AKD4383
Evaluation board Rev.B for AK4383

GENERAL DESCRIPTION

The AKD4383 is an evaluation board for the AK4383. The AK4383 accepts 192kHz PCM data and 1-Bit DSD data, ideal for a wide range of applications including DVD-Audio and SACD. The AKD4383 has the interface with AKM's wave generator using ROM data and with AKM's A/D converter evaluation boards. It has the AK5390 that outputs 1bit-data. Therefore, it is easy to evaluate PCM and DSD data. The AKD4383 also has the digital audio interface and can achieve the interface with digital audio systems via opt-connector or RCA connector.

■ Ordering guide

AKD4383 --- Evaluation board for AK4383
(Cable for connecting with printer port of IBM-AT compatible PC and control software are packed with this.)

FUNCTION

- **On-board 3nd order LPF**
- **Compatible with 3 types of interface**
  - **Direct interface with AKM's A/D converter evaluation boards and direct interface with AKM's signal generator(AKD43XX) by 10pin header**
  - **On-board AK4112B as DIR which accepts optical input and BNC Input.**
  - **Direct interface with SACD Player by 10pin header**
- **10pin header for serial control interface**

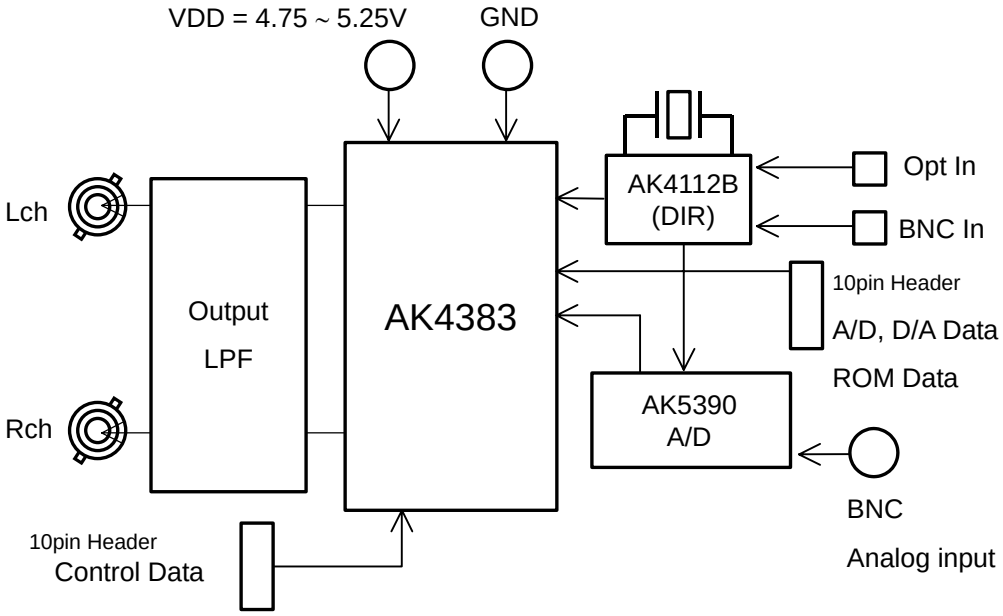


Figure 1. AKD4383 Block Diagram

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

■ External analog circuit

The 3rd order LPF is implemented on the board in order to sum the differential outputs and attenuate the shaping noise of DSD data. Analog signal is output through BNC connectors on the board. And the output level of the AK4357 is 5.65Vpp@5V.

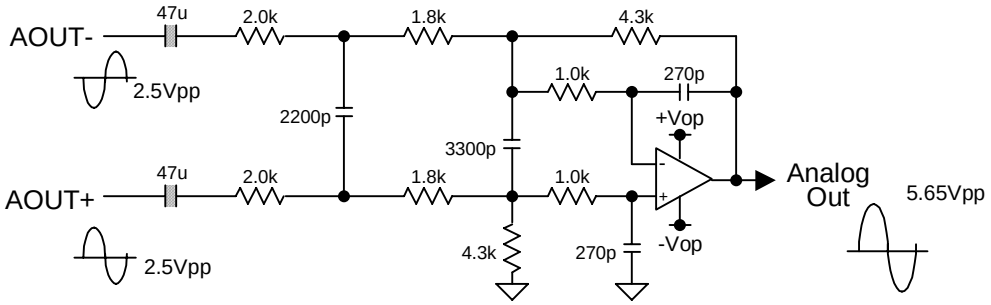


Figure 2. External 3rd order LPF Circuit Example

Frequency	Gain
20kHz	-0.05dBr
50kHz	-0.51dBr
100kHz	-16.8dBr

DC gain = 1.07dB

Table 1. 3rd order LPF (Figure 2) Response

■ Operation sequence

1) Set up the power supply lines.

[+15V]	(orange)	= +12 ~ +15V
[-15V]	(blue)	= -12 ~ -15V
[4383_5V]	(red)	= 4.75 ~ 5.25V
[AGND]	(black)	= 0V
[DGND]	(black)	= 0V

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

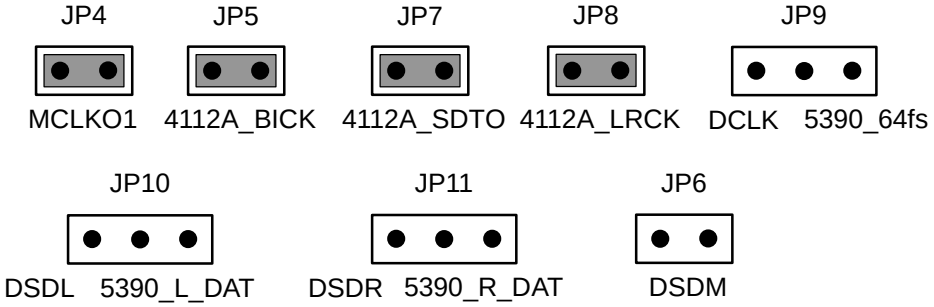
2) Set-up the evaluation modes, jumper pins and DIP switches (See the followings.)

3) Power on.
The AK4383 should be reset once bringing SW1(PDN) "L" upon power-up.

■ Evaluation mode

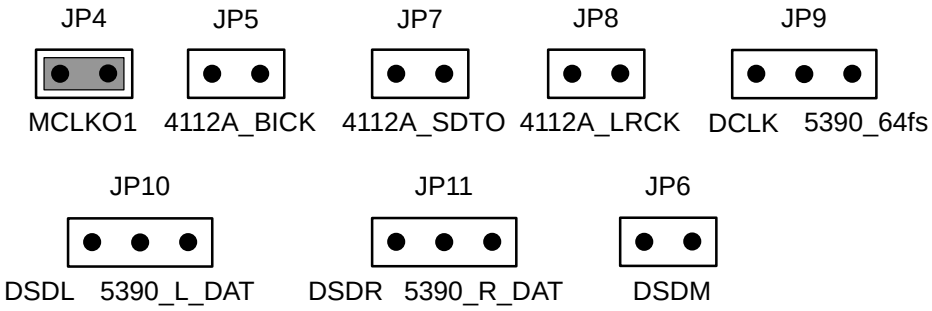
Applicable evaluation modes
PCM Mode
1) DIR (Optical Link or BNC) (default)
2) Using ROM data (AK43XX)
3) Feeding all signals from external(AK53XX)
DSD Mode
4) Feeding 1bit data to DCLK(#9), DSDL(#10), DSDR(#11) pins from AK5390
5) Feeding 1bit data to DCLK(#9), DSDL(#10), DSDR(#11) pins from external
6) Feeding 1bit data to DCLK(#2), DSDL(#3), DSDR(#4) pins

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".



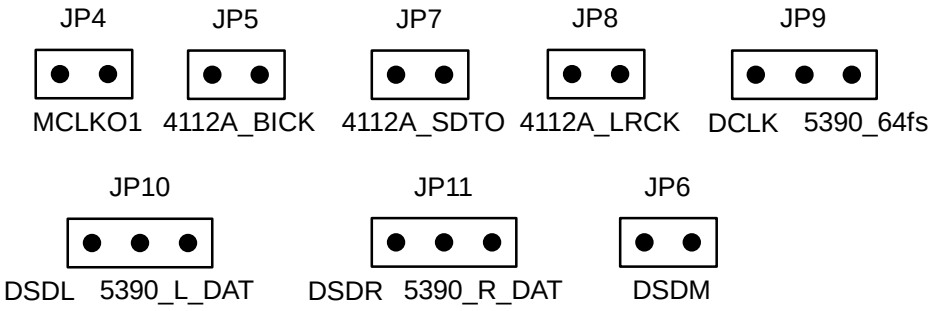
2) Ideal sine wave generated by ROM data

Connect the AKD43XX with PORT2(EXT). The AKD4383 sends MCLK to the AKD43XX which the AK4112B(DIR) generates from the received data through PORT1(TORX176: optical link) or J1(BNC). And the AKD4383 receives LRCK, BICK and SDATA from the AKD43XX. Using MCLK of the AK4112B.



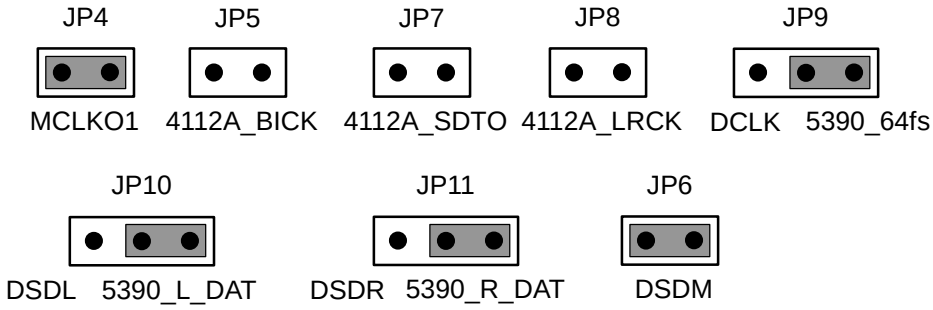
3) Feeding all signals and AKM's evaluation Board for ADC from external

Under the following set-up, AKM's evaluation Board for ADC or all external signals can be fed through POTR2(EXT).

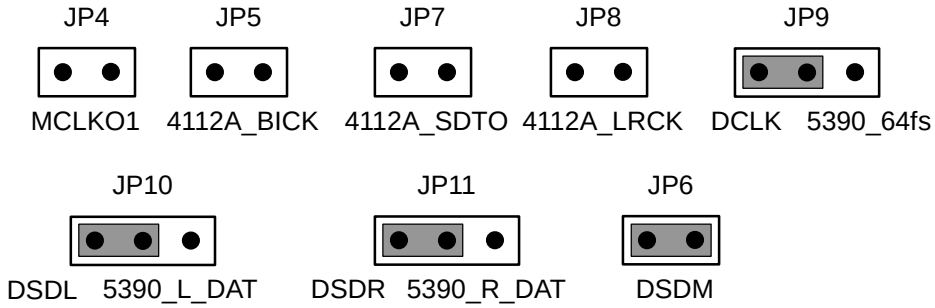


4) Feeding 1bit data to DCLK(pin#9), DSDL(pin#10), DSDR(pib#11) pins from AK5390

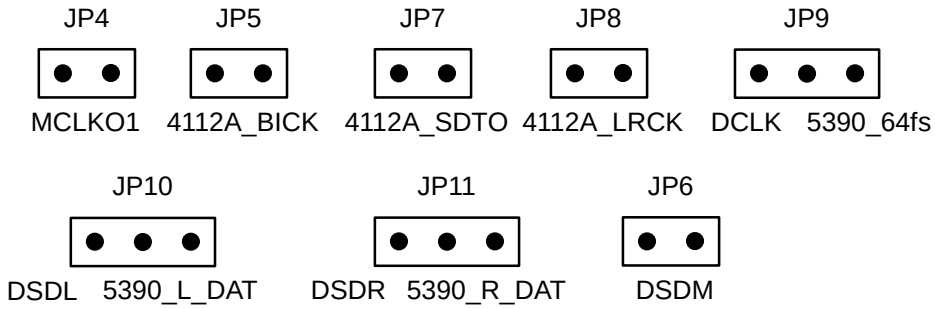
Feeding MCLK to AK4383 and AK5390 from AK4112B, feeding data to DCLK,DSDL,DSDR from AK5390



5) Feeding1bit data to DCLK(pin#9), DSDL(pin#10), DSDR(pin#11) pins from external
In case feeding MCLK,DCLK,DSDL,DSDR to AK4383 from external, feeding MCLK from PORT2(PCM_prot), feeding DCLK,DSDL,DSDR from PORT3(DSD_port)



6) Feeding 1bit data to DCLK(pin#2), DSDL(pin#3), DSDR(pin#4) pins from external
In case feeding MCLK,DCLK,DSDL,DSDR to AK4383 from external, feeding data from PORT2(PCM_port). Set register D/P bit 02H D4) "1".



■ DIP switch(S1) set up

S1 sets the mode of the AK4112B. Set-up is needed only for the evaluation mode 1,2 and 3. ON is "H" and OFF is "L".

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

Table 2. S1 set-up

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

Table 3. 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

Table 4. AK4112B MCLK frequency set-up

■ Jumpers set up

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

[JP2](GND): Digital GND of AK4383 and GND of AK4112B
Open: Digital GND of AK4383 and GND of AK4112B are disconnected.
Short: Digital GND of AK4383 and GND of AK4112B are connected. <default>

[JP3](REG): VDD of AK4383
CON: VDD is supplied from "4383_5V" jack.
REG: VDD is supplied from the regulator. <default>

[JP12](GND): Digital GND of AK4383 and analog GND of AK4383
Open: Digital GND of AK4383 and GND of AK4112B are disconnected.
Short: Digital GND of AK4383 and GND of AK4112B are connected. <default>

[JP13](GND): GND of AK5390 and Analog GND of AK4383
Open: GND of AK5390 and Analog GND of Ak4383 are disconnected.
Short: GND of AK5390 and Analog GND of Ak4383 are connected. <default>

[JP14](GND): GND of AK4112B and Analog GND of AK4383
Open: GND of AK4112B and Analog GND of Ak4383 are disconnected.
Short: GND of AK4112B and Analog GND of Ak4383 are connected. <default>

■ The function of the toggle SW

[SW1] (PDN): Resets the AK4383 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.
[LE5] (DZFL) : Zero detection
[LE6] (DZFR) : Zero detection.

■ Serial control

The AKD4383 can be controlled via the printer port (parallel port) of IBM-AT compatible PC. Connect PORT4(uP-I/F) with PC by 10-wire flat cable packed with the AKD4383.

Take care of the direction of connector. There is a mark at 1pin.
The pin layout of PORT4 is as Figure 3.

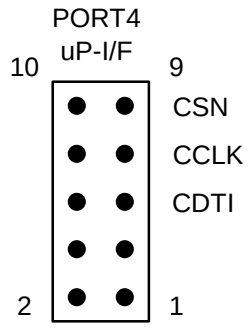


Figure 3. PORT4 pin layout

Control Software Manual

■ Set-up of evaluation board and control software

1. Set up the AKD4383 according to previous term.

2. Connect IBM-AT compatible PC with AKD4383 by 10-line type flat cable (packed with AKD4383). 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 "AKD4383 Evaluation Kit" into the CD-ROM drive.

4. Access the CD-ROM drive and double-click the icon of "AKD4383.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 AK4383.
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 AK4383, 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 AK4383, 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 AK4383 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 AK4383, 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 AK4383. 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".

