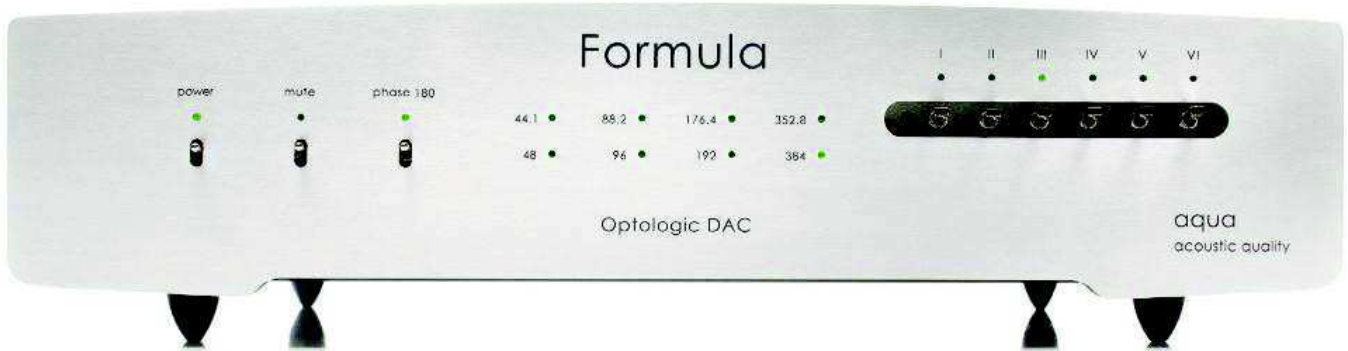


JASON VICTOR SERINUS

Aqua Acoustic Quality Formula xHD

D/A PROCESSOR



At the 2018 Consumer Electronics Show, when John Atkinson and I entered the room shared by Lamm Industries, Aqua Acoustic Quality, and Kharma, we were looking for two things: good sound, and digital products for me to review. When we spied AAQ's Formula xHD digital-to-analog converter, the possibility of evaluating a potentially excellent DAC made by someone other than the usual suspects felt like a golden opportunity.

There were two mitigating factors. First, I usually don't use a preamplifier with either of my reference DACs, dCS's Rossini (\$23,999) and Vivaldi (\$35,999). Instead, I try to keep things simple, and use the dCS DACs' onboard volume controls, rather than add to the system a preamp. (Did I just describe as "simple" an expensive digital front end that, together with the dCS Network Bridge, Scarlatti clock, and Paganini transport comprises up to four components, all connected by a maze of cables?) The conundrum

was easily solved: John suggested that I borrow Lamm Industries' L2.1 Reference preamplifier (\$22,790), which he described as "excellent," and which Art Dudley favorably reviewed in the July 2017 issue.¹

Second, I was not totally blown away by the sound of digital recordings through this room's \$649,440 system. While there was much in the system to admire, as I said in my report on this room, this rig "rounded the leading edges of tones," and I questioned "Whether it did full justice to the lower voices and wealth of detail in two of John Atkinson's superb choral recordings."² As someone who prefers to review products whose sound attracts me in the first place, I was a bit uneasy as I committed to reviewing the Formula xHD. Then again, I'd heard it in a system comprising mul-

¹ See www.stereophile.com/content/lamm-industries-l21-reference-preamplifier.

² See my report on CES 2018 at www.stereophile.com/content/lamm-and-friends-think-big.

SPECIFICATIONS

Description D/A processor with proprietary Optologic D/A conversion system. Pure R2R ladder: FPGA-based without digital filter. Compatible formats: PCM to 16–24-bit/44.1–768kHz, DSD64–DSD256 via DoP, DXD. Digital inputs: RJ45 AQLink (I²S serial bus), BNC coax (S/PDIF, 75 ohm), RCA coax (S/PDIF), AES/EBU (balanced, 110 ohm),

USB 2 Type 2.0 (OSX, Linux driverless, all formats). Modular input: AES/EBU, RCA coax, AT&T (ST Fiber), Optical TosLink. Analog outputs: 1 pair unbalanced (RCA); 1 pair transformer-coupled balanced. Maximum output level: 2.4V, unbalanced; 3.8V, balanced. Output impedance 10 ohms, unbalanced; 600 ohms, balanced. Power consump-

tion: 100–115V/220–240V, 50/60Hz—58VA.

