




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Service Manual

Equinox Evo



 Equinox Evo
by Interacoustics


Interacoustics

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1 Introduction

1.1 About this manual

This manual is for our Equinox Evo. The manual content covers instrument related data, such as disassembly and maintenance. Parts and accessories list can be found as appendices in the back of the manual.

1.2 About warnings and cautions

The below warnings, cautions and notices are applied throughout the manual, indicating the level of attention required for a given action:



WARNING

The **WARNING** label identifies conditions or practices that may present danger to the patient and/or user.



CAUTION

The **CAUTION** label identifies conditions or practices that could result in damage to the equipment.

NOTICE

NOTICE is used to address practices not related to personal injury.

1.3 General information

We continuously strive to improve our products and their performance, hence the specifications in this service manual are subject to change without further notice.

The performance and specifications of our products can only be guaranteed if technical maintenance is conducted routinely every year. Technical maintenance should be carried out by qualified personnel authorized by Interacoustics.

We are happy to receive any inquiries about our products. Our contact details are:

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2 General maintenance

2.1 Maintenance



WARNING



WARNING

Make sure that the instrument is disconnected from the power supply before starting this procedure.

To maintain electrical safety during the lifetime of the instrument, a safety check must be made regularly according to IEC 60601-1, Class II, Type B applied parts; e.g. when yearly calibration is done.

2.2 General instrument maintenance

The performance and safety of the instrument will be maintained if the following recommendations for care and maintenance are observed:

1. To ensure that the acoustical, electrical, and mechanical properties are correct, we recommend an annual service of the instrument. To guarantee proper service and repair, this should be carried out by an authorized technician.
2. Observe that no damage is present to the insulation of the mains cable or the connectors and that it is not exposed to any kind of mechanical load that could involve damage.
3. To ensure that the reliability of the instrument is maintained, we recommend that the operator at short intervals, for instance once a day, performs a test on a person with known data. This person could be the operator.
4. If the surface of the instrument or parts of it is contaminated, wipe it with a soft cloth moistened with a mild solution of water and detergent or similar. Always disconnect the mains power adaptor and battery while cleaning and be careful that no fluid enters the inside of the instrument or accessories.
5. After each patient examination, ensure that no contamination between the parts and the patient has taken place. General precautions must be observed to avoid cross-contamination of disease from one patient to another. If ear cushions are contaminated, it is strongly recommended to remove them from the transducer before they are cleaned. Water should be used for frequent cleaning, but in the case of severe contamination it may be necessary to use a disinfectant. Read more in the paragraph [Cleaning procedure](#).



3 Cleaning procedure

Precautions:

- Before cleaning, always switch off and disconnect from the mains power.
- Use a soft cloth, lightly dampened with cleaning solution to clean all exposed surfaces.
- Do not allow liquid to meet the metal parts inside the earphones / headphones.
- Do not autoclave, sterilize, or immerse the instrument or accessories in any fluid.
- Do not use hard or pointed objects to clean any part of the instrument or accessories.
- Do not let parts that have been in contact with fluids dry before cleaning.
- Rubber ear-tips or foam ear-tips are single use only components.
- Ensure that isopropyl alcohol does not come into contact with any screens on the instruments
- Ensure that isopropyl alcohol does not come into contact with any silicone tubes or rubber parts

Recommended cleaning and disinfection solutions:

- Warm water with mild, nonabrasive cleaning solution (soap)
- Normal hospital bactericides
- 70% isopropyl alcohol

Procedure

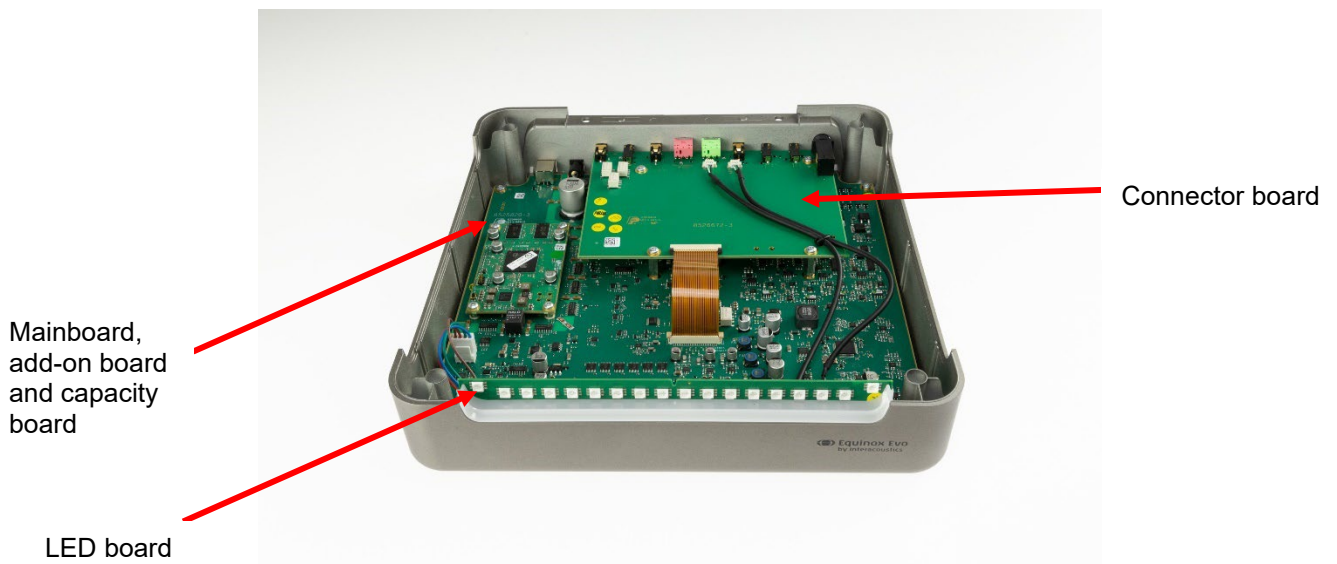
- Remove dust: Use a soft cloth lightly dampened with cleaning solution to clean all exposed surfaces.
- Clean the instrument by wiping outer case with a lint free cloth lightly dampened in cleaning solution.



4 Disassembly

The following paragraphs describe and illustrate how to disassemble the Equinox Evo and replace parts of the device.

4.1 Serviceable parts of the Equinox Evo





4.2 Tools required for disassembly

For disassembly instruction, these following tools have been used. Similar sizes should be used.

- A Torx screwdriver 10
- B Hex socket wrench 5.5



A

B



4.3 Disassembly procedure

Please refer to [Appendix A – Exploded View and Appendix B - Parts & Accessories](#) in the back of this manual.

4.3.1 Opening the cabinet and replacing the top part



Remove the feet to get access to the screws (one in each corner).



Use the screwdriver to remove the four screws.



Turn the device again and press on the two sides of the device to lift up and remove the top part.

The top part can now be replaced.



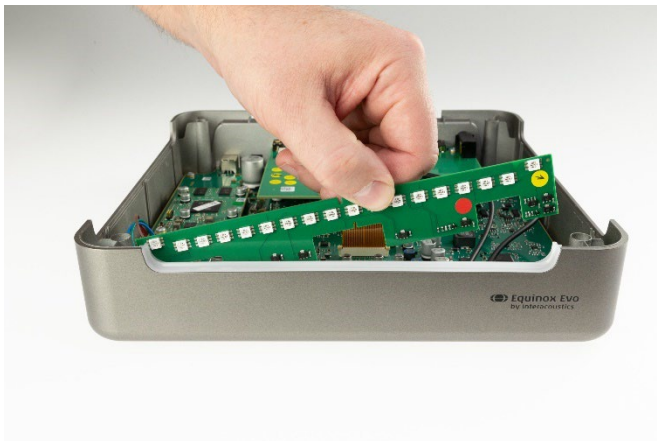
The cabinet is now open.

NOTICE

Risk of damaging the screws: Be careful not to tighten the screws too much

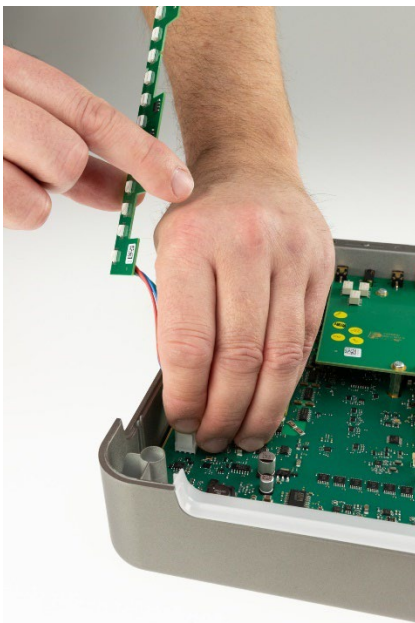


4.3.1 Replacing the LED board



Lift the LED board from the cabinet.

NOTE: The LED board is connected to the device with a cable.

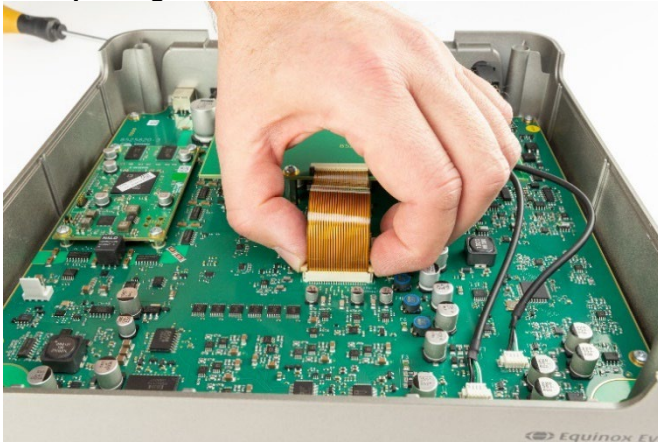


Disconnect the cable carefully.

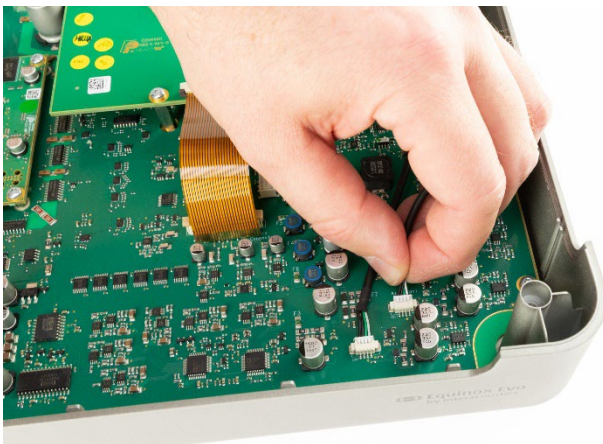
The LED board can now be replaced.



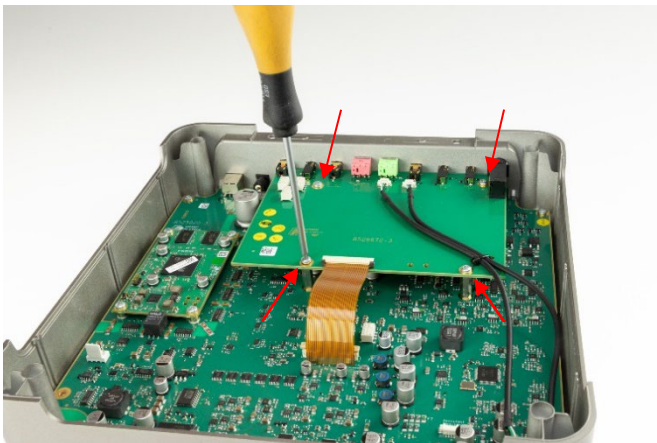
4.3.1 Replacing the connector board



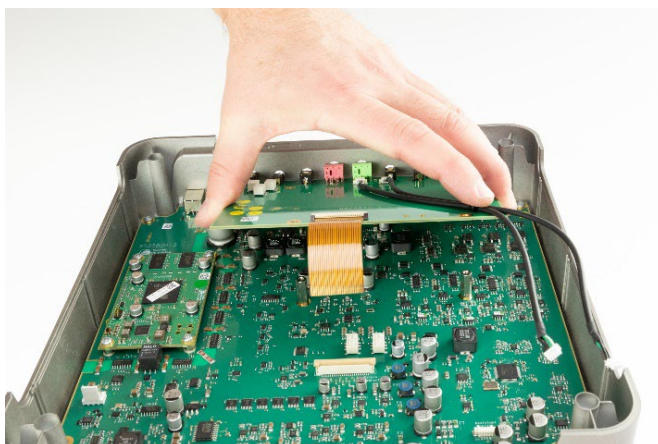
Press on each side of the cable to release it.



Pull the connectors out.



Unscrew the four screws with the screwdriver.



Lift out the connector board.

It can now be replaced.



4.3.1 Replacing the mainboard with add-on board and capacity board



Remove the light guard in the front.
Use a screwdriver to wriggle the guard out from the cabinet.



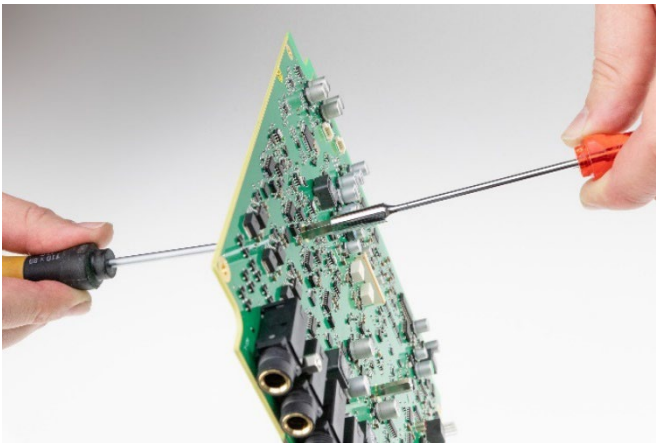
Use the screwdriver in both sides.



Use the screwdriver to remove the screws in each corner.



You can now lift the mainboard out.



Fixate the screws on the bottom side with the screwdriver, and on the top side use the socket wrench to remove the four spacer screws.
The mainboard can now be replaced.

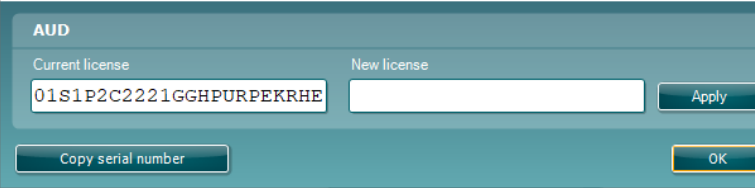
4.3.1 Replacing the bottom part



The bottom part can now be replaced



5 Troubleshooting

| ERROR MESSAGE OR PROBLEM | WHAT TO DO |
|---------------------------------|---|
| No license | <p>Via Menu / Help, click About. License. The dialog shown below pops up. Forward the DSP serial no. to Interacoustics A/S, and a new license key number will be provided.</p>  <p>Fig. 1</p> |
| Device not connected | <p>Switch off the instrument power. Check for proper USB connection. Switch on instrument power and verify that the instrument is indeed powered. Use another USB cable.</p> |
| Hardware error or timeout error | <p>Restart the instrument. If the error continues to appear contact the distributor.</p> |
| Instrument not calibrated | <p>Contact Technical Support for a calibration.</p> |
| File corrupt | <p>A faulty sound file has been selected for stimulus.</p> |
| The Suite does not start up | <p>Delete or rename the folder C:\ProgramData\Interacoustics\Affinity Suite</p> |

This chapter provides troubleshooting ideas for suspected faults with the hardware, probe, transducers, the preamplifier and electrode cables.

NOTE: Always conduct the equipment check in a quiet test environment.



5.1 Testing the functionality after the service

This chapter contains a quick guide to testing the Equinox Evo functionality.

When service has been conducted on any electrical parts of the Equinox Evo it is always recommended to check the functionality of the service parts.

If any other electrical components are serviced, the functionality of the connected transducers and accessories shall be verified.

A calibration of the device is recommended when electrical components of the device have been replaced.

When the LED board is being serviced, it is recommended that the function of the LEDs on the device is verified. The LED board shall be able to change color and brightness then connecting the device to the suite and there shall be no dark LEDs.



6 Calibration

6.1 Using the calibration software

With a USB cable, connect Equinox Evo to the computer. This switches on the device.

Open the calibration software. The calibration startup screen should look like the below screenshot, with the *Connect* button low lighted to indicate connection.

If the *Connect* button is highlighted due to missing connection to Affinity Compact, reconnect the device, switch it on again and then click *Connect*.

Due to auto-detection of applied equipment, only relevant tabs show. Here, there is for instance no REM tab.

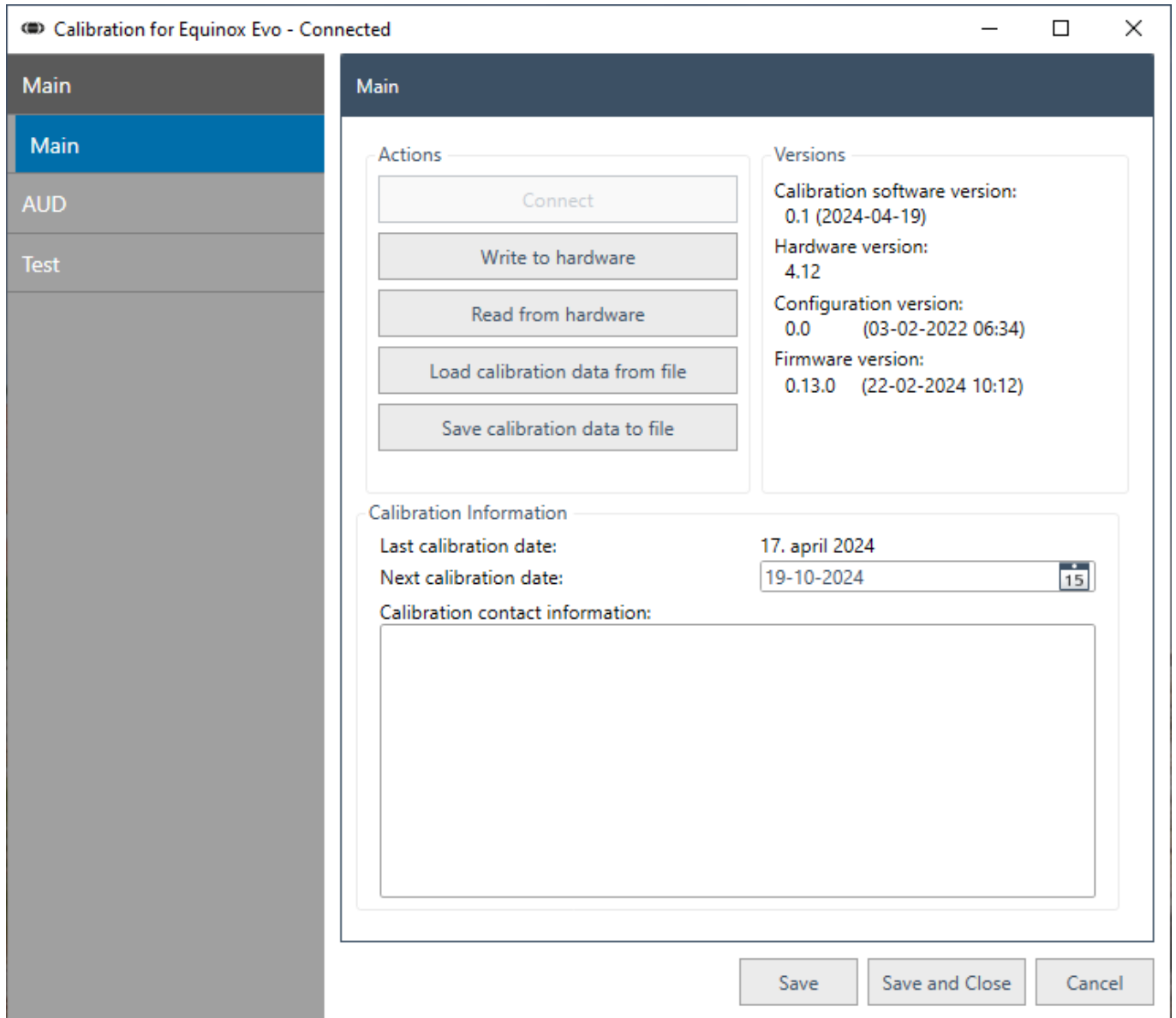


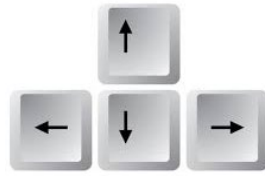
Fig. 2

| SAVE | SAVE & CLOSE |
|---|--|
| .. saves the present values at any point. This action saves all values in all screens. | .. saves all values in all screen - and exits the calibration tool. |



Left and right arrows are used for smaller, accurate adjustments on the slider

Up and down arrows are used for less accurate adjustments on the slider



Enter is used to tab to the next step, for example the next signal frequency or channel



6.1.1 AUD
6.1.1.1 Standard

| | |
|---------------------------|--|
| tone standard | Selected via AUD and <i>Standard</i> . The options are ANSI and IEC, the latter being the most common. |
| calibration method | Selected via AUD and <i>Calibration method</i> . The options are SPL mode or HL mode. |



| | |
|-----------------|--|
| SPL MODE | By default, the tab marked <i>Standard</i> is set to SPL (sound pressure level), hence it is not necessary taking the standard for the chosen transducer into account. For correction of a 2cc or 6cc coupler/microphone, it is necessary to add or subtract from the 90dB SPL level which appears on the sound level meter. |
| HL MODE | If HL (hearing level) is selected, the calibration is conducted as on a regular audiometer, where the standard is added to the HL values first, and the corrections for the coupler/microphone subsequently. |

6.1.1.2 Transducer setup

Via *AUD*, click *Transducer Setup*, and fill in the relevant information.

