Appendix B. Maximum Permissible Exposure

1. Maximum Permissible Exposure

1.1. Applicable Standard

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

(A) 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	(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

(B) 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

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

1.2. MPE Calculation Method

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = Average RF output power (W)

G = EUT Antenna numeric gain (numeric)

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

The formula can be changed to

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

From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

1.3. Calculated Result and Limit

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-1

Max Conducted Power for IEEE 802.11a (4TX) : 16.73 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5180	-0.60	0.8710	16.73	47.0977	0.0082	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(-0.60/10) = 0.8710
2. P = dBm to mW >> 10^(16.73/10) = 47.0977 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*41.0204}/0.2$ = 175.4004 V/m
5. PD(S) = (E^2/377)/10000 = ((175.4004^2)/377)/10000 = 0.0082 mW/cm^2

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-2

Max Conducted Power for IEEE 802.11a (4TX) : 23.17 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5260	-0.62	0.8670	23.17	207.4914	0.0358	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(-0.62/10) = 0.8670
2. P = dBm to mW >> 10^(23.17/10) = 207.4914 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*179.8871}/0.2$ = 367.3082 V/m
5. PD(S) = (E^2/377)/10000 = ((367.3082^2)/377)/10000 = 0.0358 mW/cm^2

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-3

Max Conducted Power for IEEE 802.11a (4TX) : 23.23 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5680	0.85	1.2162	23.23	210.3778	0.0509	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(0.85/10) = 1.2162
2. P = dBm to mW >> 10^(23.23/10) = 210.3778 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*255.8586}/0.2$ = 438.0570 V/m
5. PD(S) = (E^2/377)/10000 = ((438.0570^2)/377)/10000 = 0.0509 mW/cm²

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-4

Max Conducted Power for IEEE 802.11a (4TX) : 25.21 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5805	1.27	1.3397	25.21	331.8945	0.0885	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(1.27/10) = 1.3397
2. P = dBm to mW >> 10^(25.21/10) = 331.8945 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*444.6313}/0.2$ = 577.4716 V/m
5. PD(S) = (E^2/377)/10000 = ((577.4716^2)/377)/10000 = 0.0885 mW/cm²

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-1

Max Conducted Power for IEEE 802.11n 20MHz MCS0 (4TX) : 16.88 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5240	-0.44	0.9036	16.88	48.7528	0.0088	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(-0.44/10) = 0.9036
2. P = dBm to mW >> 10^(16.88/10) = 48.7528 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*44.0555}/0.2$ = 181.7735 V/m
5. PD(S) = (E^2/377)/10000 = ((181.7735^2)/377)/10000 = 0.0088 mW/cm²

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-2

Max Conducted Power for IEEE 802.11n 20MHz MCS0 (4TX) : 23.69 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5260	-0.62	0.8670	23.69	233.8837	0.0403	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(-0.62/10) = 0.8670
2. P = dBm to mW >> 10^(23.69/10) = 233.8837 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*202.7683}/0.2$ = 389.9695 V/m
5. PD(S) = (E^2/377)/10000 = ((389.9695^2)/377)/10000 = 0.0403 mW/cm²

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-3

Max Conducted Power for IEEE 802.11n 20MHz MCS0 (4TX) : 23.28 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5680	0.85	1.2162	23.28	212.8139	0.0515	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(0.85/10) = 1.2162
2. P = dBm to mW >> 10^(23.28/10) = 212.8139 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*258.8213}/0.2$ = 440.5859 V/m
5. PD(S) = (E^2/377)/10000 = ((440.5859^2)/377)/10000 = 0.0515 mW/cm²

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-4

Max Conducted Power for IEEE 802.11n 20MHz MCS0 (4TX) : 25.21 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5805	1.27	1.3397	25.21	331.8945	0.0885	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(1.27/10) = 1.3397
2. P = dBm to mW >> 10^(25.21/10) = 331.8945 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*444.6313}/0.2$ = 577.4716 V/m
5. PD(S) = (E^2/377)/10000 = ((577.4716^2)/377)/10000 = 0.0885 mW/cm²

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-1

Max Conducted Power for IEEE 802.11n 40MHz MCS0 (4TX) : 16.88 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5190	-0.80	0.8318	16.88	48.7528	0.0081	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(-0.80/10) = 0.8318
2. P = dBm to mW >> 10^(16.88/10) = 48.7528 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*40.5509}/0.2$ = 174.3936 V/m
5. PD(S) = (E^2/377)/10000 = ((174.3936^2)/377)/10000 = 0.0081 mW/cm²

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-2

Max Conducted Power for IEEE 802.11n 40MHz MCS0 (4TX) : 23.44 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5270	-0.63	0.8650	23.44	220.8005	0.0380	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(-0.63/10) = 0.8650
2. P = dBm to mW >> 10^(23.44/10) = 220.8005 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*190.9853}/0.2$ = 378.4693 V/m
5. PD(S) = (E^2/377)/10000 = ((378.4693^2)/377)/10000 = 0.0380 mW/cm²

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-3

Max Conducted Power for IEEE 802.11n 40MHz MCS0 (4TX) : 23.16 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5670	0.79	1.1995	23.16	207.0141	0.0494	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(0.79/10) = 1.1.995
2. P = dBm to mW >> 10^(23.16/10) = 207.0141 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*248.3133}/0.2$ = 431.5495 V/m
5. PD(S) = (E^2/377)/10000 = ((431.5495^2)/377)/10000 = 0.0494 mW/cm²

Antenna Type : PCB Antenna

<Ant. 1 + 2 + 3 + 4 > / Band-4

Max Conducted Power for IEEE 802.11n 40MHz MCS0 (4TX) : 25.09 dBm

Test Mode	Test Freq (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
5G	5795	1.27	1.3397	25.09	322.8494	0.0860	1	Complies

Note:

1. G = Antenna Gain (numeric) >> 10^(1.27/10) = 1.3397
2. P = dBm to mW >> 10^(25.09/10) = 322.8494 mW
3. D = Distance >> 0.2 m
4. E = $\sqrt{(30*P*G)}/d$ = $\sqrt{(30*432.5138}/0.2$ = 569.5484 V/m
5. PD(S) = (E^2/377)/10000 = ((569.5484^2)/377)/10000 = 0.0860 mW/cm²