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APRIL 2015

Benchmark AHB2 Stereo Power Amplifier

Photo 1: Benchmark's new AHB2 stereo power amplifier uses feed-forward error-correction technology patented by THX that virtually eliminates crossover distortion. The front panel status LEDs indicate Clip, Temperature, and Mute conditions. (Photo courtesy of Benchmark Media Systems, Inc.)

By
Gary Galo
(United States)

When I first started attending Audio Engineering Society (AES) conventions in the late 1970s, "pro" audio equipment was invariably scorned by the audiophile community. Most audiophiles would have never used the typical pro preamplifier, power amplifier, or studio monitoring loudspeaker in their home audio systems.

Some readers will remember those sizzling coaxial loudspeakers with their bright blue horn tweeters, which so many manufacturers used in exhibits back then. The prevailing view at AES was that all amplifiers sounded the same, and those who claimed to hear differences were delusional and lacking in scientific rigor. The dreadful monitoring systems in use at the time almost ensured that all amplifiers would sound the same—lousy—and that the first CDs and players would be hailed as providing "perfect sound forever."

Much has changed over the past 35 years, in part because several consumer audio manufacturers also make equipment for the professional market and manufacturers of professional audio products pay greater attention to the sonic performance of their products than they did in decades past.

The quality of professional studio monitor loudspeakers has advanced to a state where differences in the chain feeding those loudspeakers are readily audible. The result is that professional recording engineers now insist on the best-possible electronics because they know it matters and can hear the difference. High-resolution digital audio has done much to challenge equipment designers, and that has raised the bar even further for digital players, preamplifiers, power amplifiers, and monitoring loudspeakers.

Bridging the Professional and Consumer Audio Worlds

Benchmark Media Systems is a company that has successfully bridged the professional and audiophile worlds. It is an American firm that designs and manufacturers all its products at

AHB2 Stereo Power Amplifier

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www.benchmarkmedia.com
Price: $2,995

its Syracuse, NY, facility. Although this pro-audio manufacturer didn't specifically set out to cater to audiophiles, the exceptional transparency of its DAC-1 USB digital-to-audio converter caught the attention of the high-end audio press and received universal praise from audio reviewers.

For several years, I have been using the DAC-1 USB and the ADC-1 A/D converters at The Crane School of Music at SUNY Potsdam and have been extremely impressed with their performance. Now that I am retired and doing volunteer work in the school's recording archives, transferring vintage material to digital format, those Benchmark products remain essential tools in my studio.

In the spring of 2013, I purchased the PRE-420 four-channel microphone preamplifier specifically to record Benjamin Britten's *War Requiem*, which the Crane Chorus and the Crane Symphony Orchestra performed in April of that year under guest conductor Christof Perick. This exceptionally quiet and transparent microphone preamp—which I used with Schoeps MSTC-6 and MSTC-5 ORTF stereo microphones—was fully up to the task of recording Britten's complex, large-scaled work.

Benchmark's DAC2 Line

Nor has Benchmark rested on its laurels. In 2012, the company introduced its DAC2 line as a replacement for the DAC1. The DAC2 has taken the performance of its predecessor to the next level, with a 32-bit DAC chip, UltraLock2 jitter attenuation, and native direct-stream digital (DSD) conversion. Benchmark also announced a new, high-resolution stereo power amplifier at the New York AES convention in 2013, but continued refinement of the design delayed final production for about a year. The AHB2 amplifier is now available, and Benchmark is calling it "the quietest, cleanest amplifier on the planet" with a signal-to-noise ratio (SNR) of 132 dB and total harmonic distortion (THD) at –118 dB (see **Photo 1** and **Photo 2**).

Benchmark notes that while 24-bit digital audio and DSD offer better than 120 dB of dynamic range, the noise floor of most power amps prevents them from achieving anything greater than 16-bit performance. Benchmark claims that its "entirely new patented technology eliminates most sources of distortion while extending the dynamic range well beyond that of most high-end amplifiers." The AHB2's dynamic range approaches 130 dB, making it 10 to 30 dB quieter than competing products, which allows it to realize the full potential of 24-bit pulse code modulation (PCM) and 1-bit DSD audio. The technology in the AHB2 virtually eliminates crossover distortion while retaining the efficiency of Class-AB designs.

AHB2 Overview

The AHB2 was named after Allen H. Burdick, who founded Benchmark Media Systems back in 1983 and passed away in 2013. This is a fitting tribute, since the AHB2 continues the Burdick legacy of technical innovation. Indeed, Benchmark's new power amplifier is arguably the most innovative product the company has produced to date. The AHB2 challenges several established "conventions" regarding power amplifier design including:

- The best audio power amplifiers are inefficient and generate lots of heat. High-efficiency invariably means inferior performance.
- Class-AB operation of the output stage is a minimum requirement for high-end sound, but Class A is preferred (generating the greatest amount of heat).
- High-end power amplfiers are large and heavy, with massive power transformers, heatsinks, and large power supply filter capacitors.

