FCC 47 CFR MPE REPORT

Wacebo USA INC

Interactive LED Panel

Model Number: E13R-B86G

Addition Model: E13R-B65G, E13R-B75G

FCC ID: 2BKOR-WRB88T

Applicant:	Wacebo USA INC
Address:	8 The Green Ste R, Dover, Delaware, 19901 USA
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
Tel: 86-769-83081888-808	

Report Number:	ESTE-R2503278
Date of Test:	Feb. 10, 2025 ~ Mar. 24, 2025
Date of Report:	Mar. 27, 2025

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) = $\frac{\sqrt{30 \times P \times G}}{d}$ 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-NXP8997 Module

Mode	Frequency (MHz)	Antenna	Peak output power (dBm)	Peak output power (mW)
GFSK	2402	ant 1	5.35	3.428
	2441	ant 1	5.29	3.381
	2480	ant 1	4.89	3.083
π/4-DQPSK	2402	ant 1	4.9	3.090
	2441	ant 1	4.85	3.055
	2480	ant 1	4.44	2.780
8-DPSK	2402	ant 1	5.29	3.381
	2441	ant 1	5.18	3.296
	2480	ant 1	4.75	2.985
BLE 1M	2402	ant 1	5.29	3.381
	2440	ant 1	5.23	3.334
	2480	ant 1	4.78	3.006
BLE 2M	2402	ant 1	5.32	3.404
	2440	ant 1	5.29	3.381
	2480	ant 1	4.82	3.034
IEEE 802.11b	2412	ant 1	13.91	24.604
		ant 2	16.55	45.186
	2437	ant 1	13.84	24.210
		ant 2	16.89	48.865
	2462	ant 1	14.31	26.977
		ant 2	16.94	49.431
IEEE 802.11g	2412	ant 1	19.01	79.616
		ant 2	21.54	142.561
	2437	ant 1	18.99	79.250
		ant 2	21.9	154.882
	2462	ant 1	19.43	87.700
		ant 2	21.89	154.525
IEEE 802.11n HT20	2412	ant 1	15.18	32.961
		ant 2	22.16	164.437
	2437	ant 1	15.17	32.885
		ant 2	22.55	179.887
	2462	ant 1	15.58	36.141
		ant 2	22.69	185.780

IEEE 802.11n HT40	2422	ant 1	19.44	87.902
		ant 2	22.2	165.959
	2437	ant 1	19.56	90.365
		ant 2	22.22	166.725
	2452	ant 1	19.68	92.897
		ant 2	22.48	177.011
Mode	Frequency (MHz)	Antena	Peak output power (dBm)	Peak output power (mW)
IEEE 802.11a	5180	ant 1	12.41	17.418
		ant 2	10.83	12.106
	5200	ant 1	11.63	14.555
		ant 2	10.79	11.995
	5240	ant 1	11.47	14.028
		ant 2	12.07	16.106
	5745	ant 1	13.94	24.774
		ant 2	13.77	23.823
	5785	ant 1	13.47	22.233
		ant 2	14.14	25.942
	5825	ant 1	13.33	21.528
		ant 2	14.01	25.177
IEEE 802.11n20	5180	ant 1	12.66	18.450
		ant 2	13.24	21.086
	5200	ant 1	11.46	13.996
		ant 2	13.31	21.429
	5240	ant 1	11.27	13.397
		ant 2	14.57	28.642
	5745	ant 1	14.77	29.992
		ant 2	15.56	35.975
	5785	ant 1	14.27	26.730
		ant 2	15.78	37.844
	5825	ant 1	13.95	24.831
		ant 2	15.65	36.728
IEEE 802.11ac VHT20	5180	ant 1	12.82	19.143
		ant 2	11.86	15.346
	5200	ant 1	11.97	15.740
		ant 2	11.94	15.631
	5240	ant 1	10.69	11.722
		ant 2	13.25	21.135

