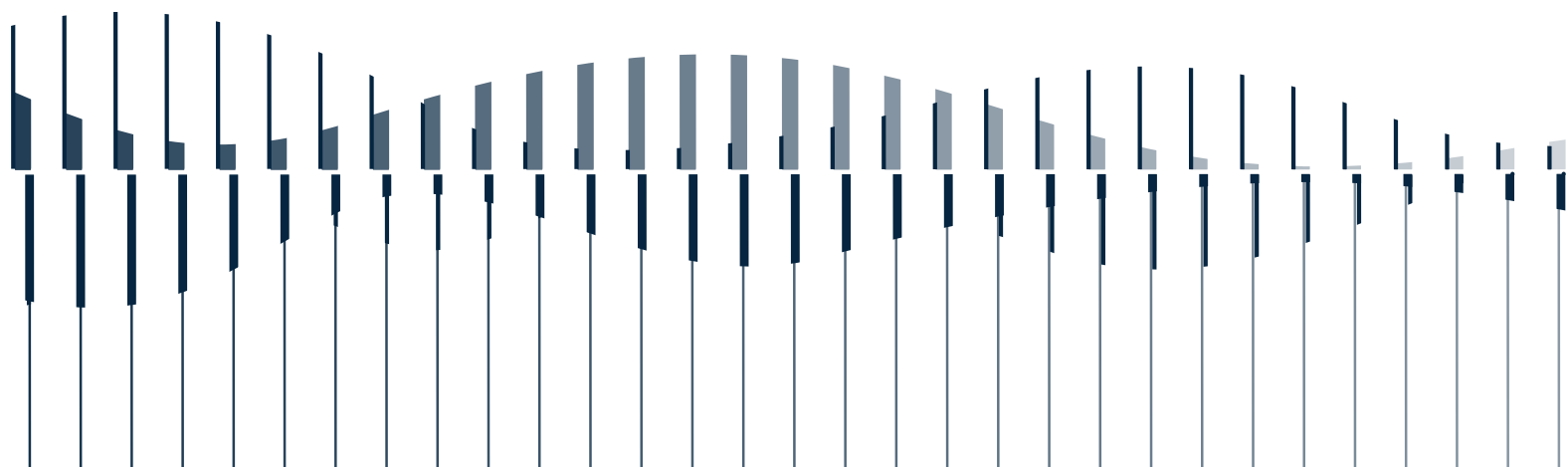




Instruction Manual

GRAS 43AG Ear and Cheek Simulator



Revision History

Any feedback or questions about this document are welcome at gras@GRASacoustics.com.

Revision	Date	Description
1	4 April 2016	First publication of manual for configurations 43AG-1 to 43AG-5
2	20 July 2016	Frequency response for 43BB Low-noise ear simulator system corrected
3	29 August 2016	Additions to section about Assembly
4	9 September 2016	Addition about assembly of 43AG-5
5	16 November 2016	Use only right pinnae, left pinnae are not flush with cheek plate
6	14 March 2017	Caution about use of force with angled adapter
7	19 December 2017	Configurations with High-Frequency Ear Simulator added
8	20 August 2019	Configurations with Hi-Res Ear Simulator added
9	2 September 2020	Correction values for calibration at 1 kHz added
10	1 June 2022	TEDS compliance section added

This manual covers the configurations 43AG-1 to 43AG-9. If you are the owner of a 43AG delivered before April 2016, the Manual for non-configured 43AG (LI0022) is the correct manual. This manual can be downloaded from the 43AG product page at www.GRASacoustics.com.

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Introduction

The GRAS 43AG Ear and Cheek Simulator is a unique multi-purpose tool that helps you accomplish the job in an effective and efficient manner. We call it the table-top KEMAR as it offers you much of the KEMAR capability in a convenient and portable packaging.

Our vision for the 43AG is to assist you in all facets of the product development cycle: from R&D to EOL testing.

The 43AG is a multi-purpose tool that can be used for testing of both concha and insert types earphones. It can also be used for headphone testing, both circum-aural and supra-aural types. Also, all common types of hearing-aids, and telephone handset can be tested with the 43AG.

To make ordering and decision making easier, we have made 43AG available in 7 configurations, fully calibrated and containing all configuration specific parts:

- 43AG-1 Ear and Cheek Simulator LEMO
- 43AG-2 Ear and Cheek Simulator CCP
- 43AG-3 Ear and Cheek Simulator w Anthropometric Pinna LEMO
- 43AG-4 Ear and Cheek Simulator w Anthropometric Pinna CCP
- 43AG-5 Ear and Cheek Simulator, Low-noise
- 43AG-6 Ear and Cheek Simulator, High-Frequency, LEMO, w Anthropometric Pinna
- 43AG-7 Ear and Cheek Simulator, High-Frequency, CCP w Anthropometric Pinna
- 43AG-8 Ear and Cheek Simulator, Hi-Res LEMO w Anthropometric Pinna
- 43AG-9 Ear and Cheek Simulator, Hi-Res CCP w Anthropometric Pinna

With these configurations, tests can be performed according to the following standards:

- IEC 60318-4 (former IEC 60711)
- ITU-T Rec. P.57 Type 2 Artificial Ear
- ITU-T Rec. P.57 Type 3.3 Pinna Simulator

TEDS Compatibility

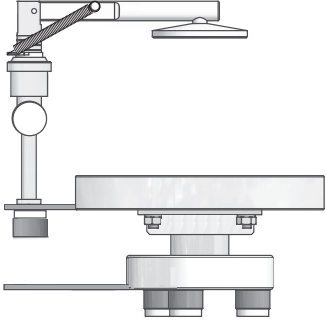








Ear and cheek simulators with constant-current power (CCP) microphone components (configurations -2, -4, -7, and -9, and specific custom CCP configurations, including -S1, -S3, and -S4) are IEEE 1451.4 TEDS v. 1.0 compliant. If your measurement platform supports Transducer Electronic Data Sheets (TEDS), you will be able to read and write data like properties and calibration data.

The Scope of this Manual








This manual covers the configurations 43AG-1 to 43AG-9. If you are the owner of a 43AG delivered before April 2016, the Manual for non-configured 43AG (LI0022) is the correct manual. This manual can be downloaded from the 43AG product page at www.GRASacoustics.com

Delivered Items

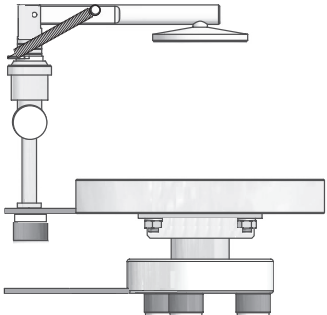








43AG-1 Ear and Cheek Simulator LEMO

43AG-1		
	Test Jig with mounting base and adjustable force clamp	RA0052
	Cheek Plate	RA0314
	Large Right Pinna 55 Shore 00	KB0065
	Ear Canal Extension	GR0917
	Externally Polarized Ear Simulator According to IEC 60318-4	RA0045
	Angled 1/2" to 1/4" Adapter	RA0001
	1/4" Preamplifier with 3 m integrated cable	26AC
	Finger Simulator	RA0199
	External Ear Canal	GR0408
	Union Nut	GR0409

43AG-2 Ear and Cheek Simulator CCP

43AG-2		
	Test Jig with mounting base and adjustable force clamp	RA0052
	Cheek Plate	RA0314
	Large Right Pinna 55 Shore 00	KB0065
	Ear Canal Extension	GR0917
	Pre-polarized Ear Simulator According to IEC 60318-4	RA0045-S1
	Angled 1/2" to 1/4" Adapter	RA0001
	1/4" Preamplifier	26CB
	Microdot to BNC Cable, 3 m	AA0070
	Finger Simulator	RA0199
	External Ear Canal	GR0408
	Union Nut	GR0409