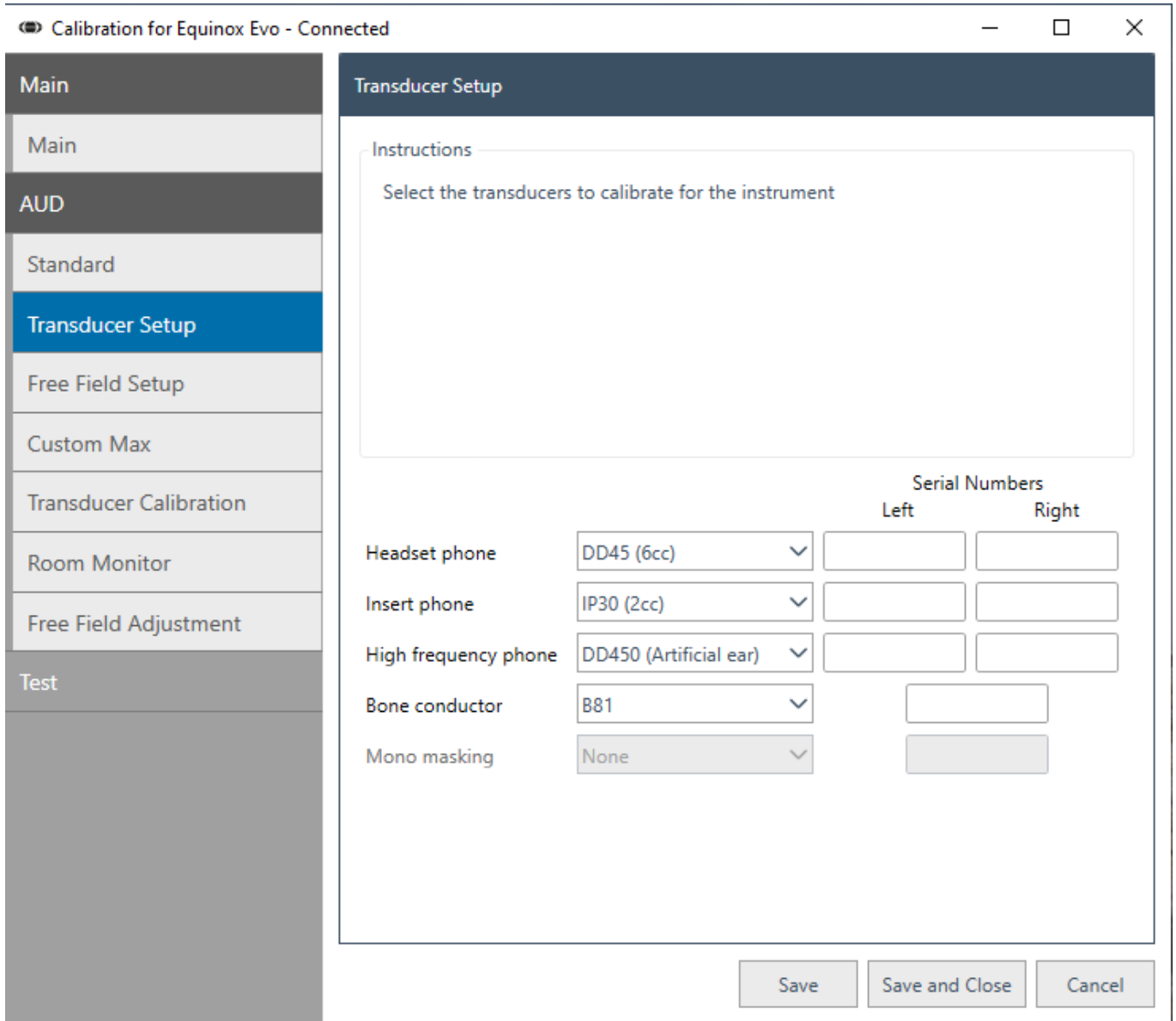


Fig. 3



6.1.1.3 Free Field setup

Via AUD, click *Free Field Setup*.

Then, follow the on-screen instructions.

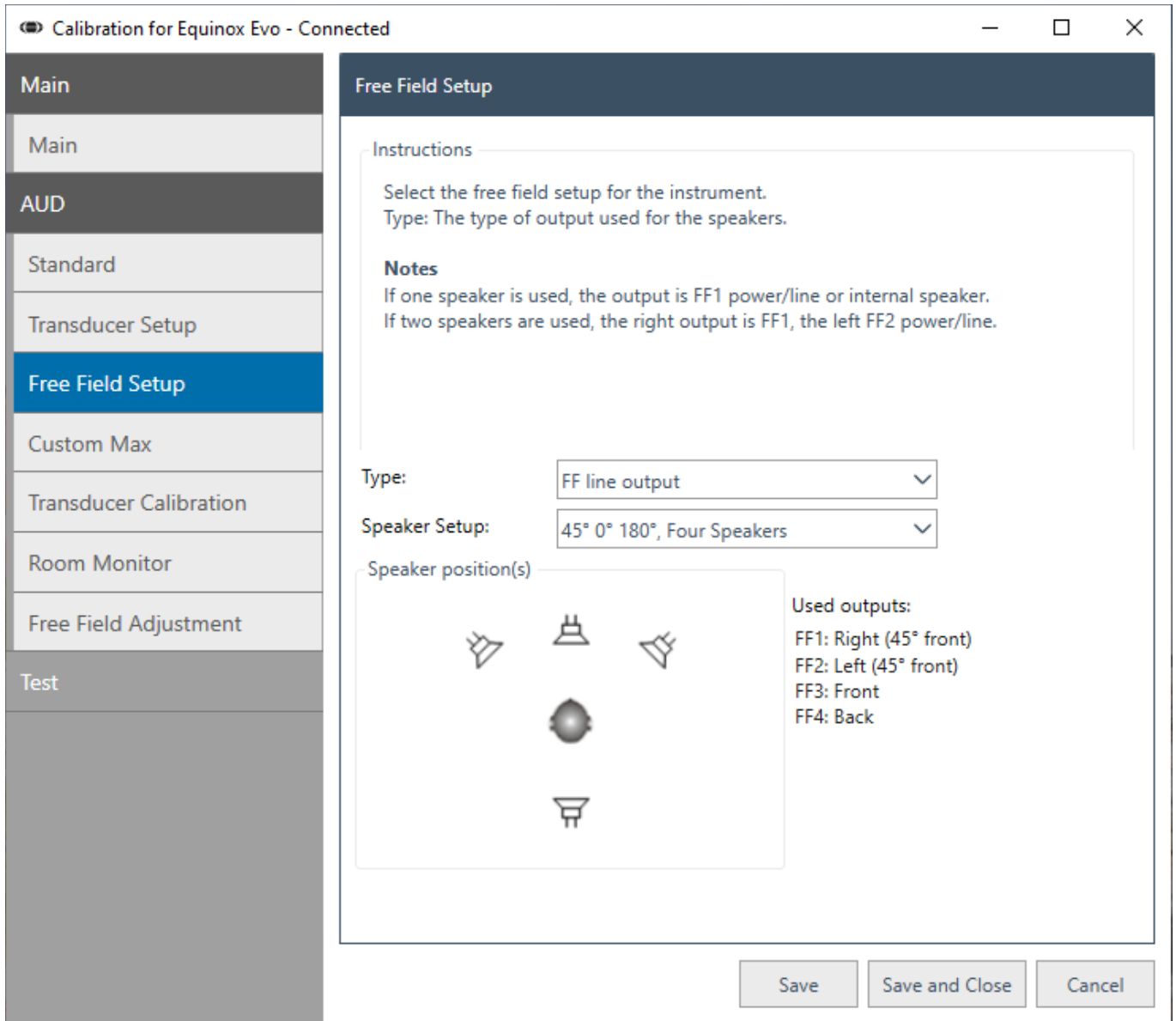


Fig. 4



6.1.1.4 Custom Max.

Via *AUD*, click *Custom Max*.

Then, follow the on-screen instructions.

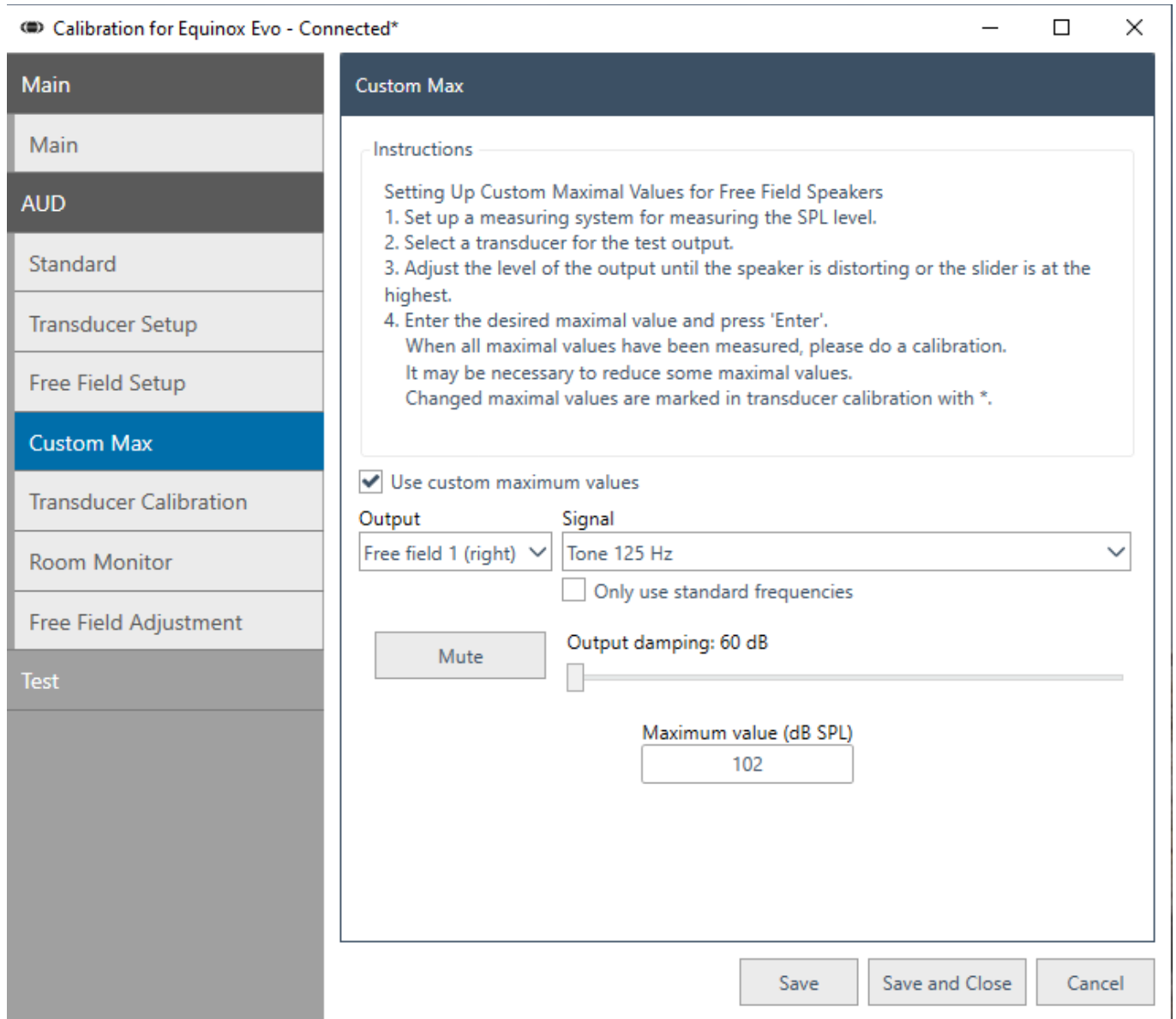


Fig. 5



6.1.1.5 Transducer calibration

Via AUD, click *Transducer Calibration*.

Then, follow the on-screen instructions.

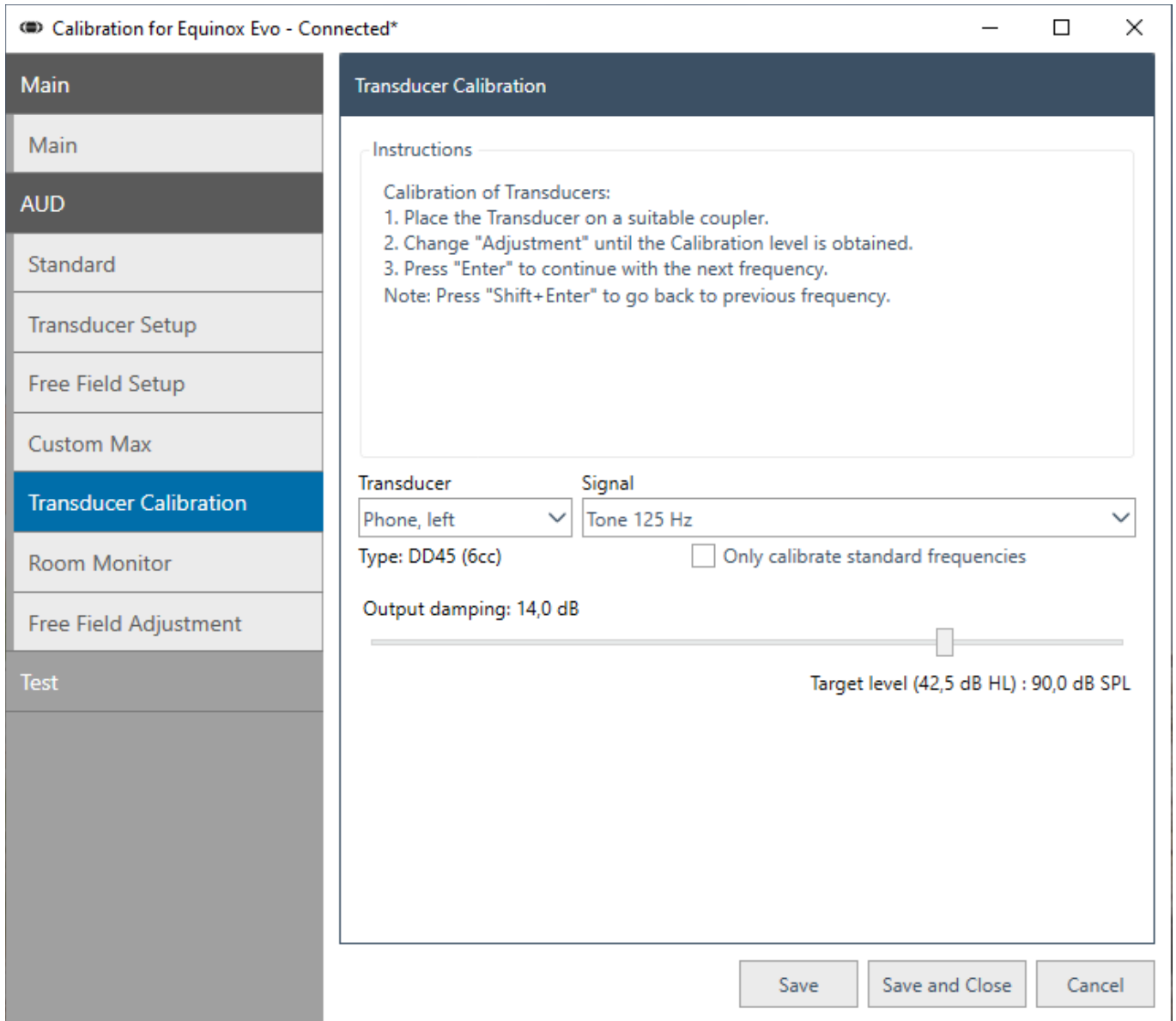


Fig. 6





6.1.1.6 Room monitor

Via AUD, click *Room Monitor*.

Then, follow the on-screen instructions.

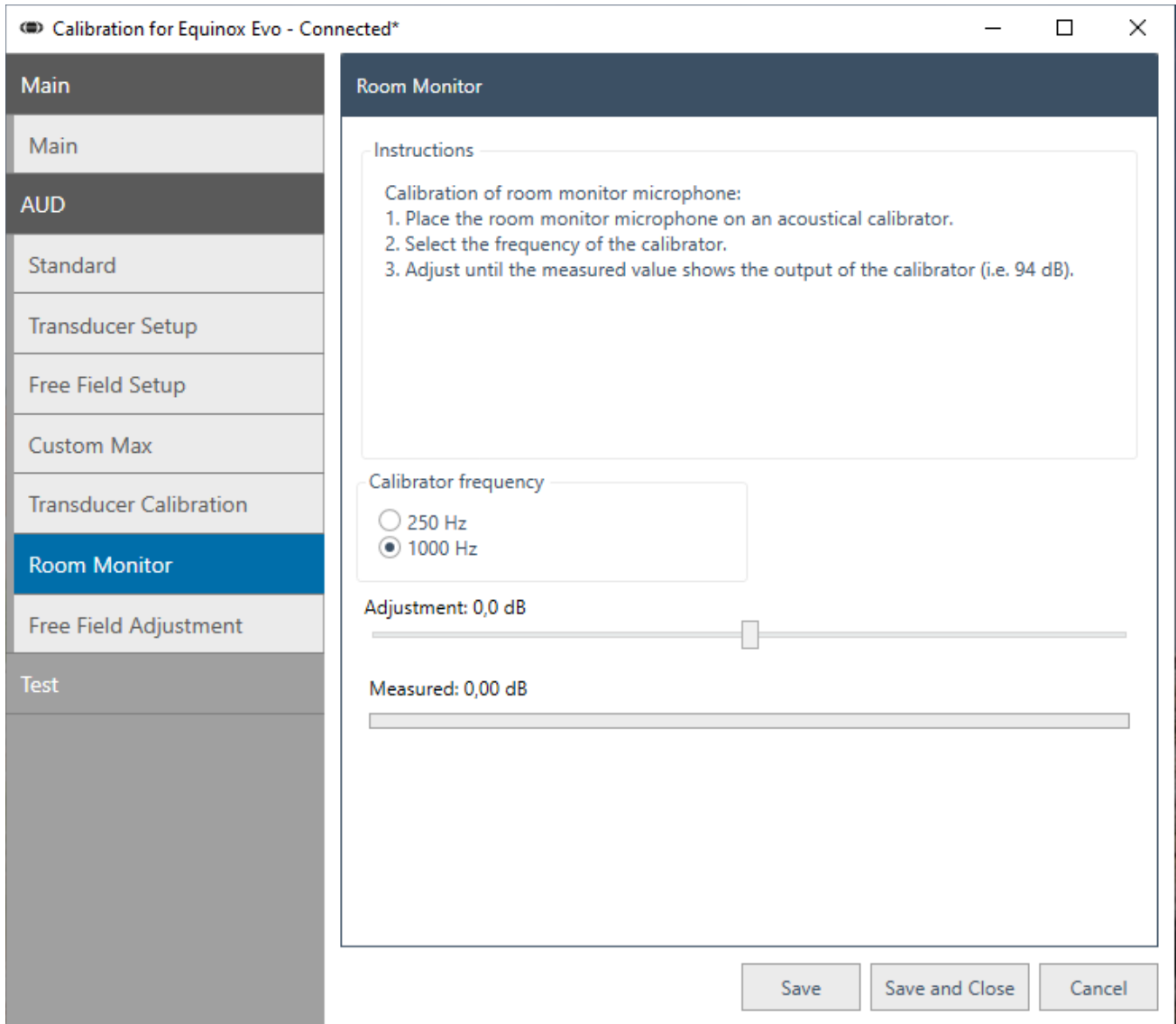


Fig. 7



Fig. 8

Place the room monitor microphone in the HIT coupler/acoustical calibrator.