	5745	ant 1	13.57	22.751
		ant 2	14.64	29.107
	5785	ant 1	13.27	21.232
		ant 2	14.85	30.549
	5825	ant 1	12.99	19.907
		ant 2	14.63	29.040
Mode	Frequency (MHz)	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)
IEEE 802.11n HT40	5190	ant 1	13.01	19.999
		ant 2	11.87	15.382
	5230	ant 1	10.83	12.106
		ant 2	13.27	21.232
	5755	ant 1	13.72	23.550
		ant 2	14.88	30.761
	5795	ant 1	12.98	19.861
		ant 2	14.9	30.903
IEEE 802.11ac VHT40	5190	ant 1	13.01	19.999
		ant 2	14.99	31.550
	5230	ant 1	11.82	15.205
		ant 2	14.55	28.510
	5755	ant 1	13.38	21.777
		ant 2	12.55	17.989
	5795	ant 1	12.82	19.143
		ant 2	12.84	19.231
IEEE 802.11ac VHT80	5210	ant 1	12.99	19.907
		ant 2	15.45	35.075
	5775	ant 1	13.36	21.677
		ant 2	13.29	21.330

3. Calculated Result and Limit-NXP8997 Module

3.1. **SISO**

The Worst Mode	Antenna	Peak output power (dBm)	Target power（dBm）	MAX Target power（dBm）	Antenna gain		Power Density (S) (mW /cm2)	Limited of Power Density (S) (mW /cm2)	Test Result
					(dBi)	(Linear)			
2.4G Band									
GFSK	ant 1	5.35	5±1	6	1.72	1.486	0.0012	1	Complies
π/4-DQPSK	ant 1	4.90	4±1	5	1.72	1.486	0.0009	1	Complies
8-DPSK	ant 1	5.29	5±1	6	1.72	1.486	0.0012	1	Complies
BLE	ant 1	5.32	5±1	6	1.72	1.486	0.0012	1	Complies
IEEE 802.11b	ant 1	14.31	14±1	15	1.72	1.486	0.0093	1	Complies
	ant 2	16.94	16±1	17	1.72	1.486	0.0148	1	Complies
IEEE 802.11g	ant 1	19.43	19±1	20	1.72	1.486	0.0296	1	Complies
	ant 2	21.90	21±1	22	1.72	1.486	0.0469	1	Complies
IEEE 802.11n HT20	ant 1	15.58	15±1	16	1.72	1.486	0.0118	1	Complies
	ant 2	22.69	22±1	23	1.72	1.486	0.0590	1	Complies
IEEE 802.11n HT40	ant 1	19.68	19±1	20	1.72	1.486	0.0296	1	Complies
	ant 2	22.48	22±1	23	1.72	1.486	0.0590	1	Complies
5G Band									
IEEE 802.11a	ant 1	13.94	13±1	14	2.57	1.807	0.0090	1	Complies
	ant 2	14.14	14±1	15	2.57	1.807	0.0114	1	Complies
IEEE 802.11n HT20	ant 1	14.77	14±1	15	2.57	1.807	0.0114	1	Complies
	ant 2	15.78	15±1	16	2.57	1.807	0.0143	1	Complies
IEEE802.11ac VHT20	ant 1	13.57	13±1	14	2.57	1.807	0.0090	1	Complies
	ant 2	14.85	14±1	15	2.57	1.807	0.0114	1	Complies

IEEE 802.11n HT40	ant 1	13.72	13±1	14	2.57	1.807	0.0090	1	Complies
	ant 2	14.9	14±1	15	2.57	1.807	0.0114	1	Complies
IEEE 802.11ac VHT40	ant 1	13.38	13±1	14	2.57	1.807	0.0090	1	Complies
	ant 2	14.99	14±1	15	2.57	1.807	0.0114	1	Complies
IEEE 802.11ac VHT80	ant 1	13.36	13±1	14	2.57	1.807	0.0090	1	Complies
	ant 2	15.45	15±1	16	2.57	1.807	0.0143	1	Complies

