

RF Exposure evaluation

FCC ID: SMQPA4

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

1. Reference

According to §1.1307(b)(1), 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 level in excess of the Commission’s guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

KDB447498 D01 V06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

2. Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
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 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	(180/f ²)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

F=frequency in MHz

*=Plane-wave equivalent power density

3. MPE Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

4. Antenna Information

Internal Identification	Antenna Identification in Internal photos	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna 1	2.4G/5G Wifi/BT	FPC antenna	2.4GHz – 2.5 GHz	0.9 dBi
			5.1GHz – 5.8 GHz	4.19 dBi

5. tune-up procedure

Target Power for WIFI 2.4G

802.11b			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	18.0	18.0	18.0
Tolerance ±(dB)	1	1	1
802.11g			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	22.0	19.0	21.0
Tolerance ±(dB)	1	1	1
802.11n HT20			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	22.0	19.0	21.0
Tolerance ±(dB)	1	1	1
802.11n HT40			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	23.0	22.0	21.0
Tolerance ±(dB)	1	1	1

Target Power for UNII

Mode	Channel	Target (dBm)
11A	5180	13 ± 1
	5200	13 ± 1

	5240	13±1
	5260	12±1
	5280	14±1
	5320	13±1
	5500	13±1
	5580	13±1
	5700	13±1
	5745	13±1
	5785	12±1
	5825	12±1
11N20SISO	5180	13±1
	5200	12±1
	5240	12±1
	5260	11±1
	5280	11±1
	5320	12±1
	5500	12±1
	5580	12±1
	5700	12±1
	5745	11±1
	5785	11±1
	5825	11±1
11N40SISO	5190	15±1
	5230	13±1
	5270	15±1
	5310	16±1
	5510	16±1
	5550	16±1
	5670	15±1
	5755	15±1
	5795	15±1
11AC20SISO	5180	14±1
	5200	14±1
	5240	14±1
	5260	13±1
	5280	14±1
	5320	14±1
	5500	14±1
	5580	14±1
	5700	13±1
	5745	12±1
	5785	12±1
	5825	12±1

11AC40SISO	5190	14 ± 1
	5230	14 ± 1
	5270	14 ± 1
	5310	14 ± 1
	5510	14 ± 1
	5550	14 ± 1
	5670	14 ± 1
	5755	14 ± 1
	5795	14 ± 1
11AC80SISO	5210	12 ± 1
	5290	12 ± 1
	5530	12 ± 1
	5610	12 ± 1
	5775	12 ± 1

Bluetooth

BLE-GFSK			
Channel	Channel 00	Channel 19	Channel 39
Target (dBm)	-3	-3	-4
Tolerance ±(dB)	1	1	1

GFSK			
Channel	Channel 00	Channel 39	Channel 78
Target (dBm)	9.0	9.0	9.0
Tolerance ±(dB)	1	1	1
8DPSK			
Channel	Channel 00	Channel 39	Channel 78
Target (dBm)	9.0	9.0	9.0
Tolerance ±(dB)	1	1	1
$\pi/4$ DQPSK			
Channel	Channel 00	Channel 39	Channel 78
Target (dBm)	9.0	9.0	9.0
Tolerance ±(dB)	1	1	1

6. Standalone MPE Result

The EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r = 20\text{cm}$, the RF power density can be obtained.

Bluetooth

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
GFSK	10	10.0000	0.9	1.2303	0.0024	1.0000
$\pi/4$ DQPSK	10	10.0000	0.9	1.2303	0.0024	1.0000
8-DPSK	10	10.0000	0.9	1.2303	0.0024	1.0000
BLE 1M	-2	0.6310	0.9	1.2303	0.0002	1.0000
BLE 2M	-2	0.6310	0.9	1.2303	0.0002	1.0000

2.4GHz WIFI

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11b	19	79.4328	0.9	1.2303	0.0194	1.0000
IEEE 802.11g	23	199.5262	0.9	1.2303	0.0488	1.0000
IEEE 802.11n HT20	23	199.5262	0.9	1.2303	0.0488	1.0000
IEEE 802.11n HT40	24	251.1886	0.9	1.2303	0.0615	1.0000

5GHz WIFI

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	15	31.6228	4.19	2.6242	0.0165	1.0000
IEEE 802.11n HT20	14	25.1189	4.19	2.6242	0.0131	1.0000
IEEE 802.11ac VHT20	15	31.6228	4.19	2.6242	0.0165	1.0000
IEEE 802.11n HT40	17	50.1187	4.19	2.6242	0.0262	1.0000
IEEE 802.11ac VHT40	15	31.6228	4.19	2.6242	0.0165	1.0000
IEEE 802.11ac VHT80	13	19.9526	4.19	2.6242	0.0104	1.0000

Remark:

1. MPE evaluate distance is 20cm from user manual provide by manufacturer.

7. Summary simultaneous transmission information

Synchronization transmit between WIFI and BT

Modulation Type	Modulation Type	Synchronization transmit
IEEE 802.11a	BT	Yes
IEEE 802.11b	BT	Yes
IEEE 802.11g	BT	Yes
IEEE 802.11n HT20	BT	Yes
IEEE 802.11n HT40	BT	Yes
IEEE 802.11ac VHT20	BT	Yes
IEEE 802.11ac VHT40	BT	Yes
IEEE 802.11ac VHT80	BT	Yes

Note: The EUT can not transmit 2.4G WIFI and 5G WIFI at the same time.

8. Summary simultaneous transmission results

Synchronization transmit between WIFI and BT

MPE _(WIFI) ratios	MPE _(BT) ratios	Σ MPE _(WIFI+BT) ratios	Limit	Results
0.0615	0.0024	0.0639	1.0	PASS

9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of Mobile Device.

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