The AHB2 uses technology patented by THX (www.thx.com), which it calls Class AAA, for "Achromatic Audio Amplifier." (In this context "achromatic" means neutral or uncolored.) The AHB2 was designed to combine the high-efficiency of Class-AB power amplifiers with noise and distortion performance that pushes the current state-of-the-art designs. The short article "A Radical Approach to Power Amplification" by John Siau, Vice President and Director of Engineering at Benchmark, describes the concepts employed in this amplifier, noting that "the AHB2 is a complete 180° departure from traditional high-end amplifier designs." (This and several other interesting papers are available on Benchmark's website under Application Notes and White Papers.) The design concepts are covered by two US and four international patents authored by

Photo 2: The Benchmark AHB2 is available with a silver front panel or with a black front panel. (Photo courtesy of Benchmark Media Systems, Inc.)

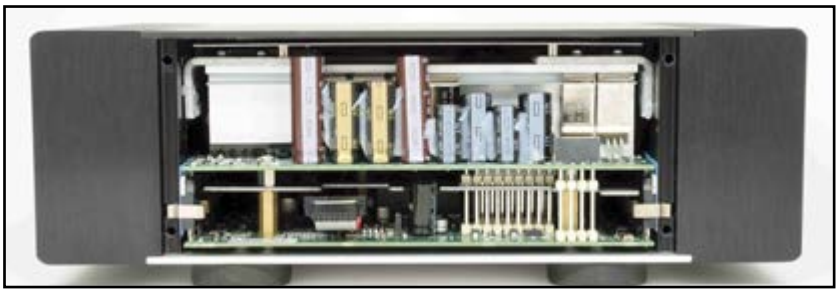


Photo 3: This is a front, inside view of the AHB2 with the front panel removed. Shown from bottom to top is the main amplification PC board, switching-mode power supply PC board, and RFI shield. (Photo courtesy of Benchmark Media Systems, Inc.)

inventors Owen Jones and Lawrence R. Fincham. US patents 8,004,355 and 8,421,531 can be downloaded as PDF files at www.google.com/patents.

Although the principles described in those patents can be applied to a Class-B output stage, Benchmark has chosen a more cautious approach and employed a Class-AB output stage in the AHB2. A sophisticated application of feed-forward error correction is the key to reducing crossover distortion to vanishingly low levels. Each channel of the AHB2 actually has two amplifiers—the main bi-polar Class-AB amplifier for driving the loudspeakers, and a low-power error-correction amplifier with ultra-low levels of distortion (see **Photo 3**).

Siau notes that the THX-patented feed-forward technology is more effective in cancelling distortion than conventional feed-forward topologies. The two amplifiers combine to create a "near-perfect null of all distortion components." The amplifier was designed to be virtually distortion-free at all output levels, with loading ranging from benign to difficult, and taxes the abilities of the finest audio measurement systems available (Benchmark uses the Audio Precision AP2722).

The concept behind feed-forward error correction is that main amplifier errors are measured, inverted in polarity and fed to the output to cancel the errors. A small, error-correction amplifier is needed to buffer the error signal, and any power amp employing error correction can be no better than the error-correction amplifier itself.

Benchmark's error-correction amplifier is an ultra-low distortion circuit that yields a "high-precision mirror" of the errors produced by the main Class-AB amplifier. Class-AB amplifiers will always produce crossover distortion, which can be minimized by precise control of the bias. But, it can't be completely eliminated. Siau also notes that conventional feedback networks have difficulty "correcting the transients caused by push-pull crossover transitions." The feed-forward error correction is fast and precise and virtually eliminates all traces of crossover distortion even under heavy loading, despite the use of very low output-stage bias currents.

In its brochure on the AHB2 design, "In a Class of its Own" (available from Benchmark), THX notes that AAA technology has the additional benefit of high power-supply rejection ratio, dramatically reducing distortion and noise induced by the power supply.

Traditional feed-forward error correction combines a conventional feedback loop with a feed-forward network. The Jones/Fincham patents make it clear that the application of error correction is more sophisticated than in previous feed-forward designs, since the technology described in the patents involves multiple networks. While the patents illustrate the concepts behind the design, the development of the AHB2 power amplifier appears to have gone even further. Jayant Datta, Director of R&D Engineering for THX, noted that the AAA technology "uses multiple networks of local and global feedback in addition to multiple feed forward error correction paths to ensure that the amplified output signal is just a scaled version of the input, with almost no distortion."

Class H is another concept employed in the AHB2. This technique is not new and involves switching the output stage to higher-voltage supply rails at higher signal levels, which is much more efficient than running the supply rails at full voltage at all times.

Class H is a technique used in conjunction with a Class-AB power amplifier, and not a replacement for Class-AB topology. The problem, of course, is that switching the supply rails increases amplifier distortion, so this concept has never gained much favor in high-end audio circles. Siau notes that with conventional negative feedback, "every rail switch point adds another layer of crossover distortion." The proprietary feed-forward technology used in the AHB2 is so effective that the output stage can be switched between multiple supply rails without any increase in distortion. In addition to honoring Burdick, the model designation also refers to the AHB2's combined use of the two classes of amplification.