Then follow the on-screen instructions.



6.1.1.7 Free Field adjustment

Via AUD, click *Free Field Adjustment*.

Then, click the on-screen instructions.

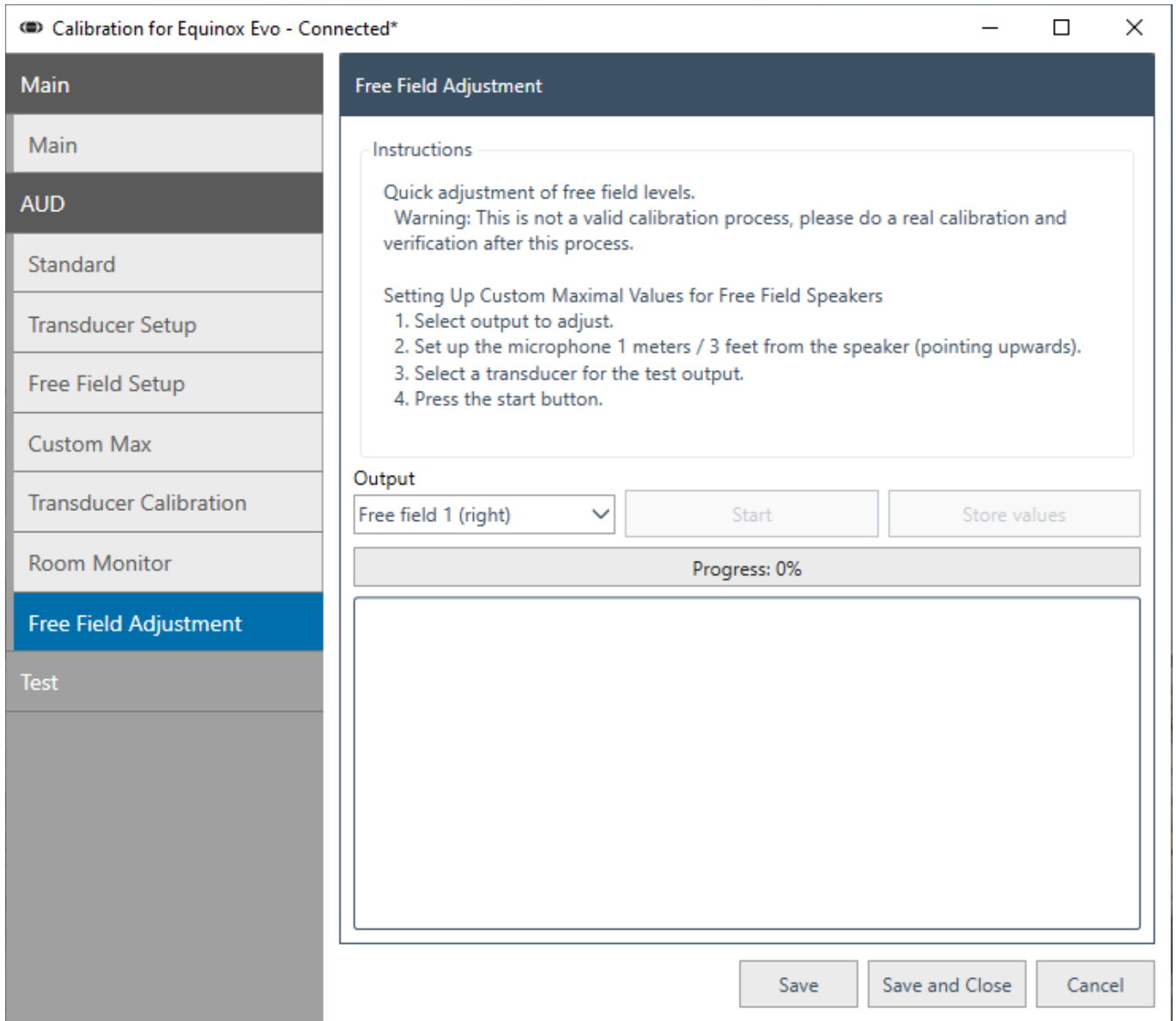


Fig. 9



6.1.2 Tests

6.1.2.1 License

Via *Test*, click *License*.

Then, fill in the serial numbers in their respective fields and click *Set*.

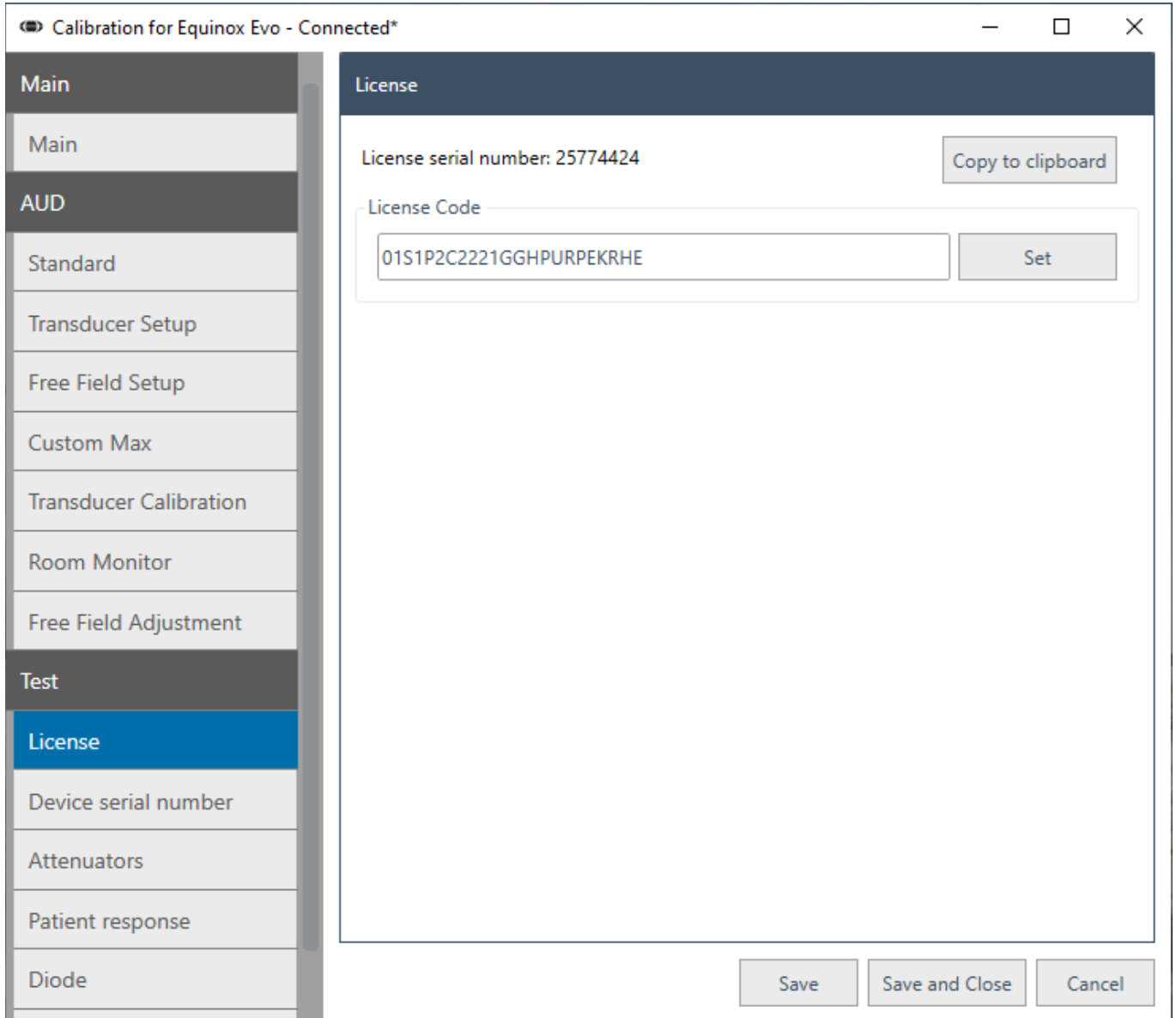


Fig. 10



6.1.2.2 Attenuators

Via *Test*, click *Attenuators*.

Then, fill in the values in their respective fields.

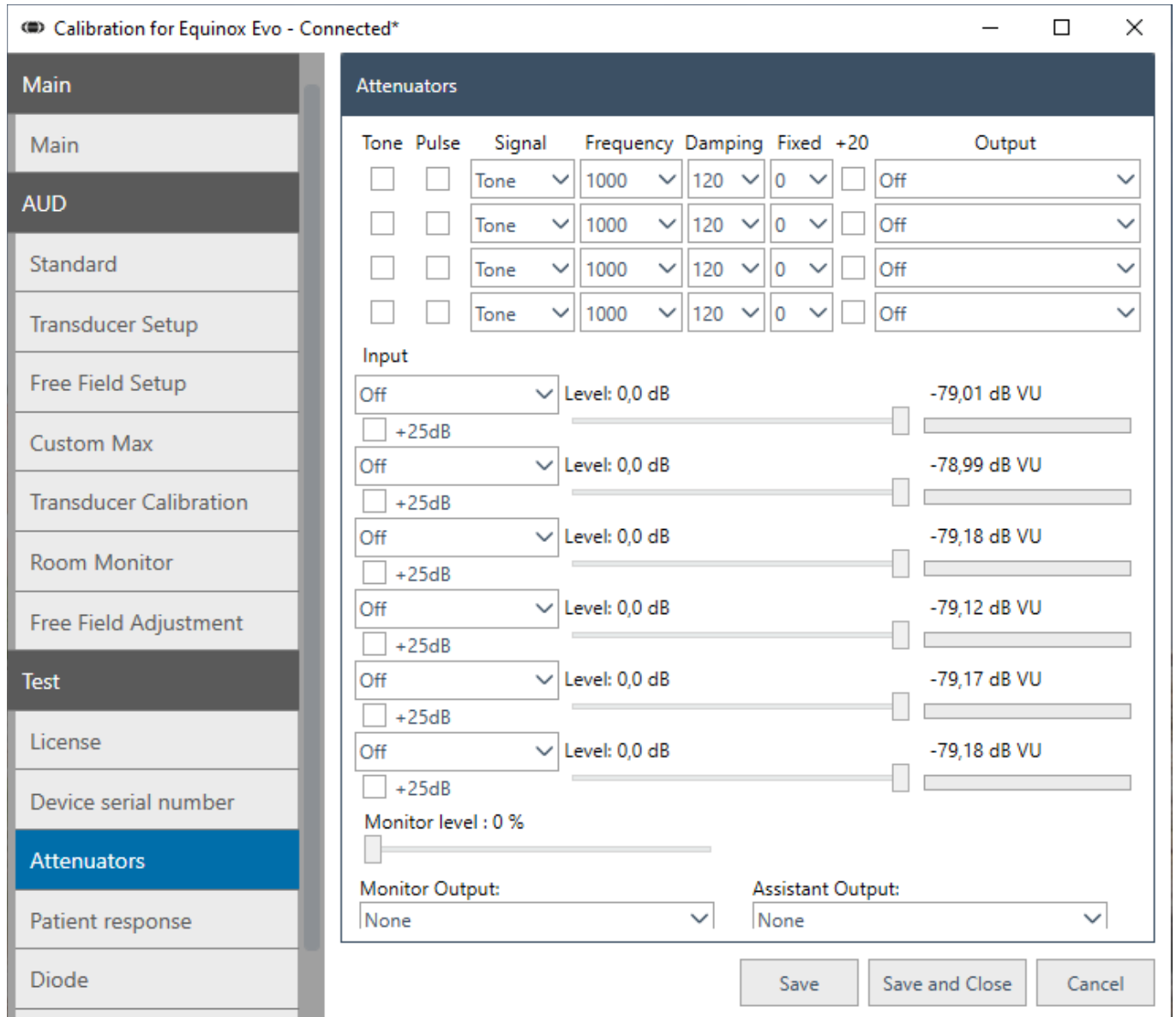


Fig. 11



6.1.2.3 Patient response

Via *Test*, click *Patient response*.

When pressing down the response button on the switch, the two grey fields appearing signify a functioning switch.

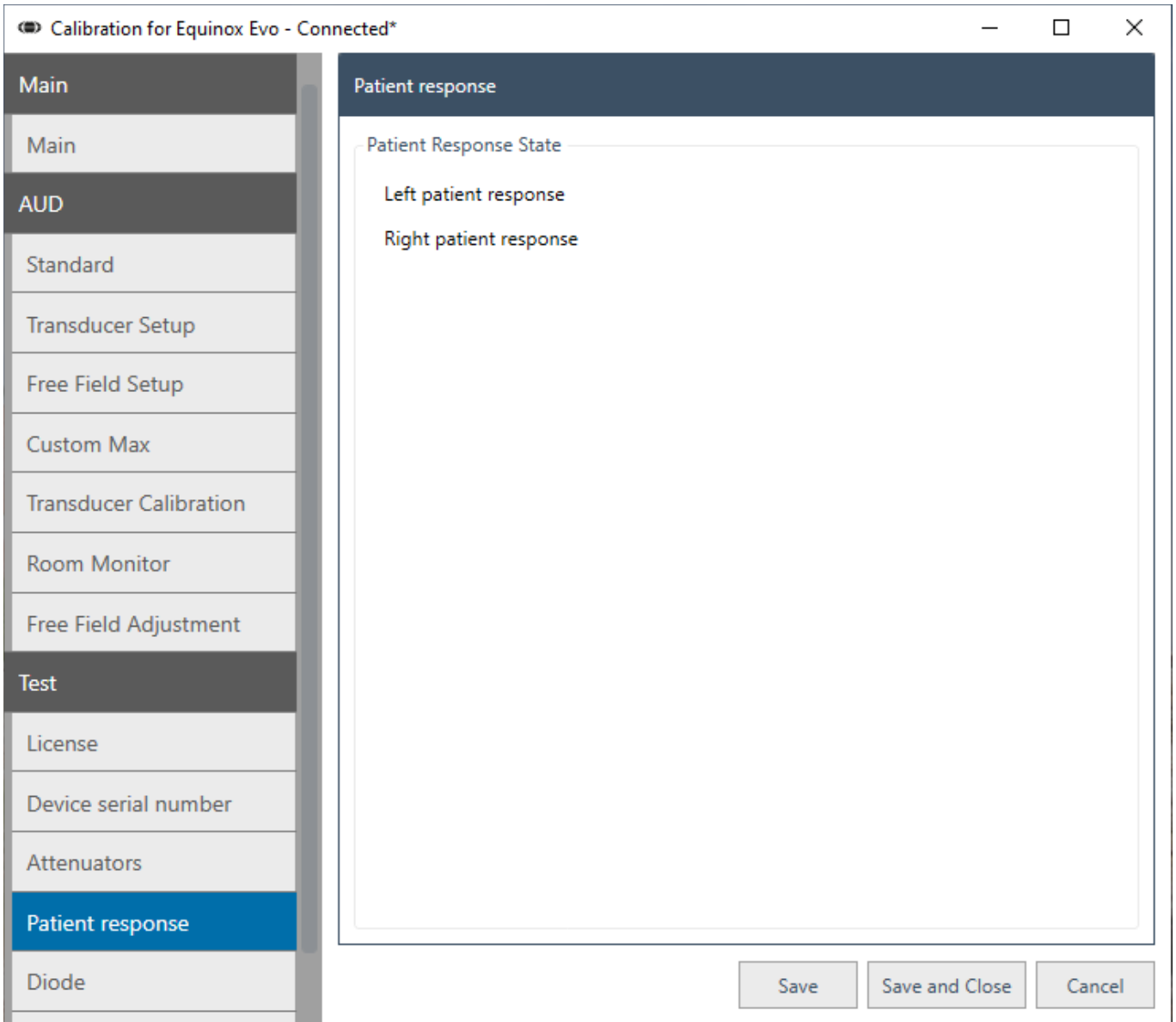


Fig. 12



6.1.2.4 Diode

Via *Test*, click *Diode* to check the diode functionality.

Via the drop-down menu, check the different diode colors individually.

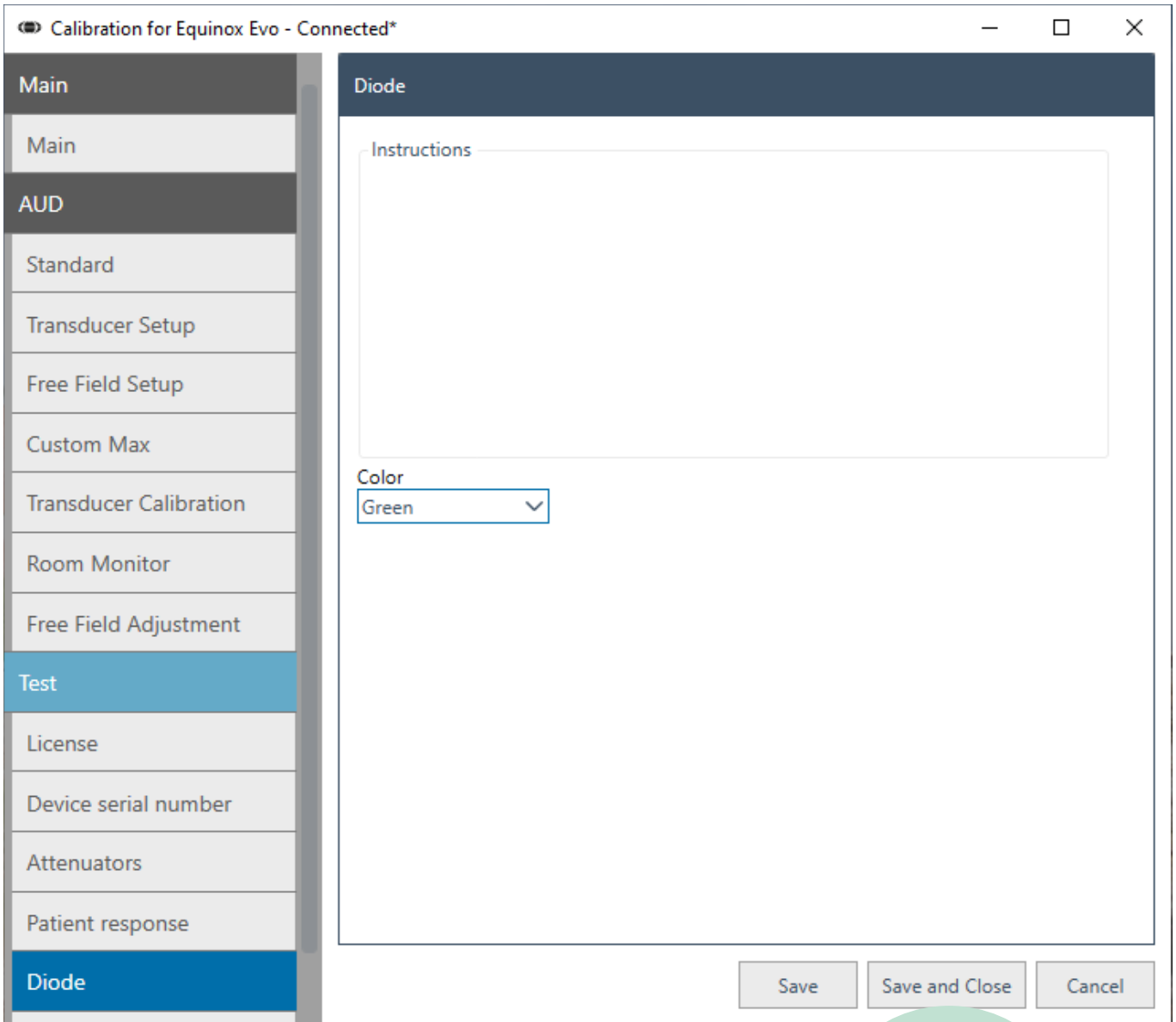


Fig. 13

Production Tests are performed during production only



6.1.2.5 External switches

Via *Test*, click *External switches* to check the VRA functionality.

