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FDA-1B DAC Manual

PCM1794A Full Balance DAC

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*High Fidelity 24 bit*192kS/s*
Digital to Analogue Converter

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Designed By Spencer Cheung of FETAudio.com
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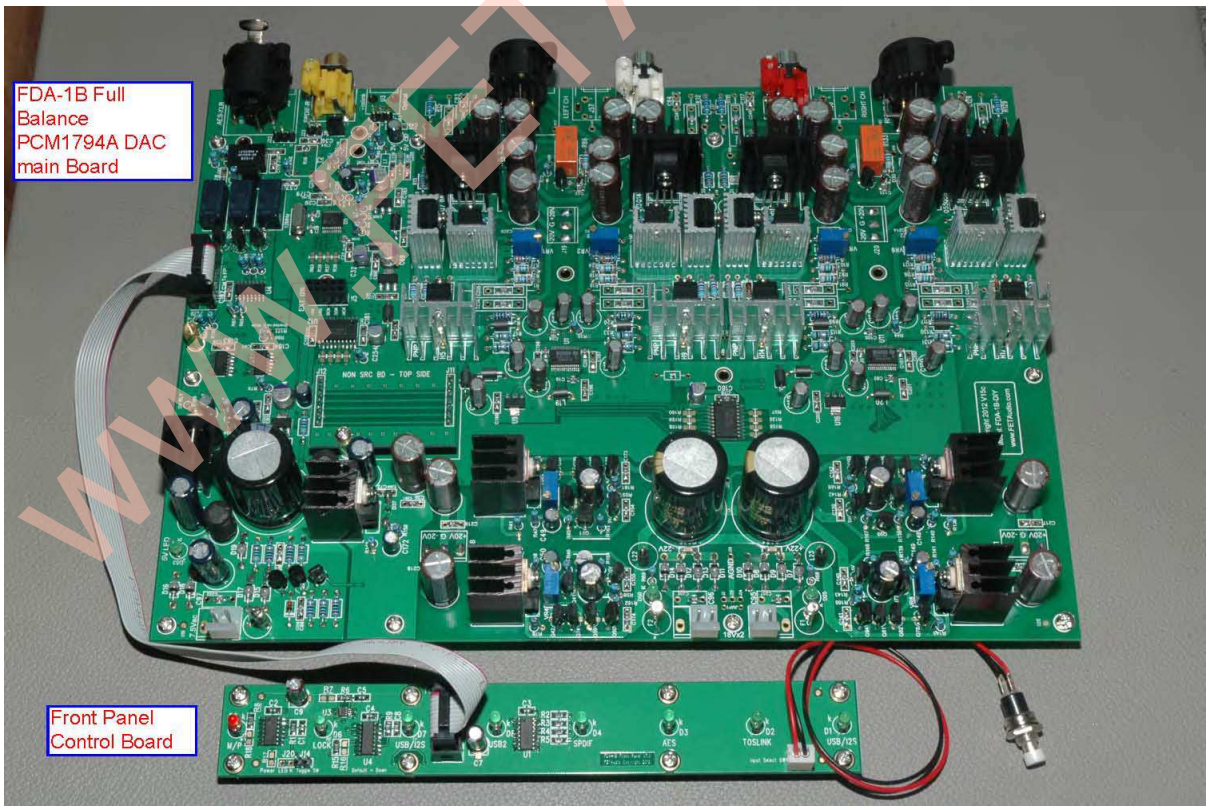


A. Introduction:

This FDA-1B PCM1794A DAC is an upgraded version of the obsolete FDA-1 Single Ended DAC. FDA-1B has been developing for 1.5 years since FDA-1 was selling. More than 7 version PCBs have been tested before launching to DIYers. It has improved all the weaknesses of FDA-1 and added additional features and functions to enhance the sonic performance and flexibility of the design. Thus it is a more complete and mature design with separate Front Panel control board, I2S input via RJ45 socket and optional ASRC function via daughter board plug-in!

Since it is a DIY DAC and thus most of the parts are selected to be through-hole parts except the ICs and some film capacitors. In fact most of the film capacitors pad are designed with both SMT (Surface Mount Technology) and TH (Through Hole) pads/holes and thus user can make a change in case better parts is available on hand. In the I/V section, all TH resistors and some filter capacitors are also provided with a SMT pads in case people want to try the SMT parts. For the digital section TH resistor pads can also be soldered with a 0805 SMT resistor due to its pitch is 2.54mm. **Thus this PCB design is really remarkable and flexible for DIYers to experiment with different types of part for sound tuning!**

For the Front Panel control board, it is mainly SMT parts with TH for LEDs and sockets. Thus it provides a good basic training for all DIYers for SMT soldering. In fact, SMT parts (with size 0603 and above) are more easy and faster to hand solder than TH parts after managing the skills. What you need is just a 5x magnify glass with stand, small head tweezers, 0.4mm to 0.5mm diameter solder wire and your two stable hands.

Major differences between FDA-1 and FDA-1B-DIY DAC are:

1. Change single end design to full balance design in a single board with both balance and single end analogy output.
2. Change digital receiver chip from CS8416 to WM8804 which is the best receiver chip with lowest jitter performance and excellence sonic performance.
3. All mirror image PCB layout for analogy regulators, DAC and IV sections to gain maximum sonic performance in 3D sound stage.
4. Improve PCB layout in all sections to achieve lowest noise level and super accurate timing for on board digital signal paths.
5. A separate front control board is provided for the digital input select control and LED indication of input and working status. Memory is provided for the input selection even after power off.
6. Add two daughter board options: One for the 4th digital I2S input via RJ45 socket and the other ASRC options using AD1896 or SRC4192 chips. CS8421 has been tested but rejected due to its harsh sonic performance.
7. Future expansion to USB input using new chipset like XMOS solution is possible via the input daughter board using the 4th I2S digital input. In fact, the XMOS reference design has been tested successfully via the I2S input at J5.

Major sonic improvement:

1. More “Beef” in the sound.
2. Improve overall resolution and details.
3. Quieter music background.
4. Much refine sound stage, and super 3D position.
5. More relax and musical sound.

With the above improvements, it is hardly can find a branded or DIY DAC that can produce music close to FDA-1B no matter what the price is.

Component choices:

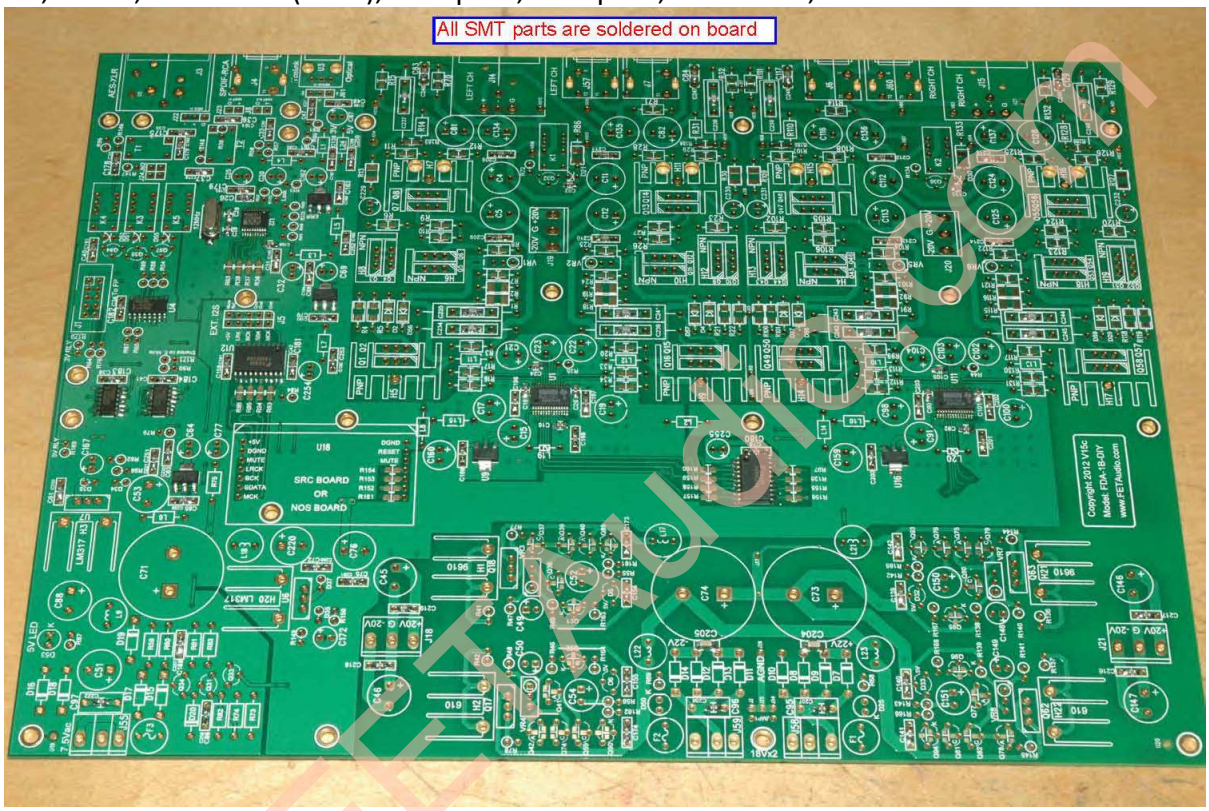
1. Many Toshiba obsolete parts are eliminated and better parts are selected from various sources to ensure continue supply. Many Fairchild transistors are used for the better specifications and easily available from Mouser or Digikey.
2. Use 50ppm/K through-hole resistors rather than the 100ppm dale resistor. Thus Vishay MRS25 and Xicon 50ppm 1% resistors are widely used.
3. Maintain the use of Elna Silmic II capacitors in the analogy sections for its best sonic performance.
4. Use more SMT capacitors (both E-cap and MLCC) in the digital section as they perform better and with lower ESR. Example is OS-con SVP or Panasonic FK series. The 6800p and 1500p low pass filter capacitors have changed to SMT type for more accurate and stable performance.
5. ROHS compliance is the first choice for all components.

B. Specifications:

1. DAC chips: Texas Instruments PCM1794A x 2 pieces 24bit/192k best in class DAC operating in mono mode for best dynamic performance – up to 132 db.
2. Digital Receiver: Wolfson WM8804 24bit/192k digital receiver. Best sound receiver chip ever made.
3. I/V and Analogy Filter: Discrete power transistor I/V (current steering) operating in pure Class A mode with NO global feedback. Aka Pass D1 I/V topology.
4. Digital Input: SPDIF, AES, Toslink and I2S Bus (RCA, XLR female, Toslink and 5x2-pin header – daughter board is required for I2S input via RJ45 socket).
5. Bit/Sampling Frequency: Up to 24bit/192k.
6. ASRC options are provided with additional cost: Two choices – AD1896 or SRC4192 can be provided. AD1896 will be at max 96k Fs and SRC4192 can be at max 192k Fs.
7. Analogy Output: Stereo Channels Single End @ 1.5Vrms and Full Balance at 3Vrms via RCA and XLR male connectors.
8. Output Impedance: 150 ohm Single End mode; 300 ohm Full Balance mode
9. Output auto muting using relays.
10. Power supply: AC 18V x 2, 1A and AC 8~9V x 1, 1A; total consumption around 250mA per AC input or around 14W/Board.
11. Display LEDs: Power/Mute, Lock, and Digital Input Selection.
12. Distortion: Maximum 0.02%, 1kHz at 0dbFS, 20kBW @ 3Vrms. Typically at 0.002% or below at -10dbFS input level.
13. Board: 11 x 8 inches double sided 1.6mm gold plated FR4; 12 x M3 supporting holes; max height part 35mm. Total board height is 37mm.

C. Assembly Instruction

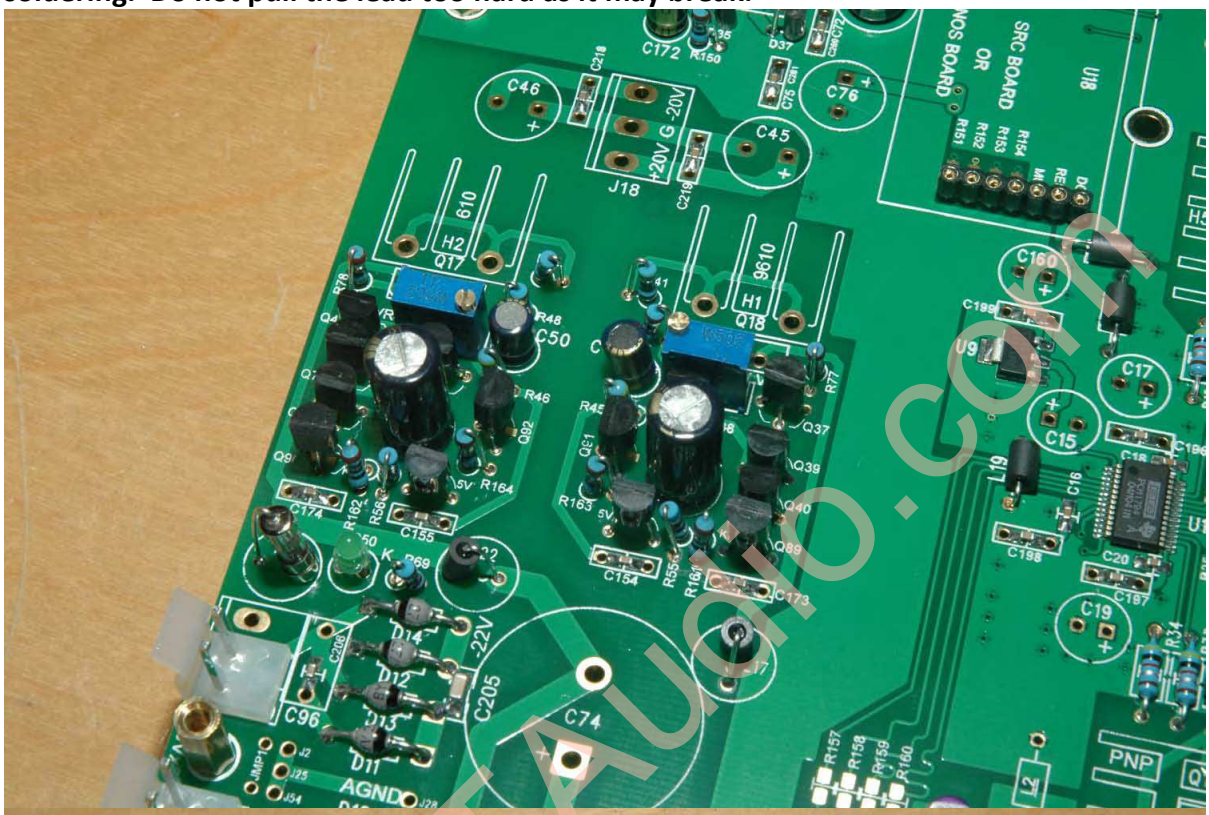
1. Please take necessary ESD precautions, as all the parts are ESD sensitive!
2. Solder all SMD IC: PCM1794A x 2, 74VHC244 x 2, WM8804 x 1, AMS1117-3v3 x 5, 74HC00D x 1, 74HC02D x 1 and 74HC238D x 1 etc... Align the markings of the IC with the text on the PCB screen-printing.
3. Solder all SMD chip capacitors provided as per below sequence. They are 15pF x 2, 470p x 2, 1u x 1, 0.047u x 2 (1206), 1500p x 4, 6800p x 8, 0.01u x 14, 0.1u x 63.

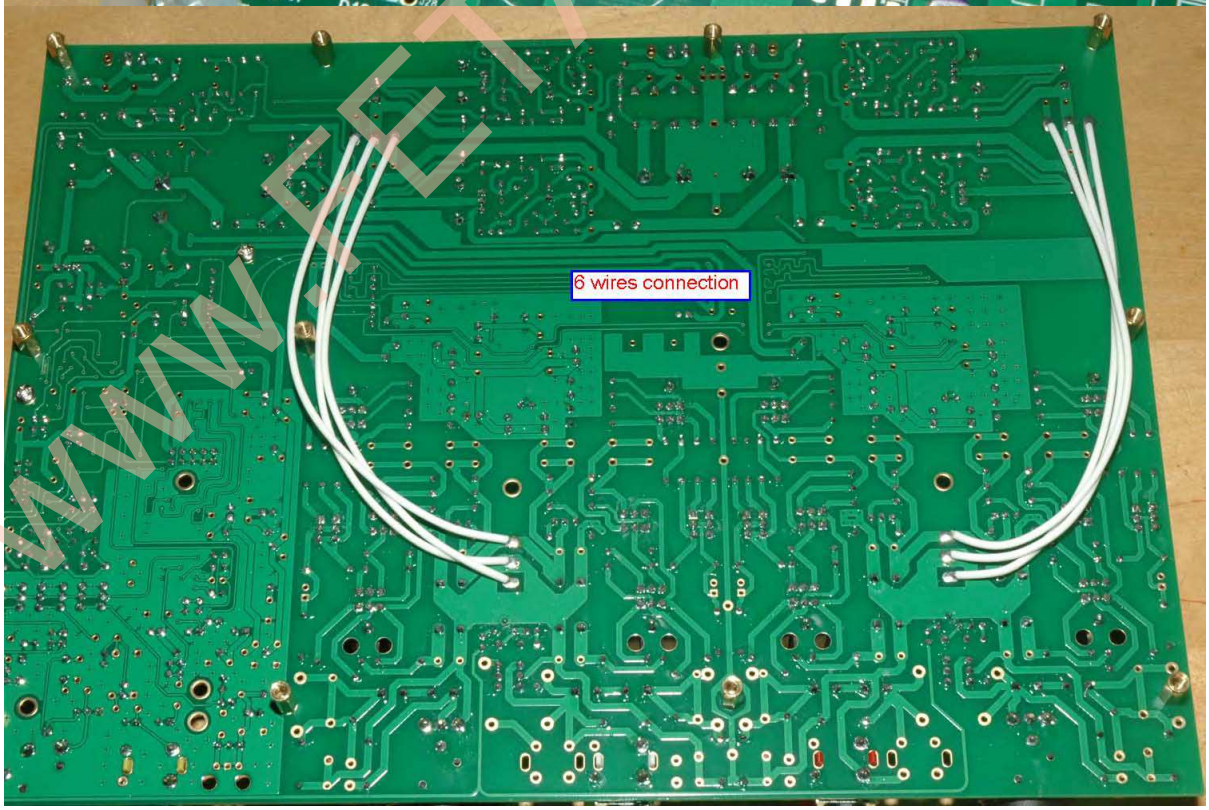


4. Solder the crystal 12MHz Y1.
5. After that wash the PCB to remove all the flux with Isopropyl Alcohol. Use a tooth brush to clean the gap of the ICs leads. After that rinse the PCB with distill water and dry it properly.
6. Use a multi meter to check all the leads of PCM1794A and WM8804 connections. Ensure no adjacent leads are shorted together unless it is designed to be shorted.