Siau believes that most power amplifier are designed with the overall gain set too high, which raises the audio system's noise floor. Lowest noise will be achieved with a low-gain amplifier fed by a sufficiently-high output signal from the source, rather than relying on the power amp to compensate for low input levels.

Another issue is that most analog volume controls have the best channel-to-channel tracking when operated around the 12:00 position—with too much power amp gain, you're always turning the volume down on the preamplifier. The AHB2 has been designed so maximum output will be achieved

with an input level of 22 dBu, or 9.8 VRMS.

To accommodate lower input levels, the amplifier's ultra-low noise input preamplifier can be switched to two higher gain settings: 14.2 dBu/4 VRMS or 8.2 dBu/2 VRMS. This enables the amplifier to be interfaced with a variety of sources, especially consumer equipment with unbalanced outputs.

Switching-Mode Power Supply

Power amplifiers generally use unregulated, linear power supplies for the output stage. Many of the better amplifiers employ regulation for the input and voltage-gain stages, where regulation will do the most good. Switching-mode power supplies are another concept that hasn't gained much favor in high-end audio, though that is gradually changing as the noise performance of these supplies continues to improve.

Siau rightly points out that the power transformers in linear supplies radiate hum fields at the line frequency and its harmonics. These hum fields can induce noise into the amplifier circuitry. Benchmark has solved this problem by using switching-mode power supplies in all of its new designs, but the switching supplies offer several performance improvements over previous types. Benchmark has set the switching frequencies well above the audio band, which allows the use of smaller magnetic components, minimizing the level of any stray magnetic fields. Benchmark also uses resonant switching, which is accomplished at low voltage and low current. This lowers switching noise and results in a supply that is much quieter than conventional switching power supplies. As is usually the case, it's not just the concept, but the actual design and execution that make a high-performance product (see **Photo 4**).

As I mentioned earlier, several amplifier manufacturers regulate the input and voltage-gain stages of their amplifiers. Regulating an output stage requires a regulator that can deliver massive amounts of current to the output devices, which requires every bit as much heatsinking on the regulators as on the output devices itself. Most designers consider this too wasteful and inefficient. Siau notes that the use of a switching-mode supply completely changes the efficiency equations because a switching supply can produce a regulated output efficiently without generating excessive heat. With regulation, the output voltage is not dependent on the AC line voltage, audio

Photo 4: This inside view of the AHB2 shows the top, switching power supply PC board in place. Benchmark's Resonant Switch-Mode supply features lower noise than conventional linear supplies. The high switching frequency allows smaller magnetic components, reducing the strength of stray magnetic fields. (Photo courtesy of Benchmark Media Systems, Inc.)

Photo 5: This inside view of the AHB2 shows the lower, main amplifier PC board. The Digital Protection Systems chip is the Xylinx Spartan 6-series FPGA device seen left of center in the front. The bipolar output transistors are mounted to the heatsinks with spring clips to ensure constant pressure regardless of temperature. (Photo courtesy of Benchmark Media Systems, Inc.)

program material, or loudspeaker loading. But, let's make one thing clear before moving on: Despite using a nonlinear switching-mode power supply, the actual amplification circuitry is linear. The AHB2 does not use a digital, or Class-D, or other type of nonlinear amplification circuit. The amplifier itself is a linear, Class-AB design.

Another radical departure from conventional amplification is the lack of large power supply filter capacitors. All conventional power amplifiers rely on the energy stored by the filter capacitors to maintain supply voltage and current, while reducing ripple. But, slow recovery after musical transients is invariably a problem. Benchmark's regulated, switching-mode supply has enabled it to eliminate nearly all post-regulator energy storage.

The regulation itself maintains constant rail voltage and current, and quickly responds to instantaneous changes in loading, while ensuring low ripple voltage and isolation from AC power line anomalies. The AHB2's exceptional low-noise performance would be compromised if the amplifier generated any mechanical noise of its own. The most common sources in power amplifiers are buzzing power transformers and cooling fans. The switching-mode power supply solves the first problem, and the amplifier design's high efficiency ensures the amp can be passively cooled without a fan.

