Introducing

The DAC1

Digital to Analog Converter

Analog Domain Audio GmbH • Bergstr. 12 • D-82024 Taufkirchen, Germany
Tel.: + 49 (0) 1608 173 193 • mail: info@analogdomain.eu • www.analogdomain.eu

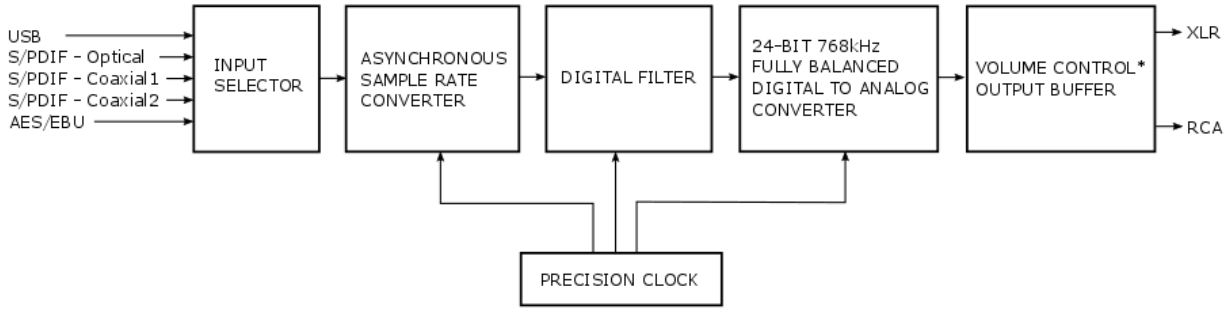
PRELIMINARY
ANALOG DOMAIN DAC1 1 November, 2016

The Analog Domain DAC1 is a high performance state of the art digital to analog converter designed for faithful reproduction of digitized music. It will accept all current and future digital formats up to S/PDIF 384kHz/32bits, DSD64 (1x), DSD128 (2x) and DSD256 (4x).

Our focus has been on maximizing the DAC1's performance with existing material while looking ahead toward upcoming formats. It's worth noting that recordings in "native" mode are mostly done at 96kHz/24bits , rarely at 192kHz/24bits and even less so at DSD128. The vast majority of recorded music is down sampled to 44.1 kHz, 16 bits. Maximum performance of the DAC1 will be obtained with higher resolutions, of course.

Yes, we do things differently in the DAC1, and for a reason:

DAC1 BLOCK DIAGRAM



All input data, regardless of its format, is converted to 24 bits and asynchronously resampled at a very high rate. DSD is unpacked, converted to PCM and resampled. The resampled data enters a Digital Filter. The Digital Filter is configured in optimal mode for the output format of the Sample Rate Converter, therefore there are no user-selectable filter modes. Data then enters the DAC stage where it is converted into an analog signal.

Jitter essentially loses its meaning in this configuration. Input data jitter is practically irrelevant. The Asynchronous Sample Rate Converter takes care of proper word alignment and timing during conversion. The three digital blocks are synchronized to a single, high precision clock to ensure perfect timing. Any CD transport can be used with the DAC1, not requiring external re-clocking or clocking from the DAC1.

The actual DAC stage is a differential output (balanced) design. Its residual distortion is approximately 0.00035% at full scale output, consistent for all input formats. At typical output levels of -10dBFS the distortion falls off to 0.0001% (-120dB) and becomes essentially zero at levels below -20dBFS, "lost in the grass" as we say, at -130dB.

This matters! It's during the quiet passages that DAC distortion becomes most noticeable. One bit is lost with every 6dB reduction in level, therefore a 16-bit DAC will be working effectively at 14-bit resolution or less most of the time. This is the reason why early designs created a bad reputation for digital audio. We hope to rectify this misunderstanding.

So, is 130dB enough? It is more than enough, and here's why: a signal which is -130dB lower relative to the full scale output voltage of 2Vrms has an amplitude of 3 *million* times less, or 0.7 *micro*volts. That is less than many amplifiers' input-referred noise voltage. We can confidently say that the DAC1 will have an insignificant noise contribution, if any, to the signal chain.

Volume control can be optionally installed on the DAC1 as a factory-add-on option, and yes, it's analog! We have applied the same proven design as in our M75 series amplifiers. With remote control, of course.

