FCC 47 CFR MPE REPORT

Zhongshan City Richsound Electronic Industrial Ltd.

Soundbar

Model Number: 9301X

FCC ID: Z8M-9301X

Applicant:	Zhongshan City Richsound Electronic Industrial Ltd.
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Maximum Permissible Exposure

1. Applicable Standards

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 limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

1.1. Limits for Maximum Permissible Exposure (MPE)

(a) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Times $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-10000			5	6

(b) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Times $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-10000			1.o	30

Note: f=frequency in MHz; *Plane-wave equivalent power density

1.2. MPE Calculation Method

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

E = Electric Field (V/m)

P = Peak 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

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak 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

2. Conducted Power Result

Mode	Frequency(MHz)	Ant.	Peak output power (dBm)	Peak output power (mW)
GFSK	2402	ant 1	5.48	3.532
	2441	ant 1	5.52	3.565
	2480	ant 1	5.51	3.556
π/4-DQPSK	2402	ant 1	8.00	6.310
	2441	ant 1	7.93	6.209
	2480	ant 1	7.86	6.109
8-DPSK	2402	ant 1	8.39	6.902
	2441	ant 1	8.26	6.699
	2480	ant 1	8.24	6.668
BLE 1M	2402	ant 1	2.71	1.866
	2440	ant 1	2.79	1.901
	2480	ant 1	3.54	2.259
IEEE 802.11b	2412	ant 1	18.67	73.621
		ant 2	18.18	65.766
	2437	ant 1	16.66	46.345
		ant 2	17.28	53.456
	2462	ant 1	16.71	46.881
		ant 2	16.56	45.290
IEEE 802.11g	2412	ant 1	23.68	233.346
		ant 2	23.96	248.886
	2437	ant 1	22.54	179.473
		ant 2	23.14	206.063
	2462	ant 1	22.40	173.780
		ant 2	22.71	186.638
IEEE 802.11n HT20	2412	ant 1	23.49	223.357
		ant 2	23.23	210.378
	2437	ant 1	22.42	174.582
		ant 2	22.67	184.927
	2462	ant 1	22.21	166.341
		ant 2	22.19	165.577
IEEE 802.11n HT40	2422	ant 1	23.61	229.615
		ant 2	23.60	229.087
	2437	ant 1	22.77	189.234
		ant 2	23.20	208.930

	2452	ant 1	22.60	181.970
		ant 2	22.67	184.927

Mode	Frequency (MHz)	Ant.	Peak output power (dBm)	Peak output power (mW)
IEEE 802.11a	5180	ant 1	14.23	26.485
		ant 2	13.51	22.439
	5200	ant 1	13.90	24.547
		ant 2	13.77	23.823
	5240	ant 1	14.09	25.645
		ant 2	13.35	21.627
	5260	ant 1	13.40	21.878
		ant 2	14.37	27.353
	5300	ant 1	13.33	21.528
		ant 2	13.85	24.266
	5320	ant 1	13.04	20.137
		ant 2	13.25	21.135
	5500	ant 1	13.63	23.067
		ant 2	13.45	22.131
	5580	ant 1	14.33	27.102
		ant 2	14.08	25.586
	5700	ant 1	13.05	20.184
		ant 2	14.33	27.102
	5745	ant 1	14.32	27.040
		ant 2	13.92	24.660
	5785	ant 1	14.60	28.840
		ant 2	15.06	32.063
	5825	ant 1	14.90	30.903
		ant 2	14.95	31.261
IEEE 802.11n20	5180	ant 1	9.84	9.638
		ant 2	9.46	8.831
	5200	ant 1	9.39	8.690
		ant 2	9.43	8.770
	5240	ant 1	9.45	8.810
		ant 2	8.93	7.816
	5260	ant 1	9.03	7.998
		ant 2	9.81	9.572

	5300	ant 1	8.87	7.709
		ant 2	9.64	9.204
	5320	ant 1	8.46	7.015
		ant 2	9.03	7.998
	5500	ant 1	9.42	8.750
		ant 2	9.42	8.750
	5580	ant 1	9.70	9.333
		ant 2	9.94	9.863
	5700	ant 1	9.17	8.260
		ant 2	10.17	10.399
	5745	ant 1	9.63	9.183
		ant 2	9.48	8.872
	5785	ant 1	10.15	10.351
		ant 2	10.56	11.376
	5825	ant 1	10.24	10.568
		ant 2	10.42	11.015
IEEE 802.11ac VHT20	5180	ant 1	9.42	8.750
		ant 2	9.31	8.531
	5200	ant 1	9.31	8.531
		ant 2	9.36	8.630
	5240	ant 1	9.27	8.453
		ant 2	8.92	7.798
	5260	ant 1	9.40	8.710
		ant 2	9.76	9.462
	5300	ant 1	9.09	8.110
		ant 2	10.00	10.000
	5320	ant 1	8.88	7.727
		ant 2	9.24	8.395
	5500	ant 1	9.43	8.770
		ant 2	9.83	9.616
	5580	ant 1	10.21	10.495
		ant 2	10.52	11.272
	5700	ant 1	9.18	8.279
		ant 2	10.49	11.194
	5745	ant 1	9.60	9.120
		ant 2	9.31	8.531
	5785	ant 1	10.07	10.162

