

FCC 47 CFR MPE REPORT

Bang & Olufsen a/s

Sound Bar

Model Number: Beosound Theatre

FCC ID: TTUBSTHEATRE

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

Antenna 1

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE 802.11b	2412	18.03	63.5331	18±1	2.79	1.901
	2437	18.66	73.4514	18±1	2.79	1.901
	2462	18.73	74.6449	18±1	2.79	1.901
IEEE 802.11g	2412	20.39	109.3956	20±1	2.79	1.901
	2437	20.86	121.8990	20±1	2.79	1.901
	2462	21.09	128.5287	21±1	2.79	1.901
IEEE 802.11n HT20	2412	19.62	91.6220	19±1	2.79	1.901
	2437	20.18	104.2317	20±1	2.79	1.901
	2462	20.18	104.2317	20±1	2.79	1.901
IEEE 802.11ax HE20	2412	18.89	77.4462	18±1	2.79	1.901
	2437	19.14	82.0352	19±1	2.79	1.901
	2462	19.10	81.2831	19±1	2.79	1.901
IEEE 802.11n HT40	2422	19.66	92.4698	19±1	2.79	1.901
	2437	19.24	83.9460	19±1	2.79	1.901
	2452	19.83	96.1612	19±1	2.79	1.901
IEEE 802.11ax HT40	2422	19.11	81.4704	19±1	2.79	1.901
	2437	19.20	83.1764	19±1	2.79	1.901
	2452	19.46	88.3080	19±1	2.79	1.901
IEEE 802.11a	5180	12.11	16.2555	12±1	2.61	1.824
	5200	12.49	17.7419	12±1	2.61	1.824
	5240	12.98	19.8609	12±1	2.61	1.824
	5260	10.52	11.2720	10±1	2.61	1.824
	5300	12.60	18.1970	12±1	2.61	1.824
	5320	12.63	18.3231	12±1	2.61	1.824
	5500	10.17	10.3992	10±1	2.61	1.824
	5580	11.23	13.2739	11±1	2.61	1.824
	5700	9.75	9.4406	9±1	2.61	1.824
	5745	11.04	12.7057	11±1	2.61	1.824
	5785	10.96	12.4738	10±1	2.61	1.824
	5825	10.93	12.3880	10±1	2.61	1.824

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE 802.11n HT20	5180	9.68	9.2897	9±1	2.61	1.824
	5200	9.80	9.5499	9±1	2.61	1.824
	5240	10.82	12.0781	10±1	2.61	1.824
	5260	10.54	11.3240	10±1	2.61	1.824
	5300	10.62	11.5345	10±1	2.61	1.824
	5320	10.69	11.7220	10±1	2.61	1.824
	5500	10.76	11.9124	10±1	2.61	1.824
	5580	11.57	14.3549	11±1	2.61	1.824
	5700	10.81	12.0504	10±1	2.61	1.824
	5745	11.09	12.8529	11±1	2.61	1.824
	5785	10.98	12.5314	10±1	2.61	1.824
	5825	11.01	12.6183	11±1	2.61	1.824
IEEE 802.11ac VHT20	5180	9.70	9.3325	9±1	2.61	1.824
	5200	9.76	9.4624	9±1	2.61	1.824
	5240	10.89	12.2744	10±1	2.61	1.824
	5260	10.28	10.6660	10±1	2.61	1.824
	5300	10.63	11.5611	10±1	2.61	1.824
	5320	10.32	10.7647	10±1	2.61	1.824
	5500	10.35	10.8393	10±1	2.61	1.824
	5580	11.63	14.5546	11±1	2.61	1.824
	5700	10.48	11.1686	10±1	2.61	1.824
	5745	11.12	12.9420	11±1	2.61	1.824
	5785	11.03	12.6765	11±1	2.61	1.824
	5825	11.01	12.6183	11±1	2.61	1.824
IEEE 802.11ax HE20	5180	9.83	9.6161	9±1	2.61	1.824
	5200	10.33	10.7895	10±1	2.61	1.824
	5240	11.01	12.6183	11±1	2.61	1.824
	5260	10.63	11.5611	10±1	2.61	1.824
	5300	10.71	11.7761	10±1	2.61	1.824
	5320	10.82	12.0781	10±1	2.61	1.824
	5500	10.91	12.3310	10±1	2.61	1.824
	5580	11.94	15.6315	11±1	2.61	1.824
	5700	10.60	11.4815	10±1	2.61	1.824
	5745	11.15	13.0317	11±1	2.61	1.824
5785	11.00	12.5893	11±1	2.61	1.824	

