AKD4385
Evaluation board Rev.A for AK4385

GENERAL DESCRIPTION

The AKD4385 is an evaluation board for the AK4385, the 24bit, 192kHz D/A converter for DVD and AC-3 amp. The AKD4385 has the interface with AKM's wave generator using ROM data and with AKM's A/D converter evaluation boards. Therefore, it is easy to evaluate the AK4385. The AKD4385 also has the digital audio interface and can achieve the interface with digital audio systems via opt-connector or BNC connector.

■ Ordering guide

AKD4385 --- Evaluation board for AK4385
(Cable for connecting with printer port of IBM-AT compatible PC and control software are packed with this. This control software does not support Windows NT.)

FUNCTION

- **On-board 2nd order LPF**
- **Compatible with 2 types of interface**
  - **Direct interface with AKM's A/D converter evaluation boards**
  - **On-board AK4112B as DIR which accepts optical or BNC input**
- **10pin header for serial control interface**

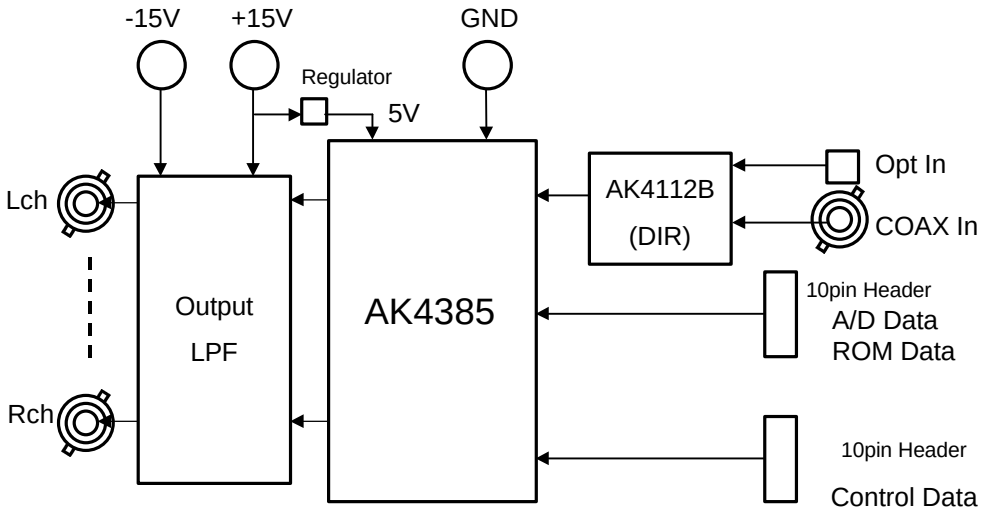


Figure 1. AKD4385 Block Diagram

* Circuit diagram and PCB layout are attached at the end of this manual.

■ External analog circuit

The 2nd order LPF (fc=93.2kHz, Q=0.712) which adds differential outputs of the AK4385 is implemented on the board. When the further attenuation of the out-band noise is needed, some additional LPF is required. Analog signal is output through BNC connectors on the board. And the output level of the AK4381 is 5.5Vpp@5V.

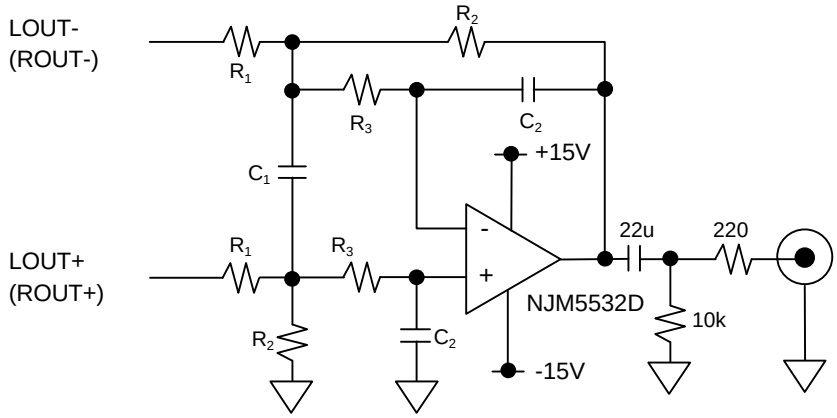


Figure 2. On-board analog filter

R_1	R_2	R_3	C_1	C_2
4.7k	4.7k	200	3300p	470p

Table 1. The value of R, C on this board

fin	20kHz	40kHz	80kHz
Frequency Response	-0.003dB	-0.122dB	-1.821dB

Table 2. Frequency Response of LPF

<Calculation>

$$\text{Amplitude} = 20 \log \frac{K}{\sqrt{[1-(f/fc)^2]^2+[(1/Q)(f/fc)]^2}} \text{ [dB]},$$

$$K = \frac{R_2}{R_1},$$

$$fc = \frac{\omega_0}{2\pi},$$

$$\omega_0 = \frac{1}{\sqrt{2C_1C_2R_2R_3}},$$

$$Q = \frac{2C_1\omega_0}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}}.$$

■ Operation sequence

1) Set up the power supply lines.

[+15V]	(orange)	= +12 ~ +15V
[-15V]	(blue)	= -12 ~ -15V
[4382_VDD]	(red)	= 4.75 ~ 5.25V (Note 2)
[AGND]	(black)	= 0V
[DGND]	(black)	= 0V

Note: 1. Each supply line should be distributed from the power supply unit.
2. JP3(REG) should be shorted and "4382_VDD" jack should be open if VDD of the AK4385 is supplied from the regulator.

2) Set-up the evaluation modes, jumper pins and DIP switches (See the followings.)

3) Power on.
The AK4385 should be reset once bringing SW1 (PDN) "L" upon power-up.

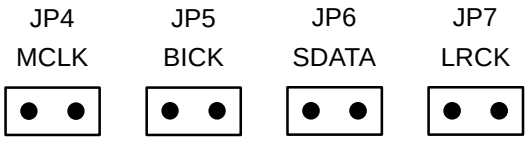
■ Evaluation mode

Applicable evaluation modes
1) DIR (Optical Link or BNC) (default)
2) Using AKM's evaluation board for ADC
3) Feeding all signals from external

1) DIR (Optical Link or BNC) <default>
The AK4112B(DIR) generates MCLK, BICK, LRCK and SDATA from the received data through PORT1(TORX176: optical link) or J1(BNC). Used for the evaluation using CD test disk. Nothing should be connected to PORT2(EXT). In case of using optical connector (TORX176), JP1(TORX/BNC) should be selected to "TORX". In case of using BNC connector, select "BNC".

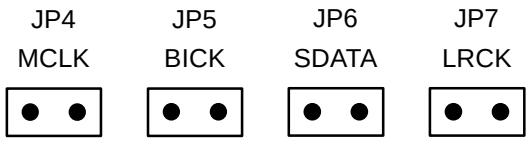
2) Using AKM's evaluation board for ADC

To evaluate the AK4385 with analog input, the AKM's evaluation board for ADC can be used. MCLK, BICK and LRCK and A/D converted data are sent to the AKD4385 through PORT2 (EXT) via 10 pin flat cable.



3) Feeding all signals from external

Under the following set-up, all external signals can be fed through POTR2 (EXT).



■ DIP switch (S1) set up

S1 sets the mode of the AK4112B. Set-up is needed only for the evaluation mode 1 and 2. ON is "H" and OFF is "L".

No.	Pin	Default	Introduction
1	CM0	OFF	Clock mode set-up (Refer to the table 4.)
2	CM1	OFF	
3	OCKS1	OFF	MCLK frequency set-up (Refer to the table 5.)
4	OCKS0	OFF	

Table 3. S1 set-up

CM1 (S1-2)	CM0 (S1-1)	MCKO	SDTO	
OFF	OFF	TORX or BNC	TORX or BNC	<default>
OFF	ON	X'tal	"0" data	

Table 4. AK4112B clock mode set-up

OCKS1 (S1-3)	OCKS0 (S1-4)	MCLK	LRCK		
			Normal	Double	
OFF	OFF	256fs	Yes	Yes	
ON	OFF	512fs	Yes	No	<default>

Table 5. AK4112B MCLK frequency set-up

■ Jumpers set up

[JP1](TORX/BNC): The source of the biphase signal input to the AK4112B
TORX: PORT1(TORX176: optical link) <default>
BNC: J1(BNC)

[JP2](GND): AGND and DGND
Open: AGND and DGND are disconnected. <default>
Short: AGND and DGND are connected. ("DGND" jack can be open.)

[JP3](REG): VDD of the AK4385
Short: VDD is supplied from the regulator ("4382_VDD" jack should be open). <default>
Open: VDD is supplied from "4382_VDD" jack.

[JP4](MCLK): MCLK of the AK4385
Short: MCLK is fed from the AK4112B. <default>
Open : MCLK is fed from the external circuit via PORT2(EXT).

[JP5](BICK): BICK of the AK4385
Short: BICK is fed from the AK4112B. <default>
Open : BICK is fed from the external circuit via PORT2(EXT).

[JP6](SDATA): SDTI of the AK4385
Short: SDATA is fed from the AK4112B. <default>
Open : SDATA is fed from the external circuit via PORT2(EXT).

[JP7](LRCK): LRCK of the AK4385
Short: LRCK is fed from the AK4112B. <default>
Open : LRCK is fed from the external circuit via PORT2(EXT).

■ The function of the toggle SW

[SW1] (PDN): Resets the AK4385 and the AK4112B. Keep "H" during normal operation.

■ The indication content for LED

[LE1] (ERF) : Unlock and parity error output of the AK4112B.
[LE2] (FS96) : 96kHz sampling detect of the AK4112B.
[LE3] (AUTO) : Non-PCM data (AC-3, MPEG etc.) detects of the AK4112B.
[LE4] (V) : Validity detect of the AK4112B.

■ Serial control

The AKD4385 can be controlled via the printer port (parallel port) of IBM-AT compatible PC. Connect PORT3 (uP-I/F) with PC by 10-wire flat cable packed with the AKD4385.

Take care of the direction of connector. There is a mark at 1pin.
The pin layout of PORT3 is as Figure 4.

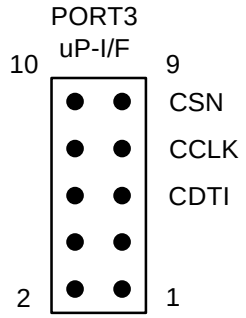


Figure 4. PORT3 pin layout

■ Set-up of evaluation board and control software

1. Set up the AKD4385 according to previous term.

2. Connect IBM-AT compatible PC with AKD4385 by 10-line type flat cable (packed with AKD4385). 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 “AK4385 Evaluation Kit” into the CD-ROM drive.

4. Access the CD-ROM drive and double-click the icon of “akd4385.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 Setup” button.
3. Click “Write default” button.
4. Then set up the dialog and input data.

■ Explanation of each buttons

1. [Port Setup] : set up the printer port.
2. [Write default] : initialize the register of AK4385.
3. [Function1] : set up the dialog which can be written by keyboard operation.
4. [Function2] : set up the dialog which can be written by keyboard operation.
5. [Write] : set up the dialog corresponding to each register which can be written by mouse operation.

■ Explanation of each dialog

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

   Address Box: Input register address in 2 figures of hexadecimal.
   Data Box: Input register data in 2 figures of hexadecimal.

   If you want to write the input data to AK4385, click “OK” button. If not, click “Cancel” button.

2. [Function2 Dialog] : Dialog to evaluate DATT

   This dialog corresponds to only addr=03H and 04H

   Address Box: Input register address in 2 figures of hexadecimal.
   Start Data Box: Input start data in 2 figures of hexadecimal.
   End Data Box: Input end data in 2 figures of hexadecimal.
   Interval Box: Data is written to AK4381 by this interval.
   Step Box: Data changes by this step.
   Mode Select Box:
   If you check 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

   If you do not check 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

   If you want to write the input data to AK4381, click “OK” button. If not, click “Cancel” button.

3. [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”.

   If you want to write the input data to AK4385, click “OK” button. If not, click “Cancel” button.

■ 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.

■ Attention on the operation

If you set up Function1 or Function2 dialog, input data to all boxes. Attention dialog is indicated if you input data or address that is not specified in the datasheet or you click “OK” button before you input data. In that case set up the dialog and input data once more again. These operation does not need if you click “Cancel” button or check the check box.

MEASUREMENT RESULTS

[Measurement condition]

- Measurement unit : Audio Precision System two Cascade
- MCLK : 512fs(44.1kHz), 256fs(96kHz), 128fs(192kHz)
- BICK : 64fs
- fs : 44.1kHz, 96kHz, 192kHz
- BW : 10Hz~20kHz (fs=44.1kHz), 10Hz~40kHz (fs=96kHz), 10Hz~40kHz (fs=192kHz)
- Bit : 24bit
- Power Supply : VDD=5V
- Interface : DIR AK4112B (44.1kHz), AK4114 (192kHz)
- Temperature : Room

fs=44.1kHz

Parameter	Input signal	Measurement filter	Lch	Rch
S/(N+D)	1kHz, 0dB	20kLPF	94.5dB	94.7dB
DR	1kHz, -60dB	20kLPF	104.5dB	104.5dB
		22kLPF, A-weighted	107.1dB	107.1dB
S/N	no signal	20kLPF	105.9dB	105.9dB
		22kLPF, A-weighted	108.7dB	108.7dB

fs=96kHz

Parameter	Input signal	Measurement filter	Lch	Rch
S/(N+D)	1kHz, 0dB	40kLPF	94.5dB	94.3dB
DR	1kHz, -60dB	40kLPF	102.2dB	102.2dB
		22kLPF, A-weighted	108.1dB	108.1dB
S/N	no signal	40kLPF	103.0dB	103.2dB
		22kLPF, A-weighted	109.1dB	109.1dB

fs=192kHz

Parameter	Input signal	Measurement filter	Lch	Rch
S/(N+D)	1kHz, 0dB	40kLPF	94.4dB	94.5dB
DR	1kHz, -60dB	40kLPF	102.4dB	102.4dB
		22kLPF, A-weighted	108.1dB	108.1dB
S/N	no signal	40kLPF	102.9dB	102.8dB
		22kLPF, A-weighted	108.8dB	108.2dB

■ Plots

[Measurement condition]