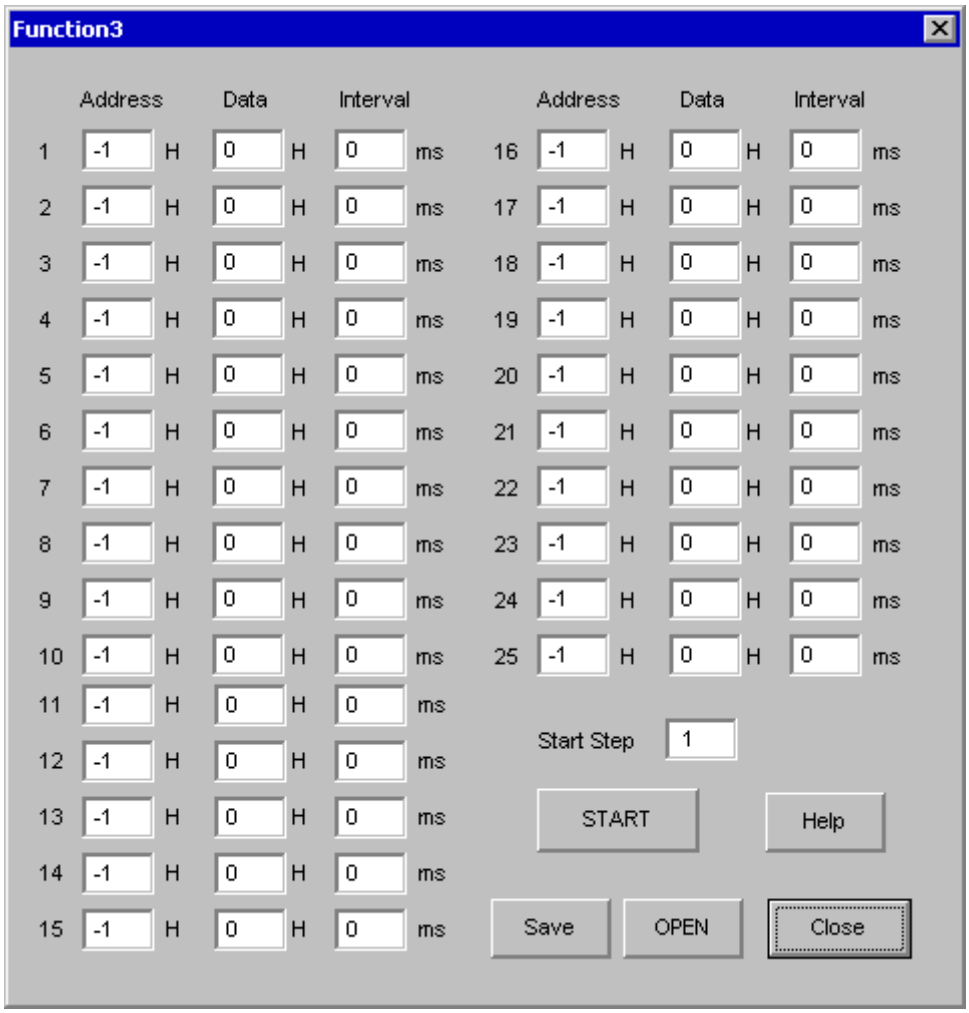


Figure 1. Window of [F3]

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 2 opens.

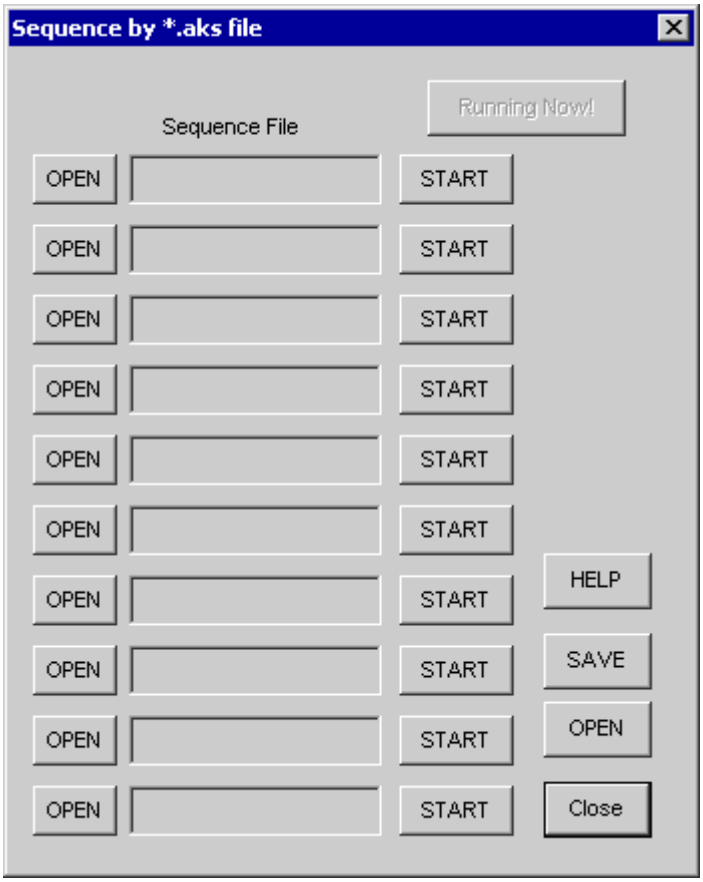


Figure 2. [F4] window

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 3.

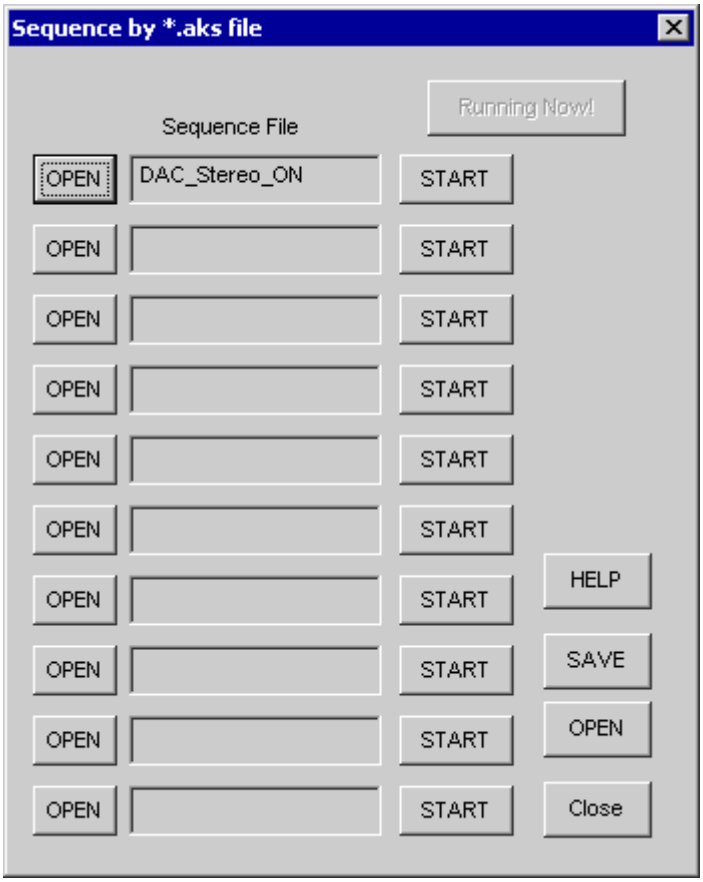


Figure 3. [F4] window(2)

(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) This function 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 4opens.

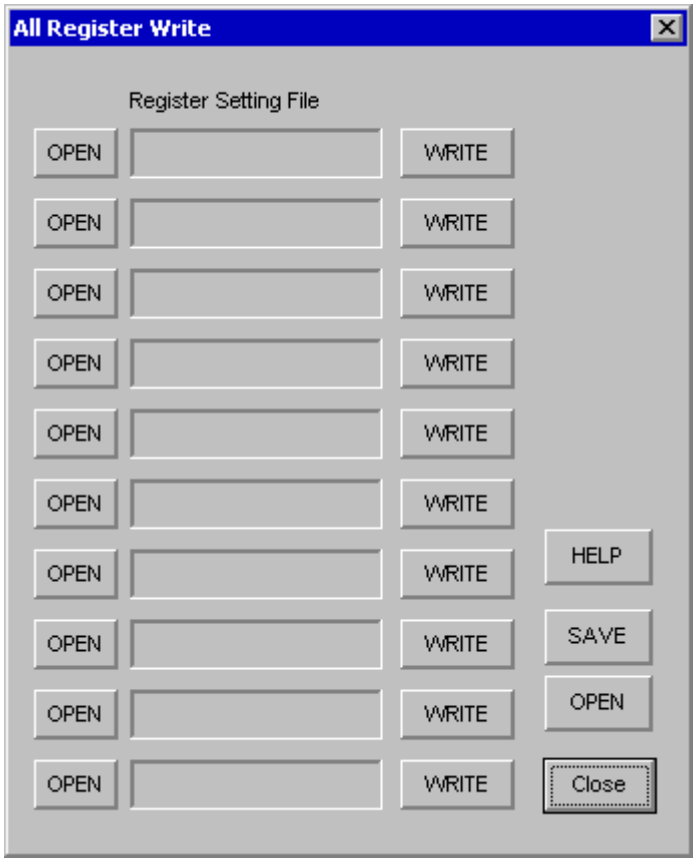


Figure 4. [F5] window

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 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 : 20Hz~20kHz(fs=44.1kHz),40Hz~40kHz(fs=96kHz,192kHz)
- Bit : 24bit
- Power Supply : VDD=5V
- Interface : AKD4394 Rev.B(Double wire)
- Temperature : Room
- Board : AKD4383 Rev.B
- DIR : AK4112B(44.1kHz,96kHz),
  CS8414(192kHz, an interface with AKD4393 Rev.B)

PCM mode

fs=44.1kHz DIR AK4112B

Parameter	Input signal	Measurement filter	Lch	Rch
S/(N+D)	1kHz, 0dB	20kLPF	92.3dB	91.4dB
DR	1kHz, -60dB	22kLPF, A-weighted	110.3dB	110.4dB
S/N	-240dB	22kLPF, A-weighted	110.8dB	110.0dB
S/N(X'tal)	-240dB	22kLPF, A-weighted	111.9dB	112.0dB

fs=96kHz

Parameter	Input signal	Measurement filter	Lch	Rch
S/(N+D)	1kHz, -0dB	40kLPF	91.0dB	90.2dB
DR	1kHz, -60dB	40kLPF	104.0dB	104.0dB
		22kLPF, A-weighted	111.3dB	110.4dB
S/N	-240dB	40kLPF	104.3dB	104.2dB
		22kLPF, A-weighted	111.8dB	111.8dB

fs=192kHz

Parameter	Input signal	Measurement filter	Lch	Rch
S/(N+D)	1kHz, -0dB	40kLPF	90.3dB	89.6dB
DR	1kHz, -60dB	40kLPF	103.9dB	103.7dB
		22kLPF, A-weighted	111.4dB	110.0dB
S/N	-240dB	40kLPF	104.0dB	103.1dB
		22kLPF, A-weighted	110.2dB	109.4dB

DSD mode

fs=44.1kHz(Input 9pin-11pin DSDM="H")

Parameter	Input signal	Measurement filter	Lch	Rch
S/(N+D)	1kHz, -0dB	20kLPF	95.6dB	94.8dB
DR	1kHz, -60dB	20kAES, A-weighted	108.7dB	108.4dB
S/N	"0"	22kLPF, A-weighted	112.0dB	111.9dB

■ Plot

[Measurement condition]

- Measurement unit : Audio Precision, System two, Cascade (fs=44.1kHz, 96kHz),
- MCLK : 512fs(44.1kHz),256fs(96kHz),128fs(192kHz)
- BICK : 64fs
- fs : 44.1kHz, 96kHz, 192kHz
- BW : 20Hz~20kHz(fs=44.1kHz),40Hz~40kHz(fs=96kHz,192kHz)
- Bit : 24bit
- Power Supply : VDD=5V
- Interface : DIR (fs=44.1kHz, 96kHz), AKD4394 Rev.B(Double wire) (fs=192kHz)
- temperature : room

1 PCM mode

fs=44.1kHz

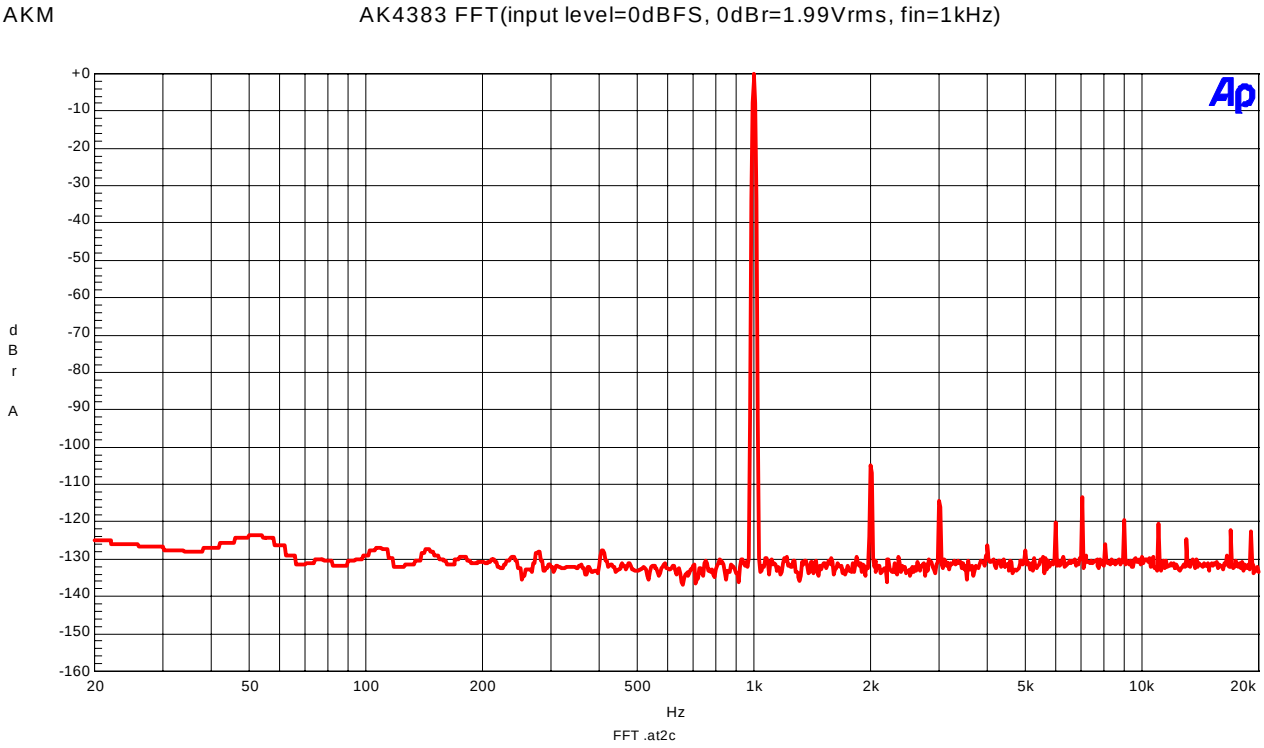


Figure 4.FFT (Input Level=0dBFS)

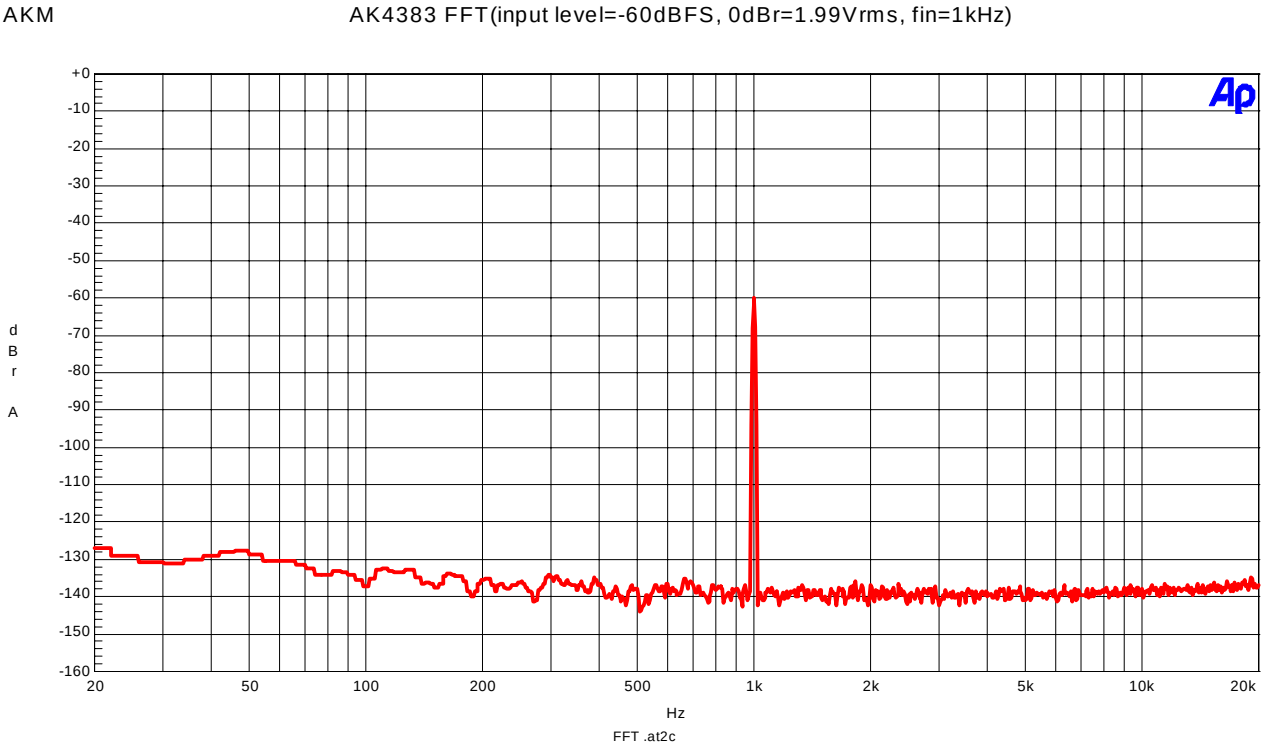


Figure 5.FFT (Input Level=-60dBFS)

