Cambridge Audio Edge W Power Amplifier

Amplification to Live With

By
Oliver A. Masciarotte
(United States)

Photo 1: Cambridge Audio's Edge W power amplifier is remarkably detailed. The sound is finely balanced, with a musical depth and clarity that comes through with every note.

For a few weeks, two *audioXpress* reviewers, Oliver Masciarotte and Stuart Yaniger, tested Cambridge Audio's Edge series power amplifier, the Edge W, which the British manufacturer introduced in 2018 as part of its 50th anniversary celebrations. *audioXpress* submitted this design, which claimed to be the culmination of the brand's audio engineering expertise, to extensive listening and measurement sessions.

In years past, I had thought of Cambridge Audio as an uninspired CE manufacturer cranking out unassuming, mid-level kit. I knew it had a distinguished legacy, but the demos never got my juices flowing. In October of 2017, all that changed.

Edge W
Cambridge Audio USA
1913 N. Milwaukee Ave., Chicago IL 60647
www.cambridgeaudio.com
Price: US $4,000

Ancillary Equipment:
Speakers—PureAudioProject Trio15 Heil ($4,495, www.pureaudioproject.com)
ProAc Studio SM100 ($3,400, www.proac-loudspeakers.com)
Isolation—IsoAcoustics GAIA II ($300, www.isoacoustics.com)
Source—Amarra Luxe 4 macOS ($99, www.sonicstudio.com/amarra)
Conversion—Mytek Digital Brooklyn DAC
Amplification—Lindell AMPX ($1,600, www.lindellaudio.se)
Cabling—VUE Digital VU-3 (USB), Soundstring GEN II Beta 2-22S (XLR), AntiCable Level 3.1 (speaker), Soundstring GEN II Digimax-18 (power)

That fall, I stepped into Cambridge Audio's room at Rocky Mountain Audio Fest (RMAF) and was greeted by a bunch of eager hi-fi guys waiting to share a story. For my show coverage, I wrote that they had been working "on a new range of higher end electronics aimed at elevated performance. With a minimal signal path, intelligent biasing and no caps to degrade the audio, their prototype component line is a departure from their normally budget-priced offerings. The stereo power amp is joined by a modern, all-inputs-welcome preamp that also builds some fresh thinking into the design and layout. Paired with a set of Bowers & Wilkins 805 D3 stand mounters, it was the most lifelike presentation I've yet heard from these guys, very promising." Last year, that promise was fulfilled.

The Edge W is part of a triad of Edge-badged products—the Edge A, the Edge NQ, and the Edge W. The $5,000 Edge A is an integrated amp, the $4,000 Edge NQ is a network-enabled preamp, and the $4,000 Edge W is purely a power amplifier (see **Photo 1)**. One might guess the line's name derives from "the cutting edge" but, in fact, the products are named after Gordon Edge, a founder and the company's

first head of engineering. Edge, with Peter Lee, created the sleek, sexy, and innovative P40, a 20 W integrated amplifier that jump started the company. One of the aspects of the P40 that allowed for its slim packaging was the pioneering use of a toroidal transformer in a production audio product.

The Edge W's Topology

I asked the current Engineering Project Manager, Nick Brown, for some details about the Edge W's operation and construction. Assuming the product was some sort of advanced Class AB, I asked if the amp transitions from Class A to Class AB. For many listeners, an ability to deliver 2 or 3 Class A watts before it moves into the Class B regime is one of the key aspects of an amp's sonic signature. Brown replied, via e–mail, that it produces about 3 W into 8 Ω and 1.5 W into 4 Ω in pure Class A mode. The Edge W develops 100 W RMS into 8 Ω, and 200 W into 4 Ω. He went on to elaborate that, "one of the Class XA's major benefits is to reduce the crossover distortion even after the transition from Class A to AB operation, compared to a high-biased Class AB stage delivering similar Class A power level. This is because of the better inherent linearity of the output stage when it's working with normal Class AB current as opposed to high bias current to deliver more watts in Class A condition."

As it turned out, the Edge W leverages Cambridge Audio's XA technology, an in–house riff derived from work done for the company by amplifier "Yoda" Douglas Self. His XD or Crossover Displacement design actively displaces the crossover point away from the traditional zero crossing. The result? Less heat and power draw that a pure Class A design and lower distortion than traditional Class AB.

Cambridge Audio boasts that there are only 14 components in the signal path (see **Photo 2**). That path is a combination of discreet and integrated components, which keeps the cost reasonable. Brown mentioned that, while the power output stage uses discrete output devices, the signal path does include an op-amp. A total of eight Sanken transistors per channel drive the output. The multi–layer circuit board employs a full ground plane, while the components populating it were all chosen for sound quality and optimal performance.

