# AKD4340-SB
## AK4340 Evaluation Board Rev.0

## General Description

AKD4340-SB is an evaluation board for AK4340 (192kHz sampling 24Bit ΔΣ DAC). AKD4340-SB has a digital audio interface (AK4113) of Optical or COAX input and can easily achieve the interface with digital audio system. Therefore, it is easy to evaluate the sound quality of AK4340.

### ■ Ordering Guide

AKD4340-SB ---- AK4340 Evaluation Board
(Cable for connecting with printer port of IBM-AT compatible PC and control software are packed with this. This control software does not operate on Windows NT.)

## Function

■ On-board digital audio interface. (AK4113)

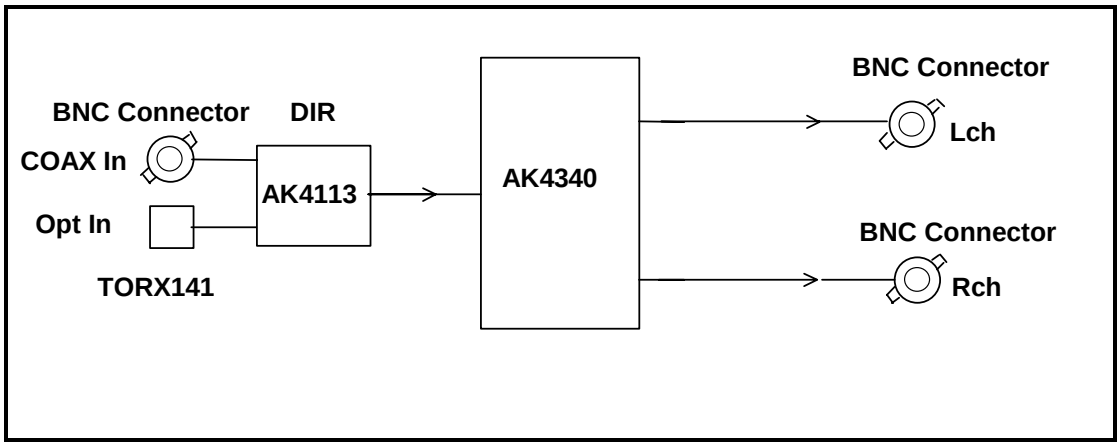



Figure 1. AKD4340-SB Block diagram
(* Circuit diagram and PCB layout are attached at the end of this manual.)

COAX is recommended for an evaluation of the Sound quality.

## ■ Operation sequence

1) Set up the power supply lines. (See “Other jumpers set-up”.)

| Name of jack | Color of jack | Voltage | Used for | Comments and attention | Default setting |
|---|---|---|---|---|---|
| +15V | Red | +12~+15V | Regulator T1, T2 | This jack should be always connected to power supply. | +12V |
| -15V | Blue | -4.5~-13.2V | HVEE of AK4340 | This jack should be always connected to power supply. | -5V |
| AGND | Black | 0V | GND | This jack should be always connected to power supply. | 0V |

Table 1. Set up of power supply lines

Each supply line should be distributed from the power supply unit.

2) Set-up the jumper pins

3) Set-up the DIP switches. (See the followings.)

4) Power on

The AK4340 should be reset once by bringing SW1 (PDN) “L” upon power-up.

## ■ Evaluation mode

1. Using DIR (COAX) (default)

It is possible to evaluate the AK4340 by using CD disk. The DIR generates MCLK, BICK, LRCK and SDATA from the received data through BNC connector (J1). Setting of jumper is shown below.

COAX is recommended for an evaluation of the Sound quality.

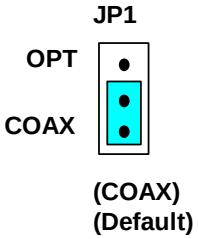



Figure 2. Jumper setting, when using DIR (COAX) (default)

2. Using DIR (Optical Link)

It is possible to evaluate the AK4340 by using CD disk. The DIR generates MCLK, BICK, LRCK and SDATA from the received data through optical connector (PORT3: TORX141). Setting of jumper is shown below.

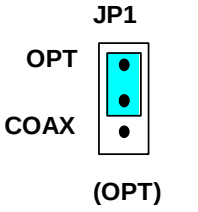



Figure 3. Jumper setting, when using DIR (Optical Link)

3. All clocks are fed through the PORT1.

Change the resistance as below.

R13: 5.1Ω → open

R15, R17, R18: 100Ω → open

R1, R2, R3, R8: open → 100Ω or short (0Ω)

## ■ DIP Switch setting

[SW2]: AK4113 setting

| No. | Pin | OFF | ON | Default |
|---|---|---|---|---|
| 1 | OCKS1 | AK4113 Master Clock setting Refer to Table4 | | ON |
| 2 | OCKS0 | | | OFF |

Table 2. SW2 setting

[SW3]: AK4340 setting

| No. | Pin | OFF | ON | Default |
|---|---|---|---|---|
| 1 | SMUTE | Soft Mute pin in Parallel Mode : “Disable” | Soft Mute pin in Parallel Mode : “Enable” | OFF |
| 2 | P/S | Parallel Control Mode | Serial Control Mode | OFF |
| 3 | ACKS | Manual Setting Mode | Auto Setting Mode | ON |
| 4 | GAIN | 0dB (2Vrms) | +1.94dB (2.5Vrms) | OFF |

Table 3. SW3 setting

The frequency of the master clock output is set by OCKS0 and OCKS1 as shown in Table 4.

| OCKS1 | OCKS0 | MCLK Frequency | |
|---|---|---|---|
| 0 | 0 | 256fs @fs=88.2/96kHz | |
| 1 | 0 | 512fs @ fs=32/44.1/48kHz | Default |
| 1 | 1 | 128fs @ fs=176.4/192kHz | |

Table 4. MCLK Clock

## ■ SW1 setting

[SW1](PDN): Reset of AK4340. Select "H" during operation.

# Control Software Manual

## ■ Set-up of evaluation board and control software

1. Set up the AKD4340-SB according to previous term.

2. Connect IBM-AT compatible PC with AKD4340-SB by 10-line type flat cable (packed with AKD4340-SB). Take care of the direction of 10pin header. (Please install the driver in the CD-ROM when this control software is used on Windows 2000/XP. Please refer "Installation Manual of Control Software Driver by AKM device control software". In case of Windows95/98/ME, this installation is not needed. This control software does not operate on Windows NT.)

3. Insert the CD-ROM labeled "AKD4340-SB Evaluation Kit" into the CD-ROM drive.

4. Access the CD-ROM drive and double-click the icon of "akd4340.exe" to set up the control program.

5. Then please evaluate according to the follows.

## ■ Operation flow

Keep the following flow.

1. Set up the control program according to explanation above.
2. Click "Port Reset" button.

## ■ Explanation of each buttons

| | |
|---|---|
| 1. [Port Reset]: | Set up the USB interface board (AKDUSBIF-A). |
| 2. [Write default]: | Initialize the register of AK4340. |
| 3. [All Write]: | Write all registers that is currently displayed. |
| 4. [Function1]: | Dialog to write data by keyboard operation. |
| 5. [Function2]: | Dialog to write data by keyboard operation. |
| 6. [Function3]: | The sequence of register setting can be set and executed. |
| 7. [Function4]: | The sequence that is created on [Function3] can be assigned to buttons and executed. |
| 8. [Function5]: | The register setting that is created by [SAVE] function on main window can be assigned to buttons and executed. |
| 9. [SAVE]: | Save the current register setting. |
| 10. [OPEN]: | Write the saved values to all register. |
| 11. [Write]: | Dialog to write data by mouse operation. |

## ■ Indication of data

Input data is indicated on the register map. Red letter indicates "H" or "1" and blue one indicates "L" or "0". Blank is the part that is not defined in the datasheet.

## ■ Explanation of each dialog

### 1. [Write Dialog]: Dialog to write data by mouse operation

There are dialogs corresponding to each register.

Click the [Write] button corresponding to each register to set up the dialog. If you check the check box, data becomes “H” or “1”. If not, “L” or “0”.

When writing the input data to AK4340, click [OK] button. If not, click [Cancel] button.

### 2. [Function1 Dialog]: Dialog to write data by keyboard operation

| | |
|---|---|
| Address Box: | Input registers address in 2 figures of hexadecimal. |
| Data Box: | Input registers data in 2 figures of hexadecimal. |

When writing the input data to AK4340, click [OK] button. If not, click [Cancel] button.

### 3. [Function2 Dialog]: Dialog to evaluate ATT

Address Box: Input registers address in 2 figures of hexadecimal.
Start Data Box: Input starts data in 2 figures of hexadecimal.
End Data Box: Input end data in 2 figures of hexadecimal.
Interval Box: Data is written to AK4340 by this interval.
Step Box: Data changes by this step.
Mode Select Box:

With checking this check box, data reaches end data, and returns to start data.
[Example] Start Data = 00, End Data = 09
Data flow: 00 01 02 03 04 05 06 07 08 09 09 08 07 06 05 04 03 02 01 00

Without checking this check box, data reaches end data, but does not return to start data.
[Example] Start Data = 00, End Data = 09
Data flow: 00 01 02 03 04 05 06 07 08 09

When writing the input data to AK4340, click [OK] button. If not, click [Cancel] button.

## 4. [Save] and [Open]

### 4-1. [Save]

Save the current register setting data. The extension of file name is “akr”.

(Operation flow)
(1) Click [Save] Button.
(2) Set the file name and push [Save] Button. The extension of file name is “akr”.

### 4-2. [Open]

The register setting data saved by [Save] is written to AK4340. The file type is the same as [Save].

(Operation flow)
(1) Click [Open] Button.
(2) Select the file (*.akr) and Click [Open] Button.

## 5. [Function3 Dialog]

The sequence of register setting can be set and executed.

(1) Click [F3] Button.

(2) Set the control sequence.
Set the address, Data and Interval time. Set "-1" to the address of the step where the sequence should be paused.

(3) Click [Start] button. Then this sequence is executed.

The sequence is paused at the step of Interval="-1". Click [START] button, the sequence restarts from the paused step.

This sequence can be saved and opened by [Save] and [Open] button on the [Function3] window. The extension of file name is "aks".

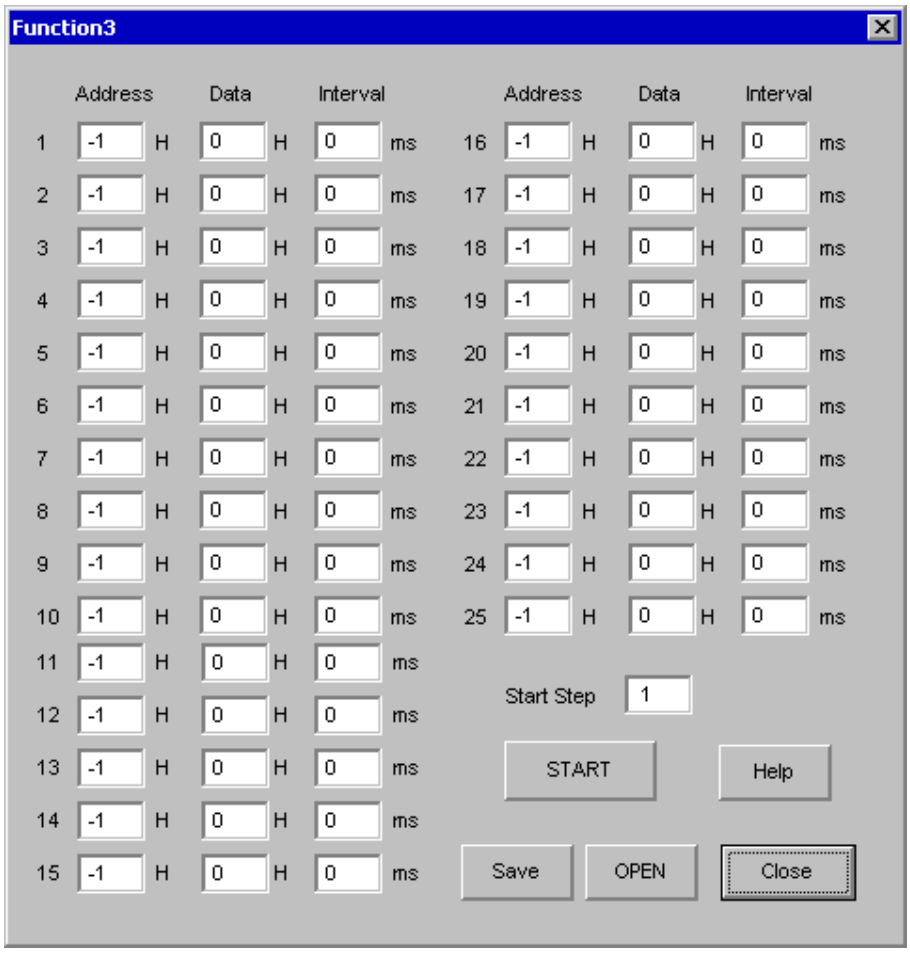



Figure 4. Window of [F3]

## 6. [Function4 Dialog]

The sequence that is created on [Function3] can be assigned to buttons and executed. When [F4] button is clicked, the window as shown in Figure 5 opens.

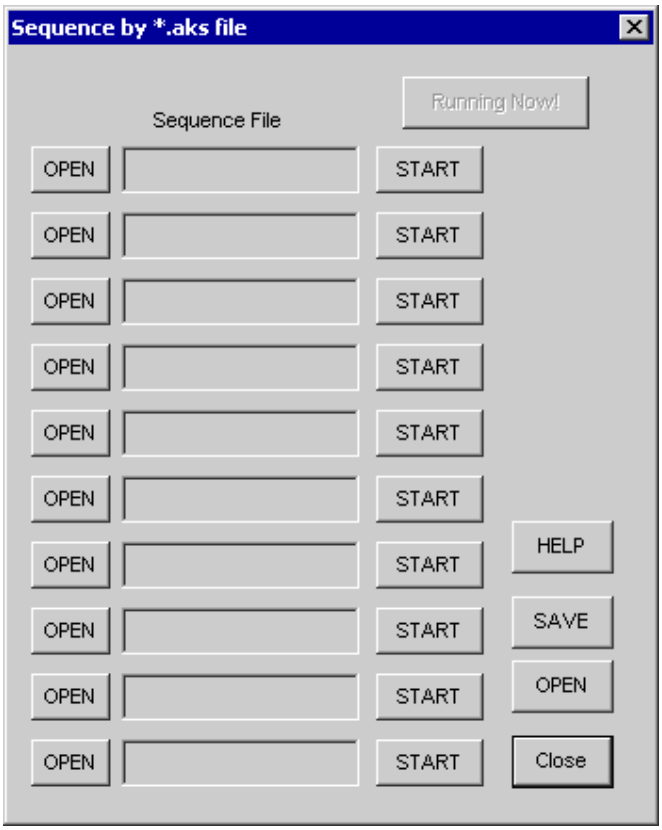



Figure 5. [F4] window

### 6-1. [OPEN] buttons on left side and [START] buttons

(1) Click [OPEN] button and select the sequence file (*.aks).

