Measuring In-Ear Monitors With a 711 Coupler and REW

Welcome. Maybe a tip change gave you more bass, or an adjustment in your music player helped and you want to know why. We wrote this handbook to help you make those comparisons at home and listen with a better idea of what changed.

A 711 coupler is an ear simulator. It imitates how a sealed adult ear canal responds to sound. An in-ear monitor (IEM) sits in its opening while Room EQ Wizard (REW) plays a test sound from bass to treble, called a sweep. The coupler microphone records the sound. The resulting frequency response shows the level at each frequency.

Start with a repeatable baseline, an uncorrected measurement you can compare with later runs. This lets you compare left and right, test an ear tip, or verify what equalization (EQ) did. Hold the rest of the setup steady when you change one thing.

IEC 60318-4 specifies ear simulation from 100 Hz to 10 kHz for a conforming unit. Your ear shape and seal affect the level at your eardrum. Hirahara and colleagues found treble differences between a 711 and real ears, and less bass in real ears when the fit leaked. Use the graph to guide your tests and listen to decide what you prefer. Page 3 explains the measurement limits.

IEC 60318-4 standard · Hirahara et al. (2010), 711 and real-ear measurements

We show the Capra Audio holder and a makeshift setup with a padded case under the earphone and a pillow under the coupler to absorb vibrations.

If a measurement looks odd, think like an IT technician. Check the simplest things first, follow where the test sound goes, and try one change at a time. Each result helps you decide what to check next.

Bench photographs and REW screenshots by Yin Yang EQ Lab.

Find your starting point

Taking your first measurement. Find the five bench steps in the contents. Page 2

A sweep looks wrong. Use the troubleshooting method and worked example. Page 15

At the bench. Open the fillable or printable checklist. Page 28

Looking for a specific answer. Jump to the question index. Page 31

Bench workflow

1. Connect the earphone and coupler microphone.

2. Mount one earpiece with a gentle seal. Keep its tiny air holes clear.

3. Choose the playback and recording devices in REW. Start low and check levels.

4. Measure both sides. Remove and refit each earpiece to see whether the readings repeat.

5. Save the REW session and a separate measurement file for each side.

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Know what the coupler measures

A **coupler** gives you a consistent place to fit an earphone and measure its response. The ear tip seals against the coupler opening. The coupler microphone records the sound inside.
A 711-style coupler is also called an occluded-ear simulator. It approximates the conditions an earphone sees when its tip seals off the ear canal.

In this guide the **fixture** is the coupler plus the holder that steadies the earphone. The **rig** is the complete measurement setup: the fixture, its microphone, the cables and audio adapter, the computer and the software.

The name "711" comes from IEC 60711, an older International Electrotechnical Commission (IEC) standard. IEC 60318-4 replaced it, and the current edition is listed on the IEC Webstore. Figure 01 shows the unit used on this bench. Its engraving (callout 1) reads "IEC60318-4 Occluded-ear simulator Type E610A."

01 Coupler engraving



The engraving identifies the simulator style. Compare reference measurements to check the setup.

1 IEC 60318-4 marking on the metal coupler body.

An engraving names the design the maker is claiming. It does not show that this particular unit meets the standard's tolerances, and a familiar-looking graph does not show that either. Compliance requires a separate tolerance test of the specific unit.

Frequency is measured in hertz (Hz), or cycles per second, and one kilohertz (kHz) is 1,000 Hz. IEC 60318-4 specifies the ear-simulation range of a conforming unit as 100 Hz to 10 kHz. With appropriate caveats, a conforming simulator can also serve as an acoustic coupler at additional frequencies down to 20 Hz and up to 16 kHz. The 20 Hz to 20 kHz range set in REW is only the span you ask it to sweep. It is not a promise of accuracy across the whole graph, so read the edges with the fixture's limits in mind. Treat roughly **8-10 kHz** as especially sensitive to insertion depth. Above 10 kHz, use this bench's traces as qualitative comparisons, since peaks and dips can shift substantially with fit or fixture.

A coupler graph also cannot predict exactly what reaches your eardrum, because ear shape, fit and leakage differ from person to person. Use the coupler for controlled comparisons: left against right, one tip against another, or before against after EQ.

Three kinds of curve or file appear throughout this guide, and they are easy to confuse:

1. A response is the level the earphone produced at each frequency before EQ.

2. A target is a sound balance you want the earphone to approach.

3. An EQ preset is a saved set of filter settings that changes playback.

A response file and an EQ preset can both end in .txt. Only the response contains measured data.

1. Connect the IEM and coupler

Gear we use and recommend

This is the setup behind the examples. Use equivalent gear if it passes the same checks. An audio interface with a compatible headphone output and microphone input can replace the dongle and splitter.

711-style coupler and microphone. We used the pictured Type E610A (Figure 01, page 3).
After alignment at 1 kHz, our AKG sweeps broadly agreed with the PEQdB Studio reference in the bass and midrange (Plot A, page 22). Check your own unit with a known reference earphone.

Apple USB-C to 3.5 mm Headphone Jack Adapter. Our starting choice for this setup. Its DAC, or digital-to-analog converter, turns the computer's test signal into audio that drives the IEM. With the compatible splitter below, the adapter also records the coupler microphone on our bench. Verify both paths on yours.

Compatible 3.5 mm headset splitter. Use a four-contact headset plug, also called TRRS, with separate headphone and microphone sockets. This makes each path easy to trace. Check which contact carries the mic signal and whether the input supplies the small voltage the mic needs, called bias.

Qudelix-5K (optional). For separate playback, plug the IEM into the 5K's 3.5 mm headphone jack. Keep the coupler mic plugged into the MIC jack on the Apple adapter's headset splitter. In REW, use the 5K over USB for playback and the Apple adapter for input. Another verified mic input works too. Turn off the 5K's EQ and effects for baseline sweeps.

Capra Audio IEC 711 IEM Holder or padded support. The holder steadies the earpiece while it seals. Our makeshift setup uses a padded case to support the earpiece and a pillow under the coupler to absorb vibrations. Either way, check that the response repeats after reinserting.

Computer with REW, a wired IEM and tips that seal. REW plays and records the test. The AKG EO-IG955 and Simgot EM6L are the guide's examples. Start with a familiar earpiece and the same tip model and size for left and right.

Microphone power. If the coupler mic needs low-voltage plug-in power, use a mic input that supplies the required voltage. To use a 48 V phantom-powered input, connect through a converter designed to supply the plug-in power the mic needs. RØDE on microphone power

Check a substitute on your bench

Check the whole playback path under the load of the IEM you're measuring. Use a clean, repeatable output with room below clipping and low output impedance so it is less likely to alter the IEM's response. Verify routing, bypass effects and keep playback and capture at a supported, consistent sample rate. If the curves differ between outputs, swap one verified device at a time with the fit and recording path fixed.

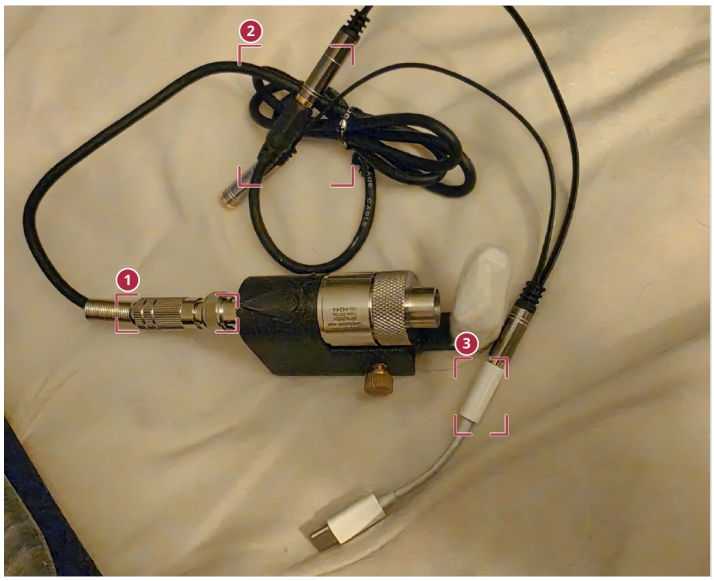
First confirm your sweeps repeat after reinserting. Compare the same earpiece on a known-good 711 setup if you can. Otherwise use a published raw measurement of the same model and version, with a similar tip, seal and depth. Look for broad agreement through the bass and midrange. This checks that the setup is useful for comparisons. Calibration for absolute sound level and testing for IEC conformity are separate checks.

See page 22 for the reference overlay and page 15 for the swap method.

Connect and check both signal paths

Playback. REW > headphone output > earpiece
Recording. Coupler microphone > mic input > REW

Figure 03 · Coupler microphone and headphone connections



1. Coupler microphone connector. 2. Splitter branches. 3. Headset-side connector at the USB-C adapter. Check the labels or wiring before connecting.

1. Plug the IEM into the headphone output and the coupler microphone into the mic input. Seat each plug fully.

2. Confirm the splitter's pinout, meaning which contact carries each signal. Check the coupler's microphone bias requirement against what the input supplies.

3. Find the actual playback and recording devices in your operating system, then select those devices and channels in REW.

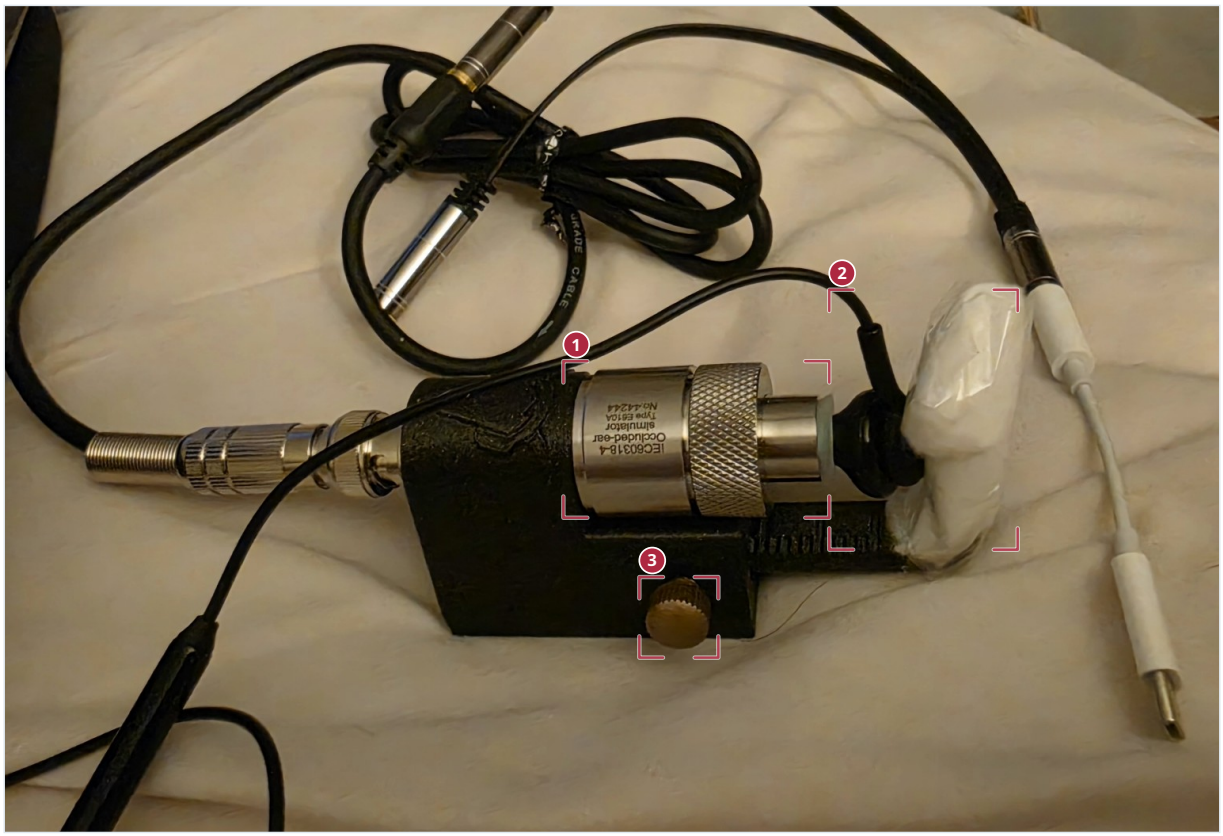
4. Switch the playback channel for the other earpiece. Keep the recording channel where the microphone signal actually arrives.

