# AKD4392-SB

## AK4392 Sound quality evaluation board Rev.0

### General Description

AKD4392-SB is an evaluation board for AK4392 corresponding to DVD-Audio, which is 32Bit DAC. The AKD4392-SB includes a LPF which can add differential analog outputs from the AK4392 and also has a digital interface. Therefore, it is easy to evaluate sound quality of the AK4392.

■ **Ordering Guide**

AKD4392-SB --- Sound quality evaluation board for AK4392

### Function

■ On-board Analog output buffer circuit

■ On-board digital audio interface. (AK4115)

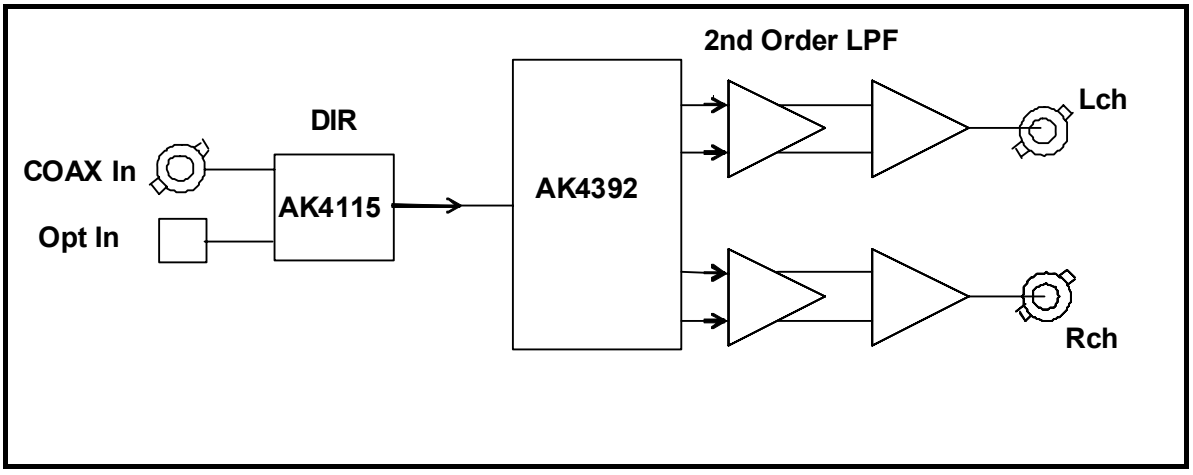


Figure 1. Block diagram

* Circuit diagram 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 | Color | Voltage | Comments | Attention |
|---|---|---|---|---|
| +15V | Red | +12~+15V | Regulator,<br>Power supply for Op-amp. | This jack is always needed. Power line |
| -15V | Blue | -12~-15V | Power supply for Op-amp. | This jack is always needed. Power line |
| AGND | Black | 0V | GND | This jack is always needed. |

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 AK4392 should be reset once bringing SW3 (PDN) “L” upon power-up.

## ■ Evaluation mode

1. DIR(COAX) (default)

The DIR generates MCLK, BICK and LRCK SDATA from the received data through BNC connector (J7). It is possible for the evaluation using such as CD test disk.

Setting:R87 = open; R88 = short (0Ω)

COAX is recommended for an evaluation of the Sound quality.

2. DIR(Optical)

The DIR generates MCLK, BICK and LRCK SDATA from the received data through Optical connector (PORT2). It is possible for the evaluation using such as CD test disk.

Setting:R87 = short (0Ω); R88 = open

3. All clocks are fed through the PORT1.

Setting:

-R54, R55, R56, R58 = open

-R50, R51, R52 = 100Ω; R53 = 5.1Ω

## ■ DIP Switch setting

[SW1]: AK4115 setting

| No. | Pin | L | H | Default |
|---|---|---|---|---|
| 1 | OCKS1 | Master Clock setting of AK4115 Refer to Table 4 | | H |
| 2 | OCKS0 | | | L |

Table 2. SW1 setting

[SW2]: AK4392 setting

| No. | Pin | L | H | Default |
|---|---|---|---|---|
| 1 | - | - | - | - |
| 2 | P/S | Serial mode | Parallel mode | L |

Table 3. SW2 setting

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

| OCKS1 | OCKS0 | MCLK Frequency | |
|---|---|---|---|
| L | L | 256fs @fs=88.2/96kHz | |
| H | L | 512fs @fs=32/44.1/48kHz | (Default) |
| H | H | 128fs @fs=176.4/192kHz | |

Table 4. MCLK Clock

## ■ SW3 setting

[SW3](PDN): Reset of AK4392. Select "H" during operation.

## ■ External Analog Circuit

The differential output circuit and LPF is implemented on board. The differential outputs of AK4392 is buffered by non-inverted circuit($2^{nd}$ order LPF, fc=106.4k, Q=0.698, G=+3.9dB). LPF adds differential outputs($1^{st}$ order LPF, fc=284k, G=-0.84dB). LME49710NA is used for op-amp on this board that has low noise and high voltage torelance characteristics. Analog signal is output via BNC connectors on the board. The output level is about 2.8Vrms (typ@VREF=5.0V) by BNC.

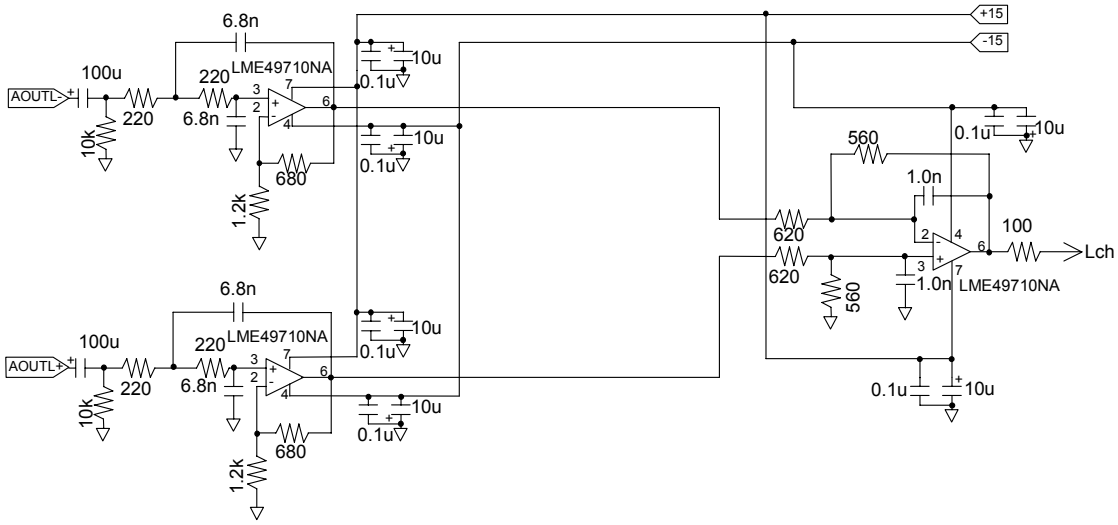


Figure 2. External Analog Filter

| AKD4392-SB Filter | 40kHz (Double) | 80kHz (quad) |
|---|---|---|
| Internal Filter | -0.3dB | -1dB |
| External LPF | -0.12dB | -1.3dB |
| Total | -0.42dB | -2.3dB |

This table shows typical value.

Table 5. Frequency Responses

**Control Software Manual**

## ■ Evaluation Board and Control Soft Settings

1. Set an evaluation board properly.
2. Connect the evaluation board to an IBM PC/AT compatible PC by a 10wire flat cable. Be aware of the direction of the 10pin header. When running this control soft on the Windows 2000/XP, the driver which is included in the CD must be installed. Refer to the “Driver Control Install Manual for AKM Device Control Software” for installing the driver. When running this control soft on the windows 95/98/ME, driver installing is not necessary. This control soft does not support the Windows NT.
3. Proceed evaluation by following the process below.

## ■ Operation Overview

Function, register map and testing tool can be controlled by this control soft. These controls are selected by upper tabs.

Buttons which are frequently used such as register initializing button “Write Default”, are located outside of the switching tab window. Refer to the “■ Dialog Boxes” for details of each dialog box setting.

1. [Port Reset]: For when connecting to USB I/F board (AKDUSBIF-A)
   Click this button after the control soft starts up when connecting USB I/F board (AKDUSBIF-A).
2. [Write Default]: Register Initializing
   When the device is reset by a hardware reset, use this button to initialize the registers.
3. [All Write]: Executing write commands for all registers displayed.
4. [Save]: Saving current register settings to a file.
5. [Load]: Executing data write from a saved file.
6. [Data R/W]: “Data R/W” dialog box is popped up.

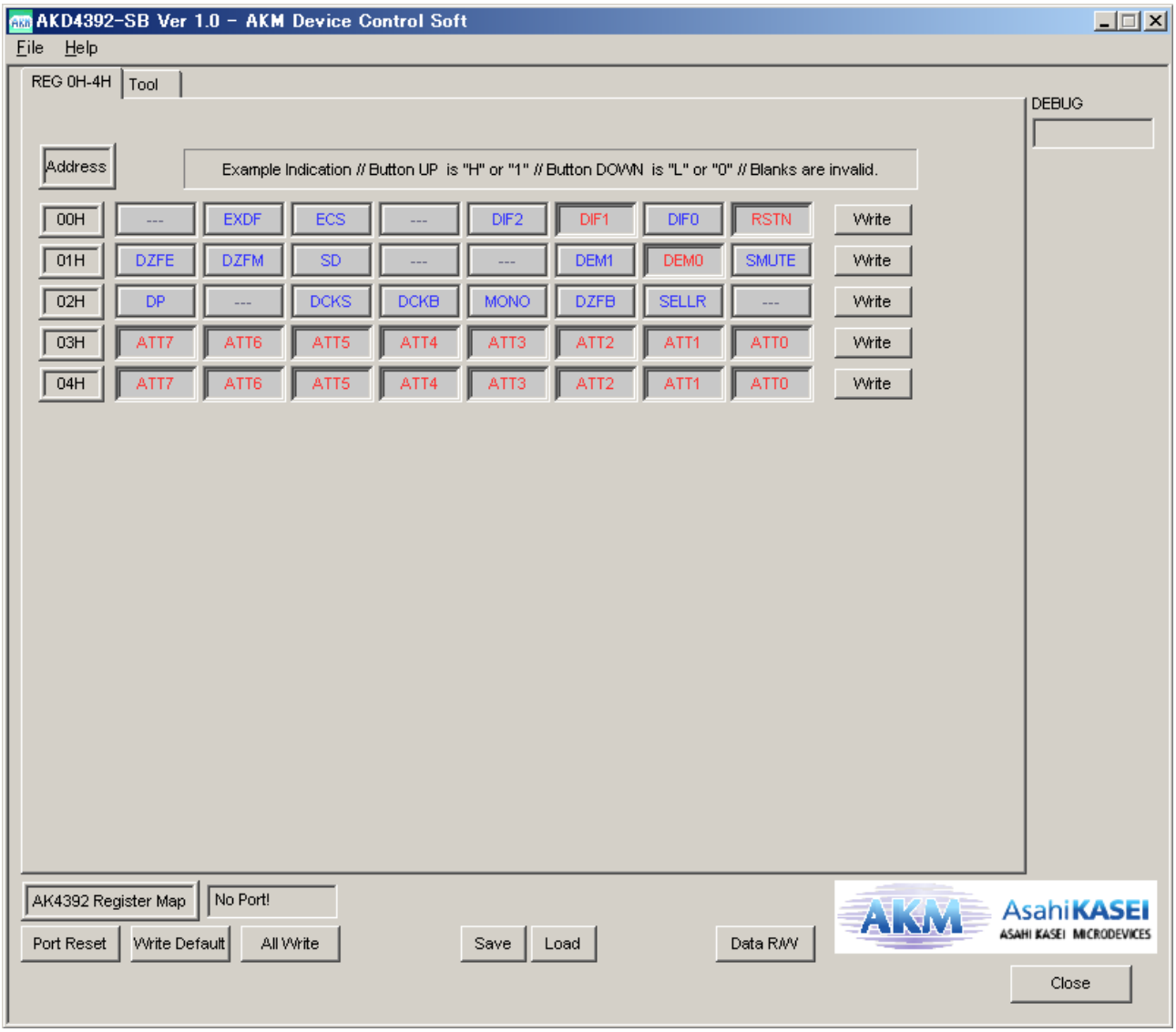


Figure 3. Window of [ FUNCTION]

## ■Dialog Boxes

### [Data R/W]: Data R/W Dialog Box

Click the [Data R/W] button in the main window for data write dialog box.
Data write is available to specified address.

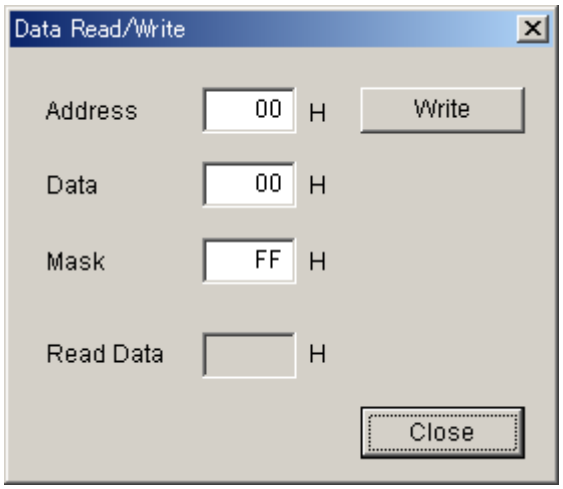


Figure 4. Window of [ Data R/W ]

Address Box: Input data address in hexadecimal numbers for data writing.
Data Box: Input data in hexadecimal numbers.
Mask Box: Input mask data in hexadecimal numbers.
This is “AND” processed input data.

[Write]: Writing to the address specified by “Address” box.
[Close]: Closing the dialog box and finish the process.
Data writing can be cancelled by this button instead of [Write] button.

*The register map will be updated after executing [Write] or [Read] commands.

## 1.[REG]: Register Map

This tab is for a register writing and reading.

Each bit on the register map is a push-button switch.
Button Down indicates “H” or “1” and the bit name is in red (when read only it is in deep red).
Button Up indicates “L” or “0” and the bit name is in blue (when read only it is in gray)

Grayout registers are Read Only registers. They can not be controlled.

The registers which is not defined in the datasheet are indicated as “---”.