		ant 2	10.41	10.990
	5825	ant 1	10.12	10.280
		ant 2	9.96	9.908
IEEE 802.11n HT40	5190	ant 1	9.71	9.354
		ant 2	9.27	8.453
	5230	ant 1	9.55	9.016
		ant 2	9.19	8.299
	5270	ant 1	8.94	7.834
		ant 2	10.57	11.402
	5310	ant 1	8.76	7.516
		ant 2	9.17	8.260
	5510	ant 1	9.82	9.594
		ant 2	9.64	9.204
	5590	ant 1	9.61	9.141
		ant 2	9.73	9.397
	5670	ant 1	9.71	9.354
		ant 2	9.93	9.840
	5755	ant 1	9.89	9.750
		ant 2	9.93	9.840
	5795	ant 1	10.08	10.186
		ant 2	10.78	11.967
IEEE 802.11ac VHT40	5190	ant 1	9.34	8.590
		ant 2	9.25	8.414
	5230	ant 1	9.49	8.892
		ant 2	9.14	8.204
	5270	ant 1	9.12	8.166
		ant 2	10.23	10.544
	5310	ant 1	8.93	7.816
		ant 2	9.67	9.268
	5510	ant 1	8.52	7.112
		ant 2	10.52	11.272
	5590	ant 1	9.82	9.594
		ant 2	10.35	10.839
	5670	ant 1	9.36	8.630
		ant 2	9.34	8.590
	5755	ant 1	9.92	9.817
		ant 2	9.93	9.840

	5795	ant 1	10.46	11.117
		ant 2	10.41	10.990
IEEE 802.11ac VHT80	5210	ant 1	9.03	7.998
		ant 2	9.34	8.590
	5290	ant 1	9.37	8.650
	5290	ant 2	10.29	10.691
	5530	ant 1	10.11	10.257
		ant 2	10.91	12.331
	5610	ant 1	9.74	9.419
		ant 2	10.26	10.617
	5775	ant 1	10.15	10.351
		ant 2	10.36	10.864

3. Calculated Result and Limit

SISO

The Worst Mode	Antenna	Peak output power (dBm)	Target power（dBm）	MAX Target power（dBm）	Antenna gain		Power Density (S) (mW /cm^2)	Limited of Power Density (S) (mW /cm^2)	Test Result
					(dBi)	(Linear)			
2.4G Band									
GFSK	ant 1	5.52	5±1	6	4.5	2.818	0.0022	1	Complies
π/4-DQPSK	ant 1	8.00	8±1	9	4.5	2.818	0.0045	1	Complies
8-DPSK	ant 1	8.39	8±1	9	4.5	2.818	0.0045	1	Complies
BLE	ant 1	3.54	3±1	4	4.5	2.818	0.0014	1	Complies
IEEE 802.11b	ant 1	18.67	18±1	19	5.16	3.281	0.0518	1	Complies
	ant 2	18.18	18±1	19	2.81	1.910	0.0302	1	Complies
IEEE 802.11g	ant 1	23.68	23±1	24	5.16	3.281	0.1640	1	Complies
	ant 2	23.96	23±1	24	2.81	1.910	0.0954	1	Complies
IEEE 802.11n HT20	ant 1	23.49	23±1	24	5.16	3.281	0.1640	1	Complies
	ant 2	23.23	23±1	24	2.81	1.910	0.0954	1	Complies
IEEE 802.11n HT40	ant 1	23.61	23±1	24	5.16	3.281	0.1640	1	Complies
	ant 2	23.60	23±1	24	2.81	1.910	0.0954	1	Complies
5G Band									
IEEE 802.11a	ant 1	14.9	14±1	15	5.58	3.614	0.0227	1	Complies
	ant 2	15.06	15±1	16	3.28	2.128	0.0169	1	Complies
IEEE 802.11n HT20	ant 1	10.24	10±1	11	5.58	3.614	0.0091	1	Complies
	ant 2	10.56	10±1	11	3.28	2.128	0.0053	1	Complies
IEEE 802.11ac VHT20	ant 1	10.21	10±1	11	5.58	3.614	0.0091	1	Complies
	ant 2	10.52	10±1	11	3.28	2.128	0.0053	1	Complies
IEEE 802.11n HT40	ant 1	10.08	10±1	11	5.58	3.614	0.0091	1	Complies
	ant 2	10.78	10±1	11	3.28	2.128	0.0053	1	Complies

IEEE 802.11ac VHT40	ant 1	10.46	10±1	11	5.58	3.614	0.0091	1	Complies
	ant 2	10.52	10±1	11	3.28	2.128	0.0053	1	Complies
IEEE 802.11ac VHT80	ant 1	10.15	10±1	11	5.58	3.614	0.0091	1	Complies
	ant 2	10.91	10±1	11	3.28	2.128	0.0053	1	Complies

MIMIO

Mode	Power Density (S) (mW /cm2) Antenna 1	Power Density (S) (mW /cm2) Antenna 2	Power Density (S) (mW /cm2) Total	Limited of Power Density (S) (mW /cm2)	Test Result
2.4G Band					
IEEE 802.11n HT20	0.1640	0.0954	0.2594	1	Complies
IEEE 802.11n HT40	0.1640	0.0954	0.2594	1	Complies
5G Band					
IEEE 802.11n HT20	0.0091	0.0053	0.0144	1	Complies
IEEE 802.11ac VHT20	0.0091	0.0053	0.0144	1	Complies
IEEE 802.11n HT40	0.0091	0.0053	0.0144	1	Complies
IEEE 802.11ac VHT40	0.0091	0.0053	0.0144	1	Complies
IEEE 802.11ac VHT80	0.0091	0.0053	0.0144	1	Complies

BT+Wi-Fi

MAX Power Density (S) (mW/cm^2) Bluetooth	MAX Power Density (S) (mW/cm^2) WiFi	Total Ratio	Limit Ratio	Test Result
0.0045	0.2594	0.2639	1	Complies

End of Test Report