***** If you buy the kit, you will get a DAC main board with all the SMT parts pre-soldered as above *****

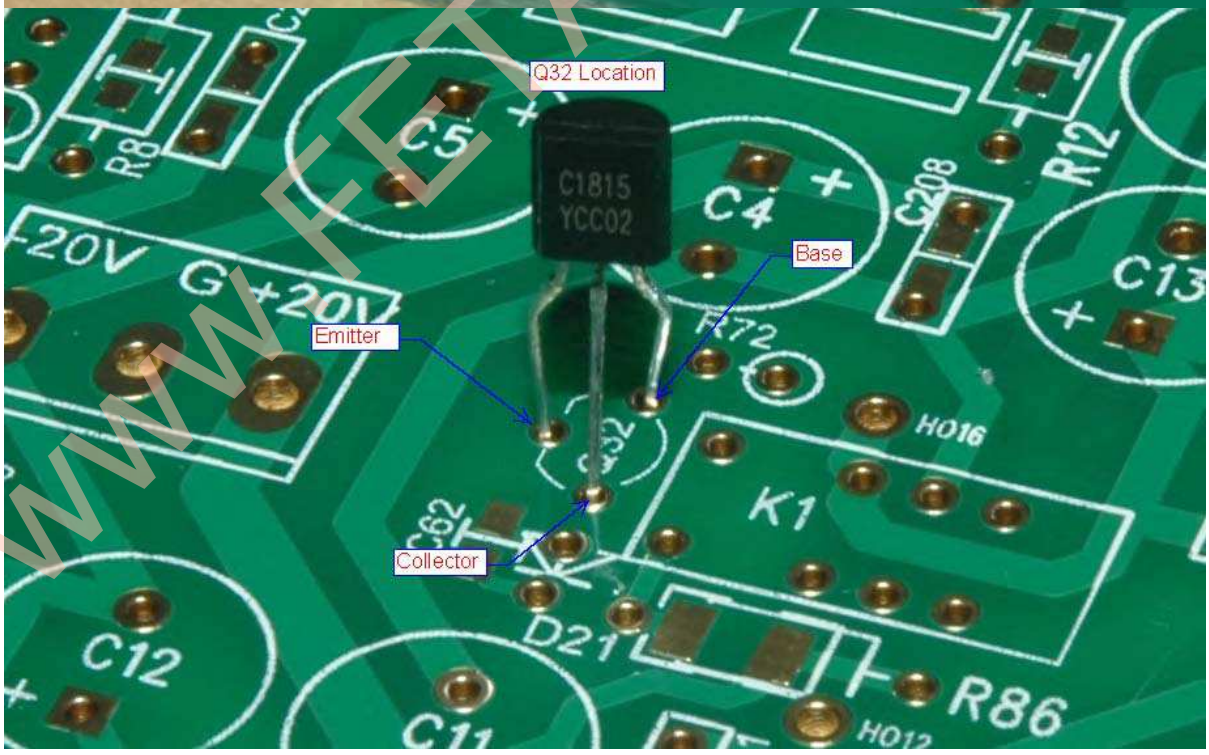
7. **Solder the rest of the parts starting from the smallest parts first, preferably also by component type. For example, resistors, chokes, beads, diodes, E-caps etc… For SMD E-capacitors (OS-con), pull the leads straight and insert into the PCB holes before soldering. Do not pull the lead too hard as it may break.**

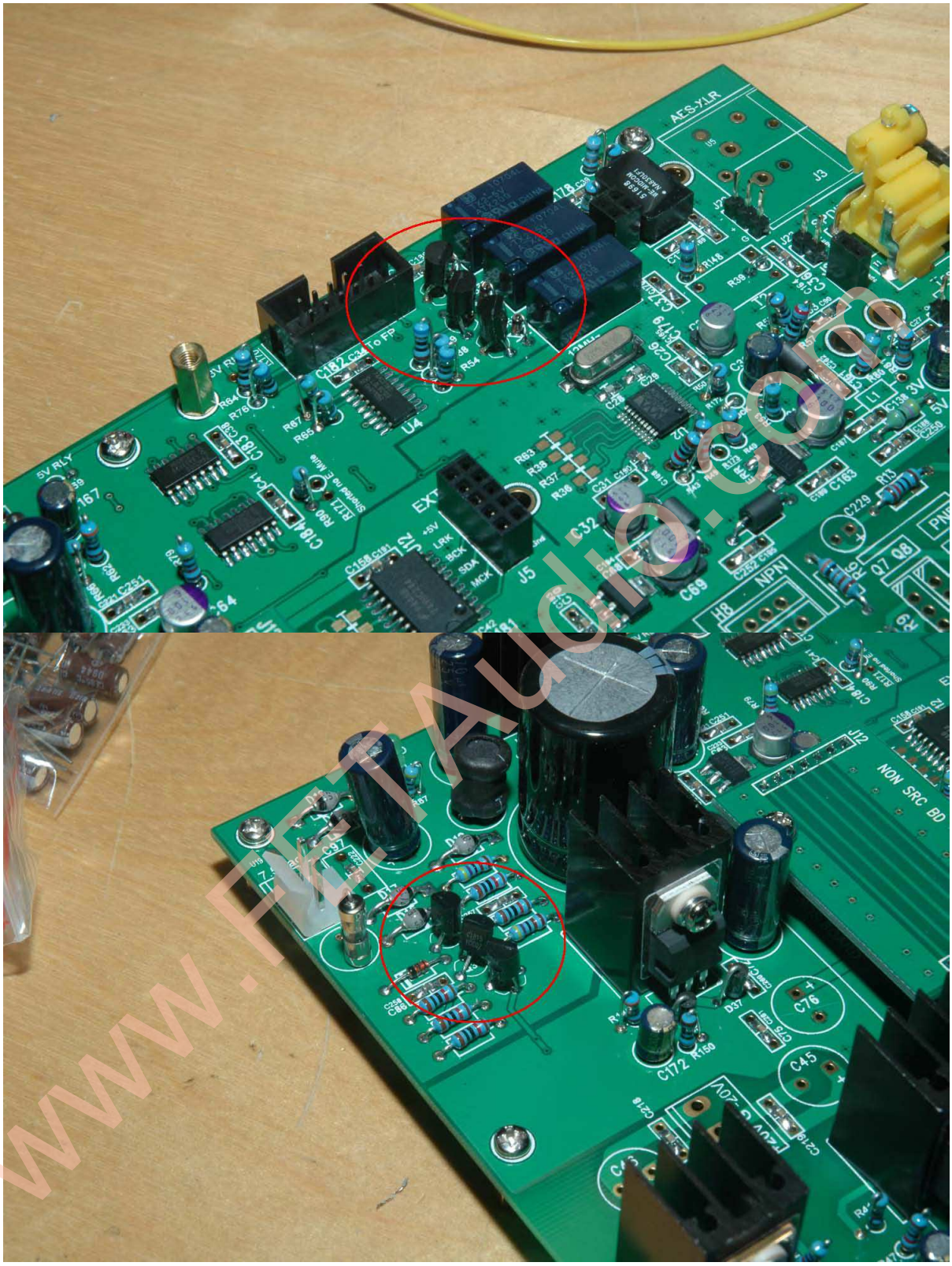


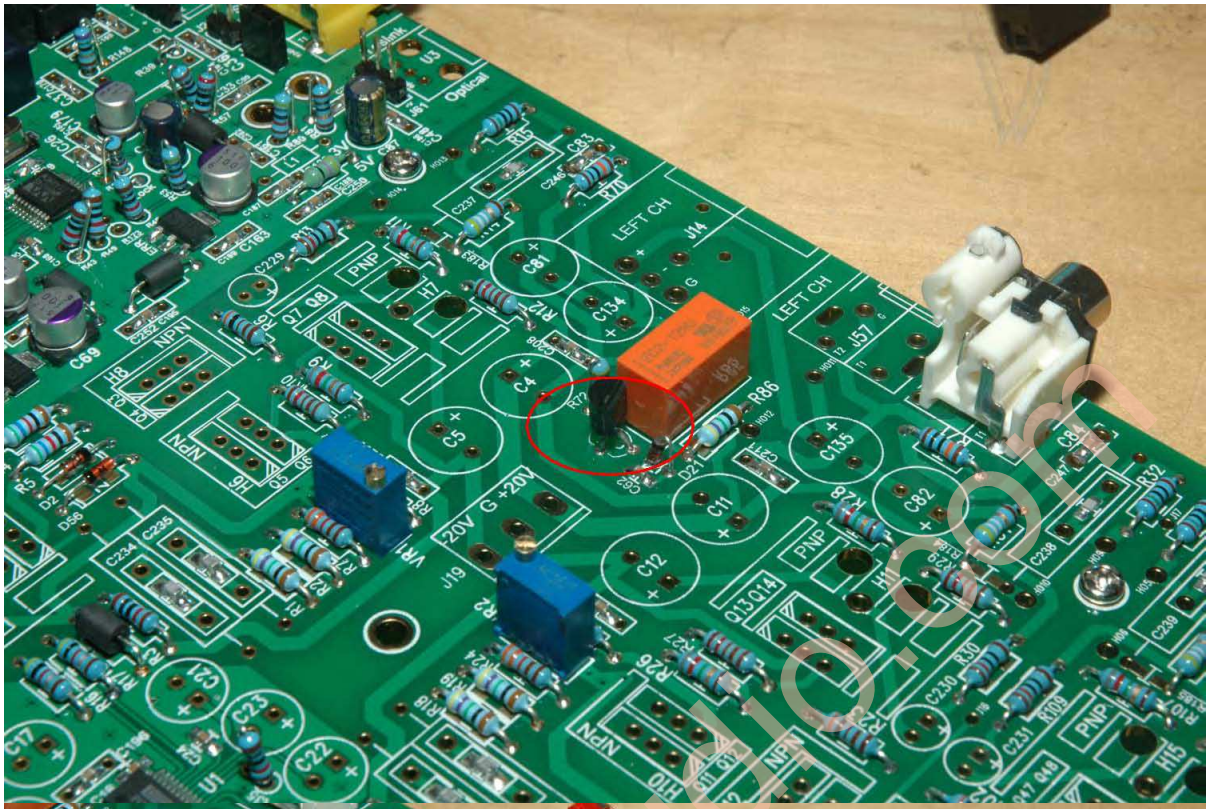


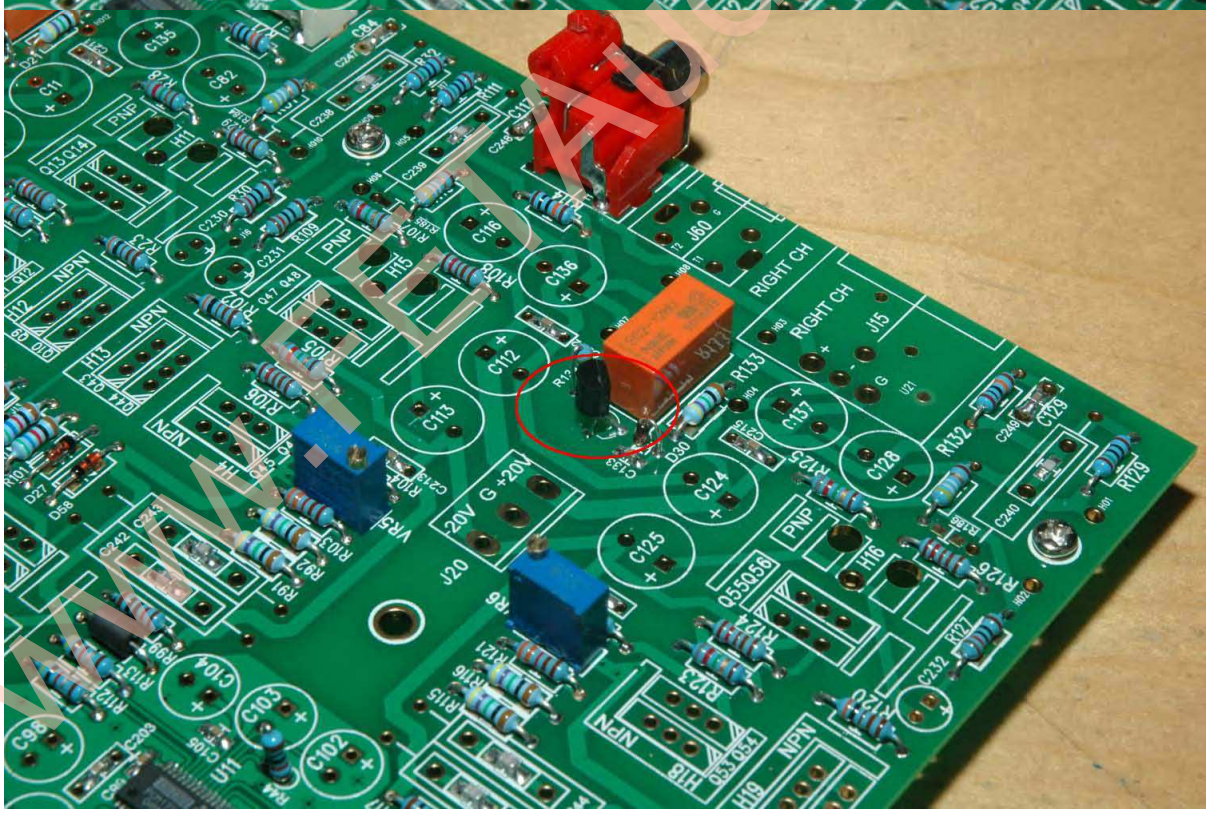
8. There are some parts that need special attentions during assembly:

8.1. Transistors C1815 x 8 pcs - **Q31, Q32, Q33, Q34, Q35, Q36, Q84, & Q97**: The pads are not properly designed and thus these parts must be inserted as per the photos below. The orientation should not follow the marking on the PCB. See below photos of all the 8 pieces C1815 transistor orientation.

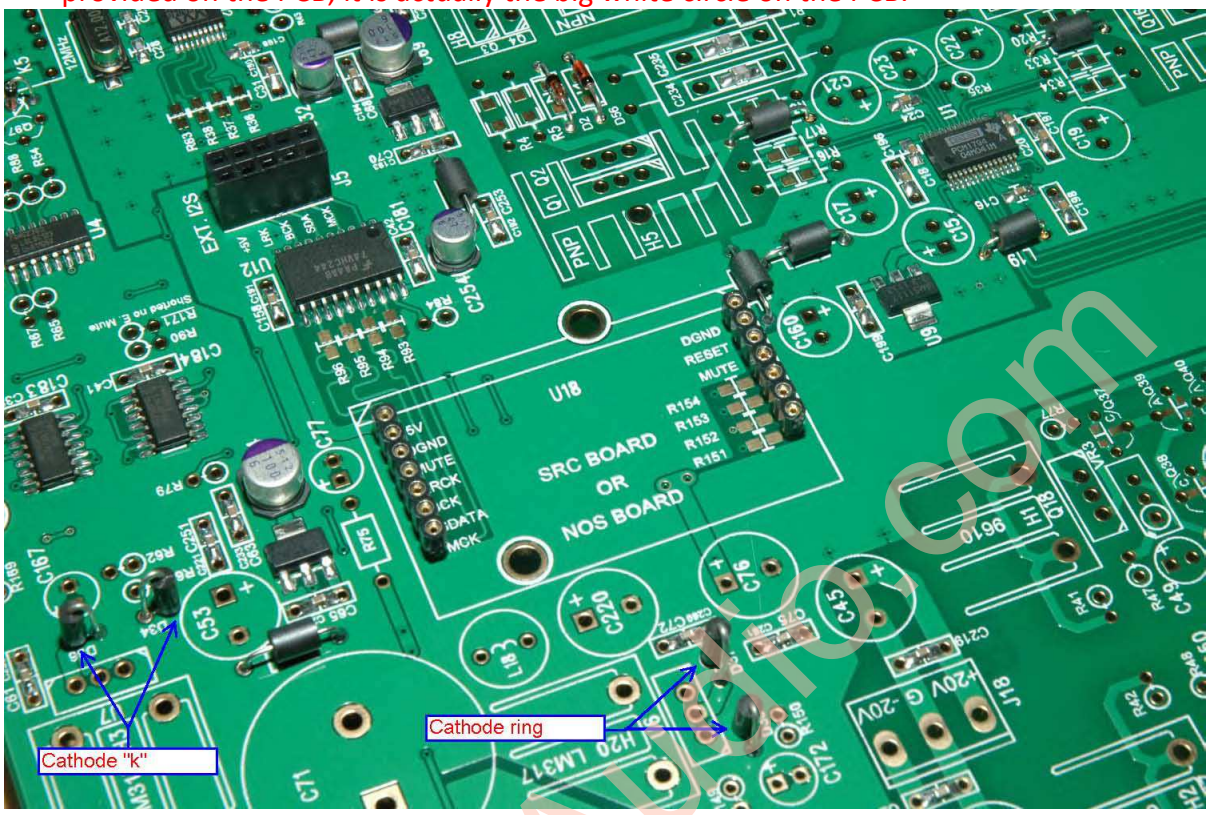




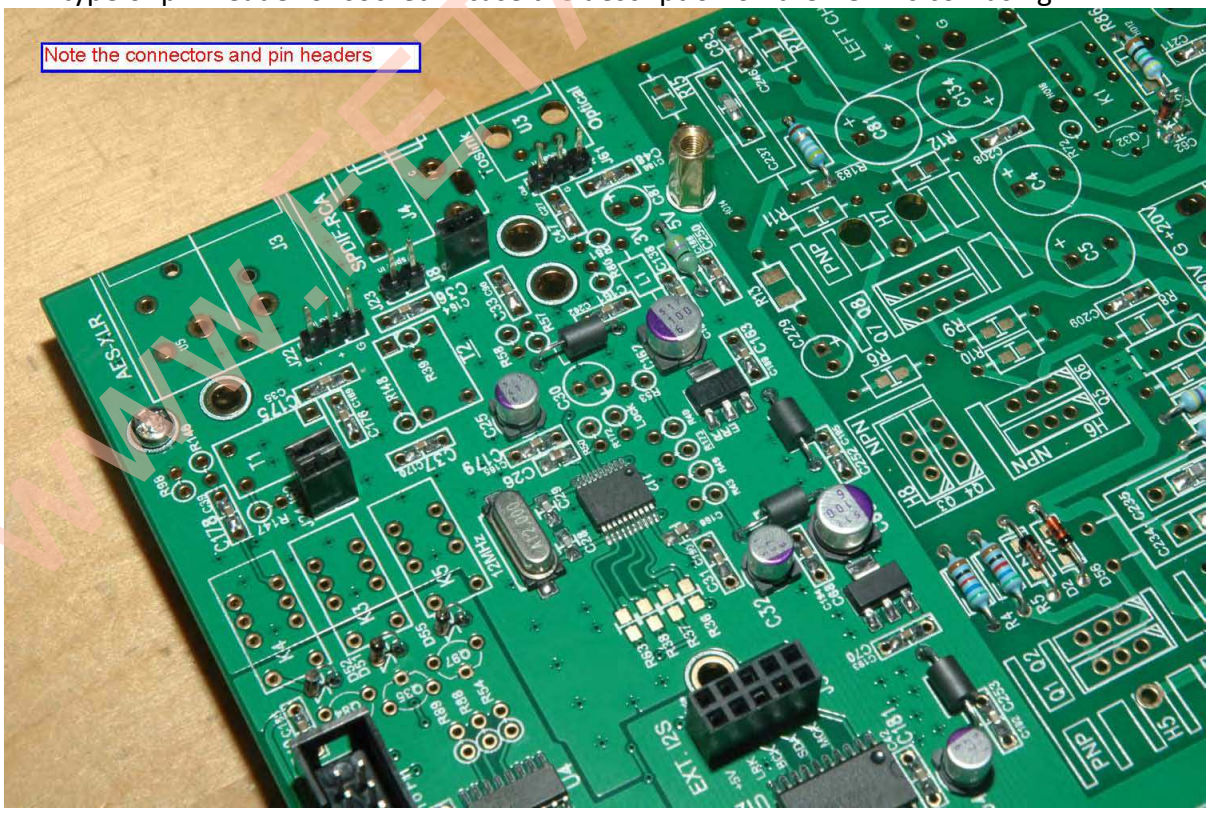




8.2. Diodes 1N4007 x 4 pcs – D34, D35, D36, & D37: The cathode mark (strip or K) is not provided on the PCB, it is actually the big white circle on the PCB.



8.3. Connectors J22, J23, J8, J61, J24, J62, J5, J1, J55, J59, & J58 – refer to photo for the type of pin header or socket in case the description on the BOM is confusing.

