

RF Exposure Report

Report No.: MFBHKO-WTW-P22010776

FCC ID: 2A3ULSB02M

Test Model: SB02M

Received Date: 2022/1/24

Test Date: 2022/3/29 ~ 2022/4/26

Issued Date: 2022/8/11

Applicant: Sonova Consumer Hearing GmbH

Address: Am Labor 1, 30900 Wedemark, Germany

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

Test Location: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

**FCC Registration /
Designation Number:** 198487 / TW2021



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Release Control Record

Issue No.	Description	Date Issued
MFBHKO-WTW-P22010776	Original release.	2022/8/11

1 Certificate of Conformity

Product Name: AMBEO Soundbar Plus

Brand Name: Sennheiser

Model No.: SB02M

Sample Status: Engineering sample

Applicant: Sonova Consumer Hearing GmbH

Test Date: 2022/3/29 ~ 2022/4/26

FCC Rule Part: FCC Part 2 (Section 2.1091 & 2.1093)

Standards: KDB 447498 D04 Interim General RF Exposure Guidance v01

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by :

Annie Chang

Date: 2022/8/11

Annie Chang / Senior Specialist

Approved by :

Jeremy Lin

Date: 2022/8/11

Jeremy Lin / Project Engineer

2 General Information

Test item description	AMBEO Soundbar
Product Name	AMBEO Soundbar Plus
Brand Name	Sennheiser
Model No.	SB02M
HW Version	DVT sample
SW Version	3.0.0.20
Status of EUT	Engineering sample
Power Ratings	AC I/P: 100-240Vac 50/60Hz max 2A
Power Supply (Nominal and Testing)	100-240Vac
Temperature Operating Range	0°C ~ 40°C
Modulation Type	GFSK
Transmission Technology	DSSS
Technology	Bluetooth
Channel Spacing	2MHz
Channel Bandwidth	80MHz
Data Transfer Rate	Bluetooth LE 4.0: 1Mbps Bluetooth LE 5.2: 2Mbps
Operating Frequency	2402MHz ~ 2480MHz
For Frequency Band	2400MHz ~ 2483.5MHz
Number of Channel	40
Output Power	Bluetooth LE 4.0: 1.919 mW (2.83 dBm) Bluetooth LE 5.2: 1.923 mW (2.84 dBm)
Accessory Device	Remote Control (Sennheiser/SB02-RC)
Data Cable Supplied	Non-shielded AC 2-Pin cable (2.0m) Shielded HDMI cable (1.5m)

Note:

1. The EUT contains following wireless modules:

Module	Wireless Function	Antenna	FCC ID
WLAN+BT Combo	WLAN 2.4G WLAN 5G BT EDR BT LE	Antenna 1&2	2AJYB-ST1955
BT LE	BT LE	Antenna 3	Certified with EUT

2. WLAN+BT Combo module & BT LE module can transmit at same time.

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

2.1 Antenna Gain

The antenna information is listed as below.

Antenna No.	Frequency Range (MHz)	Antenna Peak Gain (dBi)			Antenna Type	Antenna Connector
		ZX	ZY	XY		
Antenna 1	2400	0.67	-0.77	1.93	PCB	ipex(MHF)
	2450	2.61	-0.82	3.03	PCB	ipex(MHF)
	2500	2.34	-0.84	1.63	PCB	ipex(MHF)
	5150	-0.07	-0.46	0.75	PCB	ipex(MHF)
	5500	0.94	0.59	-0.74	PCB	ipex(MHF)
	5850	2.48	0.51	-0.35	PCB	ipex(MHF)
Antenna 2	2400	0.39	-0.97	1.63	PCB	ipex(MHF)
	2450	1.21	-0.06	1.93	PCB	ipex(MHF)
	2500	1.57	0.00	1.45	PCB	ipex(MHF)
	5150	-1.64	3.29	4.10	PCB	ipex(MHF)
	5500	-2.24	3.65	3.83	PCB	ipex(MHF)
	5850	-2.14	3.46	3.20	PCB	ipex(MHF)
Antenna 3	2400	-2.21	-0.74	2.08	PCB	ipex(MHF)
	2450	-2.63	0.30	3.17	PCB	ipex(MHF)
	2500	-2.91	-0.02	2.24	PCB	ipex(MHF)

*Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

3 Applicable RF Exposure Limit

§ 1.1310 Radiofrequency radiation exposure limits.

(a) Specific absorption rate (SAR) shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b) of this part within the frequency range of 100 kHz to 6 GHz (inclusive).

(b) The SAR limits for occupational/controlled exposure are 0.4 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 8 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 for occupational/controlled exposure is 20 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 6 minutes to determine compliance with occupational/controlled SAR limits.