2. Mount the earpiece

Fit the IEM in the coupler and keep it out of your ears for every level check and sweep. A setup mistake can make the test tone very loud.

Figure 02 on the next page shows the Capra Audio holder. The slider supports the earphone, the padding cushions it, and the knob holds the slider in place.

02 Capra Audio holder and padded slider



Bring the taped cotton gently against the earpiece to steady it. Keep the tip bore and the IEM vents clear.

1 Coupler body.

2 IEM shell and cotton-padded contact point.

3 Locking knob for the sliding support.

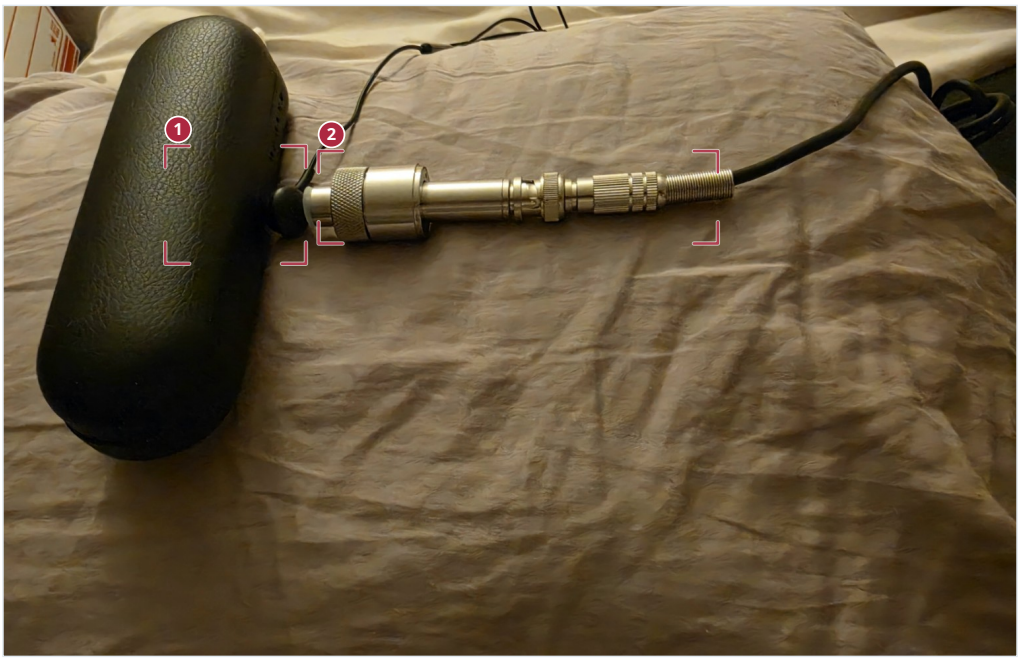
A few parts of the earphone matter here. The **ear tip** is the removable piece fitted over the **nozzle**, the short tube that carries sound out of the shell. The **bore** is the open passage through the ear tip. Some shells also have small **vents**, openings that let air move in or out.

Slide the padded support until it steadies the shell with light contact, then tighten the knob. The support should keep the earphone still without pushing it deeper. As you set it:

1. Keep the earphone's vents clear of padding, tape and the holder lip.
2. Keep the tip bore open and unbent.
3. Pad any hard contact with the shell.
4. Leave slack in the cable so it cannot tug on the shell.
5. Never force the insertion depth.

Figure 04 shows an improvised alternative without the holder. A padded case supports the IEM (callout 1), and the coupler and its connector chain lie on their side on a pillow (callout 2). The pillow was used to help absorb vibration from the surface below and to keep the coupler and earpiece steady. If you try something similar, check that the coupler cannot roll, that the cable leaves the shell undisturbed and that results repeat after you remove and reinsert the earphone.

04 Improvised padded support



The pillow helps absorb vibrations while the case supports the IEM. Check that the setup stays steady and the measurement repeats after reinserting the earphone.

1 IEM where it touches the padded case.

2 Coupler assembly resting on its side.

Seat the ear tip so it closes off the coupler opening. This **seal** matters because even a small air gap lets bass escape. Aim for a firm, airtight seal obtained without deforming the tip.

For example, this guide uses the SpinFit W1, a popular silicone replacement ear tip (see SpinFit). Like other soft tips, it can fold or crease if you force it into the coupler. That can open a gap or narrow the bore without any obvious sign from outside. Use the same tip model and size for fits you plan to compare, and record every change.

Insertion depth matters too. A **resonance** is a rise in the response where the earphone and the air space in front of it reinforce certain frequencies. On this bench a narrow treble peak moved when depth changed (see Plot B later). The peak's frequency can help you check fit consistency. Repeat the insertion at the same depth before using a narrow upper-treble feature for EQ.

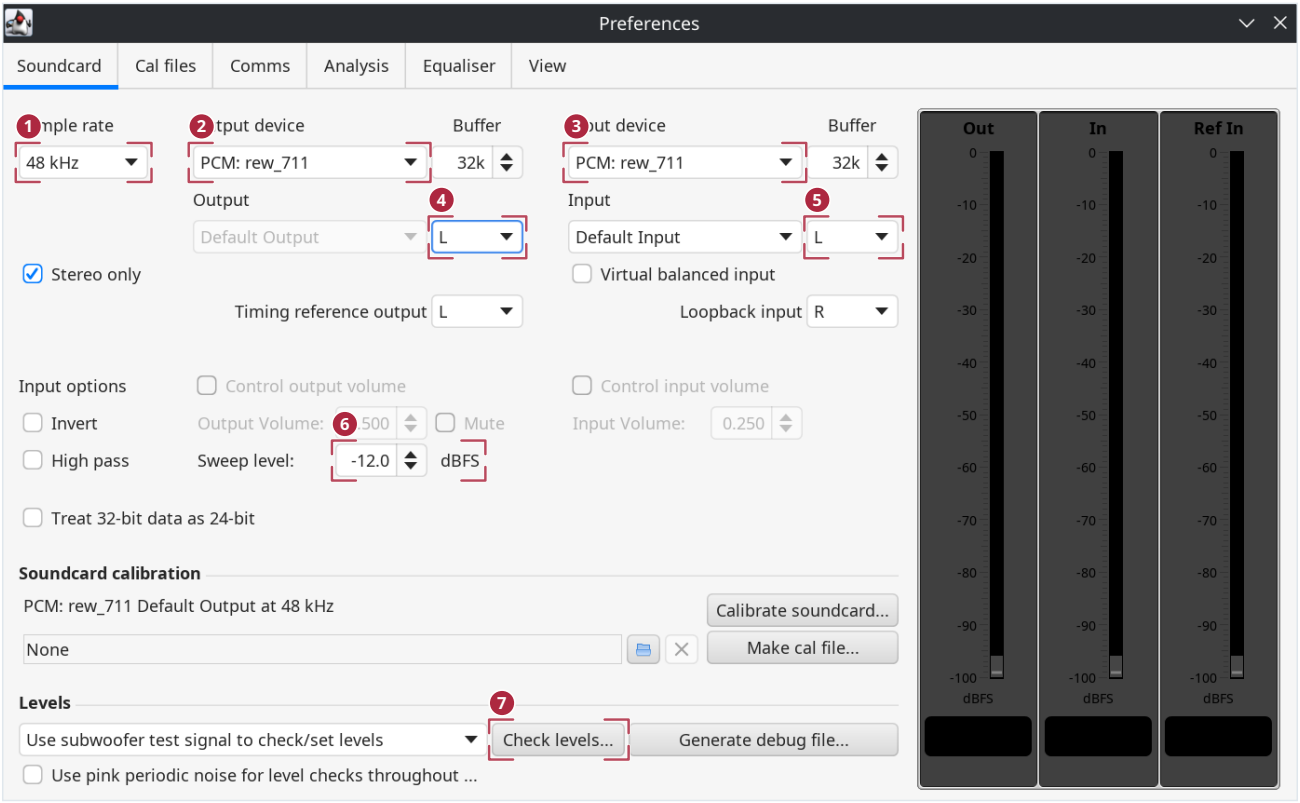
3. Set up REW and take a first sweep

Open **Preferences** and select the **Soundcard** tab (Figure 05). This capture comes from REW 5.31.3 running on Arch Linux with the KDE Plasma desktop. Your device names will differ.

Windows with the Apple USB-C dongle (page 32)

Use WASAPI exclusive mode for the dongle's playback output and coupler mic input.

05 REW Soundcard Preferences



The example uses a locally named PCM endpoint. Locate the controls on your system and select the actual playback and coupler capture paths.

1 Sample rate set to 48 kHz.
2 Output device.
3 Input device.
4 Playback channel selector.
5 Capture channel selector.
6 Sweep level shown in dBFS.
7 Use Measure for the IEM level check.

Work through the callouts in order:

1. **Sample rate.** Choose **44.1 or 48 kHz** (44,100 or 48,000 digital samples per second). Use a rate supported by both devices. Match playback and capture to the rate you set in REW wherever those settings are exposed, and keep that rate fixed for the left, right and repeat sweeps. Figure 05 shows 48 kHz as an example.
2. **Output device.** Select the hardware that drives the earphone. "PCM: rew_711" is a custom name for a software audio connection created on this computer, not a standard device.
3. **Input device.** Select the connection that receives the coupler microphone. This bench uses the same named connection for both.
4. **Output channel.** Choose L for the left earpiece or R for the right.
5. **Input channel.** Choose wherever the coupler microphone arrives. It can stay on L while you switch the output to R.
6. **Sweep level.** -12.0 dBFS is REW's default level for the digital test signal.
7. **Check levels.** The Preferences example shows the subwoofer signal. For IEMs, use Measure (Figure 06).