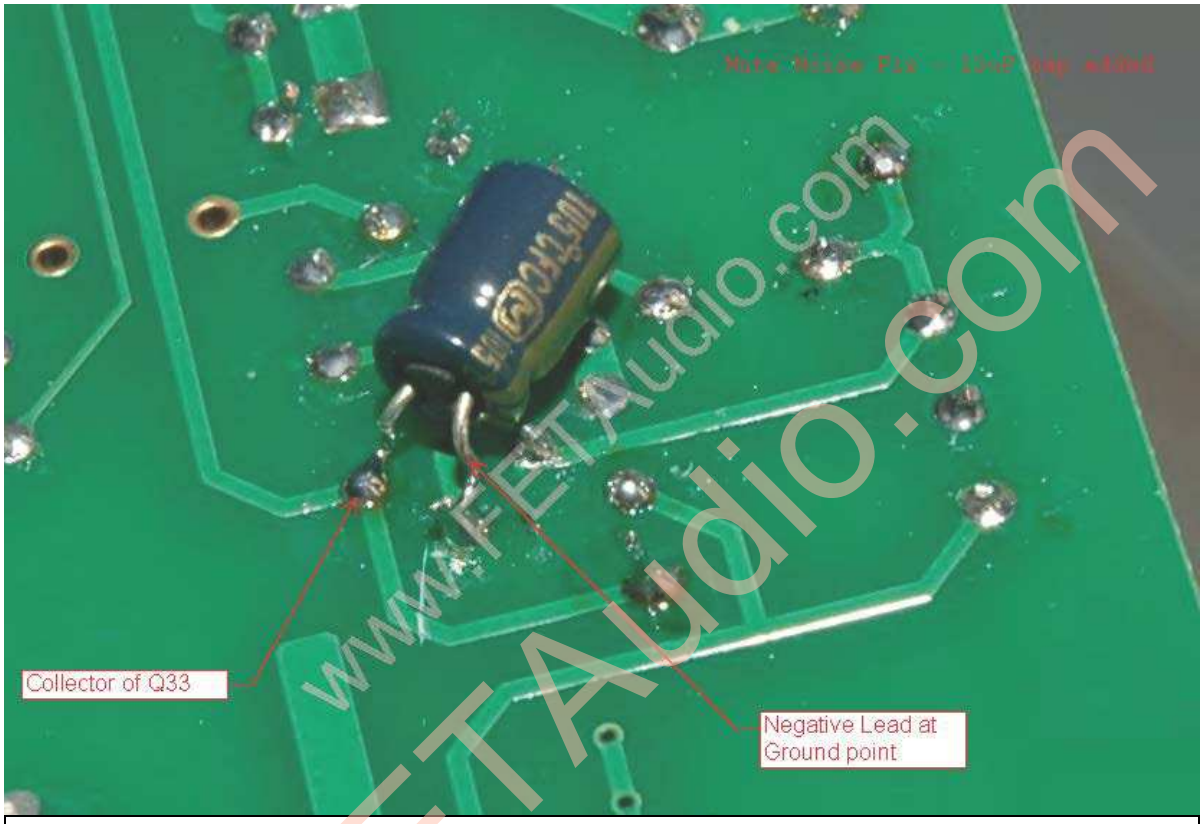


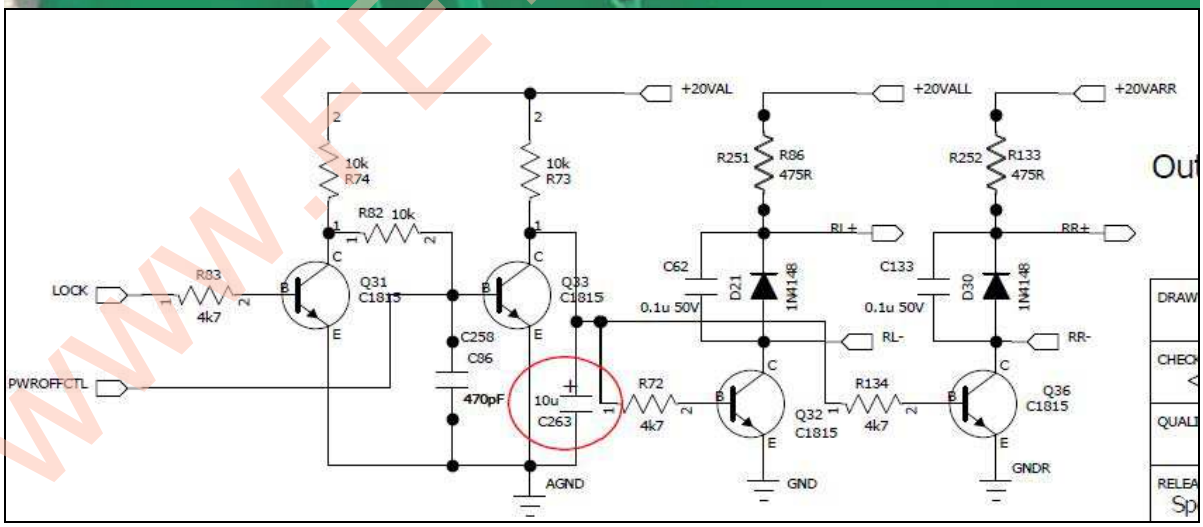
8.4. Do not connect the 6 wires at J18, J19, J20 and J21. Refer to the tuning procedure for details.

8.5. IRF9610 x 2, IRF610 x 2, and LM317T x 2, PNP and NPN Transistors are installed on all heatsink with their marking all facing upward as shown below. Note that there is a mica insulation sheet between the body of TO-220 parts and the heat sink only. The transistors do not need a mica sheet for insulation.

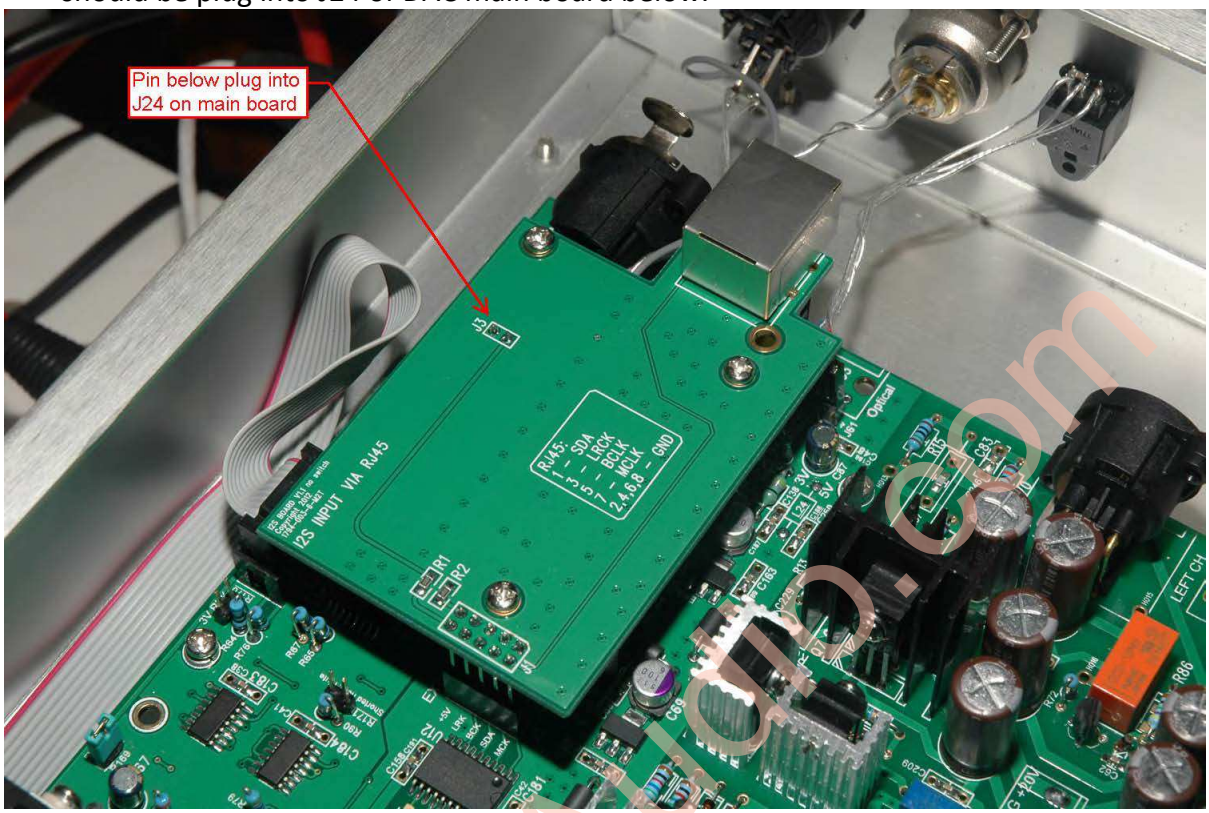
8.6. R39, R169 and R172 are jumpers and not provided. Use an excess component lead to short solder the two pads.

8.7. Digital Input Select Switching Noise fix: If you switch the digital input from I2S to SPDIF (RCA), sometimes you may hear some static noise from the speaker. The cause is due to the WM8804 slow response to lock on a SPDIF signal. The fix is to increase the mute time of the output relays and a capacitor C263 of 10u to 12u will be soldered to the collector and Emitter (ground) of Q33 as show in the photo below.



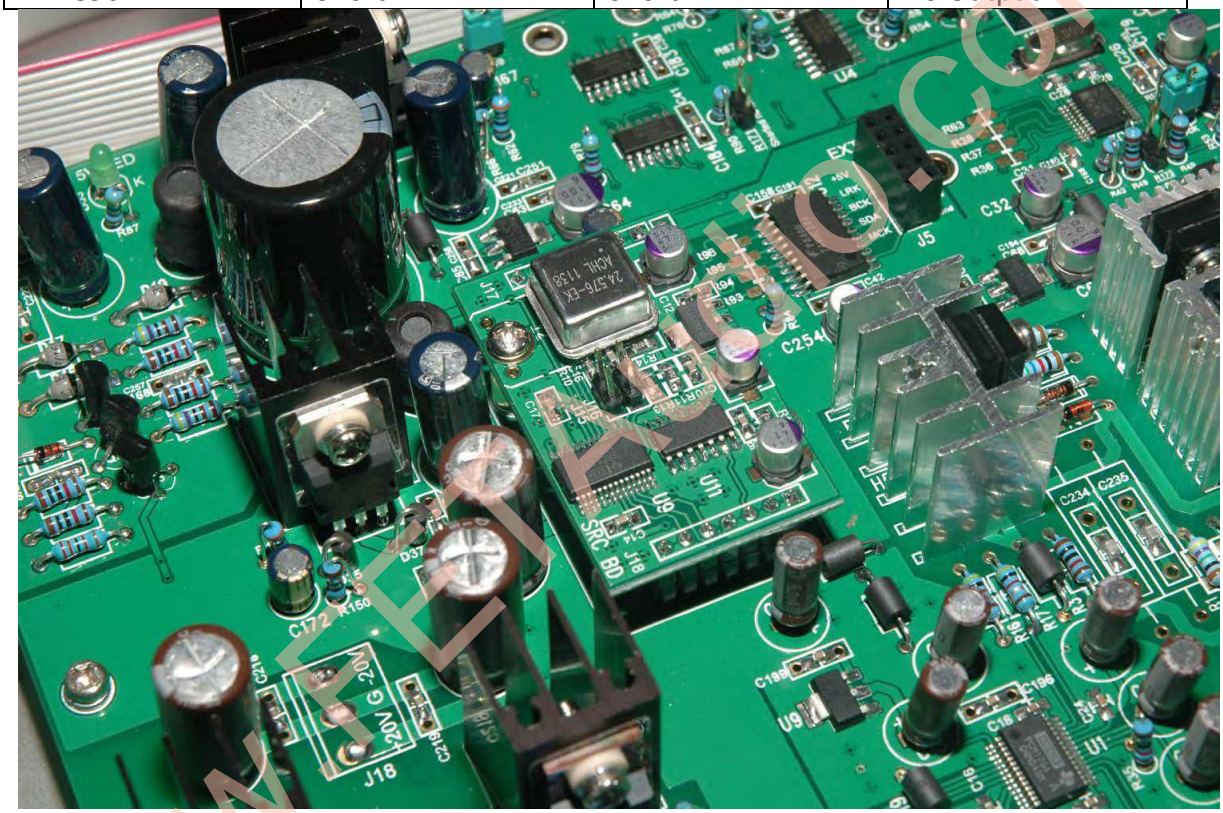


8.8. I2S board should be installed as show in below photo. Note that the 1x2 pin header should be plug into J24 of DAC main board below.



8.9. If you buy the ASRC option, the output sample frequency Fs will be as below:

ASRC Chip	J15	J16	Sample Frequency
SRC4192	Open	Open	96k
SRC4192	Open	Short	48k
SRC4192	Short	Open	192k
SRC4192	Short	Short	No Output
AD1896	Open	Open	96k
AD1896	Open	Short	48k
AD1896	Short	Open	32k
AD1896	Short	Short	No Output



D. Tuning Procedures:

1. With all the parts in place except the 6 wires provided.
2. Connect AC 8V (or a regulated power supply with current limit set to 300mA at 12Vdc) to J55 (do not connect J58 and J59 to AC 18V), check the voltages at U6 and U7 (LM317T) body heat-sink (not the big heat-sink that it attached to) relative to ground (DGND at U18 daughter board position or AGND at the middle of the two 5600u big filter capacitors). The voltage should be at about 5V +/- 0.15Vdc. If the voltage is much more than 5V (6V or above), cut off the power immediately to prevent damage to the expensive PCM1794A chips.
3. Then check the voltage at U8, U9, U10, U16, & U17 (AMS1117-3.3). The voltage at the little heat-sink of the regulators should be 3.3V +/- 0.1Vdc.
4. Plug in the Remote Control Board via J1 on both PCBs. D1 (USB/I2S) and D5 should be "ON". Press the toggle switch (at J2 or J14) to see if the LEDs D1 to D4 is "ON" one by one. The sequence is from D1 → D4 → D3 → D2 → D1 → D4 … and repeat. Also hear if the relays K3, K4 and K5 have clicking sounds when pressing the toggle switch.
5. Inject a digital SPDIF signal to J4 RCA socket, the LOCK LED (D6) should be "ON" if SPDIF (D4) is selected. This shows that the digital section is working properly.
6. Then remove the power at J55.
7. Connect AC18V (or a regulated power supply with current limit set to 300mA at 24Vdc) to J59, check for voltage at J18 and J21 for -20V to G points. The initial voltage should be around -15.5V. Adjust VR4 and VR8 until the voltage is -20V +/- 0.02Vdc. Remove the power applied to J59.
8. Connect AC18V (or a regulated power supply with current limit set to 300mA at 24Vdc) to J58, check at J18 and J21 for +20V to G points. The initial voltage should be around 15.5V. Adjust VR3 and VR7 until the voltage is +20V +/- 0.02Vdc. Remove the power applied to J58.
9. Solder the 6 wires provided from J18 to J19 and J21 to J20. Make sure that the wires are connected from -20V to -20V, G to G and +20V to +20V points. Note that there is cross-over of wires on one side.
10. Connect power to all J55, J59 and J58.
11. Check the +20V and -20V are still at about the same voltages as before. If not, the IV section is shorted somewhere.
12. Output DC offset adjustment:
13. Check the offset voltage at C246 (C83) inner hole relative to G of J57. It should be around 0.45Vdc. Adjust VR1 until this voltage to below 1mV. Repeat at C247 (C84) and adjust VR2 to nearest 0V offset.
14. Check the offset voltage at C248 (117) inner hole relative to G or J60. It should be around 0.45Vdc. Adjust VR5 until this voltage to below 1mV. Repeat at C249 (C129) and adjust VR6 to nearest 0V offset.
15. After warm up for 30 minutes, repeat above two steps to ensure the offset is below 1mV by adjustment again if necessary. For normal use, the offset of +/-5mV is ok as all output has couple capacitor to block any DC from going to the next stage.
16. If all the DC adjustment is done, proceed to AC measurement.
17. Connect a 1kHz digital signal to the SPDIF input (RCA socket). A test CD recorded with 1kHz can be used with a CD player with SPDIF output.

18. Check the output levels for 0dBFS input signal is at about 1.5Vrms at RCA and 3Vrms at XLR output sockets. Left and right channel should not be more than 0.25dB differences in levels.
19. Check that the distortion of the output 1KHz signal is below 0.02% for both channels.
20. Burn-in the DAC for about ½ hour to stabilize the parts.

E. Board Interface Specifications:

1. Power Supply Connectors:

Location	Description	Format
J58	18V to 20V AC, 1A, 20VA	3.96mm pitch
J59	18V to 20V AC, 1A, 20VA	3.96mm pitch
J55	8 to 9V AC, 1.5A, 20VA	3.96mm pitch
J2/J25/J54	Chassis Ground	Connect AGND to star ground point

2. J5: External Digital Connector: (5 x 2 Pin Header; pitch 2.54mm, CMOS 3V3 logic)

Symbol	Description	Pin	Marking on PCB
DGND	Digital Ground	1	GND
MCLK	System clock 256fs	2	MCLK
DGND	Digital Ground	3	GND
SDA	Serial Digital Data	4	SDA
DGND	Digital Ground	5	GND
BCLK	Bit clock 64fs	6	BCK
Reset	Power up reset	7	RST
LRCLK	Work clock fs	8	LRK
Mute	Output Mute (Hi = Mute)	9	Mute
+5V	+5V DC Supply for plugin	10	+5V

3. Digital Input Socket:

Location	Description	Spec	Format
J4	SPDIF input	75 ohm 24bit/192k	RCA (Yellow)
J3	AES input	110 ohm 24bit/192k	XLR female
U3	Optical input	Optical 24bit/192k	Toslink
J5	I2S, Mute & Reset	3.3V CMOS	5x2 pin header

4. Analogy Output Socket:

Location	Description	Format
J7	Left Single End Output	RCA (white)
J14	Left Balance Output	XLR Male
J6	Right Single End Output	RCA (red)
J15	Right Balance Output	XLR Male

5. Front Panel Control Board (V7.1):

Location	Description
J1	Connect to DAC main board J1 via a 10-pin flat cable
J2 & J14	Use a Push type “Toggle Switch without latch”. Switch is normal open, Connect one of them for digital input selection
J20	Power LED – optional for additional Power display
R8	Connect +3v3 to D5 – Power indicator, then R18 must be opened
R18	Connect Mute to D5 – Input Mute indicator, then R8 must be opened
R15/R16	R15 short and R16 open – count down, R15 open and R16 short – count up – this will change the switching direction of the digital input selection

6. Front Panel Control Board LED Display:

Location	Description
D1	"ON" = Select I2S/USB input (J5)
D2	"ON" = Select Toslink (Optical)
D3	"ON" = Select AES (XLR female)
D4	"ON" = Select SPDIF (RCA)
D5	Mute or Power indication (R8 = Open & R18 = 0R → Mute; R8 = 0R & R18 = Open → Power)
D6	Lock ("ON" = WM8804 is locked to digital input signal)
D7	USB/I2S; either USB or I2S plug-in is activated
D8	USB2; reserve for USB lock indicator

7. Main PCB Options:

Location	Description
R169/R170	R169 short & R170 open → use 5V relay; R169 open & R170 short → use 3v3 relay for K3, K4 & K5; default is R169 short and use 5V relays.
R171	If short, then the I2S mute is not functioning, i.e. analogy output NO-Mute; default is Mute.
R172/R173	If R172 short & R173 open → Mute is using LOCK signal; if R172 open & R173 short → Mute is using Gen Error signal. Default is LOCK signal
L1	If populated, use 3V3 Optical receiver but L24 must not used (Default)
L24	If populated, use 5V Optical receiver but L1 must be removed
J22	Same as J3, AES input
J23	Same as J4, SPDIF input
J61	Same as U3, Toslink input
J8	SPDIF output for WM8804, need to connect to a external RCA socket
JMP1	If connected, the M3 hole next to it will be connected to analogy ground
C95/C96/C97	Can be used to connect a MOV for surge suppression, not provided
H01 to H016	Output couple capacitor connection points for large film capacitor. Two groups of pads are provided. Example: H01 & H02 are the same points, and H03 & H04 are the same points. Thus connect a film capacitor from H01 to H03 and/or H02 to H04. Other connections are {H05 to H08, H06 to H07}; {H09 to H011, H010 to H012}; {H013 to H015, H014 to H016}.
C229 to C232	Optional filtering capacitors for IV, not provided
U18	A NOS daughter board will be provide as the default option. ASRC daughter board using AD1896 or SRC4192 can be purchased separately to plug into same location. The output sampling frequency from the ASRC BD is preset to either 96k for AD1896 or 192k for SRC4192.
T2	Not used and not provided
J57	Left Channel Analogy Output: T1 = +ve, T2 = -ve, G = Ground. This is for external RCA and XLR socket connection.
J60	Right Channel Analogy Output: T1 = +ve, T2 = -ve, G = Ground. This is for external RCA and XLR socket connection.