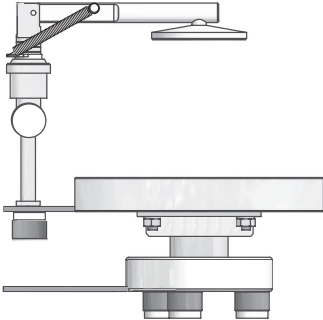


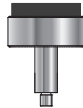







43AG-3 Ear and Cheek Simulator w. Anthropometric Pinna LEMO

43AG-3		
	Test Jig with mounting base and adjustable force clamp	RA0052
	Cheek Plate	RA0314
	Large Right Anthropometric Pinna 35 Shore 00	KB5000
	Ear Simulator Holder	GR1874
-	Finger Screws for pinna	2 x SK6012
	Externally Polarized Ear Simulator According to IEC 60318-4	RA0045
	Angled 1/2" to 1/4" Adapter	RA0001
	1/4" Preamplifier with 3 m integrated cable	26AC
	Finger Simulator	RA0199
	External Ear Canal	GR0408
	Union Nut	GR0409


43AG-4 Ear and Cheek Simulator w. Anthropometric Pinna CCP

43AG-4		
	Test Jig with mounting base and adjustable force clamp	RA0052
	Cheek Plate	RA0314
	Large Right Anthropometric Pinna 35 Shore 00	KB5000
	Ear Simulator Holder	GR1874
-	Finger Screws for pinna	2 x SK6012
	Prepolarized Ear Simulator According to IEC 60318-4	RA0045-S1
	Angled 1/2" to 1/4" Adapter	RA0001
	1/4" Preamplifier with Microdot Connector	26CB
	Microdot to BNC cable, 3 m	AA0070
	Finger Simulator	RA0199
	External Ear Canal	GR0408
	Union Nut	GR0409

43AG-5 Ear and Cheek Simulator, Low-noise

43AG-5			
	Test Jig with mounting base and adjustable force clamp	RA0052	
	Cheek Plate	RA0314	
	Large Right Anthropometric Pinna 35 Shore 00	KB5000	
	Ear Simulator Holder	GR1874	
-	Finger Screws for pinna	2 x SK6012	
	Finger Simulator	RA0199	
	External Ear Canal	GR0408	
	Union Nut	GR0409	
Low-noise Ear Simulator System		43BB	
	Low-noise Ear Simulator		
		Angled 1/2" to 1/4" Adapter	RA0001
		1/4" Preamplifier with 3 m integrated cable	
		Filter and Gain Unit	
		LEMO 7-pin to 7-pin, 1 m cable	AA0059
		Power Module for low-noise systems	12HF

43AG-6 Ear and Cheek Simulator w. High-Frequency Ear Simulator LEMO

43AG-6		
	Test Jig with mounting base and adjustable force clamp	RA0052
	Cheek Plate	RA0314
	Large Right Anthropometric Pinna 35 Shore 00	KB5000
	Ear Simulator Holder	GR1874
-	Finger Screws for pinna	2 x SK6012
	Externally polarized High-Frequency Ear Simulator	RA0401
	Angled 1/2" to 1/4" Adapter	RA0001
	1/4" Preamplifier with 3 m integrated cable	26AC
	Finger Simulator	RA0199
	External Ear Canal	GR0408
	Union Nut	GR0409

43AG-7 Ear and Cheek Simulator w. High-Frequency Ear Simulator CCP

43AG-7		
	Test Jig with mounting base and adjustable force clamp	RA0052
	Cheek Plate	RA0314
	Large Right Anthropometric Pinna 35 Shore 00	KB5000
	Ear Simulator Holder	GR1874
-	Finger Screws for pinna	2 x SK6012
	Prepolarized High-Frequency Ear Simulator	RA0402
	Angled 1/2" to 1/4" Adapter	RA0001
	1/4" Preamplifier with Microdot Connector	26CB
	Microdot to BNC cable, 3 m	AA0070
	Finger Simulator	RA0199
	External Ear Canal	GR0408
	Union Nut	GR0409

43AG-8 Ear and Cheek Simulator w. Hi-Res Ear Simulator LEMO

43AG-8		
	Test Jig with mounting base and adjustable force clamp	RA0052
	Cheek Plate	RA0314
	Large Right Anthropometric Pinna 35 Shore 00	KB5000
	Ear Simulator Holder	GR1874
-	Finger Screws for pinna	2 x SK6012
	Externally polarized Hi-Res Ear Simulator	RA0403
	Angled 1/2" to 1/4" Adapter	RA0001
	1/4" Preamplifier with 3 m integrated cable	26AC
	Finger Simulator	RA0199
	External Ear Canal	GR0408
	Union Nut	GR0409

43AG-9 Ear and Cheek Simulator w. Hi-Res Ear Simulator CCP

43AG-9		
	Test Jig with mounting base and adjustable force clamp	RA0052
	Cheek Plate	RA0314
	Large Right Anthropometric Pinna 35 Shore 00	KB5000
	Ear Simulator Holder	GR1874
-	Finger Screws for pinna	2 x SK6012
	Prepolarized Hi-Res Ear Simulator	RA0404
	Angled 1/2" to 1/4" Adapter	RA0001
	1/4" Preamplifier with Microdot Connector	26CB
	Microdot to BNC cable, 3 m	AA0070
	Finger Simulator	RA0199
	External Ear Canal	GR0408
	Union Nut	GR0409

Assembly

Before Assembly – All Versions

The cheek plate is attached to the test jig with a snap fit mechanism that locks onto the flange on the GR0917 Ear Canal Extension or the GR1874 Ear Simulator Holder, as shown in Fig. 1.

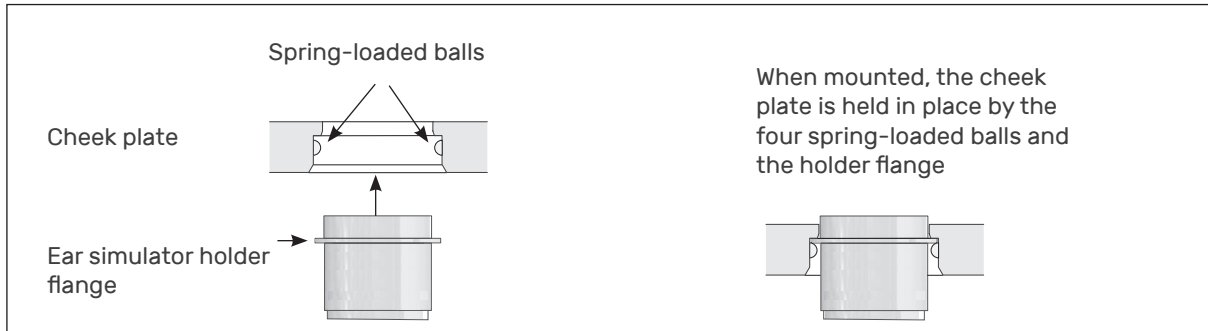


Fig. 1. The snap fit mechanism explained. Here shown with the GR1874 Ear Simulator Holder.

As delivered, the GR0408 External Ear Canal is mounted on the ear simulator. It is only needed for calibration and must be dismantled to make place for the GR0917 Ear Canal Extension or the GR1874 Ear Simulator Holder.

