



# **AEC304**

## ***Occluded Ear Simulator***

### **Reference Manual**



**LARSON DAVIS**  
A PCB DIVISION

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# Table of Contents

**Introduction .....1**

**Calibration.....2**

    Equipment Required ..... 2

    Procedure..... 2

**Using the AEC304 .....3**

    Equipment Required ..... 4

    Procedure..... 4

**Appendix A - Technical Specifications .....6**

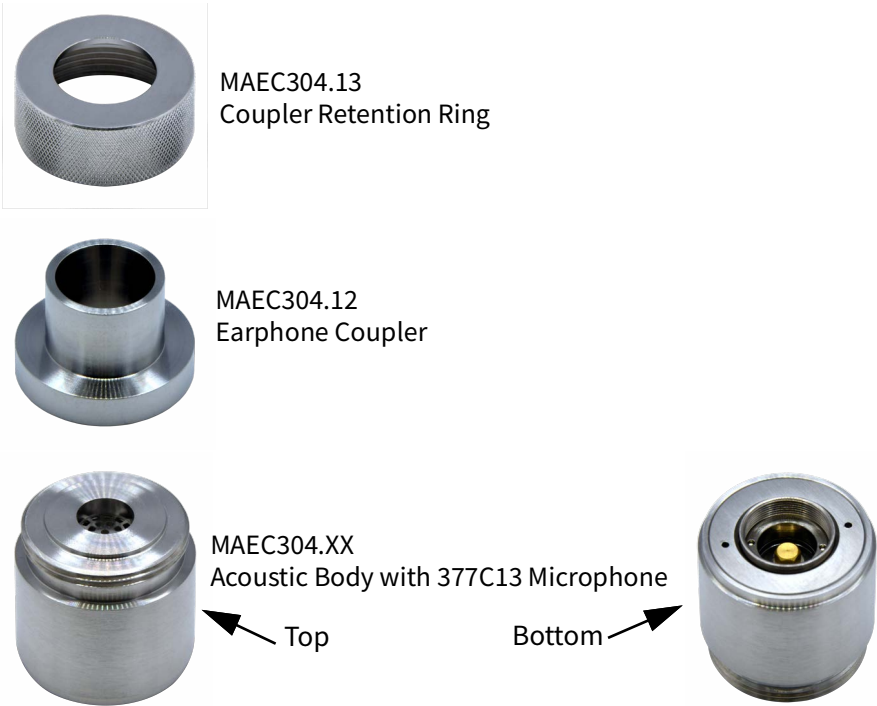
## Introduction

The AEC304 is designed to simulate the acoustic characteristics of the human ear, which makes it ideal for testing insert-type earphones such as hearing aids and in-ear headphones, as well as earplugs, or for testing how a certain audio signal may be perceived by the ear.

The AEC304 is made up of three primary components, shown in **FIGURE 1** below. The retention ring secures the earphone coupler to the base. The earphone coupler is the interface for the device under test. The PCB 377C13 pre-polarized pressure microphone is built into the base. The calibration certificate included with the unit reflects the characteristics of the microphone-coupler combination. The typical frequency response is given in **FIGURE 5**.

**CAUTION** Do not remove the microphone from the housing. Doing so may damage the microphone and will invalidate the calibration certificate included with the unit.

**FIGURE 1 AEC304 Assembly**



# Calibration

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To verify the sensitivity and performance of the internal pressure microphone within the AEC304 Artificial Ear Coupler, calibrate using the CAL1250 or CAL250 acoustic calibrator.

## Equipment Required

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- AEC304 Artificial Ear Coupler
- Acoustic Calibrator (CAL1250 or CAL250)
- Compatible preamplifier (e.g. PRM831, PRM821, 426E01)
- Measurement system (e.g sound level meter)

## Procedure

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Ensure that all equipment to be used is undamaged, clean, and free of debris, particularly in the connection points between components. Verify that the calibrator is within its valid certification period.

### 1. Connect the Preamplifier

- Screw in a compatible preamplifier to the base of the AEC304.

**FIGURE 2 Connecting a Preamplifier**



- Connect the preamplifier to measurement system.

