

FCC 47 CFR MPE REPORT

Bang & Olufsen a/s

Wireless Audio Transmitter

Model Number: Beoconnect Core

FCC ID: TTUBCCORE

Applicant:	Bang & Olufsen a/s
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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			1.0	30

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

1.2. MPE Calculation Method

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

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

BT, WIFI Mode

Mode	Frequency (MHz)	Antenna	Peak output power (dBm)	Peak output power (mW)
GFSK	2402	ant 1	4.42	2.767
	2441	ant 1	3.81	2.404
	2480	ant 1	3.80	2.399
$\pi/4$ -DQPSK	2402	ant 1	6.52	4.487
	2441	ant 1	5.86	3.855
	2480	ant 1	5.91	3.899
8-DPSK	2402	ant 1	6.81	4.797
	2441	ant 1	6.15	4.121
	2480	ant 1	6.14	4.111
BLE 1M	2402	ant 1	3.58	2.280
	2440	ant 1	2.90	1.950
	2480	ant 1	2.67	1.849
BLE 2M	2402	ant 1	3.73	2.360
	2440	ant 1	3.07	2.028
	2480	ant 1	2.88	1.941
LE Audio 1M	2402	ant 1	0.77	1.194
	2440	ant 1	0.52	1.127
	2480	ant 1	0.51	1.125
LE Audio 2M	2402	ant 1	0.91	1.233
	2440	ant 1	0.71	1.178
	2480	ant 1	0.71	1.178
IEEE 802.11b	2412	ant 1	16.00	39.811
		ant 2	15.22	33.266
	2437	ant 1	16.59	45.604
		ant 2	15.22	33.266
	2462	ant 1	16.07	40.458
		ant 2	15.40	34.674
IEEE 802.11g	2412	ant 1	21.19	131.522
		ant 2	20.53	112.980
	2437	ant 1	21.88	154.170
		ant 2	20.58	114.288

	2462	ant 1	21.49	140.929
		ant 2	21.03	126.765
IEEE 802.11n HT20	2412	ant 1	18.52	71.121
		ant 2	18.07	64.121
	2437	ant 1	19.18	82.794
		ant 2	18.22	66.374
	2462	ant 1	18.92	77.983
		ant 2	18.59	72.277
IEEE 802.11ax HE20	2412	ant 1	17.17	52.119
		ant 2	17.72	59.156
	2437	ant 1	17.62	57.810
		ant 2	17.84	60.814
	2462	ant 1	16.92	49.204
		ant 2	17.44	55.463
IEEE 802.11n HT40	2422	ant 1	18.66	73.451
		ant 2	18.14	65.163
	2437	ant 1	19.04	80.168
		ant 2	18.27	67.143
	2452	ant 1	19.40	87.096
		ant 2	18.25	66.834
IEEE 802.11ax HE40	2422	ant 1	19.29	84.918
		ant 2	19.83	96.161
	2437	ant 1	19.80	95.499
		ant 2	19.79	95.280
	2452	ant 1	20.19	104.472
		ant 2	19.85	96.605
IEEE 802.11a	5180	ant 1	14.91	30.974
		ant 2	12.38	17.298
	5200	ant 1	14.98	31.477
		ant 2	12.02	15.922
	5240	ant 1	14.69	29.444
		ant 2	11.63	14.555
	5260	ant 1	13.88	24.434
		ant 2	11.07	12.794
	5300	ant 1	13.68	23.335
		ant 2	10.82	12.078
	5320	ant 1	13.33	21.528
		ant 2	11.01	12.618