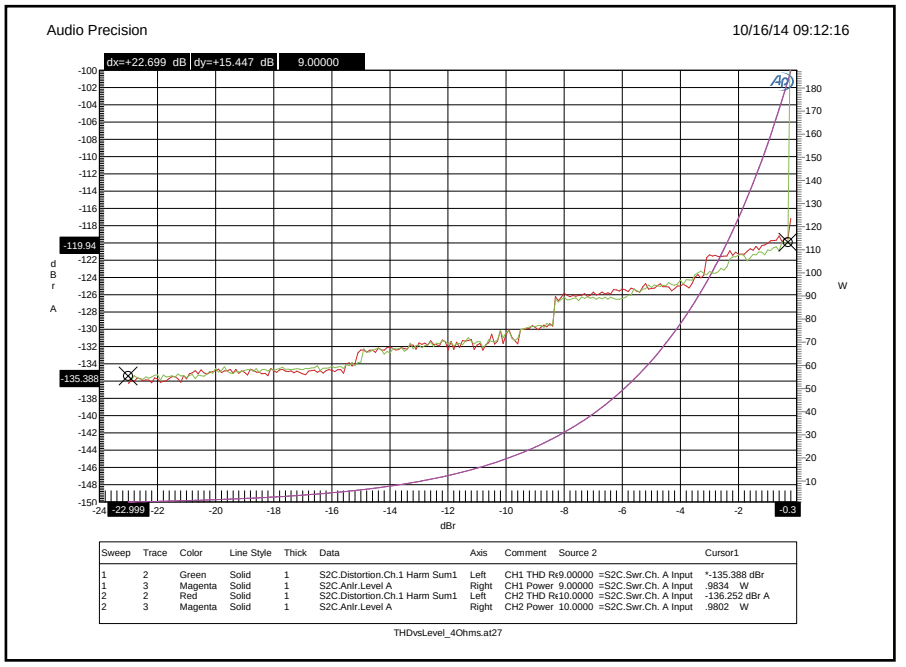
Photo 6: The AHB2's rear panel shows the balanced XLR input jacks, Neutrik SpeakON connectors, and gold-plated binding posts for loudspeaker connections, 12-V Trigger I/O, and the IEC power connector. The three-position gain and stereo/mono switches are on the lower left and right. (Photo courtesy of Benchmark Media Systems, Inc.)

Benchmark has also incorporated digital protection systems into the AHB2, which monitor the amplifier's critical functions, protecting the amp from faults and overload. The digital circuitry detects temperature, current, voltage, distortion, DC offset (very important!), short circuits, and signal loss. The circuitry is based on a Xilinx Spartan 6-series Field-Programmable Gate Array (FPGA) chip (see **Photo 5**). Benchmark has incorporated Neutrik NL4 SpeakON loudspeaker connectors. These connectors are widely used in professional audio circles, but are virtually unknown in the audiophile world.

Benchmark's tests have shown that Neutrik SpeakONs make a more reliable connection than the binding posts found on most consumer power amplifiers. The worst possible connection is the non-locking banana plug. Benchmark has actually measured higher distortion from non-locking bananas compared to the NL4s. (This is no surprise. Even with my modest Sound Technology 1700B distortion analyzer, which is limited to just below 0.002% THD, the difference between a good and a bad audio connection is often measureable.) To accommodate cables with conventional spade connectors, high-quality, gold-plated binding posts are also included, in parallel with the NL4 connectors.

The power output rating of Benchmark's new stereo power amplifier, belies its size and weight at 100 W/channel into 8 Ω. The entire package measures 11″ × 4″ × 9.5″ and weighs 12.5 lb. The AHB2, with both channels driven, can also deliver 190 W/channel into 4 Ω, and 380 W into an 8-Ω operating bridged mono. Output current is rated at 18 A, per channel, both channels driven (protection shut-down circuitry kicks in above that threshold).

The AHB2's front panel contains the power on button and a blue pilot lamp. There are three additional red LEDs per channel—Mute, Temp, and Clip—associated with the amplifier's digital protection circuitry. The Mute lamps come on when the amp is powered up, and turn off in a few seconds after safe operating conditions are established. Overheating will cause the Temp lamps to come on (and the amplifier to go into thermal shutdown). The Clip lamps will light up if the amplifier is driven into overload.



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment	Source 2	Cursor1
1	2	Green	Solid	1	S2C.Distortion.Ch.1 Harm Sum1	Left	CH1 THD R 9.00000	=S2C.Swr.Ch. A Input	*-135.388 dBr
1	3	Magenta	Solid	1	S2C.Anlr.Level A	Right	CH1 Power 9.00000	=S2C.Swr.Ch. A Input	.9834 W
2	2	Red	Solid	1	S2C.Distortion.Ch.1 Harm Sum1	Left	CH2 THD R 10.0000	=S2C.Swr.Ch. A Input	-136.252 dBr A
2	3	Magenta	Solid	1	S2C.Anlr.Level A	Right	CH2 Power 10.0000	=S2C.Swr.Ch. A Input	.9802 W

Figure 1: The AHB2's total harmonic distortion (THD) into a 4-Ω load from below 1 W to full power output is shown. The magenta curve is the output power on the right-hand vertical scale. The green and red traces are left and right channel THD, shown on the right-hand vertical scale. (Image courtesy of Benchmark Media Systems, Inc.)

The AHB2 has only balanced, XLR inputs, and Benchmark recommends a balanced source to achieve the lowest noise from the amp. The amplifier can be fed with an unbalanced preamplifier using an adapter that ties XLR pins 1 and 3 at the source, not at the power amp input. The three-position gain switch mentioned earlier is also on the rear panel, along with the Stereo/Mono switch that converts the amplifier to bridged mono operation (see **Photo 6**).

In addition to the left and right SpeakON connectors, a third SpeakON provides the bridged-mono output. If you're using the binding posts for bridged mono, the loudspeakers are connected to the left and right positive posts, with the left being the plus (+) node (the left XLR also functions as the mono input).

The amplifier contains a pair of 3.5-mm phone jacks that enable turn-on from an external 12-V trigger. These bidirectional jacks can function as inputs or outputs, enabling several amplifiers to be daisy-chained, and the external trigger can be supplied by any DAC2 DAC. The power receptacle accepts a standard IEC power cord.

