AKD4393
Evaluation board Rev.C for AK4393

AKM

General Description

The AKD4393 is an evaluation board for AK4393, which is 96kHz sampling 24Bit $\Delta\Sigma$ DAC. The AKD4393 includes a LPF which can add differential analog outputs from the AK4393 and also has a digital interface with AKM's wave generator using ROM data and AKM's ADC evaluation boards. Therefore, it is easy to evaluate the AK4393.

■ **Ordering Guide**

AKD4393 Rev.C   --- Evaluation board Rev.C for AK4393: differential output

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Function

■ On-board differential output buffer circuit
■ On-board clock generator
■ BNC connector for an external clock input
■ Compatible with 3types of interface

1. Direct interface with evaluation boards for AKM's A/D converter (AKD539X, AKD535X)
2. Interface with a signal generator (AKD43XX)
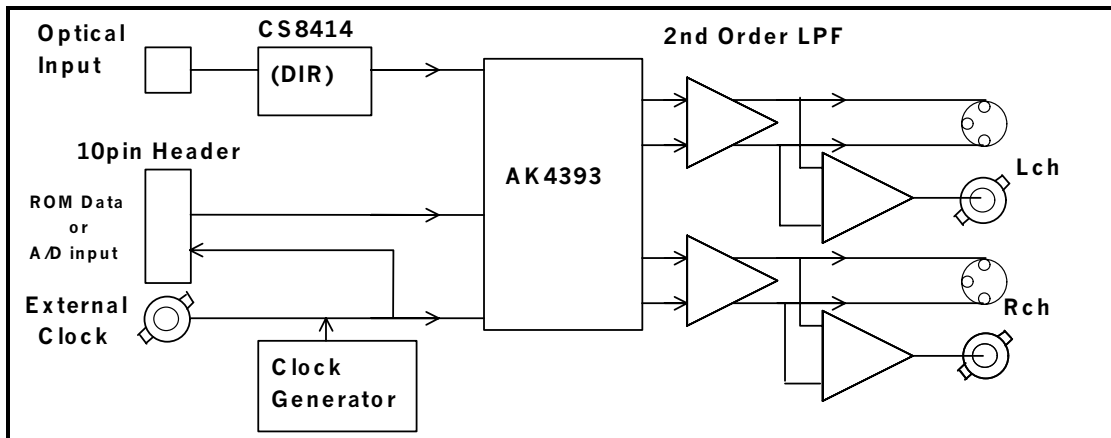3. On-board CS8414 as DIR which accepts optical input.

Fig.1 Block diagram

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

■ External Analog Circuit (Rev.C)

The differential output circuit and LPF is implemented on board. The differential outputs of AK4393 is buffered by non-inverted circuit and output via Cannon connector(differential output). LPF adds differential outputs. NJM5534D is used for op-amp on this board that has low noise and high voltage torelance characteristics. Analog signal is output via Cannon and BNC connectors on the board. The output level is about 2.94Vrms(typ@VREF=5.0V) by Cannon and 2Vrms(typ@VREF=5.0V) by BNC.
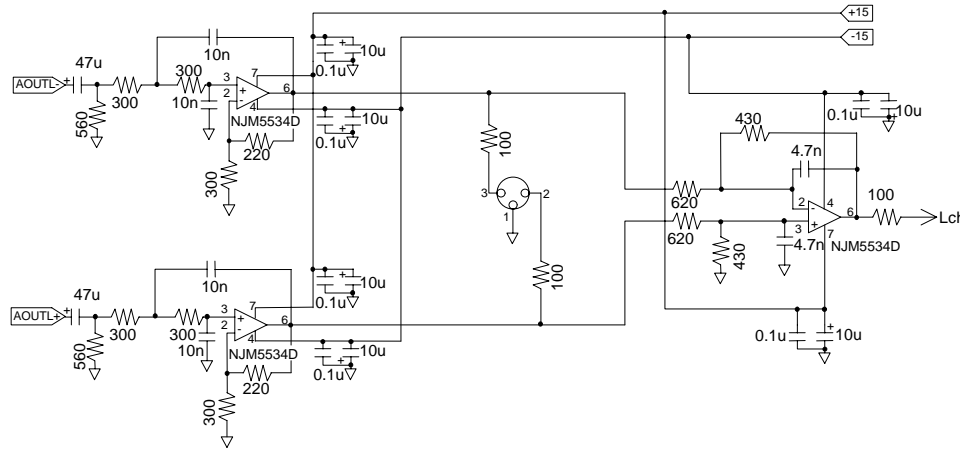

Fig.2   External Analog Filter

■ Operation sequence

1.Set up the jumpers for power supply.

[JP15(REG)] selects power supply for AVDD pin of AK4393.

short: 5V is supplied from regulator. (default)

Nothing should be connected to A5V jack.

open: 5V is supplied from A5V.

2.Set up the power supply lines.

+15V=15V, -15V=-15V: Power supply for op-amp. AVDD of AK4393 is supplied from "+15V" through regulator (JP15: short).

A5V=5V: This jack is used when AVDD of AK4393 is supplied from this. In this case, JP15 should be open.

DVDD=5V: Power supply for logic circuit on this board.

VP=3V~5.25V: Digital (set JP10 to VP),

AGND=DGND=0V .

Each supply line should be distributed from the power unit.

3.Set up the evaluation modes by jumper pins and DIP switches.(See next item.)

4.Power on.(The AK4393 should be reset once by bringing PD "L" upon power-up.)

*SW1 resets the AK4393 during operation.

The AK4393 is reset at SW1="L" and exits resetting at SW1="H".

■The evaluation modes and corresponding jumper pins setting

1. Evaluation Modes

•Applicable Evaluation Mode

(1) DIR(Optical Link)

(2) Ideal sine wave generated by ROM data

(3) Using AD converted data

(4)All interface signals including master clock are fed externally.

(1) DIR(Optical Link) (default)

PORT2 is used for the evaluation using such as CD test disk. The DIR generates MCLK, BICK and LRCK SDATAfrom the received data through optical connector(PORT2: TORX176).
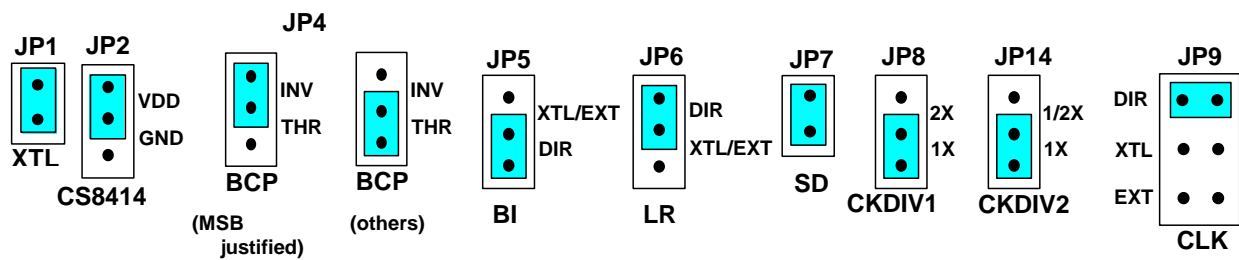

Fig.3   Jumper set-up (DIR)

(2) Ideal sine wave generated by ROM data

Digital signal generated by AKD43XX are used. PORT1 is used for the interface with AKD43XX. Master clock is sent from AKD4393 to AKD43XX then LRCK, BICK and SDATA are sent from AKD43XX to AKD4393.
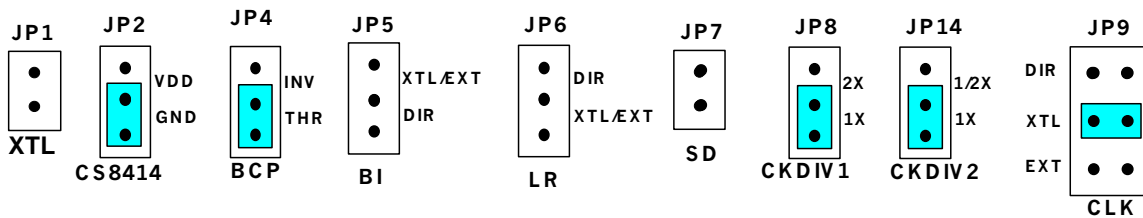

Fig.4   Jumper set-up (ROM data)

(3) Using AD converted data

AD converted data from AKM's AD evaluation boards(AKD539X, AKD535X) is used through PORT1.

* In case of using external clock through a BNC connector, select EXT of JP9 and short JP1.

* In case of using the double speed sampling mode, select 1/2X of JP8 and set S2-2(DFS) on.
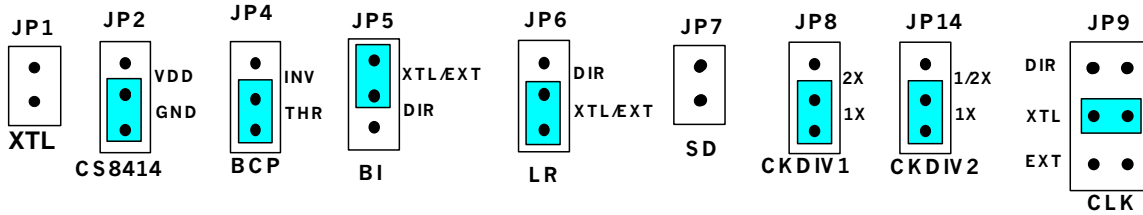

Fig.5   Jumper set-up (A/D)

(3) All interface signals including master clock are fed externally.