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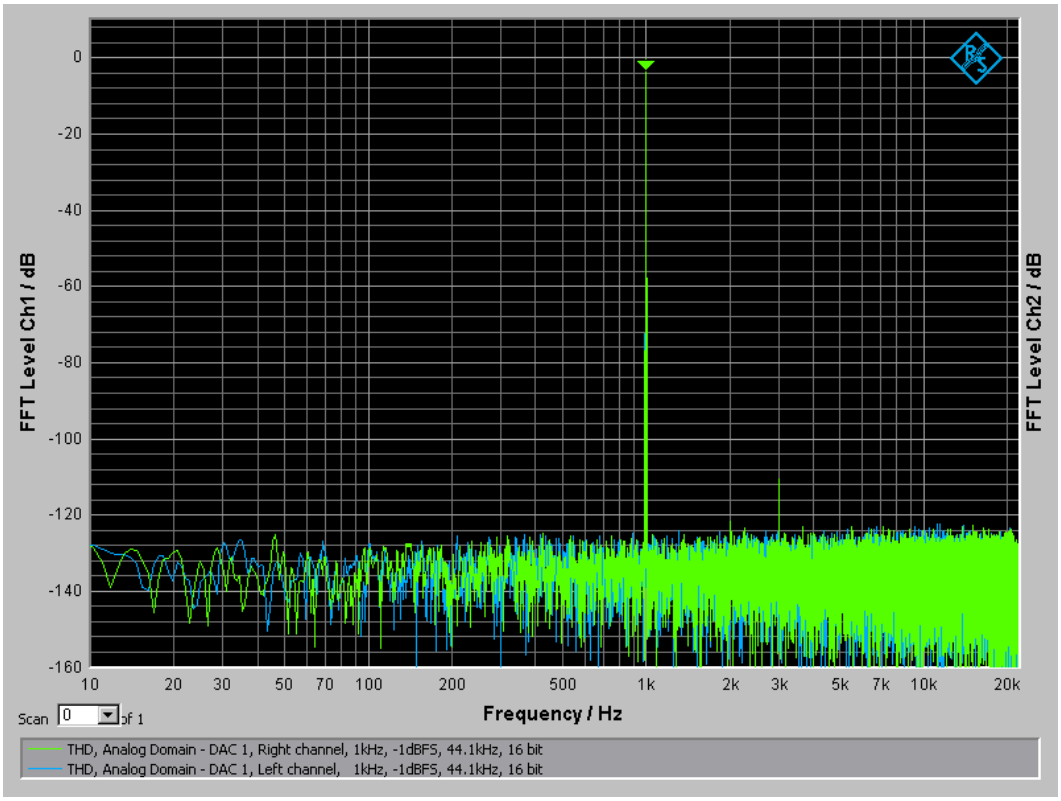
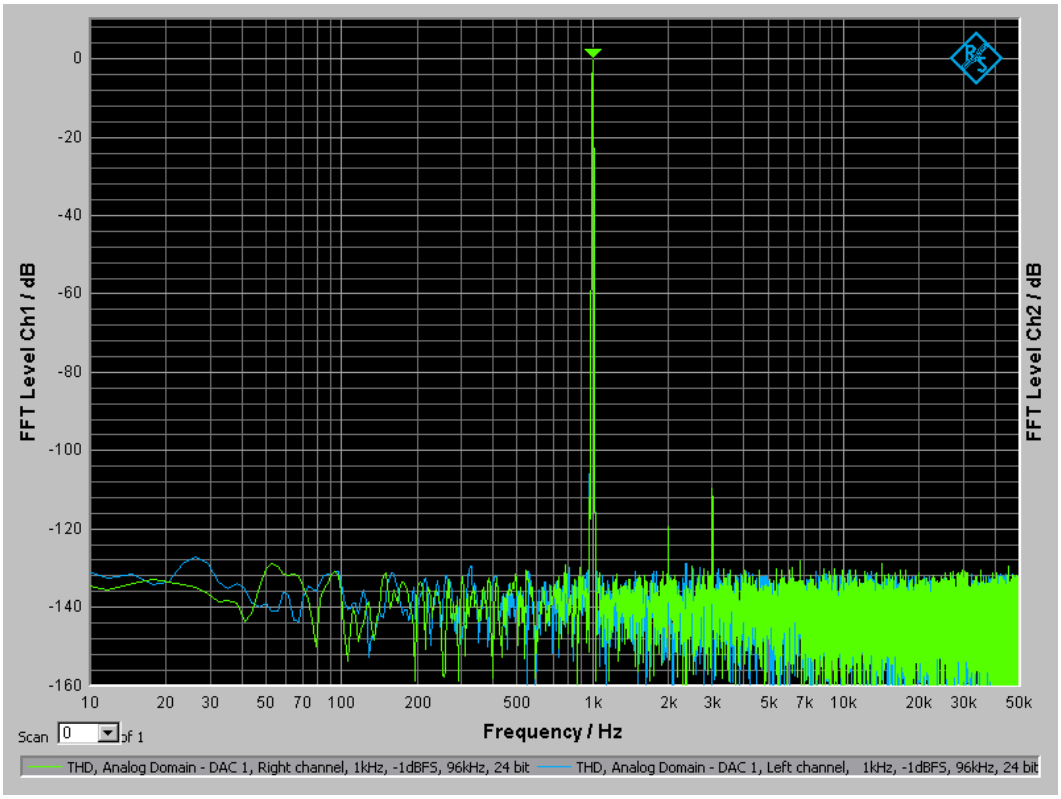
Measurement results [1]