### 2. Attach and Activate the Calibrator

- Fit the calibrator securely over the earphone coupler. The earphone coupler matches the sizing of a 1/2" microphone; you may need to install the corresponding adapter (ADP118 for the CAL1250, ADP019 for the CAL250).

**FIGURE 3 CAL1250 Mounted Onto AEC304**



- Turn on the calibrator to generate the reference signal. Calibrate using a 251.2 (250) Hz tone (see **FIGURE 5**) at 114 dB SPL.

### 3. Add and Apply Corrections

- The internal volume of the coupler may affect the effective sound pressure level delivered to the microphone. To account for this effect, enter the *corrected expected level* into the measurement system. The following table provides typical corrected expected levels to enter during calibration based on the calibrator used.

**Table 1 Typical Corrections By Calibrator**

Calibrator	Calibrator Nominal Level (dB)	Typical Correction (dB)	Corrected Expected Level (dB)
CAL1250 (@251.2 Hz)	114.00	+0.25	114.25
CAL250	114.00	-0.10	113.90

- **Example:** When using the CAL1250 with the AEC304, enter 114.25 dB as the expected calibration level in the sound level meter, **not** 114.00 dB.

### 4. Verify the Measurement

- Compare the measured sound pressure level from your analyzer or data acquisition system to the corrected expected level based on the volume and frequency response corrections.
- If the measured level does not match the corrected reference (typically within  $\pm 0.3$  dB), and the setup is confirmed to be properly sealed and connected:
  - Adjust the sensitivity or calibration factor in your measurement system to align the measurement with the corrected sound pressure level value. **Example:** If the expected corrected level is 113.75 dB but the system measures 114.5 dB, reduce the system sensitivity accordingly.
  - Reconfirm the measurement after adjustment to ensure stability and accuracy.

### 5. Document Calibration

- Record the SPL reading, date, ambient temperature and humidity, and equipment used.

## Using the AEC304

The AEC304 can be used to measure the acoustic performance of insert-type earphones such as hearing aids and in-ear headphones.

# Equipment Required

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- AEC304 Artificial Ear Coupler
- Compatible preamplifier (e.g. PRM831, PRM821, 426E01)
- Audio signal source
- Device under test (e.g. earphones, hearing aids)
- Measurement system (e.g. sound level meter)

## Procedure

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Ensure that all equipment to be used is undamaged, clean, and free of debris, particularly in the connection points between components.

### 1. Connect the Preamplifier

- Screw in a compatible preamplifier (such as PRM831, PRM821, or 426E01) to the base of the AEC304 (See **FIGURE 2**).
- Connect the other end of the preamplifier to the measurement system.

### 2. Insert the Device into the AEC304

- Carefully insert the earphone tip into the earphone coupler.
- Ensure a firm, leak-free fit. Foam and silicone eartips often seal well, but if needed, a small amount of tack may be used. Avoid allowing tack to seep into the microphone's debris shield. Follow any depth or sealing instructions provided by the relevant test standard (e.g. IEC 60318-4).
- Avoid compressing foam tips too early or forcing the earphone too far.

**FIGURE 4 Inserting the Earphone**



### 3. Play the Test Signal

- Generate the desired test signal from the audio source.
- Maintain consistent signal levels and duration per the test protocol.

### 4. Measure the Output

- Use the connected measurement system to record acoustic data such as sound pressure level, frequency response, or harmonic distortion.

