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Service Manual

Callisto™



8012216 – D-0004687-D – 2020/09



Interacoustics

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1. Introduction

1.1 About this manual

This manual is for our Hearing aid analyzer, Callisto™. The contents of this manual cover instrument related data, such as disassembly and calibration. Technical specifications, schematics and a parts & accessories list can be found as appendices in the back of this manual.

1.2 About warnings and cautions

The below warning, caution and notice symbols are used 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. Disassembly

Tools required
Torx T6



WARNING

Before starting this procedure, make sure to disconnect the instrument from the power supply

This chapter contains a disassembly guide for Callisto™. Carried out by a technician authorized by Interacoustics, the most common action(s) would be replacing the battery and/or the mainboard

The other common action that Callisto™ requires, namely calibration, is described thoroughly in [Chapter 3](#).

2.1 Replacing the battery

Use a Torx T6 to remove the screw from the rear panel.



Figure 1

Press the knob cover gently from the bottom side of the cabinet. This releases the knob.



Figure 2

While pushing the bottom cover plate downwards, slide the cover plate to the right. Then, tip the plate upwards and remove it.



Figure 3

Access to the inside of the cabinet is now enabled, and battery replacement possible.



Figure 4



2.2 Replacing the PCA mainboard



Figure 5

Having enabled access to the inside of the cabinet (as described in the previous paragraph), use a Torx T6 to remove the screw indicated to the left.



Figure 6

Separate the cabinet parts by pulling the knob outwards and lifting the bottom housing.

When the parts are pulled apart, the 4 snap locks are released.

The print board is removed by gently releasing the 2 snap locks. Then, release the mainboard.

Use a small screwdriver to carefully push back the lower cabinet locks



3. Calibration

3.1 Service, adjustment and repair

Annual calibration (ANSI/ASA S3.6 and S3.46)

The calibration procedure validates all relevant performance requirements specified in ANSI/ASA S3.6 and S3.46. After the audiometric equipment has been submitted for calibration, a calibration certificate with the recorded values must be completed, signed and dated by the technician. This demonstrates that the instrument conforms to all relevant requirements specified in this standard.

NOTICE

It is considered good practice to perform annual checks of the audiometric test room's noise level as part of the annual calibration using the applicable table per ANSI/ASA S3.1 *American National Standard Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms* to ensure that audiometer performance will not be affected by any changes in the audiometric test room's noise levels

Annual calibration (IEC 60645-1 and IEC 60645-5)

A basic calibration shall be performed by an authorized laboratory. The procedure shall be such that, after the audiometric equipment has been submitted for a basic calibration, it should meet the relevant requirements specified in IEC 60645-1 and IEC 60645-5.

Upon receipt of the calibrated instrument and before being put back into service, the instrument should be checked in accordance with the procedures outlined in [Checklist for calibration](#).

NOTICE

We recommend attaching a calibration check label, displaying the next date of calibration, to the equipment

3.2 General equipment requirements

Below, the minimum equipment requirements for performing correct calibration and hardware testing are described:

1. Spectrum analyzer (SA)
2. Tone generator (TG)
3. Oscilloscope (OS)
4. Millivoltmeter (MV)
5. Multimeter (MM)
6. Acoustical coupler, 6cc and 2cc fulfilling the demands of IEC 303 and IEC 126
7. 1" pressure field condenser microphone for the above mentioned couplers, fulfilling the demands of IEC 1094-1

Furthermore, we recommend using:

- An acoustic calibrator for the control of the complete measuring chain
- A general purpose frequency counter



3.3 Calibration of test equipment

All test equipment used for the calibration of audiometers is to be calibrated annually. Calibration of all test equipment must be performed by a laboratory traceable to the National Institute of Standards and Technology (NIST) or equivalent. Test equipment calibration documents are to be kept on file.

3.3.1 Calibration mode entering

Connection between the instrument and a computer, should be conducted as described in [Installing the Callisto Suite](#). The calibration program is activated by starting the program and following the on-screen instructions. The program is found via the below path:

32 bit: C:\Program Files\Interacoustics\Callisto Suite\CalibrationCallisto.exe

64 bit: C:\Program Files (x86)\Interacoustics\Callisto Suite\CalibrationCallisto.exe



3.3.2 Checklist for calibration ¹

This list is a useful tool for making sure that no aspect of the calibration process is forgotten. Hence, we highly recommend using the list as the structure when calibrating.

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: 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	
Frequency (Hz): actual measurement recorded (all frequencies)	
Distortion (%): recorded as a percentage of THD on all frequencies	
Output levels (all transducers): recorded as a deviation from standard	
Linearity of all channels (all transducers) (dB): recorded as a deviation from standard	
Rise/fall time (m/sec): actual measurement recorded	
Overshoot (dB): actual measurement recorded	
On/off ratio: measured and recorded in dB down	
Crosstalk: measured and recorded in dB down	
Pulse tones: duration (m/sec). Actual measurement recorded (pass/fail)	
SISI: indicate pass or fail and deviation from standard	
Unwanted noise check: record with (pass/fail)	
Interrupter switch	
Switch sounds	
Mechanical 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 percentage of 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	
Distortion: recorded as percentage of THD	

¹ Post calibration and before operation, the instrument should be checked for normal function.



3.4 Installing the Callisto Suite

The Callisto Suite comes as pre-installed software in USB format.

The suite contains the calibration software required for the annual Callisto™ calibration.

The below section includes a guide describing proper installation of the software. For further information and/or installation of other Windows® versions than Windows® 10, refer to Callisto™ Instructions for Use.

NOTICE: Using operating systems where Microsoft have discontinued software and security support will increase the risk for viruses and malware, which may result in breakdowns, data loss and data theft and misuse.

Interacoustics A/S cannot be held liable for your data. Some Interacoustics A/S products support or may work with operating systems unsupported by Microsoft. Interacoustics A/S recommends you to always use Microsoft supported operating systems that are kept fully security updated.

Insert the installation USB and follow the steps.

Accept the *License terms and conditions*, and the low-lighted *Install* will become available.

Click *Install* to initiate installation.

NOTICE

If there is no automatic initiation of the installation procedure, click *Start* and then via the file finder, click the USB drive to view the contents. Click the *setup.exe* file to initiate the installation.

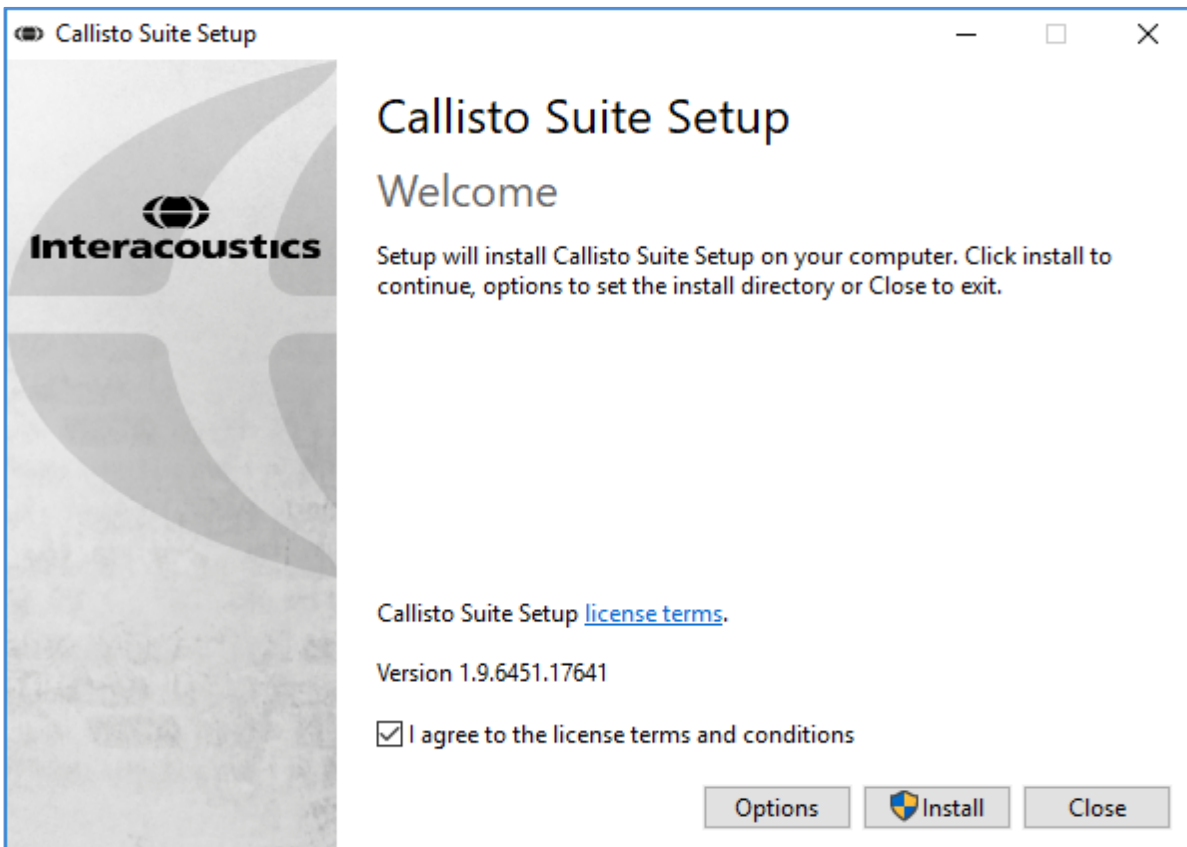


Figure 7



NOTICE Browse for an alternative location. For further information on this, refer to the Callisto™ Instructions for Use.

Click **OK** to determine the program file location.

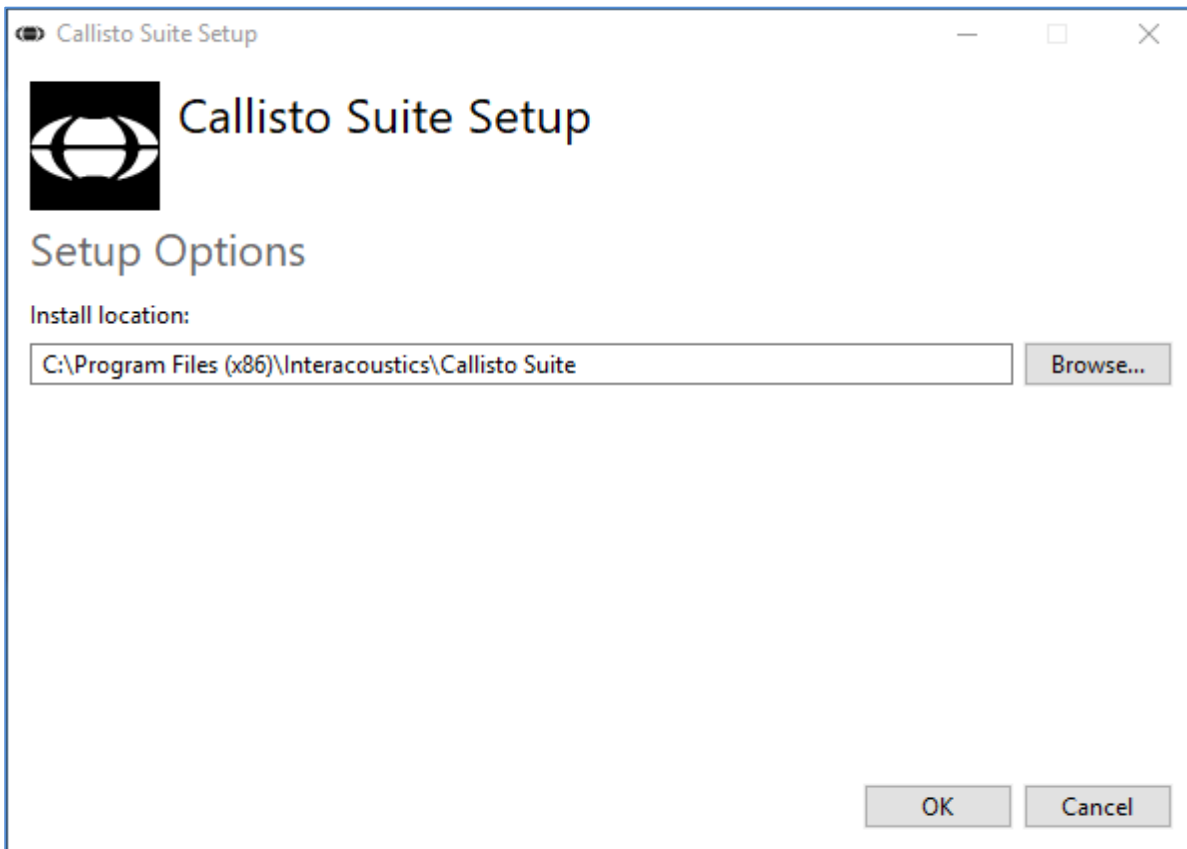
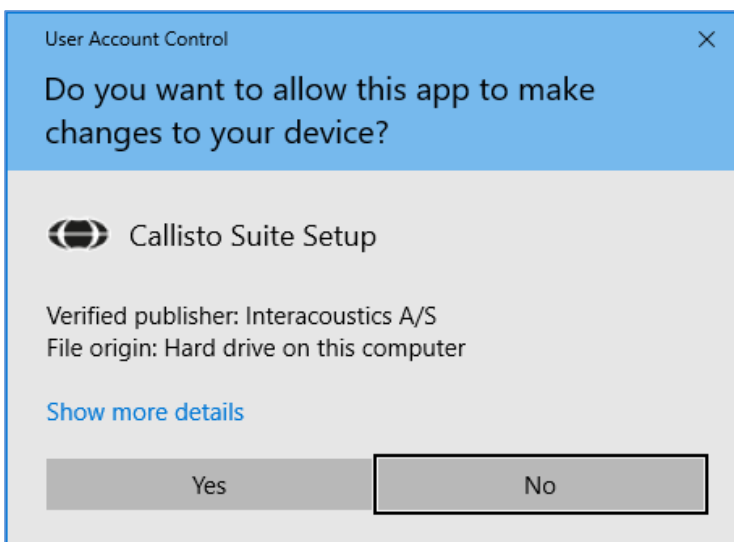


Figure 8



Finally, click **Yes** to allow installation of the Callisto™ Suite.

Figure 9



Allow the installer to process and complete the software installation.
Upon completion, click *Close*. The Suite is now installed.

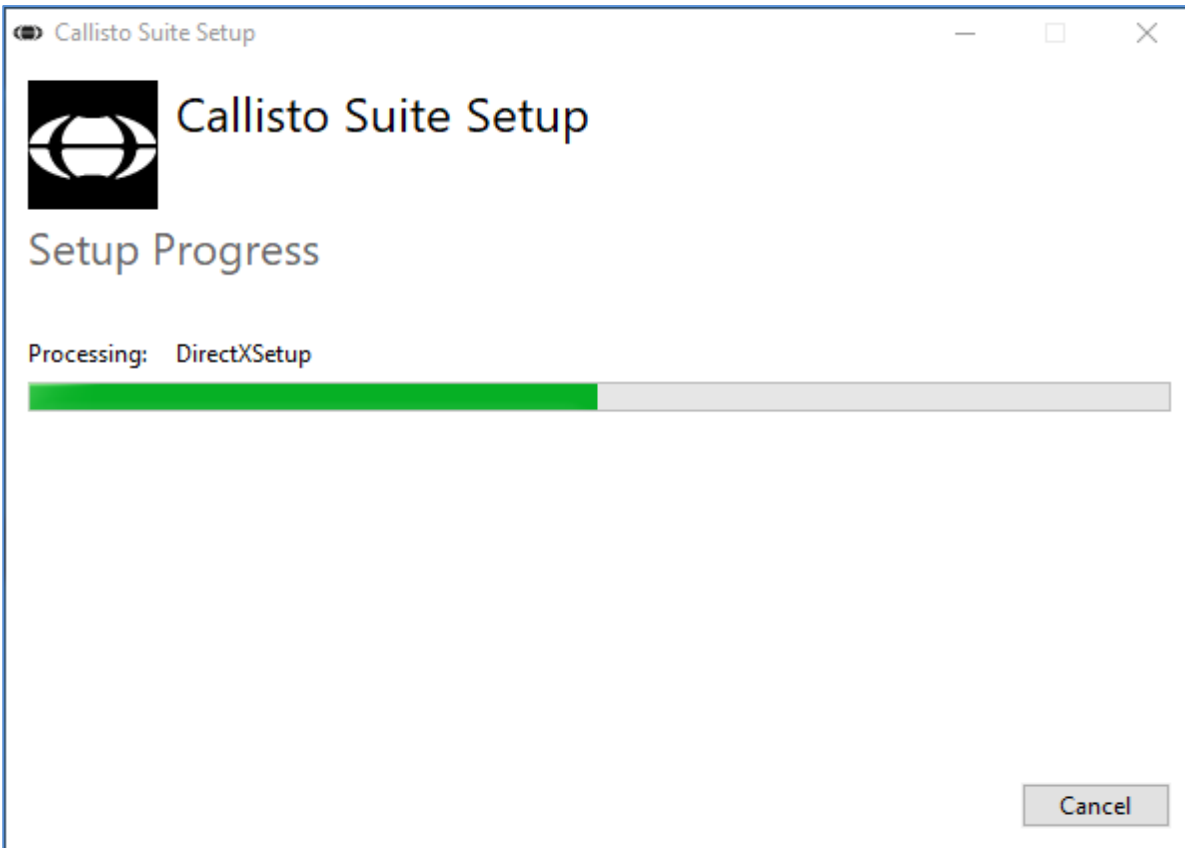


Figure 10



3.5 Main startup

Connect Callisto™ to the computer with a USB cable and switch on the instrument.

NOTICE Please note that the *Hardware* tab is used solely for production purposes. Hence, no further description of the tab in this service manual.

