

Sennheiser HD 600 Owner's Report

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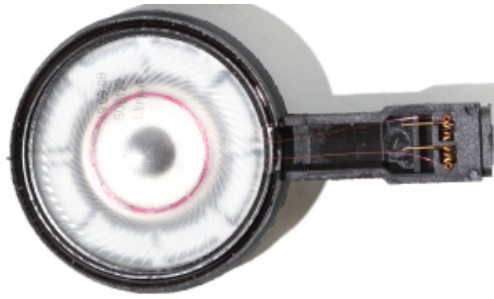
Note: I own and am reporting on the original, speckled model, manufactured in Ireland (above, left). Every indication is that the new, semi-matte black model, manufactured in Romania (above, right), is extremely similar in design and build. Any acoustic differences between the two seem to be small enough that they can't be separated from unit variation.

Summary: this is a reasonably well-built, potentially very comfortable headphone with excellent sound quality excelling in neutrality but with the weaknesses of a constricted sound-stage and sub-bass roll-off. While reaching good loudness and very decent sound quality with today's better smartphones, it scales impressively with quality electronics. The lack of any obvious attention-grab due to its plastic-laden construction plus the "merely" neutral sound signature may make its \$400 MSRP seem a bit high.

The HD 650 is a slightly treble-reduced variant. And the HD 6XX is a low-price clone of the HD 650 for those who have access to non-tariff-encumbered Drop pricing.

"Engineered for absolute clarity, the HD 600 is the professional's choice for reference playback. An instrument of Sennheiser's passion for perfect sound, it is globally recognized as the standard for analytical listening in both technical and hi-fi applications—even 20-plus years after its release." — Sennheiser marketing, 2021

Released in 1997, the HD 600 together with its near-identical twin, the HD 650, have increasingly proven to be an embarrassment to Sennheiser. They have yet to create, after more than twenty years, a headphone that is a clear and unambiguous improvement. The 2009 HD 800 and the 2015 HD 800S have improvements in many areas (including especially sound-stage width), but have such a non-natural tuning (frequency response) that only a minority of purchasers ever fully adjust to it. The late 2017 HD 660 S was supposed to be that 600/650 killer for Sennheiser. But this again has been torpedoed by its sub-optimal frequency response.



The HD 600 is built around a traditional dynamic cone driver of the type everyone is familiar with from their use in everything from laptops to ultra-expensive floor-stander loudspeakers. Most importantly, it has one of the most accurate/neutral/"flat"/natural frequency responses of any headphone model ever made.

Physical considerations

This is an over-ear, open-back headphone with dynamic drivers.

- Over-ear means the ear cups surround the ears rather than resting upon them or in them.
- Open-back means sound is vented to deliberately leak sound to the world surrounding the wearer. But in this case what the wearer hears as a roar when listening to the HD 600's, others hear as more like a whisper. Conversely, sounds from the outside world leak into the headphones and do so much more clearly. These headphones are designed for quiet-environment listening, not recording sessions or commutes.
- Dynamic drivers means the sound producers inside each ear cup use the same cone plus voice coil technology that loudspeakers commonly use. In this case the cone is acoustic silk, the voice coil aluminum and the magnets, neodymium. The drivers are 40 mm/1.6 in, but note that driver size does not correlate with bass performance.
- The HD 600s have a sensitivity (loudness) of 104 dB per 1 volt, an efficiency of 99 mW and an impedance of 300 Ohms.

Translation: most, but not necessarily all, smartphones, laptops and desktop computers from the past five to ten years will have enough power to drive the HD 600 to a (literally) deafening loudness. My iPhone 6S certainly does. While they have an impedance rise from 300 to over 500 ohms that peaks at 100 Hz, I'm not noticing any sonic change in that range when switching between iPhone, MacBook and external amplifier. Nevertheless, 600's scale well with increasing amp and DAC quality and reportedly respond extremely well to tube amplifiers.



Build, fit and comfort

As a physical object, this headphone seems very well designed. Yet the extensive use of glossy black-with-grey speckled hard plastic in the headband yoke and ear cups — undoubtedly deliberately chosen to minimize weight — will feel less than premium to some. Its 260 grams (9 ounces) of weight makes it one of the lighter full-size headphones available, which eliminates a source of discomfort or fatigue during extended listening sessions. However, a new HD 600 has a strong clamp force, especially for those with larger heads. The ear cups have enough swivel to automatically adjust to most any head shape.

Since the headband plastic used by Sennheiser is not malleable, one option is simply to live with the extra clamp and hope the metal height extenders will eventually bend out to your head

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size. I can't report from experience, since my used 600s were already fine for my small head size when I received them. But the more realistic approach is to very carefully and minimally bend the metal extenders by applying pressure with both thumbs. Use nowhere near enough force that kinking the metal is a possibility. Once excessive clamp is eliminated, the 600s become a headphone you can fall to sleep wearing. The separated, nugget style headband cushions are ideal for preventing top-of-head hot spots.