	5500	ant 1	14.92	31.046	
		ant 2	13.12	20.512	
	5580	ant 1	15.09	32.285	
		ant 2	12.98	19.861	
	5700	ant 1	16.15	41.210	
		ant 2	13.63	23.067	
	5745	ant 1	16.87	48.641	
		ant 2	14.74	29.785	
	5785	ant 1	15.70	37.154	
		ant 2	14.20	26.303	
	5825	ant 1	15.07	32.137	
		ant 2	13.61	22.961	
	IEEE 802.11n20	5180	ant 1	13.12	20.512
			ant 2	11.51	14.158
5200		ant 1	13.09	20.370	
		ant 2	11.17	13.092	
5240		ant 1	12.72	18.707	
		ant 2	10.63	11.561	
5260		ant 1	11.97	15.740	
		ant 2	11.02	12.647	
5300		ant 1	11.74	14.928	
		ant 2	10.95	12.445	
5320		ant 1	11.39	13.772	
		ant 2	11.14	13.002	
5500		ant 1	13.02	20.045	
		ant 2	12.16	16.444	
5580		ant 1	13.30	21.380	
		ant 2	12.07	16.106	
5700		ant 1	14.30	26.915	
		ant 2	12.75	18.836	
5745		ant 1	15.03	31.842	
		ant 2	13.76	23.768	
5785	ant 1	13.99	25.061		
	ant 2	13.08	20.324		
5825	ant 1	12.81	19.099		
	ant 2	12.43	17.498		
IEEE 802.11ac VHT20	5180	ant 1	13.01	19.999	
		ant 2	10.74	11.858	

	5200	ant 1	12.97	19.815
		ant 2	10.68	11.695
	5240	ant 1	12.72	18.707
		ant 2	9.95	9.886
	5260	ant 1	11.72	14.859
		ant 2	10.34	10.814
	5300	ant 1	11.65	14.622
		ant 2	10.86	12.190
	5320	ant 1	11.32	13.552
		ant 2	10.97	12.503
	5500	ant 1	12.87	19.364
		ant 2	11.73	14.894
	5580	ant 1	12.93	19.634
		ant 2	11.50	14.125
	5700	ant 1	14.00	25.119
		ant 2	12.21	16.634
	5745	ant 1	14.33	27.102
		ant 2	13.08	20.324
	5785	ant 1	13.20	20.893
		ant 2	12.30	16.982
5825	ant 1	12.24	16.749	
	ant 2	11.56	14.322	
IEEE 802.11ax HE20	5180	ant 1	13.00	19.953
		ant 2	10.77	11.940
	5200	ant 1	12.95	19.724
		ant 2	10.83	12.106
	5240	ant 1	12.84	19.231
		ant 2	10.08	10.186
	5260	ant 1	11.89	15.453
		ant 2	9.53	8.974
	5300	ant 1	11.80	15.136
		ant 2	10.05	10.116
	5320	ant 1	11.54	14.256
		ant 2	10.19	10.447
	5500	ant 1	13.19	20.845
		ant 2	11.18	13.122
	5580	ant 1	13.21	20.941
		ant 2	10.94	12.417

	5700	ant 1	14.22	26.424	
		ant 2	11.62	14.521	
	5745	ant 1	14.66	29.242	
		ant 2	13.42	21.979	
	5785	ant 1	13.38	21.777	
		ant 2	12.57	18.072	
	5825	ant 1	12.46	17.620	
		ant 2	11.88	15.417	
	IEEE 802.11n HT40	5190	ant 1	13.08	20.324
			ant 2	11.29	13.459
5230		ant 1	12.82	19.143	
		ant 2	10.82	12.078	
5270		ant 1	11.88	15.417	
		ant 2	10.51	11.246	
5310		ant 1	11.57	14.355	
		ant 2	10.95	12.445	
5510		ant 1	12.95	19.724	
		ant 2	10.61	11.508	
5550		ant 1	13.15	20.654	
		ant 2	10.87	12.218	
5670		ant 1	13.70	23.442	
		ant 2	11.21	13.213	
5755		ant 1	14.20	26.303	
		ant 2	13.32	21.478	
5795		ant 1	13.29	21.330	
		ant 2	12.28	16.904	
IEEE 802.11ac VHT40	5190	ant 1	12.89	19.454	
		ant 2	10.74	11.858	
	5230	ant 1	12.76	18.880	
		ant 2	10.35	10.839	
	5270	ant 1	11.73	14.894	
		ant 2	10.36	10.864	
	5310	ant 1	11.51	14.158	
		ant 2	10.87	12.218	
	5510	ant 1	13.03	20.091	
		ant 2	12.68	18.535	
	5550	ant 1	13.16	20.701	
		ant 2	11.91	15.524	

