

Assessment report

415157-1R3ARFWL

Date of issue: February 2, 2022

Applicant:

Sonendo, Inc.

Product:

GentleWave

Model

FG-012-00001

FCC ID:

2AY6J-FG-012-00001

IC ID:

27819-FG01200001

Type of assessment:


SAR Exemption Report

Specifications:

- ◆ FCC 47 CFR Part 2 Subpart J, §2.1093
- ◆ KDB 447498 D01 General RF Exposure Guidance v06
- ◆ RSS-102 Issue 5 Amendment 1, (February 2021) – Annex C

Lab and test locations

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Review date	February 2, 2022
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

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Section 1 Declaration

Standards:

FCC 47 CFR Part 2 Subpart J, §2.1093

KDB 447498 D01 General RF Exposure Guidance v06

RSS-102 Issue 5 Amendment 1, (February 2021) – Annex C

Attestation:

I attest that the radiocommunication apparatus meets the exemption from the routine evaluation limits in these standards; that the Technical Brief was prepared, and the information contained therein is correct; that the device evaluation was performed and/or supervised by me; that the applicable measurement methods and evaluation methodologies have been followed; and that the device meets the SAR and/or RF field strength limits of the above standards.

Date of issue: February 2, 2022

James Cunningham, EMC/MIL/WL Supervisor

Prepared by



Signature

Section 2 Evaluation summary

2.1 SAR exemption for stand-alone transmission

2.1.1 References, definition, and limits

FCC §2.1093

- (2) The SAR limits for general population/uncontrolled exposure are 0.08 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 1.6 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit is 4 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 30 minutes to determine compliance with general population/uncontrolled SAR limits.

KDB 447498 D01:

4.3.1 Standalone SAR test exclusion considerations

During normal operation, user extremities can come within 20 cm of the internal antenna and therefore product is considered as “Portable”.

- a) The 1-g head or body and 10-g extremity SAR test exclusion thresholds for 100 MHz to 6 GHz at Test separation distances ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) \div (\text{min. test separation distance, mm})] \times [v(F(\text{GHz}))] \leq 3.0$$
 for 1-g head or body SAR, and ≤ 7.5 for 10-g extremity SAR, where
 $F(\text{GHz})$ is the RF channel transmit frequency in GHz
- b) The 1 g head or body and 10 g extremity SAR test exclusion thresholds for 100 MHz to 6 GHz at Test separation distances > 50 mm are determined by:
 - 1) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{Test separation distance} - 50 \text{ mm}) \times (f_{(\text{MHz})}/150)]\}$ mW, for 100 MHz to 1500 MHz
 - 2) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{Test separation distance} - 50 \text{ mm}) \times 10]\}$ mW, for 100 MHz to 1500 MHz
- c) The 1 g head or body and 10 g extremity SAR test exclusion thresholds for below 100 MHz are determined by:
 - 1) For test separation distances > 50 mm and < 200 mm, the power threshold of the corresponding test separation distance at 100 MHz in step b) is multiplied by $[1 + \log(100/f_{(\text{MHz})})]$
 - 2) For test separation distances ≤ 50 mm, the power threshold is determined by the equation in c) 1) above for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$.

Table 2.1-1: SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

Separation:	5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	50 mm
150 MHz	39	77	116	155	194	232	271	310	349	387
300 MHz	27	55	82	110	137	164	192	219	246	274
450 MHz	22	45	67	89	112	134	157	179	201	224
835 MHz	16	33	49	66	82	98	115	131	148	164
900 MHz	16	32	47	63	79	95	111	126	142	158
1500 MHz	12	24	37	49	61	73	86	98	110	122
1900 MHz	11	22	33	44	54	65	76	87	98	109
2450 MHz	10	19	29	38	48	57	67	77	86	96
3600 MHz	8	16	24	32	40	47	55	63	71	79
5200 MHz	7	13	20	26	33	39	46	53	59	66
5400 MHz	6	13	19	26	32	39	45	52	58	65
5800 MHz	6	12	19	25	31	37	44	50	56	62

Notes: Values in the table are in mW

10-g Extremity SAR Test Exclusion Power Thresholds are 2.5 times higher than the 1-g SAR Test Exclusion Thresholds indicated above. These thresholds do not apply, by extrapolation or other means, to occupational exposure limits.