Provided accessories



The HD 600 comes with a 25.4 x 31.3 x 10.5 cm (10 x 12.3 x 4.2 inch) black cloth-covered hard-sided retro-looking box. This holds the headphones and provided cable in separate cut-outs to the foam insert.



The provided, detachable 3 meter (9.8 foot) long, straight cable is two-wire, supple and soft black rubber coated. It splits into a 25.4 cm (10 in) Y run leading to separate connections at the ear cups. The ear cup connectors are small proprietary 2-pin. The new (Romanian) version HD 600's cable terminates in a 2.35 cm (1/8 inch) phone jack (typically needed for smartphones and portable music players) but comes with the 6.35 mm (1/4 inch) termination adapter typically needed for external amplifiers. The older (Irish) version has the 1/4 inch termination and comes with a screw-on 1/8 inch adapter. (This is a dangerous combination. The extra, non-flexible length of the jack plus adapter can easily damage the socket's solder joint if torque is accidentally applied to it.)

The HD 600 come with large velour, non-memory-foam ear pads. Many prefer velour to leather or leather-like ear pads as being softer and cooler. Critically, they are porous, which means they are insensitive to whether you achieve a snug fit to your head. So glasses wearers will not experience a loss of bass loudness. However, the ear pads permanently compress over time, which changes their frequency response. So, if you find your 600s have less treble or some similar issue after a year or more of daily use, you'll need to purchase a replacement pair of actual Sennheiser ear pads. It's well known that there are no third party ear pads for the HD 600, 650 or 6XX that don't have a strongly adverse effect on their frequency response.

Reliability

Given the use of plastic in the 600's build we might expect a potential for breakage. But this model has been around for over twenty years and has a sterling reputation for reliability. This is not to say indestructible, but given a modicum of care in handling it's going to last a lifetime. I bought mine third-hand in near-perfect condition. I put a bit of black electrical tape on the places it would touch a hard surface if laid down on one. This is nearly invisible but gets the job done. The storage box, however shows a bit of scuffing that doesn't seem to be from abuse. So, if you're planning to keep everything related to your 600 in flawless condition, take extra care with the storage box.

Sound considerations

That the HD 600 has a nearly accurate/neutral sound signature is either good news or a show-stopper, depending on your idea of what a headphone should do. Most people also find it has a relatively small/intimate, left-centre-right sound-stage, as well.

Frequency response / tonality

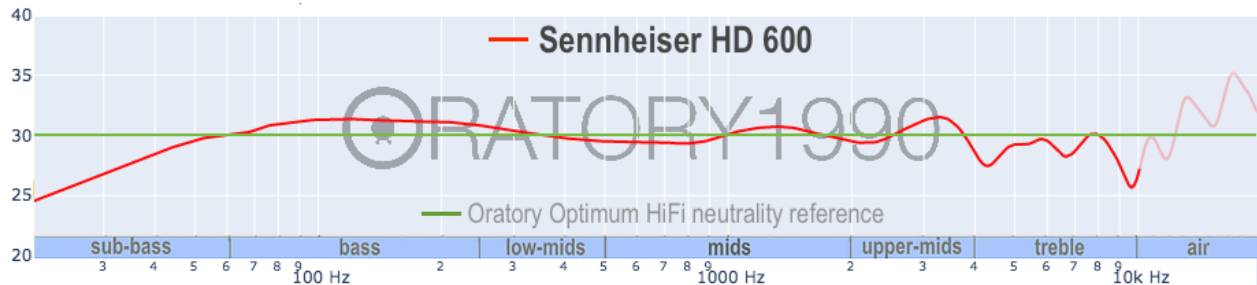


Fig. 1: HD 600 frequency response, deviation from neutral (source: [Oratory Grapher](#))

Fig. 1 is a frequency response measurement graph for the HD 600. The measurements were made using professional-grade equipment and are the average of several units. This remains an excellent showing even after two decades, and I can vouch for its accuracy in matching my own HD 600.

Don't be put off if Fig. 1 makes you want to run for cover. I'll explain everything you need to know. The vertical axis in Fig. 1 is loudness, the horizontal axis is frequency (lower/deeper pitches on the left to higher pitches on the right). The green line is the hypothetically accurate response for an over-ear headphone. The red line is one way of displaying how the HD 600 measures using state-of-art equipment. Just focusing on the red line, as you can see it departs from the green line in several places that I've circled and numbered in Fig. 2. This is getting into true nit-pickery, but let's examine each of them in turn:

