**Notes on IHS OAE HF probe system**

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Setup 1/28/2025, Tuesday

Received new equipment. HF driver shielded cable needs to be soldered to connectors that go to the sound card. Successfully accomplished.

Account for impedance difference between RME sound card (Output Z = 30 Ohms) and extended HF loudspeakers (Input Z = 8 Ohms). Using an ADCOM power amplifier with gain set to unity. Put between card output and loudspeaker input to bridge the impedance.

Initial observations:

1. The multi-pin connectors that go between the OAE Probe Power Module and the OAE HF Probe Mic Amplifier—must be very careful not to damage the pins! This could be a problem because the flat face of the connector faces up on the Power module but faces down on the Amplifier—easier to mix up the orientation if you are not being careful. Also, the rectangular plastic piece that is commonly present inside these types of connectors is absent. This means that if you insert upside down and push, you could easily bend the pins. This could be changed in future iterations of the hardware.

A close up of a device

Description automatically generated

1. Regarding this same connection, the multi-pin connector easily comes loose from the Power Module. This sometimes results in a loss of signal, but it is difficult to see that the connector has simply come loose. It doesn’t fall out, so if you don’t look closely, you don’t see that this has occurred. THIS IS OFTEN OCCURING TO ME AND IS ONE OF THE BIGGEST PROBLEMS SO FAR. THIS DESIGN PROBLEM SHOULD BE FIXED IN FUTURE ITERATIONS.

A close up of a cable

Description automatically generated

This picture shows a proper connection.

A close up of a device

Description automatically generated

This picture shows how, with slight movement, the connection becomes partially disconnected, resulting in loss of signal.

1. For use with humans, it is critical to have the probe attached to the ear in a way that minimizes probe movement and noise from cord rubbing. I attempted my standard trick of attaching to a headband (hollowed out shooters muffs). In doing so, I accidentally snapped off the plastic tip that protrudes from the loudspeaker casing. I will be very careful about this going forward. However, this is probably a weak point for the design. Softer plastic would run the risk of unintentionally pinching off the tube, which is also undesirable. Since this is break point, I SUGGEST FUTURE ITERATIONS REPLACE THIS PLASTIC TIP WITH A METAL PIECE.

A black square object with a blue and red wire

Description automatically generated

Day 2, 1/29/2025, Wednesday

Yesterday the output seemed much lower than I was expecting. Double checked input voltages and outputs using a signal generator and RMS meter. Look okay and expected. My card/power amp setup is such that maximum output of my software (+/- 1 units) yields +/- 1 Volt at the output of the power amplifier. This is good and will ensure that I don’t overdrive the loudspeakers. The drivers spec sheet does not specifically list nominal driver sensitivity and impedance, which would be a nice addition in the future. The spec sheet does say, “Output: >100 dB SPL with a 1 Vrms input between 125 Hz – 40 kHz”. This is helpful and tells me that I should be able to safely input up to 1 Volt rms.

When I initially made measurements on my system, the recorded voltages still appeared too low. I finally realized the problem: my software gain and sensitivity settings were set wrong. Etymotic OAE hardware (ER10C, ER10B+, ER10X) almost always had a mic sensitivity of 50 mV/Pa, and I would routinely use +20 dB gain on the preamp. The IHS system has a 500 mV/Pa mic sensitivity; therefore, I didn’t need to give additional gain on the power module. For those of us coming from years of ER hardware, consider making it extra clear in the spec sheet that the microphone gain is higher than ER hardware was. When I saw 1,10,100 and translated it to 0, 20, 40 dB gain, my mind thought, “this is the same as ER stuff”, which it’s not. While nothing wrong with 1, 10, 100, consider writing dB gain instead.

I made some software adjustments and tried a first Thevenin source calibration of the right driver and microphone (the left has a broken tip. Rafael is sending me a replacement). For my initial try, I went from 100 Hz to 8 kHz (did not try extended high frequencies). I used the standard tip (not the cut away one). I did this “by hand”, i.e., using a brass tube with stainless steel plunger and a ruler. (My digital caliber is out of batteries at this moment). I used a tube diameter of 0.8 cm and a green Sanibel tip on the probe. I also did this in the lab but not in my sound booth, so the recordings are noisy. I just wanted to see if I could get the thing to run. I am pleased with the results. Although noisy, the calibration looks respectable otherwise. This is good news! Results below. General observations: 1) The match between obtained and model (first figure below) is pretty good, just noisy. 2) The source pressure is smaller than I would expect. I’ll have to look into that. Likely a software setting that I missed somewhere when making changes to accommodate this new system. 3) Impedance looks okay. I don’t know what exactly to expect for this probe, but nothing looks “off”. One other note: I thought I could run this using a “shortcut” by using my ER10X calibration cavity with the IHS probe. This looks to be difficult, because I could not easily make the IHS probe sit straight in the ER10X cavity. With some messing around I could probably get it to work, though the “by hand” method will also work fine.



Comparison of model (dotted lines) with tube measurements (solid lines). Good error estimates are less than 1. This looks like acoustically noisy measurements rather than systematic error.



Source pressure (Ps)



Source impedance (Zs)