CD PLAYER/TRANSPORT REVIEWS

ATC CDA2 Mk2 CD player-preamplifier Measurements

Sidebar 3: Measurements

I measured the ATC CDA2 Mk2 using my Audio Precision SYS2722 system (see the January 2008 "As We See It"). Looking first at its performance as a CD player, the CDA2 Mk2 had the best error correction I have ever encountered, playing every track on the *Pierre Verany Digital Test CD* without glitches. This included the track with a single 4mm gap per revolution in the data spiral, and the track with repeated 3mm gaps! (The Compact Disc standard, the so-called "Red Book," requires only that a player cope with gaps of up to 0.2mm.)

As the output RCA jacks had been broken, I used crocodile clips attached to the inside of the jacks for the measurements. The balanced output impedance was 20.5 ohms at 20Hz and 1kHz, rising to 46 ohms at 20kHz. These impedances are higher than the specified 10 ohms, but still very low.

The unbalanced output impedance was higher, at 460 ohms, as was the headphone output impedance, which was 121 ohms at low and middle frequencies, and 115 ohms at the top of the audioband.

A 1kHz digital signal at 0dBFS resulted in an output level of 14.8V at the balanced output jacks, 7.37V at the unbalanced jacks, and 7.85V at the headphone output, all measured into 100k ohms with the volume control set to its maximum. All three sets of outputs preserved absolute polarity for both CD playback and for the coaxial and optical S/PDIF inputs. The latter locked to datastreams with all sample rates up to 192kHz.

Apple's USB Prober app identified the USB input as "Combo384 Amanero" from "Amanero Technologies," and the CDA2 Mk2's serial number as "413-001." (The serial number on the player's rear panel was 0046.) The USB input operated in the optimal isochronous asynchronous mode, in which the DAC, not the computer, controls the flow of data packets. My MacBook Pro's AudioMIDI app reported that the CDA2 Mk2's USB input would accept 32-bit integer data sampled at all rates from 32 to 384kHz.

The ATC's impulse response with 44.1kHz data (fig.1) indicates that its reconstruction filter is a minimum-phase type, with all ringing occurring after the single sample at 0dBFS. With 44.1kHz-sampled white noise (fig.2, red and magenta traces), the CDA2's response rolled off sharply above 20kHz, but didn't reach full stop-band suppression until above the Nyquist frequency of 22.05kHz (green vertical line). An aliased image at 25kHz of a full-scale tone at 19.1kHz (blue and cyan traces) can therefore be seen, though this lies at –100dB (0.001%). The distortion harmonics of the 19.1kHz tone are visible above the ultrasonic noise floor, the second harmonic being the highest in level, at –86dB (0.005%).

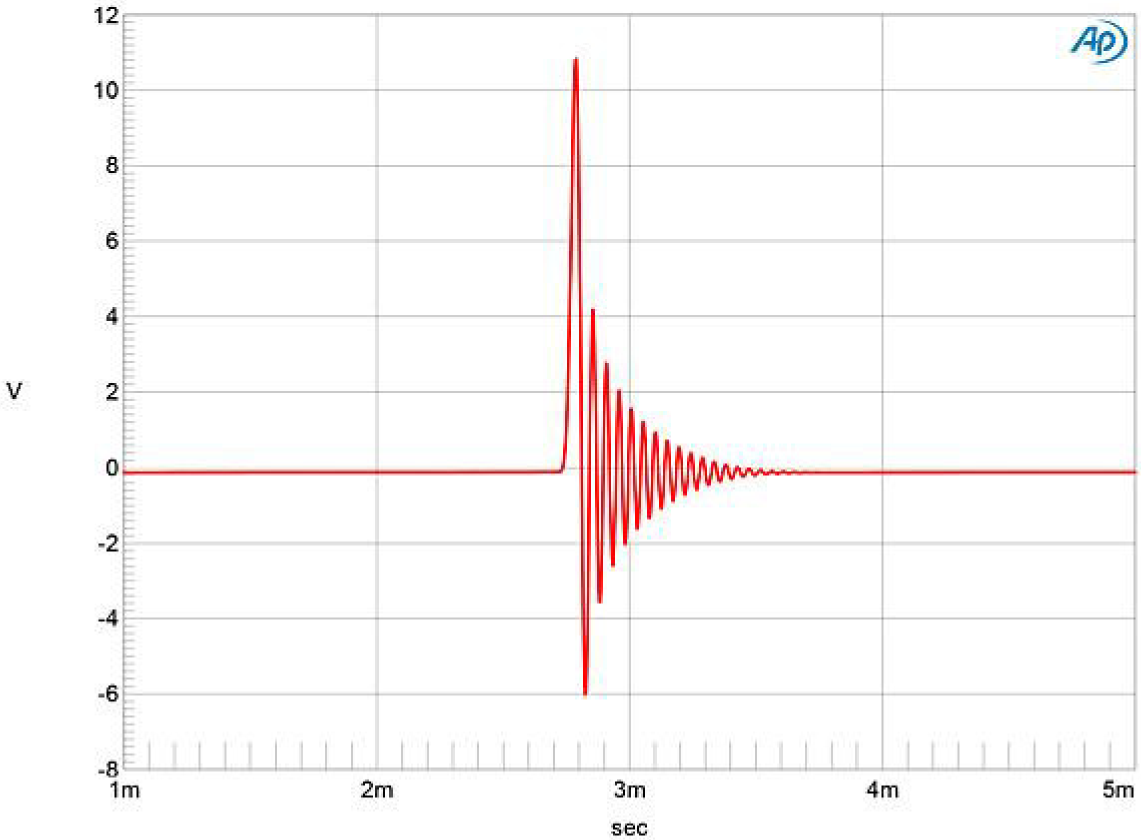


Fig.1 ATC CDA2 Mk2, digital input, impulse response (one sample at 0dBFS, 44.1kHz sampling, 4ms time window).