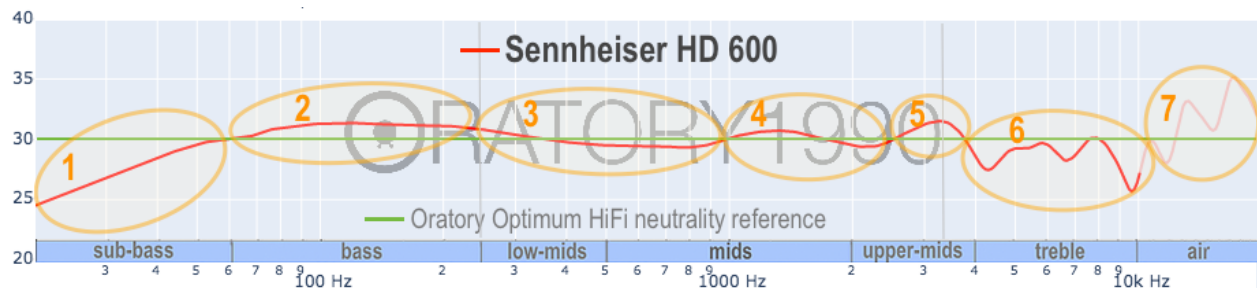


Fig. 2: HD 600 measurements with deviation areas circled

1. This sub-bass loudness roll-off looks serious but will only affect a small percentage of recorded music, since no voices and very few musical instruments produce sound in this range. Sub-bass roll-off is typical of the open-back headphone design.
2. Most people will welcome the slight mid-bass elevation, but it is a departure from a strictly accurate reproduction of the recorded sound.
3. However, the continuation of the mid-bass elevation into the mid-range combined with the slight depression of the middle mid-range creates a sonic haziness or thickness that affects certain tracks. Often it isn't even noticeable — many tracks have this area reduced in loudness, since this is a very common problem area for audio reproduction equipment.
4. The imperfection in this region is so slight that it seems unlikely to affect many people.
5. This moderate elevation right at the peak of the ear drum's amplification rise will annoy a certain percentage of listeners who are either treble sensitive, or listening at too loud a volume or who are listening to piercing electric guitar riffs or synth. You should actually welcome this feature as a warning of over-loud listening levels, grin.

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6. While not technically ideal, the dips at 4½ and 7 kilohertz tend to play well with common treble sensitivities. The dip at 9½ kilohertz is actually an aid to sound localization.
7. Spikes in this region will actually vary so significantly depending on a given individual's ear anatomy, that it's essentially meaningless to focus on what the measurement rig shows here.

In summary, only the areas in the 3 and 4 circles represent potential issues of any consequence — and that only for a minority of listeners.

Pad wear: Crinacle has measured the HD 600 with both fresh and worn ear pads. Worn pads show ½ decibel less loudness in the sub-bass, no change between fresh and worn in the bass and lower mids (70 to 800 hertz), 1 decibel less loudness from 1 to 2½ kilohertz and 3 decibels less loudness in the treble.

Noise and distortion

Another potential problem area having to do with frequency reproduction is measured as *total harmonic distortion plus noise* (roughly, any unwanted variation from the original signal):

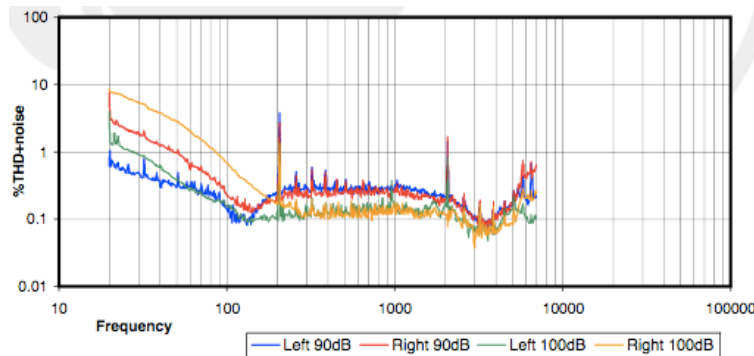


Fig. 3: HD 600 harmonic distortion (source: InnerFidelity.com)

The HD 600 measures well below the 5 to 10% threshold for humans to actually hear distortion during music playback. The higher distortion levels in the bass frequencies at ultra-loud levels may seem concerning, but humans are actually even less sensitive to distortion in the bass than at higher frequencies. In all, this is actually a very good showing for the HD 600. That's potentially important, given low distortion means a greater ability to respond to EQ.

While frequency is the single most important aspect of sound reproduction, other factors also make a big difference.