Measured Performance

A complete list of the manufacturer's specifications for this amplifier is available on the Benchmark website. Benchmark also supplied three pertinent figures for this review. One key performance feature of the AHB2 is that THD does not increase with loading. This is shown in **Figure 1** and **Figure 2**, which plot THD into 4-Ω and 8-Ω loads, from below 1 W to full power output. The magenta curve is the output power, which is shown on the right-hand vertical scale. The green and red traces are left and right channel THD, shown on the right-hand vertical scale.

Benchmark notes that the steps in the THD traces are a limitation in the Audio Precision AP2722—the performance of the AHB2 amplifier is actually better than the measurement limits of the finest audio test instruments.

Figure 3 shows a Fast Fourier Transform (FFT) plot of the AHB2 in bridge mono mode, 1 kHz at 320-W output into an 8-Ω load. The green trace shows the no-load performance and the red is with an 8-Ω load. At 320-W output into 8 Ω, there are second, third, and fifth harmonics at –131.5 dB, –122.5 dB, and –139 dB, respectively. Otherwise, the two traces are identical.

The AHB2's damping factor is 130 at 20 Hz, 121 at 1 kHz, rising to 26 at 29 kHz, ensuring exceptional control of loudspeakers, especially at low frequencies. The AHB2 is a wide-bandwidth design with –3 dB points set at 0.1 Hz and 200 kHz.

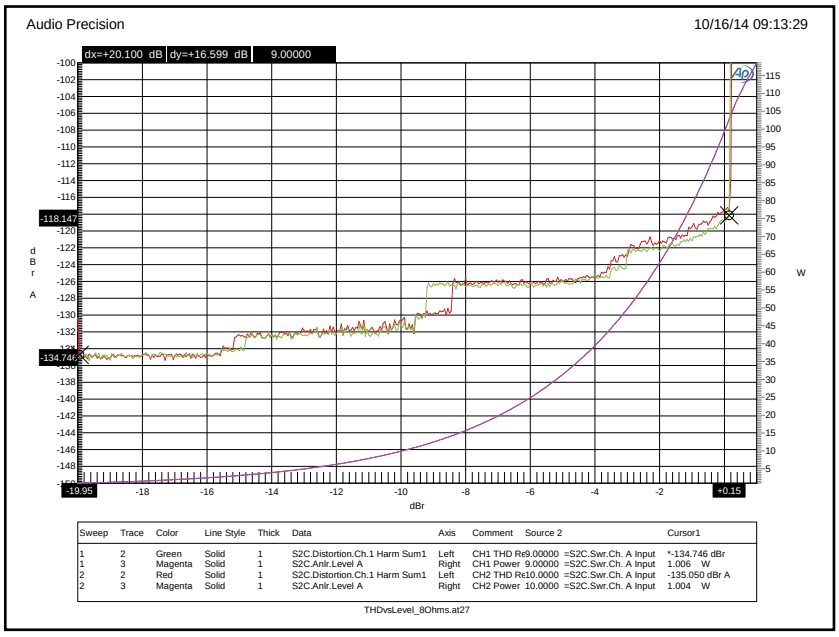


Figure 2: The AHB2's total harmonic distortion (THD) into an 8-Ω load from below 1 W to full power output is displayed. A comparison to Figure 1 shows that the distortion of the amplifier does not change with loading. (Image courtesy of Benchmark Media Systems, Inc.)

Benchmark only specifies THD at 1 kHz. It would be interesting if the company also offered THD measurements at other frequencies across the audible spectrum, along with intermodulation (IM) measurements. In particular, CCIF distortion can be very useful, sliding two tones 1 kHz apart at full power output across the spectrum. (The Audio Precision instruments can perform CCIF measurements.)

The Sound

My digital playback system consists of an OPPO Digital BDP-105 Universal Blu-ray player, my custom-built preamplifier in an Adcom GFP-565 case, a pair of Monarchy SE-100 Delux MkII power amplifiers, and Audio Concepts Sapphire III/Sub-1 loudspeaker systems with custom, all-polypropylene subwoofer-to-satellite crossovers. (Audio Concepts is no longer in business.)

I have two pair of preamp-to-power amp interconnects made with DH Labs Air Matrix cable—balance and unbalanced—which can be put into service as needed.

The unbalanced pair is fitted with DH Labs Ultimate RCA Connectors and the balanced pair have Neutrik NC3FX-B and NC3MX-B XLR connectors with gold-plated contacts. DH Labs Revelation RCA cables are used from the OPPO Digital BDP-105 to the preamplifier. Loudspeaker cables are DH Labs Q-10, bi-wired to the Sapphire III satellites with separate runs to the Sub-1 subwoofers.

I have three dedicated AC power lines for the core of my audio system, one for the low-level equipment and one for each mono power amplifier, each terminated with PS Audio Soloist Premier SE outlets. Each Soloist outlet feeds a PS Audio Power Plant Premier AC regenerator, via DH Labs Power Plus AC Cable fitted with Marinco/Wattgate connectors. The AHB2 is supplied with a 14-AWG power cord which, given the amplifier's very low power consumption, seems perfectly adequate.

