DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España

Assessment report No:

NIE: 56788RAN.004

Assessment report
RF EXPOSURE REPORT ACCORDING TO FCC 47 CFR Part 2.1093 ISED RSS -102 Issue 5:2015

Identification of item tested.....:	Hearing aid
Trademark .....:	Phonak
Model and /or type reference .....:	Phonak Audéo M90-312T
Other identification of the product .....:	---
Final HW version .....:	050-0491 to 050-0519
Final SW version .....:	067-1300 to 067-1311
Features.....:	Not provided data
Manufacturer.....:	SONOVA AG Laubisruetistrasse 28, 8712 Staefa, Switzerland
Test method requested, standard.....:	FCC 47 CFR Part 2.1093. (10-1-15 Edition) Radiofrequency radiation exposure evaluation: portable devices. ISED RSS-102 Issue 5 (2015-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
Summary.....:	IN COMPLIANCE
Approved by (name / position & signature) .....:	Miguel Lacave Antennas Lab Manager MIGUEL LACAVE GARCÍA 2018.08.31 14:11:17 +02'00'
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Identification of the client

SONOVA AG

Laubisruetistrasse 28, 8712 Staefa, Switzerland

General description of the device under evaluation

The device under evaluiation consists of a hearing aid with wireless connectivity and rechargeable battery.

The device has one transmitting antenna and is able to transmit into four different transmission modes. Simultaneous transmission is not supported by the device.

The M90 comes with three different variants: M90-13T, M90-312 and M90-312T, which are identical in terms of radio components. M90-312T was selected based on preliminary testing that identified it as worst case for radiated spurious emissions. The equipment specifications declared by the manufacturer are:

Mode	Frequency (MHz)	Max. declared output power (dBm)	Max. declared output power (mW)	Max. antenna gain (dBi)	Max. E.I.R.P (dBm)	Max. E.I.R.P (mW)
Bluetooth Low Energy/ Bluetooth Basic Rate/ Proprietary protocol DM/ Proprietary protocol Flora	2400-2483.5	0.0	1.0	-7.0	-7.0	0.2

Table 1: Declared output power and antenna gain values

Assessment summary

Radiofrequency radiation exposure limits			
FCC 47 CFR § 2.1093 & ISED RSS-102 Issue 5 (2015-03)			
Band (MHz)	**Technology**	**Band**	**VERDICT (Pass/Fail)**
2450	Bluetooth Low Energy	ISM	Pass
	Bluetooth Basic Rate		Pass
	Proprietary protocol DM		Pass
	Proprietary protocol Flora		Pass

Table 2: Assessment summary

Appendix A – FCC RF Exposure

FCC Exposure evaluation portable or mobile devices

Human exposure to RF emissions from portable devices (47 CFR §2.1093), as defined by the FCC, must be evaluated with respect to the FCC-adopted limits for SAR. Evaluation of mobile devices, as defined by the FCC, may also be performed with respect to SAR limits, but in such cases it is usually simpler and more cost-effective to evaluate compliance with respect to field strength or power density limits. For certain devices that are designed to be used in both mobile and portable configurations similar to those described in 47 CFR §2.1091(d)(4), such as certain desktop phones and wireless modem modules, compliance for mobile configurations is also satisfied when the same device is evaluated for SAR compliance in portable configurations.

FCC SAR test exclusion considerations

According to FCC OET KDB 447498 D01 General RF Exposure Guidance:

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition is satisfied.

- For distances ≤ 50 mm

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [√f(GHz)]

≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

Where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table:

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

Table 3: SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

- For distances > 50 mm

For 100 MHz to 6 GHz frequencies and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following:

1) [Power allowed at numeric threshold for 50 mm in table 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz

2) [Power allowed at numeric threshold for 50 mm in table 1) + (test separation distance - 50 mm)·10] mW, at > 1500 MHz and ≤ 6 GHz

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table

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

Table 4: SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and > 50 mm

- For frequencies below 100 MHz

The following may be considered for SAR test exclusion:

1) For test separation distances > 50 mm and < 200 mm, the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by [1 + log(100/f(MHz))]

2) For test separation distances ≤ 50 mm, the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by ½

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table

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

Table 5: SAR Test Exclusion Thresholds for frequencies < 100 MHz

FCC Evaluation Results

The maximum declared output power of the device is 0.0 dBm, which corresponds to 1.0 mW. The evaluation according to an intended use distance of 5 mm will be as follow:

Technology	Max Declared Time Avg. Output Power (dBm)		Min. Test Distance (mm)	Freq. (GHz)	Result	Test Exclusion
	(dBm)	(mW)				
Bluetooth Low Energy/ Bluetooth Basic Rate/ Proprietary protocol DM/ Proprietary protocol Flora	0.0	1.0	5	2.48	0.32	Pass

Table 6: Evaluation Result

The computed value 0.32 is < 3.0, so according to KDB 447498 D01 – General RF Exposure Guidance, this mode qualifies for Standalone SAR test exclusion for 1-g SAR and 10-g SAR.

Appendix B – ISED RF Exposure

ISED SAR test exclusion considerations

According to "RSS-102 Issue 5 (2015-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)", paragraph "2.5.1 Exemption Limits for Routine Evaluation – SAR Evaluation", the device operates below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1:

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 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. If the operating frequency of the device is between two frequencies lotaced 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

ISED Evaluation Results

According to paragraph "2.5.1 Exemption Limits for Routine Evaluation – SAR Evaluation", the exemption limits for the applicable separation distance have been calculated by linear interpolation for the following operating frequencies:

Frequency (MHz)	Distance (mm)	Exemption Limits (mW)
2402	5	4.26
2440	5	4.05
2480	5	3.95

Table 7: Exemption Limits

The maximum declared output power of the device is 0.0 dBm, which corresponds to 1.0 mW. As the transmitting antenna of the device has a negative gain, the maximum output power has been used for the evaluation as a worst case condition:

Technology	Frequency (MHz)	Max. Declared Output Power (dBm)	Max. Declared Output (mW)	ISED Exemption Limits (mW)	Verdict
Bluetooth LE	2402	0.0	1.0	4.26	Pass
	2440	0.0	1.0	4.05	Pass
	2480	0.0	1.0	3.95	Pass

Table 8: Evaluation Result

As all operating frequencies comply with SAR Test Exclusion Thresholds, according to the standard "ISED RSS-102 Issue 5 (2015-03)", SAR testing is not required.