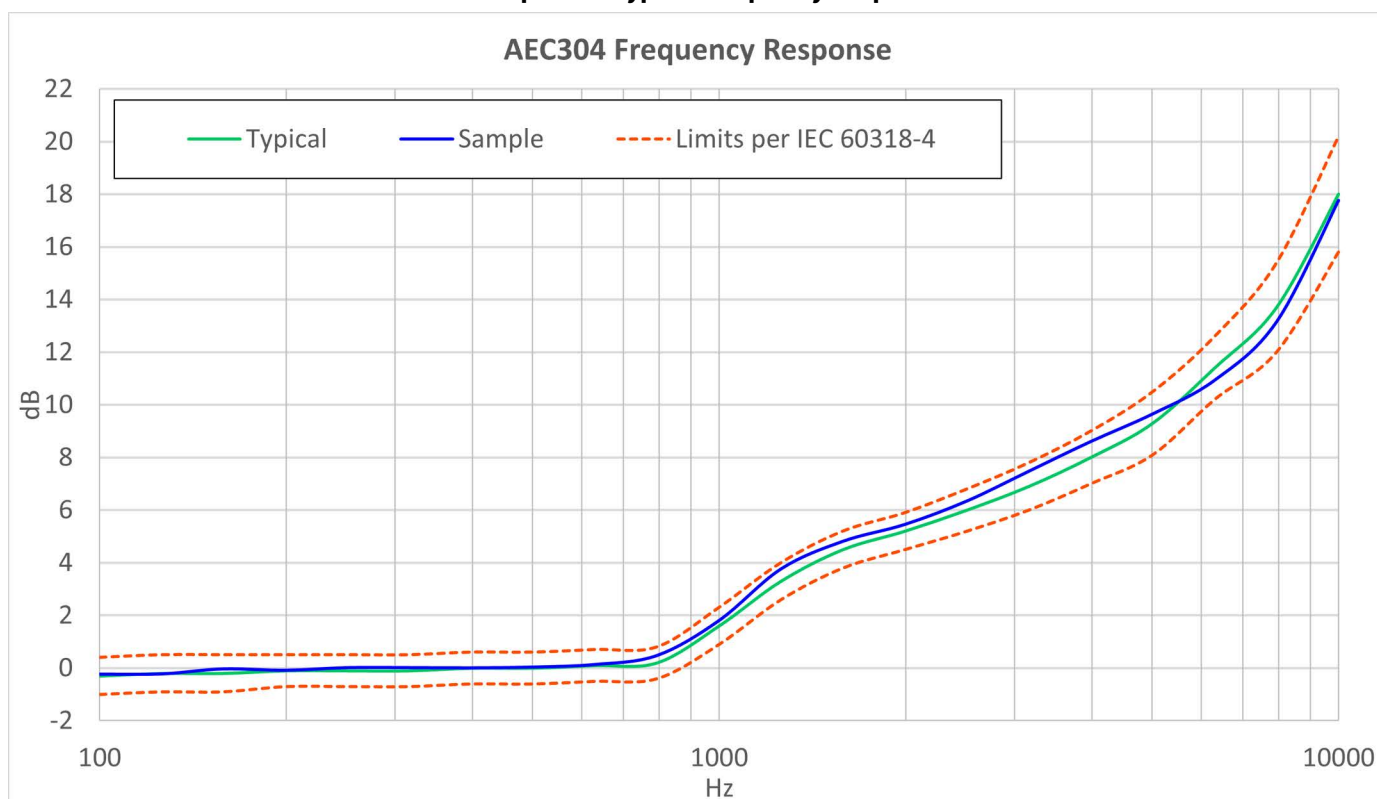
## 5. Check for Repeatability

- Remove and reinsert the earphone to verify consistency.
  - Significant variations may indicate sealing issues or improper insertion technique.

**NOTE** This procedure is intended for use with insert earphones only. The AEC304 is an occluded ear simulator and does not replicate the acoustic conditions of open or supra-aural headphones. For those applications, a different coupler type should be used, such as the Larson Davis AEC201.

# Appendix A - Technical Specifications

**FIGURE 5 Example and Typical Frequency Response of AEC304**



**Table 2 AEC304 Technical Specifications**

Parameter	Specification
Description	IEC 60318-4:2010 / IEC 60711-compliant occluded ear simulator
Standards Compliance	IEC 60318-4:2010 (formerly IEC 60711:1981)
Applications	ITC, ITE, and RIC earphones and hearing aids
Microphone	½-inch pre-polarized pressure microphone - 377C13 (factory installed and calibrated)
Preamplifier Compatibility	PRM831, PRM821, 426E01, and other compatible preamplifiers
Weight	3.3 oz (94.8 g)
Dimensions	Height: 1.5 in (3.81 cm); Diameter: 0.94 in (2.37 cm)
Calibrator Compatibility	Can be calibrated using standard sound calibrators (e.g. CAL1250); top cone and mesh removable for access
Calibrator Corrections	See <b>Table 1 "Typical Corrections By Calibrator"</b> .





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