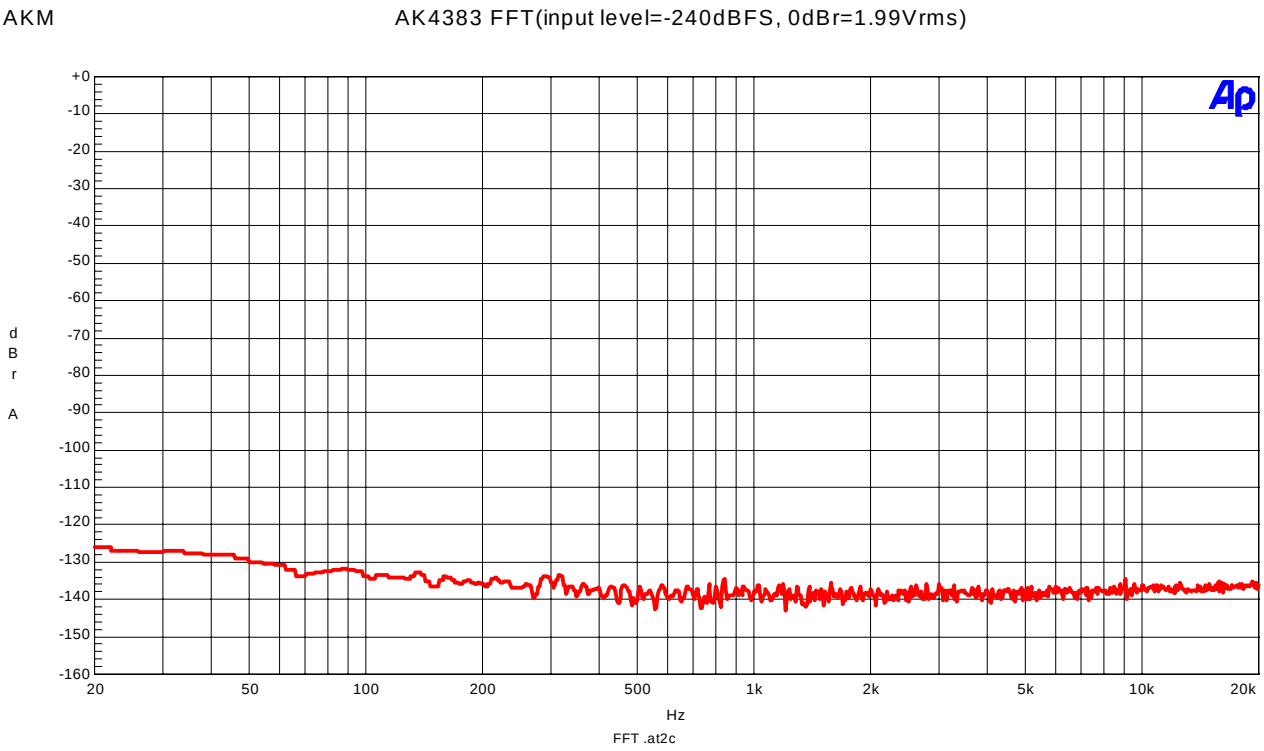


Figure 6. FFT FFT (noise floor)

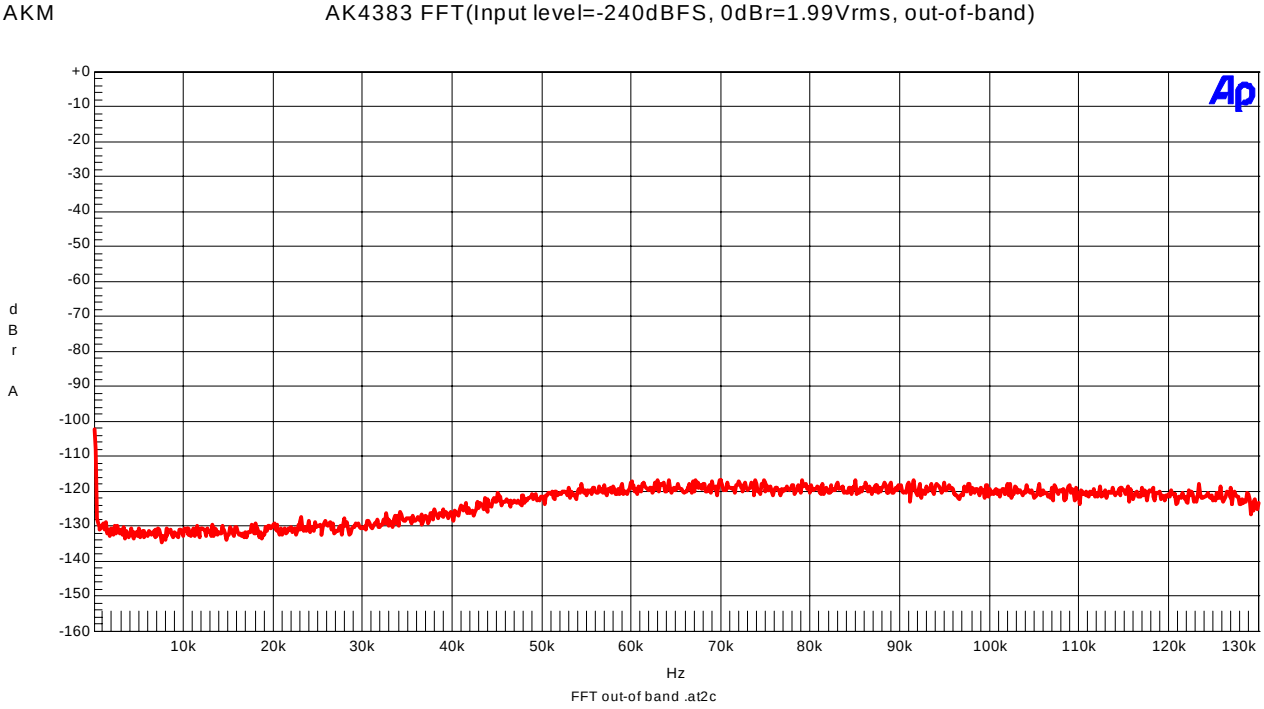


Figure 7. FFT (out-of-band noise)

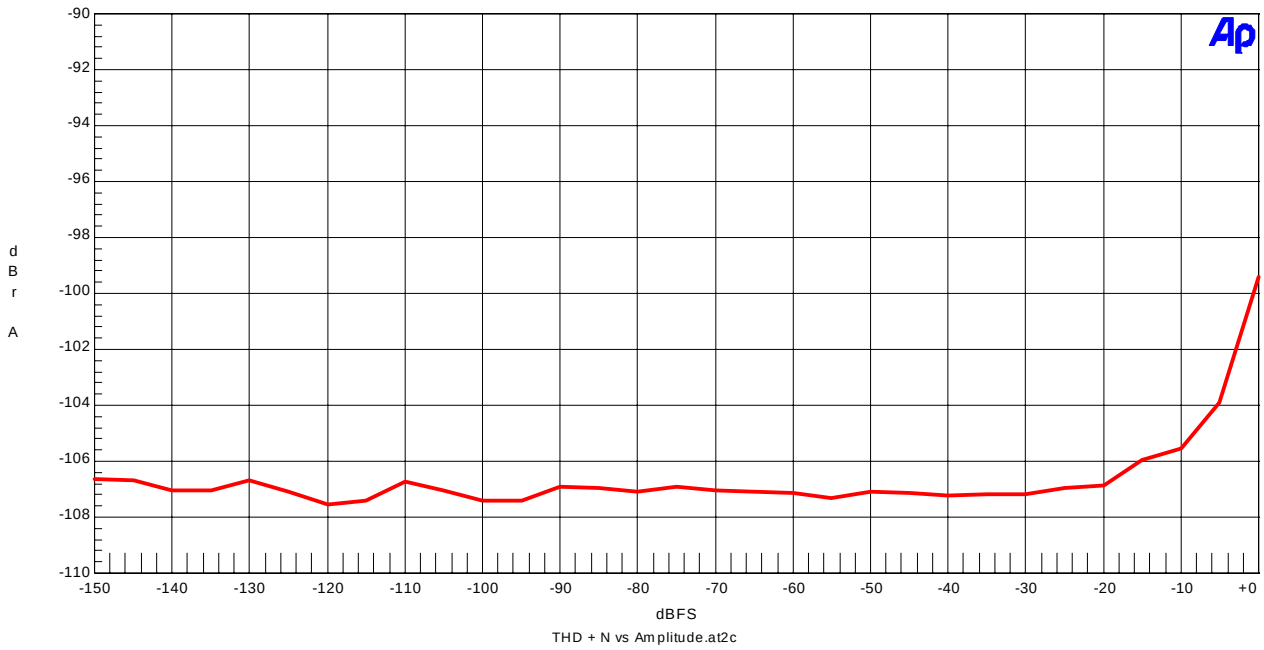


Figure 8. THD + N vs Input Level(fin=1kHz)