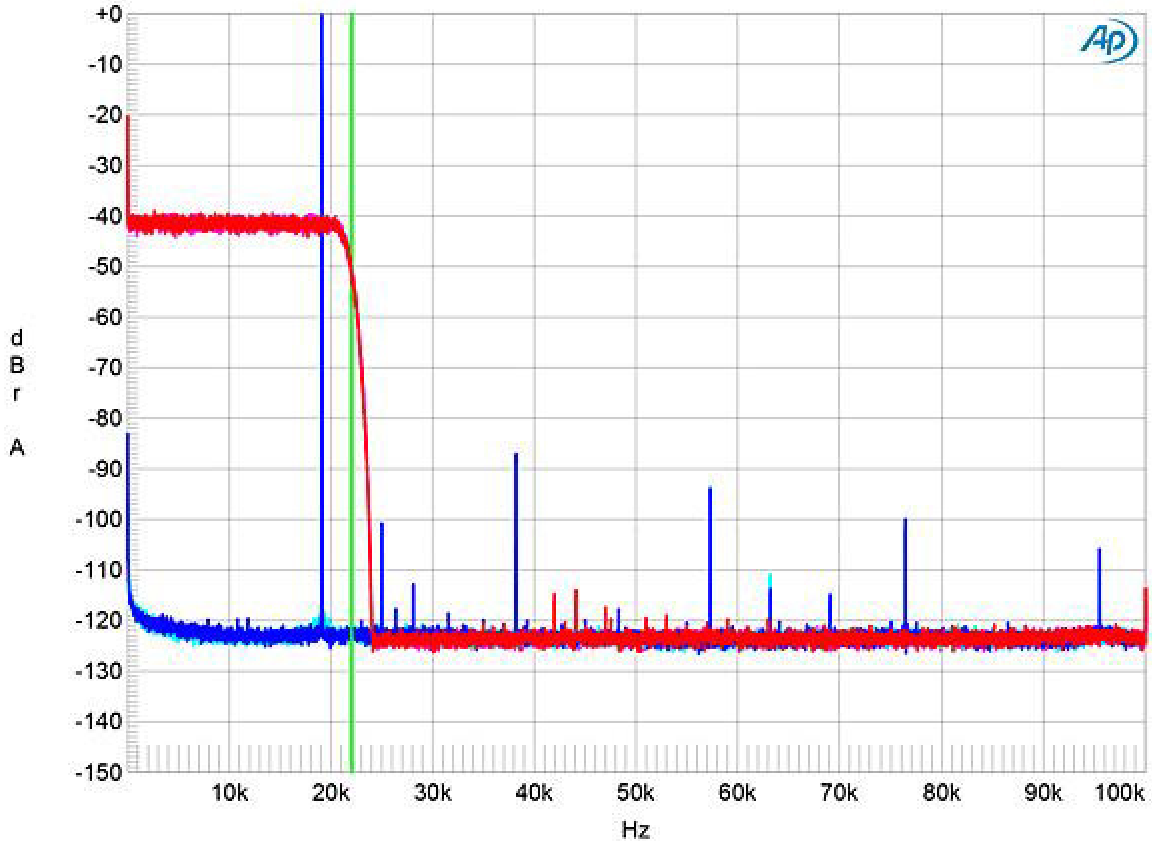
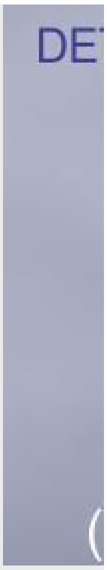


Fig.2 ATC CDA2 Mk2, digital input, wideband spectrum of white noise at –4dBFS (left channel red, right magenta) and 19.1kHz tone at 0dBFS (left blue, right cyan), with data sampled at 44.1kHz (20dB/vertical div.).



When I examined the ATC's digital frequency response with S/PDIF data at 44.1, 96, and 192kHz, the response began to roll off below each Nyquist frequency, with then a sharp rolloff at the two lower sample rates (fig.3, green and gray traces, 44.1kHz data; cyan and magenta, 96kHz data). The ultrasonic response with data sampled at 192kHz (fig.3, blue and red traces) extended slightly higher than that with 96kHz data. I haven't shown the response with data sampled at 384kHz, as it overlaid the 192kHz traces up to 96kHz, above which it continued smoothly rolling off, reaching –30dB at 130kHz. Channel separation (not shown) was excellent, at 115dB below 500Hz, and still 90dB at 20kHz. The low-frequency noise floor with 24-bit TosLink data was clean (fig.4), though a spurious tone can be seen 120Hz below the spectral spike that represents a full-scale 1kHz tone.

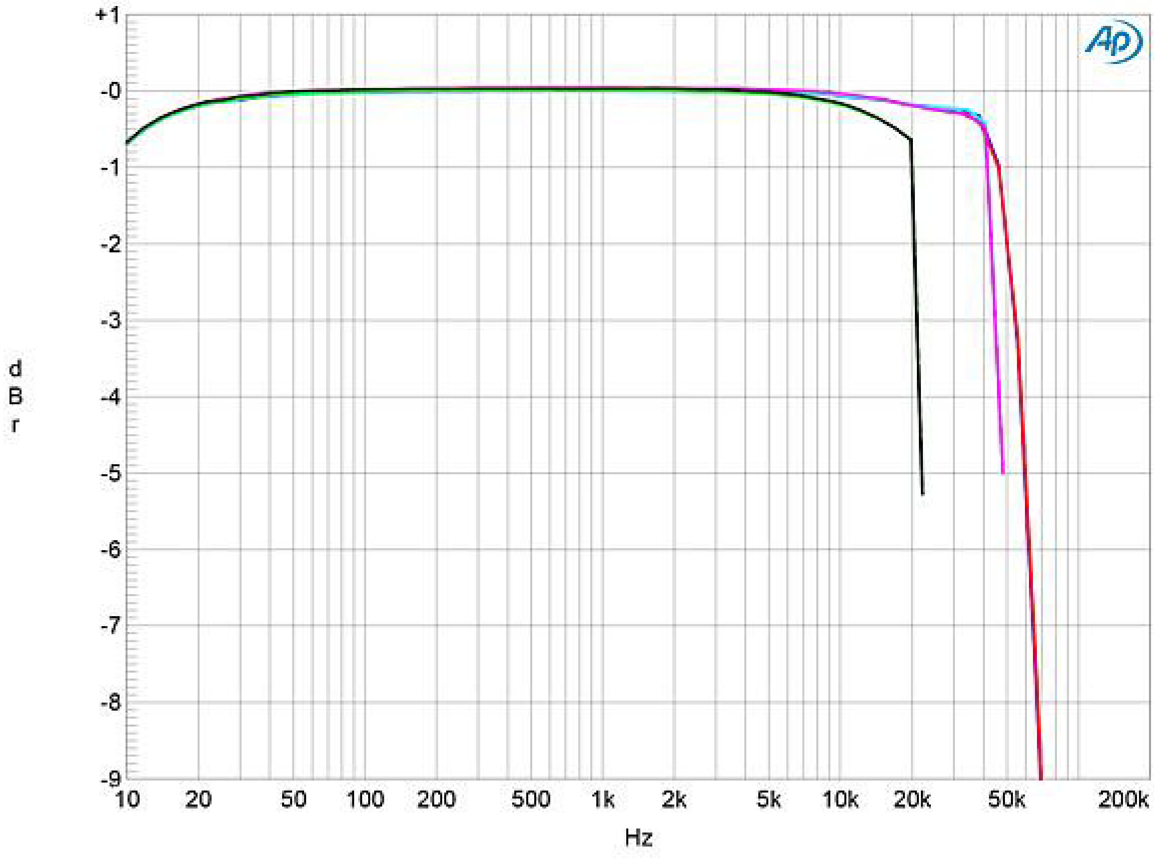


Fig.3 ATC CDA2 Mk2, digital input, frequency response at –12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel green, right gray), 96kHz (left cyan, right magenta), 192kHz (left blue, right red) (1dB/vertical div.).