1 kHz at -1dBFS, 44.1 kHz/16-bits data, “Red Book Audio” input format.

Distortion appears at
-110 dBr for H3 and respectively at -120dBr for H2. The noise floor and distortion are well below any 16-bit DA converter.



Same signal level in 96 kHz/24bits input format.

The noise floor is lower and the distortion products become more visible at -120dBr for H2 and
-110dBr for H3.

Overall distortion is approximately 0.00035% relative to the output signal.

[1] Note that the vertical scale is normalized to “0” for the fundamental tone to improve display accuracy, therefore the noise floor will appear to rise as the signal becomes lower. In reality the noise floor is at a constant level. The measurements were performed with USB input, no FFT averaging.

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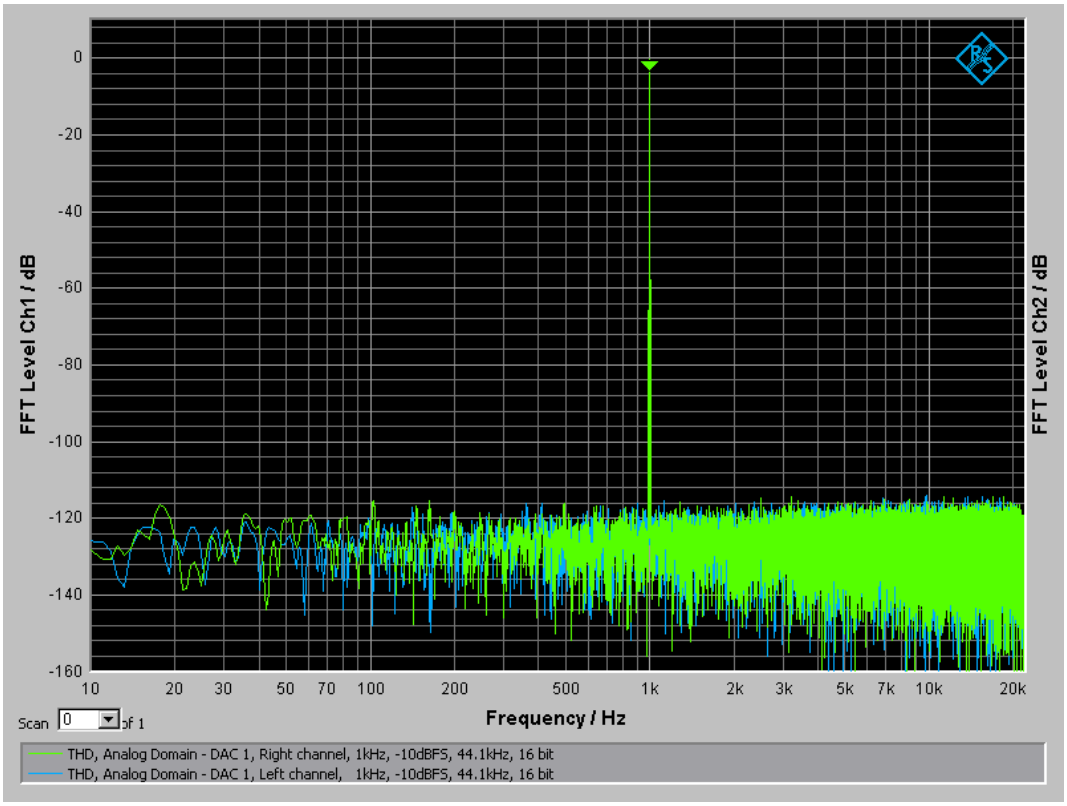
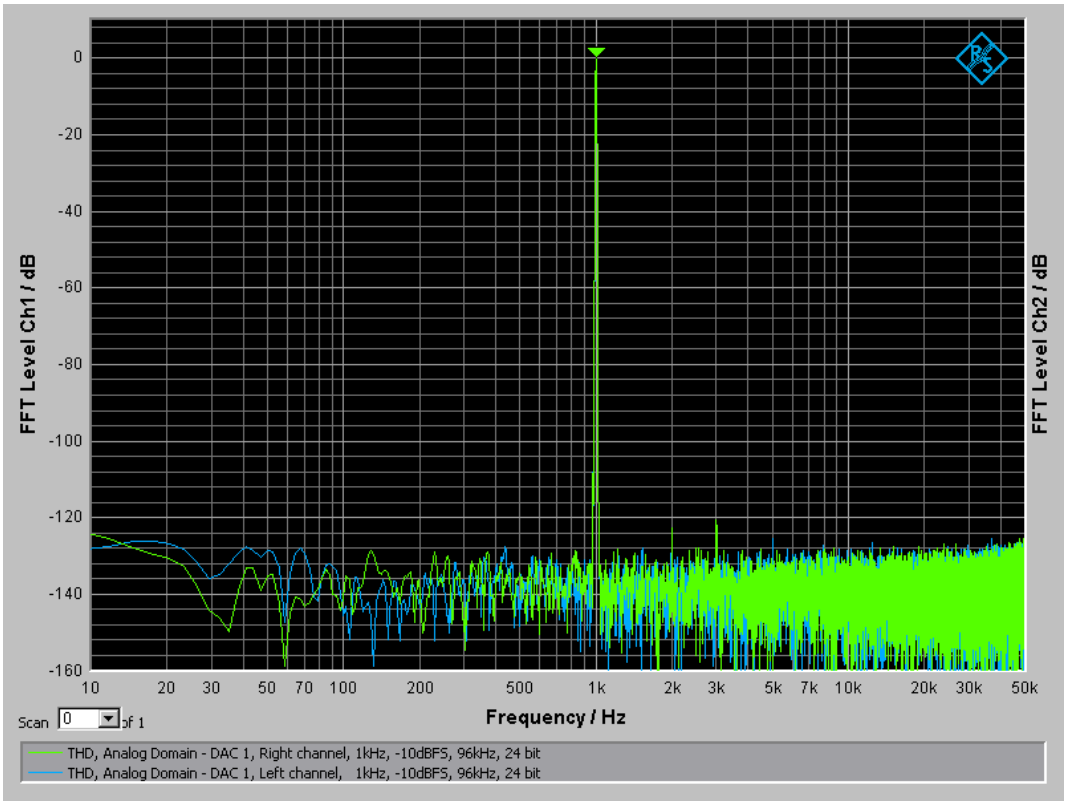
- Measurements continued[2] -