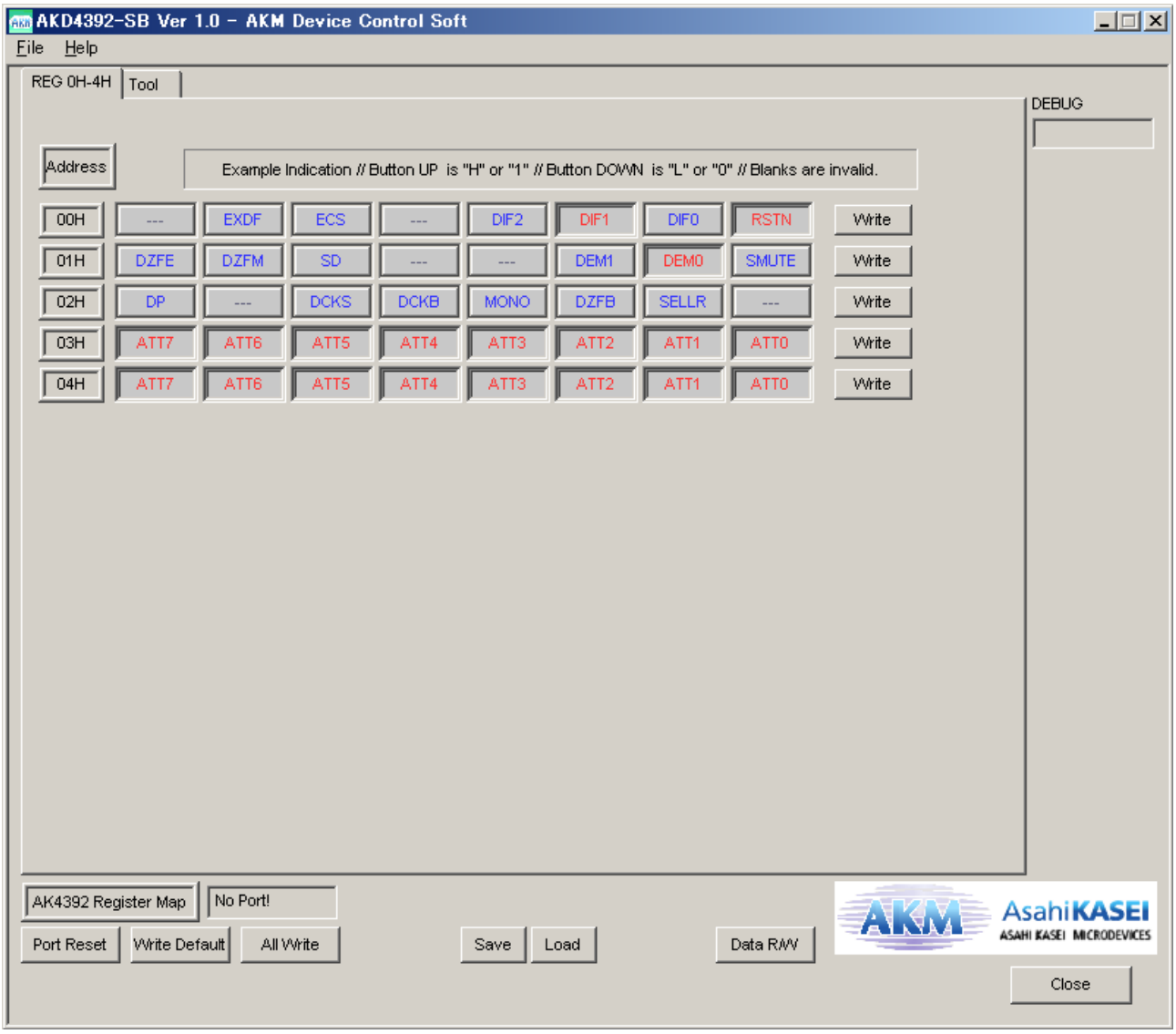


Figure 5. Window of [ REG]

### [Write]: Data Writing Dialog

It is for when changing two or more bits on the same address at the same time.

Click [Write] button located on the right of the each corresponded address for a pop-up dialog box.

When checking the checkbox, the register will be “H” or “1”, when not checking the register will be “L” or ”0”. Click [OK] to write setting value to the registers, or click [Cancel] to cancel this setting.

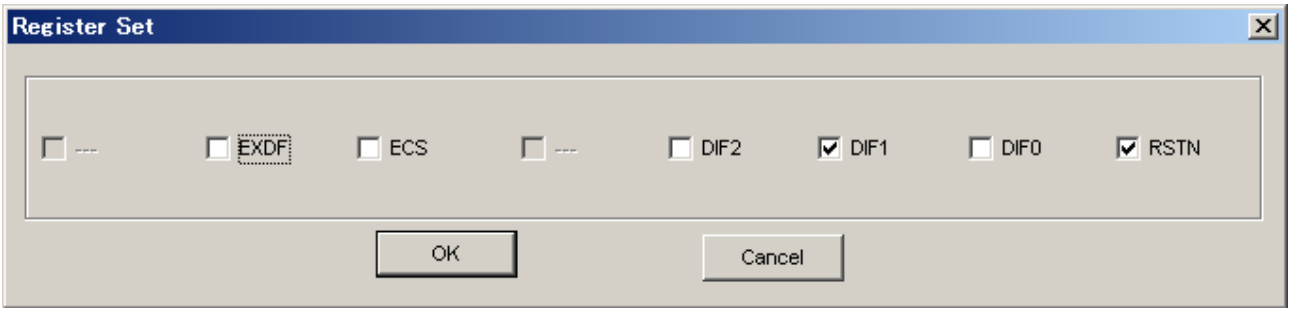


Figure 6. Window of [ Register Set ]

## 2. [Tool]: Testing Tools

This tab screen is for evaluation testing tool.
Click buttons for each testing tool.

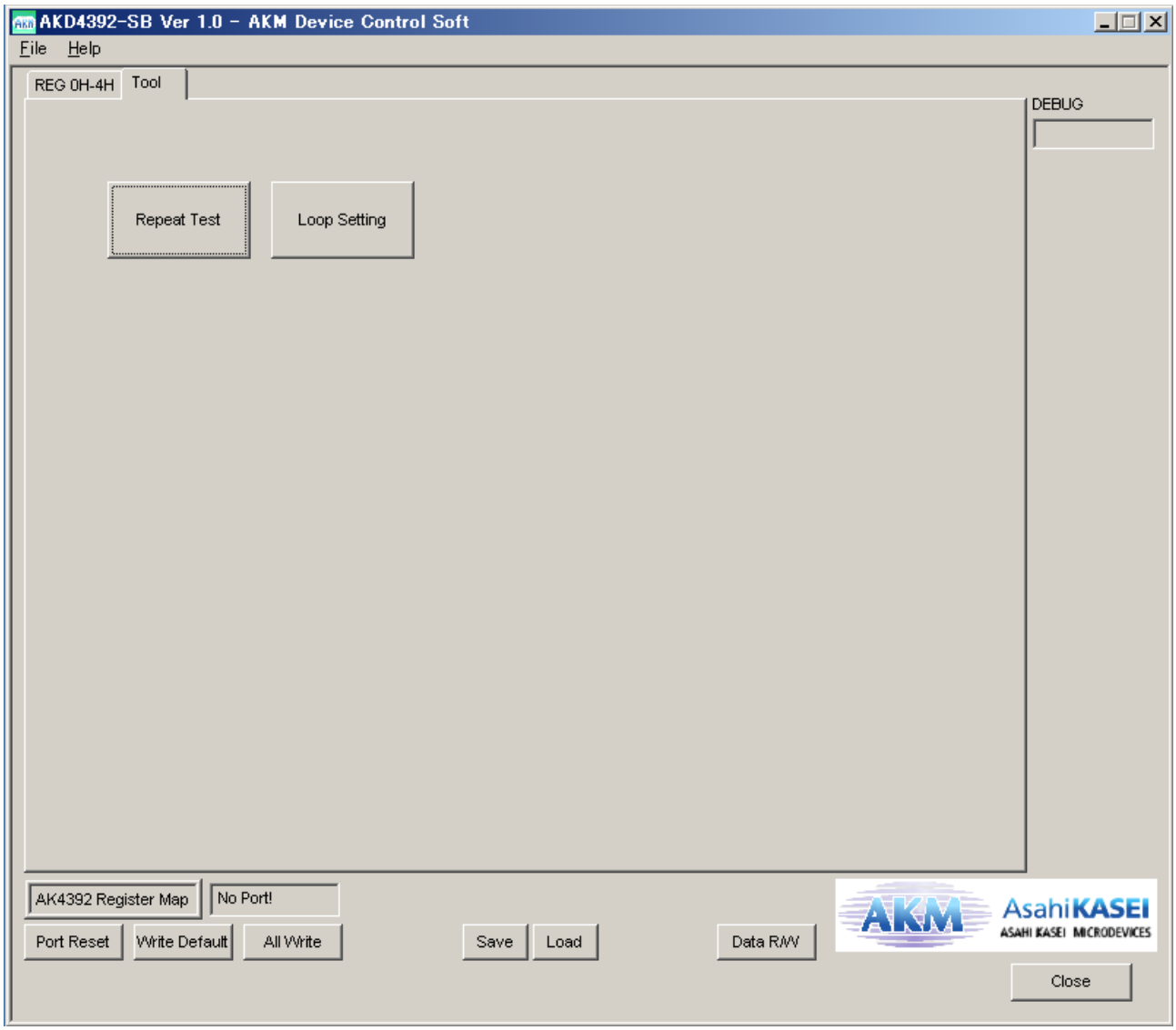


Figure 7. Window of [ Tool]

### [Repeat Test]: Repeat Test Dialog

Click [Repeat Test] button to open repeat test setting dialog box.

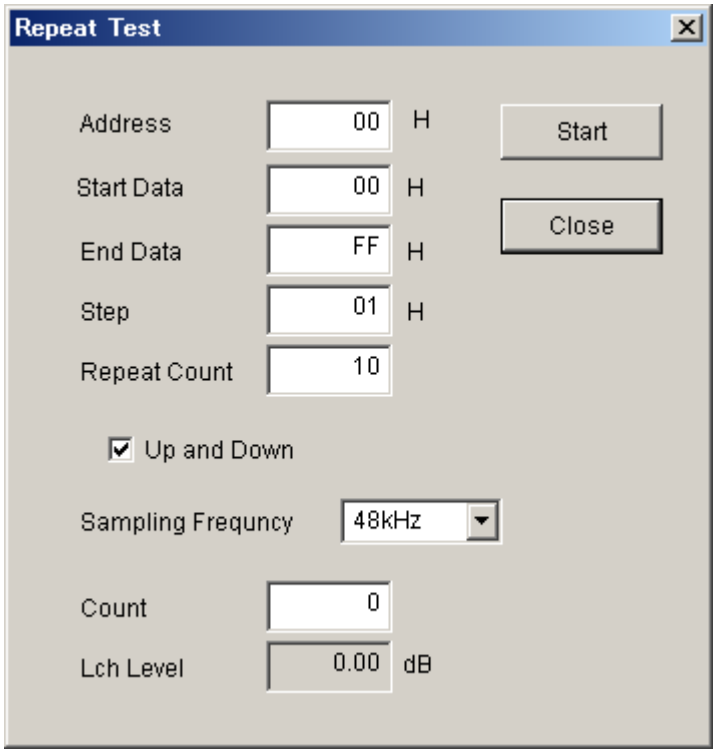


Figure 8. Window of [ Repeat Test]

### [Loop Setting]: Loop Setting Dialog

Click [Loop Setting] button to open loop setting dialog box.

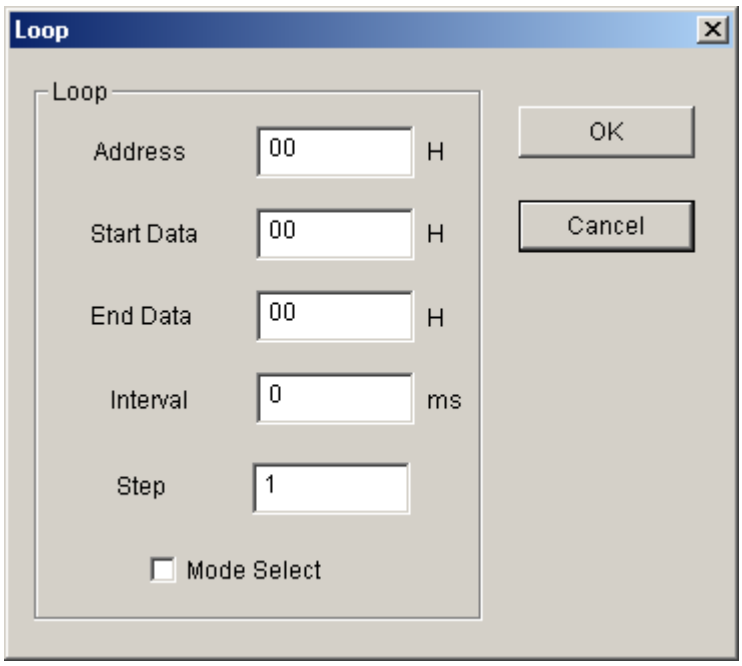


Figure 9. Window of [ Loop]

## Measurement Results

[Measurement condition]

- Measurement unit : Audio Precision System two Cascade (AP2)
- MCLK : 512fs (44.1kHz), 256fs (96kHz), 128fs (192kHz)
- BICK : 64fs
- fs : 44.1kHz, 96kHz, 192kHz
- Bit : 24bit
- Power Supply : AVDD= DVDD=5V
- Interface : Internal DIR (44.1kHz, 96kHz, 192kHz)
- Temperature : Room
- Operational Amplifiers : LME49710NA

fs=44.1kHz

| Parameter | Input signal | Measurement filter | Results Lch | Results Rch |
|---|---|---|---|---|
| S/(N+D) | 1kHz, 0dB | 20kLPF | 101.7 dB | 103.0 dB |
| DR | 1kHz, -60dB | 22kLPF, A-weighted | 118.8 dB | 119.0 dB |
| S/N | "0" data | 22kLPF, A-weighted | 119.0 dB | 119.0 dB |

fs=96kHz

| Parameter | Input signal | Measurement filter | Results Lch | Results Rch |
|---|---|---|---|---|
| S/(N+D) | 1kHz, 0dB | 40kLPF | 101.0 dB | 102.2 dB |
| DR | 1kHz, -60dB | | 116.7 dB | 116.8 dB |
| | | 22kLPF, A-weighted | 118.8 dB | 118.7 dB |
| S/N | "0" data | 40kLPF | 116.9 dB | 116.9 dB |
| | | 22kLPF, A-weighted | 119.0 dB | 119.0 dB |

fs=192kHz

| Parameter | Input signal | Measurement filter | Results Lch | Results Rch |
|---|---|---|---|---|
| S/(N+D) | 1kHz, 0dB | 40kLPF | 101.0 dB | 102.3 dB |
| DR | 1kHz, -60dB | | 116.3 dB | 116.3 dB |
| | | 22kLPF, A-weighted | 118.2 dB | 118.2 dB |
| S/N | "0" data | 40kLPF | 116.9 dB | 116.8 dB |
| | | 22kLPF, A-weighted | 119.0 dB | 119.0 dB |

**Plots**

(fs=44.1kHz)

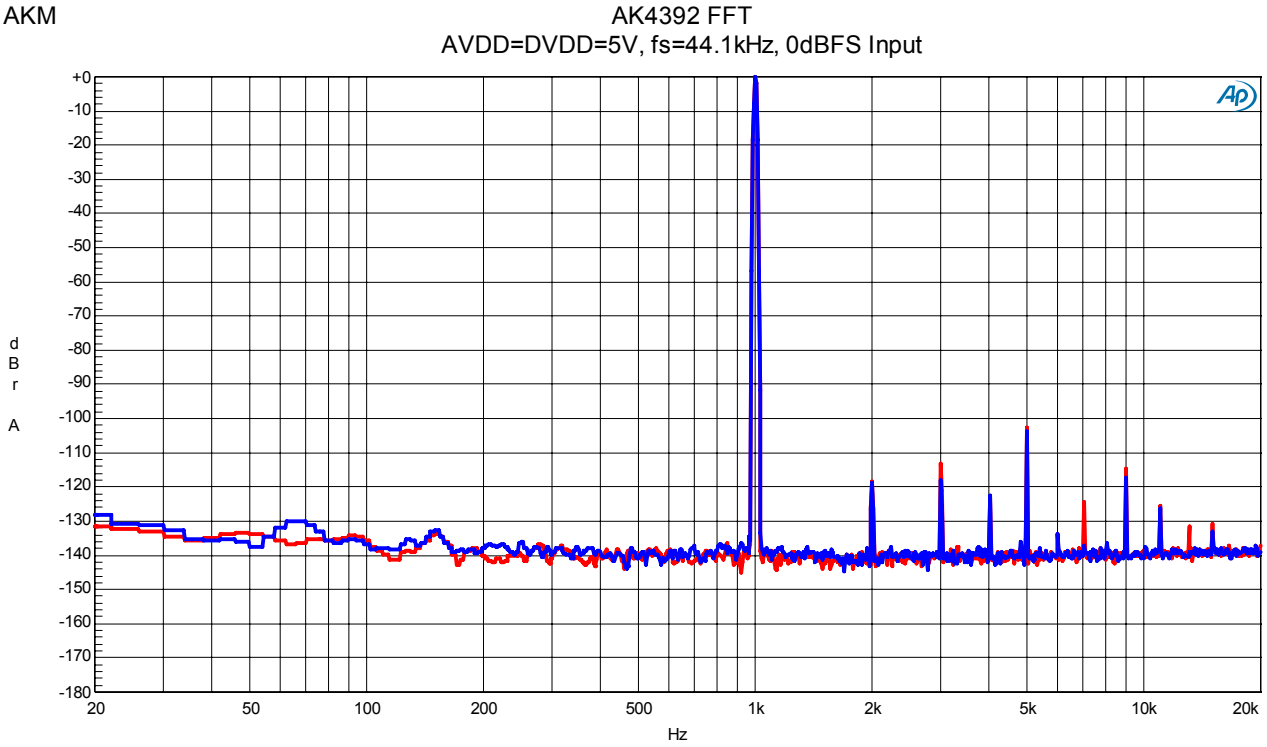


Figure 10. FFT (fin=1kHz, Input Level=0dBFS)