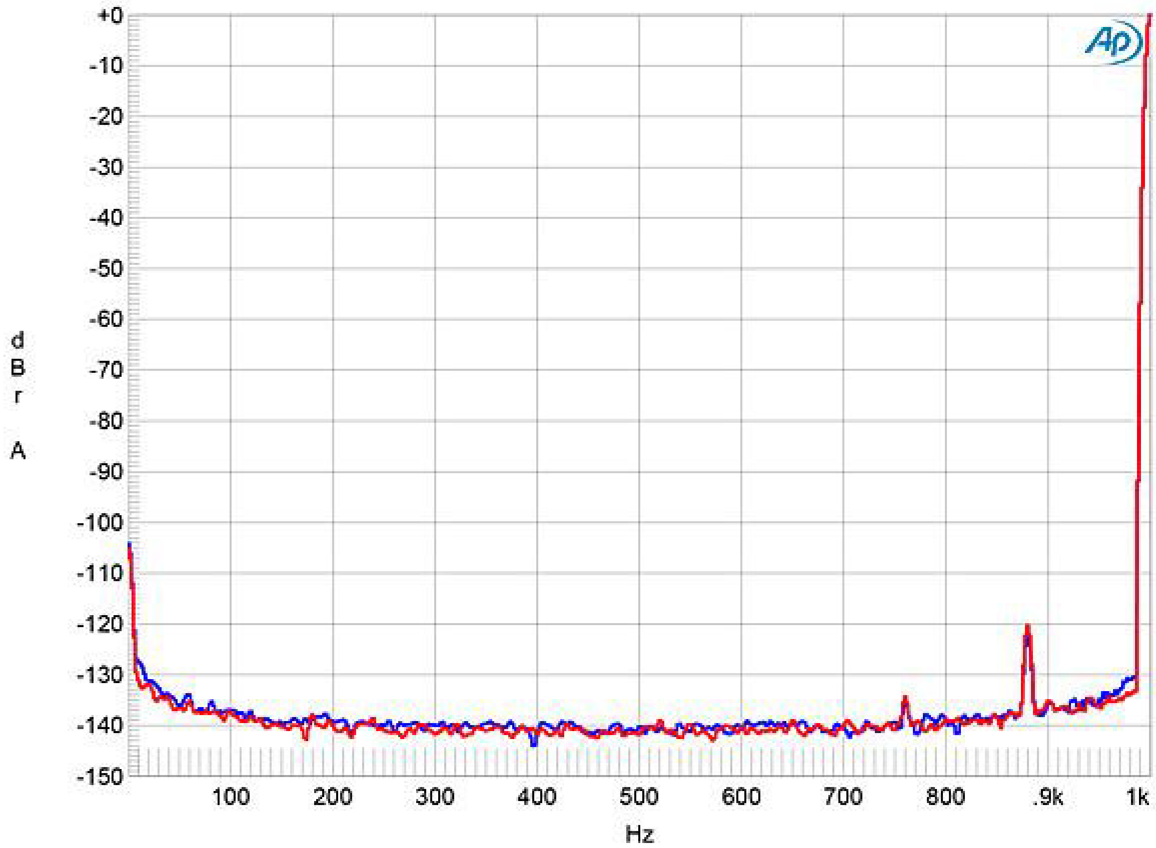


Fig.4 ATC CDA2 Mk2, digital input, spectrum of 1kHz sinewave, DC–1kHz, at 0dBFS (left channel blue, right red; linear frequency scale).

When I increased the bit depth from 16 to 24 with a dithered 1kHz tone at –90dBFS (fig.5), the noise floor dropped by almost 20dB, meaning that the CDA2 Mk2 offers more than 19 bits' worth of resolution, which is excellent. With undithered 16-bit data representing a tone at exactly –90.31dBFS (fig.6), the three DC voltage levels described by the data were well resolved, the waveform was perfectly symmetrical, and the minimum-phase ringing on the transitions was clearly evident. With undithered 24-bit data, the result was a clean sinewave (fig.7).

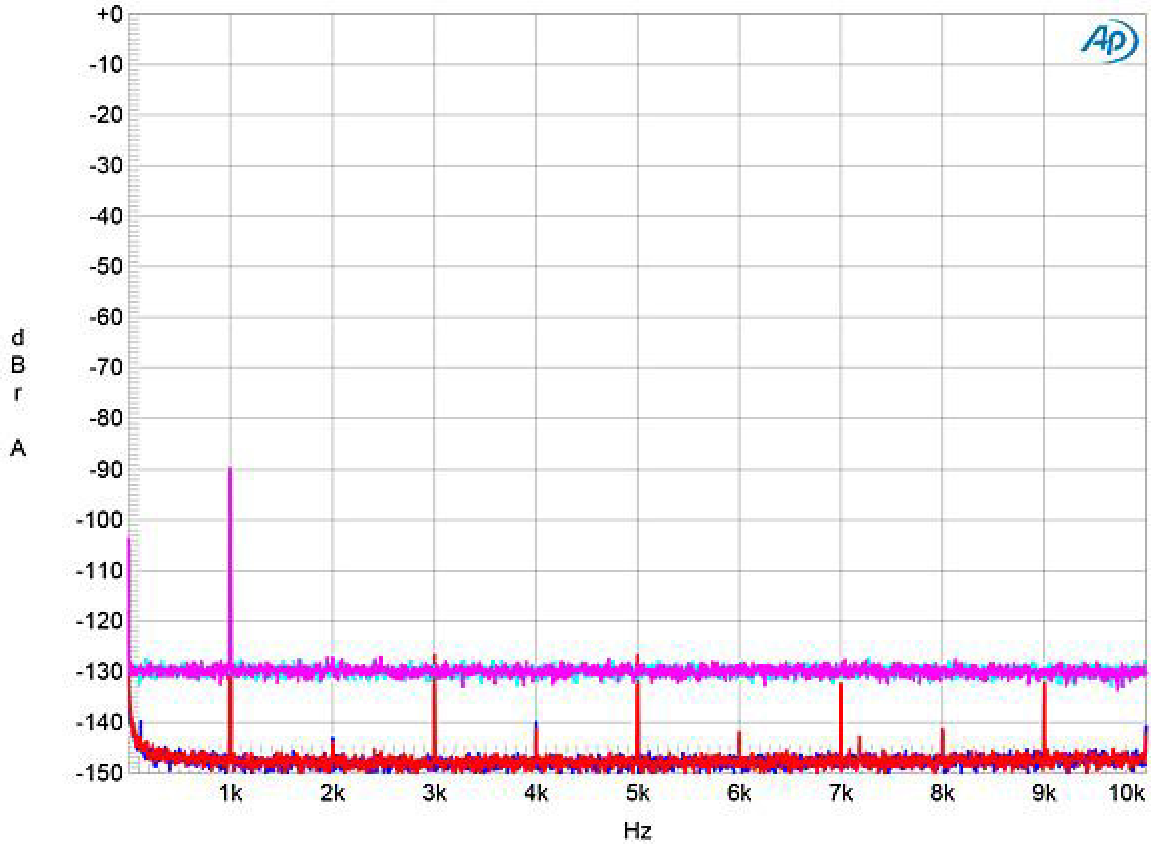


Fig.5 ATC CDA2 Mk2, digital input, spectrum with noise and spuriae of dithered 1kHz tone at –90dBFS with: 16-bit data (left channel cyan, right magenta), 24-bit data (left blue, right red) (20dB/vertical div.).