3.2. **MIMO**

Mode	Power Density (S) (mW /cm2) Antenna 0	Power Density (S) (mW /cm2) Antenna 1	Power Density (S) (mW /cm2) Total	Limited of Power Density (S) (mW /cm2)	Test Result
2.4G Band					
IEEE 802.11n HT20	0.0118	0.0590	0.0708	1	Complies
IEEE 802.11n HT40	0.0296	0.0590	0.0885	1	Complies
5G Band					
IEEE 802.11n HT20	0.0114	0.0143	0.0257	1	Complies
IEEE 802.11ac VHT20	0.0090	0.0114	0.0204	1	Complies
IEEE 802.11n HT40	0.0090	0.0114	0.0204	1	Complies
IEEE 802.11ac VHT40	0.0090	0.0114	0.0204	1	Complies
IEEE 802.11ac VHT80	0.0090	0.0143	0.0233	1	Complies

3.3. **BT+WIFI**

MAX Power Density (S) (mW/cm^2) Bluetooth	MAX Power Density (S) (mW/cm^2) WiFi	Total Ratio	Limit Ratio	Test Result
0.0012	0.0885	0.0897	1	Complies

4. Conducted Power Result- RTL8852BE Module

Mode	Frequency (MHz)	Antenna	Peak output power (dBm)	Peak output power (mW)
IEEE 802.11b	2412	ant 1	14.16	26.062
		ant 2	15.09	32.285
	2437	ant 1	13.58	22.803
		ant 2	14.93	31.117
	2462	ant 1	13.42	21.979
		ant 2	14.96	31.333
IEEE 802.11g	2412	ant 1	18.88	77.268
		ant 2	19.63	91.833
	2437	ant 1	18.21	66.222
		ant 2	19.04	80.168
	2462	ant 1	17.92	61.944
		ant 2	18.87	77.090
IEEE 802.11n HT20	2412	ant 1	19.01	79.616
		ant 2	19.42	87.498
	2437	ant 1	18.31	67.764
		ant 2	19.02	79.799
	2462	ant 1	17.96	62.517
		ant 2	18.57	71.945
IEEE 802.11ax HE20	2412	ant 1	19.44	87.902
		ant 2	20.51	112.460
	2437	ant 1	19.01	79.616
		ant 2	19.86	96.828
	2462	ant 1	18.83	76.384
		ant 2	19.63	91.833
IEEE 802.11n HT40	2422	ant 1	18.94	78.343
		ant 2	19.75	94.406
	2437	ant 1	18.58	72.111
		ant 2	19.35	86.099
	2452	ant 1	18.28	67.298
		ant 2	19.23	83.753
IEEE 802.11ax HE40	2422	ant 1	19.63	91.833
		ant 2	20.36	108.643
	2437	ant 1	19.33	85.704
		ant 2	19.92	98.175

	2452	ant 1	19.02	79.799
		ant 2	19.74	94.189
Mode	Frequency (MHz)	Antena	Peak output power (dBm)	Peak output power (mW)
IEEE 802.11a	5180	ant 1	12.77	18.923
		ant 2	12.66	18.450
	5200	ant 1	12.91	19.543
		ant 2	12.69	18.578
	5240	ant 1	12.57	18.072
		ant 2	12.14	16.368
	5260	ant 1	12.62	18.281
		ant 2	11.83	15.241
	5300	ant 1	12	15.849
		ant 2	11.87	15.382
	5320	ant 1	11.62	14.521
		ant 2	11.17	13.092
	5500	ant 1	13.28	21.281
		ant 2	13.62	23.014
	5580	ant 1	14.2	26.303
		ant 2	13.62	23.014
	5700	ant 1	14.21	26.363
		ant 2	14.27	26.730
	5745	ant 1	14.18	26.182
		ant 2	13.98	25.003
	5785	ant 1	13.75	23.714
		ant 2	13.57	22.751
	5825	ant 1	13.81	24.044
		ant 2	13.94	24.774
IEEE 802.11n20	5180	ant 1	13.75	23.714
		ant 2	13.21	20.941
	5200	ant 1	13.69	23.388
		ant 2	13.29	21.330
	5240	ant 1	13.2	20.893
		ant 2	12.66	18.450
	5260	ant 1	13.4	21.878
		ant 2	12.48	17.701
	5300	ant 1	12.78	18.967
		ant 2	12.54	17.947
	5320	ant 1	12.21	16.634