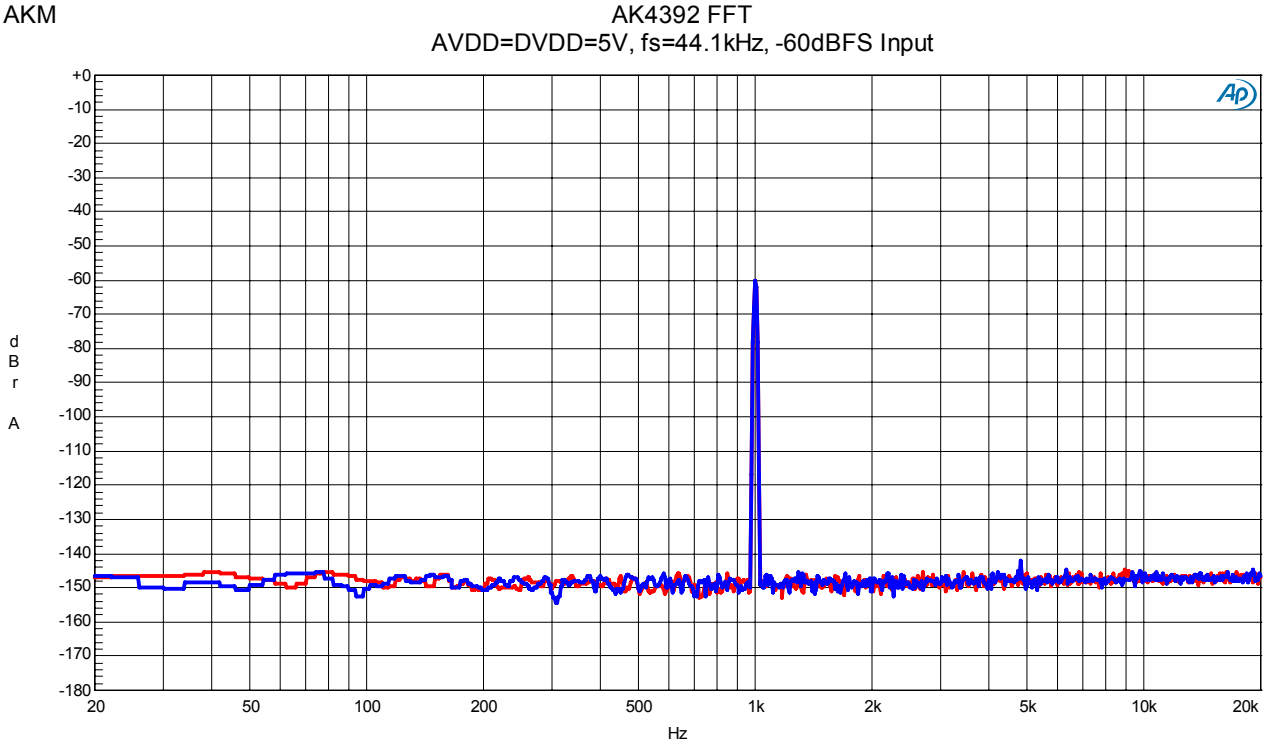


Figure 11. FFT (fin=1kHz, Input Level=-60dBFS)

(fs=44.1kHz)

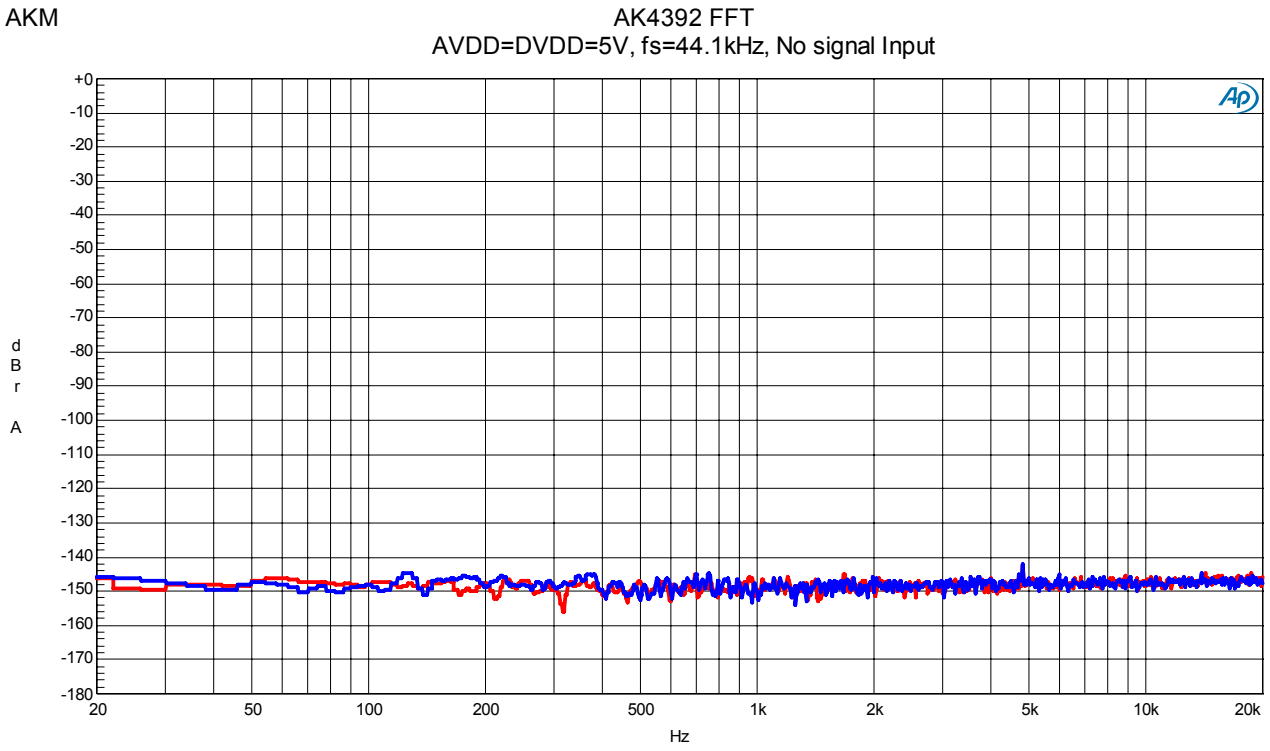


Figure 12. FFT (Noise Floor)

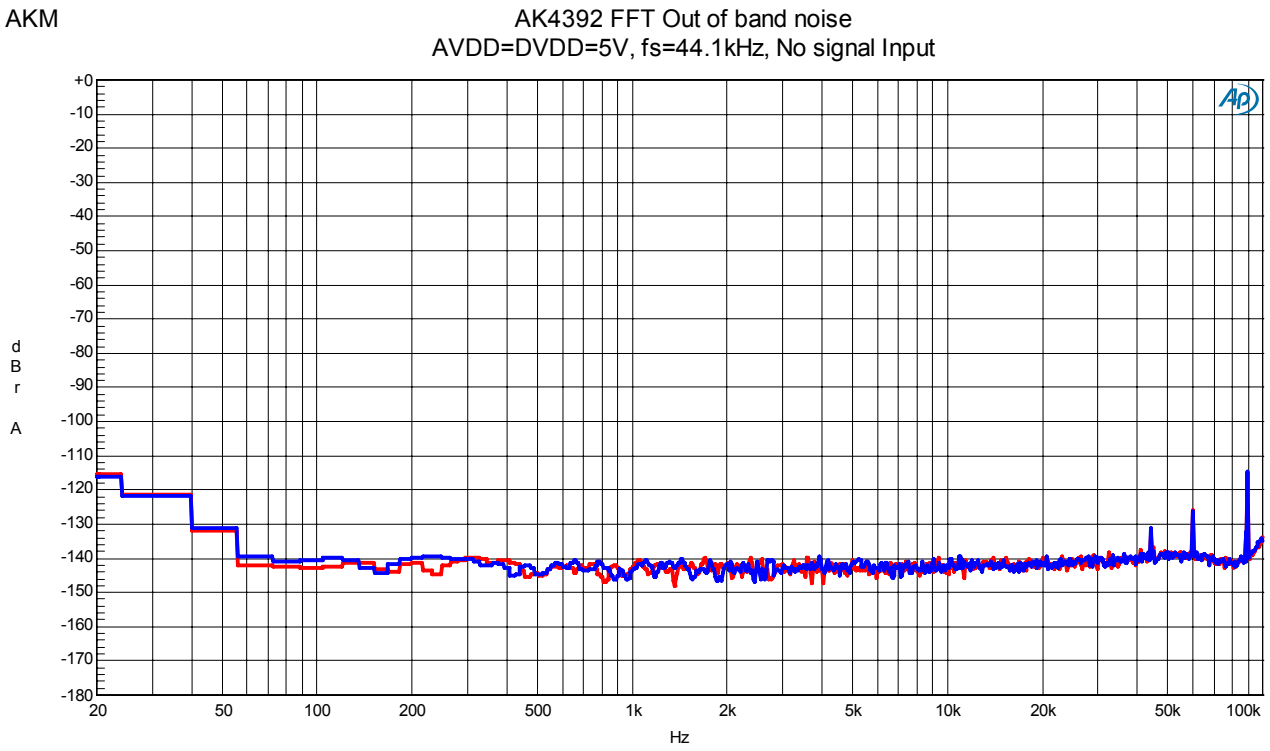


Figure 13. FFT (Out of band noise)

(fs=44.1kHz)

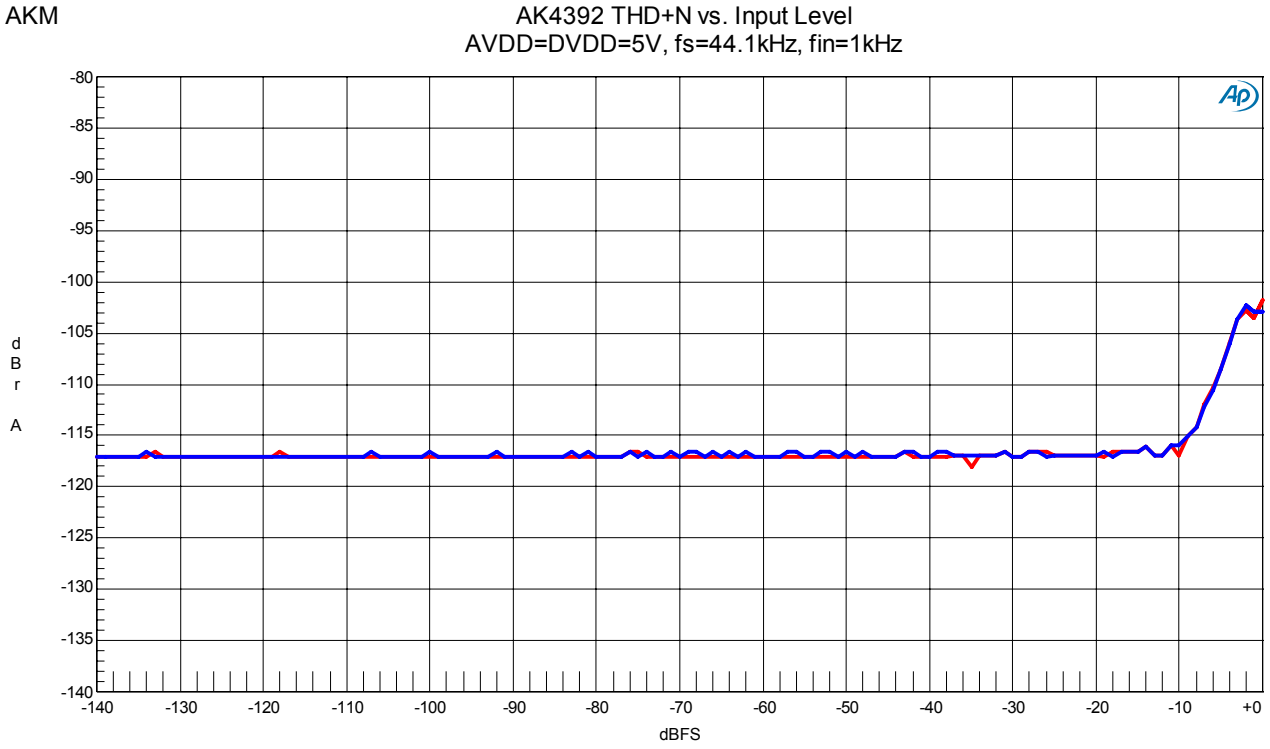


Figure 14. THD+N vs. Input level (fin=1kHz)

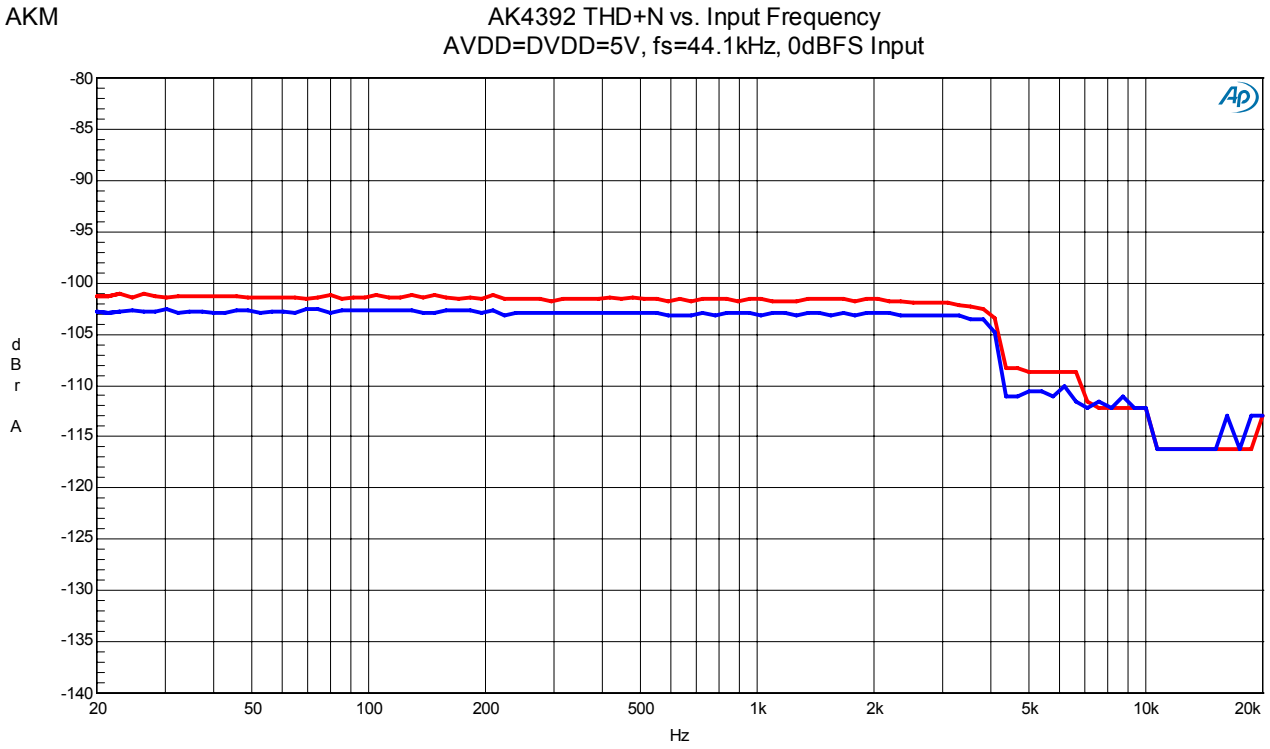


Figure 15. THD+N vs. Input Frequency (Input level=0dBFS)

