



MiEMi™ User Guide

Introduction

The MiEMi™ coupler allows you to take repeatable measurements of In Ear Monitors (IEMs) with off-the-shelf measurement hardware and software, as opposed to expensive laboratory equipment. This guide will help you get the best results out of your MiEMi™ and so we recommend reading it carefully before taking your first measurements. Of course, if you have any questions or need more help after reading this guide, please contact us at info@sls-audio.com or visit us via our website at sls-audio.com.

Getting Started

The MiEMi is available in two versions: the m7 for 7mm measurement microphones, and the m8 for 8mm microphones. The m7 can be used with iSemCon EMX-7150 microphones, and the m8 can be used with Earthworks M-series measurement microphones and the Audix TM1.

Besides the MiEMi™ coupler itself, you will also need:

- **A 7mm diameter measurement microphone such as the iSemCon EMX-7150 if you are using the MiEMi m7**
- **An 8mm diameter measurement microphone such as Earthworks M-series or Audix TM1 if you are using the MiEMi m8.**
- an audio interface with a headphone jack to drive your IEMs
- a computer running Rational Acoustics Smaart or other dual-channel audio analysis software

See “[Setting Up the Measurement Rig and Configuring Smaart](#)” for step-by-step instructions for preparing your interface and configuring Smaart for MiEMi™ measurements.

Taking Your First Measurement

Once you have your interface and measurement software ready, the next step is to fit your MiEMi™ onto the end of the measurement mic – press firmly to ensure it’s seated all the way.

Next, **fold the rubber coupler in on itself** before inserting your IEM. This is critical to enable a good seal, and in turn, a good measurement. Then, insert the IEM snugly into the MiEMi™.



Figure 1 - Fold the rubber coupler back in on itself

Understanding Repeatability

A proper insertion, with a good acoustic seal, is the key to obtaining repeatable measurements with MiEMi™. If the insertion does not create an airtight seal, you will see a low-frequency deviation in the measurement, combined with poor coherence at those frequencies. Even small variations in insertion depth can create significant variance through the top octaves of the response (typically above 6 kHz).

For this reason, we recommend using Smaart or another realtime dual-channel analyzer for MiEMi™ measurements. A realtime measurement allows you to adjust your IEM insertion as you watch the measurement results on screen, whereas with an “offline” measurement solution (such as REW), you won’t know whether the insertion depth and seal were optimal until after the measurement sweep has been captured and displayed.

Figure 2 below shows the change in HF response that occurs with varying insertion depths. Note the measurement “grass” at low frequencies, accompanied by the drop in coherence – telltale indicators of a poor acoustic seal.

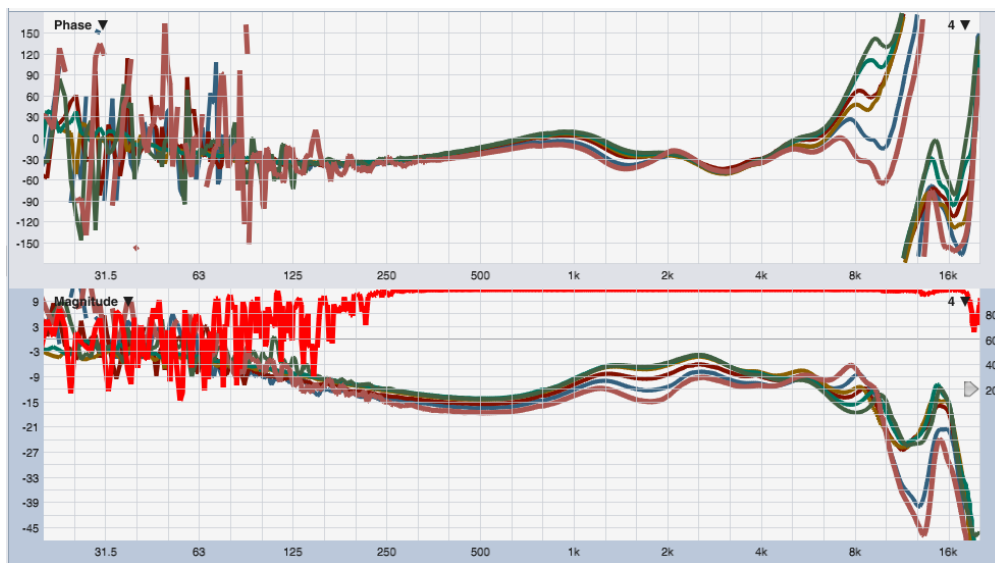


Figure 2 - the same IEM measured with varying insertion depths

IEM measurements are all about spotting trends, so we recommend starting with 1/6 or 1/3 octave smoothing on magnitude and phase, and 3 seconds or more of averaging to help stabilize the measurement. Pressing the “V” key will flush the averaging buffer and let you quickly see the effects of position changes without waiting for the averaging buffer to catch up.

