

FCC ID: 2AXDW-PNTSV

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

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

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 BT:

Operation Frequency: 2402MHz~2480MHz

Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: FPCB antenna

WIFI antenna gain: 3.5dBi;

R=20cm

$\text{mW}=10^{(\text{dBm}/10)}$

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(3.5/10)}=2.24$

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		
2402	GFSK	3.064	3±1	4	2.511886	2.24	0.00112	1
2441		2.539	3±1	4	2.511886	2.24	0.00112	1
2480		3.8	3±1	4	2.511886	2.24	0.00112	1
2402	π/4-DQPSK,	5.442	5.5±1	6.5	4.466836	2.24	0.00199	1
2441		4.774	5.5±1	6.5	4.466836	2.24	0.00199	1
2480		6.019	5.5±1	6.5	4.466836	2.24	0.00199	1
2402	8DPSK	5.741	6±1	7	5.011872	2.24	0.00223	1
2441		5.262	6±1	7	5.011872	2.24	0.00223	1
2480		6.365	6±1	7	5.011872	2.24	0.00223	1
2402	BLE(GFSK)	1.322	2±1	3	1.995262	2.24	0.00089	1
2440		2.342	2±1	3	1.995262	2.24	0.00089	1
2480		2.334	2±1	3	1.995262	2.24	0.00089	1

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,

WIFI 802.11n HT40:2422-2452MHz

Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: FPCB antenna

WIFI antenna gain: 3.5dBi;

R=20cm

$\text{mW}=10^{(\text{dBm}/10)}$

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(2/10)}=2.24$

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	14.41	14±1	15	31.62278	2.24	0.01409	1
2437		14.65	14±1	15	31.62278	2.24	0.01409	1
2462		14.51	14±1	15	31.62278	2.24	0.01409	1
2412	802.11g	13.23	13±1	14	25.11886	2.24	0.01119	1
2437		13.19	13±1	14	25.11886	2.24	0.01119	1
2462		13.31	13±1	14	25.11886	2.24	0.01119	1
2412	802.11n H20	13.21	13±1	14	25.11886	2.24	0.01119	1
2437		13.11	13±1	14	25.11886	2.24	0.01119	1
2462		13.29	13±1	14	25.11886	2.24	0.01119	1
2422	802.11n H40	12.98	12±1	13	19.95262	2.24	0.00889	1
2437		12.56	12±1	13	19.95262	2.24	0.00889	1
2452		12.46	12±1	13	19.95262	2.24	0.00889	1

Measurement Result

Module 2 BT:

Operation Frequency: 2402MHz~2480MHz

Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: FPCB antenna

WIFI antenna gain: 3.5dBi;

R=20cm

$\text{mW}=10^{(\text{dBm}/10)}$

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(3.5/10)}=2.24$

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		
2402	GFSK-1M	4.763	4±1	5	3.162278	2.24	0.00141	1
2441		6.714	6±1	7	5.011872	2.24	0.00223	1
2480		5.512	6±1	7	5.011872	2.24	0.00223	1
2402	π/4-DQPSK,	7.182	7±1	8	6.309573	2.24	0.00281	1
2441		6.791	7±1	8	6.309573	2.24	0.00281	1
2480		5.428	5±1	6	3.981072	2.24	0.00177	1
2402	8DPSK	7.636	8±1	9	7.943282	2.24	0.00354	1
2441		8.574	8±1	9	7.943282	2.24	0.00354	1
2480		8.799	8±1	9	7.943282	2.24	0.00354	1
2402	BLE(GFSK-1M)	2.37	3±1	4	2.511886	2.24	0.00112	1
2440		2.607	3±1	4	2.511886	2.24	0.00112	1
2480		3.129	3±1	4	2.511886	2.24	0.00112	1
2402	BLE(GFSK-2M)	2.595	3±1	4	2.511886	2.24	0.00112	1
2441		2.441	3±1	4	2.511886	2.24	0.00112	1
2480		3.161	3±1	4	2.511886	2.24	0.00112	1

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,

Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: FPCB antenna

WIFI antenna gain1/2: 3.5dBi;