Under the following set-up, MCLK, LRCK and SCLK signals needed for the D/A to operate could be fed through PORT1.
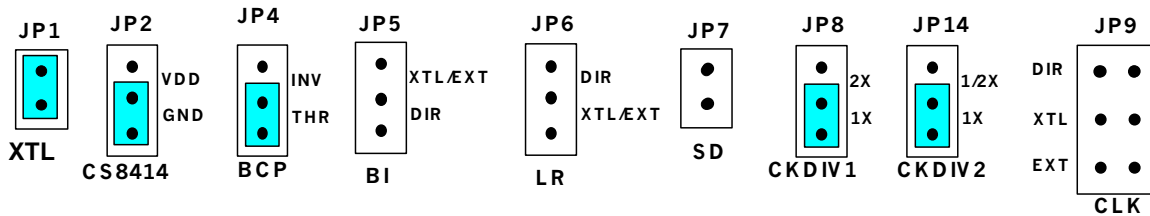

Fig.6   Jumper set-up (ext.)

2.   MCLK set-up

When the LRCK is fed from the 74HC4040 on the board, The ratio of MCLK to LRCK can be selected by JP8 and JP14.

JP14	JP8	X'tal	MCLK	fs	MCLK/LRCK
1X	1X	12.288MHz	12.288MHz	48kHz	256
1X	2X	24.576MHz	24.576MHz	48kHz	512
1/2X	1X	24.576MHz	12.288MHz	96kHz	128
1/2X	2X	49.152MHz	12.288MHz	96kHz	128

Table.1 set-up example

3.   BICK set-up

When BICK is supplied from U1(74HC4040), either 32fs or 64fs could be selected. Fig.8 shows 64fs mode. 64fs mode is recommended.

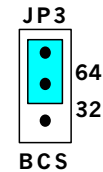   *Only mode 0(LSB justified 16bit mode) can correspond to 32fs.

Fig.7   Jumper Set-up (BCS)

4. DIP switch set-up

Confirm the set-up of the DIP switch before the operation. "ON" means "H" and "OFF" means "L".

4-1.   Set-up of SW3, SW4(Mode set-up of AK4393: see the data sheet of AK4393)

DIF2	DIF1	DIF0	Mode	BICK	
OFF	OFF	OFF	0: LSB justified, 16bit	≥32fs	
OFF	OFF	ON	1: LSB justified, 20bit	≥40fs	
OFF	ON	OFF	2: LSB justified, 24bit	≥48fs	
OFF	ON	ON	3: I^2S	≥48fs	(default)
ON	OFF	OFF	4: MSB justified, 24bit	≥48fs	

Table 2   Audio Serial Interface Format Select Pins (SW3-5,6,7)

4-2. Set-up of SW6 (Mode set-up of CS8414. About details, see the data-sheet of CS8414)

Adjust the audio data format of CS8414 (DIR) to AK4393. CS8414 does not match the LSB justified 20bit/24bit mode of AK4393.

M3 (SW6-2)	M2 (SW6-3)	M1 (SW6-4)	M0 (SW6-5)	Data format	JP4	
OFF	OFF	OFF	OFF	MSB justified, 24bit	INV	
OFF	OFF	ON	OFF	I^2S	THR	(default)
OFF	ON	OFF	ON	LSB justified, 16bit	THR	

Table 3. Set-up of SW6

SW6-1 (SEL): Usually ON.

SW6-6 (CS12): Select the channel for indicating the channel status.

ON: Rch (default), OFF: Lch

5. Parallel/Serial Control

SW5: set up P/S pin of AK4393.

H: parallel mode. PORT3 is used JP11, 12 and 13 should be open.

L: serial mode. PORT3 is used. JP11, 12 and 13 should be open.

6. Other set-up

SW1: Reset of AK4393. Select "H" during operation.

SW2: Soft-mute of AK4393. The soft-mute is executed during SW2 pushed.

LE1 : This LED shows pre-emphasis status. It turns on when the data is pre-emphasized.

LE2 : This LED shows the output of VERF pin in CS8414. It turns on when the error is occured in CS8414.

■ AK4393 Measurement Example

Conditions:

AVDD =DVDD= 5.0V

Interface = DIR (44.1kHz, 96kHz)

MCLK = 256fs(fs=44.1kHz, 96kHz)

BICK = 64fs

fs = 44.1kHz, 96kHz

Input data = 24bit

Measurement unit: Audio Precision System Two Cascade (fs=44.1kHz, 96kHz)

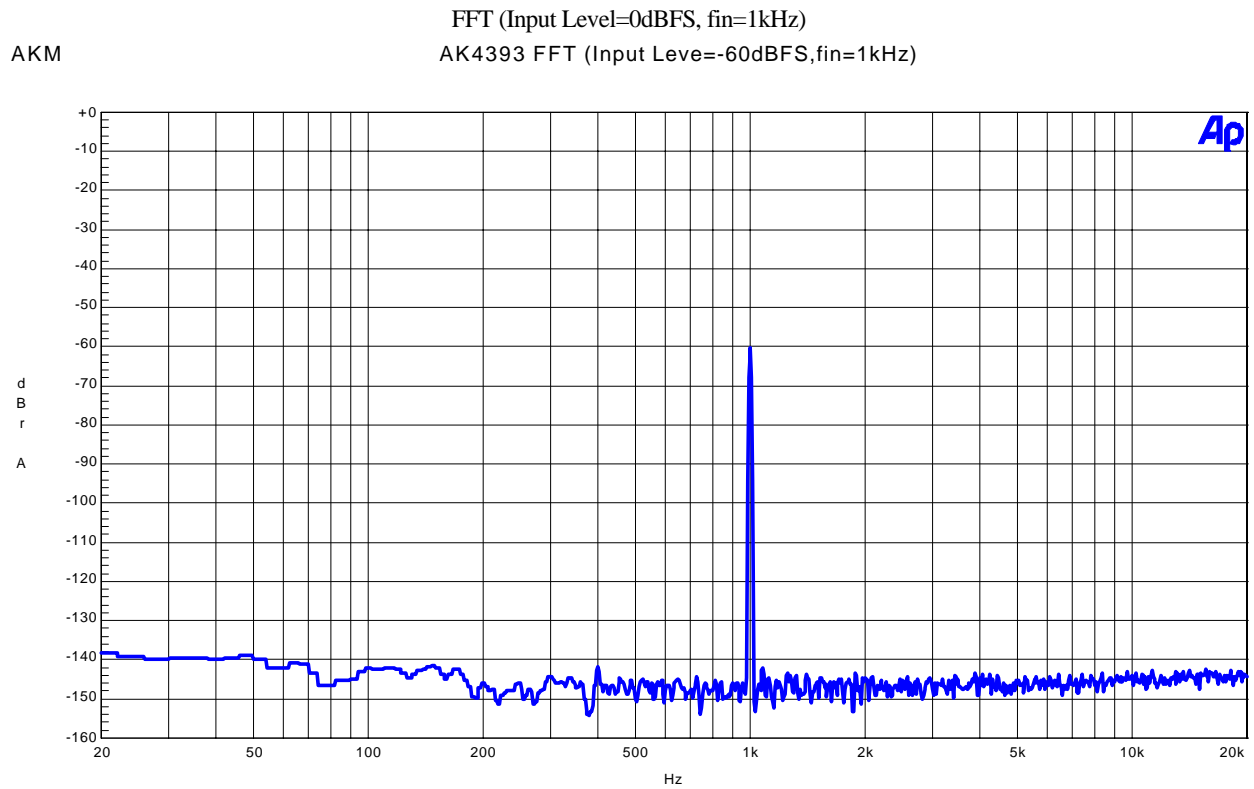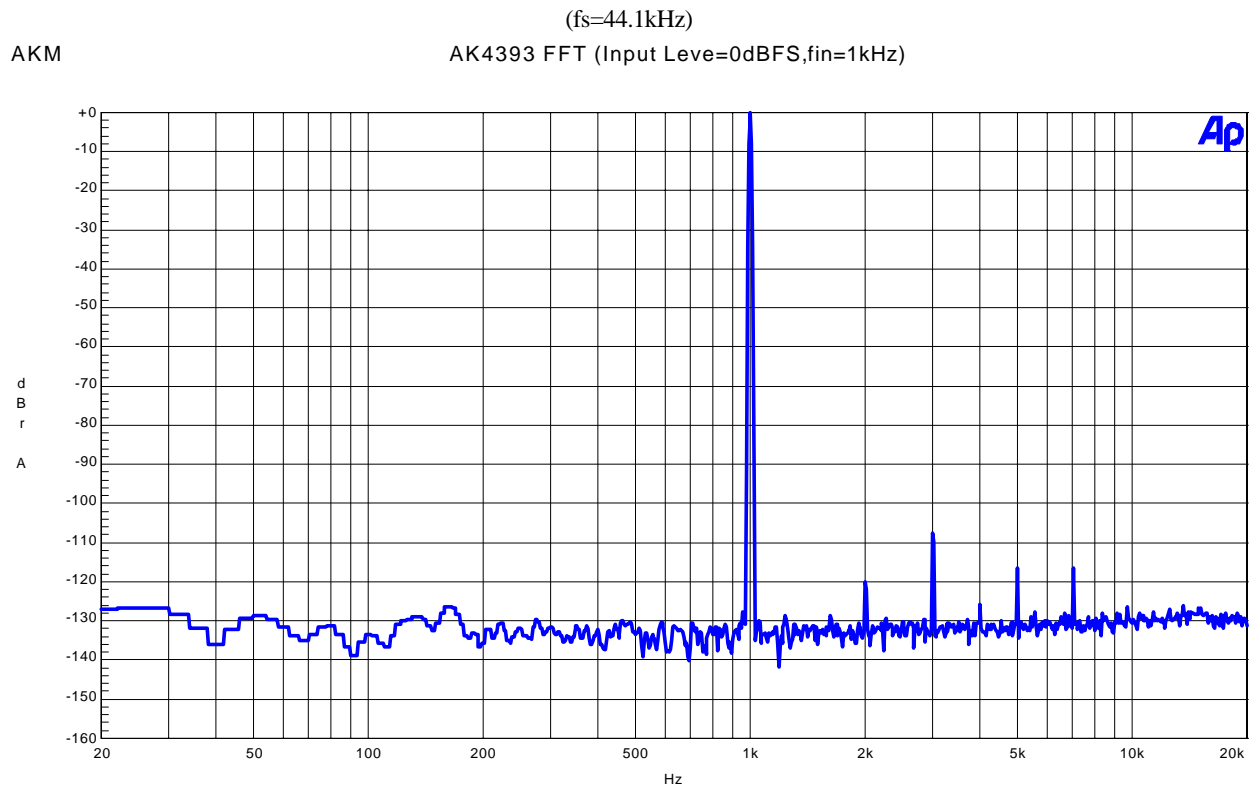(AKD4393 Rev.C: differential output)

fs		Result	
44.1kHz	THD+N	102.3	20kLPF
	DR	120.0	22kLPF + A-weighted
	S/N	119.9	22kLPF + A-weighted
96kHz	THD+N	100.9	40kLPF
	DR	119.5	80kLPF + A-weighted
	S/N	119.7	80kLPF + A-weighted