The sequence file name is displayed as shown in Figure 6.

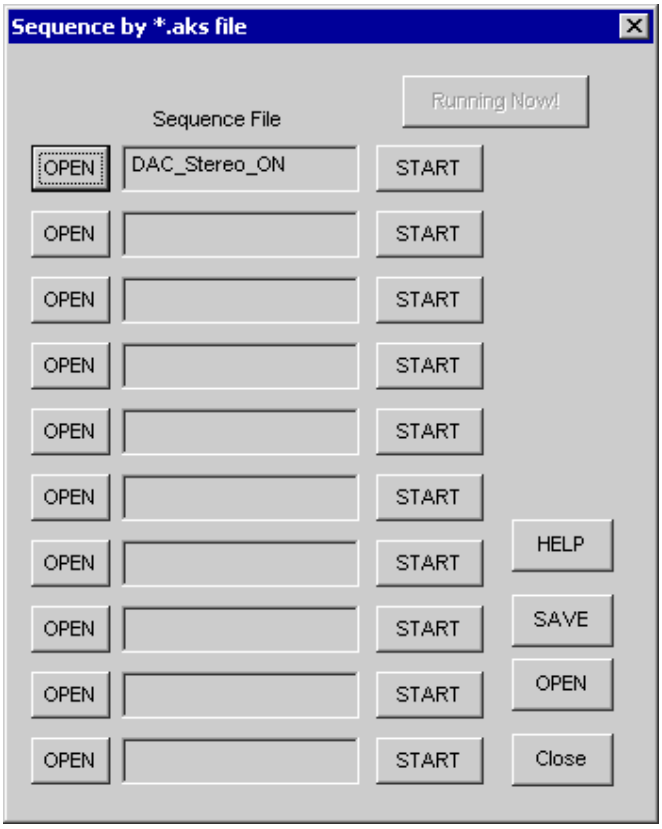



Figure 6. [F4] window(2)

(2) Click [START] button, then the sequence is executed.

### 6-2. [SAVE] and [OPEN] buttons on right side

[SAVE]: The sequence file names can assign be saved. The file name is *.ak4.

[OPEN]: The sequence file names assign that are saved in *.ak4 are loaded.

### 6-3. Note

(1) [Function4] doesn't support the pause function of sequence function.

(2) All files need to be in same folder used by [SAVE] and [OPEN] function on right side.

(3) When the sequence is changed in [Function3], the file should be loaded again in order to reflect the change.

## 7. [Function5 Dialog]

The register setting that is created by [SAVE] function on main window can be assigned to buttons and executed. When [F5] button is clicked, the following window as shown in Figure 7opens.

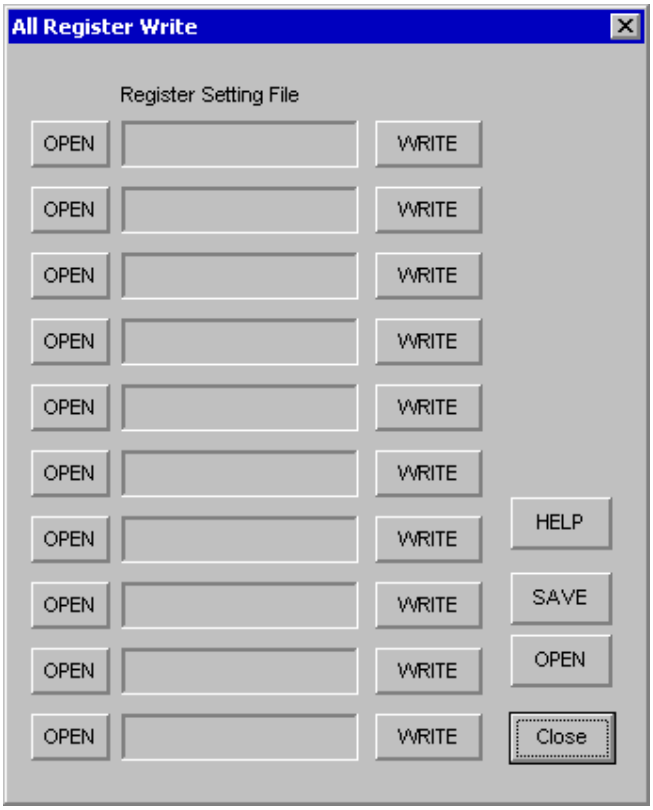



Figure 7. [F5] window

### 7-1. [OPEN] buttons on left side and [WRITE] button

(1) Click [OPEN] button and select the register setting file (*.akr).

(2) Click [WRITE] button, then the register setting is executed.

### 7-2. [SAVE] and [OPEN] buttons on right side

[SAVE]: The register setting file names assign can be saved. The file name is *.ak5.

[OPEN]: The register setting file names assign that are saved in *.ak5 are loaded.

### 7-3. Note

(1) All files need to be in same folder used by [SAVE] and [OPEN] function on right side.

(2) When the register setting is changed by [Save] Button in main window, the file should be loaded again in order to reflect the change.

## Measurement Result

[Measurement condition]

- Measurement unit : Audio Precision SYS-2722 (192K)
- MCLK : 512fs (fs=44.1kHz), 256fs (fs=96KHz), 128fs (fs=192KHz)
- BICK : 64fs
- fs : 44.1kHz, 96KHz, 192KHz
- BW : 20Hz~20kHz (fs=44.1kHz), 20Hz~40kHz (fs=96kHz, 192KHz)
- Resolution : 24bit
- Power Supply : VDD=+5V, HVEE=-5V
- Interface : AK4113 (fs=44.1kHz, 96KHz, 192KHz)
- Temperature : Room Temp
- GAIN : L

fs=44.1kHz

| Parameter | Input signal | Measurement filter | Lch Results | Rch Results |
|---|---|---|---|---|
| S/(N+D) | 1kHz, 0dB | 20kLPF | 90.7 dB | 92.2 dB |
| S/(N+D) | 1kHz, -60dB | 20kLPF | 42.6 dB | 42.6 dB |
| DR | 1kHz, -60dB | 20kLPF, A-weighted | 105.3 dB | 105.2 dB |
| S/N | “0” data | 20kLPF, A-weighted | 105.6 dB | 105.6 dB |

fs=96kHz

| Parameter | Input signal | Measurement filter | Lch Results | Rch Results |
|---|---|---|---|---|
| S/(N+D) | 1kHz, 0dB | 40kLPF | 90.4 dB | 91.7 dB |
| S/(N+D) | 1kHz, -60dB | 40kLPF | 40.7 dB | 40.8 dB |
| DR | 1kHz, -60dB | 40kLPF, A-weighted | 105.8 dB | 105.6 dB |
| S/N | “0” data | 40kLPF, A-weighted | 106.2 dB | 106.2 dB |

fs=192kHz

| Parameter | Input signal | Measurement filter | Lch Results | Rch Results |
|---|---|---|---|---|
| S/(N+D) | 1kHz, 0dB | 40kLPF | 90.2 dB | 91.4 dB |
| S/(N+D) | 1kHz, -60dB | 40kLPF | 39.2 dB | 39.4 dB |
| DR | 1kHz, -60dB | 40kLPF, A-weighted | 104.3 dB | 104.3 dB |
| S/N | “0” data | 40kLPF, A-weighted | 105.9 dB | 105.8 dB |

## ■ Plots

[Measurement Condition]

- Measurement Unit : Audio Precision SYS-2722 (192KHz)
- MCLK : 512fs (fs=44.1kHz), 256fs (fs=96kHz), 128fs (fs=192kHz)
- BICK : 64fs
- fs : 44.1kHz, 96kHz, 192kHz
- BW : 20Hz~20kHz (fs=44.1kHz), 40Hz~40kHz (fs=96kHz), 80Hz~80kHz (fs=192kHz)
- Resolution : 24bit
- Power Supply : VDD=+5V, HVEE=-5V
- Interface : AK4113 (44.1kHz, 96kHz, 192kHz)
- Temperature : Room Temp
- GAIN : L

fs=48kHz

Figure 8. FFT (Input Frequency =1kHz, Input Level =0dBFS)
Figure 9. FFT (Input Frequency =1kHz, Input Level =-60dBFS)
Figure 10. FFT (noise floor)
Figure 11. FFT (out-of-band noise)
Figure 12. THD+N vs Input Level (Input Frequency =1kHz)
Figure 13. THD+N vs Input Frequency (Input Level=0dBFS)
Figure 14. Linearity (Input Frequency =1kHz)
Figure 15. Frequency Response (Input Level=0dBFS)
Figure 16. Cross-talk (Input Level=0dBFS)

fs=96kHz

Figure 17. FFT (Input Frequency =1kHz, Input Level =0dBFS)
Figure 18. FFT (Input Frequency =1kHz, Input Level =0dBFS,Notch-on)
Figure 19. FFT (Input Frequency =1kHz, Input Level =-60dBFS)
Figure 20. FFT (noise floor)
Figure 21. FFT (out-of-band noise)
Figure 22. THD+N vs Input Level (Input Frequency =1kHz)
Figure 23. THD+N vs fin (Input Level=0dBFS)
Figure 24. Linearity (Input Frequency =1kHz)
Figure 25. Frequency Response (Input Level=0dBFS)
Figure 26. Cross-talk (Input Level=0dBFS)

fs=192kHz

Figure 27. FFT (Input Frequency =1kHz, Input Level =0dBFS)
Figure 28. FFT (Input Frequency =1kHz, Input Level =0dBFS,Notch-on)
Figure 29. FFT (Input Frequency =1kHz, Input Level =-60dBFS)
Figure 30. FFT (noise floor)
Figure 31. FFT (out-of-band noise)
Figure 32. THD+N vs Input Level (Input Frequency =1kHz)
Figure 33. THD+N vs fin (Input Level=0dBFS)
Figure 34. Linearity (Input Frequency =1kHz)
Figure 35. Frequency Response (Input Level=0dBFS)
Figure 36. Cross-talk (Input Level=0dBFS)

FFT point=16384, Avg=8, Window=Equirriple

(DAC fs=44.1kHz)

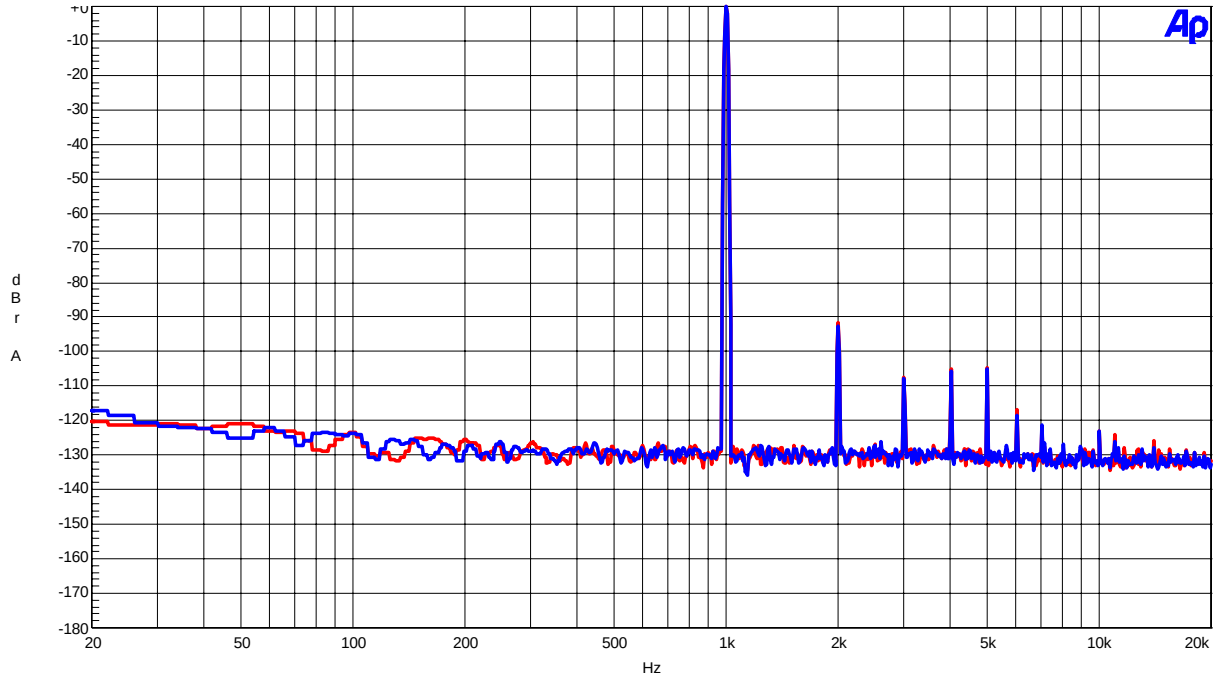



Figure 8. FFT(Input Frequency=1kHz, Input Level=0dBFS)

