Kali Audio LP-6 Powered Studio Monitor

Measure of Value

By
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Photos by Cynthia Wenslow

Photo 1: The Kali LP-6 monitor speaker has a plain, businesslike appearance, with a 6.5" woofer-midrange, a 1" tweeter, and a front-firing port.

It's been observed that if automobiles developed at the same pace as computers, a family sedan would get 10,000 miles per gallon, travel 500 miles per hour, and cost $25. Although this hasn't happened to cars, it's certainly happened in audio—we have essentially perfect sources and recording gear that cost less than a couple tanks of gas and are smaller than a dictionary.

Along those lines, the past couple of years have seen the emergence into the mainstream of a product category of small, powered loudspeakers that are highly engineered, low cost, high performance, and remarkably inexpensive. With the addition of a music source, they can form the basis of an excellent sound system, replacing separate power amplifiers and speakers with integrated solutions, and doing this for prices that would have been unimaginable just 5 years ago. They can also be used in home studios for monitoring and mastering purposes, taking a role that until recently was dominated by either poor quality inexpensive boxes with shrieking and rattling resonances or by ultra-expensive professional-grade monitors. The idea is to offer 90% of the sound of the latter at a similar price as the former—and add in amplification and equalization at no extra cost.

All of these new products have several things in common. They are designed by engineering teams in the United States, use componentry and tooling manufactured with great efficiency by high-quality companies in China, use digital signal processing (DSP) and active crossovers, leverage modern amplifier technologies, which can be built into the cabinets without worries of heat and excessive electrical use, and have form factors suitable for unobtrusive placement in homes and studios. Some even come with remote controls, which make them quite convenient to use in a living room setting.

A big driver here is the emergence of prosumer audio and home-based studios as a rapidly growing market. Musicians have discovered that with a laptop computer, a couple of microphones, some inexpensive (or free) software, and an interface, they can create music in a home setting that can rival studio productions.

The availability of high-quality recording without the expense of a studio has unleashed the creativity of hundreds of thousands of musicians who no longer have this barrier to entry. This has resulted in a flood of so-called bedroom productions, and although Sturgeon's Rule applies with a vengeance, the diversity and the creativity of available music

has been a huge boon to music enthusiasts whose preferences lay outside of the mainstream. Besides recording equipment, high-quality monitor speakers are necessary for mixing and mastering, and with the new wave of powered loudspeakers breaking free of the old constraints (passive crossovers, separate amplification), quantum leaps in performance can be achieved. That's because the loudspeaker drivers and the amplifiers are properly matched to one another, DSP can be used to generate high slope crossovers (which can reduce distortion and give unprecedented control of polar pattern) and phase correction, and the built-in signal processing capabilities can be used to equalize the speakers for different placement options.

Enter Kali

Kali Audio is a new California-based company formed by a group of (now former) JBL employees who left following the sale of Harman (JBL's parent company). They brought with them expertise in acoustic design, driver engineering, DSP, and perhaps most importantly, knowledge of how to source high-quality subcontracted product from China. Their choice of a company name has set up much speculation among bloggers and YouTubers—in Hinduism, Kali is a destroyer of evil forces, but also represents ultimate reality and liberation.

The lead engineer at Kali is Charles Sprinkle, who is best known for the fabulous JBL M2 loudspeakers, as well as the popular LS305 and LS308 monitors. The Kali LP-6s can be seen as direct competition to the 305s, and perhaps a bit more, as we shall see.

A year or so ago, I wrote a review of one of the products falling under the new paradigm, the excellent Vanatoo Transparent Zeros (see Resources). The Kali LP-6 speakers under review here are, in a sense, the opposite of the Vanatoos—the Vanatoos are home audio speakers that could be used for monitoring, whereas the Kali LP6s are monitoring speakers that could be used for home audio.

The LP-6s (the LP stands for "Lone Pine," a town in the California Sierra Mountains) have an almost Amish styling, plain but functional (see **Photo 1**). They're basically unadorned 0.75 ft^3 15 lbs. black boxes with no grilles, a 6.5" plastic coned woofer, an oddly shaped front port, and a dome tweeter that is loaded with a shallow horn or waveguide.