Attachments:

1. Circuit Diagram – 12 pages
2. FDA-1B DAC BOM – 2 pages
3. FFT measurement – 11 pages
4. PCBs mounting dimension – 6 pages

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Discrete IV Left -V

REVISION RECORD			
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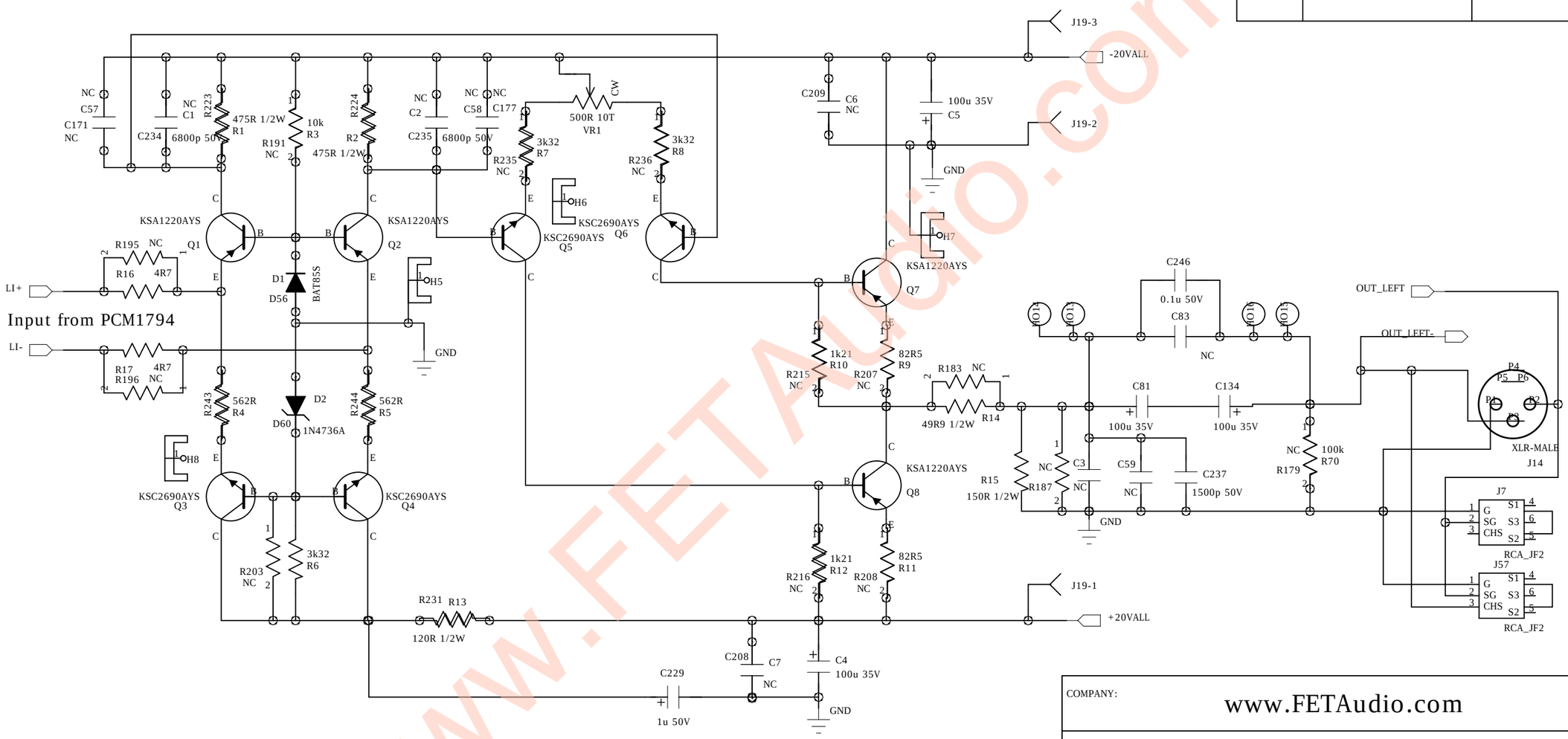

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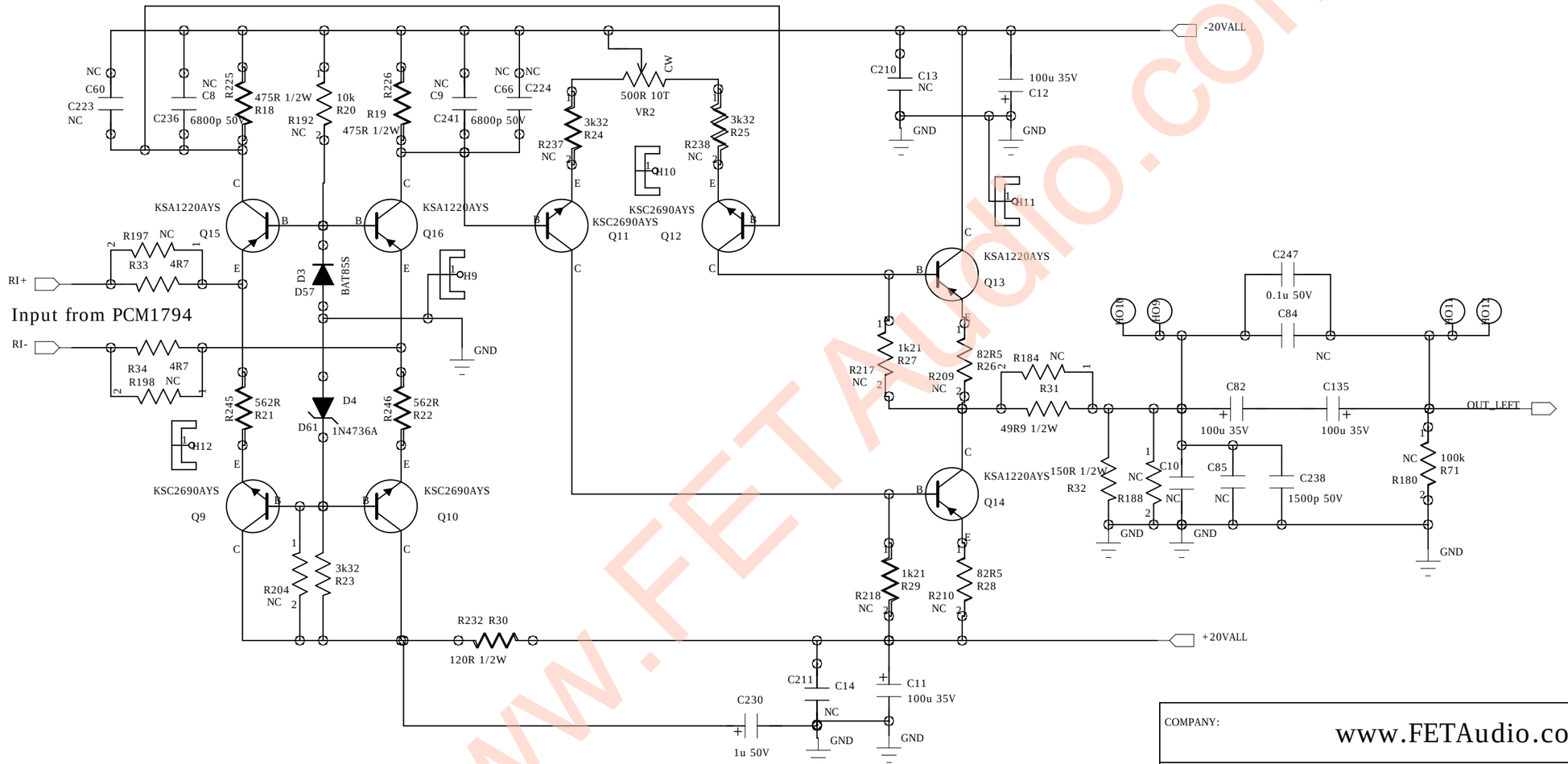
Discrete IV Left +V



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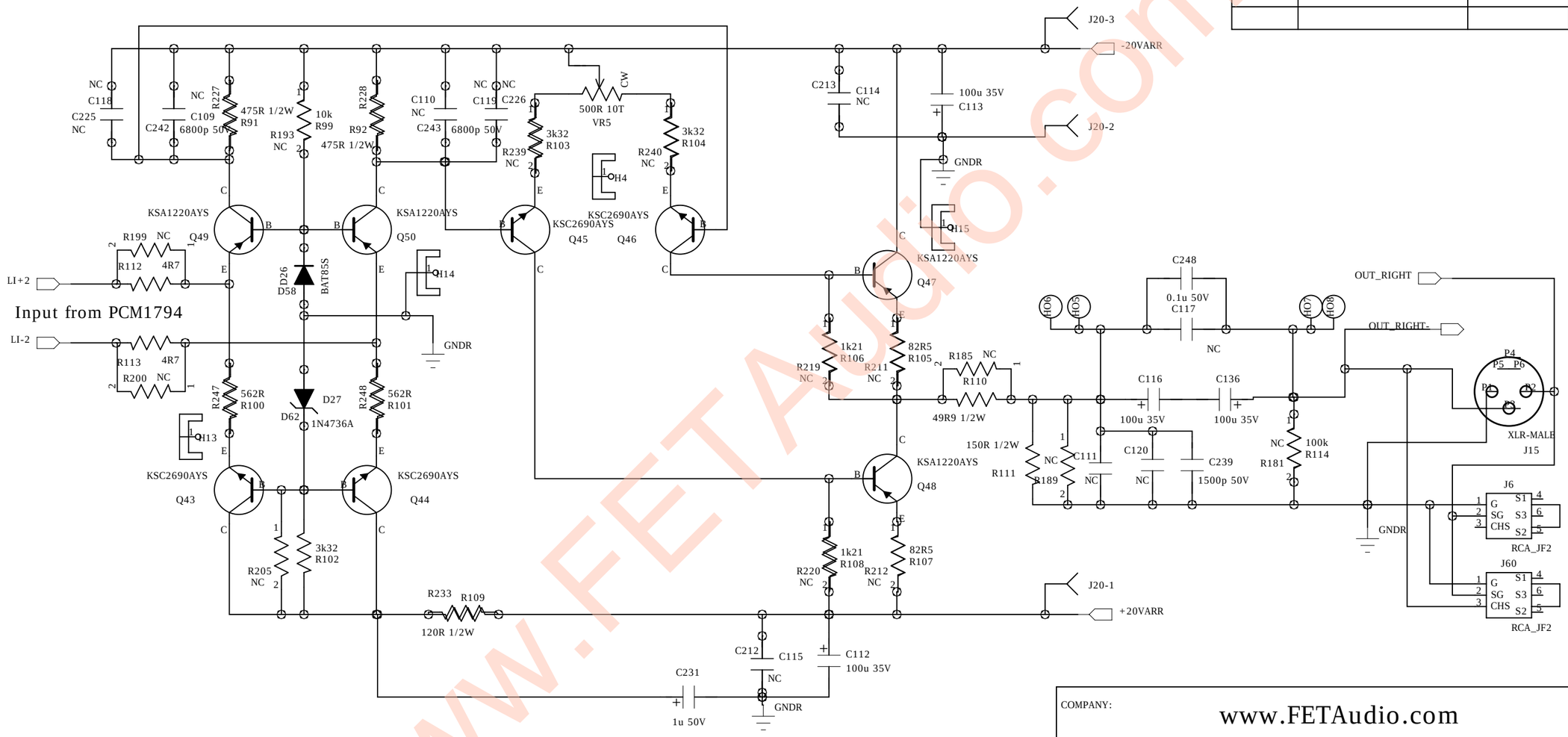
Discrete IV Right -V



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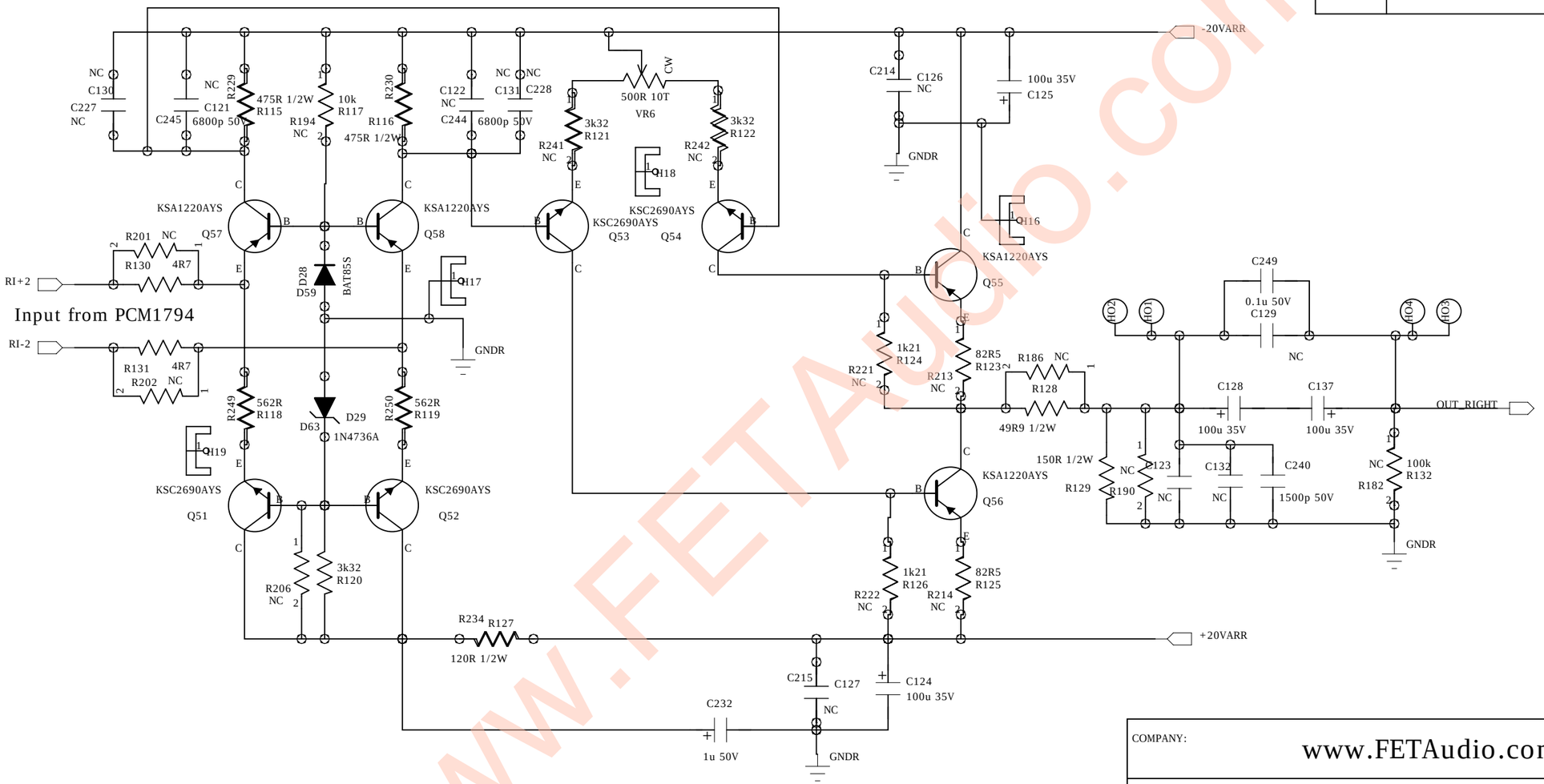
Discrete IV Right +V



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CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: FDA-1B (PCM1794A DAC)	
QUALITY CONTROL: <QC By>	DATED: <QC Date>	CODE: WM15	SIZE: B
RELEASED: Spencer Cheung	DATED: 2012-03-03	DRAWING NO: FDA-1B-15	REV: 15
		SCALE: 1:1	SHEET: 4 OF 10

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

I2S Buffer

U15-B 74VHC244M

LRCKO
SDATAO
BCLKO
MCKO
MUTE_MS_B
RESET

R157 NC
R158 NC
R159 NC
R160 NC

U15-A 74VHC244M

R97 NC
R135 NC
R155 NC
R156 NC

MCLK2
BCLK2
SDA2
LRCLK2

DGND

Left Channel

+3.3VDAC
+5VDAC
+5VLLT

C89 C198 0.1u 50V
C15 47u 6.3V
C16 0.01u 25V
C79 C196 NC
C17 47u 6.3V
C18 0.01u 25V
C19 47u 6.3V
C20 0.01u 25V
C80 C197 NC

Bead L15
Bead L11
Bead L12
GND

U1 PCM1794A

1	MONO	VCC2L	28
2	CHSL	AGND3L	27
3	DEM	IOUTL-	26
4	LRCK	IOUTL+	25
5	DATA	AGND2	24
6	BCK	VCC1	23
7	SCK	VCOM1	22
8	DGND	VCOM2	21
9	VDD	IREF	20
10	MUTE	AGND1	19
11	FMT0	IOUTR-	18
12	FMT1	IOUTR+	17
13	ZERO	AGND3R	16
14	RST_B	VCC2R	15

FMT0/FMT1 = O/O = I2S

LI+
LI-
RI+
RI-

To IV Left Ch

R35 10k

C22 47u 6.3V
C23 47u 6.3V
C21 47u 6.3V
C24 0.1u 50V

DGND

Mute control circuit

+3.3VD
R90 47k
E_MUTE
I2S1
I_MUTE

U14-B 74HC00
U14-C 74HC00
U14-D 74HC00
U14-A 74HC00

IMUTE

"High = Mute"

MUTE_B
U13-B 74HC02
R64 680R

LOCKO
MUTE_MS_B
U13-A 74HC02
LOCK
R76 680R

5x2 pin header

J5-1 J5-2 J5-3 J5-4 J5-5 J5-6 J5-7 J5-8 J5-9 J5-10

+5VREG
DGND
RESET

I2S Input and Select control

R171 NC

Ext. I2S

E_MCLK
E_SDA
E_BCLK
E_LRCK

U12-A 74VHC244M
U12-B 74VHC244M

R93 NC MCLK
R94 NC SDATA
R95 NC BCLK
R96 NC LRCLK

U13-C 74HC02
U13-D 74HC02

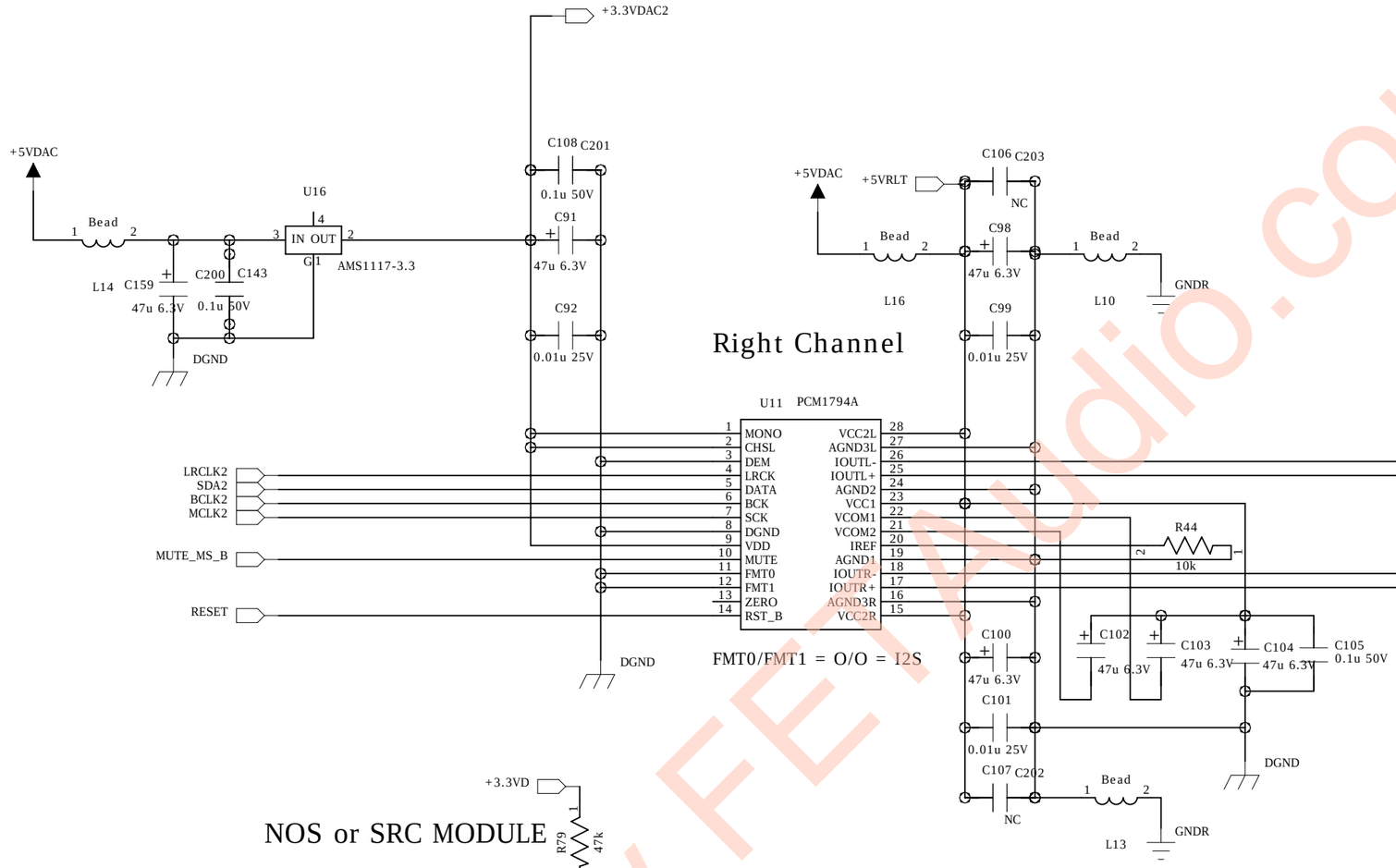
I2S1
R84 47k
DGND

I_LRCLK
I_BCLK
I_SDATA
I_MCLK

8416 I2S

DRAWN: Spencer C	DATED: 2012-03-02	COMPANY: www.FETAudio.com	
CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: FDA-1B (PCM1794A DAC)	
QUALITY CONTROL: <QC By>	DATED: <QC Date>	CODE: WM15	SIZE: B
RELEASED: Spencer Cheung	DATED: 2012-03-03	DRAWING NO: FDA-1B-15	REV: 15
		SCALE: 1:1	SHEET: 5 OF 10