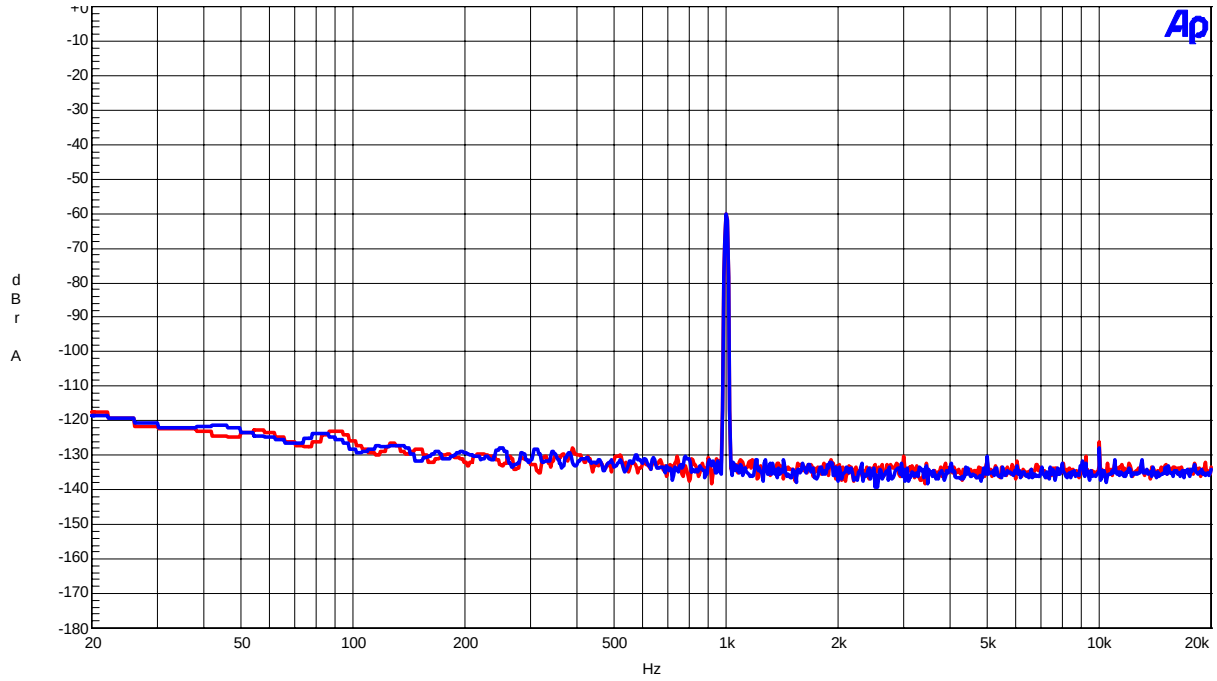



Figure 9. FFT(Input Frequency=1kHz, Input Level=-60dBFS)

(DAC fs=44.1kHz)

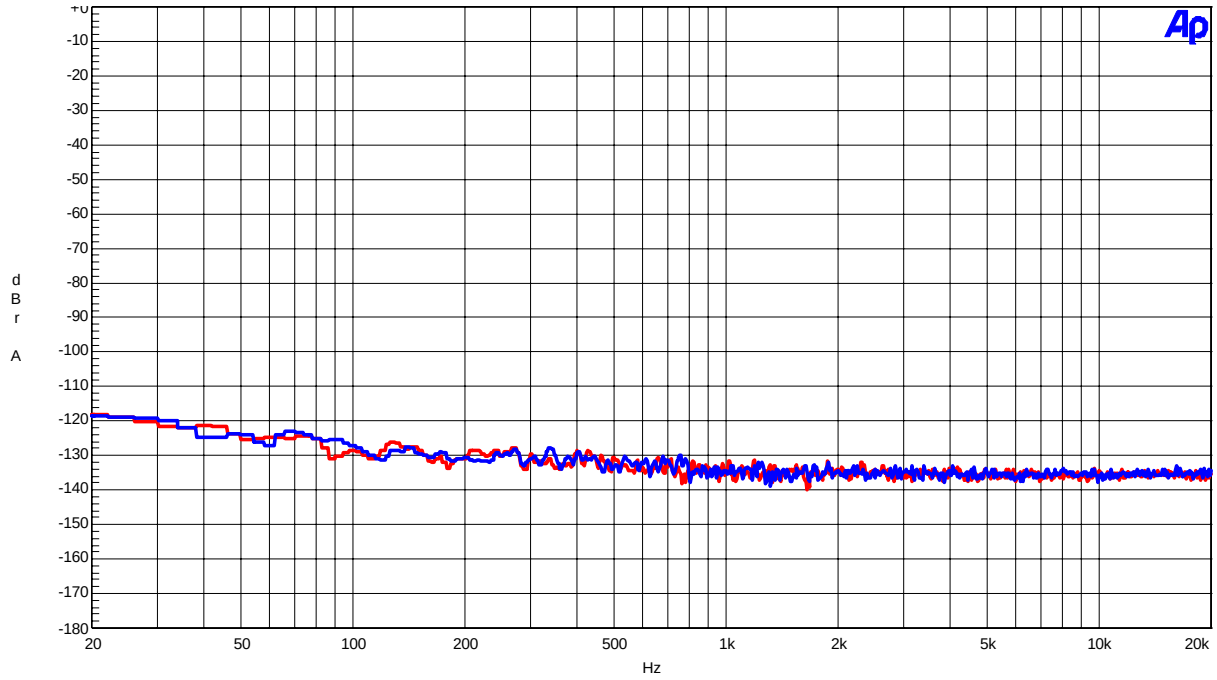



Figure 10. FFT(noise floor)

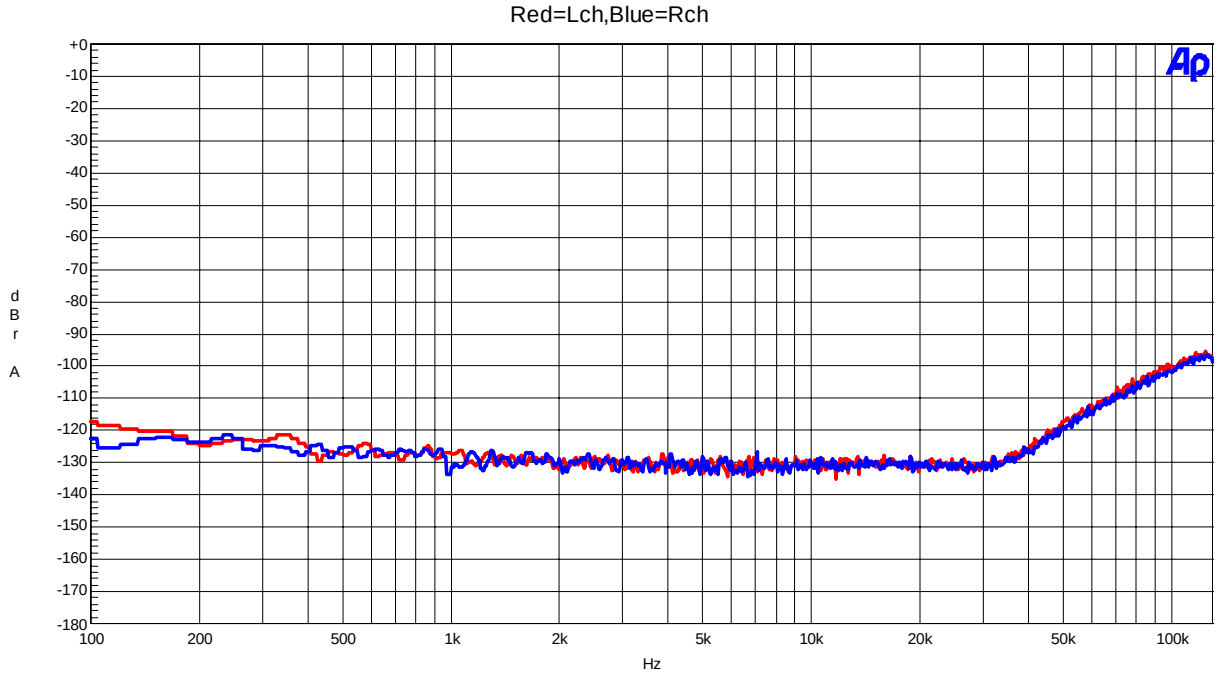



Figure 11. FFT(out-of-band noise)

(DAC fs=44.1kHz)

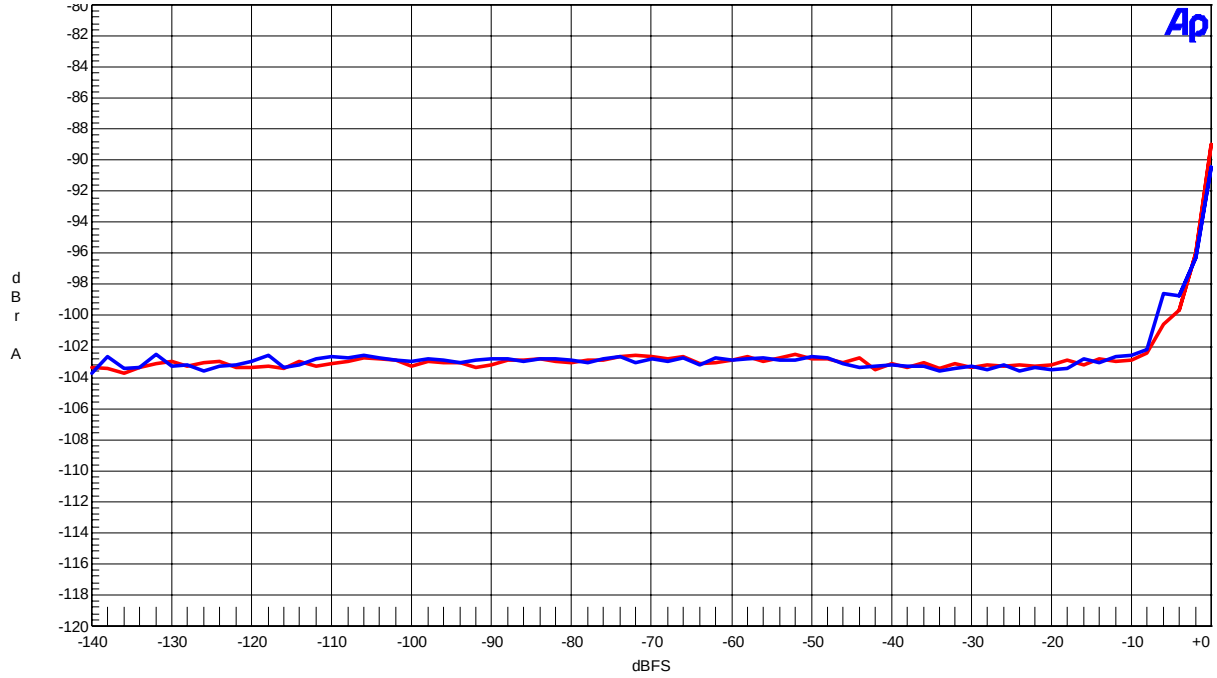



Figure 12. THD+N vs Input Level (Input Frequency=1kHz)

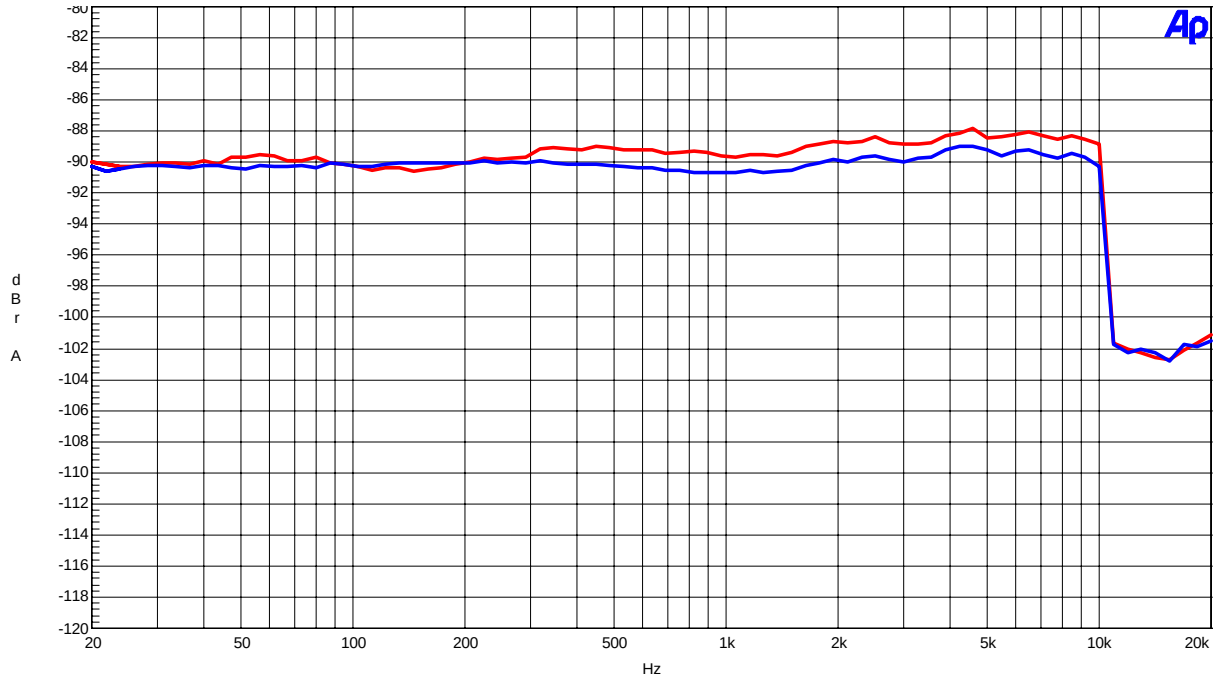



Figure 13. THD+N vs Input Frequency (Input Level=0dBFS)

(DAC fs=44.1kHz)