The lack of a grille might cause issues in living room setups where there's children present, but of course, for their intended use as monitors, the lack of grilles is a positive—there's no acoustic issues with covering the front of the speakers. Front port location is useful for maximum placement flexibility. Their matte black finish and simple near-rectangular shape allow the speakers to blend in nicely with studio consoles and not be a visual distraction—clearly this design concentrates on function rather than form. The only concession to styling is the blue LED sitting between the woofer and the tweeter, indicating that the speaker is powered on.

When we view the rear of the speaker, we get some hints of the design's sophistication (see **Photo 2**). Besides an IEC connector for power (the internal power supplies can run off any line voltage from the Japanese 100 V to European 220 V), there are three analog inputs: an unbalanced RCA and balanced 1/4" TRS and XLR sockets. The RCA input is meant for home audio sources and has a sensitivity of -10 dBV (0.32 V) for full output. The TRS and XLR inputs are set for pro audio line levels and have a sensitivity of 6 dBU (1.5 V). The sensitivities are marked near the input jacks, but it's odd that they use different units (dBV versus dBU) for each one.

Next to the XLR jack is a volume control with a range of -∞ (fully off) to +6 dB, which can be used to adjust the input sensitivity for different sources—it has a detent at 0 dB, which is where Kali Audio recommends you set it unless you have sources with non-standard output levels. The balanced connectors are wired in parallel, so they should not be used simultaneously. The user can choose between balanced and unbalanced inputs by settings on the DIP switches located just above the volume control.

The speakers each contain two 40 W Class-D amplifiers along with the DSP (see **Photo 3**). These

Photo 2: The rear of the Kali LP-6 has analog inputs, controls, and a clear set of graphics indicating DIP switch setting for different placements, frequency response tailoring, and inputs.

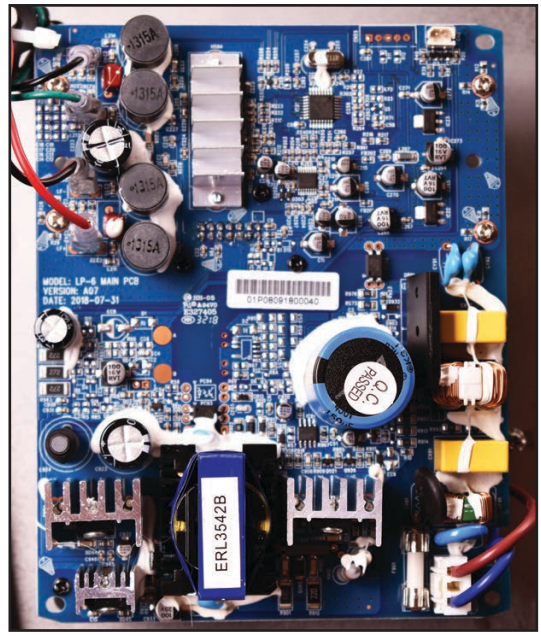

Photo 3: All DSP and audio power are provided by a pair of built-in 40 W Class-D amplifiers.

are sufficient to achieve over 100 dBSPL at a 1 m distance, far louder than I'm comfortable with. At that level, limiters start kicking in to protect the drivers from burnout. At my listening position, 90 dBSPL sounded clean and unstrained. The amplification is clearly well matched to driver efficiencies. The crossover point between the 6.5" bass/midrange driver and the tweeter is set to an unusually low 1.5 kHz. Generally, a crossover point this low will stress a small tweeter, increasing midrange distortion and reducing power handling and SPL capability. Presumably, Kali could get away with this by using high slope crossovers and taking advantage of the tweeter loading by the waveguide.

Photo 4: The oddly shaped port is made from an injection-molded plastic and is flared to reduce turbulence.

The really interesting stuff is also controlled by the DIP switch settings—equalization for boundaries. It's well known that a speaker's frequency response will change depending on where it's sited within a room. A simple example is bass response—if a conventional speaker is standing free in a large space, it is essentially firing its bass out omnidirectionally (i.e., into 4 π space), whereas the midrange and treble are firing mostly forward (i.e., into 2 π space). If you place the speaker against a wall, the bass will now be firing into 2 π space. So if a speaker is balanced to have a flat bass response when out in the room, the bass response will be doubled when the speaker is placed against the wall and will sound too heavy. There are other effects that come into play as well (e.g., interference in the midrange due to the physical depth of the speaker when wall placement is used), but clearly a speaker will only function as intended when it is placed in the type of environment for which it was designed.

