

RF Exposure Evaluation

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: $Pd = (Pout * G) / (4 * pi * r^2)$

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.

Test Result of RF Exposure Evaluation

ANT 1

	Modulation	Frequency MHz	Output power to antenna (dBm)	Target power W/tolerance (dBm)	Max Output power to antenna (dBm)	Max Output power to antenna (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
Wifi 2.4g	802.11b	2412	18.43	18±1	19	79.4328	0.0200	1.0	PASS
		2437	18.81	18±1	19	79.4328	0.0200	1.0	PASS
		2462	18.88	18±1	19	79.4328	0.0200	1.0	PASS
	802.11g	2412	16.59	16±1	17	50.1187	0.0126	1.0	PASS
		2437	16.84	16±1	17	50.1187	0.0126	1.0	PASS
		2462	16.92	16±1	17	50.1187	0.0126	1.0	PASS
	802.11n(20)	2412	15.27	15±1	16	39.8107	0.0100	1.0	PASS
		2437	15.65	15±1	16	39.8107	0.0100	1.0	PASS
		2462	15.72	15±1	16	39.8107	0.0100	1.0	PASS
	802.11n(40)	2422	14.53	15±1	16	39.8107	0.0100	1.0	PASS
		2437	14.85	15±1	16	39.8107	0.0100	1.0	PASS
		2452	15.01	15±1	16	39.8107	0.0100	1.0	PASS
	802.11ax(20)	2412	15.17	15±1	16	39.8107	0.0100	1.0	PASS
		2437	15.41	15±1	16	39.8107	0.0100	1.0	PASS
		2462	15.63	15±1	16	39.8107	0.0100	1.0	PASS
	802.11ax(40)	2422	14.31	15±1	16	39.8107	0.0100	1.0	PASS
		2437	14.77	15±1	16	39.8107	0.0100	1.0	PASS
		2452	14.94	15±1	16	39.8107	0.0100	1.0	PASS

Wifi 5.2g	802.11a	5180	17.62	17±1	18	63.0957	0.0247	1.0	PASS
		5200	16.28	17±1	18	63.0957	0.0247	1.0	PASS
		5240	16.93	17±1	18	63.0957	0.0247	1.0	PASS
	802.11n(20)	5180	15.81	15±1	16	39.8107	0.0156	1.0	PASS
		5200	15.35	15±1	16	39.8107	0.0156	1.0	PASS
		5240	14.62	15±1	16	39.8107	0.0156	1.0	PASS
	802.11n(40)	5190	13.48	13±1	14	25.1189	0.0098	1.0	PASS
		5230	13.36	13±1	14	25.1189	0.0098	1.0	PASS
	802.11ac(20)	5180	15.74	15±1	16	39.8107	0.0156	1.0	PASS
		5200	15.21	15±1	16	39.8107	0.0156	1.0	PASS
		5240	14.56	15±1	16	39.8107	0.0156	1.0	PASS
	802.11ac(40)	5190	13.05	13±1	14	25.1189	0.0098	1.0	PASS
		5230	12.83	13±1	14	25.1189	0.0098	1.0	PASS
	802.11ac(80)	5210	11.24	11±1	12	15.8489	0.0062	1.0	PASS
	802.11ax(20)	5180	14.82	14±1	15	31.6228	0.0124	1.0	PASS
		5200	14.41	14±1	15	31.6228	0.0124	1.0	PASS
		5240	13.27	14±1	15	31.6228	0.0124	1.0	PASS
	802.11ax(40)	5190	11.85	11±1	12	15.8489	0.0062	1.0	PASS
		5230	11.38	11±1	12	15.8489	0.0062	1.0	PASS
	802.11ax(80)	5210	10.97	11±1	12	15.8489	0.0062	1.0	PASS

