

1 Human Exposure Assessment

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/m ²)	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 × 10 ⁻⁴ <i>f</i> ^{0.5}	3.33 × 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/m ²)	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 × 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 × 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 (5.8G)

Transmitter Chains & Receiver Chains Information					
IEEE Std. 802.11 Protocol	Number of Transmit Chains (N _{TX})	Number of Receive Chains (N _{RX})	Correlation Signals with Multiple N _{TX}	RF Output Power (dBm)	Co-location
ac(VHT20)	1	1	Uncorrelated	18.79	Yes
ac(VHT40)	1	1	Uncorrelated	14.60	Yes
ac(VHT80)	1	1	Uncorrelated	17.34	Yes
ac(VHT20)	2	2	Uncorrelated	15.55	Yes
ac(VHT40)	2	2	Uncorrelated	15.76	Yes
ac(VHT80)	2	2	Uncorrelated	15.25	Yes
Note 1: 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.) Note 2: RF output power specifies that Maximum Conducted (Average) Output Power.					

Worst Maximum RF Output Power Result							
Exposure Environment		General Population / Uncontrolled Exposure					
Separation Distance (cm)		20					
Power Level	1	RF Output Power (dBm)					
Modulation Mode	N _{TX}	Chain-Port 1	Chain-Port 2	Sum Chain	Gain (dBi)	EIRP Power	PD (S) (mW/cm ²)
VHT20,M0	1	18.79	-	18.79	-5.42	13.37	0.00432
VHT40,M0	1	14.60	-	14.60	-5.42	9.18	0.00165
VHT40,M0	1	17.34	-	17.34	-5.42	11.92	0.00310
VHT20,M0	2	12.20	12.85	15.55	-5.42	10.13	0.00205
VHT40,M0	2	12.95	12.55	15.76	-5.42	10.34	0.00215
VHT40,M0	2	12.46	12.00	15.25	-5.42	9.83	0.00191
Maximum Permissible Exposure Limit (mW/cm ²)							1
Note 1: N _{TX} = Number of Transmit Chains							

1.1.4 Result of Maximum Permissible Exposure (5.2G~5.6G)

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
5150-5250	ac (VHT20)	5180-5240	36-48 [3]	1	15.33	Yes
5250-5350		5260-5320	52-64 [4]	1	15.57	
5470-5725		5500-5720	100-144 [4]	1	16.57	
straddle 5725		5720	144	1	9.84	
5150-5250	ac (VHT40)	5190-5230	38-46 [2]	1	15.24	Yes
5250-5350		5270-5310	54-62 [2]	1	11.49	
5470-5725		5510-5710	102-142 [4]	1	16.58	
straddle 5725		5710	142	1	2.35	
5150-5250	ac (VHT80)	5210	48 [1]	1	8.11	Yes
5250-5350		5290	58 [1]	1	10.90	
5470-5725		5530-5690	106-138 [3]	1	13.46	
straddle 5725		5690	138	1	-4.03	
5150-5250	ac (VHT20)	5180-5240	36-48 [3]	2	13.34	Yes
5250-5350		5260-5320	52-64 [4]	2	13.78	
5470-5725		5500-5720	100-144 [4]	2	16.57	
straddle 5725		5720	144	2	7.45	
5150-5250	ac (VHT40)	5190-5230	38-46 [2]	2	13.16	Yes
5250-5350		5270-5310	54-62 [2]	2	9.58	
5470-5725		5510-5710	102-142 [4]	2	16.85	
straddle 5725		5710	142	2	1.12	
5150-5250	ac (VHT80)	5210	48 [1]	2	6.51	Yes
5250-5350		5290	58 [1]	2	9.68	
5470-5725		5530-5690	106-138 [3]	2	16.87	
straddle 5725		5690	138	2	-5.11	
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. (i.e., EUT has simultaneously co-transmitting that operating 5GHz.)						

Worst Maximum Permissible Exposure Result							
Exposure Environment		General Population / Uncontrolled Exposure					
Separation Distance (cm)		20					
Condition		RF Output Power (dBm)					
Modulation Mode	N_{TX}	Chain-Port 1	Chain-Port 2	Sum Chain	DG (dBi)	EIRP Power	PD (S) (W/m²)
5.2G- ac (VHT20)	1	15.33	-	15.33	-5.42	9.91	0.00195
5.3G- ac (VHT20)	1	15.57	-	15.57	-5.42	10.15	0.00206
5.6G- ac (VHT20)	1	16.57	-	16.57	-5.42	11.15	0.00259
5.2G- ac (VHT40)	1	15.24	-	15.24	-5.42	9.82	0.00191
5.3G- ac (VHT40)	1	11.49	-	11.49	-5.42	6.07	0.00081
5.6G- ac (VHT40)	1	16.58	-	16.58	-5.42	11.16	0.00260
5.2G- ac (VHT80)	1	8.11	-	8.11	-5.42	2.69	0.00037
5.3G- ac (VHT80)	1	10.90	-	10.90	-5.42	5.48	0.00070
5.6G- ac (VHT80)	1	13.46	-	13.46	-5.42	8.04	0.00127
5.2G- ac (VHT20)	2	10.36	10.30	13.34	-5.42	7.92	0.00123
5.3G- ac (VHT20)	2	10.86	10.67	13.78	-5.42	8.36	0.00136
5.6G- ac (VHT20)	2	13.63	13.48	16.57	-5.42	11.15	0.00259
5.2G- ac (VHT40)	2	10.13	10.16	13.16	-5.42	7.74	0.00118
5.3G- ac (VHT40)	2	6.54	6.60	9.58	-5.42	4.16	0.00052
5.6G- ac (VHT40)	2	13.90	13.77	16.85	-5.42	11.43	0.00277
5.2G- ac (VHT80)	2	3.48	3.52	6.51	-5.42	1.09	0.00026
5.3G- ac (VHT80)	2	6.52	6.81	9.68	-5.42	4.26	0.00053
5.6G- ac (VHT80)	2	13.90	13.81	16.87	-5.42	11.45	0.00278
Maximum Permissible Exposure Limit (mW/cm²)							1