This is a severe restriction for monitoring. Sometimes placement on a console is desired. Sometimes speakers are placed on stands away from walls. Sometimes speakers are placed against walls, all depending on the studio (or bedroom!) layout. With this in mind, Sprinkle and his team did a series of measurements in a typical studio (in their case, The Village Studios in Los Angeles, CA) to determine the effects of different placement on the speakers' frequency response. This information was used to create a set of equalization curves, any of which can be selected by the user with DIP switch settings, depending on the speaker placement. The graphics on the back of the speaker seen in Photo 3 are simple and clear. In addition to the boundary equalization settings, the user can also select a relatively subtle (2 dB) treble or bass shelf as a tone control.

As I mentioned earlier in the article, the LP-6s use a port for the bass that appears to be an injection-molded plastic. The shape of it is rather unusual. Kali claims that the shape was determined in order to have all air flowing through the port at the same velocity (implying laminar flow). It certainly gives the front panel a distinctive appearance. **Photo 4** shows the shape of the port inside the cabinet and it clearly has a more complex flared shape than the usual cylindrical port. Between the molds needed for the port and for the tweeter waveguide, tooling costs for production would likely not have been trivial. Again, I am amazed at what Kali has been able to do for the price.

I noted that once the back panel is removed, the LED can easily be disconnected from the circuit board if it bothers you. I'm fine with it, but for some people, the blue light can be a visual distraction.

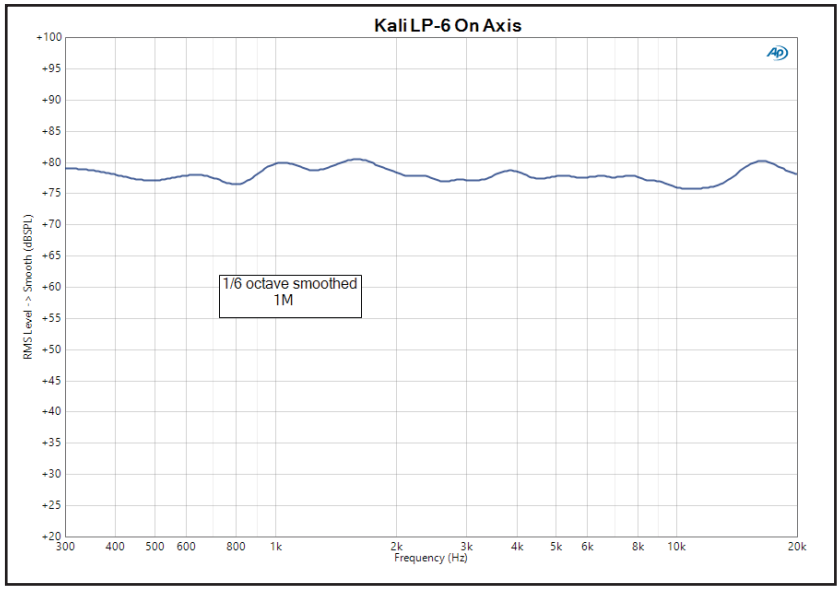

Figure 1: The on-axis quasi-anechoic response at 1 m is flat to within 2 dB.