Benchmark's John Siau was insistent that I would not fully appreciate the AHB2's performance unless it was fed from a low-noise, balanced source operating at professional output levels. To facilitate this, Benchmark also loaned me its DAC2 DX DAC, which has balanced outputs and a digital volume control, so it functions as a combination DAC and preamplifier. But, many of my reference discs are SACDs, which requires using my OPPO Digital BDP-105 as a stand-alone player with my own, unbalanced preamplifier.

I began my evaluations with my preamplifier, following Benchmark's suggestion to tie pin 1 and pin 3 together at the source. I used an adapter I made with DH Labs Air Matrix cable, Ultimate RCAs, and Neutrik XLRs. These fed my balanced Air Matrix cables, which were connected to the AHB2's balanced inputs. My Monarchy SE-100 MK II amplifiers have provided excellent performance, and at less than $2,400 per pair, they remain an excellent value in high-end amplification. I generally prefer the dual-mono approach to power amplifiers—complete isolation of the two stereo channels benefits soundstage reproduction. Getting the amplifiers close to the loudspeakers keeps speaker cables short.

Outstanding Detail

Hearing the AHB2 amplifier for the first time was a revelation. This is simply the cleanest, quietest, most detailed power amplifier that I've had in my system. Although the amplifier sounded terrific right out of the box, after a few evenings of break-in, the upper mid-range and treble region smoothed out even further. Benchmark notes that the AHB2 requires only a minute or so of warm-up time after a cold start, to reach optimum performance, which I found to be true.

The most immediately striking characteristic of this amplifier is a jaw-dropping level of detail and resolution. The AHB2 redefines the word "transparency" and will make many competing amplifiers sound veiled and foggy by comparison. The Benchmark amplifier lets you penetrate the densest orchestral scores with ease, never offering a hint of congestion. (I know I've written such things before, but the AHB2 takes it to a new level.)

It's a bit difficult to describe this amplifier's tonal character simply because it has so little "sound" of

its own. Throughout my listening evaluations, I kept thinking that I was hearing the original recording for the first time, without any intrusion by the amplifier. The AHB2 simply provides a clean window on the source in a way that no amplifier I've heard has done.

Benchmark and THX have clearly set out to produce the most accurate amplifier possible, free of the colorations—euphonic or otherwise—that we've come to expect from most amplifiers. The difficulty in creating an "accurate" amplifier, as opposed to a "euphonic" one, is that an accurate amplifier's designer must make absolutely certain the amplifier doesn't add any unpleasant character of its own. In a euphonically colored amp, low-level artifacts that might otherwise be considered undesirable can be masked by the pleasant, low-order distortion products that characterize euphonically colored amplifiers.

In this regard, the AHB2 is a resounding success. Those of us who primarily listen to classical music look for string sound that is sweet and silky—like the real thing—and not harsh and edgy. With the AHB2, the sound of massed orchestral violins is as good or bad as the recording itself. One of my reference discs for string sound is the Mercury CD of Ottorino Respighi's *The Birds*.

The recording has a bit of pleasant coloration from both the tube microphones and the original analog tape source, but the AHB2 delivers exactly what it's fed—no more and no less—with plenty of that "rosin-on-the-bow" quality that is inherent in that recording. Modern, digital recordings of orchestral strings made with natural microphone placement, such as the Reference Recordings' high-resolution .wav files of works by Igor Stravinsky, are incredibly natural and lifelike.

DG's recordings of the Richard Strauss and Gustav Holst works, made with a forest of microphones, are exposed for what they are, yet—importantly—the AHB2 adds nothing nasty to DG's up-front perspective. The words "open" and "airy" certainly describe the treble region of the AHB2 but, again, this amplifier is a truth teller and will deliver what it's fed.

The AHB2's soundstage reproduction is superb, better than my Monarchy mono amplifiers. On recordings with inherently natural soundstage information (e.g., the Mercury Berlioz SACD with Paul Paray, the Mercury CD of Arnold Schoenberg's *Five Pieces for Orchestra* with Antal Doráti, or the Classic Records DVD-Audio remastering of the Everest 35 MM recording of Manuel de Falla's *Three Cornered Hat*), localization of the various orchestra sections is rendered with greater precision than I've ever heard from my system (precise is a word that fits this amplifier in general).