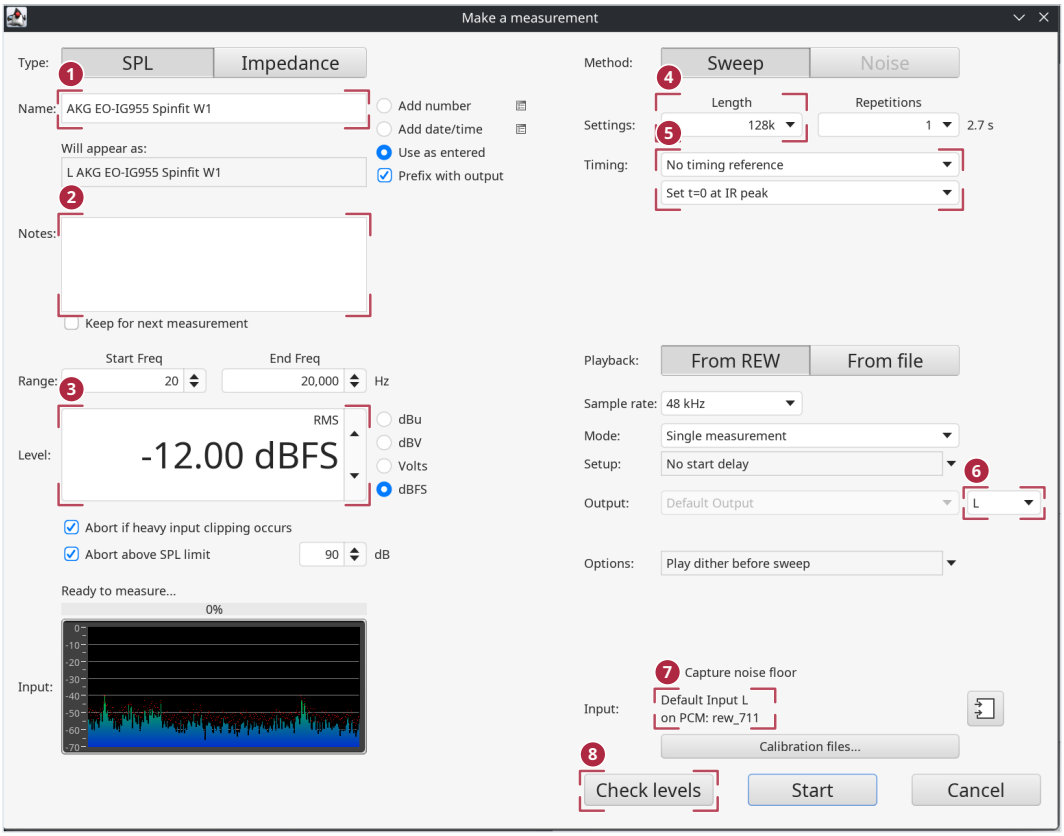
dBFS means decibels relative to digital full scale, the largest value a digital audio signal can represent. 0 dBFS is that ceiling, so negative numbers sit below it. The sweep level describes only the digital signal REW generates. It is not the playback volume, the microphone gain or the sound level in the coupler.

Confirm the actual devices rather than trusting their names. If the device list changes after a reboot or after you reconnect hardware, recheck every field.

Set up each sweep

Click **Measure** to open **Make a measurement** (Figure 06).

06 REW Make a Measurement



Start with conservative IEM playback and mic gain. The screenshot shows a personal setup with a 128k sweep and a local endpoint.

1 Name the sweep.

2 Record the tip, fit and any setup changes in Notes.

3 REW sweep level at -12.00 dBFS RMS.

4 128k sweep length for this example.

5 Timing settings for basic magnitude response.

6 Output channel selector, shown on L.

7 Selected capture source and channel. Verify this path in the OS and REW.

8 Run Check levels before pressing Start.

1. **Name** (callout 1). The example is "AKG EO-IG955 Spinfit W1." With **Prefix with output** checked, REW shows it as "L AKG EO-IG955 Spinfit W1," so each card records its channel.
2. **Notes** (callout 2). Record the tip model and size, fit, insertion depth and attempt number.
3. **Level** (callout 3). The example is -12.00 dBFS RMS. RMS (root mean square) expresses the effective, average-like strength of a changing signal.
4. **Length** (callout 4). 128k and 256k are the number of digital samples in the sweep. At 48 kHz they take about 2.7 and 5.5 seconds. At 44.1 kHz they take about 3.0 and 5.9 seconds.
5. **Timing** (callout 5). **No timing reference** is enough for level-versus-frequency measurements. **Set t=0 at IR peak** places time zero at the strongest point of the impulse response (IR), REW's estimate of how the system reacts to a very short sound.
6. **Output** (callout 6). Select the earpiece you are about to measure.

7. **Input** (callout 7). Read the actual recording device and channel, here "Default Input L on PCM: rew_711," before every sweep.
8. **Check levels** (callout 8). Run this check before you click **Start**.

A longer sweep can help the test signal stand out from background noise when playback and recording share the same clock. Separate clocks complicate that benefit.

The dialog also shows the 20 Hz to 20,000 Hz range, playback set to **From REW**, the 48 kHz sample rate, and **Abort if heavy input clipping occurs** and **Abort above SPL limit** (90 dB) both checked. Keep these safety aborts on, but remember that on an uncalibrated rig the SPL limit compares against REW's uncalibrated scale, not true acoustic level.

Set levels one control at a time

Three controls set how strong the recording is, and one acoustic result follows from them. Keep all four separate:

1. **Sweep level**, in dBFS RMS, sets the digital test signal REW generates.
2. **Playback volume** sets how strongly the headphone output drives the IEM.
3. **Microphone input gain** sets how much the recording input amplifies the coupler microphone.
4. **Sound pressure level** (SPL), shown as dB SPL, is the acoustic pressure inside the coupler that results from the sweep level and playback volume.

A **decibel** (dB) expresses a level relative to a reference, and these four use different references. A volume slider in REW or in your operating system shows a control position, not an SPL reading.

REW's SPL axis shows true acoustic level only after you calibrate it against a known sound pressure at the input gain in use, as described in REW's SPL calibration help. A frequency-response calibration file can correct a microphone's uneven sensitivity across frequencies, but it does not supply that absolute reference. The graphs in this guide are uncalibrated, so their vertical numbers are useful only for comparing sweeps taken with identical settings.

For the baseline, switch off EQ and playback or input processing such as spatial audio, volume normalization, automatic gain and microphone noise suppression. Then check the levels.

1. Mount the IEM in the coupler and set playback volume and microphone gain low.
2. Open the Measure dialog, confirm the **Output** and **Input** lines and run **Check levels**.
3. If the signal is weak, confirm the input routing and the seal before raising anything.
4. Raise playback volume in small steps with input gain fixed if the test sound is too quiet.
5. If playback is adequate and recording is still low, adjust microphone gain separately.
6. Watch headroom through the entire sweep, not just its start.

Headroom is the margin between the highest recorded peak and the input's digital full scale. REW shows it in the Measure dialog and marks values below 6 dB in red. A reading of 0.0 dB means no digital margin remains.

Headroom and the sweep's dBFS RMS field measure different things. The sweep field describes the RMS level of the signal REW sends. Headroom describes the peak of what comes back after playback volume, the earphone, the coupler and microphone gain have all acted on it. A -12 dBFS RMS sweep can still produce 0.0 dB of input headroom if the gains are too high.

Clipping happens when a signal exceeds a stage's limit and its peaks are cut off. It can occur in the digital output, the headphone amplifier, the microphone preamplifier or the input converter. Once a stage has clipped, lowering gain at a later stage cannot restore the missing peaks. Lower the level at or before the overloaded stage and measure again.

Read a usable first sweep

For this first run, leave EQ off and keep the earpiece in the coupler throughout. Set playback volume and microphone gain low before the level check.

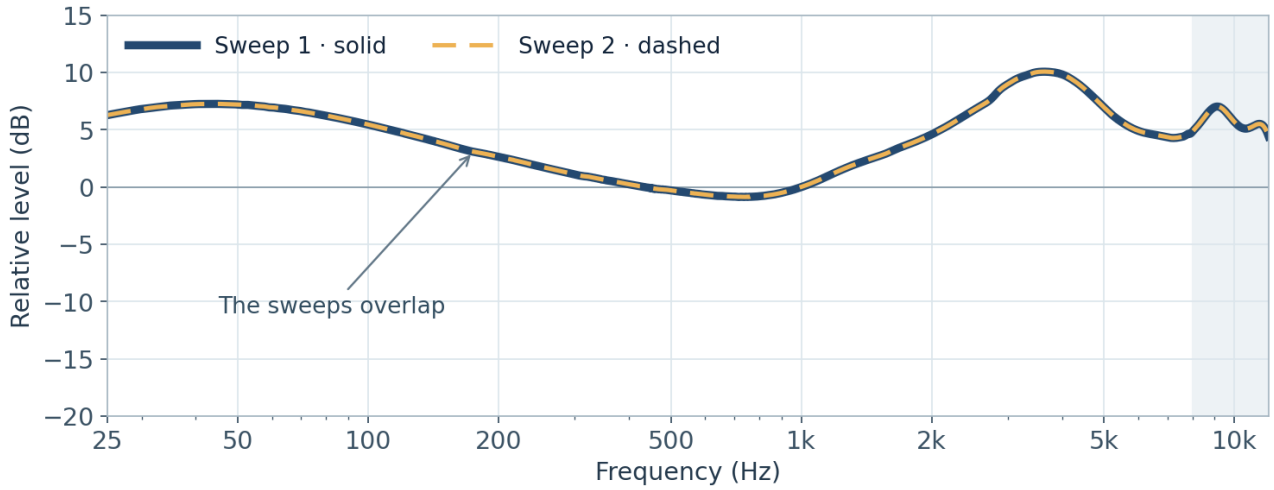
Measure dialog. SPL, Sweep, From REW, Single measurement. Use 20 Hz to 20,000 Hz, 128k, the supported sample rate you chose earlier, -12 dBFS RMS and No timing reference. Confirm Input and Output. Use Check levels in this dialog.

1. Verify that the selected channel records the coupler mic. Check the operating system input meter if you are unsure.

2. Start the sweep. Read headroom and any warnings. Repeat after correcting a red headroom reading, clipping or an interrupted sweep.

3. With the earpiece untouched and the controls unchanged, run another sweep. Save both traces. Look for similar bass and midrange with no unexplained jump in overall level.

What overlapping sweeps look like



Two saved sweeps of the left Simgot EM6L with the stock tip, Nov 3, 2026. Sweep 1 is solid and Sweep 2 is dashed. Both use Sweep 1 at 1 kHz as the zero point. The recorded sweep settings match. Whether the earpiece moved between runs is unknown. The shaded treble is especially sensitive to fit.

Decide. If the traces agree, repeat the fit and measure both sides on page 12. If there is no input, see page 17. If the sweep clips or repeats disagree, use the isolation method on page 15.

REW's headroom reading covers only the digital input, and the shape of a curve alone cannot prove that clipping did or did not occur. Rely on the headroom readout and REW's warnings, then confirm by lowering one stage and remeasuring.

No single recorded level works as a universal target. There is no general -40 dBFS rule, and an uncalibrated rig has no meaningful SPL target. Aim for a clean, repeatable recording with comfortable headroom.

Once the levels work, keep the sample rate, sweep level, playback volume and microphone gain fixed for the whole set of uncorrected left and right measurements, called the **baseline**, and log any change. Each raw response then carries two kinds of level information: its absolute height on REW's scale and its height relative to the other side. Keep both intact. You can align copies temporarily to compare shapes, but never trim one side's level in the files you keep.

4. Measure both sides and repeat the fit

Measure the left and right earpieces with the same settings and the same tip model and size. For each side, set the output channel and reread the input line before you start. Inspect the bass first, because a weak or ragged low end is a cue to check the seal, the level or the routing.