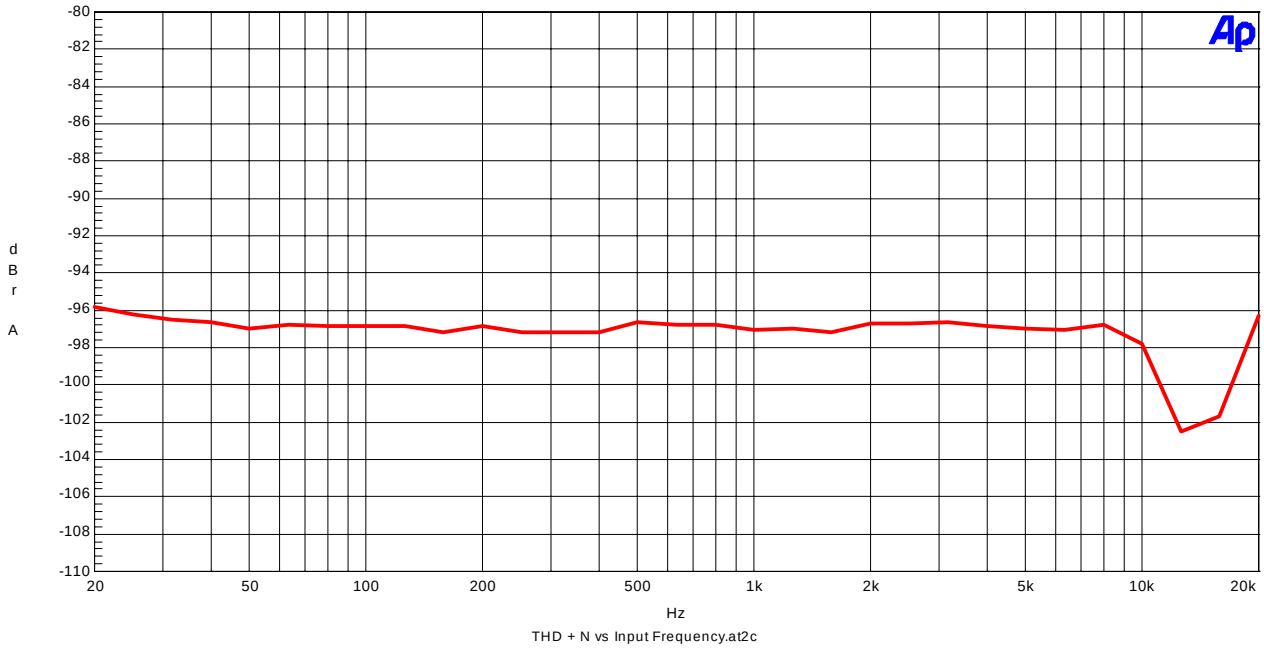


Figure 9. THD + N vs Input Frequency

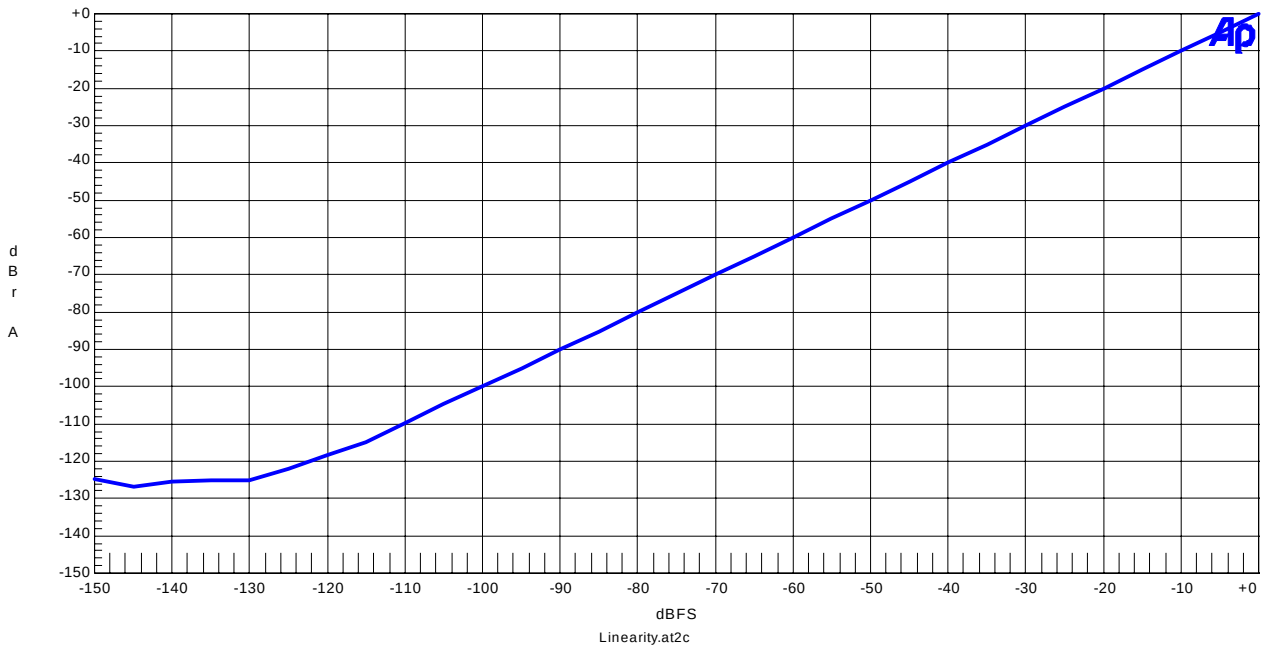


Figure 10. Linearity

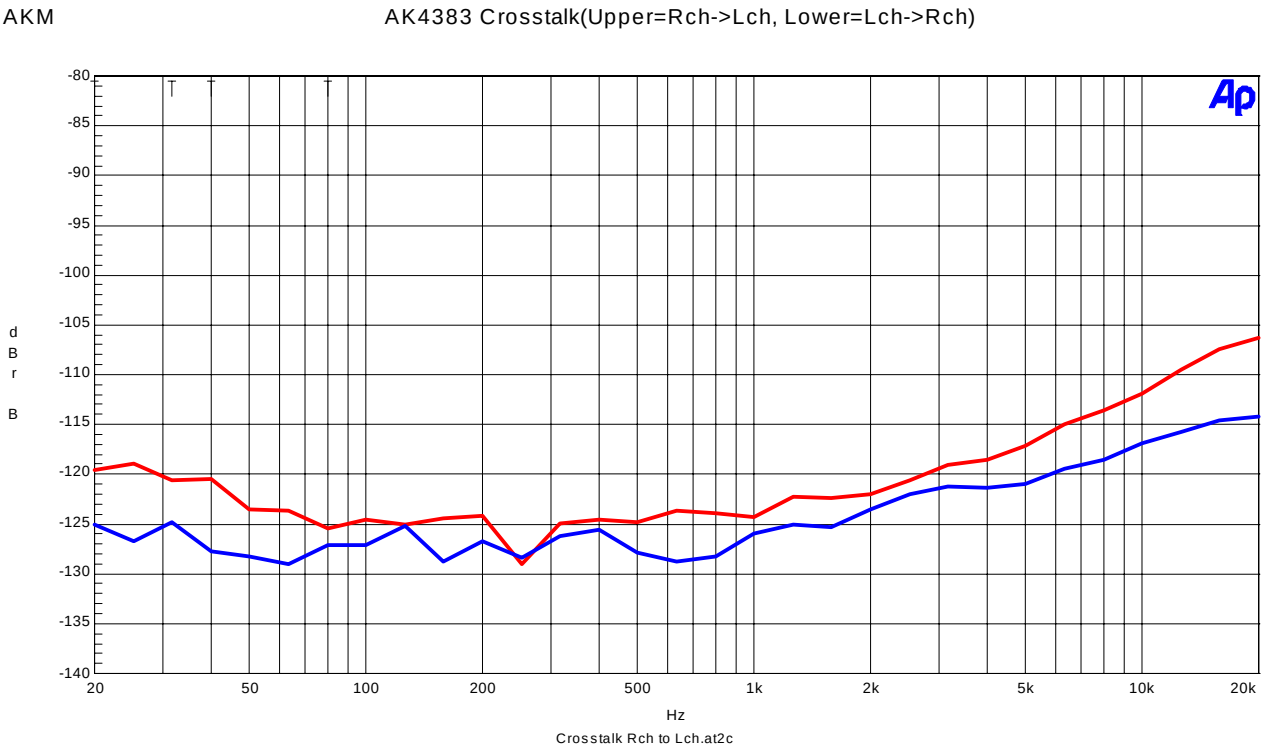


Figure 11. Crosstalk

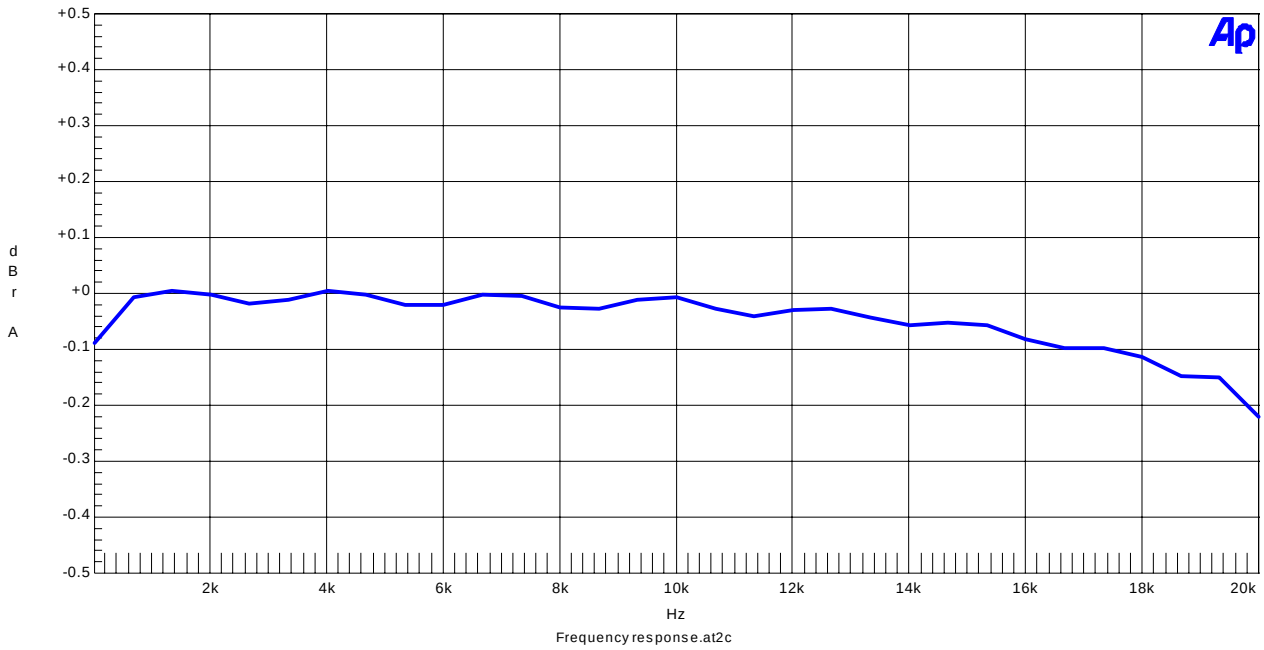


Figure 12. Frequency Response (Lin)

(20kHz External LPF –0.05dB + Internal Filter -0.2dB = -0.25dB)

fs=96kHz

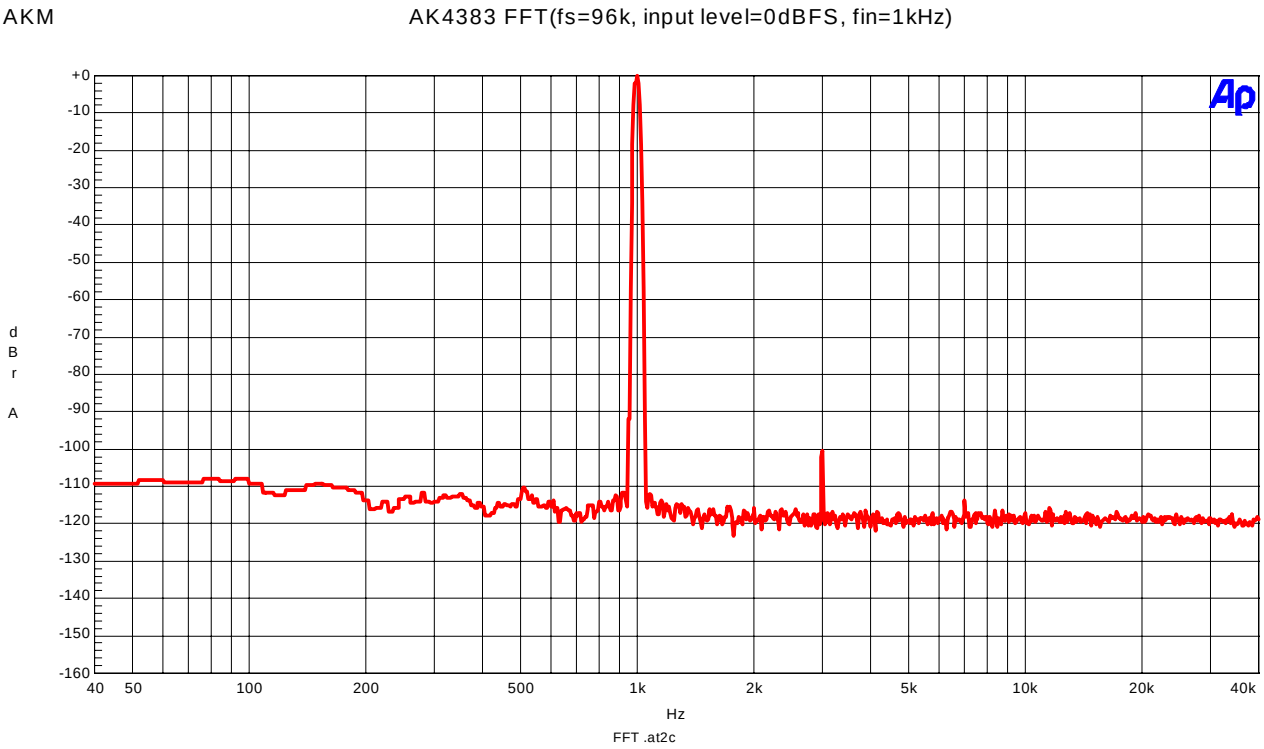


Figure 13. FFT (Input Level=0dBFS)

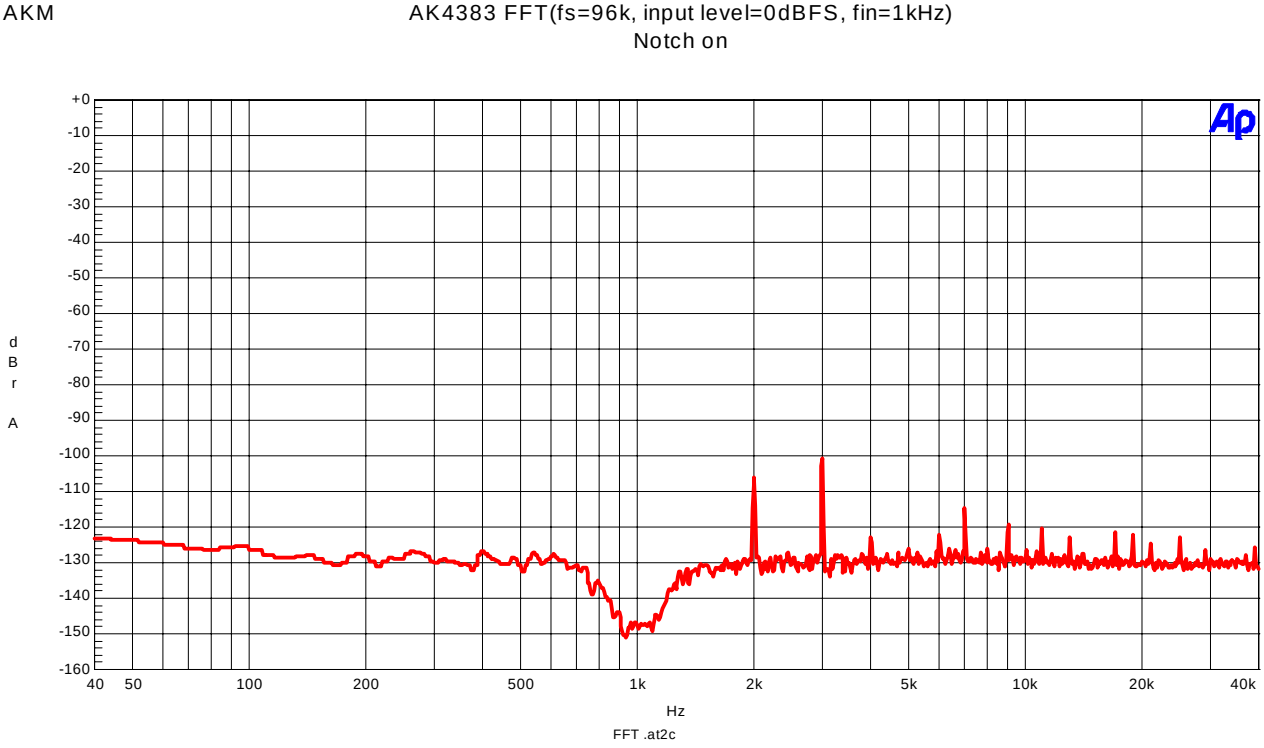


Figure 14. FFT (Input Level=0dBFS, notch=ON)

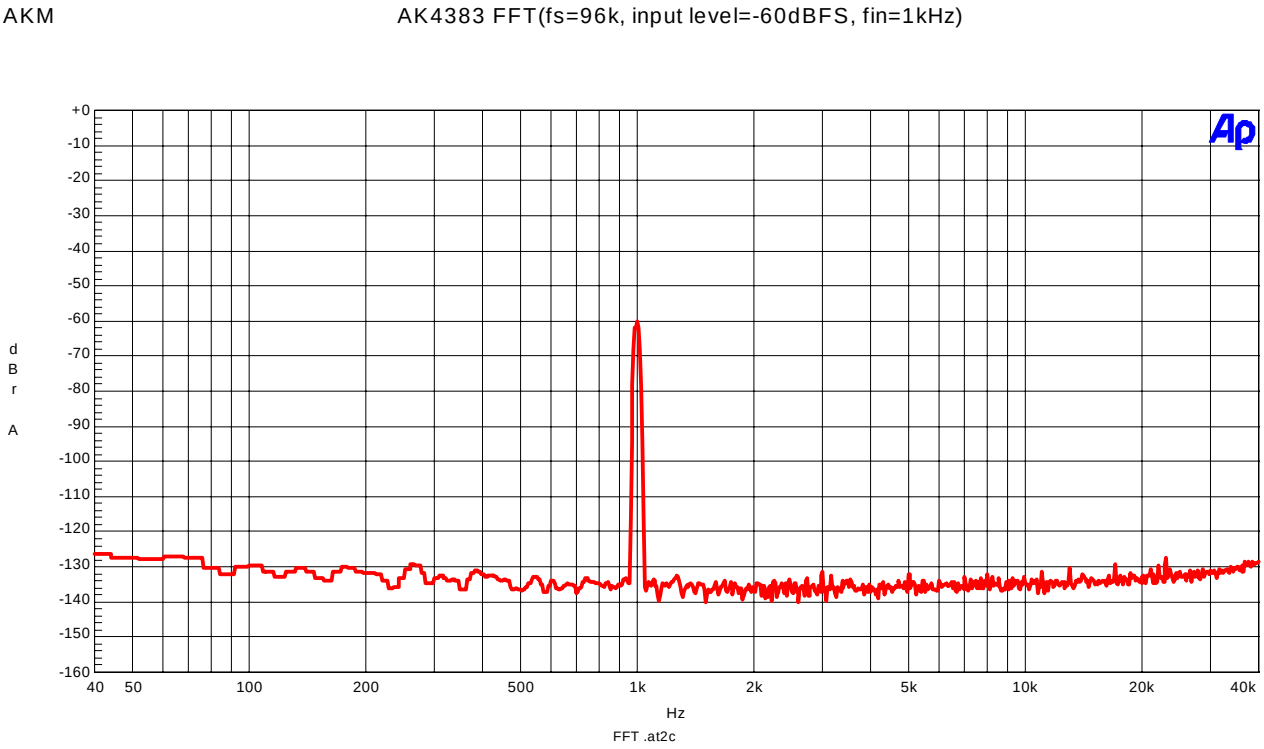


Figure 15. FFT (Input Level=-60dBFS)

