

SPECIAL
ISSUE

61

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DIE SPITZE DER
DIGITALEN PERFORMANCE

MBL'S NOBLE N31



REGA
RESEARCH'S
RP10
TURNTABLE
» P.19



IN REVIEW

**POWERFUL
AMPLIFIERS**

FROM JADIS,
PASS LABS, PS AUDIO

AMAZING LP PLAYERS
FROM MOFI & REGA

AVM'S OVATION MP 8.2
CD/MEDIA PLAYER

TAD'S MICRO EVOLUTION ONE
MINIMONITOR

» FEBRUARY 2018



TECHNICAL INVESTIGATION » MQA'S "AUDIO ORIGAMI"

JOHN ATKINSON

MBL Noble Line N31

CD PLAYER-D/A PROZESSOR

MDNu"Oqpqdnqem"Eqtqpc"E37"igj34tv"ugkv"o gkpg o "Vguv" k o "Lcjt g"4236" | w" o gkpgpXgtuv@tmgttghgtgp | gpl" Pcej fgo "kej" dgtgkvu" k o "ngv | vgp" Lcjt" gkpk i g" FCEu" igvugv" j cwvg. "yct" gu" pwp" j 3kej uvg" \ gkv. "ukej" cwe j" o kv" fgp" fki kvcngp" Rtqfwmvyp" fgu" fgwvuejgp" Jgtuvngmtu" p@jgt" | w" dguej@hvk i gpl"

ØRtqfwmvyp"kp"uej yct | g o " J qej incp | hkpkuj" ukpf" uej ygt" | w" hqvq i tchktgtp. "wpf" lej" xgtukejgtg" K j pgp. "fcuu" fgt" pgwg" P53" gkpg" Ådgt y @nki gpf g" Uej 34p j gkv" cwuuvtc j m. "fkg" cwh" fg o " Hqv" pke j v" | wt" I gnvwp i" mq o o v. 0" uej tkgd" Lqj p" Kxgtuqp" kp" u gkpg o " Dgtkej v" xqp" fgt" Eqpuw o gt" Gngvtpkpu" U j qy "42390" Wp f" vcvu@ej nke j. "cnu" kej" o gkp" Vguv o wuvgt" fgu" Pqdn g" Nkpg" P53" *ec0" 340222. / "p" cwui grcem" j cwvg. "yct" kej "uqhqt" xqp" fguugp" qrvkuejgt" Cwuuvtc j nwp i "hcu" | kpkgtv" Gkp" 70" i tqEgu" VHV/Hctdfkurnc { ".hncpmkgtv" o kv" ftk" sUqh" Mg { u0" i gpcppvgp" Vcuvgt" cwh" l g fgt" U gkv. "fq o kpkgtv" fkg" Htqprncvvg" Fctwvgt" dghkpf g" uke j" fgt" Unqv" hAt" fgp" xkdtcvkpu i g f@ o rhvgp" EF/Vtcurqt v" *Fgt" P53" gtmgppv" EF/ Vgzv" wpf" | gki v" Vkvgnkphq t o cvkqpgp" cwh" fg o " Fkurnc { "cp" +0" Fkg" Qdgtugkv" | kgtv" gkp" kp" gng i cpvg o " Y gkE" uej k o o gtpfgu" twpfgu" Vqwe j rcf. " o kv" fg o " uke j" fkg" J gmk i mgkv" fgu" Fkurnc { u" kp" uej ju" Uvwhgp" tg i gnp" n0uu v0

Fkg" TÄemugkv" fgu" P53" dgjgtdgt i v" | y gk" WUD/Rqtvu. "fki kvcng" Gkp" wpf" Cwui @pi g" kp" fgp" Hqt o cvgp" CGUIGDW. "wpf" UIRFKH" *mqczkcn" wpf" qrvkuej j. "uqyk g" u { o o gvtkuej g" wpf" wpu { o o gvtkuej g" cpcnig" Cwui @pi g" Fgt" | wu@v | nke j g" FU/Mctvgpungv" fkgp" hAt" Hkt o yctg" Wr fcvgu" Cmg" fki kvcngp" Uej j pkvuvgnmp" ukpf" i cnxcpkue j" i gvtgppv" wpf" pke j v" dgp 34vk i vg" Qu | kmvcqtgp" y gtfgp" cwvq o cvkue j" cd i gue j cnvgv0

