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 0.35m 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=0.35m, as well as the gain of the used antenna, the RF power density can be obtained.

1.3. Calculated Result and Limit

For 5GHz UNII Band 2~3:

RadioB (5G) RF module (FCC ID: UZ7RAAP800)

Antenna Type : Dipole Antenna

Test Mode : Mode 1

Max Conducted Power for IEEE 802.11ac VHT 20 MCS0/NSS1 B2 (1TX) : 21.99 dBm

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
8.00	6.3096	21.9900	158.1248	0.064845	1	Complies

Antenna Type : Panel Antenna

Test Mode : Mode 2

Max Conducted Power for IEEE 802.11a B2 (1TX) : 17.49 dBm

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
12.50	17.7828	17.4900	56.1048	0.064845	1	Complies

Antenna Type : Yagi Antenna

Test Mode : Mode 3

Max Conducted Power for IEEE 802.11ac VHT 20 MCS0/NSS1 B2 (1TX) : 21.99 dBm

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
8.00	6.3096	21.9900	158.1248	0.064845	1	Complies

Antenna Type : Patch Antenna

Test Mode : Mode 4

Max Conducted Power for IEEE 802.11n HT 20 MCS8 B3 (2TX) : 23.99 dBm

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
2.30	1.6982	23.9923	250.7451	0.027676	1	Complies

Antenna Type : Facade Antenna

Test Mode : Mode 5

Max Conducted Power for IEEE 802.11n HT20 MCS8 B3 (2TX) : 23.99 dBm

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
2.50	1.7783	23.9923	250.7451	0.028981	1	Complies

Antenna Type : Panel Antenna

Test Mode : Mode 6

Max Conducted Power for IEEE 802.11ac VHT40 MCS0/NSS3 B3 (3TX) : 20.79 dBm

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
9.20	8.3176	20.7949	120.0841	0.064917	1	Complies

Antenna Type : PIFA Antenna

Test Mode : Mode 7

Max Conducted Power for IEEE 802.11ac VHT20 MCS0/NSS2 B3 (2TX) : 23.98 dBm

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
5.30	3.3884	23.9806	250.0668	0.055072	1	Complies

For 2.4GHz Band:

RadioA (2.4G) RF module (FCC ID: UZ7KHAP800)

Antenna Type : Panel Antenna

Max Conducted Power for IEEE 802.11b (3TX) 17.12 dBm

Directional 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
18.77	75.3356	17.1200	51.5229	0.252275	1	Complies

For 2.4G Dongle:

802.11 a/b/g/n USB Dongle (FCC ID: UZ7KHUSB600)

Antenna Type : PIFA Antenna

Max Conducted Power for IEEE 802.11g: 23.31 dBm

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
8.25	6.6834	23.3100	214.2891	0.093084	1	Complies

For 5G Dongle:

802.11 a/b/g/n USB Dongle (FCC ID: UZ7KHUSB600)

Antenna Type : PIFA Antenna

Max Conducted Power for IEEE 802.11n MCS0 20MHz: 20.80 dBm

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
8.69	7.3961	20.8000	120.2264	0.057793	1	Complies

For 2.4G Dongle:

802.11 a/b/g/n USB Dongle (FCC ID: UZ7KHUSB601)

Antenna Type : Dipole Antenna

Max Conducted Power for IEEE 802.11g (1TX): 19.01 dBm

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
4.00	2.5119	19.0100	79.6159	0.012998	1	Complies

For 5G Dongle:

802.11 a/b/g/n USB Dongle (FCC ID: UZ7KHUSB601)

Antenna Type : Dipole Antenna

Max Conducted Power for IEEE 802.11n MCS8 40MHz (2TX): 20.57 dBm

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
6.35	4.3152	20.5697	114.0169	0.031977	1	Complies

1. MOTOROLA / AP-8232

CONCULSION:

Both of the RadioA(2.4G) RF module (FCC ID: UZ7KHAP800), RadioB (5G) RF module (FCC ID: UZ7RAAP800) and 2.4G/5G USB Dongle (FCC ID: UZ7KHUSB600) can transmit simultaneously on the AP (MOTOROLA / AP-8232), the formula of calculatedthe MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ...etc. < 1

CPD = Calculation power density

LPD = Limit of power density

RadioA (2.4G) Panel Antenna+RadioB (5G) Panel Antenna+USB 2.4G sensor dongle

Therefore, the worst-case situation is 0.252275/1+0.064917/1+0.093084/1=0.410276, which isless than “1”.

This confirmed that the device comply with FCC 1.1310 MPE limit.

RadioA (2.4G) Panel Antenna+RadioB (5G) Panel Antenna+USB 5G sensor dongle

Therefore, the worst-case situation is 0.252275/1+0.064917/1+0.057793/1=0.374985, which isless than “1”.

This confirmed that the device comply with FCC 1.1310 MPE limit.

2. MOTOROLA / AP-8222

CONCULSION:

Both of the RadioA(2.4G) RF module (FCC ID: UZ7KHAP800) and RadioB (5G) RF module (FCC ID: UZ7RAAP800) can transmit simultaneously on the AP (MOTOROLA / AP-8222), the formula of calculatedthe MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ...etc. < 1

CPD = Calculation power density

LPD = Limit of power density

RadioA (2.4G) Panel Antenna+RadioB (5G) Panel Antenna

Therefore, the worst-case situation is 0.252275/1+0.064917/1=0.317192, which isless than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

3. MOTOROLA / AP-8263

CONCULSION:

Both of the RadioA(2.4G) RF module (FCC ID: UZ7KHAP800), RadioB (5G) RF module (FCC ID: UZ7RAAP800) and 2.4G/5G USB Dongle (FCC ID: UZ7KHUSB601) can transmit simultaneously on the AP (MOTOROLA / AP-8263), the formula of calculatedthe MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ...etc. < 1

CPD = Calculation power density

LPD = Limit of power density

RadioA (2.4G) Panel Antenna+RadioB (5G) Panel Antenna+USB 2.4G sensor dongle

Therefore, the worst-case situation is 0.252275/1+0.064917/1+0.012998/1=0.330190, which isless than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

RadioA (2.4G) Panel Antenna+RadioB (5G) Panel Antenna+USB 5G sensor dongle

Therefore, the worst-case situation is 0.252275/1+0.064917/1+0.031977/1=0.349169, which isless than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.