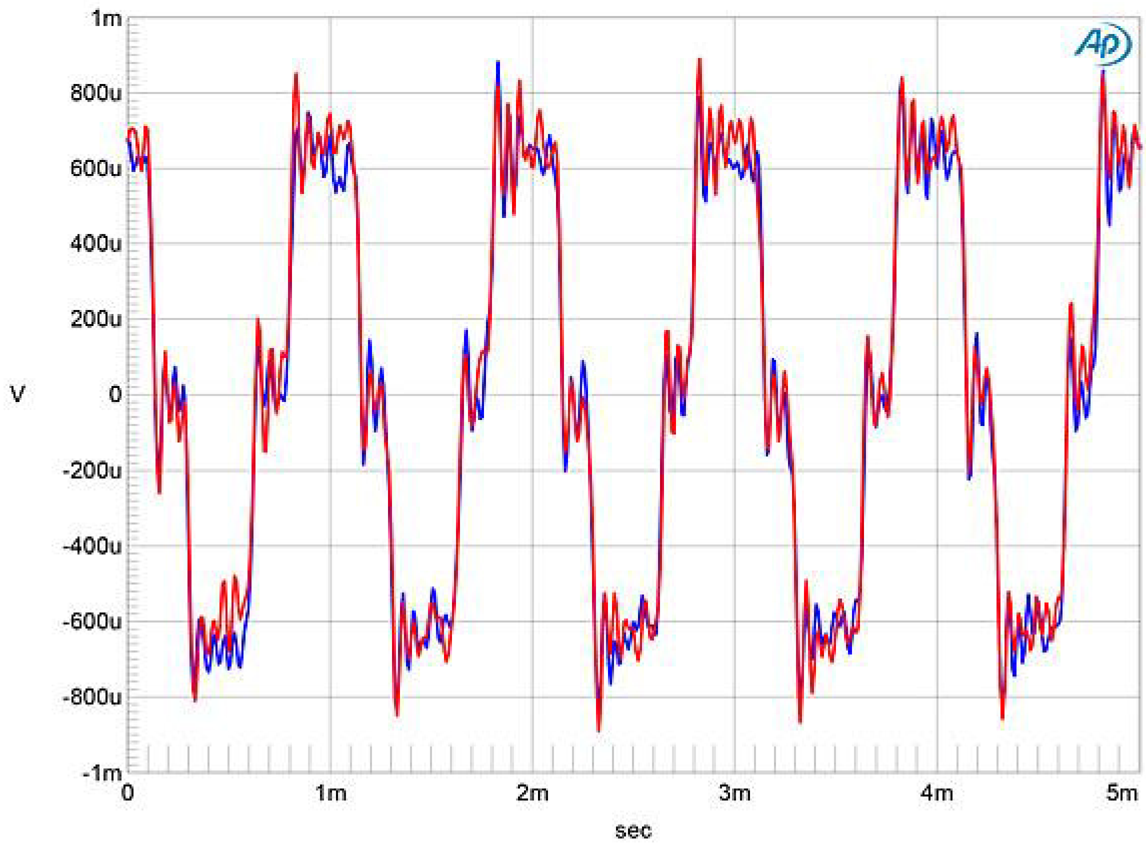


Fig.6 ATC CDA2 Mk2, digital input, waveform of undithered 16-bit, 1kHz sinewave at –90.31dBFS (left channel blue, right red).

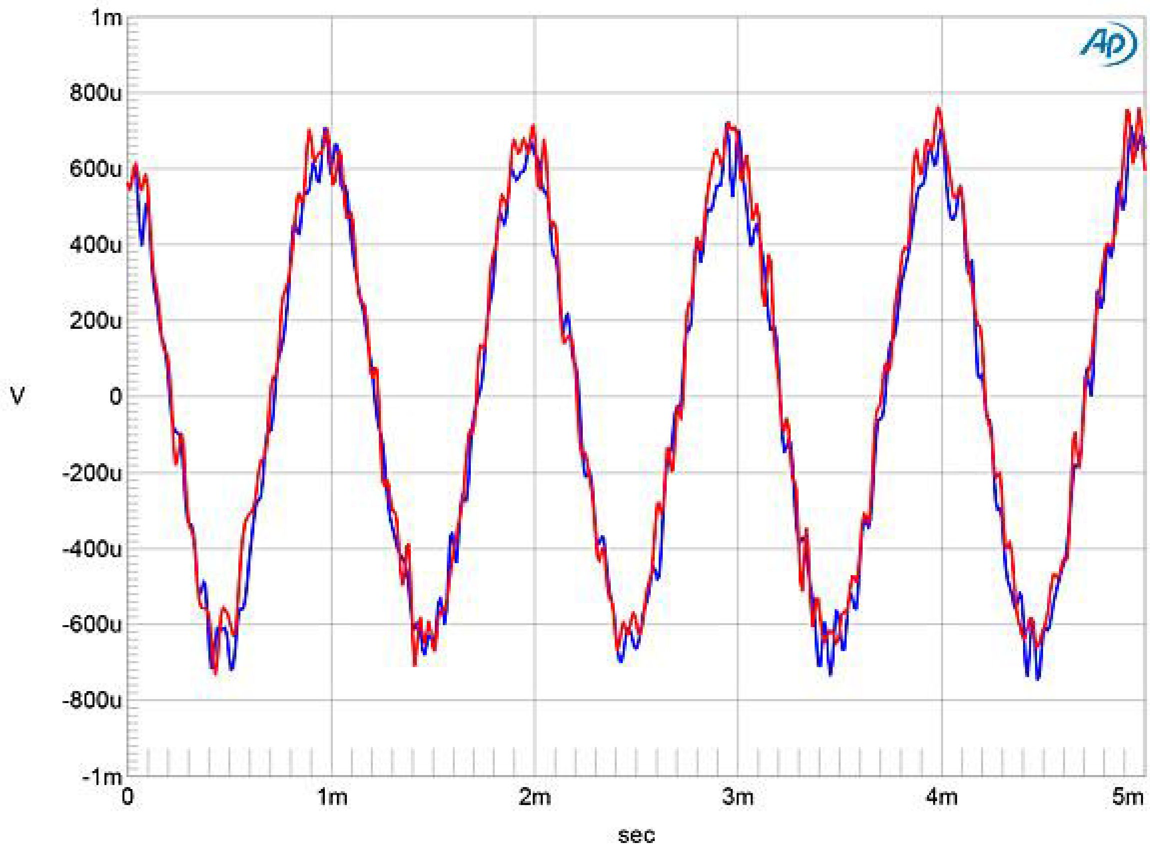


Fig.7 ATC CDA2 Mk2, digital input, waveform of undithered 24-bit, 1kHz sinewave at –90.31dBFS (left channel blue, right red).

As well as very low analog noise, the ATC CD player featured very low levels of harmonic distortion. Even into the punishing 600 ohm load, a full-scale 50Hz tone had just 0.0004% of second-harmonic content (fig.8). Intermodulation distortion with a mix of equal levels of 19 and 20kHz 24-bit tones sourced via TosLink was at low levels (fig.9), though the noise floor to either side of the high-level tones included low-level spurious tones. These spurious tones could also be seen when I tested the CDA2 Mk2's rejection of word-clock jitter with 16-bit TosLink J-Test data (fig.10). The coaxial S/PDIF input behaved identically. However, when I repeated the test with CD data (fig.11) the tones were absent, and the odd-order harmonics of the LSB-level, low-frequency squarewave were all reproduced at the correct level (sloping green line). A pair of sidebands at ±120Hz are present, but these are low in level.