Plot

FFT Point: 16384

Window: Equiripple

Averages: 4

(fs=44.1kHz)

AKM AK4393 FFT (Input Leve=0dBFS,fin=1kHz)

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

AKM AK4393 FFT (Input Leve=-60dBFS,fin=1kHz)
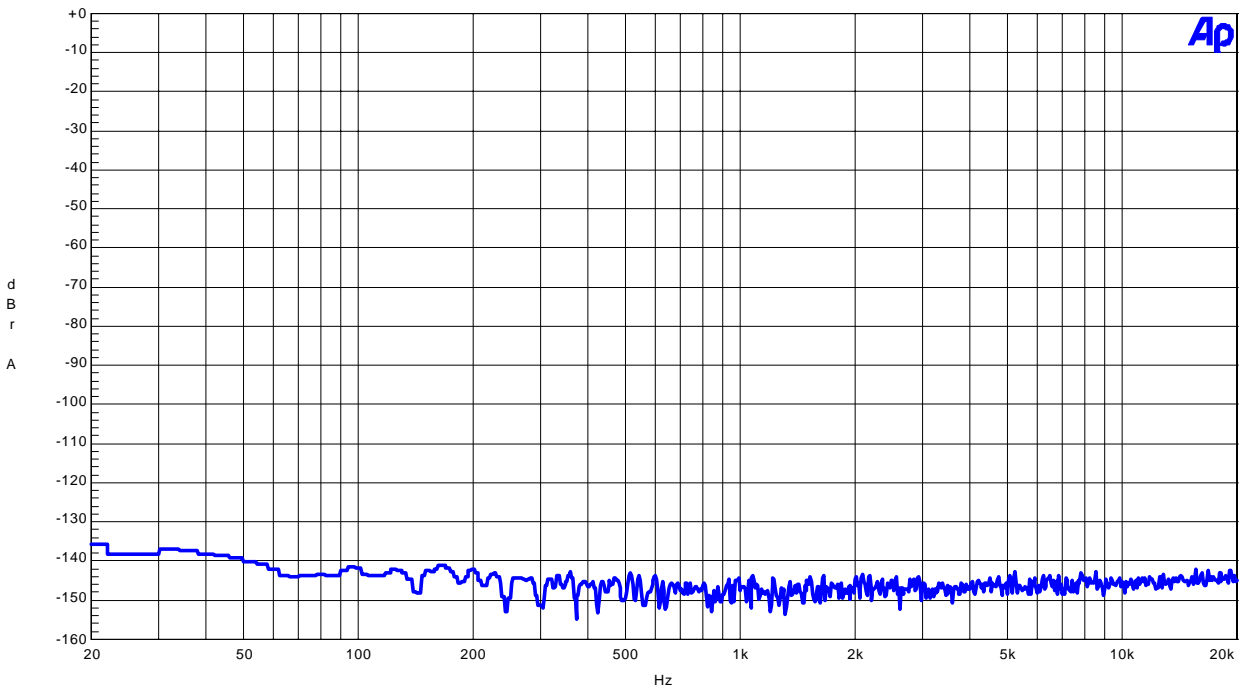
FFT (Input Level=-60dBFS, fin=1kHz)

(fs=44.1kHz)

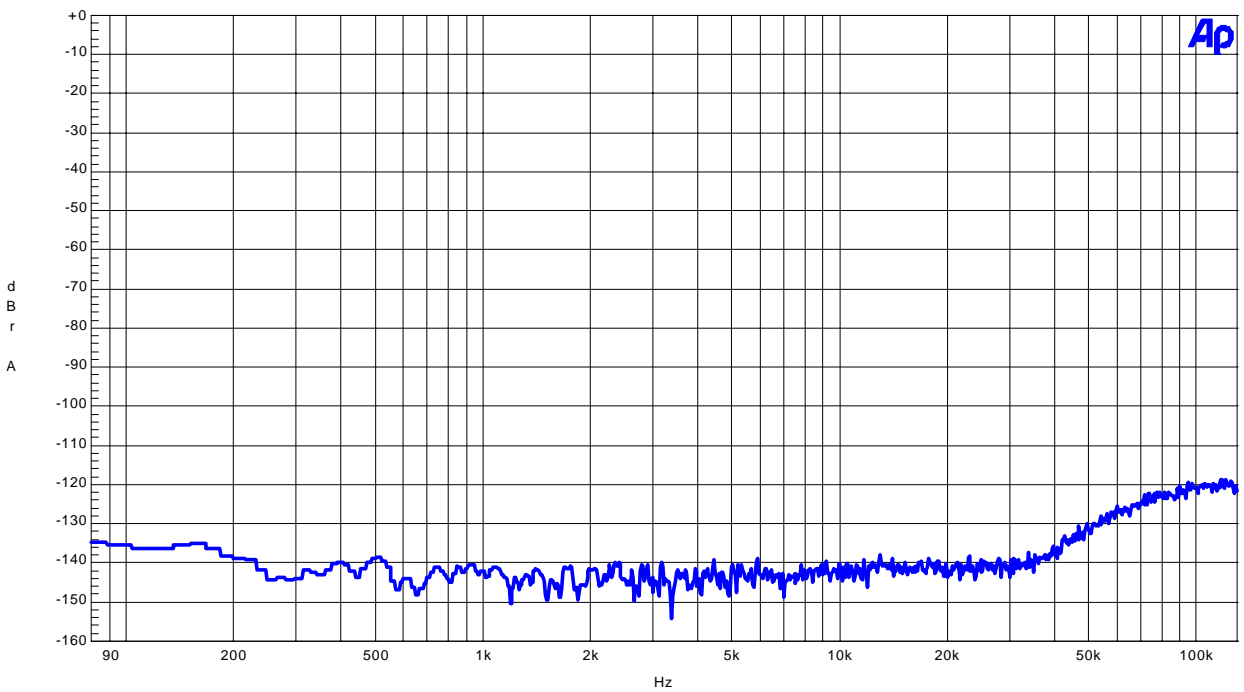AKM   AK4393 FFT (Input = "0"data)

FFT (noise floor)
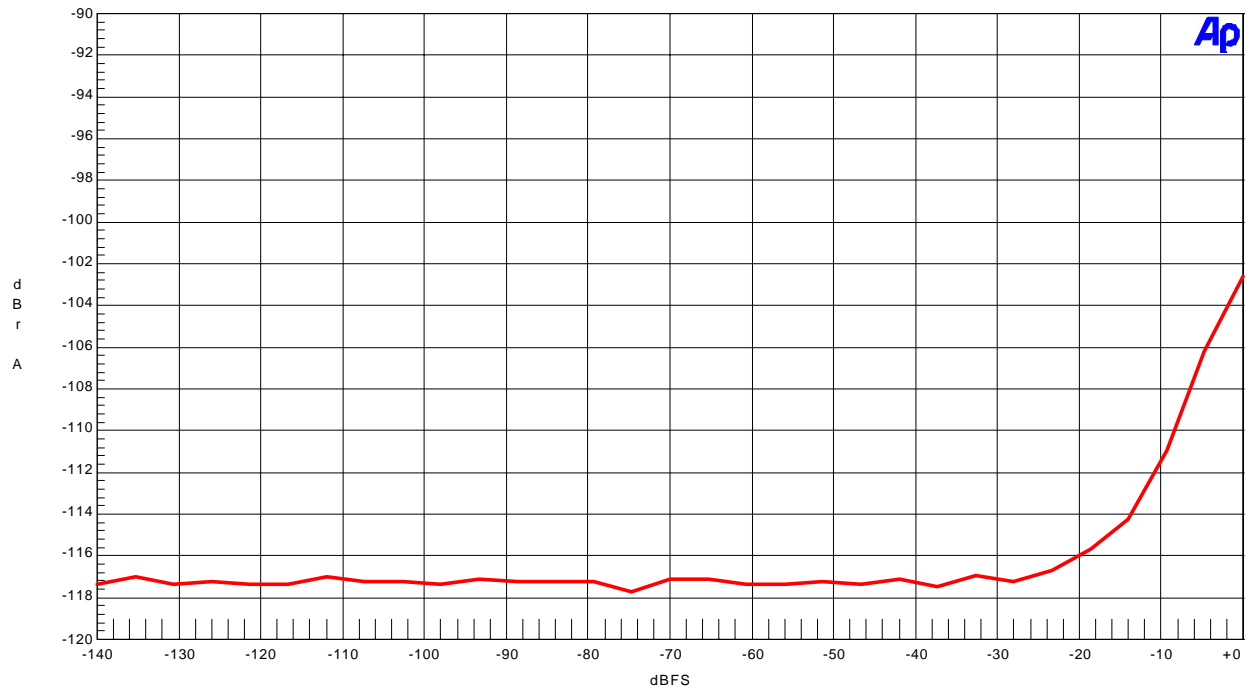
AKM   AK4393 FFT (Input = "0"data,out-of band)