(fs=44.1kHz)

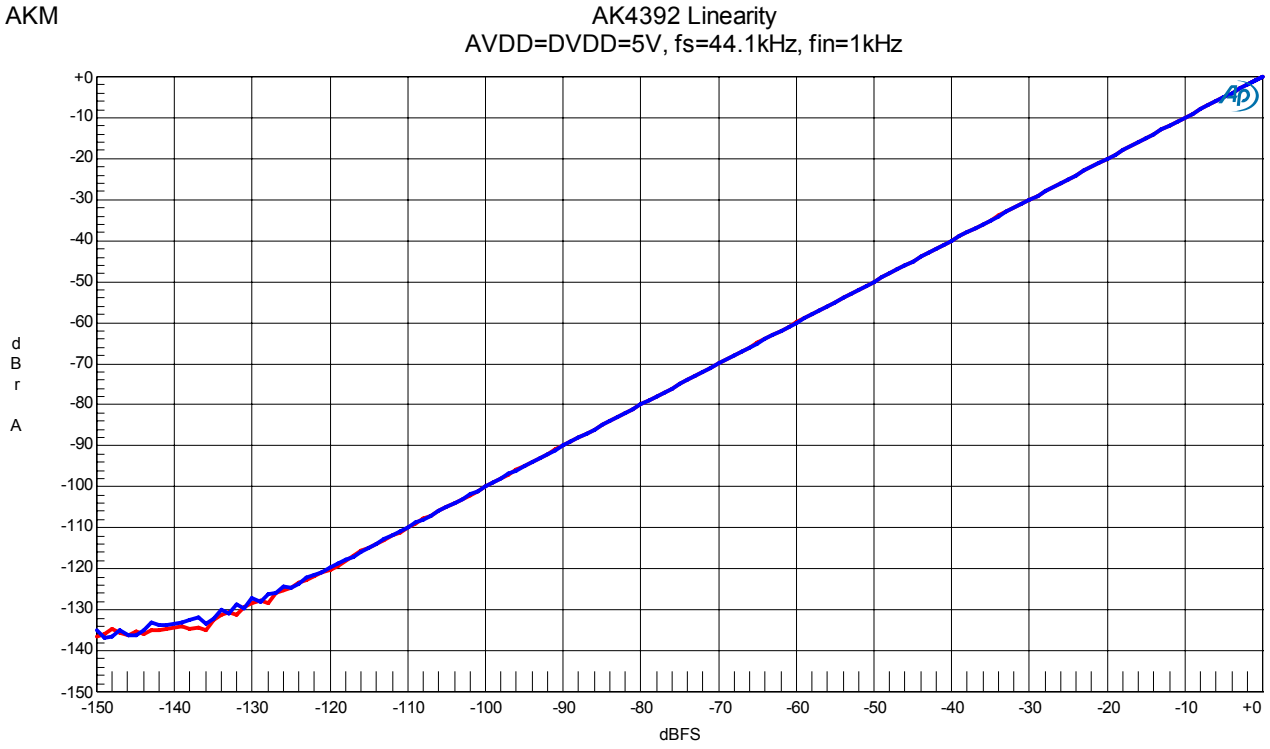


Figure 16. Linearity (fin=1kHz)

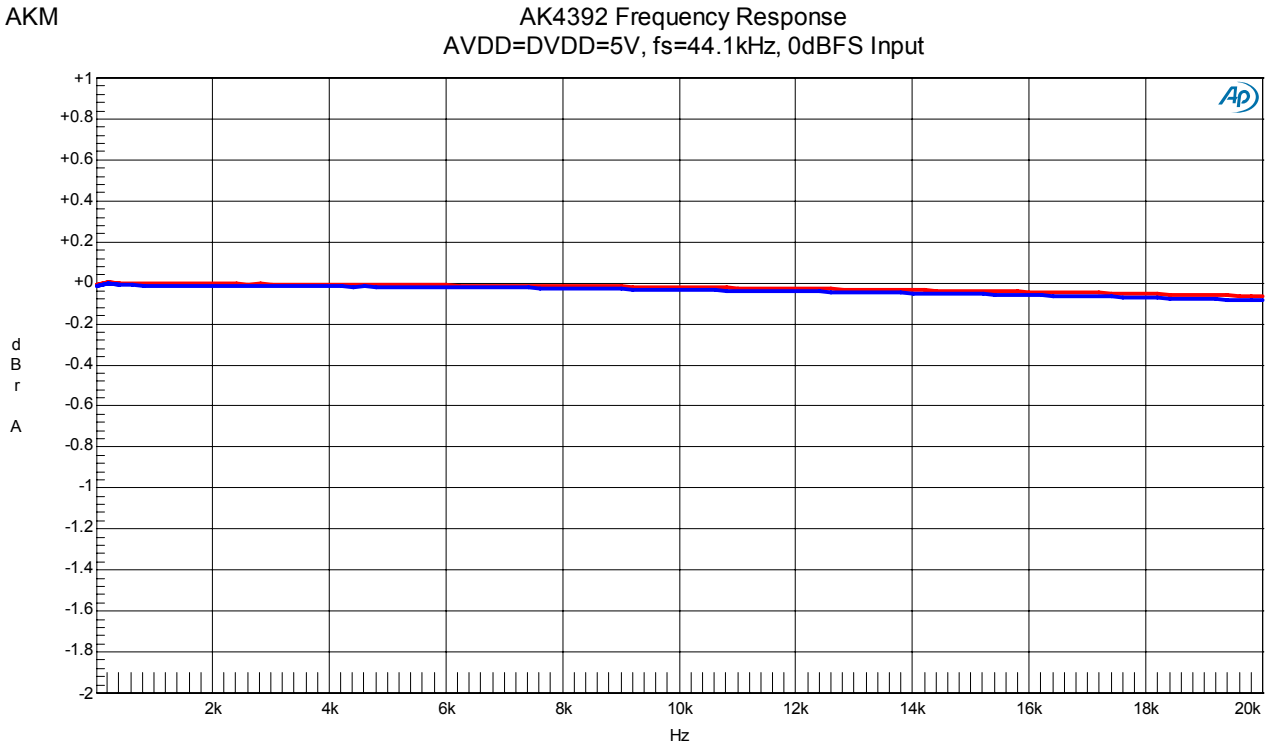


Figure 17. Frequency Response (Input level=0dBFS)

(fs=44.1kHz)

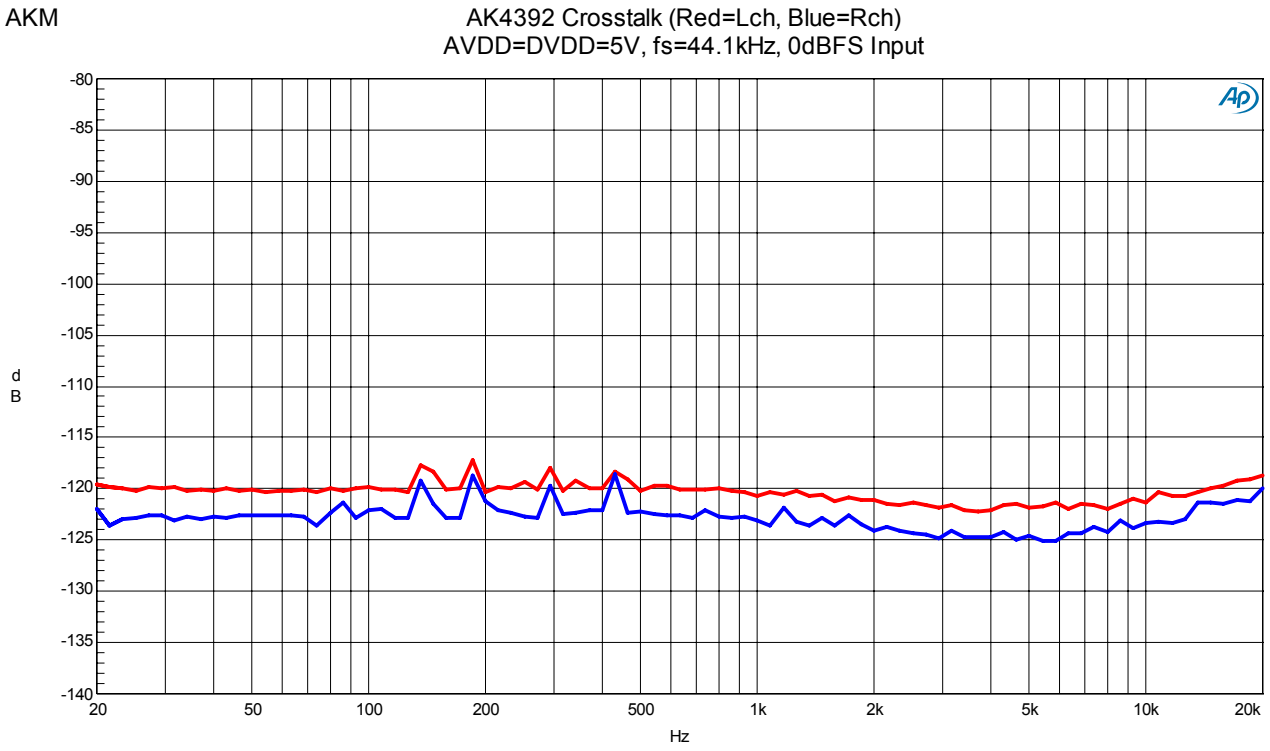


Figure 18. Crosstalk (Input level=0dBFS)

(fs=96kHz)

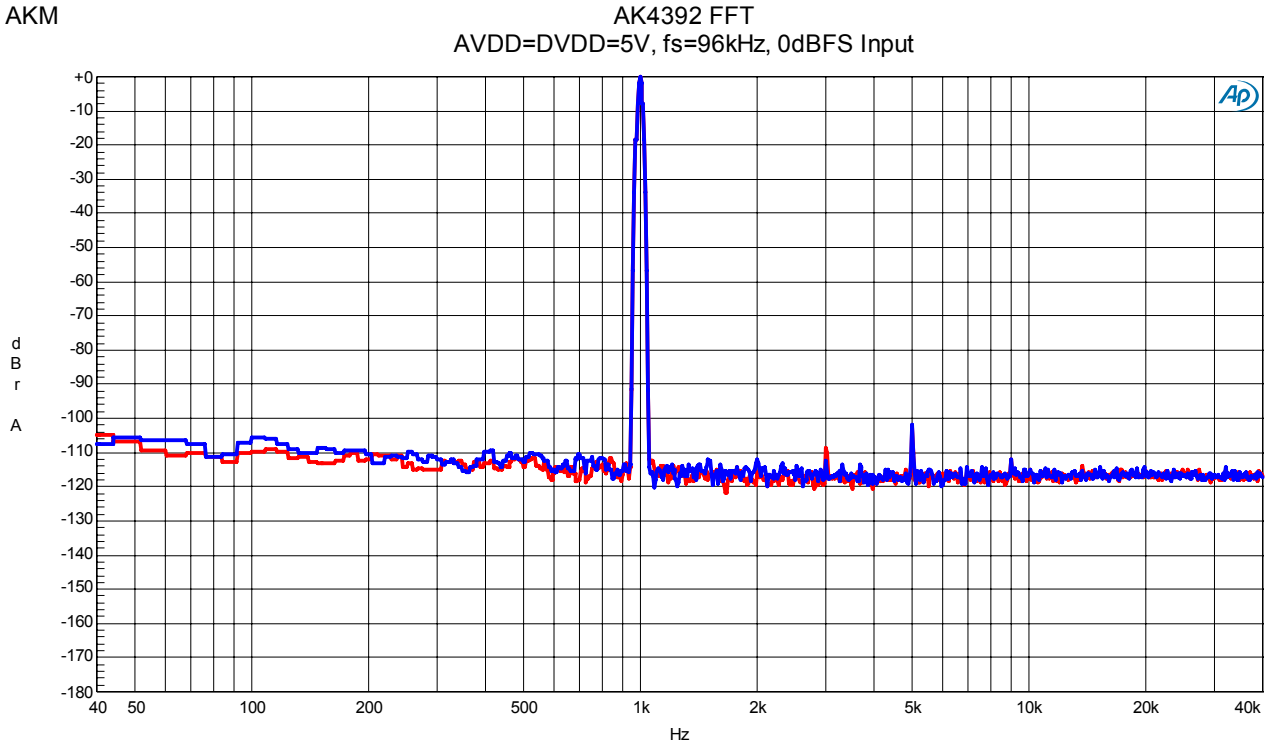


Figure 19. FFT (fin=1kHz, Input Level=0dBFS)

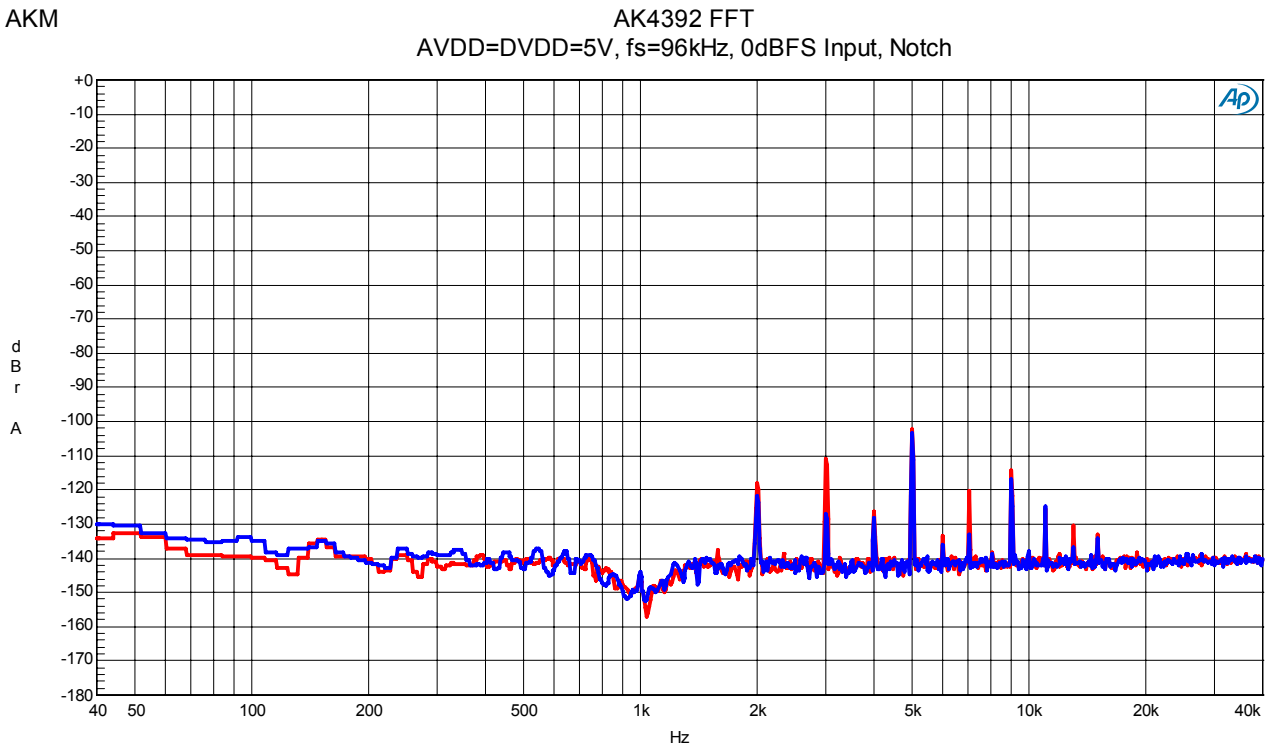


Figure 20. FFT(fin=1kHz, Input Level=0dBFS, Notch)