	5670	ant 1	13.58	22.803
		ant 2	12.10	16.218
	5755	ant 1	14.14	25.942
		ant 2	13.26	21.184
	5795	ant 1	13.17	20.749
		ant 2	12.30	16.982
IEEE 802.11ax HE40	5190	ant 1	13.30	21.380
		ant 2	11.16	13.062
	5230	ant 1	13.12	20.512
		ant 2	10.73	11.830
	5270	ant 1	11.99	15.812
		ant 2	9.79	9.528
	5310	ant 1	11.79	15.101
		ant 2	10.32	10.765
	5510	ant 1	13.47	22.233
		ant 2	11.22	13.243
	5550	ant 1	13.55	22.646
		ant 2	11.42	13.868
	5670	ant 1	13.99	25.061
		ant 2	11.50	14.125
	5755	ant 1	14.42	27.669
		ant 2	12.97	19.815
	5795	ant 1	13.57	22.751
		ant 2	12.69	18.578
IEEE 802.11ac VHT80	5210	ant 1	13.00	19.953
		ant 2	11.19	13.152
	5290	ant 1	11.80	15.136
		ant 2	10.02	10.046
	5530	ant 1	13.47	22.233
		ant 2	12.27	16.866
	5610	ant 1	13.24	21.086
		ant 2	11.74	14.928
	5775	ant 1	13.80	23.988
		ant 2	11.99	15.812
IEEE 802.11ax HE80	5210	ant 1	13.44	22.080
		ant 2	11.22	13.243
	5290	ant 1	12.14	16.368
		ant 2	10.45	11.092

	5530	ant 1	13.55	22.646
		ant 2	11.86	15.346
	5610	ant 1	17.35	54.325
		ant 2	11.29	13.459
	5775	ant 1	13.21	20.941
		ant 2	12.34	17.140

UWB Mode

Mode	Frequency (MHz)	EIRP (dBm/50MHz)	EIRP (mW/50MHz)
UWB	6489.6	-16.30	0.023
	7987.2	-13.79	0.042

3. Calculated Result and Limit

1.SISO(BT, WIFI Mode)

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	4.42	4±1	5	3.2	2.089	0.0013	1	Complies
$\pi/4$ -DQPSK	ant 1	6.52	6±1	7	3.2	2.089	0.0021	1	Complies
8-DPSK	ant 1	6.81	6±1	7	3.2	2.089	0.0021	1	Complies
BLE	ant 1	3.73	3±1	4	3.2	2.089	0.0010	1	Complies
LE Audio	ant 1	0.91	0±1	1	2.9	1.950	0.0005	1	Complies
IEEE 802.11b	ant 1	16.59	16±1	17	2.7	1.862	0.0186	1	Complies
	ant 2	15.40	15±1	16	3.1	2.042	0.0162	1	Complies
IEEE 802.11g	ant 1	21.88	21±1	22	2.7	1.862	0.0587	1	Complies
	ant 2	21.03	21±1	22	3.1	2.042	0.0644	1	Complies
IEEE 802.11n HT20	ant 1	19.18	19±1	20	2.7	1.862	0.0370	1	Complies
	ant 2	18.59	18±1	19	3.1	2.042	0.0323	1	Complies
IEEE 802.11n HT40	ant 1	19.40	19±1	20	2.7	1.862	0.0370	1	Complies
	ant 2	18.27	18±1	19	3.1	2.042	0.0323	1	Complies
IEEE 802.11ax HE20	ant 1	17.62	17±1	18	2.7	1.862	0.0234	1	Complies
	ant 2	17.84	17±1	18	3.1	2.042	0.0256	1	Complies
IEEE 802.11ax HE40	ant 1	20.19	20±1	21	2.7	1.862	0.0466	1	Complies
	ant 2	19.85	19±1	20	3.1	2.042	0.0406	1	Complies
5G Band									
IEEE 802.11a	ant 1	16.87	16±1	17	1.4	1.380	0.0138	1	Complies
	ant 2	14.74	14±1	15	2.7	1.862	0.0117	1	Complies
IEEE	ant 1	15.03	15±1	16	1.4	1.380	0.0109	1	Complies