When asked for specifics on the XA topology, Brown started with the basics, stating that in traditional Class AB amps, crossover distortion happens each time the signal crosses zero amplitude. "With Class XA, the crossover point is shifted away from zero, and thus crossover distortion only happens for signals larger than a given threshold." In the Edge W, that threshold happens at about 3 W.

"In practical terms, Class XA consists of a tuned constant current generator added to the power stage. This extra current shifts the crossover point away from 0 V. Distortion is much more detectable by the human ear at low sound level, while 3 W can generate a discrete amount of sound pressure to 'hide' crossover distortion. Also, at normal listening levels, Class XA can be over 200% more efficient (compared to a) high-biased Class AB able to deliver the same Class A power," explained Brown.

Since I was told the amp is DC-coupled, in this modern age that implies a servo'd design. Cambridge Audio uses servos to inject an equal and opposite

Photo 2: Although minimal in its exterior design, the Edge W has some complex audio engineering inside. To remove the barriers between you and your music, Cambridge Audio engineers have minimized the number of components in the signal path.

amount of DC into the signal to cancel out any detected DC offset, rather than using blocking capacitors. This is significant for its effect on low-frequency purity and transient response. Brown explained that capacitors, "...as components, have the biggest detrimental impact on the sound." He said this is because not only do they have wide tolerances, but they are also microphonic. They transform mechanical vibration into unwanted electrical noise and modulation. Removing them results in a cleaner signal path less susceptible to distortion.

Harkening back to the P40, the Edge W uses not one but two, magnetically opposing toroidal transformers. Brown mentioned they "...also apply a silicon steel screen tape around each transformer to reduce stray fields, then any that is left is cancelled out by the opposing arrangement. The result is that far less electromagnetic radiation interferes with the sensitive input stage of the amplifier." The effect works at all volume levels because each transformer is delivering the same current, so they are "in harmony," cancelling out each other's electromagnetic field throughout the whole power range.

The Edge W also utilizes a further third transformer for the preamp stage—the power amp and pre power supplies, all linear, are separate from one another. Though fuses are avoided in the audio path as they generally degrade performance, several fuses are used in the power supply circuitry as required by international safety regulations. The Edge W also integrates a full set of protection against DC offset, over-current, clipping and over-temperature. A relay will physically disconnect the speakers in case of a detected fault. With an oscilloscope attached to the speaker leads, I couldn't even get it to clip before wanting to run screaming from the room.

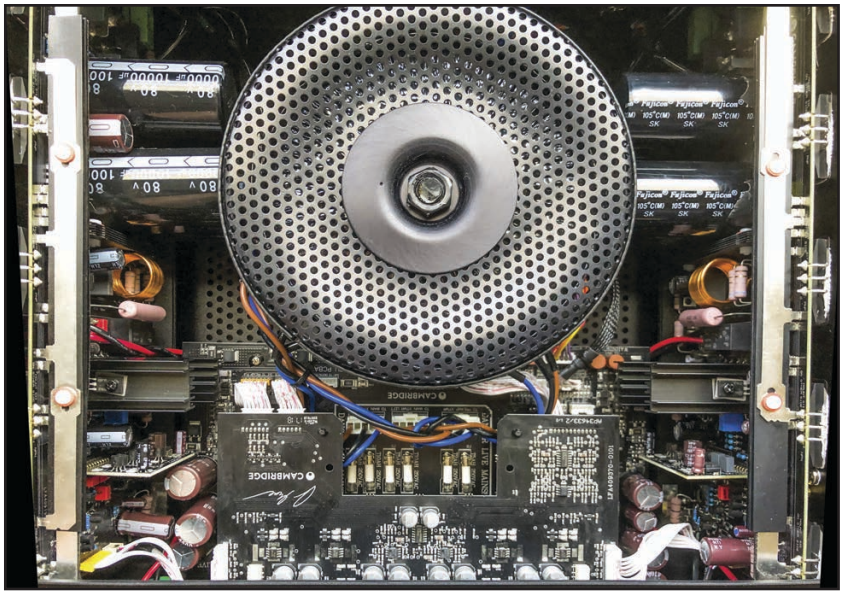

Photo 3: The Edge W has a very robust construction and sophisticated industrial design. (Photo courtesy of Stuart Yaniger and Cynthia Wenslow)

The Class XD Design

For those interested in the Class XD Design, here is a bit of information from the abstract of Patent GB2424137, which was awarded to Douglas Self:

"The crossover voltage of a Class B amplifier is displaced by sinking an extra current to the lower supply rail through a displacer circuit so that (the) upper output device... is always conducting at low input signal levels. The amplifier operates in Class A at low signal levels and in Class B at high signal levels. The displacer circuit may comprise a resistor, a constant current source, or a controlled current source. The output devices may be bipolar transistors, FETs, or thermionic valves. The crossover voltage may be displaced by 1 to 10 volts."

More information on Class XD design can be found in Douglas Self's *Audio Power Amplifier Design Handbook,* Focal Press/Elsevier 2009.