I interviewed MBL's chief designer, Jürgen Reis, at CES 2017.¹ When I asked him what was special about the N31, he told me that they'd concentrated on minimizing jitter. The USB inputs are powered from a separate transformer winding, and are optically isolated from the digital circuitry and the analog audio circuitry. There is a three-stage jitter-reduction stage: first, a digital PLL with a wide, 10kHz acceptance window to allow the N31 to lock to a source; then an analog smoothing PLL with a 1Hz corner frequency to reject higher-frequency jitter; and, finally, an asynchronous readout buffer. The output of this last stage feeds the N31's oversampling filter, which deals gracefully with "intersample overs."

Intersample overs occur when the digital data have consecutive samples at 0dBFS. When the digital reconstruction filter interpo-

lates the analog waveform, the result is a waveform that could peak up to 3dB above 0dBFS. If the DSP engineer responsible for the digital filter has not allowed any mathematical headroom, the waveform will be clipped. *Stereophile* used to routinely examine digital-filter headroom, as you can see in our reviews originally published in the early 1990s. But that was before the Loudness Wars, when CDs were mastered so that there were never consecutive samples at 0dBFS. (Some digital-audio workstations calculate the waveform on the assumption that it would be processed by a typical digital filter, thus allowing the mastering engineer to avoid intersample overs.) Such overs are rare to nonexistent in classical recordings, I've found, but both Reis and Benchmark's John Siau² have analyzed a lot of rock recordings and found many pathological examples. For example, in "Gaslighting Abbie," from Steely Dan's *Two Against Nature*, Siau found 1129 intersample overs: 3.7 per second (see "Measurements" sidebar).

Reis explained that the N31's digital filter has 3.5dB of headroom, so that when there are intersample overs, the DSP will never clip. As supplied, the DAC chip used in the N31, a balanced ESS Sabre 9018, doesn't have intersample overload protection and offers generic filters. However, the basic specifications are very good, and the chip's topology allows Reis to manipulate its behavior to eliminate the things he doesn't like about it. For example, while ESS's on-chip filter has 128 taps, Reis modified it to have just 32 taps, to obtain a subjectively desirable "short" filter. MBL also uses its own technology to differently weight the four DAC paths per channel, to smooth the transition between the delta-sigma and multi-bit sections that occurs, I understand, at around -36dBFS. The DAC is followed by an analog low-pass filter and a one-stage output buffer, resulting in a very wide dynamic range (see "Measurements" sidebar).

Setup

The N31's remote handset offers CD playback controls, as well as

1 See <https://tinyurl.com/y9xk9tdn>. Michael Lavorgna and I also talked to Jürgen Reis about more general aspects of digital audio; see www.youtube.com/watch?v=sMmdDLFP45o.

2 See <https://tinyurl.com/ybzau5vu>.

SPECIFICATIONS

Description CD player and D/A processor with remote control. Digital inputs: 1 AES/EBU (XLR), 1 coaxial S/PDIF (RCA), 1 TosLink, 1 USB Class 1 (Type B), 1 USB Class 2 (Type B), 1 SDcard slot for firmware updates, 1 MBL SmartLink (RJ45). Digital outputs: 1 TosLink, 1 coaxial S/PDIF (RCA), 1 AES/EBU (XLR), 1 MBL SmartLink (RJ45). Analog outputs: 1 pair