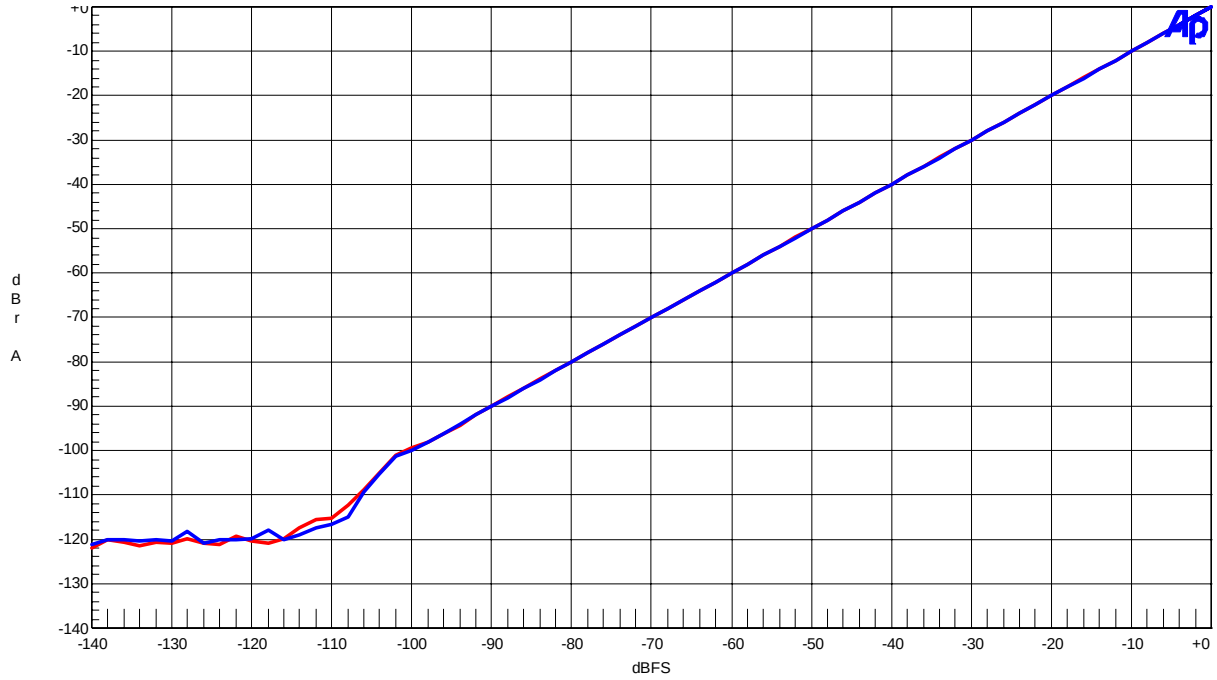



Figure 14. Linearity (Input Frequency=1kHz)

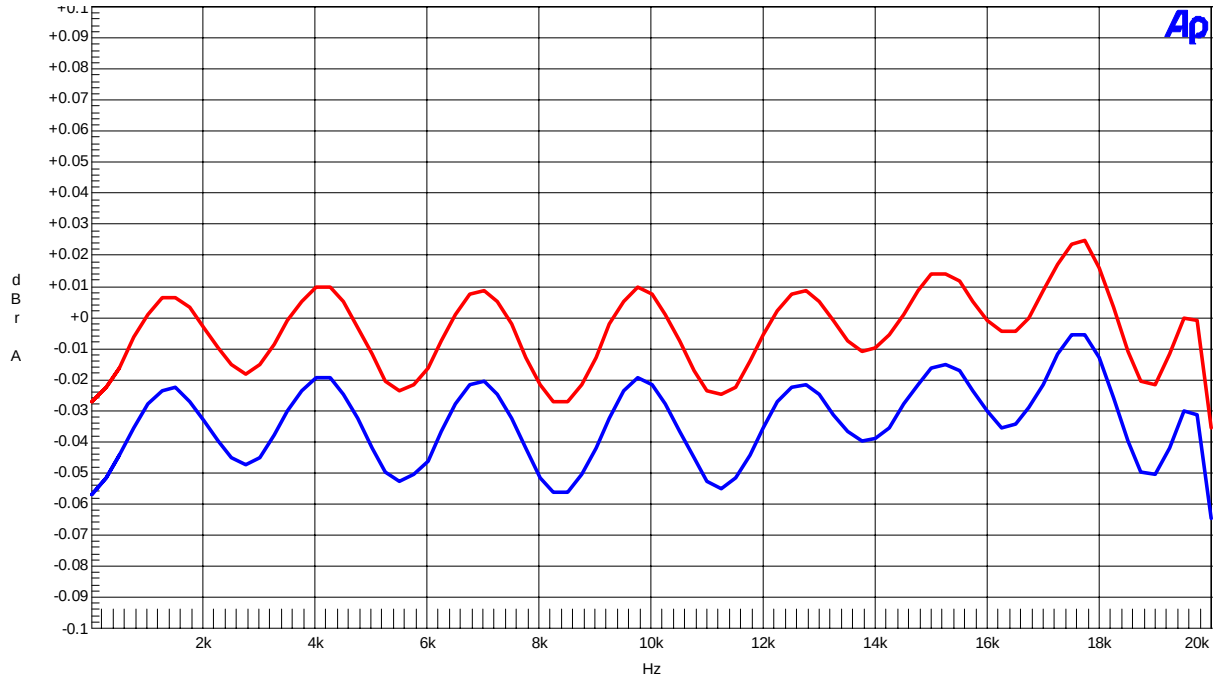



Figure 15. Frequency Response AOUTL Pin / AOUTR Pin (Input Level=0dBFS)

(DAC fs=44.1kHz)

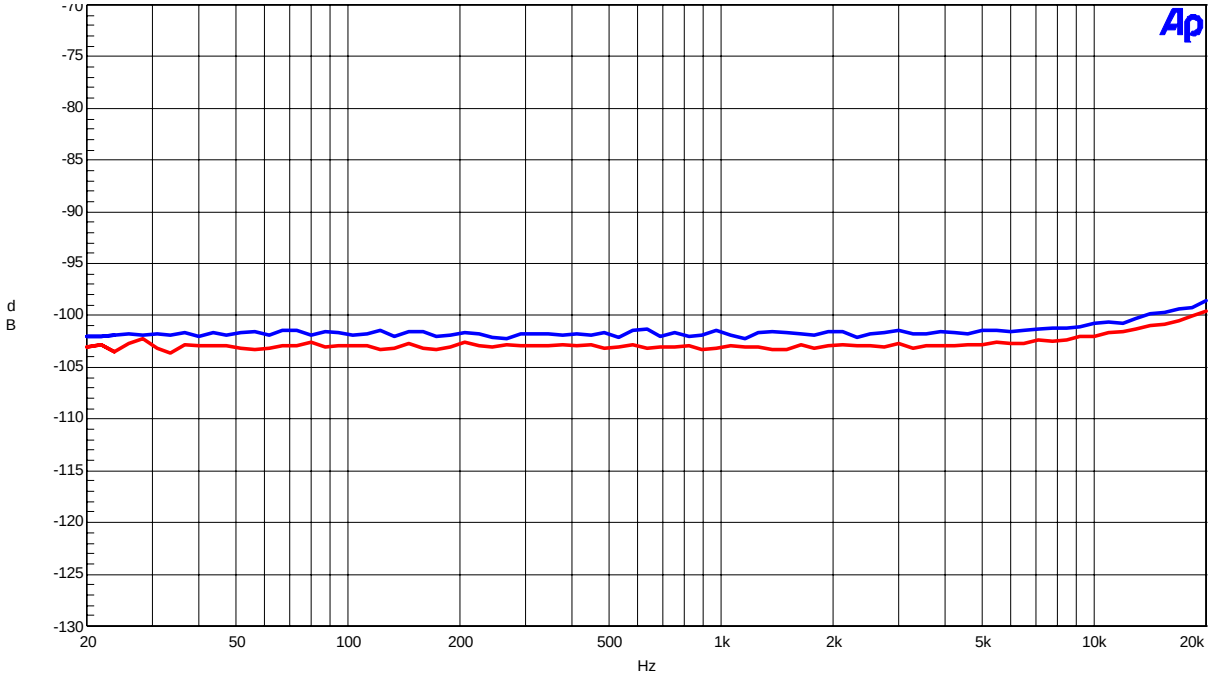



Figure 16. Cross-talk (Input Level=0dBFS)

(DAC fs=96kHz)

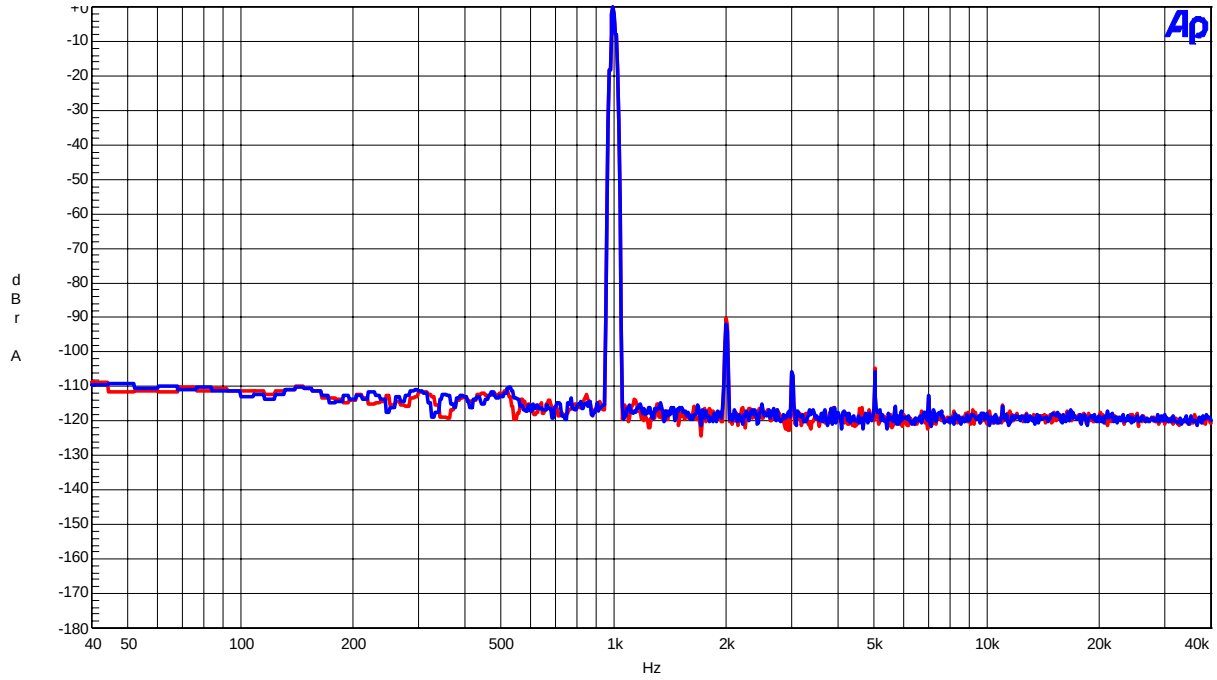



Figure 17. FFT(Input Frequency=1kHz, Input Level=0dBFS)

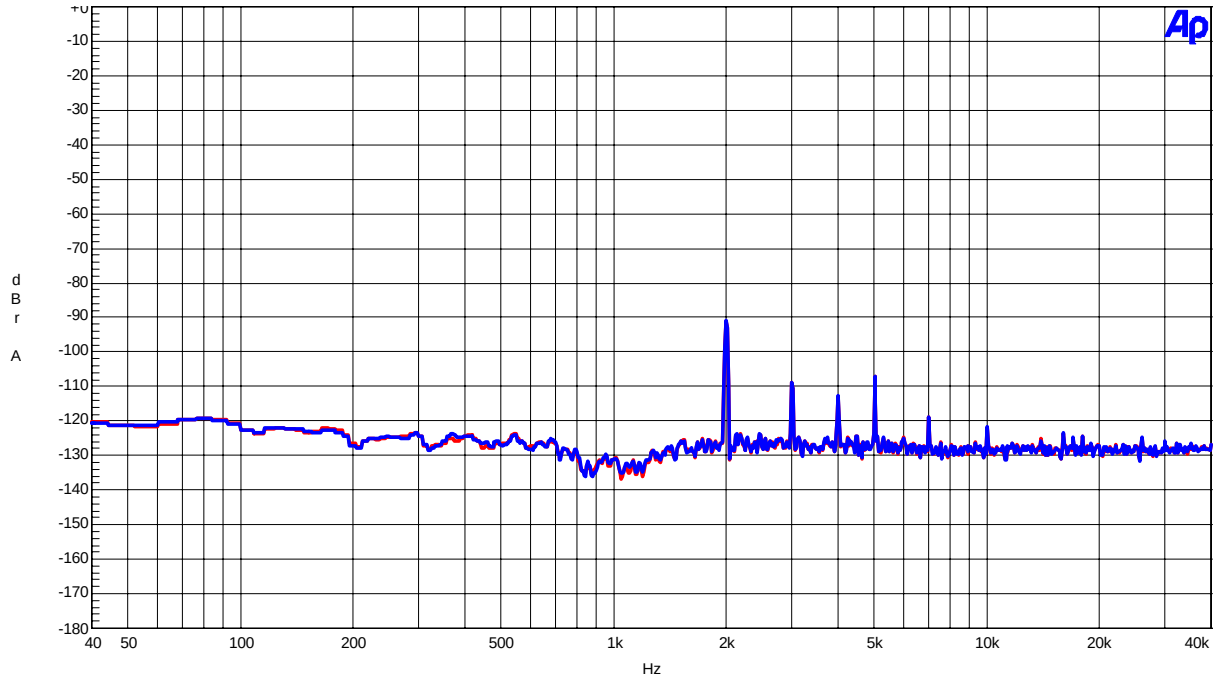



Figure 18. FFT(Input Frequency=1kHz, Input Level=0dBFS,Notch-on)

(DAC fs=96kHz)