Via the checkboxes, check the different VRA activaters.

Calibration for Equinox Evo - Connected*

Main

Main

AUD

Test

License

Device serial number

Attenuators

Patient response

Diode

External switches

External switches

Test switches

- Visual Reinforcement Audiometry 1
- Visual Reinforcement Audiometry 2
- Visual Reinforcement Audiometry 3

Save Save and Close Cancel



6.2 Calibrating the transducers

6.2.1 Selecting a transducer

The following procedure is applicable for all transducer selections. Here, we have exemplified the procedure with the transducer type DD45, which is the standard transducer for this instrument.

Following this section is a list with the specific equipment requirements along with photos of the corresponding equipment setup, for each suitable transducer type. The procedure described below is hence applicable for all the listed transducers.

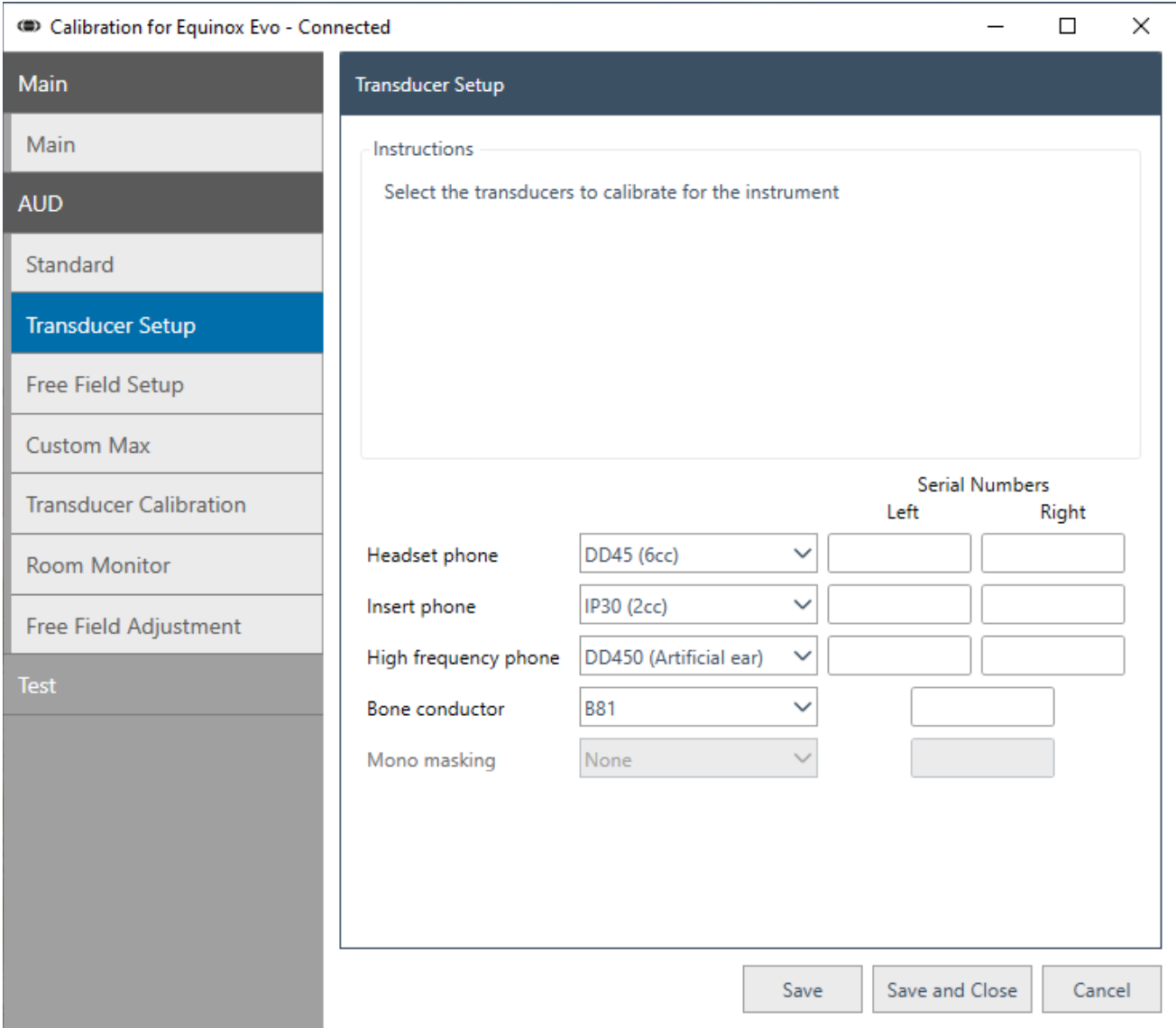
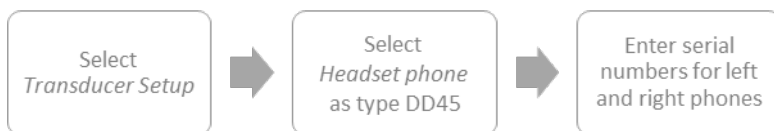


Fig. 14

EXAMPLE





6.2.2 Example with DD45

CALIBRATION OF DD45

Equipment required for this calibration:

- Measuring amplifier
- Acoustical IEC 60318-3 (IEC 303) coupler
- Frequency counter
- Correction values for coupler



Fig. 15

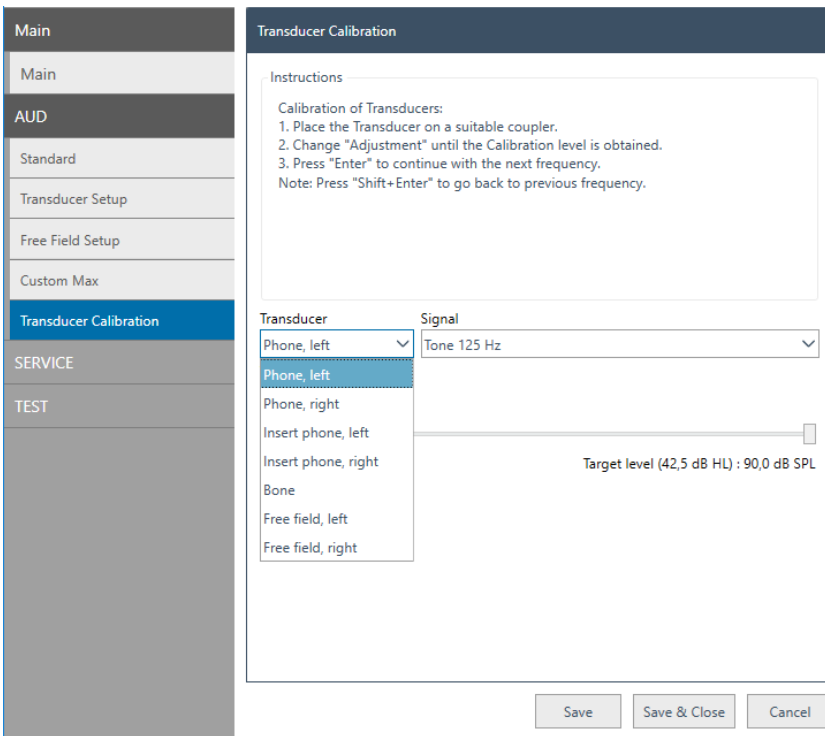


Fig. 59

From the AUD menu, select *Transducer calibration*.

Place the transducer on the 6cc IEC 60318-3 (IEC 303) coupler.

Adjust the slider until the calibration level is obtained on the measurement amplifier (i.e., 90 dB SPL).

Check the frequency accuracy with a frequency counter. The accuracy has to be better than $\pm 1\%$.

When the intended calibration level is obtained, use *Enter* to get the next frequency.

Repeat until all stimuli are calibrated, for both the left and right transducer.

NOTICE

Do not forget to add or subtract the correction for your microphone.



6.2.3 Transducer types and equipment requirements for calibration

Conduct the same procedure exemplified in [Selecting a transducer / how-to-guide](#) in the previous paragraph. It applies to all the transducers mentioned below.

B71 / B81

Equipment required:

- Measuring amplifier
- Artificial mastoid IEC 60318-6
- Frequency counter
- Correction values for mastoid

From the AUD menu, select *Transducer Calibration*.

Place the transducer on the artificial mastoid IEC 60318-6.



Fig. 16

IP30

Equipment required:

- Measuring amplifier
- Acoustical IEC 60318-5 (IEC 126) coupler
- Frequency counter
- Correction values for coupler

From the AUD menu, select *Transducer Calibration*.

Place the transducer on the 6cc IEC 60318-3 (IEC 303) coupler.



Fig. 61

DD450 / DD65 V2

Equipment required:

- Measuring amplifier
- Acoustical IEC 60318-1 coupler
- Frequency counter
- Correction values for coupler

From the AUD menu, select *Transducer Calibration*.

Place the transducer on the IEC 60318-1 coupler.



Fig. 62



6.3 Testing the functionality

This chapter contains a quick guide to testing the Affinity Compact functionality.

6.3.1 Other transducers

Repeat the procedure exemplified in [3.5.2 Example with DD45](#). It applies to both transducer types mentioned below.

6.3.2 Speaker

Via *Test*, click *Attenuators*.

Make sure that the settings of the test speaker box are reflecting the below parameters.

Tick off the *Tone* field.

Then set the *Damping* value to 60.

Select *TestboxSpeaker* in the *Output* field. This triggers a sound from the left speaker. In case no sound is audible at 1000 Hz, change the frequency.

Verify that the signal is stable and has no distortions.

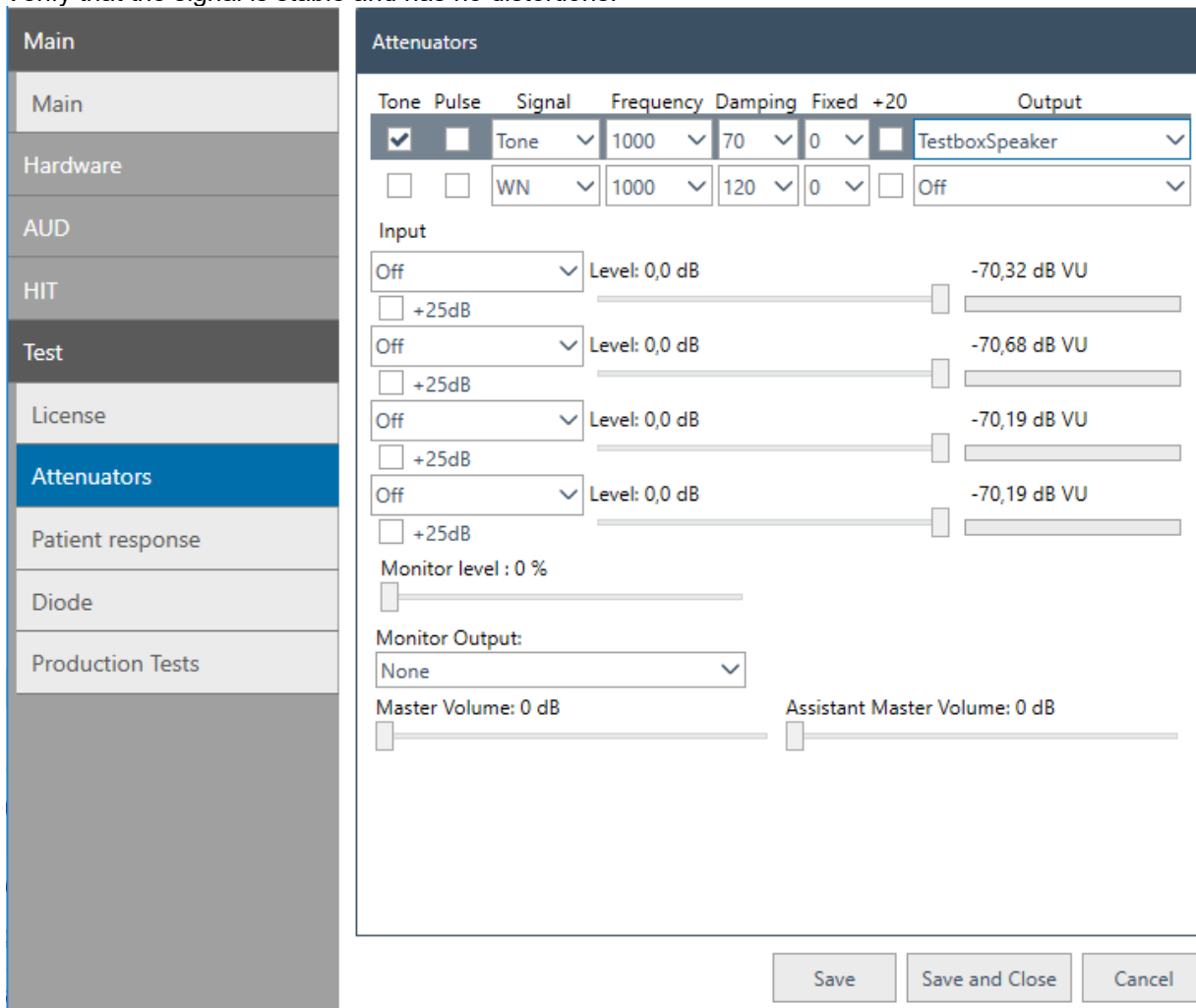


Fig. 17



6.4 Checklist for calibration

Use this list to ensure no aspect of the calibration is forgotten.

| FUNCTIONAL CHECKS | PASS / FAIL |
|--|-------------|
| Visual inspection, safety: check power cord and accessory cords for signs of wear or damage and the general physical condition of instrument | |
| Headband: check tension | |
| Cushions: check condition and replace if required | |
| Patch cords: check plugs and leads for intermittency | |
| Patient response: check for proper operation | |
| PURE-TONE ELECTROACOUSTIC MEASUREMENTS | |
| Distortion (%): recorded as THD ¹ | |
| Output levels (all transducers): recorded as a deviation from standard | |
| Linearity of all channels (all transducers) (dB): recorded as a deviation from standard | |
| On/off ratio: measured and recorded in dB | |
| Crosstalk: measured and recorded in dB | |
| Pulse tones: duration (ms). Actual measurement recorded (pass/fail) | |
| Unwanted noise check: record with (pass/fail) | |
| Switch sounds | |
| MASKING MEASUREMENTS | |
| Narrow band noise output level: measured and recorded as deviation from standard, all transducers | |
| White noise output level: measured and recorded as deviation from standard, all transducers | |
| SPEECH ELECTROACOUSTIC MEASUREMENTS | |
| Speech output level: signal applied to input, VU meter at zero. Measured and recorded as deviation from standard, all transducers | |
| Distortion: recorded as THD | |
| Speech noise: output measured and recorded as deviation from standard | |
| SOUND FIELD MEASUREMENTS | |
| Warble/FM output level: actual measurement recorded (all frequencies) as deviation from standard | |
| Speech inputs in sound field output level: signal applied to input, VU meter set at zero. Measured and recorded as deviation from standard | |
| Narrow band noise output level: measured and recorded as deviation from standard, all transducers | |
| Speech/white noise output level: measured and recorded as deviation from standard, all transducers | |

¹ Referring to the technical specifications elsewhere in this manual, start from the lowest frequency.