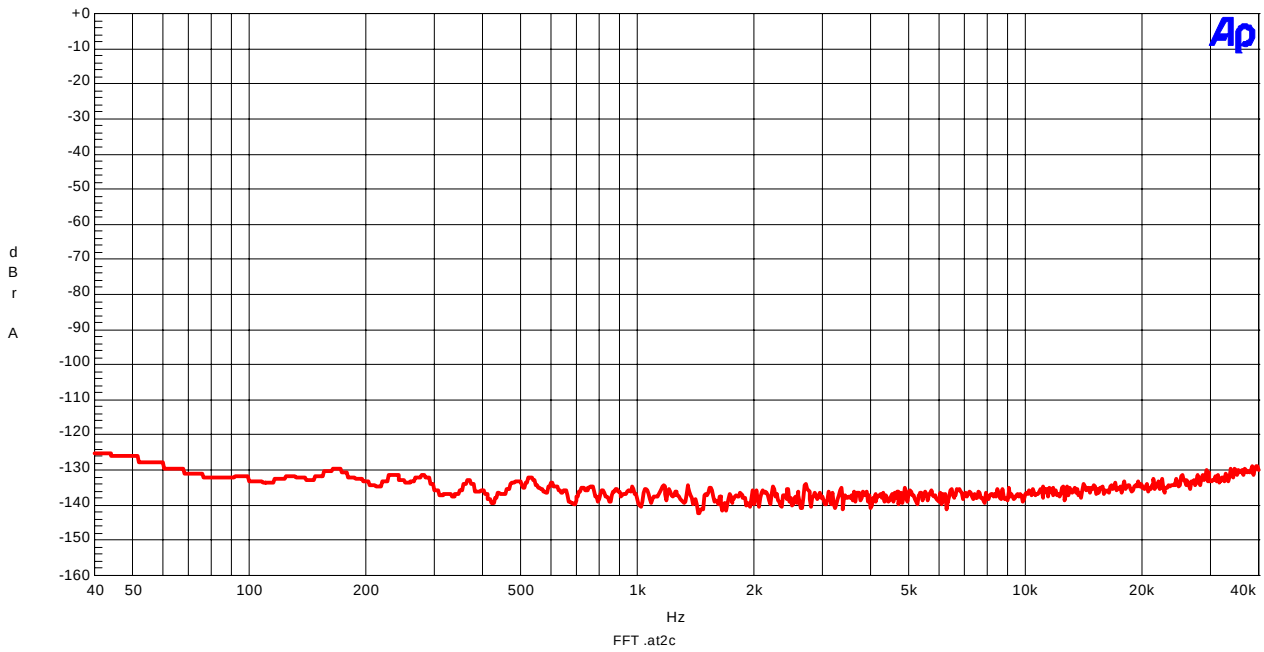


Figure 16. FFT (noise floor)

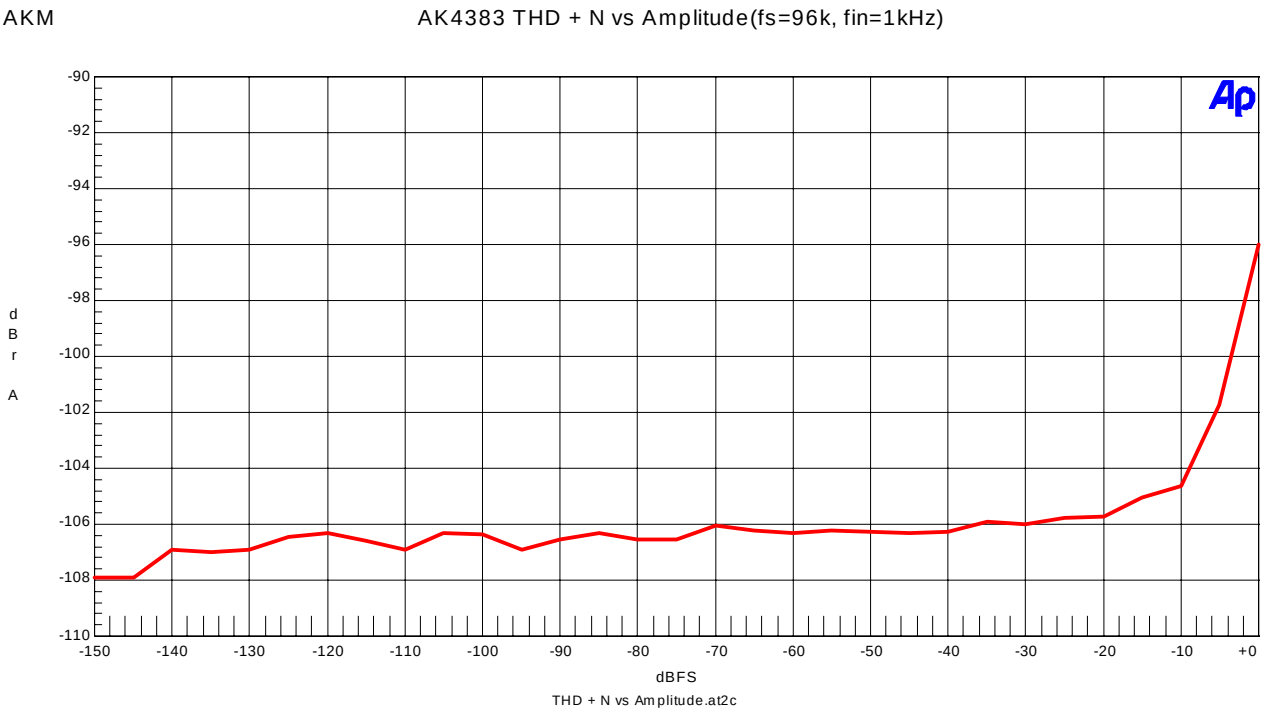


Figure 17. THD + N vs Input Level(fin=1kHz)

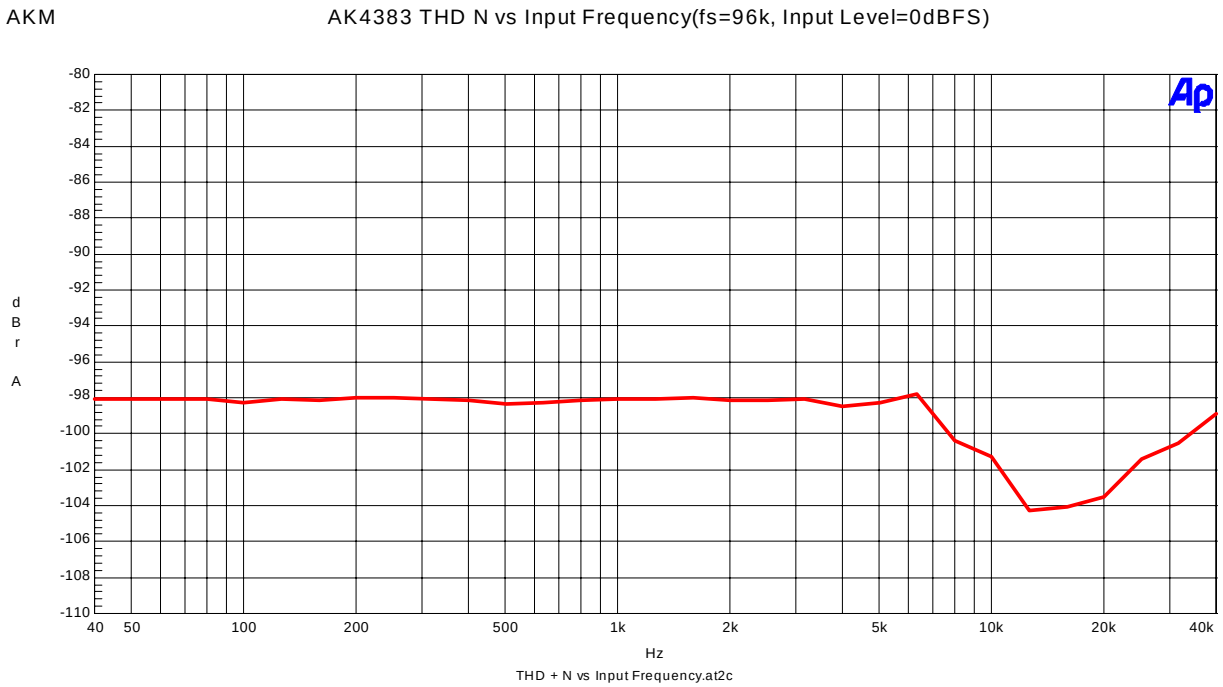


Figure 18. THD + N vs Input Frequency

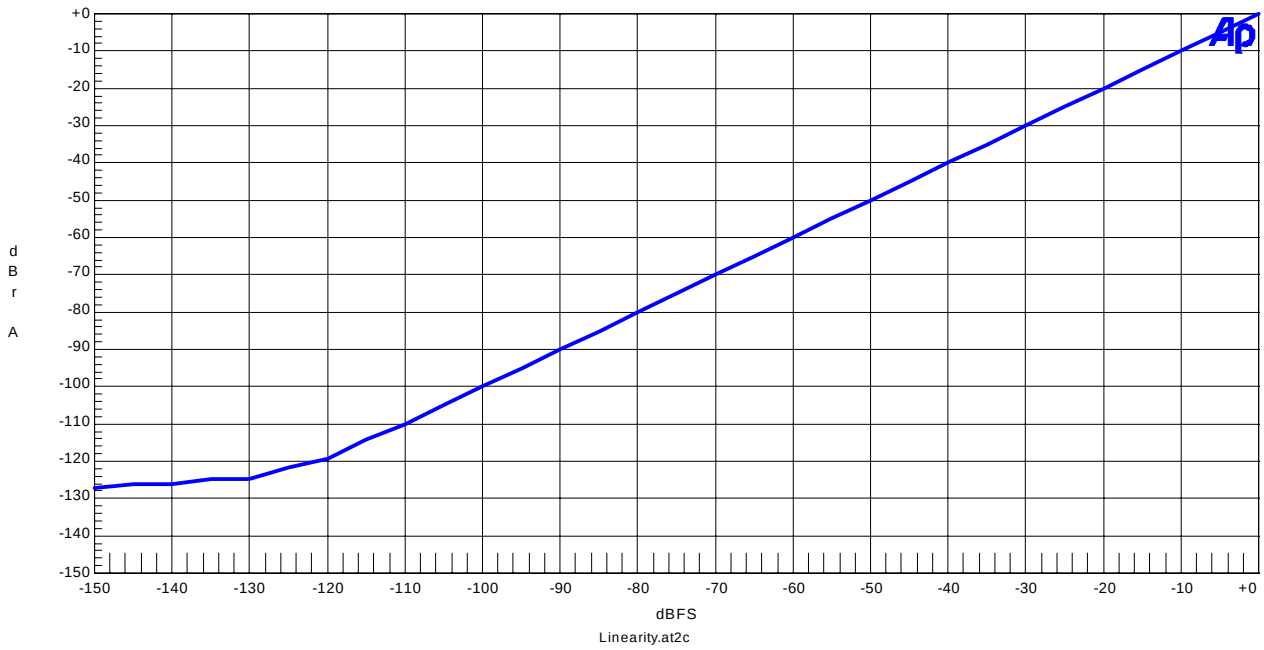


Figure 19. Linearity

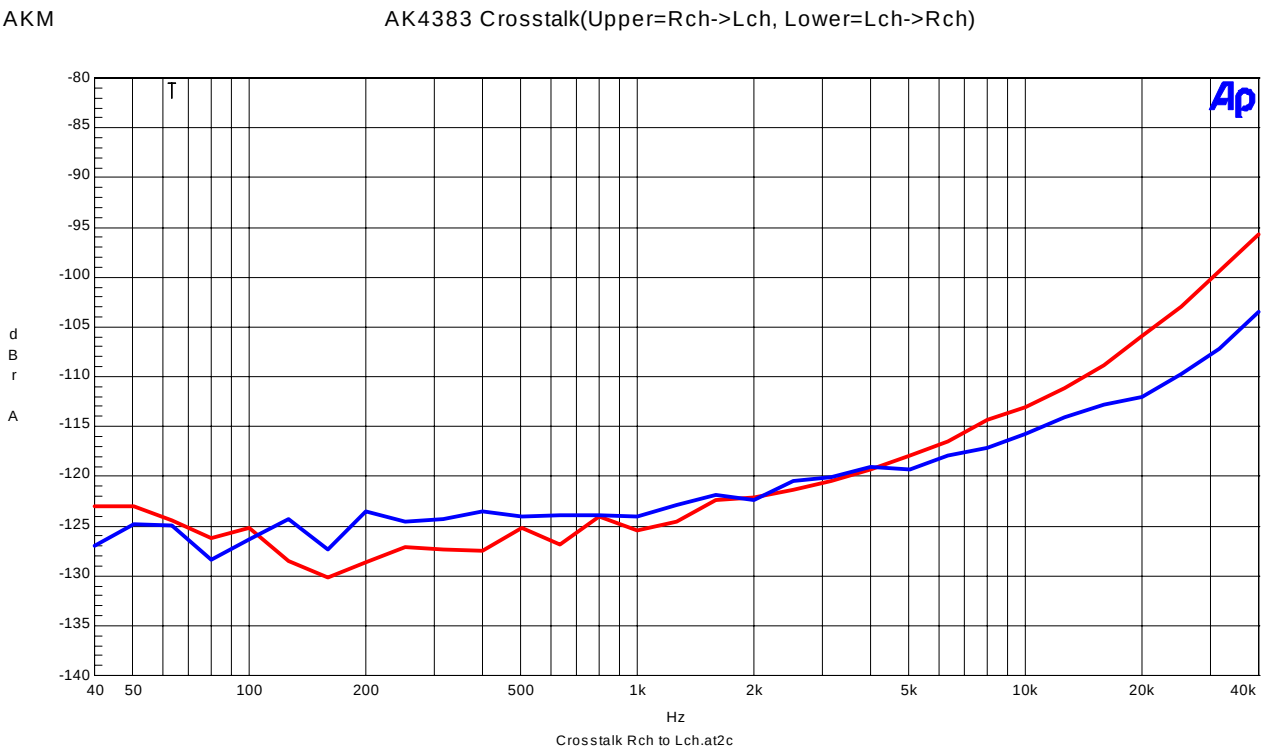


Figure 20. Crosstalk

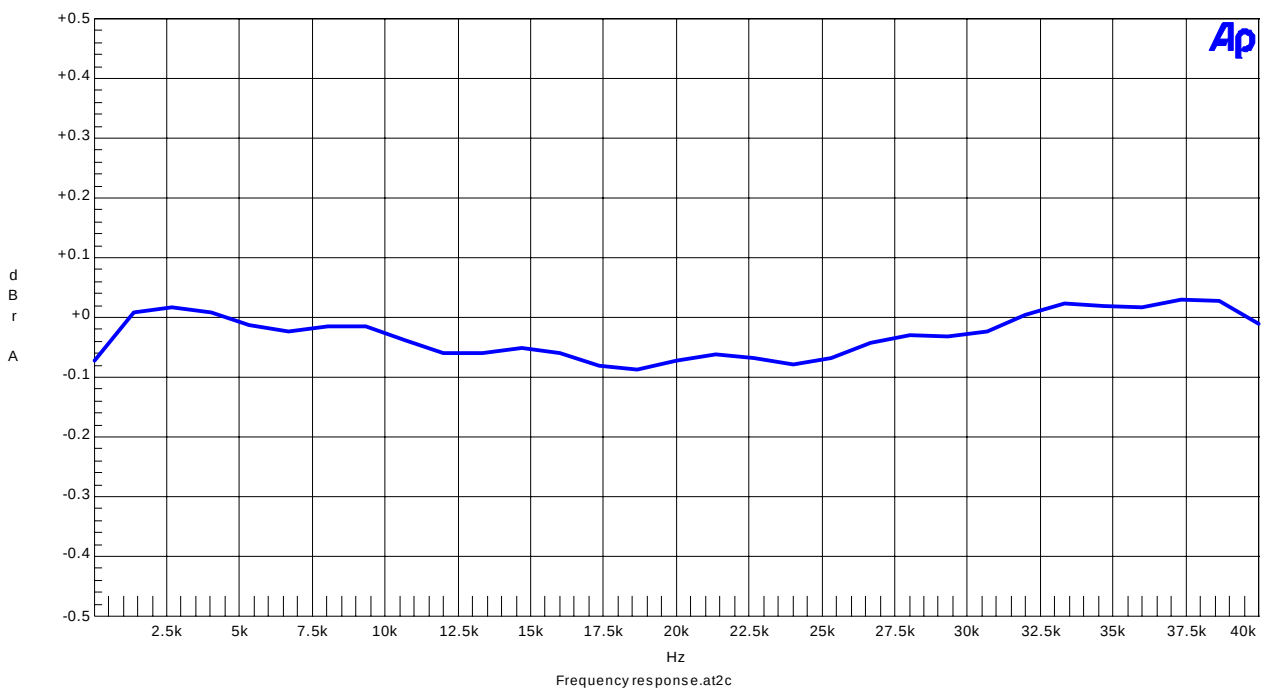


Figure 21. Frequency Response

fs=192kHz

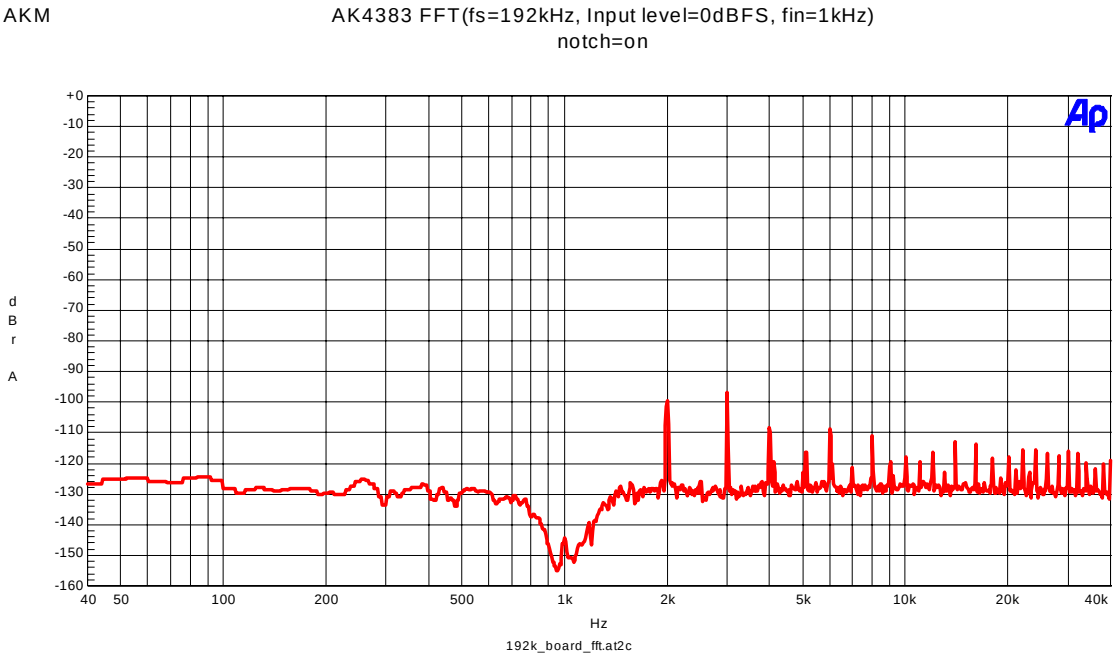


Figure 22. FFT (Input Level=0dBFS, notch=ON)