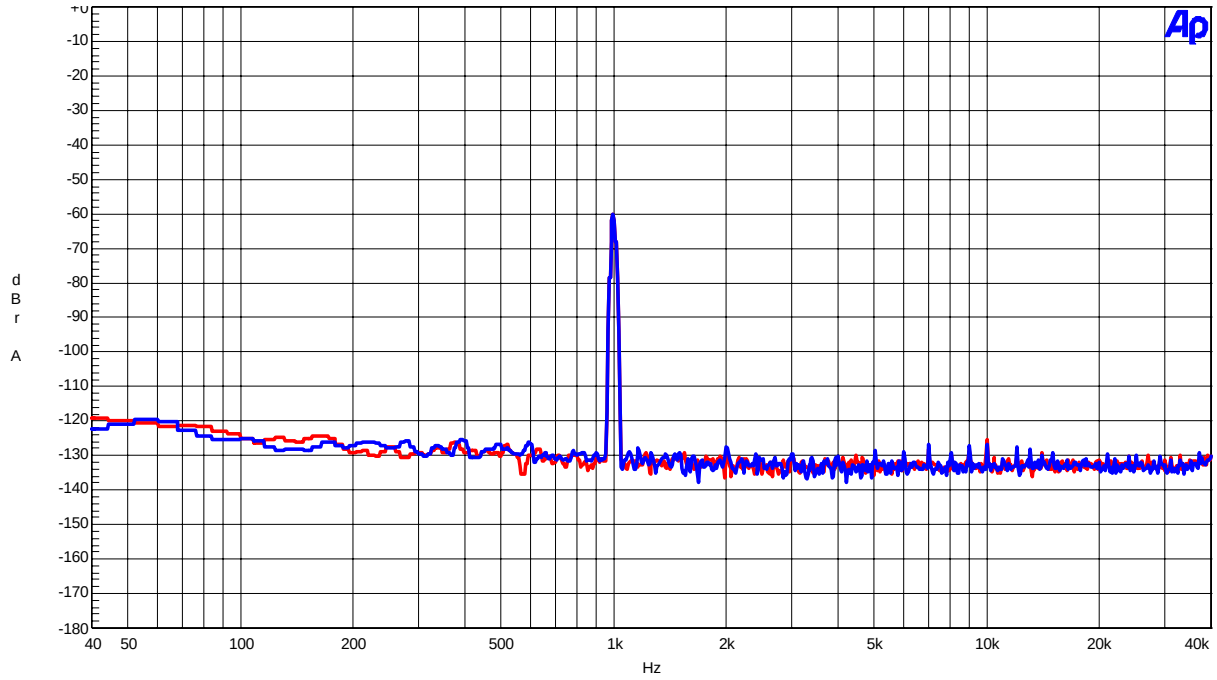



Figure 19. FFT(Input Frequency=1kHz, Input Level=-60dBFS)

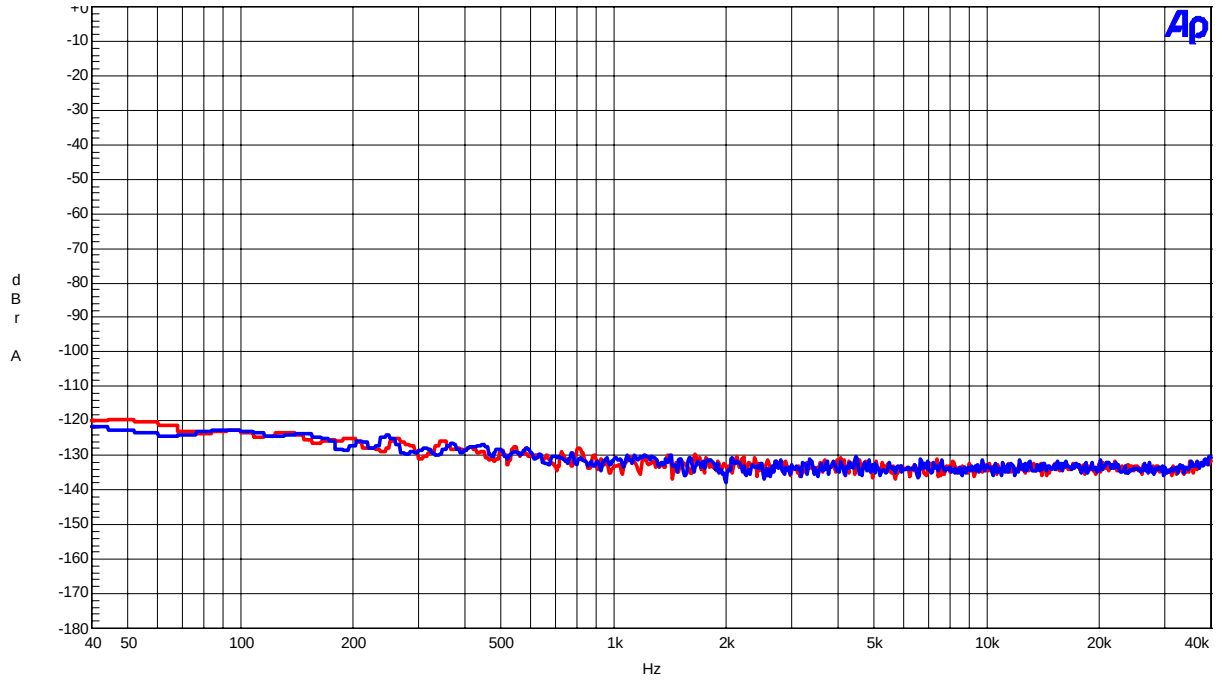



Figure 20. FFT(noise floor)

(DAC fs=96kHz)

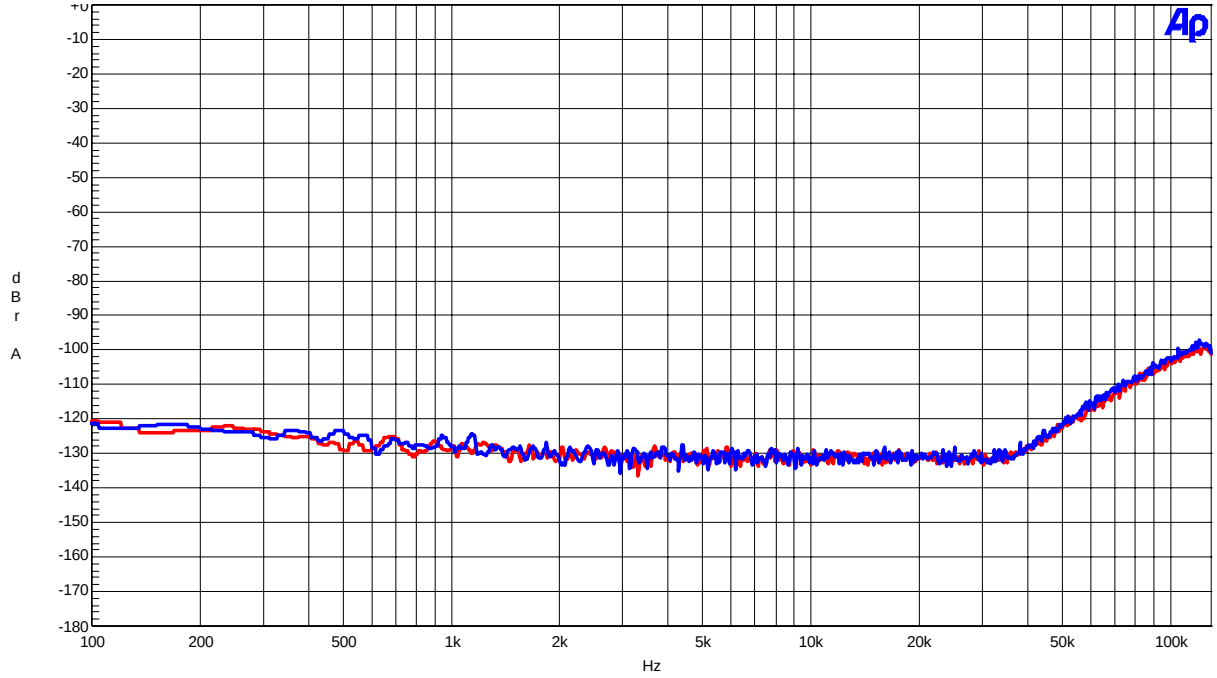



Figure 21. FFT (out-of-band noise)

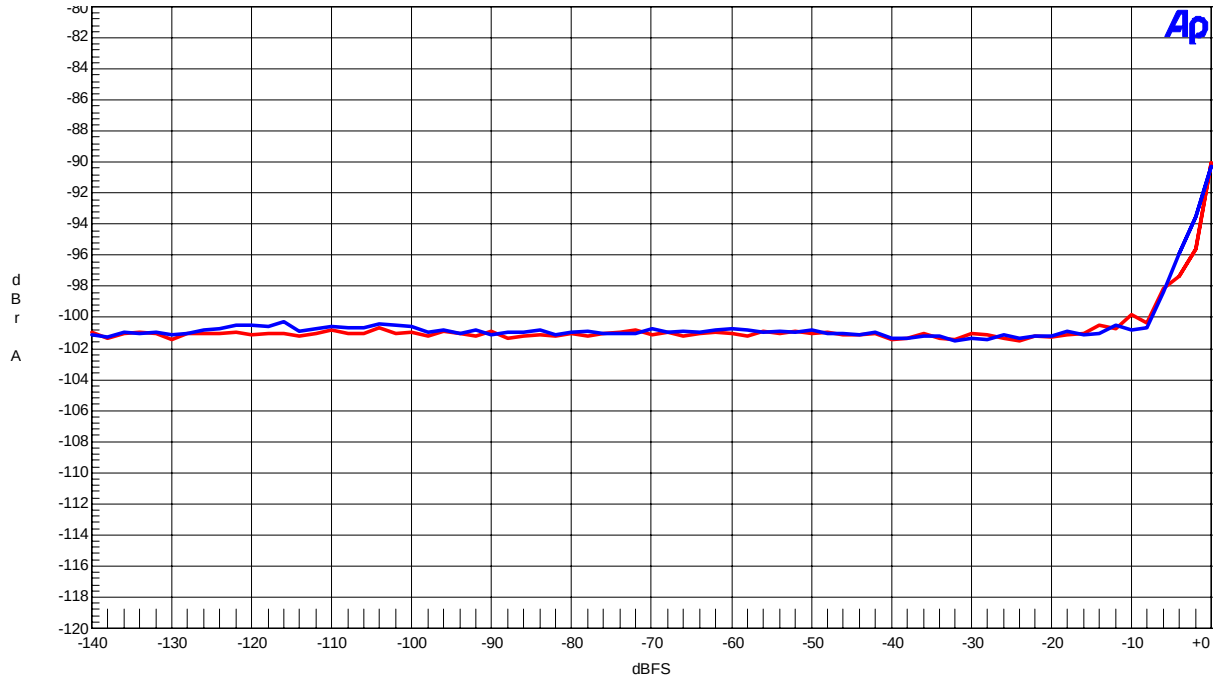



Figure 22. THD+N vs Input Level (Input Frequency=1kHz)

(DAC fs=96kHz)

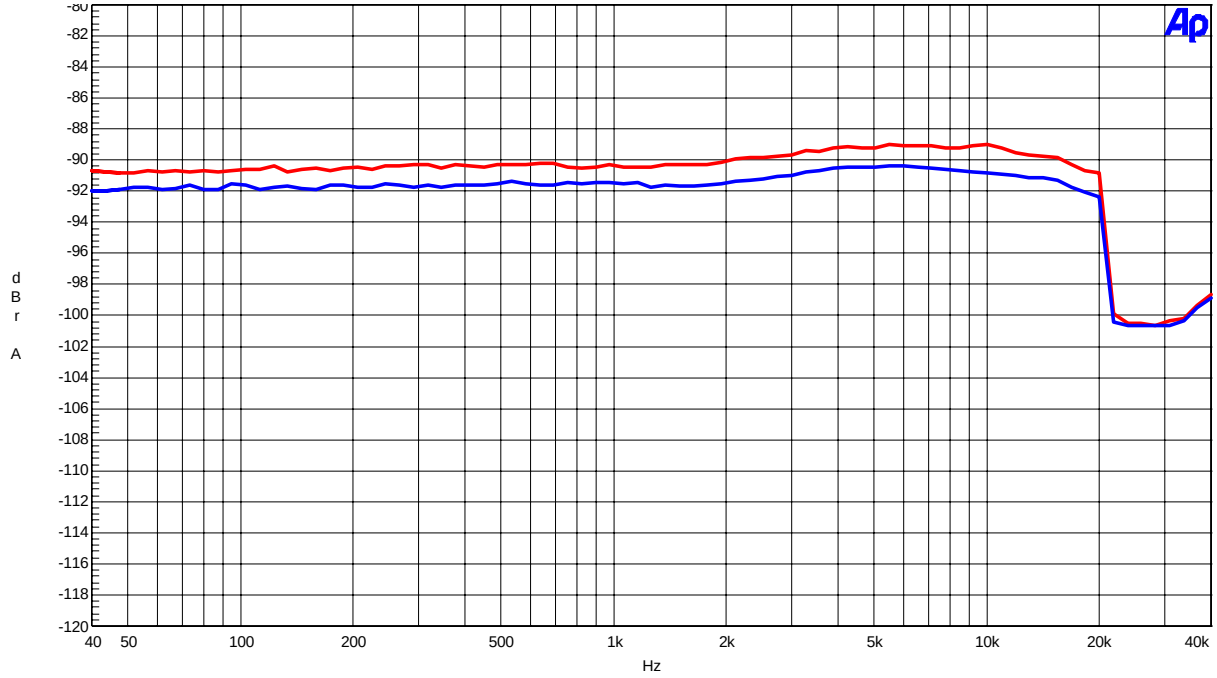



Figure 23. THD+N vs Input Frequency (Input Level=0dBFS)

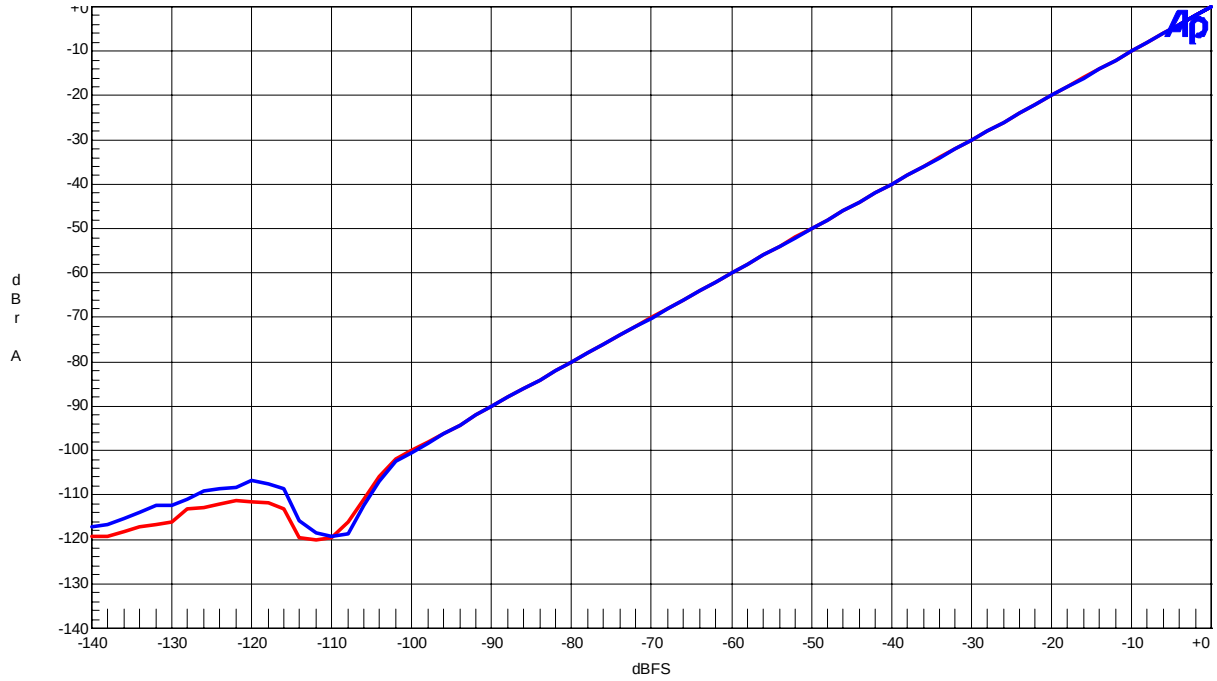



Figure 24. Linearity (Input Frequency=1kHz)