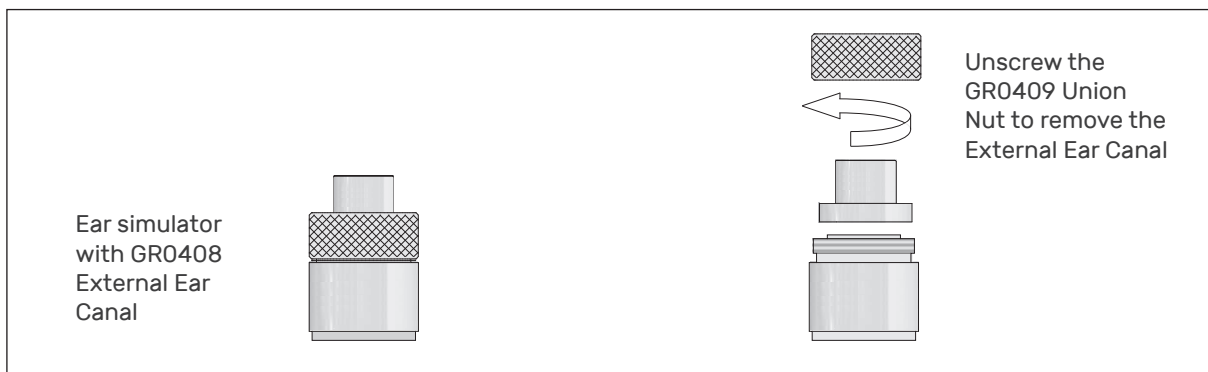


Fig. 2. The GR0408 External Ear Canal must be removed from the ear simulator prior to mounting.

43AG-1 to 43AG-4 and 43AG-6 to 43AG-9

The preamplifier and the angled adapter are already mounted in the jig. To mount the other parts, proceed as follows:

1. Screw the GR0917 Ear Canal Extension (43AG-1 and 43AG-2) or the GR1874 Ear Simulator Holder (43AG-3 and 43AG-4) onto the ear simulator.
2. Screw the ear simulator into the test jig (onto the angled adapter already mounted by GRAS). Use only finger force when tightening.

See Fig. 3 on page 15.

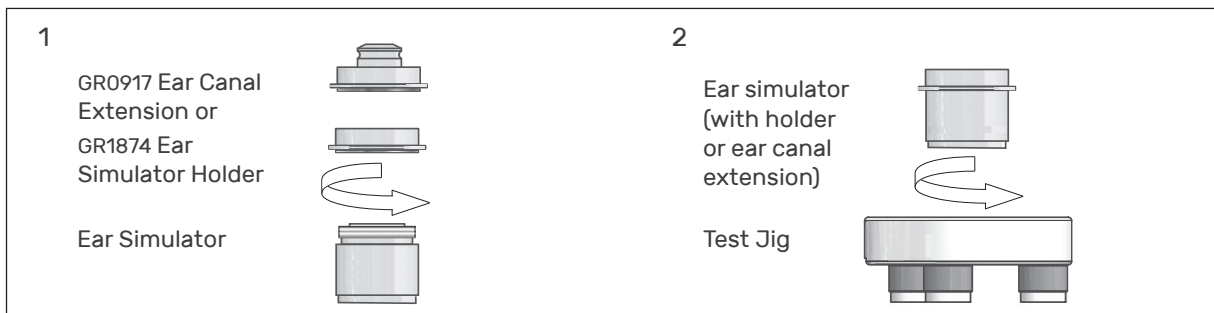


Fig. 3. Mounting the ear simulator in the test jig.

3. Push the Cheek plate down onto the test jig: While holding the jig with your hands, use your thumbs to force the cheek plate down onto and over the holder. The snap fit mechanism will engage the holder, and a click will sound when the cheek plate is properly mounted.
4. Mount the pin* onto the cheek plate's flat arm and secure it with one of the supplied screws. Slide the arm onto the pole and secure it with the finger screw.

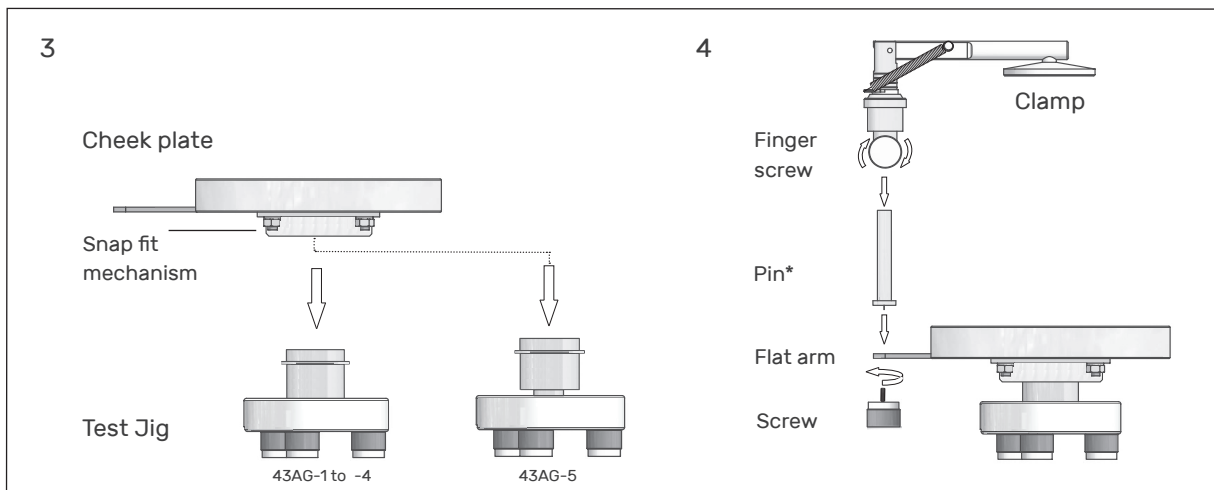


Fig. 4. Mounting the cheek plate and the spring-loaded clamp.

*Two pins are provided, a short and a long one. The short pin is 40 mm, the long is 75 mm.

43AG-5

The 43AG-5 comes with preamplifier, angled adapter and ear simulator already installed. These three parts are glued together and calibrated as a complete unit.

Important. They must not be disassembled as this will jeopardize the calibration and their low-noise performance.

The low-noise ear simulator is mounted a little higher in the Test Jig because the preamplifier is bigger (See Fig. 4). However, the ear simulators used in the 43AG configurations are mounted the same way – screwed onto the RA0001 Angled Adapter – and therefore the mechanical stability is the same. The GR0408 External Ear Canal must be replaced with the Ear Simulator Holder. See Fig. 2 and Fig. 3.1. It is not glued and can freely be removed.

Reassembling the Ear Simulator and Preamplifier

If you have removed the angled adapter and preamplifier from the ear simulator, you need to use only gentle finger force when attaching the angled adapter to the ear simulator.

Caution! Do NOT use the preamplifier as a lever to tighten the angled adapter onto the ear simulator. If you do, there is a real risk that the angled adapter will be attached so tightly to the microphone in the ear simulator that it cannot be removed again without also (unintentionally) removing the microphone.

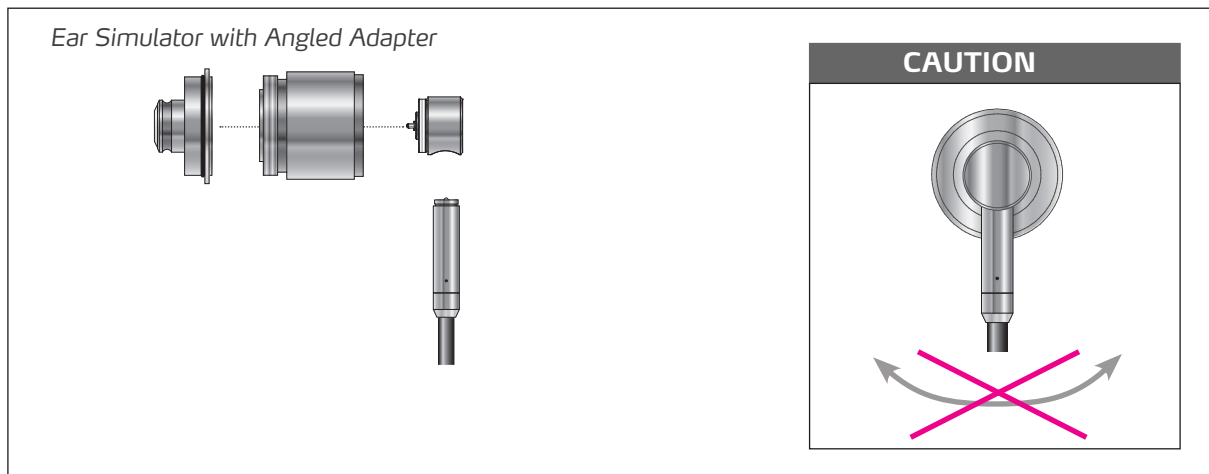


Fig. 5. Mounting the angled adapter – use only gentle finger force.