1 kHz going down to -10dBFS, 44.1 kHz/16-bits input data.

Distortion is invisible as it is below the noise floor.

This is the average level of recordings and is *the most important level for measuring a DAC's performance*.

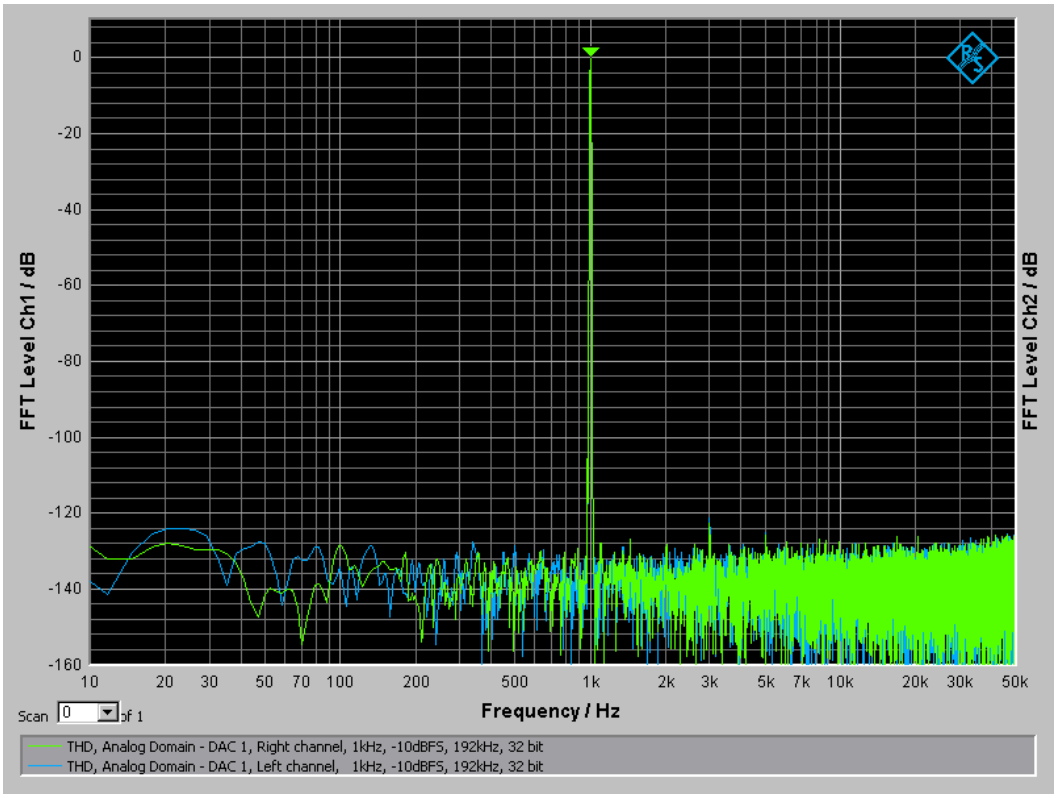


1 kHz at -10dBFS, input data rate of 96 kHz/24-bits.

The lower noise floor reveals the previously buried distortion at approximately -122dBr for both H2 and H3.

[2] Note that the vertical scale is normalized to "0" for the fundamental tone to improve display accuracy, therefore the noise floor will appear to rise as the signal becomes lower. In reality the noise floor is at a constant level. The measurements were performed with USB input, no FFT averaging.

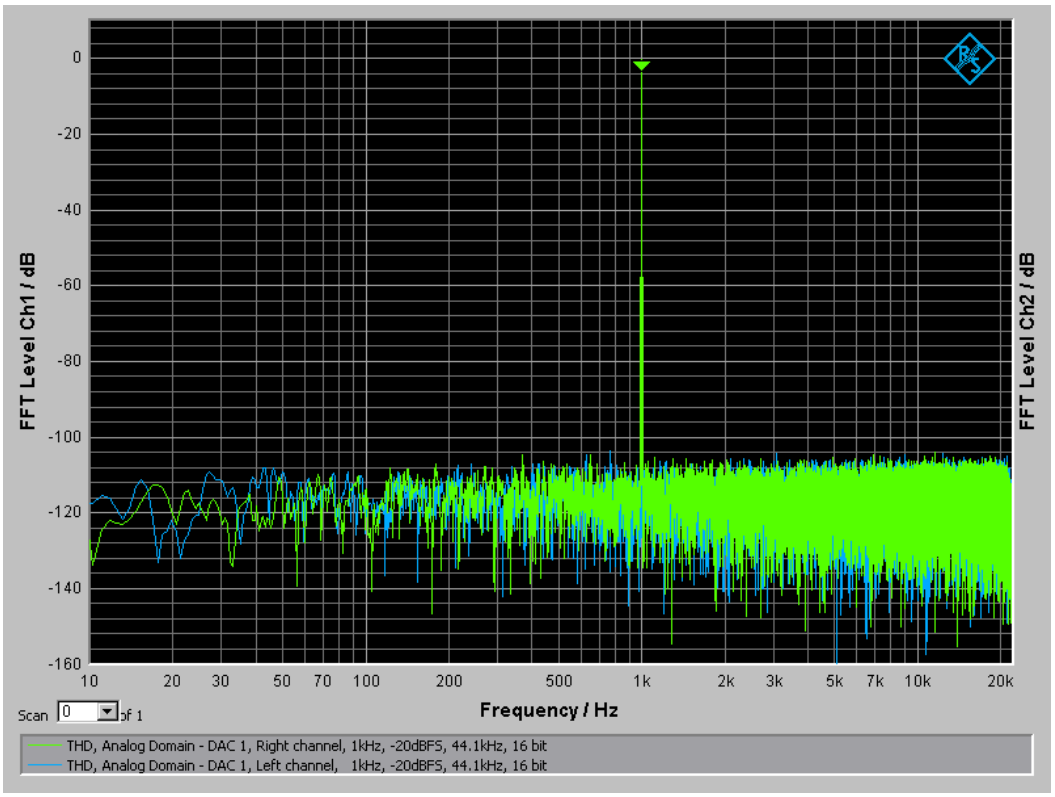
- Measurements continued [3]-



1 kHz at -10dBFS, input data rate of 192 kHz/32-bits.

Performance is identical for 24-bit data input.