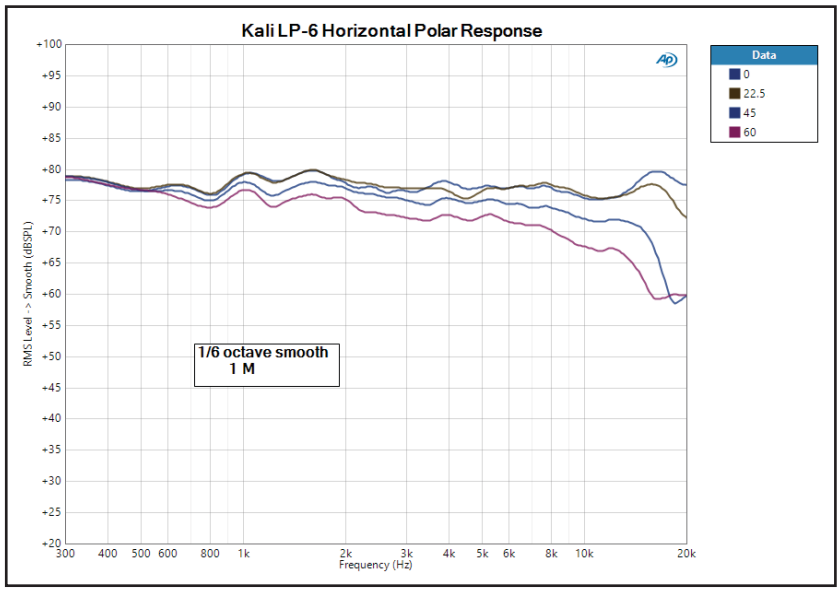

Figure 2: The LP-6's horizontal polar pattern is almost textbook, with response nearly unchanged at small angles, then rolling off smoothly at larger angles.

About the Author

Stuart Yaniger has been designing and building audio equipment for nearly half a century, and currently works as a technical director for a large industrial company. His professional research interests have spanned theoretical physics, electronics, chemistry, spectroscopy, aerospace, biology, and sensory science. One day, he will figure out what he would like to be when he grows up.

The Kali LP-6 In Use

I set the LP-6s up in my lab listening space on stands which raised them to height where the blue LEDs were at ear level. They were spaced approximately 2 m apart and about 1.5 m from each sidewall. This position brought then about 2.5 m from the back wall, and the listening position was about 3 m away. According to Kali, the positioning away from boundaries is the optimum way to use these monitors. The LP-6s were driven from a balanced source (a Focusrite Scarlett 2i2) through the XLR inputs, with the LP-6's volume controls set to 0 dB.

With a wide variety of recorded music, the tonal balance was neutral and clean, with a more forward and analytical sound than the Vanatoo T0s that were formerly in that position. Tonally, they were a close match to my reference speakers—a very close match. The apparent soundstage was not as large as the T0s, but was in no way constricted-sounding. Imaging was precise and solid. What really struck me as unusual was how wide the listening axis was—I could move my head vertically and horizontally without hearing any change in tonality or image wander. These do not have a narrow sweet spot! The LP-6s are superior to nearly everything else I have heard in this regard.

The bass is reasonably extended for the genre, covering the entire fretboard of an electric bass (to 41.2 Hz for E1), well-defined and far from anemic, but clearly the bottom octave from 20 Hz to 40 Hz just isn't there. That's not unexpected for speakers this size, but does suggest that for critical listening using material like pipe organs or electronic instruments, subwoofers might be appropriate. Hard drive did not result in any audible chuffing noise through the port, so the odd port shape seems to be effective. Overall, this was very good bass for a box its size, and pushing high SPLs didn't muddy it.

Listening to tracks from my own recordings, which are uncompressed and dynamic, I got no sense of any compression, and the ability to really take my mixes apart (aurally) was impressive—unfortunately, I was able to clearly hear a few of my clumsier fades. I'll blame the speakers because it couldn't possibly be my fault!

I then placed the speakers on my desk, flanking my mixing board (aka, the Adobe Audition control panel on my laptop), with the DIP switches set to compensate. The equalization worked as advertised, with only minor differences from stand placement. Here, though, I ran into a deficiency—with the speakers under a meter away from my ears, I could plainly hear a hiss from the tweeters. It wasn't particularly loud, but when the music faded out and the room was quiet, I could certainly notice it. Once the music started up, it was masked, but

this may be more of a problem for people with lower auditory thresholds and more extended high frequency perception than my old ears. With the speakers sited on stands 3 m away as described above, the hiss was totally inaudible to me.

Finally, returning the speakers to the stands away from boundaries, I ran the superb Sonarworks Reference 4 room measurement and correction software (see Resources). The amount of needed correction past 300 Hz was minimal, and unlike the case with other speakers with which I've used this system, the changes in sound were quite subtle. Where the Sonarworks came in handiest was allowing the LP-6s to simulate other speakers, and the chameleon-like change in the sound was striking. This was especially true for the Yamaha NS10 simulation, which was startlingly (and distressingly!) true to form. Using the Brüel & Kjær (B&K) 1974 emulation curves, the LP-6s suddenly sounded more like typical audiophile speakers—but at a fraction of the cost.