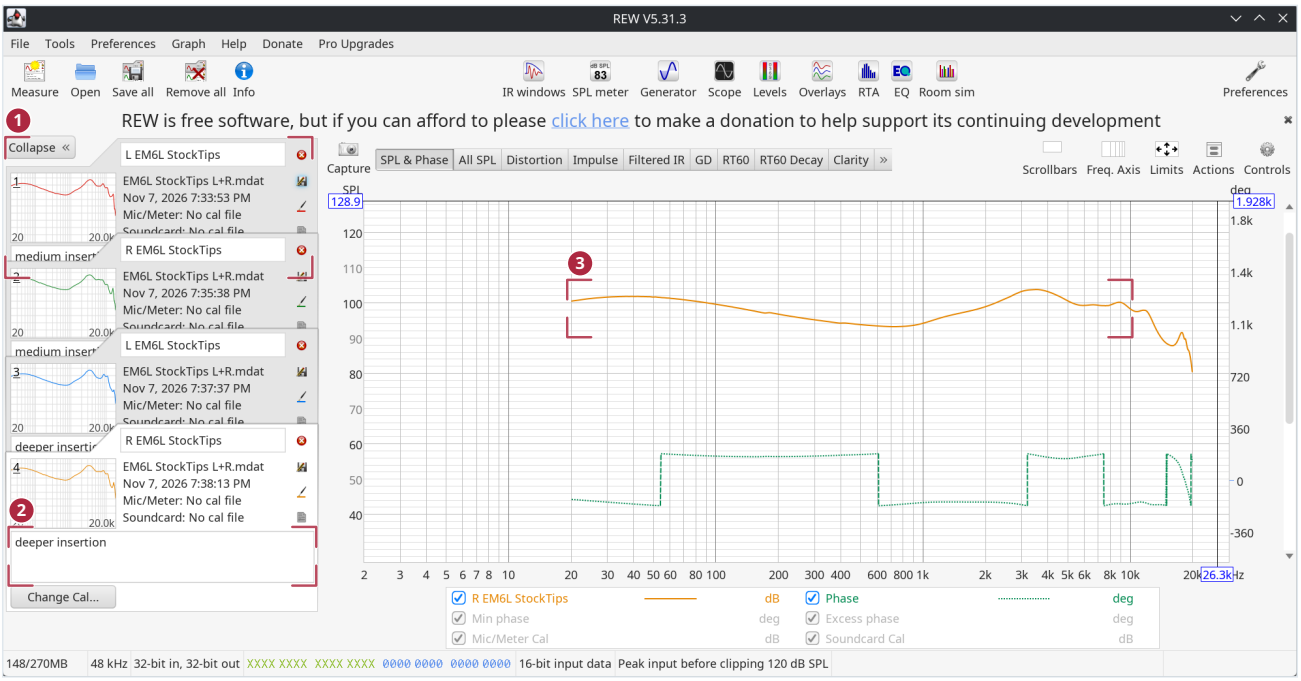
Repeatability is how closely results agree when you remove the earphone and mount it again under the same conditions. Each remove-and-reinsert is a **reseat**. As a starting point, record three to five independent reseats per side. If they agree closely, the fit is under control. If a feature moves between reseats, treat it as fit-sensitive.

Channel matching is a separate correction that reduces differences between the left and right earpieces. It depends on the baseline left and right files keeping their original levels relative to each other.

Figure 07 shows this workflow with a Simgot EM6L on its stock tips, the tips supplied with the earphone. Callout 1 marks separate cards named "L EM6L StockTips" and "R EM6L StockTips," saved together in "EM6L StockTips L+R.mdat," with notes reading "medium insertion." Callout 2 marks the notes field of a later card that reads "deeper insertion." Callout 3 marks the orange trace for the right earpiece.

In REW's plots here, the solid line is **magnitude**, the measured level in dB at each frequency. The dotted line is **phase**, which describes how far the recorded wave is shifted within its cycle at each frequency. Read the solid line for level comparisons.

07 REW measurements and fit notes



Simgot EM6L with stock tips. The left panel stores the sweep labels and fit notes. Compare valid reseats before choosing an export.

1 Measurement cards in the sidebar.

2 Fit note for the selected sweep.

3 Solid orange magnitude response. The dotted green curve shows phase.

Label each run with the side, tip model and size, fit or depth, repeat number and pair. Keep every raw run. Before you average, exclude any run in which you found a leak, a pinched tip or a covered vent, or that overloaded or was interrupted. As an alternative to averaging, choose one representative fit that repeats reliably.

REW's RMS average combines response magnitudes without phase. A vector average also combines phase, which can shift across reseats. Use the RMS average of comparable, clean sweeps or choose one representative fit. Keep the individual sweeps.

5. Save your first pair

Choose a representative, clean sweep for each side. Look for a trace near the middle of the runs that agree. Keep the raw individual sweeps and leave the left/right levels as measured.

1. Choose File > Save all measurements. This creates the .mdat session file.

2. Select the clean left sweep. Choose File > Export > Export measurement as text.

3. Repeat for the right side with the same export settings.

4. Name the files by earpiece and side, for example EM6L-Pair1-L.txt and EM6L-Pair1-R.txt.

Keep the source files together

Measurements. The .mdat session, raw runs, notes, and original left and right exports.

EQ. The target preset, optional channel-match correction, and their preamp settings.

Responses. Predicted responses and measured verification sweeps, labeled separately.

First measurement complete. You have the REW session and two unadjusted text responses. Comparison and EQ are optional. Export the originals before applying any offsets to display copies.

REW's File menu and export instructions

Isolate a measurement problem

“My computer is on, but I can’t get online” is a familiar call in IT. Start with power. The network switch serving that desk may be off or unplugged. Check that both cable ends are seated in the intended ports, inspect the cable for damage and look for link lights at both ends where available.

If several desks on the same switch fail, check the switch and its connection to the router. If one desk fails, confirm the fault with its original cable. Swap in a cable you’ve already verified, test in the same ports, then reinstall the original cable and test again. If the fault clears with the substitute and returns with the original, focus on that cable and its connections.

Each test narrows the search. Check the port separately if needed. If the network works and only one service fails, check that service’s configuration, credentials or access rules. On the bench, use the same sequence: sweep with the original part, with the verified substitute and with the original restored.

Follow the signal. Playback: REW > headphone output > earpiece. Recording: coupler mic > mic input > REW.

Keep the earpiece seated and the mic settings fixed when you test a dongle. Keep playback fixed for a mic swap. If you are tracing a left/right difference, change the earpiece or the output channel one at a time using a compatible connection.

1. Establish a repeatable reference

Save two or three sweeps without touching the setup. Compare the raw traces for level and drift. Use copies aligned near 1 kHz to compare shape separately from level. Use the spread between runs to judge whether a later change is larger than ordinary variation.

2. Isolate fit variables

Confirm the earpiece is mechanically stable in the 711 coupler, the ear simulator. With the signal chain and settings fixed, test seal, insertion depth or vent clearance in separate sweeps. A repeatable bass shift implicates that aspect. If the effect is within normal sweep variation, move to the next candidate.

3. Substitute one verified part

Swap one cable, port, input or output for a substitute verified in that role. For an output swap, hold the fit, mic input and gain fixed. Start low and run REW Check levels. Match the measured level near 1 kHz when practical and log any adjustment. Save each sweep, including the one after you restore the original.

4. Test shared playback and recording paths

If an Apple USB-C dongle and headset splitter carry both playback and capture, a swap changes both. A repeatable result points to the shared path. Test the two directions separately to narrow the search.

5. Verify computer, device and REW settings

Test one setting per sweep, such as system routing or device EQ. Check the actual REW devices and channels, keep one sample rate both devices support, and test playback volume and mic gain separately. Discard clipped sweeps.

6. Restore the original setup and verify the fix

If the symptom returns with the original and clears again with the substitute, repeat the fixed sweep. A swap can isolate a path or component while its exact failure mechanism is still unclear. Test within that path and keep the raw sweeps.

Worked example: less bass than expected

Practice scenario. The same earpiece now measures about 6 dB lower in the bass than a repeatable saved sweep. The coupler microphone records through an input separate from playback.

1. Repeat the sweep without moving the earpiece. If the bass still measures low, check the seal with the electronics held fixed. If bass returns when you close a visible gap, try to reproduce that difference and repeat the corrected fit. If the seal test makes no repeatable difference, leave the fit fixed and check playback.

2. Swap in a verified output with the capture path fixed. Start low and use Check levels. If practical, match the measured level near 1 kHz and log the adjustment. If bass recovers, the original output path is implicated. If nothing changes, the output is unlikely at this setting, and the capture path or software state becomes the next candidate.

3. Restore the original output to test whether the deficit tracks it. If bass drops again, focus on the original playback path. If bass stays normal, repeat the comparison and check whether a plug or the earpiece moved during the swap.

4. Once the change follows the playback path, check whether an existing EQ preset was active. If so, turn only that preset off and sweep again. Turn it back on to check whether the bass loss returns, then turn it off and repeat the sweep to verify the fix. If that setting makes no repeatable difference, record the path you isolated and test the next plausible change.

Bench observation. In one bench comparison, the same earpiece measured with less bass through one Qudelix unit than through an alternate playback device. The difference was associated with the playback path in that comparison. The cause remains unknown.

Use the annotated examples that follow to decide which part of your own setup to test first.

Cisco documents checking port links and testing with verified cables. NIST explains how interactions can affect one-variable tests. Cisco network troubleshooting guidance · NIST on one-variable tests

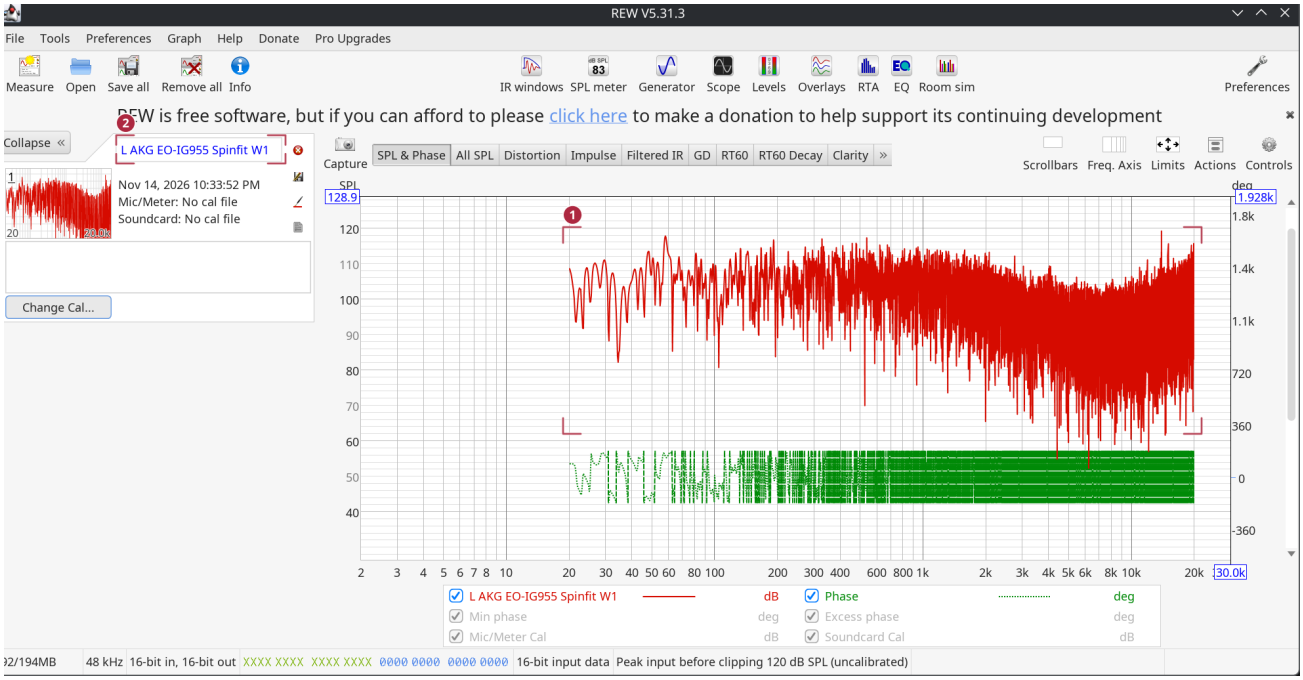
Revision 01 / 2026-11-17
Added one-variable troubleshooting, guidance for matching insertion, a full bench checklist, and EQ verification checks.

