RME ADI-2 Pro Review

Photo 1:The ADI-2 Pro converter headphone amplifier is shown with a pair of Sennheiser HD 700 headphones.

After spotting the RME ADI-2 Pro at a recent National Association of Music Merchants (NAMM) show, Bennett Prescott requested the loan of a unit so he could examine it more closely. He also enlisted his colleague Stuart Yaniger to put the converter/headphone amplifier combination through a series of measurement tests.

By
Bennett Prescott and Stuart Yaniger
(United States)

I took advantage of the relative peace and quiet during the last day of the National Association of Music Merchants (NAMM) show this year to walk the halls and see if I could find anything new and interesting. This seems to be the golden age of headphones. Even at a decidedly not hi-fi-oriented event such as the NAMM show, there were a dozen manufacturers showing new or updated models. I'm always looking to deliver great audio on a budget, and today $800 can buy one of the best headphone setups available. Try buying a good pair of monitors, not to mention an acoustically treated room, for that much! Headphones will never replace loudspeakers for me, but for less dedicated listeners, they are an outstanding option right now.

My meandering eventually brought me by the large, well-attended, and very blue RME booth. While there, I noticed RME's new ADI-2 Pro converter/headphone amplifier (see **Photo 1**) plugged into a pair of nice planar headphones. The ADI-2 Pro was introduced in late 2016, but new to me, so I gave it a listen and determined that it's impossible to critically listen to anything at a trade show. Never one to be discouraged, I emailed Synthax—RME's rep in the Americas—after the show and asked if I could borrow a unit to review, to which they generously agreed.

First Impressions

If you don't know the German brand RME, it has a stellar reputation in pro audio and recording for making no-frills, technically perfect, supremely useful audio tools. Its product line includes optical and copper format converters, high channel count interfaces with and without microphone preamps, and several kinds of DAs and ADs for USB, Thunderbolt, and PCI. RME is also one of the strongest purveyors of MADI (AES10) multichannel audio hardware, used for transport in many high-end concert and broadcast mixing consoles. The short story is that this company knows conversion and digital.

The ADI-2 Pro (not to be confused with the older, less headphone-oriented ADI-2) is a sort

Project Files

To download the user guide for the RME ADI-2 Pro, visit http://audioxpress.com/page/audioXpress-Supplementary-Material.html

of do-everything bi-directional digital-to-analog (DAC) converter with dual headphone outputs on the front, XLR and optical S/PDIF inputs and outputs on the back, plus copper S/PDIF and AES available on a breakout cable (included), which connects via DB-9 (see **Photo 2**). The converter came in a compact and well-padded retail box with nice graphics, and included an external power supply that solves one of my usual complaints by using a twist lock mechanism to hold its jack in place.

The retail price is just under $2,000 US, and for that you get two powerful DSP engines and two powerful headphone amplifiers, plus the ability to work with PCM sample rates up to 768 kHz at 32 bits, and true native DSD support up to DSD256. Those sample rates are presumably in case we ever reach a future where we all exist as vibrating, massless strings able to detect information in the megahertz range. The bottom line is this unassuming desktop unit will do instrumentation-grade conversion of audio in any imaginable format—today or probably until we start listening to quantum audio directly on our positronic brains.

Initial setup is simple, although I did have to read the manual (which can be found in the Supplementary Material section of the audioXpress website) to see how to reset the entire unit to factory defaults. Fortunately, for the uninitiated like myself, there is an auto-configuration mode, which assumes it should pass the first digital signal it sees to the XLR and headphone outputs.

Photo 2: The ADI-2 Pro has XLR and optical S/PDIF inputs and outputs on the back.

On my Mac, operation was plug and play, I could immediately get iTunes and high-resolution audio playback. The internal DSP engines can run separate multi-band parametric EQ on the headphones vs. the XLR outs (or different EQ on the two headphone outputs), provide sample rate conversion, adjust stereo width, provide calibrated loudness control (a personal favorite), run balanced or unbalanced headphones, and even display an RTA. At sample rates of 192 kHz or below, they can do all of this at the same time, at higher sample rates some features become limited as DSP horsepower is assigned to support those extreme data rates.

However, I had some small complaints about the user interface. The screen is bright and clear, but I always seemed to be pressing the wrong button to get to the menu option I wanted. Some options are only available in some modes or for certain inputs, so I found myself re-reading the manual to find the menus I needed to navigate, check or adjust a particular setting.