balanced (XLR), 1 pair unbalanced (RCA). Digital formats supported: 16–24 bit/44.1–192kHz PCM; DSD64 (DoP). Frequency response: not specified. Maximum output level: 4V RMS balanced, 2V unbalanced. Output impedance: 200 ohms balanced, 100 ohms unbalanced. THD+N: <0.001%. Signal/noise: >120dB. Power consumption: <20VA in operat-

ing mode, 0.5VA in Standby. **Dimensions** 17.7" (450mm) W by 5.9" (150mm) H by 16.3" (415mm) D. Weight: 39.7 lbs (18kg) net, 48.5 lbs (22kg) shipping. **Finishes** White/Chrome, Black/Chrome White/Gold and Black/Gold. **Serial number of unit reviewed** 0034. **Price** \$15,400. Approximate number of dealers: 10.

Manufacturer MBL Akustikgeräte GmbH & Co., KG, Kurfürstendamm 182, Berlin 10707, Germany. Tel: (49) 030-2300584-0. Fax: (49) 030-230058410. Web: www.mbl.de. US distributor: MBL North America, Inc., 217 N. Seacrest Boulevard #276, Boynton Beach, FL 33425. Tel: (561) 735-9300. Web: www.mbl-northamerica.com.



**The N31's USB 2 input
will work with iDevices
running iOS7 and up,
using Apple's Camera
Connection Kit.**

the basic functions for MBL's N51 integrated amplifier. It's a substantial, circular beast, finished in black with chrome trim, and seems to have some degree of self-awareness—when you reach for the remote, even before you've touched it, its buttons' labels light up. The N31, too, senses the user's approach, the Menu and Device (input) icons on its display appearing before any of the buttons to left or right are touched. As I'm used to touchscreens, it took me a while to learn *not* to push the onscreen icons and instead press the associated buttons next to them.

As the N31 has no volume control, I performed my initial auditioning using an Ayre Acoustics KX-5 Twenty preamplifier. But after I shipped the Ayre to Art Dudley, for him to review for the March issue, I used a balanced NHT Passive Volume Control I'd bought a few years ago, using short, balanced Canare cables, with a 1/4" TRS jack on the sending end and a male XLR on the other, to connect the NHT PVC to the amplifiers.



Sound

It's common to describe a product's greater resolution of recorded detail as always being an improvement. However, it's also common for this greater detail to be accompanied by too up-front a sound—"ruthlessly revealing," as the audiophile cliché has it. The MBL Noble Line N31 avoided this syndrome, opening a clean window on the recording's soundstage but without thrusting things forward at me. I chose for one of my "Records to Die For" in this issue Robert Silverman's performances of the two Rachmaninoff Piano Sonatas from 1980 and 1991, which we reissued in 2007 (CD, Stereophile

STPH019-2). I hadn't played this disc for some years, but packing for an office move last November, I found a CD-R I'd burned from the DDP file set I'd prepared for the pressing plant. Playing it in the N31 reminded me why I hadn't wanted these recordings to disappear. Silverman's Hamburg Steinway in Sonata 1 was hanging there between and behind the GoldenEar Technology Triton Reference speakers, "palpably present" (as that other audiophile cliché puts it). Yes, I could hear an occasional touch of flutter, but I could ignore this in favor of the sheer tangibility of the N31's presentation of the

MEASUREMENTS

I measured the MBL N31 with my Audio Precision SYS2722 system (see the January 2008 "As We See It," <http://tinyurl.com/4ffpve4>), using both the Audio Precision's optical and electrical digital outputs and USB data sourced from my MacBook Pro running on battery power with Pure Music 3.0 playing WAV and AIFF test-tone files. Apple's USB Prober utility identified the

N31 as "MBL USB Audio Class 2" from "MBL Akustikgerate, Berlin," and its serial number as "Streamlength(tm)." The MBL's USB port operated in the optimal isochronous asynchronous mode. Apple's AudioMIDI utility revealed that, via USB, the N31 accepted 24-bit integer data. The optical input accepted datastreams with sample rates up to 96kHz, and the USB 2.0, AES/EBU, and S/PDIF

inputs accepted streams of up to 192kHz. The CD drive's error correction was good rather than great, glitches appearing in the player's output when the gaps in the data spiral on the Pierre Verany Digital Test CD reached 1.25mm in length at standard track pitch or 1mm with minimum track pitch. This was still much better than the CD standard, the so-called "Red Book," which requires only

