

Human Exposure Assessment 1

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/ cm²)	Averaging Time E ², H ² or S (minutes)		
0.3-3.0	614	1.63	1.63 (100)*			
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/ cm²)	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		

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Note 1: f = frequency in MHz ; *Plane-wave equivalent power density

Note 2: For the applicable limit, see FCC 1.1310

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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/f	4.9/f	-	6	
10-30	60	4.9/f	-	6	
30-300	60	0.163	10*	6	
300-1500	3.54 f 0.5	0.0094 f 0.5	f/30	6	
1500-15000	137	0.364	50	6	
15000-150000	137	0.364	50	616000/f 1.2	
150000-300000	0.354 f 0.5	9.4 x 10-4 f 0.5	3.33 x 10-4 <i>f</i>	616000/f 1.2	
RF Field Streng	th Limits for Devices	Used by the General	l Public (Uncontrolle	ed Environment)	
Frequency Range	Electric Field	Magnetic Field	Power Density	Averaging Time	
(MHz)	(V/m rms)	(A/m rms)	(W/m2)	(minutes)	
(MHz) 0.003-1					
` '	(V/m rms)	(A/m rms)		(minutes)	
0.003-1	(V/m rms) 280	(A/m rms) 2.19		(minutes)	
0.003-1 1-10	(V/m rms) 280 280/f	(A/m rms) 2.19 2.19/f		(minutes) 6 6	
0.003-1 1-10 10-30	(V/m rms) 280 280/f 28	2.19 2.19/f 2.19/f	(W/m2) - - -	(minutes) 6 6 6	
0.003-1 1-10 10-30 30-300	(V/m rms) 280 280/f 28 28	2.19 2.19/f 2.19/f 0.073	(W/m2) - - - - 2*	(minutes) 6 6 6 6 6 6 6	
0.003-1 1-10 10-30 30-300 300-1500	(V/m rms) 280 280/f 28 28 28 1.585 f 0.5	(A/m rms) 2.19 2.19/f 2.19/f 0.073 0.0042 f 0.5	(W/m2) 2* f/150	(minutes) 6 6 6 6 6	
0.003-1 1-10 10-30 30-300 300-1500 1500-15000	280 280/f 28 28 28 28 1.585 f 0.5 61.4	(A/m rms) 2.19 2.19/f 2.19/f 0.073 0.0042 f 0.5 0.163	(W/m2) 2* f/150 10	(minutes) 6 6 6 6 6 6 6	

Note 1: f is frequency in MHz.

Note 2: For the applicable limit, see IC RSS-102

1.1.2 MPE Calculation Method

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

$$E = Electric field (V/m)$$

G = EUT Antenna numeric gain (numeric) The formula can be changed to

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

Power Density: Pd (W/m²) = $\frac{E^2}{377}$

P = RF output power (W)

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

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1.1.3 Result of Maximum Permissible Exposure - (2400 MHz~2483.5 MHz)

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
b	1	1	N/A	20.43	Yes
g	1	1	N/A	18.23	Yes
n (HT20)	1	1	Uncorrelated	17.54	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				
Condition		RF Output Power (dBm)				
Modulation Mode	N _{TX}	RF Output Power (dBm)	Gain (dBi)	EIRP Power	PD (S) (mW/cm²)	
11B-20M	1	20.43	5.01	25.44	0.03505	
Zigbee	1	23.06	3.68	26.74	0.05009	
Co-location Total					0.08514	
Maximum Permissible Exposure Limit (mW/cm²)					1	
Note 1: N _{TX} = Number of Transmit Chains						

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