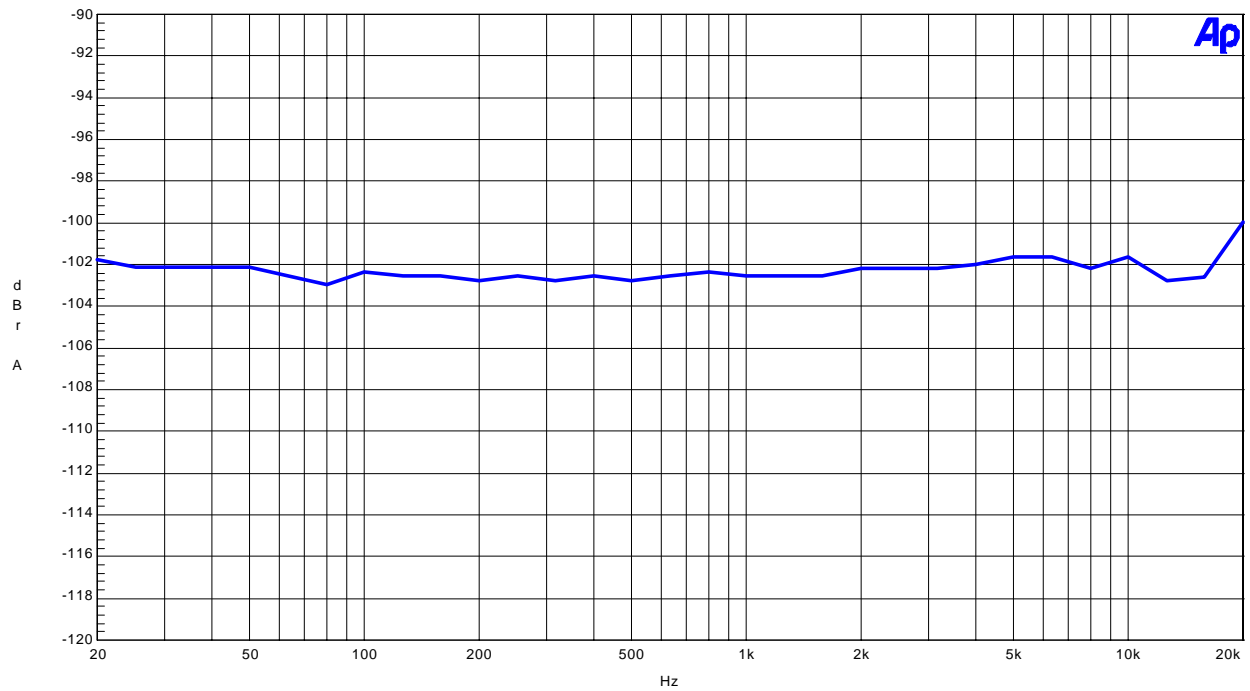FFT (noise floor, out-of band)

(fs=44.1kHz)

AKM   AK4393 THD + N vs Amplitude (fin=1kHz)

THD + N vs Amplitude (fin=1kHz)

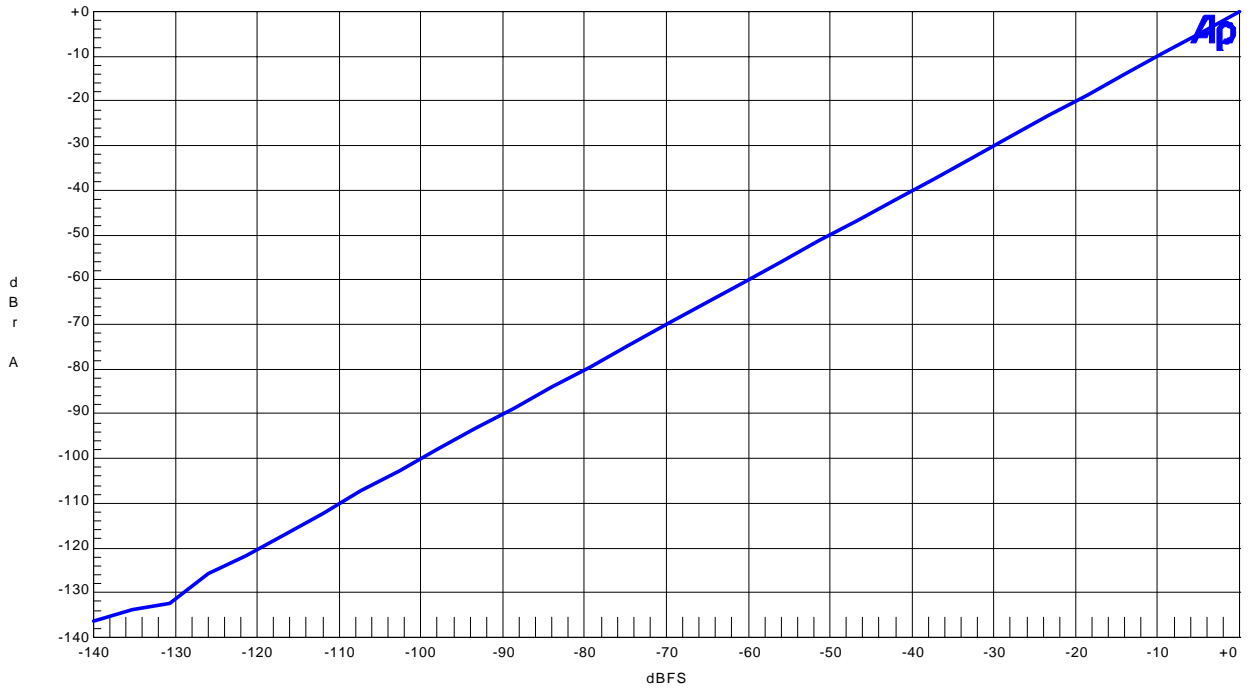AKM   AK4393 THD + N vs Input Frequency(Input Level=0dBFS)

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

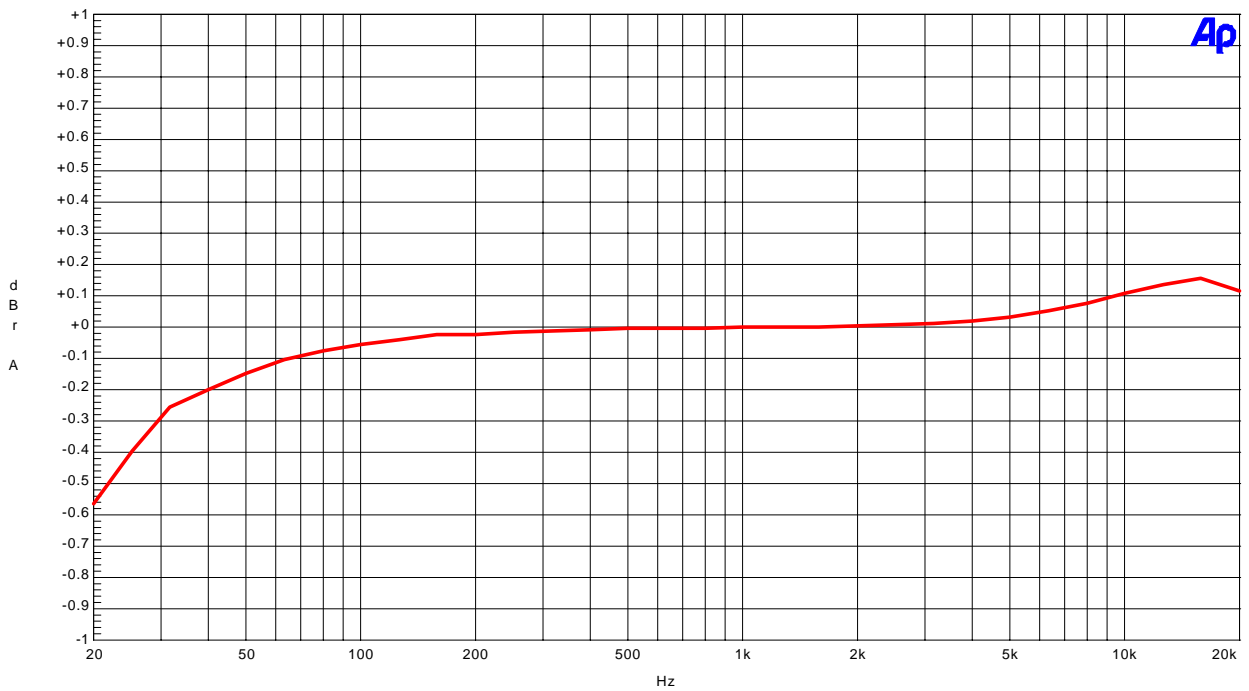(fs=44.1kHz)