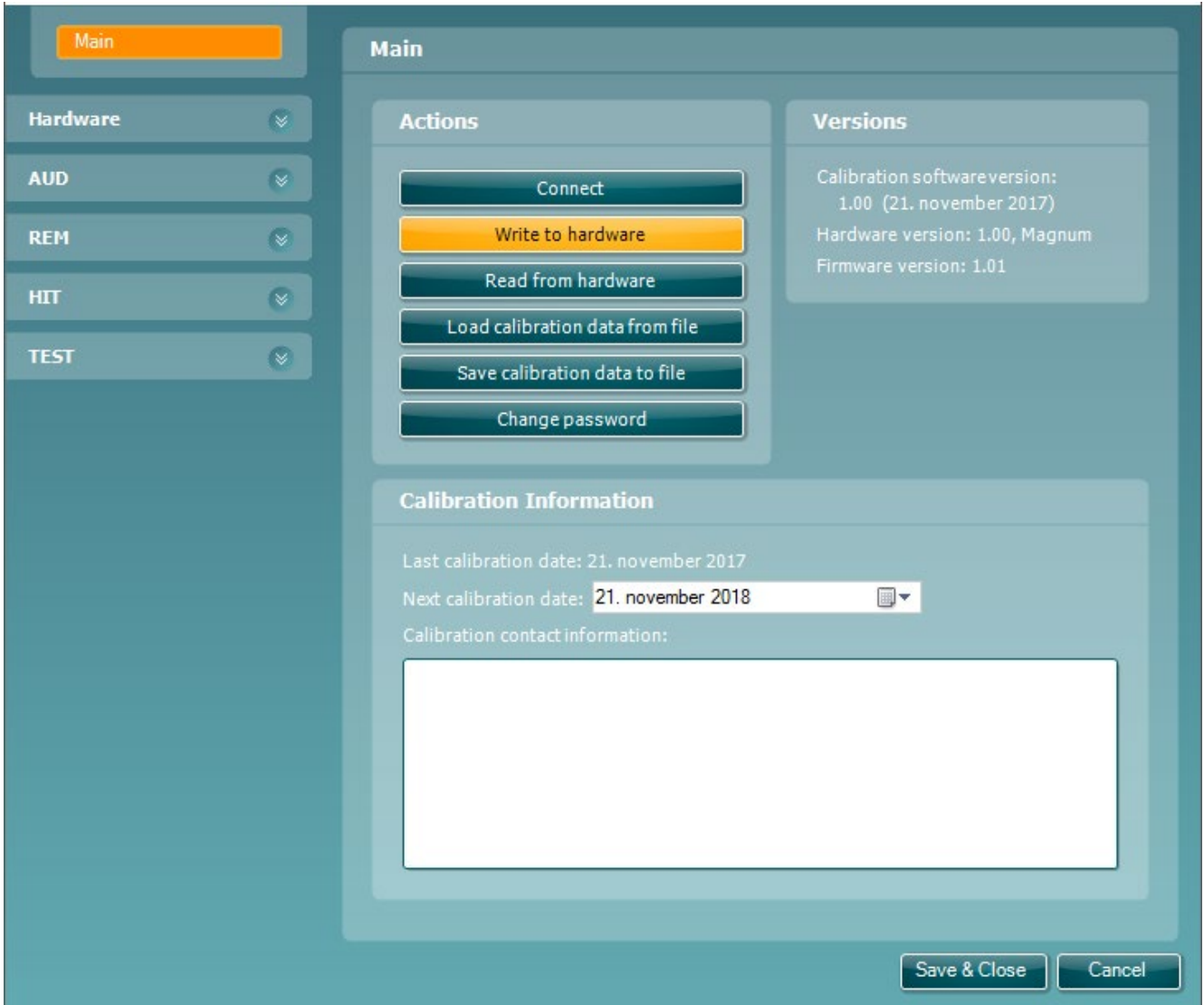


Figure 11



3.6 Saving the calibration data

This paragraph describes how to save the calibration data obtained during the calibration.

Following each calibration step, click *Main* in the menu, and then click *Write to hardware*.

A dialog box with the message *Calibration data successfully written to hardware* pops up upon successful completion of the action.

It is now possible to continue the calibration procedure via the menu tabs.

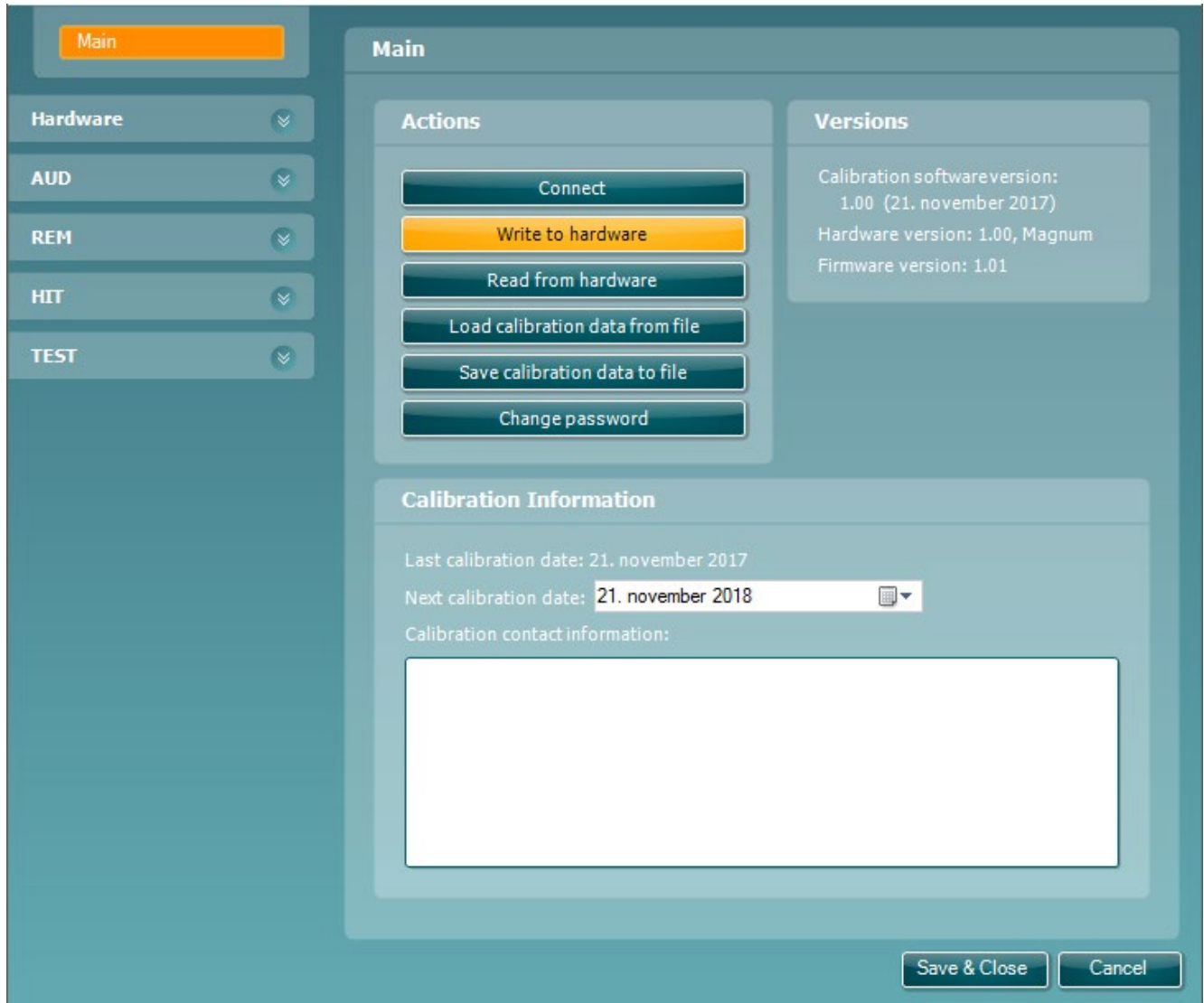


Figure 12



3.7 Calibration of the Callisto™ modules

Callisto™ offers three modules, namely HIT440, REM440 and AC440. In the following section, the calibration procedure for the three modules is described individually.

3.7.1 HIT440

Click *Connect*.

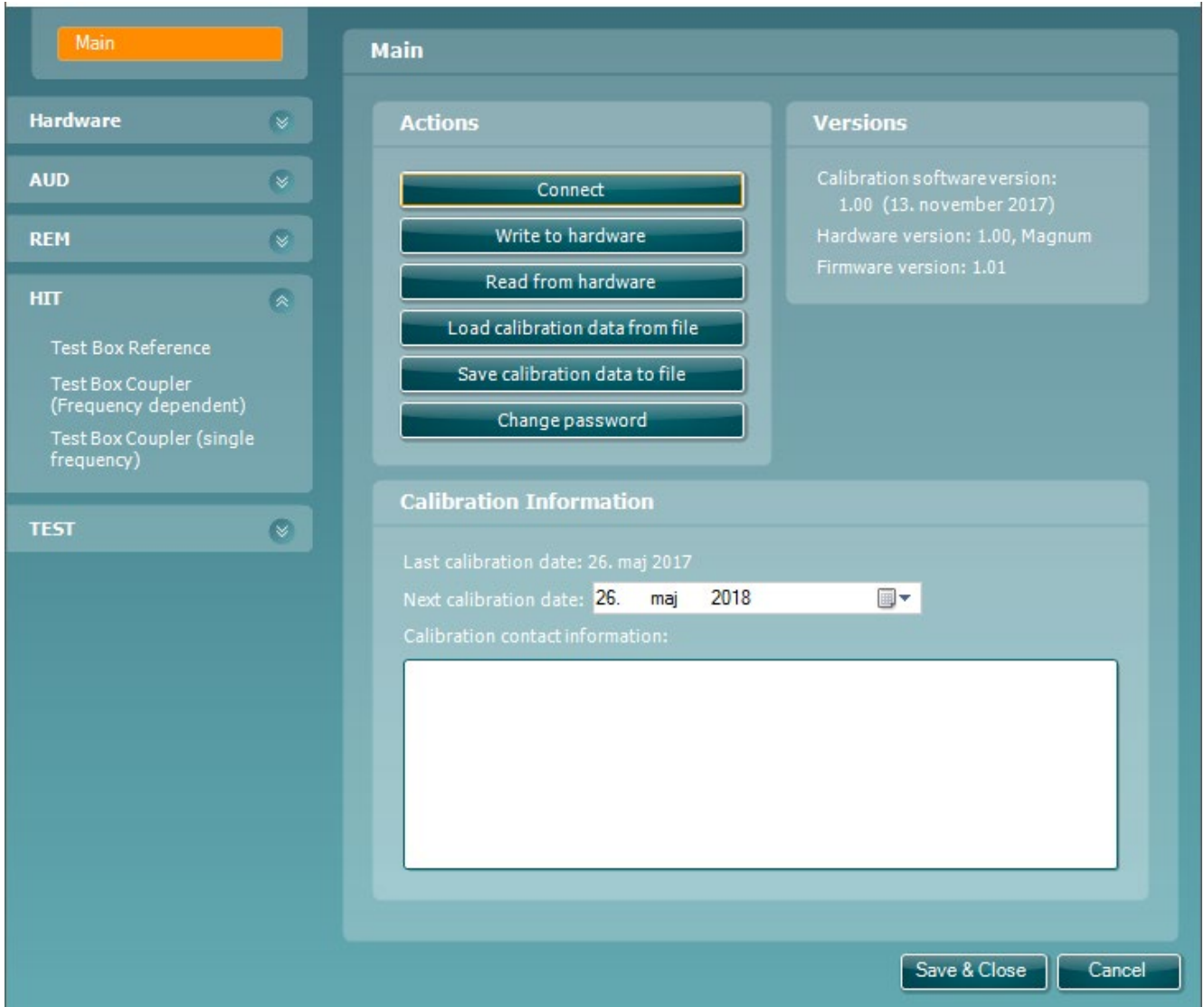


Figure 13

Equipment requirements

- 94dB (max 114dB) calibrator, or equivalent
- Calibration adaptor for HIT



3.7.1.1 Test box reference

First, uncheck the box *Uncalibrated*.

Then, place the reference microphone in the acoustical calibrator fitted with the calibration adaptor for HIT, as illustrated to the right hand side.

Select the *Calibrator frequency*.

Finally, slide the adjustment button until 94dB ±0,5dB is reached on the *Measured* bar.



Figure 14

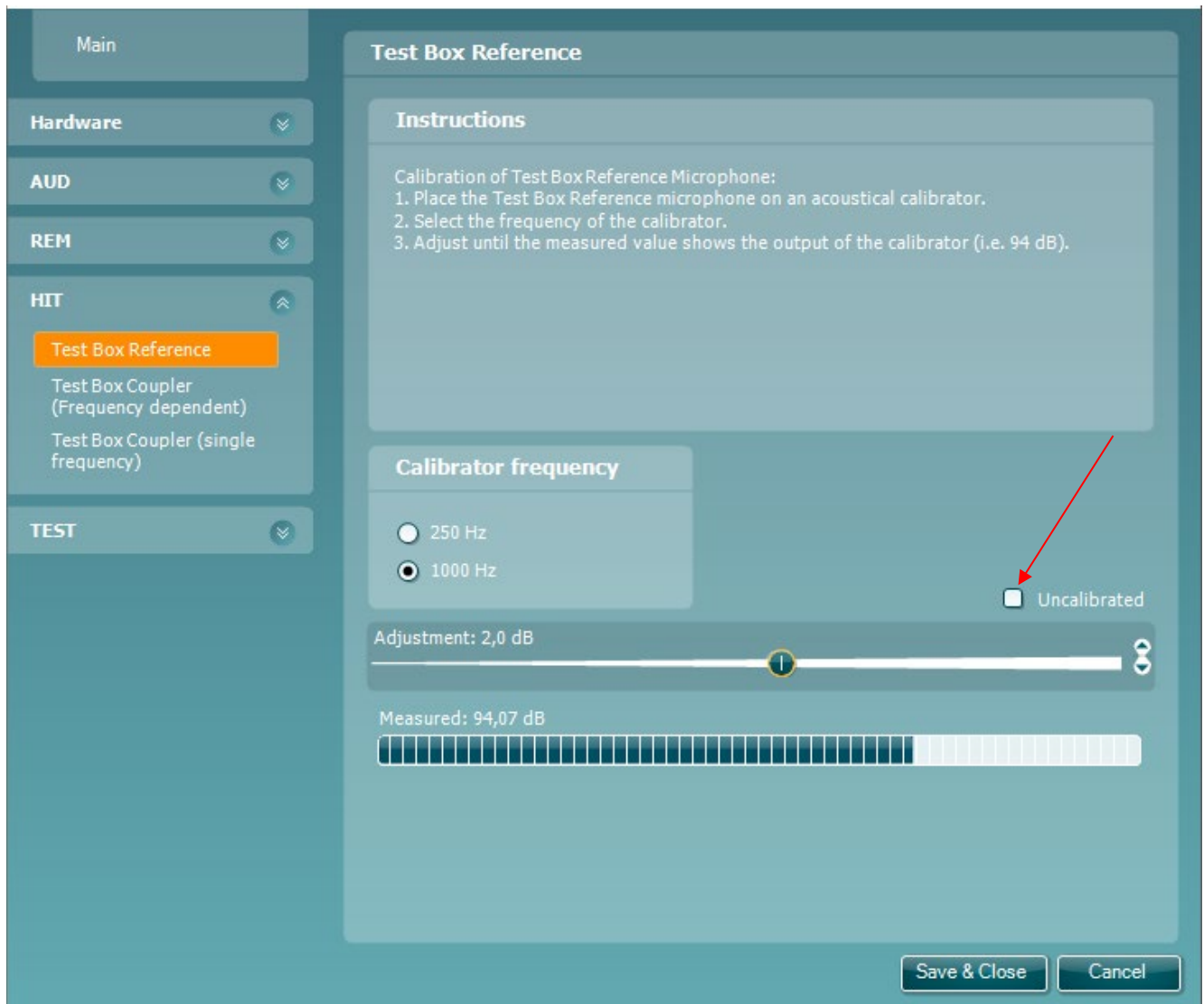


Figure 15



3.7.1.2 Test box coupler - frequency dependent

Via the menu, click *Test Box Coupler (Frequency dependent)*, and follow the on-screen instructions.

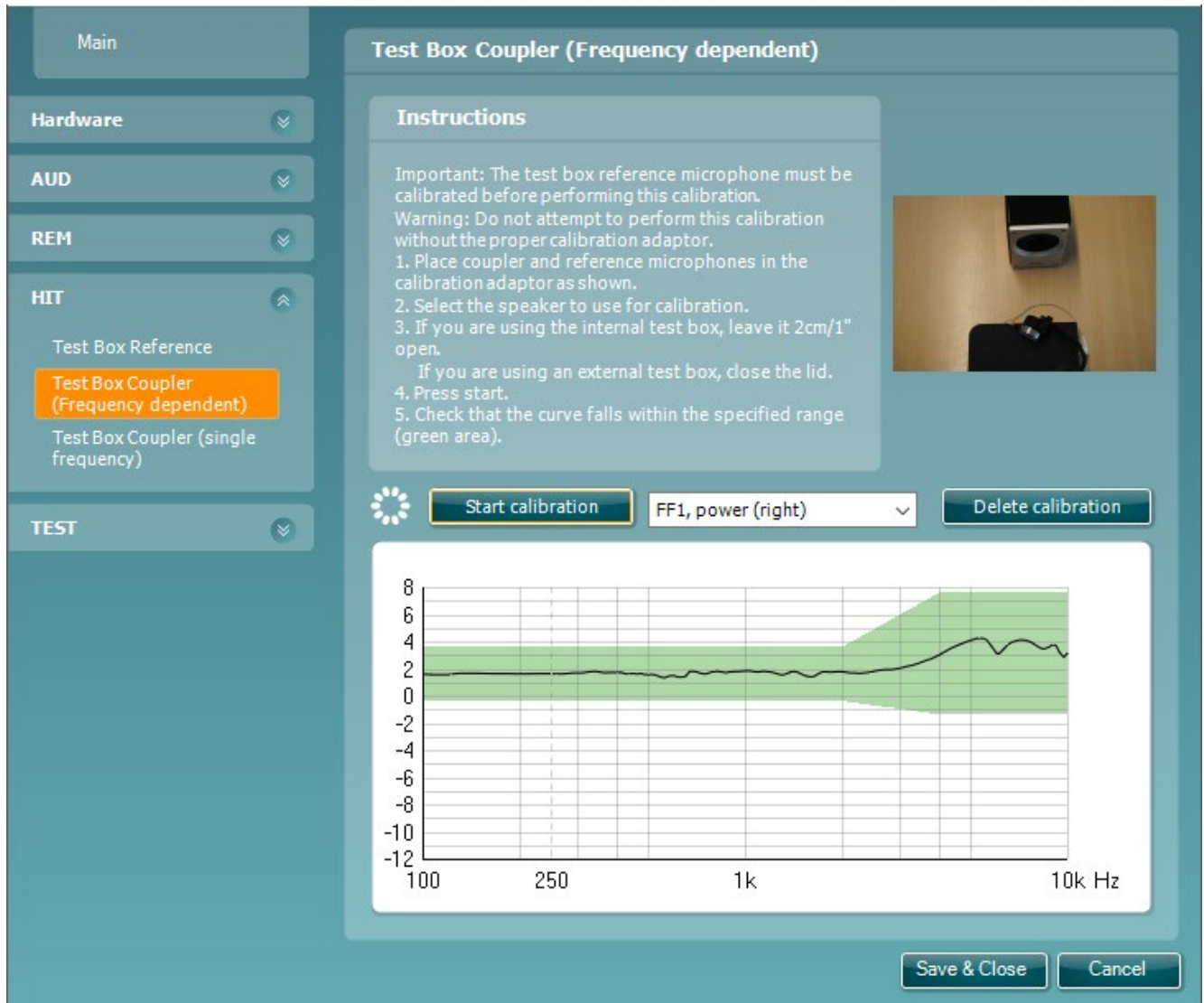


Figure 16

To the right hand side, the coupler and reference microphone set up correctly.