	5825	10.96	12.4738	10±1	2.61	1.824
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Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE 802.11n HT40	5190	10.17	10.3992	10±1	2.61	1.824
	5230	10.96	12.4738	10±1	2.61	1.824
	5270	12.63	18.3231	12±1	2.61	1.824
	5310	12.54	17.9473	12±1	2.61	1.824
	5510	10.39	10.9396	10±1	2.61	1.824
	5590	10.81	12.0504	10±1	2.61	1.824
	5670	10.31	10.7399	10±1	2.61	1.824
	5755	12.08	16.1436	12±1	2.61	1.824
	5795	11.20	13.1826	11±1	2.61	1.824
IEEE 802.11ac VHT40	5190	11.78	15.0661	11±1	2.61	1.824
	5230	11.78	15.0661	11±1	2.61	1.824
	5270	12.39	17.3380	12±1	2.61	1.824
	5310	12.34	17.1396	12±1	2.61	1.824
	5510	10.49	11.1944	10±1	2.61	1.824
	5590	11.00	12.5893	11±1	2.61	1.824
	5670	13.23	21.0378	13±1	2.61	1.824
	5755	12.12	16.2930	12±1	2.61	1.824
	5795	10.91	12.3310	10±1	2.61	1.824
IEEE 802.11ax HE40	5190	12.20	16.5959	12±1	2.61	1.824
	5230	13.01	19.9986	13±1	2.61	1.824
	5270	12.84	19.2309	12±1	2.61	1.824
	5310	12.42	17.4582	12±1	2.61	1.824
	5510	10.65	11.6145	10±1	2.61	1.824
	5590	11.09	12.8529	11±1	2.61	1.824
	5670	13.08	20.3236	13±1	2.61	1.824
	5755	11.62	14.5211	11±1	2.61	1.824
	5795	10.46	11.1173	10±1	2.61	1.824
IEEE 802.11ac VHT80	5210	12.50	17.7828	12±1	2.61	1.824
	5290	12.63	18.3231	12±1	2.61	1.824
	5530	10.58	11.4288	10±1	2.61	1.824
	5610	11.17	13.0918	11±1	2.61	1.824

	5775	10.96	12.4738	10±1	2.61	1.824
IEEE 802.11ax HE80	5210	12.70	18.6209	12±1	2.61	1.824
	5290	12.76	18.8799	12±1	2.61	1.824
	5530	10.84	12.1339	10±1	2.61	1.824
	5610	11.68	14.7231	11±1	2.61	1.824
	5775	11.17	13.0918	11±1	2.61	1.824

Antenna 2

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE 802.11b	2412	18.32	67.9204	18±1	3.43	2.203
	2437	18.40	69.1831	18±1	3.43	2.203
	2462	18.58	72.1107	18±1	3.43	2.203
IEEE 802.11g	2412	20.41	109.9006	20±1	3.43	2.203
	2437	20.45	110.9175	20±1	3.43	2.203
	2462	20.55	113.5011	20±1	3.43	2.203
IEEE 802.11n HT20	2412	19.61	91.4113	19±1	3.43	2.203
	2437	19.94	98.6279	19±1	3.43	2.203
	2462	19.96	99.0832	19±1	3.43	2.203
IEEE 802.11ax HE20	2412	19.13	81.8465	19±1	3.43	2.203
	2437	19.48	88.7156	19±1	3.43	2.203
	2462	19.69	93.1108	19±1	3.43	2.203
IEEE 802.11n HT40	2422	19.23	83.7529	19±1	3.43	2.203
	2437	19.36	86.2979	19±1	3.43	2.203
	2452	19.50	89.1251	19±1	3.43	2.203
IEEE 802.11ax HE40	2422	19.06	80.5378	19±1	3.43	2.203
	2437	19.40	87.0964	19±1	3.43	2.203
	2452	19.58	90.7821	19±1	3.43	2.203
IEEE 802.11a	5180	12.62	18.2810	12±1	2.36	1.722
	5200	12.31	17.0216	12±1	2.36	1.722
	5240	13.00	19.9526	13±1	2.36	1.722
	5260	12.89	19.4536	12±1	2.36	1.722
	5300	11.85	15.3109	11±1	2.36	1.722
	5320	11.84	15.2757	11±1	2.36	1.722
	5500	11.78	15.0661	11±1	2.36	1.722

