

1 Maximum Permissible Exposure

1.1 Maximum Permissible Exposure

1.1.1 Limit of Maximum Permissible Exposure

Limits for Occupational / Controlled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500	-	-	F/300	6
1500-100,000	-	-	5	6
Limits for General Population / Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	F/1500	30
1500-100,000	-	-	1.0	30
Note 1: f = frequency in MHz ; *Plane-wave equivalent power density				
Note 2: For the applicable limit, see FCC 1.1310				

RF Field Strength Limits for Controlled Use Devices (Controlled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m²)	Averaging Time (minutes)
0.003-1	600	4.9	-	6
1-10	600/ <i>f</i>	4.9/ <i>f</i>	-	6
10-30	60	4.9/ <i>f</i>	-	6
30-300	60	0.163	10*	6
300-1500	3.54 <i>f</i> ^{0.5}	0.0094 <i>f</i> ^{0.5}	<i>f</i> /30	6
1500-15000	137	0.364	50	6
15000-150000	137	0.364	50	616000/ <i>f</i> ^{1.2}
150000-300000	0.354 <i>f</i> ^{0.5}	9.4 x 10 ⁻⁴ <i>f</i> ^{0.5}	3.33 x 10 ⁻⁴ <i>f</i>	616000/ <i>f</i> ^{1.2}
RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m²)	Averaging Time (minutes)
0.003-1	280	2.19	-	6
1-10	280/ <i>f</i>	2.19/ <i>f</i>	-	6
10-30	28	2.19/ <i>f</i>	-	6
30-300	28	0.073	2*	6
300-1500	1.585 <i>f</i> ^{0.5}	0.0042 <i>f</i> ^{0.5}	<i>f</i> /150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}
Note 1: <i>f</i> is frequency in MHz.				
Note 2: For the applicable limit, see IC RSS-102				

1.1.2 MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d}$$

E = Electric field (V/m)

G = EUT Antenna numeric gain (numeric)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

$$\text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

P = RF output power (W)

d = Separation distance between radiator and human body (m)

1.1.3 Result of Maximum Permissible Exposure-(2.4G)

RF General Information						
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N _{TX})	RF Output Power (dBm)	Co-location
For model: R6100 / R6000						
2400-2483.5	b	2412-2462	1-11 [11]	2	25.93	Yes
2400-2483.5	g	2412-2462	1-11 [11]	2	23.56	Yes
2400-2483.5	n (HT20)	2412-2462	1-11 [11]	2	23.65	Yes
2400-2483.5	n (HT40)	2422-2452	3-9 [7]	2	18.12	Yes
Note 1: RF output power specifies that Maximum Conducted (Average) Output Power. Note 2: Co-location, Co-location is generally defined as simultaneously transmitting (co-transmitting) antennas within 20 cm of each other. (EUT has simultaneously co-transmitting that operating 2.4GHz and 5GHz.)						

Worst Maximum RF Output Power Result								
Exposure Environment	General Population / Uncontrolled Exposure							
Separation Distance (cm)	20							
Condition	RF Output Power (dBm)							
Modulation Mode	Chain-Port 1	Chain-Port 2	Chain-Port 3	Chain-Port 4	Sum Chain	DG (dBi)	EIRP Power	PD (S) (mW/cm²)
b	23.02	22.81	-	-	25.93	1.8	27.73	0.118
g	20.46	20.64	-	-	23.56	1.8	25.36	0.068
n (HT20)	20.54	20.73	-	-	23.65	1.8	25.45	0.070
n (HT40)	14.82	15.39	-	-	18.12	1.8	19.92	0.020
Maximum Permissible Exposure Limit (mW/cm²)								1

1.1.4 Result of Maximum Permissible Exposure-(5.8G)

RF General Information						
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N _{TX})	RF Output Power (dBm)	Co-location
For model: R6100						
5725-5850	a	5745-5825	149-165 [5]	2	29.77	Yes
5725-5850	n(HT20)	5745-5825	149-165 [5]	2	29.93	Yes
5725-5850	n(HT40)	5755-5795	151-159 [2]	2	29.44	Yes
5725-5850	ac(VHT20)	5745-5825	149-165 [5]	2	29.74	Yes
5725-5850	ac(VHT40)	5755-5795	151-159 [2]	2	29.30	Yes
5725-5850	ac(VHT80)	5775	155 [1]	2	22.05	Yes
For model: R6000						
5725-5850	a	5745-5825	149-165 [5]	1	29.56	Yes
5725-5850	n(HT20)	5745-5825	149-165 [5]	1	29.31	Yes
5725-5850	n(HT40)	5755-5795	151-159 [2]	1	29.12	Yes
5725-5850	ac(VHT20)	5745-5825	149-165 [5]	1	29.32	Yes
5725-5850	ac(VHT40)	5755-5795	151-159 [2]	1	29.21	Yes
5725-5850	ac(VHT80)	5775	155 [1]	1	20.42	Yes
Note 1: RF output power specifies that Maximum Conducted (Average) Output Power. Note 2: RF output power specifies that Maximum Peak Conducted Output Power for ac(VHT80) only. Note 3: Co-location, Co-location is generally defined as simultaneously transmitting (co-transmitting) antennas within 20 cm of each other. (i.e., EUT has simultaneously co-transmitting that operating 2.4GHz and 5GHz.)						