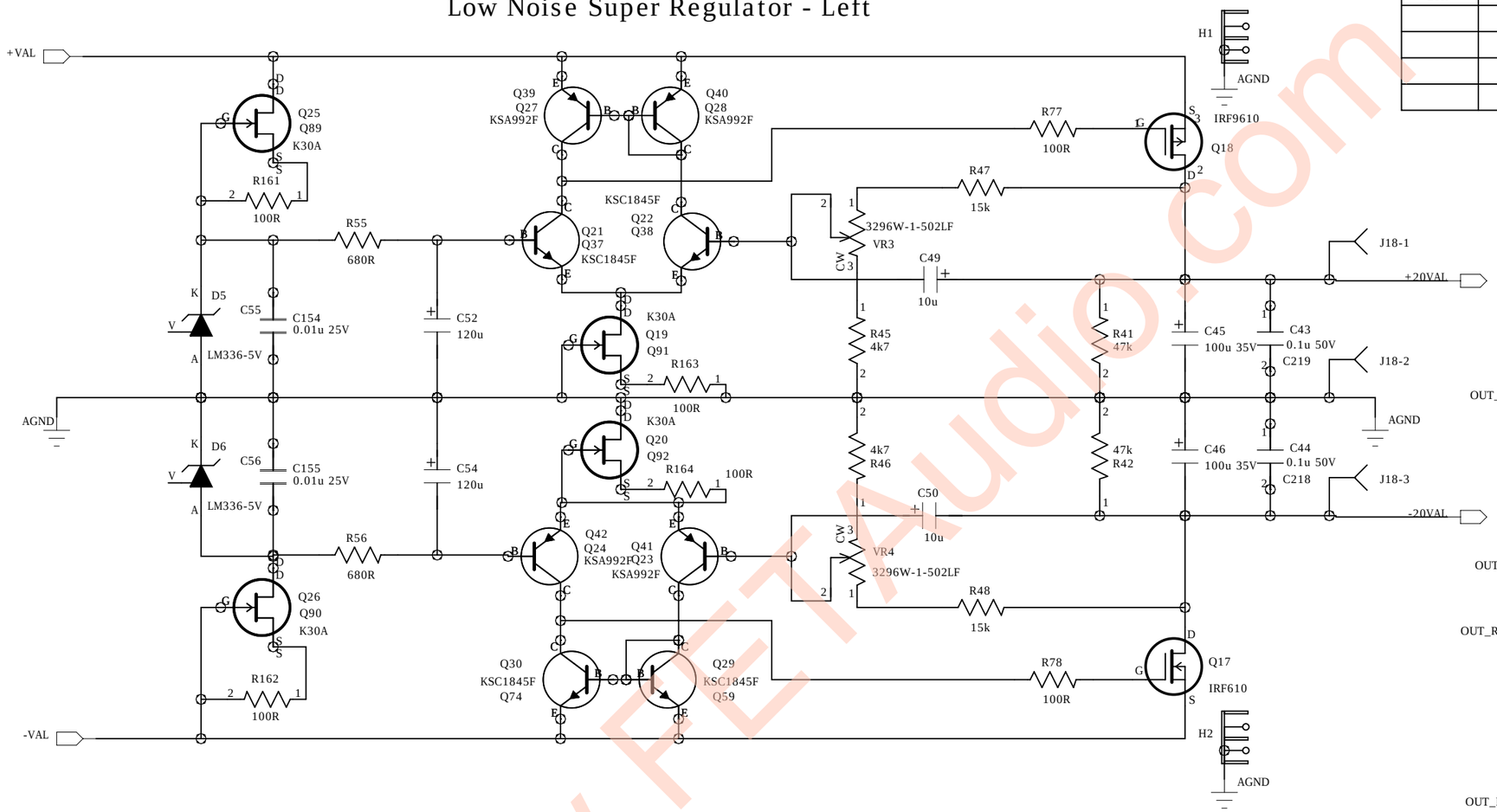
REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



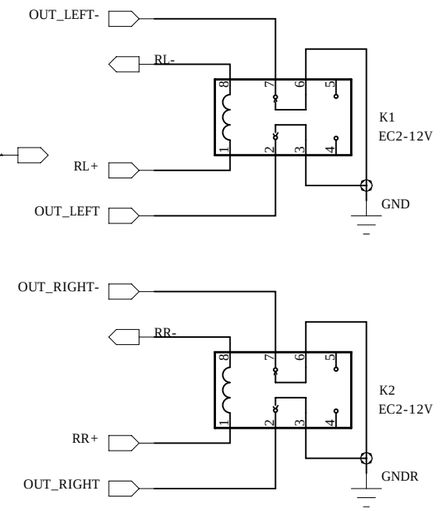
DRAWN: Spencer C	DATED: 2012-03-02	COMPANY: www.FETAudio.com	
CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: FDA-1B (PCM1794A DAC)	
QUALITY CONTROL: <QC By>	DATED: <QC Date>	CODE: WM15	SIZE: B
RELEASED: Spencer Cheung	DATED: 2012-03-03	DRAWING NO: FDA-1B-15	REV: 15
		SCALE: 1:1	SHEET: 6 OF 10

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

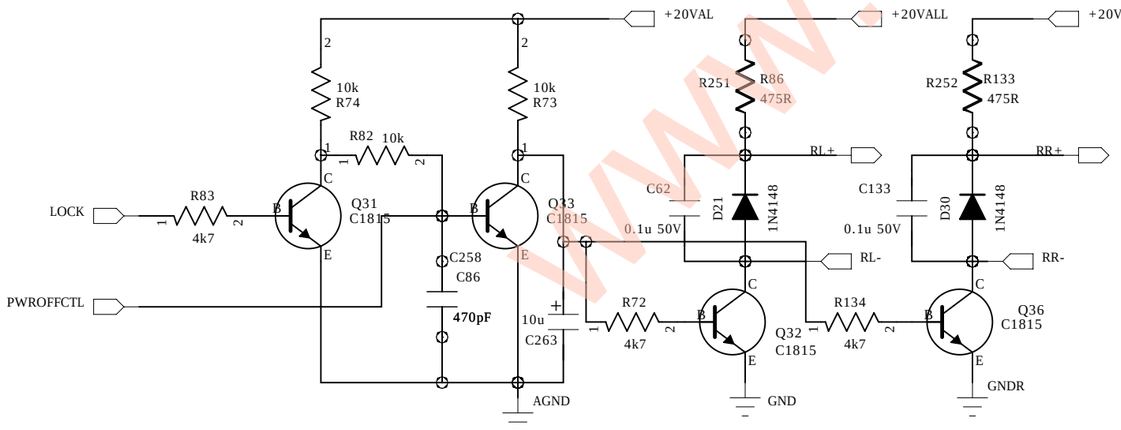
Low Noise Super Regulator - Left



Mute Relays



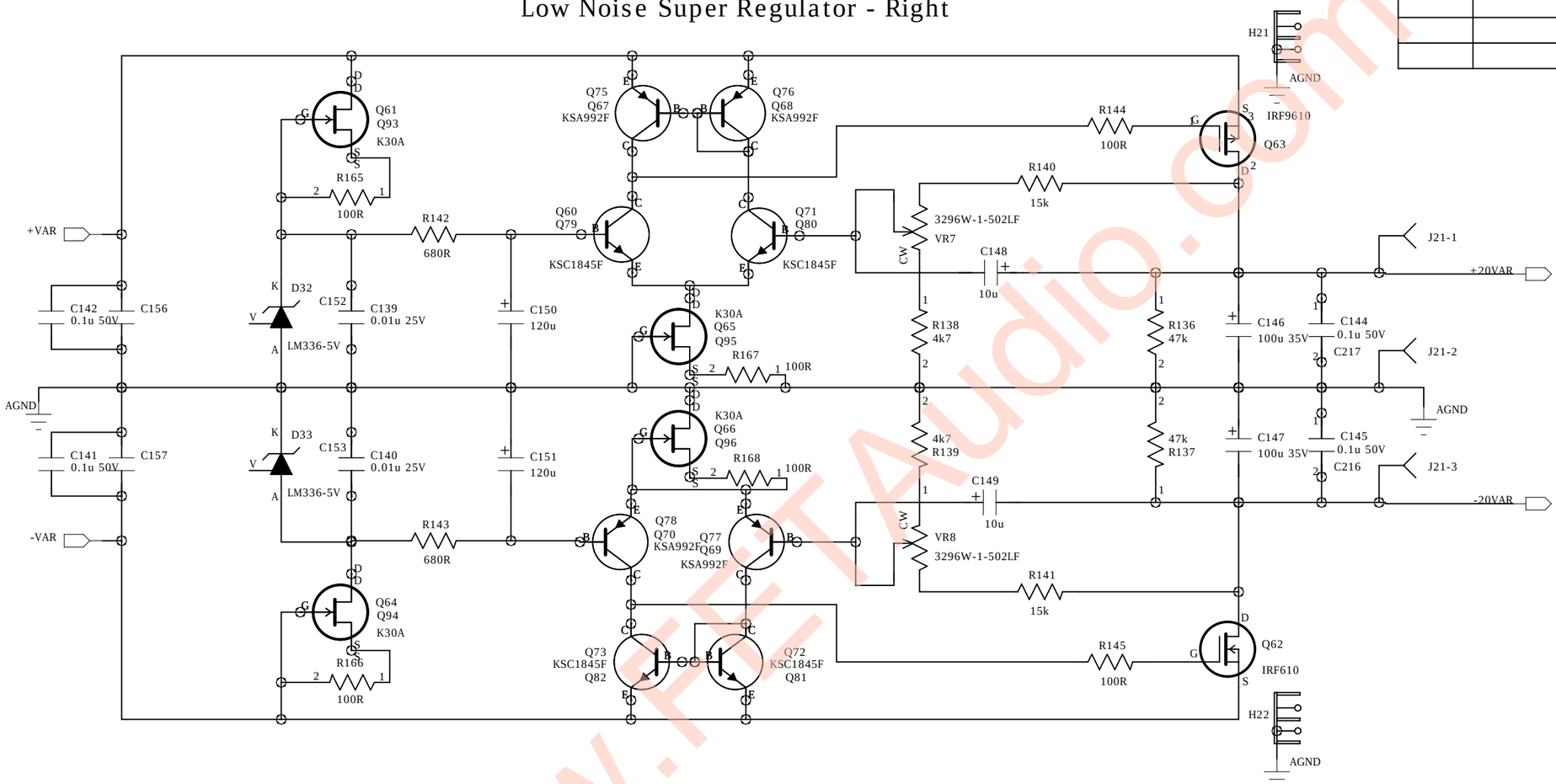
Output Muting Ckt



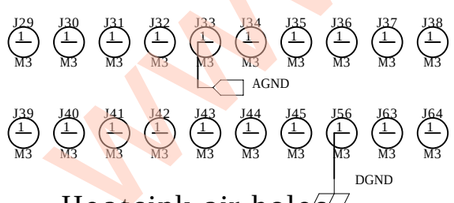
DRAWN: Spencer C	DATED: 2012-03-02	COMPANY: www.FETAudio.com	
CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: FDA-1B (PCM1794A DAC)	
QUALITY CONTROL: <QC By>	DATED: <QC Date>	CODE: WM15	SIZE: B
RELEASED: Spencer Cheung	DATED: 2012-03-03	DRAWING NO: FDA-1B-15	REV: 15
		SCALE: 1:1	SHEET: 7 OF 10

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

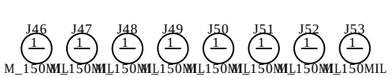
Low Noise Super Regulator - Right



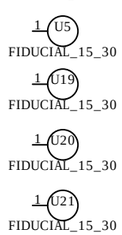
M3 Screw Holes x 17



Heatsink air holes



smt pts



DRAWN: Spencer C	DATED: 2012-03-02	COMPANY: www.FETAudio.com	
CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: FDA-1B (PCM1794A DAC)	
QUALITY CONTROL: <QC By>	DATED: <QC Date>	CODE: WM15	SIZE: B
RELEASED: Spencer Cheung	DATED: 2012-03-03	DRAWING NO: FDA-1B-15	REV: 15
		SCALE: 1:1	SHEET: 8 OF 10

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

AES XLR (1,0)

SPDIF RCA (1,1)

TOSLINK INPUT (0,1)

Relay Select

Mute Select

8804 Supply

SPDIF Out

Set dafault to RCA (1,1)

Logic power decouple

To FP

USB

USB2

DRAWN: Spencer C	DATED: 2012-03-02	COMPANY: www.FETAudio.com	
CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: FDA-1B (PCM1794A DAC)	
QUALITY CONTROL: <QC By>	DATED: <QC Date>	CODE: WM15	SIZE: B
RELEASED: Spencer Cheung	DATED: 2012-03-03	DRAWING NO: FDA-1B-15	REV: 15
		SCALE: 1:1	SHEET: 9 OF 10

Digital Pre-regulator

D36 1N4007
LM317T IN U7 OUT ADJ
D34 1N4007
+12VD — L9 1mH — R66 100R — +5VREG
C88 470u, C61 0.1u 50V, C167 10u, R62 300R, C53 470u, C158 0.1u 50V, C251 0.1u 50V, C253, C252, C192, C191, C195, C221 0.1u 50V
H3
DGND

Logic Regulator

U8
+5VREG — Bead L6 — AMS1117-3.3 — +3.3VD
C256 C65 0.1u 50V, C64 100u, C233 C63 0.1u 50V, C255 C254 47u
DGND

8804 Regulator

U10
+5VREG — Bead L7 — AMS1117-3.3 — L3 Bead — DVDD
C193 C70 0.1u 50V, C69 100u, C194 C68 0.1u 50V
DGND

1794 3v3 Regulator

U9
+5VDAC — Bead L8 — AMS1117-3.3 — +3.3VDAC
C160 47u 6.3V, C199 0.1u 50V, C67 NC
DGND

1794 5v Regulator

D37 1N4007
U6 LM317T IN ADJ OUT
+12VD — L18 1mH
C260 C220 470u, C72 0.1u 50V
D35 1N4007
H20
300R R149, C172 10u, R150 100R
C261 C75 0.1u 50V, C76 100u 35V
+5VDAC
DGND

Analogy Supply

AC+18VAA, AC+18VAB, AC+18VBA, AC+18VBB
J9-1, J9-2, J58-2, J58-1, J59-2, J59-1, J10-1, J10-2
F1 2A Fast, F2 2A Fast
D7, D8, D9, D10, D11, D12, D13, D14 SBYV27-200
C207 C95 14D471k 0.1u 50V, C206 C96 14D471k 0.1u 50V
C204 0.047u250V, C205 0.047u250V
C73 5600u 35V 35V, C74 5600u 35V 35V
R68 10k, R69 10k
D25, D50
C93, C173 0.1u 50V, C94, C174 0.1u 50V
L17 1mH +VAL, L21 1mH +VAR, L22 1mH -VAL, L23 1mH -VAR
J54, J2, J25
AGND

Digital Supply

F3 2A Fast
D15, D16, D17, D18 SBYV27-200
AC+9VA, AC+9VB
J55-2, J55-1, J11-1, J11-2
C222, C97 14D471k 0.1u 50V
C51 470u
R59 4k7, R60 10k
D19 SBYV27-200
+12VD — R87 4k7 — D53
C71 10000u 16V 16V
C168, C257 470pF
DGND

Power down control

+5VREG — R61 10k — Q34 C1815 (C, B, E)
PWROFFCTL — D20 1N4148

Ground Via

J28, J27, AGND, G1, GND_PT

Ground Bead

Bead L20, Bead L19, NC L2
DGND — DGND

Reset control

+3.3VD — R75 47k — RESET
C77 10u
DGND

Shield Holes

AGND
J12, J13, J16, J17, J26

+5VREG

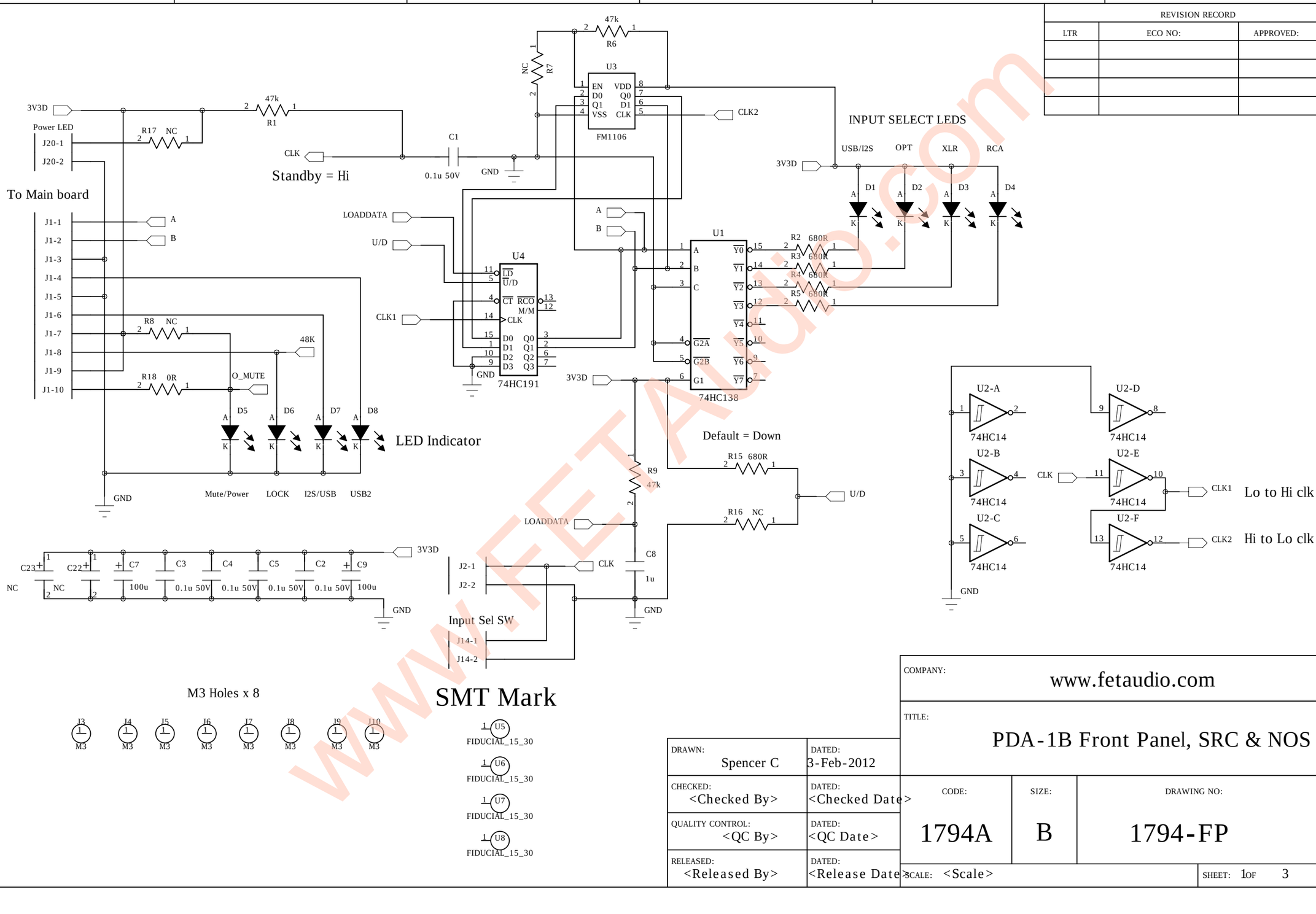
L24 NC — P2
C250 NC, C188 0.1u 50V

REVISION RECORD

LTR	ECO NO:	APPROVED:	DATE:

COMPANY:	www.FETAudio.com		
TITLE:	FDA-1B (PCM1794A DAC)		
DRAWN: Spencer C	DATED: 2012-03-02		
CHECKED: <Checked By>	DATED: <Checked Date>	CODE: WM15	SIZE: B
QUALITY CONTROL: <QC By>	DATED: <QC Date>	DRAWING NO: FDA-1B-15	REV: 15
RELEASED: Spencer Cheung	DATED: 2012-03-03	SCALE: 1:1	SHEET: 10 OF 10

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

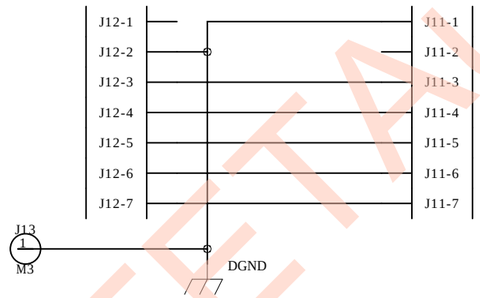


DRAWN: Spencer C	DATED: 3-Feb-2012	COMPANY: www.fetaudio.com	
CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: PDA-1B Front Panel, SRC & NOS	
QUALITY CONTROL: <QC By>	DATED: <QC Date>	CODE: 1794A	SIZE: B
RELEASED: <Released By>	DATED: <Release Date>	DRAWING NO: 1794-FP	REV: 6
		SCALE: <Scale>	SHEET: 1 OF 3

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

NOS Board

Pin Header 7 x 1



DRAWN: Spencer C	DATED: 3-Feb-2012		
CHECKED: <Checked By>	DATED: <Checked Date>		
QUALITY CONTROL: <QC By>	DATED: <QC Date>		
RELEASED: <Released By>	DATED: <Release Date>		

COMPANY: www.fetaudio.com

TITLE: PDA-1B Front Panel, SRC & NOS

CODE:	SIZE:	DRAWING NO:	REV:
1794A	B	1794-FP	6

SCALE: <Scale> SHEET: 2 OF 3

Item	Reference	Value	Qty	PCB DECAL
	FDA-1B DAC main board			
2	Q1-2 Q7-8 Q13-16 Q47-50 Q55-58	KSA1220AYS	16	TO-2-8H1A
4	Q3-6 Q9-12 Q43-46 Q51-54	KSC2690AYS	16	TO-2-8H1A
6	T1	51698-LF3 pulse trans	1	51698-LF3
7	T2	NC	1	51698-LF3
8	U14	74HC00D	1	SO14
9	U13	74HC02D	1	SO14
10	U4	74HC238D	1	SO16NB
11	U12 U15	74VHC244M	2	SO20WB
12	Q37-38 Q59 Q74 Q79-82	KSC1845F	8	TO-92D
13	Q39-42 Q75-78	KSA992F	8	TO-92D
14	D7-19	BYV27-150	13	DO35
15	C16 C18 C20 C27 C39 C92 C99 C101 C139-140 C154-155 C170 C190	0.01u 25V 0603	14	0805S
16	C37 C31 C178 C47	NC	4	CK06
17	C24 C34-35 C38 C41-42 C62 C78 C90 C105 C133 C141-142 C164-166 C169 C173-174 C185-189 C191-203 C206-219 C221-222 C233 C246-249 C256 C259-262	0.1u 50V 0603	63	0805S
18	C183-184 C33 C48 C61 C138 C40 C63 C158 C161 C163 C65 C68 C70 C72 C75 C36 C175 C251-253 C176 C179-182	NC	26	CK06
19	C237-240	1500p 50V 0805	4	0805S
20	C28-29	15p 50V 0603	2	0805S
21	C26	1u 6.3V 0805	1	0805
22	C86 C168	NC	2	CK06
23	C257-258	470pF 50V 0603	2	0805S
24	C234-236 C241-245	6800p 50V 0805	8	0805S
25	C250	NC	1	CK06
26	C204-205	0.047u250V 1206	2	1206
27	C171 C177 C223-228	NC	8	1206
28	C71	10000u 16V SU	1	CX-P10X25MM
29	C64 C69 C162	100u 6.3V OS-con	3	279B-01
30	C4-5 C11-12 C45-46 C76 C81-82 C112-113 C116 C124-125 C128 C134-137 C146-147	100u 35V Silmic II	21	ECAP-A-5X10MM
31	C30 C49-50 C77 C87 C148-149 C167 C172 C263* (* solder on bottom, refer to manual)	12u 35V FC	10	279B-01
32	C52 C54 C150-151	120u 25V FC	4	ECAP-3X8MM
33	C229-232	NC	4	279B-01
34	C51 C53 C88 C220	470u 16V FA	4	ECAP-3X8MM
35	C25 C32 C254-255	47u 6.3V OS-con	4	279B-01
36	C15 C17 C19 C21-23 C91 C98 C100 C102-104 C159-160	47u 6.3V Silmic II	14	ECAP-3X8MM
37	C73-74	5600u 35V Audio	2	CX-P10X25MM
38	C95-97	NC	3	CFR04R-B1
48	J1	2x5 Male HD	1	HD-10V
49	J8 J24 J62	2x1 female HD	3	SIP-2P
50	J23	2x1 male HD	1	SIP-2P
51	J55 J58-59	2x3.96mm male Connetor	3	CON_P2
53	J22 J61	3x1 male HD	2	SIP-3P
54	J18-21	6 x 150mm Con Wire	6	CON_P3_508
55	U18	SRC Module board IC 7-pin socket M + F	4	CS8421_SRC
56	D34-37	1N4007	4	R1/8WA
57	D20	1N4148	1	DO_MINI
58	D21 D30 D51-52 D55	1N4148	5	DIODE_V
60	D56-59	BAT85S or BAS85	4	MLL34
62	F1-3	2A T type	3	FUSE-5MM
64	J5	2x5 female HD	1	HEADER10
65	H4 H6 H8 H10 H12-13 H18-19	10x15x21mm Heat sink	8	HEATSINK_MINI
66	H5 H9 H14 H17	16x24x21mm Heat sink	4	HS_900_635MIL
67	H7 H11 H15-16	16x24x30mm Black Heat sink	4	HS_900_635MIL
68	H1-3 H20-22	16x16x25mm Black Heat sink	6	HEATSINK_630X630X1000MIL
70	L9 L18	1mH 500mA Inductor	2	IND-R-5MM
71	L1	47uH 100mA	1	IND-MOLDED_400MIL
72	L3-8 L10-17 L21-23	Bead	17	IND-MOLDED_400MIL
73	L19-20	Bead	2	IND-MOLDED_300MIL
74	L2	NC	1	IND-MOLDED_400MIL
75	L24	NC	1	IND-MOLDED_400MIL
76	Q17 Q62	IRF610	2	IRF610-GDS
77	Q18 Q63	IRF9610	2	IRF9610-GDS
78	Q89-96	K30A-Y	8	TO-92D
79	D25 D50 D53	LED TH Green	3	LED
80	D5-6 D32-33	LM336-5	4	TO-92D
81	U6-7	LM317T	2	TO-220-UP
82	U8-10 U16-17	AMS1117-3.3V	5	SOT223
84	Q31-36 Q84 Q97	KSC1815	8	TO-92D
86	U1 U11	**PCM1794A**	2	SSOP28
88	J4 J6-7	RCA H G/R/W color	3	RCA_JF2A
89	R39 R169	0R - Jumper	2	R1/8W
90	R172	0R - Jumper	1	R1/4WA
91	R66 R77-78 R144-145 R150 R161-168	100R	14	R1/4WA
92	R81 R146-147	10R	3	R1/4WA
93	R35 R44	10k	2	R1/4WA
94	R43 R40 R49-50 R68-69	10k	6	R1/4WA
95	R60-61 R73-74 R82	10k	5	R1/8W
96	R58	110R	1	R1/4WA
97	R47-48 R140-141	15k	4	R1/4WA
98	R57	210R	1	R1/4WA
99	R62 R149	301R	2	R1/4WA
100	R41-42 R53 R65 R67 R79-80 R84 R90 R136-137	47k	11	R1/4WA
101	R75	47k	1	R1/8W
102	R45-46 R72 R87 R134 R138-139	4k7	7	R1/4WA
103	R59 R83	4k7	2	R1/8W
104	R54-56 R64 R76 R88-89 R142-143	680R	9	R1/4WA
105	R148	75R	1	R1/8W
106	R98	90.9R	1	R1/4WA
120	R70-71 R114 R132	100k	4	R1/8W
121	R3 R20 R99 R117	10k	4	R1/8W

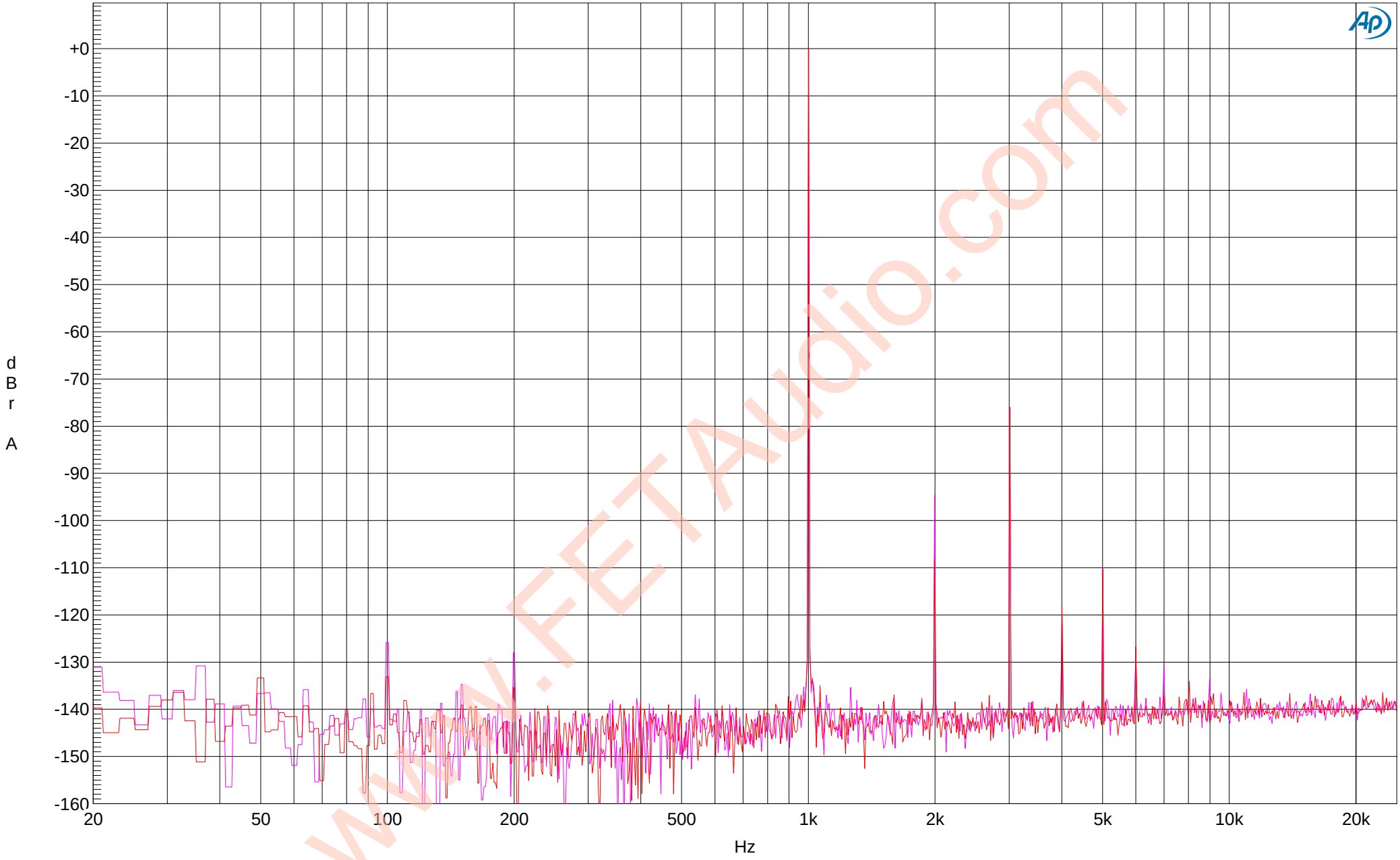
Item	Reference	Value	Qty	PCB DECAL
122	R13 R30 R109 R127	120R	4	R1/8W
123	R15 R32 R111 R129	150R	4	R1/8W
124	R10 R12 R27 R29 R106 R108 R124 R126	1k21	8	R1/8W
125	R7-8 R24-25 R103-104 R121-122	3k32	8	R1/8W
126	R6 R23 R102 R120	3k01	4	R1/8W
127	R86 R133	475R	2	R1/8W
128	R1-2 R18-19 R91-92 R115-116	475R	8	R1/8W
129	R14 R31 R110 R128	49R9	4	R1/8W
130	R16-17 R33-34 R112-113 R130-131	4R02	8	R1/8W
131	R4-5 R21-22 R100-101 R118-119	562R	8	R1/8W
132	R9 R11 R26 R28 R105 R107 R123 R125	82R5	8	R1/8W
133	K1-2	EC2-12V NED	2	RLY-NEC-EC2
134	K3-5	TX2-5V Panasonic	3	RLY-NEC-EC2
135	U3	**TORX147L, or TORX177L**	1	TORX147_OK
136	VR1-2 VR5-6	VR 500R 10T 501	4	VRES-TOP-ADJ
137	VR3-4 VR7-8	VR 5k 10T 502	4	VRES-TOP-ADJ
138	U2	WM8804	1	SSOP20-1
139	J14-15	NC3MAA-H1 XLR male	2	XLR-MALE
140	J3	NC3FAA-H2 XLR female	1	XLR_FEMALE_G
141	Y1	12MHz SMT	1	XTAL_HC49SMT
143	D2 D4 D27 D29	1N4736A 6V8 zener	4	DO_MINIS
145	PCB Main Board	FDA-1B-DIY-V15c	1	8x11 in FR4
146	NOS pcb	NOS BD PCB	1	NOS pcb
147	NOS Pcb Mount	M3x5mm Screw	2	NOS Mount
148	NOS Pcb Mount	M3 x 8mm spacer	1	NOS Mount
149	H1 to H22	M3 x 10mm Screw	22	Heatsink mount
150	H1 to H22	M3 spring washer	24	Heatsink mount
151	H1-3 H20-22	M3-R insulation washer	6	Heatsink mount
152	H1-3 H20-22	Mica TO-220	6	Heatsink mount
	FRONT PANEL CONTROL BOARD			
2	U2	74HC14D	1	SO14NB
3	U1	74HC138D	1	SO16NB
4	U4	74HC191D	1	SO16NB
6	C2-5	0.1u 50V 0603	4	0805
7	C1 C8	1u 0805	2	0805
8	C7 C9	100u 10V or 16V	2	279B-01
12	J1	2x5 2.5mm male connector	1	HD-10V
13	J2	2.5mm male HD	1	SIP-2P
17	U3	FM1106	1	SOT-23
19	D1-4 D6-7	LED Green	7	LED
20	D5	LED Red	1	LED
26	R1 R6 R9	47k	3	0805
27	R2-5 R8 R15	680R	6	0805
31	FP V7.1 pcb	FP V7.1 pcb	1	FP PCB
32	Mounting screws	Screw M3x5mm	8	
33	Mounting Spacer	Spacer M3x8mm threaded	8	
34	Flat cable 10 pin	12 inches	1	
35	5x2 2.54mm plug for flat cable	5x2 header plug	2	
36	Push Switch	Push SW	1	
37	Push SW wires with connector and socket	Wire 200mm	1	
	I2S DAUGHTER BOARD			
38	Mounting Spacer	M3 x 20mm Spacer plastic	3	
39	Mounting Washer	M3 spring washer	3	
40	Mounting screws	M3 x 10mm Screw	6	
41	J3, J6, J7 (use only one)	pins 2x1 x 18mm	1	
42	J1, J4, J5 (use only one)	Pins 2x5 x 18mm	1	
43	R2, R4, R13 (use only one)	0R	1	
44	R1, R3, R10 (use only one)	1k	1	
45	J2, J8, J20 (use only one)	RJ45	1	
46	I2S daughter board (choose FETAudio, KingRex or M2Tech)	I2S daughter BD	1	

SMD parts

FET Audio

FDA-1B FFT measurement
FFT at 0dbFS, load 100k for all measurement

04/20/12 12:21:55



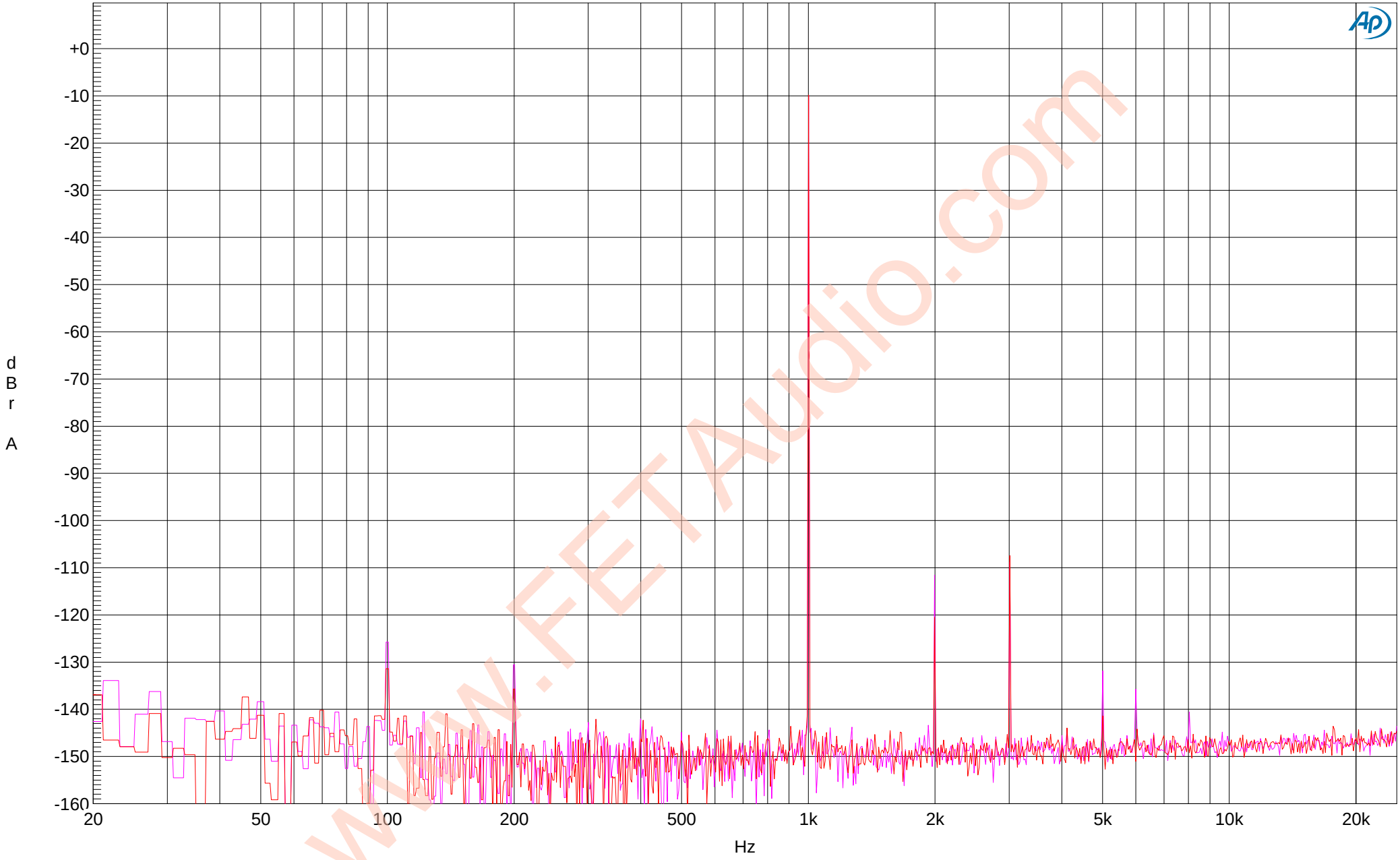
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	FDA-1B @1kHz 0dBFS
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	Distortion 0.016% @ 2.98Vrms