Appendix A - Equinox Evo - Technical Specifications

| | | |
|---|--|--|
| Medical CE mark | The CE mark indicates that Interacoustics A/S meets the requirements of the Medical Device Regulation (EU) 2017/745 Annex I. Approval of the quality system is made by TÜV – identification no. 0123. | |
| Safety standards | IEC 60601-1 2005+AMD1:2012+AMD2:2020 (Edition 3.2) ANSI/AAMI ES60601-1:2005 & A1:2012 & A2:2021 CSA-C22.2 No.60601-1:14 + A2:22 (R2022) Class I, Applied parts type B, Continuous operation | |
| EMC standard | IEC 60601-1-2:2014+AMD1:2020 Class B, group 1 | |
| Calibration | Technical information is in the specifications for the software modules. Calibration information and instructions are located in the Service manual. | |
| PC requirements (Minimum requirements) | 2 GHz Intel i3 processor 5 th generation or equal 4GB Ram 2.5 GB available disk space 1280x720 resolution (1280x1024 or higher recommended) Hardware accelerated DirectX/Direct3D graphics card. One or more USB ports, version 2.0 or higher. | |
| Operating Systems | Windows® 10 (64 bit) Windows® 11 (64 bit) | |
| Compatible software | Noah 4, OtoAccess® and XML compatible. | |
| Input specifications | Talk back | 226mVrms at max. input gain for 0dB VU-reading Input impedance: 68KΩ 7mVrms max input with 10 dB headroom over 0dB Vu-reading |
| | Mic. – Talk Forward | 226mVrms at max. input gain for 0dB VU-reading Input impedance: 68KΩ 7mVrms max input with 10 dB headroom over 0dB Vu-reading |
| | Assistant monitor Mic. | 226µVrms at max input gain for 0 dB Vu-reading, Input impedance 68kΩ. 7mVrms max input with 10 dB headroom over 0dB Vu-reading |
| | Patient respond | Switches 3.3V to the logic input. (The switch current is 1.5mA) |
| | AUX 1-2 | 16mVrms at max. input gain for 0dB VU-reading Input impedance: 68KΩ 500mVrms max input with 10 dB headroom over 0dB Vu-reading |
| | Talk back Ambient mic. | Max input level before clipping 70mVrms. Calibration by 94 dB SPL 250Hz or 1kHz. Input impedance: 68KΩ |
| Output specifications | Phone | Up to 7.0 Vrms by 10 W load 70Hz-20kHz ±3dB |
| | Insert | Up to 7.0 Vrms by 10 Ω load 70Hz-20kHz ±3dB |
| | HF | Up to 7Vrms by 10 W load 70Hz-20kHz ±3dB |
| | Bone | Up to 7.0 Vrms by 10 Ω load 70Hz-20kHz ±3dB |
| | FF1 / FF2 power | Up to 14.0Vrms by 8 W load 70Hz-20kHz ±3dB Minimum speaker impedance: 4W |
| | FF1-2 Line | Up to 7.0 Vrms by 1 kΩ load 70Hz-20kHz ±3dB |
| | FF3-4 Line | Up to 7.0 Vrms by 1 kΩ load 70Hz-20kHz ±3dB |
| | Monitor | Up to 1.5Vrms by 8Ω load 125-20kHz ±3dB |



| | | |
|------------------------------|--|--|
| | Assistant monitor | Up to 1.5Vrms by 8Ω load 125-20kHz ±3dB |
| | VRA | Contact switch current < 500mA |
| Data connections | USB-PC | USB B socket for connection to PC (compatible with USB 2.0 and later) |
| Dimensions (LxWxH) | 26.4 x 26.4 x 6 cm / 10.4 x 10.4 x 2.4 inches | |
| Weight | 1.8 kg / 4.0 lbs. | |
| Power supply | Type: UES65-240250SPA3 Input: 100-240VAC 50/60Hz, 2.0 A Output: 24.0 VDC, 2.5 A Average consumption: 24.1W | |
| Operation environment | Atmospheric pressure: 98 kPa – 104 kPa Temperature: 15 °C – 35 °C Re. Humidity: 30 – 90 % Non-condensing | |
| Transport and storage | Transport temperature: -20 °C – 50 °C Storage temperature: 0 °C – 50 °C Re. Humidity: 10 – 95 % Non-condensing | |



Tone reference equivalent threshold values for transducers

| PURE TONE RETSPL | | | | | | | | |
|------------------|--------|----------------|----------------|--------|---------|----------|---------|----------|
| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | RETSPL | RETSPL | RETSPL | RETSPL | RETFL | RETFL | RETFL | RETFL |
| Tone 125 Hz | 47.5 | 30.5 | 30.5 | 26 | | | | |
| Tone 160 Hz | 40.5 | 25.5 | 26 | 22 | | | | |
| Tone 200 Hz | 33.5 | 21.5 | 22 | 18 | | | | |
| Tone 250 Hz | 27 | 17 | 18 | 14 | 67 | 79 | 67 | 79 |
| Tone 315 Hz | 22.5 | 14 | 15.5 | 12 | 64 | 76.5 | 64 | 76.5 |
| Tone 400 Hz | 17.5 | 10.5 | 13.5 | 9 | 61 | 74.5 | 61 | 74.5 |
| Tone 500 Hz | 13 | 8 | 11 | 5.5 | 58 | 72 | 58 | 72 |
| Tone 630 Hz | 9 | 6.5 | 8 | 4 | 52.5 | 66 | 52.5 | 66 |
| Tone 750 Hz | 6.5 | 5.5 | 6 | 2 | 48.5 | 61.5 | 48.5 | 61.5 |
| Tone 800 Hz | 6.5 | 5 | 6 | 1.5 | 47 | 59 | 47 | 59 |
| Tone 1000 Hz | 6 | 4.5 | 5.5 | 0 | 42.5 | 51 | 42.5 | 51 |
| Tone 1250 Hz | 7 | 3.5 | 6 | 2 | 39 | 49 | 39 | 49 |
| Tone 1500 Hz | 8 | 2.5 | 5.5 | 2 | 36.5 | 47.5 | 36.5 | 47.5 |
| Tone 1600 Hz | 8 | 2.5 | 5.5 | 2 | 35.5 | 46.5 | 35.5 | 46.5 |
| Tone 2000 Hz | 8 | 2.5 | 4.5 | 3 | 31 | 42.5 | 31 | 42.5 |
| Tone 2500 Hz | 8 | 2 | 3 | 5 | 29.5 | 41.5 | 29.5 | 41.5 |
| Tone 3000 Hz | 8 | 2 | 2.5 | 3.5 | 30 | 42 | 30 | 42 |
| Tone 3150 Hz | 8 | 3 | 4 | 4 | 31 | 42.5 | 31 | 42.5 |
| Tone 4000 Hz | 9 | 9.5 | 9.5 | 5.5 | 35.5 | 43.5 | 35.5 | 43.5 |
| Tone 5000 Hz | 13 | 15.5 | 14 | 5 | 40 | 51 | 40 | 51 |
| Tone 6000 Hz | 20.5 | 21 | 17 | 2 | 40 | 51 | 40 | 51 |
| Tone 6300 Hz | 19 | 21 | 17.5 | 2 | 40 | 50 | 40 | 50 |
| Tone 8000 Hz | 12 | 21 | 17.5 | 0 | 40 | 50 | 40 | 50 |
| Tone 9000 Hz | | | 19 | | | | | |
| Tone 10000 Hz | | | 22 | | | | | |
| Tone 11200 Hz | | | 23 | | | | | |
| Tone 12500 Hz | | | 27.5 | | | | | |
| Tone 14000 Hz | | | 35 | | | | | |
| Tone 16000 Hz | | | 56 | | | | | |
| Tone 18000 Hz | | | 83 | | | | | |
| Tone 20000 Hz | | | 105 | | | | | |

DD45 6ccm uses IEC 60318-3 or NBS 9A coupler and RETSPL comes from ISO 389-1:2017, ANSI S3.6-2018 and ISO389-1:2017. Force 4.5N ±0.5N

DD65V2 Artificial ear uses IEC 60318-1 coupler with type 1 adaptor and RETSPL comes from PTB 1.61-4091606 2018 & AAU 2018, Force 11.5N ±0.5N

DD450 Artificial ear uses IEC 60318-1 coupler with type 1 adaptor and RETSPL comes from ANSI S3.6-2018 and ISO 389-8:2004. Force 9N ±0.5N

IP30 2ccm use ANSI S3.7-1995 or IEC 60318-5 coupler (HA-2 with 5mm rigid Tube) and RETSPL comes from ANSI S3.6-2018 and ISO 389-2:1994.

B71 / B-81 use ANSI S3.13 or IEC 60318-6:2007 mechanical coupler and RETFL come from ANSI S3.6:2018 and ISO 389-3:2016 Force 5.4N ±0.5N



PURE TONE MAX. HL

| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
|----------------|-------------|-----------------------|-----------------------|-------------|----------------|-----------------|----------------|-----------------|
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| Signal | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL |
| Tone 125 Hz | 90 | 85 | 100 | 90 | | | | |
| Tone 160 Hz | 95 | 90 | 105 | 95 | | | | |
| Tone 200 Hz | 100 | 95 | 105 | 100 | | | | |
| Tone 250 Hz | 110 | 100 | 110 | 105 | 45 | 30 | 50 | 35 |
| Tone 315 Hz | 115 | 105 | 115 | 105 | 50 | 35 | 60 | 45 |
| Tone 400 Hz | 120 | 110 | 115 | 110 | 65 | 50 | 70 | 55 |
| Tone 500 Hz | 120 | 110 | 115 | 110 | 65 | 50 | 70 | 55 |
| Tone 630 Hz | 120 | 110 | 120 | 115 | 70 | 55 | 75 | 60 |
| Tone 750 Hz | 120 | 115 | 120 | 115 | 70 | 55 | 75 | 60 |
| Tone 800 Hz | 120 | 115 | 120 | 115 | 70 | 55 | 75 | 60 |
| Tone 1000 Hz | 120 | 115 | 120 | 120 | 70 | 60 | 85 | 75 |
| Tone 1250 Hz | 120 | 115 | 110 | 120 | 70 | 60 | 90 | 80 |
| Tone 1500 Hz | 120 | 115 | 115 | 120 | 70 | 55 | 90 | 80 |
| Tone 1600 Hz | 120 | 115 | 115 | 120 | 70 | 55 | 90 | 75 |
| Tone 2000 Hz | 120 | 115 | 115 | 120 | 75 | 60 | 90 | 75 |
| Tone 2500 Hz | 120 | 115 | 115 | 120 | 80 | 65 | 85 | 70 |
| Tone 3000 Hz | 120 | 115 | 115 | 120 | 80 | 65 | 85 | 70 |
| Tone 3150 Hz | 120 | 115 | 115 | 120 | 80 | 65 | 85 | 70 |
| Tone 4000 Hz | 120 | 110 | 115 | 115 | 80 | 70 | 85 | 70 |
| Tone 5000 Hz | 120 | 105 | 105 | 105 | 60 | 45 | 70 | 55 |
| Tone 6000 Hz | 115 | 100 | 105 | 100 | 50 | 35 | 60 | 50 |
| Tone 6300 Hz | 115 | 100 | 105 | 100 | 50 | 40 | 55 | 45 |
| Tone 8000 Hz | 110 | 95 | 105 | 95 | 50 | 40 | 50 | 40 |
| Tone 9000 Hz | | | 100 | | | | | |
| Tone 10000 Hz | | | 100 | | | | | |
| Tone 11200 Hz | | | 95 | | | | | |
| Tone 12500 Hz | | | 90 | | | | | |
| Tone 14000 Hz | | | 80 | | | | | |
| Tone 16000 Hz | | | 60 | | | | | |
| Tone 18000 Hz | | | 30 | | | | | |
| Tone 20000 Hz | | | 15 | | | | | |



| NB NOISE EFFECTIVE MASKING LEVEL | | | | | | | | |
|----------------------------------|------|----------------|----------------|------|---------|----------|---------|----------|
| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | EM | EM | EM | EM | EM | EM | EM | EM |
| NB 125 Hz | 51.5 | 34.5 | 34.5 | 30 | | | | |
| NB 160 Hz | 44.5 | 29.5 | 30 | 26 | | | | |
| NB 200 Hz | 37.5 | 25.5 | 26 | 22 | | | | |
| NB 250 Hz | 31 | 21 | 22 | 18 | 71 | 83 | 71 | 83 |
| NB 315 Hz | 26.5 | 18 | 19.5 | 16 | 68 | 80.5 | 68 | 80.5 |
| NB 400 Hz | 21.5 | 14.5 | 17.5 | 13 | 65 | 78.5 | 65 | 78.5 |
| NB 500 Hz | 17 | 12 | 15 | 9.5 | 62 | 76 | 62 | 76 |
| NB 630 Hz | 14 | 11.5 | 13 | 9 | 57.5 | 71 | 57.5 | 71 |
| NB 750 Hz | 11.5 | 10.5 | 11 | 7 | 53.5 | 66.5 | 53.5 | 66.5 |
| NB 800 Hz | 11.5 | 10 | 11 | 6.5 | 52 | 64 | 52 | 64 |
| NB 1000 Hz | 12 | 10.5 | 11.5 | 6 | 48.5 | 57 | 48.5 | 57 |
| NB 1250 Hz | 13 | 9.5 | 12 | 8 | 45 | 55 | 45 | 55 |
| NB 1500 Hz | 14 | 8.5 | 11.5 | 8 | 42.5 | 53.5 | 42.5 | 53.5 |
| NB 1600 Hz | 14 | 8.5 | 11.5 | 8 | 41.5 | 52.5 | 41.5 | 52.5 |
| NB 2000 Hz | 14 | 8.5 | 10.5 | 9 | 37 | 48.5 | 37 | 48.5 |
| NB 2500 Hz | 14 | 8 | 9 | 11 | 35.5 | 47.5 | 35.5 | 47.5 |
| NB 3000 Hz | 14 | 8 | 8.5 | 9.5 | 36 | 48 | 36 | 48 |
| NB 3150 Hz | 14 | 9 | 10 | 10 | 37 | 48.5 | 37 | 48.5 |
| NB 4000 Hz | 14 | 14.5 | 14.5 | 10.5 | 40.5 | 48.5 | 40.5 | 48.5 |
| NB 5000 Hz | 18 | 20.5 | 19 | 10 | 45 | 56 | 45 | 56 |
| NB 6000 Hz | 25.5 | 26 | 22 | 7 | 45 | 56 | 45 | 56 |
| NB 6300 Hz | 24 | 26 | 22.5 | 7 | 45 | 55 | 45 | 55 |
| NB 8000 Hz | 17 | 26 | 22.5 | 5 | 45 | 55 | 45 | 55 |
| NB 9000 Hz | | | 24 | | | | | |
| NB 10000 Hz | | | 27 | | | | | |
| NB 11200 Hz | | | 28 | | | | | |
| NB 12500 Hz | | | 32.5 | | | | | |
| NB 14000 Hz | | | 40 | | | | | |
| NB 16000 Hz | | | 61 | | | | | |
| NB 18000 Hz | | | 88 | | | | | |
| NB 20000 Hz | | | 110 | | | | | |
| White noise | 0 | 0 | 0 | 0 | 42.5 | 51 | 42.5 | 51 |
| TEN noise | 25 | | | 16 | | | | |

Effective masking value is RETSPL / RETFL add 1/3 octave correction for Narrow-band noise from ANSI S3.6-2018 or ISO 389-4:1994.



NB NOISE MAX. HL

| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
|-------------|---------|----------------|--------------|---------|---------|----------|---------|----------|
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | Max. HL | Max. HL | Max HL | Max. HL | Max. HL | Max HL | Max. HL | Max HL |
| NB 125 Hz | 75 | 75 | 75 | 90 | | | | |
| NB 160 Hz | 80 | 80 | 80 | 95 | | | | |
| NB 200 Hz | 90 | 85 | 80 | 100 | | | | |
| NB 250 Hz | 95 | 90 | 85 | 105 | 35 | 20 | 40 | 25 |
| NB 315 Hz | 100 | 95 | 90 | 105 | 40 | 25 | 50 | 35 |
| NB 400 Hz | 105 | 100 | 95 | 105 | 55 | 40 | 60 | 45 |
| NB 500 Hz | 110 | 100 | 95 | 110 | 55 | 40 | 60 | 45 |
| NB 630 Hz | 110 | 100 | 95 | 110 | 60 | 45 | 65 | 50 |
| NB 750 Hz | 110 | 105 | 100 | 110 | 60 | 45 | 65 | 50 |
| NB 800 Hz | 110 | 105 | 100 | 110 | 60 | 45 | 65 | 50 |
| NB 1000 Hz | 110 | 105 | 100 | 110 | 60 | 50 | 70 | 60 |
| NB 1250 Hz | 110 | 105 | 95 | 110 | 60 | 50 | 75 | 60 |
| NB 1500 Hz | 110 | 105 | 100 | 110 | 60 | 45 | 75 | 60 |
| NB 1600 Hz | 110 | 105 | 100 | 110 | 60 | 45 | 75 | 60 |
| NB 2000 Hz | 110 | 105 | 100 | 110 | 65 | 50 | 70 | 55 |
| NB 2500 Hz | 110 | 105 | 100 | 110 | 65 | 50 | 65 | 50 |
| NB 3000 Hz | 110 | 105 | 100 | 110 | 65 | 50 | 65 | 50 |
| NB 3150 Hz | 110 | 100 | 100 | 110 | 65 | 50 | 65 | 50 |
| NB 4000 Hz | 110 | 100 | 100 | 110 | 65 | 55 | 60 | 50 |
| NB 5000 Hz | 110 | 95 | 95 | 105 | 50 | 35 | 55 | 45 |
| NB 6000 Hz | 105 | 90 | 90 | 100 | 45 | 30 | 50 | 40 |
| NB 6300 Hz | 105 | 90 | 90 | 100 | 40 | 30 | 45 | 35 |
| NB 8000 Hz | 100 | 85 | 90 | 95 | 40 | 30 | 40 | 30 |
| NB 9000 Hz | | | 85 | | | | | |
| NB 10000 Hz | | | 85 | | | | | |
| NB 11200 Hz | | | 80 | | | | | |
| NB 12500 Hz | | | 75 | | | | | |
| NB 14000 Hz | | | 70 | | | | | |
| NB 16000 Hz | | | 50 | | | | | |
| NB 18000 Hz | | | 20 | | | | | |
| NB 20000 Hz | | | 0 | | | | | |
| White noise | 120 | 120 | 115 | 110 | 70 | 70 | 70 | 60 |
| TEN noise | 110 | | | 100 | | | | |



Speech reference equivalent threshold value for transducer

| ANSI SPEECH RETSPL | | | | | | | | |
|-------------------------|--------|----------------|----------------|--------|---------|----------|---------|----------|
| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | RETSPL | RETSPL | RETSPL | RETSPL | RETFL | RETFL | RETFL | RETFL |
| Impedance | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| Speech | 18.5 | 17 | 19 | | | | | |
| Speech Equ.FF. | 18.5 | 16.5 | 18.5 | | | | | |
| Speech Non-linear | 6 | 4.5 | 5.5 | 12.5 | 55 | 63.5 | 55 | 63.5 |
| Speech noise | 18.5 | 17 | 19 | | | | | |
| Speech noise Equ.FF. | 18.5 | 16.5 | 18.5 | | | | | |
| Speech noise Non-linear | 6 | 4.5 | 5.5 | 12.5 | 55 | 63.5 | 55 | 63.5 |
| White noise in speech | 21 | 19.5 | 21.5 | 15 | 57.5 | 66 | 57.5 | 66 |

DD45 (G_F-G_C) PTB-DTU report 2009-2010.

DD65V2 (GF-GC) PTB-AAU report 2018.

DD450 (G_F-G_C) ANSI S3.6-2018 and ISO 389-8:2004.

ANSI Speech level 12.5 dB + 1 kHz RETSPL ANSI S3.6-2018 (acoustical linear weighting).

ANSI Speech Equivalent free field level 12.5 dB + 1 kHz RETSPL - (G_F-G_C) from ANSI S3.6-2018 (acoustical equivalent sensitivity weighting).

ANSI Speech Not linear level 1 kHz RETSPL ANSI S3.6-2018 (DD45, DD65V2, DD450) and IP30, B71 and B81 12.5 dB + 1 kHz RETSPL ANSI S3.6-2018 (no weighting).

| ANSI SPEECH MAX. HL | | | | | | | | |
|-------------------------|---------|----------------|----------------|---------|---------|----------|---------|----------|
| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL |
| Speech | 110 | 100 | 90 | | | | | |
| Speech Equ.FF. | 100 | 95 | 85 | | | | | |
| Speech Non-linear | 120 | 110 | 110 | 110 | 60 | 40 | 60 | 50 |
| Speech noise | 100 | 95 | 85 | | | | | |
| Speech noise Equ.FF. | 100 | 90 | 80 | | | | | |
| Speech noise Non-linear | 115 | 105 | 105 | 110 | 50 | 40 | 50 | 40 |
| White noise in speech | 95 | 95 | 90 | 95 | 55 | 45 | 60 | 50 |



IEC SPEECH RETSPL

| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
|-------------------------|----------|----------------|----------------|----------|---------|----------|---------|----------|
| Impedance | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | RETSPL L | RETSPL | RETSPL | RETSPL L | RETFL | RETFL | RETFL | RETFL |
| Speech | 20 | 20 | 20 | | | | | |
| Speech Equ.FF. | 3.5 | 1.5 | 3.5 | | | | | |
| Speech Non-linear | 6 | 4.5 | 5.5 | 20 | 55 | 63.5 | 55 | 63.5 |
| Speech noise | 20 | 20 | 20 | | | | | |
| Speech noise Equ.FF. | 3.5 | 1.5 | 3.5 | | | | | |
| Speech noise Non-linear | 6 | 4.5 | 5.5 | 20 | 55 | 63.5 | 55 | 63.5 |
| White noise in speech | 22.5 | 22.5 | 22.5 | 22.5 | 57.5 | 66 | 57.5 | 66 |

DD45 (G_F-G_C) PTB-DTU report 2009-2010.

DD65V2 (GF-GC) PTB-AAU report 2018.

DD450 (G_F-G_C) ANSI S3.6-2018 and ISO 389-8:2004.

IEC Speech level IEC 60645-1:2017 (acoustical linear weighting).

IEC Speech Equivalent free field level (G_F-G_C) from IEC 60645-1:2017 (acoustical equivalent sensitivity weighting).

IEC Speech Not linear level 1 kHz RETSPL (DD45, DD65V2, DD450) and IP30, B7 and B81 IEC 60645-1:2017 (no weighting).