Adjusting Clamp Height and Force

Adjusting the Clamp Height

The distance of the spring-loaded clamp to the cheek plate can be adjusted continuously from 25 mm to 90 mm. Two pin lengths are supplied, one 40 mm and another 75 mm long. A distance between 25 to 55 mm can be achieved using the short pin, a distance of 55 mm to 90 mm can be achieved using the long pin.

In Fig. 6A the clamp is at its lowest position on the short pin.

In Fig. 6B the clamp is in its uppermost position on the short pin or its lowest position on the long pin.

In Fig. 6C the clamp is in its uppermost position on the long pin.

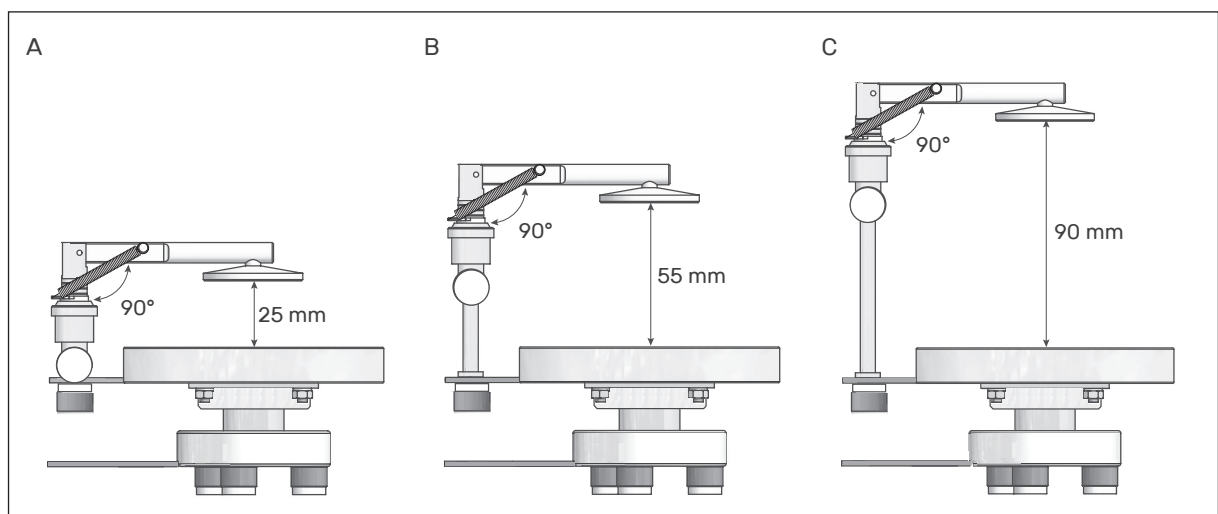


Fig. 6. Adjusting the spring-loaded clamp's distance to the cheek plate.

In the examples shown above, the flat arm holding the pin and the spring adjusted clamp is attached to the cheek plate.

If you use the flat arm attached to the test jig, you must use the long pin and can achieve a distance from 25 to 55 mm.

Adjusting the Spring Tension and Measuring its Force

The force applied to the device under test is determined by springs on the side of the clamp-arm assembly. The assembly can accommodate two or four springs. Furthermore, the force can be adjusted by adjusting the preload to the springs. Turning the knurled knob counter-clockwise will pull the spring holder downwards, thus increasing the preload to the spring. Alternatively, turning the knurled knob clockwise will allow the holder to move upwards and decrease the tension.

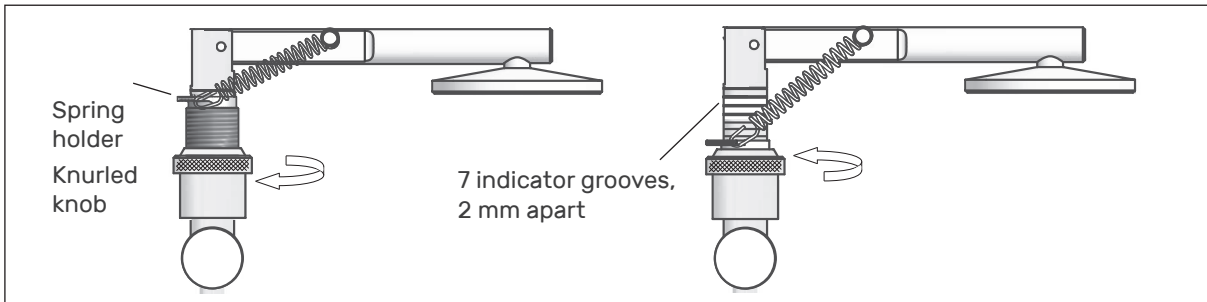


Fig. 7. Adjusting the preload of the springs.

The tension that can be achieved largely depends on the condition of the springs, and can vary depending on previous use and it is therefore not possible to give precise figures. Broadly speaking, a tension of about 1 N to 8 N can be achieved with one set of springs. With four springs about 6 to 12 N can be achieved. Standard tension for most applications is 5N. With the RA0184 Force Gauge you can determine the actual force applied to the DUT as shown in Fig. 8.

The clamp can easily be removed with a small Phillips screwdriver and replaced with an RA0199 Finger Simulator, as shown in Fig. 9.

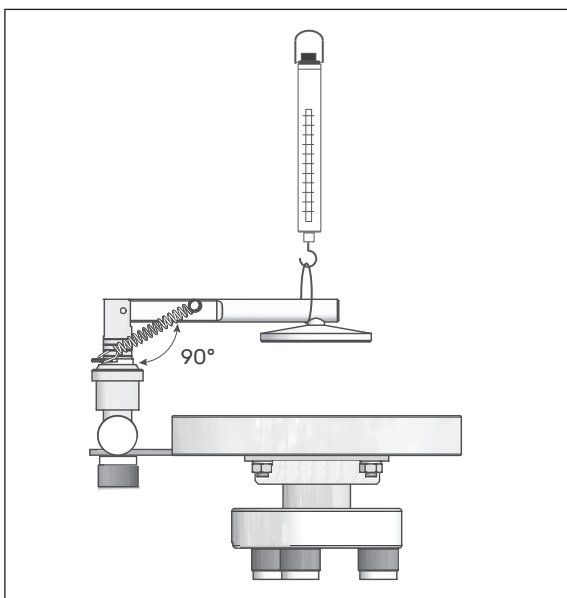


Fig. 8. Measuring the force applied to the DUT.

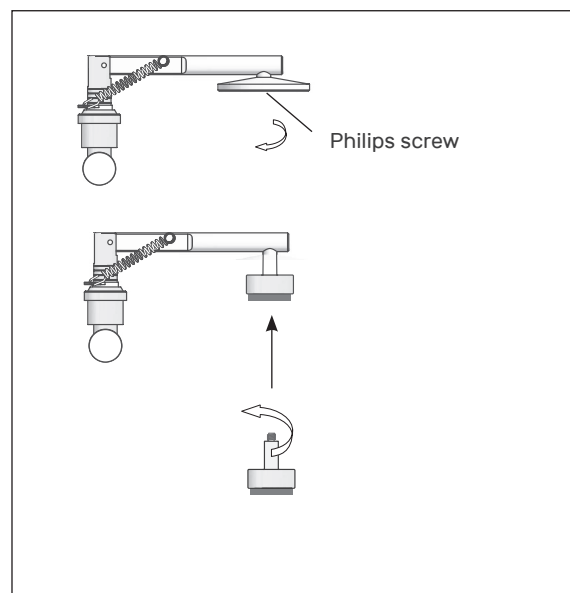


Fig. 9. Mounting the RA0199 Finger Simulator.