Rolled-off or jagged bass on Windows? See the exclusive-mode setup (page 32).

No input or wrong input

Start at low output. Confirm the coupler mic is in the mic input and that the computer's input meter responds on the chosen device. If the computer sees it but REW does not, check REW's microphone access and its selected input and channel. If neither sees it, check the mic power requirement, connections and splitter pinout.

Figure 08 · Wrong recording input



Callout 1 shows the erratic magnitude trace. Callout 2 shows that REW still created a named measurement. A named result does not identify the device REW recorded.

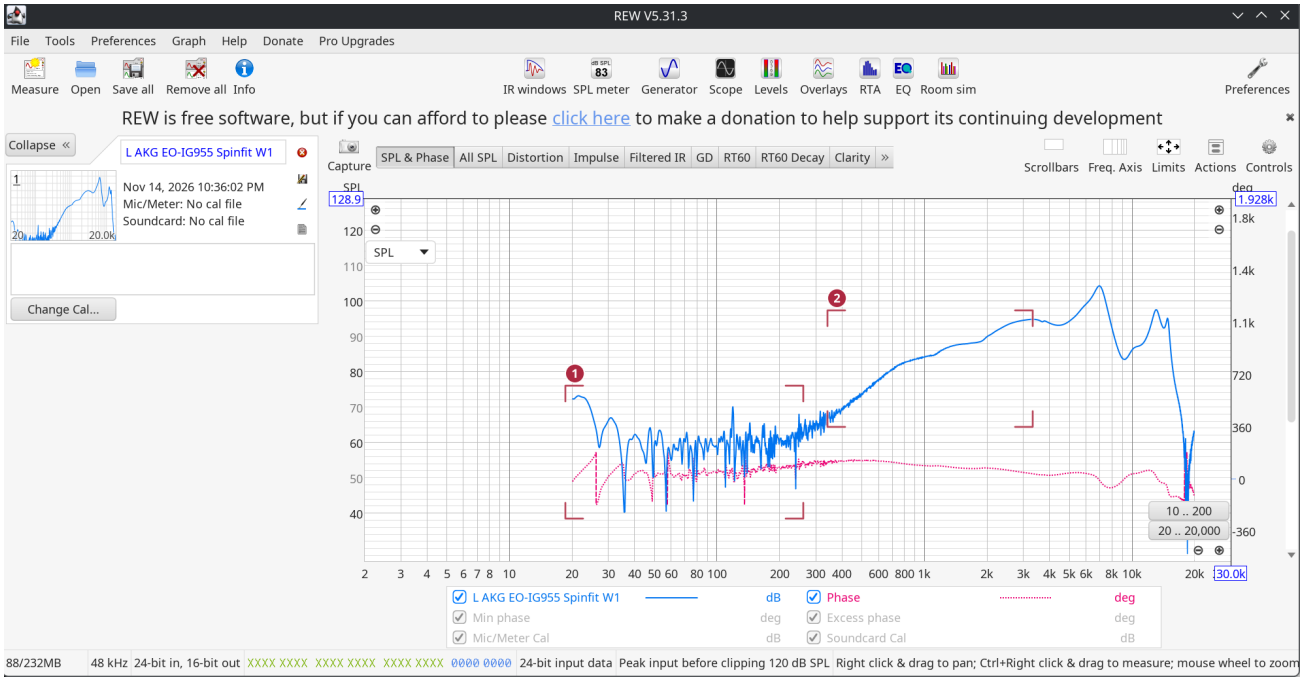
Next check. Verify the actual input in both Soundcard Preferences and the Measure dialog before starting another sweep.

REW input setup and microphone access

Leaky seal

In this demonstration the AKG ear tip was angled, leaving a gap. Weak or irregular bass is a reason to look for a leak. Playback level and routing can cause misleading bass results too.

Figure 09 · Loose fit and missing seal



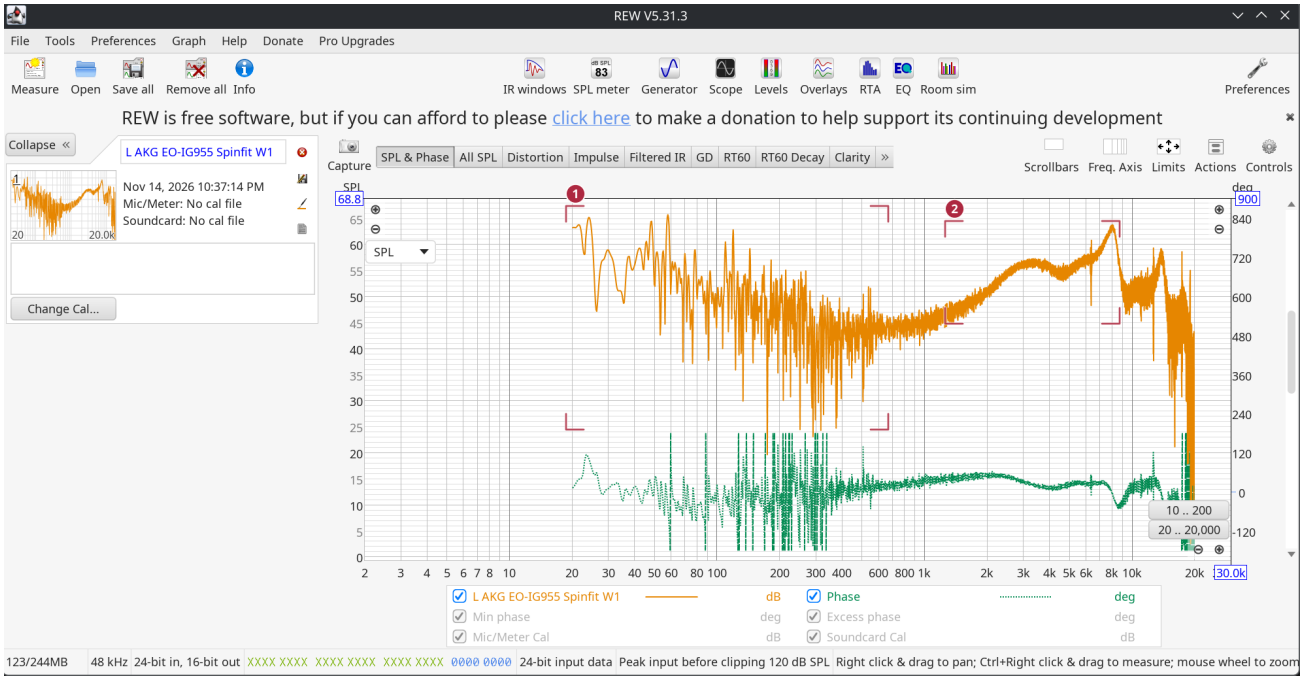
Callout 1 shows the low and irregular bass. Callout 2 marks the trace rising into the midrange.

Next check. Reseat the tip squarely with the settings unchanged. Clear the tip opening and vents. Sweep again to see whether the bass returns and repeats.

Playback too quiet

This AKG earpiece had a good seal, but the playback signal was too quiet. Parts of the curve still looked recognizable. The irregular bass was consistent with the test signal being too close to the recording's background noise.

Figure 10 · Sealed fit at low playback volume



Callout 1 shows ragged bass on the orange magnitude trace. Callout 2 marks the recognizable upper part of the response.

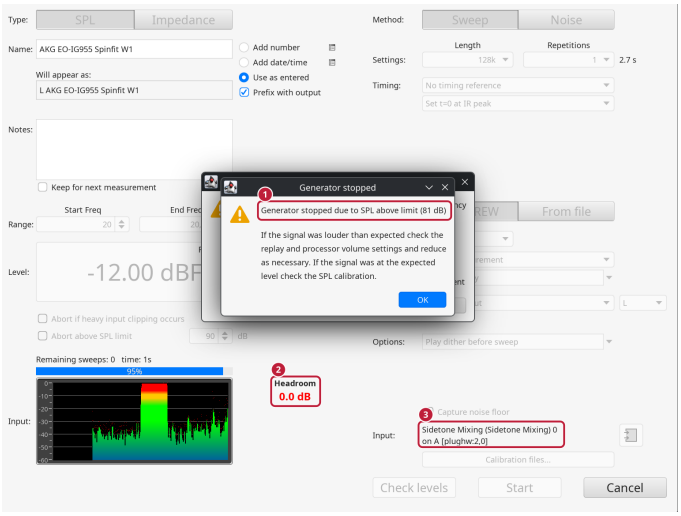
Next check. Confirm the seal and input. Hold microphone gain fixed, raise playback cautiously and recheck headroom before recording another sweep.

Overloaded or misrouted recording

During this bench session, we observed that both playback volume and microphone gain were set too high. REW showed 0.0 dB of input headroom and warned of 33.4% measurement distortion. The 81 dB generator stop used this rig's uncalibrated level reading.

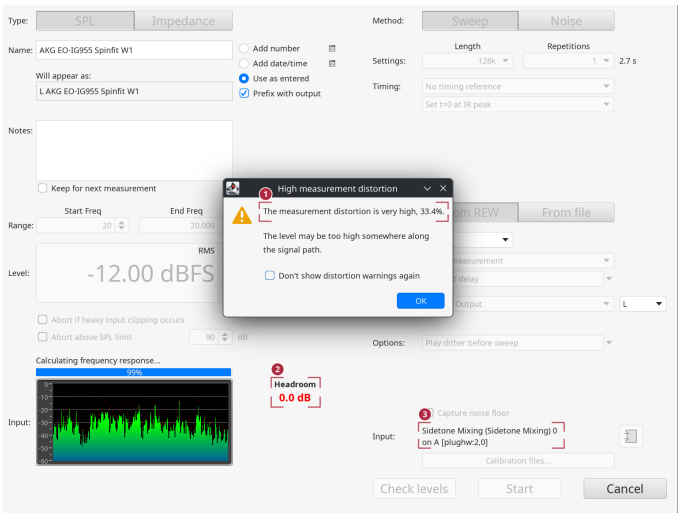
The selected input was labeled Sidetone Mixing. The signal reaching REW through it was unverified. The warnings are enough to discard the sweep. The source of the distortion remains unresolved.