Dimensions 17.7" (450mm) W by 3.9" (100mm) H by 14.6" (370mm) D. Weight: 19.8 lb (9kg).

Finishes Silver, Black.

Serial number of unit reviewed 1370.

Price \$17,000. Approximate number of dealers: 14. Warranty: 5 years.

Manufacturer

AQ Technologies S.r.l., Via Luciano Manara 17, 20122 Milan, Italy. Tel: (39) 338-2300347. Web: www.aquahifi.com. US distributor: Well Pleased Audio Vida, 1934 Old Gallows Road, Suite 350-R, Tyson's Corner, VA 22182. Tel: (703) 750-5461. Web: www.wellpleasedav.com.

numbered LEDs on the front. You just have to remember which is which.

The remote control, which is the same as the one provided with AQT's La Diva transport, can also be used to select inputs and invert polarity on the Formula xHD. I doubt the remote's design was responsible for my inability to figure out how to use it to switch inputs.

Setup

Mark Sossa, of Aqua Acoustic Quality's US distributor, Well Pleased A/V, sent me the very same unit JA and I had heard at CES. Even before installing the Formula xHD, I connected the dCS Rossini DAC to the two-piece Lamm L2.1 Reference preamp, and spent a while evaluating the Lamm's sound. It took me not very long to confirm that it was extremely transparent and open on top, and fully capable of transmitting deep bass, while adding an extra touch of warmth and midrange generosity. While the Lamm 2.1 did beef up the upper lows and lower mids, the extra weight felt natural rather than bloated.

My goal was to use the best source components at my disposal to send the Formula xHD music from discs, files, and Tidal. I first hooked up the dCS Paganini transport via BNC, and dCS's Network Bridge network player via Eth-



ernet. The Formula xHD's unbalanced outputs were connected to the Lamm preamp and it sat on a Grand Prix Formula Platform—these help my system achieve utmost transparency—which I in turn placed on a shelf of my Grand Prix Monaco equipment rack.

Sossa assured me that the review sample had already seen 300 hours of use, which AAQ considers sufficient. He also said that some users have claimed that the Formula xHD needs 500 hours of

break-in before it can fully strut its stuff.

Listening

After playing Nordost break-in tones through the system for 24 hours, to ensure that the cables were settled in, I began listening. What possessed me to begin with Michael Tilson Thomas and the San Francisco Symphony's download-only recording of Berg's *Three Pieces for Orchestra* (24/192 FLAC, SFS Media/HDtracks), whose disturbing atonalities seem to presage WWI, I don't know. But detailed listens to it and other pieces over the next two days through dCS's Network Bridge and Paganini transport convinced me that while the Aqua Formula xHD fully conveyed the emotion of music, the highs were subdued and the color palette limited. In

measurements, continued

at a sample rate of 200kHz). There is no digital reconstruction filter, and with white noise sampled at 44.1kHz (fig.2, magenta and red traces) there was a slow rolloff above the audioband, disturbed by nulls at 44.1 and 88.2kHz. Consequently, the aliased image of a full-scale 19.1kHz tone (cyan and blue traces) was hardly suppressed at all.

Looking in more detail at the frequency response from the balanced outputs (fig.3): Other than a rolloff below 25Hz, it is flat in the audioband at all sample rates, though there is a very

slight rising trend toward 100kHz at the higher sample rates. Measured at the unbalanced outputs, the response was flat from 10Hz up (not shown). The channels were well matched from both sets of outputs.

The Formula xHD's channel separation was excellent, at >105dB from 100Hz to 10kHz, and the low-frequency noise floor was virtually free from any power-supply-related spurs (fig.4). One thing I noted during this test was that the 1kHz waveform on my oscilloscope was stepped rather than

smooth, which is typical of an NOS (Non-OverSampling) DAC. A relevant issue with resistor-ladder DACs is the linearity error: Will a digital signal at, say, -80dBFS be reproduced at the outputs by an analog signal the same 80dB down from full level? However, the Aqua performed well in this respect. When I examined its linearity (fig.5), the error was negligible down to -80dBFS, and remained below 1dB down to -104dBFS.

I My thanks to Jürgen Reis of MBL for suggesting this test to me.

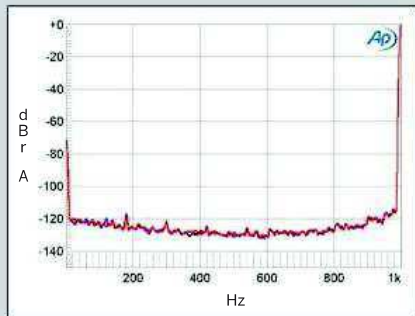


Fig.4 Aqua Formula xHD, spectrum, 0Hz-1kHz, of dithered 1kHz tone at 0dBFS (20dB/vertical div.).