IEC SPEECH MAX. HL

| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
|-------------------------|---------|----------------|----------------|---------|---------|----------|---------|----------|
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL |
| Speech | 110 | 95 | 90 | | | | | |
| Speech Equ.FF. | 115 | 110 | 100 | | | | | |
| Speech Non-linear | 120 | 110 | 110 | 100 | 60 | 40 | 60 | 50 |
| Speech noise | 100 | 90 | 85 | | | | | |
| Speech noise Equ.FF. | 115 | 10 | 95 | | | | | |
| Speech noise Non-linear | 115 | 105 | 105 | 90 | 50 | 40 | 50 | 40 |
| White noise in speech | 95 | 95 | 90 | 85 | 55 | 45 | 60 | 50 |



SWEDEN SPEECH RETSPL

| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
|-------------------------|--------|----------------|----------------|--------|---------|----------|---------|----------|
| Impedance | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | RETSPL | RETSPL | RETSPL | RETSPL | RETFL | RETFL | RETFL | RETFL |
| Speech | 22 | 20 | 20 | | | | | |
| Speech Equ.FF. | 3.5 | 1.5 | 3.5 | | | | | |
| Speech Non-linear | 22 | 4.5 | 5.5 | 21 | 55 | 63.5 | 55 | 63.5 |
| Speech noise | 27 | 20 | 20 | | | | | |
| Speech noise Equ.FF. | 3.5 | 1.5 | 3.5 | | | | | |
| Speech noise Non-linear | 27 | 4.5 | 5.5 | 26 | 55 | 63.5 | 55 | 63.5 |
| White noise in speech | 22.5 | 22.5 | 22.5 | 22.5 | 57.5 | 66 | 57.5 | 66 |

DD45 (G_F-G_C) PTB-DTU report 2009-2010.

DD65V2 (GF-GC) PTB-AAU report 2018.

DD450 (G_F-G_C) ANSI S3.6-2018 and ISO 389-8:2004.

Sweden Speech level STAF 1996 and IEC 60645-1:2017 (acoustical linear weighting).

Sweden Speech Equivalent free field level (G_F-G_C) from IEC 60645-1:2017 (acoustical equivalent sensitivity weighting).

Sweden Speech Not linear level 1 kHz RETSPL (DD45, DD65V2, DD450) and IP30, B71 and B81 STAF 1996 and IEC 60645-1:2017 (no weighting).

SWEDEN SPEECH MAX. HL

| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
|-------------------------|---------|----------------|----------------|---------|---------|----------|---------|----------|
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL | Max. HL |
| Speech | 108 | 95 | 90 | | | | | |
| Speech Equ.FF. | 115 | 110 | 100 | | | | | |
| Speech Non-linear | 104 | 110 | 110 | 99 | 60 | 40 | 60 | 50 |
| Speech noise | 93 | 90 | 85 | | | | | |
| Speech noise Equ.FF. | 115 | 100 | 95 | | | | | |
| Speech noise Non-linear | 94 | 105 | 105 | 84 | 50 | 40 | 50 | 40 |
| White noise in speech | 95 | 95 | 90 | 85 | 55 | 45 | 60 | 50 |



NORWAY SPEECH RETSPL

| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
|-------------------------|---------|----------------|----------------|---------|---------|----------|---------|----------|
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | RETSP L | RETSPL | RETSPL | RETSP L | RETFL | RETFL | RETFL | RETFL |
| Speech | 40 | 40 | 40 | | | | | |
| Speech Equ.FF. | 3.5 | 1.5 | 3.5 | | | | | |
| Speech Non-linear | 6 | 4.5 | 5.5 | 40 | 75 | 83.5 | 75 | 83.5 |
| Speech noise | 40 | 40 | 40 | | | | | |
| Speech noise Equ.FF. | 3.5 | 1.5 | 3.5 | | | | | |
| Speech noise Non-linear | 6 | 4.5 | 5.5 | 40 | 75 | 83.5 | 75 | 83.5 |
| White noise in speech | 22.5 | 22.5 | 22.5 | 22.5 | 57.5 | 66 | 57.5 | 66 |

DD45 (G_F-G_C) PTB-DTU report 2009-2010.

DD65V2 (GF-GC) PTB-AAU report 2018.s

DD450 (G_F-G_C) ANSI S3.6-2018 and ISO 389-8:2004.

Norway Speech level IEC 60645-1:2017 +20dB (acoustical linear weighting).

Norway Speech Equivalent free field level (G_F-G_C) from IEC 60645-1:2017 (acoustical equivalent sensitivity weighting).

Norway Speech Not linear level 1 kHz RETSPL (DD45, DD65V2, DD450) and IP30, B71 and B81 IEC 60645-1 2017 +20dB (no weighting).

NORWAY SPEECH MAX. HL

| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
|-------------------------|---------|----------------|----------------|---------|---------|----------|---------|----------|
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | Max. HL | Max. HL | Max HL | Max. HL | Max. HL | Max HL | Max. HL | Max HL |
| Speech | 90 | 75 | 70 | | | | | |
| Speech Equ.FF. | 115 | 110 | 100 | | | | | |
| Speech Non-linear | 120 | 110 | 110 | 80 | 40 | 20 | 40 | 30 |
| Speech noise | 80 | 70 | 65 | | | | | |
| Speech noise Equ.FF. | 115 | 100 | 95 | | | | | |
| Speech noise Non-linear | 115 | 105 | 105 | 70 | 30 | 20 | 30 | 20 |
| White noise in speech | 95 | 95 | 90 | 85 | 55 | 45 | 60 | 50 |



| JAPAN SPEECH RETSPL | | | | | | | | |
|-------------------------|---------|----------------|----------------|--------|---------|----------|---------|----------|
| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | RETSP L | RETSPL | RETSPL | RETSPL | RETFL | RETFL | RETFL | RETFL |
| Speech | 14 | 14 | 14 | | | | | |
| Speech Equ.FF. | 3.5 | 1.5 | 3.5 | | | | | |
| Speech Non-linear | 6 | 4.5 | 5.5 | 14 | 49 | 57.5 | 49 | 57.5 |
| Speech noise | 14 | 14 | 14 | | | | | |
| Speech noise Equ.FF. | 3.5 | 1.5 | 3.5 | | | | | |
| Speech noise Non-linear | 6 | 4.5 | 5.5 | 14 | 49 | 57.5 | 49 | 57.5 |
| White noise in speech | 22.5 | 22.5 | 22.5 | 22.5 | 57.5 | 66 | 57.5 | 66 |

DD45 (G_F-G_C) PTB-DTU report 2009-2010.

DD65 v2 (GF-GC) PTB-AAU report 2018.

DD450 (G_F-G_C) ANSI S3.6 2018 and ISO 389-8:2004.

Japan Speech level JIS T1201-2:2000 (acoustical linear weighting).

Japan Speech Equivalent free field level (G_F-G_C) from IEC60645-1 2017 (acoustical equivalent sensitivity weighting).

Japan Speech Not linear level 1 kHz RETSPL (DD45, DD65V2, DD450) and IP30, B71 and B81 IEC 60645-1:2017 (no weighting).

| JAPAN SPEECH MAX. HL | | | | | | | | |
|-------------------------|---------|----------------|----------------|---------|---------|----------|---------|----------|
| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | Max. HL | Max. HL | Max HL | Max. HL | Max. HL | Max HL | Max. HL | Max HL |
| Speech | 116 | 101 | 96 | | | | | |
| Speech Equ.FF. | 115 | 110 | 100 | | | | | |
| Speech Non-linear | 120 | 110 | 110 | 106 | 66 | 46 | 66 | 56 |
| Speech noise | 106 | 96 | 91 | | | | | |
| Speech noise Equ.FF. | 115 | 100 | 95 | | | | | |
| Speech noise Non-linear | 115 | 105 | 105 | 96 | 56 | 46 | 56 | 46 |
| White noise in speech | 95 | 95 | 90 | 85 | 55 | 45 | 60 | 50 |



| SPL SPEECH RETSPL | | | | | | | | |
|-------------------------|--------|----------------|----------------|--------|---------|----------|---------|----------|
| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | RETSPL | RETSPL | RETSPL | RETSPL | RETFL | RETFL | RETFL | RETFL |
| Speech | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Speech Equ.FF. | 0 | 0 | 0 | | | | | |
| Speech Non-linear | 0 | 0 | 0 | | | | | |
| Speech noise | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Speech noise Equ.FF. | 0 | 0 | 0 | | | | | |
| Speech noise Non-linear | 0 | 0 | 0 | | | | | |

DD45 (G_F-G_C) PTB-DTU report 2009-2010.

DD65V2 (GF-GC) PTB-AAU report 2018.

DD450 (G_F-G_C) ANSI S3.6-2018 and ISO 389-8:2004.

| SPL SPEECH MAX. HL | | | | | | | | |
|-------------------------|---------|----------------|----------------|---------|---------|----------|---------|----------|
| TRANSDUCER | DD45 | DD65 v2 | DD450 | IP30 | B71 | B71 | B81 | B81 |
| IMPEDANCE | 10 Ω | 10 Ω | 40 Ω | 10 Ω | 10 Ω | 10 Ω | 12.5 Ω | 12.5 Ω |
| COUPLER | 6ccm | ARTIFICIAL EAR | ARTIFICIAL EAR | 2ccm | MASTOID | FOREHEAD | MASTOID | FOREHEAD |
| | Max. HL | Max. HL | Max HL | Max. HL | Max. HL | Max HL | Max. HL | Max HL |
| Speech | 120 | 115 | 105 | 120 | 110 | 105 | 110 | 105 |
| Speech Equ.FF. | 115 | 110 | 100 | | | | | |
| Speech Non-linear | 120 | 110 | 115 | | | | | |
| Speech noise | 115 | 110 | 100 | 110 | 105 | 100 | 105 | 100 |
| Speech noise Equ.FF. | 115 | 105 | 95 | | | | | |
| Speech noise Non-linear | 120 | 105 | 110 | | | | | |
| White noise in speech | 115 | 115 | 110 | 105 | 110 | 108.5 | 115 | 113.5 |



FREE FIELD

| ANSI S3.6-2018 | | | | | FREE FIELD MAX. SPL | | | | | |
|----------------|----------|--------|--------|----------------------|--|----------|-----------------|----------|---------------------|----------|
| ISO 389-7:2005 | | | | | FREE FIELD MAX. HL IS FOUND BY SUBTRACTING THE SELECTED RETSPL VALUE | | | | | |
| FREQUENCY | BINAURAL | | | BINAURAL TO MONAURAL | FREE FIELD POWER | | FREE FIELD LINE | | FREE FIELD INTERNAL | |
| | 0° | 45° | 90° | CORRECTION | TONE | NB | TONE | NB | TONE | NB |
| Hz | RETSPL | RETSPL | RETSPL | RETSPL | MAX. SPL | MAX. SPL | MAX. SPL | MAX. SPL | MAX. SPL | MAX. SPL |
| | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB |
| 125 | 22 | 21.5 | 21 | 2 | 97 | 82 | 102 | 97 | 82 | 72 |
| 160 | 18 | 17 | 16.5 | 2 | 93 | 83 | 98 | 93 | 78 | 68 |
| 200 | 14.5 | 13.5 | 13 | 2 | 94.5 | 84.5 | 104.5 | 99.5 | 84.5 | 74.5 |
| 250 | 11.5 | 10.5 | 9.5 | 2 | 96.5 | 86.5 | 106.5 | 101.5 | 86.5 | 76.5 |
| 315 | 8.5 | 7 | 6 | 2 | 93.5 | 83.5 | 103.5 | 98.5 | 83.5 | 73.5 |
| 400 | 6 | 3.5 | 2.5 | 2 | 96 | 86 | 106 | 101 | 91 | 81 |
| 500 | 4.5 | 1.5 | 0 | 2 | 94.5 | 84.5 | 104.5 | 99.5 | 89.5 | 79.5 |
| 630 | 3 | -0.5 | -2 | 2 | 93 | 83 | 103 | 98 | 88 | 78 |
| 750 | 2.5 | -1 | -2.5 | 2 | 92.5 | 82.5 | 102.5 | 97.5 | 87.5 | 77.5 |
| 800 | 2 | -1.5 | -3 | 2 | 92 | 87 | 107 | 102 | 87 | 77 |
| 1000 | 2.5 | -1.5 | -3 | 2 | 92.5 | 82.5 | 102.5 | 97.5 | 87.5 | 77.5 |
| 1250 | 3.5 | -0.5 | -2.5 | 2 | 93.5 | 83.5 | 103.5 | 98.5 | 88.5 | 78.5 |
| 1500 | 2.5 | -1 | -2.5 | 2 | 92.5 | 82.5 | 102.5 | 97.5 | 87.5 | 77.5 |
| 1600 | 1.5 | -2 | -3 | 2 | 96.5 | 86.5 | 106.5 | 101.5 | 91.5 | 81.5 |
| 2000 | -1.5 | -4.5 | -3.5 | 2 | 93.5 | 83.5 | 103.5 | 98.5 | 88.5 | 78.5 |
| 2500 | -4 | -7.5 | -6 | 2 | 91 | 81 | 101 | 96 | 86 | 76 |
| 3000 | -6 | -11 | -8.5 | 2 | 94 | 84 | 104 | 94 | 89 | 79 |
| 3150 | -6 | -11 | -8 | 2 | 94 | 84 | 104 | 94 | 89 | 79 |
| 4000 | -5.5 | -9.5 | -5 | 2 | 94.5 | 84.5 | 104.5 | 99.5 | 89.5 | 79.5 |
| 5000 | -1.5 | -7.5 | -5.5 | 2 | 93.5 | 83.5 | 108.5 | 98.5 | 88.5 | 78.5 |
| 6000 | 4.5 | -3 | -5 | 2 | 94.5 | 84.5 | 104.5 | 99.5 | 89.5 | 79.5 |
| 6300 | 6 | -1.5 | -4 | 2 | 96 | 86 | 106 | 96 | 91 | 81 |
| 8000 | 12.5 | 7 | 4 | 2 | 87.5 | 72.5 | 92.5 | 87.5 | 87.5 | 77.5 |
| White Noise | 0 | -4 | -5.5 | 2 | | 90 | | 100 | | 85 |

ANSI FREE FIELD

| ANSI S3.6-2018 | | | | | FREE FIELD MAX. SPL | | |
|--|----------|--------|--------|----------------------|---------------------|-----------------|---------------------|
| FREE FIELD MAX. HL IS FOUND BY SUBTRACTING THE SELECTED RETSPL VALUE | | | | | | | |
| | BINAURAL | | | BINAURAL TO MONAURAL | FREE FIELD POWER | FREE FIELD LINE | FREE FIELD INTERNAL |
| | 0° | 45° | 90° | CORRECTION | 0° - 45° - 90° | 0° - 45° - 90° | 0° - 45° - 90° |
| | RETSPL | RETSPL | RETSPL | RETSPL | MAX. SPL | MAX. SPL | MAX. SPL |
| Speech | 15 | 11 | 9.5 | 2 | 90 | 100 | 80 |
| Speech Noise | 15 | 11 | 9.5 | 2 | 85 | 100 | 75 |
| Speech WN | 17.5 | 13.5 | 12 | 2 | 87.5 | 97.5 | 82.5 |

IEC FREE FIELD

| ISO 389-7:2005 | | | | | FREE FIELD MAX. SPL | | |
|--|----------|------------|--------|----------------------|---------------------|-----------------|---------------------|
| FREE FIELD MAX. HL IS FOUND BY SUBTRACTING THE SELECTED RETSPL VALUE | | | | | | | |
| | BINAURAL | | | BINAURAL TO MONAURAL | FREE FIELD POWER | FREE FIELD LINE | FREE FIELD INTERNAL |
| | 0° | CORRECTION | 90° | CORRECTION | 0° - 45° - 90° | 0° - 45° - 90° | 0° - 45° - 90° |
| | RETSPL | RETSPL | RETSPL | RETSPL | MAX. SPL | MAX. SPL | MAX. SPL |
| Speech | 0 | -4 | -5.5 | 2 | 90 | 100 | 80 |
| Speech Noise | 0 | -4 | -5.5 | 2 | 85 | 100 | 75 |
| Speech WN | 2.5 | -1.5 | -3 | 2 | 87.5 | 97.5 | 82.5 |



SWEDEN FREE FIELD

| ISO 389-7:2005 | | | | | FREE FIELD MAX. SPL | | |
|----------------|--------|--------|--------|----------------------|--|-----------------|---------------------|
| | | | | | FREE FIELD MAX. HL IS FOUND BY SUBTRACTING THE SELECTED RETSPL VALUE | | |
| BINAURAL | | | | BINAURAL TO MONAURAL | FREE FIELD POWER | FREE FIELD LINE | FREE FIELD INTERNAL |
| 0° | 45° | 90° | | CORRECTION | 0° - 45° - 90° | 0° - 45° - 90° | 0° - 45° - 90° |
| RETSPL | RETSPL | RETSPL | RETSPL | RETSPL | MAX. SPL | MAX. SPL | MAX. SPL |
| Speech | 0 | -4 | -5.5 | 2 | 90 | 100 | 80 |
| Speech Noise | 0 | -4 | -5.5 | 2 | 85 | 100 | 75 |
| Speech WN | 2.5 | -1.5 | -3 | 2 | 87.5 | 97.5 | 82.5 |

NORWAY FREE FIELD

| ISO 389-7:2005 | | | | | FREE FIELD MAX. SPL | | |
|----------------|--------|--------|--------|----------------------|--|-----------------|---------------------|
| | | | | | FREE FIELD MAX. HL IS FOUND BY SUBTRACTING THE SELECTED RETSPL VALUE | | |
| BINAURAL | | | | BINAURAL TO MONAURAL | FREE FIELD POWER | FREE FIELD LINE | FREE FIELD INTERNAL |
| 0° | 45° | 90° | | CORRECTION | 0° - 45° - 90° | 0° - 45° - 90° | 0° - 45° - 90° |
| RETSPL | RETSPL | RETSPL | RETSPL | RETSPL | MAX. SPL | MAX. SPL | MAX. SPL |
| Speech | 0 | -4 | -5.5 | 2 | 90 | 100 | 80 |
| Speech Noise | 0 | -4 | -5.5 | 2 | 85 | 100 | 75 |
| Speech WN | 2.5 | -1.5 | -3 | 2 | 87.5 | 97.5 | 82.5 |

JAPAN FREE FIELD

| ISO 389-7:2005 | | | | | FREE FIELD MAX. SPL | | |
|----------------|--------|--------|--------|----------------------|--|-----------------|---------------------|
| | | | | | FREE FIELD MAX. HL IS FOUND BY SUBTRACTING THE SELECTED RETSPL VALUE | | |
| BINAURAL | | | | BINAURAL TO MONAURAL | FREE FIELD POWER | FREE FIELD LINE | FREE FIELD INTERNAL |
| 0° | 45° | 90° | | CORRECTION | 0° - 45° - 90° | 0° - 45° - 90° | 0° - 45° - 90° |
| RETSPL | RETSPL | RETSPL | RETSPL | RETSPL | MAX. SPL | MAX. SPL | MAX. SPL |
| Speech | 10 | 6 | 4.5 | 2 | 90 | 100 | 80 |
| Speech Noise | 10 | 6 | 4.5 | 2 | 85 | 100 | 75 |
| Speech WN | 2.5 | -1.5 | -3 | 2 | 87.5 | 97.5 | 82.5 |