Figure 17



3.7.1.3 Test box coupler - single frequency

First, uncheck the box *Uncalibrated*.

Then, place the measuring microphone in the acoustical calibrator fitted with a calibration adaptor for HIT, as illustrated to the right hand side.

Select the *Calibrator frequency*.

Finally, slide the adjustment button until 94dB ±0,5dB is reached on the *Measured* bar.



Figure 18

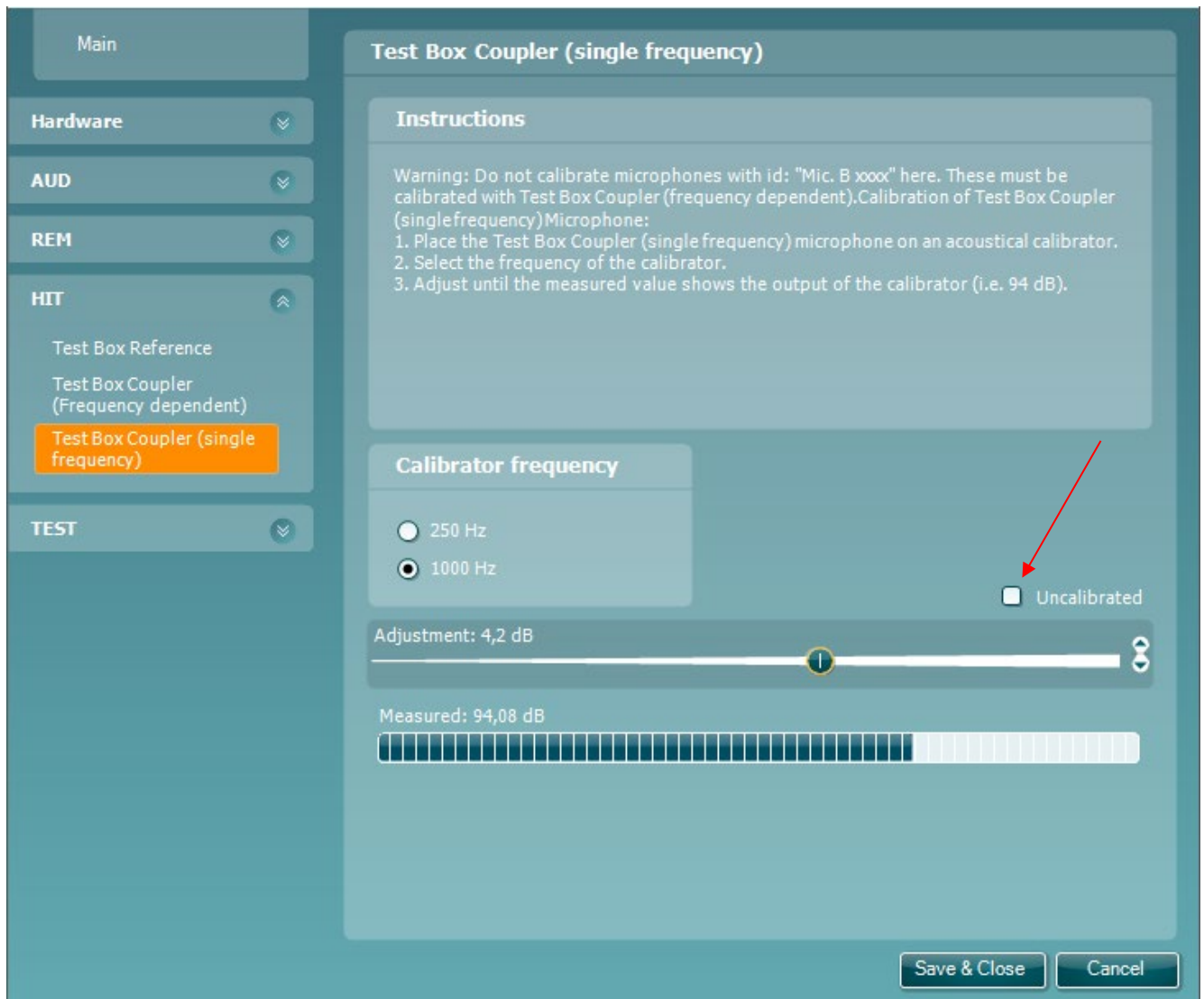


Figure 19



3.7.2 REM440

The REM features are found when folding out the *REM* menu.

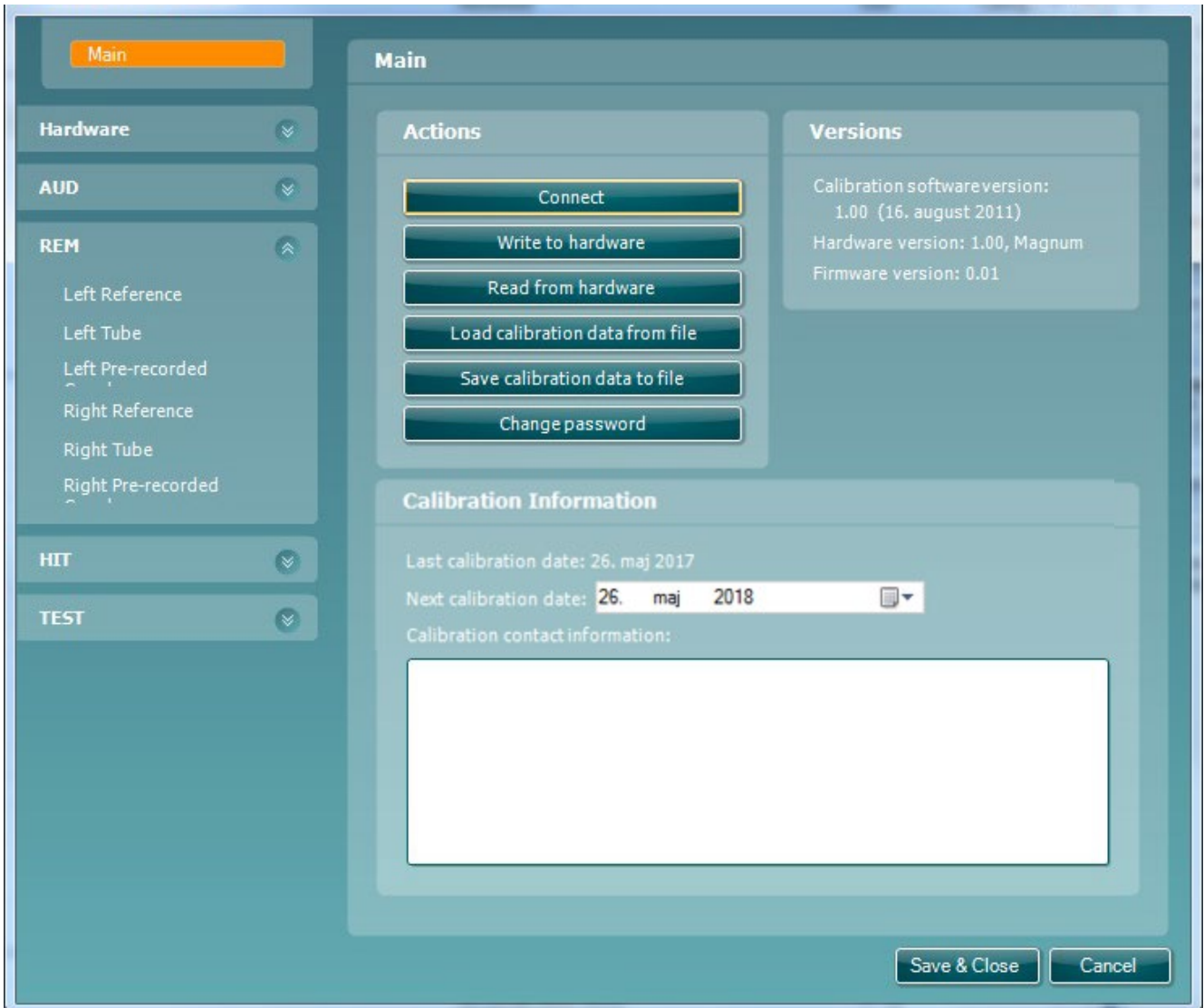


Figure 20

Equipment requirements

- The in-situ reference microphone
- The in-situ measuring microphone
- The SPL probe microphone
- In-situ probe measuring
- SPL probe measuring



3.7.2.1 The in-situ reference microphone

Via the *REM* menu, select the calibration type.

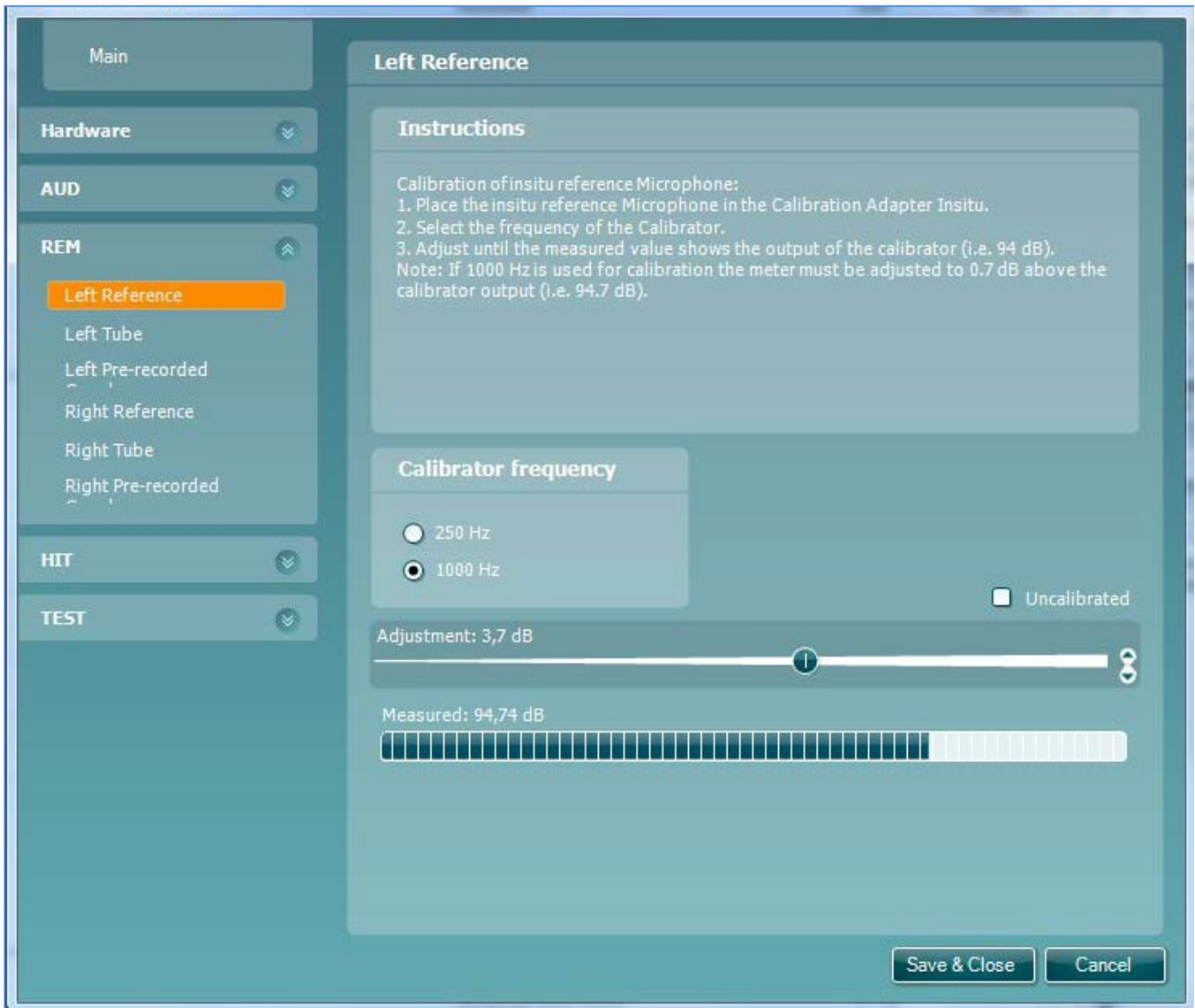


Figure 21



Figure 22

Equipment requirements:

- 94 dB (max.114 dB) calibrator
- Calibration adaptor for HIT
- Calibration adaptor for in-situ reference
- REM calibration adaptor²
- SPL60 probe
- Tube nipple³
- IGT60 probe tubes



Figure 23

² REM calibration adaptor only necessary to calibrate SPL60 probe.

³ Also used on EARTone 3A.



3.7.2.2 The in-situ measuring microphone

Follow the on-screen instructions.

NOTICE *Start Measuring* mentioned under step 3 is in fact the *Start calibration* field.

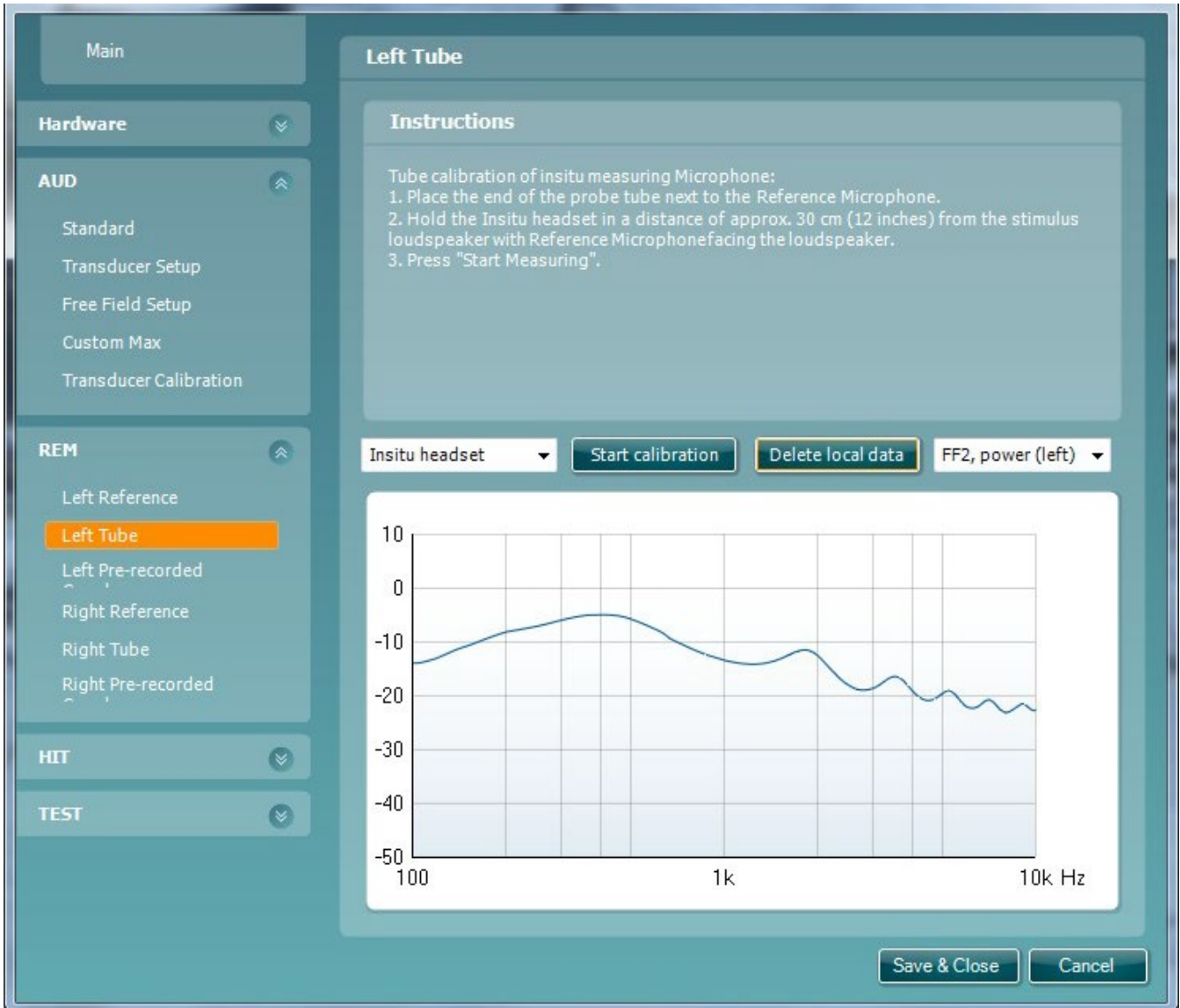


Figure 24



Figure 25



Figure 26



3.7.2.3 The SPL probe microphone

Follow the on-screen instructions.

NOTICE *Start Measuring* mentioned under step 3 is in fact the *Start calibration* field.

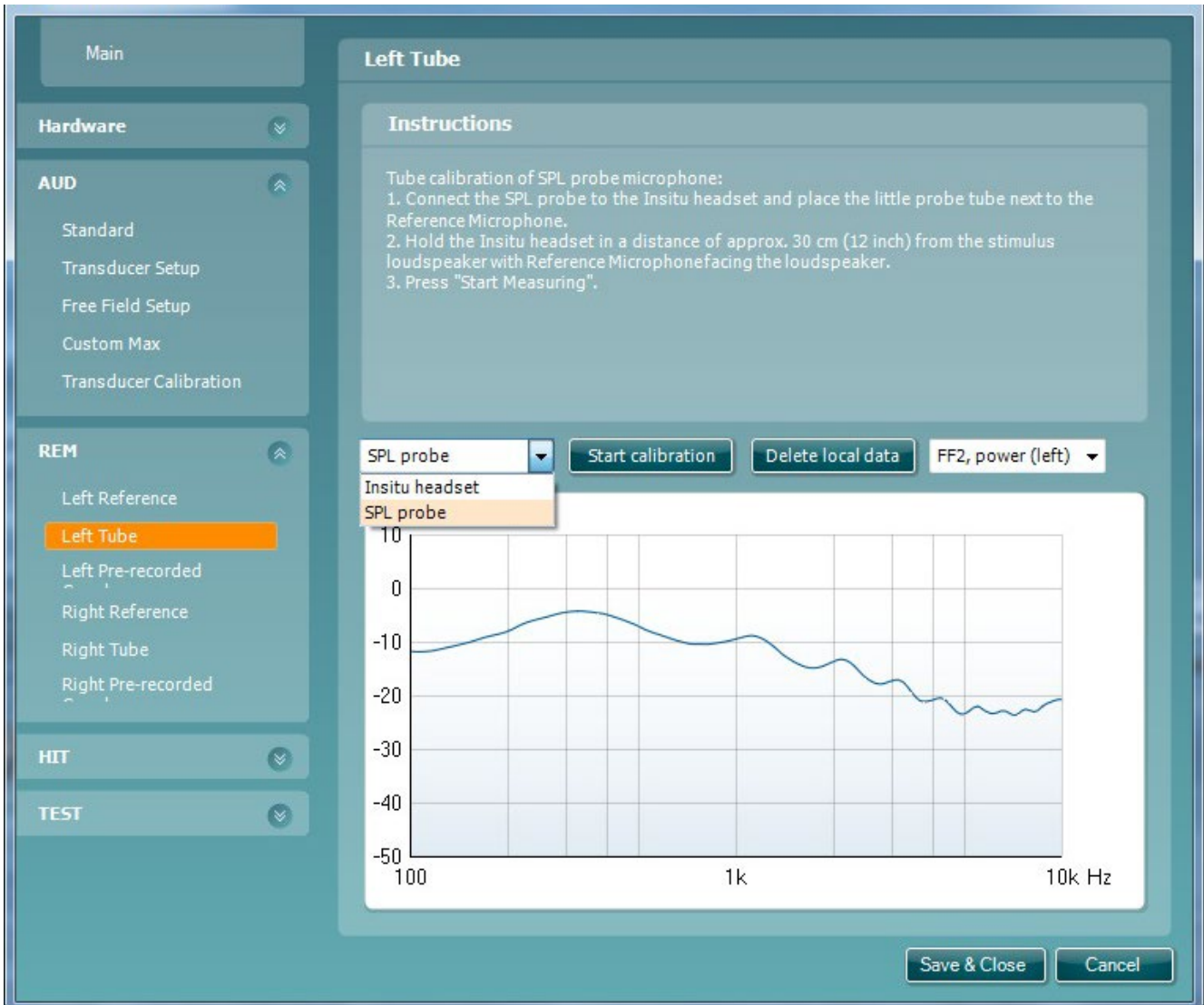


Figure 27



Figure 28



Figure 29





3.7.2.4 In-situ headset pre-measuring of coupler data

Follow the on-screen instructions

NOTICE *Start Measuring* mentioned under step 3 is in fact the *Start calibration* field.