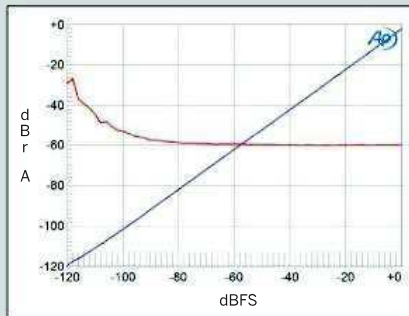


Fig.5 Aqua Formula xHD, 1kHz output level vs data level in dBFS (blue, 10dB/vertical div.); linearity error (red, 1dB/vertical div.).

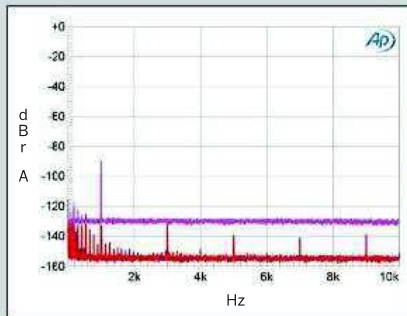


Fig.6 Aqua Formula xHD, spectrum with noise and spurs of dithered 1kHz tone at -90dBFS with: 16-bit data (left channel cyan, right magenta), 24-bit data (left blue, right red) (20dB/vertical div.).

fact, the sound reminded me of what I'd heard in the Aqua-Lamm-Kharma room at CES 2018.

Three days and three pages of extremely detailed notes later, after the Formula xHD had passed the 400-hour mark, its top began to open up, revealing a sound suffused with light and a beautiful, warm midrange. Burning it in further while reviewing soprano Sonya Yoncheva's *The Verdi Album*, with Massimo Zanetti conducting the Munich Radio Orchestra (CD, Sony Music 0889854179823; 24/96, Primephonic),³ I finally noticed the emergence of a three-dimensional soundstage, and the Formula xHD's ability to reveal the changing colors and weights of voice and orchestra as emotions shifted—as well as moments when Yoncheva's vocalism was less than spot on. I threw out my notes and started over.

One familiar recording that I love, and play regularly to test systems, is Eileen Farrell's *Sings Verdi* (CD, Sony Classical Masterworks 62358/ArkivCD). Through the Formula xHD her low tones sounded wonderful, and the warmth of her voice remained intact. That said, her highs were softer and didn't float as freely as I'm accustomed to hearing, and the cello section of the Columbia Symphony Orchestra (conducted by Max Rudolf) had less weight. Ditto Beverly Sills's performance of Richard Strauss's transcendently beautiful song "Breit' über mein haupt," with Aldo Ceccato conducting the London Philharmonic, from *The Art of Beverly Sills* (CD, EMI Classics 64425/ArkivCD): the midrange was gorgeous, but the highs seemed less radiant than I'd hoped for.

Some of the gruffness that has recently surfaced in the voice of baritone Matthias Goerne is audible in his and pianist Markus Hinterhäuser's recording of "Meine Rose," from Schumann's Six Poems, Op.90, on their recital *Ein-samkeit* (24/96 WAV, Harmonia Mundi HMM 902243/HDtracks)—but the Formula xHD smoothed it over. In addition, the deepest resonances of the voice and the bottom line of the piano were shortchanged.

When I turned to Murray Perahia's recording (on piano) of one of my favorite Handel works, the Harpsichord Suite in E, HWV 430 (CD, Sony Classical 62785), his instrument was less naturally percussive than I'm accustomed to—it sounded as if the soft pedal was depressed. Given that I also heard less bass foundation and natural treble ring than usual, the joy at the center of this superb performance touched me less.

Although I couldn't play the two-channel DSD layers of SACDs from my Paganini transport, which requires a DAC with dual AES/EBU inputs, I listened to the 16/44.1 layer of a recording of Vadim Gluzman performing Brahms's Violin Concerto, with the Lucerne Symphony Orchestra under James Gaffigan (SACD/CD, BIS 2172). Focus was excellent, with beautiful warmth and fullness in the midrange, a sweetness to the sound, and a credible halo of air around the violin. I didn't hear the level of color saturation I know this recording contains, but that may well be because I was listening to PCM 16/44.1 instead of DSD64.