Wifi 5.8g	802.11a	5745	12.89	13±1	14	25.1189	0.0098	1.0	PASS
		5785	12.17	13±1	14	25.1189	0.0098	1.0	PASS
		5825	12.04	13±1	14	25.1189	0.0098	1.0	PASS
	802.11n(20)	5745	12.89	13±1	14	25.1189	0.0098	1.0	PASS
		5785	12.19	13±1	14	25.1189	0.0098	1.0	PASS
		5825	12.04	13±1	14	25.1189	0.0098	1.0	PASS
	802.11n(40)	5755	11.94	12±1	13	19.9526	0.0078	1.0	PASS
		5795	11.71	12±1	13	19.9526	0.0078	1.0	PASS
	802.11ac(20)	5745	10.75	10±1	11	12.5893	0.0049	1.0	PASS
		5785	10.29	10±1	11	12.5893	0.0049	1.0	PASS
		5825	10.86	10±1	11	12.5893	0.0049	1.0	PASS
	802.11ac(40)	5755	13.23	13±1	14	25.1189	0.0098	1.0	PASS
		5795	12.06	13±1	14	25.1189	0.0098	1.0	PASS
	802.11ac(80)	5775	11.90	11±1	12	15.8489	0.0062	1.0	PASS
	802.11ax(20)	5745	12.32	13±1	14	25.1189	0.0098	1.0	PASS
		5785	13.54	13±1	14	25.1189	0.0098	1.0	PASS
		5825	12.30	13±1	14	25.1189	0.0098	1.0	PASS
	802.11ax(40)	5755	13.21	13±1	14	25.1189	0.0098	1.0	PASS
		5795	12.07	13±1	14	25.1189	0.0098	1.0	PASS
	802.11ax(80)	5775	11.38	11±1	12	15.8489	0.0062	1.0	PASS

ANT 2

	Modulation	Frequency MHz	Output power to antenna (dBm)	Target power W/tolerance (dBm)	Max Output power to antenna (dBm)	Max Output power to antenna (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
Wifi 2.4g	802.11b	2412	18.02	18±1	19	79.4328	0.0200	1.0	PASS
		2437	18.52	18±1	19	79.4328	0.0200	1.0	PASS
		2462	18.67	18±1	19	79.4328	0.0200	1.0	PASS
	802.11g	2412	16.31	16±1	17	50.1187	0.0126	1.0	PASS
		2437	16.61	16±1	17	50.1187	0.0126	1.0	PASS
		2462	16.68	16±1	17	50.1187	0.0126	1.0	PASS
	802.11n(20)	2412	15.05	16±1	17	50.1187	0.0126	1.0	PASS
		2437	15.46	16±1	17	50.1187	0.0126	1.0	PASS
		2462	15.53	16±1	17	50.1187	0.0126	1.0	PASS
	802.11n(40)	2422	14.32	14±1	15	31.6228	0.0080	1.0	PASS
		2437	14.67	14±1	15	31.6228	0.0080	1.0	PASS
		2452	14.96	14±1	15	31.6228	0.0080	1.0	PASS
	802.11ax(20)	2412	14.94	15±1	16	39.8107	0.0100	1.0	PASS
		2437	15.23	15±1	16	39.8107	0.0100	1.0	PASS
		2462	15.49	15±1	16	39.8107	0.0100	1.0	PASS
	802.11ax(40)	2422	14.05	14±1	15	31.6228	0.0080	1.0	PASS
		2437	14.32	14±1	15	31.6228	0.0080	1.0	PASS
		2452	14.83	14±1	15	31.6228	0.0080	1.0	PASS