AKM   AK4393 Linearity
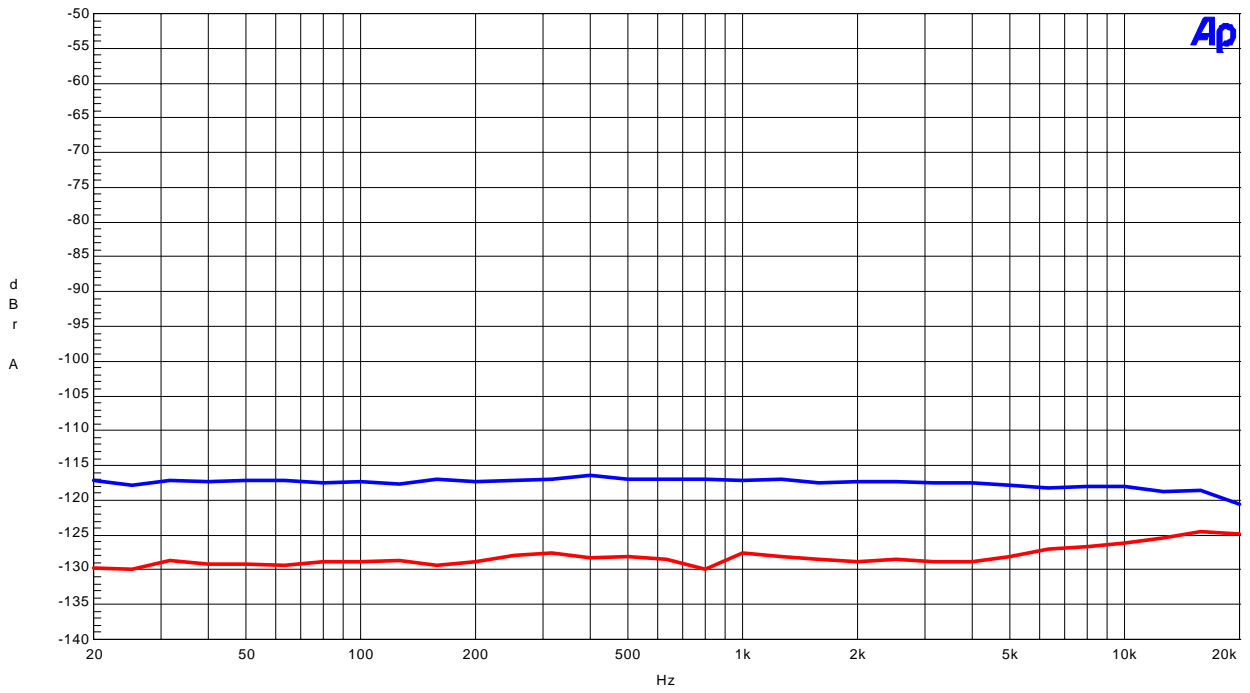

Linearity (fin=1kHz)

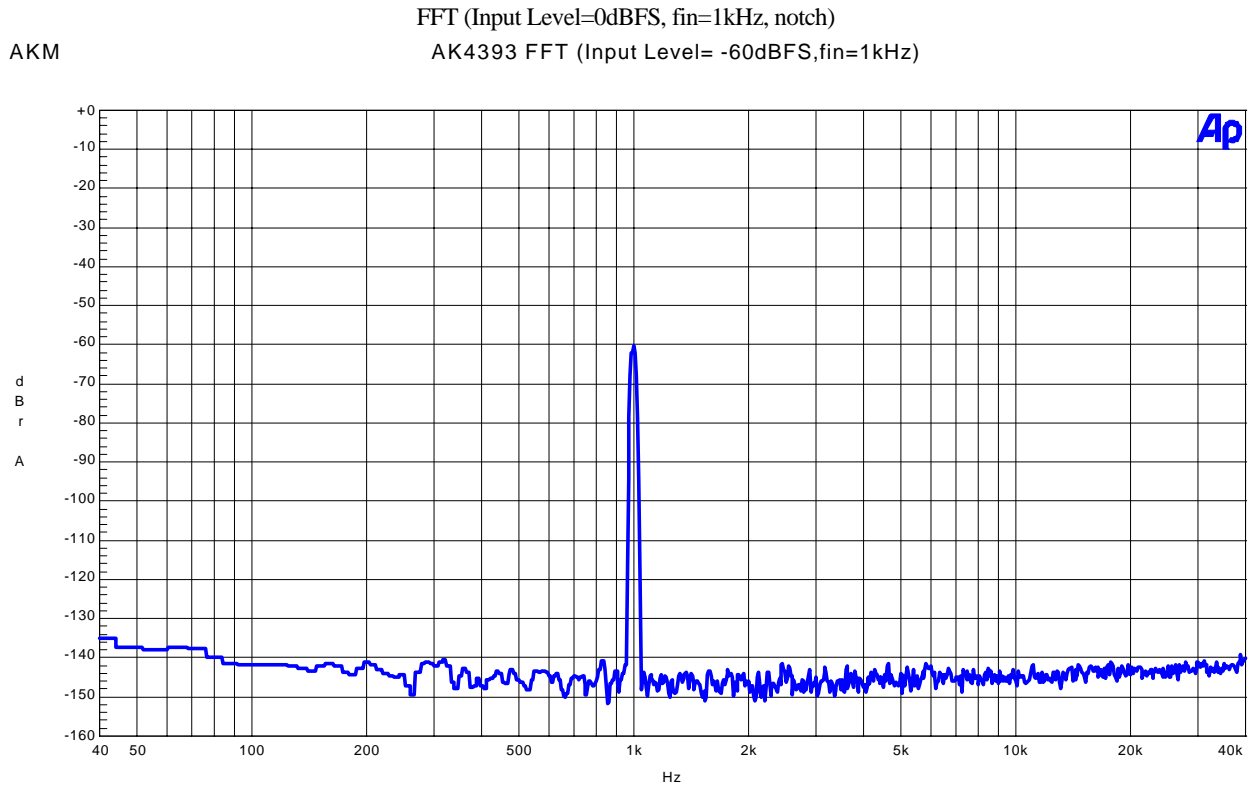AKM   AK4393 Frequency Response
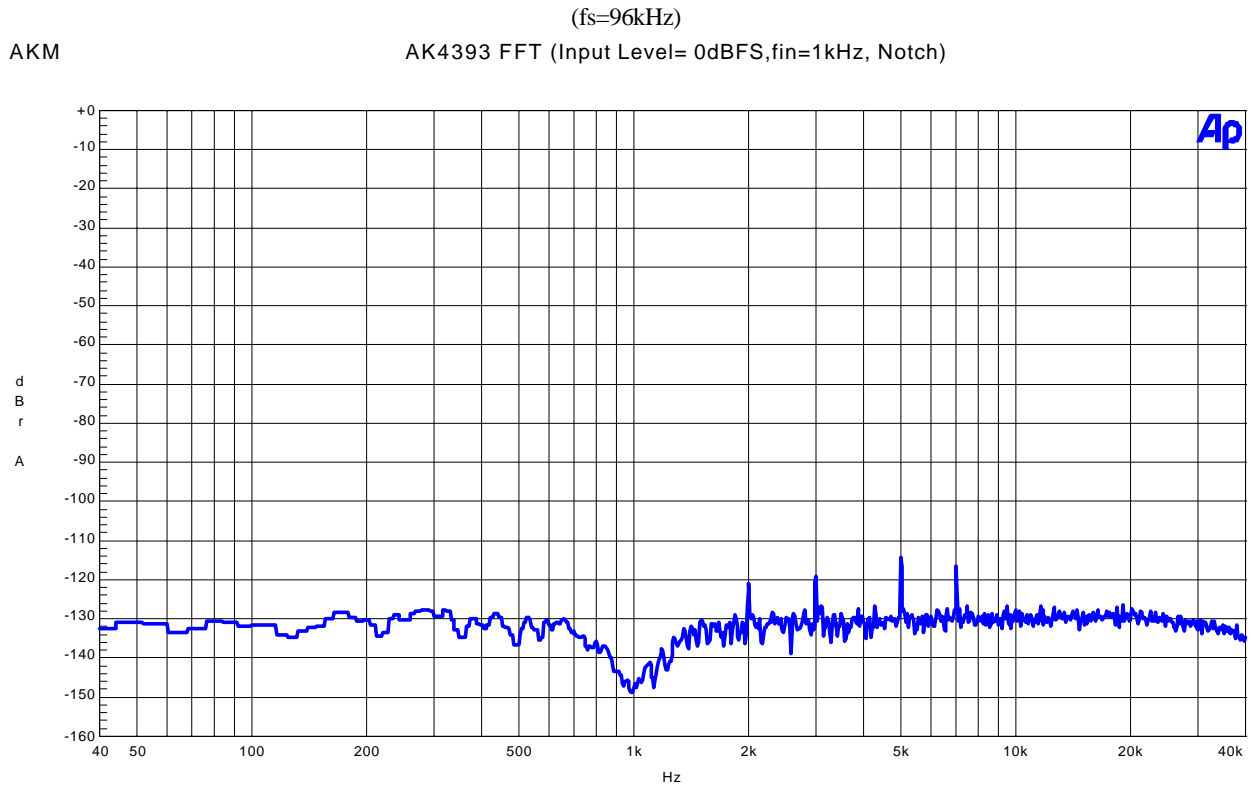

Frequency Response (Input Level=0dBFS)

(fs=44.1kHz)