D-A FFT DAC 1794 XLR.at27

FET Audio

04/20/12 12:31:24

FFT at -10dbFS



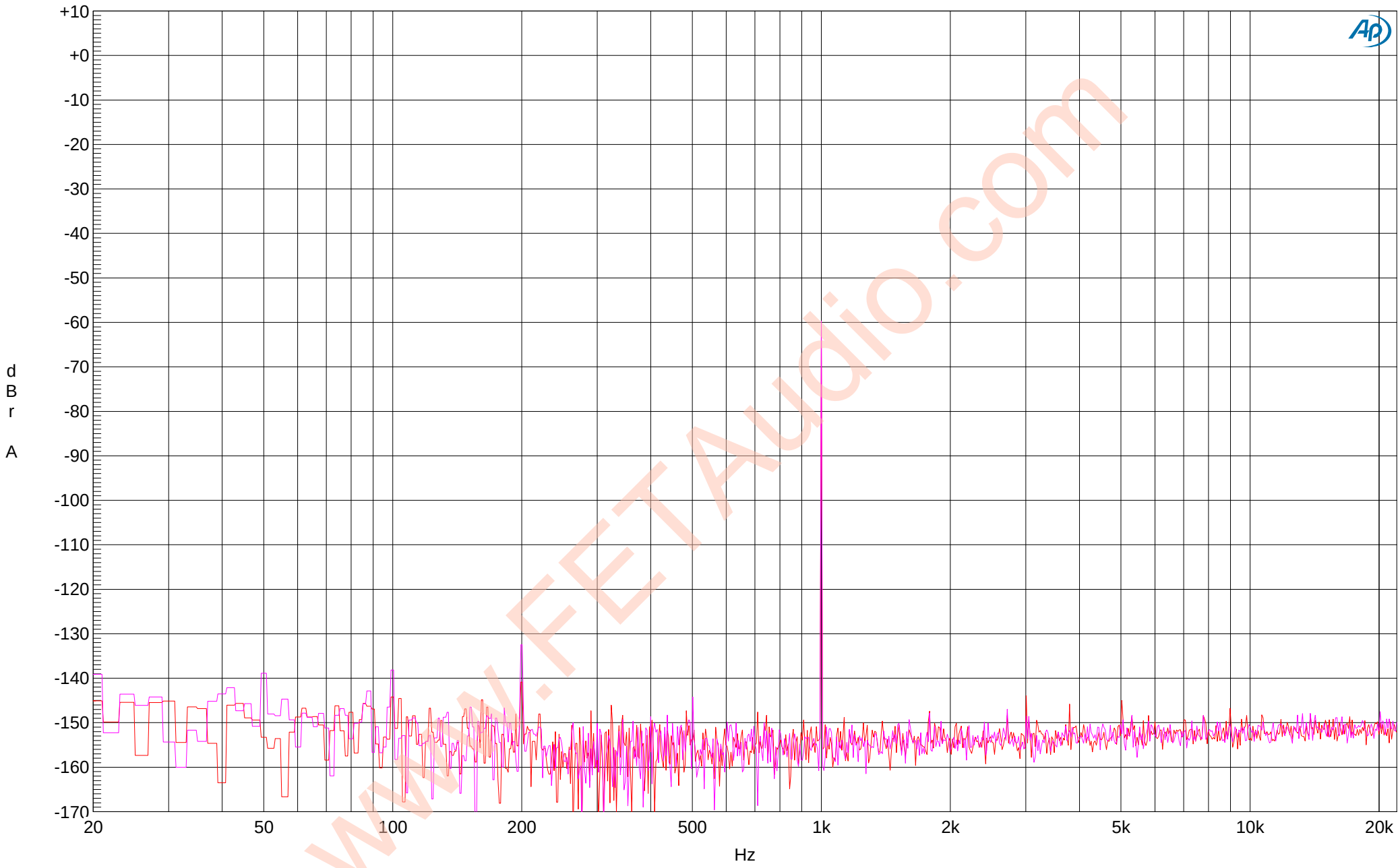
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	input at -10dbFS
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	distortion 0.0017%

D-A FFT DAC 1794 XLR.at27

FET Audio

04/20/12 12:33:48

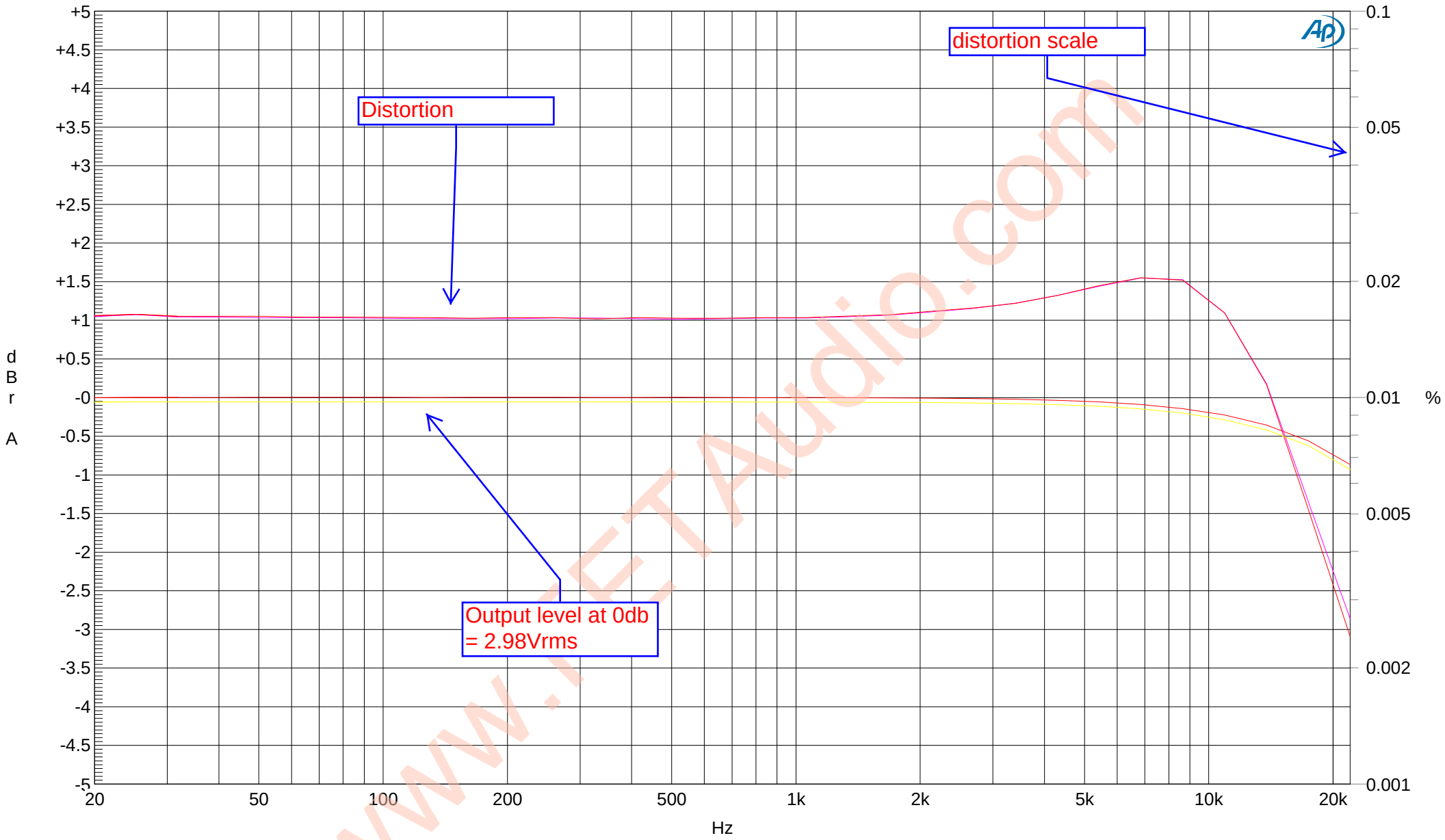
FFT at -60dbFS



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	at -60dBFS
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	

D-A FFT DAC 1794 -60dbfs.at27

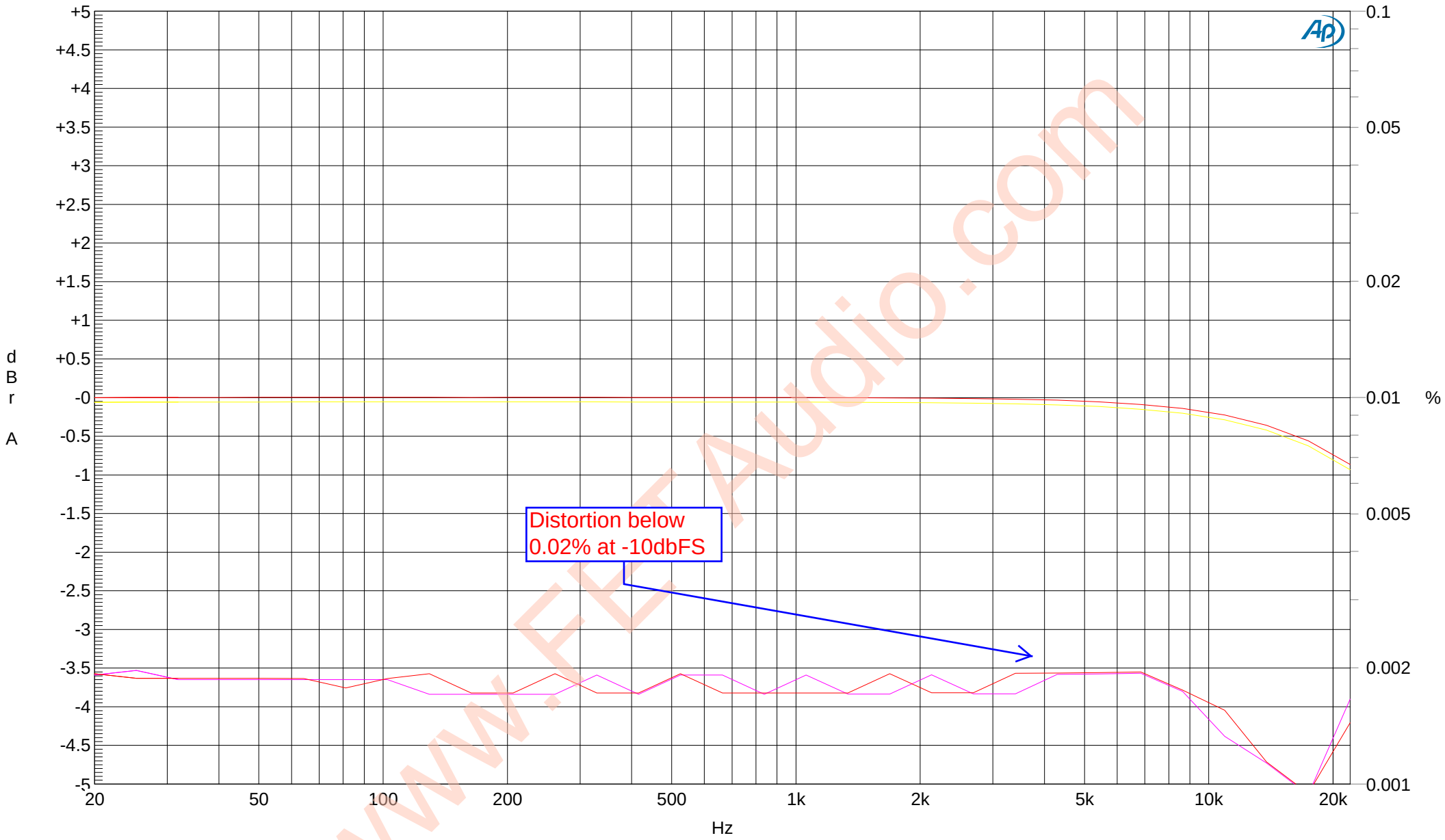
Frequency Response and Distortion 0dbFS



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Anlr.Level A	Left	2.98Vrms
1	2	Magenta	Solid	1	Anlr.THD+N Ratio	Right	Distortion at 0dBFS
1	3	Yellow	Solid	1	Anlr.Level B	Left	
1	4	Red	Solid	1	Anlr.THD+N Ratio	Right	

FET Audio 04/20/12 12:27:29

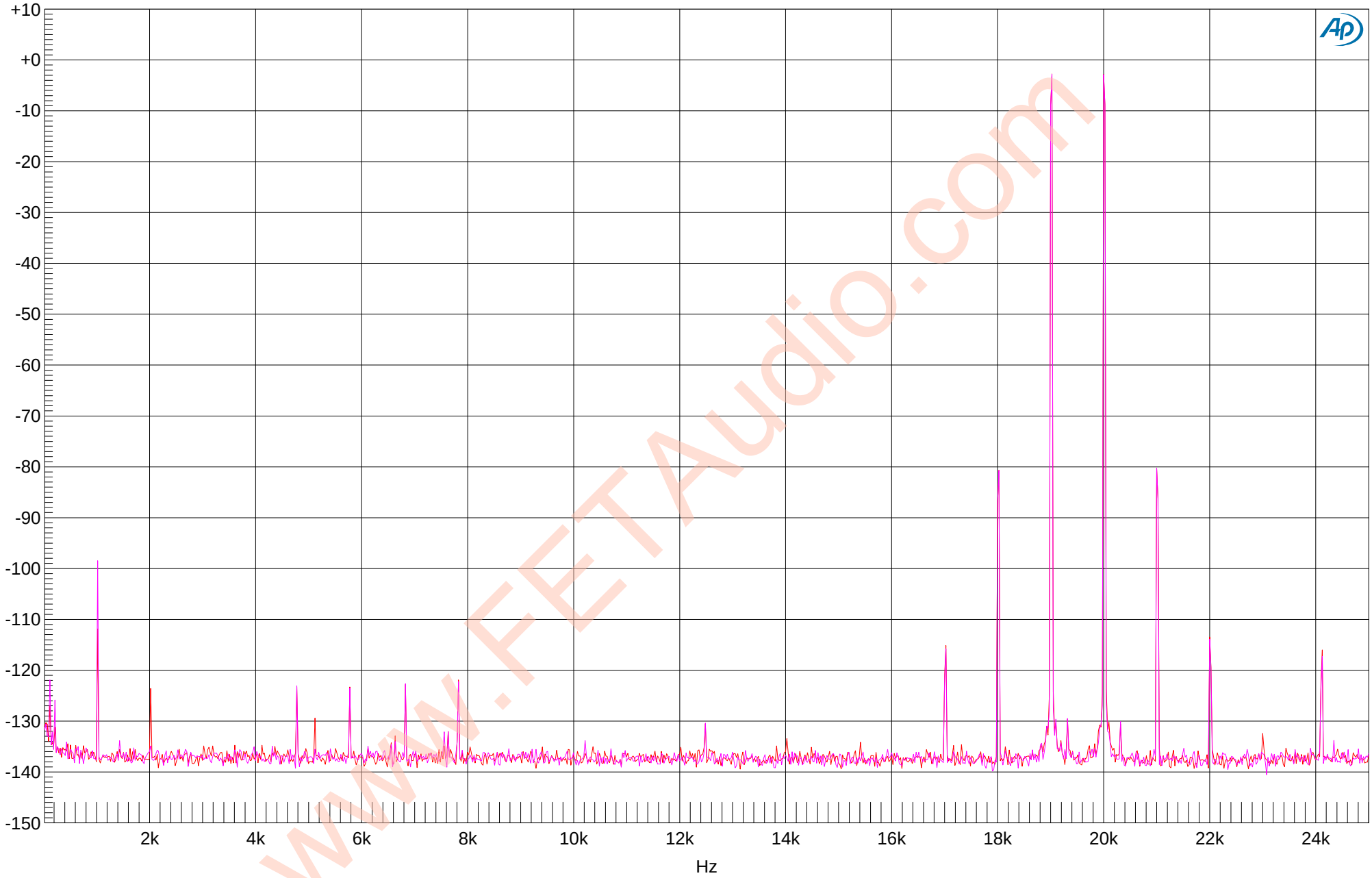
Frequency Response and Distortion -10dbFS



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Anlr.Level A	Left	at -10dbFS
1	2	Magenta	Solid	1	Anlr.THD+N Ratio	Right	distortion below 0.002%
1	3	Yellow	Solid	1	Anlr.Level B	Left	
1	4	Red	Solid	1	Anlr.THD+N Ratio	Right	

D-A FFT DAC 1794 Freq Respon.at27

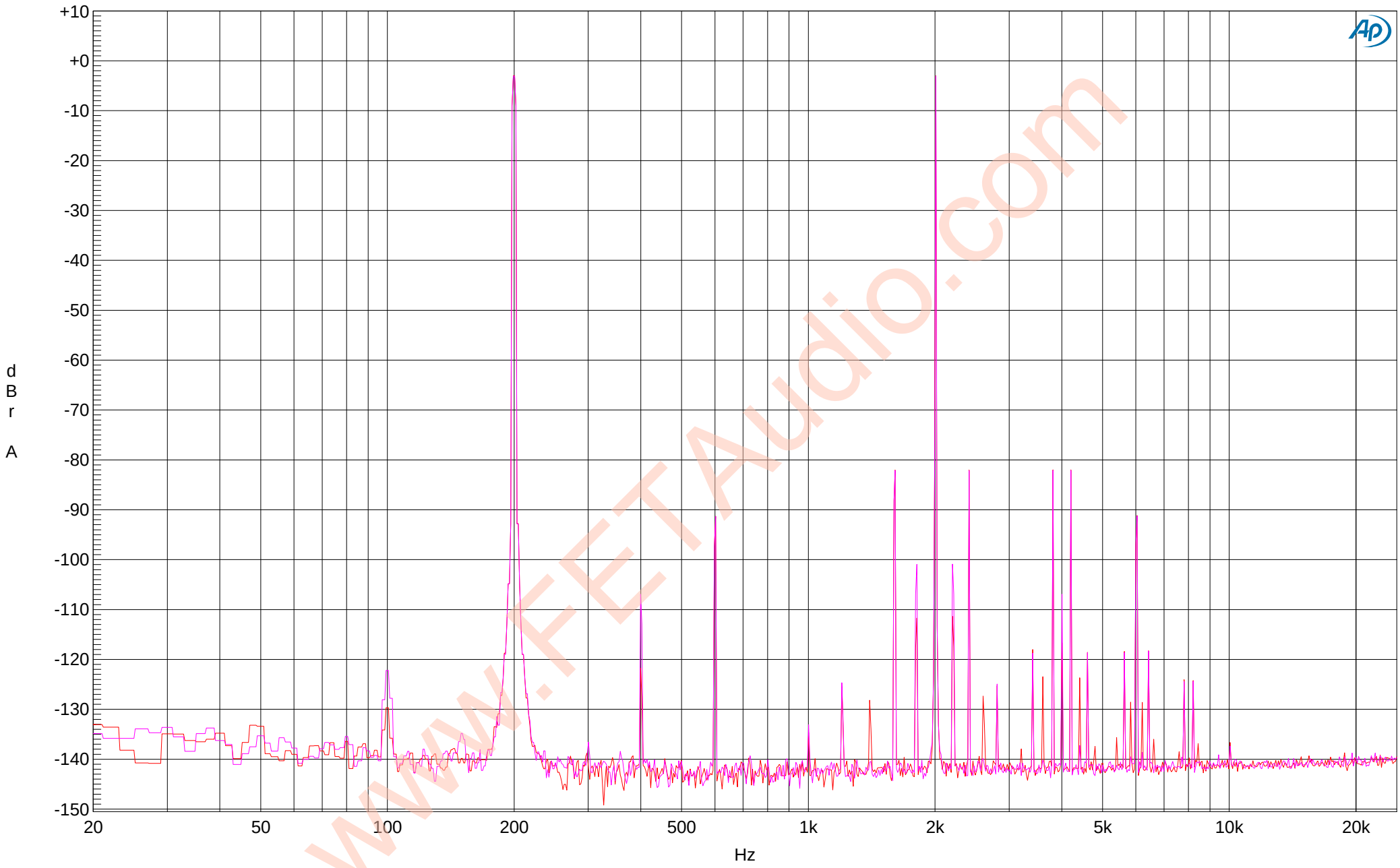
IMD distortion at
19k and 20kHz



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	19&20kHz IMD
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	