(DAC fs=96kHz)

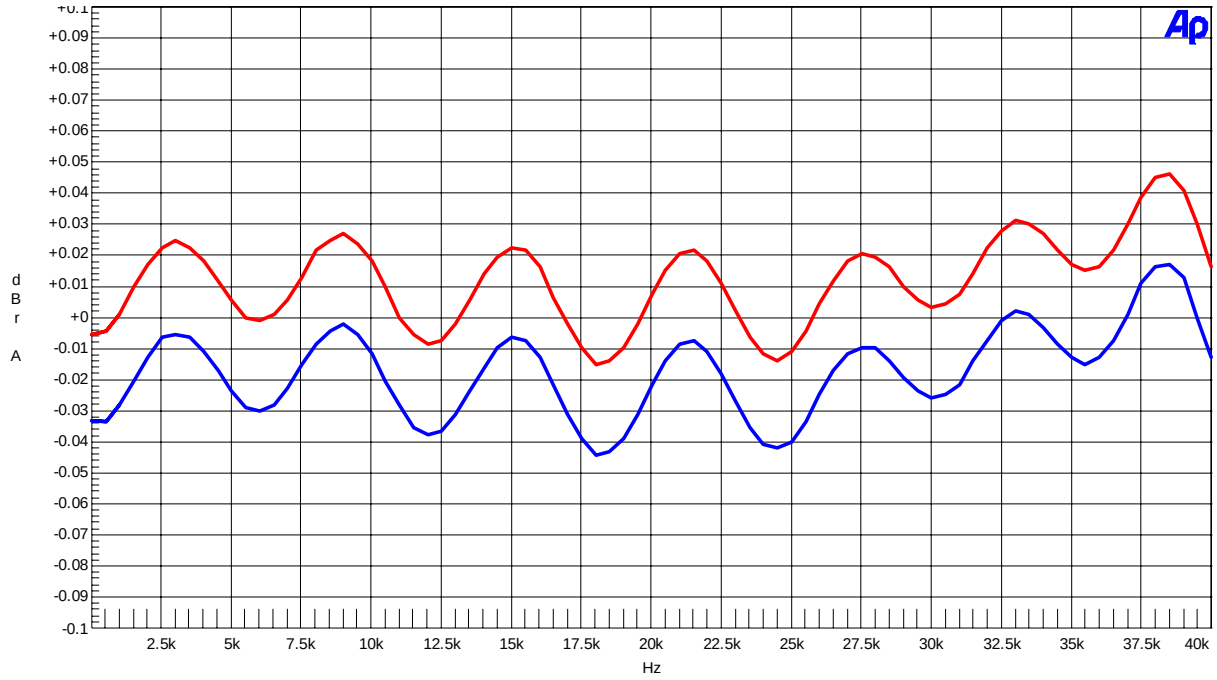



Figure 25. Frequency Response AOUTL Pin / AOUTR Pin (Input Level=0dBFS)

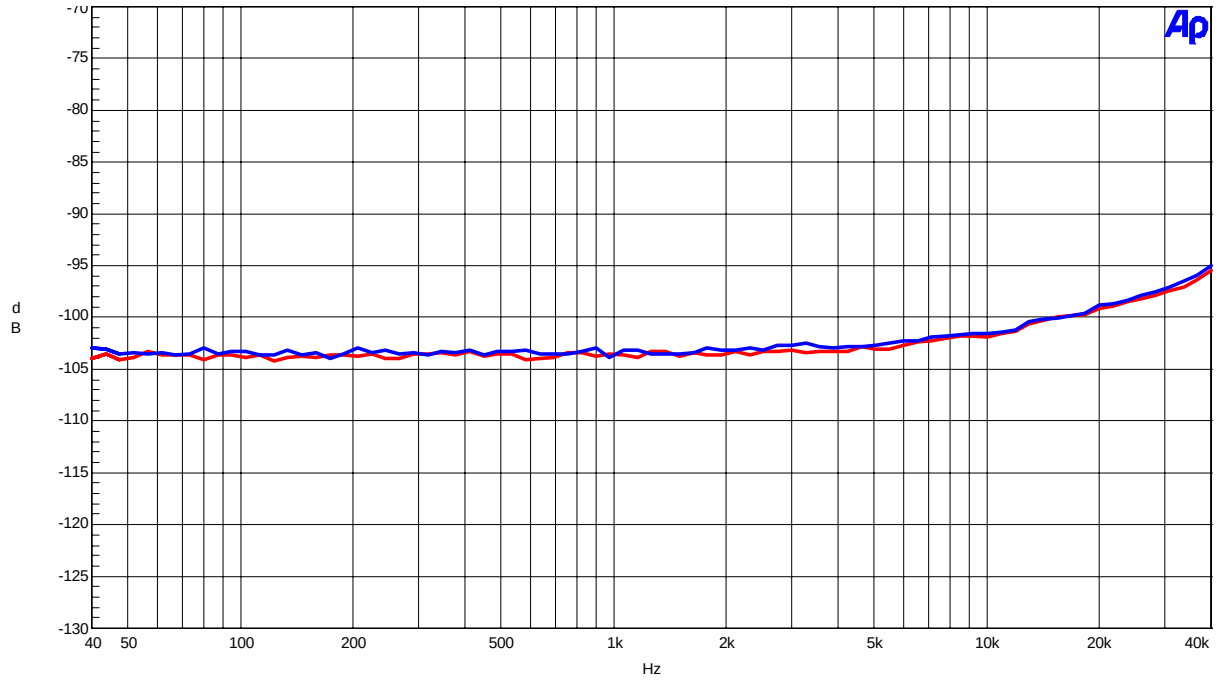



Figure 26. Cross-talk (Input Level=0dBFS)

(DAC fs=192kHz)

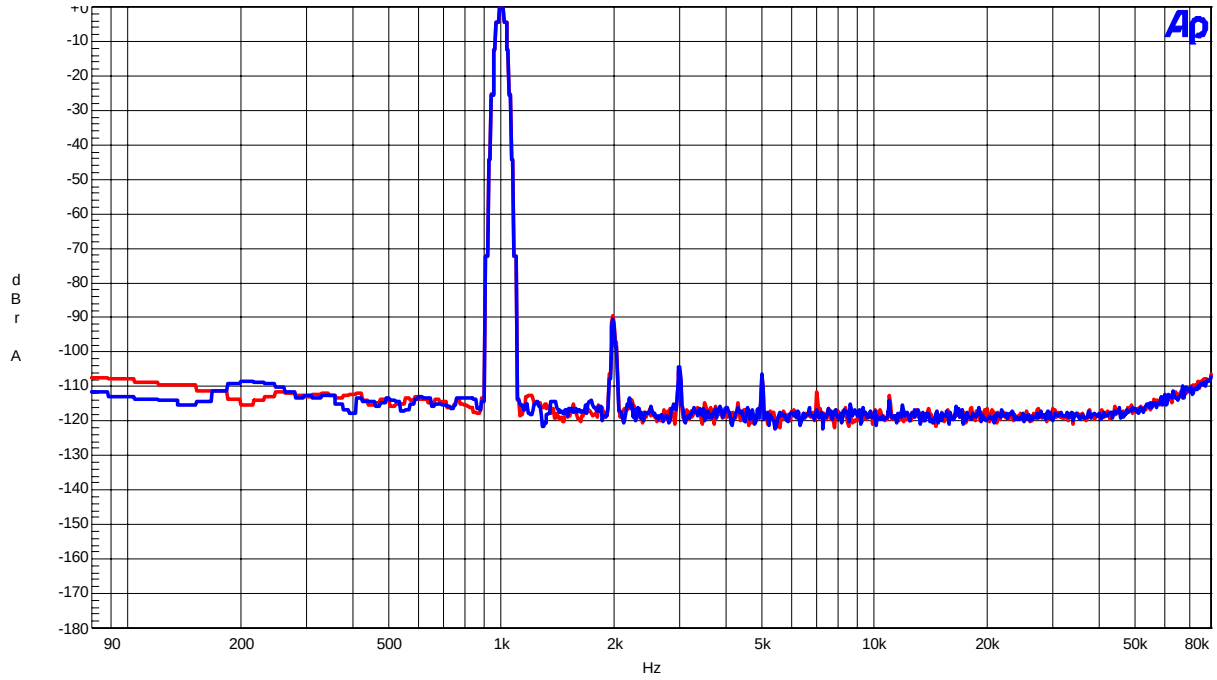



Figure 27. FFT(Input Frequency=1kHz, Input Level=0dBFS)

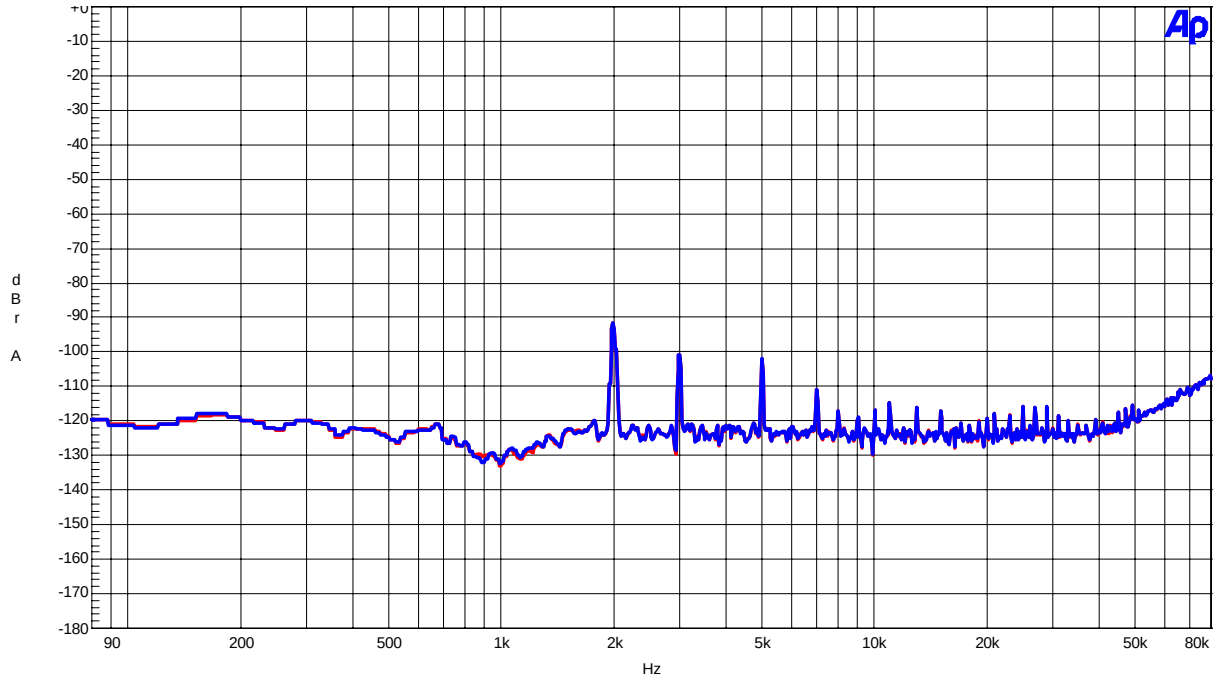



Figure 28. FFT(Input Frequency=1kHz, Input Level=0dBFS,Notch-on)

(DAC fs=192kHz)

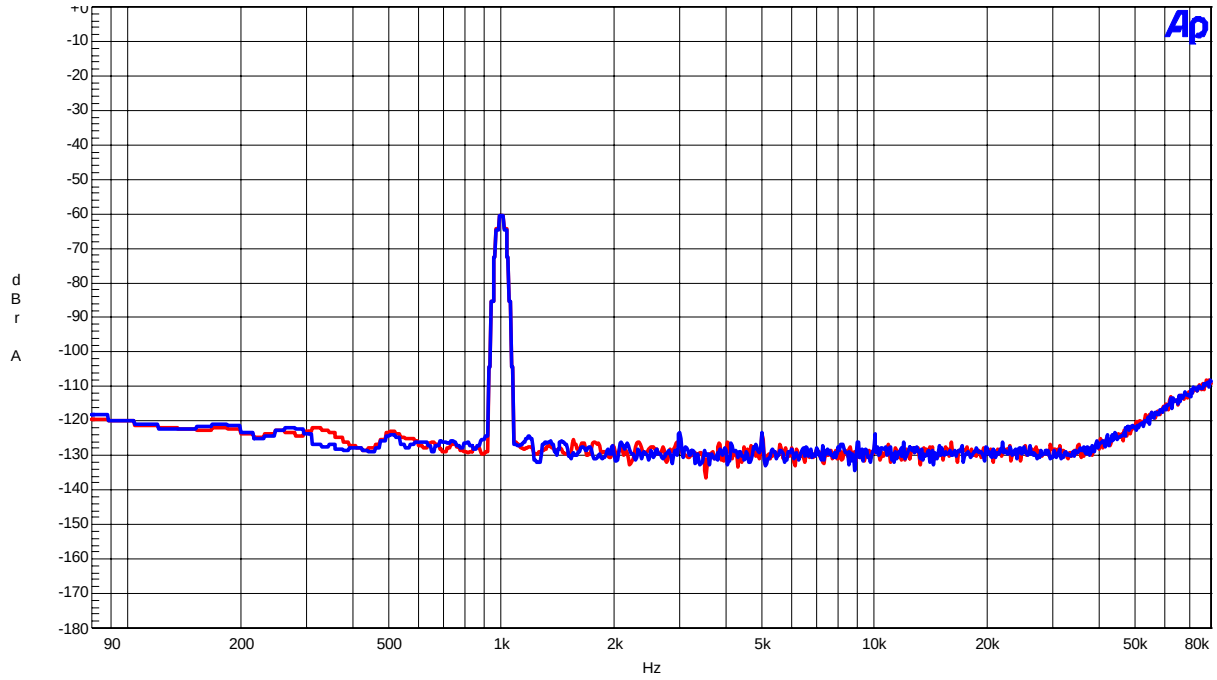



Figure 29. FFT(Input Frequency=1kHz, Input Level=-60dBFS)