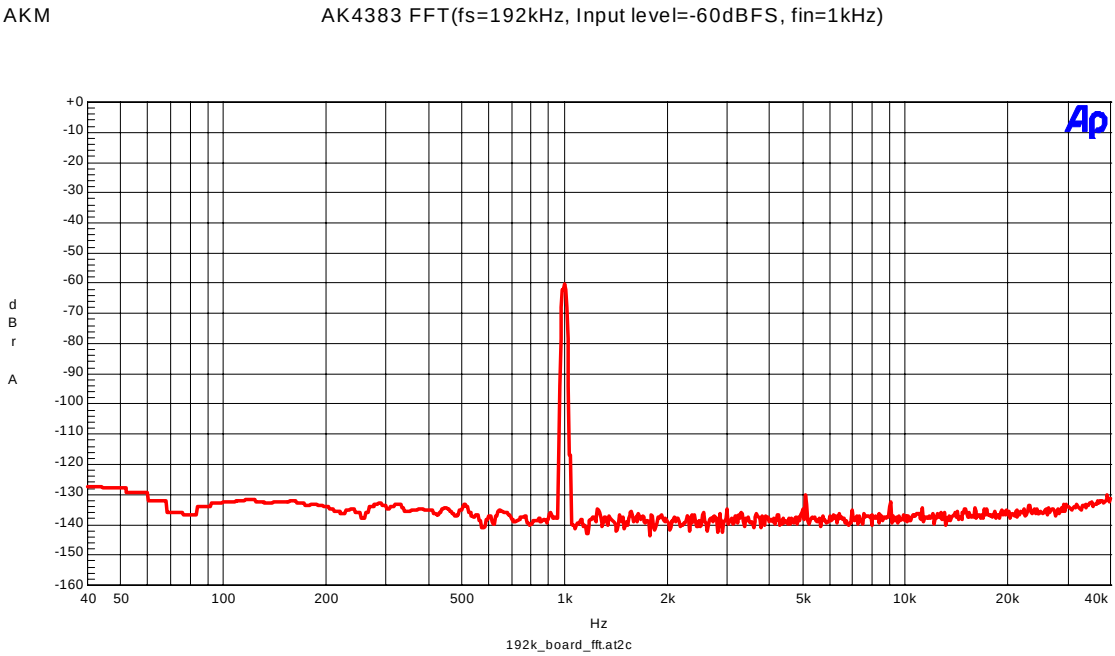


Figure 23. FFT (Input Level=-60dBFS)

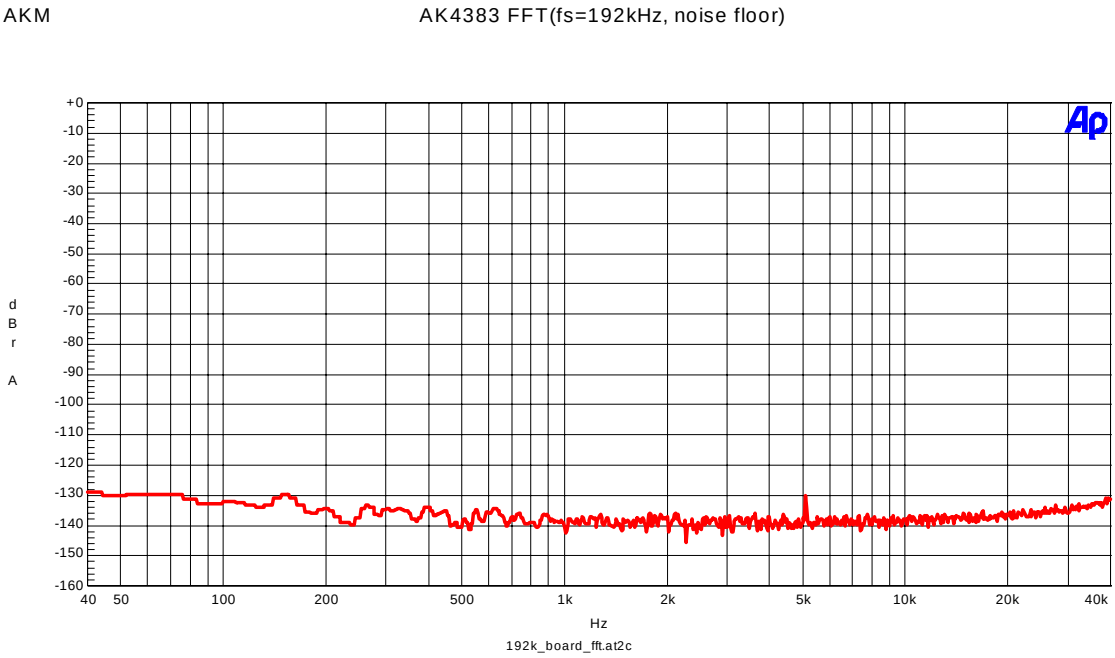


Figure 24. FFT (noise floor)

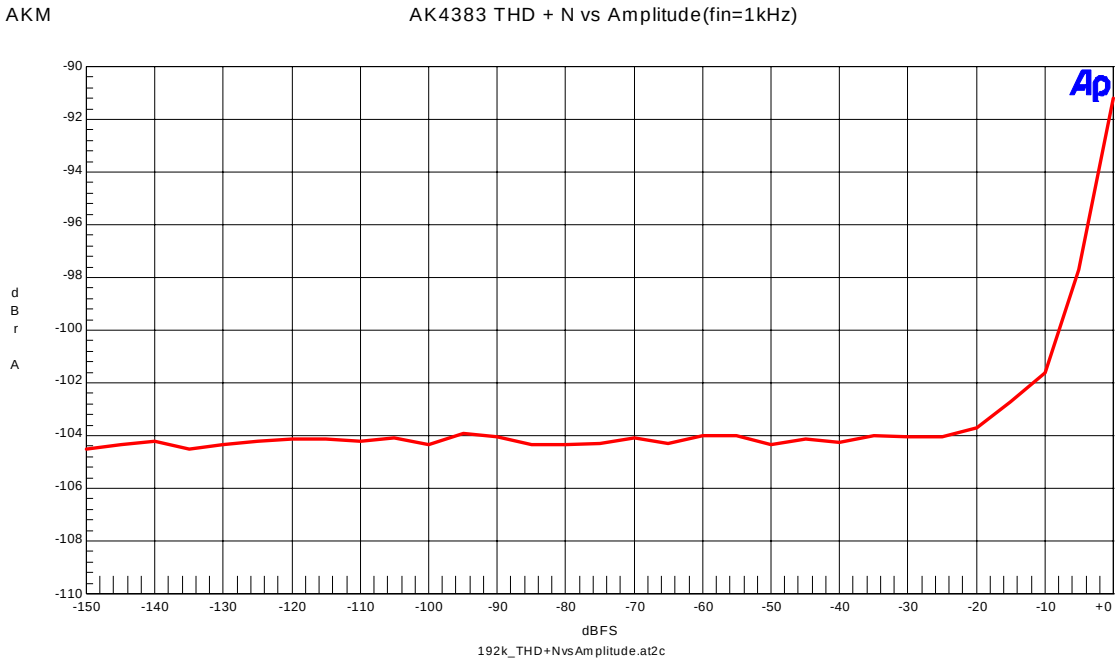


Figure 25. THD + N vs Input Level(fin=1kHz)

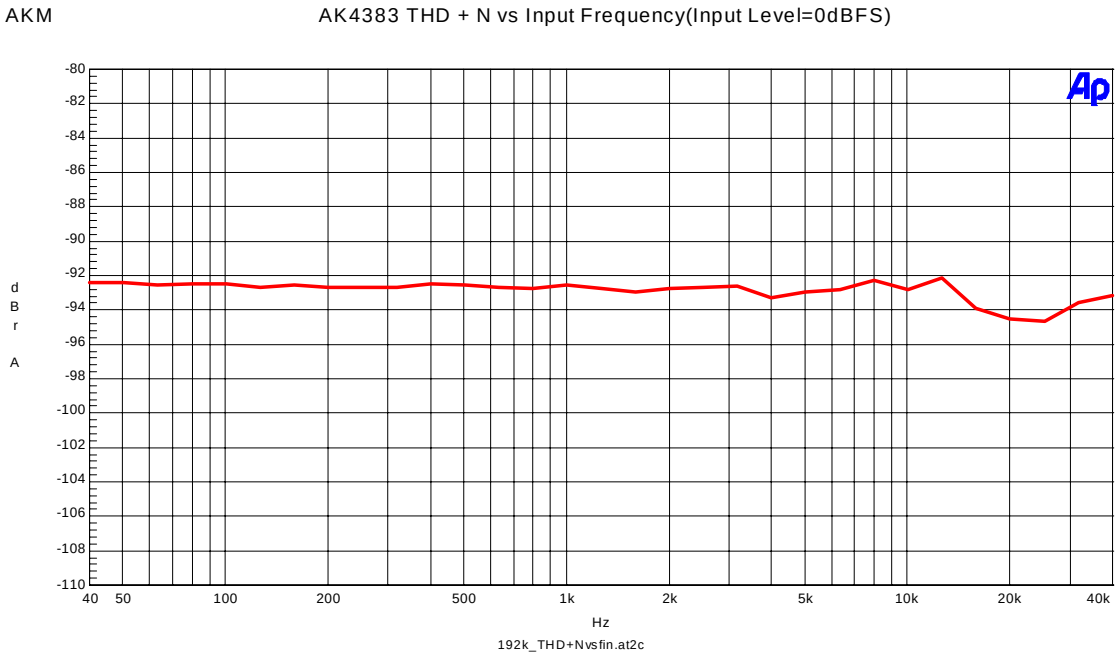


Figure 26. THD + N vs Input Frequency

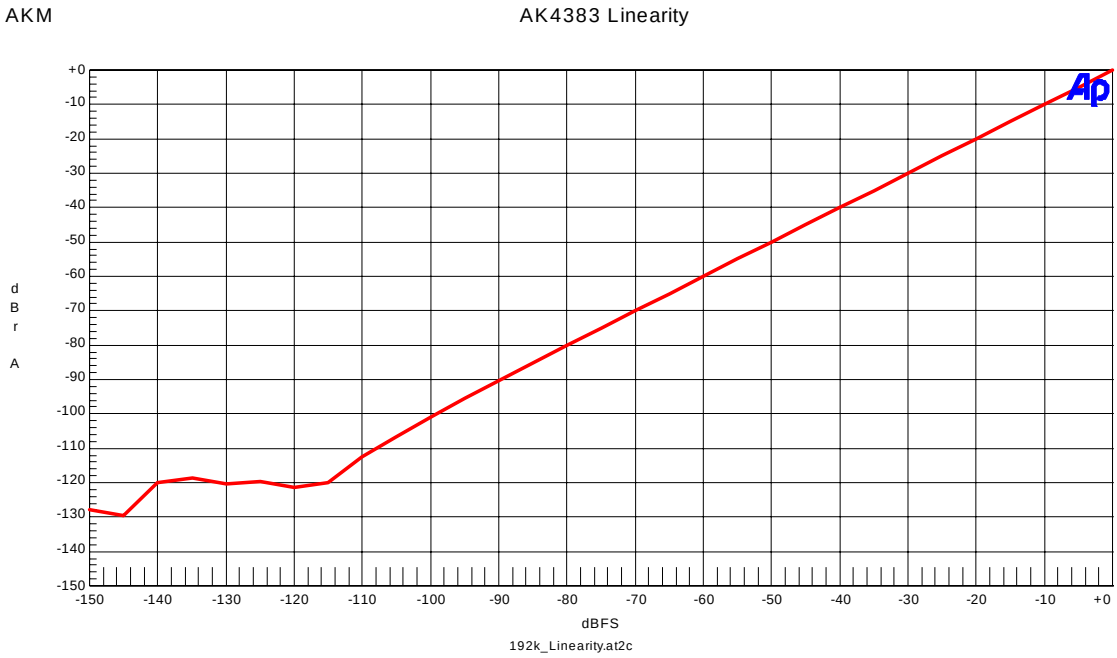


Figure 27. Linearity

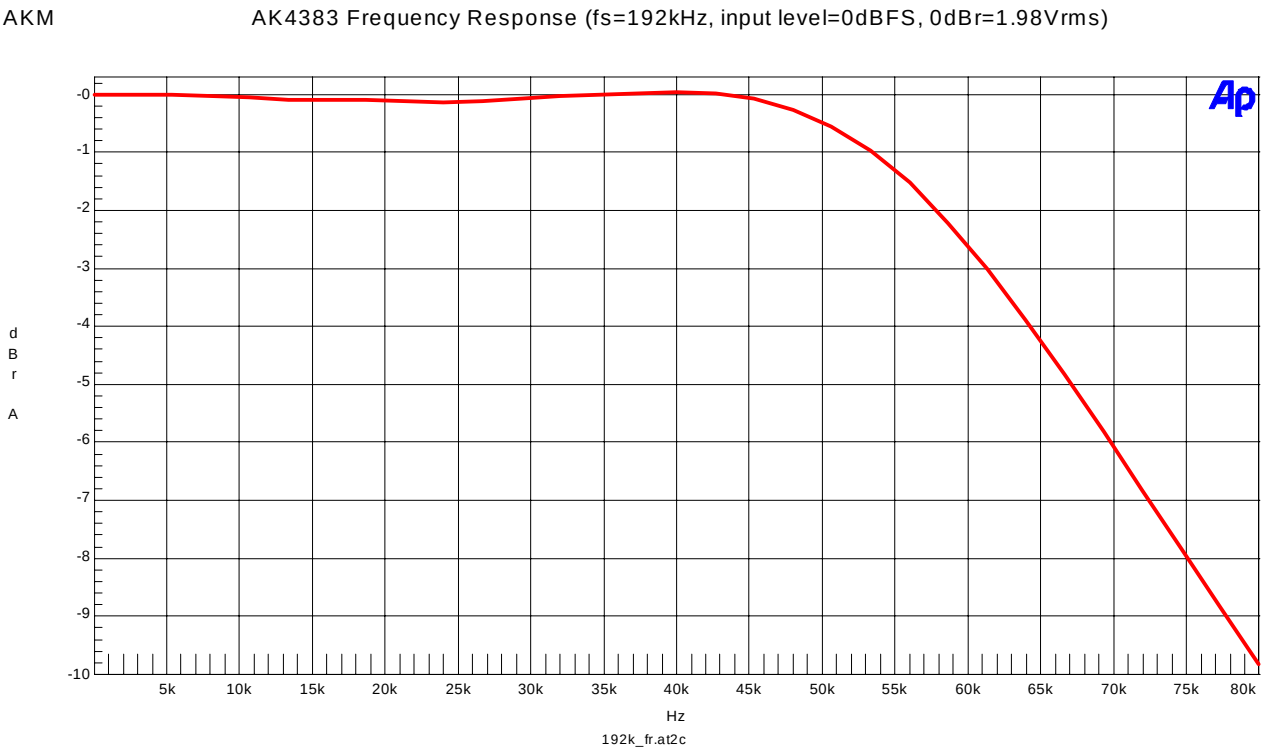


Figure 28.Frequency Response(Lin)