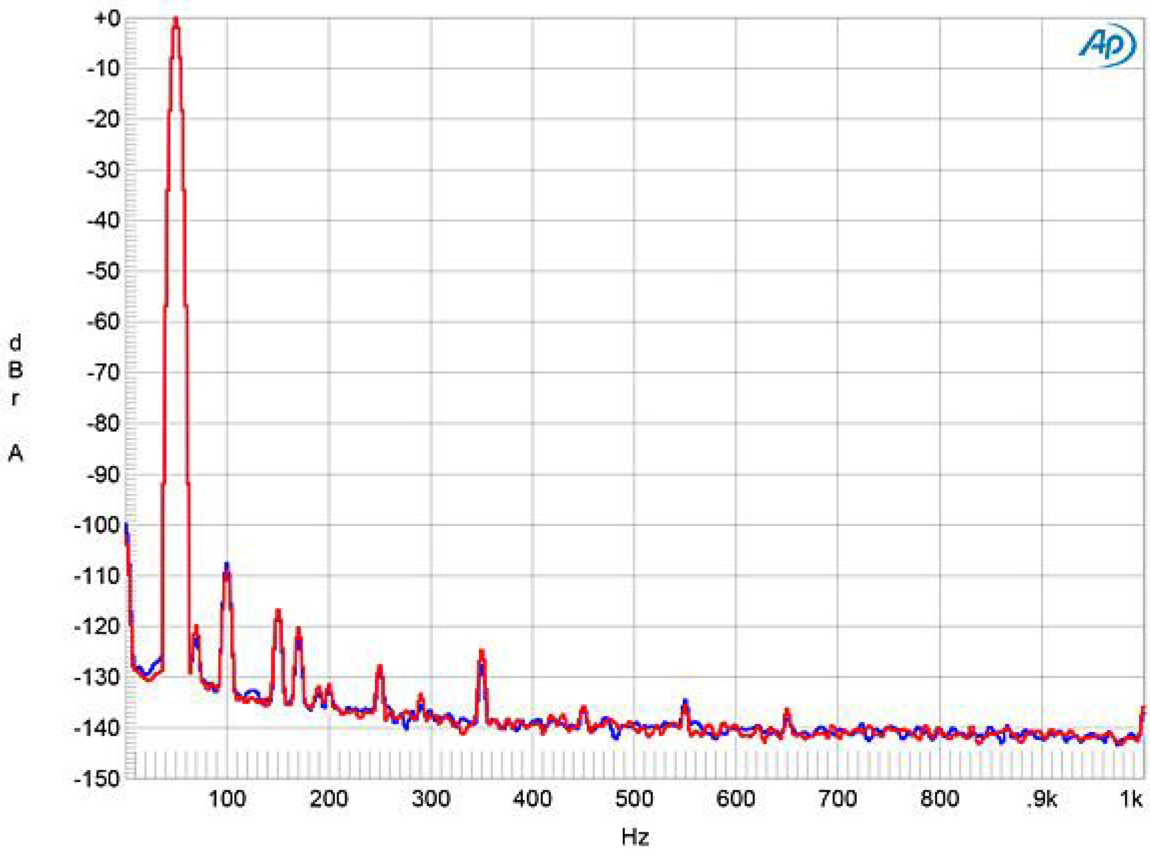


Fig.8 ATC CDA2 Mk2, digital input, spectrum of 50Hz sinewave at 0dBFS, DC–1kHz, into 600 ohms (left channel blue, right red; linear frequency scale).

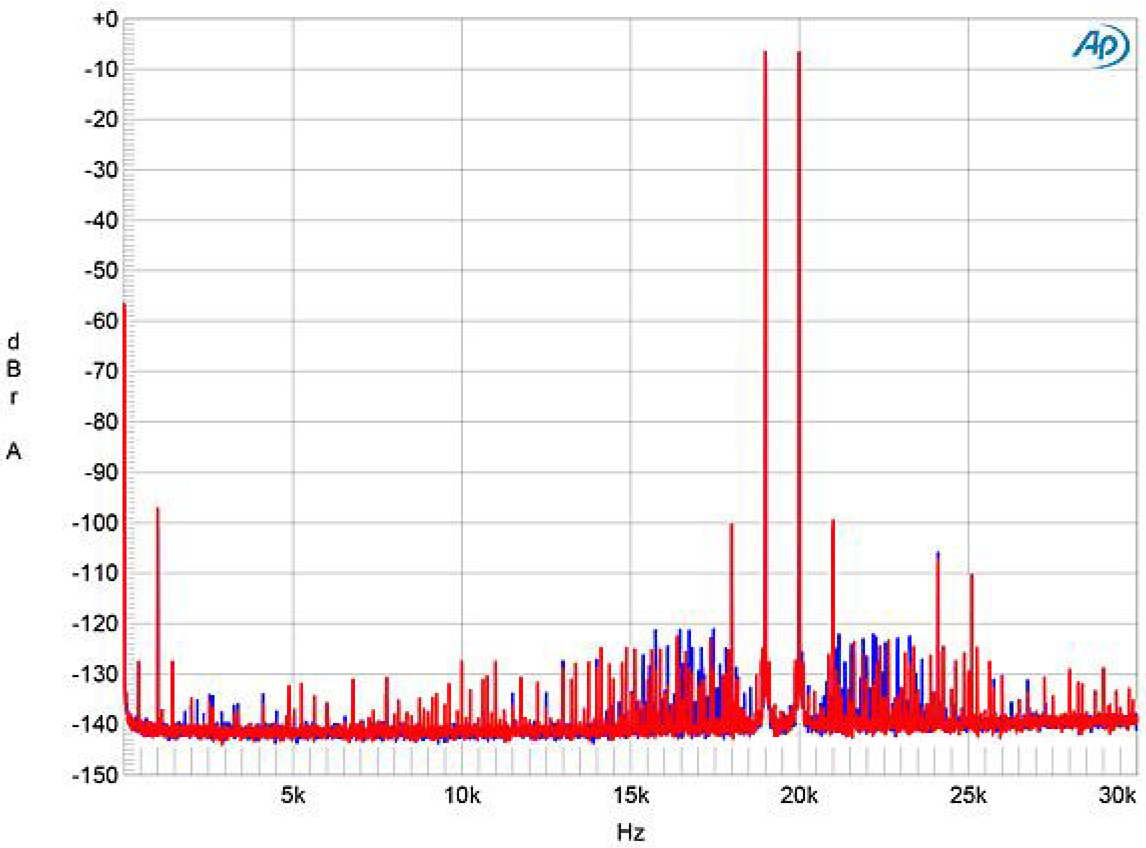


Fig.9 ATC CDA2 Mk2, digital input, HF intermodulation spectrum (DC–30kHz), 19+20kHz at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