(fs=96kHz)

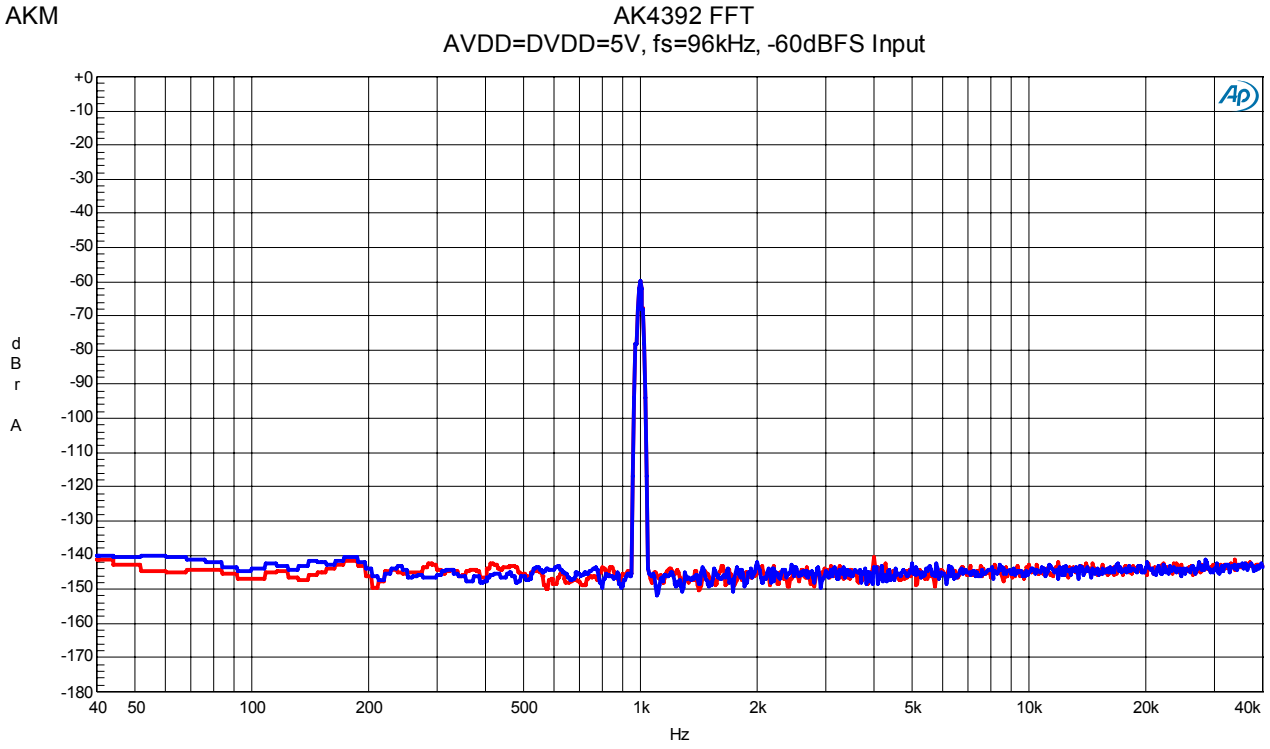


Figure 21. FFT (fin=1kHz, Input Level=-60dBFS)

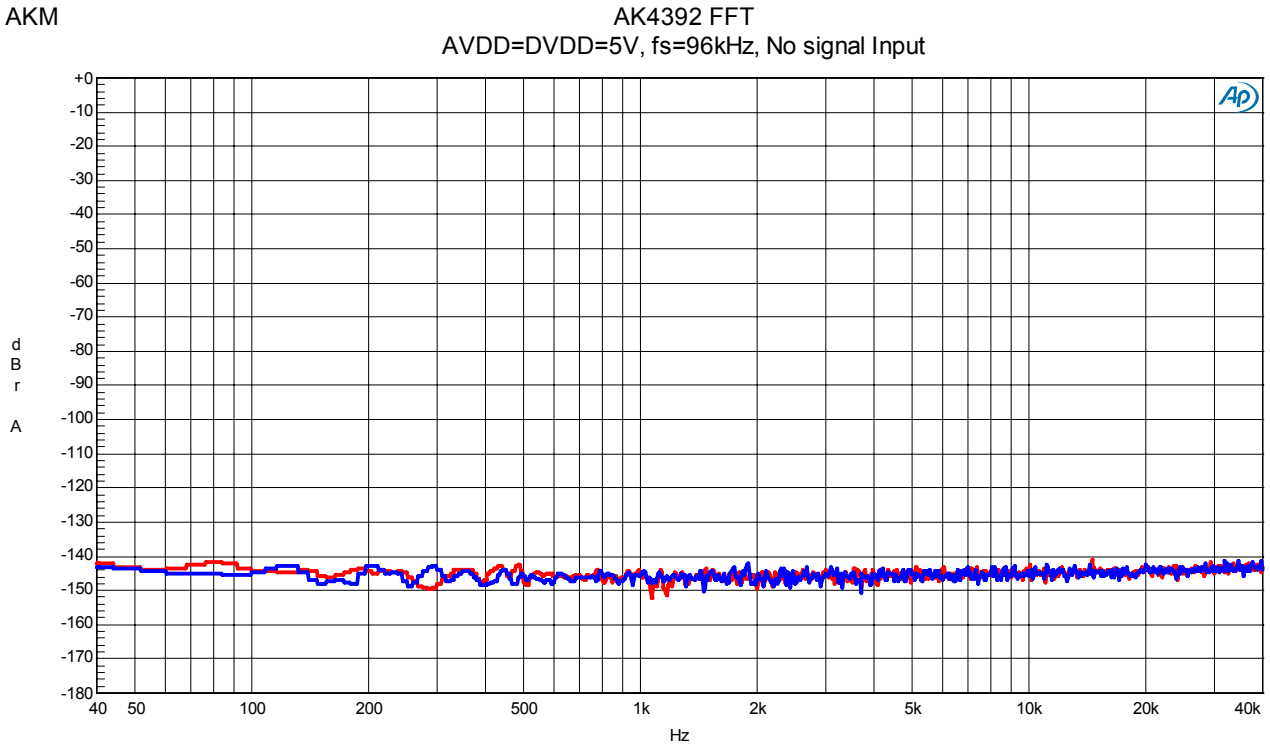


Figure 22. FFT (Noise Floor)

(fs=96kHz)

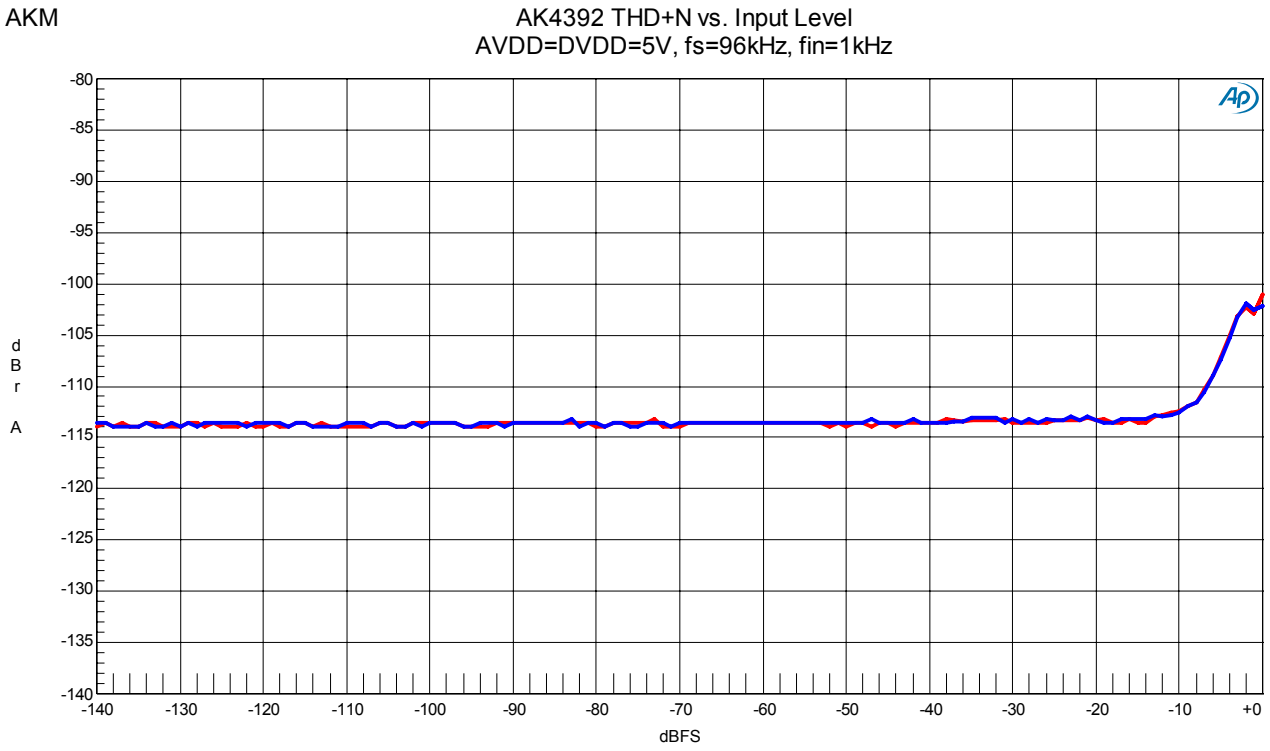


Figure 23. THD+N vs. Input level (fin=1kHz)

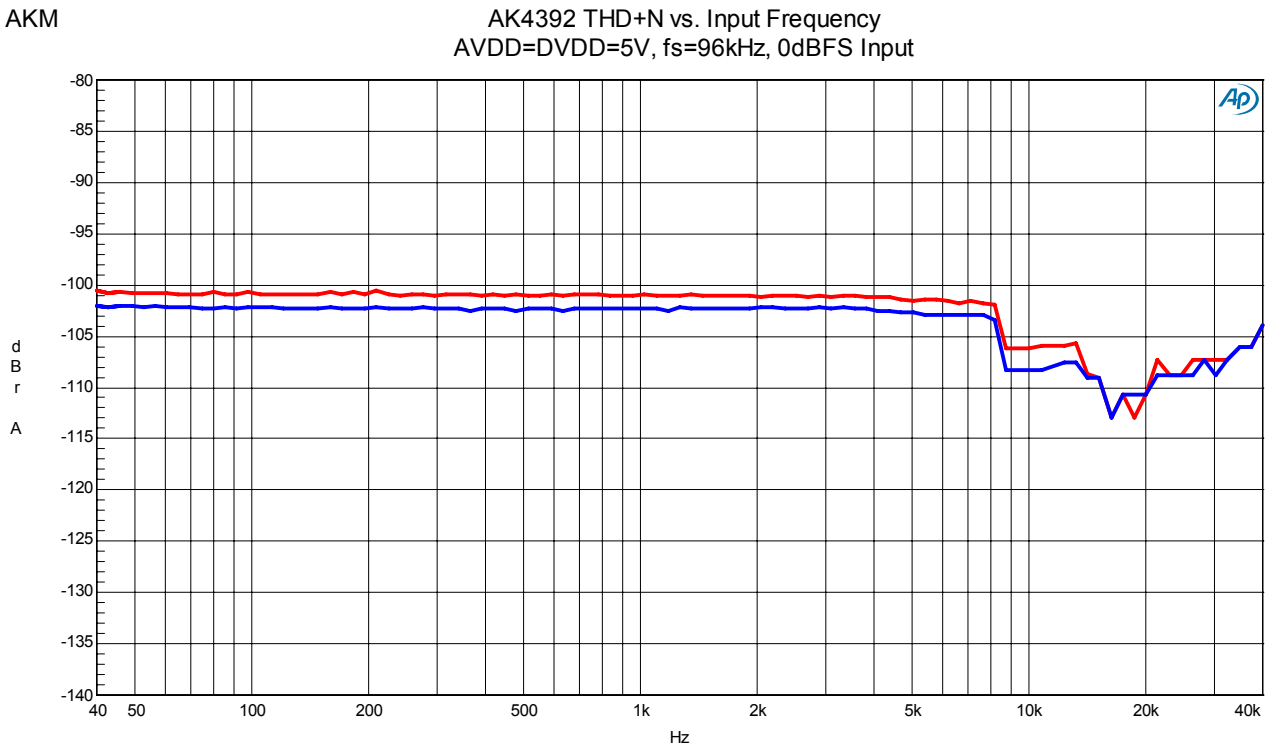


Figure 24. THD+N vs. Input Frequency (Input level=0dBFS)

(fs=96kHz)

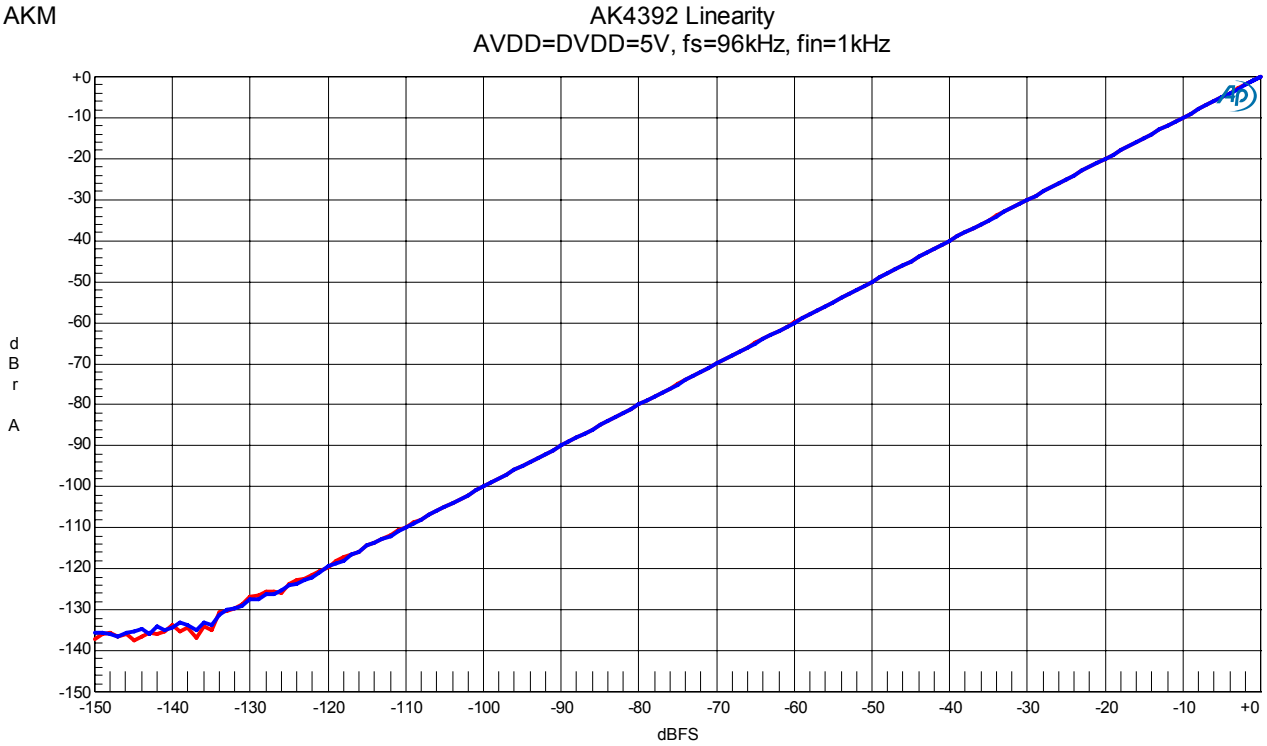


Figure 25. Linearity (fin=1kHz)