In the "Introduction" to *Three Cornered Hat*,

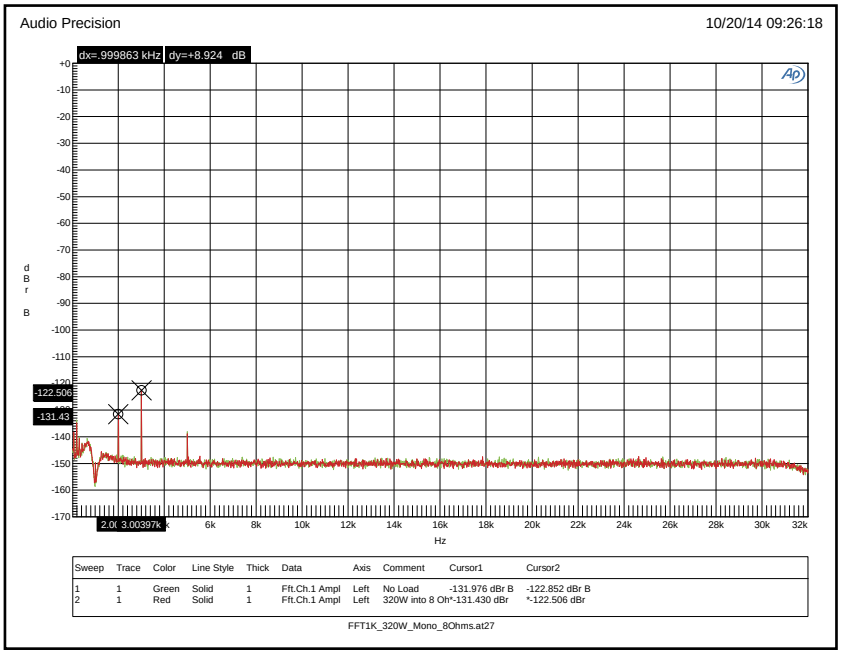


Figure 3: The AHB2's Fast Fourier Transform (FFT) plot in bridge mono mode is shown at 1 kHz at 320 W output into 8 Ω. The green trace is the no-load performance and the red is with an 8-Ω load. At 320 W output into 8 Ω, there are second, third, and fifth harmonics at –131.5 dB, –122.5 dB, and –139 dB, respectively. Otherwise, the two traces are identical. (Image courtesy of Benchmark Media Systems, Inc.)

About the Author

Gary Galo retired in June 2014 after 38 years as an Audio Engineer at the Crane School of Music, SUNY, in Potsdam, NY. He now works as a volunteer, transferring vintage analog recordings in the Crane archive to digital format. He is the author of more than 280 articles and reviews on both musical and technical subjects. He is an active member of the Association for Recorded Sound Collections (ARSC) and has been a regular presenter at ARSC conferences. Several of his conference papers have been published in the *ARSC Journal*.

the castanets are accompanied by a rattle lower in frequency than the instruments themselves. On my reference amplifiers, this rattle's localization is rather vague. Fut with the AHB2, it is clearly located near the front of the soundstage, just right of center.

The AHB2 is an incredibly "fast" amplifier. Some amplifiers can sound a bit sluggish when faced with full-force orchestral transients, such as those in the Donald Johanos recording of Sergei Rachmaninoff's *Symphonic Dances* (either the SACD or the DAD; I prefer the SACD), or the Stravinsky works on Reference Recordings. When misapplied, this is a sonic characteristic that's given negative feedback a bad name.

The speed of this amplifier gives percussion instruments a crisp, well-defined quality, especially evident with the castanets and tympani in the Everest de Falla recording. The AHB2 gives the impression of effortless speed and articulation, and the amp's ability to really control a loudspeaker across the entire spectrum is outstanding.

This amplifier's performance in the bass is nothing short of phenomenal—easily the best I've ever heard. It's not just that the amplifier has better low-frequency extension and weight than my reference amplifiers, which it surely does. It's also the uncanny level of definition in the bass region. When a bass drum is struck, we first hear the initial impact followed by the bloom and decay.

With many amplifiers, the initial impact and bloom are homogenized, but the AHB2 delivers the entire envelope of sound with incredible precision and realism. On Telarc's SACD of Aaron Copland's *Fanfare for the Common Man* conducted by Erich Kunzel, the deepest most extended part of the envelope is in the bloom that follows the initial attack, all delivered with amazing clarity by the AHB2.

I have long considered clean power to be an essential part of any high-performance audio system. And, although I achieved good results with conventional power line conditioning for many years, the performance of my system was improved markedly when I switched to PS Audio's AC regenerators (power line filters will attenuate high-frequency noise, but they can't fix the flat-topping caused by the non-linear loads on the AC line).

About half of my AHB2 listening was with the amplifier powered by one of my PS Audio Power Plant Premier regenerators. I then spent two evenings comparing the amplifier with and without the PS Audio regenerator, using a variety of my reference discs. I was hard-pressed to hear any audible differences with and without the regenerator.

I also went back and forth between one of my PS Audio Soloist outlets and a raw, 20A Pass and Seymour outlet on a different branch circuit. Again, audible differences were difficult to determine (the basic common-mode filtering in the Soloist outlets can be beneficial for equipment with switching power supplies because they minimize the transfer of noise generated by those supplies to associated equipment, especially when other equipment doesn't have the benefit of AC regeneration).

I mentioned this to Laurie Fincham and Jayant Datta during a telephone conversation and suggested that the reason for the lack of audible difference might be because switching power supplies are AC regenerators. They agreed with my theory. THX AAA circuitry's excellent power-supply rejection ratio undoubtedly contributes to the amplifier's immunity

Project File

A listing of the recordings used for the evaluation can be found at http://audioxpress.com/page/audioXpress-Supplementary-Material.html.