Wifi 5.2g	802.11a	5180	15.73	15±1	16	39.8107	0.0156	1.0	PASS
		5200	15.71	15±1	16	39.8107	0.0156	1.0	PASS
		5240	15.34	15±1	16	39.8107	0.0156	1.0	PASS
	802.11n(20)	5180	14.73	14±1	15	31.6228	0.0124	1.0	PASS
		5200	14.21	14±1	1	1.2589	0.0005	1.0	PASS
		5240	13.54	14±1	15	31.6228	0.0124	1.0	PASS
	802.11n(40)	5190	13.56	14±1	15	31.6228	0.0124	1.0	PASS
		5230	13.41	14±1	15	31.6228	0.0124	1.0	PASS
	802.11ac(20)	5180	13.56	14±1	15	31.6228	0.0124	1.0	PASS
		5200	13.41	14±1	15	31.6228	0.0124	1.0	PASS
		5240	13.56	14±1	15	31.6228	0.0124	1.0	PASS
	802.11ac(40)	5190	13.34	14±1	15	31.6228	0.0124	1.0	PASS
		5230	13.06	14±1	15	31.6228	0.0124	1.0	PASS
	802.11ac(80)	5210	11.38	11±1	12	15.8489	0.0062	1.0	PASS
	802.11ax(20)	5180	14.59	14±1	15	31.6228	0.0124	1.0	PASS
		5200	14.33	14±1	15	31.6228	0.0124	1.0	PASS
		5240	13.01	14±1	15	31.6228	0.0124	1.0	PASS
	802.11ax(40)	5190	11.93	11±1	12	15.8489	0.0062	1.0	PASS
5230		11.46	11±1	12	15.8489	0.0062	1.0	PASS	
802.11ax(80)	5210	11.02	11±1	12	15.8489	0.0062	1.0	PASS	

Wifi 5.8g	802.11a	5745	12.11	13±1	14	25.1189	0.0098	1.0	PASS
		5785	13.92	13±1	14	25.1189	0.0098	1.0	PASS
		5825	13.60	13±1	14	25.1189	0.0098	1.0	PASS
	802.11n(20)	5745	12.30	12±1	13	19.9526	0.0078	1.0	PASS
		5785	11.98	12±1	13	19.9526	0.0078	1.0	PASS
		5825	11.63	12±1	13	19.9526	0.0078	1.0	PASS
	802.11n(40)	5755	12.96	12±1	13	19.9526	0.0078	1.0	PASS
		5795	11.15	12±1	13	19.9526	0.0078	1.0	PASS
	802.11ac(20)	5745	11.22	11±1	12	15.8489	0.0062	1.0	PASS
		5785	10.90	11±1	12	15.8489	0.0062	1.0	PASS
		5825	10.63	11±1	12	15.8489	0.0062	1.0	PASS
	802.11ac(40)	5755	11.36	11±1	12	15.8489	0.0062	1.0	PASS
		5795	10.17	11±1	12	15.8489	0.0062	1.0	PASS
	802.11ac(80)	5775	10.12	11±1	12	15.8489	0.0062	1.0	PASS
	802.11ax(20)	5745	11.53	12.5±1	13.5	22.3872	0.0088	1.0	PASS
		5785	13.06	12.5±1	13.5	22.3872	0.0088	1.0	PASS

		5825	11.73	12.5±1	13.5	22.3872	0.0088	1.0	PASS
	802.11ax(40)	5755	12.17	12±1	13	19.9526	0.0078	1.0	PASS
		5795	11.62	11±1	12	15.8489	0.0062	1.0	PASS
	802.11ax(80)	5775	10.08	10±1	11	12.5893	0.0049	1.0	PASS

ANT 1+ANT 2

	Modulation	Frequency MHz	ANT 1 Power Density at R=20cm (mW/cm ²)	ANT 2 Power Density at R=20cm (mW/cm ²)	ANT1+ANT2 Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
Wifi 2.4g	802.11b	2412	0.0200	0.0200	/	1.0	PASS
		2437	0.0200	0.0200	/	1.0	PASS
		2462	0.0200	0.0200	/	1.0	PASS
	802.11g	2412	0.0126	0.0126	/	1.0	PASS
		2437	0.0126	0.0126	/	1.0	PASS
		2462	0.0126	0.0126	/	1.0	PASS
	802.11n(20)	2412	0.0100	0.0126	0.0226	1.0	PASS
		2437	0.0100	0.0126	0.0226	1.0	PASS
		2462	0.0100	0.0126	0.0226	1.0	PASS
	802.11n(40)	2422	0.0100	0.0080	0.0180	1.0	PASS
		2437	0.0100	0.0080	0.0180	1.0	PASS
		2452	0.0100	0.0080	0.0180	1.0	PASS
	802.11ax(20)	2412	0.0100	0.0100	0.0200	1.0	PASS
		2437	0.0100	0.0100	0.0200	1.0	PASS
		2462	0.0100	0.0100	0.0200	1.0	PASS
	802.11ax(40)	2422	0.0100	0.0080	0.0180	1.0	PASS
		2437	0.0100	0.0080	0.0180	1.0	PASS
		2452	0.0100	0.0080	0.0180	1.0	PASS