R=20cm

$\text{mW}=10^{(\text{dBm}/10)}$

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(3.5/10)}=2.24$

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	13.96	13±1	14	25.11886	2.24	0.01119	1
2437		13.91	13±1	14	25.11886	2.24	0.01119	1
2462		13.59	13±1	14	25.11886	2.24	0.01119	1
2412	802.11g	12.66	12±1	13	19.95262	2.24	0.00889	1
2437		12.57	12±1	13	19.95262	2.24	0.00889	1
2462		12.13	12±1	13	19.95262	2.24	0.00889	1
2412	802.11n H20	12.53	12±1	13	19.95262	2.24	0.00889	1
2437		12.33	12±1	13	19.95262	2.24	0.00889	1
2462		12.15	12±1	13	19.95262	2.24	0.00889	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: FPCB antenna

WIFI antenna1/2 gain: 3.5dBi;

R=20cm

$mW=10^{(dBm/10)}$

antenna gain Numeric= $10^{(dBi/10)}=10^{(3.5/10)}=2.24$

5.2G

SISO

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna Gain Numeric	Evaluation result at 20cm Power density(mW/cm2)	Power density Limits (mW/cm2)
				tune-up power				
		(dBm)	(dBm)	(dBm)	(mW)			
5180	802.11a	10.568	10±1	11	12.58925	2.24	0.00561	1
5200		10.576	10±1	11	12.58925	2.24	0.00561	1
5240		10.697	10±1	11	12.58925	2.24	0.00561	1
5180	802.11n H20	10.463	10±1	11	12.58925	2.24	0.00561	1
5200		10.62	10±1	11	12.58925	2.24	0.00561	1
5240		10.668	10±1	11	12.58925	2.24	0.00561	1
5190	802.11n H40	10.029	10±1	11	12.58925	2.24	0.00561	1
5230		10.143	10±1	11	12.58925	2.24	0.00561	1
5180	802.11ac 20	10.522	10±1	11	12.58925	2.24	0.00561	1
5200		10.558	10±1	11	12.58925	2.24	0.00561	1
5240		10.654	10±1	11	12.58925	2.24	0.00561	1
5190	802.11ac 40	9.976	10±1	11	12.59	2.24	0.00561	1
5230		10.115	10±1	11	12.59	2.24	0.00561	1
5210	802.11ac 80	10.099	10±1	11	12.58925	2.24	0.00561	1

5.3G

SISO

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna Gain Numeric	Evaluation result at 20cm Power density(mW/cm2)	Power density Limits (mW/cm2)
				tune-up power				
		(dBm)	(dBm)	(dBm)	(mW)			
5260	802.11a	10.676	10.5±1	11.5	14.12538	2.24	0.00629	1
5280		10.881	10.5±1	11.5	14.12538	2.24	0.00629	1
5320		11.085	10.5±1	11.5	14.12538	2.24	0.00629	1
5260	802.11n H20	10.43	10±1	11	12.58925	2.24	0.00561	1
5280		10.359	10±1	11	12.58925	2.24	0.00561	1
5320		10.369	10±1	11	12.58925	2.24	0.00561	1
5270	802.11n H40	9.764	9±1	10	10	2.24	0.00446	1
5310		9.981	9±1	10	10	2.24	0.00446	1
5260	802.11ac 20	10.395	10±1	11	12.58925	2.24	0.00561	1
5280		10.305	10±1	11	12.58925	2.24	0.00561	1
5320		10.357	10±1	11	12.58925	2.24	0.00561	1
5270	802.11ac 40	9.842	9±1	10	10	2.24	0.00446	1
5310		9.916	9±1	10	10	2.24	0.00446	1
5290	802.11ac 80	9.615	9±1	10	10	2.24	0.00446	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	10.704	10±1	11	12.58925	2.24	0.00561	1
5600		10.312	10±1	11	12.58925	2.24	0.00561	1
5700		10.699	10±1	11	12.58925	2.24	0.00561	1
5500	802.11n H20	10.693	10±1	11	12.58925	2.24	0.00561	1
5600		10.196	10±1	11	12.58925	2.24	0.00561	1
5700		10.637	10±1	11	12.58925	2.24	0.00561	1
5510	802.11n H40	10.274	10±1	11	12.58925	2.24	0.00561	1
5590		9.794	10±1	11	12.58925	2.24	0.00561	1
5670		9.845	10±1	11	12.58925	2.24	0.00561	1
5500	802.11ac 20	10.721	10±1	11	19.95	2.24	0.00627	1
5600		10.201	10±1	11	19.95	2.24	0.00627	1
5700		10.709	10±1	11	19.95	2.24	0.00627	1
5510	802.11ac 40	10.159	10±1	11	19.95	2.24	0.00627	1
5590		9.885	10±1	11	19.95	2.24	0.00627	1
5670		9.789	10±1	11	19.95	2.24	0.00627	1
5530	802.11ac 80	10.188	10±1	11	19.95	2.24	0.00627	1
5610		9.814	10±1	11	19.95	2.24	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	10.516	10±1	11	12.58925	2.24	0.00561	1
5785		10.957	10±1	11	12.58925	2.24	0.00561	1
5825		10.963	10±1	11	12.58925	2.24	0.00561	1
5745	802.11n20	10.695	10.5±1	11.5	14.12538	2.24	0.00629	1
5785		10.87	10.5±1	11.5	14.12538	2.24	0.00629	1
5825		11.035	10.5±1	11.5	14.12538	2.24	0.00629	1
5755	802.11n40	10.332	10±1	11	12.58925	2.24	0.00561	1
5795		10.688	10±1	11	12.58925	2.24	0.00561	1
5745	802.11ac 20	10.747	10.5±1	11.5	14.12538	2.24	0.00629	1
5785		11.028	10.5±1	11.5	14.12538	2.24	0.00629	1
5825		11.039	10.5±1	11.5	14.12538	2.24	0.00629	1
5755	802.11ac 40	10.109	10±1	11	12.58925	2.24	0.00561	1
5795		10.557	10±1	11	12.58925	2.24	0.00561	1
5775	802.11ac 80	10.832	10±1	11	12.59	2.24	0.00561	1

