



# 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 <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900/f <sup>2</sup> )*	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 <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f <sup>2</sup> )*	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 <sup>2</sup> )	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> <sup>0.5</sup>	0.0094 <i>f</i> <sup>0.5</sup>	<i>f</i> /30	6
1500-15000	137	0.364	50	6
15000-150000	137	0.364	50	616000/ <i>f</i> <sup>1.2</sup>
150000-300000	0.354 <i>f</i> <sup>0.5</sup>	9.4 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	3.33 x 10 <sup>-4</sup> <i>f</i>	616000/ <i>f</i> <sup>1.2</sup>
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 <sup>2</sup> )	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> <sup>0.5</sup>	0.0042 <i>f</i> <sup>0.5</sup>	<i>f</i> /150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> <sup>1.2</sup>
150000-300000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616000/ <i>f</i> <sup>1.2</sup>
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 (5.250 G~5.350G)

Transmitter Chains & Receiver Chains Information				
IEEE Std. 802.11 Protocol	Number of Transmit Chains (N <sub>TX</sub> )	Number of Receive Chains (N <sub>RX</sub> )	Correlation Signals with Multiple N <sub>TX</sub>	RF Output Power (dBm)
a	1	1	Correlated	20.58
n(HT20)	2	2	Uncorrelated	22.49
n(HT40)	2	2	Uncorrelated	23.25
ac(VHT20)	2	2	Uncorrelated	22.37
ac(VHT40)	2	2	Uncorrelated	23.78
ac(VHT80)	2	2	Uncorrelated	15.92

Note 1: 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 <sub>TX</sub>	Chain-Port 1	Chain-Port 2	Sum Chain	Gain (dBi)	EIRP Power	PD (S) (mW/cm <sup>2</sup> )
a	1	20.58	-	20.58	2.58	23.16	0.04118
n(HT20)	2	19.34	19.61	22.49	5.59	28.08	0.12779
n(HT40)	2	19.95	20.52	23.25	5.59	28.84	0.15248
ac(VHT20)	2	19.13	19.58	22.37	5.59	27.96	0.12441
ac(VHT40)	2	20.39	21.12	23.78	5.59	29.37	0.17212
ac(VHT80)	2	12.61	13.19	15.92	5.59	21.51	0.02817
Maximum Permissible Exposure Limit (mW/cm <sup>2</sup> )							1

Note 1: N<sub>TX</sub> = Number of Transmit Chains



1.1.4 Result of Maximum Permissible Exposure (5.470G~5.725G)

Transmitter Chains & Receiver Chains Information				
IEEE Std. 802.11 Protocol	Number of Transmit Chains (N <sub>TX</sub> )	Number of Receive Chains (N <sub>RX</sub> )	Correlation Signals with Multiple N <sub>TX</sub>	RF Output Power (dBm)
a	1	1	Correlated	20.99
n(HT20)	2	2	Uncorrelated	21.56
n(HT40)	2	2	Uncorrelated	22.44
ac(VHT20)	2	2	Uncorrelated	21.64
ac(VHT40)	2	2	Uncorrelated	22.64
ac(VHT80)	2	2	Uncorrelated	16.12

Note 1: 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 <sub>TX</sub>	Chain-Port 1	Chain-Port 2	Sum Chain	Gain (dBi)	EIRP Power	PD (S) (mW/cm <sup>2</sup> )
a	1	20.99	-	20.99	2.58	23.57	0.04526
n(HT20)	2	18.80	18.29	21.56	5.59	27.15	0.10329
n(HT40)	2	19.41	19.45	22.44	5.59	28.03	0.12641
ac(VHT20)	2	18.88	18.37	21.64	5.59	27.23	0.10521
ac(VHT40)	2	19.54	19.71	22.64	5.59	28.23	0.13224
ac(VHT80)	2	13.04	13.18	16.12	5.59	21.71	0.02950
Maximum Permissible Exposure Limit (mW/cm <sup>2</sup> )							1

Note 1: N<sub>TX</sub> = Number of Transmit Chains