I mentioned earlier that cost savings was part of the mandate to keep the product affordable. The Edge was designed and engineered in the UK by Cambridge Audio's team of in-house engineers. Being one of the first audio businesses to invest in China in 1994, the system is assembled there, where Cambridge has a dedicated team overseeing engineering tasks, QC and best practices. The Edge W is built like the proverbial brick house, with clean lines and a forward-facing wrap of anodized dark gray metal possessing only an illuminated power switch and engraved logotype.

Listening to the Edge W

As my reference e22 Mark II DAC was at the factory for some special modifications, I relied on a straight path from my Mytek Brooklyn into the Edge W via balanced Soundstring GEN II Beta 2-22S cables. For comparison, I used two identical Soundstring GEN II Digimax-18 power cables for the Edge W and my Class A Lindell AMPX reference (see **Photo 3**). At the time of the review, my Level 3 speaker cables had reached the end of their service life, so I reached out to Paul Speltz at Anticables, who provided an upgraded set of Level 3.1 cables.

After a burn-in period, the new pair exhibited improved resolution and mo' betta bottom, so I felt I was ready to dig into the subjective portion of the review. The Trio15 Heils from PureAudioProject I reviewed last September were still in-house, awaiting a HORN1 upgrade, and my good friend Steve Severson lent me his ProAc SM100 stand mounters. Both are low distortion, neutrally voiced speakers, and the low efficiency ProAcs were a good test of the Edge W's beefiness. In their own way, both speakers were perfect for this evaluation.

All well and good, this clever XA displacer

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arrangement, but how does the Edge W actually sound? In short, like nothing. More exactly, like nothing is interfering between you and your music. The Edge W is a straight wire with gain, delivering performance that handily competes with budget busting competitors boasting five digit price tags.

For a dose of real-world acoustic environment and atmosphere, I turned to the Feenbrothers Play Dave Brubeck [Sound Liason: 352.8 kHz]. This live, one microphone recording, was made with a Josephson C700S feeding a Merging Technology Horus. The production is minimalist and the clean, spacious presentation was conveyed with an ease and depth simply not painted as well with lesser electronics.

Another supernaturally realistic recording comes from Morten Lindberg, who I finally got to meet at the recent 2019 Audio Engineering Society (AES) convention in New York. His Hoff Ensemble recording "Polarity" [2L: 352.8 kHz], like the Feenbrothers album mentioned earlier, is free of extraneous production. Through the Edge W, I was joyfully enveloped in an authentic, palpable and well delineated sense of place.

Whether it's the pile driver bottom of Visax's "Monster" [TIDAL: 44.1 kHz], or Massive Attack's ominous synth bass in the track "Angel" [Qobuz: 44.1 kHz], Edge W's ferrous-free grip takes no prisoners. Listening to this amp, I simply cannot understand why anyone would want a capacitor or inductor sticking their nonlinear noses between listener and their tunes.

It's not just the low end where this more than 50 lbs. beast shines. The published bandwidth spec is less than 3 Hz to 80 kHz, ±1 dB, and Stuart Yaniger's accompanying tests bear this out. One of my favorite tracks to experience a stripped down production cleanliness is J.S. Ondara's "Lebanon" from his *Tales of America* [Qobuz: 192 kHz]. Ondara's Tracy Chapman voice plus guitar, trap set and chorus, is a fun fest of folky flavors, served up without flaws by Cambridge Audio.

The production credits accompanying my DVD-Audio rip [WAMO: 192 kHz] of Linda Ronstadt's "What's New" reads like a who's who of audio production—Peter Asher as producer; Nelson Riddle lending his arranger and conductor chops; George Massenburg engineering and mixing at The Complex in Los Angeles, CA; and Doug Sax at his mastering desk. The Edge W effortlessly communicated Ronstadt's powerful voice, the velvet smoothness of Riddle's strings and Massenburg and Sax's tasteful helming.

Photo 4: For my test setup I paired the Edge W, in combination with the Brooklyn DAC and Trio15 Heil open baffles, which offers an unsullied, slightly dry presentation.

The Verdict

The ProAcs, being studio monitors, are honesty personified except at the bottom half octave, and the Edge W is as uncolored and exemplary as those little two-ways. When comparing the AMPX to the Edge W, the latter throws a much wider soundstage, has more precise transient response, an airy extended top end and a much tighter, more extended low end. I can effortlessly drive the AMPX into tasteful clipping, not so with the Edge W. Both amps exhibit a low distortion clarity, dare I say sweetness; not a euphonic flattery but a truth I enjoy more than any "warm," even harmonic distortion signature. I love my AMPX but the Edge, she really got the edge!