3 Read my review at www.stereophile.com/content/yoncheva-and-calleja-give-verdi-workout.

measurements, continued

Increasing the bit depth from 16 to 24 with a dithered 1kHz tone at -90dBFS (fig.6) dropped the noise floor by 25dB. However, the many distortion harmonics visible in the 24-bit signal suggest that something is not optimal in the Formula xHD's handling of low-level data with this bit depth. As with the HoloAudio Spring DAC reviewed in May, another resistor-ladder DAC, perhaps the LSBs are being truncated. With undithered data representing a tone at exactly -90.31dBFS (fig.7), the three DC voltage levels described by the data were well resolved. With

undithered 24-bit data, the result was a clean sinewave (not shown).

When I tested the Formula xHD's harmonic distortion from its balanced outputs, I got a surprise: With the 50Hz tone I usually use, the distortion was extremely high. Even at -3dBFS into 100k ohms (fig.8), the third harmonic lay at just -20dB (10%), which will be very audible. The unbalanced outputs offered very much lower distortion, even into 600 ohms (fig.9). Fig.10 plots the percentage of THD+noise against frequency with a full-scale signal into the high 100k

ohms load from both balanced and unbalanced outputs. You can see that while both outputs offer similarly low distortion in the treble, the balanced THD+N percentage increases rapidly below 200Hz, with almost complete waveform clipping below 80Hz. As the distortion from the balanced output is almost completely odd-order harmonics, I suspect that what we are seeing in fig.10 is saturation of the output transformer's core. Fortunately, as Jason Victor Serinus used only the Aqua's unbalanced outputs, he dodged this bullet.

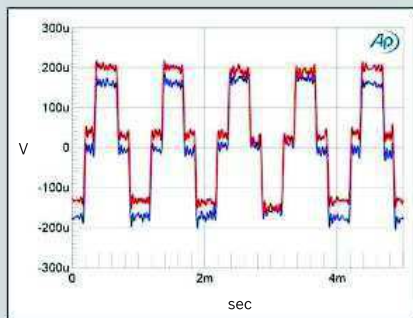


Fig.7 Aqua Formula xHD, waveform of undithered 1kHz sinewave at -90.31dBFS, 16-bit TosLink data (left channel blue, right red).

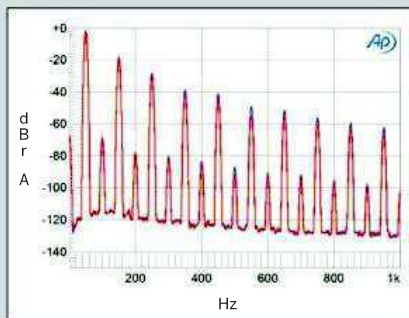


Fig.8 Aqua Formula xHD, balanced output, spectrum of 50Hz sinewave, DC-1kHz, at -3dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

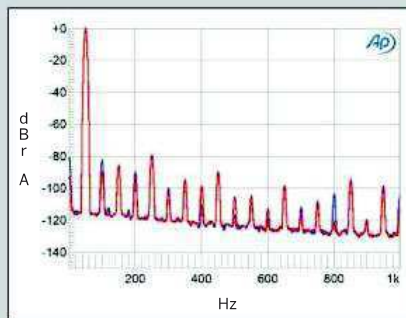


Fig.9 Aqua Formula xHD, unbalanced output, spectrum of 50Hz sinewave, DC-1kHz, at 0dBFS into 600 ohms (left channel blue, right red; linear frequency scale).

Computer Playback

After John Atkinson pointed out that almost no-one who buys a Formula xHD will own a dCS Network Bridge, out came ye olde MacBook Pro running Audirvana Plus, a Nordost Valhalla 2 USB cable, and two AudioQuest JitterBug USB noise attenuators. Around the same time, I switched amplification from my Pass Laboratories XA200.8 monoblocks to Dan D'Agostino Master Systems Progression monoblocks, which, from previous experience, I expected to deliver tighter, stronger bass, as well as more detail and wider dynamic range.

While previous listening had convinced me that the sound of files played from a computer could not equal that from the Network Bridge, my MacBook Pro came into its own after I'd spent half an hour subjecting it to warm-up and demagnetization tracks. Only then did its soundstage widen and its edginess decrease, and listening again become a pleasure.