Module 3 WCDMA/LTE

Antenna Type: FPCB antenna

WCDMA Antenna gain: Band II: 1.74 dBi; Band IV: 2.85dBi; Band V: 0.81dBi

LTE Antenna gain: Band 2: 1.4dBi; Band 4: 2.85dBi ; Band 5: 0.81dBi ;

Band 12:0.28dBi ;Band 13:0.81dBi; Band 25: 1.74dBi; Band 26: 0.81dBi; Band 41: 1.89dBi; Band 66: 2.85dBi;

Operating Mode	Maximum measured EIRP(ERP)	Maximum measured EIRP(ERP)	Evaluation result	Power density Limits
	(dBm)	(mW)	(mW/cm ²)	(mW/cm ²)
WCDMA Band 2	23.12	205.1162179	0.0408	1.0000
WCDMA Band 4	23.41	219.2804935	0.0436	1.0000
WCDMA Band 5	22.77	189.2343619	0.0376	0.5644
LTE Band 2	22.71	186.6379691	0.0371	1.0000
LTE Band 4	22.79	190.107828	0.0378	1.0000
LTE Band 5	24.62	289.7343588	0.0576	1.0000
LTE Band 12	23.86	243.2204009	0.0484	0.4717
LTE Band 13	21.52	141.9057522	0.0282	0.5213
LTE Band 25	24.47	279.898132	0.0557	1.0000
LTE Band 26A	23.21	209.4112456	0.0417	0.5460
LTE Band 26B	22.44	175.3880502	0.0349	0.5577
LTE Band 41	23.24	210.862815	0.0419	1.0000
LTE Band 66	21.92	155.5965632	0.0310	1.0000

Module 2 WLAN2.4G MIMO

Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Calculation result	Conclusion
Ant 1	12.53	3.5	16.03	40.09	20	0.007975	1	0.015931	Pass
Ant 2	12.52	3.5	16.02	39.99	20	0.007956	1		

Module 2 WLAN5G MIMO

Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Calculation result	Conclusion
Ant 1	10.749	3.5	14.249	26.60	20	0.005292	1	0.010949	Pass
Ant 2	11.039	3.5	14.539	28.44	20	0.005657	1		

Conclusion:

The conclusion should be $0.0576 < 0.4717$ for Max Power Density, Compliance the RF Exposure requirement.

The 2.4Gwifi module 2 has the maximum Power Density value 0.015931 mW/cm² in 2.4G MIMO transmitting mode;

The 5Gwifi module 2 has the maximum Power Density value 0.010949 mW/cm² in 5G MIMO transmitting mode;

Module 1&Module 2 and Module 3 cannot be transmitted at the same time.

In a separate module, WIFI and BT cannot be sent at the same time.

Signature:

Date: 2021-11-03



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