802.11n HT20	ant 2	13.76	13±1	14	2.7	1.862	0.0093	1	Complies
IEEE 802.11ac VHT20	ant 1	14.33	14±1	15	1.4	1.380	0.0087	1	Complies
	ant 2	13.08	13±1	14	2.7	1.862	0.0093	1	Complies
IEEE 802.11ax HE20	ant 1	14.66	14±1	15	1.4	1.380	0.0087	1	Complies
	ant 2	13.42	13±1	14	2.7	1.862	0.0093	1	Complies
IEEE 802.11n HT40	ant 1	14.20	14±1	15	1.4	1.380	0.0087	1	Complies
	ant 2	13.32	13±1	14	2.7	1.862	0.0093	1	Complies
IEEE 802.11ac VHT40	ant 1	14.14	14±1	15	1.4	1.380	0.0087	1	Complies
	ant 2	13.26	13±1	14	2.7	1.862	0.0093	1	Complies
IEEE 802.11ax HE40	ant 1	14.42	14±1	15	1.4	1.380	0.0087	1	Complies
	ant 2	12.69	12±1	13	2.7	1.862	0.0074	1	Complies
IEEE 802.11ac VHT80	ant 1	13.80	13±1	14	1.4	1.380	0.0069	1	Complies
	ant 2	12.27	12±1	13	2.7	1.862	0.0074	1	Complies
IEEE 802.11ax HE80	ant 1	17.35	17±1	18	1.4	1.380	0.0173	1	Complies
	ant 2	12.34	12±1	13	2.7	1.862	0.0074	1	Complies

2.UWB Mode

Mode	EIRP (dBm/50MHz)	Target EIRP (dBm/50MHz)	MAX Target EIRP (dBm/50MHz)	Power Density (S) (mW /cm2)	Limited of Power Density (S) (mW /cm2)	Test Result
UWB	-13.79	-13±1	-12	0.00001	1	Complies

3.MIMO(WIFI Mode)

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	0.0370	0.0323	0.0693	1	Complies
IEEE 802.11n HT40	0.0370	0.0323	0.0693	1	Complies
IEEE 802.11ax HE20	0.0234	0.0256	0.0490	1	Complies
IEEE 802.11ax HE40	0.0466	0.0406	0.0872	1	Complies
5G Band					
IEEE 802.11n HT20	0.0109	0.0093	0.0202	1	Complies
IEEE 802.11ac VHT20	0.0087	0.0093	0.0180	1	Complies
IEEE 802.11ax HE20	0.0087	0.0093	0.0180	1	Complies
IEEE 802.11n HT40	0.0087	0.0093	0.0180	1	Complies
IEEE 802.11ac VHT40	0.0087	0.0093	0.0180	1	Complies
IEEE 802.11ax HE40	0.0087	0.0074	0.0161	1	Complies
IEEE 802.11ac VHT80	0.0069	0.0074	0.0143	1	Complies
IEEE 802.11ax HE80	0.0173	0.0074	0.0247	1	Complies

Note: 2.4 and 5GHz bands are share an antenna, Can't both the 2.4 and 5 GHz bands operate simultaneously.

4.Simultaneous Transmission Mode (BT+WIFI+UWB Mode)

Mode	Result	Limit	Simultaneous Transmissions Result	Simultaneous Transmissions Limit	Total Result
BT	0.0021	1	0.08931	1	Complies
WIFI	0.0872	1			
UWB	0.00001	1			

End of Test Report