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AKD4649-B
AK4649 Evaluation board Rev.0

GENERAL DESCRIPTION

AKD4649-B is an evaluation board for the AK4649, Stereo CODEC with built-in MIC/SPK amplifier. The AKD4649-B can evaluate A/D converter and D/A converter separately in addition to loop-back mode (A/D → D/A). The AKD4649-B also has the digital audio interface and can achieve the interface with digital audio systems via opt-connector.

■ Ordering guide

AKD4649-B --- Evaluation board for AK4649
(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

- **DIT/DIR with optical input/output**
- **10pin Header for serial control mode**

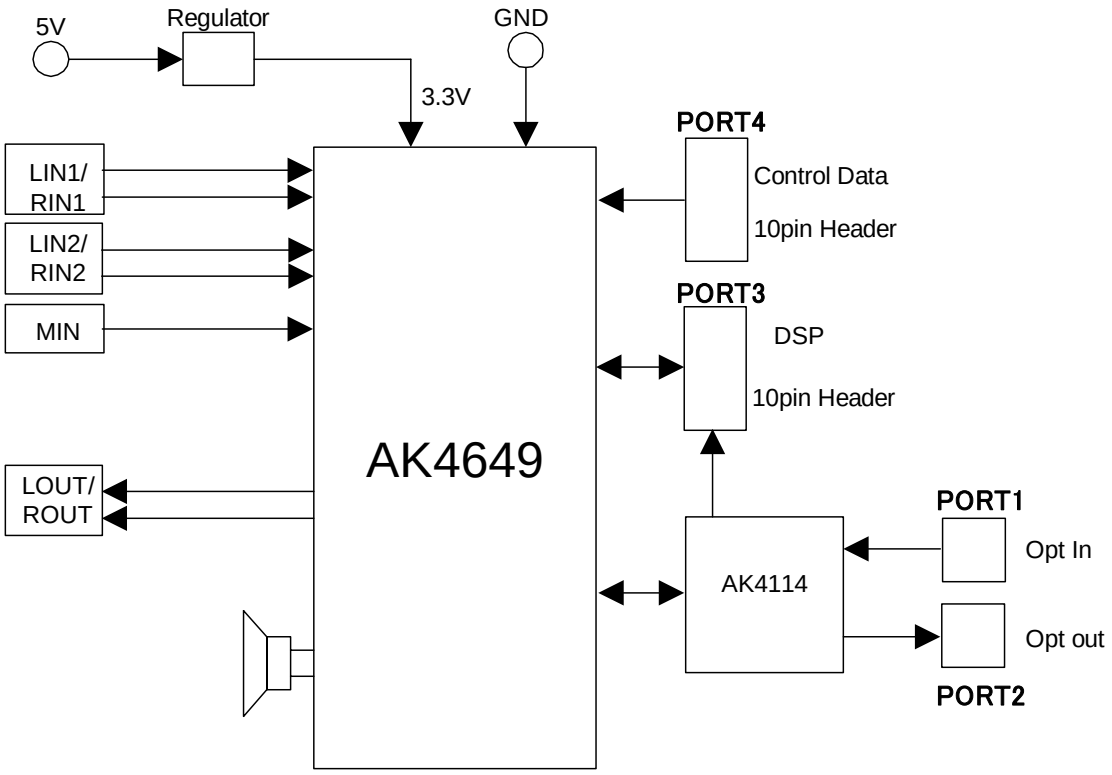


Figure 1. AKD4649-B Block Diagram

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

BOARD OUTLINE CHART

■ Outline Chart

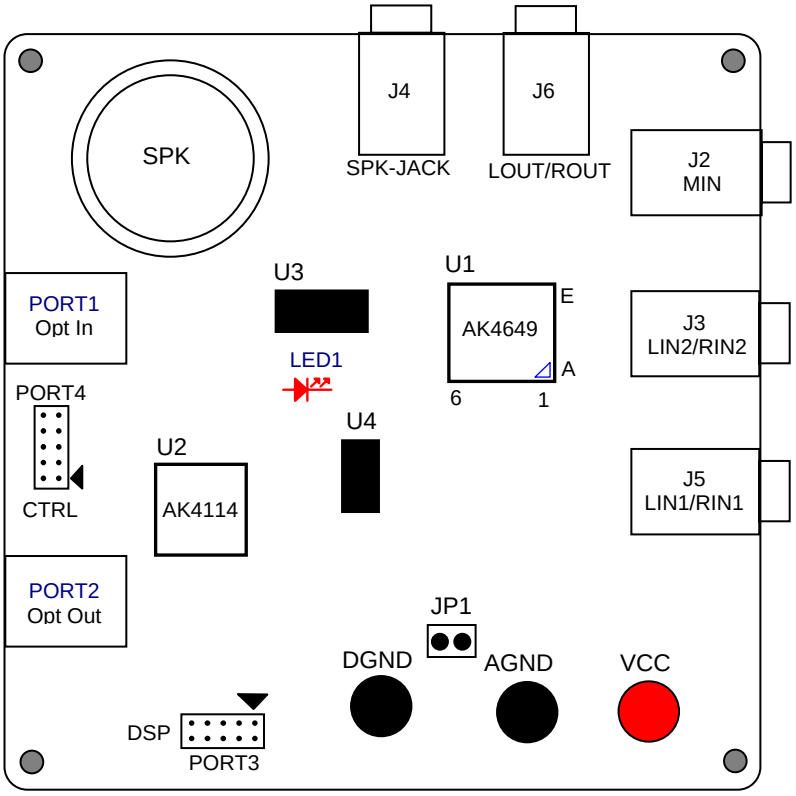


Figure 2. AKD4649-B Outline Chart

■ Comment

(1) J2, J3, J5 (Mini Jacks)
Analog signal input.

(2) J4, J6 (Mini Jacks)
Analog signal output.

(3) VCC, AGND, DGND (Power Supply Terminal)
Connect power supply with these terminals.

(4) PORT1, PORT2 (Optical Connectors)
PORT1 (DIR) : Input optical signal (SPDIF, Fs:32～48kHz) to AK4114.
PORT2 (DIT) : Output optical signal (SPDIF, Fs:32～48kHz) from AK4114.
.

(5) PORT4 (10pin Header)
Control port. Connect the bundled cable into this port.

(6) PORT3 (10pin Header)
DSP port. MCLK, BICK, LRCK, SDTO and SDTI can be input/output from PORT3.

Evaluation Board Manual

■ Operation sequence

1) Set up the power supply lines.

Name	Color	Voltage	Comments	Attention
VCC	Red	+5.0V	Regulator	Power line is needed for this jack.
AGND	Black	0V	Analog ground	Power line is needed for this jack.
DGND	Black	0V	Digital ground	Power line is needed for this jack.

Table 1 Set up of power supply lines

2) Set up the evaluation mode, jumper pins. (See the followings.)

3) Power on.
The AK4649 and AK4114 should be reset once bringing SW1 "L" upon power-up.

■ Evaluation mode

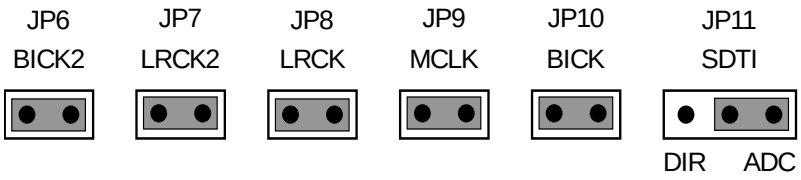
(1) Slave mode

(1-1) Evaluation of Recording block (MIC, ADC) using DIT of AK4114
(1-2) Evaluation of Playback block (SPK, Lineout) using DIR of AK4114
(1-3) Evaluation of Loop-back using AK4114 <Default>
(1-4) All interface signals including master clock are fed externally.

The AK4114's audio interface format is fixed to MSB Justified.

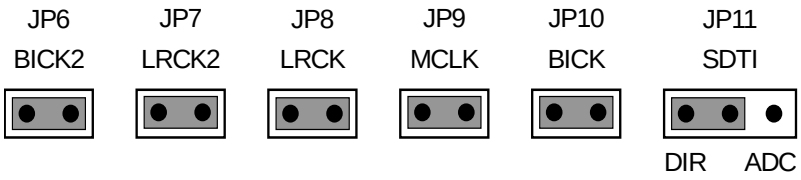
(1-1) Evaluation of Recording block using DIT of AK4114

PORT2 (DIT) and X1 (X'tal) are used. DIT generates audio bi-phase signal from received data and which is output through optical connector (TOTX141). Nothing should be connected to PORT1 (DIR) and PORT3 (DSP).



(1-2) Evaluation of Playback block using DIR of AK4114

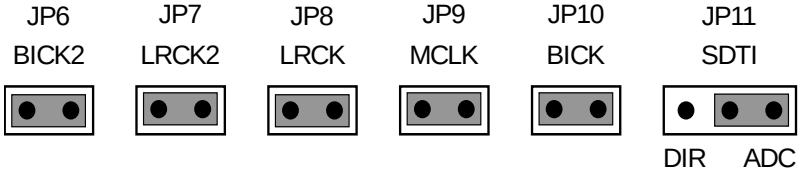
PORT1 (DIR) is used. Nothing should be connected to PORT3 (DSP).



The AK4114 operates at fs of 32kHz or more. If the fs is slower than 32kHz, any other evaluation mode without using DIR should be used.

(1-3) Evaluation of Loop-back using AK4114 <Default>

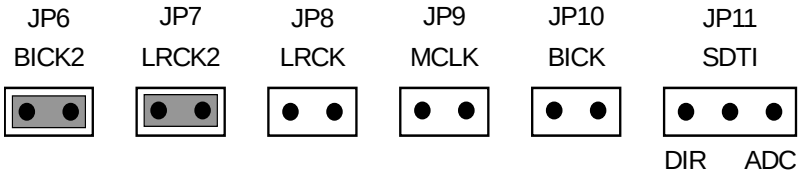
X'tal oscillator (X1) is used. Nothing should be connected to PORT1 (DIR) and PORT3 (DSP).



The AK4114 operates at fs of 32kHz or more. If the fs is slower than 32kHz, any other evaluation mode without using DIR should be used.

(1-4) All interface signals including master clock are fed externally.

PORT3 (DSP) is used. Nothing should be connected to PORT1 (DIR).

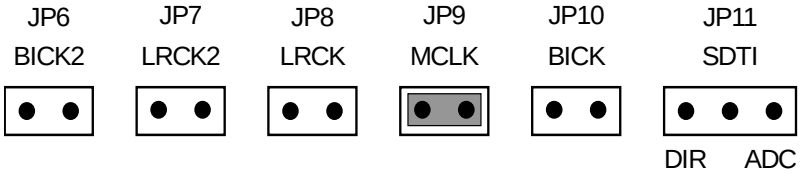


(2) Master mode

(2-1) Evaluation of Loop-back using MCLK of AK4114
(2-2) Master clock is fed externally

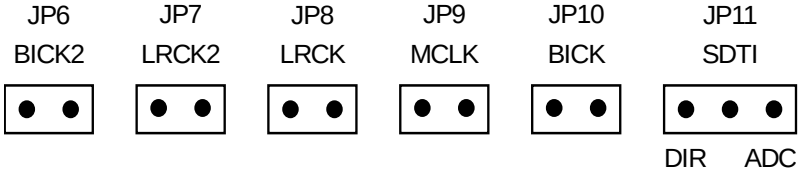
(2-1) Evaluation of Loop-back using MCLK of AK4114

X'tal oscillator (X1) is used. Nothing should be connected to PORT1 (DIR) and PORT3 (DSP). It can be evaluated at internal loop-back mode (ADCPF = PFDAC bits = "1"). It is possible to evaluate at various sampling frequencies using built-in AK4649's PLL.



(2-2) Master clock is fed externally

PORT3 (DSP) is used and MCLK is fed from PORT3. Nothing should be connected to PORT1 (DIR). It can be evaluated at internal loop-back mode (ADCPF = PFDAC bits = "1"). It is possible to evaluate at various sampling frequencies using built-in AK4649's PLL.



■ In case of using the digital microphone

	Analog MIC	Digital MIC
JP17	LIN1	DMDAT
JP18	RIN1	DMCLK
JP19	Don't care	DMP: Supply the power to the digital microphone from DMP pin.
		AVDD: Supply the power to the digital microphone from AVDD.
JP20	MPWR	DMP

Table 2 .The setting of jump pins for the digital microphone

■ Other jumper pins set up

1. JP1 (GND) : Connection between AGND and DGND.
   OPEN : Both grounds are separated on board.
   SHORT : Both grounds are connected on board. <Default>

2. JP2, JP3 : Connection of mic power.
   OPEN: Mic power is not connected.
   SHORT : Mic power is connected. <Default>

3. JP4, JP5 : Select speaker type.
   EXT : SPP and SPN signals are output from J4.
   Dynamic : Dynamic speaker <Default>

4. JP12, JP21, JP22, JP23 : Select I/F Mode.
   3-wire : 3-wire Serial Mode.
   I2C : I2C Bus Mode <Default>

5. JP13 (CAD0) : Select chip address in I2C Mode.
   OPEN : Chip address (CAD0) = "1" <Default>
   SHORT : Chip address (CAD0) = "0"

6. JP16 : Connection of MIN External Resistance.
   OPEN : External Resistance Mode (BPM bit = "0") <Default>
   SHORT : Internal Resistance Mode (BPM bit = "1")

■ The function of the toggle SW

[SW1] (PDN): Power down of AK4649 and AK4114. Keep "H" during normal operation.

■ Indication for LED

[LED1] (ERF): Monitor INT0 pin of the AK4114. LED turns on when some error has occurred to AK4114.

■ Serial Control

The AK4649 can be controlled via the printer port (parallel port) of IBM-AT compatible PC. Connect PORT4 (CTRL) with PC by 10 wire flat cable packed with the AKD4649.

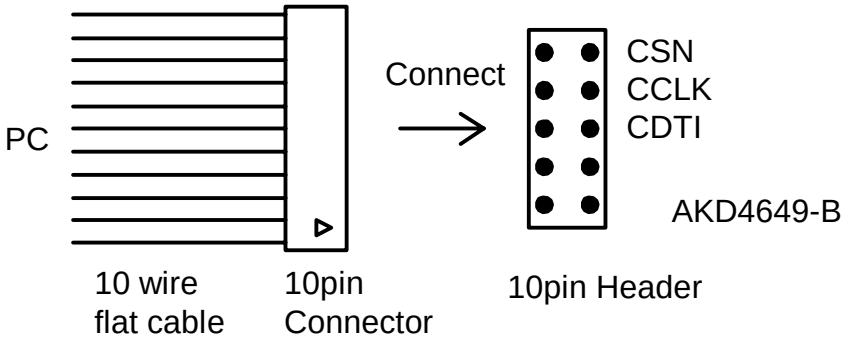


Figure 3. Connect of 10 wire flat cable

The AK4649 supports 3-wire serial control mode and I2C-bus control mode (fast-mode, max : 400kHz).Please Set the jump pins as the table 1 when you want to change another mode.

Mode	JP12, JP21, JP22, JP23	JP13
3-wire	3-wire	Open
I2C	I2C (CAD0 = "0")	Short
	I2C (CAD0 = "1")	Open

Table 3 .Select Control Mode

■ Analog Input/Output Circuits

(1) Input Circuits

1. MIN Input Circuit

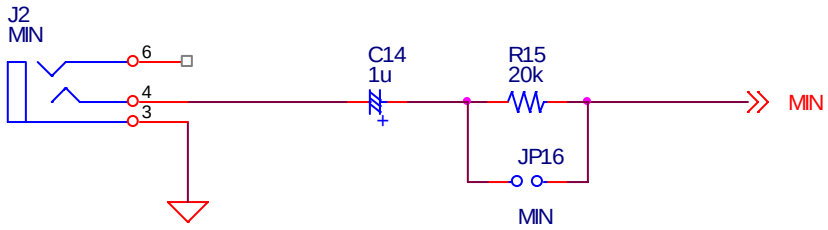


Figure 4. MIN Input Circuit

2. LINE1 Input Circuit

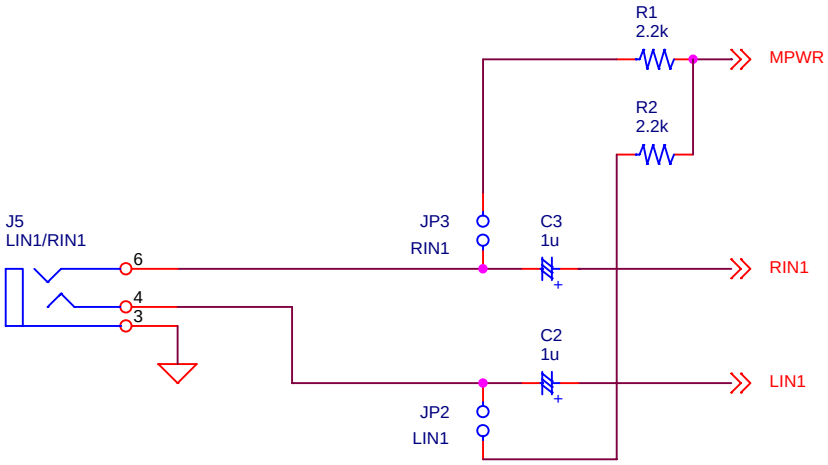


Figure 5. LIN1/RIN1 Input Circuit

3. LINE2 Input Circuit

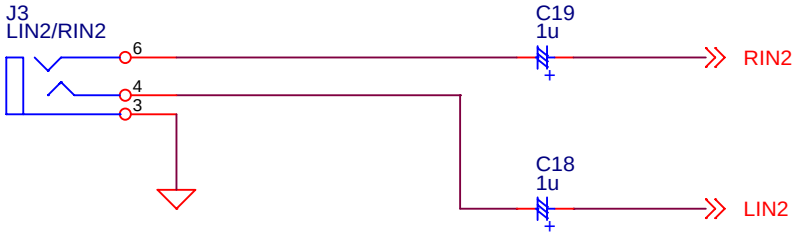


Figure 6. LIN2/RIN2 Input Circuit

(2) Output Circuits

1. STEREO LINE Output Circuit

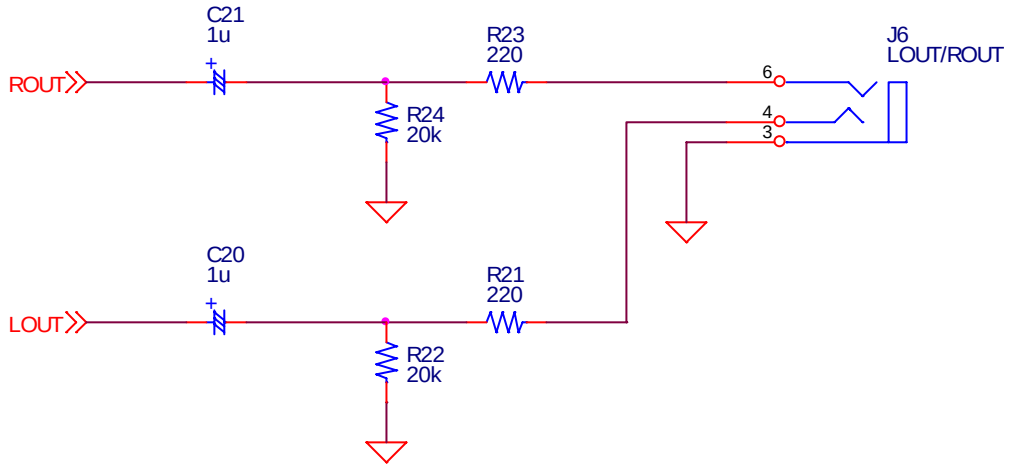


Figure 7 . STEREO LINE Output Circuit

2. SPEAKER Output Circuit

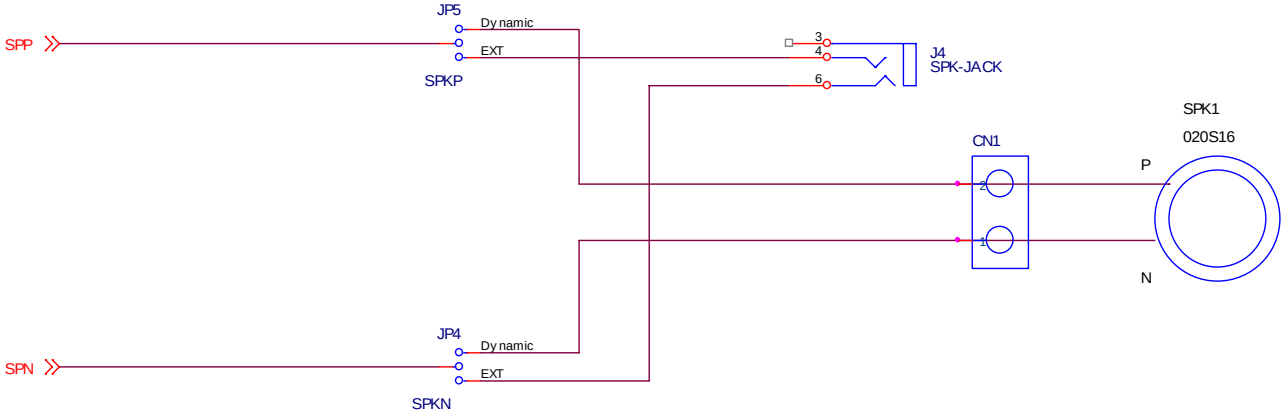


Figure 8. SPEAKER Output Circuit

Control Software Manual

■ Set-up of evaluation board and control software

1. Set up the AKD4649-B according to previous term.

2. Connect IBM-AT compatible PC with AKD4649-B by 10-line type flat cable (packed with AKD4649-B). 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 "AKD4649-B Evaluation Kit" into the CD-ROM drive.

4. Access the CD-ROM drive and double-click the icon of "AKD4649.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.
3. Click "Write default" button

■ Explanation of each buttons

1. [Port Reset] : Set up the port. When this is pushed, the printer port or USB port is selected automatically.
2. [Write default] : Initialize the register of the AK4649
3. [All Write] : Write all registers that is currently displayed
4. [Function1] : Dialog to write data by keyboard operation.
5. [Function2] : Dialog to evaluate IVL/R, OVL/R, DVOL.
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. [Write] : Dialog to write data by mouse operation.
10. [SAVE] : Save the current register setting.
11. [OPEN] : Write the save values to all register.

■ 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”.

If you want to write the input data to the AK4649, 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.

If you want to write the input data to the AK4649, click [OK] button. If not, click [Cancel] button.

3. [Function2 Dialog] : Dialog to evaluate volume.

There are dialogs corresponding to register of 09h, 0Ah, 0Ch, 0FH and 25H.

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 the AK4649 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 the AK4649, click [OK] button. If not, click [Cancel] button.

4. [SAVE] and [OPEN]

4-1. [SAVE]

All of current register setting values displayed on the main window are saved to the file. The extension of file name is "akr".

<Operation flow>
(1) Click [SAVE] Button.
(2) Set the file name and click [SAVE] Button. The extension of file name is "akr".

4-2. [OPEN]

The register setting values saved by [SAVE] are written to the AK4649. 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".