		ant 2	11.79	15.101
	5500	ant 1	14.12	25.823
		ant 2	14.33	27.102
	5580	ant 1	14.95	31.261
		ant 2	14.3	26.915
	5700	ant 1	14.64	29.107
		ant 2	14.64	29.107
	5745	ant 1	14.65	29.174
		ant 2	14.34	27.164
	5785	ant 1	14.51	28.249
		ant 2	13.99	25.061
	5825	ant 1	14.53	28.379
		ant 2	14.57	28.642
IEEE 802.11ac VHT20	5180	ant 1	13.53	22.542
		ant 2	13.12	20.512
	5200	ant 1	13.55	22.646
		ant 2	13.17	20.749
	5240	ant 1	13.08	20.324
		ant 2	12.65	18.408
	5260	ant 1	13.17	20.749
		ant 2	12.48	17.701
	5300	ant 1	12.77	18.923
		ant 2	12.53	17.906
	5320	ant 1	12.16	16.444
		ant 2	11.73	14.894
	5500	ant 1	14.02	25.235
		ant 2	14.27	26.730
	5580	ant 1	14.91	30.974
		ant 2	14.3	26.915
	5700	ant 1	14.76	29.923
		ant 2	14.65	29.174
	5745	ant 1	14.77	29.992
		ant 2	14.52	28.314
	5785	ant 1	14.44	27.797
		ant 2	14.06	25.468
	5825	ant 1	14.58	28.708
		ant 2	14.52	28.314
IEEE 802.11ax HE20	5180	ant 1	13.79	23.933
		ant 2	13.39	21.827

	5200	ant 1	13.66	23.227
		ant 2	13.43	22.029
	5240	ant 1	13.29	21.330
		ant 2	12.76	18.880
	5260	ant 1	13.47	22.233
		ant 2	12.71	18.664
	5300	ant 1	12.83	19.187
		ant 2	12.59	18.155
	5320	ant 1	12.27	16.866
		ant 2	11.83	15.241
	5500	ant 1	14.07	25.527
		ant 2	14.33	27.102
	5580	ant 1	14.97	31.405
		ant 2	14.35	27.227
	5700	ant 1	14.88	30.761
		ant 2	14.95	31.261
	5745	ant 1	14.98	31.477
		ant 2	14.65	29.174
	5785	ant 1	14.65	29.174
		ant 2	14.56	28.576
	5825	ant 1	14.63	29.040
		ant 2	14.74	29.785
Mode	Frequency (MHz)	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)
IEEE 802.11n HT40	5190	ant 1	14.03	25.293
		ant 2	13.69	23.388
	5230	ant 1	13.74	23.659
		ant 2	13.22	20.989
	5270	ant 1	13.31	21.429
		ant 2	12.66	18.450
	5310	ant 1	12.51	17.824
		ant 2	12.13	16.331
	5510	ant 1	14.15	26.002
		ant 2	14.49	28.119
	5550	ant 1	15.17	32.885
		ant 2	14.72	29.648
	5670	ant 1	15.26	33.574
		ant 2	14.76	29.923
	5755	ant 1	15.12	32.509

