

RF Exposure evaluation

FCC ID: SMC-T72P

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: 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

$$S=PG/4\pi R^2$$

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

J79-4D1 can only use antennas certificated as follows provided by manufacturer.

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Directional gain:
WIFI ANT 1	FPC antenna	2.4GHz – 2.5 GHz 5.1GHz – 5.8 GHz	4.83dBi 3.77dBi	2.4G:7.84dBi 5G:7.57dBi
WIFI ANT 2	FPC antenna	2.4GHz – 2.5 GHz 5.1GHz – 5.8 GHz	2.91dBi 4.56dBi	
BT ANT	FPC antenna	2.4GHz – 2.5 GHz	3.57dBi	

5. Conducted power

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Mode	Channel	Frequency(MHz)	Peak Conducted Output Power (dBm)	Tune_Up
GFSK	00	2402	6.21	6±1
	39	2441	6.37	6±1
	78	2480	6.32	6±1
π/4DQPSK	00	2402	8.37	8±1
	39	2441	8.44	8±1
	78	2480	8.43	8±1
8-DPSK	00	2402	8.91	9±1
	39	2441	9.01	9±1
	78	2480	9.04	9±1
BLE_1Mbps	00	2402	6.60	6±1
	19	2440	6.71	6±1
	39	2480	6.62	6±1
BLE_2Mbps	00	2402	6.57	6±1
	19	2440	6.74	6±1
	39	2480	6.66	6±1

[2.4GHz WLAN SISO Mode]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)		Tune_Up	
			Antenna1	Antenna2	Antenna1	Antenna2
<i>IEEE 802.11b</i>	1	2412	15.80	14.83	15±1	14±1
	7	2437	14.02	14.06	15±1	14±1
	13	2462	14.23	13.44	15±1	14±1
<i>IEEE 802.11g</i>	1	2412	20.26	19.81	20±1	19±1
	7	2437	19.76	19.05	20±1	19±1
	13	2462	20.13	18.55	20±1	19±1
<i>IEEE 802.11n HT20</i>	1	2412	18.78	18.56	18±1	18±1
	7	2437	18.29	17.49	18±1	18±1
	13	2462	18.38	17.13	18±1	18±1
<i>IEEE 802.11n HT40</i>	3	2422	19.36	18.66	19±1	18±1
	7	2437	18.69	17.89	19±1	18±1
	11	2452	18.57	17.46	19±1	18±1

[2.4GHz WLAN MIMO Mode]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)	Tune_Up
<i>IEEE 802.11n HT20</i>	1	2412	21.9	22±1
	7	2437	21.0	22±1
	13	2462	21.0	22±1
<i>IEEE 802.11n HT40</i>	3	2422	22.1	22±1
	7	2437	21.4	22±1
	11	2452	21.1	22±1

[5GHz WLAN Band 1 SISO Mode]

Mode	Channel	Frequency	Average Conducted Output Power (dBm)		Tune_Up	
			Antenna1	Antenna2	Antenna1	Antenna2
IEEE 802.11a	36	5180	15.67	16.33	16±1	16±1
	40	5200	16.07	16.52	16±1	16±1
	48	5240	16.78	16.35	16±1	16±1
IEEE 802.11n HT20	36	5180	15.43	14.16	16±1	15±1
	40	5200	16.23	14.51	16±1	15±1
	48	5240	16.67	14.06	16±1	15±1
IEEE 802.11n HT40	38	5190	15.06	13.46	16±1	14±1
	46	5230	16.31	13.81	16±1	14±1
IEEE 802.11ac VHT20	36	5180	12.51	12.63	13±1	12±1
	40	5200	13.10	12.87	13±1	12±1
	48	5240	13.91	12.58	13±1	12±1
IEEE 802.11ac VHT40	38	5190	12.10	12.26	12±1	12±1