Resources

G. Galo, "OPPO Digital's New 3-D Blu-ray Disc Player Raises the Bar," *audioXpress*, October 2013.

———, "Monarchy SE 100 MK2 & SM-70 Pro," *audioXpress*, October 2012.

———, "OPPO 95 BDP Blu-ray Player," *audioXpress*, January 2011.

———, "PS Audio Power Plant Premier," *audioXpress*, April 2010, online version only.

———, "Benchmark DAC1 USB," *audioXpress*, January 2009.

———, "DH Labs Cables," *audioXpress*, February 2005.

O. Jones and L. R. Fincham, "Low Dissipation Amplifier," US Patent 8,004,355 and US Patent 8,421,531, www.google.com/patents.

J. Siau, "A Radical Approach to Power Amplification," Benchmark Media Systems, www.benchmarkmedia.com.

THX, www.thx.com.

Sources

AP2722 Audio analyzer
Audio Precision | www.ap.com

Air Matrix cable, Ultimate RCA Connectors, and Q-10s
DH Labs | www.silversonic.com

SE-100 Delux MkII power amplifiers
Monarchy Audio | www.monarchyaudio.com

NL4 SpeakON loudspeaker connectors and NC3FX-B and NC3MX-B XLR connectors
Neutrik AG | www.neutrik.com

BDP-105 Universal Blu-ray player
OPPO Digital | www.oppodigital.com

Spartan 6-series FPGA chip
Xilinx, Inc. | www.xilinx.com

to noisy power lines. This is an important factor when considering the AHB2's cost.

Since you won't need to spend a large sum of money on exotic power line conditioning or regeneration, your amplification's real cost may actually be less with the Benchmark amplifier.

In my own case, more than $6,000 of mono amplification plus two regenerators was sonically beaten by a $3,000 amplifier with no regeneration. This makes the AHB2 seem like an extremely good value. I do recommend a basic, but high-quality, line filter/surge protector, as insurance against lightning strikes and other potentially-damaging power line anomalies.

Audio professionals, including recording and audio restoration engineers, need accurate monitoring tools, and the ultra-accurate AHB2 is an ideal amplifier for a high-performance monitoring system. I was quite amazed at some of the non-musical low-level details that emerged from some of my reference recordings. In Ansermet's Decca SACD of the "Interlude and Dance" from de Falla's *La vida breve*, low-level crackling can be heard on the original tape beginning around 40 s into this track. With the AHB2 amplifier, the crackling begins sooner and is of longer duration than I had previously realized.

After I downloaded the high-resolution .wav files of the DG Strauss and Holst recording conducted by William Steinberg, I followed my usual practice and made a DVD-Audio disc using discWelder Bronze 1000m (www.minnetonkaaudio.com; discontinued). I also copied the .wav files to a DVD, and to a Gigaware 16 GB USB flash drive.

I compared the three versions and was surprised at the result. My OPPO BDP-105 will play .wav files directly off a disc or USB drive. But, I expected the .wav files played from the flash drive to sound the best of the three, since a lack of rotating media should, theoretically, result in less jitter. I heard exactly the opposite.

The USB flash drive was sonically in last place—slightly veiled and grainy. Playing the .wav files off the DVD came in second, but the DVD-Audio disc was the best of all, with a cleaner, more detailed sonic presentation. I'm a bit mystified by this, but with the AHB2 as my monitoring amplifier, the differences were easily audible. I also heard a couple of audible analog tape splices on my reference discs that had previously gone undetected.

All my observations were made with my unbalanced preamplifier as the source, fed from my OPPO BDP-105, using a variety of source material, including 44.1 kHz/16-bit Red Book CDs and high-resolution SACDs, DVD-Audio, and Blu-ray Audio discs. Even with sources that don't match the AHB2 in absolute noise performance, the amplifier's incredible detail and lack of coloration are readily apparent.

Switching from my own source to the DAC2 DX, using the OPPO as a transport via S/PDIF and reducing the AHB2's gain to minimum, did result in several audible improvements. The noise floor is definitely lower, which enables hall decay to descend more effortlessly into silence. But, I can't say that moving from a SNR in the minus 90s to one approaching minus 130 actually produced an audible reduction in noise.

Even with my own unbalanced source, noise is inaudible even with my ear within inches of my loudspeaker. There was also a bit more inner detail, a greater sense of spaciousness and "air" in the treble, and greater extension in the bass.

Without a doubt, feeding the AHB2 from a low-noise, balanced source allows you to hear the virtues of this amplifier to their fullest. But, a high-performance unbalanced source, which I certainly consider my own preamp to be, will get you at least three-quarters of the way there. Don't be put off if you have an unbalanced preamp—you'll still appreciate most of what this amplifier can deliver.

Overall Impressions

Benchmark's AHB2 Achromatic Audio Amplifier is, without question, a breakthrough product. If this amplifier were a 30-lb space heater, its audio performance would still be remarkable. That Benchmark and THX have been able to deliver this level of performance in such a compact and efficient package is an extraordinary achievement.

The AHB2 is the closest thing I've heard to an amplifier that simply does its job without offering any sonic colorations of its own, and is highly recommended to anyone look for state-of-the-art performance.