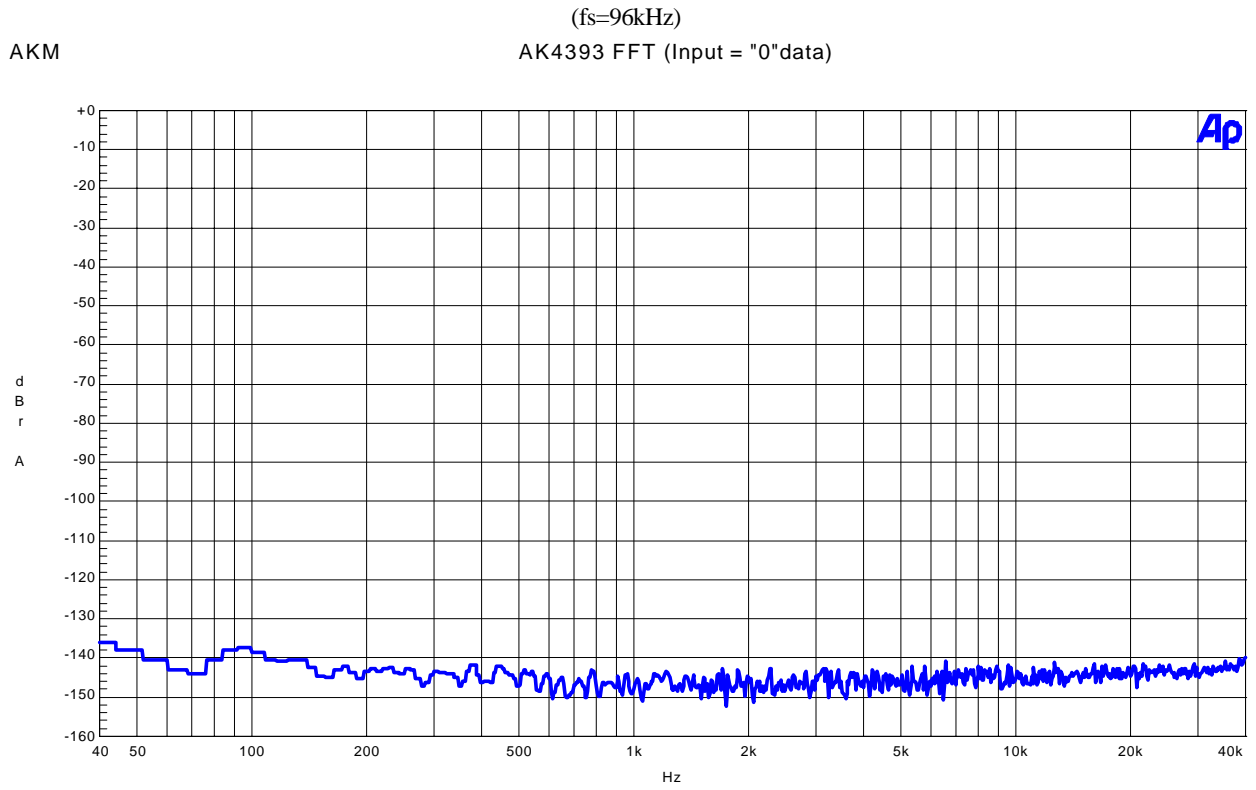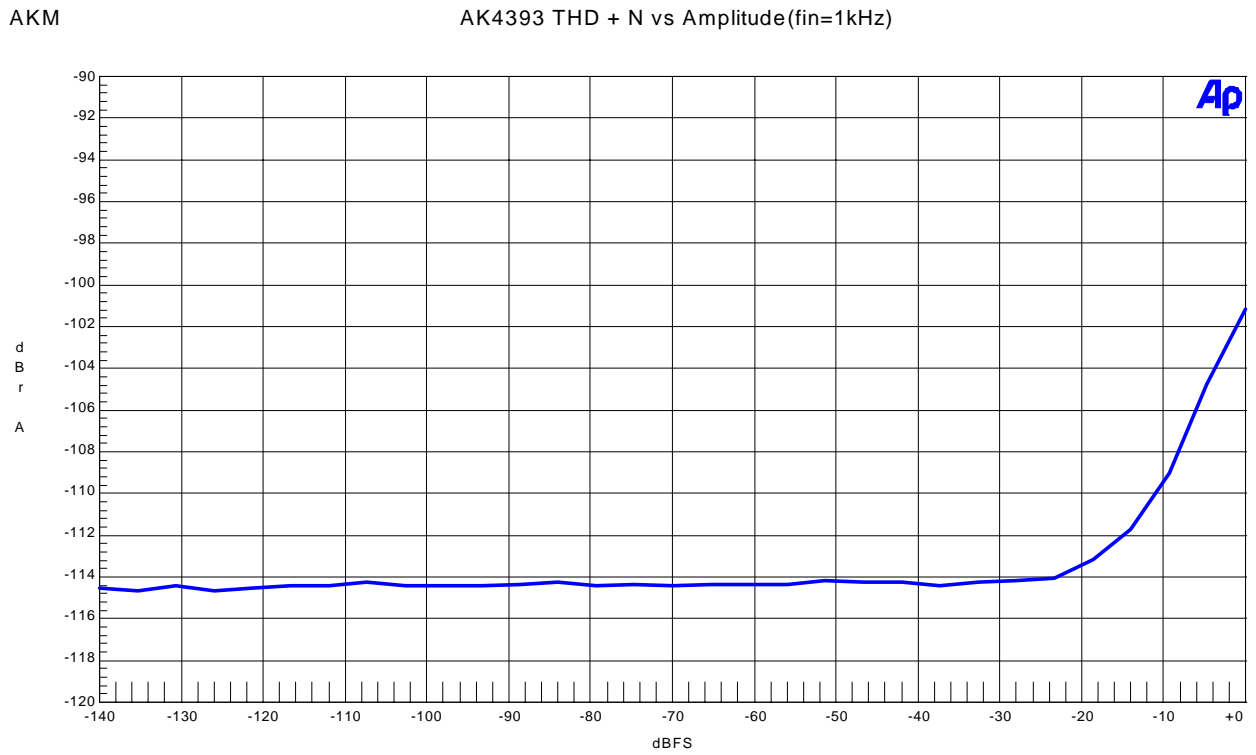AKM   AK4393 Crosstalk

Crosstalk (upper = Rch, Lower = Lch)

(fs=96kHz)

FFT (Input Level=0dBFS, fin=1kHz, notch)

AKM   AK4393 FFT (Input Level= -60dBFS,fin=1kHz)

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

(fs=96kHz)

AKM   AK4393 FFT (Input = "0"data)

FFT (noise floor)

AKM   AK4393 THD + N vs Amplitude(fin=1kHz)
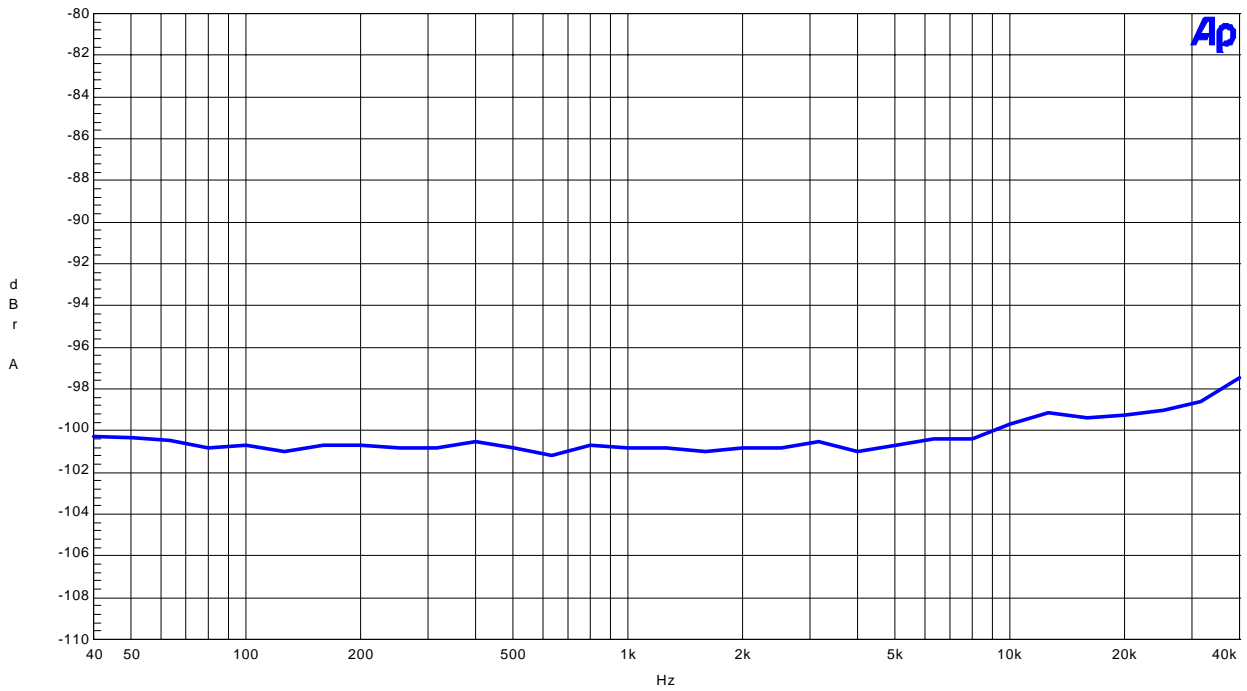
THD + N vs Amplitude (fin=1kHz)

(fs=96kHz)

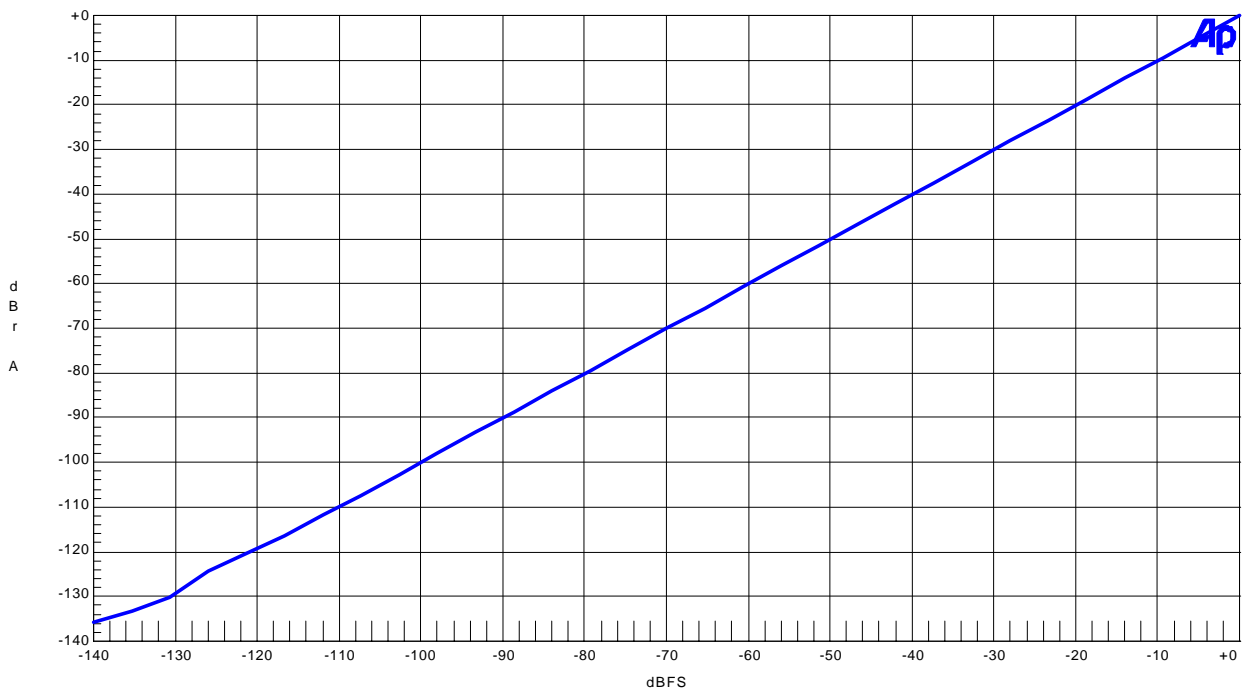AKM   AK4393 THD + N vs Input Frequency (Input Level=0dBFS)