Distortion is now lower, H3 “dominates” at approx. -122dB relative to the output level.



Going down...

1 kHz at -20dBFS, 44.1 kHz/16-bits data input.

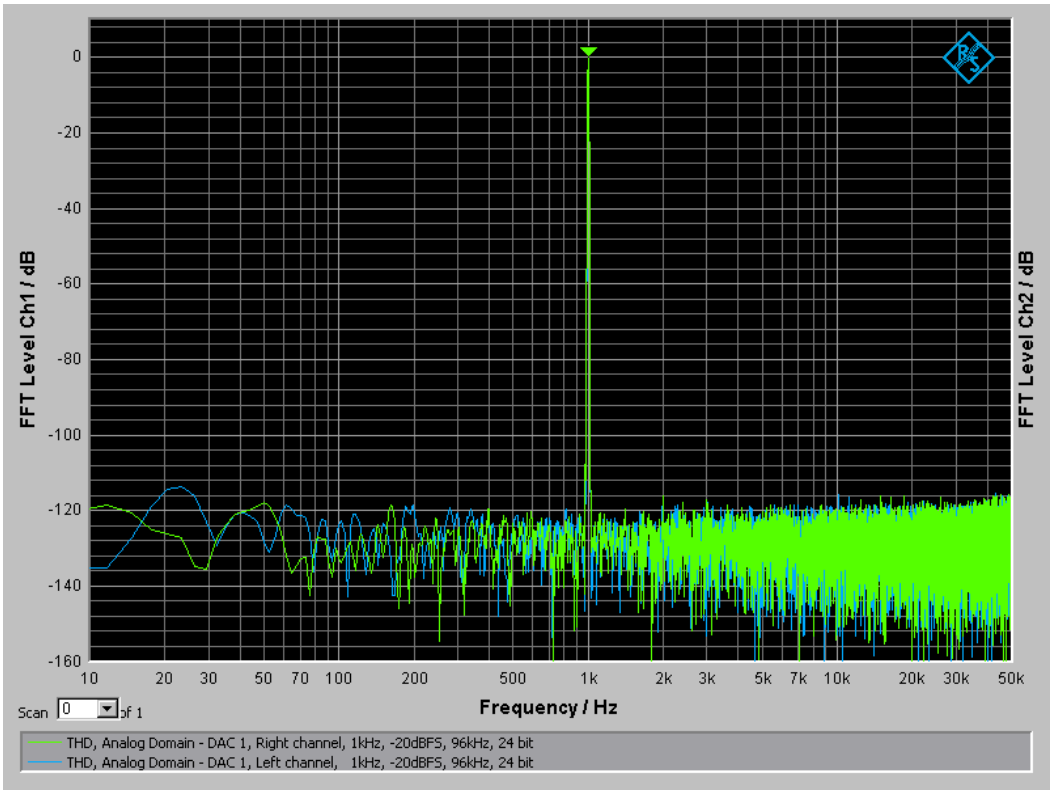
This is the average level of quieter passages.

The noise floor appears to be elevated as the scale has been normalized.

Distortion is “lost in the grass” at -110dBr.