Mounting the KEMAR Pinnae

When mounting a pinna, ensure that the posterior part of the helix is positioned towards the arm. A standardized pinna as used with the 43AG-1 and 43AG-2 is mounted by simply pushing it into the recess. Ensure that the pinna is flush with the cheek plate.

The anthropometric pinna used with 43AG-3 to 43AG-7 is mounted in the same way, but in addition to the push mounting, they must be secured by the two finger screws mounted from the underside of the cheek plate, as shown in Fig. 10 below. To mount these screws, you must first remove the cheek plate assembly, see Fig. 4.

Important. To ensure that the base of the pinna is flush with the cheek plate, only right pinnae should be used. KEMAR is not symmetrical, and the base of a left KEMAR pinna will not be flush with the cheek plate.

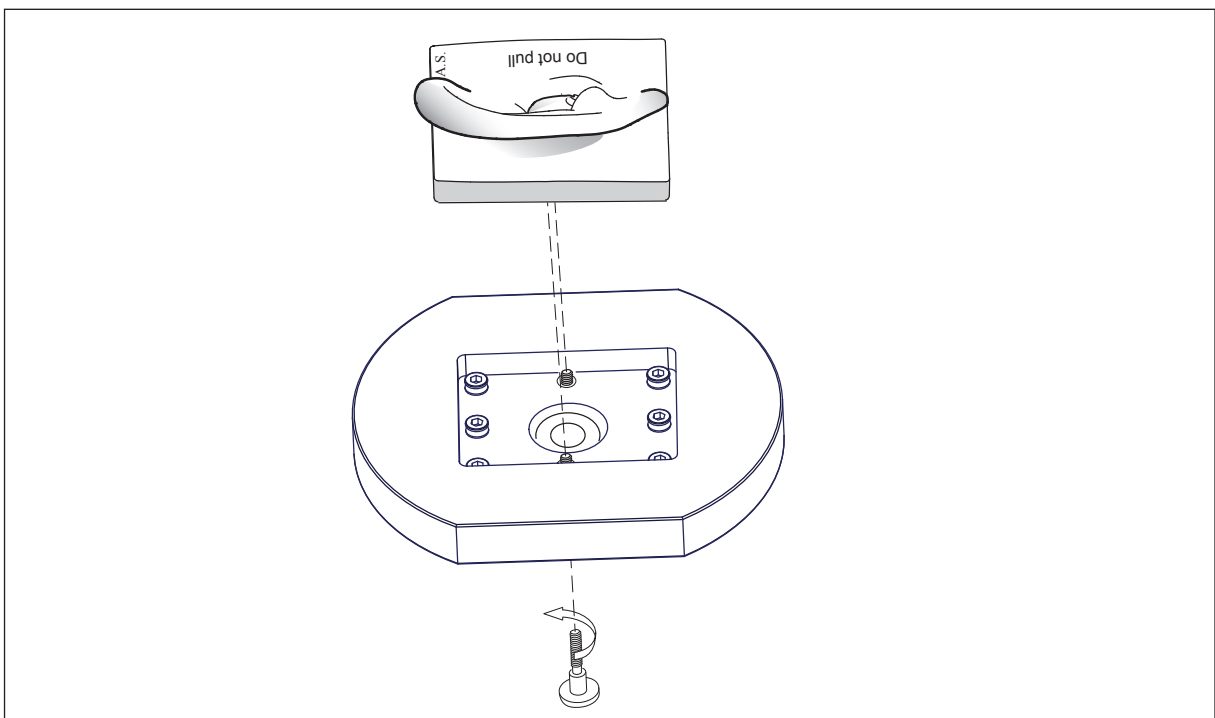


Fig. 10. Securing an anthropometric pinna with two finger screws.

1. Remove the cheek plate from the test jig by pulling it up until released by the snap fit mechanism. This is the opposite of step 3 on page 12. See also Fig. 4.
2. Push the ear down over the studs.
3. Mount the two finger screws from the underside and tighten, using finger force only.
4. Remount the cheek plate by pushing it down onto the jig until it is held in place by the snap fit mechanism as shown in Fig. 4 on page 15.

Test Setups

A typical test setup for the externally polarized versions 43AG-1, 43AG-3 and 43AG-6 is shown in Fig. 11. For the prepolarized versions 43AG-2, 43AG-4 and 43AG-7, the 12AQ 2-Channel Universal Power Module with signal conditioning and PC interface can be used.

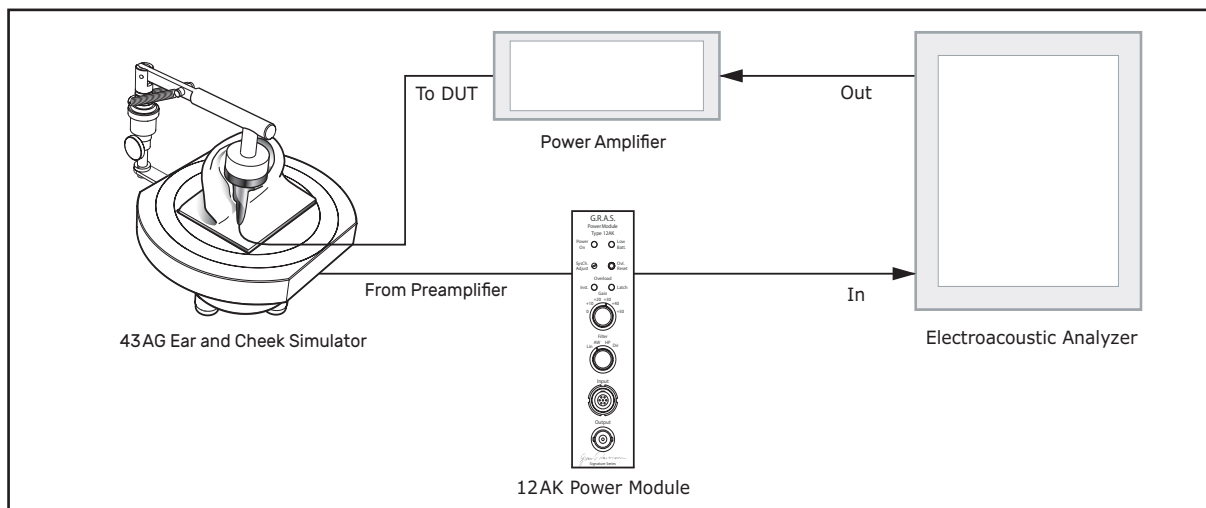


Fig. 11. Typical test setup for 43AG, here for the externally polarized 43AG-1, 43AG-3 and 43AG-6.

The G.R.A.S 12AU 1-Channel Universal Power Module with signal conditioning and power amplifier has a built-in power amplifier, and therefore it can be substituted for both the 12AK Power module and the separate power amplifier shown above.

A typical test setup for 43AG-5 is shown in Fig. 12. The 26HT Gain Unit and 12HF Power Module are part of the delivery and cannot be replaced by other equipment.