Figure 11 · Generator stop



1. Stop warning at 81 dB on this rig. 2. No input headroom. 3. Verify what the Sidetone Mixing input carries.

Figure 12 · Distortion warning

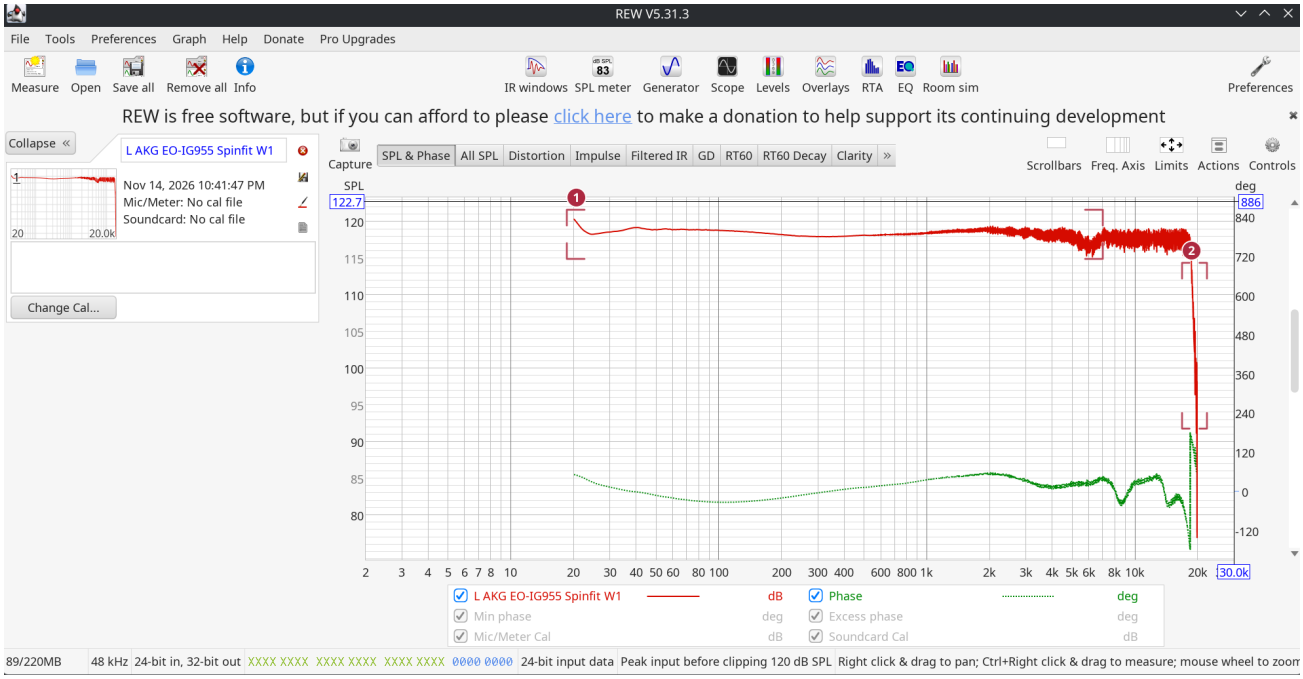


1. 33.4% measurement distortion. 2. 0.0 dB input headroom. 3. Trace the selected input to the coupler mic.

Next check. With the IEM in the coupler, start with playback volume and mic gain low. Verify that REW receives the coupler mic on the selected input and channel. Run Check levels, adjust only one control at a time, and repeat the sweep.

Overloaded or misrouted recording (continued)

Figure 13 · Flat trace from the invalid run



Callout 1 shows the nearly flat red magnitude trace. Callout 2 marks the sharp drop near the sweep edge.

Exclude this sweep from EQ and channel matching. The missing headroom and distortion warning justify discarding it. If you see a similar shape in a run without warnings, confirm the input and repeat the sweep.

REW: Measurement headroom

Check the bench against a published response

Measure your own IEMs first. For EQ and left/right matching, take repeatable sweeps of your own pair on your rig and use the same procedure for both sides. A published graph can come from a different unit, rig or measurement protocol. Use a trusted raw response of the same model as a reference and check what the publisher reports about its setup.

Even the same earpiece can measure differently across benches. Check the coupler, calibration, tip, seal, insertion depth, playback device and EQ state. To test for unit variation, measure both units on the same rig with the same procedure and repeat the fit. Different fixture designs, such as a 711 and a Brüel & Kjær 5128, can change the curve shape by different amounts for each IEM.

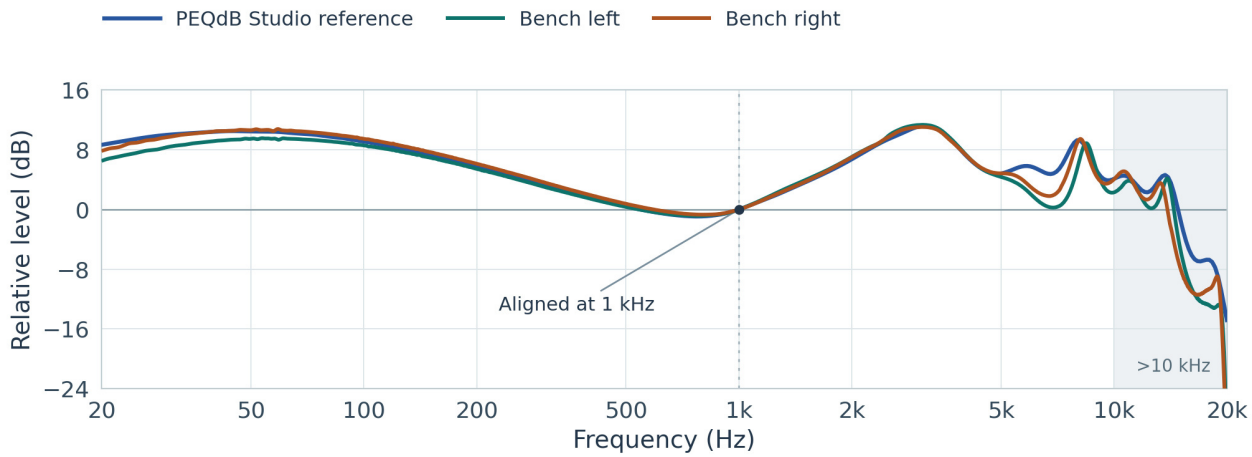
Olive (2024), AES Convention Paper 10193, Section 2

With comparable fits and settings, different 711-style clone couplers often agree closely through the bass and midrange after a **level offset** near 1 kHz. This moves a copy of the whole trace up or down by the same number of dB. A leak can still change the bass, and depth and coupler differences can still shift treble peaks and dips. Use original levels for channel matching and calibrated measurements for absolute SPL.

Compare in REW

1. In PEQdB Studio, choose **AKG EO-IG955** under **PEQdB**, select **Spinfit W1 - v2**, and use the graph card's download arrow.
2. Open your sweeps in REW and use **File > Import Frequency Response** for the reference. Show them in **All SPL** with the same smoothing and with EQ and target compensation off.
3. In **Measurement actions**, apply temporary SPL offsets to line up the traces near **1 kHz**. Remove the offsets when finished and keep the original left and right levels.

Plot A AKG EO-IG955 against the PEQdB Studio reference



The blue trace is PEQdB's Spinfit W1 - v2 response. Teal and orange are the Lab's Pair 2 left and right sweeps with medium SpinFit W1 tips. The traces align at 1 kHz. Bass and mids broadly agree, with more spread in the treble. The exact reference coupler and insertion depth are unknown.

If one sweep is an outlier, check the fit and earpiece. If several valid repeats differ in the same way, check the shared setup and the reference. Change one thing at a time. Absolute SPL calibration and IEC compliance require independent checks.

Check fit and mounting before you adjust EQ

A measurement **artifact** is a feature the setup introduces or changes. If a peak or dip moves between sweeps, check these causes one at a time and take a fresh sweep to confirm.

1. **Weak seal.** A loose tip can leak and reduce bass.
2. **Crease or air gap.** Inspect the whole tip edge for folds under good light.
3. **Uneven squeeze.** Tilt or hard clamping can deform the tip and change its depth.
4. **Blocked bore.** Check that pressure has not narrowed the opening through the tip.
5. **Covered vent.** Keep the tip flange, cotton pad and holder clear of vents.
6. **Movement or vibration.** Pad hard contact points and leave the cable slack.

Keep the same side, tip, approximate depth and settings while you test one change. Use a gentle seal. For a suspected blocked vent or overload, fix the setup and resweep. Insert earphone modeling and measurement by IEC-60711 coupler

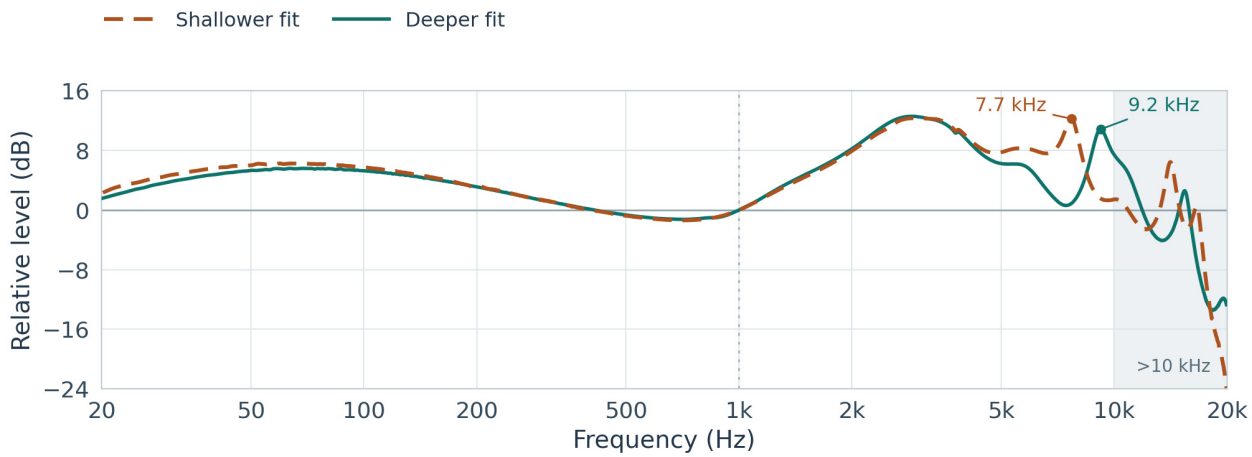
The lowest major resonance near 8 kHz

Sound reflects in the sealed air space between the IEM outlet and the 711 microphone. When roughly half a wavelength fits along this path, reflections reinforce the sound and can produce a narrow peak. This **first half-wave resonance** is the lowest major standing-wave resonance along that air path. A deeper insertion shortens the path and raises the peak frequency. A shallower insertion lowers it.

In a peer-reviewed study, moving an acoustic probe deeper into a 711 simulator shifted the first half-wave resonance from **6.8 to 9.8 kHz**. Plot B shows the same pattern with one AKG earpiece. Souza et al. (2014), Journal of the Acoustical Society of America, Fig. 8

Use **about 8 kHz** as a practical starting point when the seal repeats. A different IEM, tip or coupler can put the peak elsewhere. For left/right checks, use small physical reseats to bring a clear depth-sensitive peak near the same frequency on both sides. Keep the measured dB levels. If the peaks are hard to match, record the repeatable sealed fit with the vents open. Your ear has its own shape and fit, so base EQ on features that repeat. In-Ear Fidelity's insertion-depth test and 8 kHz convention

Plot B Same AKG earpiece at two insertion depths



Saved left AKG EO-IG955 sweeps with a large ET100AB tip on November 14, 2026. Both traces align at 1 kHz. Bass stays similar while the peak shifts from 7.7 kHz (shallower) to 9.2 kHz (deeper). Keep both traces for troubleshooting.

Generate target EQ

Target EQ changes the average response toward a chosen sound balance. Use a target documented for your coupler and build corrections from features that repeat. Keep the raw left and right levels intact.