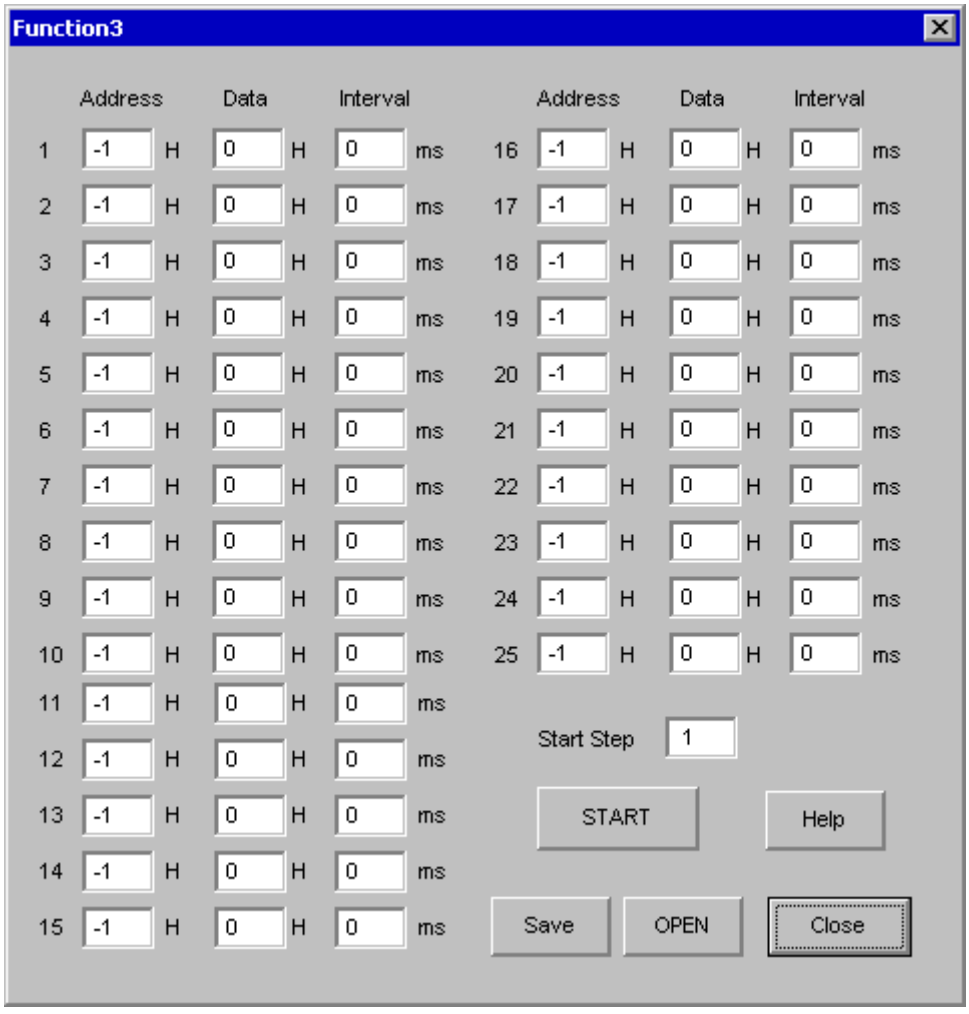


Figure 9. Window of [F3]

6. [Function4 Dialog]

The sequence file (*.aks) saved by [Function3] can be listed up to 10 files, assigned to buttons and then executed. When [F4] button is clicked, the window as shown in Figure 10 opens.

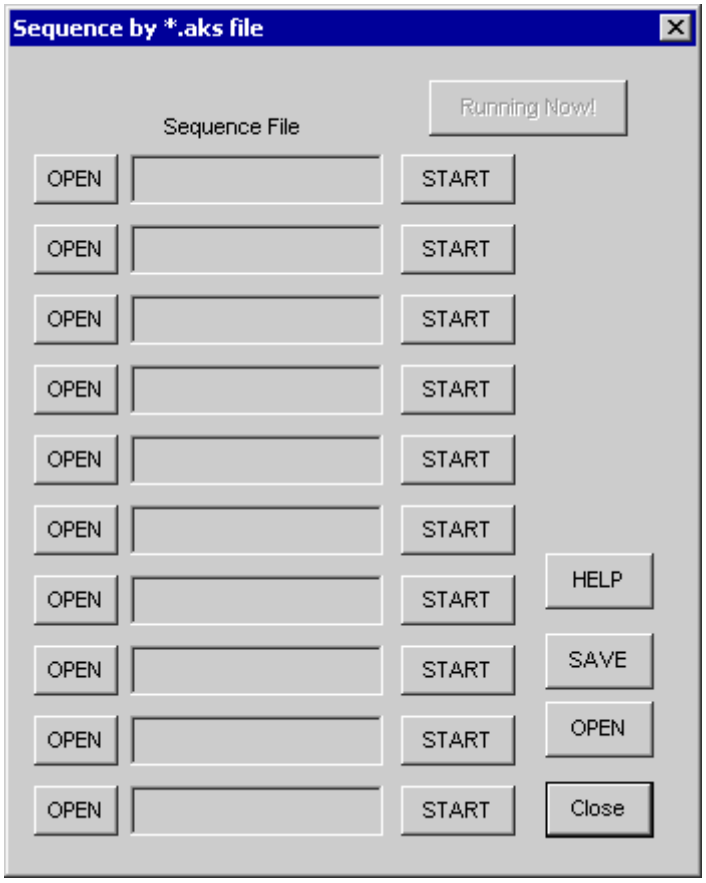


Figure 10. [F4] window

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

(1) Click [OPEN] button and select the sequence file (*.aks) saved by [Function3].

The sequence file name is displayed as shown in Figure 11. (In case that the selected sequence file name is "DAC_Stereo_ON.aks")

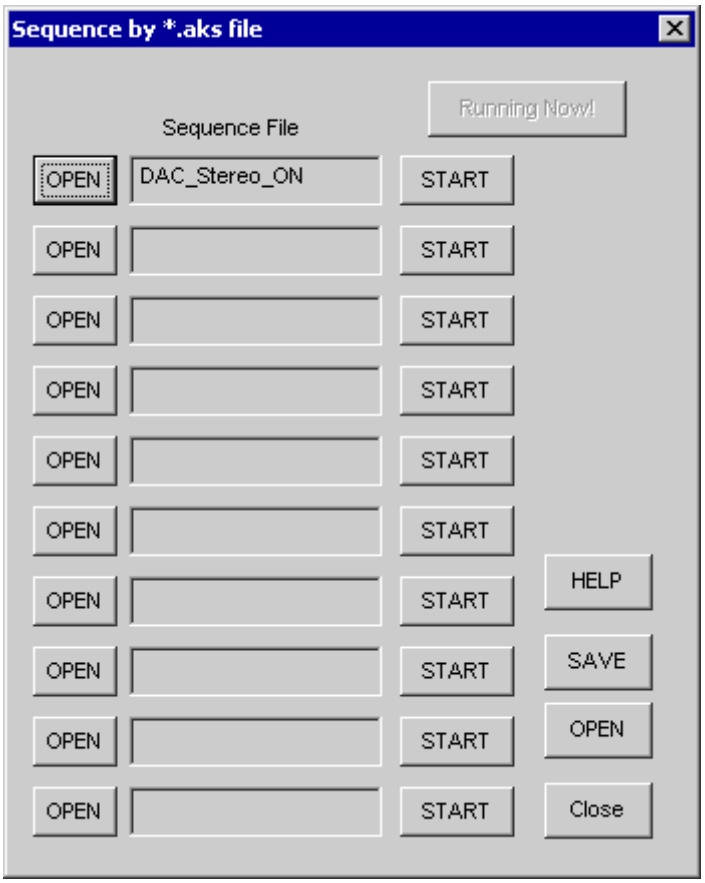


Figure 11. [F4] window(2)

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

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

[SAVE] : The name assign of sequence file displayed on [Function4] window can be saved to the file. The file name is "*.ak4".

[OPEN] : The name assign of sequence file(*.ak4) saved by [SAVE] is loaded.

6-3. Note

(1) This function doesn't support the pause function of sequence function.

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

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

7. [Function5 Dialog]

The register setting file(*.akr) saved by [SAVE] function on main window can be listed up to 10 files, assigned to buttons and then executed. When [F5] button is clicked, the window as shown in Figure 12 opens.

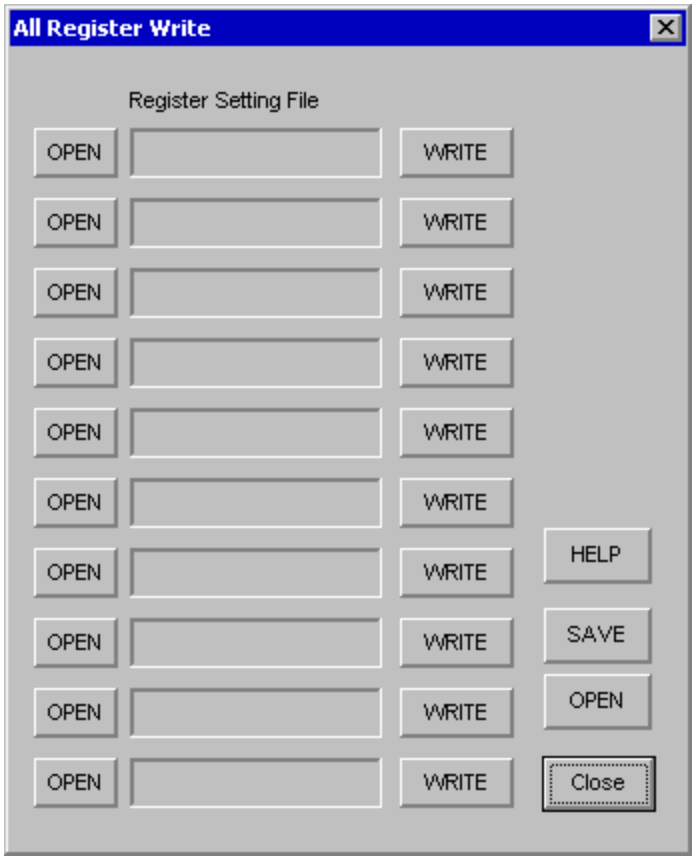


Figure 12. [F5] window

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

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

The register setting file name is displayed as shown in Figure 13. (In case that the selected file name is "DAC_Output.akr")

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

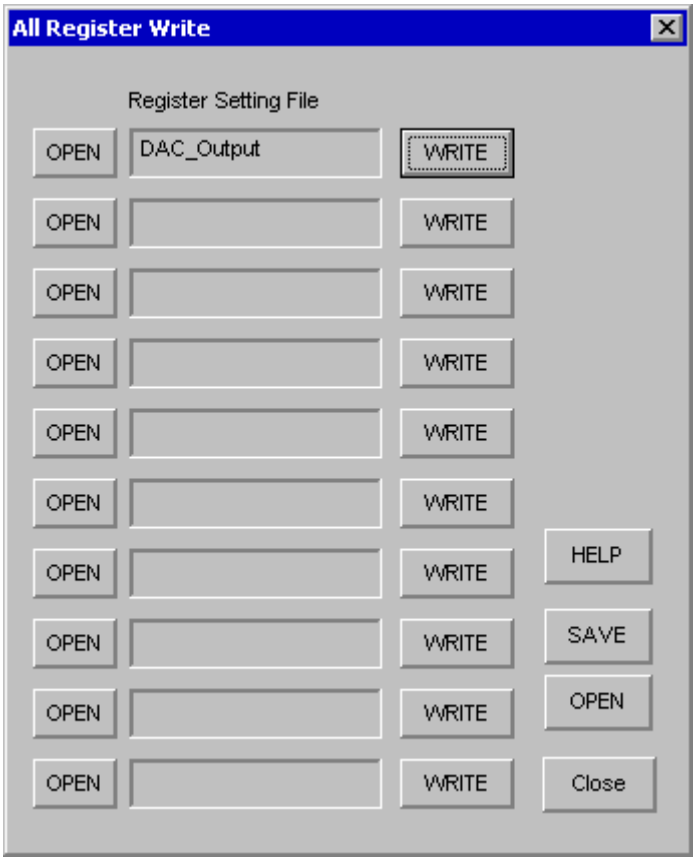


Figure 13. [F5] windows(2)

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

[SAVE] : The name assign of register setting file displayed on [Function5] window can be saved to the file. The file name is "*.ak5".
[OPEN] : The name assign of register setting file(*.ak5) saved by [SAVE] is loaded.

7-3. Note

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

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

8. [Filter Dialog]

A calculation of a coefficient of Digital Programmable Filter such as HPF,EQ filter ,a write to a register and check frequency response such as HPF,EQ filter.
Window to show to Figure 14 opens when push a [Filter] button .

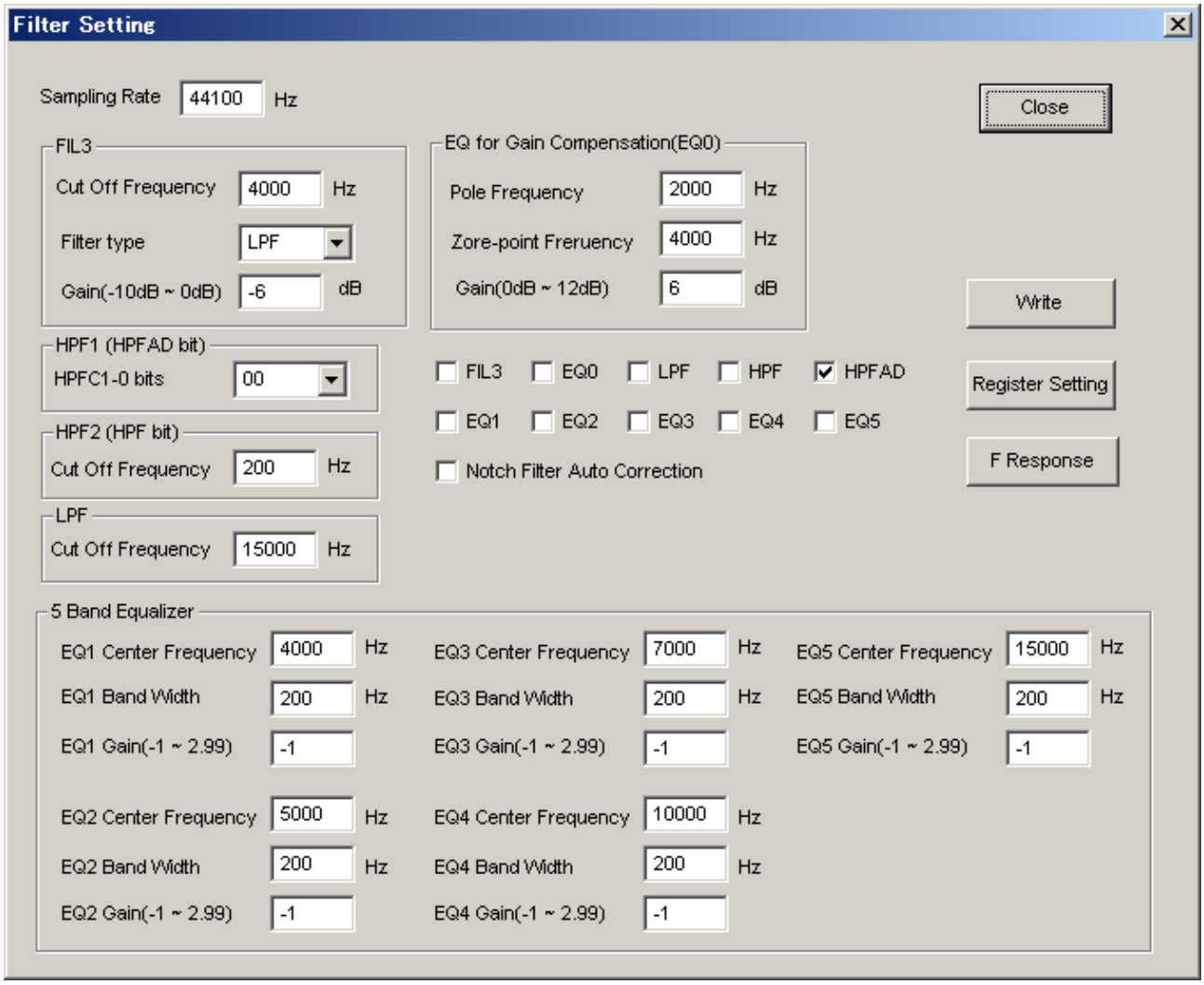


Figure 14. Main Window

8-1. Setting of a parameter

(1) Please set a parameter of each Filter.

Item	Contents	Setting range
Sampling Rate	Sampling frequency (fs)	7350Hz ≤ fs ≤ 48000Hz
FIL3		
Cut Off Frequency	Stereo separation emphasis filter cut cff frequency	fs/10000 ≤ Cut Off Frequency ≤ (0.497 * fs)
Filter type	Type of stereo separation emphasis filter	LPF or HPF
Gain	Gain of stereo separation emphasis filter	–10dB ≤ Gain ≤ 0dB
HPF		
Cut Off Frequency	High pass filter cut off frequency	fs/10000 ≤ Cut Off Frequency ≤ (0.497 * fs)
LPF		
Cut Off Frequency	Low pass filter cut off frequency	fs/20 ≤ Cut Off Frequency ≤ (0.497 * fs)
EQ for Gain Compensation (EQ0)		
Pole Frequency	Pole Frequency	fs/10000 ≤ Pole Frequency ≤ (0.497 * fs)
Zero-point Frequency	Zero-point Frequency	fs/10000 ≤ Zero-point Frequency ≤ (0.497 * fs)
Gain	Gain	0dB ≤ Gain ≤ +12dB
5 Band Equalizer		
EQ1-5 Center Frequency	EQ1-5 Center Frequency	0Hz ≤ Center Frequency < (0.497 * fs)
EQ1-5 Band Width	EQ1-5 Band Width (Note 1)	1Hz ≤ Band Width < (0.497 * fs)
EQ1-5 Gain	EQ1-5 Gain (Note 2)	-1≤ Gain < 3

Note 1. A gain difference is a bandwidth of 3dB from center frequency.
Note 2. When a gain is smaller than 0 , EQ becomes a notch filter.

(2) "FIL3", "EQ0", "LPF", "HPF", "HPFAD", "EQ1", "EQ2", "EQ3", "EQ4", "EQ5" Please set ON/OFF of Filter with a check button. When checked it, Filter becomes ON. When checked "Notch Filter Auto Correction", perform automatic revision of center frequency of a notch filter. ("Cf. 8-4. automatic revision of center frequency of a notch filter")

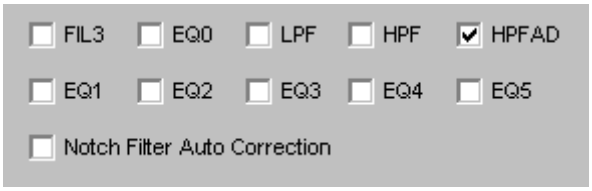


Figure 15. Filter ON/OFF setting button

8-2. A calculation of a register

A register set value is displayed when push a [Register Setting] button. When a value out of a setting range is set, error message is displayed, and a calculation of register setting is not carried out.

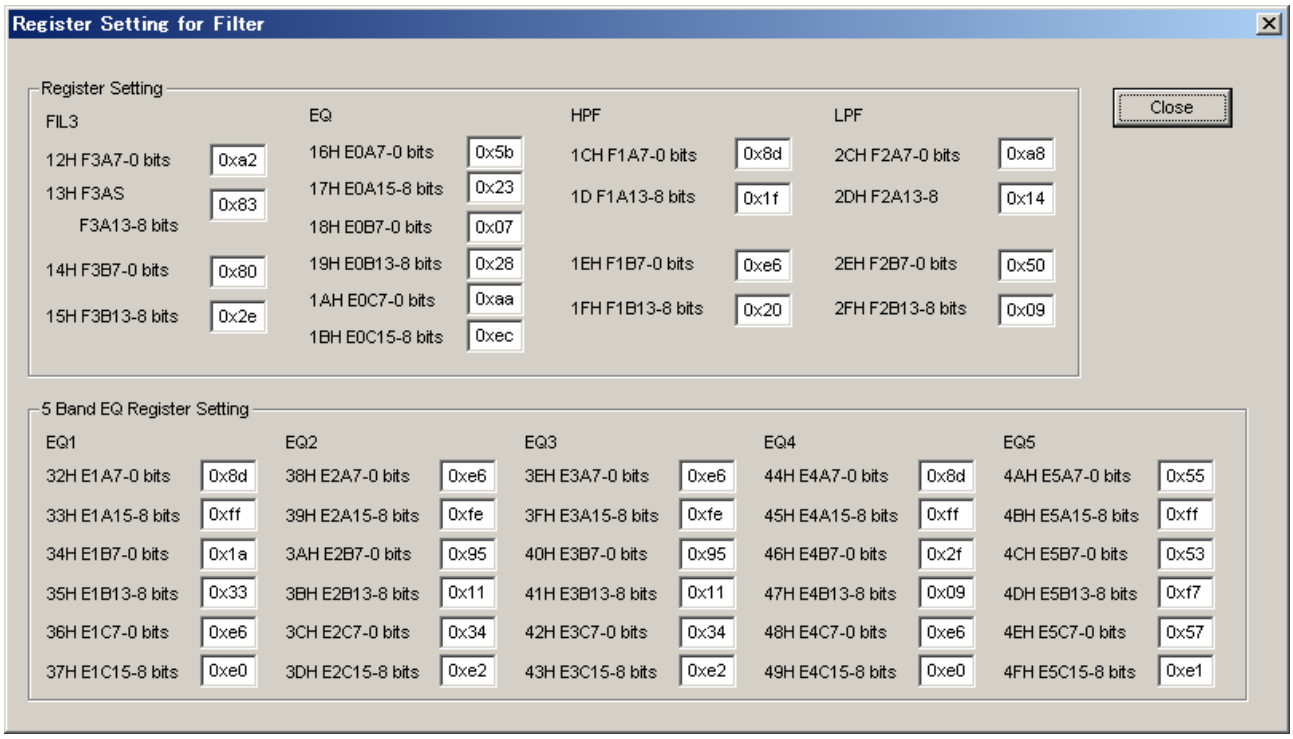


Figure 16. A register setting calculation result

When it is as follows that a register set value is updated.
(1) When [Register Setting] button was pushed.
(2) When [Frequency Response] button was pushed.
(3) When [UpDate] button was pushed on a frequency characteristic indication window.
(4) When set ON/OFF of a check button “Notch Filter Auto Correction”

8-3.Indication of a frequency characteristic

A frequency characteristic is displayed when push a [Frequency Response] button. In addition, a register set point is updated then, too.
Change "Frequency Range", and indication of a frequency characteristic is updated when push a [UpDate] button.

