

RF Exposure Evaluation

According to KDB 447498 D01 General RF Exposure Guidance v06 and part 2.1091, Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied.

Limits

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 Exposures				
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
(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
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz

Friis transmission formula: $Pd = (P_{out} * G) / (4 * \pi * r^2)$

Where

Pd = power density in mW/cm², **Pout** = output power to antenna in mW;

G = gain of antenna in linear scale, **Pi** = 3.1416;

R = distance between observation point and center of the radiator in cm

Pd is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

The product is SISO system.

Test Result of RF Exposure Evaluation

	Antenna 0	Antenna 1
Bluetooth 2.4G gain	5.52 dBi	/
WIFI 2.4G gain	5.52 dBi	3.56 dBi
WIFI 5G gain	9.66 dBi	8.8 dBi

Bluetooth

Antenna port:	modulation	Channel Freq. (MHz)	Measured power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
Antenna 0	BT: GFSK	2402	8.96	±1	9.96	3.56	0.007026	1
		2441	8.85	±1	9.85	3.56	0.006851	1
		2480	9.19	±1	10.19	3.56	0.007408	1
	BT: π /4-DQPSK	2402	8.91	±1	9.91	3.56	0.006946	1
		2441	8.82	±1	9.82	3.56	0.006803	1
		2480	8.9	±1	9.90	3.56	0.006930	1
	BT: 8DPSK	2402	8.8	±1	9.80	3.56	0.006772	1
		2441	9.04	±1	10.04	3.56	0.007157	1
		2480	9.01	±1	10.01	3.56	0.007108	1
	BLE: GFSK(1M)	2402	8.88	±1	9.88	3.56	0.006898	1
		2440	8.97	±1	9.97	3.56	0.007043	1
		2480	8.92	±1	9.92	3.56	0.006962	1

Wifi 2.4G

Antenna port:	modulation	Channel Freq. (MHz)	Measured power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
Antenna 0	802.11b	2412	9.45	±1	10.45	3.56	0.007866	1
		2437	10.43	±1	11.43	3.56	0.009857	1
		2462	10.5	±1	11.50	3.56	0.010017	1
	802.11g	2412	6.07	±1	7.07	3.56	0.003612	1
		2437	6.91	±1	7.91	3.56	0.004383	1
		2462	7.32	±1	8.32	3.56	0.004816	1
	802.11n20	2412	5.92	±1	6.92	3.56	0.003489	1
		2437	6.77	±1	7.77	3.56	0.004244	1
		2462	7.11	±1	8.11	3.56	0.004589	1
	802.11n40	2422	6.27	±1	7.27	3.56	0.003782	1
		2437	6.66	±1	7.66	3.56	0.004137	1
		2452	6.77	±1	7.77	3.56	0.004244	1
Antenna 1	802.11b	2412	8.81	±1	9.81	2.27	0.004322	1

		2437	9.31	±1	10.31	2.27	0.004850	1
		2462	9.39	±1	10.39	2.27	0.004940	1
	802.11g	2412	6.06	±1	7.06	2.27	0.002295	1
		2437	6.31	±1	7.31	2.27	0.002431	1
		2462	6.57	±1	7.57	2.27	0.002581	1
	802.11n20	2412	5.75	±1	6.75	2.27	0.002137	1
		2437	6.28	±1	7.28	2.27	0.002414	1
		2462	6.31	±1	7.31	2.27	0.002431	1
	802.11n40	2422	5.81	±1	6.81	2.27	0.002166	1
		2437	7.65	±1	8.65	2.27	0.003309	1
		2452	7.66	±1	8.66	2.27	0.003317	1

WIFI 5G

Antenna port:	Frequency range	Channel Freq. (MHz)	Measured power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
Antenna 0	UNII-1	802.11a	10.8	±1	11.80	9.25	0.027844	1
		802.11n	13.06	±1	14.06	9.25	0.046852	1
		802.11ac	12.44	±1	13.44	9.25	0.040619	1
	UNII-2A	802.11a	10.81	±1	11.81	9.25	0.027908	1
		802.11n	10.57	±1	11.57	9.25	0.026408	1
		802.11ac	11.17	±1	12.17	9.25	0.030320	1
	UNII-2C	802.11a	12.09	±1	13.09	9.25	0.037474	1
		802.11n	11.22	±1	12.22	9.25	0.030671	1
		802.11ac	12.3	±1	13.30	9.25	0.039330	1
	UNII-3	802.11a	11.59	±1	12.59	9.25	0.033399	1
		802.11n	12.06	±1	13.06	9.25	0.037216	1
		802.11ac	12.09	±1	13.09	9.25	0.037474	1
Antenna 1	UNII-1	802.11a	10.63	±1	11.63	7.59	0.021965	1
		802.11n	12.01	±1	13.01	7.59	0.030181	1
		802.11ac	13.61	±1	14.61	7.59	0.043624	1
	UNII-2A	802.11a	10.5	±1	11.50	7.59	0.021317	1
		802.11n	11.75	±1	12.75	7.59	0.028427	1
		802.11ac	11.87	±1	12.87	7.59	0.029223	1
	UNII-2C	802.11a	12.63	±1	13.63	7.59	0.034812	1
		802.11n	13.12	±1	14.12	7.59	0.038970	1
		802.11ac	13.2	±1	14.20	7.59	0.039694	1
	UNII-3	802.11a	11.58	±1	12.58	7.59	0.027336	1
		802.11n	11.97	±1	12.97	7.59	0.029904	1
		802.11ac	11.99	±1	12.99	7.59	0.030042	1

The BT, BLE, WIFI 2.4G and WIFI 5G can not transmit simultaneously.

The worst-case situation is 0.046852, which is less than “1”,

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