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

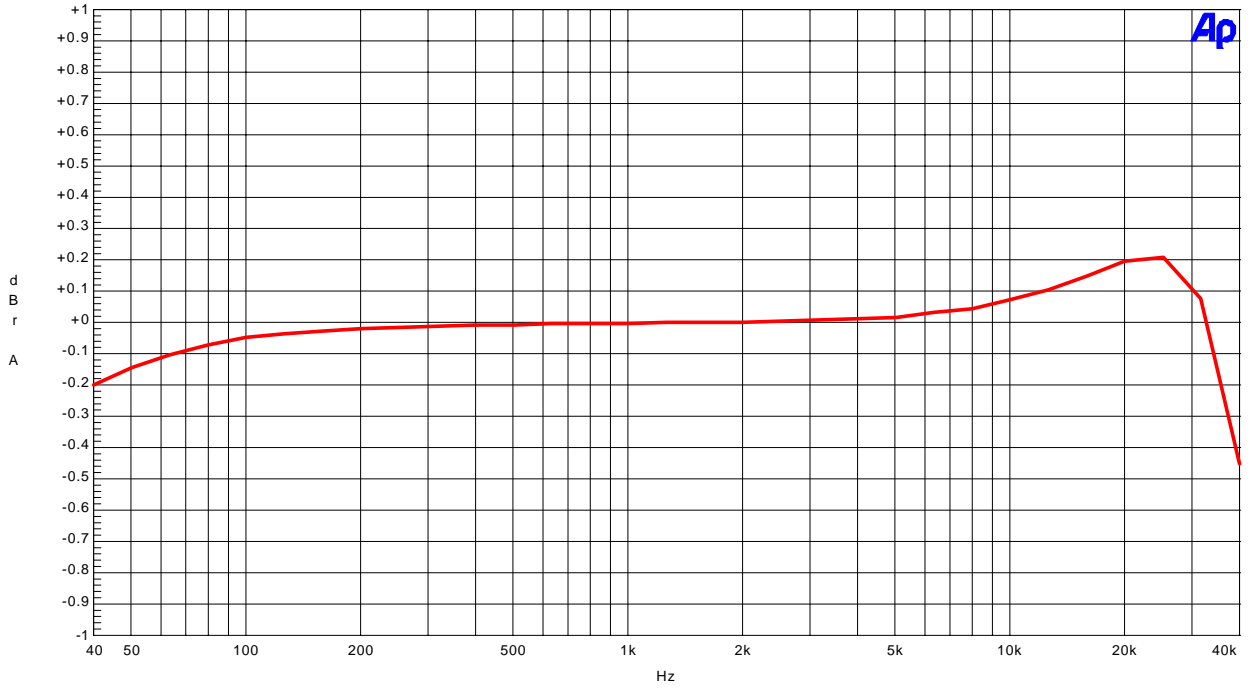AKM   AK4393 Linearity

Linearity (fin=1kHz)

(fs=96kHz)

AKM   AK4393 Crosstalk
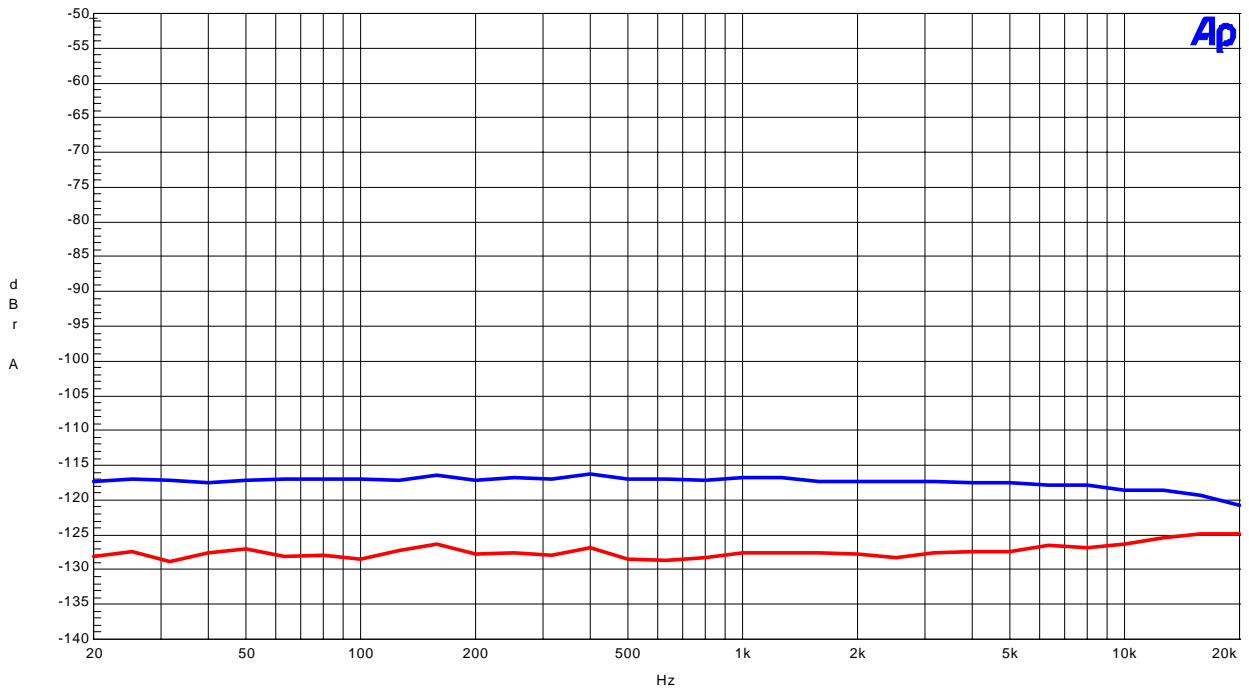

Frequency Response (Input Level=0dBFS)