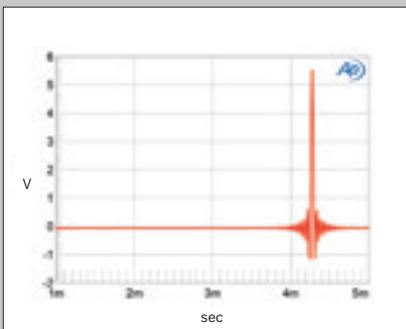


Fig.1 MBL N31, Fast filter, impulse response (one sample at OdBFS, 44.1kHz sampling, 4ms time window).

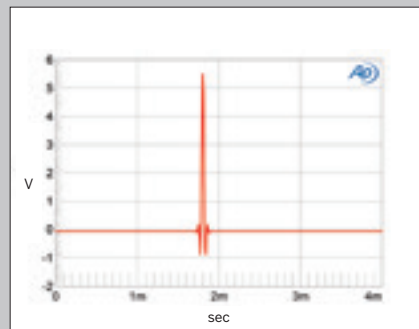


Fig.2 MBL N31, Slow filter, impulse response (one sample at OdBFS, 44.1kHz sampling, 4ms time window).

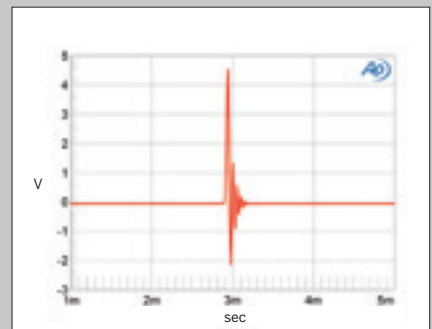


Fig.3 MBL N31, Min filter, impulse response (one sample at OdBFS, 44.1kHz sampling, 4ms time window).

sound, and the forceful nature of the piano's lowest register.

This was with the N31's Min filter. In my interview with him, Jürgen Reis had told me that he feels the minimum-phase Min to sound the most musically natural of the three reconstruction filters. With the MQA-encoded versions of Bob Silverman's recording of Beethoven's 32 piano sonatas (24-bit/88.2kHz FLAC files) sourced from the NAD M50.2 music server, which performed the first "unfolding" (see Jim Austin's article on MQA, p.125), there was a slight ringing in the upper midrange with the Min filter that I hadn't heard with the Rachmaninoff CD. This was reduced with the Fast filter, but so was some of the palpability of the piano sound. With this Beethoven recording, I ended up using the Slow filter, though when I played the Portland State Chamber Choir's performance of Purcell's "Hear My Prayer," from their *Into Unknown Worlds* (16/44.1 ALAC file from CD, CDBaby), this filter was a touch too aggressive.

In fact, I found the differences among the three filters greater in degree than with other DACs that offer a choice of filters. The Min filter gave the best balance between presentation of detail and



listenability with "Whaling Stories," from Procol Harum's *Live: In Concert with the Edmonton Symphony Orchestra* (16/44.1 ALAC rip from CD, Mobile Fidelity/A&M). I always felt that drummer B.J. Wilson overplayed—I saw this lineup of the band in concert in England not long after this album was recorded—but the MBL DAC with Min filter prevented him from overpowering both the rest of the band and the orchestra. Alan Cartwright's bass guitar in this live recording has always sounded a bit "plummy," but the MBL DAC retained the leading edges of the instrument's sound.