- Measurement unit : Audio Precision System two Cascade
- MCLK : 512fs(44.1kHz), 256fs(96kHz), 128fs(192kHz)
- BICK : 64fs
- fs : 44.1kHz, 96kHz, 192kHz
- BW : 10Hz~20kHz (fs=44.1kHz), 10Hz~40kHz (fs=96kHz), 10Hz~40kHz (fs=192kHz)
- Bit : 24bit
- Power Supply : VDD=5V
- Interface : DIR AK4112B (44.1kHz, 96kHz), AK4114 (192kHz)
- Temperature : Room

fs=44.1kHz

Figure 6. FFT (1kHz, 0dBFS input)
Figure 7. FFT (1kHz, -60dBFS input)
Figure 8. FFT (noise floor)
Figure 9. FFT (out-of-band noise)
Figure10. THD+N vs Input Level (fin=1kHz)
Figure11. THD+N vs fin (Input level=0dBFS)
Figure12. Linearity (fin=1kHz)
Figure13. Frequency Response (Input level=0dBFS)
Figure14. Cross-talk (Input level=0dBFS)

fs=96kHz

Figure15. FFT (1kHz, 0dBFS input, Notch=OFF)
Figure16. FFT (1kHz, 0dBFS input, Notch=ON)
Figure17. FFT (1kHz, -60dBFS input)
Figure18. FFT (noise floor)
Figure19. FFT (outband noise)
Figure20. THD+N vs Input Level (fin=1kHz)
Figure21. THD+N vs fin (Input level=0dBFS)
Figure22. Linearity (fin=1kHz)
Figure23. Frequency Response (Input level=0dBFS)
Figure24. Cross-talk (Input level=0dBFS)

fs=192kHz

Figure25. FFT (1kHz, 0dBFS input, Notch=OFF)
Figure26. FFT (1kHz, 0dBFS input, Notch=ON)
Figure27. FFT (1kHz, -60dBFS input)
Figure28. FFT (noise floor)
Figure29. FFT (outband noise)
Figure30. THD+N vs Input Level (fin=1kHz)
Figure31. THD+N vs fin (Input level=0dBFS)
Figure32. Linearity (fin=1kHz)
Figure33. Frequency Response (Input level=0dBFS)
Figure34. Cross-talk (Input level=0dBFS)

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

(fs=44.1kHz)

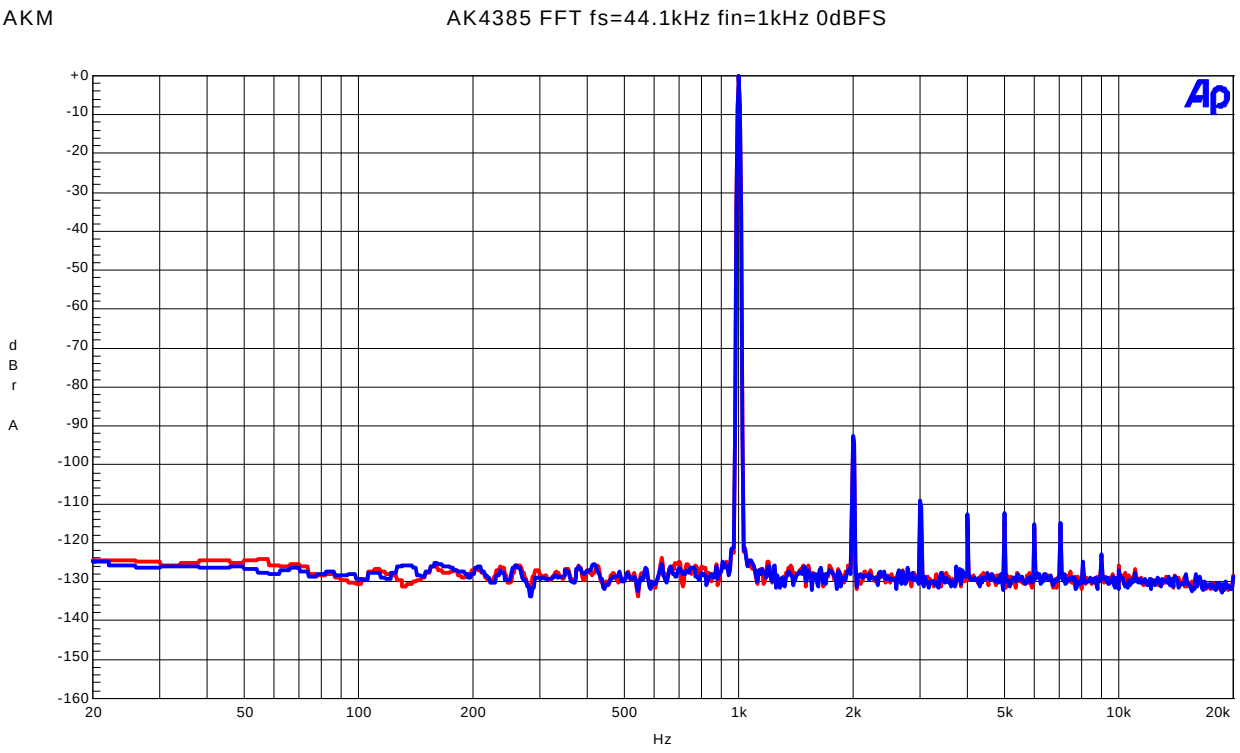


Figure 6 . FFT (1kHz, 0dBFS input)

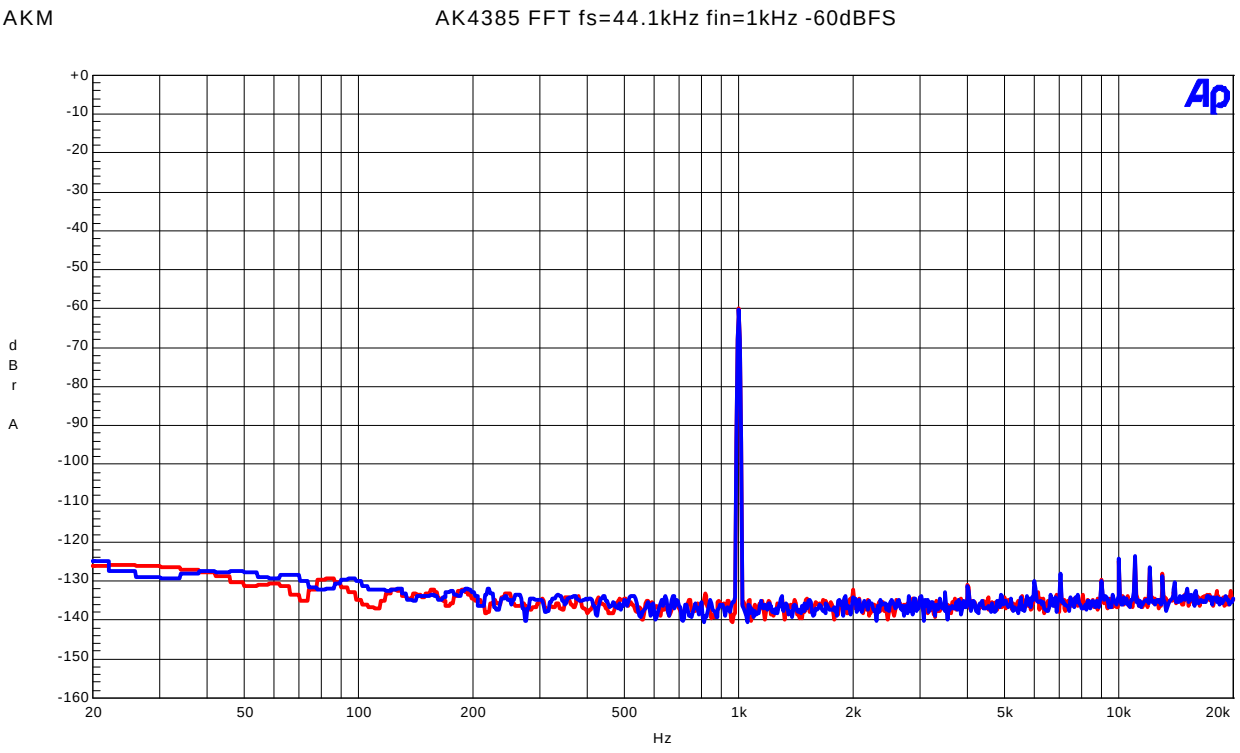


Figure 7 . FFT (1kHz, -60dBFS input)

(fs=44.1kHz)

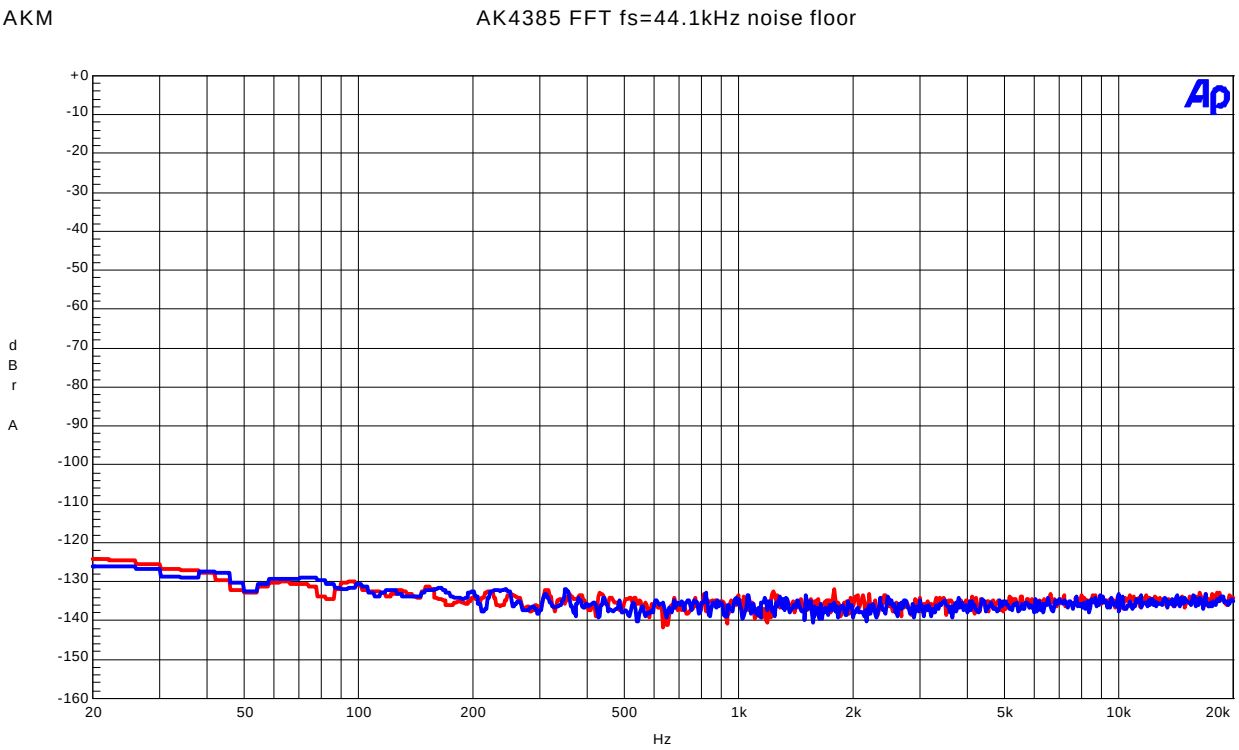


Figure 8 . FFT (noise floor)

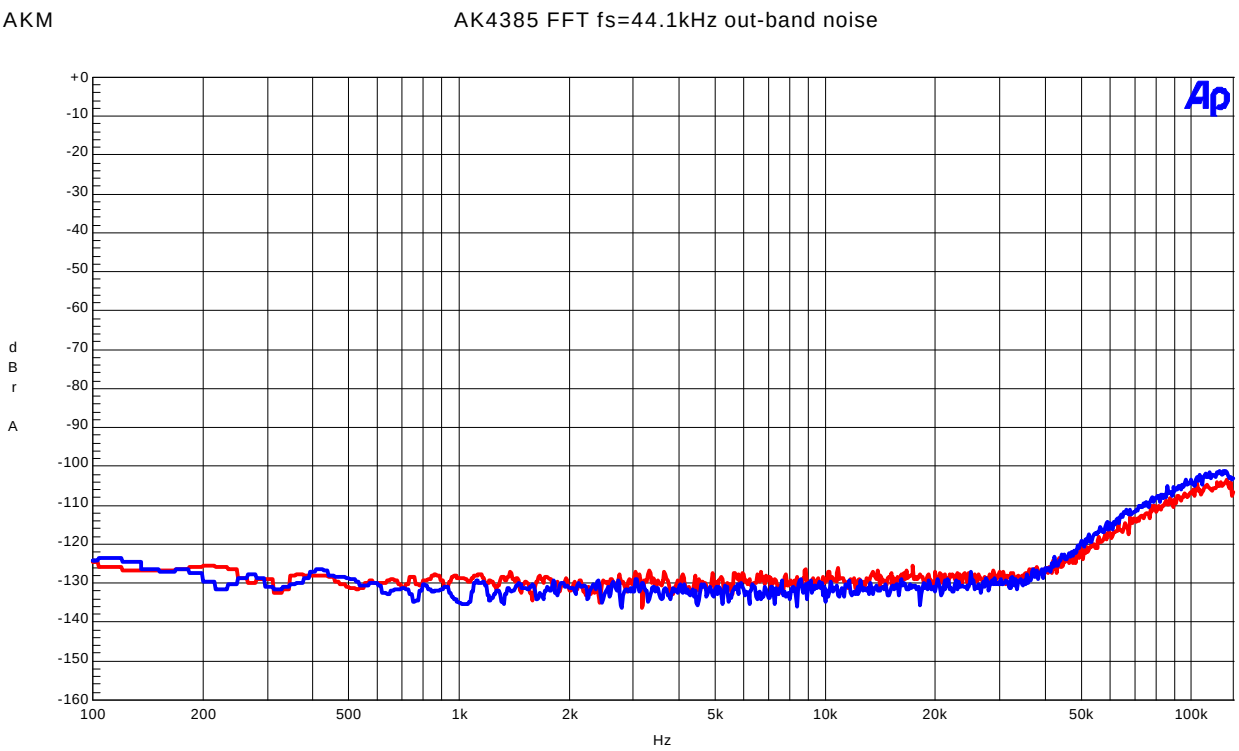


Figure 9 . FFT (out-of-band noise)

(fs=44.1kHz)

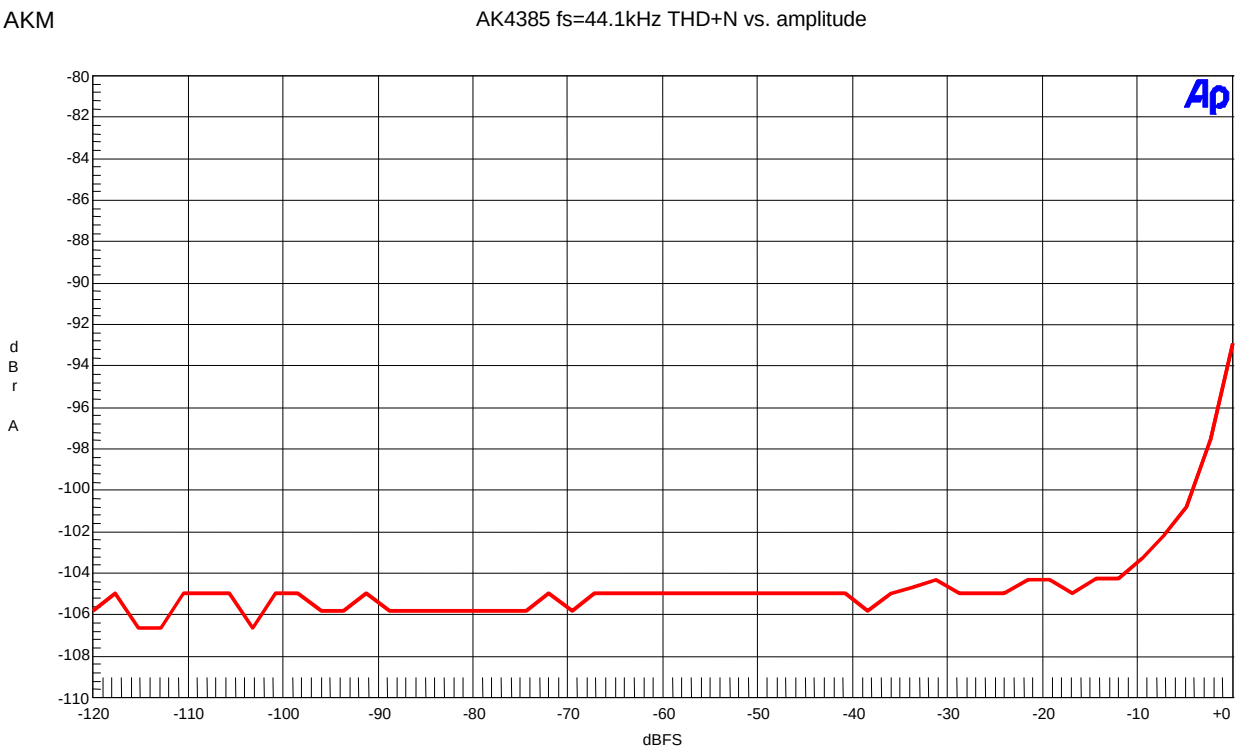


Figure10. THD+N vs Input Level (fin=1kHz)