Relative vs Absolute Measurements

IEM transfer function measurement data must be considered in a different context than a more typical acoustic measurement of a loudspeaker. Since IEMs seal the ear canal and are placed in close proximity to the eardrum, we cannot draw the same connections between the measurement data and the perceived tonality of the device as we would with a loudspeaker measurement. In other words, you may not feel that the measurement “looks like it sounds.” Headphone and IEM measurements are sometimes treated with “correction curves” that account for the resonances and other tonal effects

imparted on a signal by the physiology of the human ear¹. This makes the concept of an **absolute measurement** – a measurement that directly represents the tonal response of the IEM – somewhat complicated. We recommend that you consider the IEM measurement data in context with their perceived tonality – this can build “eye-ear coordination” between how the devices measure and how they sound to you. You may also find it helpful to visit the IEM Measurement database on our website to view and download measurements from a number of different models of IEM for comparison.

A **relative measurement**, on the other hand, is concerned not with the absolute response of the device, but how that response changes over time. This is an important question for audio professionals. You might measure the response of IEMs belonging to each band member before the first show, and then save those measurement traces in the analyzer. They can be used as reference for future “checkup” measurements – if the new measurements match, all is well. Any significant differences might indicate blocked canals or blown drivers. Another important relative measurement would be to compare the Left and Right IEMs and make sure they match each other.

Appendix: Setting up the Measurement Rig and Configuring Smaart

The best way to measure the response of IEMs is a transfer function measurement. A transfer function measurement is a comparison between two signals – in this case, we are asking the analyzer to compare the signal that went into your IEMs against the sound that came out. This tells us about the response of the IEMs themselves.

The transfer function measurement uses two inputs from the audio interface: the **measurement input**, which is the input connected to the microphone fitted with the MiEMi coupler, and the **reference input**, which is simply a copy of the signal being sent into the IEMs. The best way to do this is by using a physical “loopback” – use a cable to connect one of the interface’s outputs directly back to one of its inputs. Finally, connect your IEMs to the headphone output of your interface, and make sure Phantom Power (+48V) is enabled on the mic input preamp.

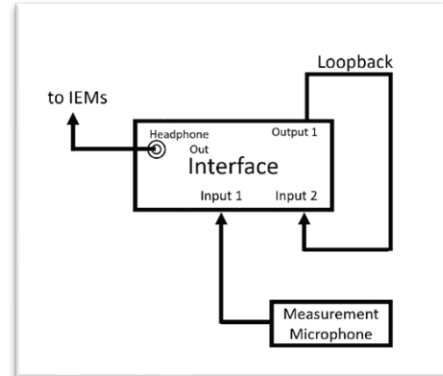


Figure 3 - Interface connection block diagram

Now, open Smaart, enter IO Config and select your audio interface. Choose the input connected to the loopback cable and the input connected to your measurement microphone, and uncheck everything else. (You may wish to give these two inputs “Friendly Names” in the software to keep them straight.)

Next, on the Measurement Config tab, click “New TF Measurement,” choose the mic input for “Meas Ch” and choose the loopback input for “Ref Ch.” Now open the Signal Generator options and set the Main and Aux outputs to outputs 1 and 2 of your interface so the test signals are sent to both sides of your IEMs.

¹ <https://crinnacle.com/2020/04/08/graphs-101-how-to-read-headphone-measurements/>

Note: if you are using an audio interface that offers a built-in internal loopback, such as some interfaces manufactured by RME and Audient, you can use the internal software loopback to provide the reference signal in lieu of a physical loopback cable. Be sure to select the appropriate input in Smaart's IO Config and configure the transfer function measurement appropriately.

Gain Structure

Start the Signal Generator running, select Pink Noise as the signal type and set the level to around -12. Now we can press "S" to enter Spectrum View, and click the green Run button on the measurement engines for the Mic and Loopback inputs. Adjust the input gain on the loopback input until the meter on the measurement engine is just occasionally flickering into the yellow. Once you have your IEM seated into your MiEMi coupler, you'll want to adjust the preamp for the microphone input in the same manner. This ensures that you have matched signals levels coming into the analyzer.

Then press "T" for Transfer Function view, click the green Run button on the transfer function engine, and you're ready to start taking measurements with your MiEMi!