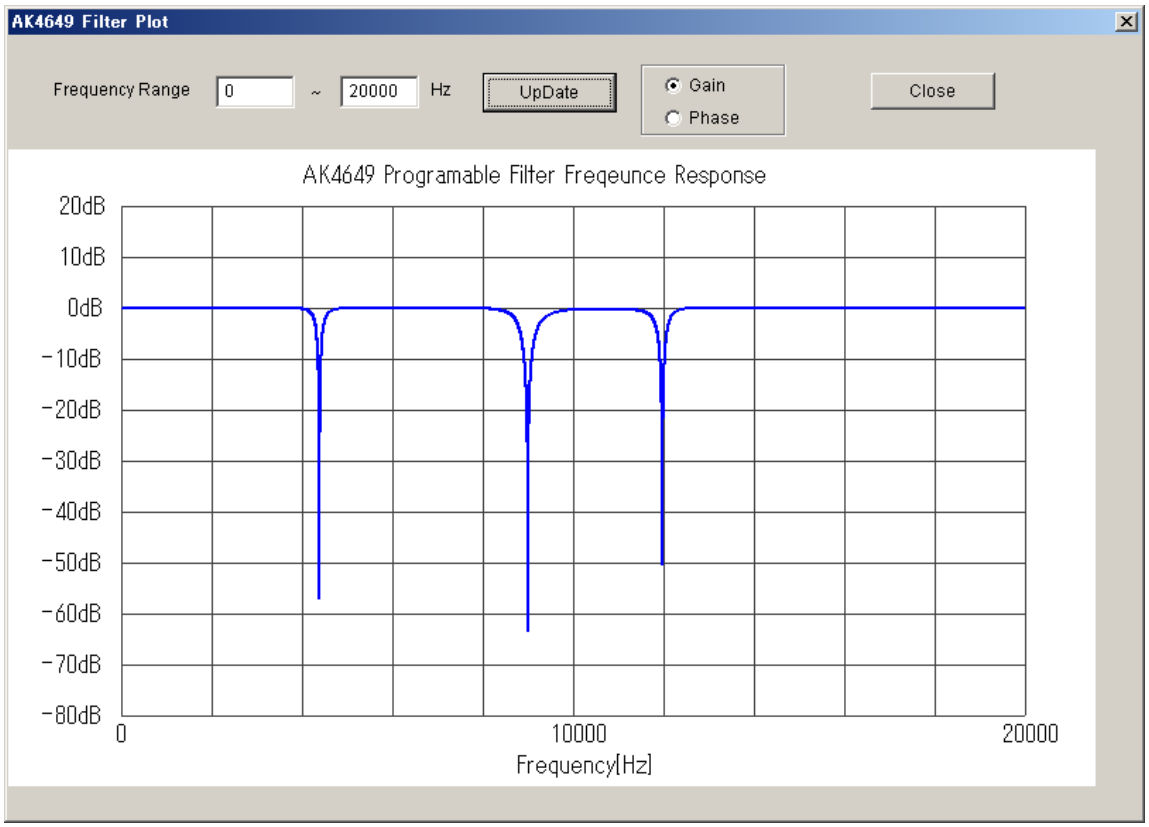


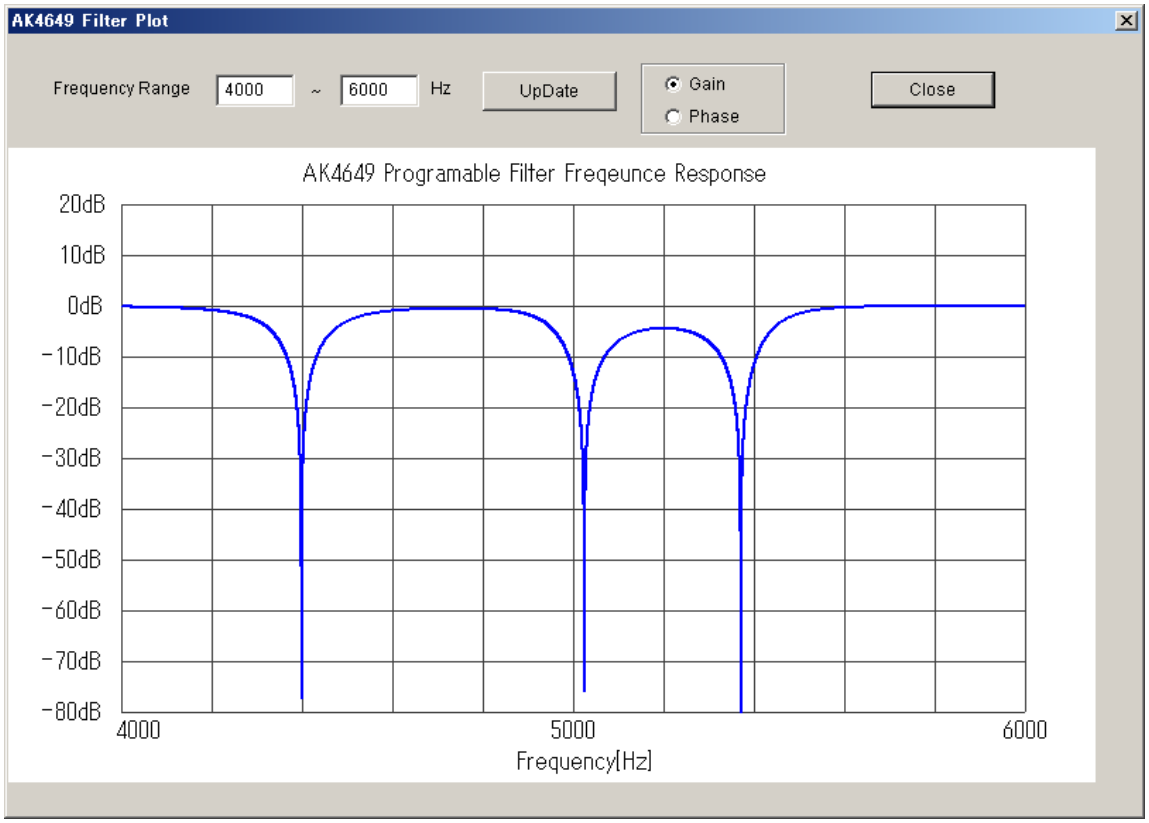
Figure 17. A frequency characteristic indication result

When it is as follows that a register set point is updated.
(1) When [Register Setting] button was pushed.
(2) When [Frequency Response] button was pushed.
(3) When [UpDate] button was pushed on a frequency characteristic indication window.
(4) When set ON/OFF of a check button “Notch Filter Auto Correction”

8-4. Automatic revision of center frequency of a notch filter

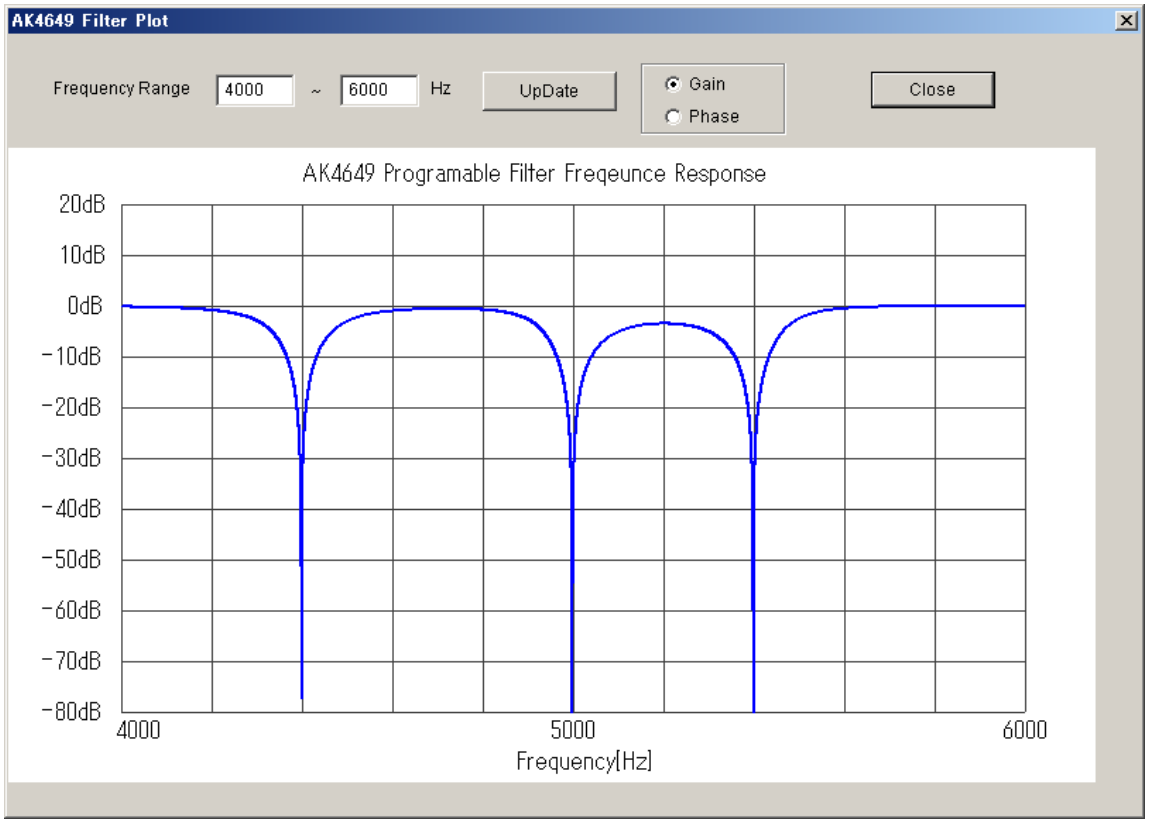
When set a gain of 5 band Equalizer to -1, Equalizer becomes a notch filter. When center frequency of plural notch filters is adjacent, produce a gap to central frequency (Figure 18). When check "a Notch Filter Auto Correction" button, perform automatic revision of central frequency of a notch filter, display register setting after automatic revision and a frequency characteristic (Figure 19). This automatic revision is availability for Equalizer Band which set a gain to "-1".

(Note) When distance among center frequency is smaller than band width, there is a possibility that automatic revision is not performed definitely. Please confirm a revision result by indication of a frequency characteristic.



Setting of center frequency: 4400Hz, 5000Hz, 5400Hz / Band Width : 200Hz(3 band common)

Figure 18. When there is no revision of center frequency



Setting of center frequency: 4400Hz, 5000Hz, 5400Hz / Band Width : 200Hz(3 band common)

Figure 19. When there is revision of center frequency

MEASUREMENT RESULTS

[Measurement condition]

- Measurement unit : Audio Precession System Two Cascade
- MCLK : 11.2896MHz
- BICK : 64fs
- fs : 44.1kHz
- Bit : 24bit
- Power Supply : AVDD = DVDD = SVDD = 3.3V
- Measurement Filter : 10Hz ~ 20kHz
- Temperature : Room

1. LIN1/RIN1 → ADC

a) MGAIN = +20dB

Parameter		Result (Lch / Rch)	Unit
ADC Analog Input Characteristics: (LIN1/RIN1 pins → ADC → IVOL, IVOL = 0dB, ALC = OFF), MGAIN = +20dB, PMMP = "1"			
S/(N+D)	(-1dBFS Output)	81.8 / 81.7	dB
D-Range	(-60dB Output, A-weighted)	89.3 / 89.3	dB
S/N	(A-weighted)	89.5 / 89.6	dB

b) MGAIN = 0dB

Parameter		Result (Lch / Rch)	Unit
ADC Analog Input Characteristics: (LIN1/RIN1 pins → ADC → IVOL, IVOL = 0dB, ALC = OFF), MGAIN = 0dB, PMMP = "1"			
S/(N+D)	(-1dBFS Output)	82.2 / 82.1	dB
D-Range	(-60dB Output, A-weighted)	99.6 / 99.4	dB
S/N	(A-weighted)	102.2 / 102.1	dB

2. LIN2/RIN2 → ADC

a) MGAIN = +20dB

Parameter		Result (Lch / Rch)	Unit
ADC Analog Input Characteristics: (LIN2/RIN2 pins → ADC → IVOL, IVOL = 0dB, ALC = OFF), MGAIN = +20dB, PMMP = "0"			
S/(N+D)	(-1dBFS Output)	82.1 / 81.8	dB
D-Range	(-60dB Output, A-weighted)	89.2 / 89.2	dB
S/N	(A-weighted)	89.4 / 89.5	dB

b) MGAIN = 0dB

Parameter		Result (Lch / Rch)	Unit
ADC Analog Input Characteristics: (LIN2/RIN2 pins → ADC → IVOL, IVOL = 0dB, ALC = OFF), MGAIN = 0dB, PMMP = "0"			
S/(N+D)	(-1dBFS Output)	82.0 / 82.1	dB
D-Range	(-60dB Output, A-weighted)	99.6 / 99.4	dB
S/N	(A-weighted)	102.2 / 102.0	dB

3. DAC → LINEOUT

Parameter		Result (Lch / Rch)	Unit
Stereo Line Output Characteristics: (DAC → LOUT/ROUT pins), ALC = OFF, LOVL1-0 bit = "00", RL=10kΩ, DVOL = OVOL = DATT = 0dB			
S/(N+D)	(-3dBFS Output)	88.8 / 88.7	dB
D-Range	(-60dB Output, A-weighted)	96.9 / 96.9	dB
S/N	(A-weighted)	97.3 / 97.3	dB

4. DAC → SPK

Parameter		Result	Unit
Speaker-Amp Characteristics: (DAC → SPP/SPN pins), ALC = OFF, RL=8Ω, DVOL = OVOL = DATT = 0dB, SPKG1-0 bits = "00"			
S/(N+D)	(-0.5dBFS Output)	58.8	dB
S/N	(A-weighted)	98.2	dB

Parameter		Result	Unit
Speaker-Amp Characteristics: (DAC → SPP/SPN pins), ALC = OFF, RL=8Ω, DVOL = OVOL = DATT = 0dB, SPKG1-0 bits = "01"			
S/(N+D)	(-0.5dBFS Output)	59.2	dB
S/N	(A-weighted)	98.9	dB

PLOT DATA
1. LINEIN1 (LIN1 / RIN1 → ADC)

AK4649 LIN1/RIN1 THD+N vs. Input Level (fin = 1kHz, MGAIN = +20dB, PMMP = "1")

AKM

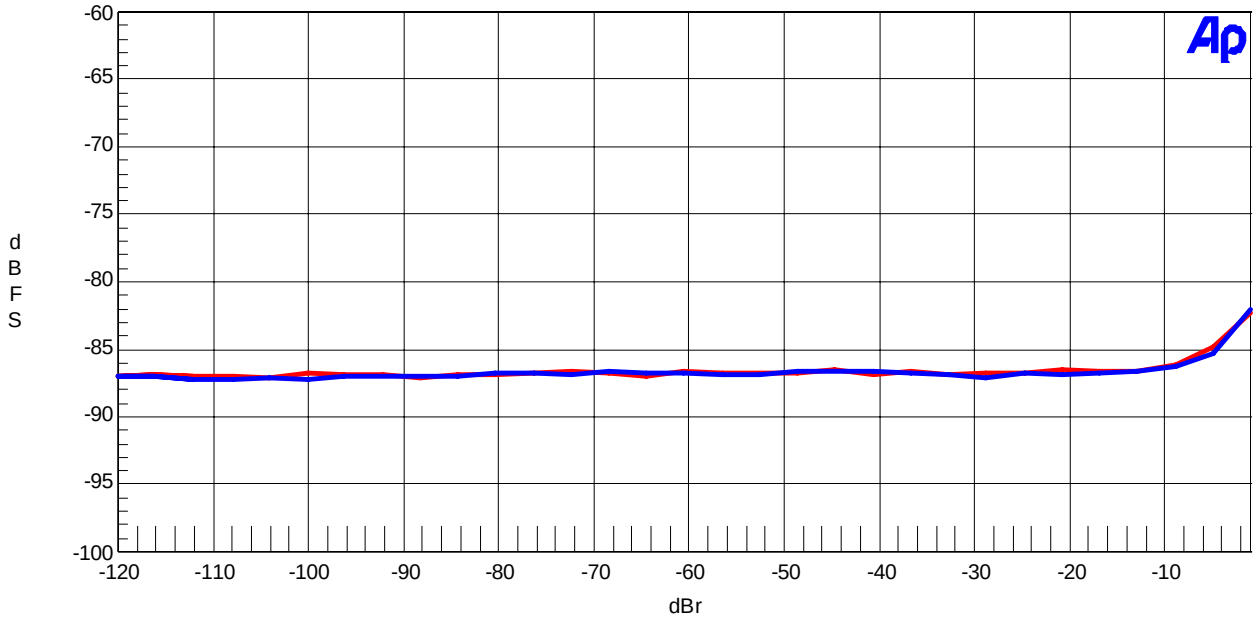


Figure 20. THD+N vs. Input Level

AK4649 LIN1/RIN1 THD+N vs. Input Frequency (Input Level = -1dBr, MGAIN = +20dB, PMMP = "1")

AKM

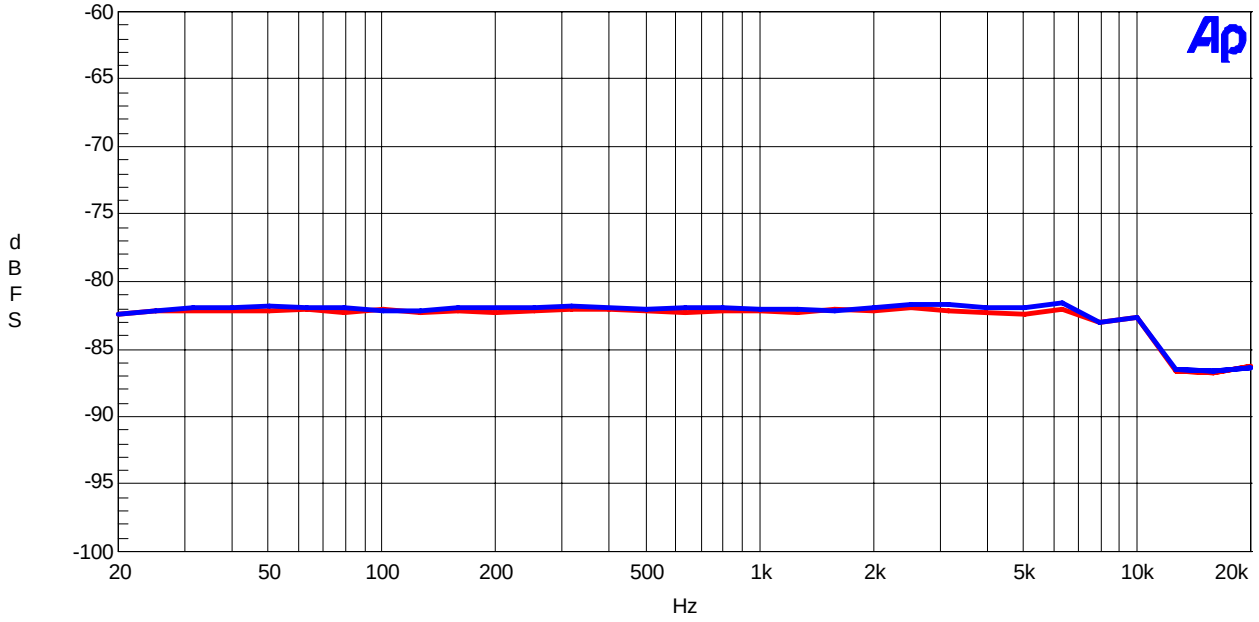


Figure 21. THD+N vs. Input Frequency

AK4649 LIN1/RIN1 Linearity(fin=1kHz, MGAIN = +20dB, PMMP = "1")

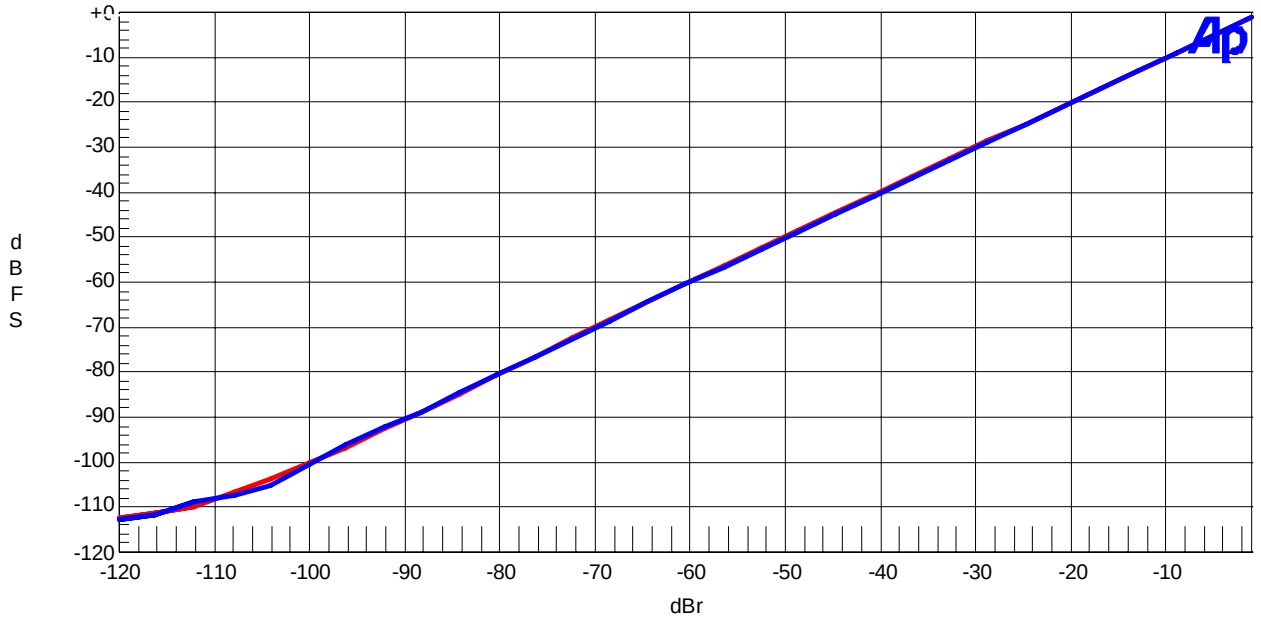


Figure 22. Linearity

AK4649 LIN1/RIN1 Frequency Response (Input Level = -1dBr, MGAIN = +20dB, PMMP = "1")

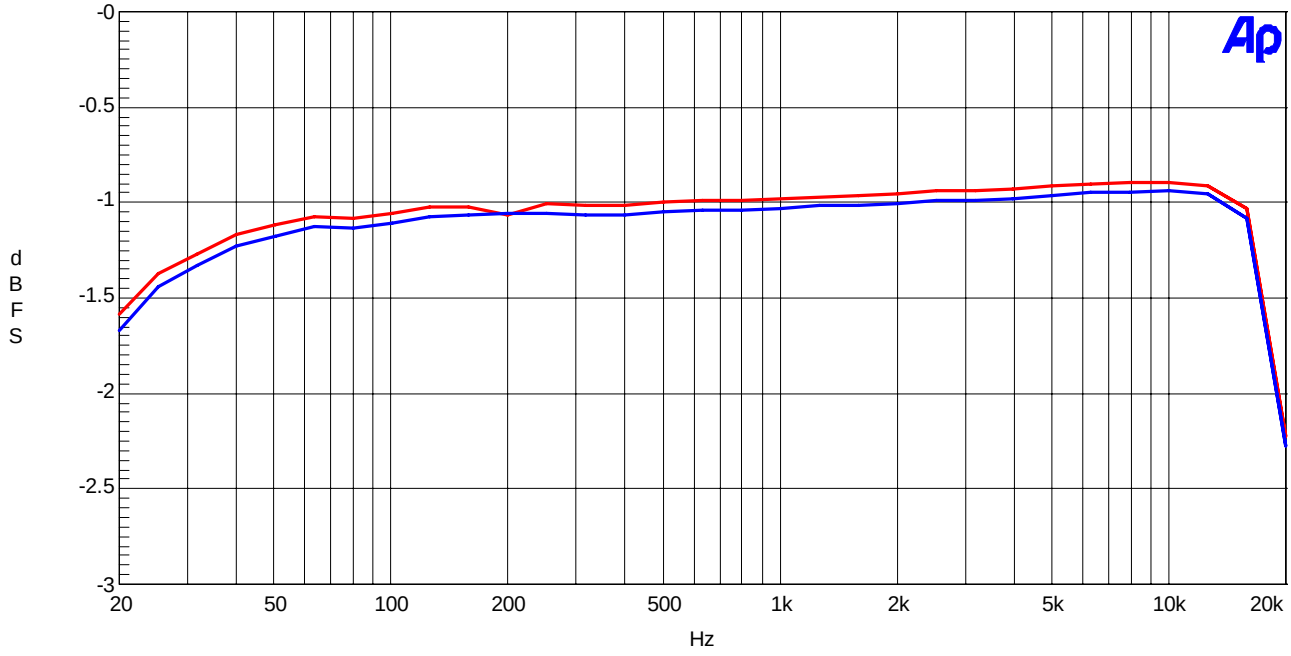


Figure 23. Frequency Response

AK4649 LIN1/RIN1 FFT (fin=1kHz, Input= -1dBr, MGAIN = +20dB, PMMP = "1")
FFT point=16384, Average=8