Speed and detail

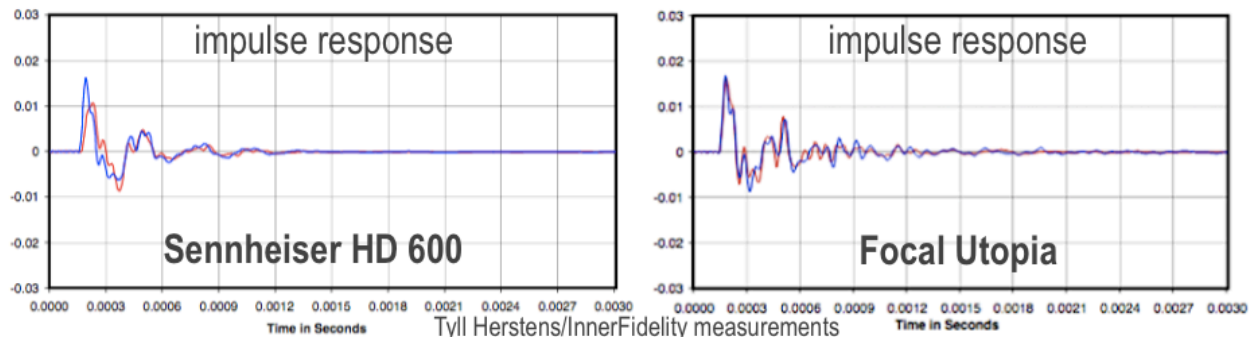


Fig. 4: impulse response comparison (source: InnerFidelity.com)

In this context speed refers to how quickly a headphone can start and stop producing a sound. This is technically referred to as *impulse response* or *ringing*. A faster headphone has greater accuracy than a slower one in the time domain. A “fast” headphone is not still producing a

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sound beyond the sound's actual presence in the recording. That said, it's rare that any headphone fails to reproduce the whole auditory range out to at least 20,000 hertz (20,000 vibrations each second). So 0.00005 second seems plenty adequate to achieve sound separation. In fact, as we see in Fig. 4, the InnerFidelity impulse response graph for the HD 600 is nearly identical to, but slightly cleaner than, that of the 10x pricier Focal Utopia.

The slight lower mids elevation combined with the middle mids recession serves to take the edge off mid-range sounds, which translates into an almost subliminal sense of detail fuzziness in that portion of the audio spectrum. One need only EQ out these issues, then listen to recordings with little or no content in the upper frequencies to determine that the HD 600 has the potential to provide a very real clarity and level of detail across the entire audible range.

Dynamics

Dynamics is, at least partially, another time domain property. It refers both to the range from quiet to loud a device is capable of reproducing, and to how well it can reproduce sudden changes in loudness. Time domain measurements are hard to come by and in any case no one knows how to measure dynamics, but reviewers are pretty consistent in reporting that the HD 600 has excellent, realistic dynamics. This matches my own experience.

Soundstage and imaging

Soundstage is the ability of speakers or headphones to create the auditory illusion that the sound they produce comes from a larger three dimensional space instead of just from the devices themselves. Imaging is the precision in which sound sources can be located within this illusory space.

Due to some hearing loss in one ear I cannot properly evaluate this feature. Other reviewers are very consistent in reporting that HD 600 as well as the HD 650/6XX has a small sound-stage with a tendency to place sounds left, front or centre with little gradation in between. Some people actually enjoy this presentation as creating a more intimate connection with the recording. But for most people, sound-stage is a weakness of these headphone models. Ironically, however, the imaging or placement of sound sources within the soundstage is regarded as being very good.

Timbre

The word timbre usually refers to the characteristic sound of one musical instrument vs another. But sound reproduction devices can sometimes have a distinctive departure from naturalness of their own, such as a metallic or plasticky accent. The HD 600 has the natural timbre typical of a non-metallic dynamic driver.

EQ-ability

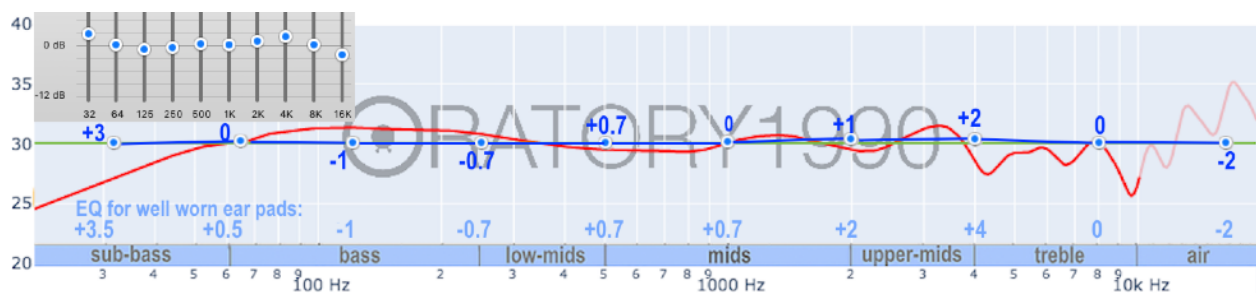


Fig. 4: possible 10-band EQ for HD 600 with analytical ear pads

If you should desire an even more accurate sound reproduction Fig. 4 shows that you can achieve excellent results using even one of the 10-band graphic EQ tools that tend to be readily available. The blue line in the Fig. 4 graph shows the EQ result overlaid on top of the reference neutral green line. And the blue line covers the green line almost exactly when

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implemented with the adjustment values shown. But note that a quality frequency response graph, such as shown in Fig. 4, is based on a population-average ear anatomy. Your ears will differ from that, so you need to tweak the shown adjustment values as needed, especially above 4000 hertz until an aggregate of many tracks of music sounds most correct.