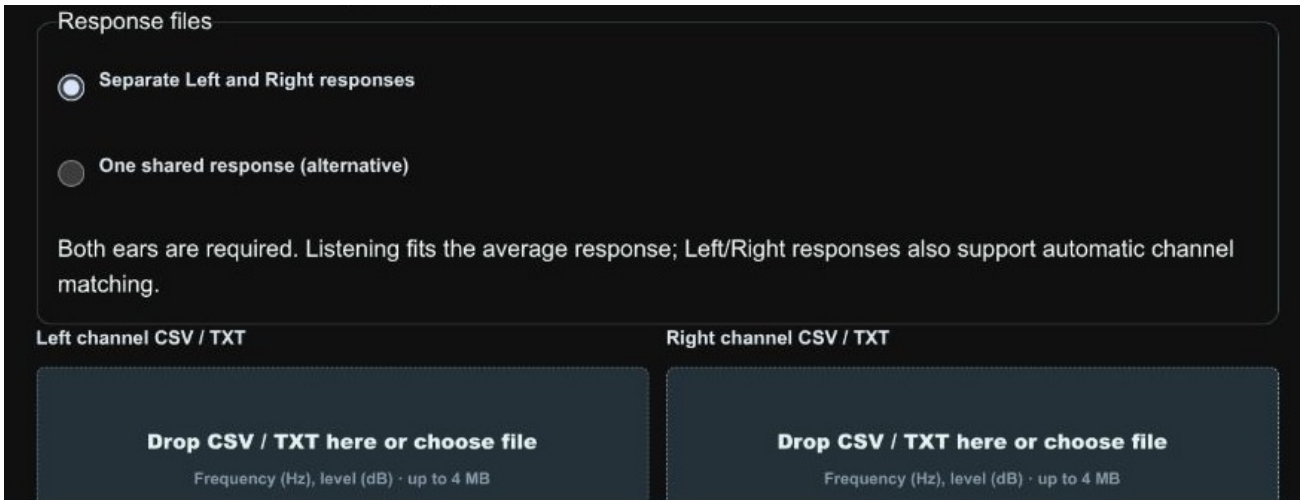
1. Open Preference Tuning. Under Headphones and Target, choose In-Ear and Use my file or Use my measurement file.

2. Open Add a headphone measurement. Enter a name, earphone model and rig, then select Separate Left and Right responses.

3. Upload the clean left and right frequency-response files in the matching boxes. Select Save measurement and select the saved measurement.

4. Choose a target and select Generate My EQ. In EQ results, pick a fitting and download or save it. Choose an export format your player accepts.

Figure 14 · Upload both raw response files



Use the Left and Right response inputs. Each takes a frequency and level CSV or TXT file. Research participation is a separate choice.

What you get. The external target export carries the shared EQ filters and their preamp. If you want to correct a persistent left/right difference, see the separate channel-match step.

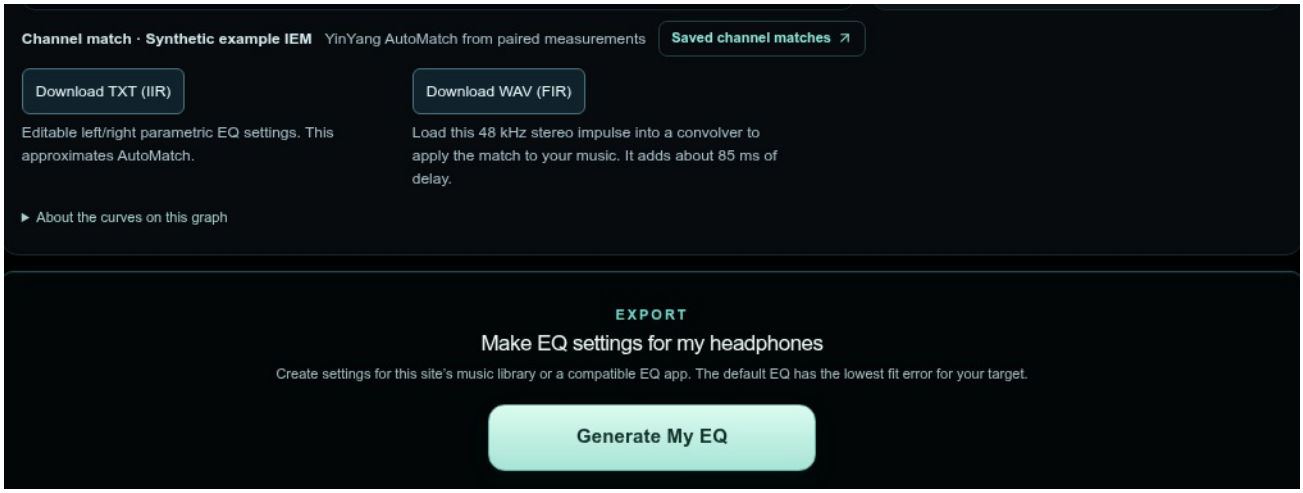
PEQdB Studio and other EQ tools can also fit a target. Choose a tool that reads your response files and exports a preset your player can apply.

Match left and right (optional)

YinYang AutoMatch is the site's automatic channel matching. It compares the uploaded left and right measurements and calculates a separate EQ correction for each side, moving both toward their shared average response. It works independently of target EQ.

Use channel matching when a difference repeats across clean reseats. Keep the original left and right levels in the uploaded files so AutoMatch can see the measured difference.

Figure 15 · Separate target and channel-match outputs



The lower button generates target EQ. The top two buttons export the left/right correction. The screenshot uses synthetic example data.

1. With paired measurements selected, turn on Channel match under Listening options if you want to hear it in YinYang EQ.

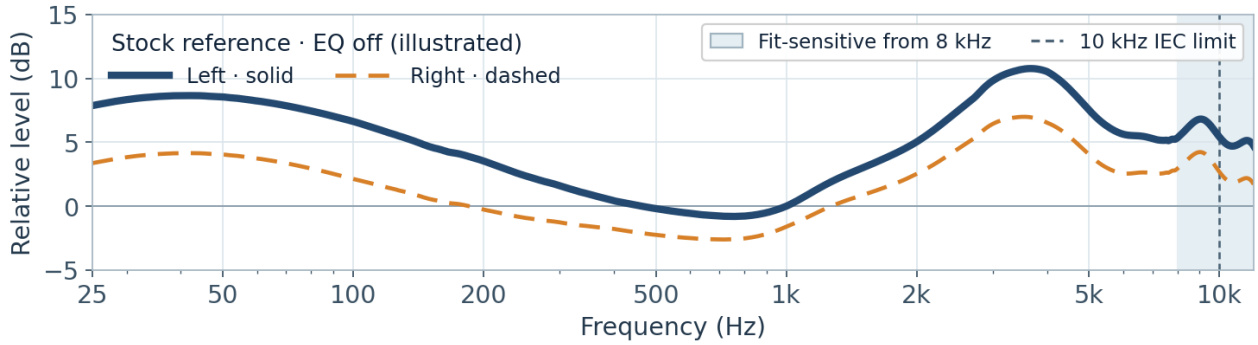
2. For external playback choose one channel-match export. TXT (IIR) gives editable left/right parametric filters that approximate AutoMatch. WAV (FIR) gives a 48 kHz stereo correction file for a convolver, which can introduce delay.

3. If you use both target EQ and channel matching outside the site, apply each correction once. Keep the required preamp settings and check headroom with both stages active.

Verify EQ with a measured sweep

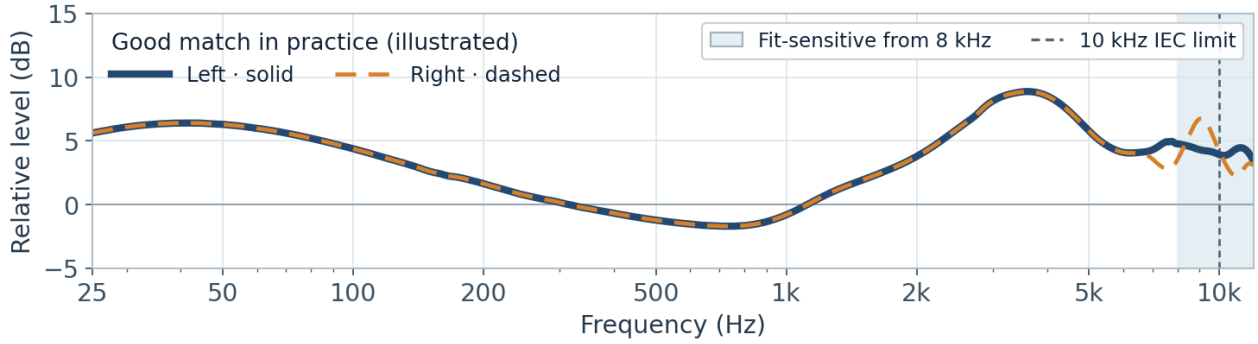
Start low. Keep the fit and settings fixed as you sweep each side with EQ off and on. For player-only EQ, play REW's sweep file through that player in both states.

Before · Stock reference, EQ off (illustrated)



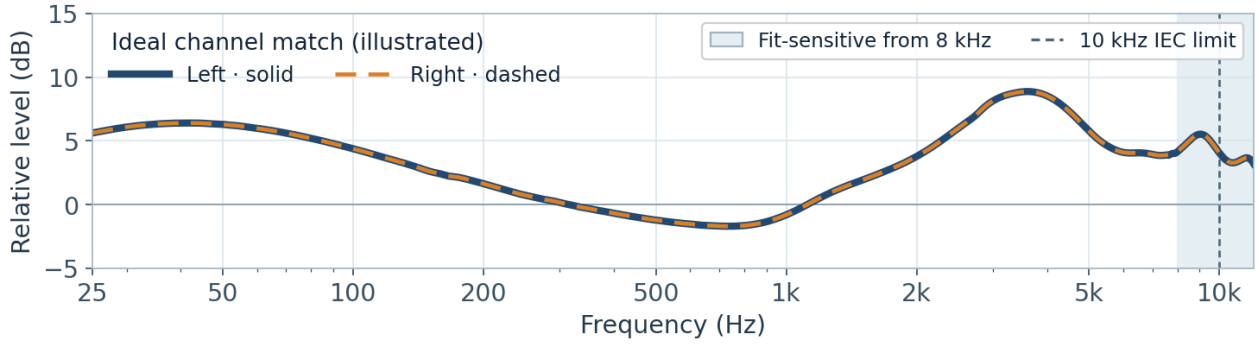
An intentional left/right mismatch added to a measured Simgot EM6L response with stock tips. All three charts use the same scale and reference level.

Good match in practice (illustrated)



The curves track closely, with only a few narrow treble gaps. That can be a good result on a 711.

Ideal channel match (illustrated)



The calculated goal puts both traces at the average of the two stock levels at each frequency.

Overlay left and right EQ-on sweeps at their measured levels. Aligning each side at 1 kHz can hide a level difference. Save the sweeps in Responses. Shading from 8 kHz marks fit-sensitive treble. The dashed 10 kHz marker is the IEC ear-simulation limit. Coupler resonances make detail beyond it approximate. Narrow gaps that move on reinsertion are usually normal. Investigate broad gaps that repeat.

REW file playback · IEC 60318-4 · In-Ear Fidelity fit test · GRAS on coupler resonance

Appendix: Arch Linux and KDE Plasma device lists

This optional appendix applies only if you use a similar system. The bench in this guide runs Arch Linux, a Linux distribution, with the KDE Plasma desktop. On that system an audio-device list refresh caused REW to lose its selected input and output devices.

Two changes solved it on this setup. A stable, named software audio connection was created ("PCM: rew_711" in Figures 05 and 06), and the underlying devices were hidden from the selection lists: the raw USB-C adapter, the coupler input and the Qudelix-5K.

After changing audio routing, confirm these points before measuring.

1. The sample rate is still what you expect.
2. Left and right playback reach the correct earpieces.
3. REW records the coupler microphone on the expected input channel.
4. No monitoring or sidetone path feeds playback back into the recording.
5. Headroom behaves as it did before the change.