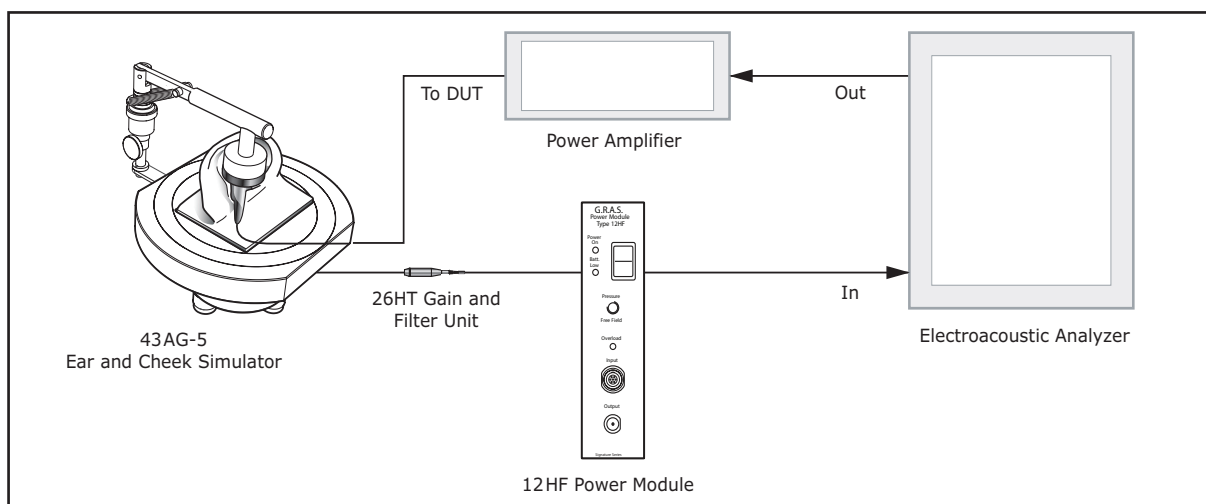


Fig. 12. Test setup for 43AG-5 with 26HT Gain Unit and the 12HF Power Module.

Calibration

Do not attempt to remove the microphone from the Ear Simulator – you must calibrate the ear simulator as a complete unit. The instructions below assume that the 43AG is connected to power module and analyzer.

43AG-1 and 43AG-2

43AG-1 and 43AG-2 can be calibrated in situ using an RA0157 Calibration Adapter. This is described in Method 1 below. Alternatively, you can remove pinna and cheek plate and calibrate the RA0045 with the external ear canal mounted.

The two methods are equally accurate.

Method 1 – In-situ Calibration with RA0157 Calibration Adapter

1. Remove the pinna from the cheek plate.
2. Unscrew the collar of the Pistonphone and remove the O-ring.
3. Mount the RA0157 Calibration Adapter into the pistonphone.
4. Position the pistonphone strictly vertically over the RA0045.

Refer to your Pistonphone's manual for further information, including how to correct for barometric pressure. The correction factor is: -0.62 dB . Ideally your analyzer should read $114 \text{ dB} - 0.62 \text{ dB} = 113.38 \text{ dB} \pm \text{correction for ambient pressure}$.

Method 2 – The Cheek Plate Removed and GR0408 Exterior Ear Canal is Used

The pistonphone should be fitted with a $\frac{1}{2}$ inch coupler.

1. Remove the cheek plate by pulling it upwards until it is released by the snap-fit mechanism.
2. Unscrew the mounting flange from the ear simulator.
3. Using the GR0409 Union Nut, mount the GR0408 Exterior Ear Canal on the Ear Simulator.
4. Unscrew the collar of the Pistonphone and remove the O-ring.
5. Position the Pistonphone strictly vertically over the RA0045 and push it down gently till it can go no further.

Refer to your Pistonphone's manual for further information, including how to correct for barometric pressure. The correction factor is -1.03 dB . Ideally your analyzer should read $114 \text{ dB} - 1.03 \text{ dB} = 112.97 \text{ dB} \pm \text{correction for ambient pressure}$.

43AG-1 to 43AG-9

43AG-3 and AG-4 w. Anthropometric Pinna

43AG-6 and AG-7 w. High-Frequency Ear Simulator and Anthro. Pinna

43AG-8 and AG-9 w. Hi-Res Ear Simulator and Anthro. Pinna

The instructions below assume that 43AG-3/43AG-4 is connected to power module and analyzer.

Calibration of a 43AG fitted with an anthropometric pinna can only be done when the pinna and the cheek plate have been removed from the ear simulator (mounted in the test jig).

As the anthropometric pinna does not use an ear canal extension, the GR0408 External Ear Canal must be fitted on the ear simulator for the calibration.

The steps required are shown on Fig. 2 on page 14, but should be reversed. However, do not remove the ear simulator from the test jig.

1. Remove the Cheek Plate by pulling it upwards until released by the snap-fit mechanism (reverse of Fig. 4, 3).
2. Unscrew the Ear Simulator Holder from the Ear Simulator (reverse of Fig. 3, 1).
3. Using the GR0409 Union Nut, mount the GR0408 Exterior Ear Canal on the Ear Simulator.
4. Position the Pistonphone strictly vertically over the External Ear Canal.

Refer to your Pistonphone's manual for further information, including how to correct for barometric pressure.

The correction factor is - 1.03 dB.

Ideally your analyzer should read $114 \text{ dB} - 1.03 \text{ dB} = 112.97 \text{ dB} \pm \text{correction for ambient pressure}$.

43AG-5 Low-noise

The instructions below assume that 43AG-5 is connected to power module, filter and gain unit and analyzer.

System Sensitivity

Since the microphone signal is amplified by 20 dB by the 26HT Gain and Filter Unit, the nominal system sensitivity corresponds to 0.8 V/Pa. When the output voltage from the Power Module is 0.8 V RMS, the microphone is subjected to 94 dB re. 20 μ Pa. The actual system sensitivity is quoted on the calibration chart supplied with the system.

Calibration

To avoid overload, the 42AG Multifunction Sound Calibrator is recommended as it can produce a calibration signal of 94 dB.

1. Remove the cheek plate by pulling it upwards until released by the snap-fit mechanism, see Fig. 4 on page 15.
2. Replace the Ear Simulator Holder with the External Ear Canal see Fig. 13.

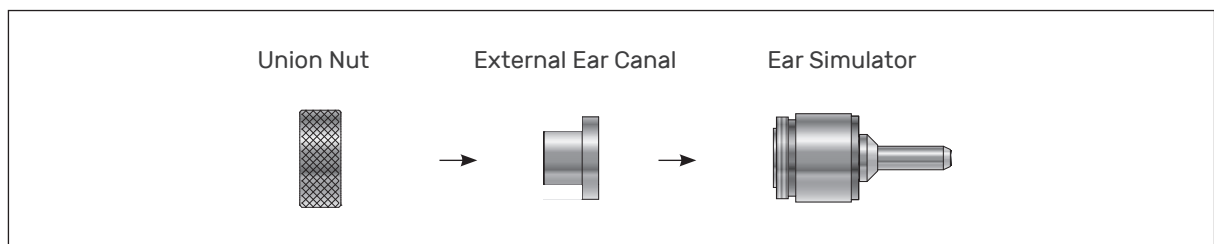


Fig. 13. Mounting the GR0408 External Ear Canal on the ear simulator.

3. Push fit the $\frac{1}{2}$ " coupler onto the 1" coupler of the 42AG. The $\frac{1}{2}$ " is a spare part delivered with the 42AG.
4. Set the 42AG to 250Hz, 94 dB.
5. With the ear simulator still mounted in the test jig, mount the 42AG onto the ear simulator so the ear simulator fits into the $\frac{1}{2}$ " coupler.
Do NOT remove the Ear Simulator from the test jig. Doing this will compromise its low-noise performance.
6. Adjust the analyzer to indicate 94 dB re. 20 μ Pa. Adjust this value by a further **-0.09 dB** to account for the additional ear simulator volume.

Refer to your 42AG manual for further information.

Correction Factors

The correction factors for the various calibration options are listed below. The correction factors are needed because the different calibration options introduce varying effective volumes.

The correction factors have nothing to do with the different pinnae used.