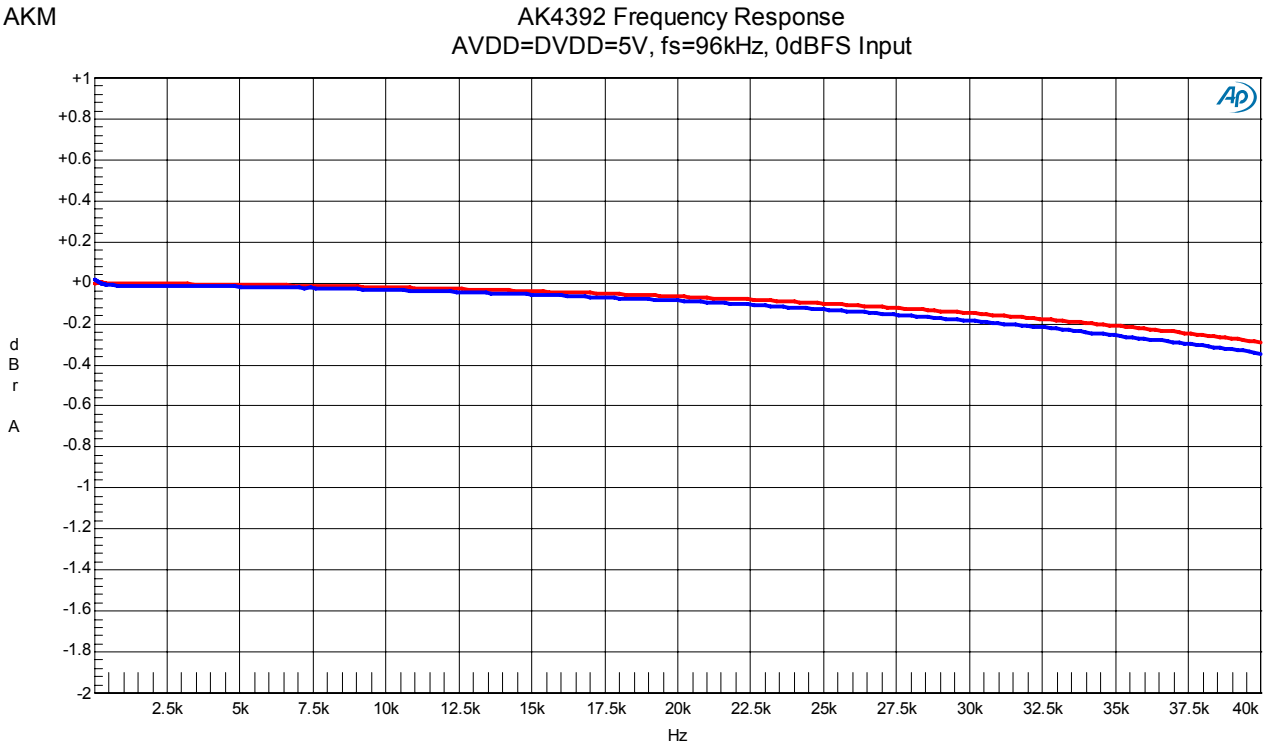


Figure 26. Frequency Response (Input level=0dBFS)

(fs=96kHz)

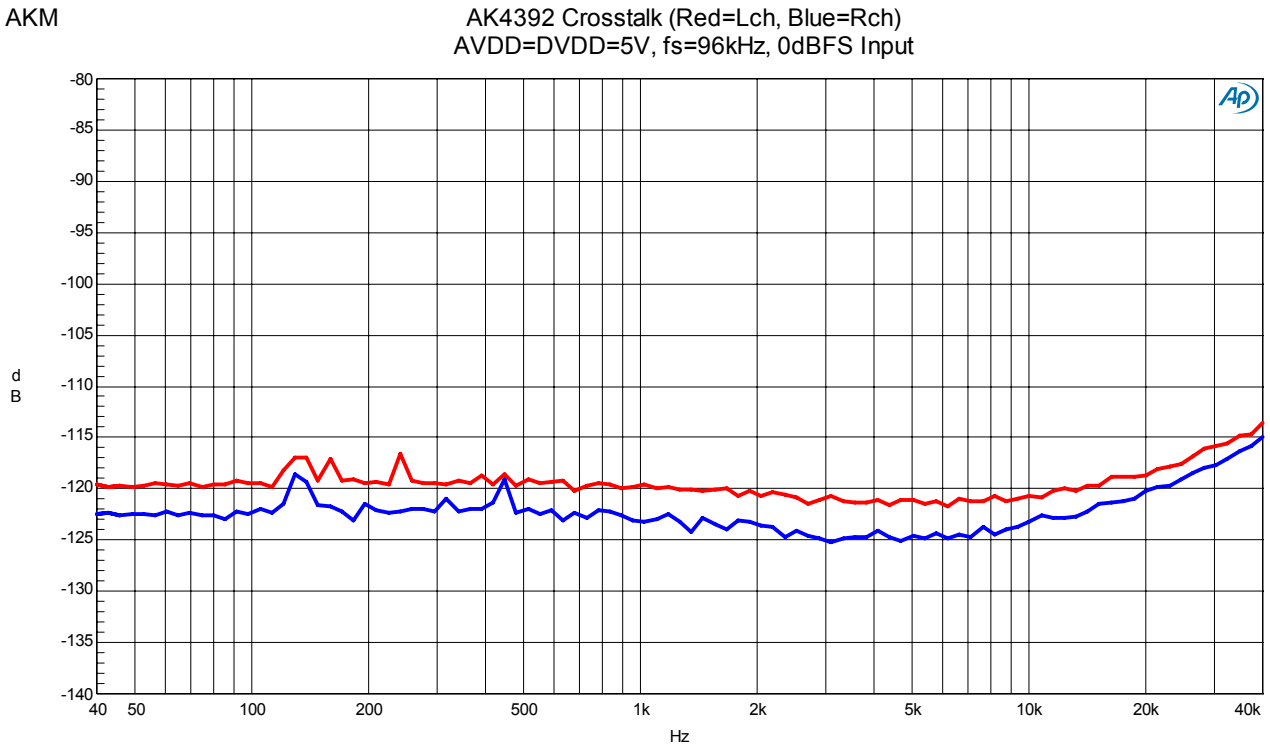


Figure 27. Crosstalk (Input level=0dBFS)

(fs=192kHz)

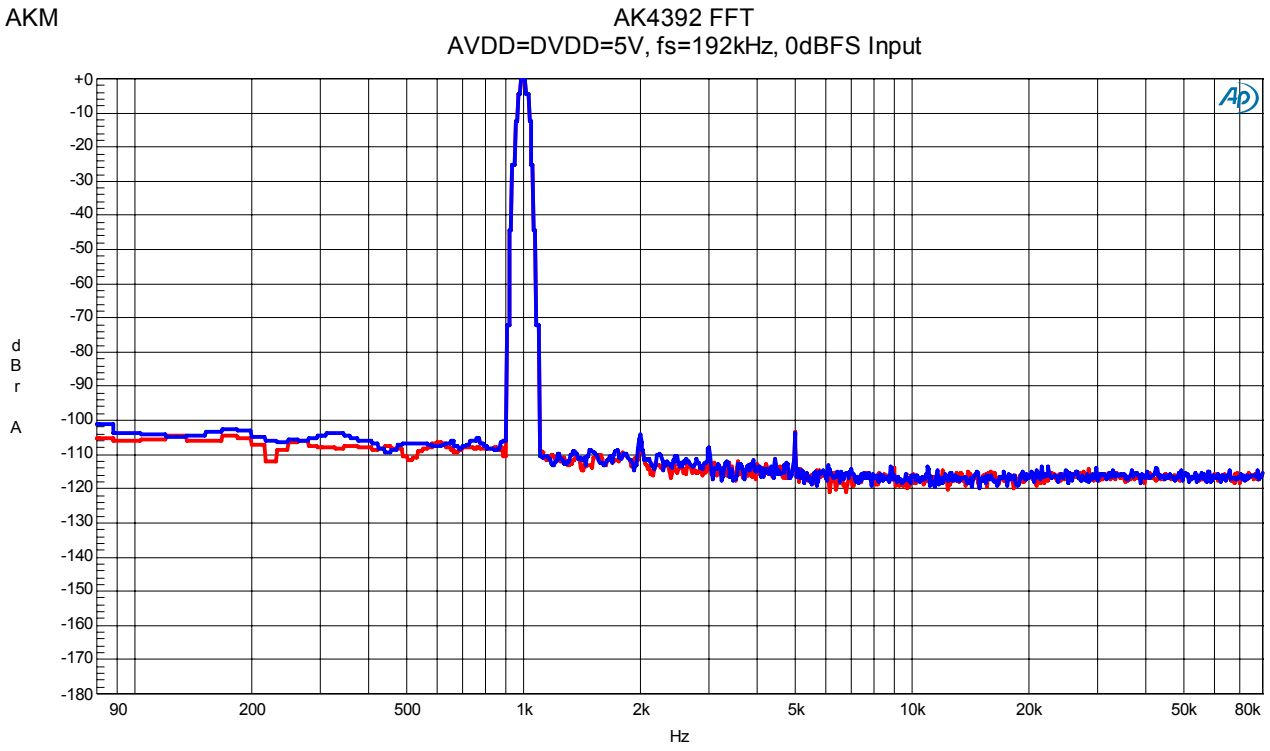


Figure 28. FFT (fin=1kHz, Input Level=0dBFS)

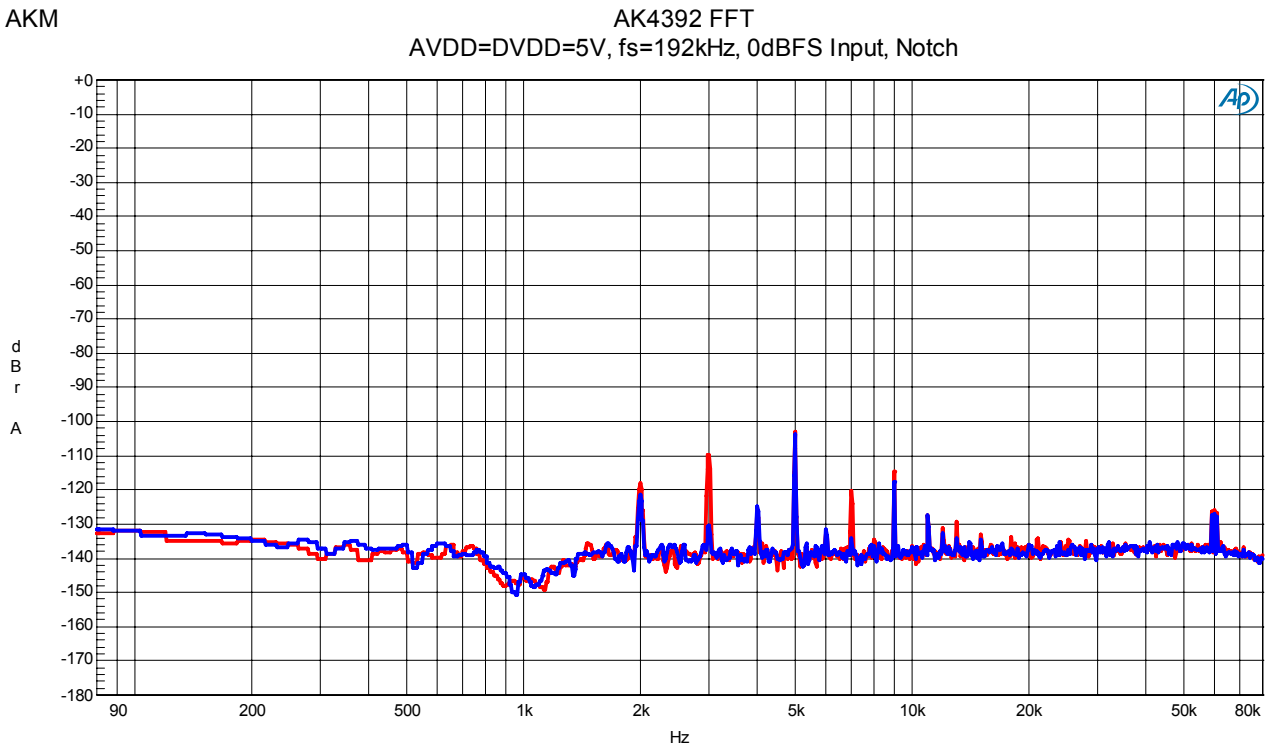


Figure 29. FFT(fin=1kHz, Input Level=0dBFS, Notch)

(fs=192kHz)

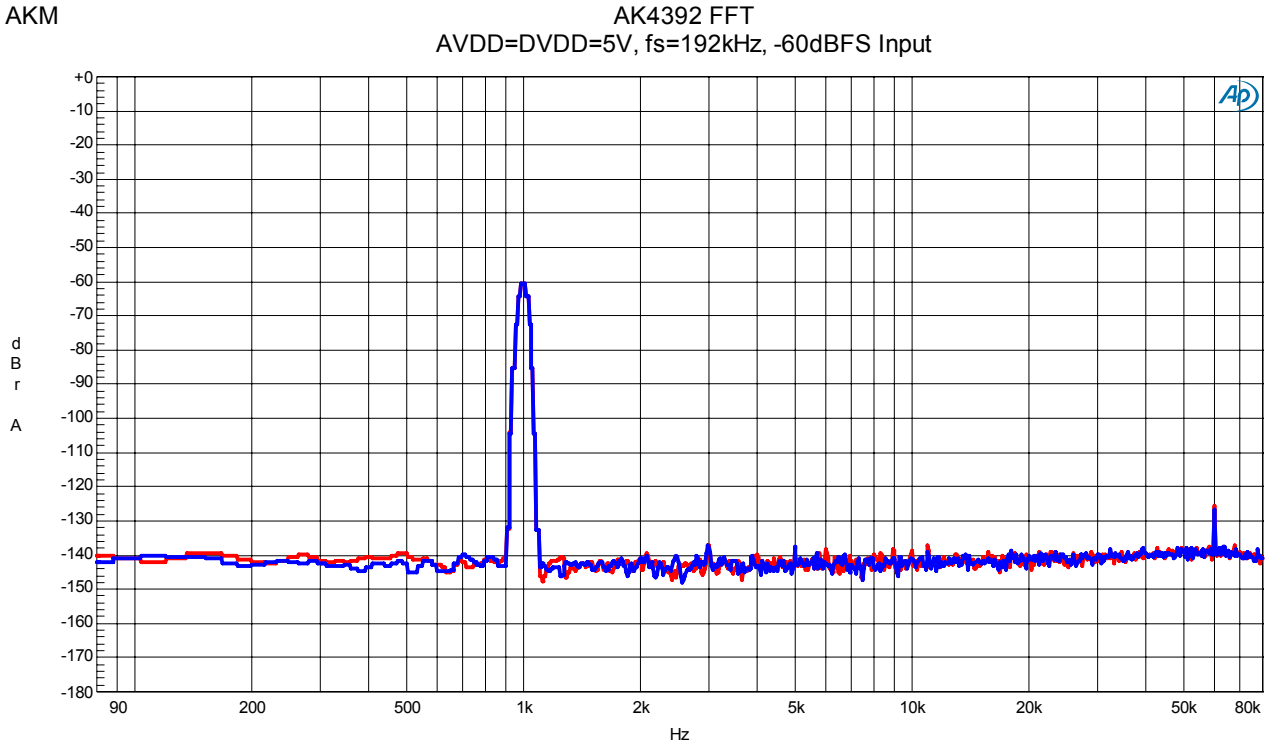


Figure 30. FFT (fin=1kHz, Input Level=-60dBFS)