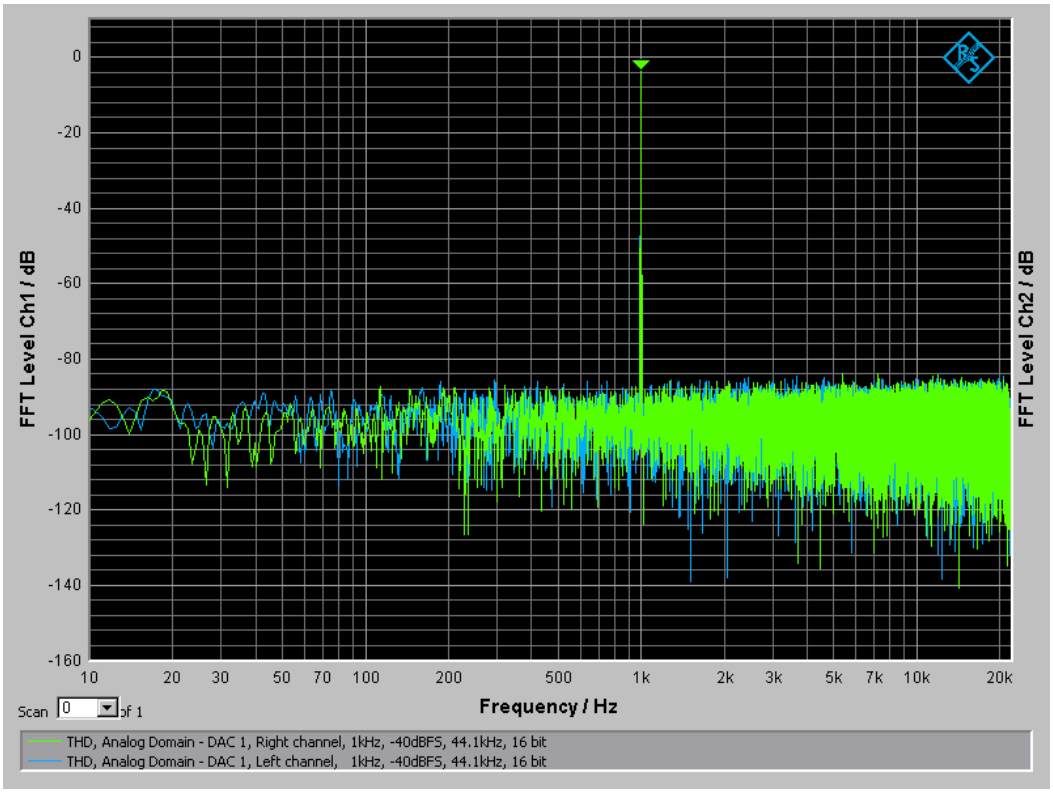
[3] Note that the vertical scale is normalized to “0” for the fundamental tone to improve display accuracy, therefore the noise floor will appear to rise as the signal becomes lower. In reality the noise floor is at a constant level. The measurements were performed with USB input, no FFT averaging.

- Measurements continued[4] -



1 kHz at -20dBFS, 96 kHz/24-bits input data rate.

Distortion barely visible at about -116dB relative to the output level.

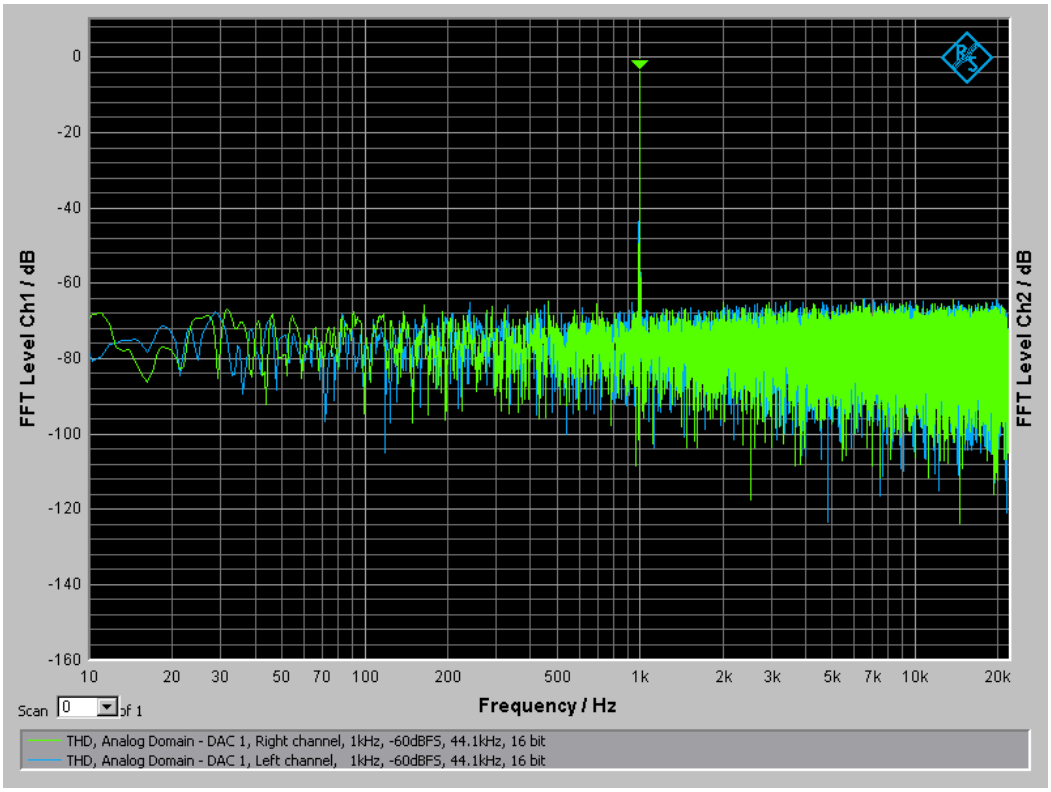


1 kHz signal at -40dBFS, 44.1 kHz/ 16-bits input.