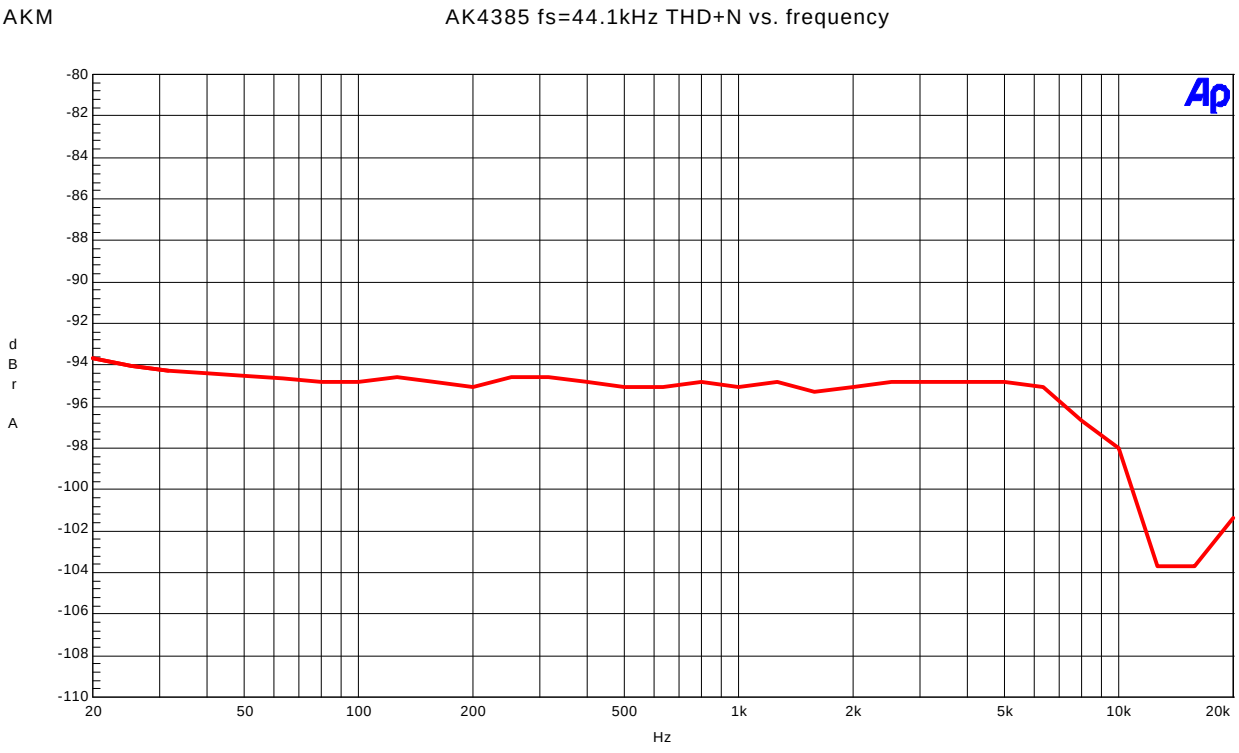


Figure11. THD+N vs fin (Input level=0dBFS)

(fs=44.1kHz)

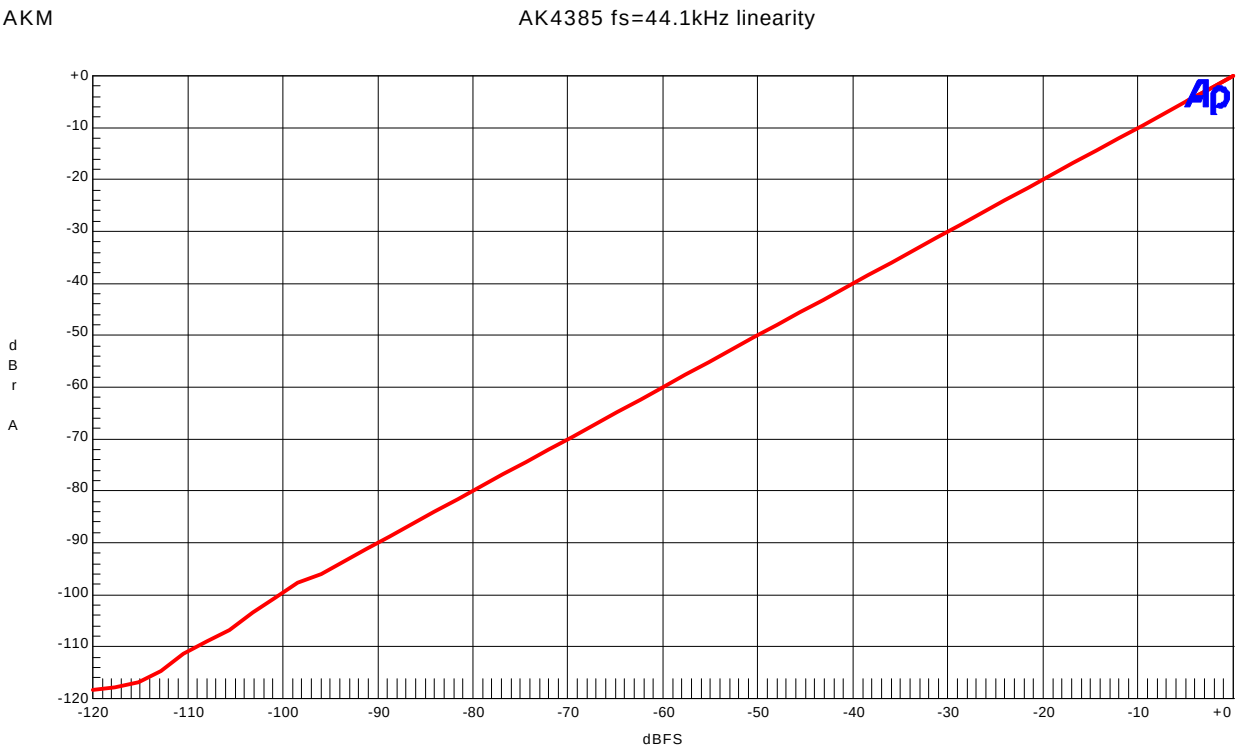


Figure12. Linearity (fin=1kHz)

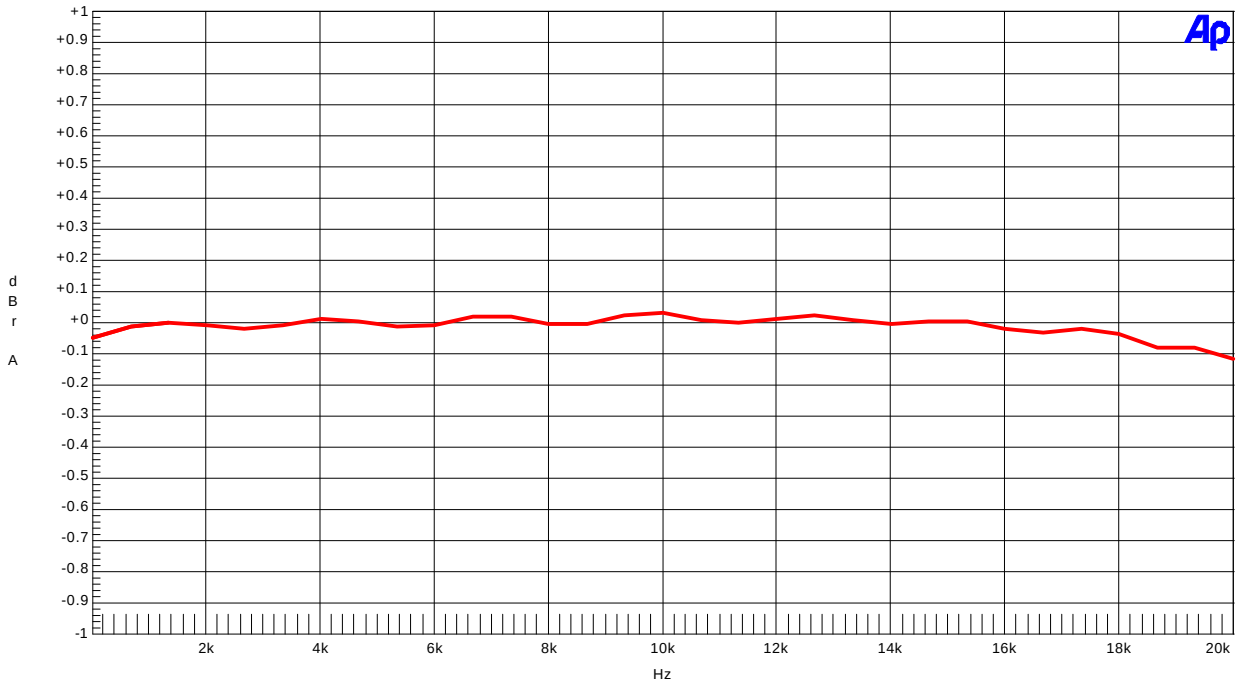


Figure13. Frequency Response (Input level=0dBFS)

(fs=44.1kHz)

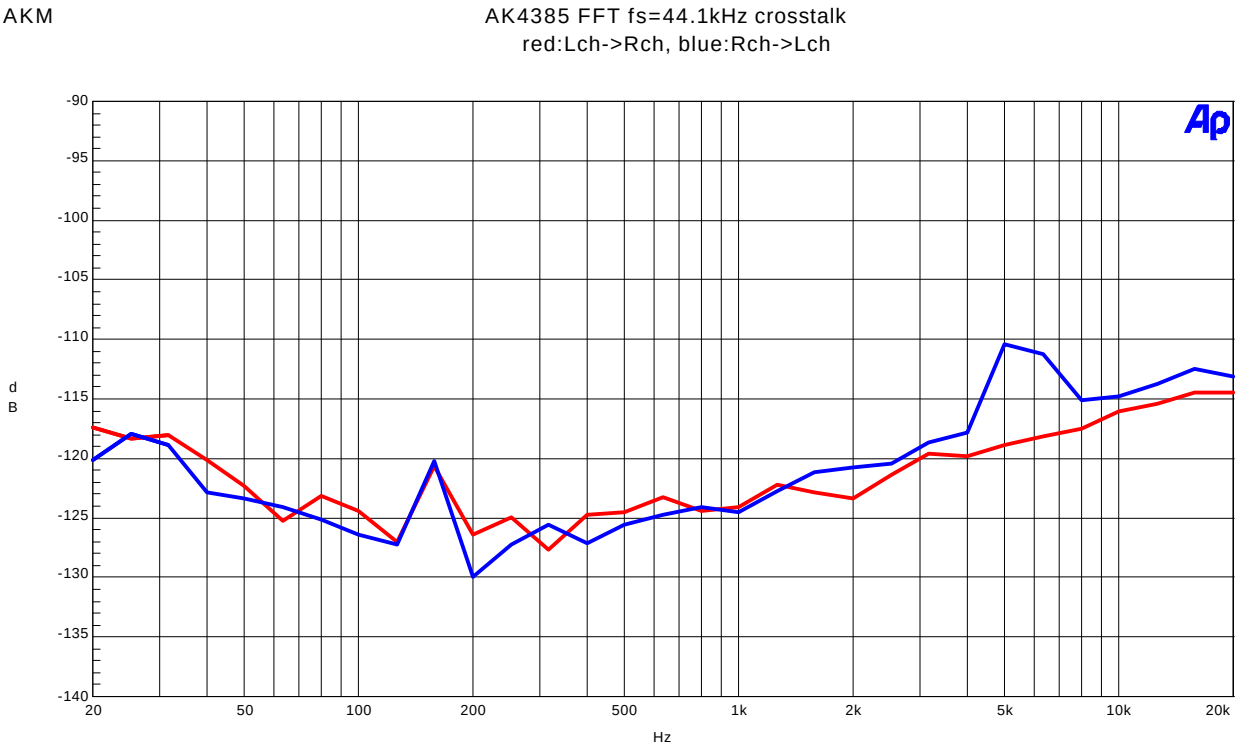


Figure14. Cross-talk (Input level=0dBFS)

(fs=96kHz)

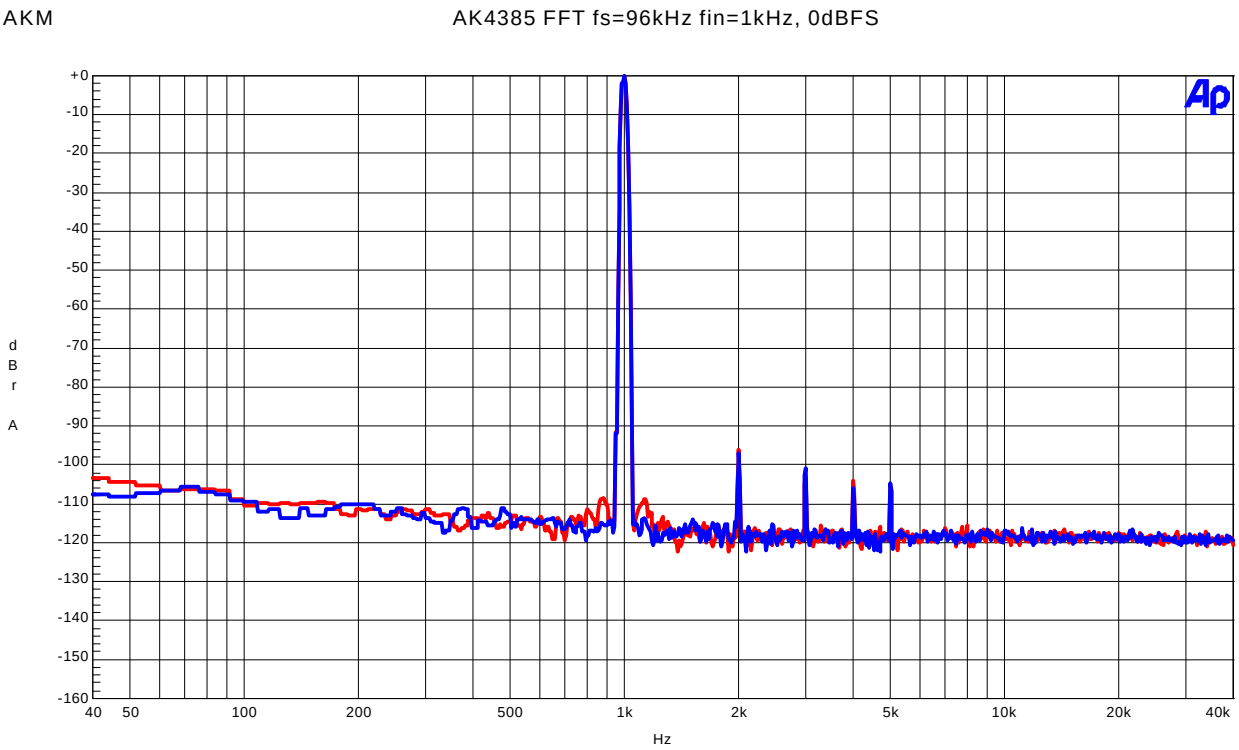


Figure15. FFT (1kHz, 0dBFS input, Notch=OFF)