Nonetheless, the sonic limitations of using a multipurpose computer as a source became apparent when I played a bass-response demo track given me by Wilson Audio's Peter McGrath: "Limit to Your Love," from James Blake's *James Blake* (16/44.1 WAV, A&M 949999). As much as this track sounded clear and transparent, low bass was present but of lesser impact than what I'm used to. Ditto "Electrified II," from Yello's *Toy* (24/48 WAV, Polydor 4782160/HDtracks), in which the bass response was more moderate than through my reference DAC, and the annoying sizzle around voices was toned down. When I briefly listened via

the dCS Network Bridge, the sound of both recordings was wetter, with brighter highs, clearer snaps in the Blake, quieter backgrounds, and slightly more bass.

Further exploration of treble and bass response via computer confirmed that, in a high-resolution version of *Bach Trios*, by mandolinist Chris Thile, cellist Yo-Yo Ma, and double bassist Edgar Meyer (24/96 WAV, Nonesuch 558933/HDtracks), Meyer's instrument was diminished in presence and prominence. As for Ludovic Morlot and the Seattle Symphony's recording of Stravinsky's *The Rite of Spring* (24/96 WAV, Seattle Symphony Media SSM1005/HDtracks), the bass was less heart-stopping, and the extra frisson in the highs that I'm used to hearing was absent.

How Does It Stack Up?

Were this lack of bass from audio files and the toned-down response on top due to the computer source alone, or was it also revealing limitations in the Aqua Formula xHD? I removed the dCS Paganini transport and replaced it with the dCS Rossini DAC (\$23,999), whose MQA update I evaluated in our May 2018 issue.

To ensure an even playing field, I set the Rossini's volume control for unattenuated output, and used the Lamm L2.1 Reference preamp to control volume. I also used the same MacBook Pro and Nordost USB link to send digital files.

To those tempted to cry foul at this comparison of the Formula xHD with the dCS Rossini, which costs \$7000 more, note that the Rossini has its own volume control. In

measurements, continued

The poor ultrasonic rejection visible in fig.2 resulted in a multitude of aliased images with a full-scale mix of 19 and 20kHz tones (fig.11), and reducing the signal level by up to 10dB produced no change in the number of images. Fortunately, music rarely has significant energy toward the top of the audioband.

When I tested the Formula xHD for its rejection of word-clock jitter, using undithered 16-bit J-Test data fed to its AES/EBU input, the odd-order harmonics of the low-frequency, LSB-level squarewave were much higher than they should have been (fig.12). (The correct levels are indicated by the sloping green line.) This behavior was identical when I repeated the test using the coaxial inputs. However, the picture looked a little cleaner with 24-bit J-Test data sourced via USB (fig.13).

Most of the questionable aspects of the Aqua Formula xHD's measured performance stem from its lack of a reconstruction filter. But its poor rejection of word-clock jitter, and that inadequate transformer used to implement the balanced outputs, are flaws that should have been avoided.

—John Atkinson

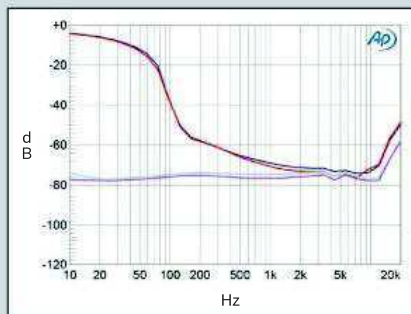


Fig.10 Aqua Formula xHD, THD+N (%) vs frequency at 0dBFS: balanced output (left channel blue, right red), unbalanced output (left cyan, right magenta).

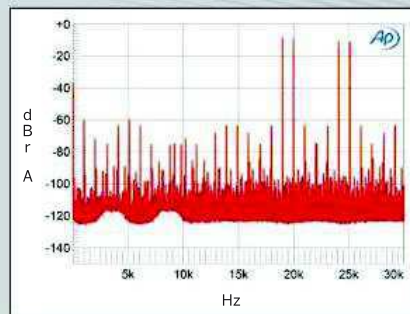


Fig.11 Aqua Formula xHD, balanced output, HF intermodulation spectrum, DC-30kHz, 19+20kHz at 0dBFS into 600 ohms, 44.1kHz data (left channel blue, right red; linear frequency scale)

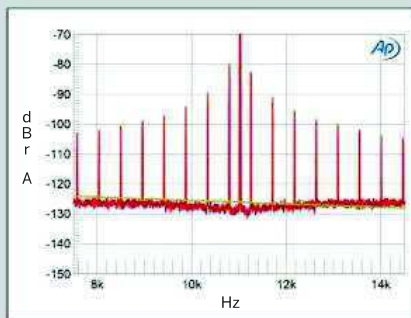


Fig.12 Aqua Formula xHD, high-resolution jitter spectrum of analog output signal, 11.025kHz at -6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 16-bit AES/EBU data (left channel blue, right red). Center frequency of trace, 11.025kHz; frequency range, ± 3.5 kHz.