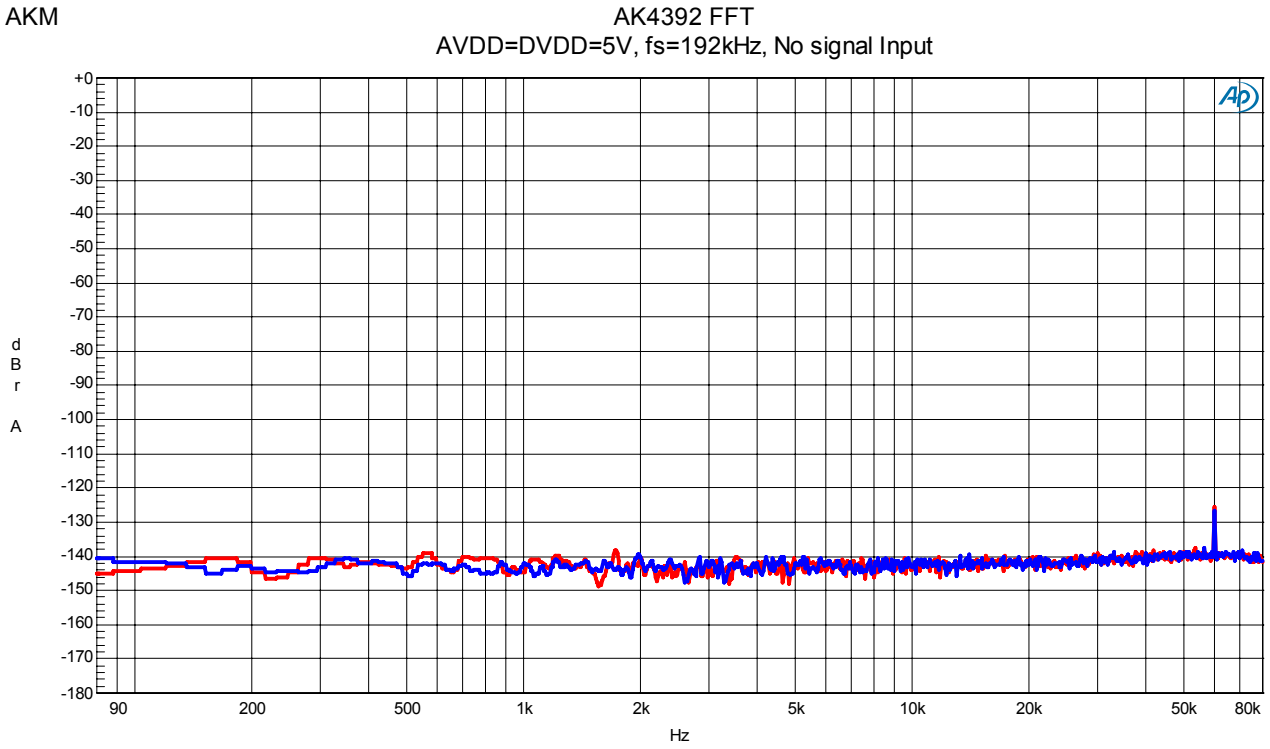


Figure 31. FFT (Noise Floor)

(fs=192kHz)

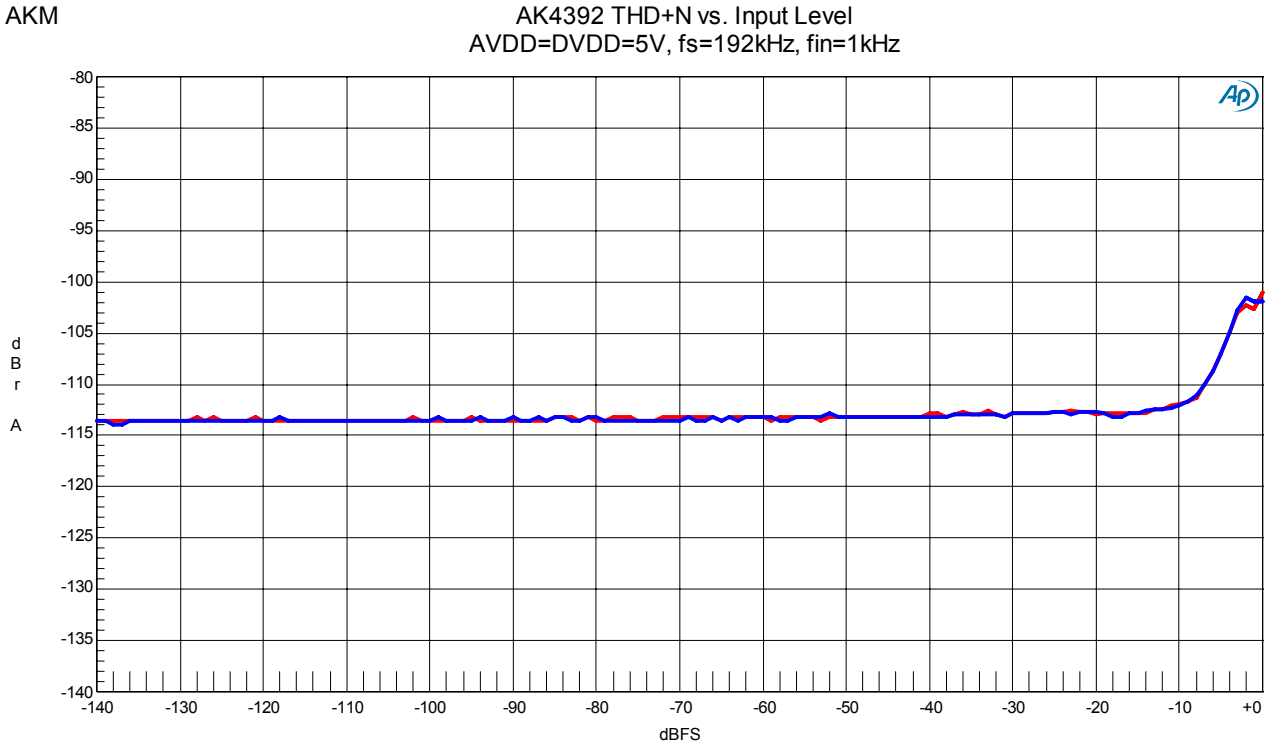


Figure 32. THD+N vs. Input level (fin=1kHz)

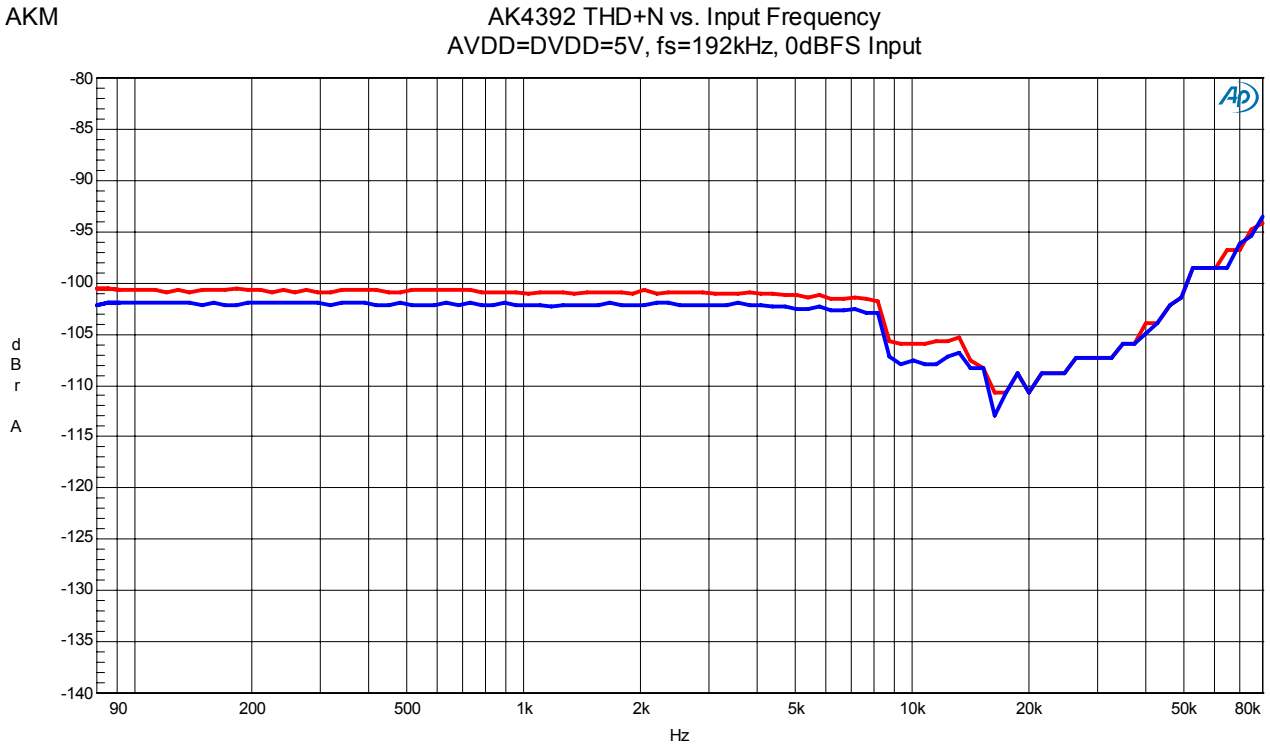


Figure 33. THD+N vs. Input Frequency (Input level=0dBFS)

(fs=192kHz)

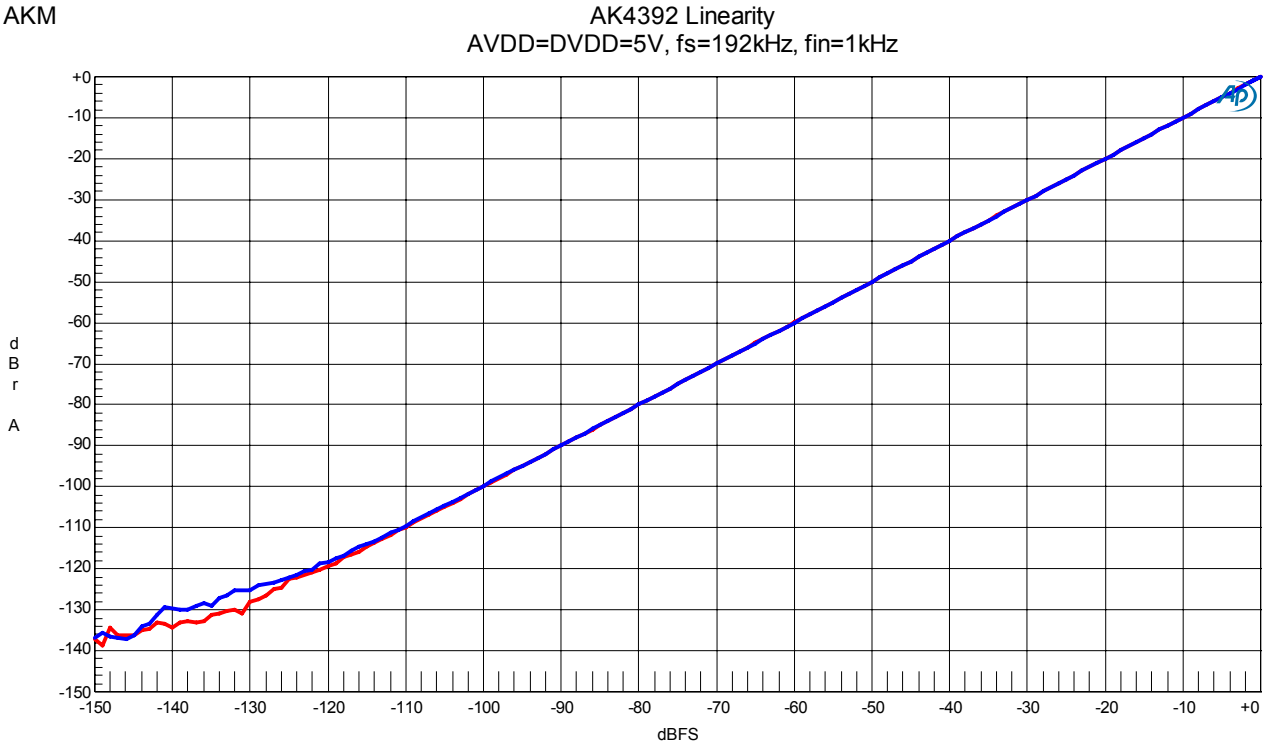


Figure 34. Linearity (fin=1kHz)

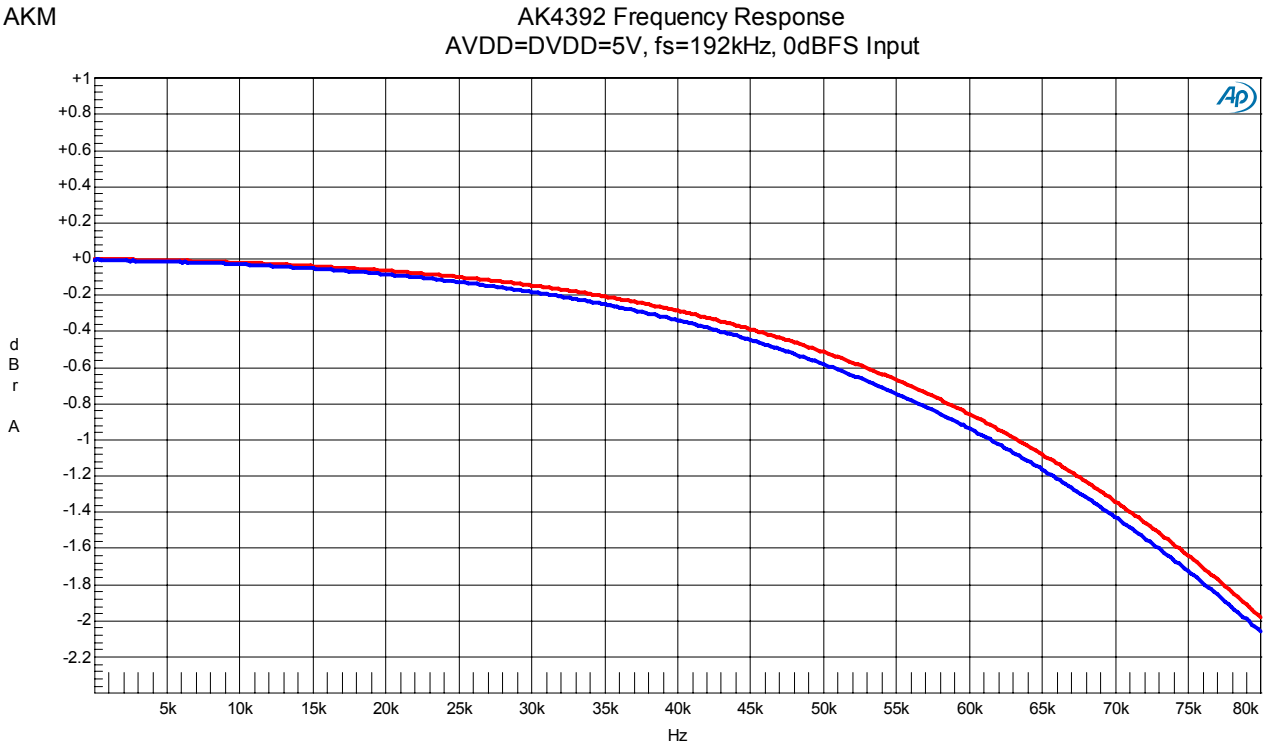


Figure 35. Frequency Response (Input level=0dBFS)