Distortion is below the noise floor.

[4] Note that the vertical scale is normalized to "0" for the fundamental tone to improve display accuracy, therefore the noise floor will appear to rise as the signal becomes lower. In reality the noise floor is at a constant level. The measurements were performed with USB input, no FFT averaging.

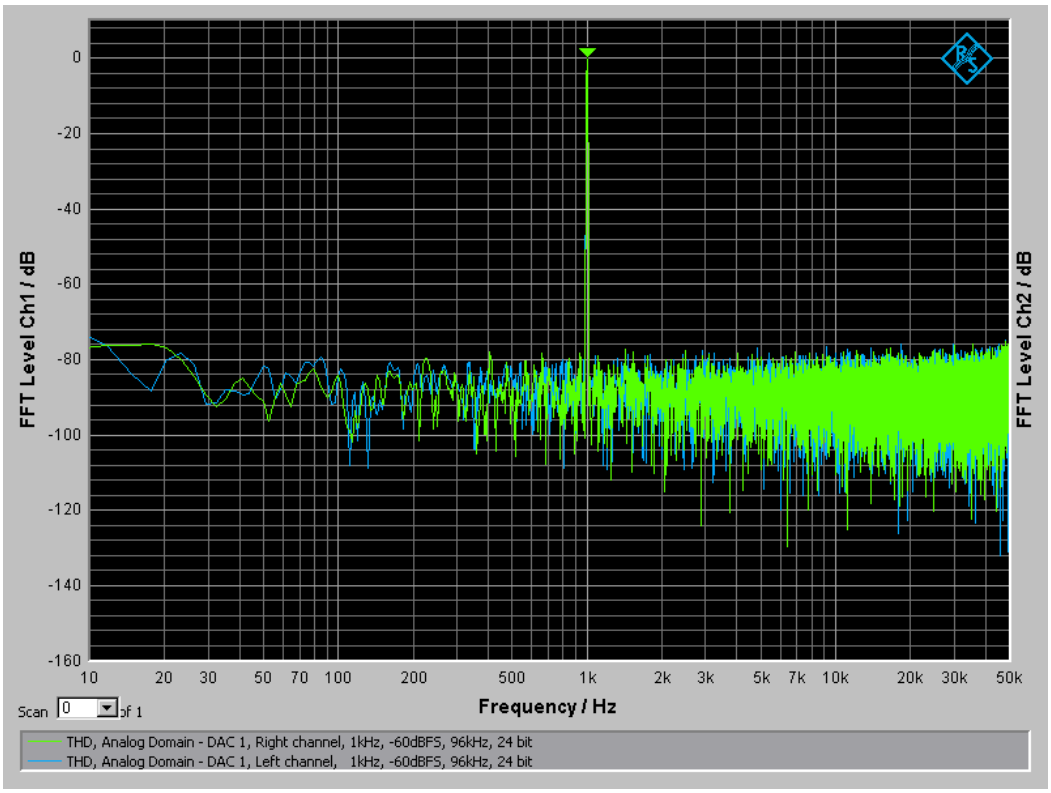
Most *other* DAC's nightmare modes[5]:



1 kHz at -60dBFS.

44.1 kHz/16-bits data.

Distortion is below the noise floor.



1 kHz at -60dBFS.

96 kHz/24-bits data.

Distortion is below the noise floor.

[5] Note that the vertical scale is normalized to "0" for the fundamental tone to improve display accuracy, therefore the noise floor will appear to rise as the signal becomes lower. In reality the noise floor is at a constant level. The measurements were performed with USB input, no FFT averaging.

We'd like you to relax while enjoying your favorite music instead of fumbling around with meaningless settings or worrying about numbers. We've done it for you. The DAC1's goal is to bring back the enjoyment of music.

The user interface and layout have been carefully considered for ease of use. The input data rate is not displayed on the front panel for that reason, and, as demonstrated with the above measurement results and verified in extensive listening test - because it is practically irrelevant with the DAC1.

Front view

The rear panel

The DAC1 has the same dimensions as the M75 range of amplifiers, 440x400mm, and is available in matching finishing options. Height with feet: approx. 90mm. Weight – approx. 12kg. 115/230V user-selectable.

Full specifications will be available with the official launch of the DAC1 for those interested in comparing numbers. For everyone else – plug, play, sit back and experience your favourite music to the maximum!

The DAC1 can be preordered now. For prices and details please contact your local dealer, or contact us directly if there is no official representation in your country. Contact details are available on our web site.

Enjoy!

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