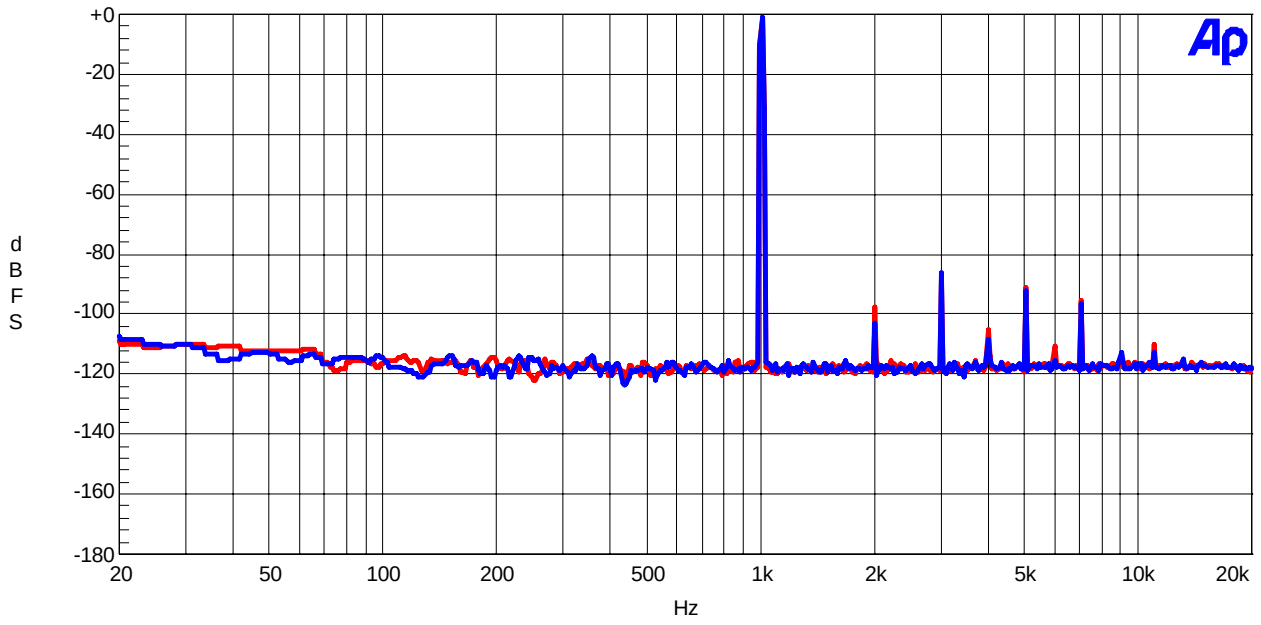


Figure 24. FFT Plot (Input = -1dBr, 0dBr = 82.98mVrms)

AK4649 LIN1/RIN1 FFT (fin=1kHz, Input= -60dBr, MGAIN = +20dB, PMMP = "1")
FFT point=16384, Average=8

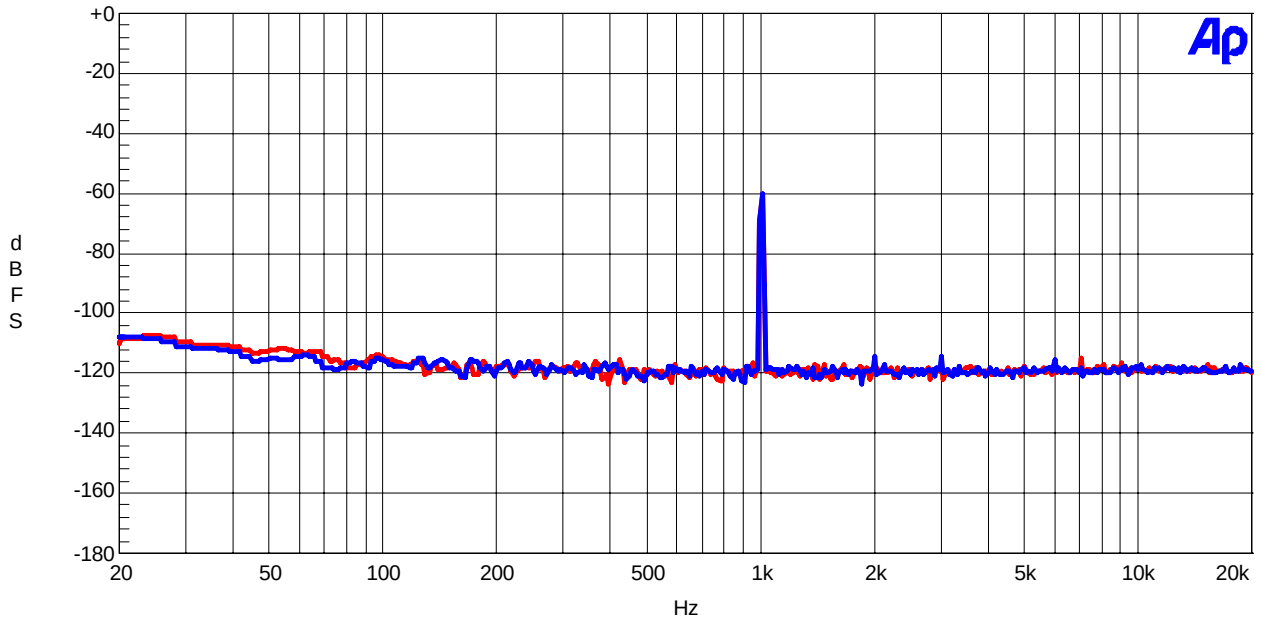


Figure 25. FFT Plot (Input=-60dBr, 0dBr = 82.98mVrms)

AK4649 LIN1/RIN1 FFT (Input=no signal)
FFT point=16384, Average=8

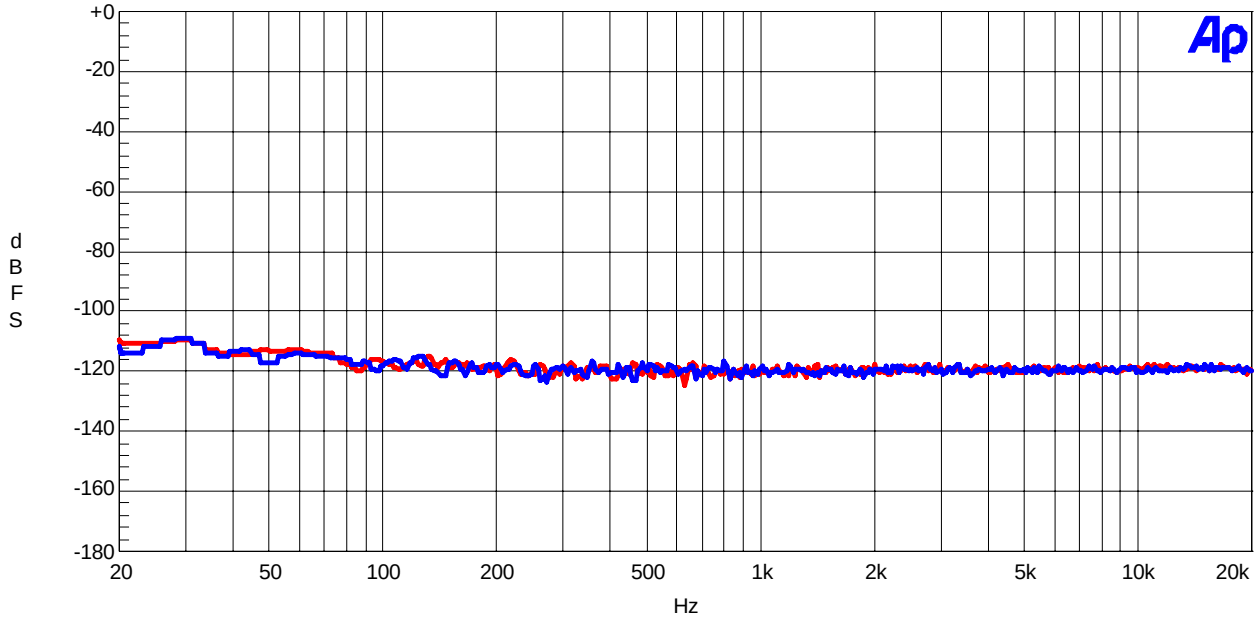


Figure 26. FFT Plot (no signal input)

AK4649 LIN1/RIN1 Crosstalk (Input Level = -1dBr)
RED: Rch → Lch, BLUE: Lch → Rch

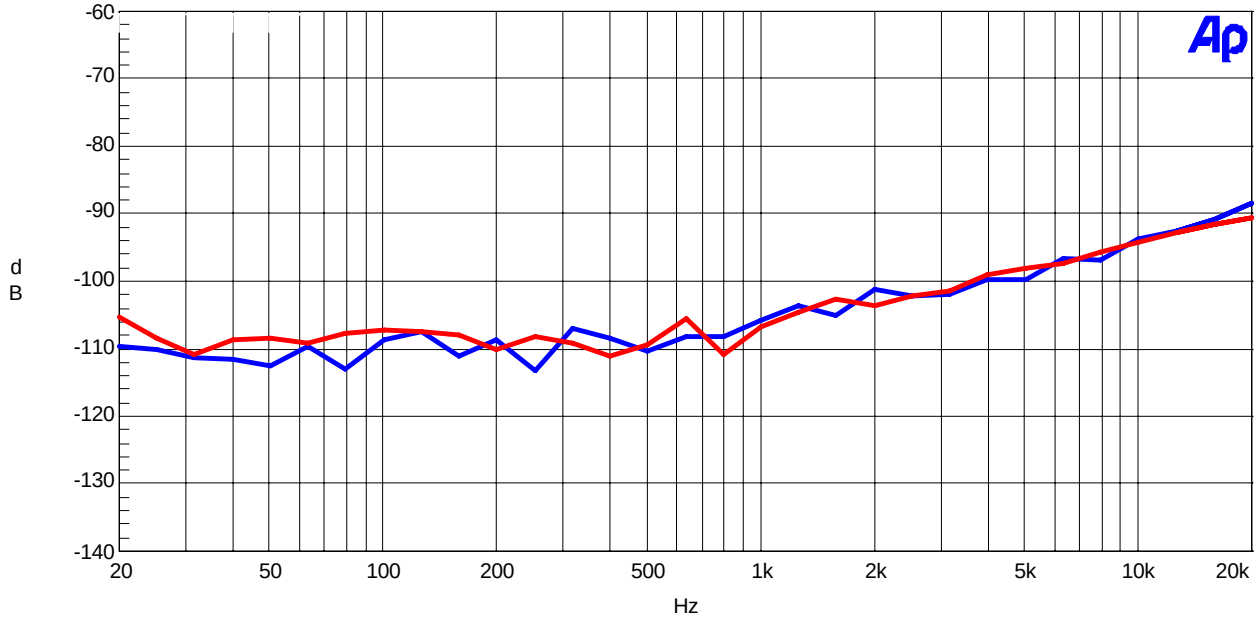


Figure 27. Crosstalk

2. LINEIN2 (LIN2 / RIN2 → ADC)

AK4649 LIN2/RIN2 THD+N vs. Input Level (fin = 1kHz, MGAIN = 0dB, PMMP = "0")

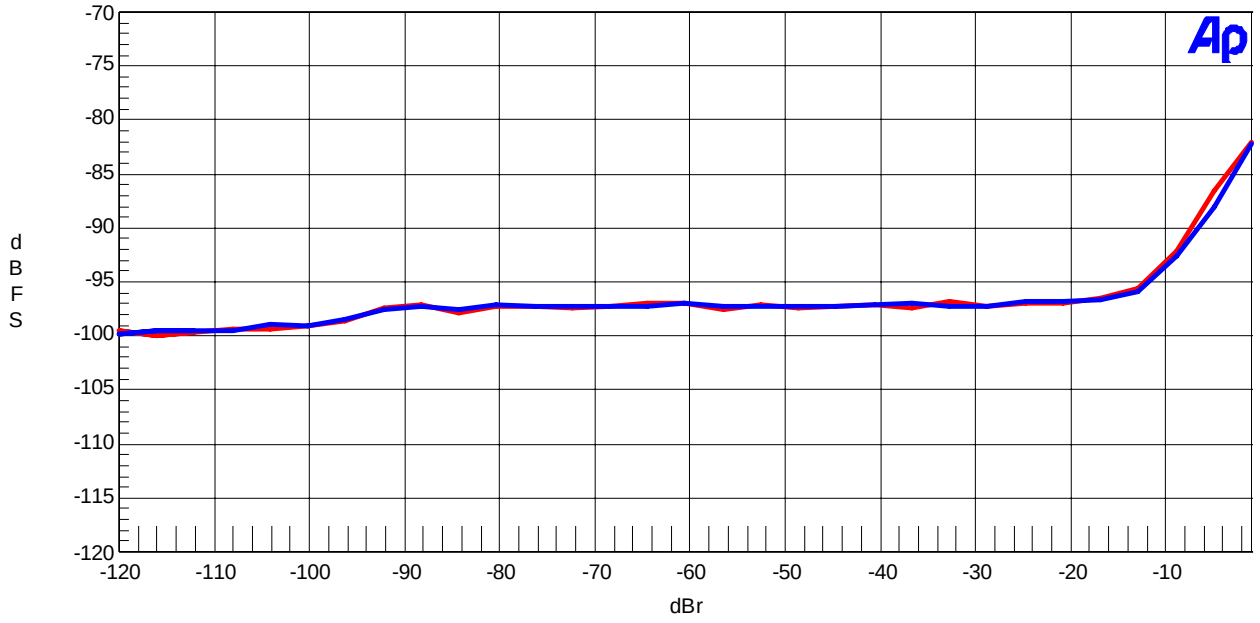


Figure 28. THD+N vs. Input Level

AK4649 LIN2/RIN2 THD+N vs. Input Frequency (Input Level = -1dBr, MGAIN = 0dB, PMMP = "0")

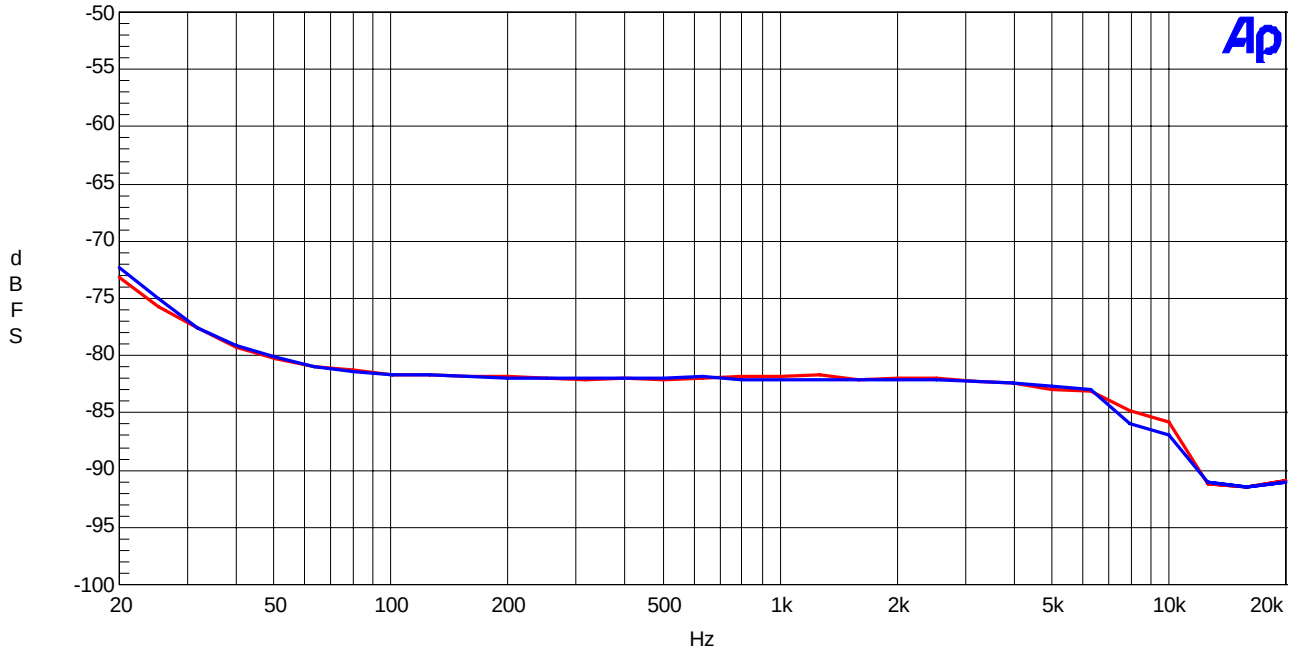


Figure 29. THD+N vs. Input Frequency

C18 and C19: Tantalum Capacitor

In this case, a tantalum capacitor is used LIN2 and RIN2 pin on the AKD4649-B.As the performance of a tantalum capacitor is not so good about low frequency signal. Refer to Figure 30 about the performance of AK4649.

AK4649 LIN2/RIN2 THD+N vs. Input Frequency (Input Level = -1dBr, MGAIN = 0dB, PMMP = “0”)

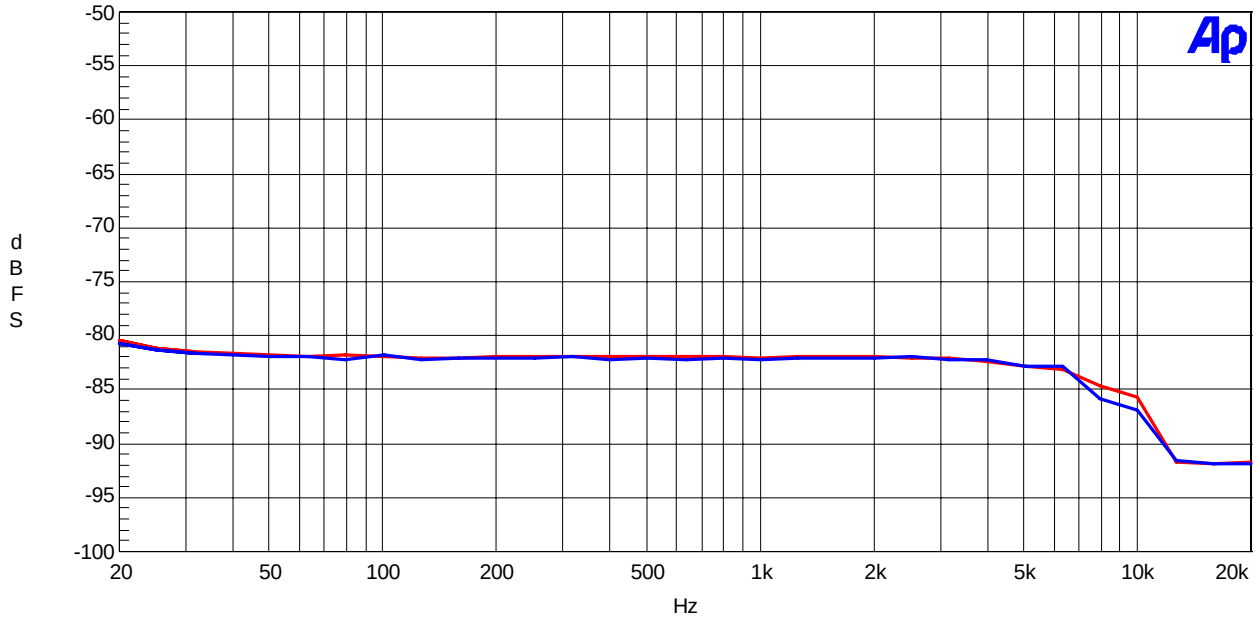


Figure 30. THD+N vs. Input Frequency
C18 and C19: Electrolytic Capacitor

AK4649 LIN2/RIN2 FFT (fin=1kHz, Input= -1dBr, MGAIN = 0dB, PMMP = “0”)
FFT point=16384, Average=8

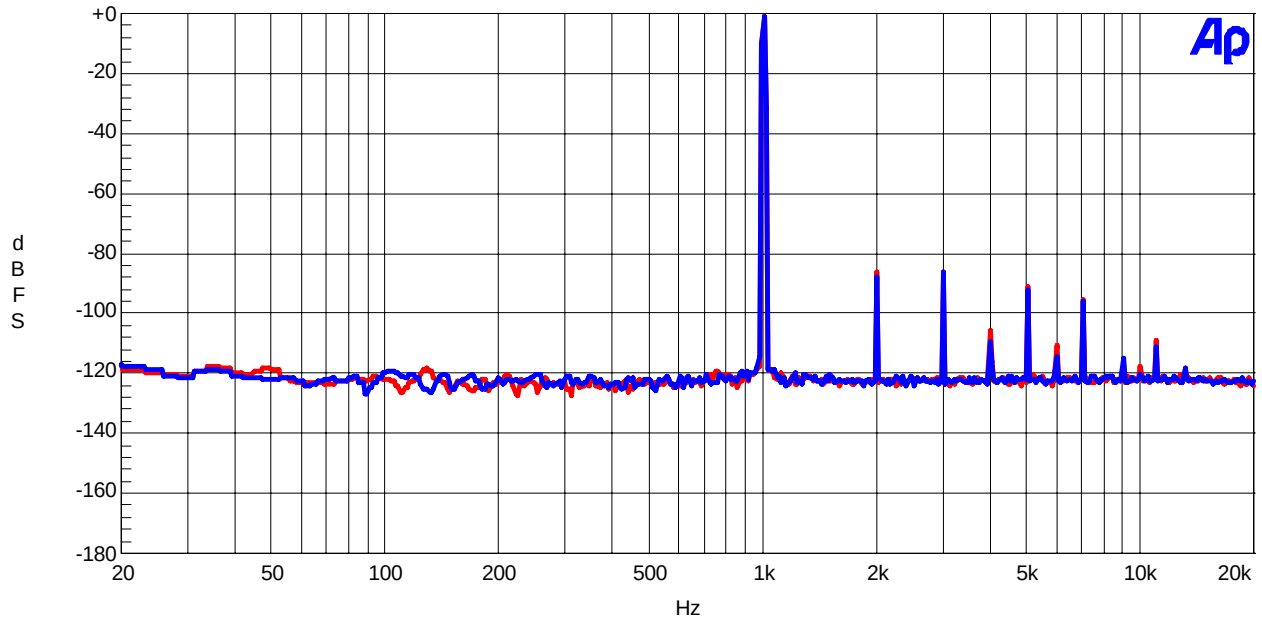


Figure 31. FFT Plot (Input = -1dBr, 0dBr = 823.2mVrms)

AK4649 LIN2/RIN2 FFT (fin=1kHz, Input= -60dBr, MGAIN = 0dB, PMMP = “0”)
FFT point=16384, Average=8