What about intersample overs? Vince Gill and Paul Franklin's album *Bakersfield* (16/44.1 ALAC file, MCA Nashville) has been in constant rotation here since its release in 2013, but like so many recordings these days, it has a relentlessly loud quality. "The Fightin' Side of Me" has some intersample overs, but it didn't sound as in-my-face as I'm used to through the MBL's DAC. Was this a benefit of the N31's digital filter headroom? When I played "Gaslighting Abbie," from Steely Dan's *Two Against Nature* (CD, Giant), it lit up the red clipping LEDs on my 1993-vintage Dorrough digital-input level meter, which I'd hooked up to the N31's AES/EBU output.

measurements, continued

that a player cope with gaps of up to 0.2mm. The maximum output level at 1kHz was 4.15V from the balanced outputs, 2.04V from the unbalanced, and both outputs preserved absolute polarity. (The XLR jacks are wired with pin 2 hot.) The output impedance conformed to the specification at 198 ohms balanced and 93 ohms unbalanced.

The Fast filter's impulse response (fig.1)

indicated that it is a conventional linear-phase finite impulse response (FIR) type, with symmetrical ringing either side of the single sample at OdBFS. The Slow filter (fig.2) is also an FIR type but is much shorter, while the Min filter (fig.3) is also short but is a minimum-phase type, with all the ringing following the single high sample. The Fast filter rolled off rapidly above half the sampling

frequency when the N31 decoded white noise sampled at 44.1kHz (not shown),¹ and reached the full stop-band suppression at 25kHz. By contrast, the Slow filter did indeed roll off slowly above the audioband (fig.4, magenta and red traces). As a result, there was very little suppression of the aliased

¹ My thanks for Jürgen Reis for suggesting this test, which I have been using for five years.

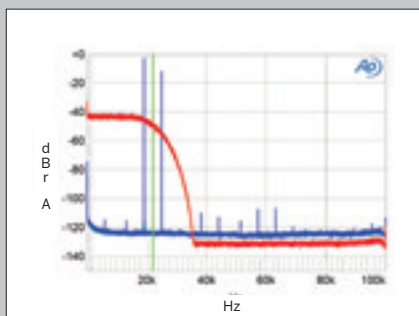


Fig.4 MBL N31, Slow filter, wideband spectrum of white noise at -4dBFS (left channel red, right magenta) and 19.1kHz tone at OdBFS (left blue, right cyan), with data sampled at 44.1kHz (20dB/vertical div.).

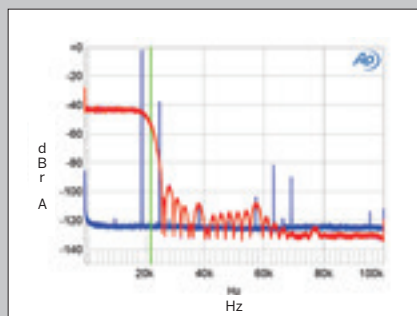


Fig.5 MBL N31, Min filter, wideband spectrum of white noise at -4dBFS (left channel red, right magenta) and 19.1kHz tone at OdBFS (left blue, right cyan), with data sampled at 44.1kHz (20dB/vertical div.).

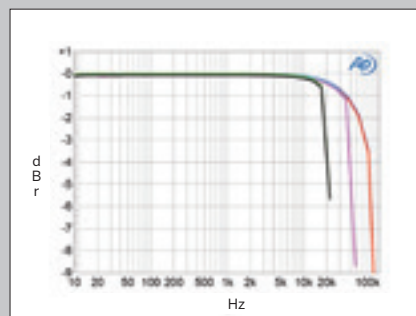


Fig.6 MBL N31, Min filter, frequency response at -12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel green, right gray), 96kHz (left cyan, right magenta), 192kHz (left blue, right red) (1dB/vertical div.).

This happened with the wound-up-tight snare drum. Of course, a clipped snare drum doesn't sound very different from an unclipped snare drum; nevertheless, the N31 with its Min filter gracefully reproduced this overcooked track.