The master volume control has no feel to it, which makes quickly adjusting volume a pain: Too slow and it takes forever to change half a decibel, too fast and suddenly 10 dB have come and gone. The two smaller knobs take on different personalities depending on the mode, but can often be used to adjust the headphone output volume separately from the XLR output volume—with the same complaint. Overall, the ADI-2 Pro looks nice but lacks the gravitas of other high-end DACs. For something that costs as much as a nice laptop and that I might interact with every day, a machined faceplate and volume knobs I can set with my eyes closed do not seem like much to ask for.

Listening

I got excited about the ADI-2 Pro in the first place due to its two high-power headphone outputs, which is how I did the majority of my listening. I have a few headphones but have settled upon the Sennheiser HD700 as a reliable reference. They have a pretty hyped high end but few other flaws. It's nice to be able to do critical listening with headphones: A lot of audio errors are much easier to hear as room effects are more or less eliminated, the full audio bandwidth is available without crossovers, and stereo separation is complete. I can also listen to headphones at moderate volumes for hours without generating noise complaints.

First, a digression: One of the options available in the setup menus is to select the DA oversampling filter. Choices are Sharp, Slow, and Non-Oversampling—the former two are available in IIR "short delay" versions as well. These different

reconstruction filters enable you to trade frequency response flatness for an impulse response that looks better to the untrained eye. Why this choice, especially NOS with its zero reconstruction and stair-step response, would be available at all is beyond me. The need for a reconstruction filter to behave a certain way is well understood by DSP engineers; there are a few defensible choices and anything else just enables end-users to add error to their audio. The manual is quite clear on the trade-offs, at least.

Unfortunately, either by default or by accident, I did all my listening using the "Slow" filter, which has substantial high-frequency rolloff. As a result, in comparison to my reference Benchmark DAC2 DX, I found the ADI-2 Pro to be a little dull. Aside from this dullness I found sound quality to be excellent, with wide imaging and very clear details in instrument tones and room reverberation. Fortunately, my mistake was discovered and invalidated in measurement and should not be held against this product.

Aside from my unfortunate use of the wrong reconstruction filter, I found the ADI-2 Pro to be extremely consistent and high quality in every way. The metering is accurate, quick, and useful. Headphone output sounded the same whether "Extreme Power" was selected or not (and it wasn't necessary with my 150 Ω headphones). Driving two headphones seemed to have no effect. Although I could only provide 192 kHz source material, different sample rates were handled gracefully and changes accomplished quickly.

The software brains are especially commendable, they provide a nice volume ramp-up when connecting headphones, remember the last used gain including different gains and EQ for each headphone output, and generally make using the ADI-2 Pro easy. The five-band parametric EQ on each headphone output is a killer feature, it sounds good and behaves as expected, making it much easier to compare or switch between different pairs of headphones—or translate between headphones and studio monitors.

Measurements

Stuart Yaniger, a regular contributor to *audioXpress*, did extensive measurement and listening with the ADI-2 Pro using his ears as well as an Audio Precision APx515. A subset of his impressions and results can be found in the sidebar article that accompanies this review.

Conclusion

It's very hard to find a piece of gear that appeals to studio purists, audiophiles, pro audio engineers, and measurement experts. The RME ADI-2 Pro may have enough horsepower to make everyone happy. It can drive any headphone at any conceivable volume, convert analog sources to digital with zero compromise, output any digital source to multiple formats at multiple clock rates, and even equalize headphones to match monitors and monitors to correct for room modes. If you want one box to put on your desk or take with you on tour that does it all, I suggest you take a close look at this great converter from RME.

About the Authors

Bennett Prescott is Sales & Operations Manager for B&C Speakers North America, and co-founder of the popular discussion and news site SoundForums.net. He lives in southern Connecticut, and can be reached at bennettprescott@gmail.com.

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.

RME ADI-2 Pro Measurements

As usual, all measurements were taken using an Audio Precision APx515, with software running under Windows 7. The ADI-2 Pro has so many input, output, equalization, and sampling options that a complete set of measurements would occupy 100 pages or more, so I'm restricting this set to a few of the highlights.