	5580	13.09	20.3704	13±1	2.36	1.722
	5700	12.52	17.8649	12±1	2.36	1.722
	5745	11.73	14.8936	11±1	2.36	1.722
	5785	12.40	17.3780	12±1	2.36	1.722
	5825	12.19	16.5577	12±1	2.36	1.722

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE 802.11n HT20	5180	10.51	11.2460	10±1	2.36	1.722
	5200	10.61	11.5080	10±1	2.36	1.722
	5240	10.50	11.2202	10±1	2.36	1.722
	5260	10.50	11.2202	10±1	2.36	1.722
	5300	9.99	9.9770	9±1	2.36	1.722
	5320	9.12	8.1658	9±1	2.36	1.722
	5500	11.36	13.6773	11±1	2.36	1.722
	5580	11.79	15.1008	11±1	2.36	1.722
	5700	11.79	15.1008	11±1	2.36	1.722
	5745	11.78	15.0661	11±1	2.36	1.722
	5785	11.86	15.3462	11±1	2.36	1.722
	5825	12.76	18.8799	12±1	2.36	1.722
IEEE 802.11ac VHT20	5180	10.44	11.0662	10±1	2.36	1.722
	5200	10.64	11.5878	10±1	2.36	1.722
	5240	10.34	10.8143	10±1	2.36	1.722
	5260	11.60	14.4544	11±1	2.36	1.722
	5300	11.20	13.1826	11±1	2.36	1.722
	5320	10.88	12.2462	10±1	2.36	1.722
	5500	10.76	11.9124	10±1	2.36	1.722
	5580	11.98	15.7761	11±1	2.36	1.722
	5700	12.18	16.5196	12±1	2.36	1.722
	5745	12.47	17.6604	12±1	2.36	1.722
	5785	12.41	17.4181	12±1	2.36	1.722
	5825	12.77	18.9234	12±1	2.36	1.722
IEEE 802.11ax HE20	5180	10.67	11.6681	10±1	2.36	1.722
	5200	10.22	10.5196	10±1	2.36	1.722
	5240	10.58	11.4288	10±1	2.36	1.722
	5260	10.84	12.1339	10±1	2.36	1.722
	5300	10.12	10.2802	10±1	2.36	1.722

	5320	9.84	9.6383	9±1	2.36	1.722
	5500	10.75	11.8850	10±1	2.36	1.722
	5580	11.92	15.5597	11±1	2.36	1.722
	5700	12.35	17.1791	12±1	2.36	1.722
	5745	11.91	15.5239	11±1	2.36	1.722
	5785	12.71	18.6638	12±1	2.36	1.722
	5825	12.80	19.0546	12±1	2.36	1.722

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE 802.11n HT40	5190	12.39	17.3380	12±1	2.36	1.722
	5230	12.66	18.4502	12±1	2.36	1.722
	5270	11.86	15.3462	11±1	2.36	1.722
	5310	12.44	17.5388	12±1	2.36	1.722
	5510	11.26	13.3660	11±1	2.36	1.722
	5590	12.07	16.1065	12±1	2.36	1.722
	5670	12.27	16.8655	12±1	2.36	1.722
	5755	12.16	16.4437	12±1	2.36	1.722
IEEE 802.11ac VHT40	5190	12.46	17.6198	12±1	2.36	1.722
	5230	12.78	18.9671	12±1	2.36	1.722
	5270	12.40	17.3780	12±1	2.36	1.722
	5310	12.46	17.6198	12±1	2.36	1.722
	5510	11.88	15.4170	11±1	2.36	1.722
	5590	12.04	15.9956	12±1	2.36	1.722
	5670	12.24	16.7494	12±1	2.36	1.722
	5755	12.41	17.4181	12±1	2.36	1.722
IEEE 802.11ax HE40	5190	12.68	18.5353	12±1	2.36	1.722
	5230	12.92	19.5884	12±1	2.36	1.722
	5270	12.56	18.0302	12±1	2.36	1.722
	5310	12.62	18.2810	12±1	2.36	1.722
	5510	11.53	14.2233	11±1	2.36	1.722
	5590	12.26	16.8267	12±1	2.36	1.722
	5670	12.45	17.5792	12±1	2.36	1.722
	5755	12.73	18.7499	12±1	2.36	1.722
	5795	12.89	19.4536	12±1	2.36	1.722