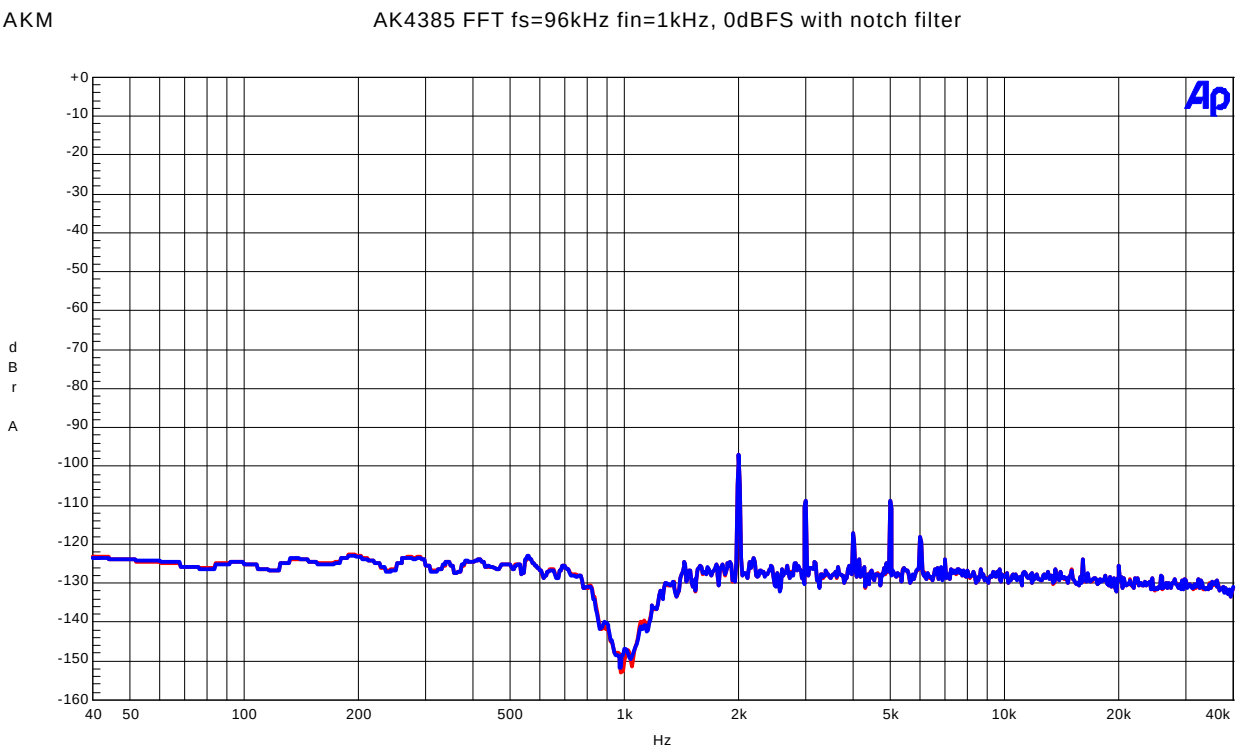


Figure16. FFT (1kHz, 0dBFS input, Notch=ON)

(fs=96kHz)

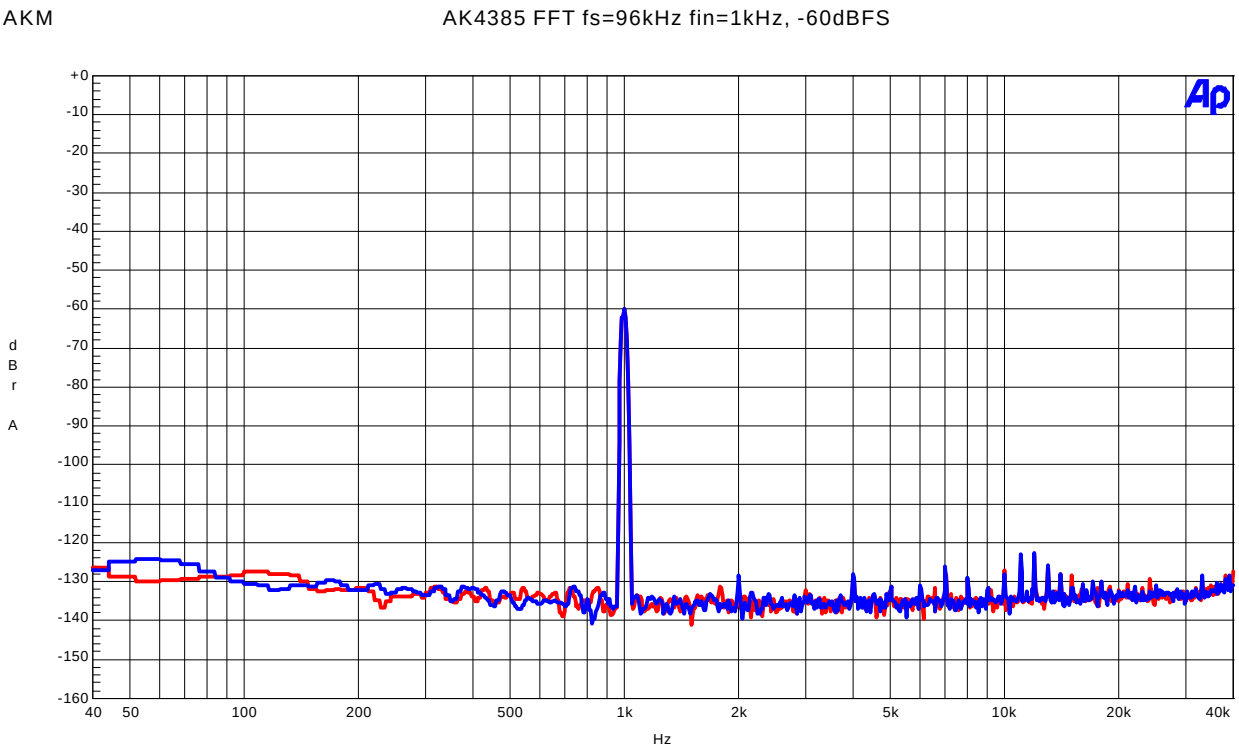


Figure17. FFT (1kHz, -60dBFS input)

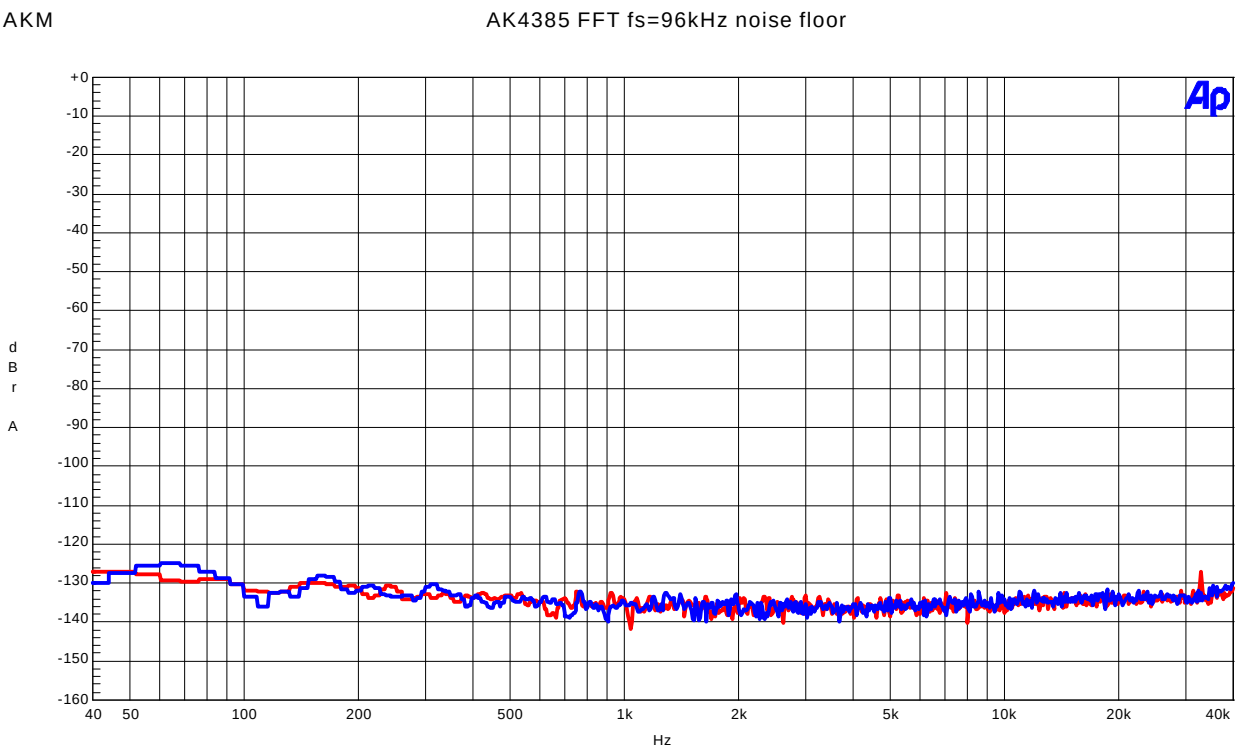


Figure18. FFT (noise floor)

(fs=96kHz)

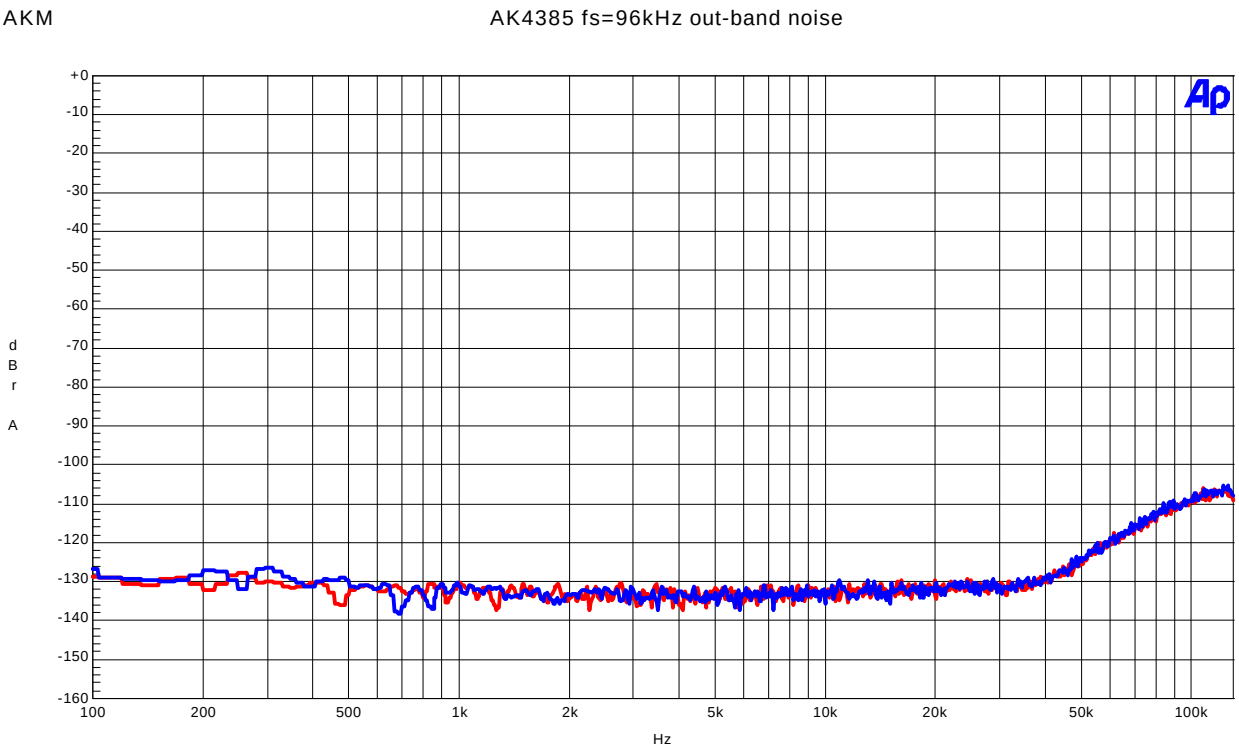


Figure19. FFT (out-of-band noise)

(fs=96kHz)

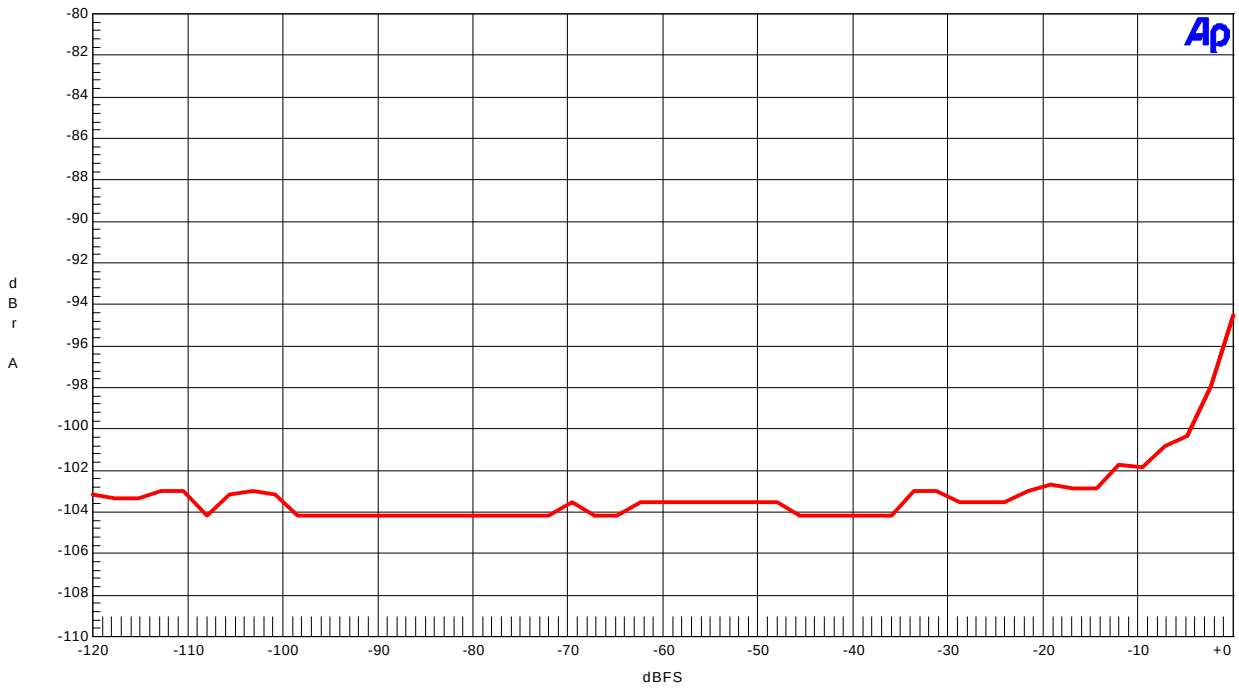


Figure20. THD+N vs Input Level (fin=1kHz)