Worst Maximum RF Output Power Result								
Exposure Environment	General Population / Uncontrolled Exposure							
Separation Distance (cm)	20							
Condition	RF Output Power (dBm)							
For model: R6100								
Modulation Mode	Chain-Port 1	Chain-Port 2	Chain-Port 3	Chain-Port 4	Sum Chain	DG (dBi)	EIRP Power	PD (S) (mW/cm²)
a	27.03	26.48	-	-	29.77	2.7	32.47	0.351
n(HT20)	26.95	26.88	-	-	29.93	2.7	32.63	0.365
n(HT40)	26.56	26.29	-	-	29.44	2.7	32.14	0.326
ac(VHT20)	26.94	26.51	-	-	29.74	2.7	32.44	0.349
ac(VHT40)	26.42	26.15	-	-	29.30	2.7	32.00	0.315
ac(VHT80)	19.23	18.85	-	-	22.05	2.7	24.75	0.059
For model: R6000								
Modulation Mode	Chain-Port 1	Chain-Port 2	Chain-Port 3	Chain-Port 4	Sum Chain	DG (dBi)	EIRP Power	PD (S) (mW/cm²)
a	29.56	-	-	-	29.56	2.7	32.26	0.335
n(HT20)	29.31	-	-	-	29.31	2.7	32.01	0.316
n(HT40)	29.12	-	-	-	29.12	2.7	31.82	0.303
ac(VHT20)	29.32	-	-	-	29.32	2.7	32.02	0.317
ac(VHT40)	29.21	-	-	-	29.21	2.7	31.91	0.309
ac(VHT80)	20.42	-	-	-	20.42	2.7	23.12	0.041
Maximum Permissible Exposure Limit (mW/cm²)								1

1.1.5 Result of Maximum Permissible Exposure-(5.2G)

RF General Information						
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N _{TX})	RF Output Power (dBm)	Co-location
For model: R6100						
5150-5250	a	5180-5240	36-48 [4]	2	16.48	Yes
5150-5250	n(HT20)	5180-5240	36-48 [4]	2	16.42	Yes
5150-5250	n(HT40)	5190-5230	38-46 [2]	2	16.94	Yes
5150-5250	ac(VHT20)	5180-5240	36-48 [4]	2	16.51	Yes
5150-5250	ac(VHT40)	5190-5230	38-46 [2]	2	16.88	Yes
5150-5250	ac(VHT80)	5210	42 [1]	2	14.81	Yes
For model: R6000						
5150-5250	a	5180-5240	36-48 [4]	1	16.36	Yes
5150-5250	n(HT20)	5180-5240	36-48 [4]	1	16.78	Yes
5150-5250	n(HT40)	5190-5230	38-46 [2]	1	16.76	Yes
5150-5250	ac(VHT20)	5180-5240	36-48 [4]	1	16.82	Yes
5150-5250	ac(VHT40)	5190-5230	38-46 [2]	1	16.77	Yes
5150-5250	ac(VHT80)	5210	42 [1]	1	12.15	Yes
Note 1: RF output power specifies that Maximum Conducted Output Power. Note 2: RF output power specifies that Maximum Peak Conducted Output Power for ac(VHT80) only. Note 3: Co-location, Co-location is generally defined as simultaneously transmitting (co-transmitting) antennas within 20 cm of each other. (i.e., EUT has simultaneously co-transmitting that operating 2.4GHz and 5GHz.)						

Worst Maximum RF Output Power Result								
Exposure Environment	General Population / Uncontrolled Exposure							
Separation Distance (cm)	20							
Condition	RF Output Power (dBm)							
For model: R6100								
Modulation Mode	Chain-Port 1	Chain-Port 2	Chain-Port 3	Chain-Port 4	Sum Chain	DG (dBi)	EIRP Power	PD (S) (mW/cm²)
a	13.59	13.34			16.48	2.9	19.38	0.017
n(HT20)	13.44	13.38			16.42	2.9	19.32	0.017
n(HT40)	13.94	13.91			16.94	2.9	19.84	0.019
ac(VHT20)	13.56	13.43			16.51	2.9	19.41	0.017
ac(VHT40)	13.84	13.89			16.88	2.9	19.78	0.0189
ac(VHT80)	11.88	11.72			14.81	2.9	17.71	0.0117
For model: R6000								
Modulation Mode	Chain-Port 1	Chain-Port 2	Chain-Port 3	Chain-Port 4	Sum Chain	DG (dBi)	EIRP Power	PD (S) (mW/cm²)
a	16.36	-	-	-	16.36	2.9	19.26	0.017
n(HT20)	16.78	-	-	-	16.78	2.9	19.68	0.018
n(HT40)	16.76	-	-	-	16.76	2.9	19.66	0.018
ac(VHT20)	16.82	-	-	-	16.82	2.9	19.72	0.019
ac(VHT40)	16.77	-	-	-	16.77	2.9	19.67	0.018
ac(VHT80)	12.15	-	-	-	12.15	2.9	15.05	0.006
Maximum Permissible Exposure Limit (mW/cm²)								1

MPE of Co-location evaluation:

2.4 and 5GHz can transmit at the same time, MPE evaluation is as below formula

$$PD1 / \text{Limit1} + PD2 / \text{Limit 2} + \dots < 1$$

PD = Power density

- 1) $2.4 + 5.2\text{GHz} = 0.118 / 1 + 0.019 / 1 = 0.137 < 1$
- 2) $2.4 + 5.8\text{GHz} = 0.118 / 1 + 0.365 / 1 = 0.483 < 1$