2 DSD mode
4383
AKM AK4383 FFT(input level=7.699Vpp(AK5390), fin=1kHz)

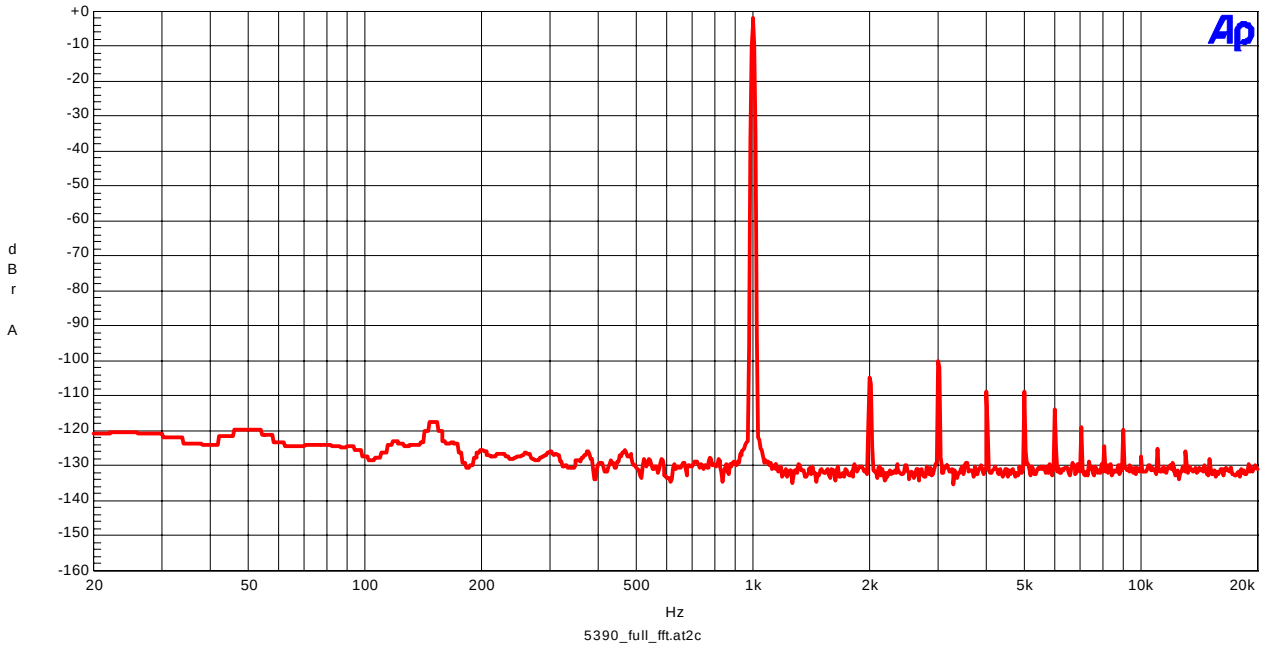


Figure 29. FFT (Input Level=0dBFS)

AKM AK4383 FFT(input level=7.699mVpp(AK5390), fin=1kHz)

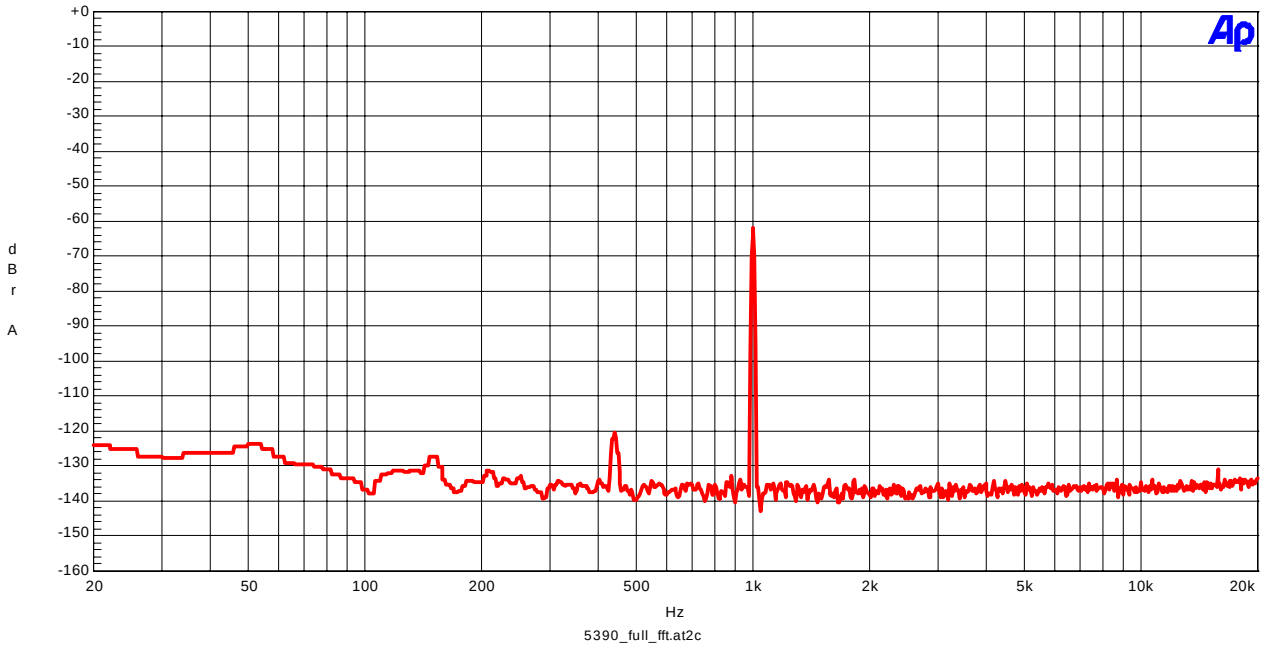


Figure30. FFT (Input Level=-60dBFS)

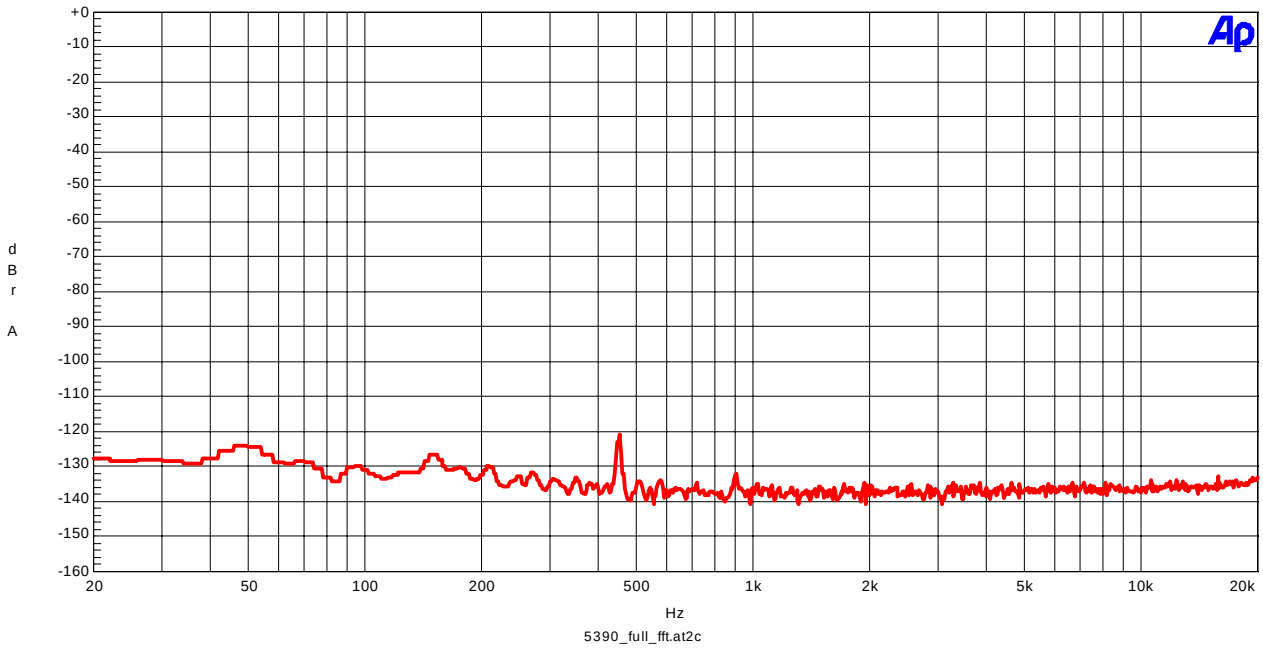
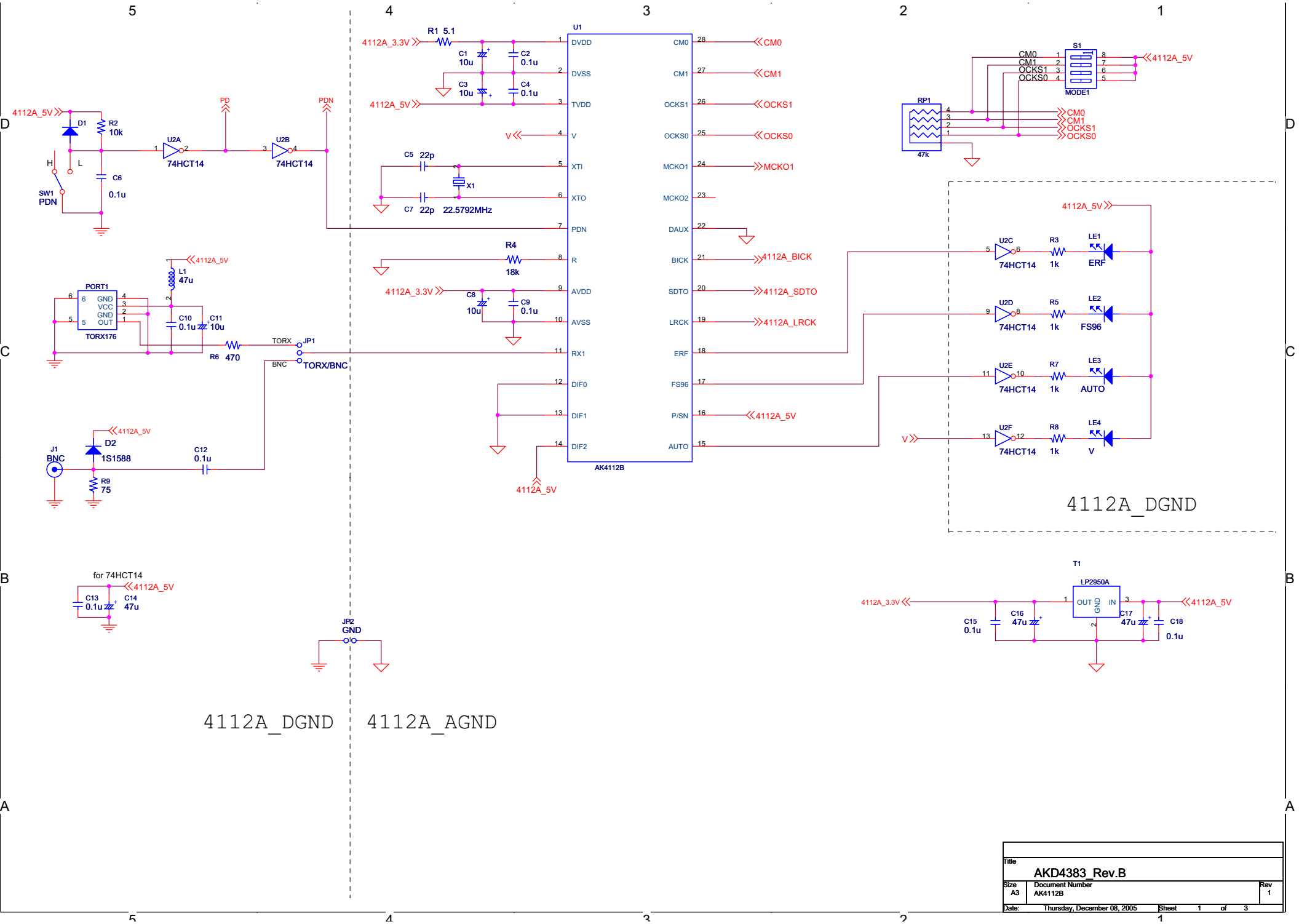


Figure 31. FFT (noise floor)

Revision History

Date (YY/MM/DD)	Manual Revision	Board Revision	Reason	Contents
05/12/08	KM064104	B	Change Description	P7-13: Change Control Software Manual
			Correct error	P1, 3-6, 14 Circuit diagram 2 of 3: AK4112A → AK4112B P6: Open:VDD is supplied from "4383_5V" jack. → CON: VDD is supplied from "4383_5V" jack. Short:VDD is supplied from the regulator. <default> → REG: VDD is supplied from the regulator. <default> Figure 3. PORT3 pin layout →Figure 3. PORT4 pin layout P8: Interval Box:Data is written to AK4642 by this interval. →Interval Box:Data is written to AK4383 by this interval.
			Add Description	P14: CS8414(192kHz, an interface with AKD4393 Rev.B)