I've seen and heard super-amps at shows, you know the ones. With few exceptions, they are European. They cost well upward of $20,000, and they define the state-of-the-art in amplifier construction, if not excess. Giant tubes, giant meters, and giant casework with an equally gargantuan price tag. I do have a pair of $10,000 (each) Class D amps in-house and, frankly, the Edge W flattens them without even noticing the bloody corpse in the rearview mirror. If you're on the hunt for upscale performance at an affordable price, and want to save money on AC and HVAC bills, then I cannot endorse the Edge W enough... simply highly recommended!

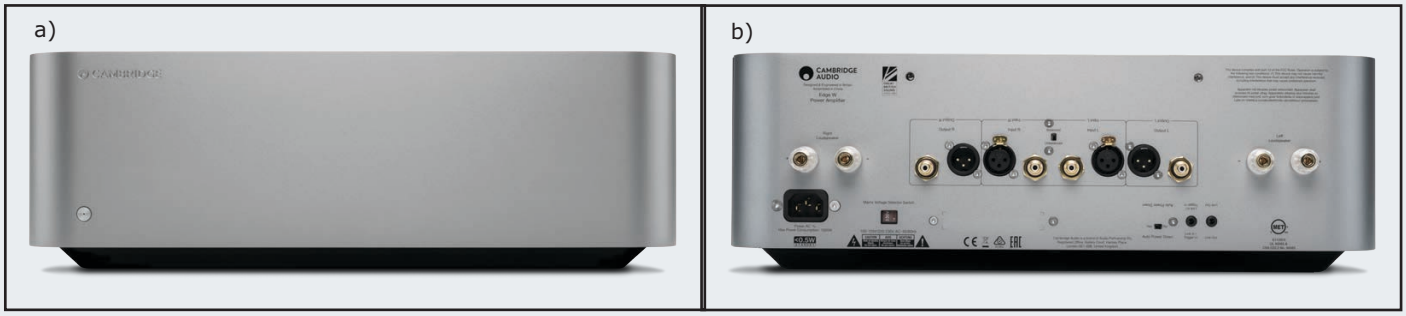
Keep reading as Stuart Yaniger puts the Edge W through his own set of listening tests.

About the Author

O. A. Masciarotte has spent 40 years immersed in tech, working worldwide on facilitation, marketing, and product development. His writings include *To Serve & Groove*, a book covering file-based music for the home and well over 100 articles. At present, Masciarotte is CMO and co-founder of MAAT, a developer of pro audio hardware and software solutions.

The Measurements

When it was his turn to test Cambridge Audio's Edge series power amplifier, the Edge W, Stuart Yaniger discovered some very smart engineering.



Cambride Audio's Edge W power amplifier has a clean muscular look with a sleek new logo (a). The Edge W also has an added bias voltage to a traditional Class AB design, reducing distortion to inaudible levels. This unique configuration also produces less heat and is intended to make the entire system much more efficient.

By
Stuart Yaniger

Thanks to my millennial daughter, I have become aware of a genre of entertainment known as "unboxing videos." For people older and/or even less hip than I am, it is exactly what it sounds like, someone receiving a product and going through the process of getting it out of its packaging. For reasons that escape me, YouTube videos of unboxing various items get millions of views.

If you have had an ambition to create an unboxing video and want it to run for over an hour, you need the Cambridge Audio Edge W power amplifier. I have never, in my 50 years doing audio electronics, seen packaging this elaborate. There is an outer box, which is cut open. This allows you to slip out an inner box with removable handles and clamps. With the handles removed, the inner box can be removed to reveal yet another box, with a large block of sculpted foam as the top. Remove the sculpted foam and you find... another box with a zippered fiber bag. Unzip the bag and there's several more pieces of fiberboard and a silicone gasket. Remove them and you are finally in a position to liberate the amplifier from the lower box.

Suffice it to say that this beautiful piece of equipment is unlikely to suffer shipping damage. Nor did it in my case.

The Measurements

As usual, my measurements were performed with an Audio Precision APx-525 analyzer and various homemade dummy loads. When the Edge W is plugged in, it goes into Standby mode, where power consumption is a negligible 0.5 W or so. Depressing the power button starts the turn-on cycle, which caused the lamps and appliances in my lab to briefly dim; the power supply reservoir is clearly rather large!

I began the measurements by connecting 8 Ω dummy loads and letting the amplifier come up to operating temperature over an hour. After that time, I used an IR thermometer to check the temperature of the heatsinks (the hottest part of the amplifier), which was stable at about 52°C. I then ran the standard Fast Thermal Cycling (FTC)

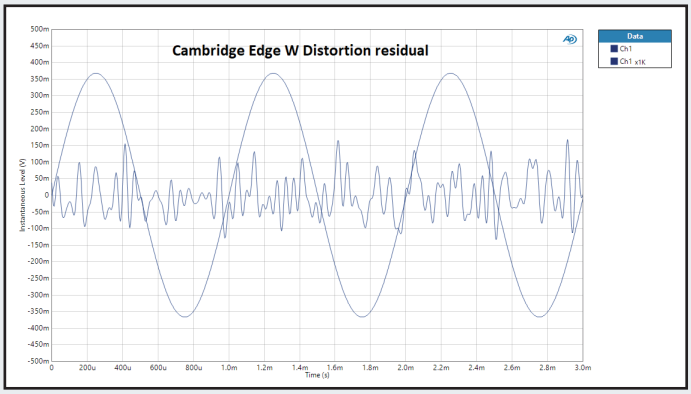


Figure 1: The waveform of a 250 mV sine wave shows no trace of crossover distortion. The residual (shown at ×1000 magnification) is noise-dominated.