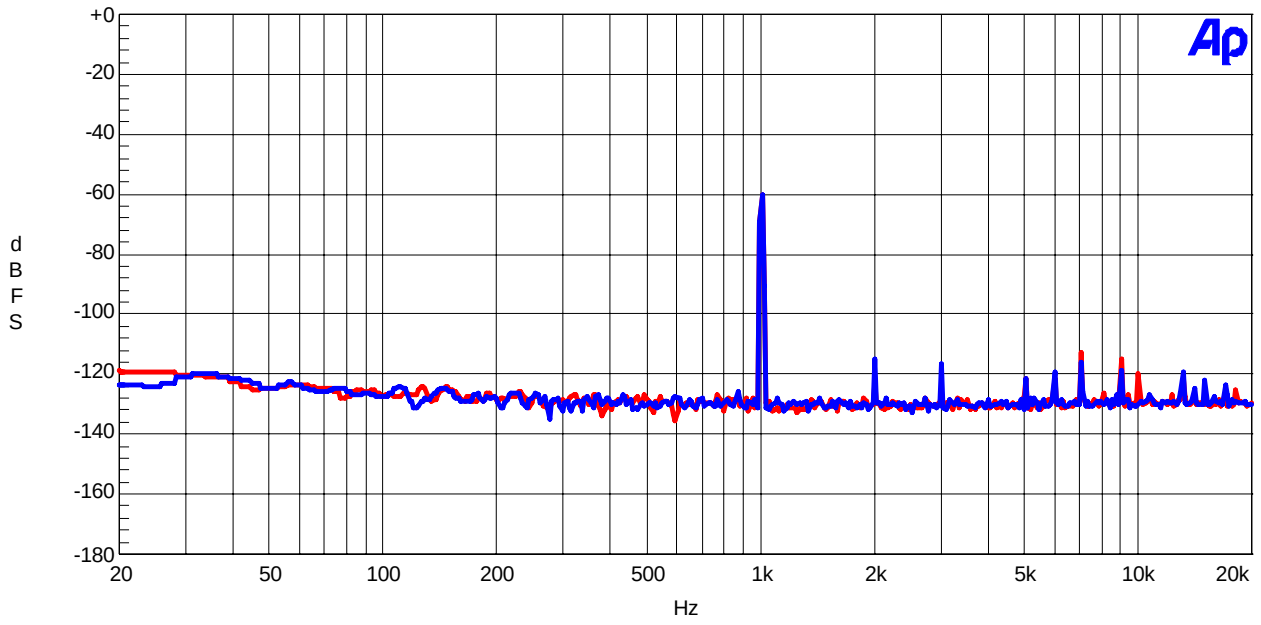


Figure 32. FFT Plot (Input=-60dBr, 0dBr = 823.2mVrms)

AK4649 LIN2/RIN2 FFT (Input=no signal)
FFT point=16384, Average=8

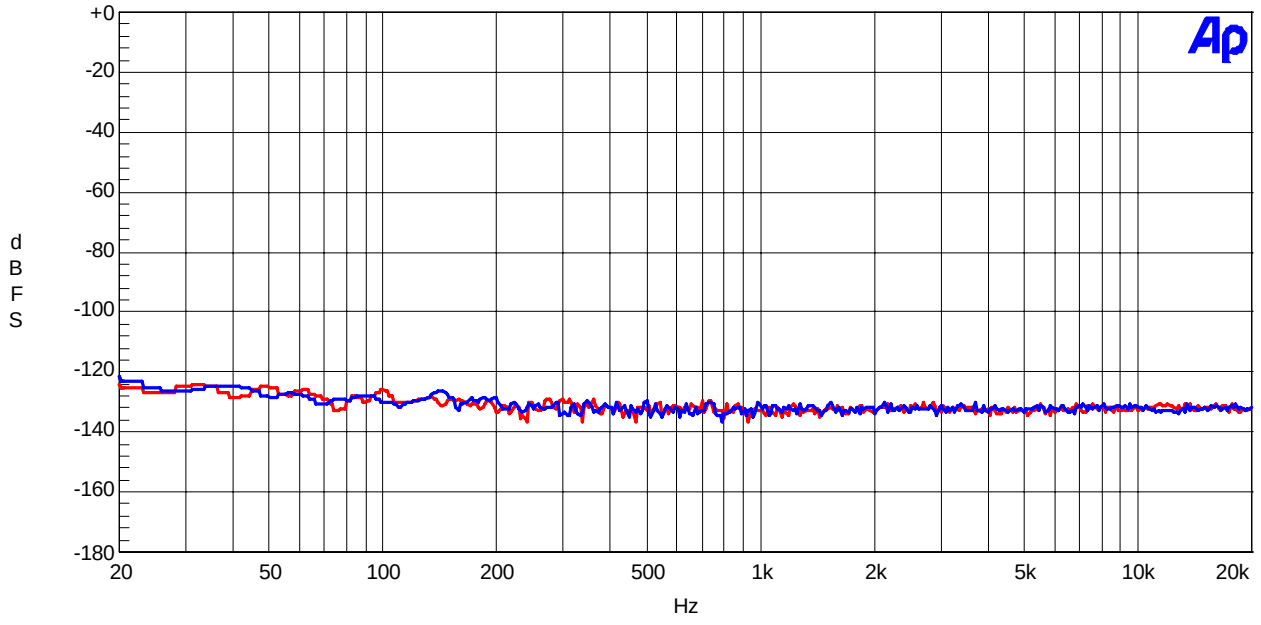


Figure 33. FFT Plot (no signal input)

AK4649 LIN2/RIN2 Crosstalk (Input Level = -1dBr)
RED: Rch → Lch, BLUE: Lch → Rch

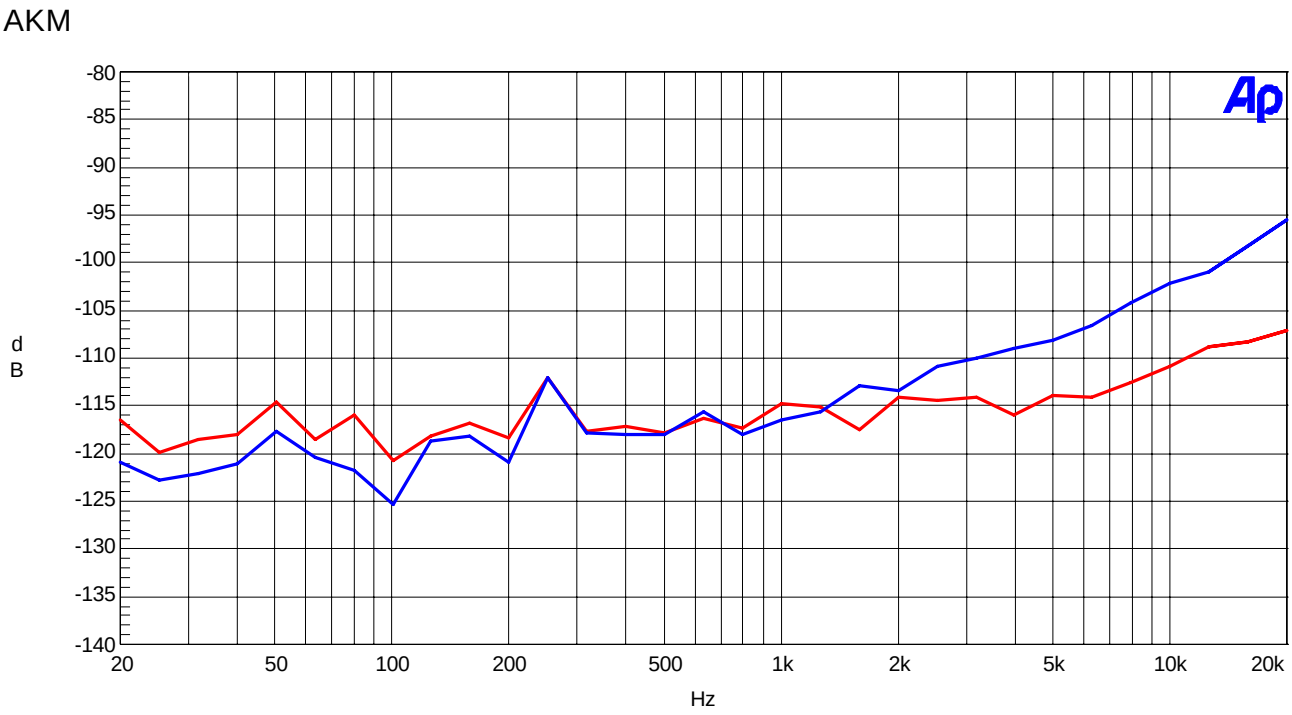


Figure 34. Crosstalk

3. LINEOUT (DAC → LOUT / ROUT pins)

AK4649 LINEOUT THD+N vs. Input Level (fin = 1kHz)

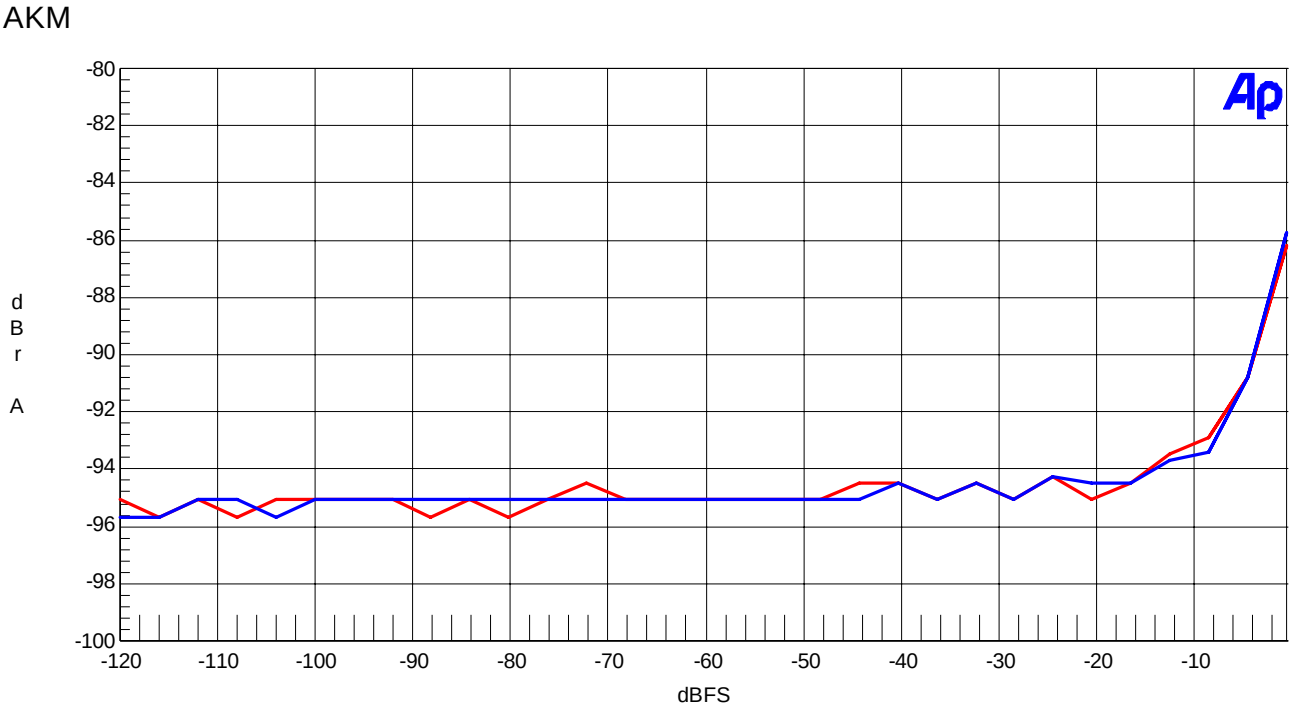


Figure 35. THD+N vs. Input Level

AK4649 LINEOUT THD+N vs. Input Frequency (Input Level= -3dBFS)

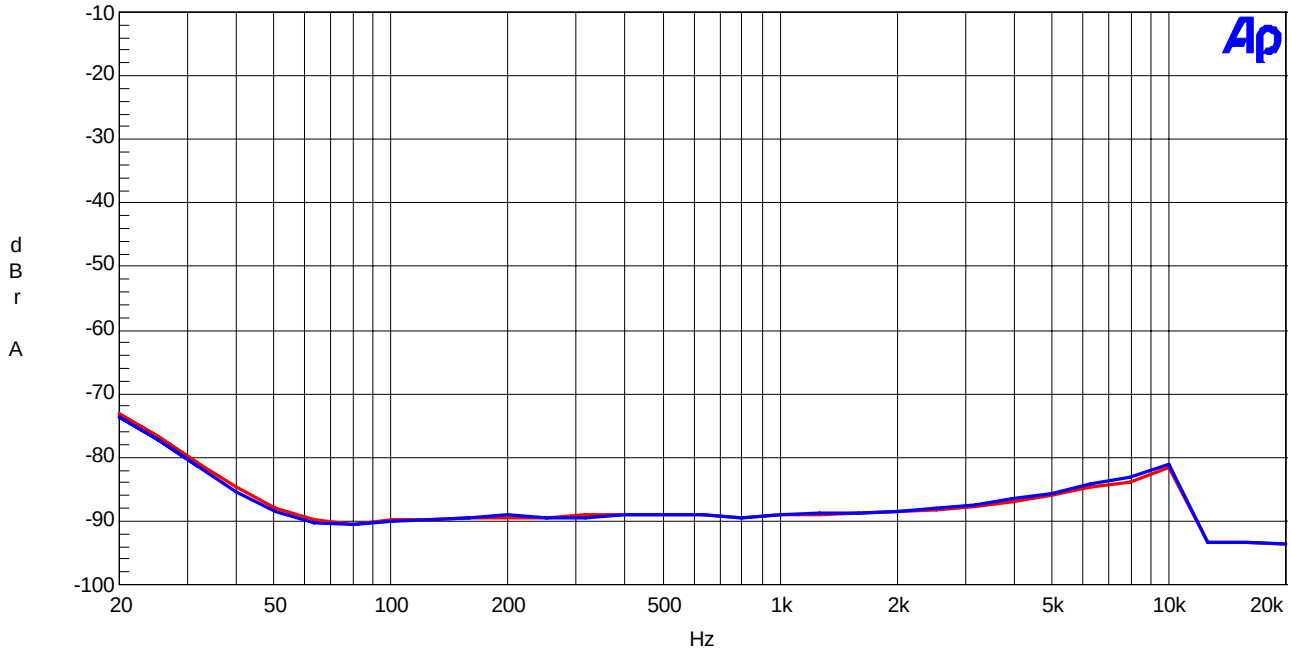


Figure 36. THD+N vs. Input Frequency

C20 and C21: Tantalum Capacitor

In this case, a tantalum capacitor is used LOUT and ROUT pin on the AKD4649-B.As the performance of a tantalum capacitor is not so good about low frequency signal. Refer to Figure 37 about the performance of AK4649.

AK4649 LINEOUT THD+N vs. Input Frequency (Input Level= -3dBFS)

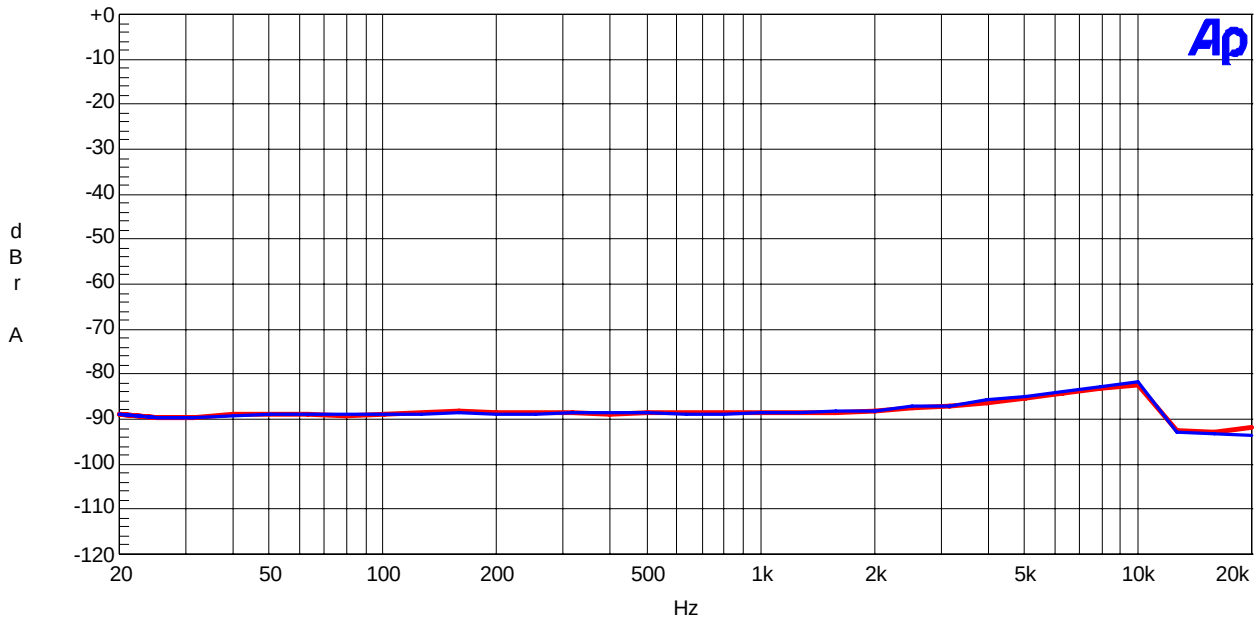


Figure 37. THD+N vs. Input Frequency
C20 and C21: Electrolytic Capacitor

AK4649 LINEOUT Linearity (fin=1kHz)

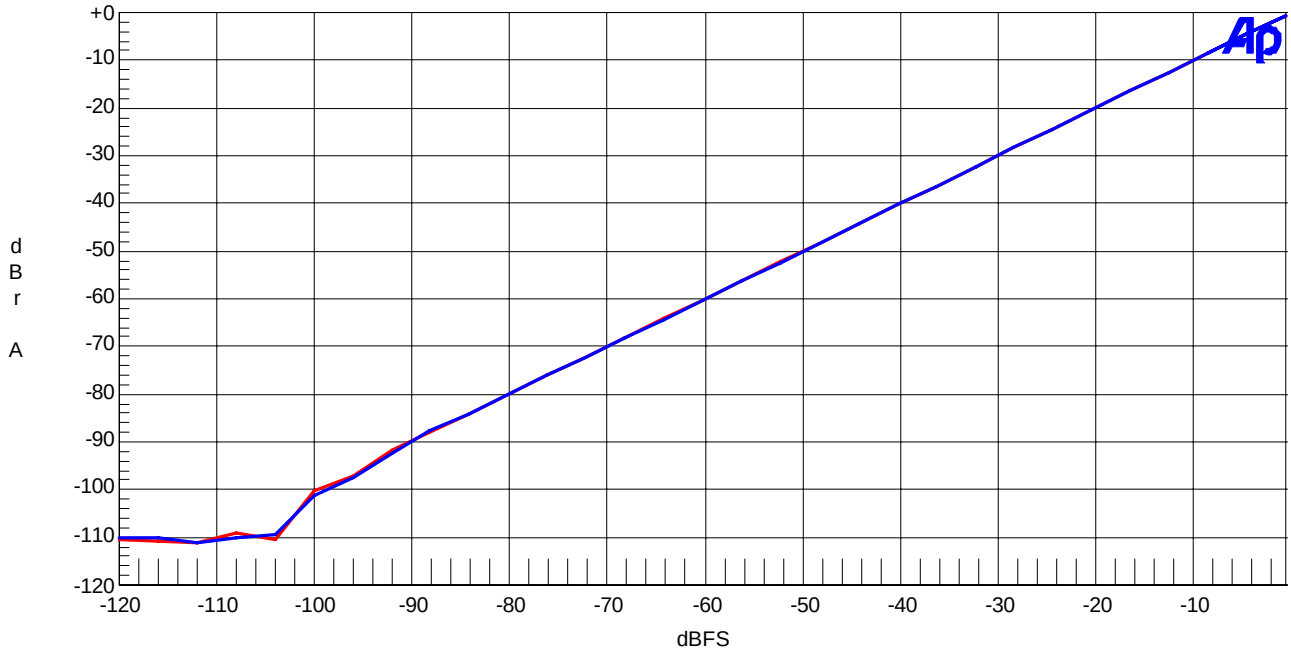


Figure 38. Linearity

AK4649 LINEOUT Frequency Response (Input Level = -3dBFS)

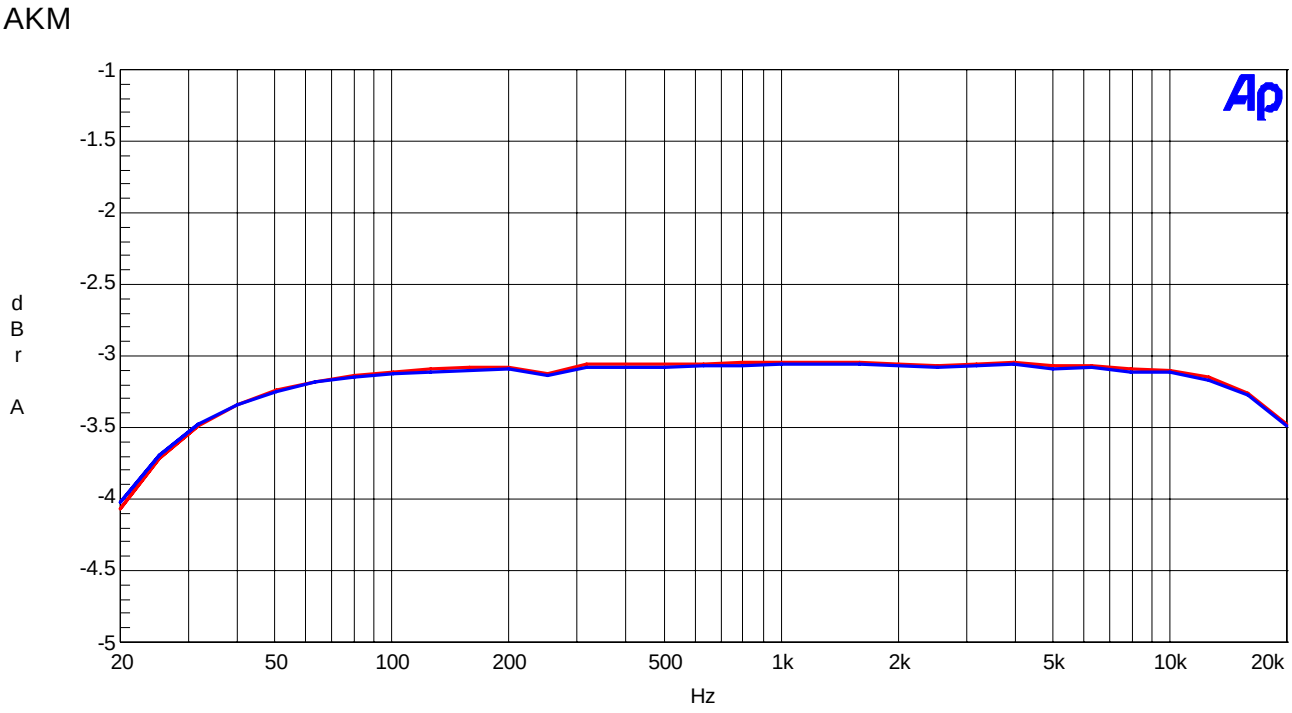


Figure 39. Frequency Response

AK4649 LINEOUT FFT (fin = 1kHz, Input = -3dBFS)
FFT point=16384, Average=8

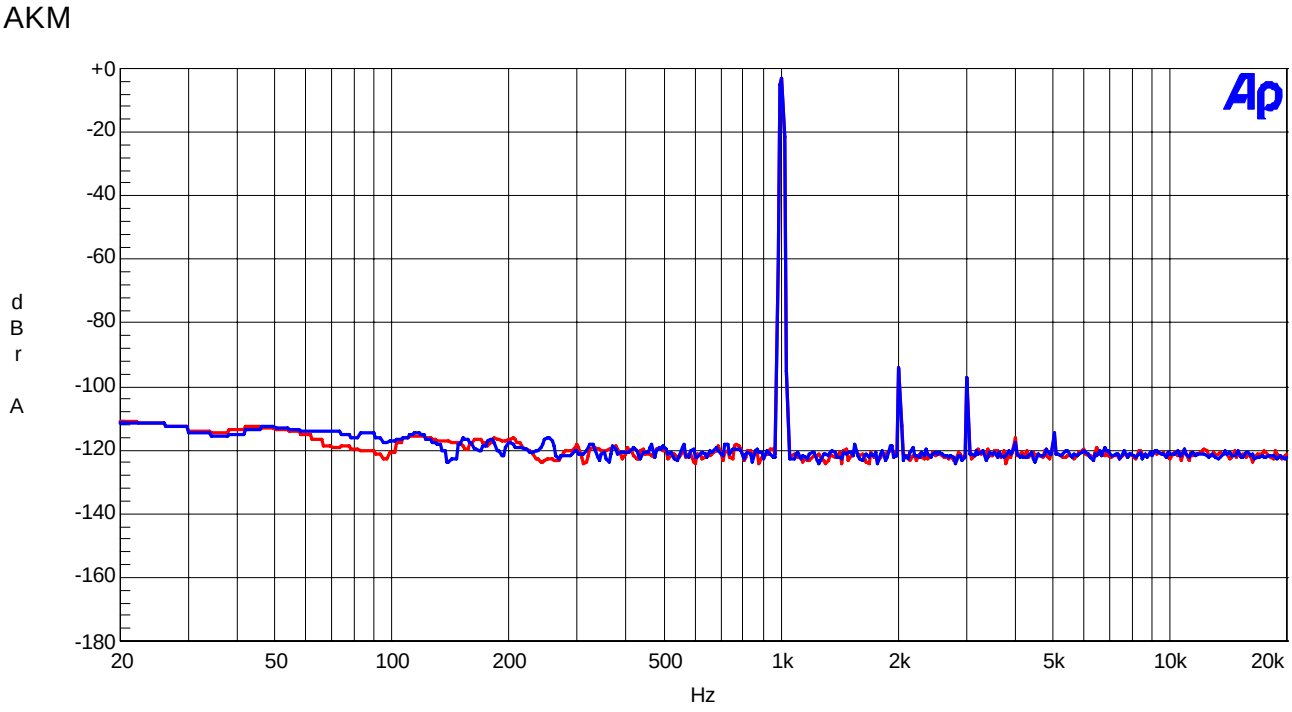


Figure 40. FFT Plot (Input = -3dBFS)

