPE) Evaluation:

802.11a (Aux)

Average Power Output (dBm)

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
5745.00	14.03	0.02529	1
5785.00	14.25	0.02661	1
5825.00	14.92	0.03105	1

Maximum average output power at antenna input	14.92	(dBm)
Maximum average output power at antenna input	31.04559588	(mW)
Duty cycle:	100	(%)
Maximum Pav :	31.04559588	(mW)
Antenna gain (typical):	10.92	(dBi)
Maximum antenna gain:	12.35947433	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5825	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0763748	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0763748W/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 5825MHz.

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802.11n (5GHz)_20M MIMO Chain 0+ Chain1

Average Power Output (dBm)

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
5745.00	17.23	0.05284	1
5785.00	17.53	0.05662	1
5825.00	17.37	0.05458	1

Maximum average output power at antenna input	17.53	(dBm)
Maximum average output power at antenna input	56.6239289	(mW)
Duty cycle:	100	(%)
Maximum Pav :	56.6239289	(mW)
Antenna gain (typical):	9.96	(dBi)
Maximum antenna gain:	9.908319449	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5785	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.1116736	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.1116736 W/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 5785MHz.

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802.11n (5GHz)_40M MIMO Chain 0+Chain 1

Average Power Output (dBm)

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
5755.00	11.53	0.01422	1
5798.00	11.44	0.01393	1

Maximum average output power at antenna input	11.53	(dBm)
Maximum average output power at antenna input	14.22328787	(mW)
Duty cycle:	100	(%)
Maximum Pav :	14.22328787	(mW)
Antenna gain (typical):	9.96	(dBi)
Maximum antenna gain:	9.908319449	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5755	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0280511	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0280511 W/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 5755MHz.

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14.3 Standard Applicable:

According to RSS 102 issue 4 §2.5.2 RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and the device's radiating element is greater than 20 cm, except when the device operates as follows:

below 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 2.5 W;

at or above 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 5 W.

This is a Mobile device, at which separation distance between the user and the device's antenna is 20cm. Therefore, section 2.5.2 shall be complied with.

RF Evaluation**The worst case: 802.11a (Aux)**

Maximum average output power at antenna input	14.92	(dBm)
Maximum average output power at antenna input	31.04559588	(mW)
Antenna gain (typical):	10.92	(dBi)
Maximum antenna gain:	12.35947433	(numeric)

Evaluation Result

The radiated power is $14.92 + 10.92 = 25.84$ dBm(EIRP) = 383.707mW = 0.383707W

that is less than or equal to 5W. Hence, following section 2.5.2 of RSS102 issue 4,

RF exposure evaluation is no longer required.

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The worst case: 802.11n_20M MIMO mode Chain 0+ Chain1

Maximum average output power at antenna input	17.53	(dBm)
Maximum average output power at antenna input	56.6239289	(mW)
Antenna gain (typical):	9.96	(dBi)
Maximum antenna gain:	9.908319449	(numeric)

Evaluation Result

The radiated power is $17.53 + 9.96 = 27.49$ dBm(EIRP) = 561.048mW = 0.561048W that is less than or equal to 5W. Hence, following section 2.5.2 of RSS102 issue 4, RF exposure evaluation is no longer required.

The worst case: 802.11n_40M MIMO mode Chain 0+ Chain1

Maximum average output power at antenna input	11.53	(dBm)
Maximum average output power at antenna input	14.22328787	(mW)
Antenna gain (typical):	9.96	(dBi)
Maximum antenna gain:	9.908319449	(numeric)

Evaluation Result

The radiated power is $11.53 + 9.96 = 21.49$ dBm(EIRP) = 140.929mW = 0.140929W that is less than or equal to 5W. Hence, following section 2.5.2 of RSS102 issue 4, RF exposure evaluation is no longer required.

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