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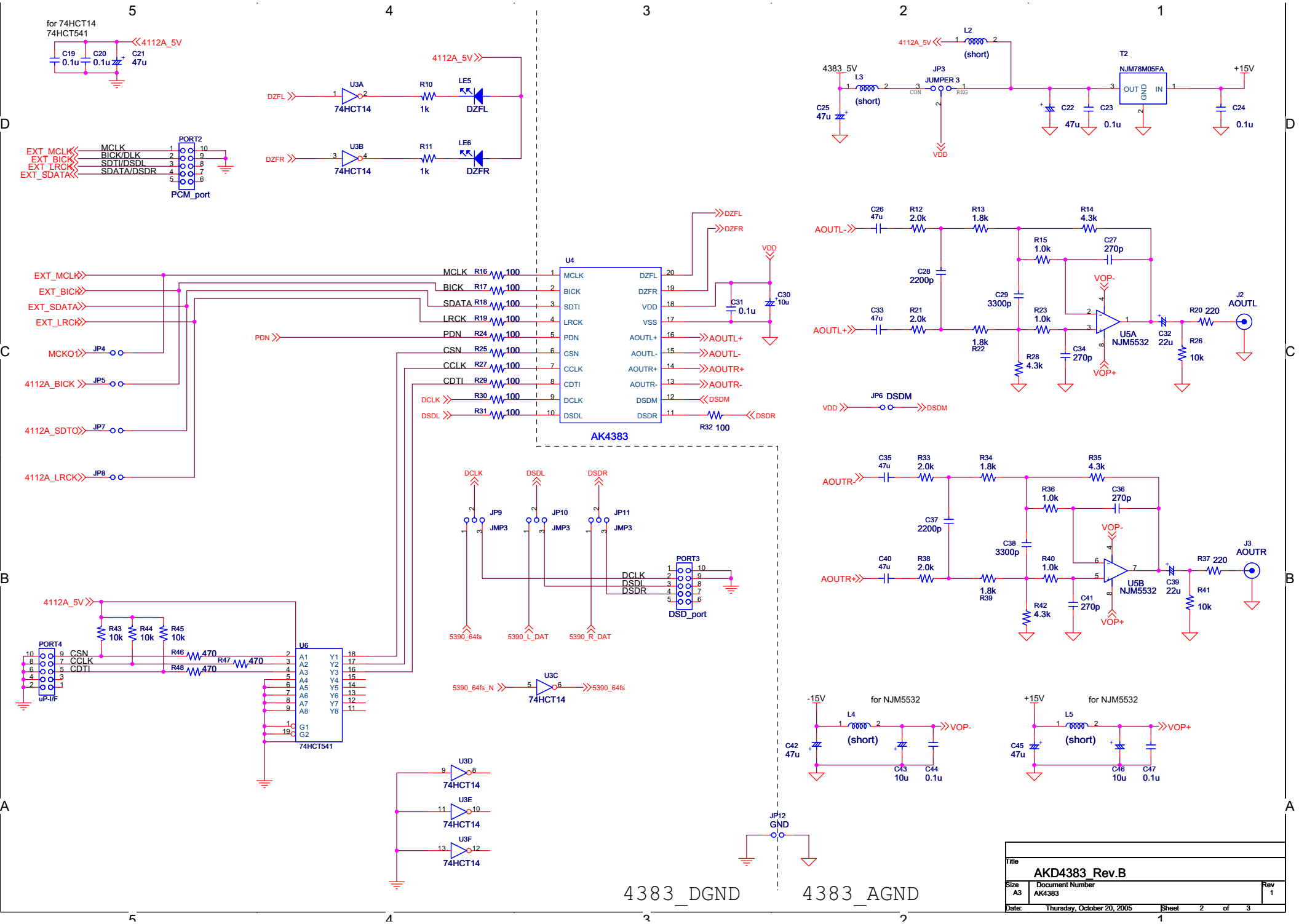
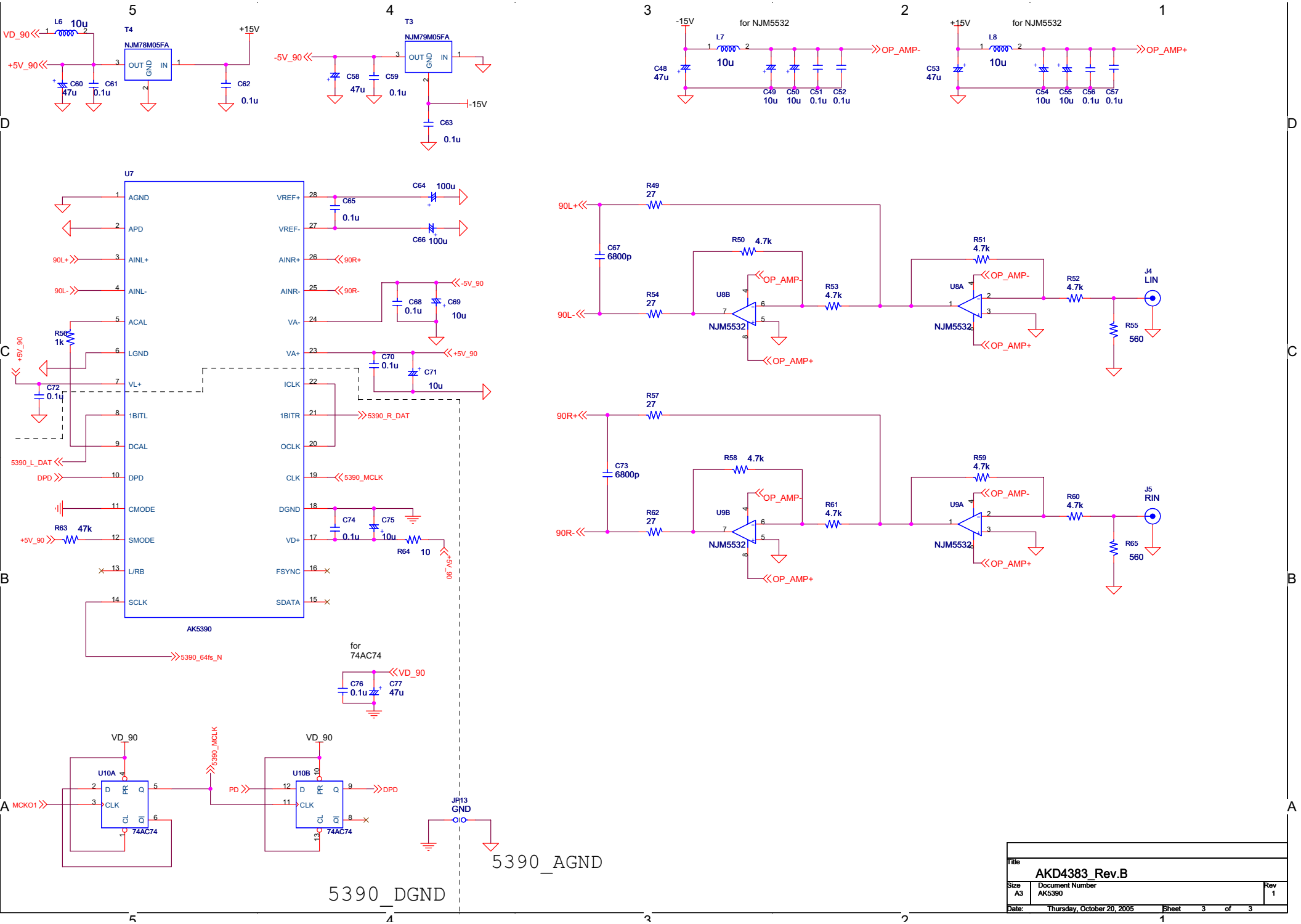
Size A3	Document Number AK4112B	Rev 1
Date: Thursday, December 08, 2005	Sheet 1 of 3	


for 74HCT14
74HCT541
C19 0.1u
C20 0.1u
C21 47u
4112A_5V
PORT2
EXT_MCLK
EXT_BICK
EXT_LRCK
EXT_SDATA
MCLK
BICK/DLK
SDTI/DSDL
SDATA/DSDR
PCM_port
DZFL
DZFR
U3A
U3B
74HCT14
R10 1k
R11 1k
LE5 DZFL
LE6 DZFR
U4
AK4383
MCLK R16 100
BICK R17 100
SDATA R18 100
LRCK R19 100
PDN R24 100
CSN R25 100
CCLK R27 100
CDTI R29 100
DCLK R30 100
DSDL R31 100
DSDR R32 100
AOUTL+
AOUTL-
AOUTR+
AOUTR-
DSDM
VDD
C30 10u
C31 0.1u
JP4 MCKO1
JP5 4112A_BICK
JP7 4112A_SDTO
JP8 4112A_LRCK
JP6 DSDM
JP9 DCLK
JP10 DSDL
JP11 DSDR
JMP3
PORT3
DSD_port
5390_64fs
5390_L_DAT
5390_R_DAT
5390_64fs_N
U3C
U3D
U3E
U3F
PORT4
uP-I/F
CSN
CCLK
CDTI
R43 10k
R44 10k
R45 10k
R46 470
R47 470
R48 470
U6
74HCT541
JP12 GND
4383_DGND
4383_AGND
4383_5V
JP3 JUMPER 3
L2 (short)
L3 (short)
T2 NJM78M05FA
+15V
C22 47u
C23 0.1u
C24 0.1u
C25 47u
AOUTL-
AOUTL+
C26 47u
C33 47u
R12 2.0k
R21 2.0k
R13 1.8k
R22 1.8k
R14 4.3k
R15 1.0k
R23 1.0k
R28 4.3k
C27 270p
C28 2200p
C29 3300p
C34 270p
VOP-
VOP+
U5A NJM5532
C32 22u
R20 220
R26 10k
J2 AOUTL
AOUTR-
AOUTR+
C35 47u
C40 47u
R33 2.0k
R38 2.0k
R34 1.8k
R39 1.8k
R35 4.3k
R36 1.0k
R40 1.0k
R42 4.3k
C36 270p
C37 2200p
C38 3300p
C41 270p
U5B NJM5532
C39 22u
R37 220
R41 10k
J3 AOUTR
-15V
for NJM5532
L4 (short)
C42 47u
C43 10u
C44 0.1u
VOP-
+15V
for NJM5532
L5 (short)
C45 47u
C46 10u
C47 0.1u
VOP+
Title
AKD4383_Rev.B
Size A3
Document Number AK4383
Rev 1
Date: Thursday, October 20, 2005
Sheet 2 of 3



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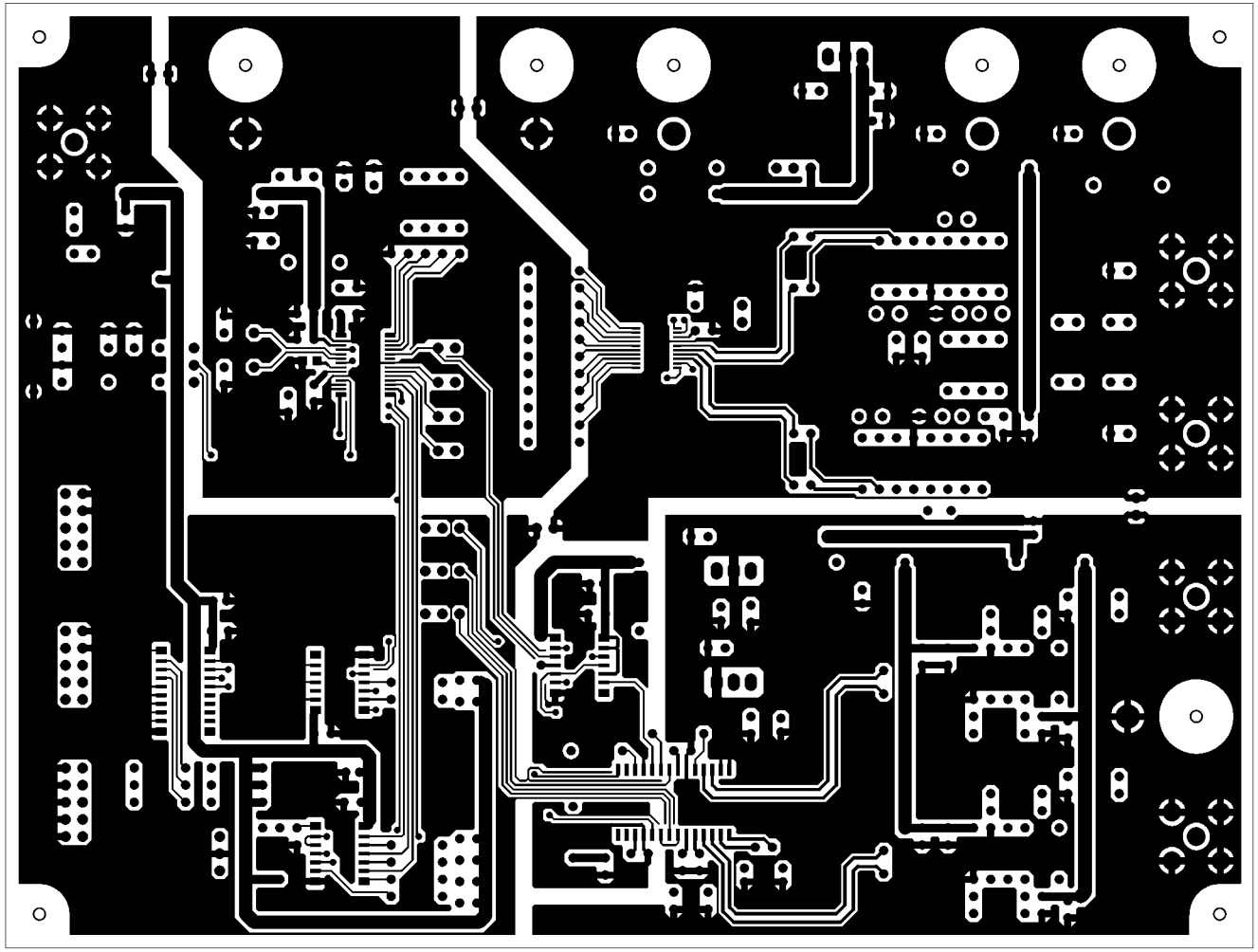
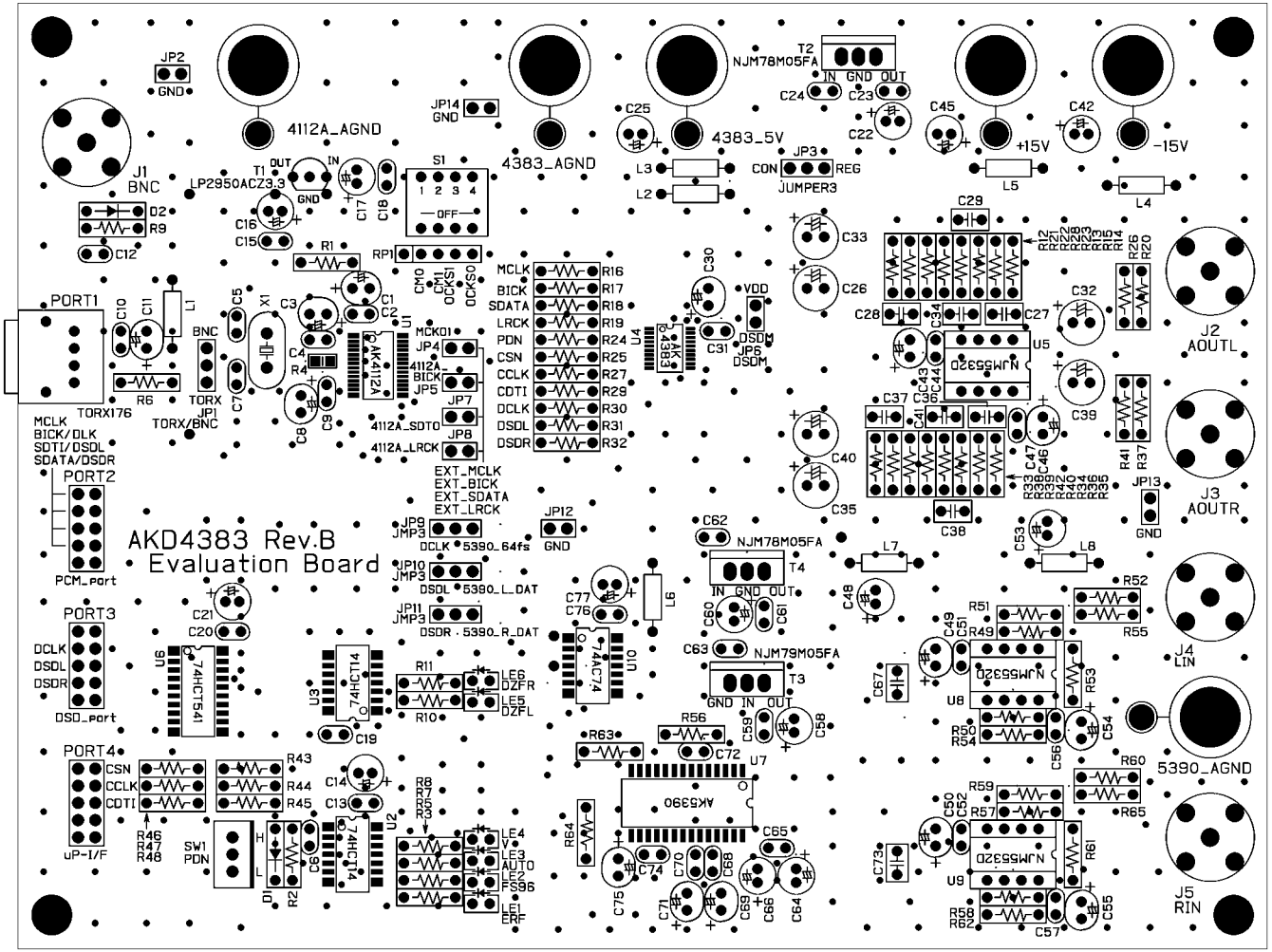


AKD4383 Rev.B L1

AKD4383 Rev.B LS



AKD4383 Rev.B L1 SR SILK