Measurements

As usual, my measurement setup consisted of an Audio Precision APx525 audio analyzer, an Audio Precision APx1701 acoustic interface, and a PCB Piezotronics 377B01 ½" calibrated condenser laboratory microphone. For near-field woofer and port measurements, I switched mics to the PCB Piezotronics 377C03 ¼" mic, which has a higher SPL capability than the 377B01.

The APx525 balanced outputs were cabled to the LP-6 balanced XLR input, with the LP-6 volume control set to 0 dB. Frequency response and distortion

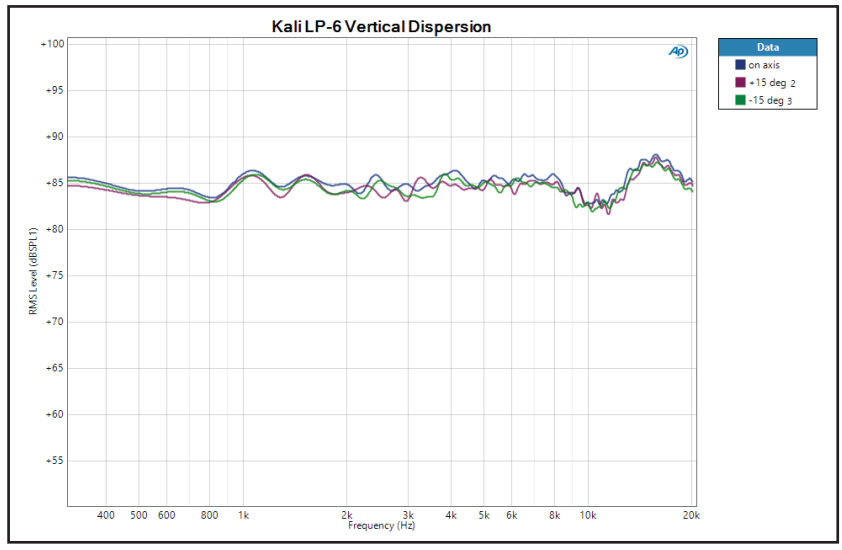

Figure 3: Despite non-coincident drivers, the LP-6's vertical polar response is impressively even.

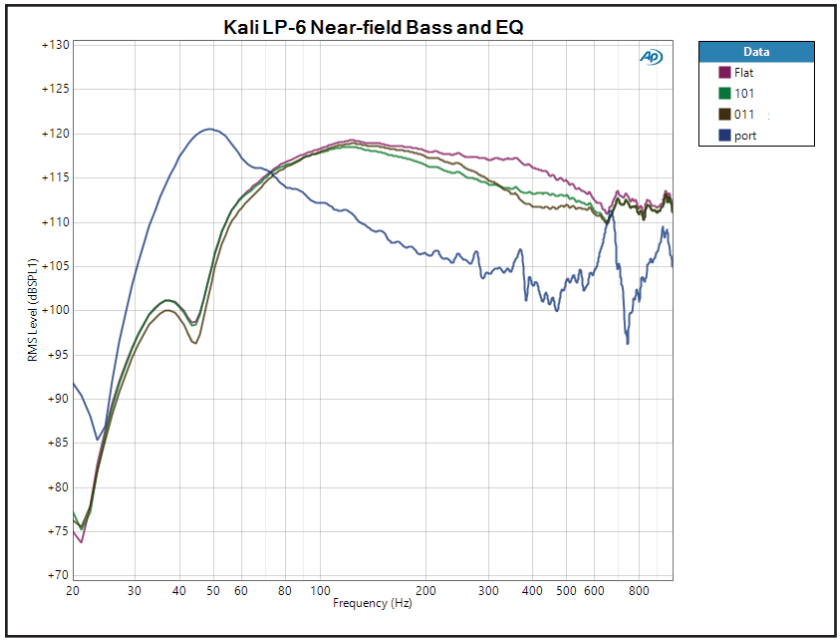

Figure 4: Near-field measurements of the woofer and port show response starting to roll off at 40 Hz. The DIP switch settings, indicated by their binary code, adjust equalization for different placements (see text).