Distortion vs. frequency with an AES (digital) input and the headphone output at 1.5 V into 32 Ω is shown in **Figure 1**. It remains impressively low across the audible spectrum, and does not exhibit the commonly-seen rise at higher frequencies. Distortion versus level at 1 kHz is shown in **Figure 2**, again with a 32 Ω load at the headphone output. It is shown using both the "normal" headphone output and with the "Hi Power" option engaged. The downward slope of the curve with increasing voltage indicates that the results are noise-limited up until the clipping point; actual distortion is minuscule. The Hi Power option increases clipping voltage to 6 V, at the expense of a small amount of extra noise because of the increased gain.

Note that in extended Hi Power testing, the ADI-2 Pro would have a thermal shutdown after 5 minutes or so of continuous output at 5 V into 32 Ω. The protection circuitry is effective—after shutdown, the unit returned to normal operation after a few minutes, unscathed. For the majority of headphones, this is a moot issue; these levels would destroy any headphones that I have on hand.

Figure 3 shows the residual distortion expanded 100,000 times; this certainly looks noise dominated, as implied by the Figure 2 curves.

One unusual feature is selectable reconstruction (anti-imaging) filters for each of the two DACs. Each DAC has five options (Slow, Fast, Short Delay Slow, Short Delay Fast, and NOS). And each of these options yields a different frequency response, impulse response, image rejection, and delay. **Figure 4** shows the frequency response for a 48 kHz sample rate with each of the filter options. The two Sharp options overlay one another, as do the two Slow