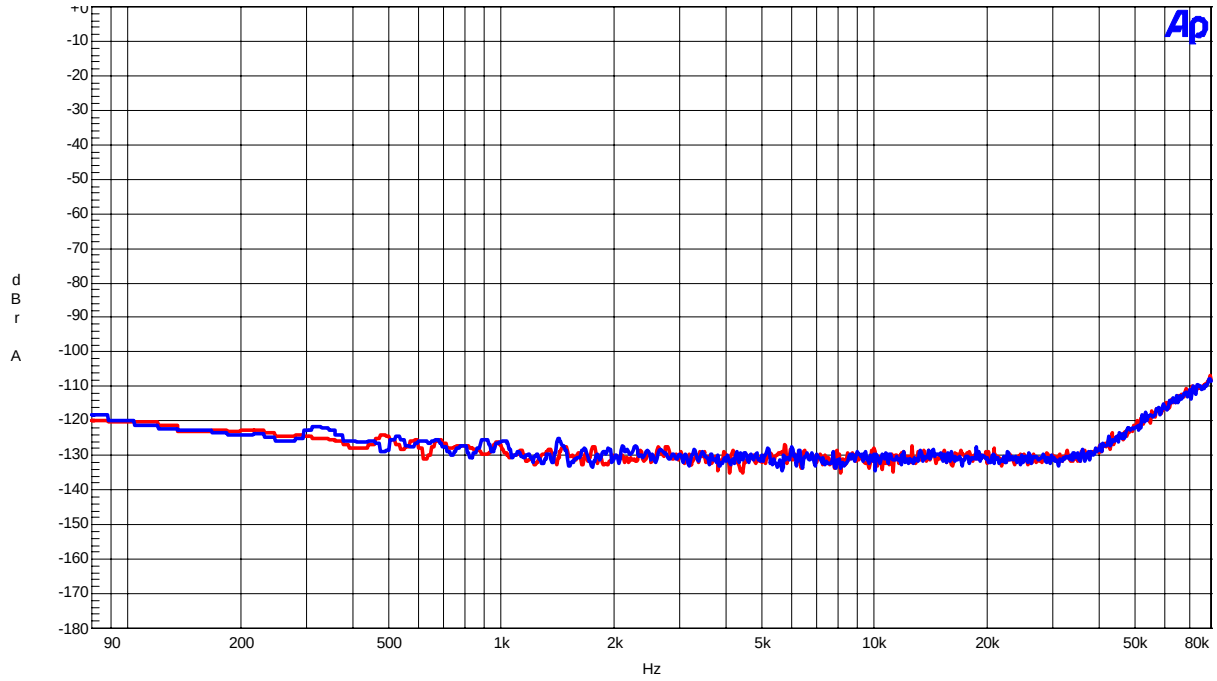



Figure 30. FFT(noise floor)

(DAC fs=192kHz)

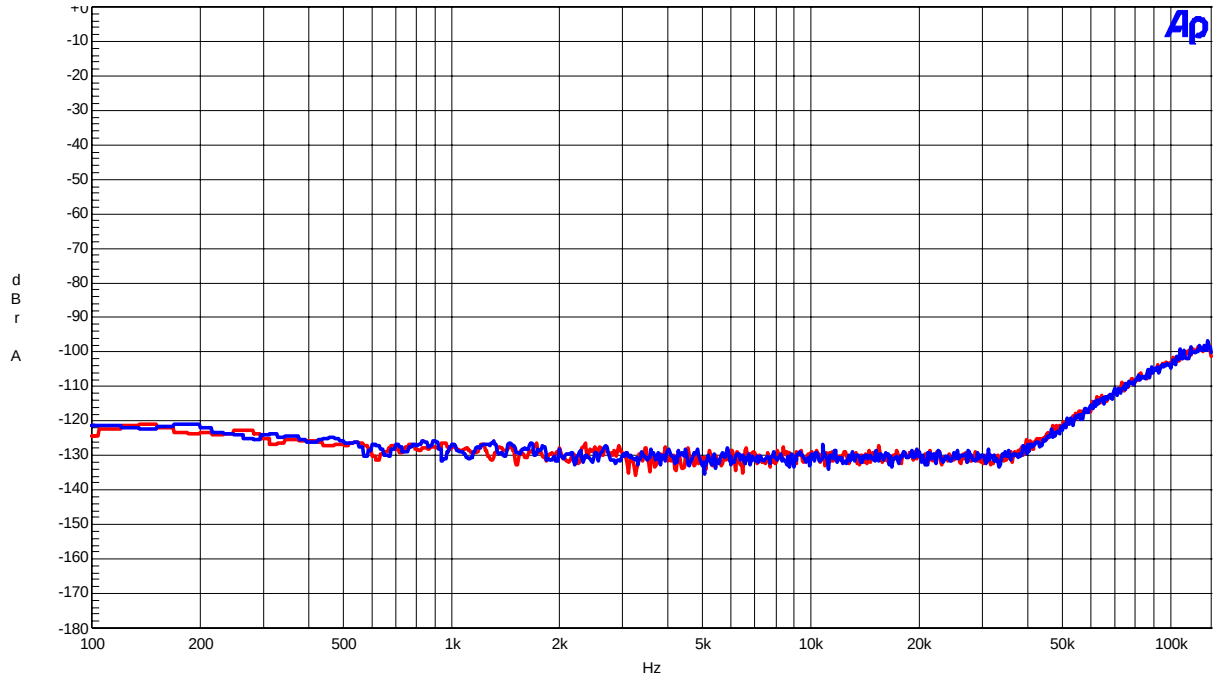



Figure 31. FFT(out-of-band noise)

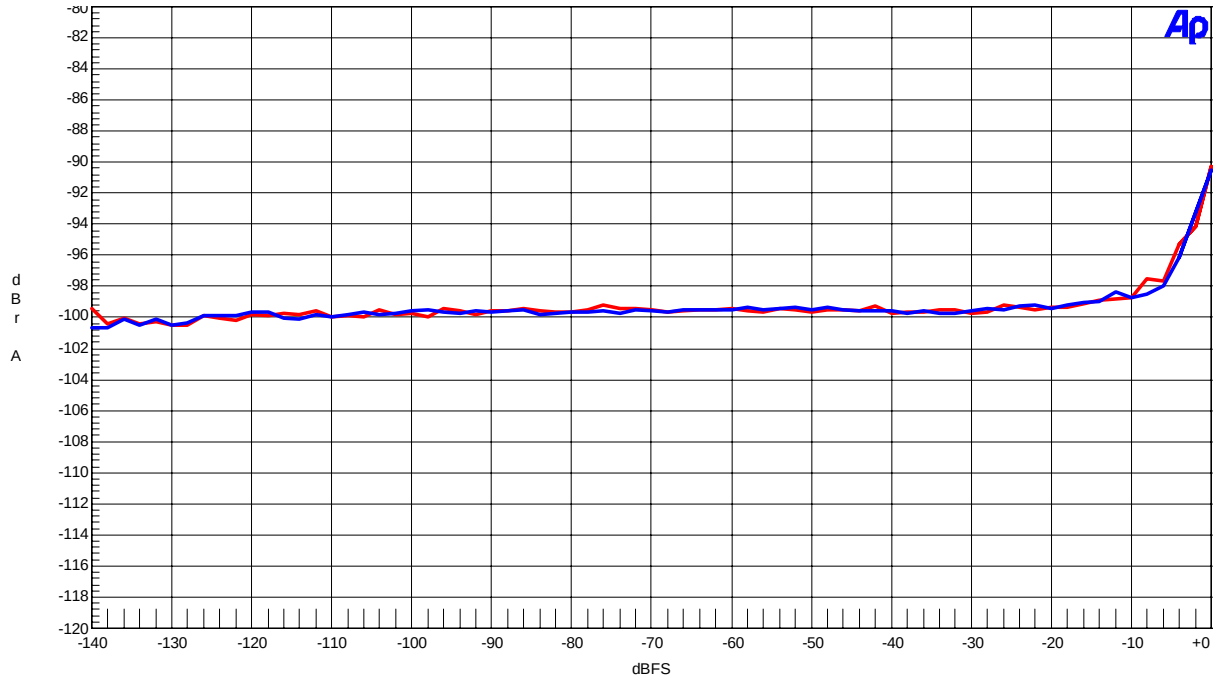



Figure 32. THD+N vs Input Level (Input Frequency=1kHz)

(DAC fs=192kHz)

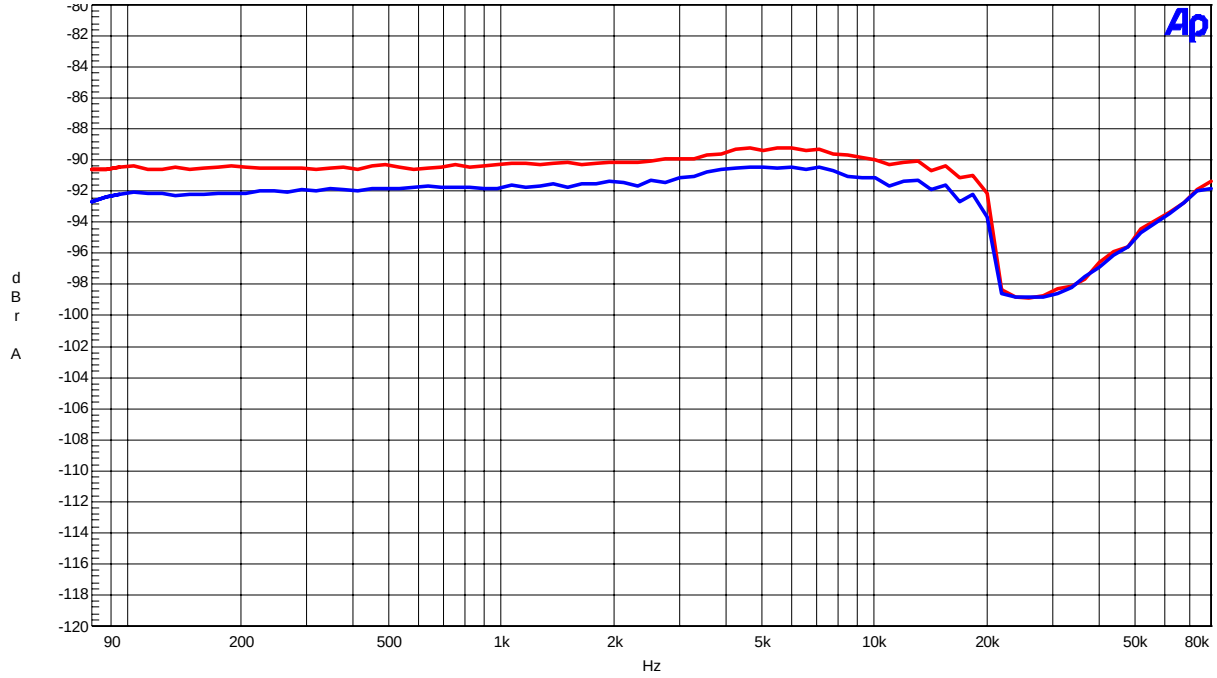



Figure 33. THD+N vs Input Frequency (Input Level=0dBFS)

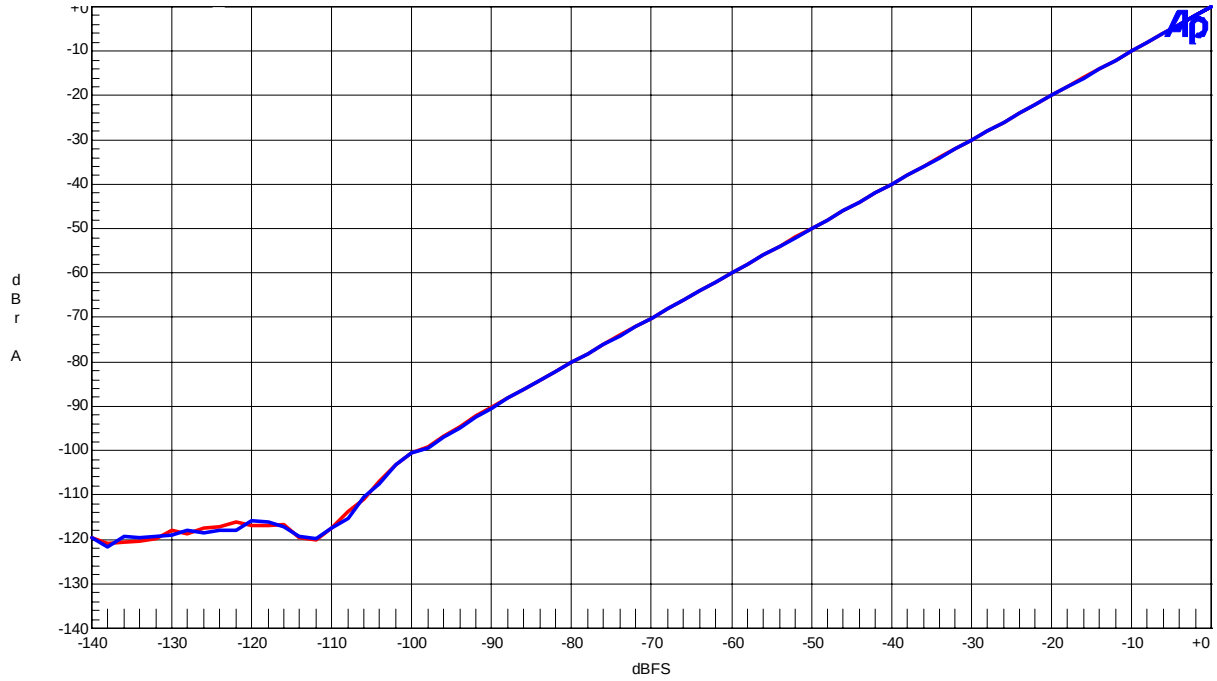



Figure 34. Linearity (Input Frequency=1kHz)