Elevating the bass via EQ is also quite workable, at least at reasonable loudness levels. To achieve the Harman target bass set the 32 decibel band to +8 and the 64 decibel band to +4.5. The rest would stay the same as shown in Fig. 4.

Another consideration is frequency response change over time as ear pads wear in. As detailed above, this can be significant after extensive use. Try the pale blue EQ values shown in Fig. 4 for well-worn ear pads. (I explore pad wear in more detail in [Appendix A](#), below.)

Sennheiser's HD 6-series alternatives



Fig. 5: HD 600 and HD 650 compared (source: [Oratory Grapher](#))

We see from Fig. 5 how similarly the HD 600 and 650 measure. Here I've aligned them so they overlap all across the left side of the graph. (Not shown here, but the Drop HD 6XX measures the same as the HD 650 within the limits of unit-to-unit variance.) This graph shows only one of several aspects of sound quality. But all evidence suggests no difference at all in the other areas of sound-stage, imaging, distortion, dynamics and detail. Because the HD 650/6XX has a bit of reduction in relative loudness compared to the HD 600 past 1 kilohertz point, listeners variously report the HD 650 as having more bass and/or as having a slightly recessed high end (at one time controversially called the Sennheiser veil).

If you listen to a lot of rock, metal or synth or you have treble sensitivity, you may well do better with the HD 650. That said, neither has the kind of bass elevation and slam that are often associated with those and other genres.

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The relatively new HD 660S, on the other hand, is a very different headphone. I haven't heard these, but the measurements show a frequency response that is neither accurate/neutral nor bass-emphasized, nor v-shaped nor anything else that makes any sense. Nothing I've heard or read suggests they have sufficient improvements in other areas to explain their reason for being. But of course you'll want to do your own research if interested, and of course as you'll discover, there are people who swear by them.

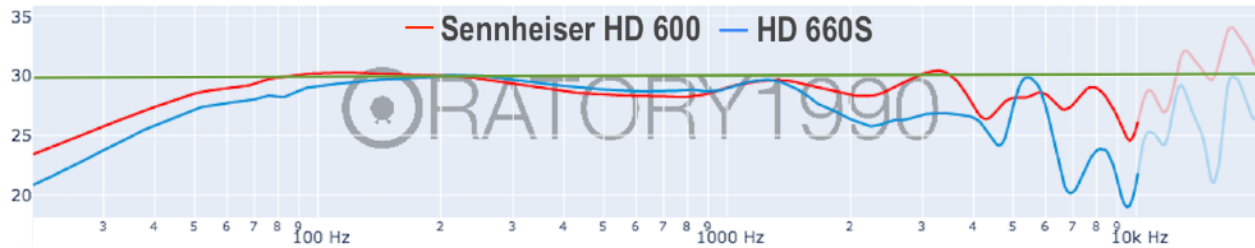


Fig. 6: HD 600 and HD 660S compared (source: [Oratory Grapher](#))

Value



To me, there are three sides to the HD 600 value proposition. As a part of a budget-oriented sound solution, they represent reasonable value at their current retail price (US\$399) and arguably vie with competing models from other manufacturers for anyone looking for accurate/neutral audio reproduction. If you happen to own a tube amplifier, the HD 600/650/6XX are in that select group of headphones that have a high enough impedance to play well with your amp. For many, this is the proverbial marriage made in heaven. But the third perspective is to pair them with electronics costing up to ten times their price. I have no experience in that stratosphere of scalability, but I've read of this from some very experienced folk who have yet to find a headphone at any price that they'd rather be listening to.

Personally, I use the HD 600 along with an Earmen TR-amp (US\$300) and am very happy with what I'm hearing. It delights in using its pair of acoustic silk diaphragms to deliver the nuances the Sabre 9038 DAC chip in the TR-amp makes available. This is the only headphone with which I can listen to large swaths of music without EQ. But I'll never be *truly* happy until Sennheiser/Sonova releases an HD 600R — a headphone otherwise exactly like the HD 600, except with an even closer to true-neutral frequency response like the HD 560S.