SPL FREE FIELD

| ISO 389-7:2005 | | | | | FREE FIELD MAX. SPL | | |
|----------------|--------|--------|--------|----------------------|--|-----------------|---------------------|
| | | | | | FREE FIELD MAX. HL IS FOUND BY SUBTRACTING THE SELECTED RETSPL VALUE | | |
| BINAURAL | | | | BINAURAL TO MONAURAL | FREE FIELD POWER | FREE FIELD LINE | FREE FIELD INTERNAL |
| 0° | 45° | 90° | | CORRECTION | 0° - 45° - 90° | 0° - 45° - 90° | 0° - 45° - 90° |
| RETSPL | RETSPL | RETSPL | RETSPL | RETSPL | MAX. SPL | MAX. SPL | MAX. SPL |
| Speech | 0 | 0 | 0 | 0 | 90 | 100 | 80 |
| Speech Noise | 0 | 0 | 0 | 0 | 85 | 100 | 75 |
| Speech WN | 2.5 | -1.5 | -3 | 2 | 87.5 | 97.5 | 82.5 |



EQUIVALENT FREE FIELD

| SPEECH AUDIOMETER | | | |
|-------------------|--------------------------------|--------------------------------|--------------------------------|
| | DD45 | DD65V2 | DD450 |
| | PTB – DTU 2010 | PTB-AAU 2018 | ISO389-8:2004 |
| COUPLER | IEC 60318-3 | IEC 60318-1 | IEC 60318-1 |
| FREQUENCY | G _F -G _c | G _F -G _c | G _F -G _c |
| 125 | -21.5 | -4.5 | -5,0 |
| 160 | -17.5 | -3.5 | -4,5 |
| 200 | -14.5 | -4.5 | -4,5 |
| 250 | -12.0 | -4.5 | -4,5 |
| 315 | -9.5 | -4.0 | -5,0 |
| 400 | -7.0 | -2.0 | -5,5 |
| 500 | -7.0 | -3.0 | -2,5 |
| 630 | -6.5 | -2.0 | -2,5 |
| 750 | | | |
| 800 | -4.0 | -2.0 | -3,0 |
| 1000 | -3.5 | -1.5 | -3,5 |
| 1250 | -3.5 | -1.5 | -2,0 |
| 1500 | | | |
| 1600 | -7.0 | -3.0 | -5,5 |
| 2000 | -7.0 | -2.5 | -5,0 |
| 2500 | -9.5 | -2.5 | -6,0 |
| 3000 | | -5.5 | |
| 3150 | -12.0 | -9.5 | -7,0 |
| 4000 | -8.0 | -9.5 | -13,0 |
| 5000 | -8.5 | -13.0 | -14,5 |
| 6000 | | | |
| 6300 | -9.0 | -9.0 | -11,0 |
| 8000 | -1.5 | -4.5 | -8,5 |


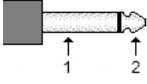
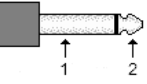
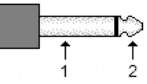
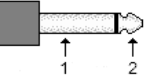
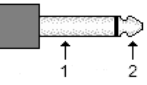

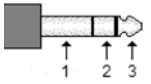





SOUND ATTENUATION VALUES FOR EARPHONES

| FREQUENCY | ATTENUATION | | | |
|-----------|--|-------|--------|-------|
| | DD45 with MX41/AR or PN 51 Cushion | IP30 | DD65V2 | DD450 |
| [Hz] | [dB]* | [dB]* | [dB]* | [dB]* |
| 125 | 3 | 33 | 8.3 | 15 |
| 160 | 4 | 34 | 8.7 | 15 |
| 200 | 5 | 35 | 11.7 | 16 |
| 250 | 5 | 36 | 15.5 | 16 |
| 315 | 5 | 37 | 19.5 | 18 |
| 400 | 6 | 37 | 23.4 | 20 |
| 500 | 7 | 38 | 26.1 | 23 |
| 630 | 9 | 37 | 28.5 | 25 |
| 750 | - | | | |
| 800 | 11 | 37 | 28.2 | 27 |
| 1000 | 15 | 37 | 32.4 | 29 |
| 1250 | 18 | 35 | 30.8 | 30 |
| 1500 | - | | | |
| 1600 | 21 | 34 | 33.7 | 31 |
| 2000 | 26 | 33 | 43.6 | 32 |
| 2500 | 28 | 35 | 47.5 | 37 |
| 3000 | - | | | |
| 3150 | 31 | 37 | 41.5 | 41 |
| 4000 | 32 | 40 | 43.8 | 46 |
| 5000 | 29 | 41 | 46.7 | 45 |
| 6000 | - | | | |
| 6300 | 26 | 42 | 45.7 | 45 |
| 8000 | 24 | 43 | 45.6 | 44 |




*ISO 8253-1:2010



Pin assignments

| Socket | Connector | Pin 1 | Pin 2 | Pin 3 | Pin 4 |
|------------------|---|----------------|-----------------|---|-------|
| Mains +24Vdc |  DC connector | +24Vdc | 0Vdc | N/A | N/A |
| AC1-Left |  6.3mm Mono | Ground | Signal | N/A | N/A |
| AC1-Right | | | | | |
| AC2-Left |  6.3mm Mono | Ground | Signal | N/A | N/A |
| AC2-Right | | | | | |
| AC3-Left |  6.3mm Mono | Ground | Signal | N/A | N/A |
| AC3-Right | | | | | |
| Bone |  6.3mm Mono | Ground | Signal | N/A | N/A |
| FF1 |  6.3mm Mono | Signal - | Signal + | N/A | N/A |
| FF2 |  6.3mm Mono | Signal - | Signal + | N/A | N/A |
| Patient response |  6.3mm Stereo | Ground | Ground |  | N/A |
| FF1-2 line out |  3.5mm Stereo | Ground | Signal FF1 line | Signal FF2 line | N/A |
| FF3-4 line out |  3.5mm Stereo | Ground | Signal FF3 line | Signal FF4 line | N/A |
| Monitor Headset |  3.5mm Stereo | Monitor ground | Monitor Right | Monitor Left | N/A |
| Talk Forward Mic |  3.5mm Stereo | Ground | DC bias | Signal | N/A |



| Socket | Connector | Pin 1 | Pin 2 | Pin 3 | Pin 4 |
|------------------------|---|-------------|---------------|---------------|--------------|
| AUX |  3.5mm Stereo | Ground | AUX-2 | AUX-1 | N/A |
| Assistant Monitor |  3.5mm 4-pin | Mic. signal | Ground | Monitor Right | Monitor Left |
| Talk Back/Ambient-Mic. | | Ground | Mic. One wire | Mic. Bias | Mic. Signal |
| VRA | | Common | VRA-3 | VRA-2 | VRA-1 |
| USB connector |  USB device | +5 VDC | Data - | Data + | Ground |



Electromagnetic compatibility (EMC) Equinox Evo

The Equinox Evo is suitable in hospital and clinical environments except for near-active HF surgical equipment and RF-shielded rooms of systems for magnetic resonance imaging, where the intensity of electromagnetic disturbance is high.

ESSENTIAL PERFORMANCE for this instrument is defined by the manufacturer as:

This instrument does not have an ESSENTIAL PERFORMANCE

Absence or loss of ESSENTIAL PERFORMANCE cannot lead to any unacceptable immediate risk

Final diagnosis shall always be based on clinical knowledge.

Use of this instrument adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this instrument and the other equipment should be observed to verify that they are operating normally.

Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of this equipment, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result in improper operation.

This instrument is in compliance with IEC60601-1-2:2014+AMD1:2020, emission class B group 1

NOTICE: There are no deviations from the collateral standard and allowances uses

NOTICE: All necessary instruction for maintaining compliance with regard to EMC can be found in the general maintenance section in this instruction. No further steps required.

To ensure compliance with the EMC requirements as specified in IEC 60601-1-2, it is essential to use only the following accessories:

| Item | Manufacturer | Model |
|--------------|---------------------|------------------|
| Power supply | Fuhua/UE Electronic | UES65-240250SPA3 |
| USB cable | Sanibel | 8011241 |

Conformance to the EMC requirements as specified in IEC 60601-1-2 is ensured if the cable types and cable lengths are as specified below:

| Description | Length max [m] | Shielded (Yes/No) |
|---|----------------|-------------------|
| Audiometric Headsets | 2.0 | Y |
| Audiometric Insert-Headsets | 2.0 | Y |
| Audiometric Headsets for High Frequency | 2.0 | Y |
| Bone conductors | 2.0 | N |
| Assistants Monitor Headsets | 2.9 | Y |
| Monitor Headsets w. microphone | 2.9 | Y |
| Patient response buttons | 2.0 | Y |
| Ambient Microphone | 5.0 | Y |
| Microphone for Talk Forward | 2.0 | Y |
| Microphone for Talk Back | 2.0 | Y |
| FF-Line cables for amplifier | 1.0 | Y |
| Loudspeakers (FF Power) | 1.8 | N |
| VRA cable | 1.2 | N |



| Guidance and manufacturer's declaration - electromagnetic emissions | | |
|--|------------------------------|--|
| The EQUINOX EVO is intended for use in the electromagnetic environment specified below. The customer or the user of the EQUINOX EVO should assure that it is used in such an environment. | | |
| Emissions Test | Compliance | Electromagnetic environment - guidance |
| RF emissions CISPR 11 | Group 1 | The EQUINOX EVO uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment. |
| RF emissions CISPR 11 | Class B | The EQUINOX EVO is suitable for use in all commercial, industrial, business, and residential environments. |
| Harmonic emissions IEC 61000-3-2 | Complies Class A Category | |
| Voltage fluctuations / flicker emissions IEC 61000-3-3 | Complies | |

| Recommended separation distances between portable and mobile RF communications equipment and the EQUINOX EVO. | | | |
|---|--|---|--|
| The EQUINOX EVO is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the EQUINOX EVO can help prevent electromagnetic interferences by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the EQUINOX EVO as recommended below, according to the maximum output power of the communications equipment. | | | |
| Rated Maximum output power of transmitter [W] | Separation distance according to frequency of transmitter [m] | | |
| | 150 kHz to 80 MHz $d = 1.17\sqrt{P}$ | 80 MHz to 800 MHz $d = 1.17\sqrt{P}$ | 800 MHz to 2.7 GHz $d = 2.23\sqrt{P}$ |
| 0.01 | 0.12 | 0.12 | 0.23 |
| 0.1 | 0.37 | 0.37 | 0.74 |
| 1 | 1.17 | 1.17 | 2.33 |
| 10 | 3.70 | 3.70 | 7.37 |
| 100 | 11.70 | 11.70 | 23.30 |
| For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. | | | |
| Note 1 At 80 MHz and 800 MHz, the higher frequency range applies. | | | |
| Note 2 These guidelines may not apply to all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people. | | | |



Guidance and Manufacturer's Declaration - Electromagnetic Immunity

The **EQUINOX EVO** is intended for use in the electromagnetic environment specified below. The customer or the user of the **EQUINOX EVO** should assure that it is used in such an environment.


| Immunity Test | IEC 60601 Test level | Compliance | Electromagnetic Environment-Guidance |
|--|--|---|---|
| Electrostatic Discharge (ESD) IEC 61000-4-2 | +8 kV contact +15 kV air | +8 kV contact +15 kV air | Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be greater than 30%. |
| Electrical fast transient/burst IEC61000-4-4 | +2 kV for power supply lines +1 kV for input/output lines | +2 kV for power supply lines +1 kV for input/output lines | Mains power quality should be that of a typical commercial or residential environment. |
| Surge IEC 61000-4-5 | +1 kV differential mode +2 kV common mode | +1 kV differential mode +2 kV common mode | Mains power quality should be that of a typical commercial or residential environment. |
| Voltage dips, short interruptions and voltage variations on power supply lines IEC 61000-4-11 | < 5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles <5% UT (>95% dip in UT) for 5 sec | < 5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles <5% UT | Mains power quality should be that of a typical commercial or residential environment. If the user of the EQUINOX EVO requires continued operation during power mains interruptions, it is recommended that the EQUINOX EVO be powered from an uninterruptable power supply or its battery. |
| Power frequency (50/60 Hz) IEC 61000-4-8 | 30 A/m | 30 A/m | Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or residential environment. |

Note: UT is the A.C. mains voltage prior to application of the test level.



Guidance and manufacturer's declaration — electromagnetic immunity

The **EQUINOX EVO** is intended for use in the electromagnetic environment specified below. The customer or the user of the **EQUINOX EVO** should assure that it is used in such an environment,

| Immunity test | IEC / EN 60601 test level | Compliance level | Electromagnetic environment – guidance |
|--|---|--|---|
| <p>Conducted RF IEC / EN 61000-4-6</p> <p>Radiated RF IEC / EN 61000-4-3</p> | <p>3 Vrms 150kHz to 80 MHz</p> <p>6 Vrms in ISM bands 150kHz to 80 MHz 80 % AM at 1 kHz</p> <p>3 V/m 80 MHz to 2,7 GHz 80 % AM at 1 kHz</p> | <p>3 Vrms</p> <p>6 Vrms</p> <p>3 V/m</p> | <p>Portable and mobile RF communications equipment should be used no closer to any parts of the EQUINOX EVO, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p>Recommended separation distance</p> $d = 1,2\sqrt{P}$ $d = 1,2\sqrt{P}$ <p>80 MHz to 800 MHz</p> $d = 2,3\sqrt{P}$ <p>800 MHz to 2,7 GHz</p> <p>Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, (a) should be less than the compliance level in each frequency range (b)</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p>  |

NOTE1 At 80 MHz and 800 MHz, the higher frequency range applies

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

(a) Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the **EQUINOX EVO** is used exceeds the applicable RF compliance level above, the **EQUINOX EVO** should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the **EQUINOX EVO**.

(b) Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.



Appendix B – Free field adjustment tips and tricks

This section walks using the Free Field adjustment function for the Affinity Compact and provides tips and tricks on how to work with the function.

This function will both be covered from a technician and an end user standpoint.

Please refer to the quick guide Free Field adjustment on the Interacoustics website for overall use of this function.

In this section Free Field will be shortened FF.

Use in calibration software

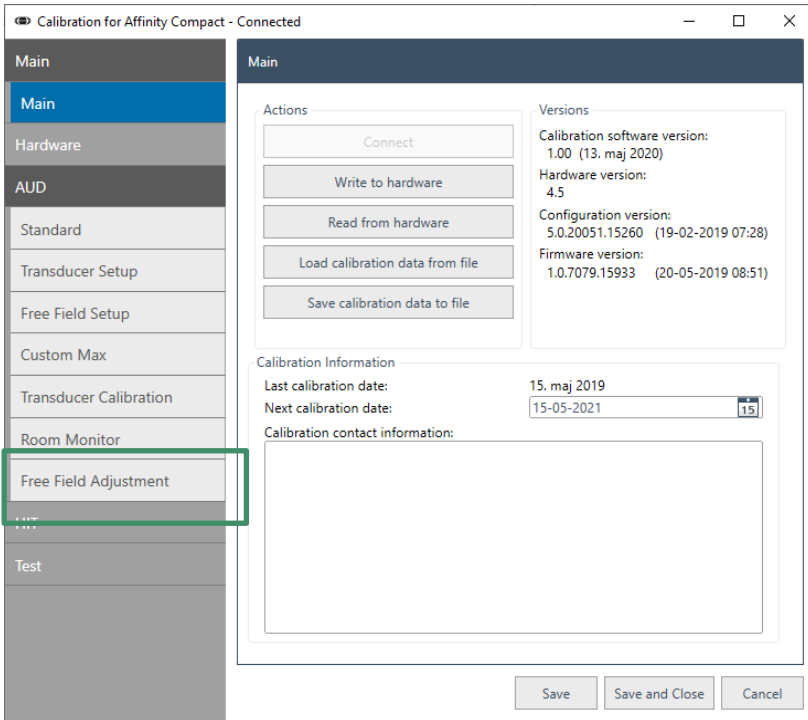


Fig. i

The Free Field adjustment is available in the Calibration for Affinity Compact software for all Affinity Compact units.

To use this functionality, the user must be in position of a calibrated Room monitor microphone.

This microphone must be connected to the unit before launching the calibration software.

The functionality can be found under the AUD tab.

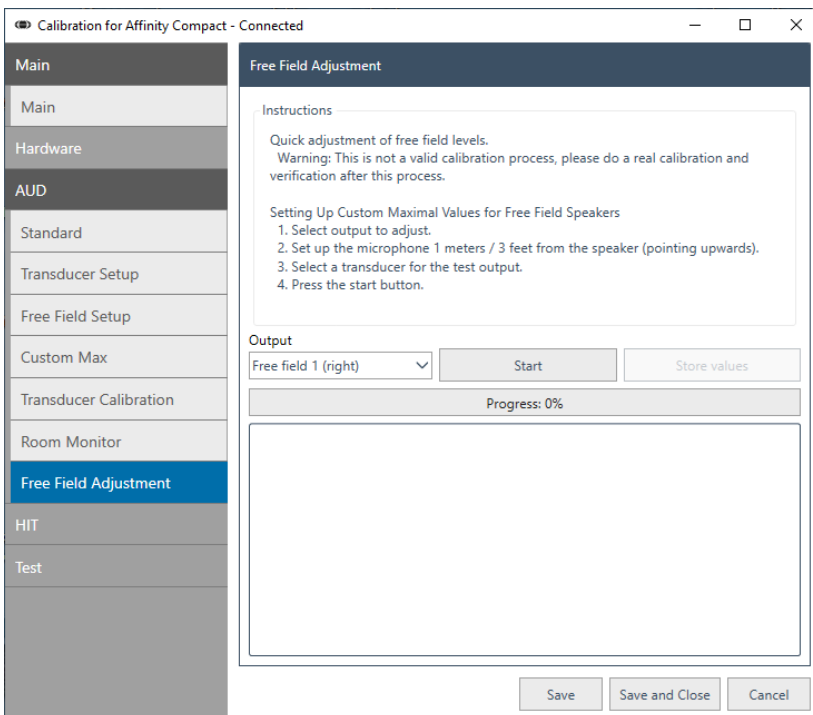


Fig. ii

Performing an adjustment

In the Free Field adjustment screen the user can select what speaker that is being tested on.

In the calibration software only one speaker can be tested at the time. The speaker that is to be tested needs to be selected in the Output drop down list.

When the correct speaker has been selected, make sure that the microphone is placed correctly and then press the Start button to start the adjustment.

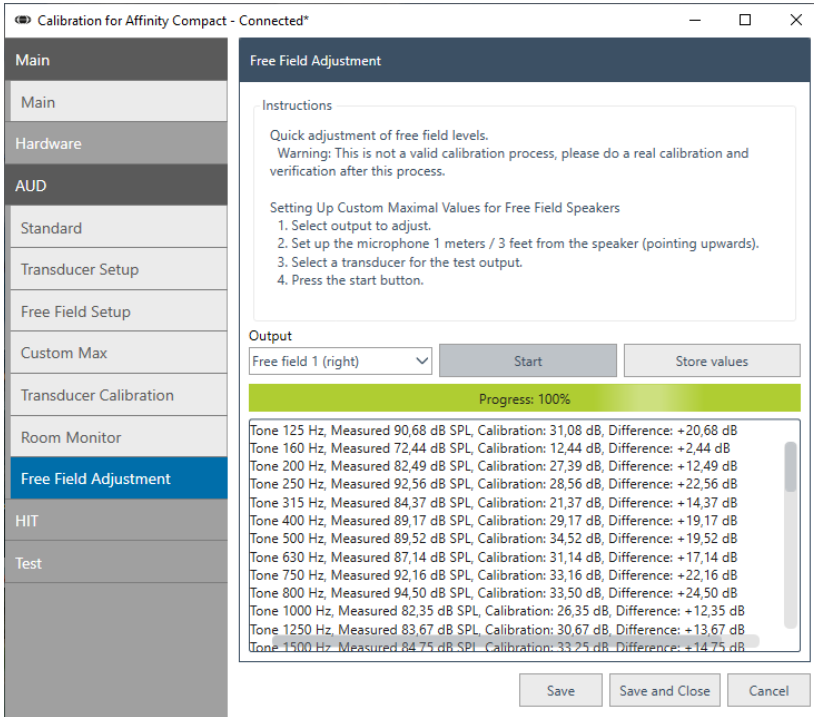


Fig. iii

When an adjustment has been completed the *Store values* can be pressed and the system then adjust the output of the unit setting, a good reference point for further validation of the calibration.