Wifi 5.2g	802.11a	5180	0.0247	0.0156	0.0403	1.0	PASS
		5200	0.0247	0.0156	0.0403	1.0	PASS
		5240	0.0247	0.0156	0.0403	1.0	PASS
	802.11n(20)	5180	0.0156	0.0124	0.0280	1.0	PASS
		5200	0.0156	0.0005	0.0161	1.0	PASS
		5240	0.0156	0.0124	0.0280	1.0	PASS
	802.11n(40)	5190	0.0098	0.0124	0.0222	1.0	PASS
		5230	0.0098	0.0124	0.0222	1.0	PASS
	802.11ac(20)	5180	0.0156	0.0124	0.0280	1.0	PASS
		5200	0.0156	0.0124	0.0280	1.0	PASS
		5240	0.0156	0.0124	0.0280	1.0	PASS
	802.11ac(40)	5190	0.0098	0.0124	0.0222	1.0	PASS
		5230	0.0098	0.0124	0.0222	1.0	PASS
	802.11ac(80)	5210	0.0062	0.0062	0.0124	1.0	PASS
	Wifi 5.2g	802.11ax(20)	5180	0.0124	0.0124	0.0248	1.0
5200			0.0124	0.0124	0.0248	1.0	PASS
5240			0.0124	0.0124	0.0248	1.0	PASS
802.11ax(40)		5190	0.0062	0.0062	0.0124	1.0	PASS
		5230	0.0062	0.0062	0.0124	1.0	PASS
802.11ax(80)		5210	0.0062	0.0062	0.0124	1.0	PASS

	Modulation	Frequency MHz	ANT 1 Power Density at R=20cm (mW/cm ²)	ANT 2 Power Density at R=20cm (mW/cm ²)	ANT1+ANT2 Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
Wifi 5.8g	802.11a	5745	0.0098	0.0098	0.0196	1.0	PASS
		5785	0.0098	0.0098	0.0196	1.0	PASS
		5825	0.0098	0.0098	0.0196	1.0	PASS
	802.11n(20)	5745	0.0098	0.0078	0.0176	1.0	PASS
		5785	0.0098	0.0078	0.0176	1.0	PASS
		5825	0.0098	0.0078	0.0176	1.0	PASS
	802.11n(40)	5755	0.0078	0.0078	0.0156	1.0	PASS
		5795	0.0078	0.0078	0.0156	1.0	PASS
	802.11ac(20)	5745	0.0049	0.0062	0.0111	1.0	PASS
		5785	0.0049	0.0062	0.0111	1.0	PASS
		5825	0.0049	0.0062	0.0111	1.0	PASS
	802.11ac(40)	5755	0.0098	0.0062	0.0160	1.0	PASS
		5795	0.0098	0.0062	0.0160	1.0	PASS
	802.11ac(80)	5775	0.0062	0.0062	0.0124	1.0	PASS
	802.11ax(20)	5745	0.0098	0.0088	0.0186	1.0	PASS
		5785	0.0098	0.0088	0.0186	1.0	PASS
		5825	0.0098	0.0088	0.0186	1.0	PASS
	802.11ax(40)	5755	0.0098	0.0078	0.0176	1.0	PASS
		5795	0.0098	0.0062	0.0160	1.0	PASS
	802.11ax(80)	5775	0.0062	0.0049	0.0111	1.0	PASS