Other resources

Measurements

- Oratory1990: <https://headphonedatabase.com/oratory/headphones?ids=271>
- Rtings.com: <https://www.rtings.com/headphones/reviews/sennheiser/hd-600>
- Tyll Hersten: <https://www.stereophile.com/content/very-important-sennheiser-hd-580-hd-600-and-hd-650>

Miscellaneous

- Tyll Hersten's overview of HD 600 & HD 650: <https://www.youtube.com/watch?v=c2Es9S9tXTY>
- Tyll Hersten's disassembly & repair of HD 600: <https://www.youtube.com/watch?v=mBpic9jbjs>
- Clamp force reduction: https://www.reddit.com/r/headphones/comments/ojca7n/is_it_possible_to_reduce_hd_600_clamping_force/h50xm3z/?context=3

Appendix A: HD600 vs HD650 vs pad wear

Throughout the presentation above I use Oratory1990 frequency response graphs that are compensated such that an accurate/neutral frequency response is shown as a straight line in green. Unfortunately, Oratory hasn't done measurements of fresh compared to worn ear pads, so I have to now turn to Crinacle who has done this. Unfortunately again, Crinacle doesn't provide an accurate/neutral compensated graphing option at what I consider an acceptable price, so I will have to work with uncompensated, or raw, data graphs for this section.

To start here is the Oratory measurements for the HD 600 both in compensated (on top) and raw (on bottom) forms:

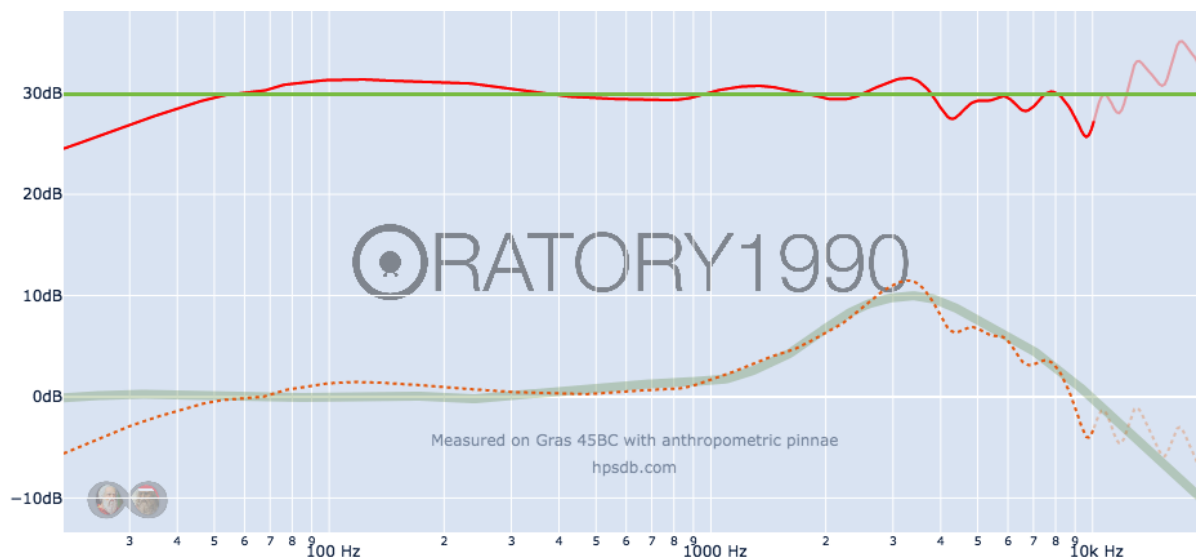


Fig. A1: compensate vs raw measurement presentation

We see that the top/compensated version shows exactly the same divergence of the red line of the HD 600's frequency response compared to the neutral green line as we see in the bottom uncompensated graph. The only difference is that on the bottom we have to follow the red+green pair's rise and fall with our eyes.

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Now here are Crinacle's measurements for HD 600 and HD 650 compared to Oratory's in raw form only:

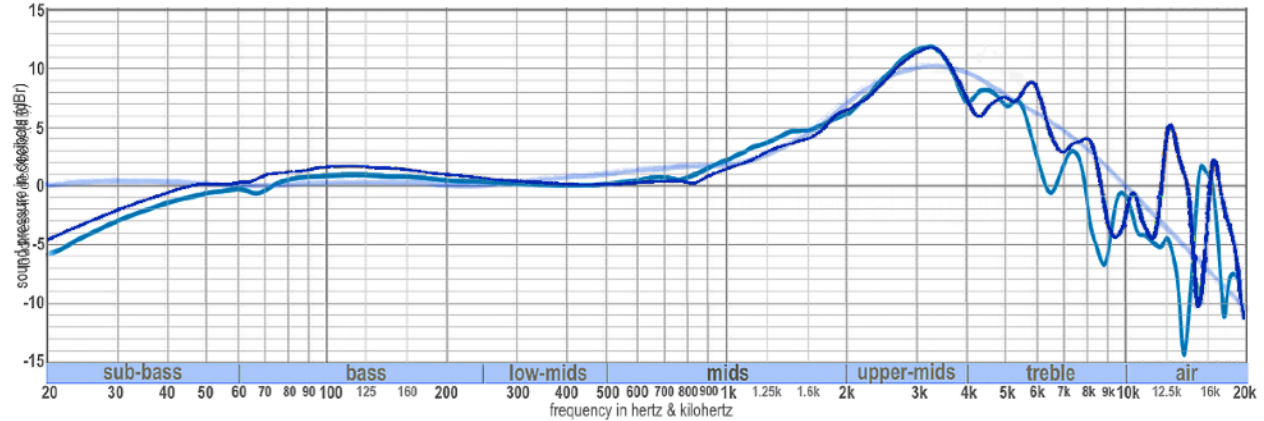


Fig. A2: HD 600 measurements: Oratory1990 (navy) vs Crinacle (turquoise) (neutral = pale blue curve)