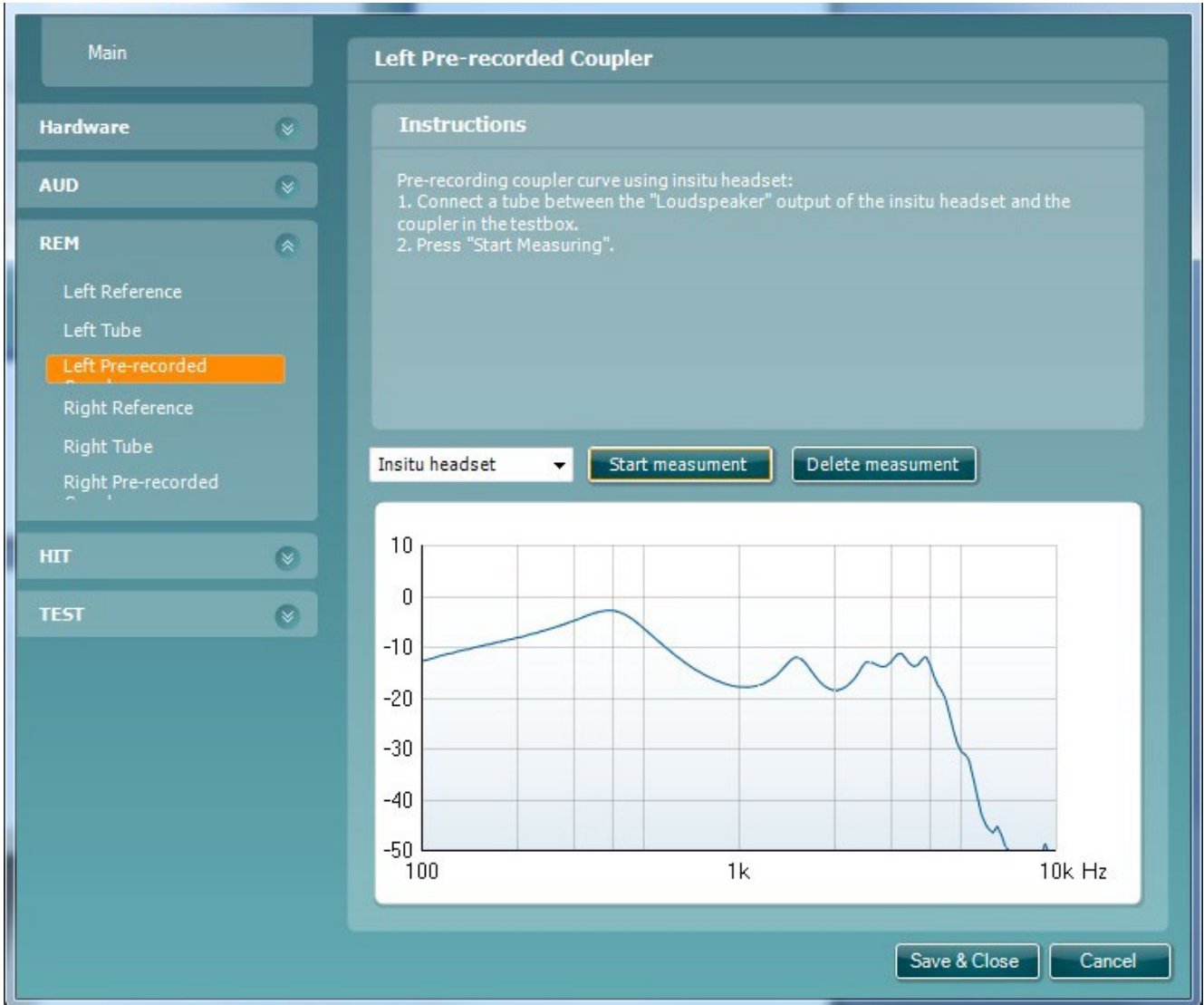


Figure 30



Figure 31



3.7.2.5 SPL probe pre-measuring of coupler data

Follow the on-screen instructions

NOTICE *Start Measuring* mentioned under step 3 is in fact the *Start calibration* field.

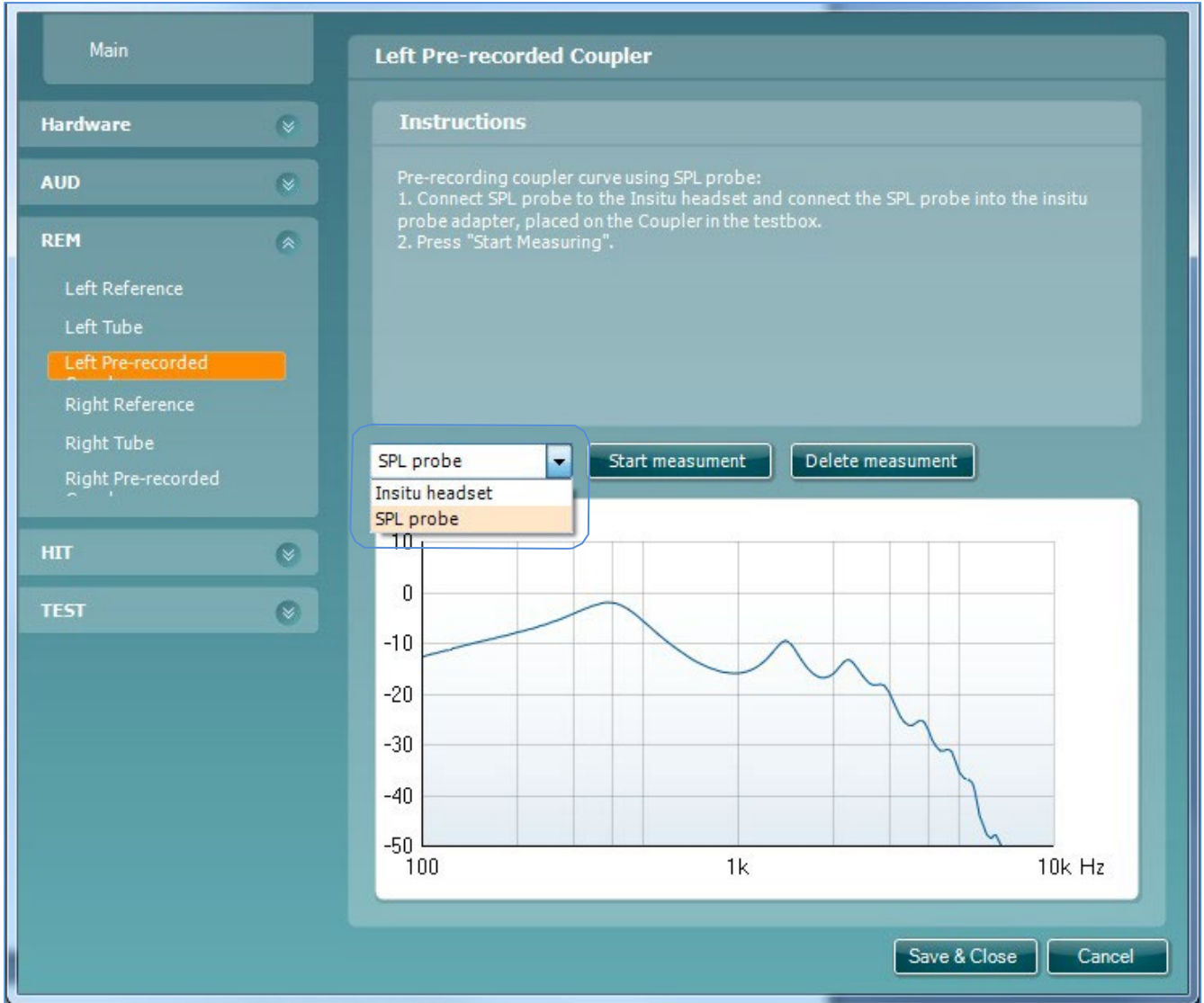


Figure 32



NOTICE *Start Measuring* mentioned under step 3 is in fact the *Start calibration* field.

Follow the on-screen instructions.

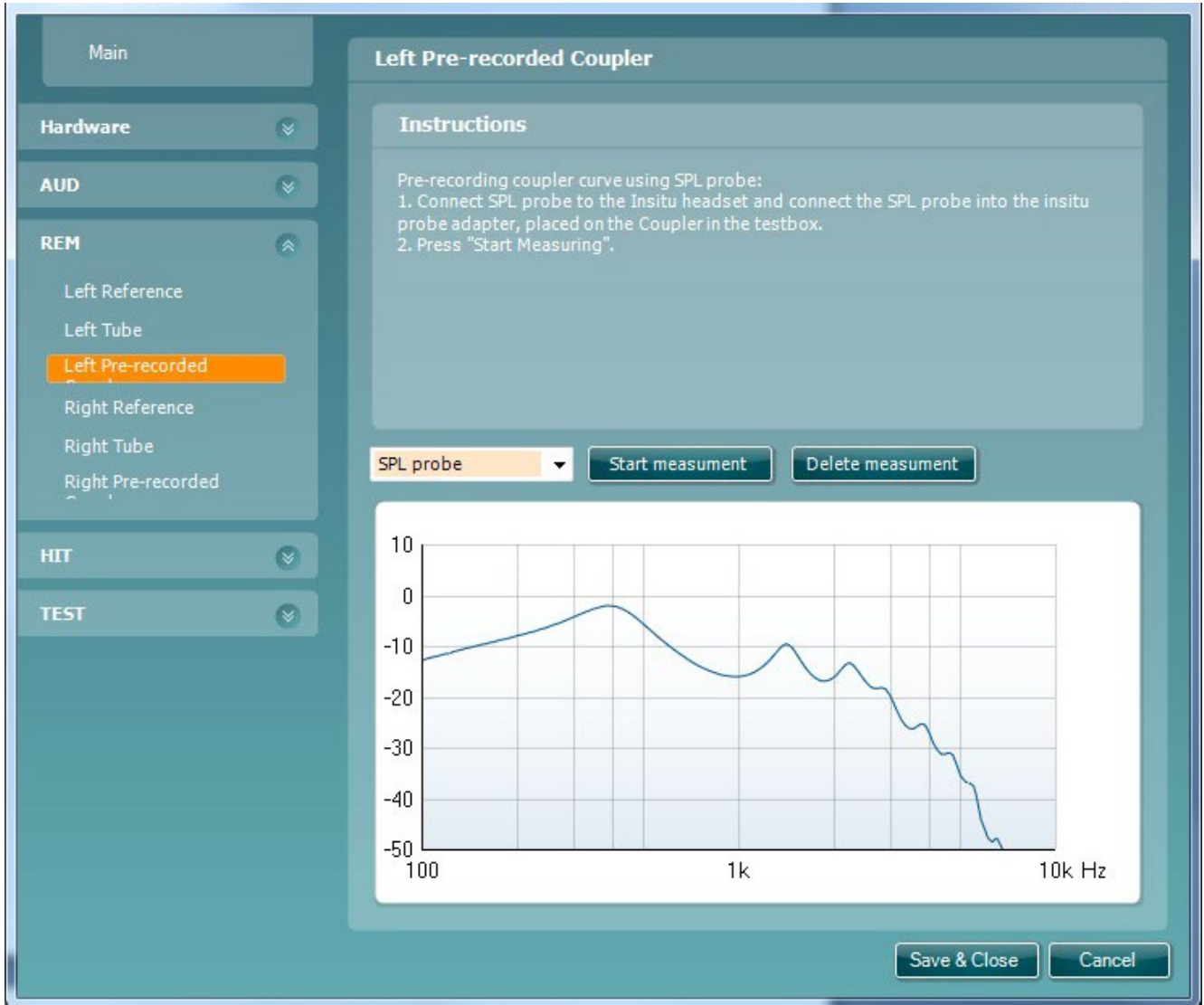


Figure 33



Figure 34

NOTICE Repeat the total procedure for all the right in-situ transducers



3.8 Calibration of transducers

This chapter contains calibration standards for Callisto.

3.8.1 Calibration standard for Audiometer

- Tone standard** Selected via AUD and *Standard*. The options are ANSI and IEC, the latter being the most common.
- Calibration method** Selected via AUD and *Calibration method*. The options are SPL mode or HL mode.
- SPL mode** The tab marked *Standard* is set to SPL (sound pressure level) by default, so taking the standard for the chosen transducer into account is not necessary. For correction of a 2cc or 6cc coupler/microphone, it is necessary to add or subtract from the 90dB SPL level which can be read on the sound level meter.
- HL mode** If HL (hearing level) is selected, the calibration can be conducted as on a regular audiometer, where the standard is added to the HL values first, and the corrections for the coupler/microphone subsequently.

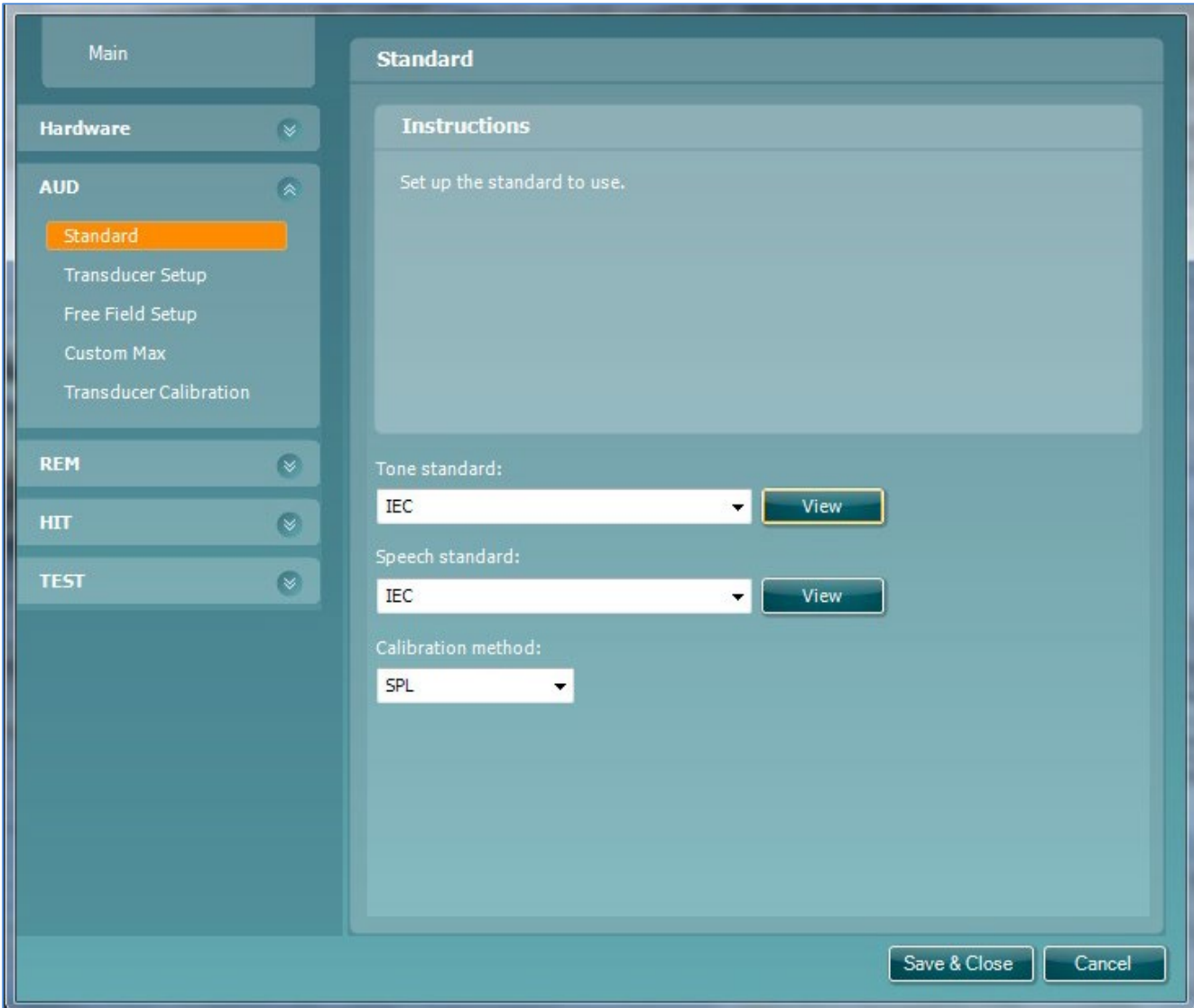


Figure 35



3.8.2 Selecting a transducer / how-to-guide

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.