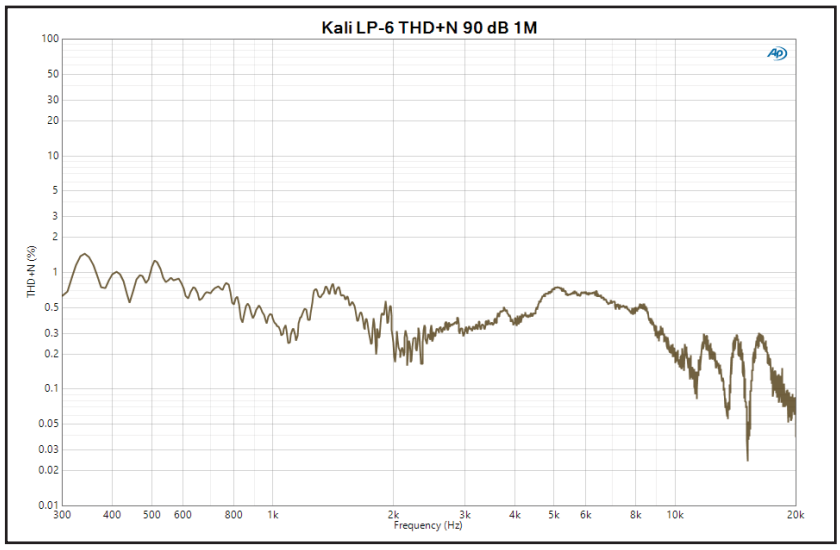

Figure 5: This graph indicates harmonic distortion versus frequency at 1 m on axis.

measurements were acquired using a swept tone, which is transformed into an impulse response and Fourier transformed after gating out the reflections.

Figure 1 shows the unsmoothed quasi-anechoic (gated FFT) frequency response at 1 m on-axis, the axis being in line with the blue LED. The response is quite smooth and flat and doesn't show the typical downward slope or midrange dips seen in many other speakers. The response fits within a ±2 dB window. In the treble, the waveguide causes a small dip and peak, but I emphasize "small." I was unable to hear any coloration that I could attribute to this feature, despite my personal prejudice about anything resembling a horn. There's a slight elevation at around 1 kHz, which may correlate with my impression of a "forward" sound.

And the horn, errrr, waveguide does seem to work as intended, especially coupled with the crossover and DSP. **Figure 2** shows the variation in frequency response with horizontal angle, taken at a 1 m distance. The response at 22.5° off-axis is almost unchanged from the on-axis response. As the angle increases to 45° and 60°, the treble smoothly rolls off. This engineered polar pattern unsurprisingly follows the recommendations developed at Harman by Floyd Toole through extensive psychoacoustic testing (see Resources).

Looking at vertical polar pattern, comparing on-axis frequency response to responses at +15° and -15° (see **Figure 3**), the waveguide and crossover combine to provide an extremely smooth result—usually, one sees significant lobing vertically when a tweeter and woofer are non-coincident, with big peaks and dips in the midrange. This is extremely impressive, some of the best results in this respect that I've ever seen. The horizontal and vertical dispersion results imply that the "sweet spot" is rather broad and that imaging should be excellent, which indeed it was.

Figure 4 is admittedly a bit busy. At the low end, it shows the bass response at the cone and at the port taken as a near-field measurement as described

Resources

D. B. Keele, "Low Frequency Loudspeaker Assessment By Near Field Sound Pressure measurement," *Journal of the Audio Engineering Society*, Volume 22-3, pp. 154-162, April 1974,
www.xlrtechs.com/dbkeele.com/PDF/Keele%20(1974-04%20AES%20Published)%20-%20Nearfield%20Paper.pdf

F. Toole, *Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeaker and Rooms*, 3rd edition, Routledge, 2018.

S. Yaniger, "Vanatoo Transparent Zero Powered Speakers," *audioXpress*, January 2018.
www.audioxpress.com/article/fresh-from-the-bench-vanatoo-transparent-zero-powered-speakers

S. Yaniger, "Sonarworks Reference 4 Studio Edition Loudspeaker and Headphone Correction System," *audioXpress*, July 2018,
www.audioxpress.com/article/fresh-from-the-bench-sonarworks-reference-4-studio-edition-loudspeaker-and-headphone-correction-system

by Don Keele (see Resources). I measured the cone and vent separately and overlaid their spectra. You can see that the reflex is tuned to 45 Hz, and the overall response below that rolls off at a fourth-order (24 dB/octave) rate. The speaker's bass response holds up very well to the roll-off point, which correlates with my subjective impression of strong but not ultra-deep bass. The peaks and dips at 600 Hz to 900 Hz are likely due to reflections from the rear of the cabinet reflected through the port or from pipe resonances in the port itself. In listening tests, I did not notice coloration in that region.