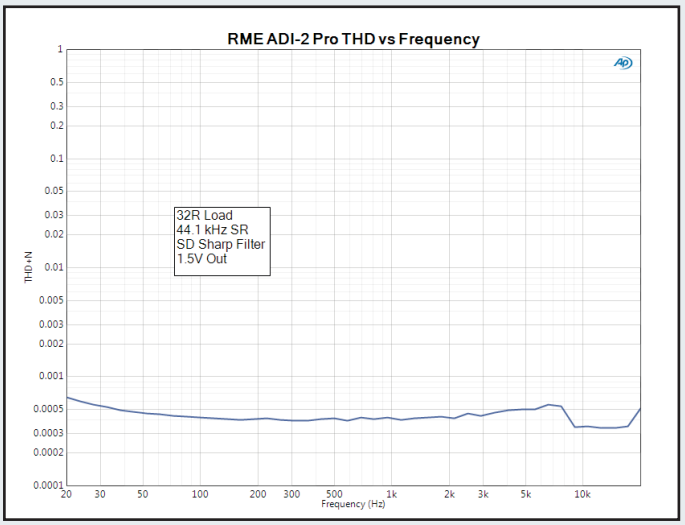

Figure 1: Distortion vs. frequency

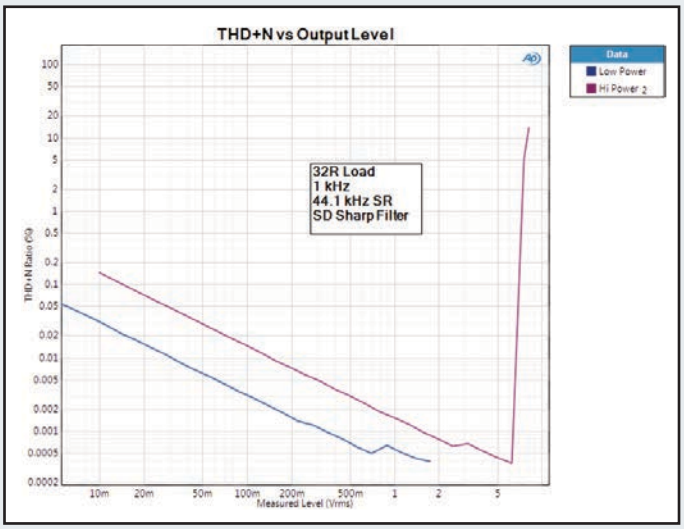

Figure 2: Distortion vs. level at 1 kHz

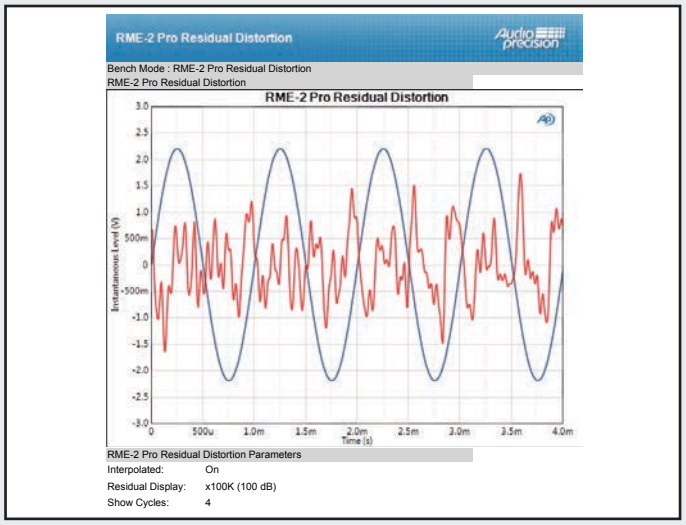

Figure 3: Residual distortion expanded 100,000 times

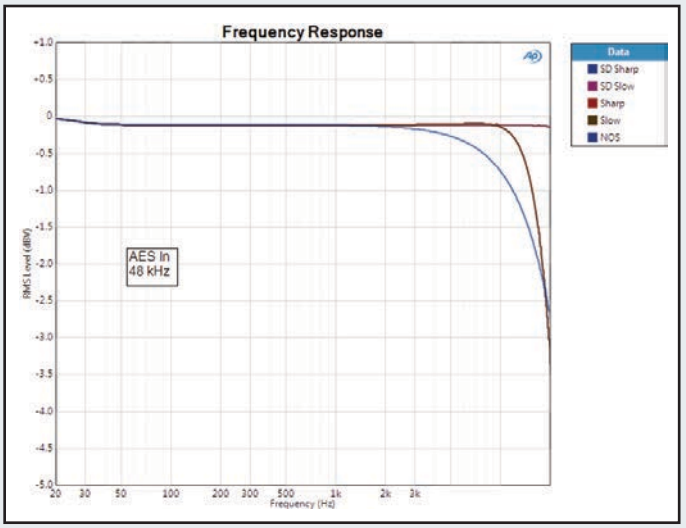

Figure 4: Frequency response for a 48 kHz sample rate

options, with the latter showing significant rolloff in the top octave. The NOS option rolls off even earlier, something that should even be audible to a casual listener.

The amount of treble rolloff with the Slow and NOS is naturally a function of the sampling rate. **Figure 5** compares the frequency response with a Slow filter at 44.1 kHz and 96 kHz sampling rates, the difference being well into the "audible" magnitude.

The choice of filter also affects the suppression of images. The 10 kHz distortion spectra illustrated in **Figure 6** show this clearly. I displaced the fundamental by 500 Hz between the two filter measurements so that the differences would be more visible in the graphs. The image at sample rate minus fundamental (at about 34 kHz) shows 60 dB better for the Sharp filter compared to Slow.

Figure 7 shows impulse response differences for three of the filter options at a 44.1 kHz sample rate. The delay varies from about 0.2 to 0.9 ms, with NOS showing the shortest delay. All of those numbers are well below audibility, but the Short Delay (SD) option will reduce them even further, with SD Sharp showing a delay of under 350 microsecond.

My favorite signal torture test is a multitone measurement, with equal level tones spaced a half octave apart, covering the audio spectrum. Any misbehavior of the electronics shows as tones or hash between the "teeth" of the "comb." **Figure 8** shows the multitone spectrum of the ADI-2 Pro through the headphone output loaded with 32 ohms. It's textbook clean, an outstanding result. I ran this test two ways, using an AES input and using the analog inputs to exercise the AD converters. The results look identical, so the AD half of this unit does not let down the superb performance of the DA and headphone amps.

All in all, the bench test performance of the ADI-2 Pro is flawless. The sound can be tailored using the filter options or equalization if a departure from neutrality is desired.

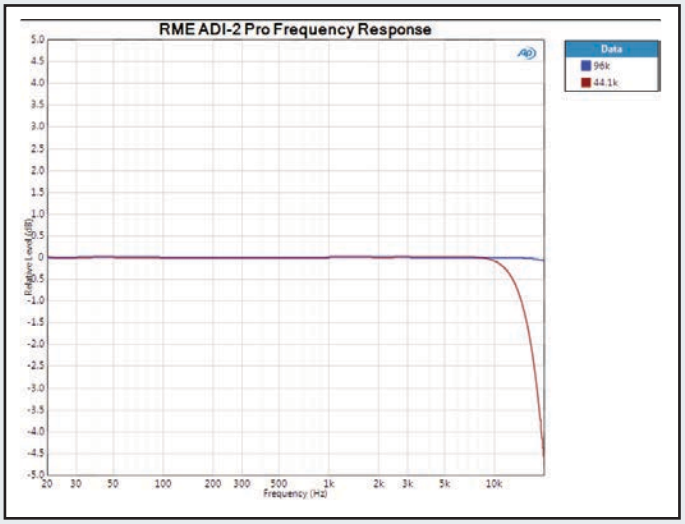

Figure 5: The frequency response with a Slow filter at 44.1 kHz and 96 kHz sampling rates