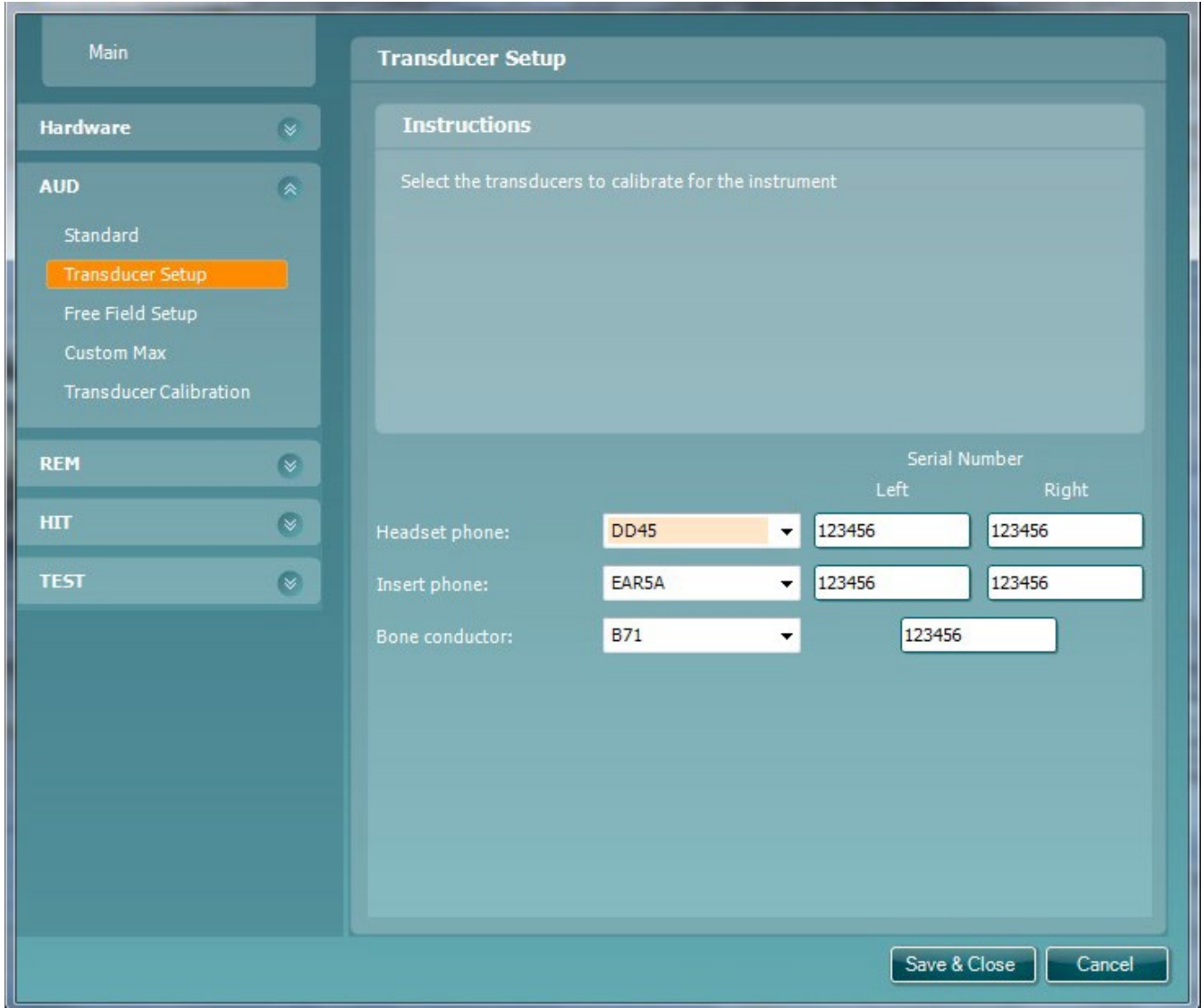


Figure 36

Example:

Select *Transducer Setup*.

Select *Headset phone* as type DD45.

Enter the serial numbers for the left and right phones in the fields *Left* and *Right*, respectively.



3.8.2.1 Calibration exemplified with DD45

From the AUD menu, select *Transducer calibration*.

Follow the on-screen instructions.

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

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

Save the calibration values via the *Main* menu and writing to hardware as described earlier in this service manual.

Equipment required for DD45 calibration:

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

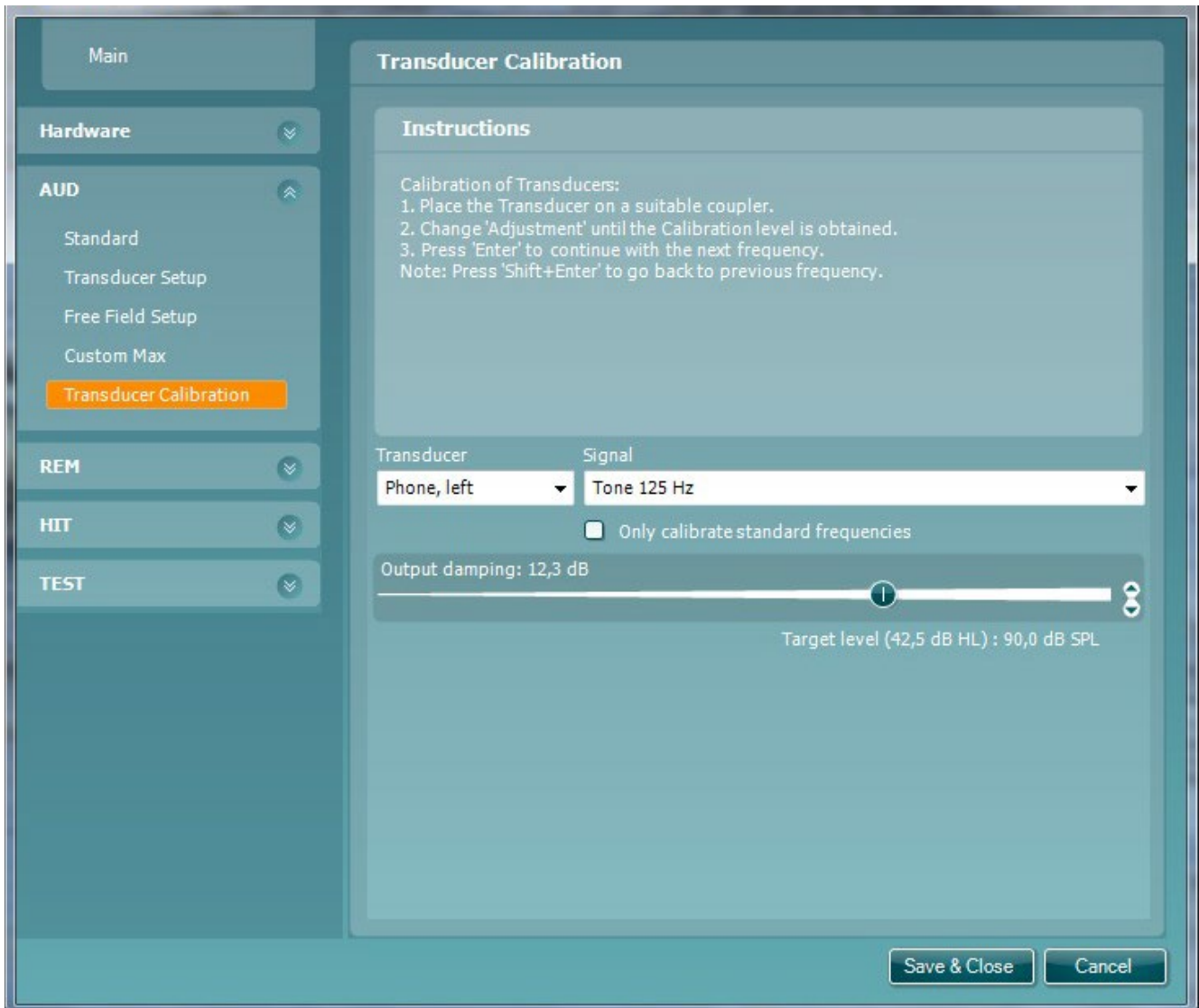


Figure 37

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



3.8.3 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 for B71 calibration:
- 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.



Figure 38

TDH39

Equipment required for TDH39 calibration:

- Measuring amplifier
- Acoustical IEC 60318-3 (IEC 303) 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.



Figure 39

IP30

- Equipment required for IP30 calibration:
- 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.



Figure 40



HDA200 / DD450/DD65 V2

Equipment required for calibration:

- Measuring amplifier
- Acoustical IEC 60318-3 (IEC 303) coupler
- Frequency counter
- Correction values for coupler
- Spacer for HDA200 to coupler IEC 60318-3 (IEC 303)

From the AUD menu, select *Transducer Calibration*.

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



Figure 41

HDA300

Equipment required for HDA300 calibration:

- Measuring amplifier
- Acoustical IEC 60318-1 coupler
- Frequency counter
- Correction values for coupler
- Calibration adapter for HDA300 to IEC 60318-1 coupler ⁴

From the AUD menu, select *Transducer Calibration*.

Place the transducer on the IEC 60318-1 coupler.



Figure 42

E-A-RTone® 3A / E-A-RTone® 5A

Equipment required for E-A-RTONE® 3A / 5A calibration:

- Measuring amplifier
- Acoustical IEC 60318-5 (IEC 126) coupler
- Frequency counter
- Correction values for coupler
- 30° adaptor cable

From the AUD menu, select *Transducer Calibration*.

Place the transducer on the 2cc IEC 60318-5 (IEC 126) coupler.



Figure 43



Figure 44

⁴ Correct placement of the transducer is ensured by using the HDA300 positioning tool mentioned in the spare parts section of this manual.



3.8.4 Free Field

The calibration program is activated by selecting between either the ANSI or IEC standards.

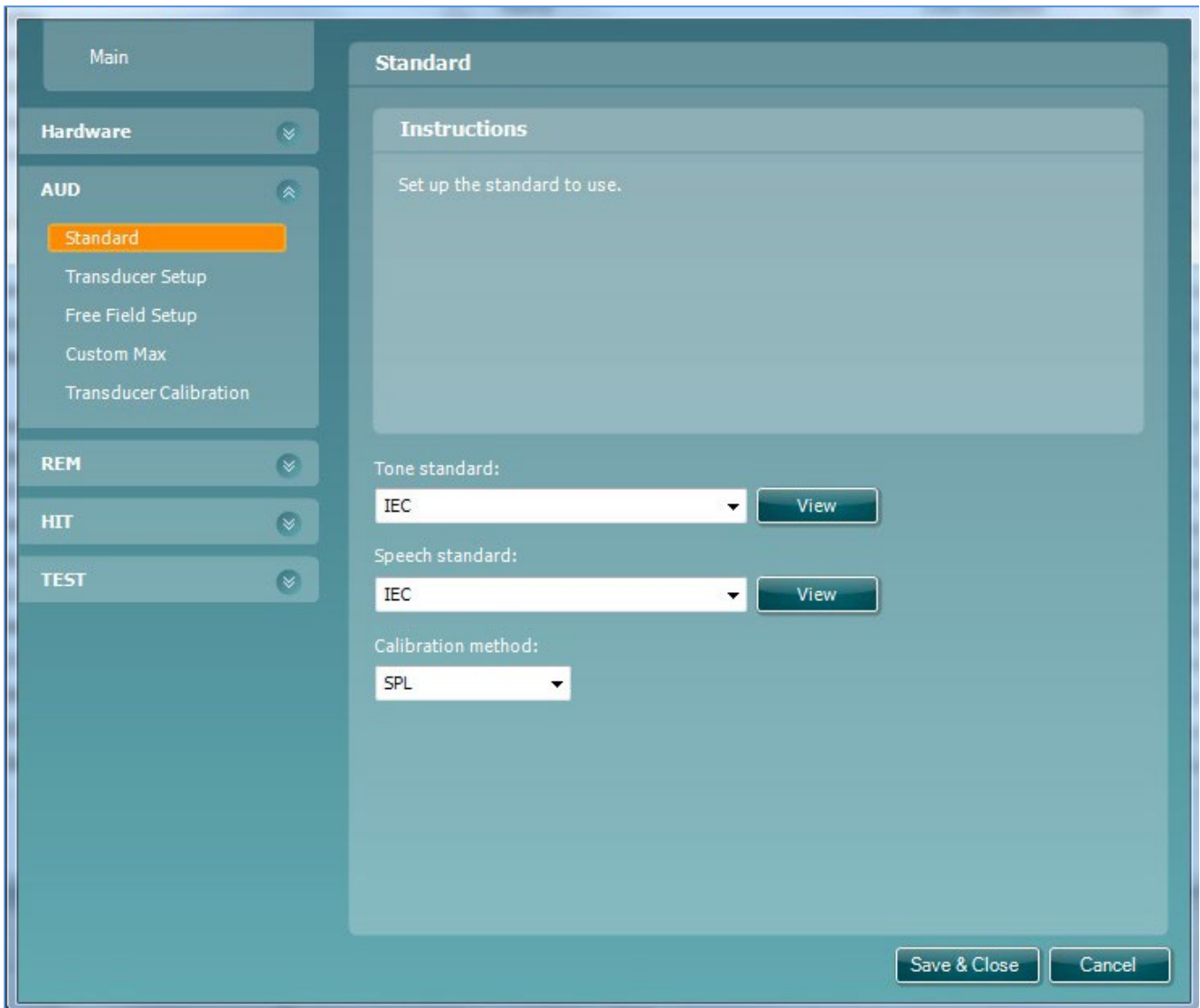


Figure 45



From the AUD menu, select *Free Field Setup*.

Select the appropriate speaker setup.

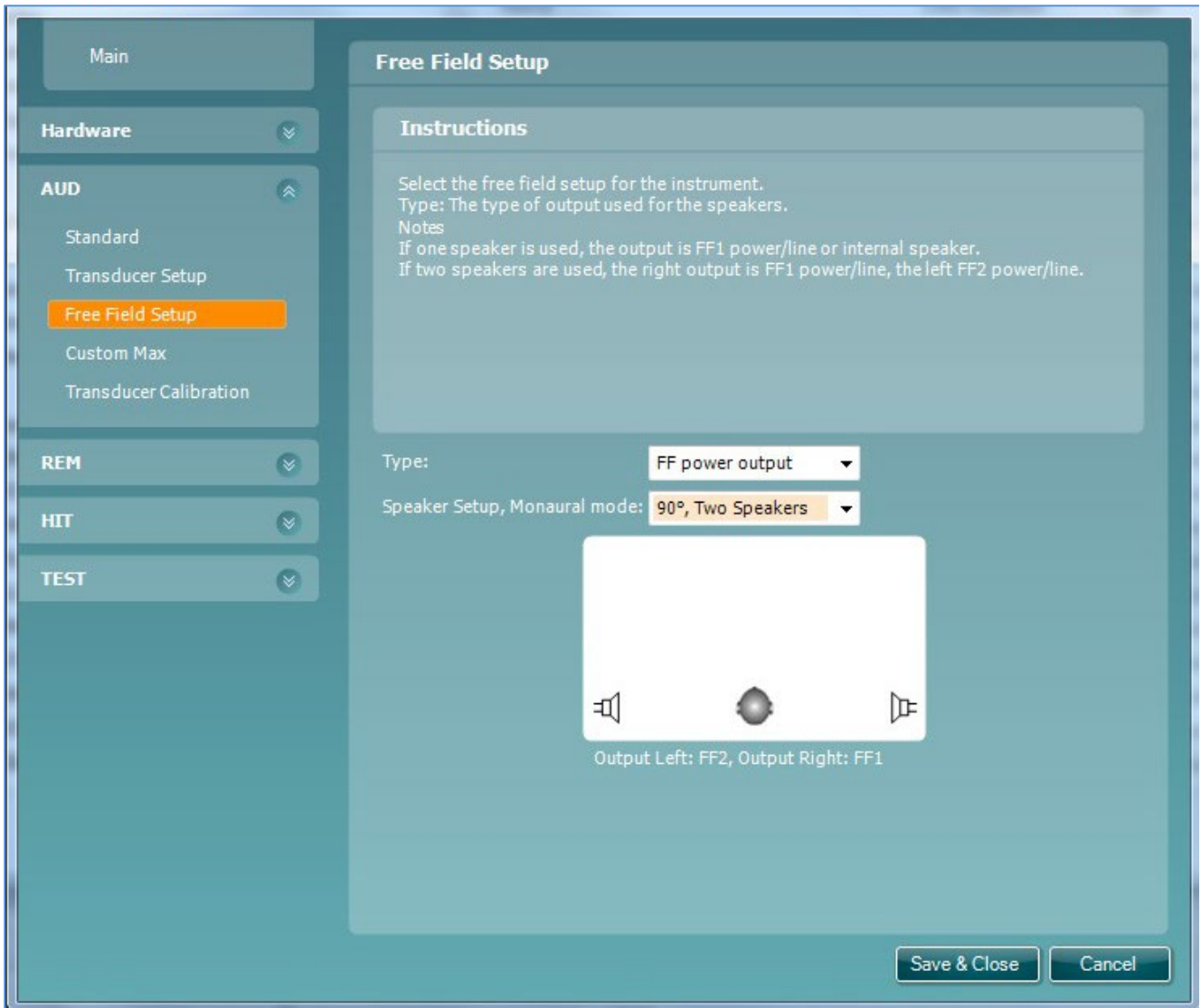


Figure 46



3.8.5 Custom max.

Follow the on-screen instructions.

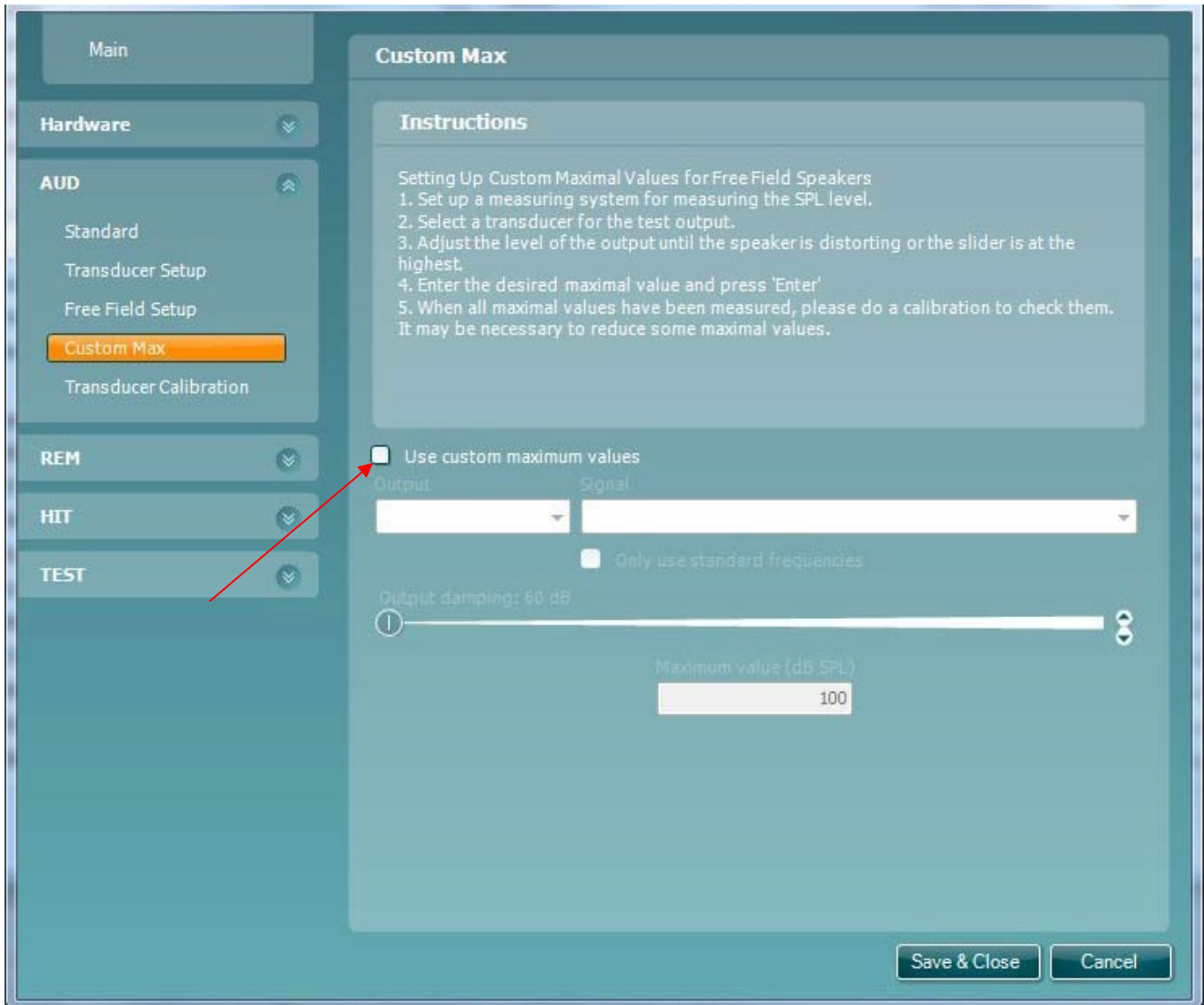


Figure 47

In case the speaker or amplifier setup does not hold sufficient power to stimulate with the predefined maximum output, decreasing the maximum output to fit a given configuration is possible.