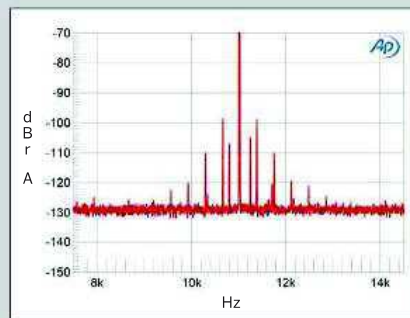


Fig.13 Aqua Formula xHD, high-resolution jitter spectrum of analog output signal, 11.025kHz at -6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 24-bit USB data (left channel blue, right red). Center frequency of trace, 11.025kHz; frequency range, ± 3.5 kHz.

an all-digital system—even one with a BD player such as the Oppo Digital UDP-205, which can output to an external DAC—this feature obviates the need for a preamp (here, one that costs \$22,790).

After several days of warm-up, the Rossini was ready. Upsampling to DXD (the Rossini's upsampling can't be defeated), it delivered more profound bass, greater three-dimensionality, and more deeply contrasting colors with the James Blake track. The Stravinsky was even more telling: the Formula xHD's lovely warmth was replaced by a more saturated but neutral color palette. The Rossini also produced a more convincing impression of the so-so acoustic of Benaroya Hall, where the Seattle Symphony performs and records: the image of the orchestra was set farther back, and the soundstage was wider and higher. Finally, the Rossini's greater bass translated into a more thrilling listening experience that made it more clear why the audience erupted in cheers after that huge, final bass wallop.

Conclusions

Aqua Acoustic Quality's Formula xHD is an extremely fine-sounding DAC whose warmth and ability to decode files of extremely high resolution should win it many admirers. Many will also applaud its designer's rejection of digital filters, oversampling, upsampling, and MQA. Thanks to the Formula xHD's ability to smooth over digital's rough edges, I don't hesitate to recommend that it be auditioned by anyone with \$17,000 to spare, and whose system suffers from bright or harsh sound, or who values, above all else, the warmth and bloom often ascribed to analog sources. ■

ASSOCIATED EQUIPMENT

Digital Sources dCS Paganini SACD/CD transport & Scarlatti clock & Rossini DAC & Vivaldi DAC & Network Bridge network player; Oppo Digital UDP-205 universal BD player; Intel NUC7i7BNH with 8GB RAM, 128GB SSD running Roon; Linksys router with 2 TP-Link gigabit Ethernet media converters & multimode duplex fiber-optic cable; Apple MacBook Pro computer with Intel i7, SSD, 8GB RAM; iPad Pro; external hard drives, USB sticks.

Preamplifier Lamm Industries L2.1 Reference.

Power Amplifiers Dan D'Agostino Master Systems Progression, Pass Laboratories XA200.8 (all monoblocks).

Loudspeakers Wilson Audio Specialties Alexia 2.

Cables Digital: AudioQuest Diamond, Wireworld Platinum Starlight Cat8 (Ethernet); Nordost Odin 1 & 2 & Valhalla 2 (USB). Interconnect: Nordost Odin 2. HDMI: Transparent. Speaker: Nordost Odin 2. AC: Nordost Odin 2.

Accessories Grand Prix Monaco rack & amp stands, 1.5" Formula platform; Nordost QX4, QK1, QV2 AC power accessories; Synergistic Research Transporter & Power-Cell; Isotek EVO3 Sigmas & Audience aR2p-TSSOX power conditioners, GreenWave filter, AudioQuest NRG Edison outlets; Nordost Sort Lifts for speaker cables; Marigo Clear Transformation mat; Stein Music Signature Harmonizers, Blue Suns/Diamonds, Quantum Organizer; Bybee Room Neutralizers; Absolare Stabilizers; Resolution Acoustics room treatment; Stillpoints Aperture panels.

Room 20' L by 16' W by 9' H.—Jason Victor Serinus

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