AK4693 LINEOUT FFT (fin=1kHz, Input=-60dBFS)
FFT point=16384, Average=8

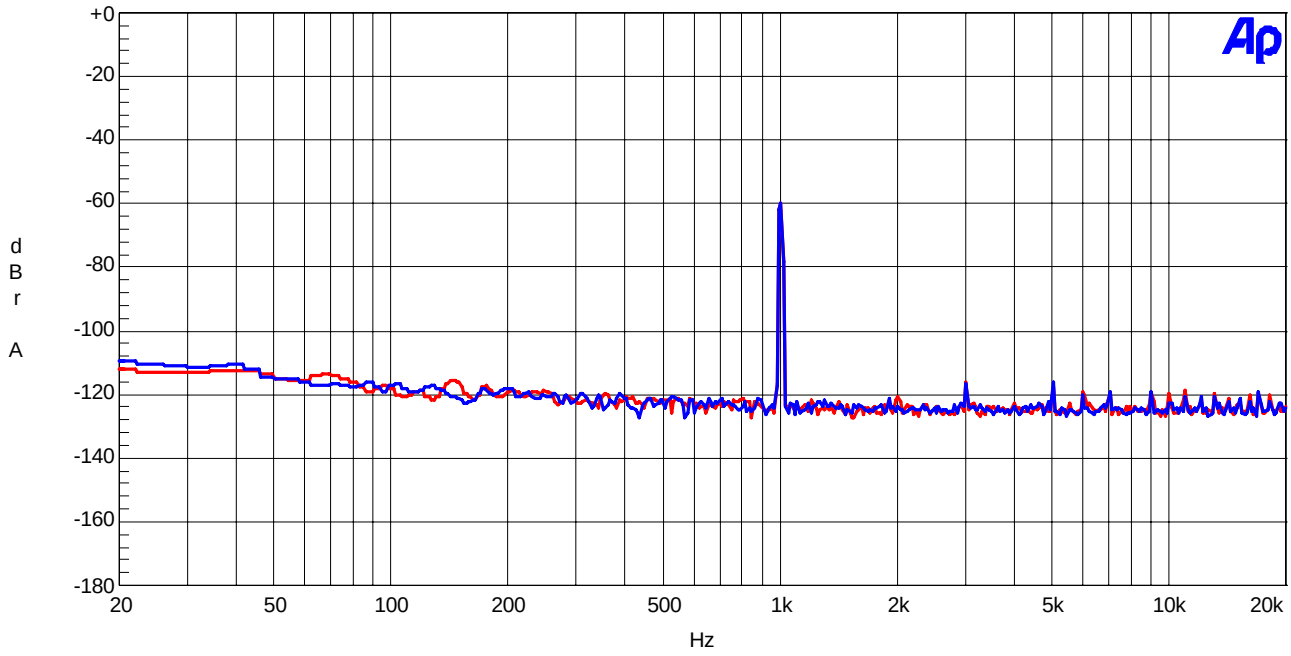


Figure 41. FFT Plot (Input = -60dBFS)

AK4649 LINEOUT FFT (Input=no data)
FFT point=16384, Average=8

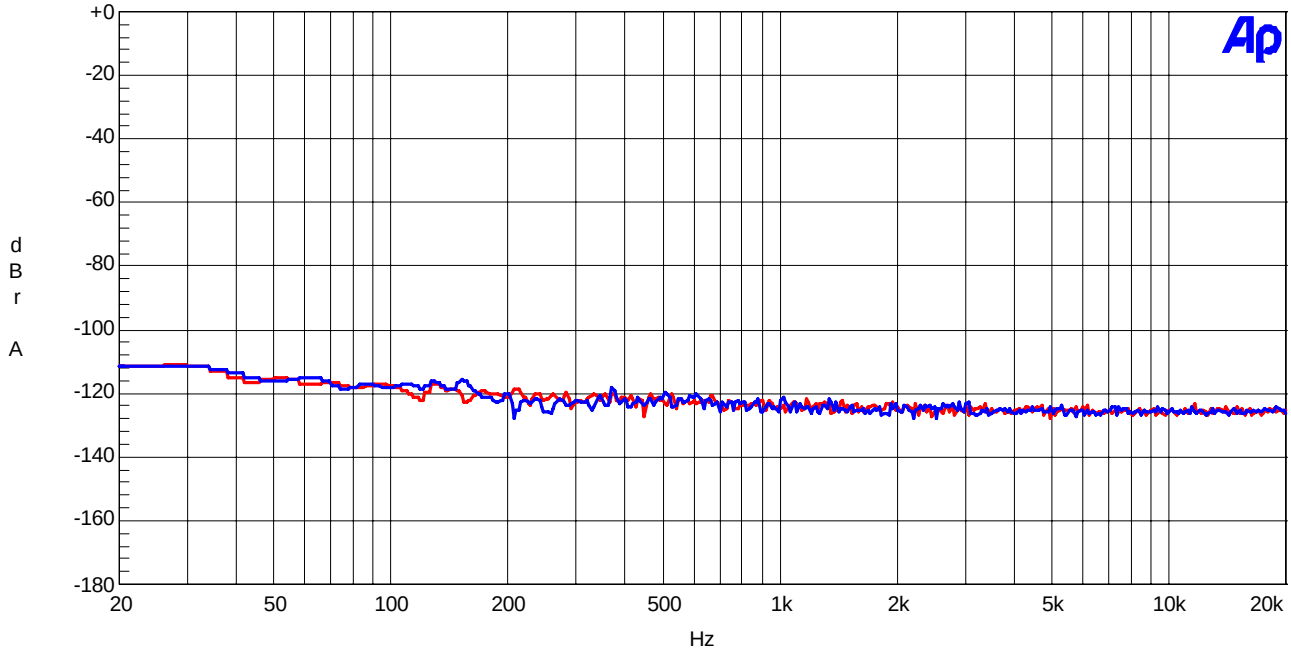


Figure 42. FFT Plot (no data input)

AK4649 LINEOUT Out-of-band noise (Input=no data)
FFT point=16384, Average=8

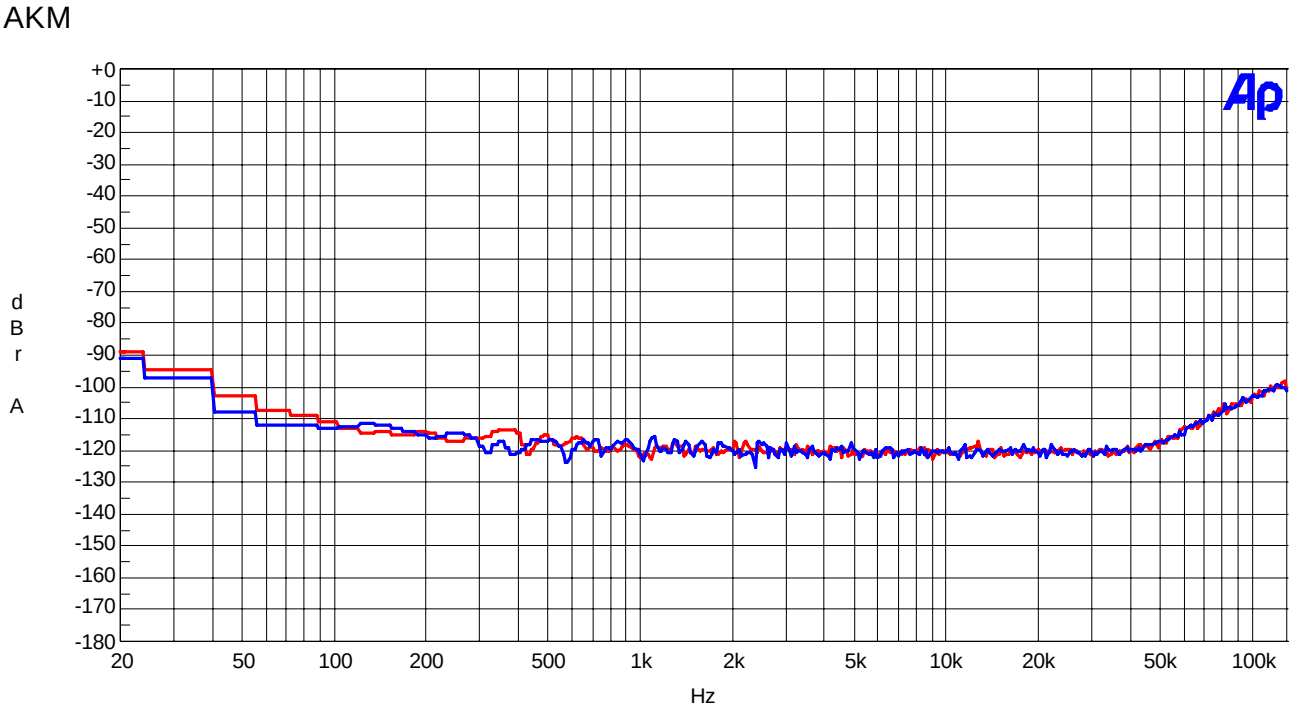


Figure 43. Out-of-band noise (no data input)

AK4649 LINEOUT Crosstalk (Input Level = -3dBFS)
RED: Rch → Lch, BLUE: Lch → Rch

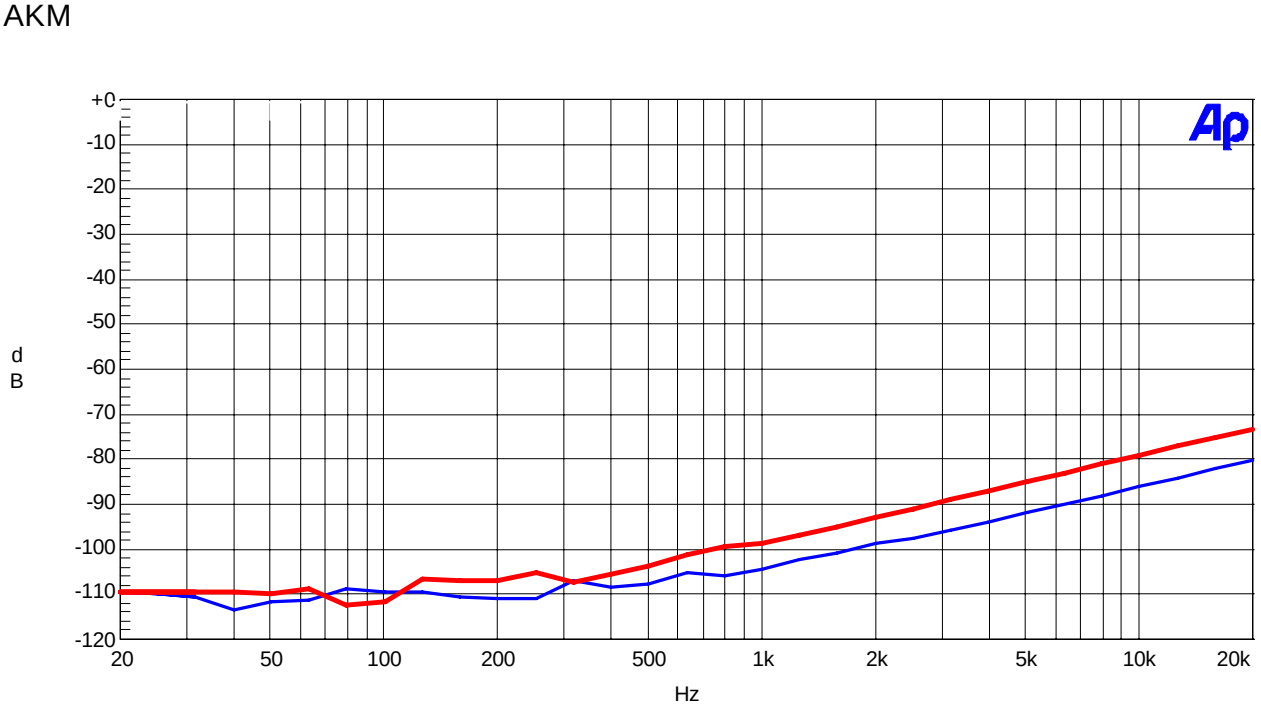


Figure 44. Crosstalk

4. SPK (DAC → SPK) PLOT DATA

AK4649 SPK THD+N vs. Input Level (fin = 1kHz, SPKG1-0 = "00")

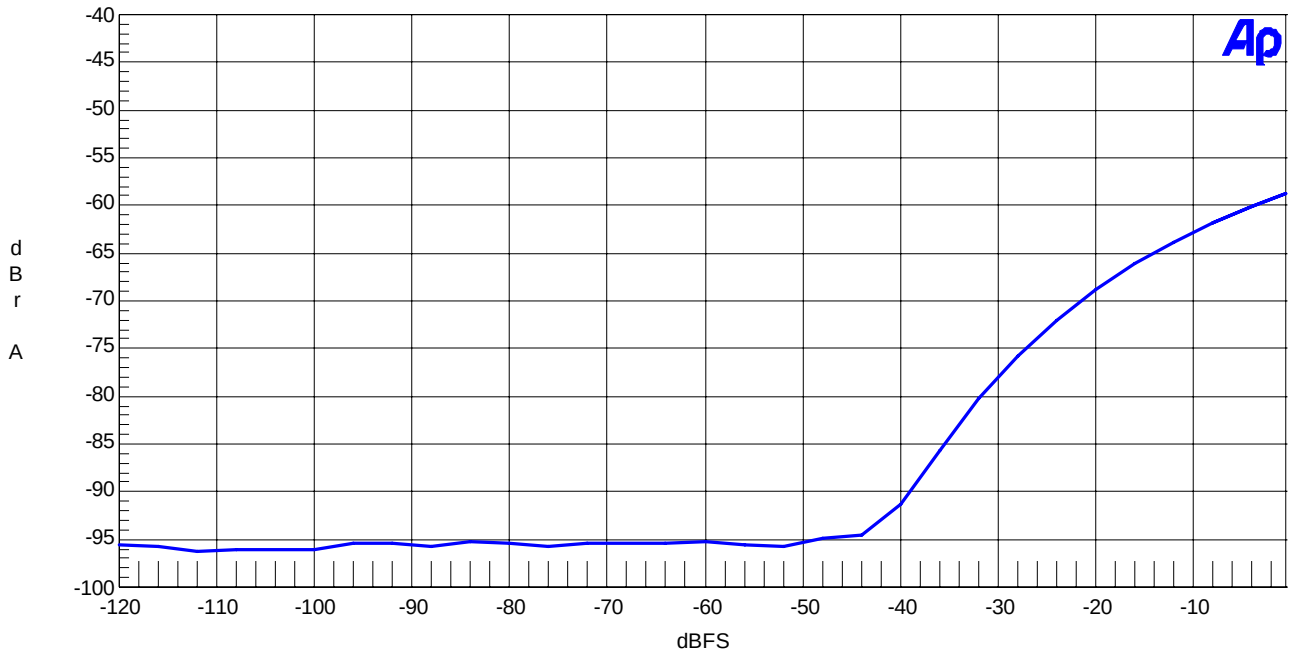


Figure 45. THD+N vs. Input Level

AK4649 SPK THD+N vs. Input Frequency (Input Level = -0.5dBFS, SPKG1-0 = "00")

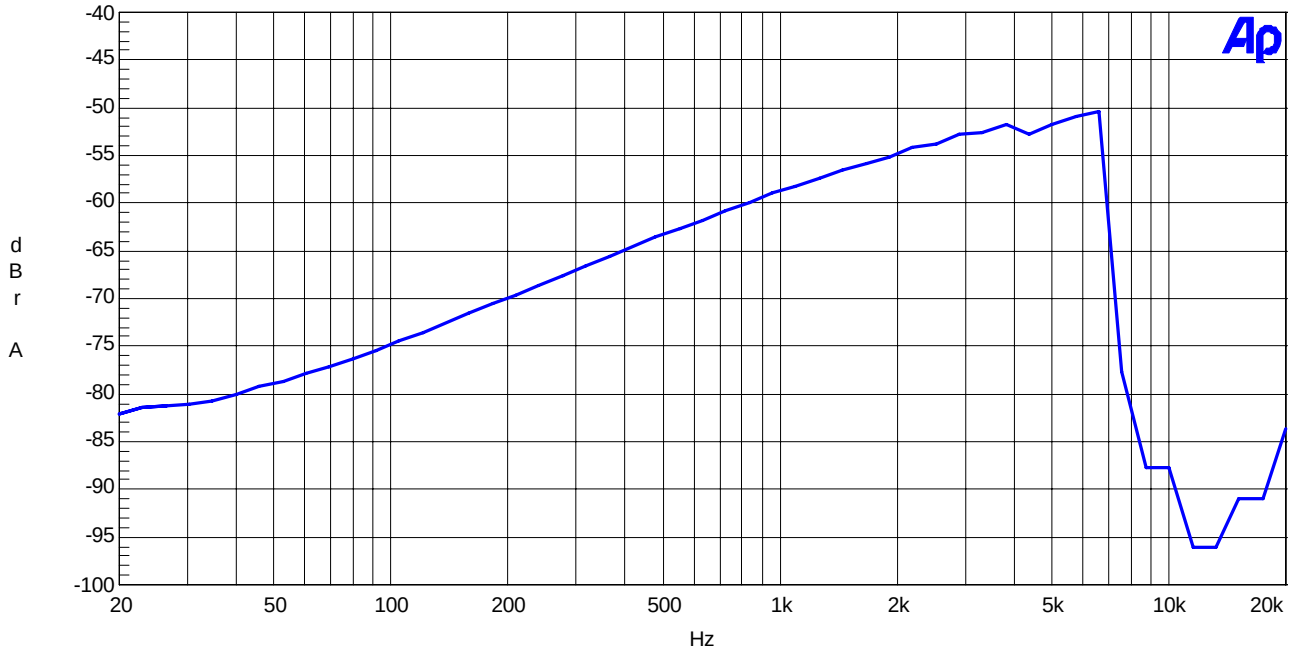


Figure 46. THD+N vs. Input Frequency (Input Level = -0.5dBFS, SPKG1-0 = "00")

AK4649 SPK FFT (fin = 1kHz, Input = -0.5dBFS, SPKG1-0 = “00”)
FFT point=16384, Average=8

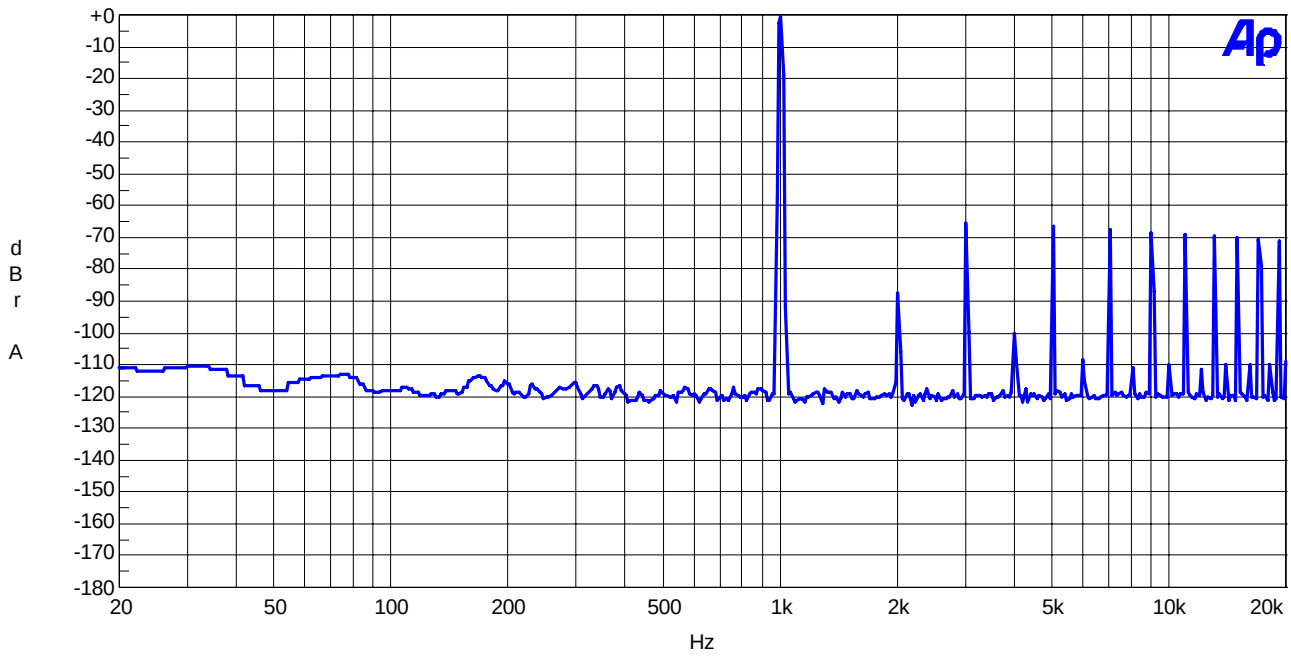


Figure 47. FFT Plot (Input = -0.5dBr, SPKG1-0 = “00”)

AK4649 FFT (fin = 1kHz, Input = -60dBFS, SPKG1-0 = “00”)
FFT point=16384, Average=8