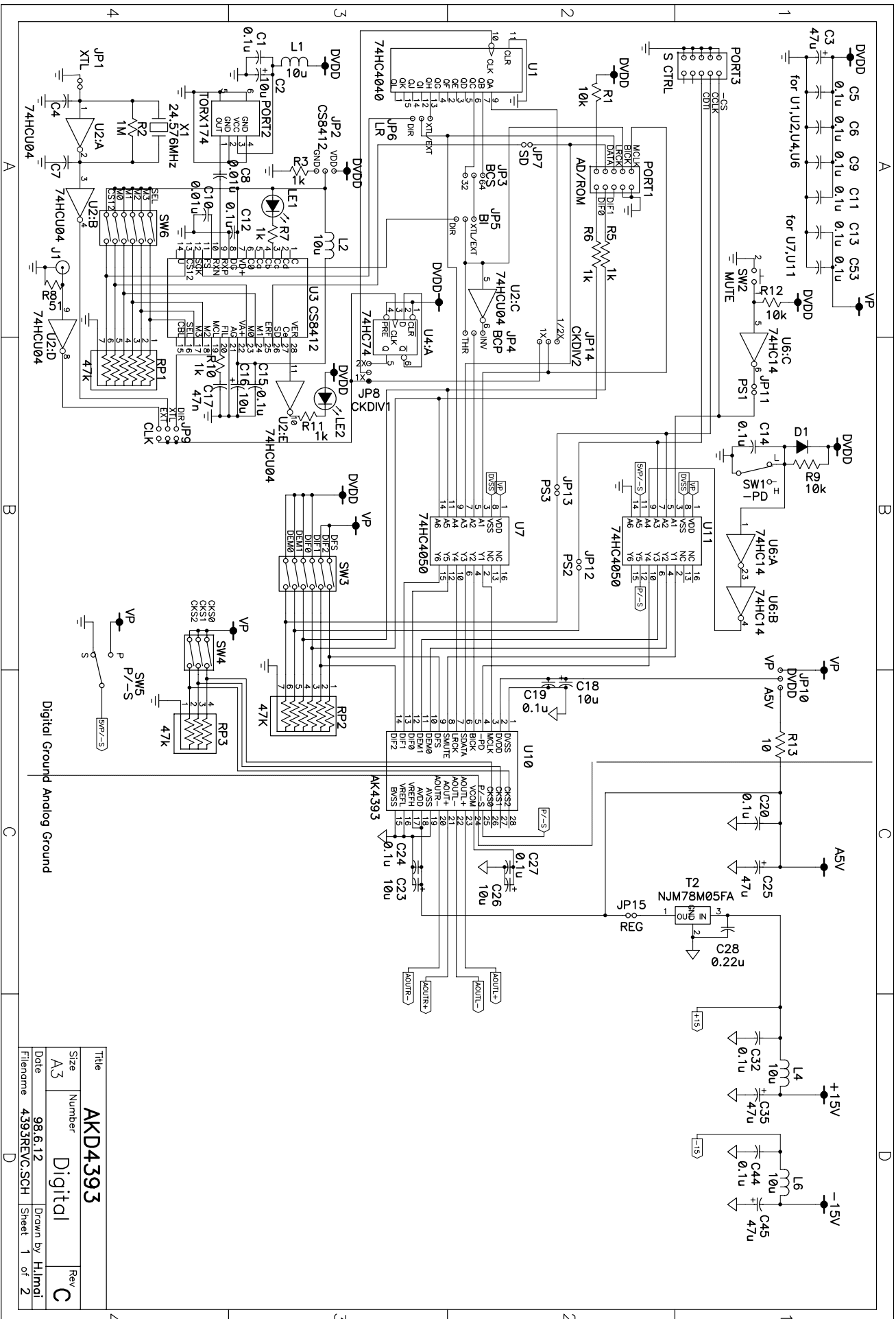AKM   AK4393 Crosstalk

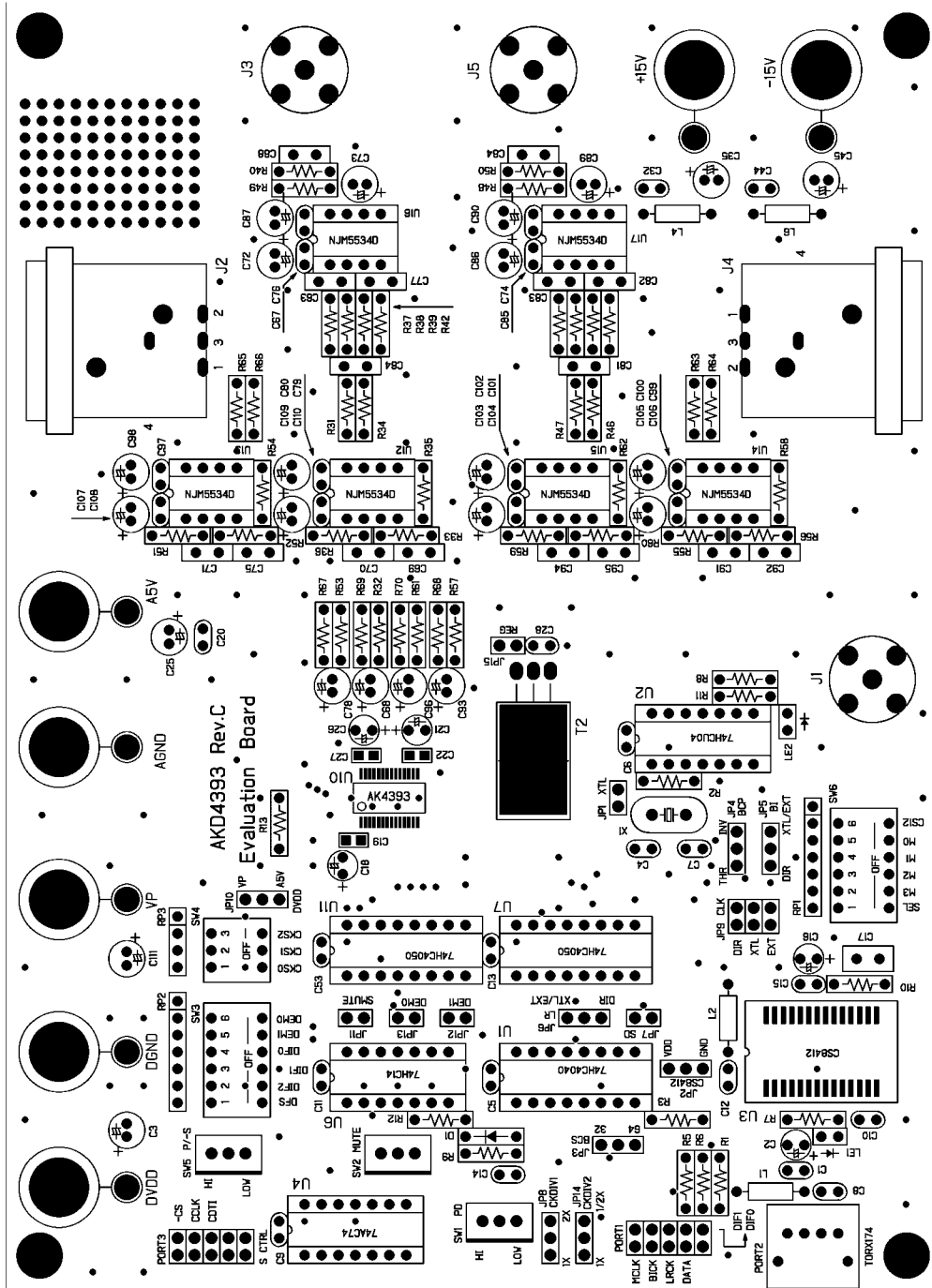
Crosstalk (upper = Rch, Lower = Lch)

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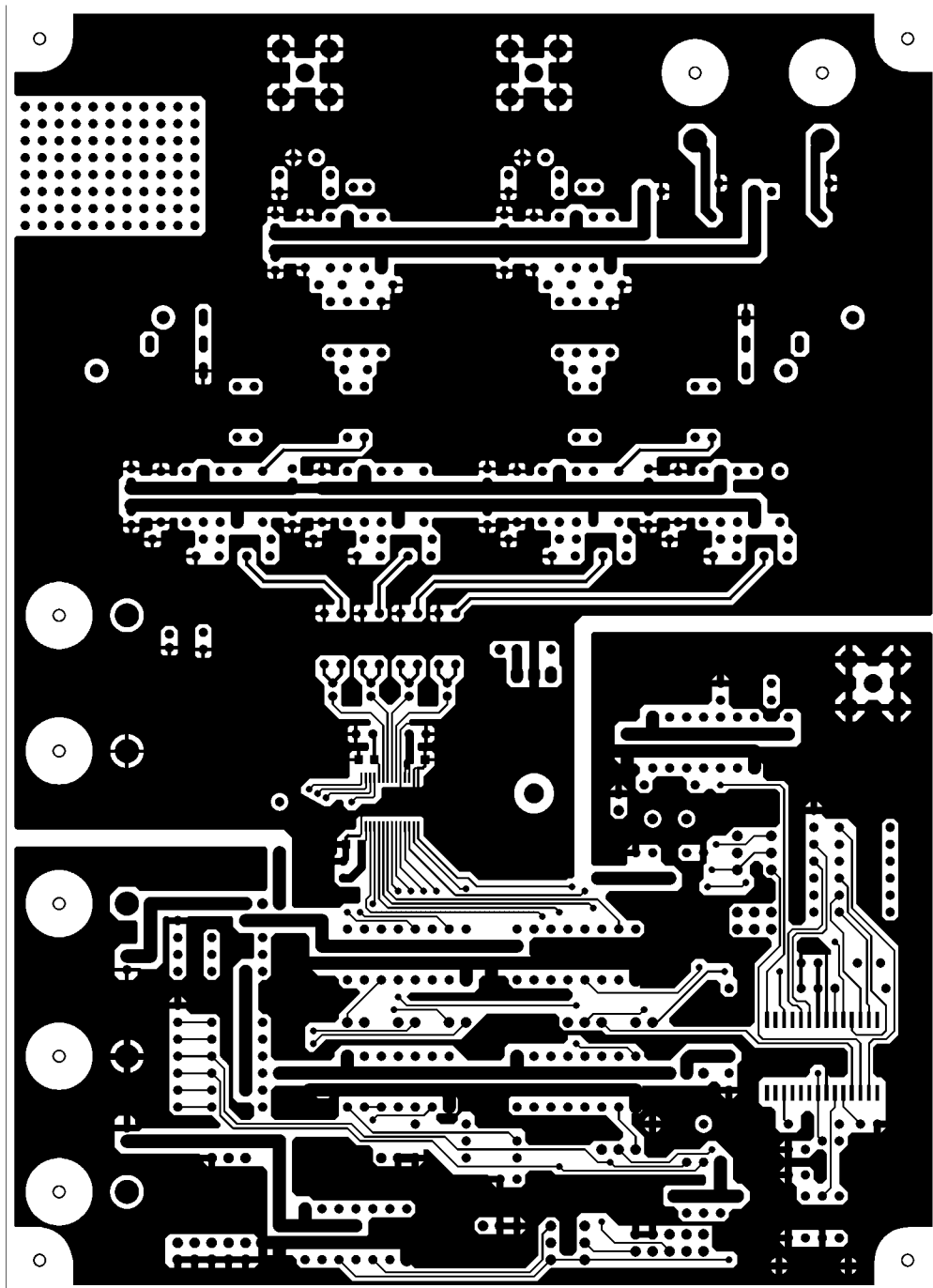
Digital Ground Analog Ground

AOUTR+
AOUTR−
AOUTL+
AOUTL−

R70 560
R68 560
R67 560
R69 560

C96 47u
C93 47u
C78 47u
C68 47u

R61 300
R57 300
R53 300
R32 300

R60 300
R56 300
R52 300
R33 300

C94 10n
C91 10n
C71 10n
C70 10n

R59 300
R55 300
R51 300
R36 300

C95 10n
C92 10n
C75 10n
C69 10n

R62 220
R58 220
R54 220
R35 220

U15 NJM5534D
U14 NJM5534D
U13 NJM5534D
U12 NJM5534D

C104 0.1u
C101 0.1u
C106 0.1u
C99 0.1u
C108 0.1u
C97 0.1u
C110 0.1u
C79 0.1u

C103 10u
C102 10u
C105 10u
C100 10u
C107 10u
C98 10u
C109 10u
C80 10u

R63 100
R64 100
J4

R65 100
R66 100
J2

R46 620
R47 620
R34 620
R31 620

R43 430
C81 (open)
R44 (short)
R45 (short)
R41 430
C83 4.7n
C82 4.7n

R42 430
C64 (open)
R39 (short)
R38 (short)
R37 430
C63 4.7n
C77 4.7n

C74 0.1u
C90 10u
U17 NJM5534D

C76 0.1u
C87 10u
U16 NJM5534D

C67 0.1u
C72 10u
C73 (short)

C89 (short)
C85 0.1u
C86 10u

R48 (open)
C84 (open)
R50 100

R49 (open)
C88 (open)
R40 100

J5 Rch
J3 Lch

−15
+15

4393C L1 SR SILK

4393C L1

4933C L2