(DAC fs=192kHz)

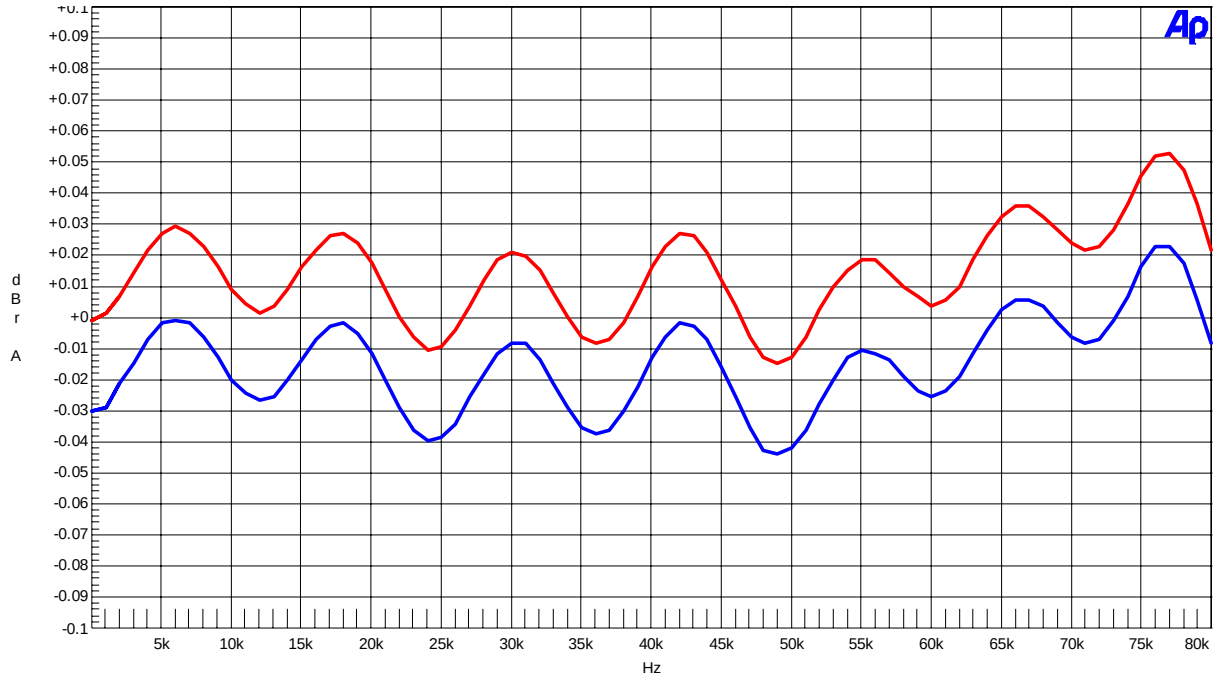



Figure 35. Frequency Response AOUTL Pin / AOUTR Pin (Input Level=0dBFS)

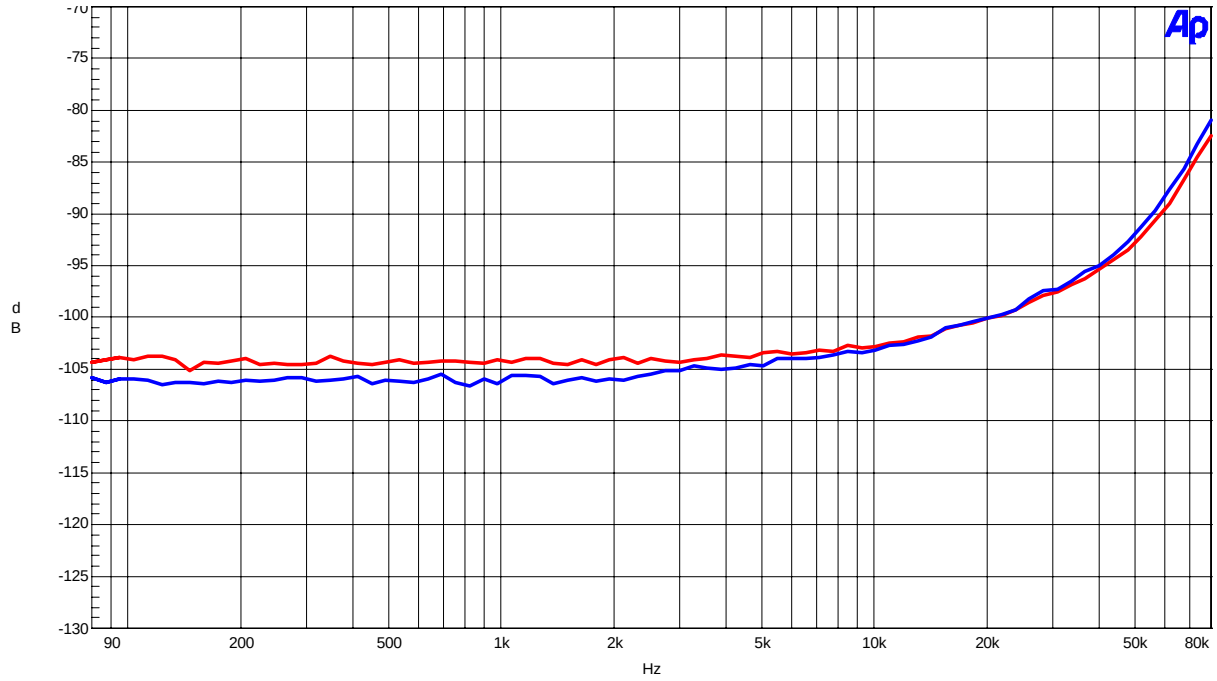
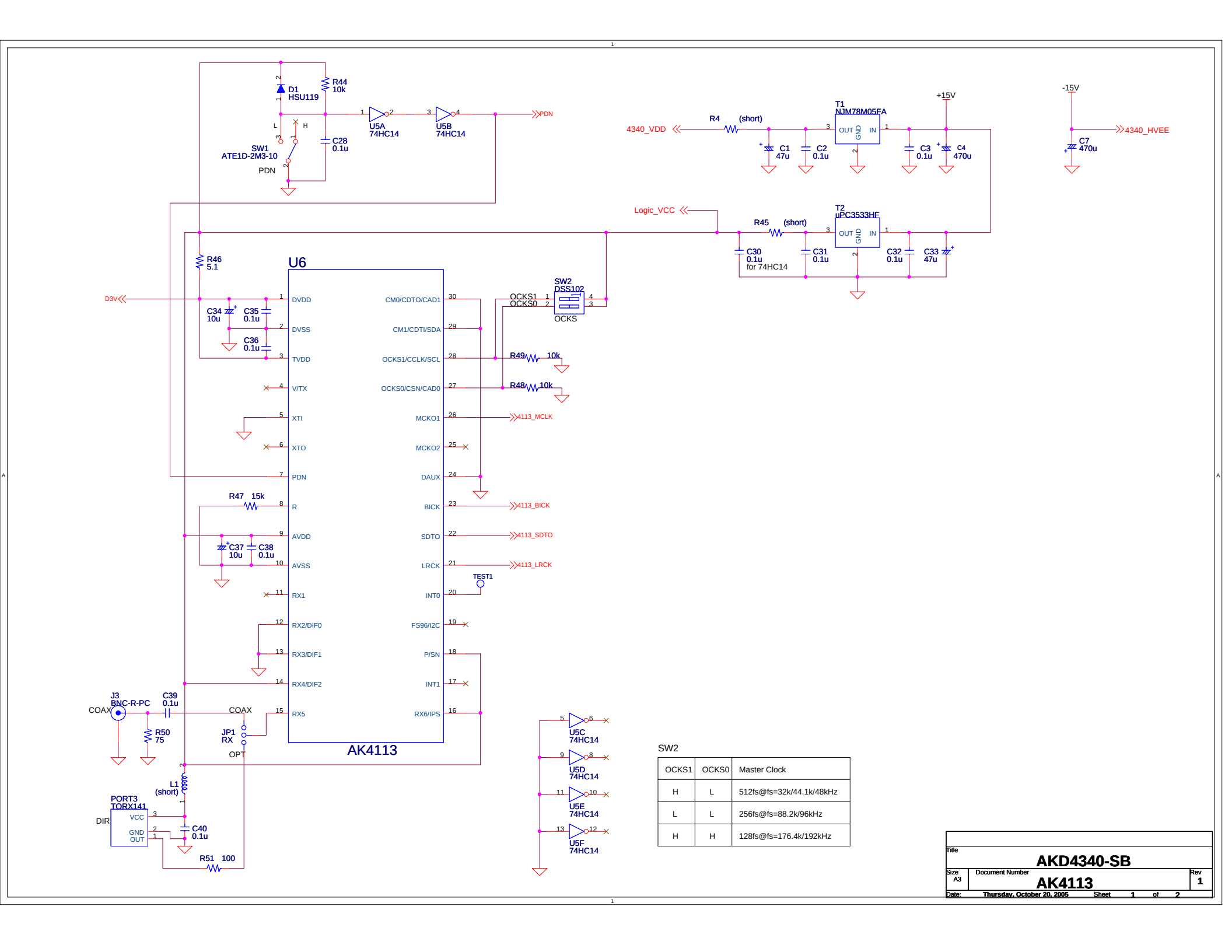



Figure 36. Cross-talk (Input Level=0dBFS)

## Revision History

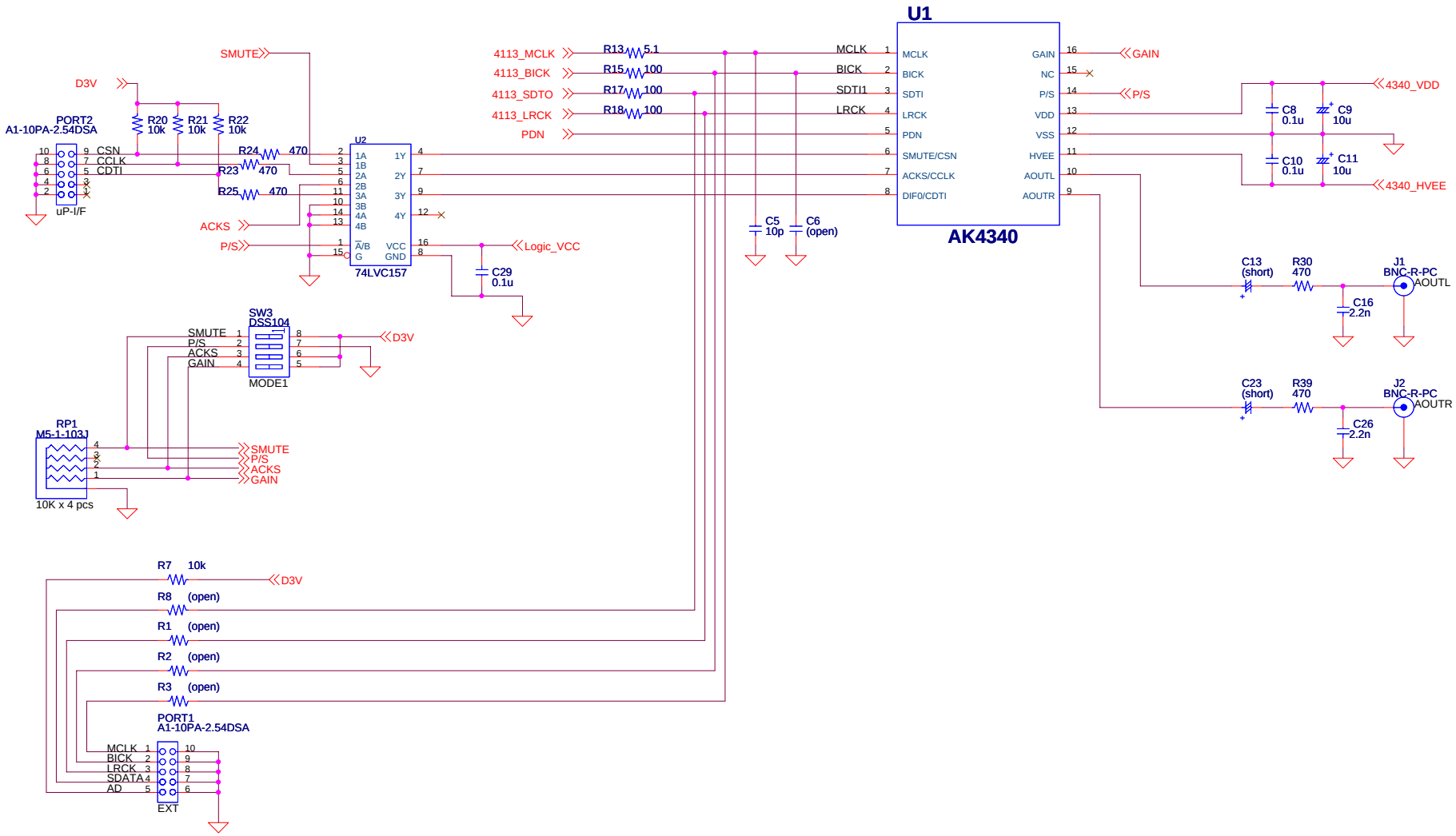
| Date (YY/MM/DD) | Manual Revision | Board Revision | Reason | Contents |
|---|---|---|---|---|
| 05/12/05 | KM079900 | 0 | First Edition | |




SW2

| OCKS1 | OCKS0 | Master Clock |
|---|---|---|
| H | L | 512fs@fs=32k/44.1k/48kHz |
| L | L | 256fs@fs=88.2k/96kHz |
| H | H | 128fs@fs=176.4k/192kHz |

| | | |
|---|---|---|
| Title | AKD4340-SB | |
| Size A3 | Document Number AK4113 | Rev 1 |
| Date: Thursday, October 20, 2005 | Sheet 1 of 2 | |




| | | | |
|---|---|---|---|
| Title | AKD4340-SB | | |
| Size A3 | Document Number AK4340 | | Rev 1 |
| Date: Thursday, October 20, 2005 | Sheet 2 of 2 | | |