FCC ID:2AZSF-WATER-S

Maximum Permissible Exposure (MPE)

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	$*900/f^2$	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	$*180/f^2$	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

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

MPE Calculation Method

E (V/m) = $\frac{\sqrt{30*P*G}}{d}$ 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 = $\frac{30*P*G}{377*D^2}$

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.

Measurement Result

Module 1

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,
WIFI 802.11n HT40:2422-2452MHz
Power density limited: 1mW/ cm^2

Antenna Type: Glue stick antenna
WIFI antenna gain: 2.5dBi;
R=20cm
mW=10^(dBm/10)
antenna gain Numeric=10^(dBi/10)= 10^(2.5/10)=1.78

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2	(mW/cm2)
				(dBm)	(mW)	Numeric		
2412	802.11b	12.55	12.5±1	13.5	22.38721	1.78	0.00793	1
2437		13.36	12.5±1	13.5	22.38721	1.78	0.00793	1
2462		13.29	12.5±1	13.5	22.38721	1.78	0.00793	1
2412	802.11g	11.51	11.5±1	12.5	17.78279	1.78	0.00630	1
2437		12.15	11.5±1	12.5	17.78279	1.78	0.00630	1
2462		12.23	11.5±1	12.5	17.78279	1.78	0.00630	1
2412	802.11n H20	11.25	11.5±1	12.5	17.78279	1.78	0.00630	1
2437		11.9	11.5±1	12.5	17.78279	1.78	0.00630	1
2462		12.05	11.5±1	12.5	17.78279	1.78	0.00630	1
2422	802.11n H40	11.94	11.5±1	12.5	17.78279	1.78	0.00630	1
2437		11.67	11.5±1	12.5	17.78279	1.78	0.00630	1
2452		12.09	11.5±1	12.5	17.78279	1.78	0.00630	1

Measurement Result

Module 2

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,HT40:2422-2452MHz
Power density limited: 1mW/ cm^2
Antenna Type: Glue stick antenna
WIFI antenna gain1/2: 2.5dBi;
R=20cm
mW=10^(dBm/10)
antenna gain Numeric=10^(dBi/10)=10^(2.5/10)=1.78
SISO

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2	(mW/cm2)
				(dBm)	(mW)	Numeric		
2412	802.11b	12.46	11.5±1	12.5	17.78279	1.78	0.00630	1
2437		12.26	11.5±1	12.5	17.78279	1.78	0.00630	1
2462		12.29	11.5±1	12.5	17.78279	1.78	0.00630	1
2412	802.11g	12.48	11.5±1	12.5	17.78279	1.78	0.00630	1
2437		12.21	11.5±1	12.5	17.78279	1.78	0.00630	1
2462		11.95	11.5±1	12.5	17.78279	1.78	0.00630	1
2412	802.11n H20	12.21	1.5±1	13.5	22.38721	1.78	0.00793	1
2437		11.91	1.5±1	13.5	22.38721	1.78	0.00793	1
2462		13.21	1.5±1	13.5	22.38721	1.78	0.00793	1
2422	802.11n H40	12.15	1.5±1	13.5	22.38721	1.78	0.00793	1
2437		12.64	1.5±1	13.5	22.38721	1.78	0.00793	1
2452		13.14	1.5±1	13.5	22.38721	1.78	0.00793	1

Module 2

5G WIFI:

Operation Frequency: WIFI 802.11a/ac/n(HT20): 5180-5240MHz;5260-5320MHz,5500-5700MHz,5745-5825MHz;WIFI 802.11ac/n(HT40): 5190-5230MHz;5270-5310MHz,5510-5670MHz5755-5795MHz; WIFI 802.11ac80:5210-5210MHz;5290-5290MHz;5530-5610MHz;5775-5775MHz
Power density limited: 1mW/cm
Antenna Type: Glue stick antenna
WIFI antenna1/2 gain: 2.5dBi;
R=20cm
mW=10^(dBm/10)
antenna gain Numeric=10^(dBi/10)= 10^(2.5/10)=1.78
5.2G
SISO

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2	(mW/cm2)
				(dBm)	(mW)	Numeric		
5180	802.11a	9.79	9±1	10	10	1.78	0.00354	1
5200		9.3	9±1	10	10	1.78	0.00354	1
5240		9.24	9±1	10	10	1.78	0.00354	1
5180	802.11n H20	9.72	9±1	10	10	1.78	0.00354	1
5200		8.8	9±1	10	10	1.78	0.00354	1
5240		8.81	9±1	10	10	1.78	0.00354	1
5190	802.11n H40	9.79	9±1	10	10	1.78	0.00354	1
5230		9.66	9±1	10	10	1.78	0.00354	1
5180	802.11ac 20	9.82	9±1	10	10	1.78	0.00354	1
5200		9.33	9±1	10	10	1.78	0.00354	1
5240		8.92	9±1	10	10	1.78	0.00354	1
5190	802.11ac 40	10.03	9.5±1	10.5	11.22	1.78	0.00397	1
5230		9.64	9.5±1	10.5	11.22	1.78	0.00397	1
5210	802.11ac 80	9.38	8.5±1	9.5	8.91	1.78	0.00316	1