In fact, with older digital recordings, the N31 sounded simply magnificent. I was playing "Southern Cross," from Crosby, Stills & Nash's CSN (4 CDs, 16/44.1; 320kbps AAC file, Atlantic 82319-2). I love the chorus of this song, based as it is on the soul-satisfying 1-4-5, tonic-subdominant-dominant, departure-discovery, return-and-reaffirmation blues progression, but I felt the music wasn't quite matched by the sound quality of the lossy compressed file. But, as before, the N31 allowed sonic shortcomings to step to one side, letting the rock'n'roll magic flow forth. And again, the N31's presentation of detail was superb. The quiet solo guitar in the song's instrumental bridge, for example, stood clear of the multitracked guitars that accompany it in the refrain, but was presented well behind the loudspeakers.

The N31's USB 2 input will work with iDevices running iOS7 and up, using the Lightning-USB adapter from Apple's Camera Connection Kit. I connected both my iPad mini and iPhone 6S, using the CCK and a long Belkin Gold USB cable, and noted that their own volume controls were disabled, allowing full-resolution data to be sent to the N31. Apple's Music app will work for 44.1 and 48kHz files, while an app such as Onkyo's HF Player will allow the N31 to play 24-bit files with sample rates up to 192kHz as well as DSD files. The iPhone and iPad are not sources I routinely use in my listening room, but their sound quality with both the Music and Tidal apps was excellent driving the N31.

A recent discovery on Tidal was Daniel Barenboim and the Staatskapelle Berlin's 2016 performance of Elgar's Symphony 1

(16/44.1, Decca/Tidal HiFi). Facebook recently informed me that Sir Thomas Beecham regarded Elgar's music as "the musical equivalent of St. Pancras Station," but I love both Elgar's wonderful Victorian music and the equally wonderful Victorian architecture of London's St. Pancras, especially now that the station has been renovated. With the Tidal app on my iPad mini streaming this majestically scored symphony to the N31, I could hear no difference between this source and using Tidal on the NAD M50.2 server feeding the same data via S/PDIF to the N31, or using Room/Tidal on my Mac mini via USB.

Comparisons

I first compared the N31 with the PS Audio PerfectWave DirectStream D/A converter (\$6899 with Bridge II network adapter card), which I bought following the publication of Art Dudley's review, in 2014.³ The DirectStream DAC perhaps sacrifices ultimate resolution in favor of a "comfortable" sound. Compared with the PS Audio, and even after compensating for the PerfectWave's 3.3dB lower level, with the N31 the MBL had a sense of greater drive and impact, especially in the bass. (To make sure the playing field was level, all comparisons were performed with the NHT PVC used to match levels at 1kHz.) Not only was the MBL DAC rather more resolving of recorded detail, there was a feeling of drive in its low frequencies with Bob Silverman's Rachmaninoff recording that made the PS Audio sound too soft.

I then turned to the Ayre QX-5 Twenty (\$8950), which I reviewed last August,⁴ again with levels matched at 1kHz. (The Ayre's maximum output is 0.7dB hotter than the MBL's.) The Ayre's Listen filter is similar in the time domain to the N31's Min filter, and Silverman's Rachmaninoff sonatas sounded very similar on the two DACs

measurements, continued

image of a full-scale 19.1kHz tone (cyan and blue traces). The Min filter (fig.5) rolled off a little faster than the Slow, but the ultrasonic noise floor has an odd-looking, scalloped appearance.

With the Min filter and 44.1kHz data, the response was flat up to 18kHz but was then -3dB at 20kHz (fig.6, gray and green traces). With the Slow filter (not shown), the rolloff began lower in the audioband, above

12kHz. At higher sample rates with all three filters, the rolloff continued smoothly until half of each sample rate, at which point the response dropped rapidly. Channel separation was >125dB in both directions below 1kHz, decreasing slightly to a still-superb 113dB at 20kHz. The N31's analog noise floor was both free from power-supply-related spurious and extraordinarily low in level. When I increased the bit depth from 16 to 24

with a dithered 1kHz tone at -90dBFS (fig.7), the noise floor dropped by almost 30dB, meaning that the MBL offers 21 bits' worth of resolution—the current state of the DAC art. With undithered data representing a tone at exactly -90.31dBFS (fig.8), the three DC voltage levels described by the data were well resolved, as was the Min filter's minimum-phase ringing at the level transitions. With undithered 24-bit data, the result was a clean