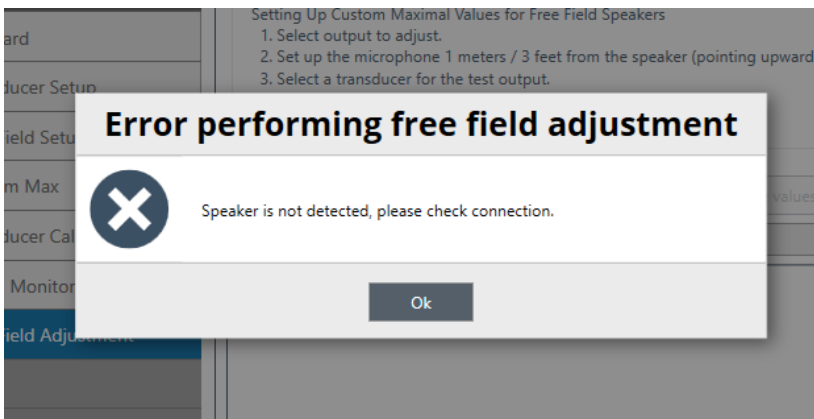


Fig. iv

No speaker connected

When the adjustment process has started the unit, try, and locate if a speaker is connected before running through the rest of the process. This is done by emitting a tone that the system will detect.

Should the unit not detect the location tone the software will inform that no speaker is connected. If this message appears, check that the speaker is correctly connected and run the procedure again.

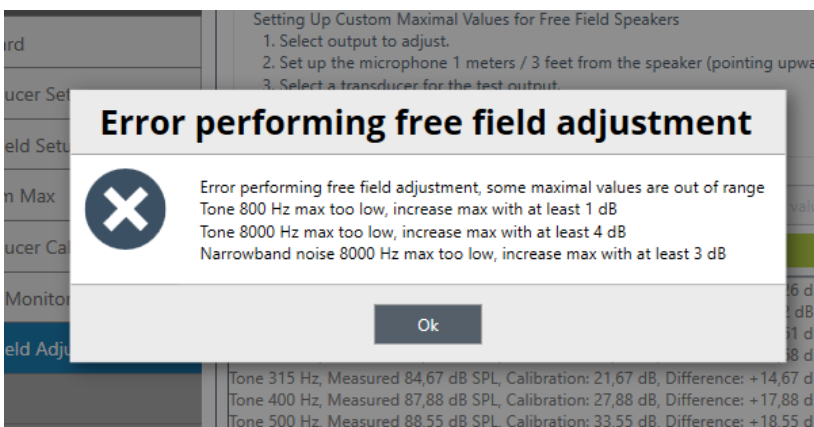


Fig. v

Some maximal values out of range

When running the adjustment process in the calibration software, error messages can appear at the end of the measurement.

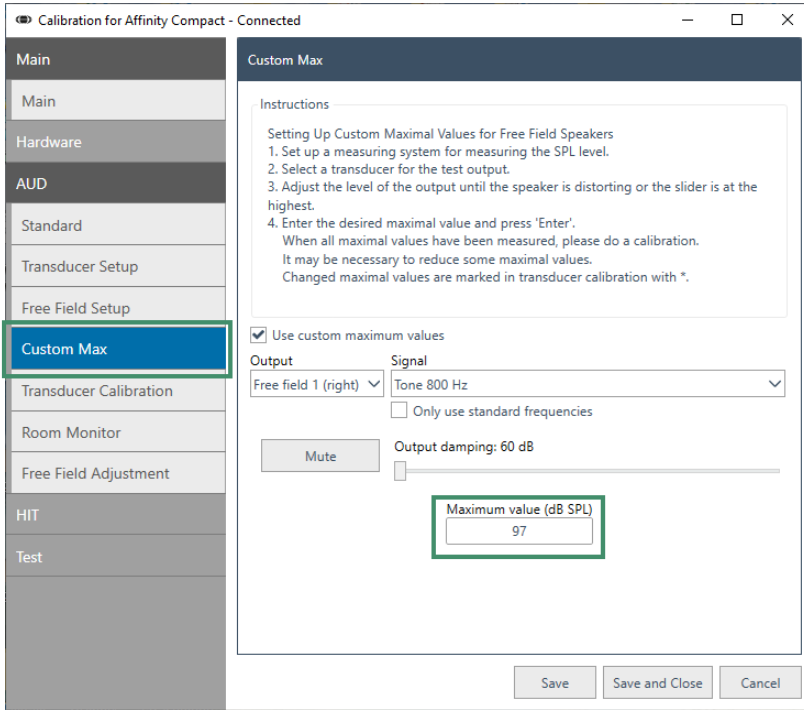


Fig. vi

This error message does not mean that the adjustment was performed incorrectly but is an information that the Free Field adjustment could not be completed.

When this message appears, it means that the maximum at the stimuli and frequency listed is either too high or too low to complete the adjustment. To rectify this and get a pass on the Free Field adjustment, custom max must be adjusted.

This is done by entering the menu setting Custom Max. This can be found under the AUD tab.

When running a Free Field adjustment and the error comes up stating e.g., *Tone 800Hz max too low, increase max with at least 1dB* the *Maximum value (dB SPL)* should be adjusted for the given stimuli and frequency.

Because Free Field is a very sensitive environment it is recommended to always change with 1dB more than the software suggest. Changing the allowed maximum with this additional 1dB more than the Free Field adjustment suggests is not required but does allow for more headroom.

The additional headroom means that the Free Field setup gets less sensitive to minor changes in the Free Field environment allowing for an easier pass of the Free Field Adjustment.

Verify output attenuation

After a Free Field adjustment has been completed and when the calibration of the unit is being verified, it is recommended also to pay attention to the positioning of the output damping sliders.

If a slider is close to or at the upper or lower limit (with in 1dB) getting a consistent pass, from one day to another, on the Free Field adjustment can prove difficult. This is because small variations in the test environment such as a positioning of a chair or microphone placement can cause small differences to the sound characteristic. In most of the cases the Free Field adjustment feature can handle these minor changes in the sound environment, but if the calibration sliders are at the limit the Free Field adjustment does not have headroom to make its adjustments and can end up not giving a pass.

The way to overcome this is to adjust the allowed maximum output for that given frequency. This is done in calibration software under custom max as mentioned earlier in this document. Here, changing the maximum just 1 dB will allow for the system to easier passing the Free Field adjustment from one day to another.



Using free field adjustment in the Affinity suite

The Free Field adjustment feature is available in the Affinity suite for all Affinity Compact units. In the suite it is a feature that allows for the user to verify/confirm their Free Field setup. Before launching the software, it is important to make sure that the Free Field adjustment microphone is connected to the Affinity Compact.

This feature can be accessed through the Free Field adjustment icon located in the left menu bar:

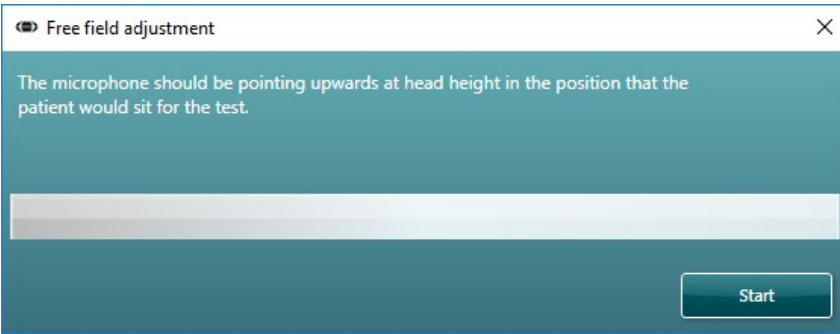
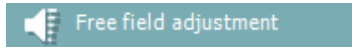


Fig. vii

When launching the feature, a window opens on top of the software.

This window allows for start of the Free Field adjustment. Make sure that the microphone is in place before starting the adjustment.

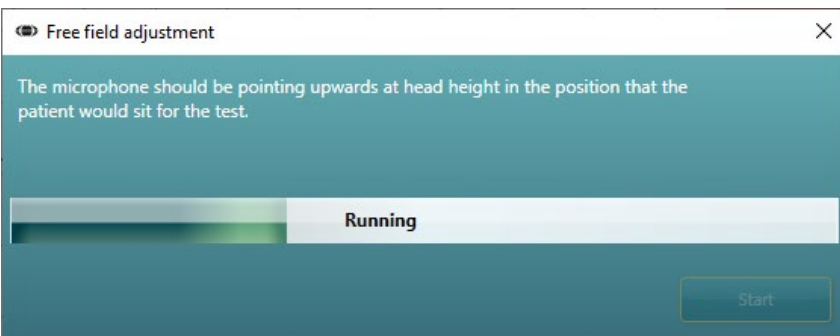


Fig. viii

When the microphone is in place the adjustment process can be started by pressing the Start button.

When the measurement is running the progress will be illustrated in the progress bar.

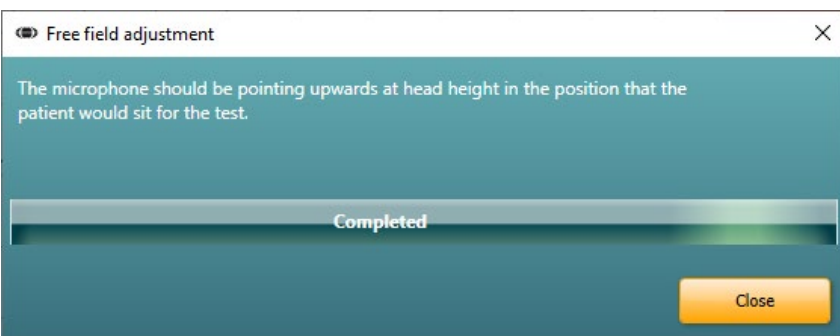


Fig. ix

When running the system will run through the speakers sequentially if two speakers are connected.

When a Free Field adjustment has been successfully completed the window will display a completed message on the screen.



No speaker connected

When the adjustment process has started the unit try and locate if a speaker is connected before running through the rest of the process. This is done by emitting a tone that the system will detect.

Should the unit not detect the location tone the software will inform that the adjustment cannot be completed.

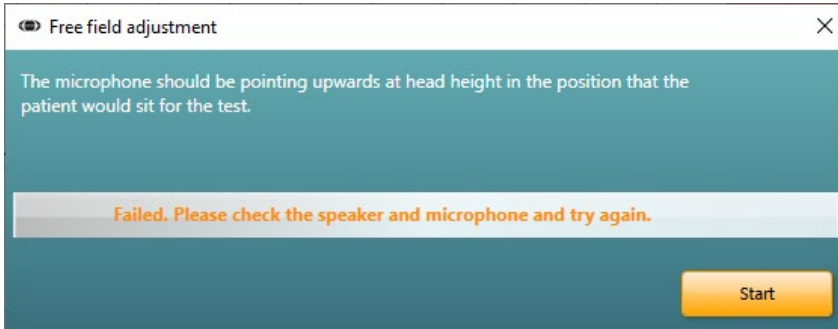


Fig. x

If the speaker is not connected it can be determined by the timing of the error message. If the message comes right after starting the adjustment progress it means that the primary speaker (FF1) is not connected. If the error message appears exactly halfway into the progress it means that the secondary speaker (FF2) is not connected.

Free Field adjustment fails

When the Free Field adjustment fails in the suite it can mean several different things. Below, some of the causes are being listed.

The microphone is not at reference point

Should the Free Field adjustment fail it should be considered if the right reference point has been selected. This is especially relevant at home visits as finding the correct reference point for Free Field testing can prove difficult in a home testing scenario.

In more fixed setups the placement of the reference point is still important to have verified. When having tested multiple clients the chair in which they are placed can move and end up not being at the reference point.

External amplifier has been adjusted

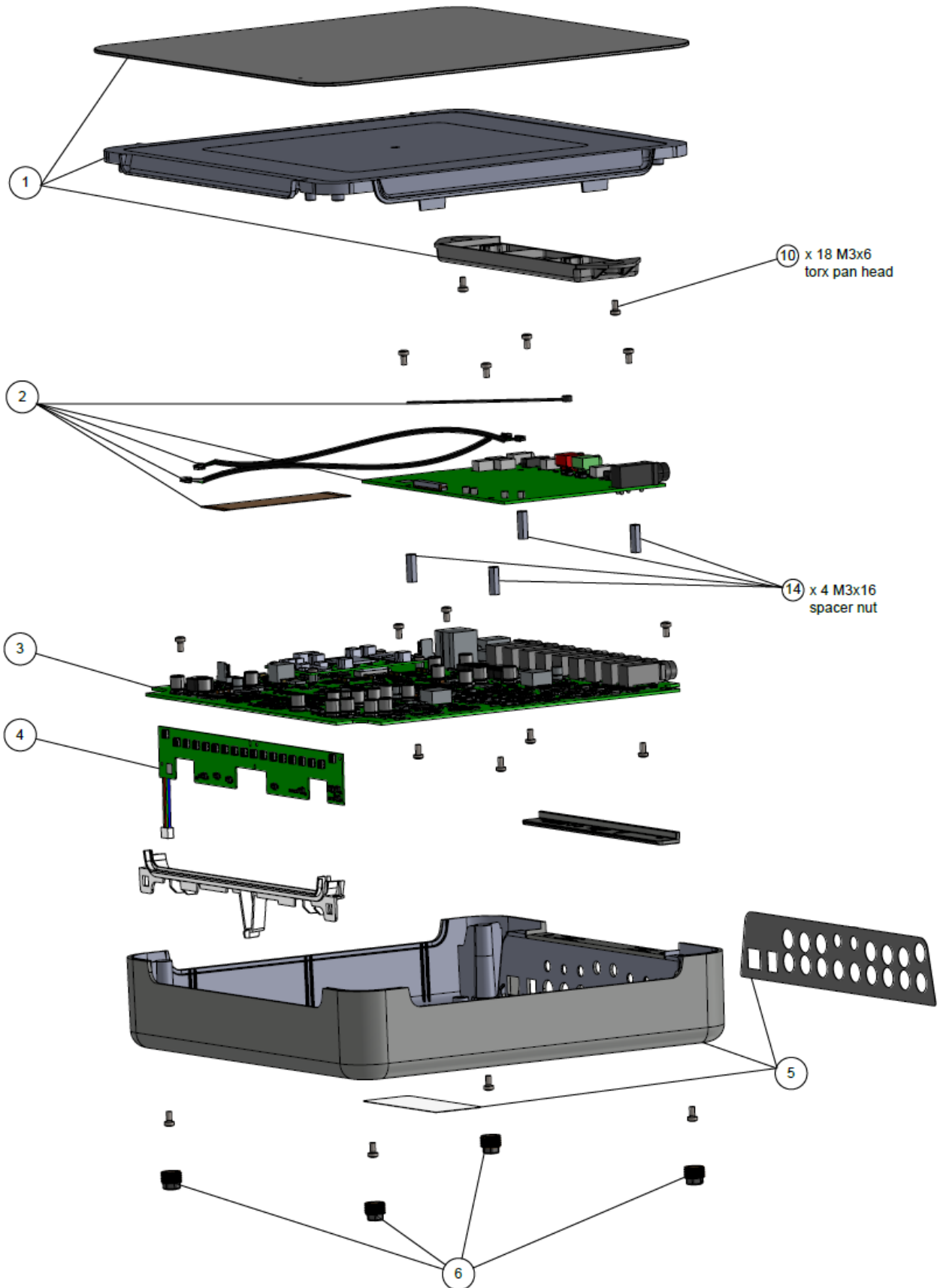
In some Free Field setups, an external amplifier is used to activate the needed level. As the majority of amplifiers can adjust the level of amplification it provides, it should be considered if this level has been changed since calibration and therefore cause a failure in the Free Field adjustment progress.

The test environment has been modified

Free Field is a very sensitive measurement that can easily be affected by changes to the testing environment. If a Free Field adjustment fails it should be considered if the test environment has been modified since last calibration.



Appendix C – Exploded view





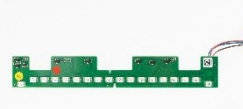



















| Item no. on exploded view | Part no. | Description |
|------------------------------|----------|---|
| 1 | 8539161 | Kit: Top part with glass and slot |
| 2 | 8539164 | Connector board incl. cables and flex PCB |
| 3 | 8539163 | Kit: Mainboard, add-on board and Capacity board (capacity board |
| 4 | 8603541 | LED board |
| 5 | 8539178 | Bottom part incl. overlay and label |
| 6 | 8603558 | Feet (4 pcs) |
| 10 | 8002981 | M3x6 torx pan head |
| 14 | 8029083 | M3x16 spacer nut |












Appendix D – Parts & accessories

| SPARE PARTS | PART NUMBER | DESCRIPTION |
|---|-------------|---|
|  | 8539161 | Kit: Top part with glass and slot |
|  | 8539163 | Kit: Mainboard, add-on board and Capacity board (capacity board underneath) |
|  | 8539164 | Connector board incl. cables and flex PCB |
|  | 8539178 | Bottom part incl. overlay and label |
|  | 8603541 | LED board |
|  | 8603558 | Feet (4 pcs) |
|  | 8010817 | HBA audiometric headband |
|  | 8507208 | Headband P3045 |
|  | 8507210 | Headband P3100 |
|  | 8507268 | DD45 telephone, 10 Ω |












| SPARE PARTS | PART NUMBER | DESCRIPTION |
|---|-------------|---|
|  | 8010894 | DD51 cushion |
|  | 8010822 | Earphone cable IEC-M21, symmetric mono For DD45/TDH39 headsets |
|  | 8517507 | DD450 / DD65v2 cable replacement kit |
|  | 8011094 | IEC-B11 conductor cable |
|  | 8107612 | Bone conductor cable 2000 |
|  | 8011241 | Cable USB, 2 m |
|  | 8506737 | B81 Bone conductor only |
|  | 8506731 | B71 Bone conductor only |
|  | 8507213 | P3333 headband, for B71 / B81 |
|  | 8524210 | Power supply 24V/2.5A UES65-240250SPA3 |






| ACCESSORIES / DISPOSABLES | PART NUMBER | DESCRIPTION |
|---|-------------|--|
|  | 8503851 | DD45 audiometric headset P3045 |
|  | 8503852 | DD45 audiometric headset P3100 |
|  | 8106339 | DD45 audiometric headset |
|  | 8520328 | DD65v2 headset |
|  | 8520321 | DD450 high frequency headset |
|  | 8106352 | DD45 RE-7 |
|  | 8106343 | DD45AA |
|  | 8101884 | IP30, 10 Ω |
|  | 8510371 | B81 bone conductor, complete, 30° plug |



| ACCESSORIES / DISPOSABLES | PART NUMBER | DESCRIPTION |
|---|-------------|---|
|  | 8510370 | B71 bone conductor, complete, 30° plug |
|  | 8010870 | Monitor headset |
|  | 8103838 | APS3 patient response switch |
|  | 8107182 | Splitter cable for patient response |
|  | 8505949 | EMS400 electret microphone For wall or table |
|  | 8508451 | Talk back microphone/Sound room monitor |
|  | 8107483 | SP90A speaker |
|  | 8539154 | Table mount bracket |
|  | 8539153 | Wall mount bracket |



| ACCESSORIES / DISPOSABLES | PART NUMBER | DESCRIPTION |
|---|-------------|---------------------------------------|
|  | 8517560 | Accessory bracket |
|  | 8106227 | Ear tip 3B E·A·Rtone, small, 100 pcs. |
|  | 8500100 | Ear tip 3C E·A·Rtone, large, 24 pcs. |



Appendix E – Update history

The following modifications have been made to the instrument and/or the manual:

| DATE | ACTION | REMARKS |
|---------|---------------------------|---------|
| 2025/01 | Release of service manual | |