(c) 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.

(e) Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields

➤ Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (minutes)
Limits For General Population / Uncontrolled Exposure				
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	f/1500	30
1500-100,000	1.0	30

➤ Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (minutes)
Limits For General Population / Uncontrolled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6

4 Applicable Evaluation Criteria

1 mW Blanket Exemption – §1.1307(b)(3)(i)(A)

- The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A).

MPE-based Exemption – §1.1307(b)(3)(i)(C)

- The minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. Table applies to any RF source (i.e. single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits.

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R ² .
1.34-30	3,450 R ² /f ² .
30-300	3.83 R ² .
300-1,500	0.0128 R ² f.
1,500-100,000	19.2R ² .
R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters.	

MPE-based Exemption – §1.1307(b)(3)(i)(B)

- For mobile devices that are not exempt per Table 1 of §1.1307(b)(1)(i)(C) and device at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz.

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

SAR-based Exemption - §1.1307(b)(3)(i)(B)

- The SAR-based exemption formula of §1.1307(b)(3)(i)(B), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW). This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}}(d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

and f is in GHz, d is the separation distance (cm)

When 10-g extremity SAR applies, SAR test exemption may be considered by applying a factor of 2.5 to the SAR-based exemption thresholds.

Multiple RF Sources

Sum of multiple sources is less than 1 mW during the time-averaging period – §1.1307(b)(3)(ii)(A)

- The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

Fixed RF sources operating in the same time-averaging period – §1.1307(b)(3)(ii)(B)

- Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (Evaluated_k term) should be used to determine exemption for simultaneous transmission according to Formula below,

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

The sum of the ratios of the applicable terms for SAR-based, MPE-based and measured SAR or MPE should be less than 1, to determine simultaneous transmission exposure compliance.

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using [paragraph \(b\)\(3\)\(i\)\(B\)](#) of this section for P_{th} , including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

$P_{th,i}$ = the exemption threshold power (P_{th}) according to [paragraph \(b\)\(3\)\(i\)\(B\)](#) of this section for fixed, mobile, or portable RF source i .

$ERP_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source j , at a distance of at least $\lambda/2\pi$ according to the applicable formula of [paragraph \(b\)\(3\)\(i\)\(C\)](#) of this section.

$Exposure Limit_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k , as applicable from [§ 1.1310 of this chapter](#).

b = number of fixed, mobile, or portable RF sources claiming exemption using [paragraph \(b\)\(3\)\(i\)\(C\)](#) of this section for Threshold ERP, including existing exempt transmitters and those being added.

P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

ERP_j = the ERP of fixed, mobile, or portable RF source j .

$Evaluated_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

5 Test Result

FCC ID: 2A3ULSB02M

MPE-based Exemption §1.1307(b)(3)(i)(C)							
Operation Mode	Frequency Band (MHz)	Average Power (mW)	Antenna Gain (dBi)	Maximum ERP (mW)	Distance (cm)	Limit Threshold (mW)	Test Result
Bluetooth	2402-2480	1.892	3.17	2.393	20	768	Pass

Contain FCC ID: 2AJYB-ST1955

MPE-based Exemption §1.1307(b)(3)(i)(C)							
Operation Mode	Frequency Band (MHz)	Average Power (mW)	Antenna Gain (dBi)	Maximum ERP (mW)	Distance (cm)	Limit Threshold (mW)	Test Result
WLAN 2.4GHz	2412-2462	99.31	3.03	121.617	20	768	Pass
WLAN 5GHz	5180-5825	32.35	4.1	50.684	20	768	Pass
Bluetooth	2402-2480	4.27	3.03	5.229	20	768	Pass

Note:

- Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- FCC ID: 2AJYB-ST1955 & FCC ID: 2A3ULSB02M can transmit at same time.

Multiple RF Sources (Simultaneous Operations)

Co-location Condition

Multiple RF Sources (Simultaneous Operations)							
Exemption Evaluation					Sum of Ratios	Limit of Ratios	Test Result
Operation Mode	Frequency Band (MHz)	Maximum ERP (mW)	Limit Threshold (mW)	Ratio			
WLAN 2.4GHz (FCC ID: 2AJYB-ST1955)	2412-2462	121.617	768	0.158	0.161	1	Pass
Bluetooth (FCC ID: 2A3ULSB02M)	2402-2480	2.393	768	0.003			

6 Conclusion

Source-base time average power is below Exemption Criteria and/or MPE thresholds, therefore the device is compliant FCC RF exposure requirement.

7 Construction photos of EUT

Please refer to the attached file: BHKO-WTW-P22010776 (EUT Photo).

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