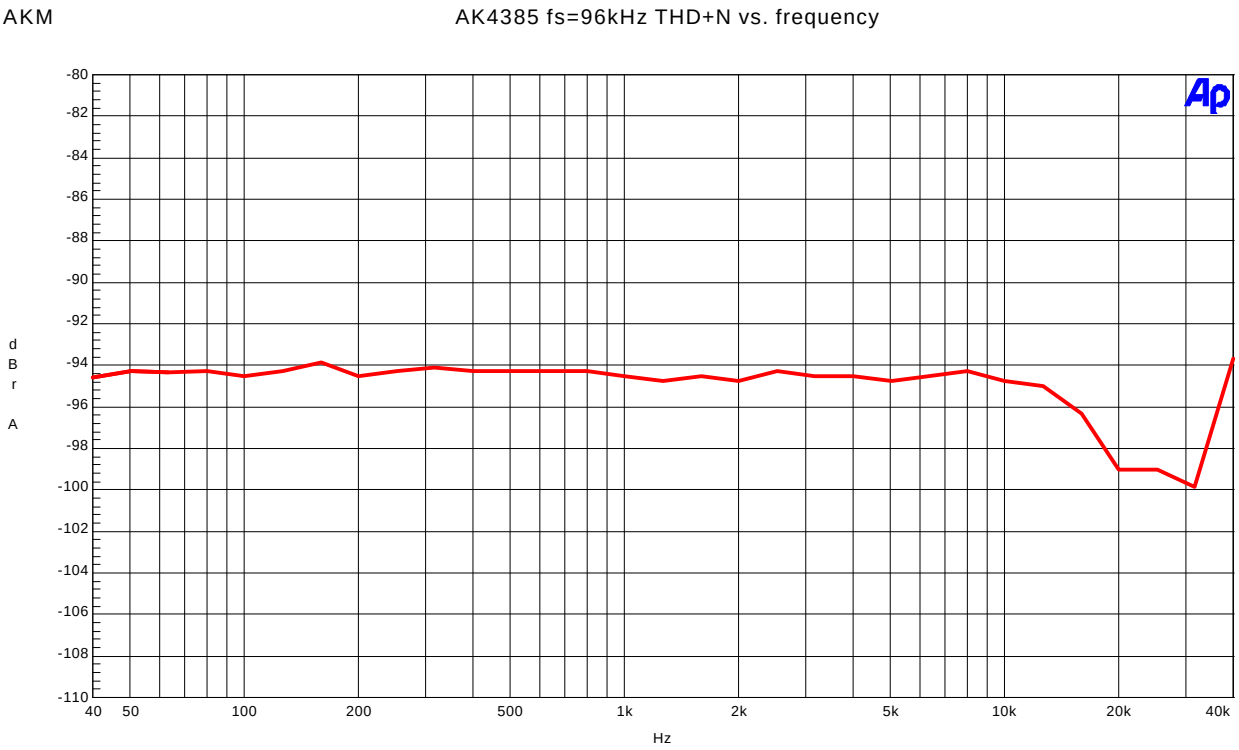


Figure21. THD+N vs fin (Input level=0dBFS)

(fs=96kHz)

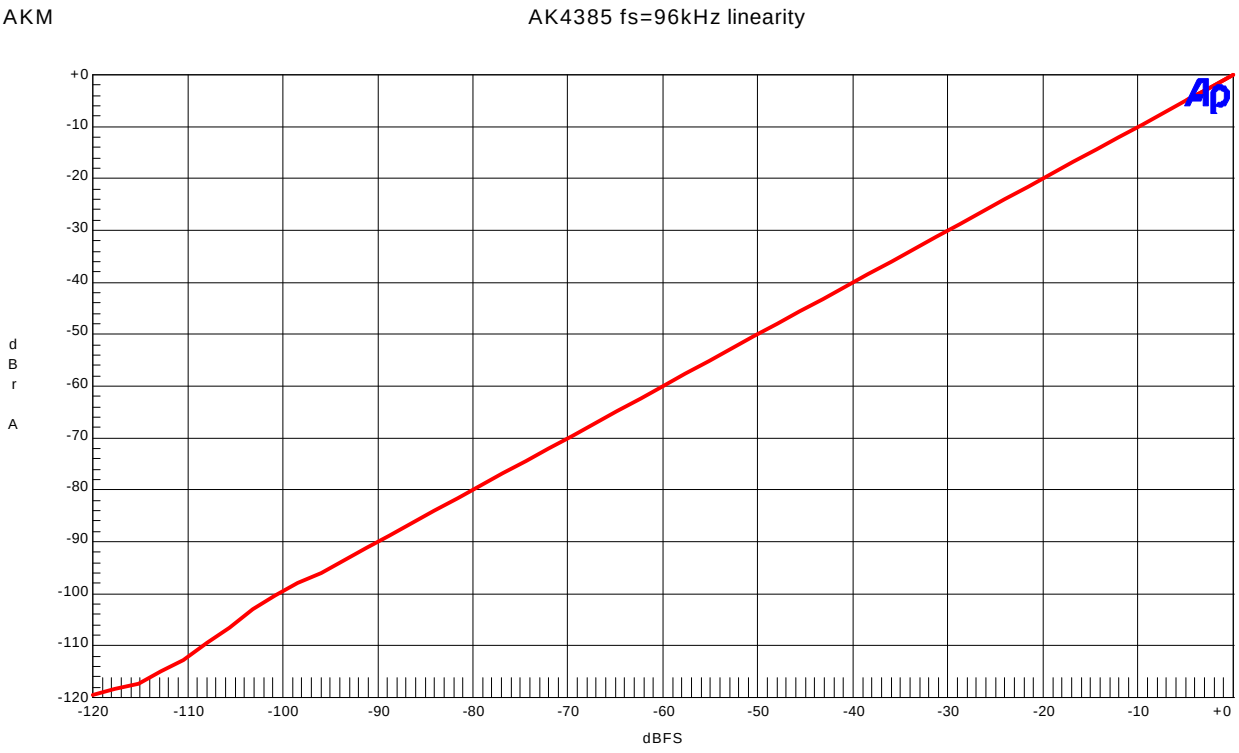


Figure22. Linearity (fin=1kHz)

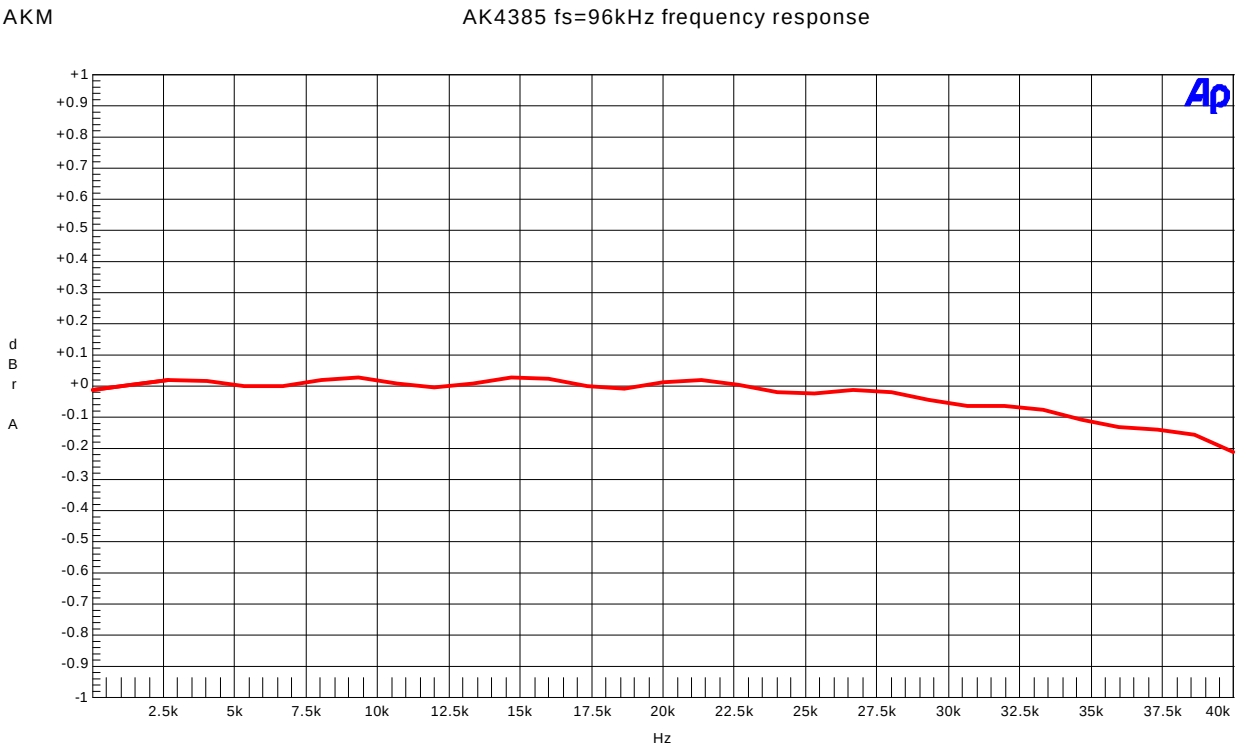


Figure23. Frequency Response (Input level=0dBFS)
(Including external LPF)

(fs=96kHz)

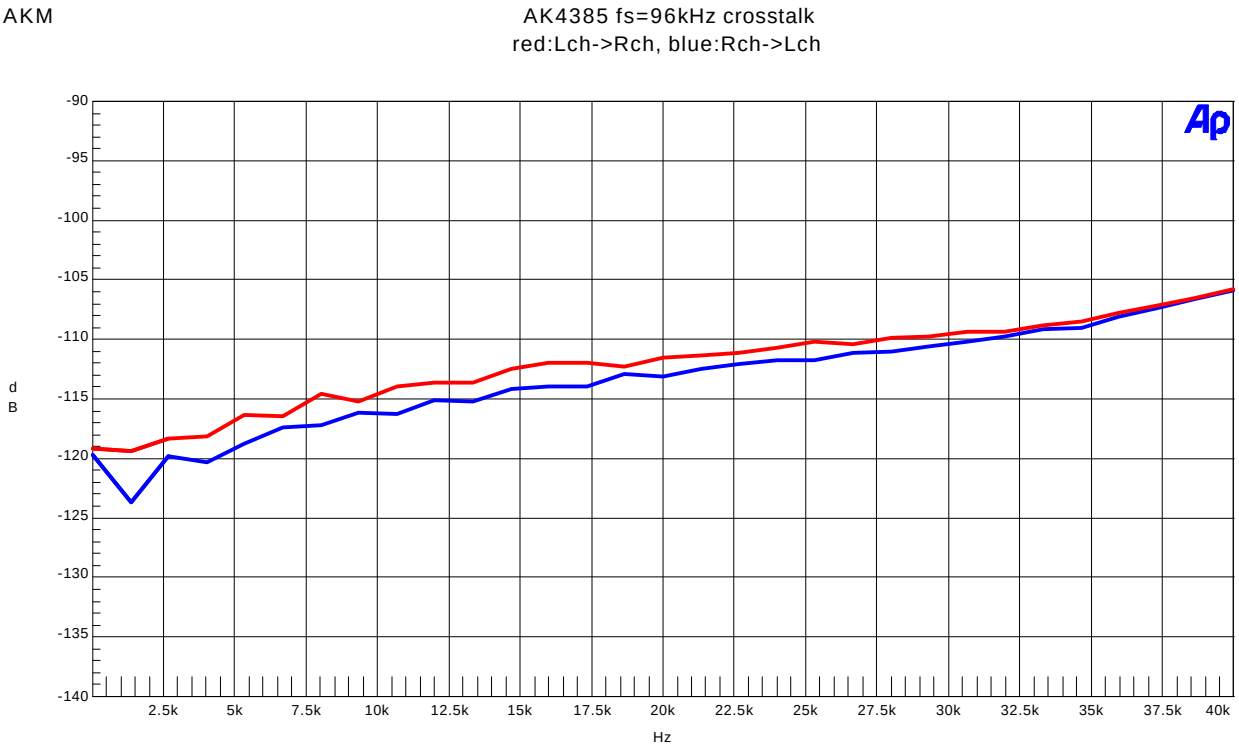


Figure24. Cross-talk (Input level=0dBFS)

(fs=192kHz)

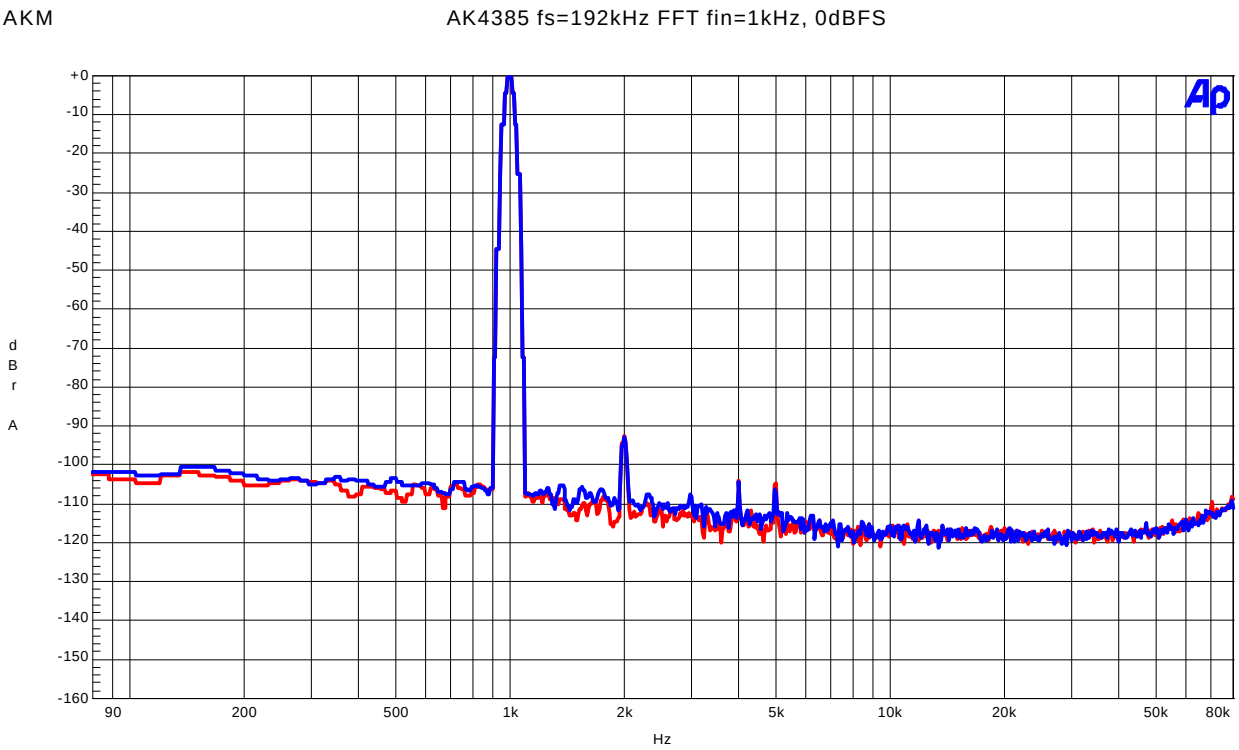


Figure25. FFT (1kHz, 0dBFS input, Notch=OFF)