5.3G

SISO

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2	(mW/cm2)
				(dBm)	(mW)	Numeric		
5260	802.11a	9.84	9±1	10	10	1.78	0.00354	1
5280		9.29	9±1	10	10	1.78	0.00354	1
5320		9.66	9±1	10	10	1.78	0.00354	1
5260	802.11n H20	8.9	9±1	10	10	1.78	0.00354	1
5280		9.85	9±1	10	10	1.78	0.00354	1
5320		9.34	9±1	10	10	1.78	0.00354	1
5270	802.11n H40	9.94	9±1	10	10	1.78	0.00354	1
5310		9.55	9±1	10	10	1.78	0.00354	1
5260	802.11ac 20	8.86	9±1	10	10	1.78	0.00354	1
5280		9.68	9±1	10	10	1.78	0.00354	1
5320		9.33	9±1	10	10	1.78	0.00354	1
5270	802.11ac 40	9.54	9±1	10	10	1.78	0.00354	1
5310		9.43	9±1	10	10	1.78	0.00354	1
5290	802.11ac 80	9.43	8.5±1	9.5	8.91	1.78	0.00316	1

5.6G
SISO

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2	(mW/cm2)
				(dBm)	(mW)	Gain		
5500	802.11a	9.74	9±1	10	10	1.78	0.00354	1
5600		9.84	9±1	10	10	1.78	0.00354	1
5700		9.76	9±1	10	10	1.78	0.00354	1
5500	802.11n H20	9.34	9±1	10	10	1.78	0.00354	1
5600		9.85	9±1	10	10	1.78	0.00354	1
5700		9.8	9±1	10	10	1.78	0.00354	1
5510	802.11n H40	9.46	8.5±1	9.5	8.91	1.78	0.00316	1
5590		9.48	8.5±1	9.5	8.91	1.78	0.00316	1
5670		8.63	8.5±1	9.5	8.91	1.78	0.00316	1
5500	802.11ac 20	9.16	9±1	10	10	1.78	0.00627	1
5600		9.93	9±1	10	10	1.78	0.00627	1
5700		9.67	9±1	10	10	1.78	0.00627	1
5510	802.11ac 40	9.37	8.5±1	9.5	8.91	1.78	0.00627	1
5590		9.25	8.5±1	9.5	8.91	1.78	0.00627	1
5670		8.72	8.5±1	9.5	8.91	1.78	0.00627	1
5530	802.11ac 80	8.75	9±1	10	10	1.78	0.00627	1
5610		9.65	9±1	10	10	1.78	0.00627	1

5.8G
SISO

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2	(mW/cm2)
				(dBm)	(mW)	Numeric		
5745	802.11a	9.35	9±1	9.5	8.91	1.78	0.00316	1
5785		9.34	9±1	9.5	8.91	1.78	0.00316	1
5825		9.53	9±1	9.5	8.91	1.78	0.00316	1
5745	802.11n20	9.21	8.5±1	9.5	8.91	1.78	0.00316	1
5785		9.25	8.5±1	9.5	8.91	1.78	0.00316	1
5825		9.26	8.5±1	9.5	8.91	1.78	0.00316	1
5755	802.11n40	9.58	9±1	10	10	1.78	0.00354	1
5795		9.65	9±1	10	10	1.78	0.00354	1
5745	802.11ac 20	9.44	8.5±1	9.5	8.91	1.78	0.00316	1
5785		9.32	8.5±1	9.5	8.91	1.78	0.00316	1
5825		9.49	8.5±1	9.5	8.91	1.78	0.00316	1
5755	802.11ac 40	9.21	9±1	10	10	1.78	0.00354	1
5795		9.66	9±1	10	10	1.78	0.00354	1
5775	802.11ac 80	8.98	8±1	9	7.94	1.78	0.00281	1

Module 4 LTE
Antenna Type:Glue stick Antenna
WCDMA Antenna gain: Band 41:2.5dBi;

Operating Mode	Maximum measured EIRP Power	Maximum measured EIRP(ERP)	Evaluation result	Power density Limits
	(dBm)	(mW)	(mW/cm2)	(mW/cm2)
LTE Band 41	24.65	291.76	0.0580	1.0000

Module 2 WLAN2.4G MIMO

Antenna	conducted power (dBm)	Gain (dBi)	EIRP (dBm)	Max Tune-up (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	MPE Limit (mW/cm^2)	Calculation result	Conclusion
Ant 1	13.14	2.5	15.64	16	39.81	20	0.007920	1	0.01584	Pass
Ant 2	12.74	2.5	15.24	16	39.81	20	0.007920	1		

Module 2 WLAN5G MIMO

Antenna	conducted power (dBm)	Gain (dBi)	EIRP (dBm)	Max Tune-up (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	MPE Limit (mW/cm^2)	Calculation result	Conclusion
Ant 1	9.64	2.5	12.14	13	19.95	20	0.003969	1	0.007938	Pass
Ant 2	10.03	2.5	12.53	13	19.95	20	0.003969	1		

Conclusion:

The conclusion should be 0.058＜1 for Max Power Density, Compliance the RF Exposure requirement.
The 2.4Gwifi module 2 has the maximum Power Density value 0.01584 mW/cm2 in 2.4G MIMO transmitting mode;
The 5Gwifi module 2 has the maximum Power Density value 0.007938 mW/cm2 in 5G MIMO transmitting mode;
Module 1&Module 2 and Module 4 cannot be transmitted at the same time.

Signature:
Date: 2021-08-03

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