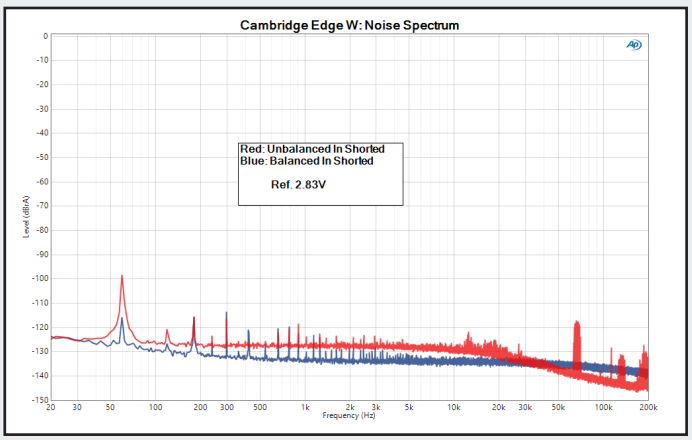


Figure 2: The spectrum of the amplifier's output with a shorted input shows very low noise, with the worst case (60 Hz in unbalanced mode) being -99 dB down from the 1 W reference.

preconditioning cycle, with 33 W (1/3 rated power) from each channel at 1 kHz into the 8 Ω loads for an hour. The heatsink temperature rose to about 60°C, which is hot to the touch, but not to the dangerous point. In use, I would ensure that these amps get at least moderate ventilation, and the temperatures will stay within reason.

The rather small temperature shift between idle and one-third power suggests that the output stage is biased a bit rich. I connected a meter across one of the output stage emitter resistors to check this and found that the idle current was about 220 mA per device, with 50 V power rails. There are five output transistors of each polarity (10 total) per channel, so the total idle current is about 1.1 A for 110 W of idle dissipation per channel. No wonder this amp runs warm! That idle current implies Class A operation up to about 10 W into 8 Ω.

Looking at a 250 mV 1 kHz sinewave and the distortion residual (see **Figure 1**, distortion residual magnified 1000 times), it is evident that there's no visible crossover distortion, the residual being noise-dominated. A low-level sine wave like this is a very sensitive test for crossover artifacts. If it were present, crossover distortion would be indicated by spikes in the residual coinciding with the signal zero-crossing. Many of Cambridge Audio's amplifiers use an output configuration that it calls Class XD, where a current is injected into the output stage transistors' bases to displace the zero crossing, and if this is used here, it certainly does its job

After preconditioning, I checked the basics in both balanced and unbalanced mode. In balanced mode, the voltage gain was 22.25 dB (or about 13 V/V). In unbalanced mode (switch selectable), the gain was 28.3 dB (or about 26 V/V). DC output offset voltages with inputs shorted were below my meter's ability to accurately measure. This suggests a design using some very low offset servos, which functioned flawlessly through the testing. Input impedance was 56 kΩ in unbalanced and 102 kΩ in balanced mode. Source impedance at 1 kHz and below measured 22.5 mΩ, rising to 55 mΩ at 20 kHz, equivalent to a damping factor of 145. These source impedances are low enough that frequency response variations due to the amplifier with loudspeaker loads will be absolutely insignificant.

The noise spectrum in both balanced and unbalanced mode with inputs shorted and referenced to 1 W into 8 Ω (2.83 V) is shown in **Figure 2**. In unbalanced mode, the noise was dominated by a 60 Hz component at -99 dB. In an absolute sense, this is not a large number (32 µV), but for an amplifier of this quality, it's slightly larger than expected, though of no significant audible consequence. The balanced mode shows nearly an order of magnitude lower hum.