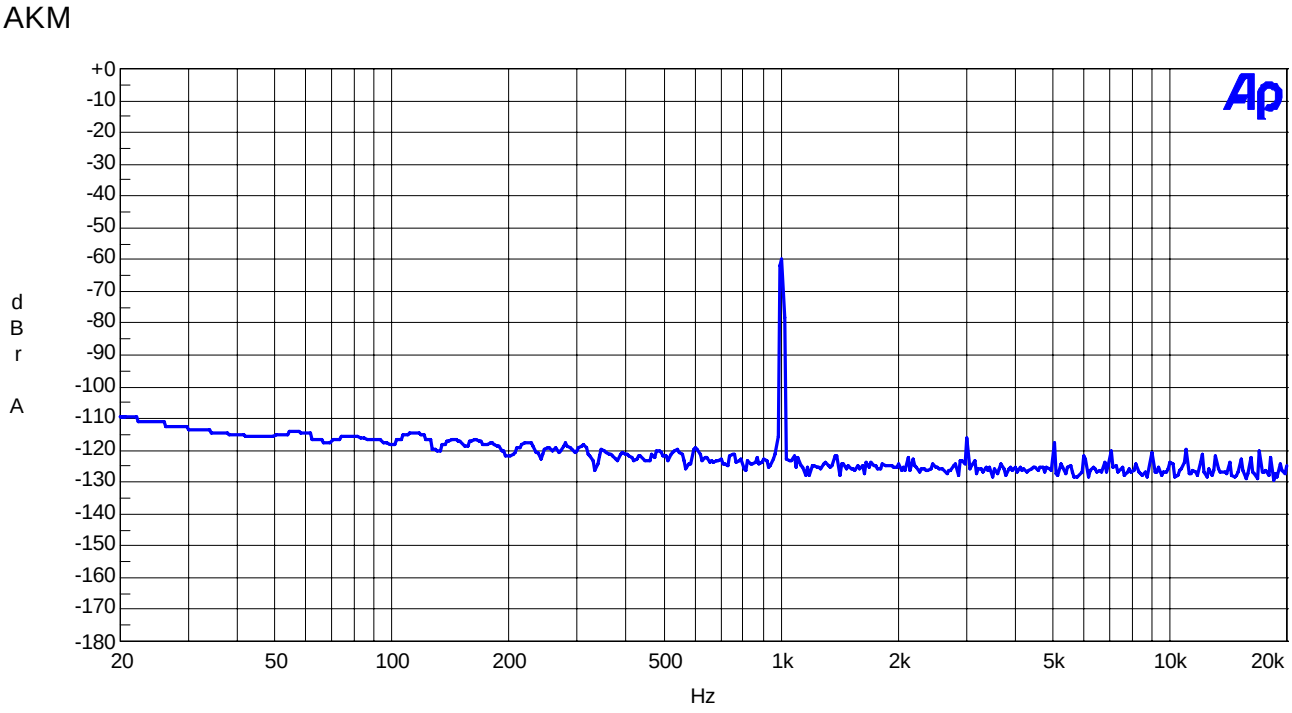


Figure 48. FFT Plot (Input = -60dBFS, SPKG1-0 = “00”)

AK4649 SPK FFT (Input=no data, SPKG1-0 = “00”)
FFT point=16384, Average=8

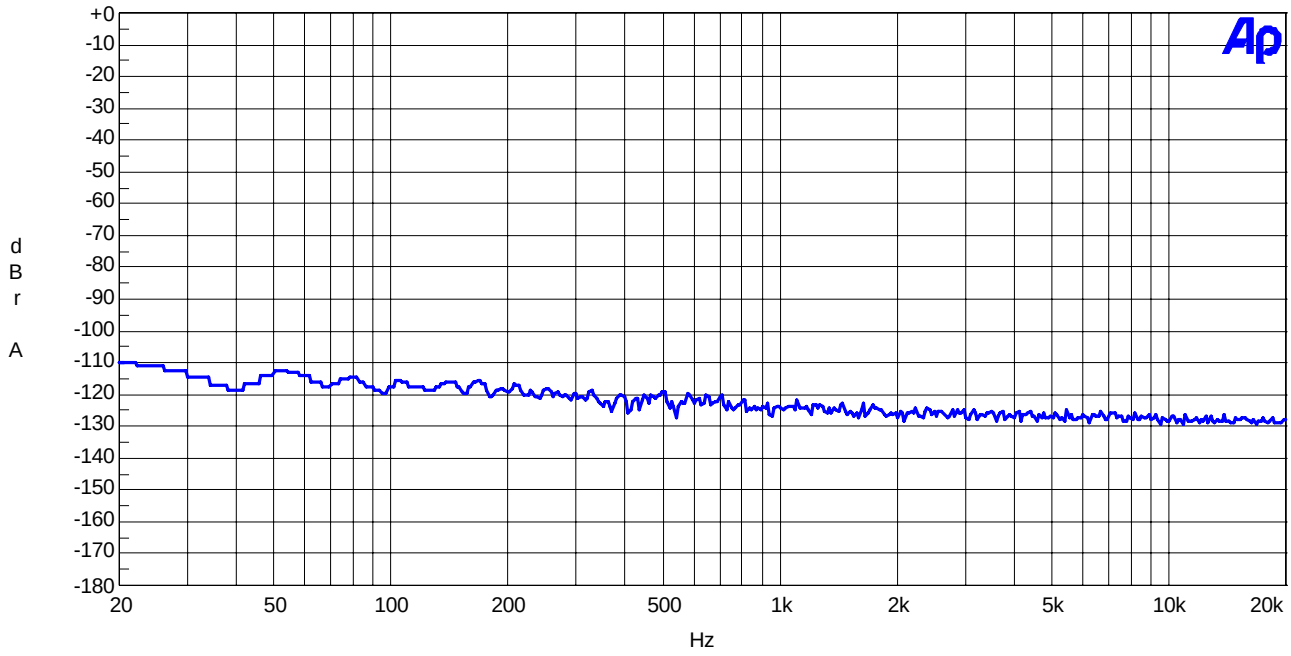


Figure 49. FFT Plot (no data input, SPKG1-0 = “00”)

AK4649 SPK Out-of-band noise Input=no data, SPKG1-0 = “00”
FFT point=16384, Average=8

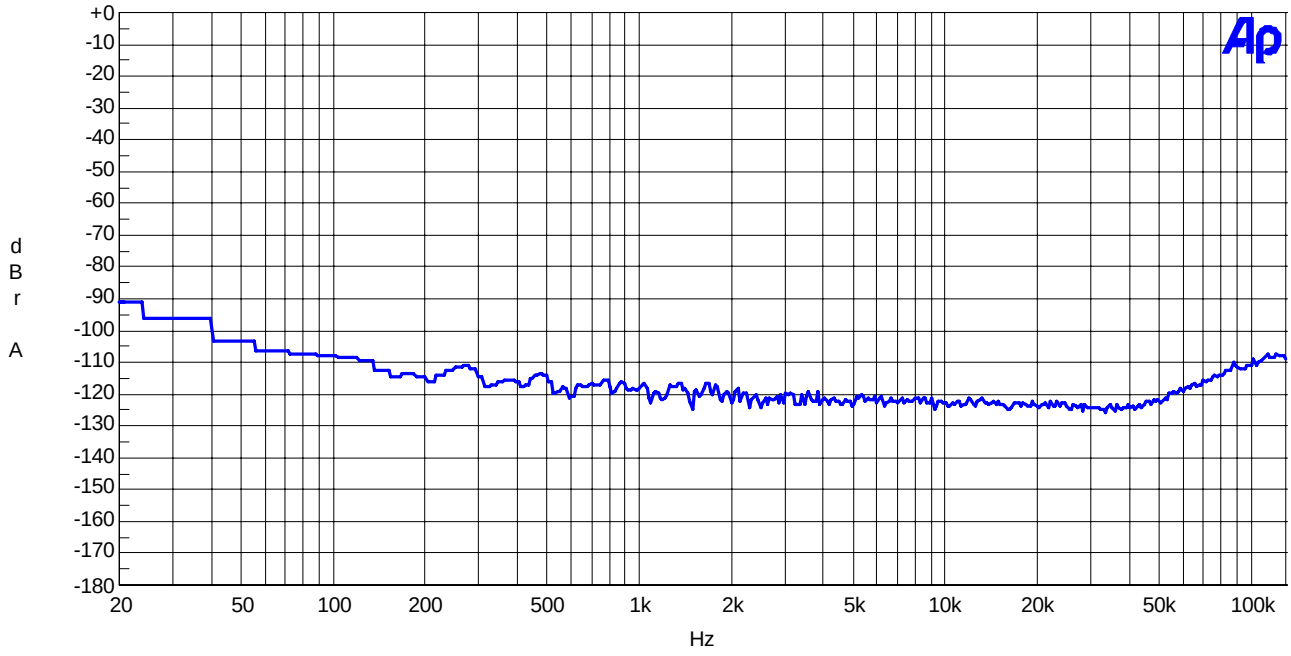
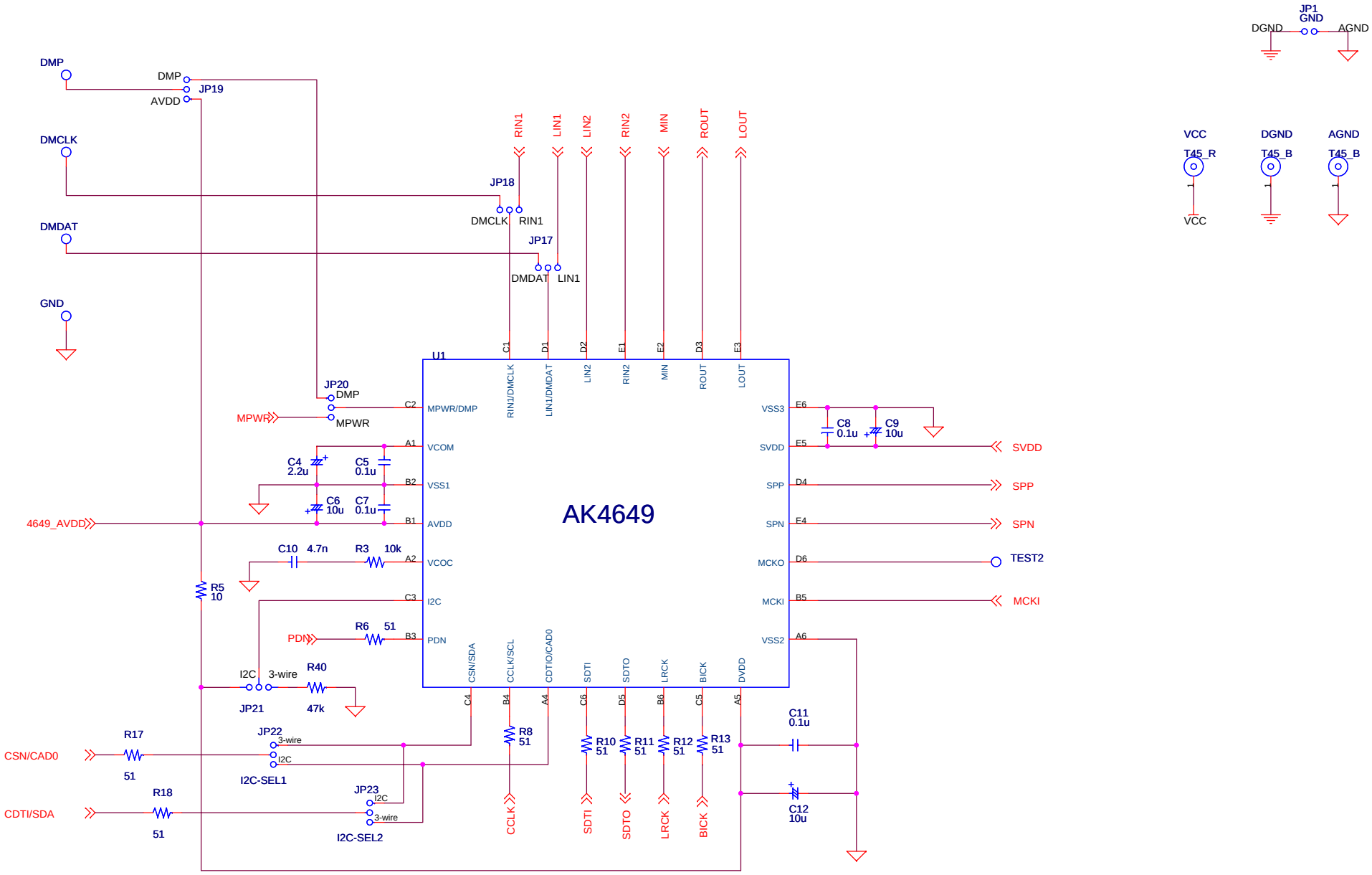


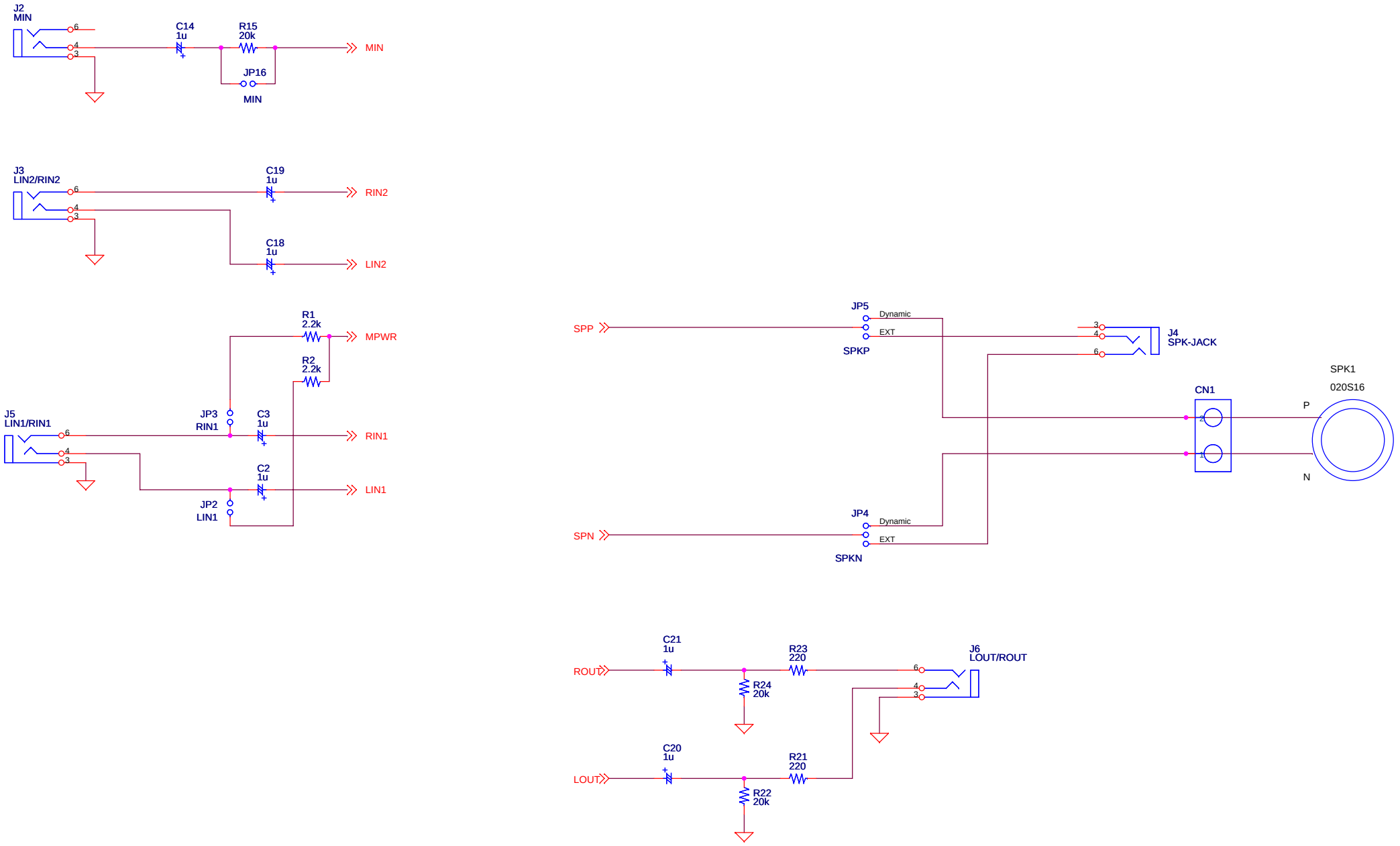
Figure 50. Out-of-band noise (no data input, SPKG1-0 = “00”)

REVISION HISTORY

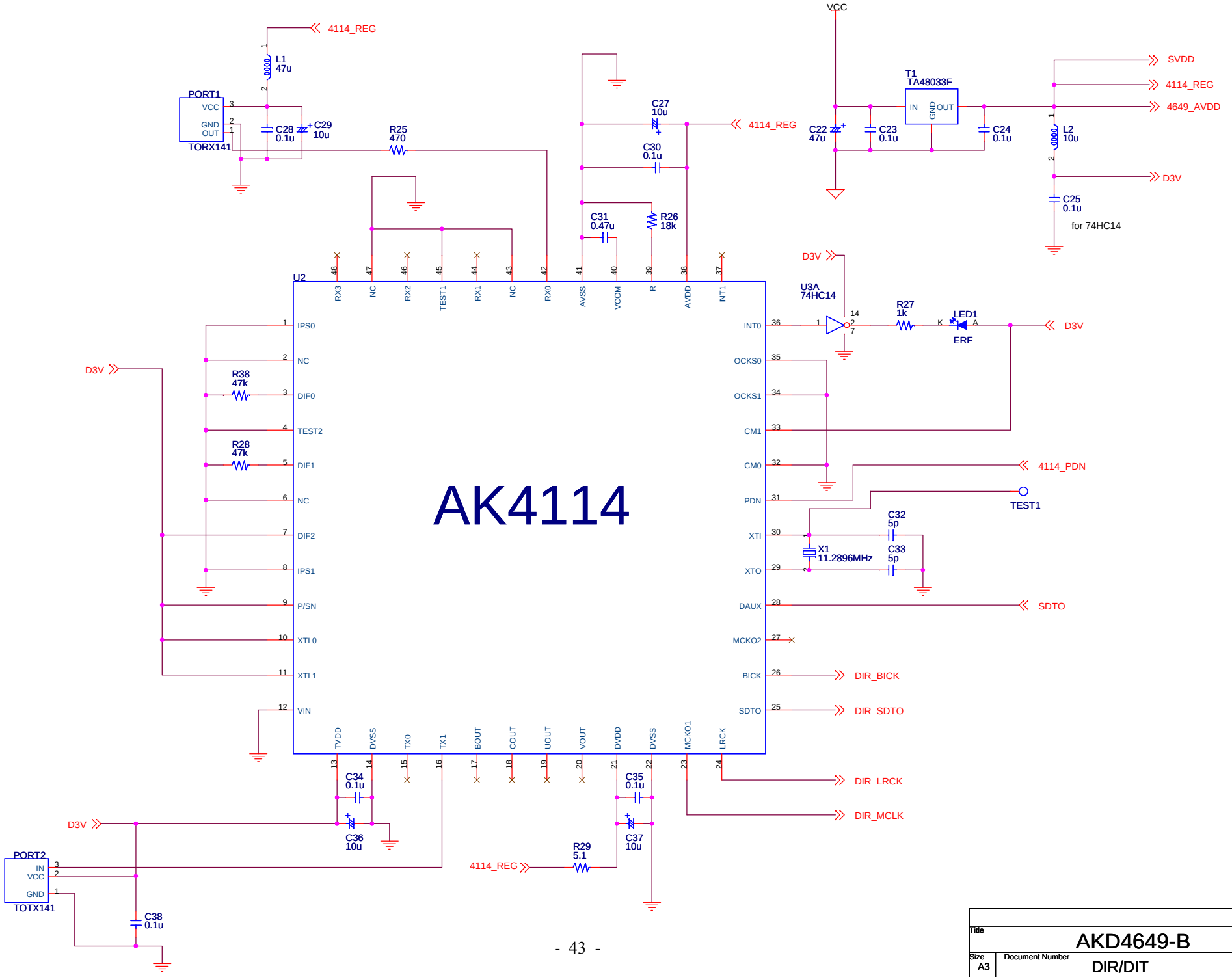
Date (YY/MM/DD)	Manual Revision	Board Revision	Reason	Page	Contents
08/11/12	KM097100	0	First Edition		



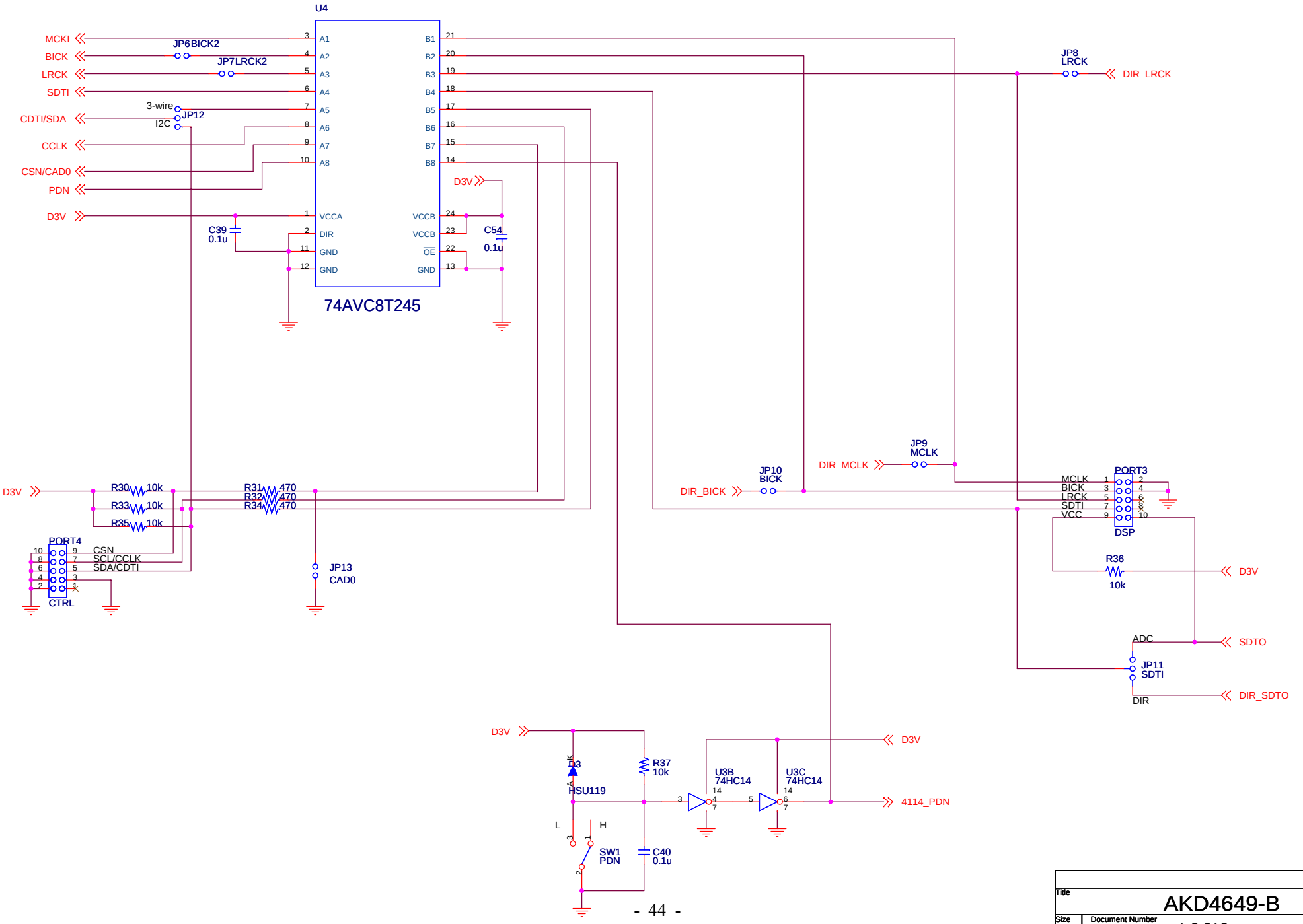
Title	AKD4649-B	
Size: A3	Document Number: AK4649	Rev: 0
Date: Tuesday, November 11, 2008	Sheet 1 of 5	