	46	5230	12.94	12.11	12±1	12±1
IEEE 802.11ac VHT80	42	5210	10.66	12.80	11±1	12±1

[5GHz WLAN Band 1 MIMO Mode]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)	Tune_Up
IEEE 802.11n HT20	36	5180	14.59	14±1
	40	5200	14.14	14±1
	48	5240	14.29	14±1
IEEE 802.11n HT40	38	5190	13.72	14±1
	46	5230	14.15	14±1
IEEE 802.11ac VHT20	36	5180	13.26	14±1
	40	5200	13.69	14±1
	48	5240	14.13	14±1
IEEE 802.11ac VHT40	38	5190	14.93	14±1
	46	5230	15.35	14±1
IEEE 802.11ac VHT80	42	2210	14.97	14±1

[5GHz WLAN Band 3 SISO Mode]

Mode	Channel	Frequency	Average Conducted Output Power (dBm)		Tune_Up	
			Antenna1	Antenna2	Antenna1	Antenna2
IEEE 802.11a	149	5745	18.35	16.74	18±1	16±1
	157	5785	18.41	16.67	18±1	16±1
	165	5825	18.60	16.64	18±1	16±1
IEEE 802.11n HT20	149	5745	18.29	14.90	18±1	14±1
	157	5785	18.35	14.32	18±1	14±1
	165	5825	18.69	14.36	18±1	14±1
IEEE 802.11n HT40	151	5755	18.32	15.04	18±1	15±1
	159	5795	18.01	13.81	18±1	14±1
IEEE 802.11ac VHT20	149	5745	15.26	13.26	15±1	13±1
	157	5785	15.53	13.15	15±1	13±1
	165	5825	15.69	13.16	15±1	13±1
IEEE 802.11ac VHT40	151	5755	15.69	13.16	15±1	13±1
	159	5795	14.66	12.14	14±1	13±1
IEEE 802.11ac VHT80	155	5775	13.96	13.27	13±1	13±1

[5GHz WLAN Band 3 MIMO Mode]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)	Tune_Up
IEEE 802.11n HT20	149	5745	20.62	20±1
	157	5785	20.58	20±1
	165	5825	20.67	20±1
IEEE 802.11n HT40	151	5755	20.85	20±1
	159	5795	20.33	20±1
IEEE 802.11ac VHT20	149	5745	17.33	17±1
	157	5785	17.30	17±1
	165	5825	17.41	17±1
IEEE 802.11ac VHT40	151	5755	17.33	17±1
	159	5795	16.71	17±1
IEEE 802.11ac VHT80	155	5775	17.15	17±1

6. Standalone MPE Result

As declared by the Applicant, 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, $r=20\text{cm}$, as well as the gain of the used antenna, 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	7.00	5.0119	3.57	2.2751	0.0023	1.0000
$\pi/4$ DQPSK	9.00	7.9433	3.57	2.2751	0.0036	1.0000
8-DPSK	10.00	10.0000	3.57	2.2751	0.0045	1.0000
BLE_1Mbps	7.00	5.0119	3.57	2.2751	0.0023	1.0000
BLE_2Mbps	7.00	5.0119	3.57	2.2751	0.0023	1.0000

2.4GHz WLAN S/SO MODE ANT1

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11b	16.00	39.8107	4.83	3.0409	0.0241	1.0000
IEEE 802.11g	21.00	125.8925	4.83	3.0409	0.0762	1.0000
IEEE 802.11n HT20	19.00	79.4328	4.83	3.0409	0.0481	1.0000
IEEE 802.11n HT40	20.00	100.0000	4.83	3.0409	0.0605	1.0000

2.4GHz WLAN SISO MODE ANT2

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11b	15.00	31.6228	2.91	1.9543	0.0123	1.0000
IEEE 802.11g	20.00	100.0000	2.91	1.9543	0.0389	1.0000
IEEE 802.11n HT20	19.00	79.4328	2.91	1.9543	0.0309	1.0000
IEEE 802.11n HT40	19.00	79.4328	2.91	1.9543	0.0309	1.0000

2.4GHz WLAN MIMO MODE

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11n HT20	23.00	199.5262	7.84	6.0814	0.2414	1.0000
IEEE 802.11n HT40	23.00	199.5262	7.84	6.0814	0.2414	1.0000