This became a somewhat larger issue when the Audio Precision was used as a signal source: the 60 Hz component increased to -80 dB, which is potentially getting into the range where it could possibly be heard in a very quiet listening area with highly sensitive speakers. With my lab speakers (rated at 90 dB/2.83 V/m), the hum

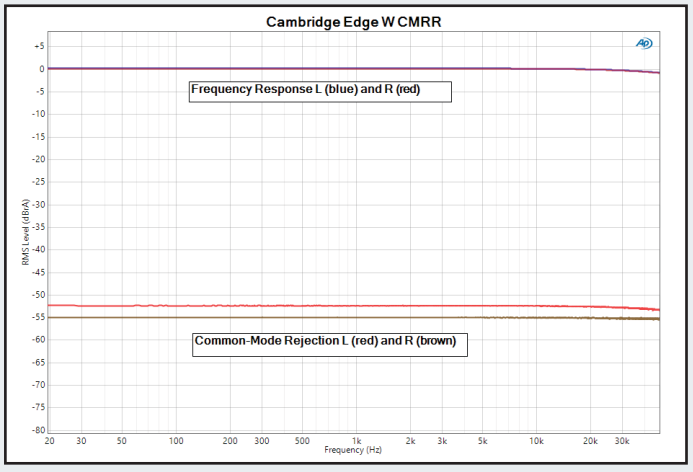


Figure 3: The Cambridge Edge W's frequency response is dead flat (upper curve), and the common mode rejection (CMR) in balanced mode referred to the input is better than -70 dB.

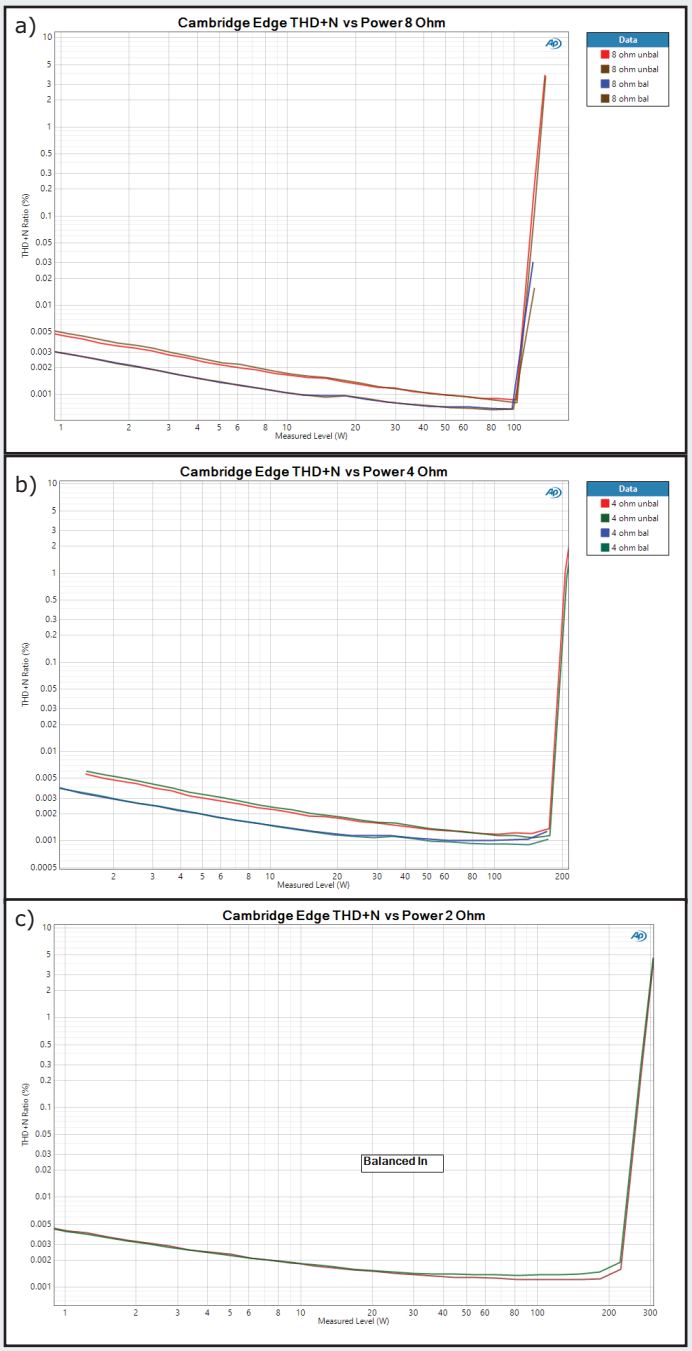


Figure 4: Distortion versus power at 8 Ω (a), 4 Ω (b), and 2 Ω (c) shows the Edge W comfortably meeting specification.

was absolutely inaudible. To be fair, this is not any more hum than is usually found in this class of power amplification, but it stuck out to me because the other measurements were so excellent that seeing one that's normal is a bit jarring!

I tried several alternative grounding schemes between the Edge W in unbalanced mode and the Audio Precision, including running them from separate branches of our house power, but could not get significant improvement. Inserting a Jensen JT11P-1 1:1 input transformer into the line between the Audio Precision and the Edge W to achieve galvanic isolation drastically reduced the measured hum to the same levels seen with a shorted input.