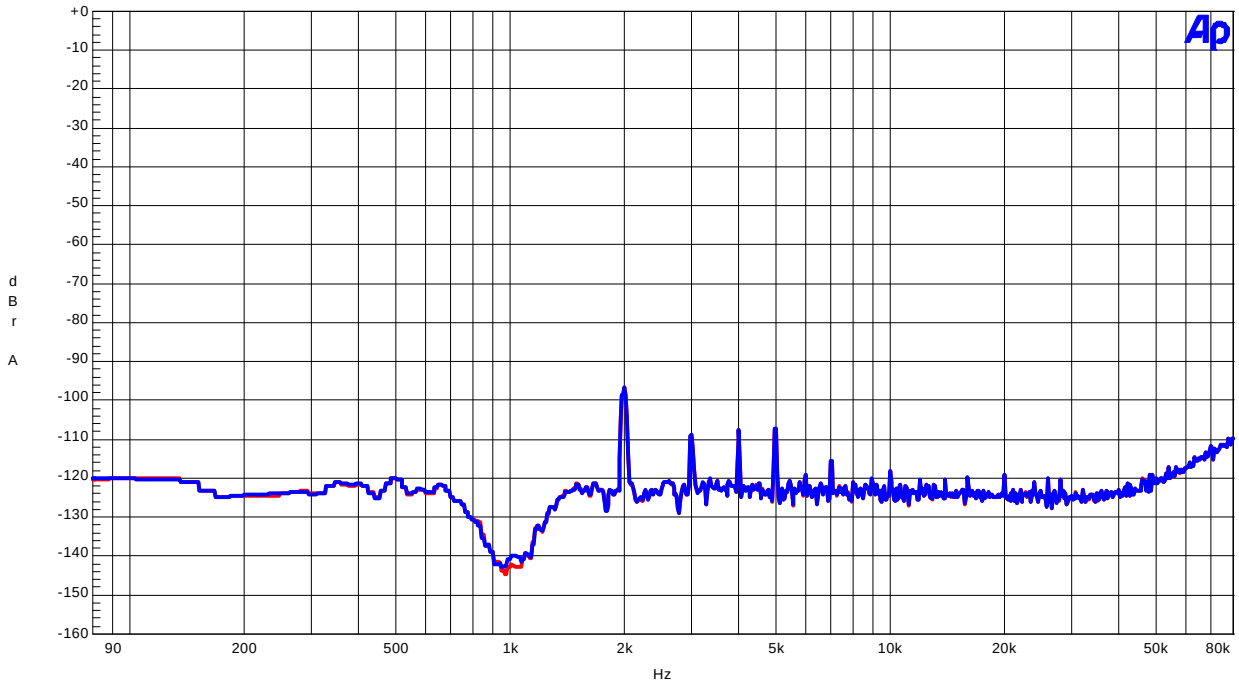


Figure26. FFT (1kHz, 0dBFS input, Notch=ON)

(fs=192kHz)

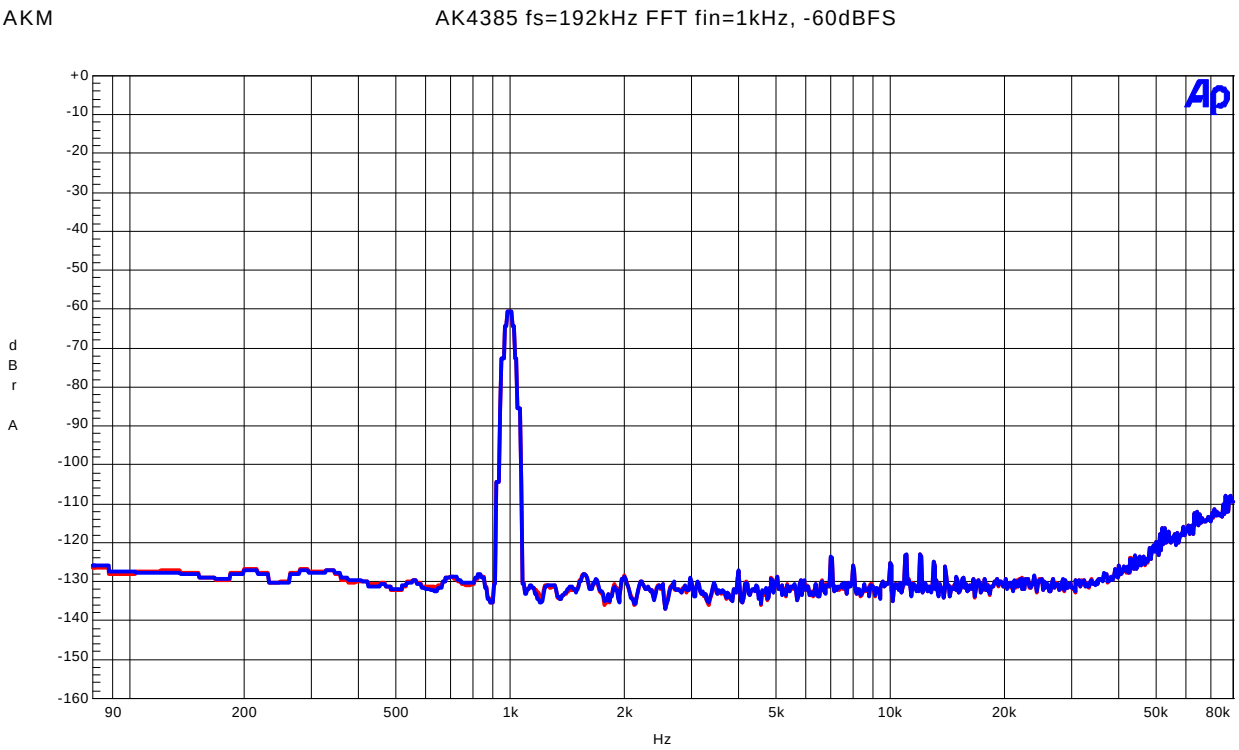


Figure27. FFT (1kHz, -60dBFS input)

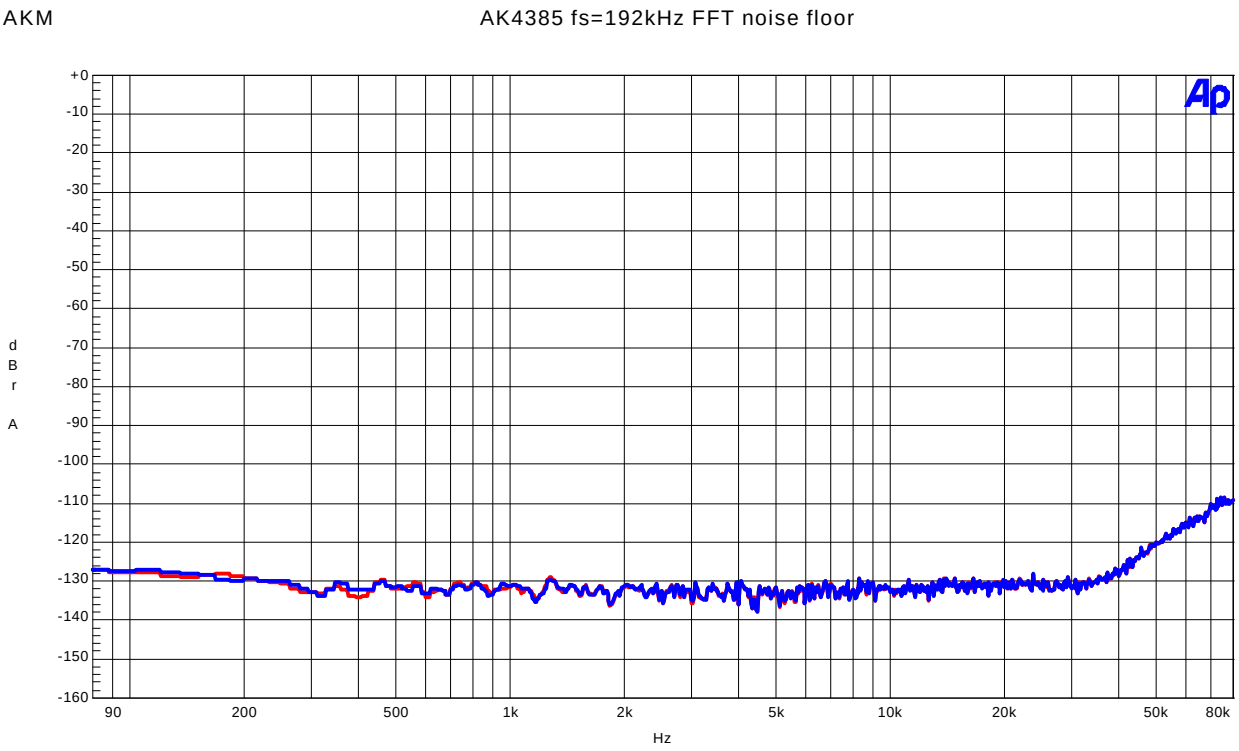


Figure28. FFT (noise floor)

(fs=192kHz)

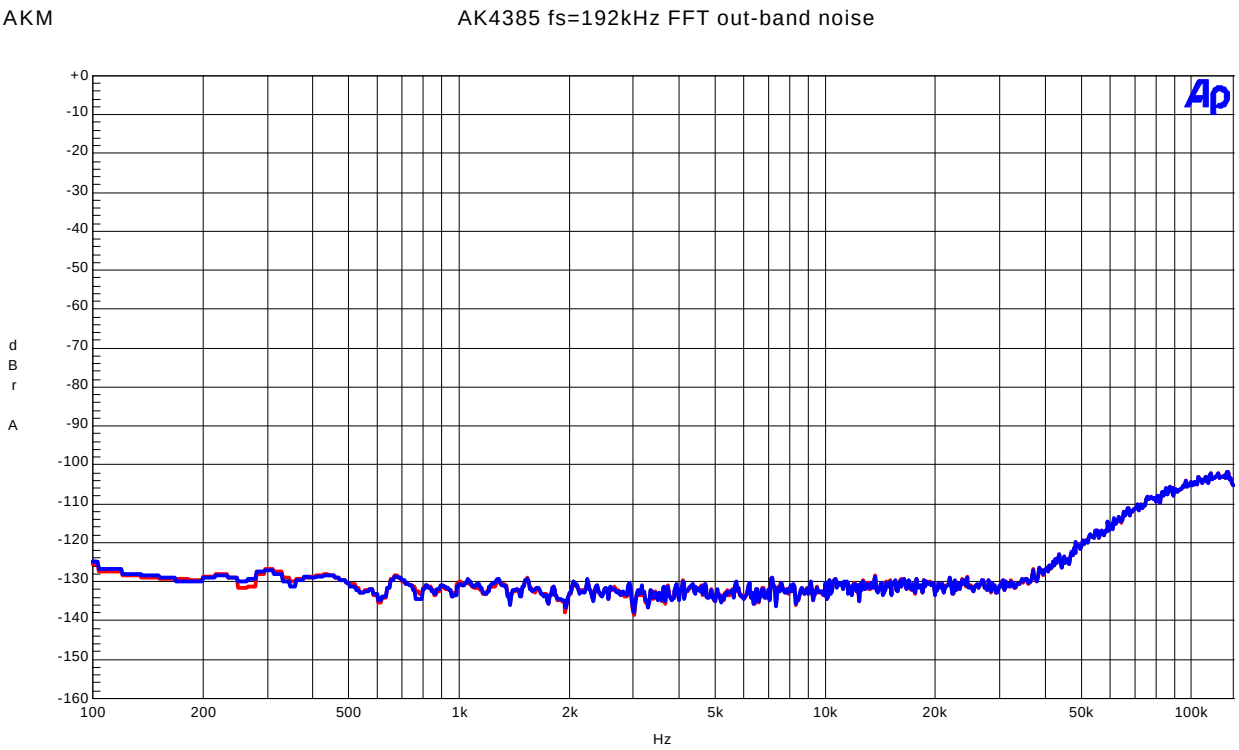


Figure29. FFT (out-of-band noise)

(fs=192kHz)

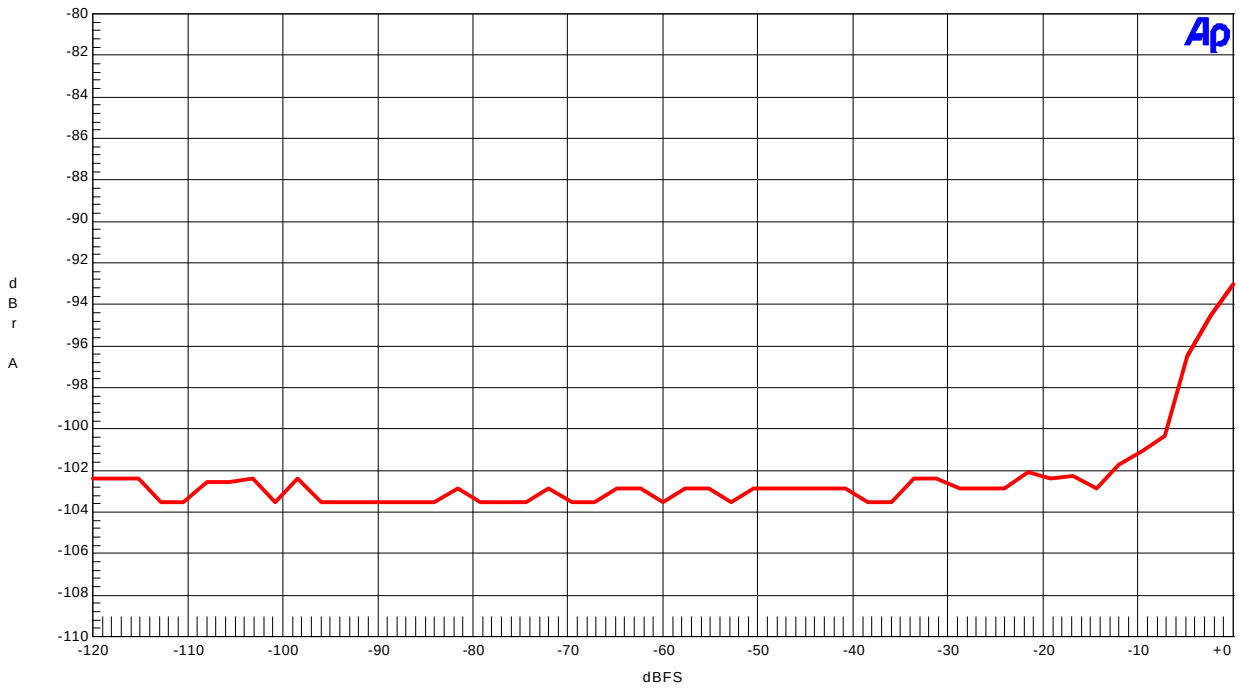


Figure30. THD+N vs Input Level (fin=1kHz)