5GHz WLAN Band 1 SISO MODE ANT1

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	17.00	50.1187	3.77	2.3823	0.0238	1.0000
IEEE 802.11n HT20	17.00	50.1187	3.77	2.3823	0.0238	1.0000
IEEE 802.11n HT40	17.00	50.1187	3.77	2.3823	0.0238	1.0000
IEEE 802.11ac VHT20	14.00	25.1189	3.77	2.3823	0.0119	1.0000
IEEE 802.11ac VHT40	13.00	19.9526	3.77	2.3823	0.0095	1.0000
IEEE 802.11ac VHT80	12.00	15.8489	3.77	2.3823	0.0075	1.0000

5GHz WLAN Band 1 SISO MODE ANT2

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	17.00	50.1187	4.56	2.8576	0.0285	1.0000
IEEE 802.11n HT20	16.00	39.8107	4.56	2.8576	0.0226	1.0000
IEEE 802.11n HT40	15.00	31.6228	4.56	2.8576	0.0180	1.0000
IEEE 802.11ac VHT20	13.00	19.9526	4.56	2.8576	0.0113	1.0000
IEEE 802.11ac VHT40	13.00	19.9526	4.56	2.8576	0.0113	1.0000
IEEE 802.11ac VHT80	13.00	19.9526	4.56	2.8576	0.0113	1.0000

5GHz WLAN Band 1 MIMO MODE

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11n HT20	15.00	31.6228	7.57	5.7148	0.0360	1.0000
IEEE 802.11n HT40	15.00	31.6228	7.57	5.7148	0.0360	1.0000
IEEE 802.11ac VHT20	15.00	31.6228	7.57	5.7148	0.0360	1.0000
IEEE 802.11ac VHT40	15.00	31.6228	7.57	5.7148	0.0360	1.0000
IEEE 802.11ac VHT80	15.00	31.6228	7.57	5.7148	0.0360	1.0000

5GHz WLAN Band 3 SISO MODE ANT1

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	19.00	79.4328	3.77	2.3823	0.0376	1.0000
IEEE 802.11n HT20	19.00	79.4328	3.77	2.3823	0.0376	1.0000
IEEE 802.11n HT40	19.00	79.4328	3.77	2.3823	0.0376	1.0000
IEEE 802.11ac VHT20	16.00	39.8107	3.77	2.3823	0.0189	1.0000
IEEE 802.11ac VHT40	16.00	39.8107	3.77	2.3823	0.0189	1.0000
IEEE 802.11ac VHT80	15.00	31.6228	3.77	2.3823	0.0150	1.0000

5GHz WLAN Band 3 SISO MODE ANT2

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	17.00	50.1187	4.56	2.8576	0.0285	1.0000
IEEE 802.11n HT20	15.00	31.6228	4.56	2.8576	0.0180	1.0000
IEEE 802.11n HT40	16.00	39.8107	4.56	2.8576	0.0226	1.0000
IEEE 802.11ac VHT20	14.00	25.1189	4.56	2.8576	0.0143	1.0000
IEEE 802.11ac VHT40	14.00	25.1189	4.56	2.8576	0.0143	1.0000
IEEE 802.11ac VHT80	14.00	25.1189	4.56	2.8576	0.0143	1.0000

5GHz WLAN Band 3 MIMO MODE

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11n HT20	21.00	125.8925	7.57	5.7148	0.1431	1.0000
IEEE 802.11n HT40	21.00	125.8925	7.57	5.7148	0.1431	1.0000
IEEE 802.11ac VHT20	18.00	63.0957	7.57	5.7148	0.0717	1.0000
IEEE 802.11ac VHT40	18.00	63.0957	7.57	5.7148	0.0717	1.0000
IEEE 802.11ac VHT80	18.00	63.0957	7.57	5.7148	0.0717	1.0000

Remark:

1. Output power including turn-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. 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 HT20	BT	Yes
IEEE 802.11n HT40	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

8. Summary simultaneous transmission results

Synchronization transmit between WIFI and BT

Max. $\sum MPE_{(wifi)}$ (mW/cm ²)	$MPE_{(BT)}$ (mW/cm ²)	$\sum MPE_{(WIFI+BT)}$ ratios	Limit	Results
0.2414	0.0045	0.2459	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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