The signal-to-noise ratio (SNR) is specified as better than 93 dB referenced to 2.83 V out, with nothing said about balanced or unbalanced inputs. That's almost exactly what I measured using the balanced inputs and a 1 kHz test signal. The unbalanced inputs did not measure as well, and were limited to -80 dB due to the 60 Hz hum loop.

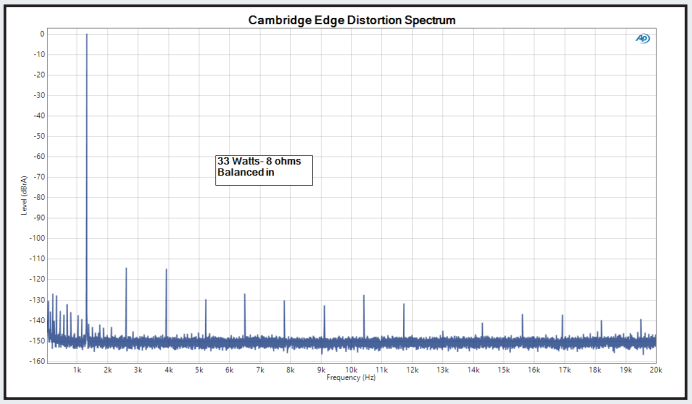


Figure 5: The distortion spectrum of a 1.3 kHz sine wave at 33 W into 8 Ω challenges my measurement capability.

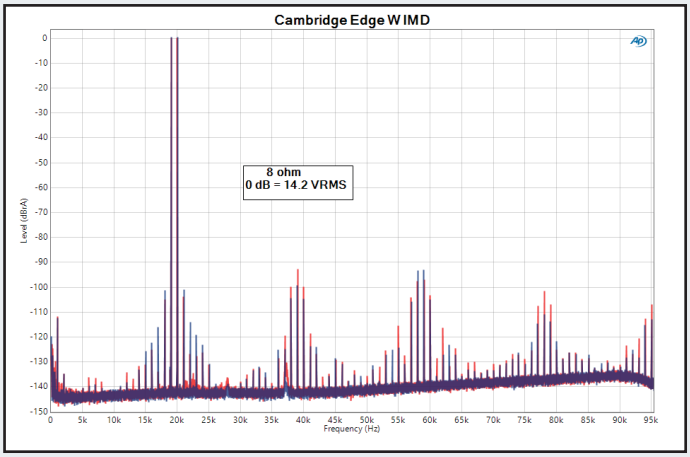


Figure 6: The intermodulation distortion of a mixed 19/20 kHz signal is remarkably low.

Using the balanced inputs, I ran frequency response sweeps in both differential and common mode (see **Figure 3**). We see that the differential mode response is dead flat in the audible range; I measured the -3 dB frequency at over 100 kHz, so this amplifier easily meets its 80 kHz specification. On the low end, my limit was the 10 Hz high-pass filter of the analyzer, with the Edge W's response still being flat to that frequency.

Ideally, the common mode response of a balanced input should be zero (i.e., infinite common mode rejection ratio). The lower curves show the output-referred common mode rejection (CMR) of the Edge W's balanced circuitry at -52 dB and -55 dB for the left and right channel, respectively. In order to convert this to the more usual input-referred figures, the gain must be subtracted, so the actual CMR is -74 dB and -77 dB, which are decent figures, and sufficient to knock down any reasonable level of induced hum at the inputs to levels below audibility. The CMR is relatively constant with frequency, an indicator of good input circuit design.

Using 8 Ω, 4 Ω, and 2 Ω dummy loads, I ran sweeps of distortion versus output power (see **Figure 4**). At 8 Ω, the distortion rise began at 100 W, with the distortion reaching 1% at about 120 W. Power at 4 Ω is nearly doubled, with the distortion rise beginning at about 180 W and 1% being reached at over 200 W. At 2 Ω, the Edge W delivers more than 200 W. This amp should have no problem driving difficult loudspeaker loads. Note that the balanced distortion is somewhat lower than unbalanced, though both results are quite good. Some of the difference could also be attributable to the input transformer I used to knock out the hum loop in unbalanced mode.

As one can infer from the power measurement data, where the Edge W really shines is distortion. **Figure 5** shows the distortion spectrum of a 1.3 kHz sine wave at 33 W out into an 8 Ω load. All harmonics are below -115 dB (0.00017%), hugging the residuals of the APx525 analyzer I use, so the Edge W's distortion likely well below that spectacular figure. The spectrum of the intermodulation distortion (IMD) torture test (19 kHz and 20 kHz, equal magnitude) with two 14.2 V sines into 8 Ω is shown in **Figure 6**; taking into account the summed signal, the first order IMD is at nearly -120 dB and the worst sidebands are at nearly -110 dB. One would expect that a multitone measurement would look pretty good, and one would be correct (see **Figure 7**). This is the spectrum of a 40-tone signal at 1 V per tone, and other than the previously noted hum components, there's no distortion components bigger than -112 dBV (2.5 µV). This is excellent and impressive performance.