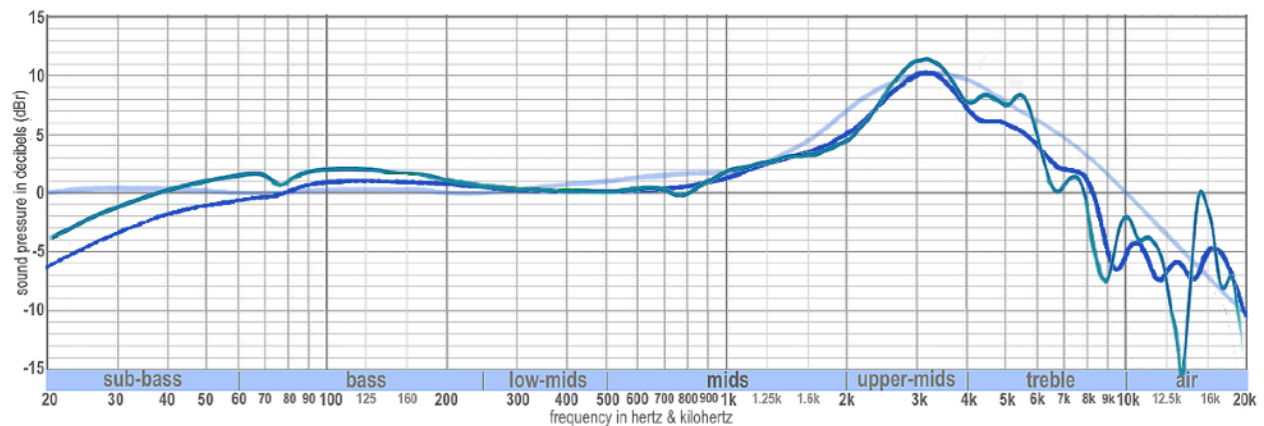


Fig. A3: HD 650 measurements: Oratory1990 (navy) vs Crinacle (turquoise) (neutral = pale blue curve)

We see that Crinacle's unit of the HD 600 measures somewhat lower in loudness than Oratory's before 200 hertz and after 4000 hertz. This could be simple unit variation (although Oratory's graph is the average of multiple units' measurements) or it could also include some difference in measurement technique. What we do know is both Oratory's and Crinacle's measurement equipment have been precisely calibrated to the same standard. We can't know, but we do know that Sennheiser has a strong reputation for unit to unit consistency, so the degree of high frequency divergence here is a just a bit surprising to me.

Now let's concentrate solely on Crinacle's data. Here's how the Crinacle HD 600 and HD 650 compare:

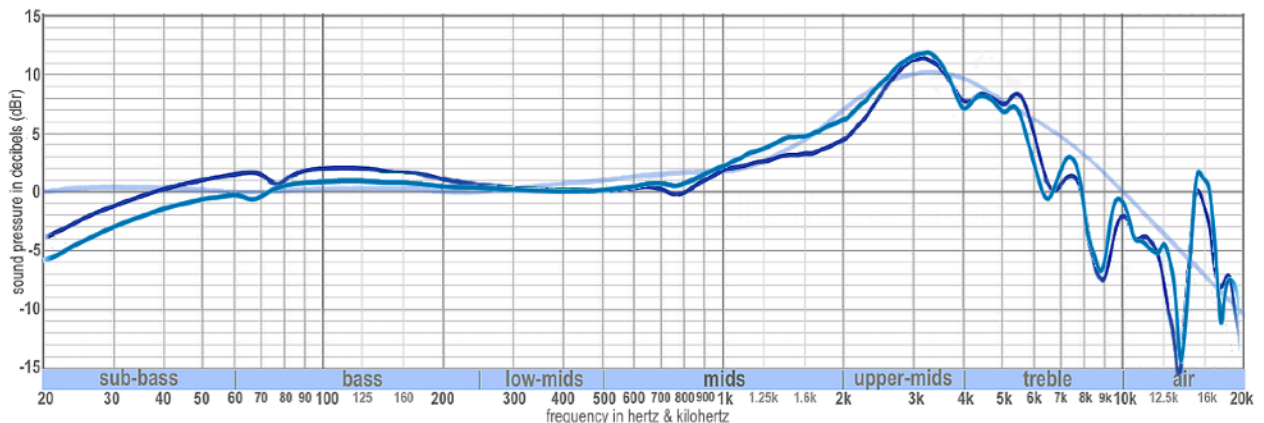


Fig. A4: Crinacle measurements: HD 600 (turquoise) and HD 650 (navy)

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As with Oratory1990's measurements in Fig. 5 above, Crinacle's are consistent with the headphone community consensus that the HD 650 is somewhat warmer (more bass and/or less treble) than the HD 600 but it gets there in a different way.