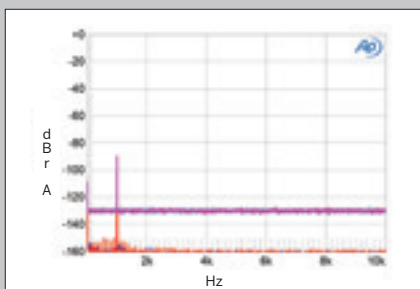


Fig.7 MBL N31, spectrum with noise and spurs of dithered 1kHz tone at -90dBFS with: 16-bit data (left channel cyan, right magenta), 24-bit data (left blue, right red) (20dB/vertical div.).

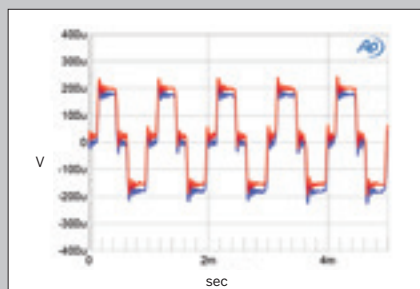


Fig.8 MBL N31, waveform of undithered 1kHz sine wave at -90.31dBFS, 16-bit TosLink data (left channel blue, right red).

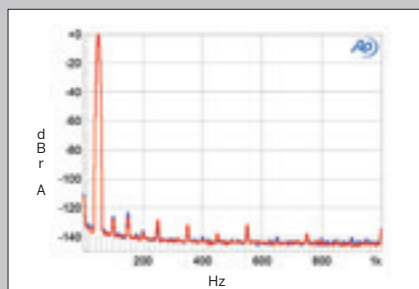


Fig.9 MBL N31, spectrum of 50Hz sine wave, DC-1kHz, at 0dBFS into 600 ohms (left channel blue, right red; linear frequency scale).

in both tonal quality and soundstage presentation. “Gaslighting Abbie” also sounded similar to how it had through the N31. I don’t know how the Ayre’s digital filter deals with intersample overs, but if I had to swear on it, that overcooked snare drum did sound *slightly* less natural through the QX-5 Twenty.

Finally, I compared the N31 with the AVM Ovation MP 8.2 (\$10,995), which Art Dudley reviews elsewhere in this issue and which has a maximum output 4.6dB lower than the MBLs. Art called it correctly when he wrote that this German DAC did “an exceptional job of allowing the songs as much flow and momentum, and consequent emotional impact,” as he’d heard from an XTC CD. With the Silverman Rachmaninoff CD-R, and with the MP 8.2’s filter set to Smooth and 176.4kHz upsampling, the sound of the piano was a little more forward in the midrange, but there was a little less bottom-end weight. The forward midrange was also a factor with CSN’s “Southern Cross,” with the slight amount of congestion in the backing vocals more audible than it had been with the N31. “Gaslighting Abbie” also sounded more forward than it did through the N31, with a propulsive sense of drive and excellent definition of the bass guitar, but the snare drum did sound a touch more aggressive with the MP 8.2 than with either the MBL or the Ayre.

Overall, I preferred the MBL N31 to the PS Audio and AVM, though with the Ayre it was a close call.

