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Test report No:
NIE: 60224RAN.001

Assessment report
RF EXPOSURE REPORT ACCORDING TO
IEEE Std C95.3TM -2002 (R2008)
ISED RSS-102 Issue 5:2015

Identification of item tested	Excalibur is a device that allows to wirelessly communicate with Sonova hearing devices in Sonova's production environments
Trademark	Bluetooth IF Excalibur
Model and /or type reference	Excalibur
Other identification of the product	FCC ID: KWC-BIO IC: 2262A-BIO HW Version: 1.1 SW Version: 1.0.0.1
Features	Bluetooth LE
Manufacturer (EU)	SONOVA AG Laubisruetistrasse 28, 8712 Staefa, Zurich, Switzerland
Test method requested, standard	IEEE Std C95.3TM -2002 (R2008). IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile 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 2019.03.25 09:32:41 +01'00'
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Data provided by the client

Excalibur is a device that allows to wirelessly communicate with Sonova hearing devices in Sonova's production environments.

The Excalibur is compatible to all Sonova wireless Boston HI devices and future Bluetooth HIs based on BLE.

It can be used by any Sonova brand.

The use of the Excalibur is restricted to Operation Centers (OCs) and Group Companies (GCs).

The Excalibur is intended to be installed and operated by trained personal only. The operator will not be in permanent contact with the Excalibur device.

The Excalibur is used to communicate with the DUT, during manufacturing processes and only during that period time.

The Excalibur device:

- establishes a wireless connection with the DUT, and a wired connection with the computer controlling the test
- sends and receives data via Bluetooth BLE, using a Sonova specific profile only
- allows configuration and programming of DUT during manufacturing tests
- is re-usable for future HI generations of the Sonova AG
- has LEDs for visual feedback about its power state and its status
- can be used by all Sonova Hearing aids brands
- does NOT process any personal data, therefore no further detailed privacy impact assessment is required

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Identification of the client

SONOVA AG

Laubisruetistrasse 28, 8712 Staefa, Zurich, Switzerland

Document history

Report number	Date	Description
60224RAN.001	2019-03-25	First release

General description of the device under evaluation

The device under evaluation allows to wirelessly communicate with Sonova hearing devices in Sonova's production environments.

According to the manufacturer, during its normal use, the separation distance between the device and the body of nearby users will be greater than 30 cm. In order to perform the assessment a conservative separation distance of 20 cm has been used.

The equipment specifications declared by the manufacturer for the Bluetooth LE supported feature are:

Mode	Frequency (MHz)	Max. declared output power (dBm)	Max. antenna gain (dBi)	Max. E.I.R.P (dBm)	Max. E.I.R.P (mW)
Bluetooth LE	2402 - 2480	4.0	-0.9	3.1	2.04

Table 1: Declared output power and antenna gain values

Assessment summary

Radiofrequency radiation exposure limits				
FCC 47 CFR § 2.1091 & ISED RSS-102 Issue 5 (2015-03)				
Assessment	**Band (MHz)**	**Technology**	**Band**	**VERDICT (Pass/Fail)**
1	2450	Bluetooth LE	ISM	Pass

Table 2: Assessment summary

Appendix A: FCC RF Exposure

FCC RF Exposure evaluation

Devices operating in standalone mobile device exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously. A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits. The distance must be at least 20 cm and fully supported by the operating and installation configurations of the transmitter and its antenna(s), according to the source-based time-averaged maximum power requirements of § 2.1091(d)(2). In cases where cable losses or other attenuations are applied to determine compliance, the most conservative operating configurations and exposure conditions must be evaluated. The minimum test separation distance required for a device to comply with mobile device exposure conditions must be clearly identified in the installation and operating instructions, for all installation and exposure conditions, to enable users and installers to comply with RF exposure requirements. For mobile devices that have the potential to operate in portable device exposure conditions, similar to the configurations described in § 2.1091(d)(4), a KDB inquiry is required to determine the SAR test requirements for demonstrating compliance.

When a device qualifies for the categorical exclusion provision of § 2.1091(c), the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance. When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to §1.1310 Radiofrequency radiation exposure limits, paragraph (e), the limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields are:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3–3.0	614	1.63	*100	6
3.0–30	1842/f	4.89/f	*900/f²	6
30–300	61.4	0.163	1.0	6
300–1,500	.....	.....	f/300	6
1,500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*100	30
1.34–30	824/f	2.19/f	*180/f²	30
30–300	27.5	0.073	0.2	30
300–1,500	.....	.....	f/1500	30
1,500–100,000	.....	.....	1.0	30

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

FCC MPE Evaluation Results

Each supported transmission technology will be evaluated to determine if it is in compliance with limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

In order to perform the assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst case" or conservative prediction:

Power density: $S[mW/cm^2] = \frac{P_{E.I.R.P.}[mW]}{4\Pi R[cm]^2}$

Minimum compliance distance: $R_{\min}[cm] = \sqrt{\frac{P_{E.I.R.P.}[mW]}{4\Pi S[mW/cm^2]}}$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

$R_{\min}$ = distance to the center of radiation of the antenna

Assessment 1 – Bluetooth 2.45 GHz Band

Maximum output power (dBm):	4.0
Maximum antenna Gain (dBi):	-0.9
Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	2402.0
Maximum EIRP (dBm):	3.1
Maximum EIRP (mW):	2.04
General population - Power density limit (mW/cm^2):	1.0

Power density at minimum use distance:

Power density (mW/cm^2):	0.00041
General population - Power density limit (mW/cm^2):	1.0
Verdict for general population:	PASS

The power density level for this transmission mode is below general population exposure power density limit.

Minimum compliance distance for this technology:

Minimum compliance distance for general population (cm):	0.4
Minimum use distance (cm):	20.0
Verdict for general population:	PASS

The minimum use distance is greater than general population exposure minimum compliance distance.

Appendix B: ISED RF Exposure

ISED RF Exposure evaluation

According to RSS-102 Issue 5, Paragraph "4. Exposure Limits", Industry of Canada has adopted the RF field strength limits established in Health Canada's RF exposure guideline, Safety code 6:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142\,f^{0.3417}$	$0.008335\,f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158\,f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

ISED MPE Evaluation Results

Each supported transmission technology will be evaluated to determine if it is in compliance with RSS-102 Issue 5, RF Field Strength Limits for devices used by the General Public.

In order to perform the assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst case" or conservative prediction:

Power density: $S[W/m^2] = \frac{P_{E.I.R.P.}[W]}{4\Pi R[m]^2}$

Minimum compliance distance: $R_{\min}[m] = \sqrt{\frac{P_{E.I.R.P.}[W]}{4\Pi S[W/m^2]}}$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

$R_{\min}$ = distance to the center of radiation of the antenna

Assessment 1 – Bluetooth 2.45 GHz Band

Maximum output power (dBm):	4.0
Maximum antenna gain (dBi):	-0.9
Minimum use distance (m):	0.2
Worst Case Frequency (MHz):	2402.0
Maximum EIRP (dBm):	3.10
Maximum EIRP (W):	0.002
General public - Power density limit (W/m^2):	5.35

Power density at minimum use distance:

Power density (W/m^2):	0.004
General public - Power density limit (W/m^2):	5.35
Verdict for general public:	PASS

The power density level for this transmission mode is below general public power density limit.

Minimum compliance distance for this technology:

Minimum compliance distance for general public (m):	0.006
Minimum use distance (m):	0.2
Verdict for general public:	PASS

The minimum use distance is greater than general public minimum compliance distance.