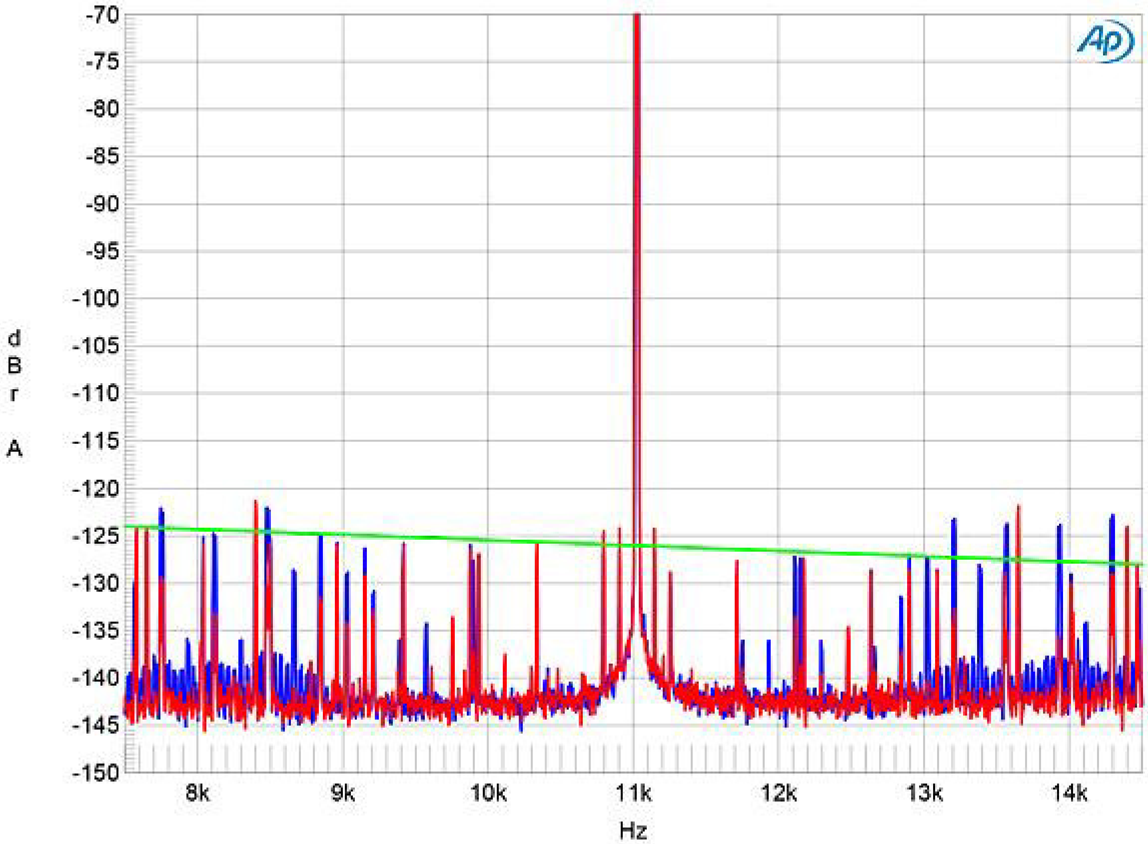


Fig.10 ATC CDA2 Mk2, digital input, high-resolution jitter spectrum of analog output signal, 11.025kHz at –6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 16-bit TosLink data (left channel blue, right red). Center frequency of trace, 11.025kHz; frequency range, ±3.5kHz.

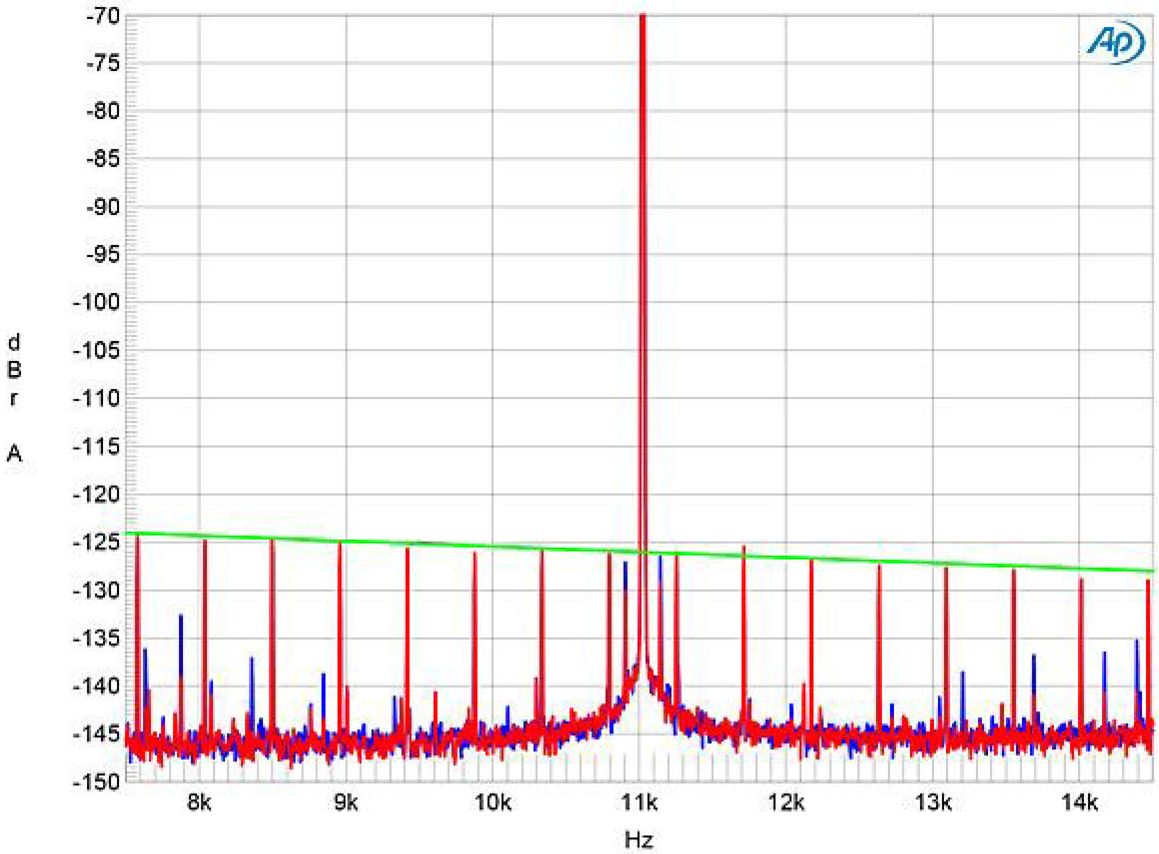


Fig.11 ATC CDA2 Mk2, digital input, high-resolution jitter spectrum of analog output signal, 11.025kHz at –6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 16-bit CD data (left channel blue, right red). Center frequency of trace, 11.025kHz; frequency range, ±3.5kHz.

Turning to the line-level analog inputs: With the ATC's volume control set to its maximum, the maximum voltage gain at 1kHz into 100k ohms measured 16.3dB from the balanced outputs, 10.4dB from the unbalanced outputs, and 10.85dB from the headphone outputs. The analog inputs preserved absolute polarity (*ie*, were non-inverting), and the input impedance was close to the specified 14k ohms, at 13k ohms from 20Hz to 20kHz. The frequency response from the analog inputs was flat from 30Hz to 30kHz, with slow rolloffs above and below that range (fig.12). Channel separation was excellent, at >110dB in both directions below 2kHz and still 90dB at 20kHz.