802.11ac VHT80	IEEE	5210	13.09	20.3704	13±1	2.36	1.722
		5290	12.60	18.1970	12±1	2.36	1.722
		5530	13.30	21.3796	13±1	2.36	1.722
		5610	14.03	25.2930	14±1	2.36	1.722
		5775	13.02	20.0447	13±1	2.36	1.722
802.11ax HE80	IEEE	5210	13.86	24.3220	13±1	2.36	1.722
		5290	12.72	18.7068	12±1	2.36	1.722
		5530	12.12	16.2930	12±1	2.36	1.722
		5610	13.92	24.6604	13±1	2.36	1.722
		5775	13.22	20.9894	13±1	2.36	1.722

3. Calculated Result and Limit

Antenna 1

Mode	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						
IEEE 802.11b	19	2.79	1.901	0.0300	1	Complies
IEEE 802.11g	22	2.79	1.901	0.0599	1	Complies
IEEE 802.11n HT20	21	2.79	1.901	0.0476	1	Complies
IEEE 802.11ax HE20	20	2.79	1.901	0.0378	1	Complies
IEEE 802.11n HT40	20	2.79	1.901	0.0378	1	Complies
IEEE 802.11ax HE40	20	2.79	1.901	0.0378	1	Complies
5G Band						
IEEE 802.11a	13	2.61	1.824	0.0072	1	Complies
IEEE 802.11n HT20	12	2.61	1.824	0.0060	1	Complies
IEEE 802.11ac VHT20	12	2.61	1.824	0.0060	1	Complies
IEEE 802.11ax HE20	12	2.61	1.824	0.0060	1	Complies
IEEE 802.11n HT40	13	2.61	1.824	0.0075	1	Complies
IEEE 802.11ac VHT40	14	2.61	1.824	0.0095	1	Complies
IEEE 802.11ax HE40	14	2.61	1.824	0.0095	1	Complies
IEEE 802.11ac VHT80	12	2.61	1.824	0.0060	1	Complies
IEEE 802.11ax HE80	13	2.61	1.824	0.0075	1	Complies

Antenna 2

Mode	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						
IEEE 802.11b	19	3.43	2.203	0.0348	1	Complies
IEEE 802.11g	21	3.43	2.203	0.0552	1	Complies
IEEE 802.11n HT20	20	3.43	2.203	0.0438	1	Complies
IEEE 802.11ax HE20	20	3.43	2.203	0.0438	1	Complies
IEEE 802.11n HT40	20	3.43	2.203	0.0438	1	Complies
IEEE 802.11ax HE40	20	3.43	2.203	0.0438	1	Complies
5G Band						
IEEE 802.11a	14	2.36	1.722	0.0272	1	Complies
IEEE 802.11n HT20	13	2.36	1.722	0.0431	1	Complies
IEEE 802.11ac VHT20	13	2.36	1.722	0.0343	1	Complies
IEEE 802.11ax HE20	13	2.36	1.722	0.0343	1	Complies
IEEE 802.11n HT40	13	2.36	1.722	0.0343	1	Complies
IEEE 802.11ac VHT40	13	2.36	1.722	0.0343	1	Complies
IEEE 802.11ax HE40	13	2.36	1.722	0.0060	1	Complies
IEEE 802.11ac VHT80	15	2.36	1.722	0.0087	1	Complies
IEEE 802.11ax HE80	14	2.36	1.722	0.0083	1	Complies

Antenna 1+2

Mode	Power Density (S) (mW/cm ²) Antenna 1	Power Density (S) (mW/cm ²) Antenna 2	Power Density (S) (mW/cm ²) Total	Limited of Power Density (S) (mW/cm ²)	Test Result
2.4G Band					
IEEE 802.11n HT20	0.0476	0.0438	0.0914	1	Complies
IEEE 802.11ax HE20	0.0378	0.0438	0.0816	1	Complies
IEEE 802.11n HT40	0.0378	0.0438	0.0816	1	Complies
IEEE 802.11ax HE40	0.0378	0.0438	0.0816	1	Complies
5G Band					
IEEE 802.11n HT20	0.0060	0.0431	0.0491	1	Complies
IEEE 802.11ac VHT20	0.0060	0.0343	0.0403	1	Complies
IEEE 802.11ax HE20	0.0060	0.0343	0.0403	1	Complies
IEEE 802.11n HT40	0.0075	0.0343	0.0418	1	Complies
IEEE 802.11ac VHT40	0.0095	0.0343	0.0438	1	Complies
IEEE 802.11ax HE40	0.0095	0.0060	0.0155	1	Complies
IEEE 802.11ac VHT80	0.0060	0.0087	0.0147	1	Complies
IEEE 802.11ax HE80	0.0075	0.0083	0.0158	1	Complies

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

End of Test Report