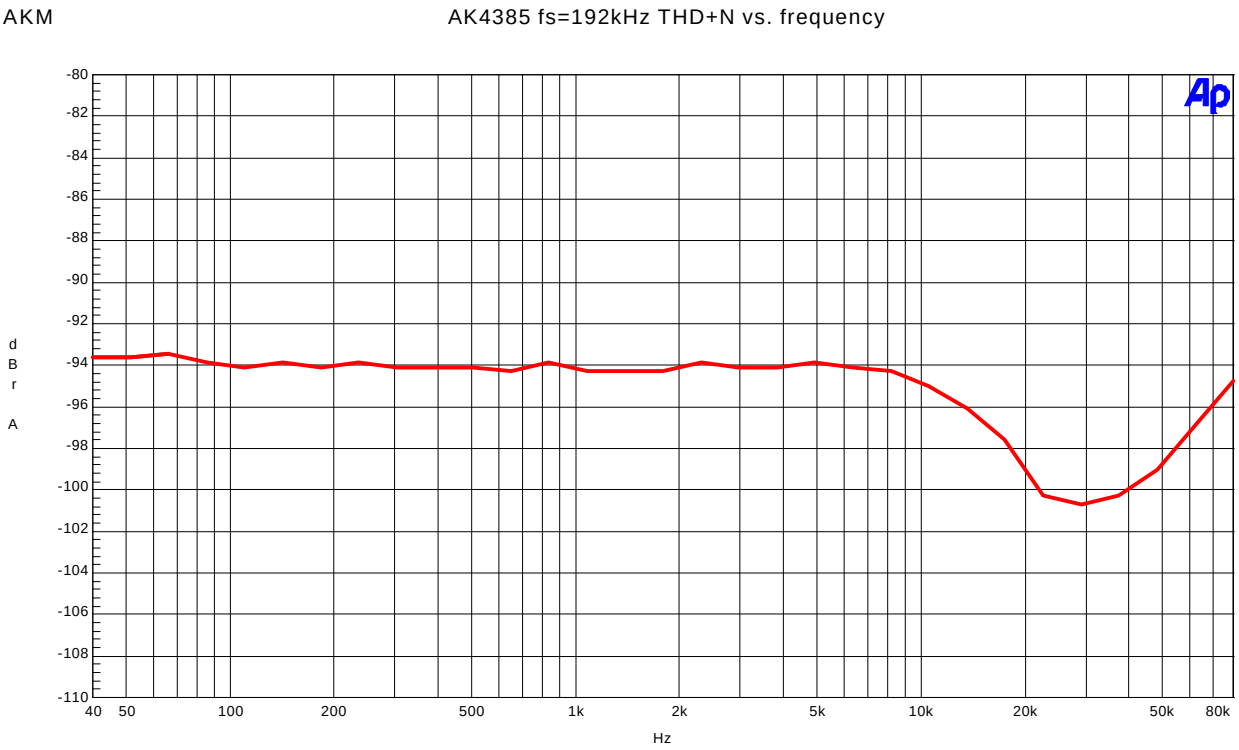


Figure31. THD+N vs fin (Input level=0dBFS)

(fs=192kHz)

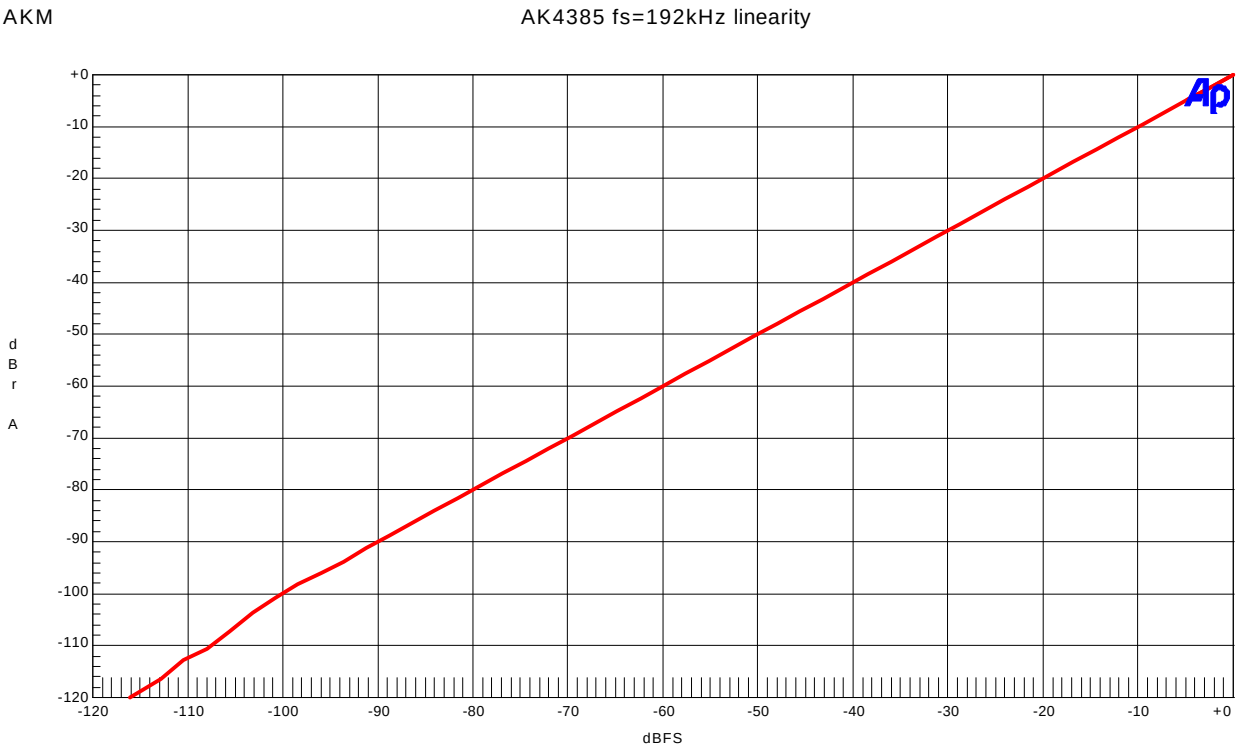


Figure32. Linearity (fin=1kHz)

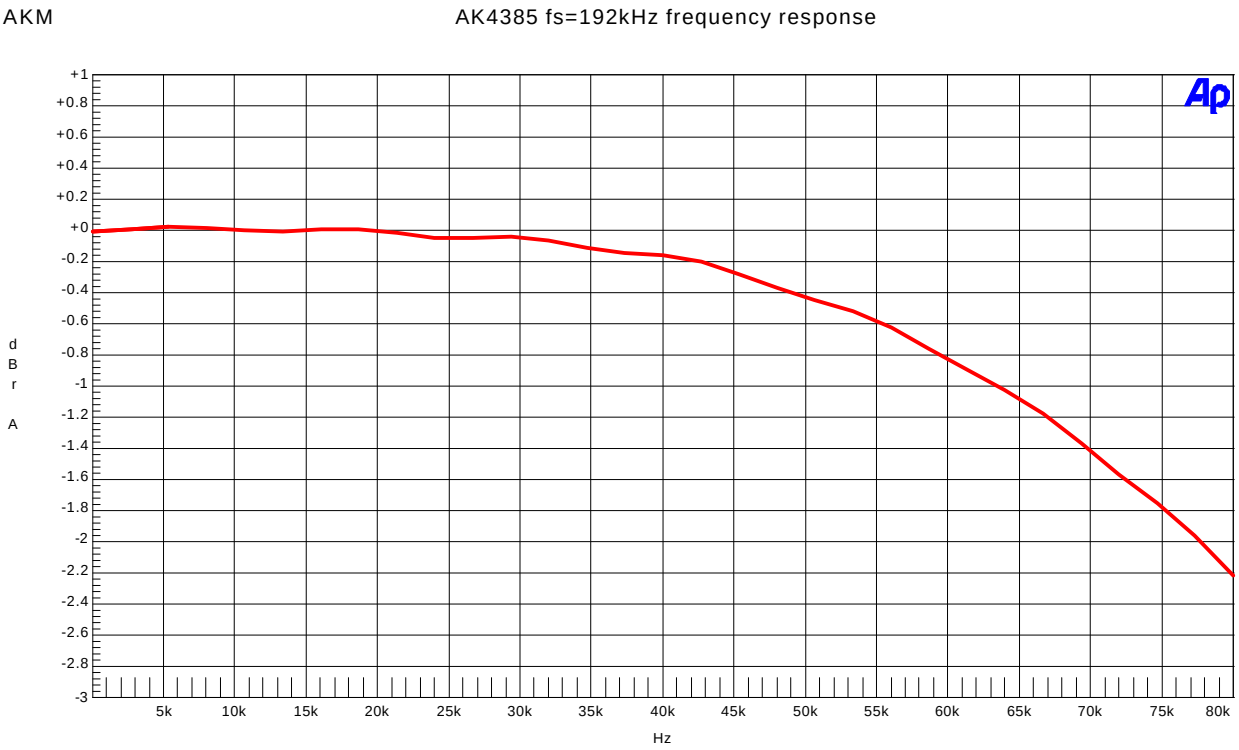


Figure33. Frequency Response (Input level=0dBFS)
(Including external LPF)

(fs=192kHz)

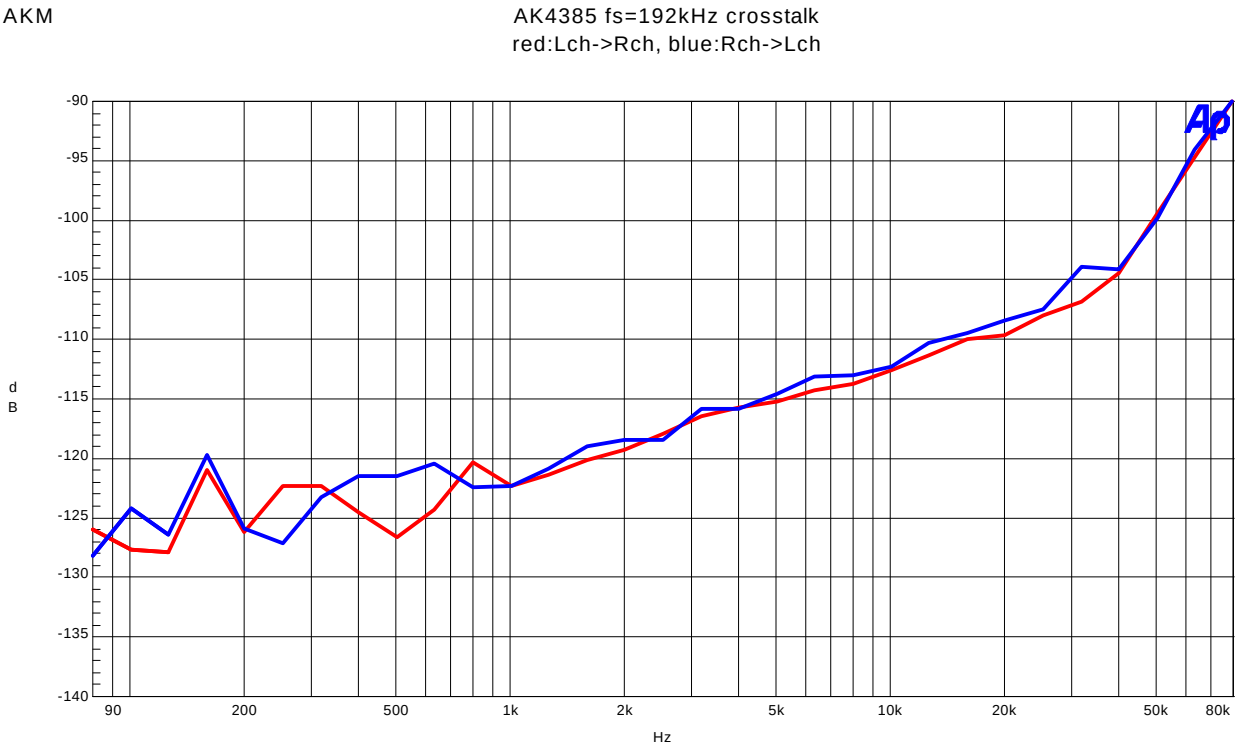
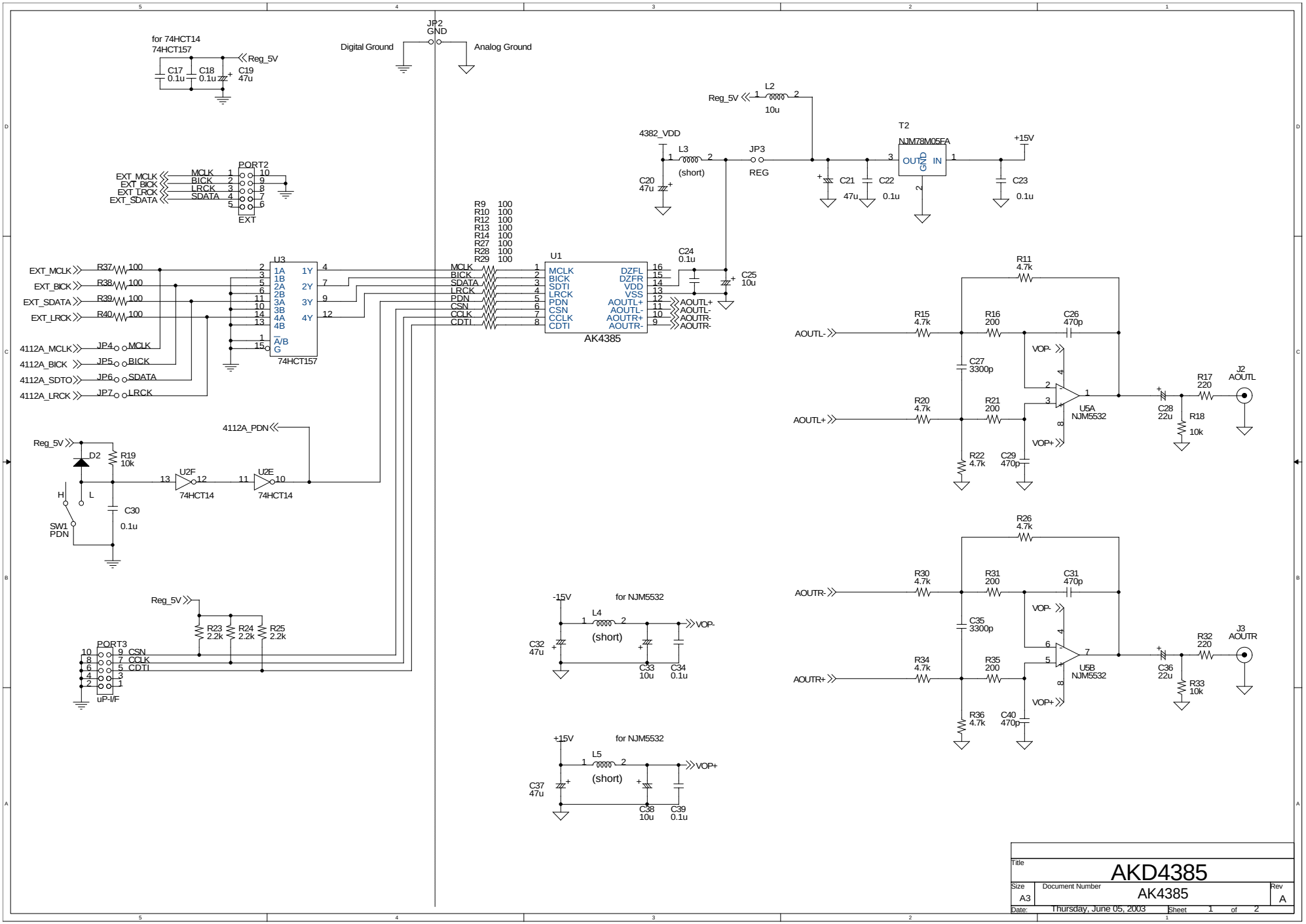