When *Custom max.* is not in use, the field *Use custom maximum values* must remain unchecked.

Notices max. output level on the sound level meter. Type in sound level meter values.

Repeat with all frequencies.



B&K 2250 Sound level meter

Select speaker, and then frequency.

Adjust the slider until the speaker is distorting or the slider is at the highest.

Notices max. output level on the sound level meter. Type in sound level meter values.

Repeat with all frequencies.

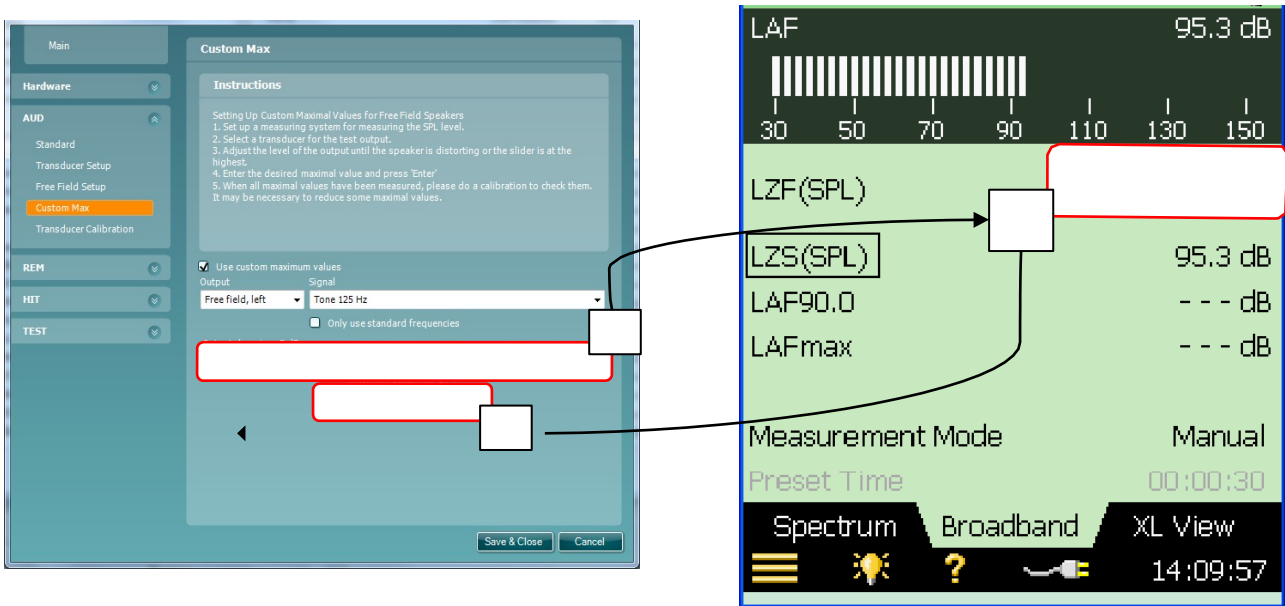


Figure 48



3.8.6 Transducer calibration

Calibrate the left and right speaker.

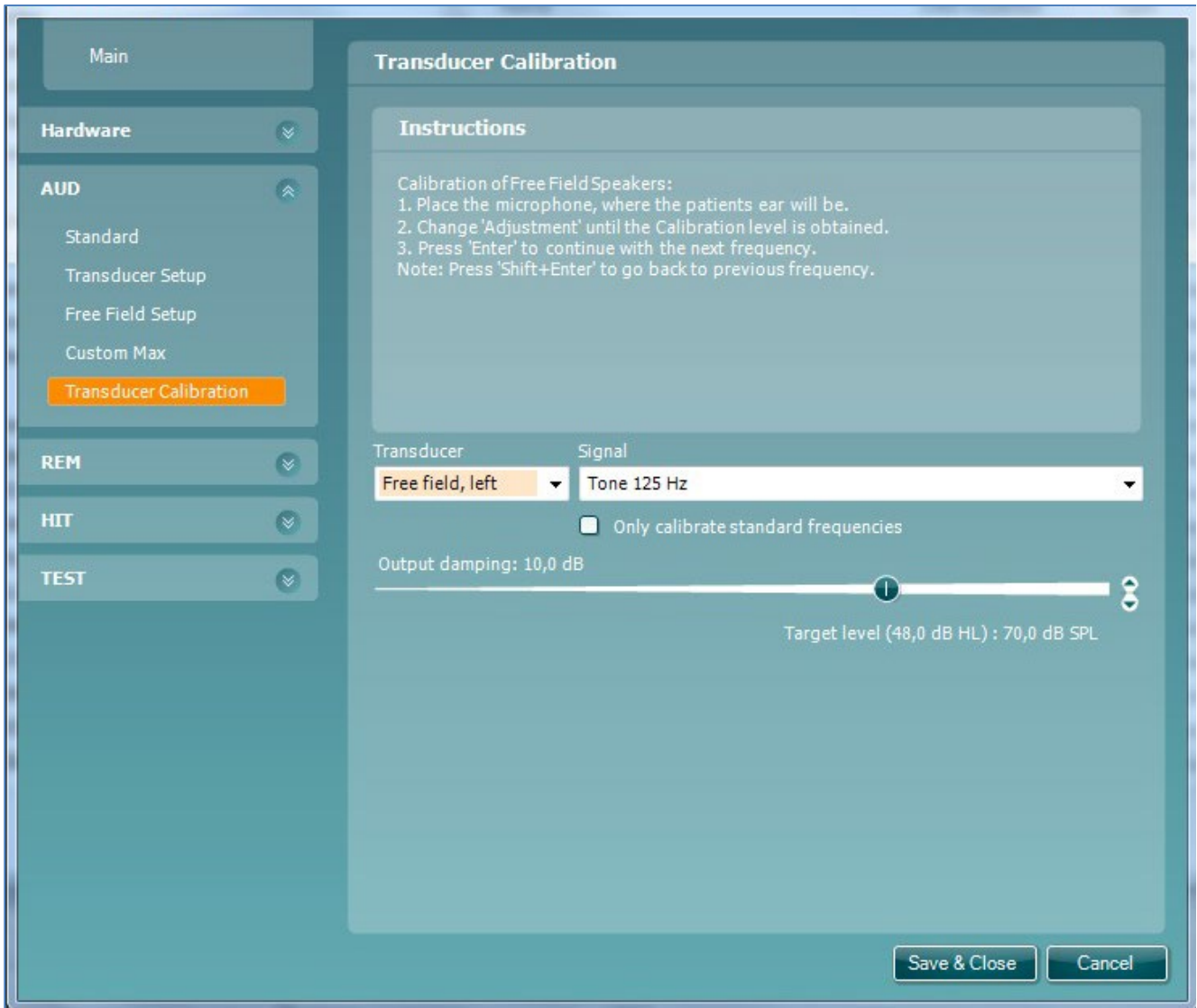
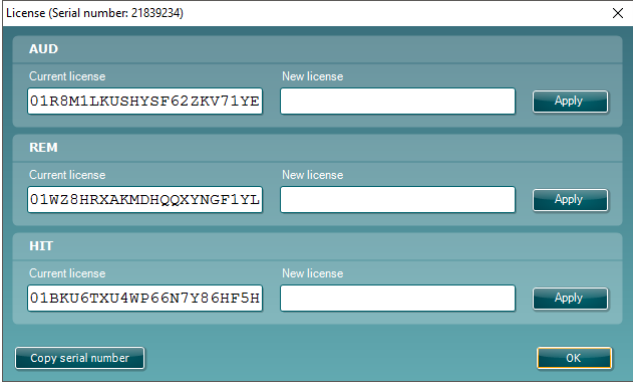


Figure 49



4. Troubleshooting

Error Message	What to do
<p>No License</p>	<p>Via <i>Menu / Help</i>, click <i>About</i>.</p> <p><i>License</i>. 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>Figure 50</p>
<p>Device not connected</p>	<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>
<p>Hardware error or timeout error</p>	<p>Restart the instrument. If the error continues to appear contact the distributor.</p>
<p>Instrument not calibrated</p>	<p>Contact the distributor for a calibration.</p>
<p>Loudspeaker or reference microphone disconnected</p>	<p>Verify that the reference microphone is connected inside the test box. Check that the stimulus loudspeaker is connected.</p>
<p>File corrupt</p>	<p>A faulty sound file has been selected for stimulus.</p>
<p>The stimulus level is set louder than the dynamic properties of this stimulus allows.</p>	<p>Reduce stimulus level or change stimulus. Follow the instructions.</p>



Appendices

Appendix A - Technical Specifications

Survey of reference and max hearing level tone audiometer

Pure Tone RETSPL										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETFL	RETFL
Tone 125 Hz	47.5	45.0	30.5	30.5	27.0	26.0	26.0	26.0		
Tone 160 Hz	40.5	37.5	25.5	26.0	24.5	22.0	22.0	22.0		
Tone 200 Hz	33.5	31.5	21.5	22.0	22.5	18.0	18.0	18.0		
Tone 250 Hz	27.0	25.5	17	18.0	20.0	14.0	14.0	14.0	67.0	67.0
Tone 315 Hz	22.5	20.0	14	15.5	16.0	12.0	12.0	12.0	64.0	64.0
Tone 400 Hz	17.5	15.0	10.5	13.5	12.0	9.0	9.0	9.0	61.0	61.0
Tone 500 Hz	13.0	11.5	8	11.0	8.0	5.5	5.5	5.5	58.0	58.0
Tone 630 Hz	9.0	8.5	6.5	8.0	6.0	4.0	4.0	4.0	52.5	52.5
Tone 750 Hz	6.5	8 / 7.5	5.5	6.0	4.5	2.0	2.0	2.0	48.5	48.5
Tone 800 Hz	6.5	7.0	5	6.0	4.0	1.5	1.5	1.5	47.0	47.0
Tone 1000 Hz	6.0	7.0	4.5	5.5	2.0	0.0	0.0	0.0	42.5	42.5
Tone 1250 Hz	7.0	6.5	3.5	6.0	2.5	2.0	2.0	2.0	39.0	39.0
Tone 1500 Hz	8.0	6.5	2.5	5.5	3.0	2.0	2.0	2.0	36.5	36.5
Tone 1600 Hz	8.0	7.0	2.5	5.5	2.5	2.0	2.0	2.0	35.5	35.5
Tone 2000 Hz	8.0	9.0	2.5	4.5	0.0	3.0	3.0	3.0	31.0	31.0
Tone 2500 Hz	8.0	9.5	2	3.0	-2.0	5.0	5.0	5.0	29.5	29.5
Tone 3000 Hz	8.0	10.0	2	2.5	-3.0	3.5	3.5	3.5	30.0	30.0
Tone 3150 Hz	8.0	10.0	3	4.0	-2.5	4.0	4.0	4.0	31.0	31.0
Tone 4000 Hz	9.0	9.5	9.5	9.5	-0.5	5.5	5.5	5.5	35.5	35.5
Tone 5000 Hz	13.0	13.0	15.5	14.0	10.5	5.0	5.0	5.0	40.0	40.0
Tone 6000 Hz	20.5	15.5	21	17.0	21.0	2.0	2.0	2.0	40.0	40.0
Tone 6300 Hz	19.0	15.0	21	17.5	21.5	2.0	2.0	2.0	40.0	40.0
Tone 8000 Hz	12.0	13.0	21	17.5	23.0	0.0	0.0	0.0	40.0	40.0
Tone 9000 Hz				19.0	27.5					
Tone 10000 Hz				22.0	18.0					
Tone 11200 Hz				23.0	22.0					
Tone 12500 Hz				27.5	27.0					
Tone 14000 Hz				35.0	33.5					
Tone 16000 Hz				56.0	45.5					

Table 1

DD45 6ccm uses IEC60318-3 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

TDH39 6ccm uses IEC60318-3 or NBS 9A coupler and RETSPL comes from ANSI S3.6 2018 and ISO 389-1 2017. Force 4.5N ±0.5N

DD65V2 Artificial ear uses IEC60318-1 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 IEC60318-1 coupler with type 1 adaptor and RETSPL comes from ANSI S3.6 2018 and ISO 389-8 2004. Force 9N ±0.5N

HDA300 Artificial ear uses IEC60318-1 coupler with type 1 adaptor and RETSPL comes from PTB report 2012. Force 8.8N ±0.5N

IP30 / EAR3A 2ccm use ANSI S3.7-1995 IEC60318-5 coupler (HA-2 with 5mm rigid Tube) and RETSPL comes from ANSI S3.6 2018 and ISO 389-2 1994.

B71 / B81 use ANSI S3.13 or IEC60318-6 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	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
Signal	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL
Tone 125 Hz	85	85	85	95	110.0	90.0	90.0	95		
Tone 160 Hz	90	90	90	100	110	95	95	95		
Tone 200 Hz	95	100	95	105	115	100	100	100		
Tone 250 Hz	105	105	100	105	115	105	105	100	45	50
Tone 315 Hz	110	110	105	110	120	105	105	105	50	60
Tone 400 Hz	115	115	110	110	120	110	110	105	65	70
Tone 500 Hz	120	120	110	115	120	110	110	110	65	70
Tone 630 Hz	120	120	110	115	120	115	115	115	70	75
Tone 750 Hz	120	120	115	115	120	115	115	120	70	75
Tone 800 Hz	120	120	115	115	120	115	115	120	70	75
Tone 1000 Hz	120	120	115	115	120	120	120	120	70	85
Tone 1250 Hz	120	120	115	110	120	120	120	120	70	90
Tone 1500 Hz	120	120	115	110	120	120	120	120	70	90
Tone 1600 Hz	120	120	115	110	120	120	120	120	70	90
Tone 2000 Hz	120	120	115	110	120	120	120	120	75	90
Tone 2500 Hz	120	120	115	115	120	120	120	120	80	85
Tone 3000 Hz	120	120	115	115	120	120	120	120	80	85
Tone 3150 Hz	120	120	115	110	120	120	120	120	80	85
Tone 4000 Hz	120	120	110	110	120	115	115	120	80	85
Tone 5000 Hz	120	115	105	105	115	105	105	110	60	70
Tone 6000 Hz	110	120	100	100	105	100	100	105	50	60
Tone 6300 Hz	110	115	100	100	105	100	100	105	50	55
Tone 8000 Hz	105	105	95	100	105	90	90	100	50	50
Tone 9000 Hz				95	95					
Tone 10000 Hz				90	100					
Tone 11200 Hz				90	100					
Tone 12500 Hz				85	95					
Tone 14000 Hz				75	80					
Tone 16000 Hz				55	65					

Table 2



NB noise effective masking level										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	EM	EM	EM	EM	EM	EM	EM	EM	EM	EM
NB 125 Hz	51.5	49.0	34.5	34.5	31.0	30.0	30.0	30.0		
NB 160 Hz	44.5	41.5	29.5	30.0	28.5	26.0	26.0	26.0		
NB 200 Hz	37.5	35.5	25.5	26.0	26.5	22.0	22.0	22.0		
NB 250 Hz	31.0	29.5	21.0	22.0	24.0	18.0	18.0	18.0	71.0	71.0
NB 315 Hz	26.5	24.0	18.0	19.5	20.0	16.0	16.0	16.0	68.0	68.0
NB 400 Hz	21.5	19.0	14.5	17.5	16.0	13.0	13.0	13.0	65.0	65.0
NB 500 Hz	17.0	15.5	12.0	15.0	12.0	9.5	9.5	9.5	62.0	62.0
NB 630 Hz	14.0	13.5	11.5	13.0	11.0	9.0	9.0	9.0	57.5	57.5
NB 750 Hz	11.5	12.5	10.5	11.0	9.5	7.0	7.0	7.0	53.5	53.5
NB 800 Hz	11.5	12.0	10.0	11.0	9.0	6.5	6.5	6.5	52.0	52.0
NB 1000 Hz	12.0	13.0	10.5	11.5	8.0	6.0	6.0	6.0	48.5	48.5
NB 1250 Hz	13.0	12.5	9.5	12.0	8.5	8.0	8.0	8.0	45.0	45.0
NB 1500 Hz	14.0	12.5	8.5	11.5	9.0	8.0	8.0	8.0	42.5	42.5
NB 1600 Hz	14.0	13.0	8.5	11.5	8.5	8.0	8.0	8.0	41.5	41.5
NB 2000 Hz	14.0	15.0	8.5	10.5	6.0	9.0	9.0	9.0	37.0	37.0
NB 2500 Hz	14.0	15.5	8.0	9.0	4.0	11.0	11.0	11.0	35.5	35.5
NB 3000 Hz	14.0	16.0	8.0	8.5	3.0	9.5	9.5	9.5	36.0	36.0
NB 3150 Hz	14.0	16.0	9.0	10.0	3.5	10.0	10.0	10.0	37.0	37.0
NB 4000 Hz	14.0	14.5	14.5	14.5	4.5	10.5	10.5	10.5	40.5	40.5
NB 5000 Hz	18.0	18.0	20.5	19.0	15.5	10.0	10.0	10.0	45.0	45.0
NB 6000 Hz	25.5	20.5	26.0	22.0	26.0	7.0	7.0	7.0	45.0	45.0
NB 6300 Hz	24.0	20.0	26.0	22.5	26.5	7.0	7.0	7.0	45.0	45.0
NB 8000 Hz	17.0	18.0	26.0	22.5	28.0	5.0	5.0	5.0	45.0	45.0
NB 9000 Hz				24.0	32.5					
NB 10000 Hz				27.0	23.0					
NB 11200 Hz				28.0	27.0					
NB 12500 Hz				32.5	32.0					
NB 14000 Hz				40.0	38.5					
NB 16000 Hz				61.0	50.5					
White noise	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.5	42.5
TEN noise	25.0	25.0				16.0	16.0			

Table 3

Effective masking value is RETSPL / RETFL add 1/3 octave correction for Narrow-band noise from ANSI S3.6 2010 or ISO389-4 1994.