The Edge W's Secret

One clue to why this amp works so is revealed in **Figure 8**,

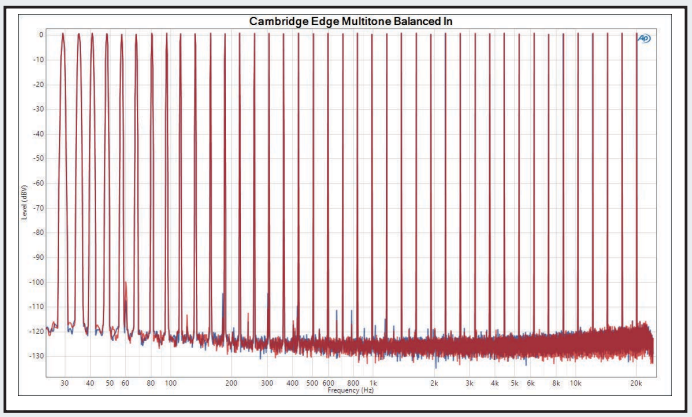


Figure 7: A 40-tone signal's very clean spectrum is a demonstration of the Edge W's low harmonic and intermodulation distortion.

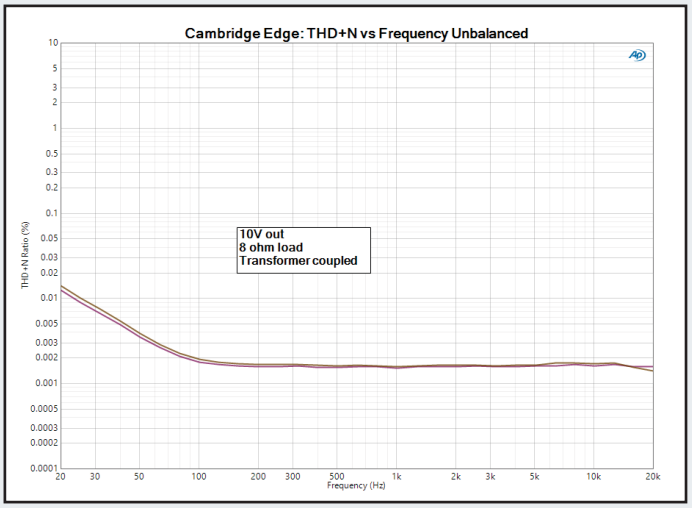


Figure 8: Distortion versus frequency at 12.5 W into 8 Ω is very low and constant, indicating well-engineered feedback and compensation. The rise at low frequencies is a test setup artifact (see text).

a plot of THD+noise versus frequency at 10 V out into an 8 Ω load. Ignore the rise in distortion at low frequencies—this is caused by the transformer I had to insert to break up the unbalanced input's ground loop—but note that the distortion does not rise at higher frequencies. This suggests some very smart engineering of the feedback and/or feedforward, since in most other amplifiers, the distortion in the top octave starts to rise because of the roll-off of open loop gain and consequent reduction of feedback. In summary, aside from the ground loop problem in unbalanced mode, these are superb measurements.

In Use

Once I finished the measurements, I used the Edge W in my main stereo system to drive the midbass, midrange, and tweeter section of my speakers. These speakers are not a particularly onerous load with impedance staying at 4 Ω or above at any frequency, but they aren't particularly efficient, either. Much to the distress of the other inhabitants of the house, I tend to listen at levels approximating live music.

In use, the Edge W seemed sonically to do exactly what I want a power amp to do: make a small signal larger and as little else as possible. The sound never showed any hint of coloration or strain. Quiet and neutral are the best things one can get out of a power amp, and the Edge W in balanced mode did exactly what it should, being an efficient servant and not getting in the way of the music.

Conclusions

The Cambridge Audio Edge W is a gorgeously constructed unit whose measurements show a lot of attention to the engineering. The distortion is low enough to challenge my measurement capabilities, the amp had no problems with low load impedances, source impedance is very low, and the bandwidth is far better than anything you'll ever need. In balanced mode, which is how my stereo system is wired, the measured performance correlated with my subjective impression of complete neutrality and lack of unwanted adventure.

The only real shortcoming is the sensitivity of the unbalanced inputs to ground loops, and this may be a function of which equipment the Edge W is paired with and details of the grounding arrangement. It may or may not be an issue for you, and even at its worst it may not be actually audible in your setup unless you have very sensitive speakers and a very quiet listening area.

Except for the single issue with minor hum at the unbalanced input in my particular testing set-up, it was a delight to have the Edge W on my bench, and I'd be perfectly happy to have it in my system for a long, long time to come.

Resources

"Class XD Explained," Cambridge Audio, https://www.cambridgeaudio.com/usa/en/blog/class-xd-explained