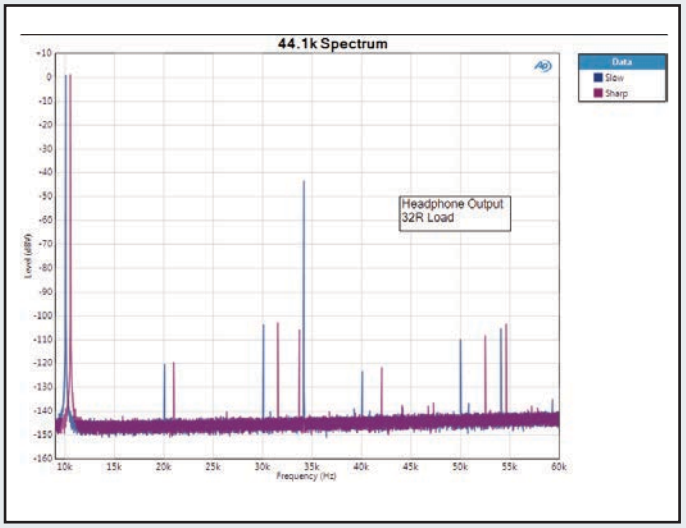

Figure 6: The distortion spectra at 10 kHz show the choice of filter also affects the suppression of images.

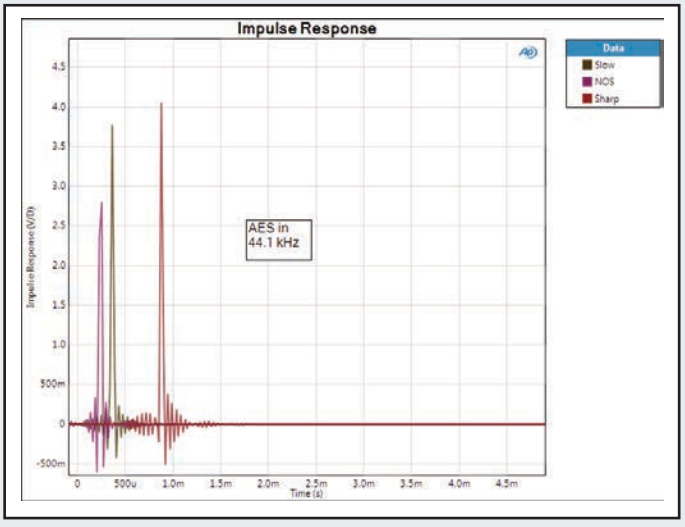

Figure 7: Impulse response differences for three of the filter options at a 44.1 kHz sample rate

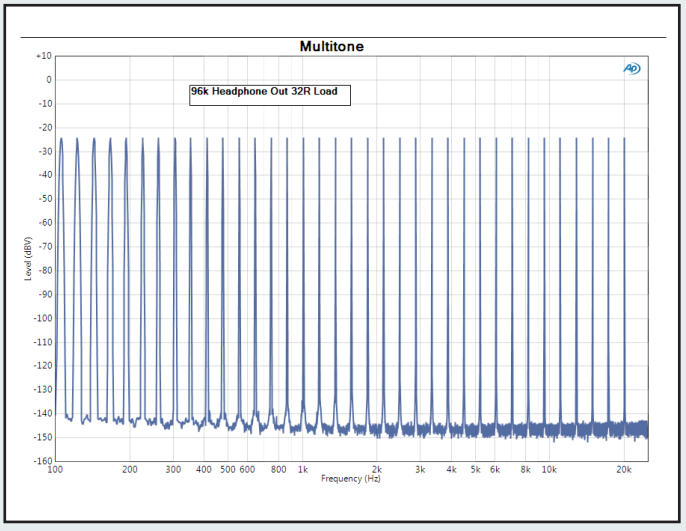

Figure 8: The multitone spectrum of the ADI-2 Pro through the headphone output loaded with 32 Ω