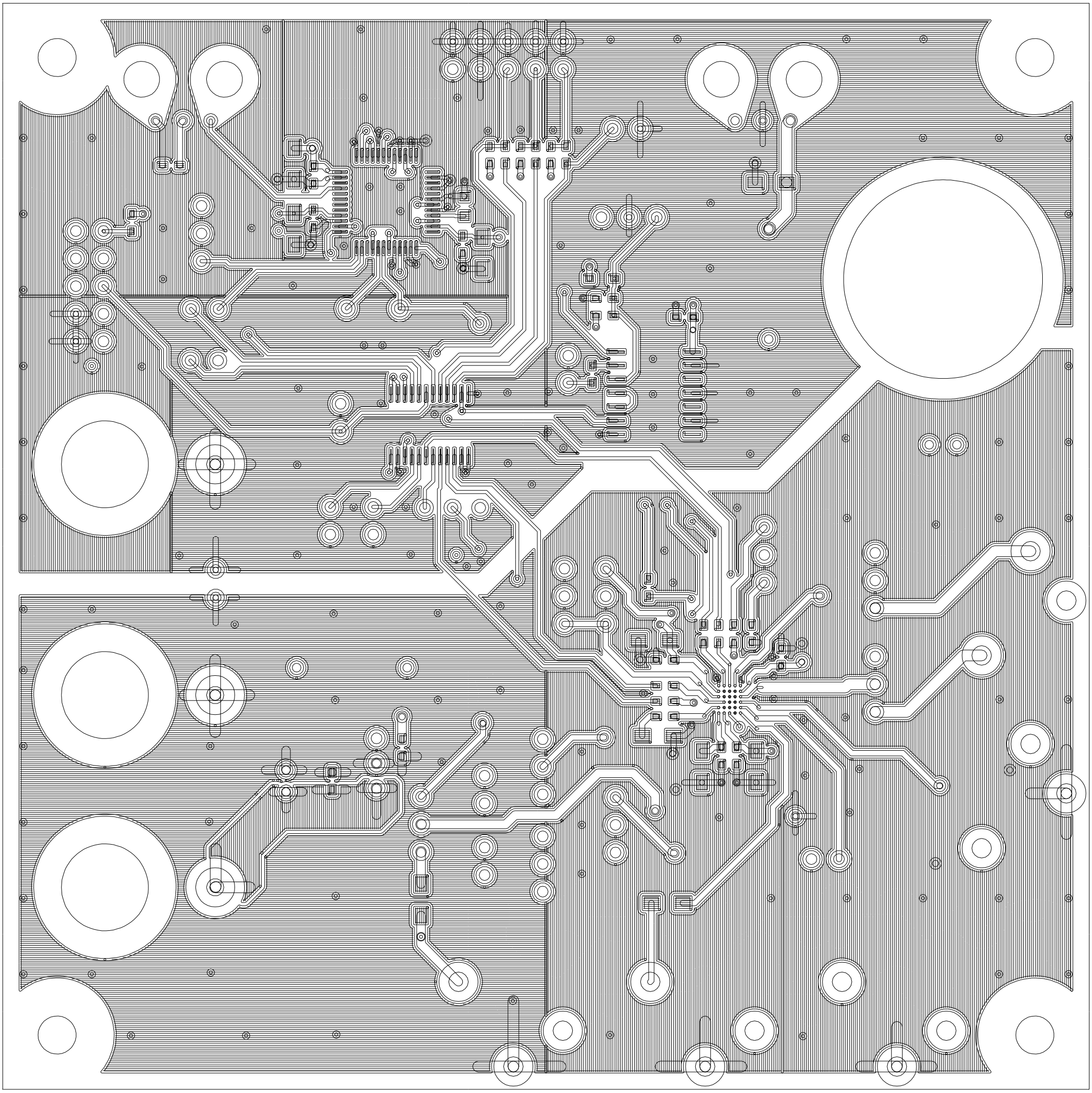
Title	AKD4649-B	
Size: A3	Document Number: Input/Output	Rev: 0
Date: Thursday, August 14, 2008	Sheet 2 of 5	



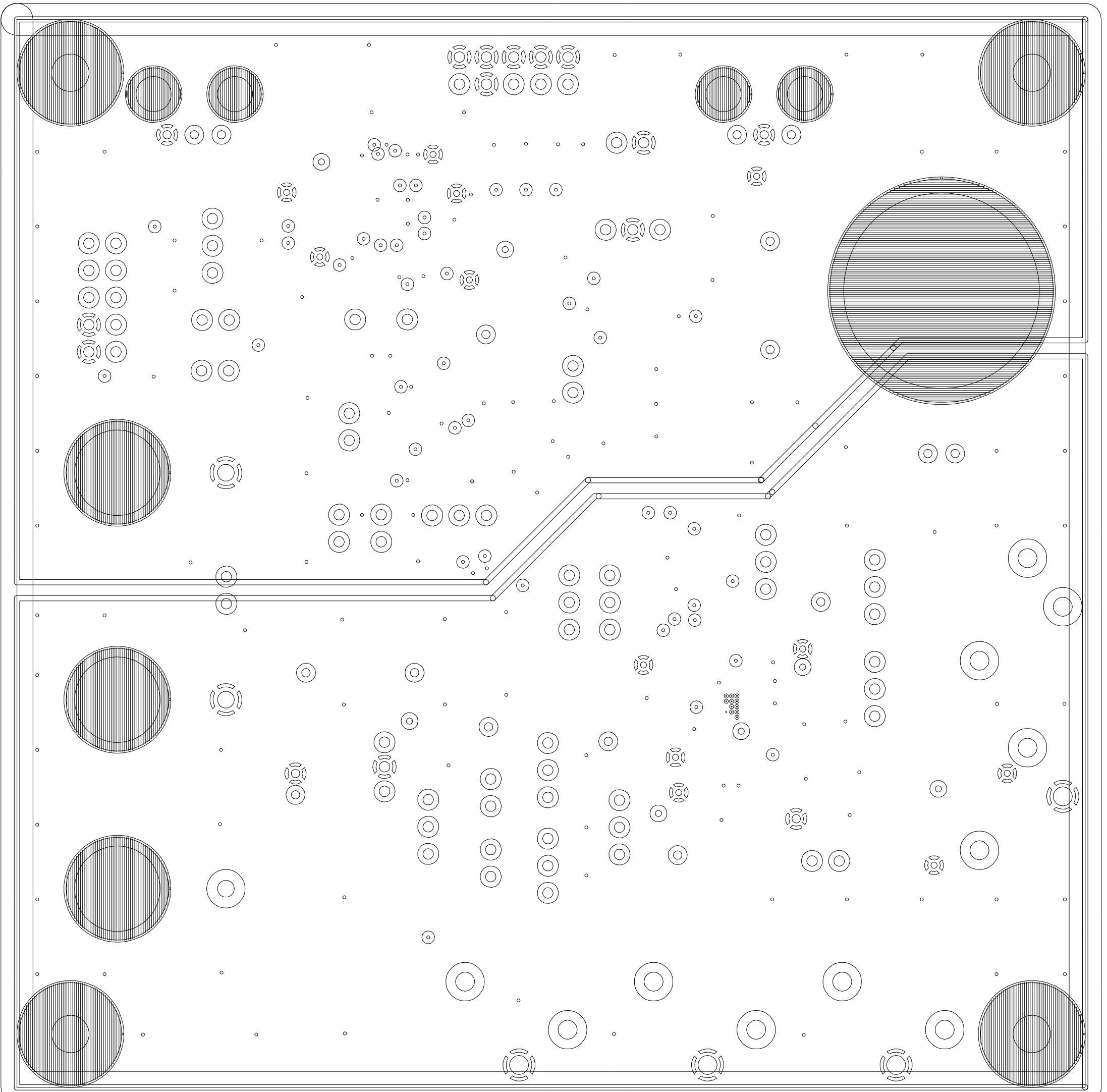
Title	AKD4649-B	
Size A3	Document Number DIR/DIT	Rev 0
Date: Monday, September 08, 2008	Sheet 3 of 5	



Title	AKD4649-B	
Size: A3	Document Number: LOGIC	Rev: 0
Date: Tuesday, August 26, 2008	Sheet 4 of 5	



AKD4649-B Rev.0
080909 24435 L1 パターン



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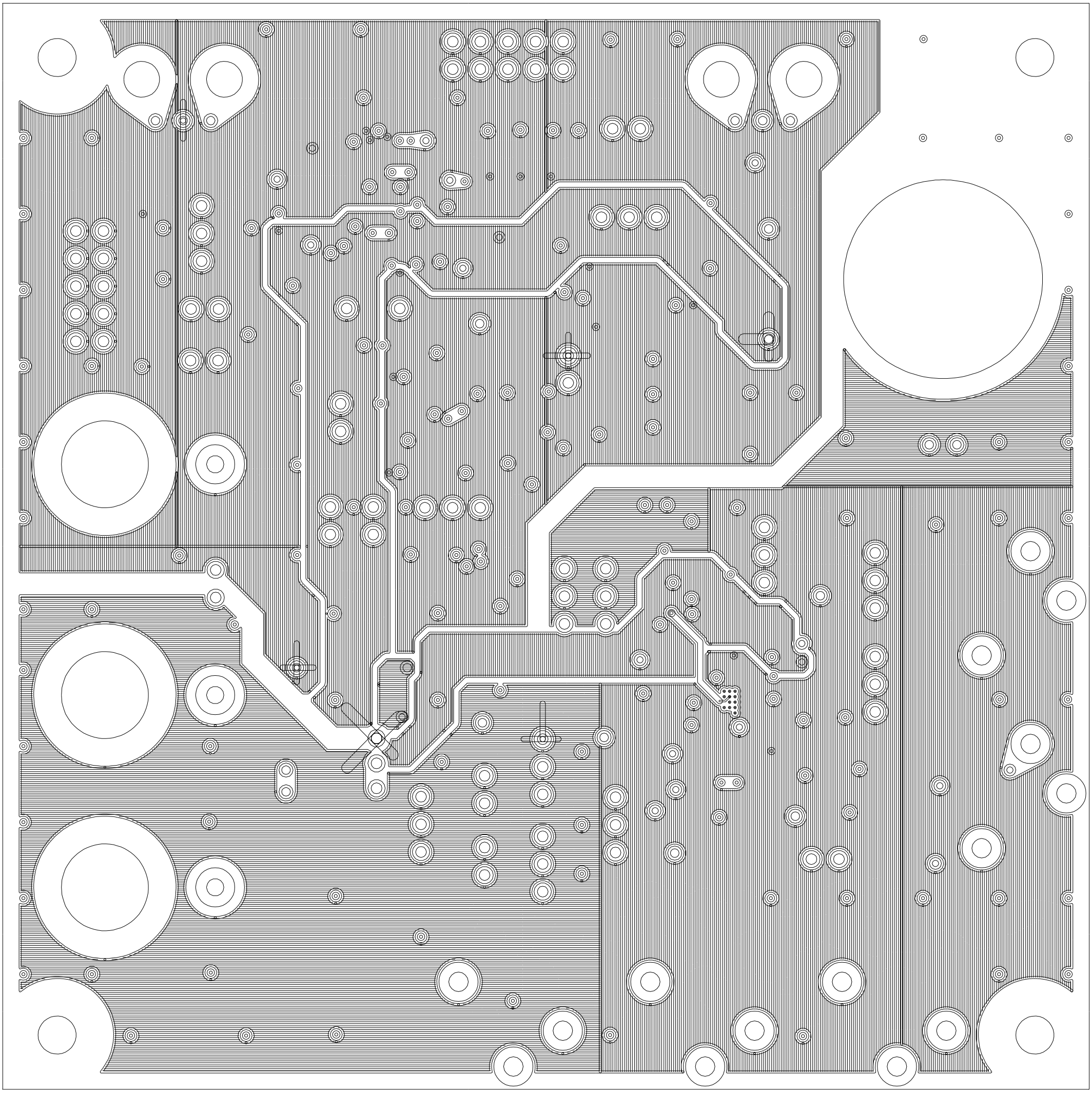

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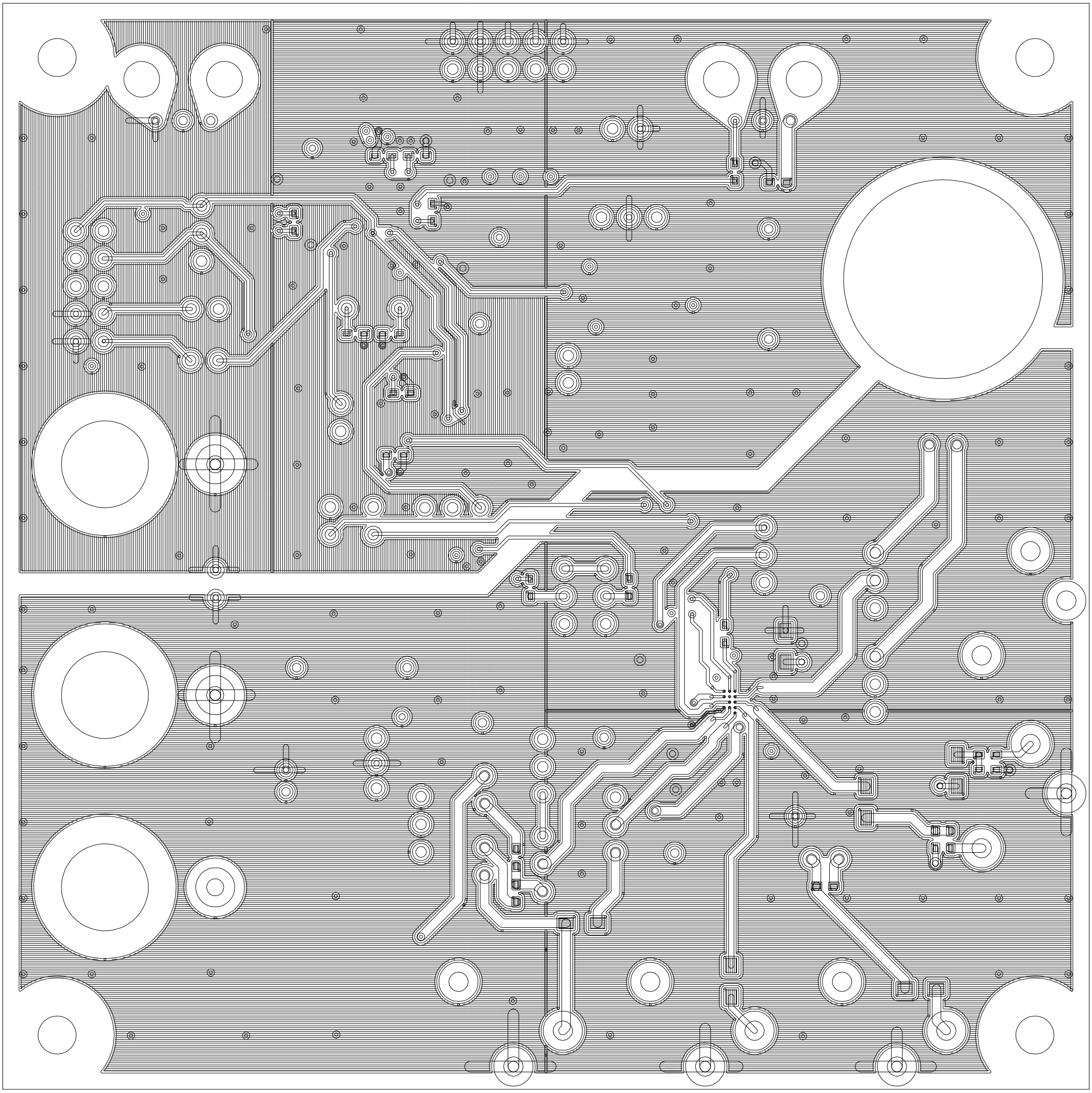

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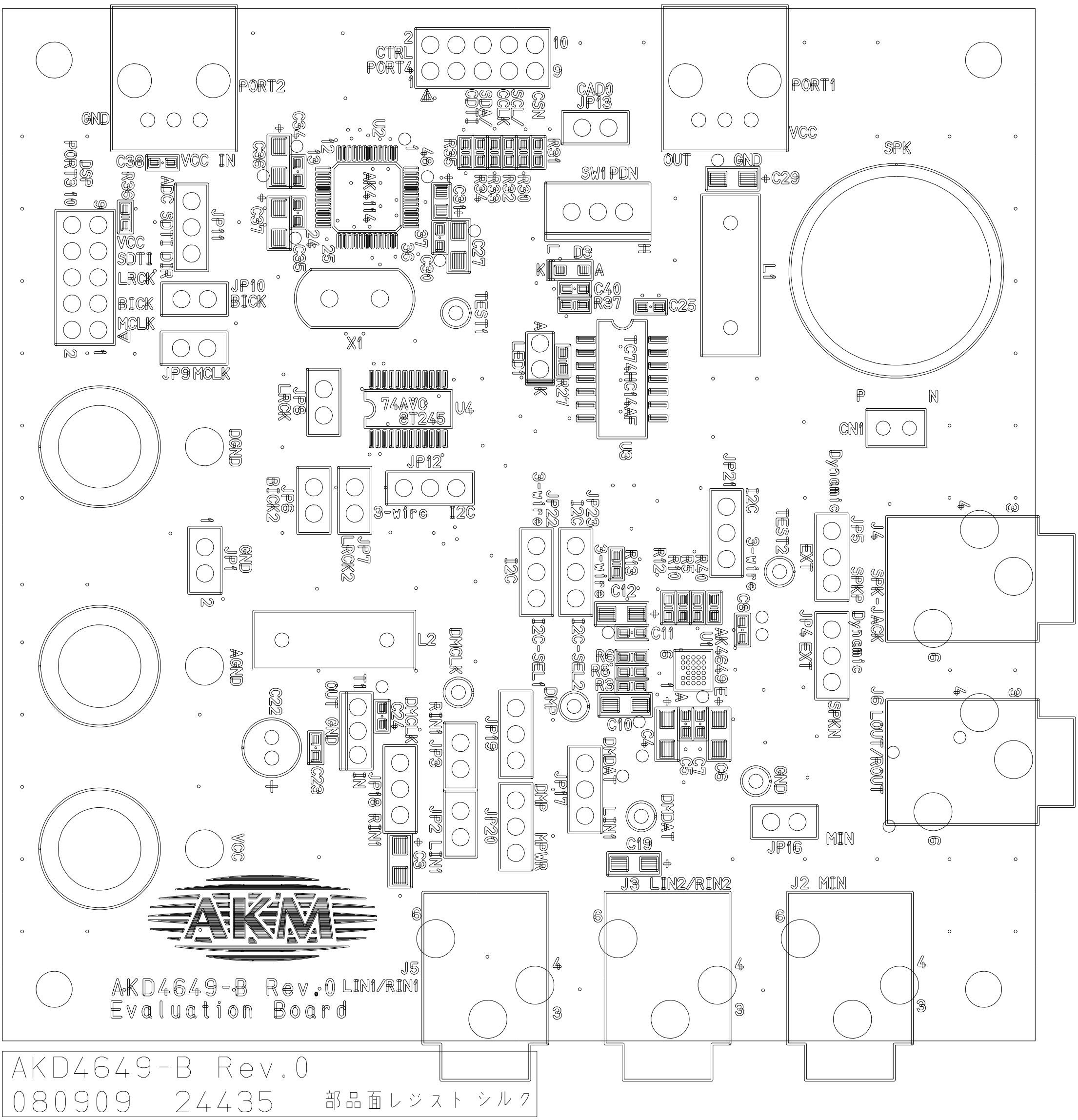

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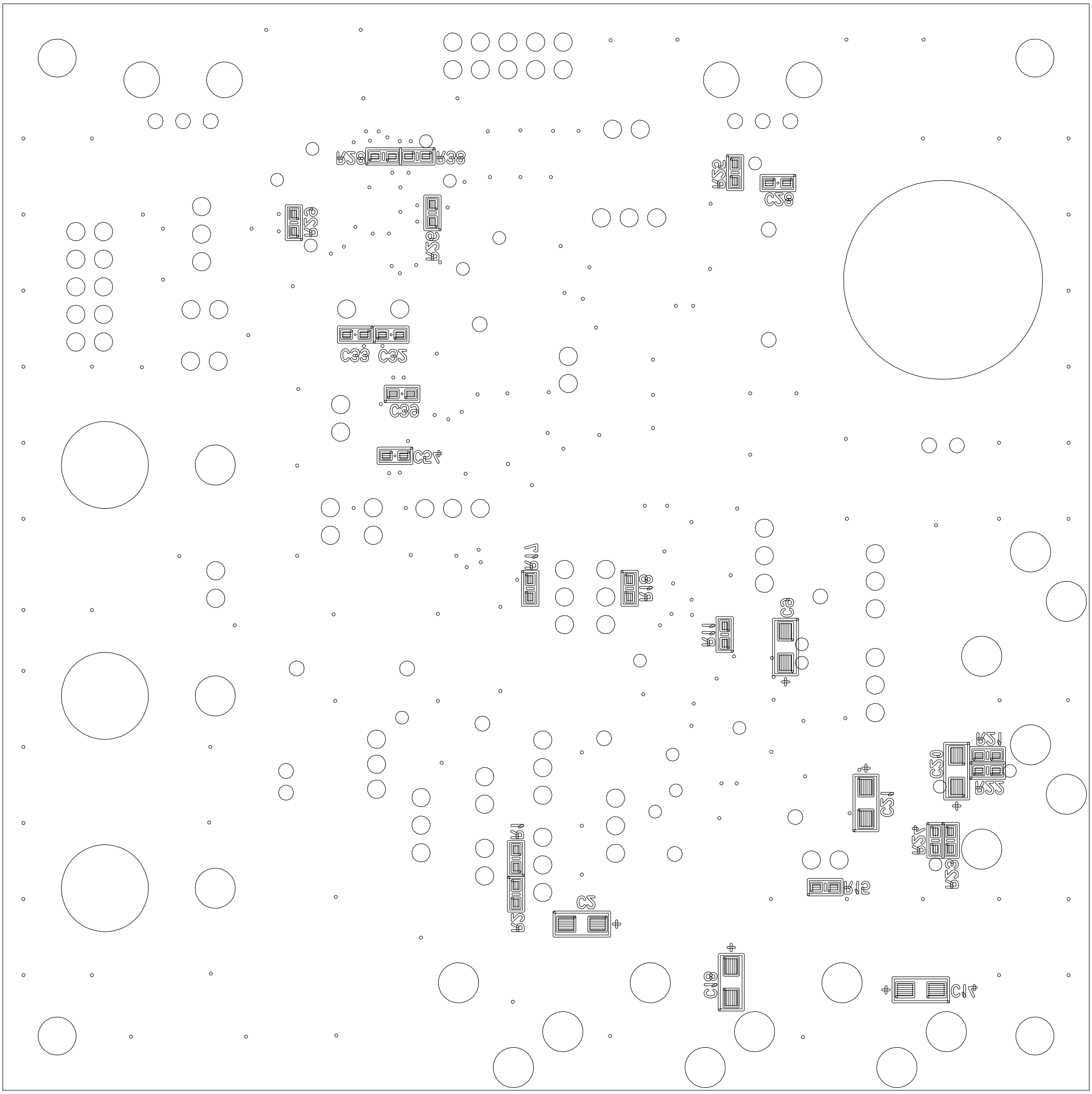
080909 24435 部品面レジスト シルク



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080909 24435 半田面レジスト シルク