

# 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)*	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)*	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-(5.3G~5.6G)**

RF General Information					
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N <sub>TX</sub> )	RF Output Power (dBm)
5250-5350	a	5260-5320	52-64 [4]	1	21.92
5470-5725		5500-5700	100-140 [8]	1	21.88
5250-5350	n (HT20)	5260-5320	52-64 [4]	1	21.99
5470-5725		5500-5700	100-140 [8]	1	22.03
5250-5350	n (HT40)	5270-5310	54-62 [2]	1	23.24
5470-5725		5510-5670	102-134 [3]	1	23.28
5250-5350	n (HT20)	5260-5320	52-64 [4]	3	21.05
5470-5725		5500-5700	100-140 [8]	3	21.25
5250-5350	n (HT40)	5270-5310	54-62 [2]	3	23.91
5470-5725		5510-5670	102-134 [3]	3	23.92
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 2.4GHz and 5GHz.)					

<b>Worst Maximum Permissible Exposure Result</b>								
<b>Exposure Environment</b>		General Population / Uncontrolled Exposure						
<b>Separation Distance (cm)</b>		20						
<b>Condition</b>		<b>RF Output Power (dBm)</b>						
<b>Modulation Mode</b>	<b>N<sub>TX</sub></b>	<b>Chain-Port 1</b>	<b>Chain-Port 2</b>	<b>Chain-Port 3</b>	<b>Sum Chain</b>	<b>DG (dBi)</b>	<b>EIRP Power</b>	<b>PD (S) (W/m<sup>2</sup>)</b>
11A5.3G-20M	1	-	21.92	-	21.92	2.08	24.00	0.05000
11A5.6G-20M	1	-	21.88	-	21.88	2.08	23.96	0.04950
11N5.3G-20M	1	-	21.99	-	21.99	2.08	24.07	0.05081
11N5.6G-20M	1	-	22.03	-	22.03	2.08	24.11	0.05128
11N5.3G-40M	1	-	23.24	-	23.24	2.08	25.32	0.06776
11N5.6G-40M	1	-	23.28	-	23.28	2.08	25.36	0.06838
11N5.3G-20M	3	15.27	17.91	15.06	21.05	2.08	23.13	0.04092
11N5.6G-20M	3	16.46	16.55	16.42	21.25	2.08	23.33	0.04285
11N5.3G-40M	3	18.23	20.79	17.76	23.91	2.08	25.99	0.07906
11N5.6G-40M	3	19.08	19.74	18.57	23.92	2.08	26.00	0.07924
<b>Maximum Permissible Exposure Limit (mW/cm<sup>2</sup>)</b>								<b>1</b>