		ant 2	14.59	28.774
	5795	ant 1	14.83	30.409
		ant 2	14.53	28.379
IEEE 802.11ac VHT40	5190	ant 1	13.83	24.155
		ant 2	13.48	22.284
	5230	ant 1	13.49	22.336
		ant 2	12.97	19.815
	5270	ant 1	13.37	21.727
		ant 2	12.51	17.824
	5310	ant 1	12.41	17.418
		ant 2	12.22	16.672
	5510	ant 1	14.41	27.606
		ant 2	14.42	27.669
	5590	ant 1	15	31.623
		ant 2	14.63	29.040
	5670	ant 1	15.47	35.237
		ant 2	15.05	31.989
	5755	ant 1	15.12	32.509
		ant 2	14.76	29.923
	5795	ant 1	14.77	29.992
		ant 2	14.52	28.314
IEEE 802.11ax HE40	5190	ant 1	14.09	25.645
		ant 2	13.84	24.210
	5230	ant 1	13.64	23.121
		ant 2	13.3	21.380
	5270	ant 1	13.35	21.627
		ant 2	12.62	18.281
	5310	ant 1	12.67	18.493
		ant 2	12.28	16.904
	5510	ant 1	14.66	29.242
		ant 2	14.62	28.973
	5590	ant 1	15.11	32.434
		ant 2	14.9	30.903
	5670	ant 1	15.24	33.420
		ant 2	14.93	31.117
	5755	ant 1	15.11	32.434
		ant 2	14.79	30.130
	5795	ant 1	14.74	29.785

		ant 2	14.64	29.107
IEEE 802.11ac VHT80	5210	ant 1	14.03	25.293
		ant 2	13.63	23.067
	5290	ant 1	12.8	19.055
		ant 2	12.32	17.061
	5530	ant 1	15	31.623
		ant 2	14.83	30.409
	5610	ant 1	14.78	30.061
		ant 2	13.87	24.378
	5775	ant 1	14.86	30.620
		ant 2	14.35	27.227
IEEE 802.11ax HE80	5210	ant 1	13.76	23.768
		ant 2	13.51	22.439
	5290	ant 1	12.66	18.450
		ant 2	12.26	16.827
	5530	ant 1	15.07	32.137
		ant 2	14.63	29.040
	5610	ant 1	14.28	26.792
		ant 2	13.76	23.768
	5775	ant 1	14.66	29.242
		ant 2	14.2	26.303

5. Calculated Result and Limit- RTL8852BE Module

5.1. **SISO**

The Worst Mode	Antenna	Peak output power (dBm)	Target power（dBm）	MAX Target power（dBm）	Antenna gain		Power Density (S) (mW/cm2)	Limited of Power Density (S) (mW/cm2)	Test Result
					(dBi)	(Linear)			
2.4G Band									
IEEE 802.11b	ant 1	14.16	14 ±1	15	3.9	2.455	0.0154	1	Complies
	ant 2	15.09	15 ±1	16	3.9	2.455	0.0194	1	Complies
IEEE 802.11g	ant 1	18.88	18 ±1	19	3.9	2.455	0.0388	1	Complies
	ant 2	19.63	19 ±1	20	3.9	2.455	0.0488	1	Complies
IEEE 802.11n HT20	ant 1	19.01	19 ±1	20	3.9	2.455	0.0488	1	Complies
	ant 2	19.42	19±1	20	3.9	2.455	0.0488	1	Complies
IEEE 802.11n HT40	ant 1	18.94	18±1	19	3.9	2.455	0.0388	1	Complies
	ant 2	19.75	19±1	20	3.9	2.455	0.0488	1	Complies
IEEE802.11ax HE20	ant 1	19.44	19±1	20	3.9	2.455	0.0488	1	Complies
	ant 2	20.51	20±1	21	3.9	2.455	0.0615	1	Complies
IEEE802.11ax HE40	ant 1	19.63	19±1	20	3.9	2.455	0.0488	1	Complies
	ant 2	20.36	20±1	21	3.9	2.455	0.0615	1	Complies
5G Band									
IEEE 802.11a	ant 1	14.21	14 ±1	15	5.1	3.2359	0.0204	1	Complies
	ant 2	14.27	14 ±1	15	5.1	3.2359	0.0204	1	Complies
IEEE 802.11n HT20	ant 1	14.95	14 ±1	15	5.1	3.2359	0.0204	1	Complies
	ant 2	14.64	14±1	15	5.1	3.2359	0.0204	1	Complies
IEEE802.11ac VHT20	ant 1	14.91	14±1	15	5.1	3.2359	0.0204	1	Complies
	ant 2	14.65	14 ±1	15	5.1	3.2359	0.0204	1	Complies
IEEE802.11ax HE20	ant 1	14.98	14 ±1	15	5.1	3.2359	0.0204	1	Complies
	ant 2	14.95	14 ±1	15	5.1	3.2359	0.0204	1	Complies
IEEE 802.11n HT40	ant 1	15.26	15 ±1	16	5.1	3.2359	0.0256	1	Complies
	ant 2	14.76	14 ±1	15	5.1	3.2359	0.0204	1	Complies
IEEE 802.11ac VHT40	ant 1	15.47	15±1	16	5.1	3.2359	0.0256	1	Complies
	ant 2	15.05	15 ±1	16	5.1	3.2359	0.0256	1	Complies