(fs=192kHz)

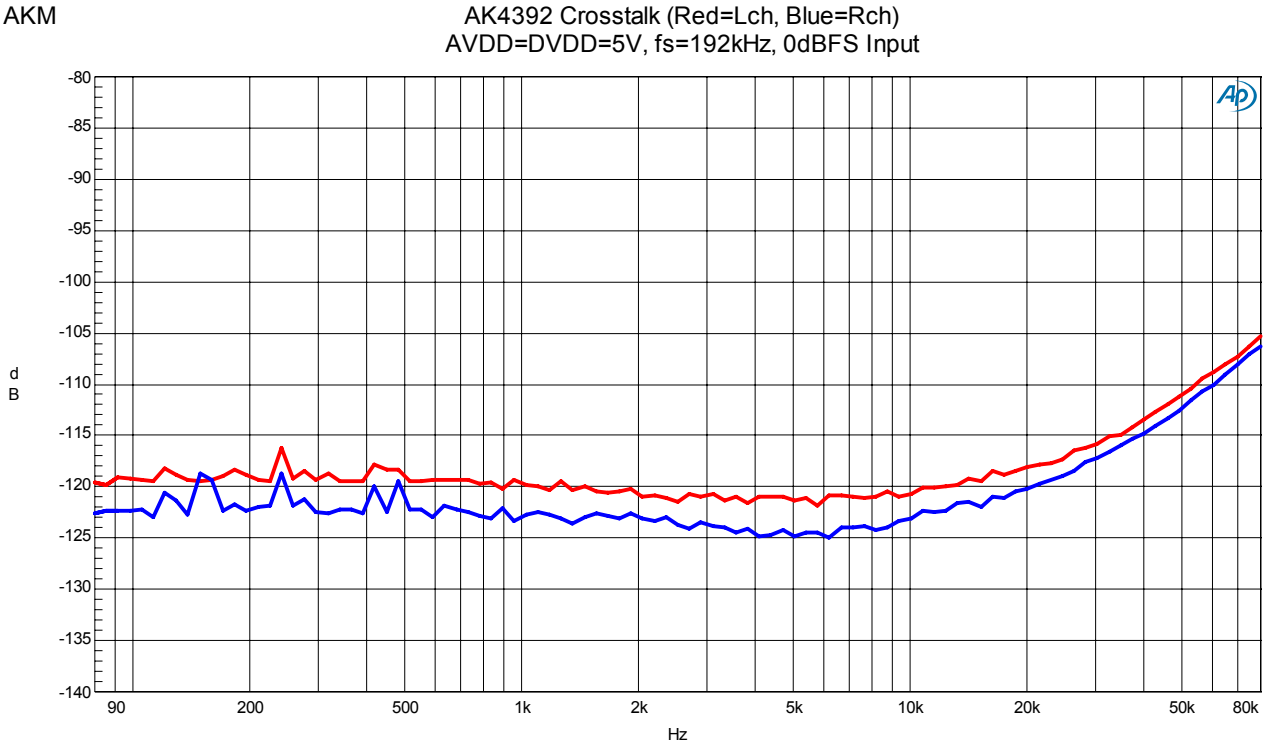


Figure 36. Crosstalk (Input level=0dBFS)

## Revision History

| Date (YY/MM/DD) | Manual Revision | Board Revision | Reason | Page | Contents |
|---|---|---|---|---|---|
| 09/06/01 | KM099800 | 0 | First edition | - | |

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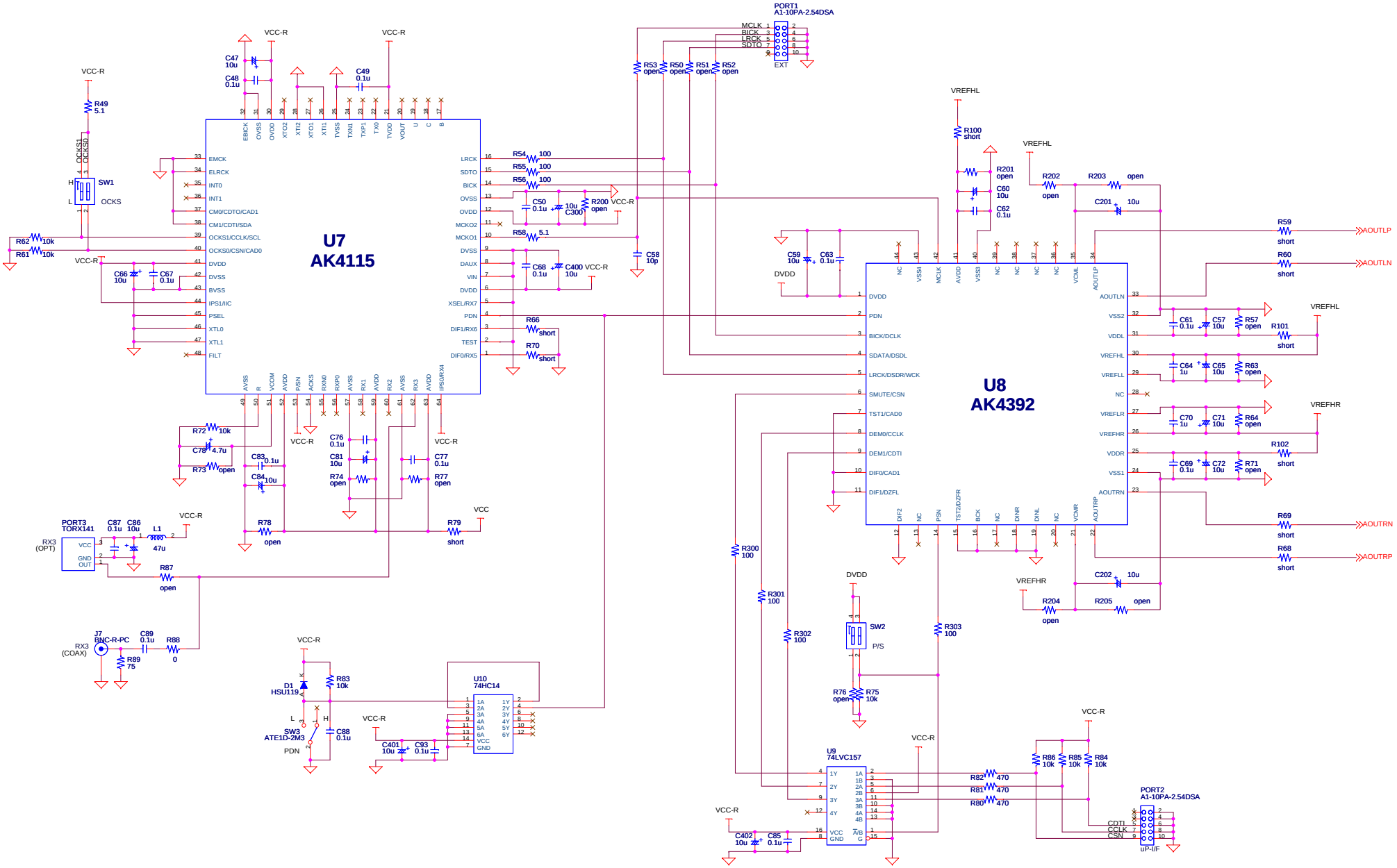
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U8
AK4392
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BICK
LRCK
SDTO
SW1
OCKS
SW2
P/S
SW3
ATE1D-2M3
PDN
PORT3
TORX141
RX3
(OPT)
J7
BNC-R-PC
RX3
(COAX)
D1
HSU119
U10
74HC14
U9
74LVC157
PORT2
A1-10PA-2.54DSA
uP-I/F
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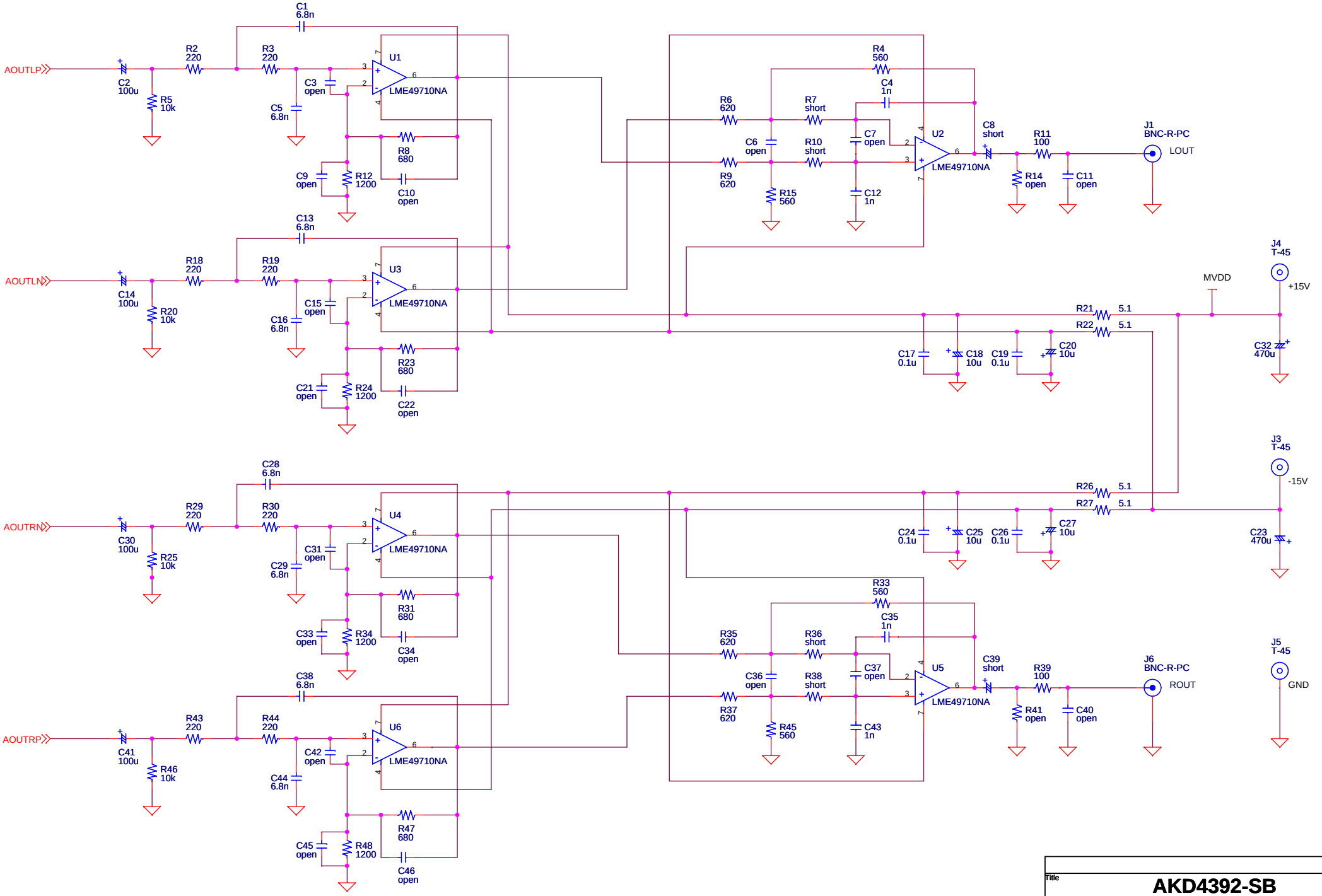


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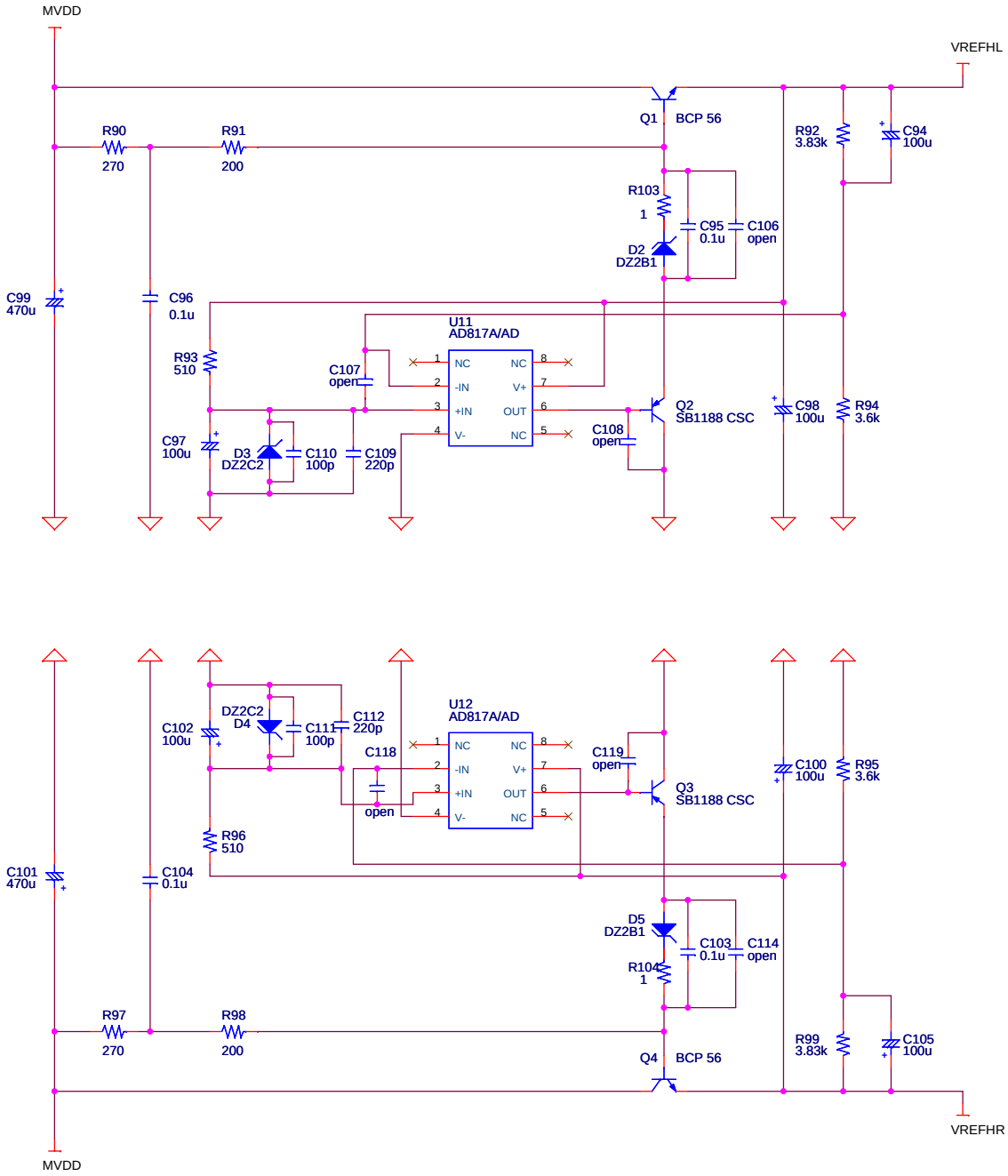


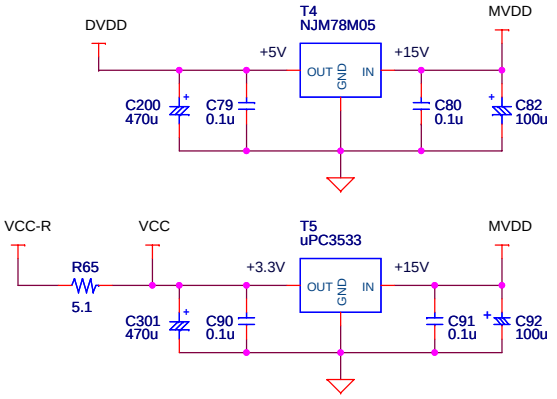


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