Conclusions

The N31’s absence of a volume control might be a problem for those who’ve sold their preamplifiers, as will be the lack of a network port for those who’ve banished their noisy NAS drives from the listening room. And I wish that MBL’s filters could be selected

ASSOCIATED EQUIPMENT

Digital Sources NAD M50.2 music server; iPad mini & iPhone 6S with Apple Camera Connection Kit; AVM Ovation MP 8.2, Ayre Acoustics QX5 Twenty, PS Audio PerfectWave DirectStream DACs; Mac mini running Roon 1.3.
Preamplifier Ayre Acoustics KX-5 Twenty, NHT Balanced Passive Volume Control.
Power Amplifiers MBL Corona C15, Pass Labs XA60.8 monoblocks.
Loudspeakers GoldenEar Technology Triton Reference.
Cables Digital: AudioQuest Coffee (DACs), Belkin Gold (iDevices), USB; DH Labs, AES/EBU; Esperanto, S/PDIF. Interconnect (balanced): AudioQuest Wild Blue, Canare. Speaker: AudioQuest K2. AC: AudioQuest Dragon, manufacturers’ own.
Accessories Target TT-5 equipment racks; Ayre Acoustics Myrtle Blocks; ASC Tube Traps, RPG Abffusor panels; Shunyata Research Dark Field cable elevators; AudioQuest Niagara 5000 Low-Z Power Noise-Dissipation System. AC power comes from two dedicated 20A circuits, each just 6’ from breaker box. —John Atkinson

with the remote. But, as I say in the “Measurements” sidebar, digital audio engineering doesn’t get any better—nor, I feel, does digital sound quality. At \$15,400 it may be expensive, but MBL’s Noble Line N31 is beyond reproach. ■

measurements, continued

sinewave (not shown).

Not only did the N31 offer very low levels of analog noise, its distortion was also superbly low. With a full-scale 50Hz tone, the distortion harmonics all lay below -120B (0.0001%), even into the punishing 600 ohm load (fig.9). Intermodulation distortion was also vanishingly low in level (fig.10), though with the Slow and Min filters, the aliased images of the 19 and 20kHz tones with which

I test IMD were not well suppressed. The MBL’s rejection of word-clock jitter, with all its digital inputs as well as CD (fig.11), was superb. Digital audio engineering doesn’t get any better.

Finally, as Jürgen Reis emphasizes the N31’s ability to cope gracefully with intersample overs, I looked at the CD track of Steely Dan’s “Gaslighting Abbie” using the no-longer-available BIAS Peak program,

which doesn’t interpolate between samples for its waveform display. There were indeed multiple instances of consecutive samples at 0dBFS that would result in intersample overs. The red arrows in fig.12, for example, show two such instances in the non-interpolated waveform at 3:27, the one in the left channel (top) having three consecutive samples at 0dBFS, and that in the right (bottom) two consecutive samples. —John Atkinson

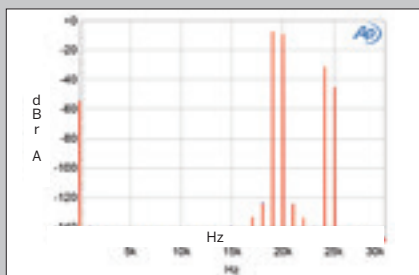


Fig.10 MBL N31, Min filter, HF intermodulation spectrum, DC-30kHz, 19+20kHz at 0dBFS into 600 ohms, 44.1kHz data (left channel blue, right red; linear frequency scale).

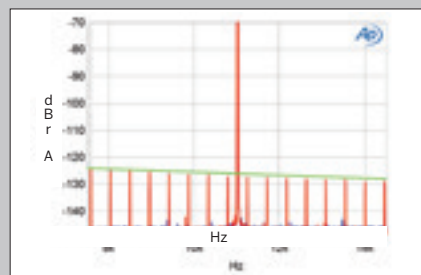


Fig.11 MBL N31, high-resolution jitter spectrum of analog output signal, 11.025kHz at -6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 16-bit AES/EBU data (left channel blue, right red). Center frequency of trace, 11.025kHz; frequency range, ±3.5kHz.



Fig.12 Steely Dan’s “Gaslighting Abbie,” sample-level waveform display. Red arrows indicate consecutive samples at 0dBFS that would result in intersample overs.



high end audio