IEEE802.11ax HE40	ant 1	15.24	15 ±1	16	5.1	3.2359	0.0256	1	Complies
	ant 2	14.93	14 ±1	15	5.1	3.2359	0.0204	1	Complies
IEEE 802.11ac VHT80	ant 1	15	15 ±1	16	5.1	3.2359	0.0256	1	Complies
	ant 2	14.83	14 ±1	15	5.1	3.2359	0.0204	1	Complies
IEEE802.11ax HE80	ant 1	15.07	15 ±1	16	5.1	3.2359	0.0256	1	Complies
	ant 2	14.63	14 ±1	15	5.1	3.2359	0.0204	1	Complies

5.2. **MIMO**

Mode	Power Density (S) (mW /cm2) Antenna 0	Power Density (S) (mW /cm2) Antenna 1	Power Density (S) (mW /cm2) Total	Limited of Power Density (S) (mW /cm2)	Test Result
2.4G Band					
IEEE 802.11n HT20	0.0488	0.0488	0.0977	1	Complies
IEEE 802.11n HT40	0.0488	0.0615	0.1103	1	Complies
IEEE802.11ax HE20	0.0388	0.0488	0.0876	1	Complies
IEEE802.11ax HE40	0.0488	0.0615	0.1103	1	Complies
5G Band					
IEEE 802.11n HT20	0.0204	0.0204	0.0407	1	Complies
IEEE 802.11ac VHT20	0.0204	0.0204	0.0407	1	Complies
IEEE802.11ax HE20	0.0204	0.0204	0.0407	1	Complies
IEEE 802.11n HT40	0.0256	0.0204	0.0460	1	Complies
IEEE 802.11ac VHT40	0.0256	0.0256	0.0513	1	Complies
IEEE802.11ax HE40	0.0256	0.0204	0.0460	1	Complies
IEEE 802.11ac VHT80	0.0256	0.0204	0.0460	1	Complies
IEEE802.11ax HE80	0.0256	0.0204	0.0460	1	Complies

5.3. WIFI

MAX Power Density (S) (mW/cm^2) WiFi	Limit Ratio	Test Result
0.1103	1	Complies

5.4. NXP8997 Module +RTL8852BE Module

NXP8997 Module MAX Power Density (S) (mW/cm^2)	8852BE Module MAX Power Density (S) (mW/cm^2)	Total Ratio	Limit Ratio	Test Result
0.0897	0.1103	0.2	1	Complies

End of Test Report