Maximum hearing level settings provided at each test frequency

NB noise max HL										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL
NB 125 Hz	65	70	70	70	75.0	85.0	85.0	80		
NB 160 Hz	70	80	75	75	75	90	90	85		
NB 200 Hz	80	85	80	80	80	95	95	90		
NB 250 Hz	85	90	85	85	80	100	100	95	35	40
NB 315 Hz	90	95	90	85	85	100	100	95	40	50
NB 400 Hz	95	100	95	85	90	100	100	100	55	60
NB 500 Hz	100	105	95	90	90	105	105	105	55	60
NB 630 Hz	105	105	95	90	95	105	105	105	60	65
NB 750 Hz	105	105	100	95	95	110	110	110	60	65
NB 800 Hz	105	105	100	95	95	110	110	110	60	65
NB 1000 Hz	105	105	100	95	95	110	110	110	60	70
NB 1250 Hz	105	105	100	95	95	110	110	110	60	75
NB 1500 Hz	105	105	100	95	95	110	110	110	60	75
NB 1600 Hz	105	105	100	95	95	110	110	110	60	75
NB 2000 Hz	105	105	95	95	100	110	110	105	65	70
NB 2500 Hz	105	105	95	95	105	110	110	105	65	65
NB 3000 Hz	105	105	100	95	105	110	110	105	65	65
NB 3150 Hz	105	105	95	95	105	110	110	105	65	65
NB 4000 Hz	105	105	95	95	105	105	105	105	65	60
NB 5000 Hz	105	100	90	90	100	100	100	100	50	55
NB 6000 Hz	95	100	85	85	90	95	95	100	45	50
NB 6300 Hz	95	100	85	85	90	95	95	100	40	45
NB 8000 Hz	95	95	80	85	90	90	90	95	40	40
NB 9000 Hz				80	80					
NB 10000 Hz				75	90					
NB 11200 Hz				75	85					
NB 12500 Hz				70	75					
NB 14000 Hz				65	70					
NB 16000 Hz				45	55					
White noise	120	120	115	110	110	110	110	110	65	
TEN noise	110	100				100	100			

Table 4



ANSI Speech RETSPL										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL
Speech	18.5	19.5	17	19.0	14.5					
Speech Equ.FF.	18.5	15.5	16.5	18.5	16.0					
Speech Non-linear	6.0	7.0	4.5	5.5	2.0	12.5	12.5	12.5	55.0	55.0
Speech noise	18.5	19.5	17	19.0	14.5					
Speech noise Equ.FF.	18.5	15.5	16.5	18.5	16.0					
Speech noise Non-linear	6.0	7.0	4.5	5.5	2.0	12.5	12.5	12.5	55.0	55.0

Table 5

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

TDH39 (G_F-G_C) ANSI S3.6 2018.

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

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

HDA300 (G_F-G_C) PTB report 2013.

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, TDH39, DD65V2, DD450, HDA300) and EAR 3A, IP30, B71 and B81 12.5 dB + 1 kHz RETSPL ANSI S3.6 2018 (no weighting).

ANSI Speech max HL										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL
Speech	100	100	90	85	95					
Speech Equ.FF.	95	95	90	80	90					
Speech Non-linear	115	110	100	105	115	105	105	110	60	60
Speech noise	95	95	85	80	90					
Speech noise Equ.FF.	90	95	85	75	90					
Speech noise Non-linear	110	105	100	100	115	100	100	100	50	50
White noise in speech	95	95	90	85	95	95	95	95	55	60

Table 6



IEC Speech RETSPL										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETFL	RETFL
Speech	20.0	20.0	20	20.0	20.0					
Speech Equ.FF.	3.5	0.5	1.5	3.5	1.0					
Speech Non-linear	6.0	7.0	4.5	5.5	2.0	20.0	20.0	20.0	55.0	55.0
Speech noise	20.0	20.0	20	20.0	20.0					
Speech noise Equ.FF.	3.5	0.5	1.5	3.5	1.0					
Speech noise Non-linear	6.0	7.0	4.5	5.5	2.0	20.0	20.0	20.0	55.0	55.0

Table 7

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

TDH39 (G_F-G_C) IEC60645-2 1997.

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

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

HDA300 (G_F-G_C) PTB report 2013.

IEC Speech level IEC60645-2 1997 (acoustical linear weighting).

IEC Speech Equivalent free field level (G_F-G_C) from IEC60645-2 1997 (acoustical equivalent sensitivity weighting).

IEC Speech Not linear level 1 kHz RETSPL (DD45, TDH39, DD65V2, DD450, HDA300) and EAR3A, IP30, B7 and B81 IEC60645-2 1997 (no weighting).

IEC Speech max HL										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL
Speech	100	100	85	85	90					
Speech Equ.FF.	110	110	105	95	105					
Speech Non-linear	115	110	100	105	115	95	95	100	60	60
Speech noise	95	95	80	80	85					
Speech noise Equ.FF.	105	110	95	90	105					
Speech noise Non-linear	110	105	100	100	115	90	90	90	50	50
White noise in speech	95	95	90	85	90	85	85	85	55	60

Table 8



Sweden Speech RETSPL										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETFL	RETFL
Speech	22.0	22.0	20	20.0	20.0					
Speech Equ.FF.	3.5	0.5	1.5	3.5	1.0					
Speech Non-linear	22.0	22.0	4.5	5.5	2.0	21.0	21.0	21.0	55.0	55.0
Speech noise	27.0	27.0	20	20.0	20.0					
Speech noise Equ.FF.	3.5	0.5	1.5	3.5	1.0					
Speech noise Non-linear	27.0	27.0	4.5	5.5	2.0	26.0	26.0	26.0	55.0	55.0

Table 9

TDH39 (G_F-G_C) IEC60645-2 1997.

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

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

HDA300 (G_F-G_C) PTB report 2013.

Sweden Speech level STAF 1996 and IEC60645-2 1997 (acoustical linear weighting).

Sweden Speech Equivalent free field level (G_F-G_C) from IEC60645-2 1997 (acoustical equivalent sensitivity weighting).

Sweden Speech Not linear level 1 kHz RETSPL (DD45, TDH39, DD65V2, DD450, HDA300) and EAR 3A, IP30, B71 and B81 STAF 1996 and IEC60645-2 1997 (no weighting).

Sweden Speech max HL										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL
Speech	98	98	85	85	90					
Speech Equ.FF.	110	110	105	95	105					
Speech Non-linear	99	95	100	105	115	94	94	99	60	60
Speech noise	88	88	80	80	85					
Speech noise Equ.FF.	105	110	95	90	105					
Speech noise Non-linear	89	85	100	100	115	84	84	84	50	50
White noise in speech	95	95	90	85	90	85	85	85	55	60

Table 10



Norway Speech RETSPL										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETFL	RETFL
Speech	40.0	40.0	40	40.0	40.0					
Speech Equ.FF.	3.5	0.5	1.5	3.5	1.0					
Speech Non-linear	6.0	7.0	4.5	5.5	2.0	40.0	40.0	40.0	75.0	75.0
Speech noise	40.0	40.0	40	40.0	40.0					
Speech noise Equ.FF.	3.5	0.5	1.5	3.5	1.0					
Speech noise Non-linear	6.0	7.0	4.5	5.5	2.0	40.0	40.0	40.0	75.0	75.0

Table 11

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

TDH39 (G_F-G_C) IEC60645-2 1997.

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

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

HDA300 (G_F-G_C) PTB report 2013.

Norway Speech level IEC60645-2 1997+20dB (acoustical linear weighting).

Norway Speech Equivalent free field level (G_F-G_C) from IEC60645-2 1997 (acoustical equivalent sensitivity weighting).

Norway Speech Not linear level 1 kHz RETSPL (DD45, TDH39, DD65V2, DD450, HDA300) and EAR 3A, IP30, B71 and B81 IEC60645-2 1997 +20dB (no weighting).

Norway Speech max HL										
Transducer	DD45	TDH39	DD65V2	HDA200	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL
Speech	80	80	65	65	70					
Speech Equ.FF.	110	110	105	95	105					
Speech Non-linear	115	110	100	105	115	75	75	80	40	40
Speech noise	75	75	60	60	65					
Speech noise Equ.FF.	105	110	95	90	105					
Speech noise Non-linear	110	105	100	100	115	70	70	70	30	30
White noise in speech	95	95	90	85	90	85	85	85	55	60

Table 12



Japan Speech RETSPL										
Transducer	DD45	TDH39	DD65V2	DD450	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETFL	RETFL
Speech	14	14	14	14	14					
Speech Equ.FF.	3.5	0.5	1.5	3.5	1					
Speech Non-linear	6	7	4.5	5.5	2	14	14	14	49	49
Speech noise	14	14	14	14	14					
Speech noise Equ.FF.	3.5	0.5	1.5	3.5	1					
Speech noise Non-linear	6	7	4.5	5.5	2	14	14	14	49	49

Table 13

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

TDH39 (G_F-G_C) IEC60645-2 1997.

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

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

HDA300 (G_F-G_C) PTB report 2013.

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

Japan Speech Equivalent free field level (G_F-G_C) from IEC60645-2 1997 (acoustical equivalent sensitivity weighting).

Japan Speech Not linear level 1 kHz RETSPL (DD45, TDH39, DD65V2, DD450, HDA300) and EAR 3A, IP30, B71 and B81 IEC60645-2 1997 (no weighting).

Japan Speech max HL										
Transducer	DD45	TDH39	DD65V2	DD450	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL
Speech	106	106	91	91	96					
Speech Equ.FF.	110	110	105	95	105					
Speech Non-linear	115	110	100	105	115	101	101		66	66
Speech noise	101	101	86	86	91					
Speech noise Equ.FF.	105	110	95	90	105					
Speech noise Non-linear	110	105	100	100	115	96	96		56	56
White noise in speech	95	95	90	85	90	85	85	85	55	60

Table 14

SPL Speech RETSPL										
Transducer	DD45	TDH39	DD65V2	DD450	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETSPL	RETFL	RETFL
Speech	0	0	0	0	0					
Speech Equ.FF.	0	0	0	0	0					
Speech Non-linear	0	0	0	0	0	0	0	0	0	0
Speech noise	0	0	0	0	0					
Speech noise Equ.FF.	0	0	0	0	0					
Speech noise Non-linear	0	0	0	0	0	0	0	0	0	0

Table 15

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

TDH39 (G_F-G_C) IEC60645-2 1997.

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

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

HDA300 (G_F-G_C) PTB report 2013.

IEC SPL Speech level IEC60645-2 1997 (acoustical linear weighting).



IEC Speech Equivalent free field level (G_F-G_C) from IEC60645-2 1997 (acoustical equivalent sensitivity weighting).

IEC Speech Not linear level 1 kHz RETSPL (DD45, TDH39, DD65V2, DD450, HDA300) and EAR3A, IP30, B7 and B81 IEC60645-2 1997 (no weighting).

SPL Speech max HL										
Transducer	DD45	TDH39	DD65V2	DD450	HDA300	EAR3A	IP30	EAR5A	B71	B81
Impedance	10 Ω	10 Ω	10 Ω	40 Ω	23 Ω	10 Ω	10 Ω	10 Ω	10 Ω	12.5 Ω
Coupler	6ccm	6ccm	Artificial ear	Artificial ear	Artificial ear	2ccm	2ccm	2ccm	Mastoid	Mastoid
	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL	Max HL
Speech	115	115	105	95	105					
Speech Equ.FF.	110	110	105	90	105					
Speech Non-linear	120	115	100	110	115	115	115	120	110	110
Speech noise	110	110	100	90	100					
Speech noise Equ.FF.	105	110	100	85	105					
Speech noise Non-linear	115	110	100	105	115	110	110	110	105	105
White noise in speech	115	115	110	105	110	105	105	105	110	115

Table 16

Free Field						
ANSI S3.6-2010					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 correction	Free Field Power	
	0°	45°	90°		Tone	NB
Hz	RETSPL	RETSPL	RETSPL	RETSPL	Max SPL	Max SPL
	dB	dB	dB	dB	dB	dB
125	22	21.5	21	2	97	82
160	18	17	16.5	2	93	83
200	14.5	13.5	13	2	94	84
250	11.5	10.5	9.5	2	96	86
315	8.5	7	6	2	93	83
400	6	3.5	2.5	2	96	86
500	4.5	1.5	0	2	94	84
630	3	-0.5	-2	2	93	83
750	2.5	-1	-2.5	2	92	82
800	2	-1.5	-3	2	92	87
1000	2.5	-1.5	-3	2	92	82
1250	3.5	-0.5	-2.5	2	93	83
1500	2.5	-1	-2.5	2	92	82
1600	1.5	-2	-3	2	96	86
2000	-1.5	-4.5	-3.5	2	93	83
2500	-4	-7.5	-6	2	91	81
3000	-6	-11	-8.5	2	94	84
3150	-6	-11	-8	2	94	84
4000	-5.5	-9.5	-5	2	94	84
5000	-1.5	-7.5	-5.5	2	93	83
6000	4.5	-3	-5	2	94	84
6300	6	-1.5	-4	2	96	86
8000	12.5	7	4	2	87	72
WhiteNoise	0	-4	-5.5	2		90

Table 17



ANSI Free Field					
ANSI S3.6-2010					Free Field max SPL
					Free Field max HL is found by subtracting the selected RETSPL value
	Binaural			Binaural to Monaural correction	Free Field Power
	0°	45°	90°		0° - 45° - 90°
	RETSPL	RETSPL	RETSPL	RETSPL	Max SPL
Speech	15	11	9.5	2	90
Speech Noise	15	11	9.5	2	85
Speech WN	17.5	13.5	12	2	87

Table 18

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 correction	Free Field Power
	0°	45°	90°		0° - 45° - 90°
	RETSPL	RETSPL	RETSPL	RETSPL	Max SPL
Speech	0	-4	-5.5	2	90
Speech Noise	0	-4	-5.5	2	85
Speech WN	2.5	-1.5	-3	2	87

Table 19

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 correction	Free Field Power
	0°	45°	90°		0° - 45° - 90°
	RETSPL	RETSPL	RETSPL	RETSPL	Max SPL
Speech	0	-4	-5.5	2	90
Speech Noise	0	-4	-5.5	2	85
Speech WN	2.5	-1.5	-3	2	87

Table 20

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 correction	Free Field Power
	0°	45°	90°		0° - 45° - 90°
	RETSPL	RETSPL	RETSPL	RETSPL	Max SPL
Speech	0	-4	-5.5	2	90
Speech Noise	0	-4	-5.5	2	85
Speech WN	2.5	-1.5	-3	2	87

Table 21



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 correction	Free Field Power
	0°	45°	90°		0° - 45° - 90°
	RETSPL	RETSPL	RETSPL	RETSPL	Max SPL
Speech	10	6	4.5	2	90
Speech Noise	10	6	4.5	2	85
Speech WN	2.5	-1.5	-3	2	87

Table 22

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 correction	Free Field Power
	0°	45°	90°		0° - 45° - 90°
	RETSPL	RETSPL	RETSPL	RETSPL	Max SPL
Speech	0	-4	-5.5	2	90
Speech Noise	0	-4	-5.5	2	85
Speech WN	2.5	-1.5	-3	2	87

Table 23

Equivalent Free Field					
Speech Audiometer					
	TDH39	DD45	DD65V2	HDA200	HDA300
	IEC60645-2 1997 ANSI S3.6-2010	PTB – DTU 2010	PTB-AAU 2018	ISO389-8 2004	PTB 2013
Coupler	IEC60318-3	IEC60318-3	IEC60318-1	IEC60318-1	IEC60318-1
Frequency	G _F -G _C	G _F -G _C	GF-GC	G _F -G _C	G _F -G _C
125	-17.5	-21.5	-4.5	-5.0	-12.0
160	-14.5	-17.5	-3.5	-4.5	-11.5
200	-12.0	-14.5	-4.5	-4.5	-11.5
250	-9.5	-12.0	-4.5	-4.5	-11.5
315	-6.5	-9.5	-4.0	-5.0	-11.0
400	-3.5	-7.0	-2.0	-5.5	-10.0
500	-5.0	-7.0	-3.0	-2.5	-7.5
630	0.0	-6.5	-2.0	-2.5	-5.0
750					
800	-0.5	-4.0	-2.0	-3.0	-3.0
1000	-0.5	-3.5	-1.5	-3.5	-1.0
1250	-1.0	-3.5	-1.5	-2.0	0.0
1500					
1600	-4.0	-7.0	-3.0	-5.5	-0.5
2000	-6.0	-7.0	-2.5	-5.0	-2.0
2500	-7.0	-9.5	-2.5	-6.0	-3.0
3000			-5.5		
3150	-10.5	-12.0	-9.5	-7.0	-6.0
4000	-10.5	-8.0	-9.5	-13.0	-4.5
5000	-11.0	-8.5	-13.0	-14.5	-10.5
6000					
6300	-10.5	-9.0	-9.0	-11.0	-7.0
8000	+1.5	-1.5	-4.5	-8.5	-10.0

Table 24



Sound attenuation values for earphones					
	Attenuation				
	TDH39/DD45 with MX41/AR or PN 51 Cushion	EAR 3A IP30 EAR 5A	DD65v2	HDA200	HDA300
Frequency [Hz]	[dB]*	[dB]*	[dB]	[dB]*	[dB]
125	3	33	8.3	15	12.5
160	4	34	8.7	15	
200	5	35	11.7	16	
250	5	36	15.5	16	12.7
315	5	37	19.5	18	
400	6	37	23.4	20	
500	7	38	26.1	23	9.4
630	9	37	28.5	25	
750	-				
800	11	37	28.2	27	
1000	15	37	32.4	29	12.8
1250	18	35	30.8	30	
1500	-				
1600	21	34	33.7	31	
2000	26	33	43.6	32	15.1
2500	28	35	47.5	37	
3000	-				
3150	31	37	41.5	41	
4000	32	40	43.8	46	28.8
5000	29	41	46.7	45	
6000	-				
6300	26	42	45.7	45	
8000	24	43	45.6	44	26.2