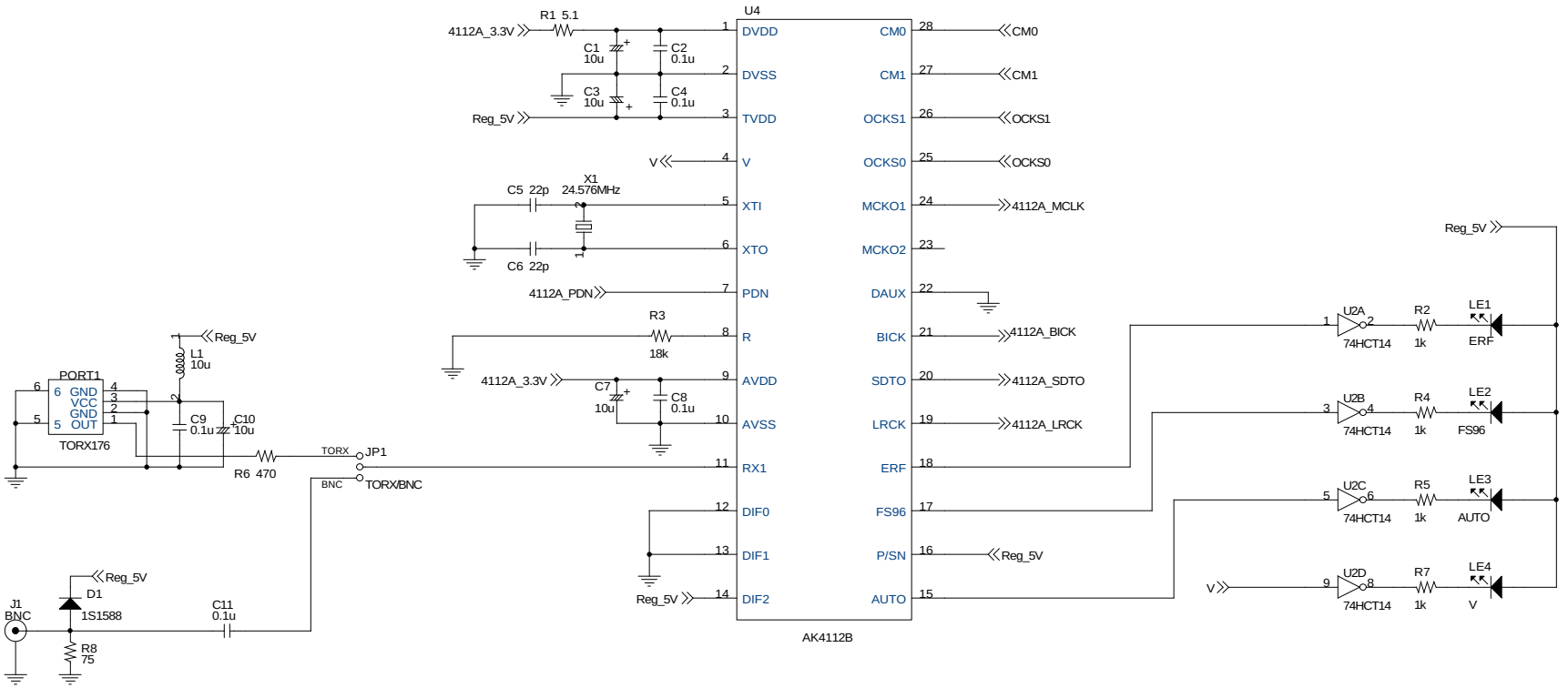
Figure34. Cross-talk (Input level=0dBFS)

IMPORTANT NOTICE

- These products and their specifications are subject to change without notice. Before considering any use or application, consult the Asahi Kasei Microsystems Co., Ltd. (AKM) sales office or authorized distributor concerning their current status.
- AKM assumes no liability for infringement of any patent, intellectual property, or other right in the application or use of any information contained herein.
- Any export of these products, or devices or systems containing them, may require an export license or other official approval under the law and regulations of the country of export pertaining to customs and tariffs, currency exchange, or strategic materials.
- AKM products are neither intended nor authorized for use as critical components in any safety, life support, or other hazard related device or system, and AKM assumes no responsibility relating to any such use, except with the express written consent of the Representative Director of AKM. As used here:
  (a) A hazard related device or system is one designed or intended for life support or maintenance of safety or for applications in medicine, aerospace, nuclear energy, or other fields, in which its failure to function or perform may reasonably be expected to result in loss of life or in significant injury or damage to person or property.
  (b) A critical component is one whose failure to function or perform may reasonably be expected to result, whether directly or indirectly, in the loss of the safety or effectiveness of the device or system containing it, and which must therefore meet very high standards of performance and reliability.
- It is the responsibility of the buyer or distributor of an AKM product who distributes, disposes of, or otherwise places the product with a third party to notify that party in advance of the above content and conditions, and the buyer or distributor agrees to assume any and all responsibility and liability for and hold AKM harmless from any and all claims arising from the use of said product in the absence of such notification.



Title	AKD4385	
Size: A3	Document Number: AK4385	Rev: A
Date: Thursday, June 05, 2003	Sheet 1 of 2	

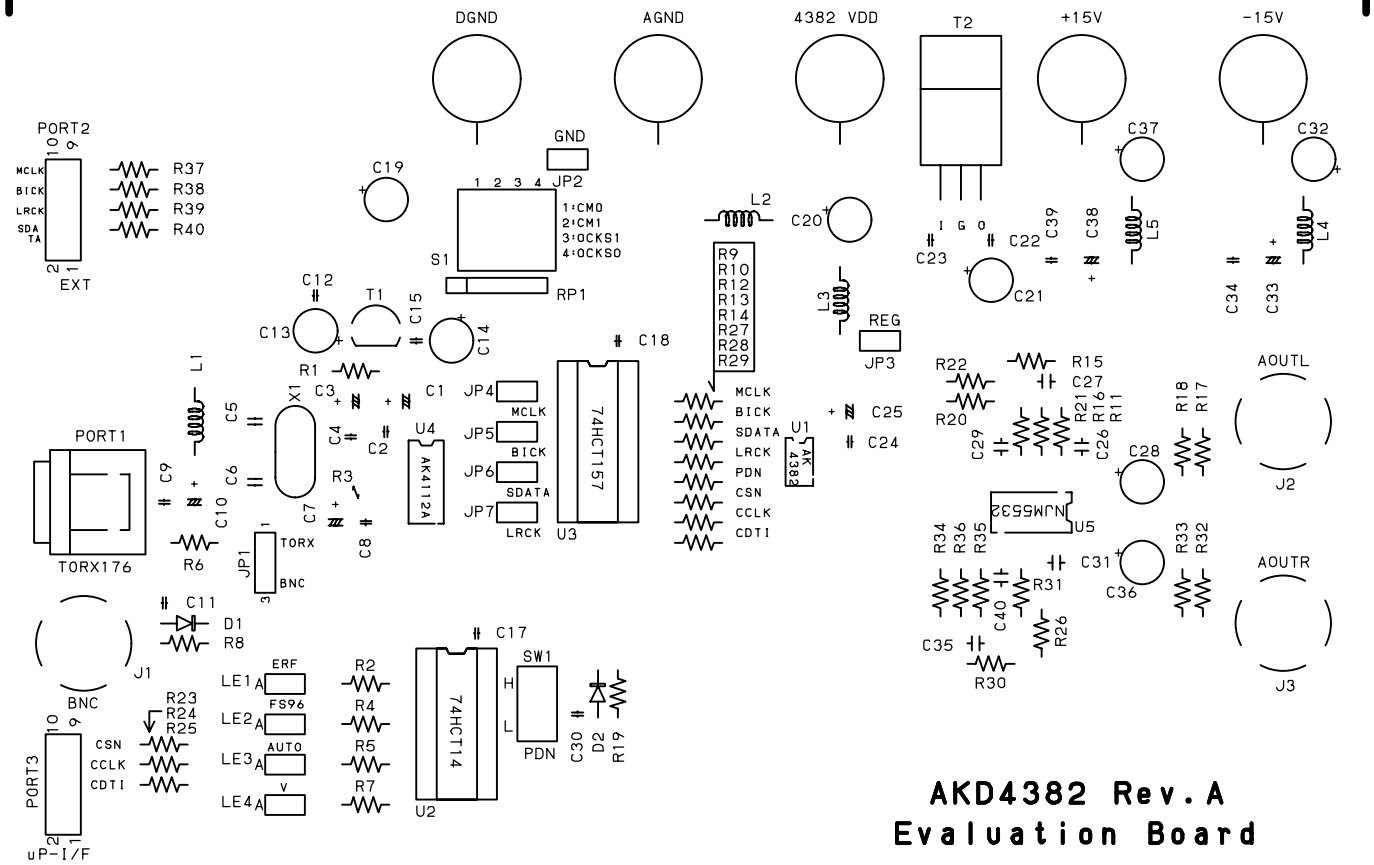


Title	AKD4385	
Size A3	Document Number AK4112B	Rev A
Date: Thursday, June 05, 2003	Sheet 2 of 2	

AKD4382 Rev.A
Evaluation Board

SILK図

ROGO	UL	DAY
○	X	2000.4.5



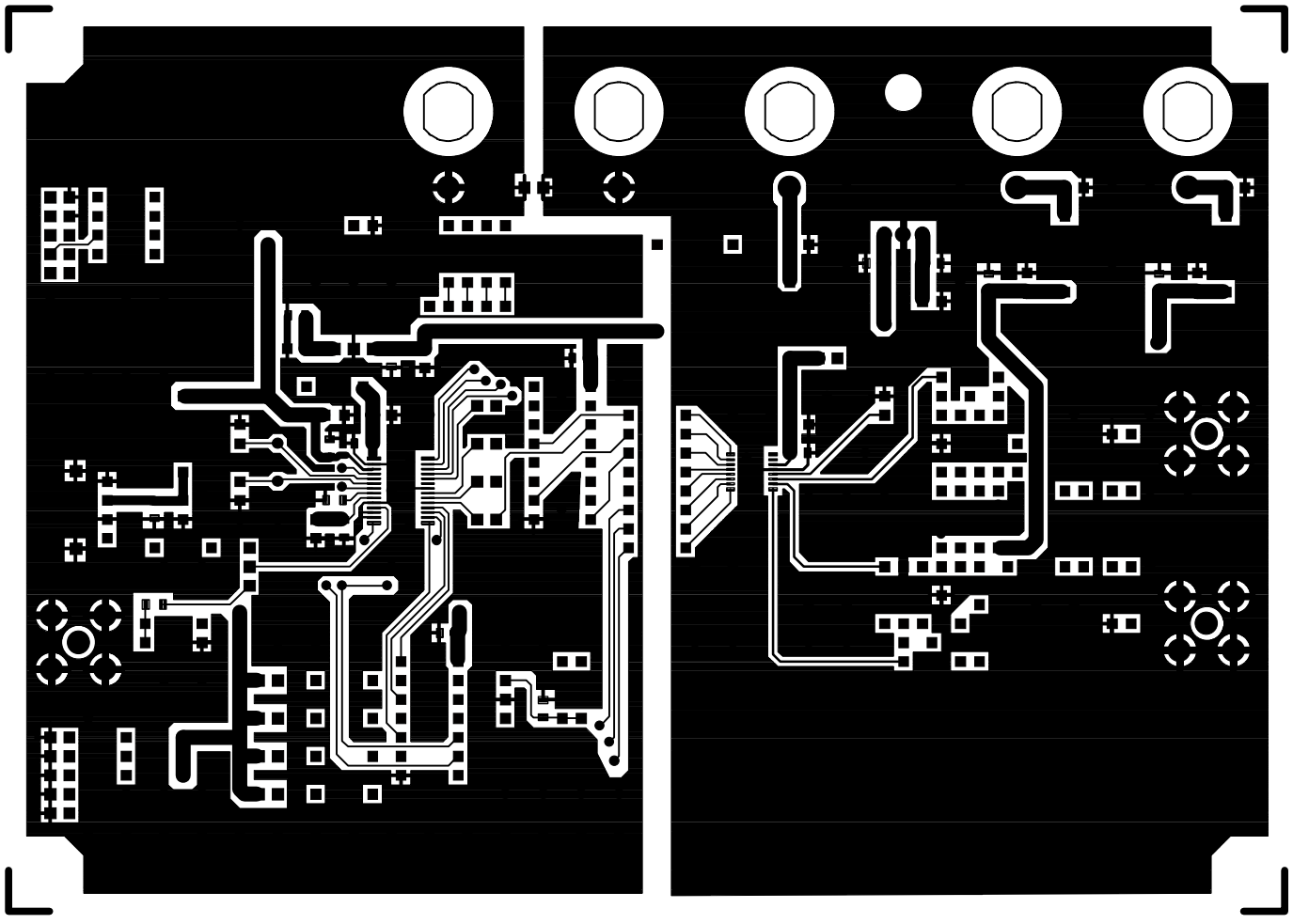
AKD4382 Rev.A
Evaluation Board

AKD4382 Rev.A
Evaluation Board

R R

ROGO	UL	DAY
○	X	2000.4.5

部品面図



AKD4382 Rev.A
Evaluation Board

半田面図

DAY	UL	ROGO
2000.4.5	X	○

AKD4382 Rev.A
Evaluation Board