43AG-1 to -4 and 43AG-6 to -9 with Standard Ear Simulator (RA0045-series and RA040X-series)		
<i>In-situ calibration, without dismantling</i>		
	Accessories	Correction factor
42AP and 42AA	RA0157	-0.62 dB
<i>The cheek plate removed</i>		
42AP and 42AA	GR0408	-1.03 dB
42AG @250 Hz, 114 dB	GR0408	-0.09 dB
42AG @250 Hz, 94 dB	GR0408	-0.09 dB
42AG @1KHz, 114 dB	GR0408	-0.2 dB*
42AG @1KHz, 114 dB	GR0408	-0.2 dB*
43AG-5 with Low-noise Ear Simulator		
42AP and 42AA	GR0408	-0.7 dB
42AG @250 Hz, 94 dB	GR0408	-0.09 dB
42AG @1KHz, 94 dB	GR0408	-0.2 dB*

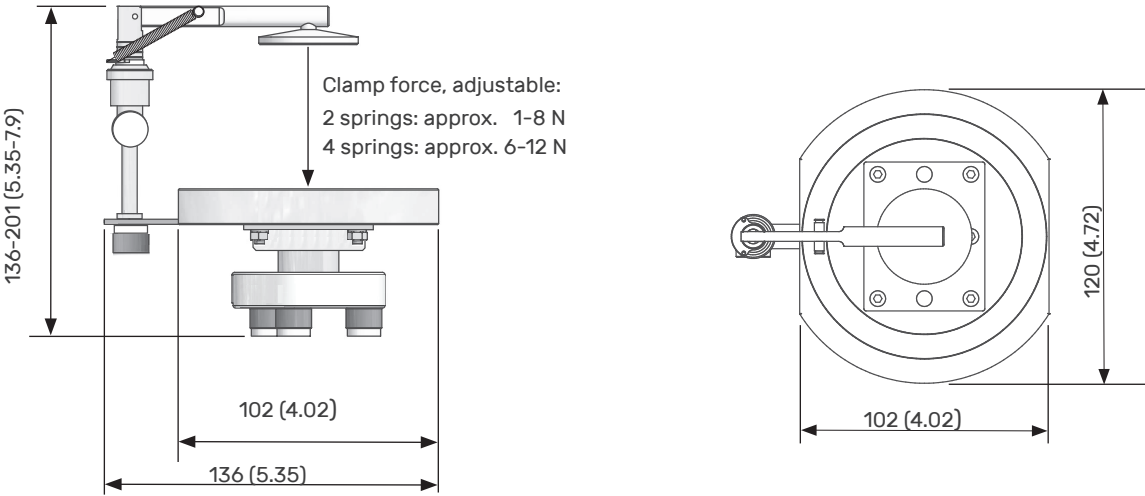

* See the following section **Calibration at 1 kHz**.

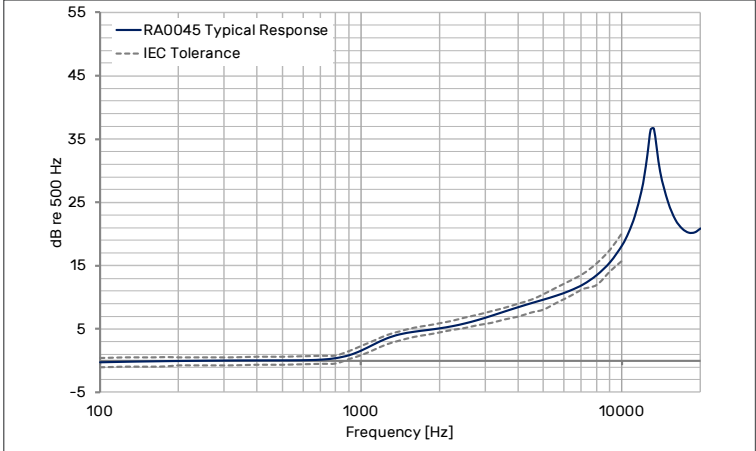
Calibration at 1 kHz

At 1 kHz, the frequency response changes from unit to unit. The actual value for the specific ear simulator is stated on the calibration chart and must be added to the correction. For example:

If the response of the specific ear simulator at 1 kHz is + 1.45 dB (re 500 Hz), the final correction value will be $-0.2 + 1.45 = 1.25$ dB. GRAS recommends calibrating at 250 Hz whenever possible.

Technical Specifications

43AG Ear and Cheek Simulator	
Weight	1.95 kg
43AG Dimensions	
<div>  <p>Technical drawing of the 43AG Ear and Cheek Simulator. The side view (left) shows a vertical dimension of 136-201 (5.35-7.9) and a horizontal dimension of 102 (4.02). The top view (right) shows a circular base with a diameter of 120 (4.72) and a horizontal dimension of 102 (4.02). A note indicates: "Clamp force, adjustable: 2 springs: approx. 1-8 N, 4 springs: approx. 6-12 N".</p> </div>	
Pinna Base and Ear Canal Extension Dimensions	
<div>  <p>Technical drawing of the Pinna Base and Ear Canal Extension. The side view (left) shows a vertical dimension of 60.0 (2.362) and a horizontal dimension of 50.0 (1.97). The cross-section view (right) shows a diameter of 7.50 (0.295) and a vertical dimension of 7.90 (0.311). The cross-section is labeled A-A.</p> </div>	

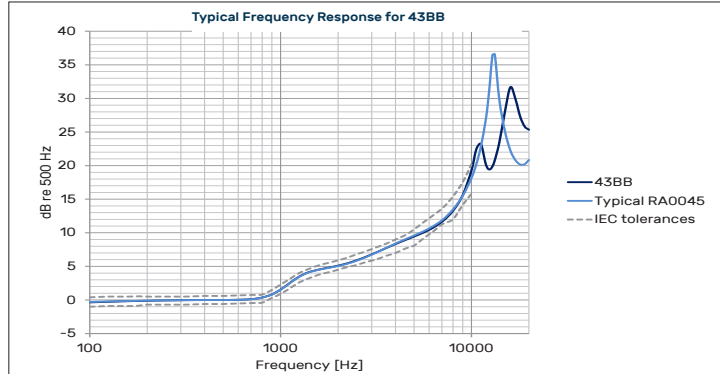
RA0045 Ear Simulator (43AG-1 to 43AG-4)	
Standards	
IEC 60318-4	Occluded-ear simulators for the measurement of earphones coupled to the ear by ear inserts
ITU-T Recommendation P.57	Series P: Telephone transmission quality, Objective measuring apparatus: Artificial ears
ANSI S3.25/ASA-2009	American National Standard For an Occluded Ear Simulator
Frequency Response	
Typical transfer impedance re 500 Hz	
Resonance frequency	13.5 kHz \pm 1 kHz (at reference point)
Sensitivity	
Sensitivity	12.5 mV/Pa
Dynamic Range	
RA0045 (LEMO)	25 dBA to 164 dB
RA0045-S1 (CCP)	25 dBA to 153 dB
Effective Volume	
at 500 Hz	1260 mm ³
Dimensions	
Height	23.0 mm
Diameter	23.75 mm

43BB Low-noise Ear Simulator System (43AG-5)

Frequency Response

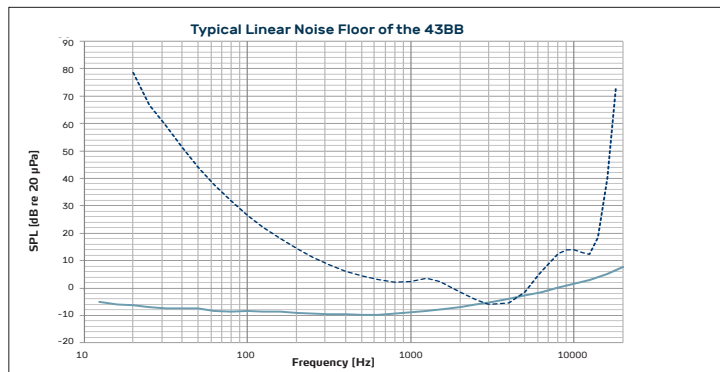
Typical frequency response
re 500 Hz

Typical frequency response (dark blue) versus the IEC tolerances (dashed grey) and the ideal IEC 60318-4 frequency response (light blue)