In Figure 4, I also included the effects of a couple of the boundary equalization settings. The "flat" response is with the speaker set for stand mounting away from walls. I marked the others with the DIP switch setting for their particular speaker placement.

There are eight settings in all, but I show two examples here for the purposes of brevity. The 101 and 011 settings are the equalized responses for desktop mounting away from a rear wall surface and desktop mounting against a rear wall, respectively. I had been expecting a simple bass correction, but the curves shown here indicate that the equalization not only cover the bass range, but also boundary effects in the midrange up to 600 Hz or so. Not shown are the bass and the treble trim options, also DIP switch selectable, which shelve the regions above and below 1600 Hz or so by about 2 dB up or down.

The distortion versus frequency at 90 dB SPL and 1 m distance is shown in **Figure 5**. While not exactly a low-distortion champion, the LP-6's distortion is reasonably low in the critical midrange and treble, with none of the spikes one can see in inexpensive speakers having significant resonances or poorly implemented crossover slopes and positions. In fact, through the critical parts of the midband, the distortion remains at 0.3% and lower. Analysis of the harmonic content (see **Figure 6**) shows that the distortion is dominated by third-order, especially in the tweeter range, which suggests a very symmetrical motor assembly on the drivers.

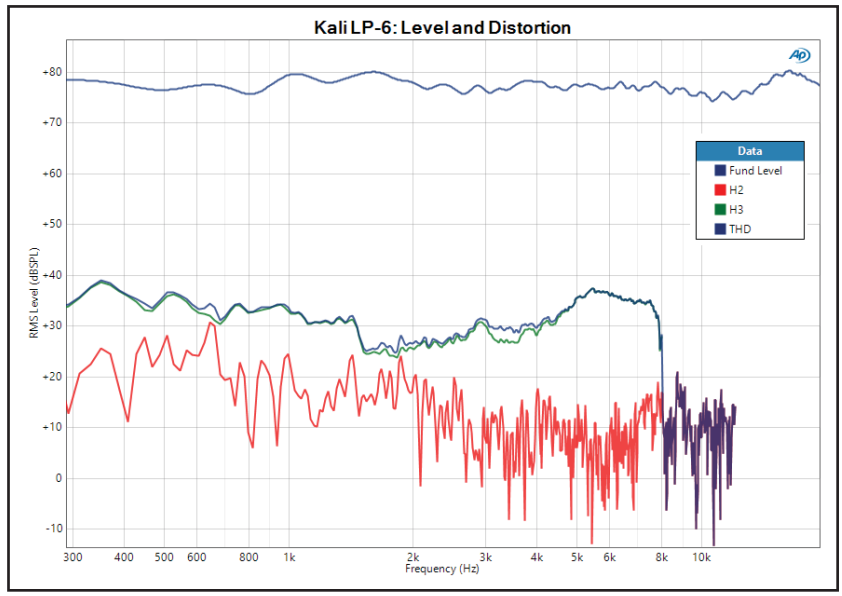

Figure 6: Comparing total distortion to distortion by individual harmonics, the third-order products are seen to be dominant.

Photo 5: Near-field measurement of the Kali Audio LP-6 Studio Monitor shows excellent bass extension and quality.

Overall Evaluation

You're probably sick of me saying "I can't believe what you get for $300 per pair!" so I won't say it again. But I'll sure think it. The sound is clean, dynamic, and uncolored, and from 40 Hz up, makes one reconsider whether spending more will get real improvement.

There are a few downsides: the slight hiss at close range, the lack of true deep bass and wall-shaking SPLs in larger rooms, and a lack of digital inputs. The last is supposed to be addressed with a Bluetooth adapter bridge scheduled for release sometime during mid-2019, but I would like it more if there were a TOSLINK optical or coaxial digital input. For home music use, I miss having a remote control like the one supplied with the Vanatoo speakers.

But home use is a bonus. For studio mixing, mastering, and monitoring, the Kali LP-6 more than delivers the goods, with clean, dynamic sound, superb dispersion, and a very clever and well-thought-out boundary correction system. All of that for $300 including amplification (see **Photo 5**). Highly, highly recommended.