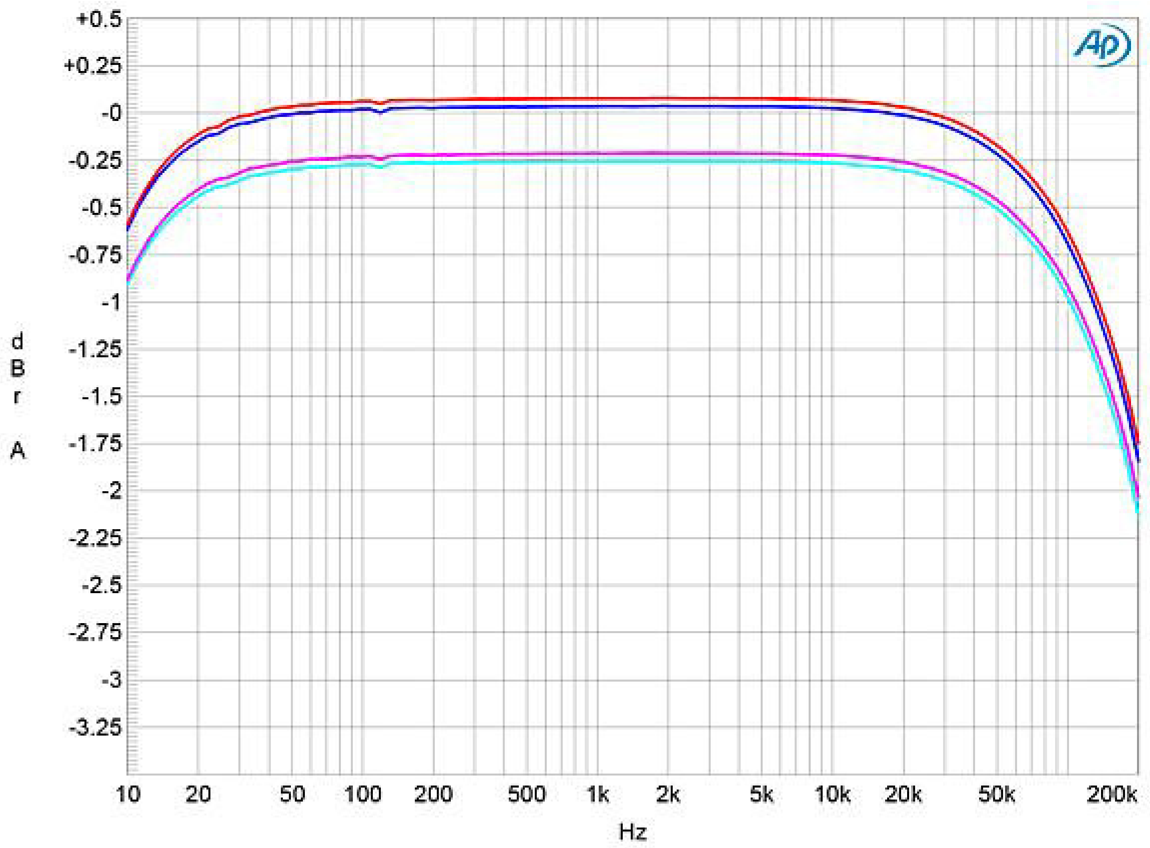


Fig.12 ATC CDA2 Mk2, analog input, frequency response at 1V into 100k ohms (left channel blue, right red) and 600 ohms (left cyan, right magenta) (0.5dB/vertical div.).

With clipping defined as when the percentage of THD+noise in the output reaches 1%, the CDA2 Mk2's balanced outputs didn't clip until a very high 19V into 100k ohms (fig.13). The downward slope of the trace in this graph indicates that actual distortion lies below the very low noise floor until the output approaches 10V. The picture is very similar into the punishing 600 ohm load (fig.14), a tribute to the CDA2 Mk2's apparently bombproof discrete output devices. Spectral analysis reveals that the distortion signature for the analog inputs, like that for the digital inputs, is primarily second-harmonic in nature (fig.15).

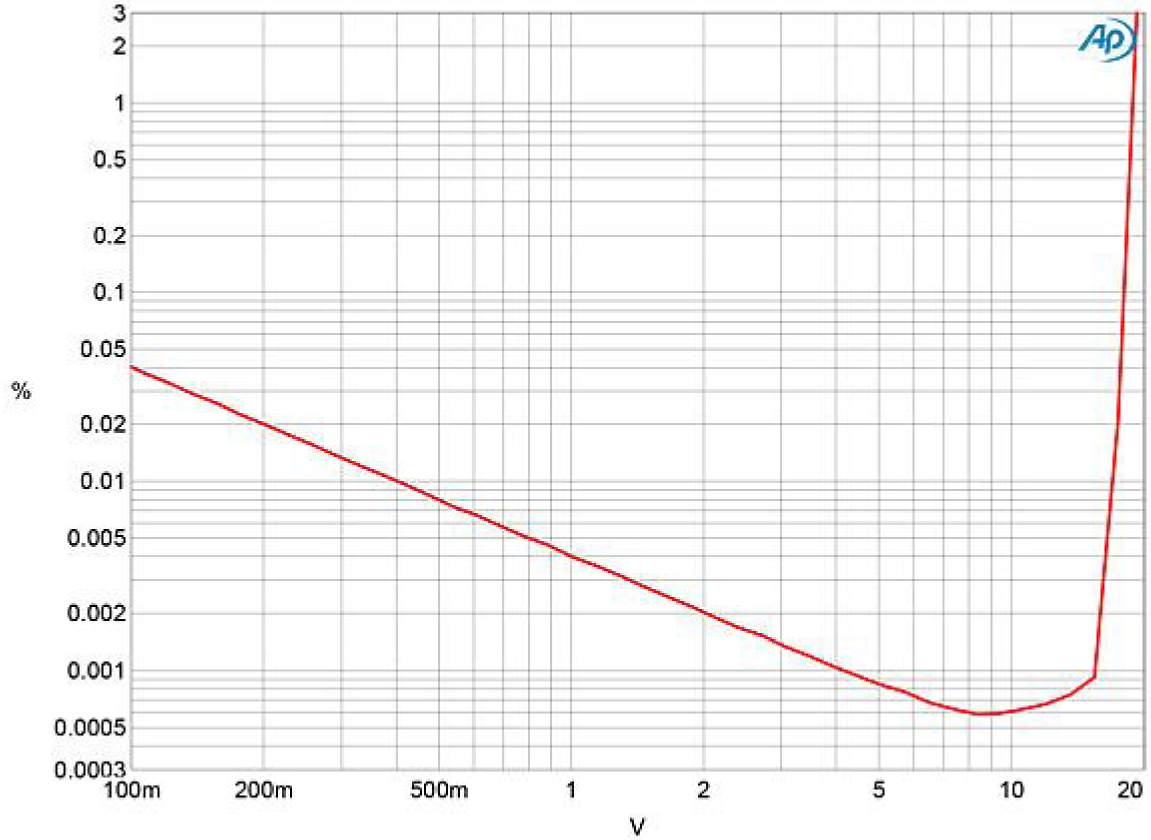


Fig.13 ATC CDA2 Mk2, analog input, distortion (%) *vs* 1kHz output voltage into 100k ohms.