Noise floor

The noise floor (solid curve) is typically below the threshold of human hearing (dashed curve)



Sensitivity

Sensitivity 800 mV/pa

Dynamic Range

RA0234 10.5 dBA to 113 dB

Effective Volume

at 500 Hz 1260 mm³

Dimensions

Height 23.0 mm

Diameter 23.75 mm

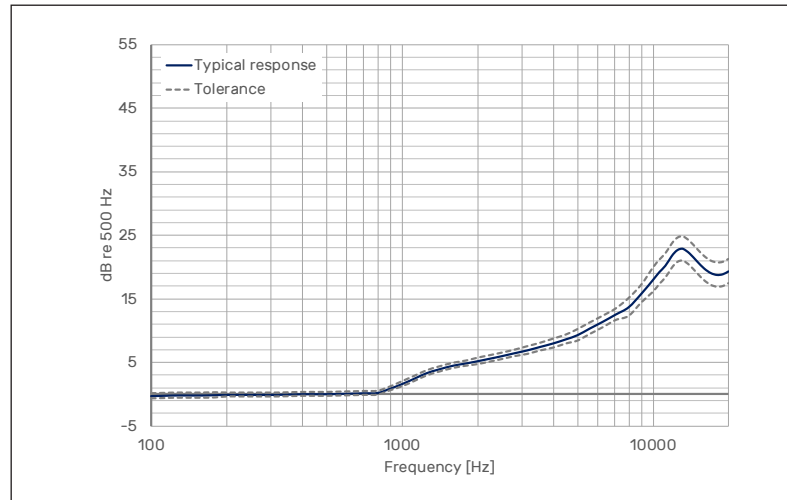
RA0401/0402 High-Frequency Ear Simulator (43AG-6 and 43AG-7)

Standards

IEC 60318-4	Occluded-ear simulators for the measurement of earphones coupled to the ear by ear inserts
ITU-T Recommendation P.57	Series P: Telephone transmission quality, Objective measuring apparatus: Artificial ears
ANSI S3.25/ASA-2009	American National Standard For an Occluded Ear Simulator

Frequency Response

Typical transfer impedance
re 500 Hz



Resonance frequency 13.5 kHz \pm 1 kHz (at reference point)

Sensitivity

Sensitivity 12.5 mV/Pa

Dynamic Range

RA0401 (LEMO) 25 dBA to 164 dB

RA0402 (CCP) 25 dBA to 153 dB

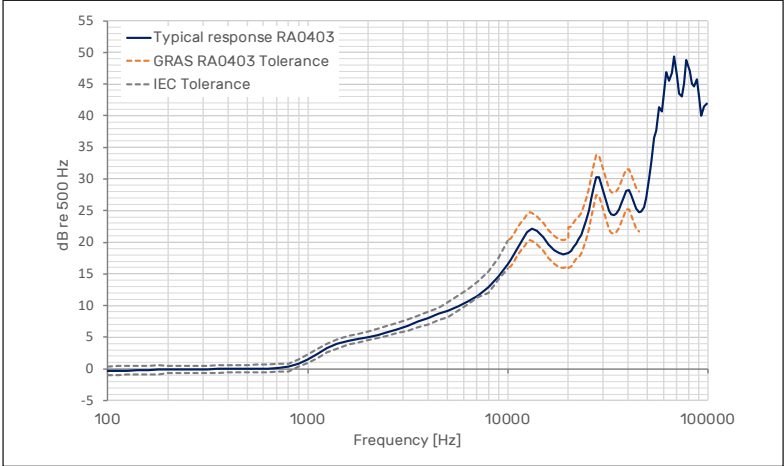
Effective Volume

at 500 Hz 1260 mm³

Dimensions

Height 23.0 mm

Diameter 23.75 mm

RA0403/0404 Hi-Res Ear Simulator (43AG-8 and 43AG-9)	
Standards	
IEC 60318-4	Occluded-ear simulators for the measurement of earphones coupled to the ear by ear inserts
ITU-T Recommendation P.57	Series P: Telephone transmission quality, Objective measuring apparatus: Artificial ears
ANSI S3.25/ASA-2009	American National Standard For an Occluded Ear Simulator
Frequency Response	
Typical transfer impedance re 500 Hz	
Resonance frequency	13.5 kHz \pm 1 kHz (at reference point)
Sensitivity	
Sensitivity	1.6 mV/Pa
Dynamic Range	
RA0403 (LEMO)	44 dBA to 169 dB
RA0404 (CCP)	46 dBA to 166 dB
Effective Volume	
at 500 Hz	1260 mm ³
Dimensions	
Height	23.0 mm
Diameter	23.75 mm

Accessories

Pinnae	
<i>Hardness 55 Shore OO (hard)</i>	
Small Right Pinna	KB0060
Large Right Pinna (included with 43AG-1 and -2)	KB0065
Large Right Pinna (VA style)	KB0090
<i>Hardness 35 Shore OO (soft)</i>	
Small Right Pinna	KB1060
Large Right Pinna	KB1065
Large Right Pinna (VA style)	KB1090
Large Right Anthropometric Pinna (included with 43AG-3-7)	KB5000
Power Modules	
2-Channel Universal Power Module with signal conditioning and PC interface	12AQ
1-Channel Power Module with gain, filters and SysCheck generator	12AK
1-Channel Universal Power Module with signal conditioning and power amplifier	12AU
Calibration Equipment	
Intelligent Pistonphone Class 0	42AP
Pistonphone Class 1	42AA
½" Calibration Adapter for KEMAR pinnae	RA0157
94 dB Pistonphone Coupler	RA0090
Force Gauge	RA0184
LEMO Cables	
3 m LEMO 7-pin - LEMO 7-pin Cable	AA0008
10 m LEMO 7-pin - LEMO 7-pin Cable	AA0009
Customized length LEMO 7-pin - LEMO 7-pin Cable (Specify length in cm)	AA0020-CL
CCP Cables	
3 m Microdot - BNC Cable	AA0070

Cables for 43BB Low-noise Ear-simulator System	
3 m LEMO 7-pin - LEMO 7-pin Cable for Low-noise measuring systems	AA0046
10 m LEMO 7-pin - LEMO 7-pin Cable for Low-noise measuring systems	AA0047
Customized length LEMO 7-pin - LEMO 7-pin Cable for Low-noise measuring systems. CLXXXX= Cable length in centimeters to be specified by customer	AA0053-CL

Warranty, Service and Repair

Calibration

Before leaving the factory, all GRAS products are calibrated in a controlled laboratory environment using traceable calibration equipment.

We recommend a yearly recalibration at minimum, depending on the use, measurement environment, and internal quality control programs.

We recommend calibration prior to each use to ensure the accuracy of your measurements.

Warranty

Damaged diaphragms in microphones can be replaced. The microphone diaphragm, body, and improved protection grid are made of high-grade stainless steel, which makes the microphone resistant to physical damage, as well as corrosion caused by aggressive air or gasses. This, combined with the reinforced gold-plated microphone terminal which guarantees a highly reliable connection, enables GRAS to offer 5 years warranty against defective materials and workmanship.

The warranty does not cover products that are damaged due to negligent use, an incorrect power supply, or an incorrect connection to the equipment.

Service and Repairs

All repairs are made at GRAS International Support Center located in Denmark. Our Support Center is equipped with the newest test equipment and staffed with dedicated and highly skilled engineers. Upon request, we make cost estimates based on fixed repair categories. If a product covered by warranty is sent for service, it is repaired free of charge, unless the damage is the result of negligent use or other violations of the warranty. All repairs are delivered with a service report, as well as an updated calibration chart.

Manufactured to conform with:

CE marking directive:
93/68/EEC



WEEE directive:
2002/96/EC



RoHS directive:
2002/95/EC



GRAS Sound & Vibration continually strives to improve the quality of our products for our customers; therefore, the specifications and accessories are subject to change.