Here is how the two headphone models differ when measured with new/fresh ear pads compared to well worn ear pads:

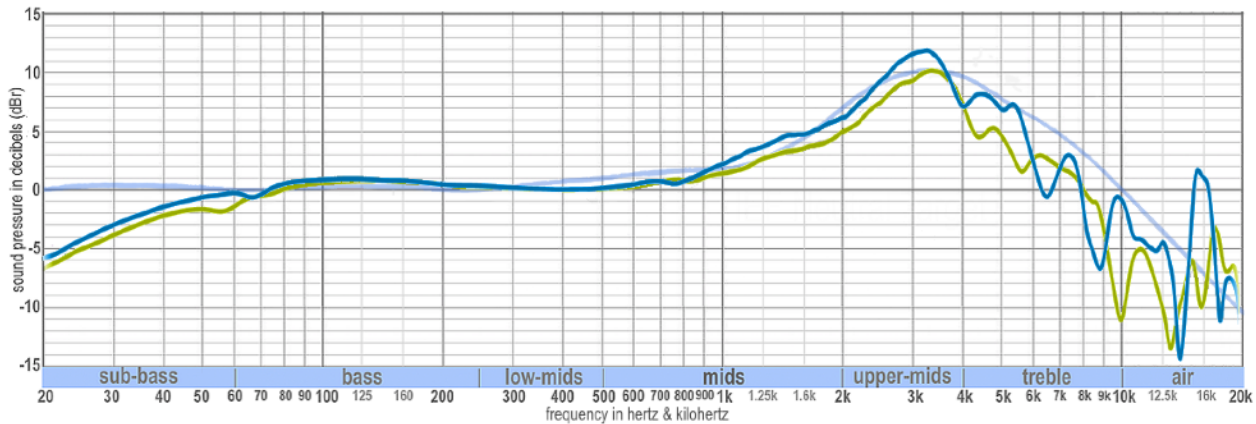


Fig. A5: HD 600 (Crinacle): fresh (turquoise) vs worn (olive) ear pads

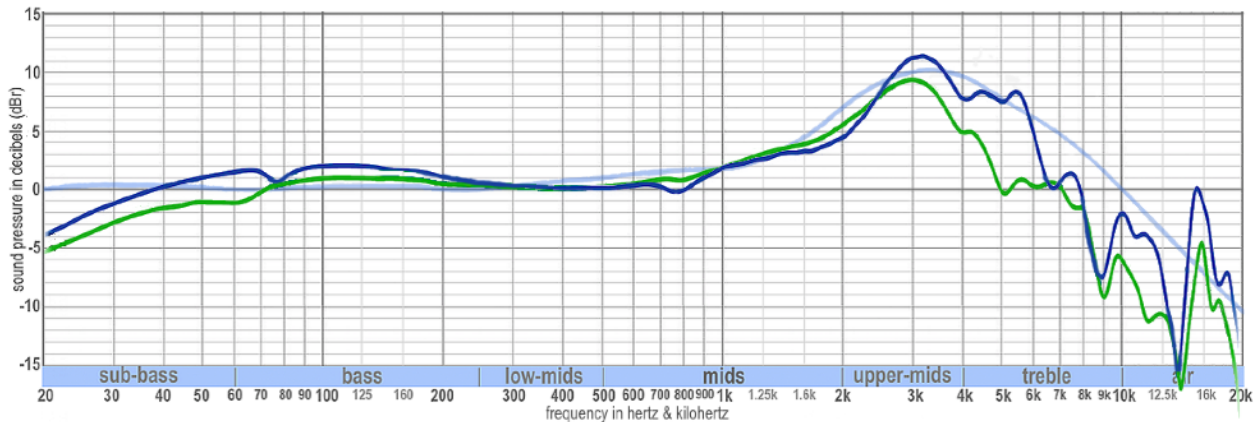


Fig. A6: HD 650 (Crinacle): fresh (navy) vs worn (green) ear pads

The HD 600 does get somewhat darker (less treble) with pad wear, but the HD 650 gets drastically darker. Given unit to unit variation, we'd need more data to conclude that the HD 650 drastic pad wear result is predictive. But I think we can conclude that pad wear for both the HD 600 and HD 650 will gradually result in a decrease in treble response over time.