References

1. IEC 60318-4:2010, IEC Webstore
2. REW Help: Making Measurements
3. REW Help: Soundcard Preferences
4. REW Help: Calibrating the SPL Reading
5. REW Help: Importing Measurement Data
6. REW Help: All SPL Graph
7. REW Help: File Menu
8. Capra Audio IEC 711 IEM Holder
9. PEQdB Studio, AKG EO-IG955 (Spinfit W1 - v2)
10. YinYang EQ Preference Tuning
11. SpinFit ear tips
12. Insert earphone modeling and measurement by IEC-60711 coupler

Bench checklist, part 1

Setup and first sweep

Work through the steps in order. Use a PDF viewer that supports forms or print this page.

Set up the hardware

- [ ] **Gather the equipment.**
  Have REW, the 711 coupler and mic, a steady holder, the IEM and tips, a headphone output and a compatible mic input.

- [ ] **Connect both signal paths.**
  Plug the IEM into headphone out and the coupler mic into mic in. If they share a headset jack, use a compatible splitter and check whether the mic needs bias power.

- [ ] **Start with a plain signal path.**
  Turn off playback EQ, loudness effects, automatic gain and mic noise suppression. Check that the computer sees the intended playback and recording devices.

- [ ] **Mount the earpiece and check the seal.**
  Note the side and tip model and size. Seal gently, keep the tip opening and vents clear, steady the holder and leave the cable slack.

Set up REW and run the first sweep

- [ ] **Choose the devices, channels and sample rate.**
  In Preferences, open Soundcard and select the IEM output and coupler mic input. Set output L or R for the side and the actual mic channel separately. Use 44.1 or 48 kHz consistently.

- [ ] **Open Measure and name the run.**
  Choose SPL, Sweep, From REW and Single measurement. For the example use 20-20,000 Hz, 128k, −12 dBFS and No timing reference. Confirm Input and Output.

- [ ] **Start low and run Check levels.**
  With the IEM in the coupler, start playback volume and mic gain low. In Measure, choose Check levels. Fix missing input before raising volume.

- [ ] **Start the sweep and inspect it.**
  Check for clipping or a stopped sweep. Confirm REW is recording the coupler mic. Repeat the same run and compare the two traces before reseating.

- [ ] **Repeat once without moving the earpiece.**
  Save both runs. If they disagree, look for movement, background noise or routing trouble. Use the troubleshooting method before swapping multiple parts.

Bench checklist, part 2

Repeat, save, compare and verify

Work through the steps in order. Use a PDF viewer that supports forms or print this page.

Repeat and save the left and right sweeps

- [ ] **Reseat each side three to five times.**
  Remove and reinsert between runs. Switch playback L or R for each side. Keep the mic channel, levels and other settings fixed. Save valid and failed runs.

- [ ] **Check that both sides sit at a similar depth.**
  If both sides show a clear depth-sensitive peak around 7-10 kHz, compare its frequency. About 8 kHz is a starting point. Keep the seal and preserve the measured dB levels.

- [ ] **Choose representative, clean left and right sweeps.**
  Choose a trace near the middle of the clean repeats for each side. Keep the individual runs. Exclude leaks, wrong inputs and clipping from averages.

- [ ] **Save the REW session and export L and R.**
  Save the .mdat and separate frequency-response text files in Measurements. Keep baseline levels unchanged. Store filters in EQ and predicted or remeasured results in Responses.

Compare with another sweep or verify EQ if needed

- [ ] **Compare the same setup details first.**
  Confirm physical earpiece or model variant, side, tip, depth, rig, drive device and EQ state. Even the same earpiece can measure differently on another bench.

- [ ] **Use equivalent graphs.**
  Use the same scale and smoothing and compare raw with raw. Align copies near 1 kHz for shape. Keep the baseline levels and use calibrated rigs for absolute SPL comparisons.

- [ ] **Check whether the difference survives a reseat.**
  A narrow moving peak or dip is fit-sensitive. Use extra care around 8-10 kHz and treat details above 10 kHz as rough comparisons.

- [ ] **If making EQ, check the inputs and headroom.**
  Import the uncorrected left and right files. Choose a target for the rig, avoid chasing deep dips that move, and apply each correction once with enough preamp headroom.

- [ ] **If verifying EQ, sweep through the active preset.**
  Confirm the test tone passes through the EQ. Remeasure with the same fit and settings and save the verified result separately from the prediction.

When measurements still disagree

Use these checks after you have clean sweeps and a fit you can repeat. Document the conditions you can compare.

Check the output and the IEM as a pair

The output's impedance can interact with an IEM whose electrical impedance varies with frequency. That can change the curve with a different dongle or amplifier. Keep the output, output mode and any adapters the same for repeat measurements. When a result follows a swap, keep the input and fit fixed, verify device EQ and compare again with a known-good output.

Sonarworks' measured source-impedance examples

Keep a reference for your own bench

Save a repeatable sweep of a familiar physical earpiece and keep its tip and setup notes. Rerun it after a hardware or software change. For comparisons with someone else, record the exact earpiece or model variant, tip and insertion, coupler and calibration, drive device and EQ state. Compare raw response with raw response and document any remaining differences.

IEC 60318-4 ear-simulator scope

Know what your calibration covers

A frequency-response correction file and an absolute SPL reference solve different problems. Use a correction file supplied for your own microphone or rig as documented. A calibrated microphone sensitivity or an acoustic reference must correspond to the recording chain and gain in use. Recheck the absolute calibration after changes to that path.

REW calibration-file and sensitivity guidance

Check separate-device timing if sweeps disagree

Matching sample-rate settings still leaves playback and recording devices with their own clocks. If long sweeps produce inconsistent results, try a shorter sweep first. For a timing-dependent measurement, use the appropriate REW timing-reference method.

REW measurement and timing instructions

Base corrections on features that survive a reseat

Use a documented target for your coupler and keep any correction modest where fit has a large effect. Narrow upper-treble peaks and deep dips can move between insertions. A balanced coupler fit helps isolate a channel difference. Listening fit and response also depend on the individual ear. Verify the preset through the playback path that actually applies it.

Repeated in-ear measurements on human ears and an ear simulator

Find answers by question

Select a question to jump to the relevant section.

What went wrong with my sweep? Page 15
Start here to repeat the symptom and rule out one variable at a time.

Why does REW show no input? Page 17
Confirm the coupler mic, OS input meter, microphone permission and connector wiring.

Why did REW record noise or the wrong input? Page 17
Check the coupler microphone, device and channel.

Why is my bass missing? Page 16
Start with the seal, then check playback level and the output path.

Why is my sweep clipped or distorted? Page 10
Check playback volume, mic gain and headroom.

Why do measurements change when I reseat the earpiece? Page 12
Check fit and learn how to judge repeat sweeps.

Should I line up the peaks near 8 kHz? Page 23
Use peak frequency as a fit check when both peaks respond to depth.

Why doesn’t my sweep match someone else’s? Page 22
Compare the fit, rig and graph settings before interpreting the difference.

When can I use the sweeps to make EQ? Page 24
Start with repeatable, uncorrected left and right sweeps.

Why doesn’t REW show the EQ I applied? Page 26
Check that the sweep actually passes through the active EQ.

What else can change a comparison? Page 30
Check drive impedance, calibration, clocks and the listening fit.

Why is my sweep jagged or missing bass on Windows? (Page 32)

Windows with the Apple USB-C dongle

Use WASAPI exclusive mode for playback and recording when measuring with REW, the Apple USB-C dongle and a 711 coupler. Shared mode can cause steep sub-bass roll-off and jagged, inconsistent sweeps.

Set up both devices

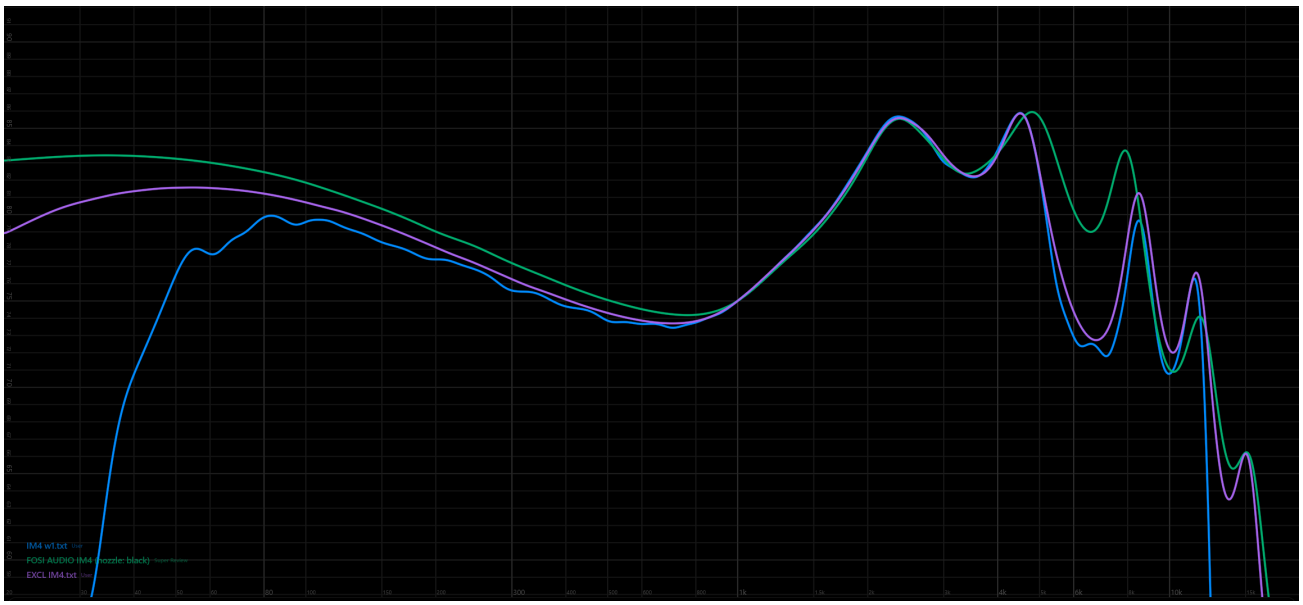
1. In the Windows **Sound** control panel, open **Properties > Advanced** for the dongle's playback device and again for its recording device. Turn on **Allow applications to take exclusive control of this device** for both.
2. In REW, open **Preferences > Soundcard** and choose **Java** under **Drivers**. Select the Apple dongle output prefixed with **EXCL:** and the **EXCL:** input that carries the coupler mic. Use a sample rate both devices support.
3. Run **Check levels**, then take two sweeps without moving the IEM. Confirm that the bass and midrange repeat before using the measurement for EQ.

If either **EXCL:** entry is missing or busy, close other apps using the dongle, check the Windows settings for both devices and reopen REW. REW audio device setup.

Turn off microphone enhancements on Windows 11

Some input enhancements, such as noise suppression, can reduce bass and make a sweep look high-pass filtered. Under **Settings > System > Sound > Input**, select the dongle's recording device and set **Audio enhancements** to **Off**, if shown. Check the recording device's **Enhancements** or **Advanced** tab in the Sound control panel if needed. Microsoft microphone enhancement instructions.

Fosi Audio IM4 comparison



Blue is the shared-mode sweep, with steep sub-bass roll-off and more ripples. Purple is the exclusive-mode sweep, with much more sub-bass. Green is the separate Super Review reference for the black nozzle.

If an exclusive-mode sweep still rolls off or varies, check the tip seal and confirm that REW is recording the coupler mic. Change one variable at a time.