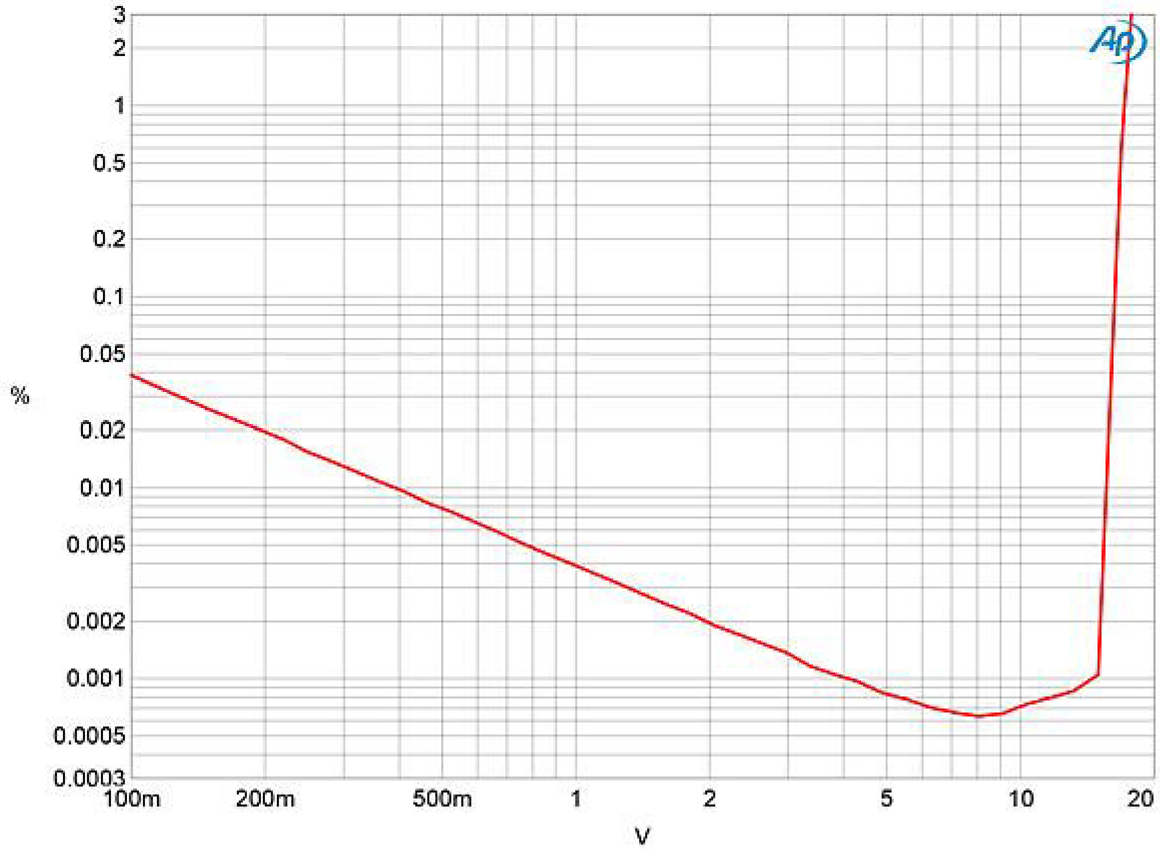


Fig.14 ATC CDA2 Mk2, analog input, distortion (%) *vs* 1kHz output voltage into 600 ohms.

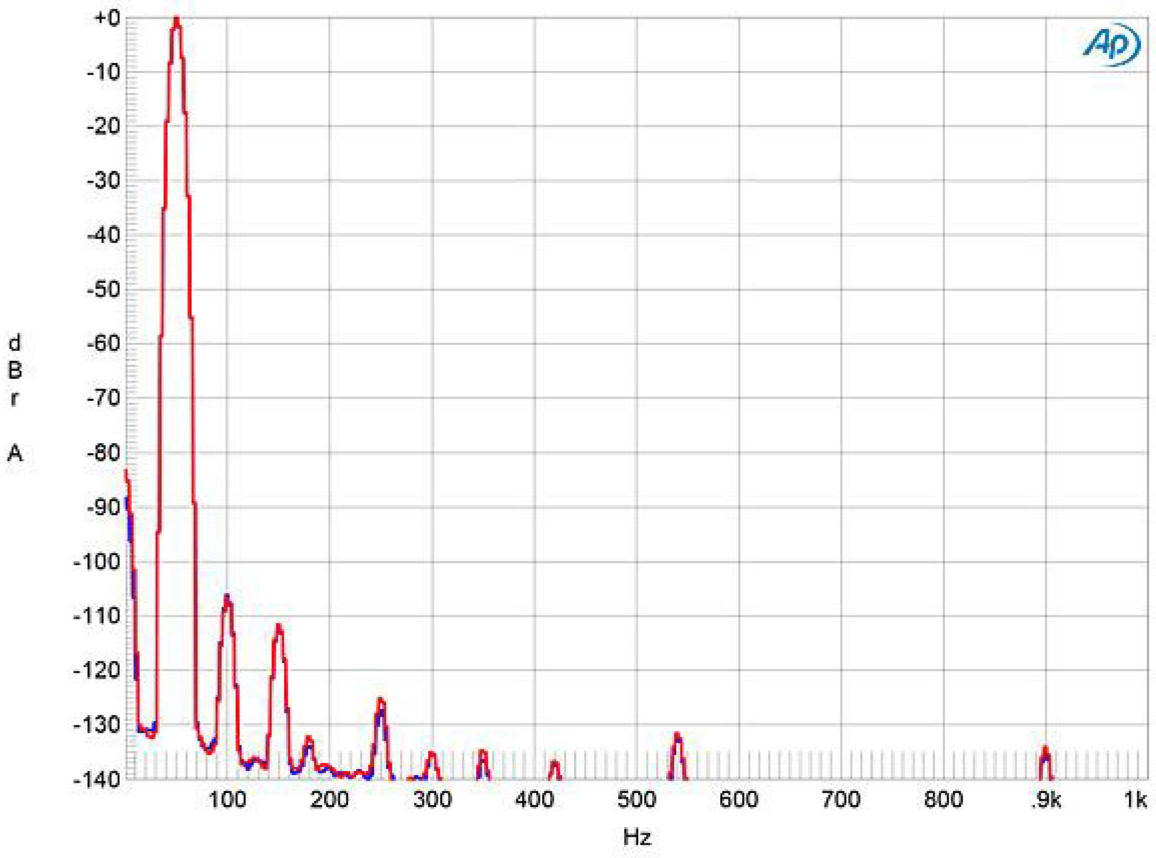


Fig.15 ATC CDA2 Mk2, analog input, spectrum of 50Hz sinewave at 0dBFS, DC–1kHz, into 600 ohms (left channel blue, right red; linear frequency scale).

ATC's CDA2 Mk2 offers generally superb measured performance, though its S/PDIF inputs aren't up to the standard of jitter rejection offered by CD playback and the USB input.—**John Atkinson**

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