Table 2.1-2: SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and > 50 mm

Separation:	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm	110 mm	120 mm	130 mm	140 mm	150 mm	160 mm	170 mm	180 mm	190 mm
100 MHz	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567
150 MHz	387	397	407	417	427	437	447	457	467	477	487	497	507	517	527
300 MHz	274	294	314	334	354	374	394	414	434	454	474	494	514	534	554
450 MHz	224	254	284	314	344	374	404	434	464	494	524	554	584	614	644
835 MHz	164	220	275	331	387	442	498	554	609	665	721	776	832	888	943
900 MHz	158	218	278	338	398	458	518	578	638	698	758	818	878	938	998
1500 MHz	122	222	322	422	522	622	722	822	922	1022	1122	1222	1322	1422	1522
1900 MHz	109	209	309	409	509	609	709	809	909	1009	1109	1209	1309	1409	1509
2450 MHz	96	196	296	396	496	596	696	796	896	996	1096	1196	1296	1396	1496
3600 MHz	79	179	279	379	479	579	679	779	879	979	1079	1179	1279	1379	1479
5200 MHz	66	166	266	366	466	566	666	766	866	966	1066	1166	1266	1366	1466
5400 MHz	65	165	265	365	465	565	665	765	865	965	1065	1165	1265	1365	1465
5800 MHz	62	162	262	362	462	562	662	762	862	962	1062	1162	1262	1362	1462

Notes: Values in the table are in mW

Table 2.1-3: SAR Test Exclusion Thresholds for <100 MHz and < 50 mm

Separation:	<50 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm	110 mm	120 mm	130 mm	140 mm	150 mm	160 mm	170 mm	180 mm	190 mm
100 MHz	237	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567
50 MHz	308	617	625	634	643	651	660	669	677	686	695	703	712	721	729	738
10 MHz	474	948	961	975	988	1001	1015	1028	1041	1055	1068	1081	1095	1108	1121	1135
1 MHz	711	1422	1442	1462	1482	1502	1522	1542	1562	1582	1602	1622	1642	1662	1682	1702
0.1 MHz	948	1896	1923	1949	1976	2003	2029	2056	2083	2109	2136	2163	2189	2216	2243	2269
0.05 MHz	1019	2039	2067	2096	2125	2153	2182	2211	2239	2268	2297	2325	2354	2383	2411	2440
0.01 MHz	1185	2370	2403	2437	2470	2503	2537	2570	2603	2637	2670	2703	2737	2770	2803	2837

Notes: Values in the table are in mW

RSS-102, Section 2.5.1

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in table below

Table 2.1-4: Exemption limits for routine evaluation based on frequency and separation distance

Separation:	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
≤300 MHz	71	101	132	162	193	223	254	284	315	345
450 MHz	52	70	88	106	123	141	159	177	195	213
835 MHz	17	30	42	55	67	80	92	105	117	130
900 MHz	7	10	18	34	60	99	153	225	316	431
2450 MHz	4	7	15	30	52	83	123	173	235	309
3500 MHz	2	6	16	32	55	86	124	170	225	290
5800 MHz	1	6	15	27	41	56	71	85	97	106

Notes: Values in the table are in mW

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table above are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table above are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants' device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

2.1.2 EUT technical information

Type of EUT use	Head
Minimum separation distance	5 mm
Operational frequency	13.56 MHz
Antenna type	Integrated antenna
Maximum EIRP	-21.61 dBm (0.0069 mW)

2.1.3 Justification for SAR test exclusion

Calculation according to KDB 447498 D01, Clause 4.3.1:

- $\frac{1}{2} \left[1 + \log \left(\frac{100}{100} \right) \right] \times \left[\left(\text{Power allowed at numeric threshold for 50 mm in step a} \right) + (50 \text{ mm} - 50 \text{ mm}) \times \left(\frac{100}{150} \right) \right]$
- $\frac{1}{2} [1 + 0] \times \left[\left(\text{Power allowed at numeric threshold for 50 mm in step a} \right) + (0) \times \left(\frac{100}{150} \right) \right]$
- $\frac{1}{2} [\text{Power allowed at numeric threshold for 50 mm in step a}]$
- $\frac{\text{max power}}{\text{min distance}} \times \sqrt{f} \leq 3.0$
- $\text{max power} \leq \frac{3.0 \times \text{min distance}}{\sqrt{f}}$
- $\text{max power} \leq \frac{3.0 \times \text{min distance}}{\sqrt{0.16 \text{ Hz}}} = 474 \text{ mW}$
- $\text{max power} = \frac{1}{2} \times 474 \text{ mW} = 237 \text{ mW}$

The ERP of the EUT is 0.0069 mW which is less than the maximum allowed power.

Table 2.1-5: SAR exemption verification for ISSED

Transmit frequency, MHz	Maximum EIRP, mW	Separation distance, mm	Limit, mW	Margin, dB
13.56	0.0069	5	71	40.1

Note: Margin was calculated as follows: $10 \times \log_{10}(\text{Limit} / \text{Maximum EIRP})$

2.1.4 Verdict

The calculation is below the threshold; therefore, the product is exempt from the SAR test requirements.

End of report