*ISO 8253-1 2010

Table 25



Technical specifications of the AC440 software

Medical CE-mark:	The CE-mark indicates that Interacoustics A/S meets the requirements of Annex II of the Medical Device Directive 93/42/EEC. Approval of the quality system is made by TÜV – identification no. 0123.	
Audiometer Standards:	Tone: IEC60645-1/ANSI S3.6 Type 1 Speech: IEC60645-2/ANSI S3.6 Type A or A-E	
Transducers & Calibration	Calibration information and instructions are located in the Service manual. Check the accompanying Appendix for RETSPL levels for transducers	
Air Conduction		
DD45	ISO 389-1 2017, ANSI S3.6-2018	Headband Static Force 4.5N ±0.5N
TDH39	ISO 389-1 2017, ANSI S3.6-2018	Headband Static Force 4.5N ±0.5N
DD65 v2	PTB 1.61-4091606/18, AAU 2018	Headband Static Force 11.5N±0.5N
HDA300	PTB report 1.61.4066893/13	Headband Static Force 8,8N ±0.5N
DD450	ISO 389-8 2004, ANSI S3.6-2018	Headband Static Force 10N ±0.5N
E.A.R Tone 3A/5A	ISO 389-2 1998, ANSI S3.6-2018	
IP30	ISO 389-2 1998, ANSI S3.6-2018	
CIR 33	ISO 389-2	
Bone Conduction	Placement: Mastoid	
B71	ISO 389-3 2016, ANSI S3.6-2018	Headband Static Force 5.4N ±0.5N
B81	ISO 389-3 2016, ANSI S3.6-2018	Headband Static Force 5.4N ±0.5N
Free Field	ISO 389-7 2005, ANSI S3.6-2018	
High Frequency	ISO 389-5 2004, ANSI S3.6-2018	
Effective masking	ISO 389-4 1994, ANSI S3.6-2018	
Patient response switch	Handheld push button.	
Patient communication	Talk Forward and Talk Back.	
Monitor	Output through external earphone or speaker.	
Stimuli	Pure tone, Warble tone, NB, SN, WN, TEN noise, Wave files.	
Tone	125-16000Hz separated in two ranges 125-8000Hz and 8000-16000Hz. Resolution 1/2-1/24 octave.	
Warble Tone	1-10 Hz sine +/- 5% modulation	
Wave file	44100Hz sampling, 16 bits, 2 channels	
Masking	Automatic selection of narrow band noise (or white noise) for tone presentation and speech noise for speech presentation.	
Narrow band noise:	IEC 60645-1:2001, 5/12 Octave filter with the same center frequency resolution as pure Tone.	
White noise:	80-16000Hz measured with constant bandwidth	
Speech Noise.	IEC 60645-2 1993 & ANSI S3.6 2010: 125-6000Hz falling 12dB/octave above 1KHz +/-5dB	
Presentation	Manual or Reverse. Single or multiple pulses. pulse time adjustable from 200ms-5000ms in 50mS steps. Simultaneous or alternating.	
Intensity	Check the accompanying Appendix for maximum output levels	
Steps	Available Intensity Steps is 1, 2 and 5dB	
Accuracy	Sound pressure levels: ± 2 dB Vibration force levels: ± 5 dB	
Extended range function	If not activated, the Air Conduction output will be limited to 20 dB below maximum output.	
Frequency	Range: 125Hz to 8kHz (Optional High Frequency: 8 kHz to 16 kHz) Accuracy: Better than ± 1 %	
Distortion (THD)	Sound pressure levels: below 1.5 % Vibration force levels: below 3 %.	



Signal Indicator (VU)	Time weighting: 350mS Dynamic range: -20dB to +3dB Rectifier characteristics: RMS Selectable inputs are provide with an attenuator by which the level can be adjusted to the indicator reference position(0dB)
Storing capability	Tone audiogram: dB HL, MCL, UCL, Tinnitus, R+L
Compatible software	Speech Audiogram: WR1, WR2, WR3, MCL, UCL, Aided, Unaided, Binaural. Noah 4, OtoAccess® and XML compatible

REM software - Technical specifications

Medical CE-mark:	The CE-mark indicates that Interacoustics A/S meets the requirements of Annex II of the Medical Device Directive 93/42/EEC. Approval of the quality system is made by TÜV – identification no. 0123.	
Real Ear Measurement standards	IEC 61669, ANSI S3.46.	
Stimuli	Live voice Warble tone Pure tone Speech noise Random noise Pseudo Random noise Pink noise Chirp White noise band limited ICRA	Real speech ISTS Narrow band noise /SS/ /SH/ IFFM IF noise Real life sounds Custom sound files (automatic calibration available)
Frequency range	100Hz – 10kHz	
Frequency accuracy	< ± 1 %	
Distortion	< 2%	
Intensity range	40 – 100 dB	
Intensity accuracy	< ± 1.5 %	
Measurement Intensity Range	Probe microphone: 40-140 dB SPL ± 2 dB Reference microphone: 40 – 100 dB ± 2 dB	
Frequency Resolution:	1/3, 1/6, 1/12, 1/24 octave or 1024-point FFT.	
Cross talk	Cross talk in the probe and probe tube will alter the obtained results with less than 1 dB at all frequencies.	
Narrow band noise	5/12 Octave filtered	
Available tests:	REUR REIG RECD REAR REAG REOR	REOG REUG Input/output FM Transparency Directionality Visible speech mapping
Compatible Software:	Noah 4, OtoAccess® and XML compatible	

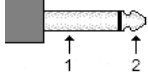
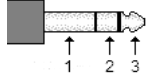

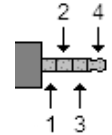

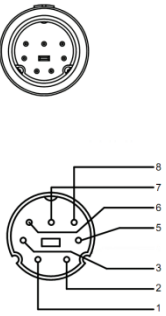


HIT440 software - Technical specifications

Medical CE-mark	The CE-mark indicates that Interacoustics A/S meets the requirements of Annex II of the Medical Device Directive 93/42/EEC. Approval of the quality system is made by TÜV – identification no. 0123.	
Hearing Aid Analyzer Standards	IEC 60118-0, IEC 60118-7, ANSI S3.22.	
Frequency Range	100-10000Hz.	
Frequency Resolution	1/3, 1/6, 1/12 and 1/24 octave or 1024-point FFT.	
Frequency Accuracy	< ± 1 %	
Stimuli	Warble tone	ISTS
	Pure tone	ICRA
	Narrow band noise	Real speech
	Random noise	IFFM
	Pseudo random noise	IF Noise
	Pink noise	/SS/
	White noise band limited	/SH/
	Speech noise	Custom sound files (automatic calibration available)
	Chirp	
Sweep Speed	1,5 – 80 sec.	
FFT	Resolution 1024-points. Averaging: 10 – 500.	
Stimuli intensity range	40-100 dB SPL in 1 dB step.	
Intensity accuracy	< ± 1.5 dB	
Measurement Intensity Range:	Probe microphone 40-145 dB SPL ± 2 dB.	
Stimulus Distortion:	< 1 % THD.	
Available tests:	Additional tests can be designed by user	
	OSPL90	Harmonic Distortion
	Full On Gain	Intermodulation Distortion
	Input/output	Microphone Directionality
	Attack/Recovery Time	
	Reference Test Gain	
	Frequency Response	
	Equivalent Input Noise	
Pre-Programmed Protocols:	HIT440 software comes with a set of Test Protocols loaded. Additional Test Protocols can be designed by user, or easily imported into the system.	
Compatible Software:	Noah 4, OtoAccess® and XML compatible	



Pin assignments

Socket	Connector	Pin 1	Pin 2	Pin 3	Pin 4
Left	 6.3mm Mono	Ground	Signal	-	-
Right		Signal -	Signal +		
Bone					
Pat. Resp.	 6.3mm Stereo	Pin 1 & 2 are connected to Ground			-
TB/Coupler	 3.5mm 4 pole	Ground	DC bias	TB-mic. or REF-mic. Signal	Coupler-mic. Signal
FF		Ground R	Ground L	Signal R	Signal L
Monitor		Ground		Signal R	Signal L
TF		Ground		DC bias	Signal
USB	 USB B	+5 VDC	Data -	Data +	Ground
Socket	Connector	Pin no.	Description		
Insitu L. & R.	 DIN 7 pole	1.	Ground		
		2.	Speaker signal		
		3.	Ground		
		4.	-		
		5.	DC bias – Probe mic.		
		6.	Signal & DC bias – Ref. mic.		
		7.	Ground		
		8.	Signal - Probe mic.		
		Housing.	Ground		



Electromagnetic Compatibility (EMC)

- This instrument is suitable in hospital 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
- 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
- Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation. The list of accessories, transducers and cables can be found in this appendix.
- 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 instrument, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result

NOTICE 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 There are no deviations from the collateral standard and allowances uses
- This instrument is in compliance with IEC60601-1-2:2014, 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.

Portable and mobile RF communications equipment can affect the Callisto™. Install and operate the Callisto™ according to the EMC information presented in this chapter.

The Callisto™ has been tested for EMC emissions and immunity as a standalone instrument. Do not use the Callisto™ adjacent to or stacked with other electronic equipment. If adjacent or stacked use is necessary, the user should verify normal operation in the configuration. The use of accessories, transducers and cables other than those specified, with the exception of servicing parts sold by Interacoustics as replacement parts for internal components, may result in increased EMISSIONS or decreased IMMUNITY of the device. Anyone connecting additional equipment is responsible for making sure the system complies with the IEC 60601-1-2 standard.

Guidance and manufacturer’s declaration - electromagnetic emissions		
The Callisto™ is intended for use in the electromagnetic environment specified below. The customer or the user of the Callisto™ should assure that it is used in such an environment.		
Emissions Test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The Callisto™ 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 Callisto™ is suitable for use in all commercial, industrial, business, and residential environments.
Harmonic emissions IEC 61000-3-2	Not Applicable	
Voltage fluctuations / flicker emissions IEC 61000-3-3	Not applicable	



Recommended separation distances between portable and mobile RF communications equipment and the Callisto™.

The Callisto™ is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Callisto™ can help prevent electromagnetic interferences by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Callisto™ 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 2.5 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 Callisto™ is intended for use in the electromagnetic environment specified below. The customer or the user of the Callisto™ 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	+6 kV contact +8 kV air	+6 kV contact +8 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	Not applicable +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	Not applicable	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% <i>UT</i> (>95% dip in <i>UT</i>) for 0.5 cycle 40% <i>UT</i> (60% dip in <i>UT</i>) for 5 cycles 70% <i>UT</i> (30% dip in <i>UT</i>) for 25 cycles <5% <i>UT</i> (>95% dip in <i>UT</i>) for 5 sec	Not applicable	Mains power quality should be that of a typical commercial or residential environment. If the user of the Callisto™ requires continued operation during power mains interruptions, it is recommended that the Callisto™ be powered from an uninterruptable power supply or its battery.
Power frequency (50/60 Hz) IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or residential environment.
Note: <i>UT</i> is the A.C. mains voltage prior to application of the test level.			



Guidance and manufacturer's declaration — electromagnetic immunity			
The Callisto™ is intended for use in the electromagnetic environment specified below. The customer or the user of the Callisto™ 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>3 V/m 80 MHz to 2,5 MHz</p>	<p>3 Vrms</p> <p>3 V/m</p>	<p>Portable and mobile RF communications equipment should be used no closer to any parts of the Callisto™, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p>Recommended separation distance</p> $d = 1,2\sqrt{P}$ $d = 1,2\sqrt{P} \quad 80 \text{ MHz to } 800 \text{ MHz}$ $d = 2,3\sqrt{P} \quad 800 \text{ MHz to } 2,5 \text{ GHz}$ <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> 

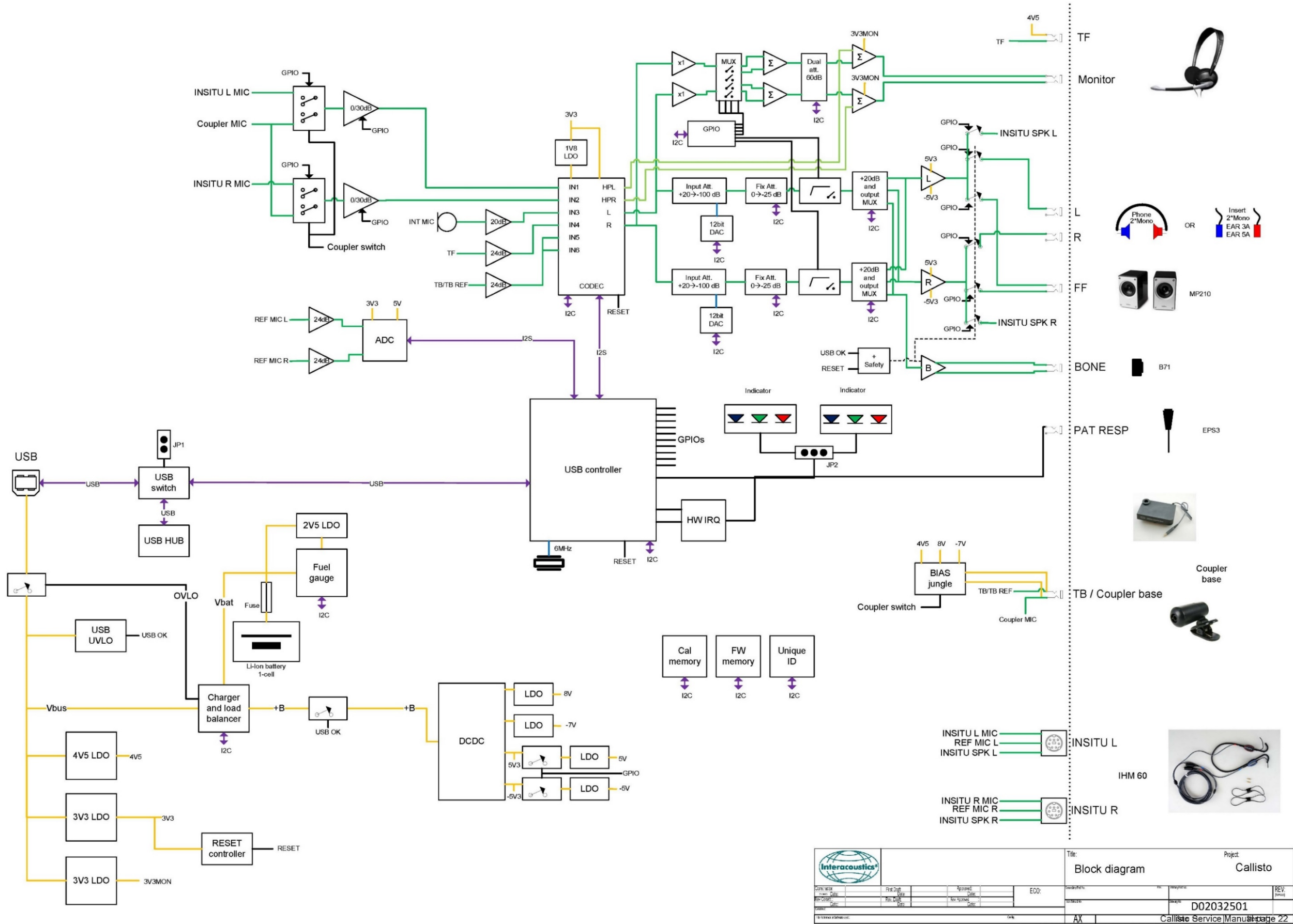
NOTE1 At 80 MHz and 800 MHz, the higher frequency range applies

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 Callisto™ is used exceeds the applicable RF compliance level above, the Callisto™ should be observed to verify normal operation, If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Callisto™.

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

Appendix B - Block diagram



		Title: Block diagram		Project: Callisto	
		EDO: Date: Rev: No. of pages: No. of sheets:		REV: Date: No. of pages: No. of sheets:	
D02032501		Callisto Service Manual Page 22			



Appendix C - Parts & accessories

	<p>8010879 8010819</p>	<p>DD45 audiometric headset TDH 39 audiometric headset</p>
	<p>8520328</p>	<p>DD65v2 headset</p>
	<p>8520321</p>	<p>DD450 high frequency headset</p>
	<p>8010876</p>	<p>DD45 telephone 10 ohm</p>
	<p>8010625</p>	<p>TDH39P 10 Ohm earphone Telephonics</p>
	<p>8010817</p>	<p>HBA audiometric head band</p>
	<p>8010894</p>	<p>DD51 cushion</p>
	<p>8010822</p>	<p>Earphone cable IEC-M21 symmetric mono For DD45/TDH39 headsets</p>
	<p>8106380</p>	<p>TDH39AA with Amplivox headset</p>



	8010893	HDA200 headset 30° plugs
	8004172	IEC-M31 earphone cord for HDA 200 headset
	8107154	Calibration adapter
	8010815	EARtone 3A 10 Ohm insert earphones
	8010797	EARtone 5A insert earphones including 4 large 3C, 10 small 3B and 50 medium 3A ear tips
	8106227	Ear tip 3B EARtone, small, 100 pcs
	8106226	Ear tip 3A EARtone, medium, 100 pcs
	8500100	Ear tip 3C EARtone, large, 24 pcs
	8010800	B71 bone conductor complete 30° plug
	8105742	B71 bone Conductor only
	8011098	P3333 headband for B71



	8011094	IEC-B11 conductor cable
	8010870	Monitor headset with boom PC-131 stereo headset
	8501068	1/2" microphone
	8011102	2 cc coupler
	8011104	BTE adaptor with O-ring
	8011105	Body adaptor with O-ring
	8011106	ITE Adaptor with O-ring
	8011291	Reference Microphone
	8004556	Adaptor hose BTE
	8010930	IHM60 in-situ headset kit



	8010868	Headband small complete
	8010867	Headband large complete
	8006481	Goose neck kit in-situ headset For in-situ headset 8010930
	8011472	Nipple tube kit For in-situ headset 8010930
	8002535	Clip headband in-situ For in-situ headset 8010930
	8012831	IGT60 probe tubes, 36 Pcs.
	8103838	APS3 patient response switch
	8012841	Assortment box BET60 SPL audiometric ear tips
	8011379	Probe tip set SPL60 8012841 included 8011206 calibration adaptor included
	8011313	Microphone clip-On
	8000361	Callisto 1.0 1106



	8009978	NP120 3.7V 1700mAh Battery lithium ion 53x35.2x11
	8006286	PCA mainboard 1106
	8002617	Cradle 1106
	8011361	Coupler base 1106 complete
	8010679	Loudspeaker 8 Ohm edifier MP210
	8505541	Cable free field 1106, right
	8004418	Cable free field 1106, left for loudspeaker 2
	8011241	Cable USB 2m
	80405101	Wax



Appendix D - Update news

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

Date	Action	Remarks
2020/	Revision of Service manual	<ul style="list-style-type: none"> - New CVI - DD65V2 is added and necessary changes are done. - Calibration table is updated - Parts and accessory list are updated. - General informative notice is added about unsupportive windows and effects.
2017/12	Service manual update to new format. Addition of new information relating to HDA300, DD450, B81 and IP30. Including new technical specifications. Update software paths and addition of test box information. Update part numbers.	<ul style="list-style-type: none"> - Changed the service manual part number for document file from old format D06013501 to new format 8012216.