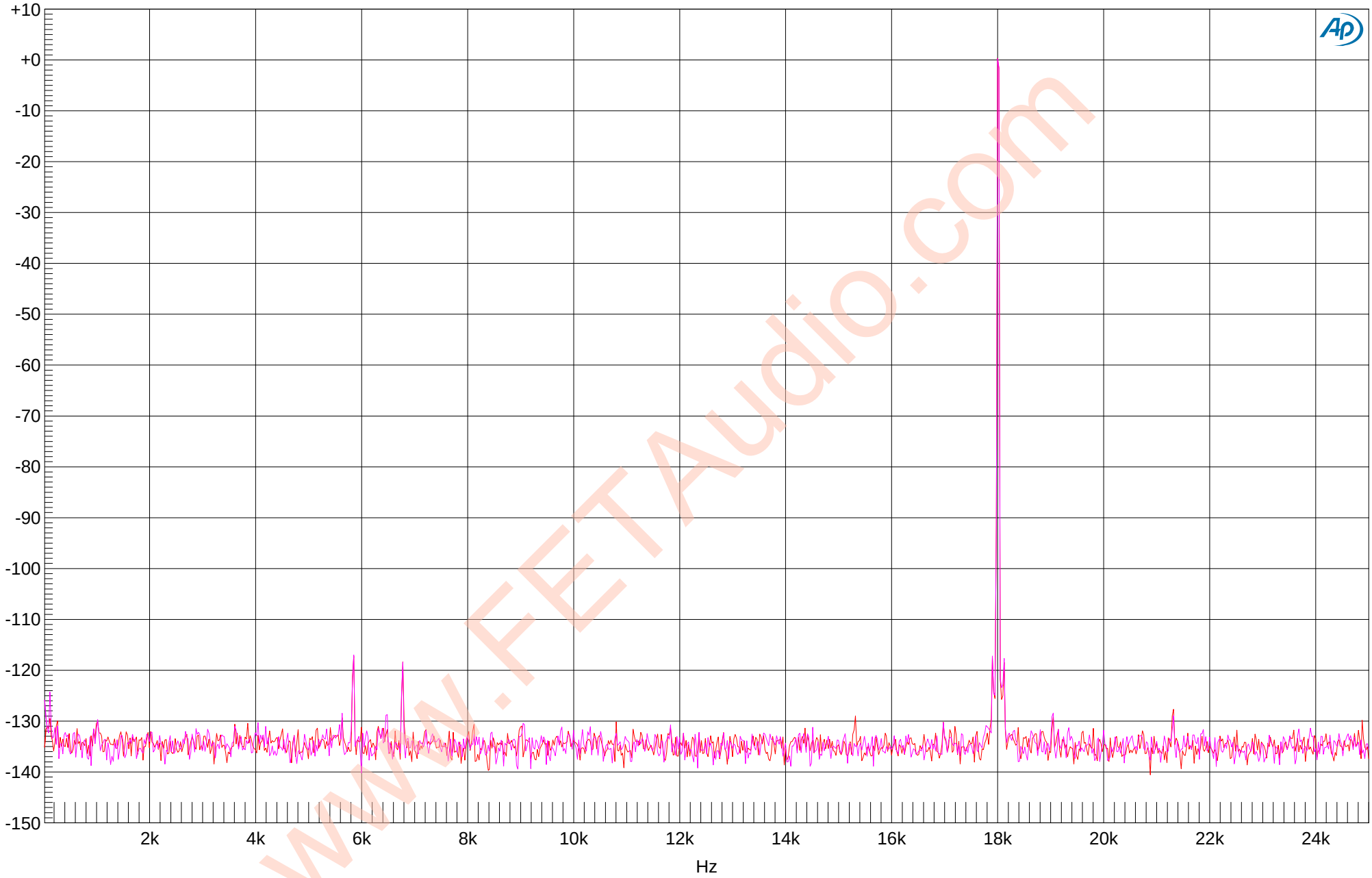
D-A FFT DAC 1794 IMD 19_20k.at27

IMD at 200 and 2kHz



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	200 & 2k IMD
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	

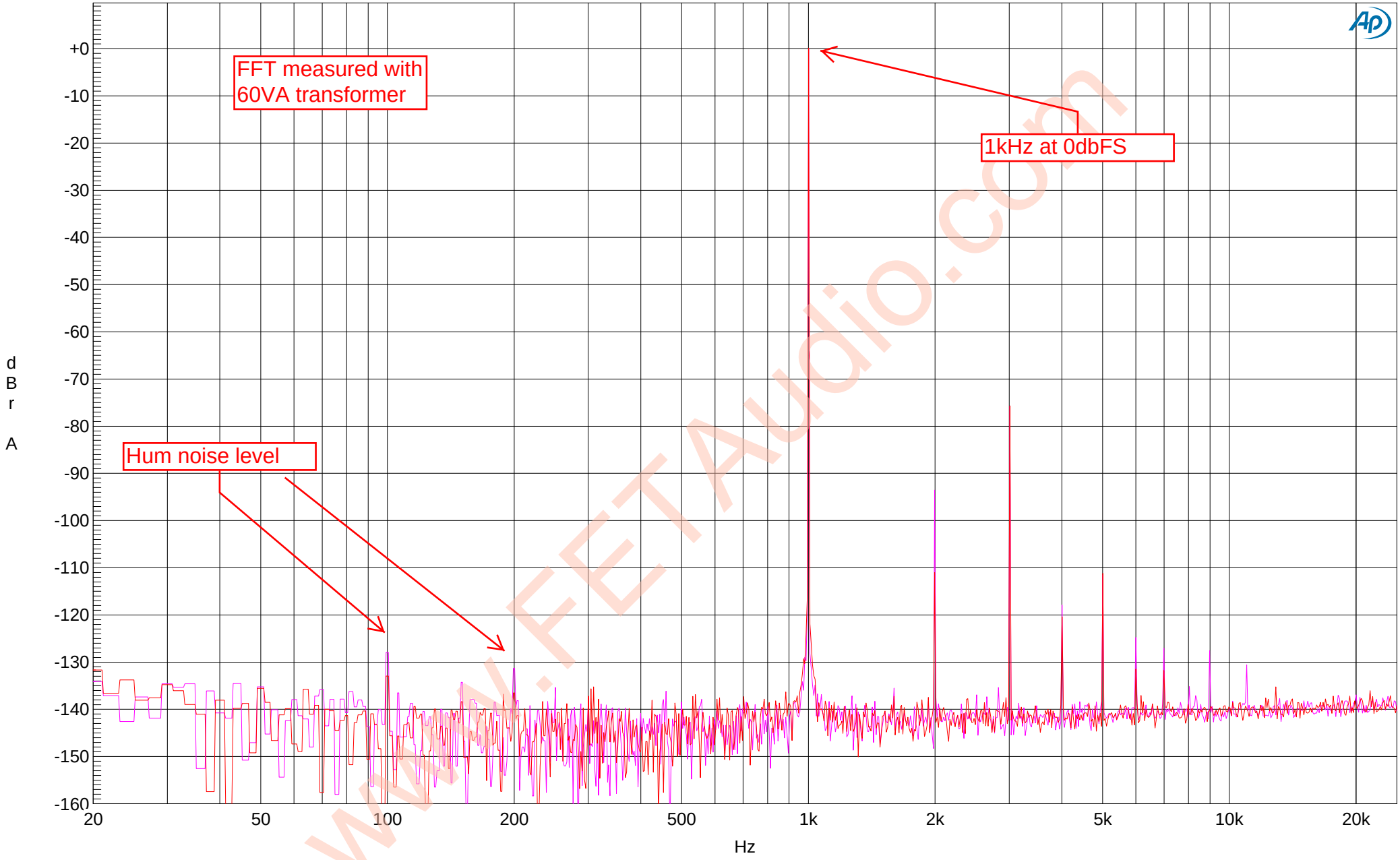
Jitter rejection at 10mUI 18k signal



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	jitter at 10mUI
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	

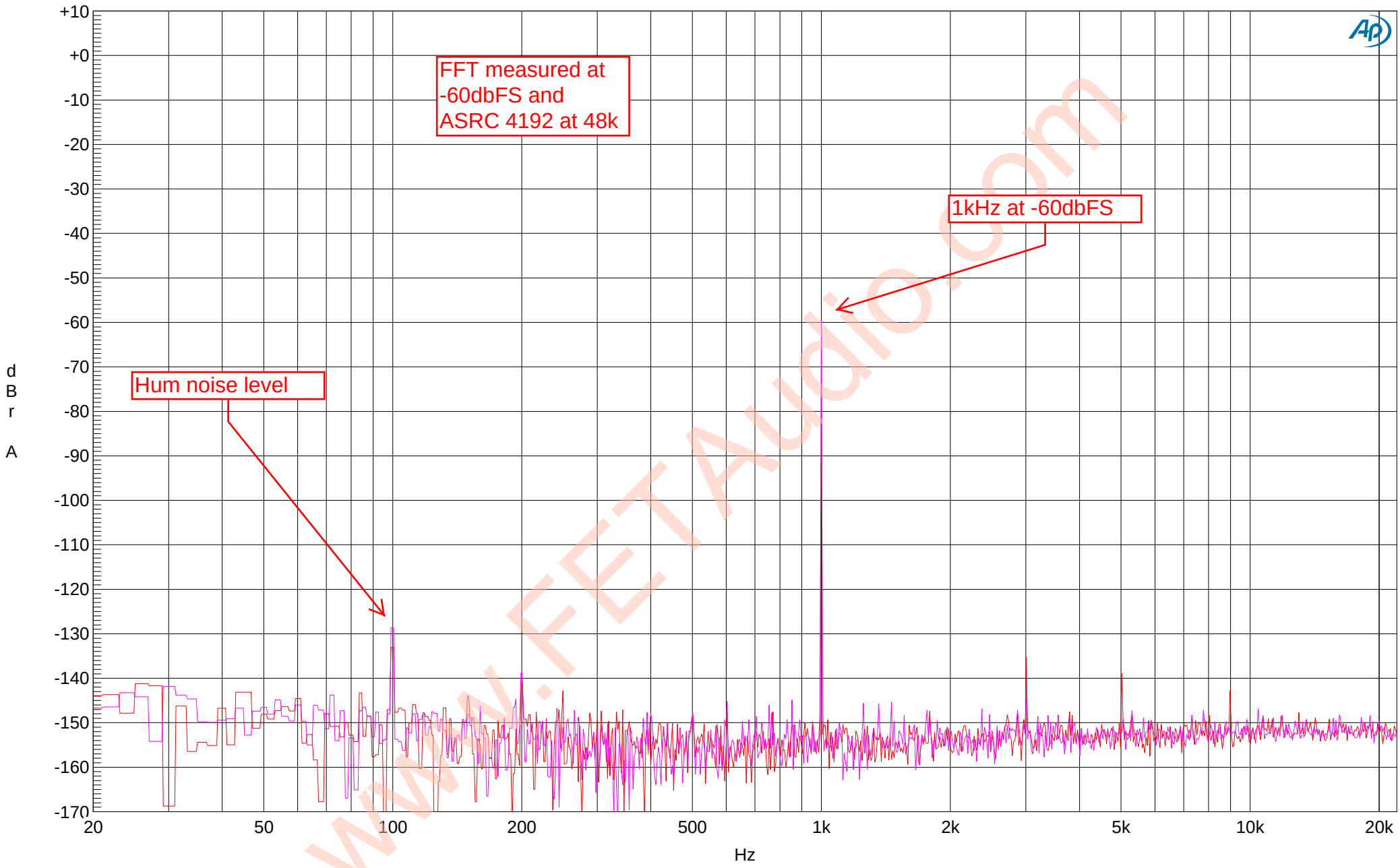
D-A FFT DAC 1794 Jitter 10mUI.at27


Below two pages
FFT measurement
is using this set.
ASRC is set to 48k
out with SRC4192



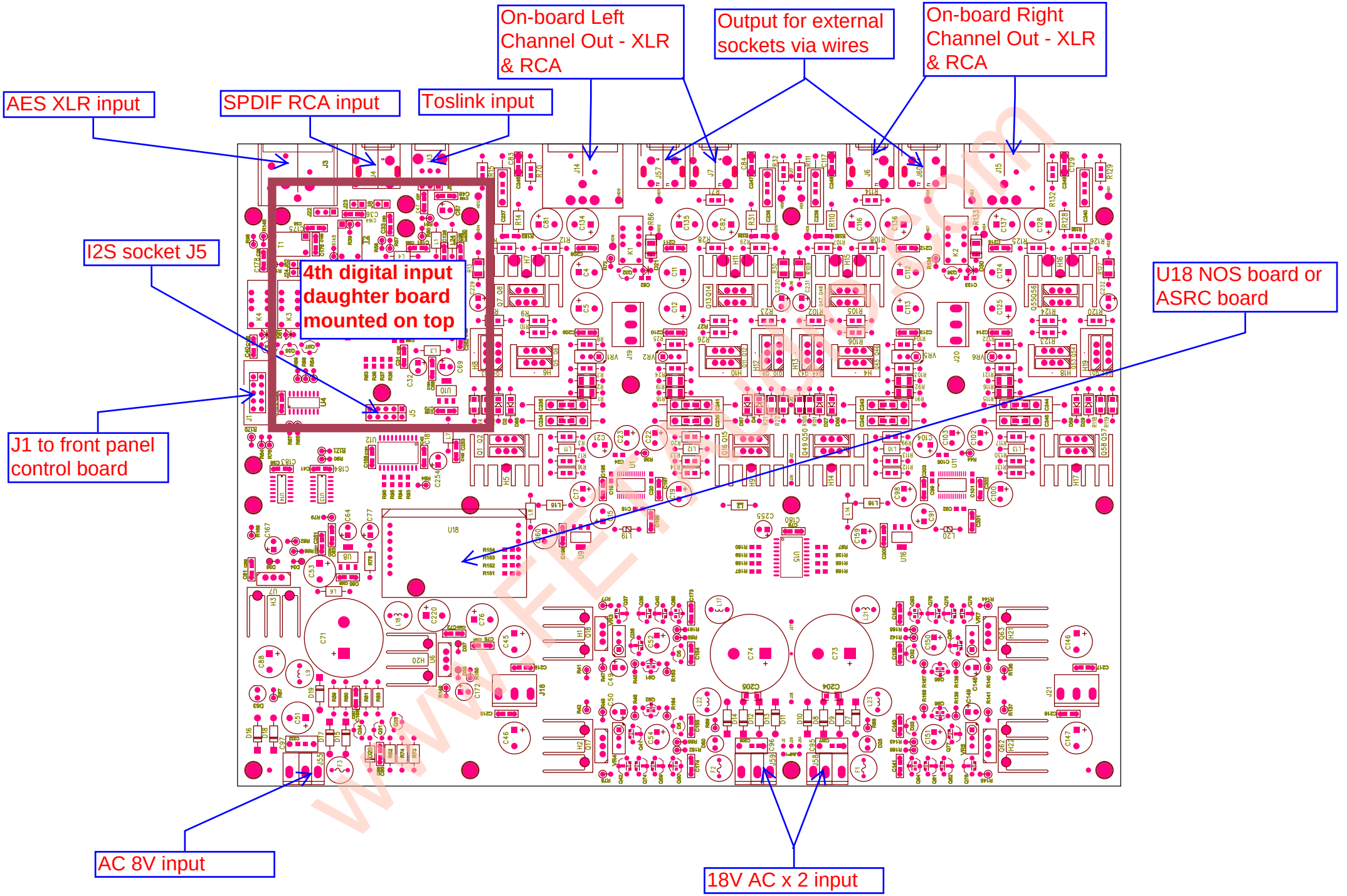
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	60W transformer
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	0dbFS

D-A FFT DAC 1794 XLR.at27



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	

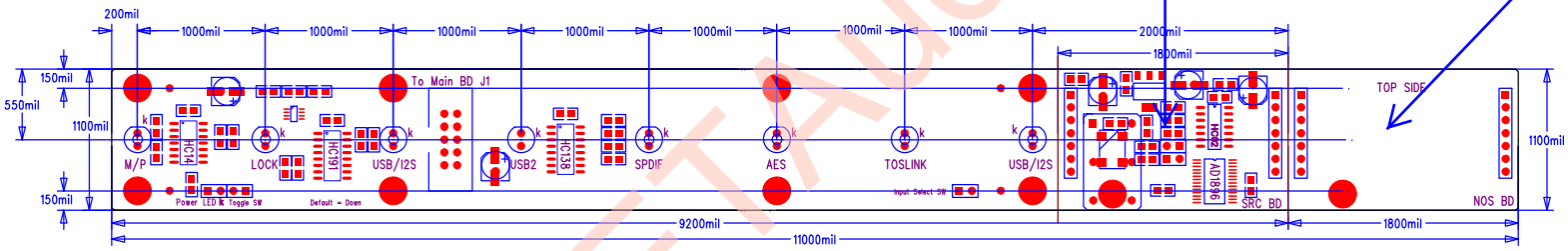
D-A FFT DAC 1794 -60dbfs.at27



Mounting dimension of Front Panel Control Board

ASRC BD not included

NOS BD provided

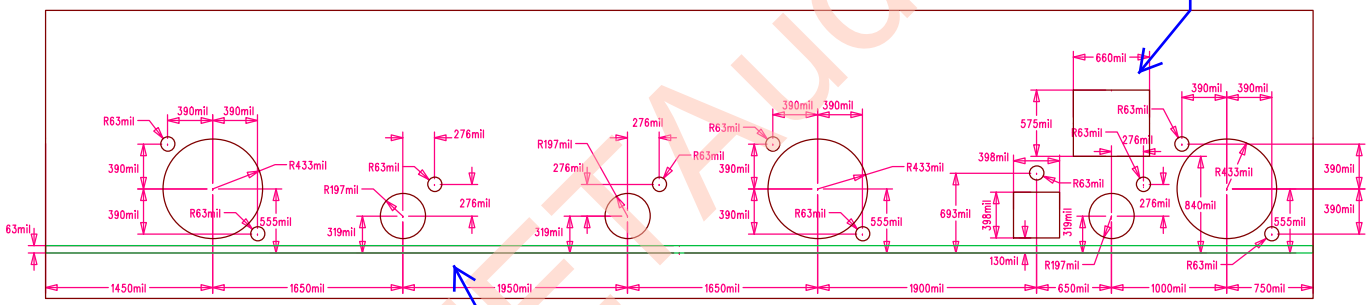


LEDs are soldered on bottom side when mounted to case front panel

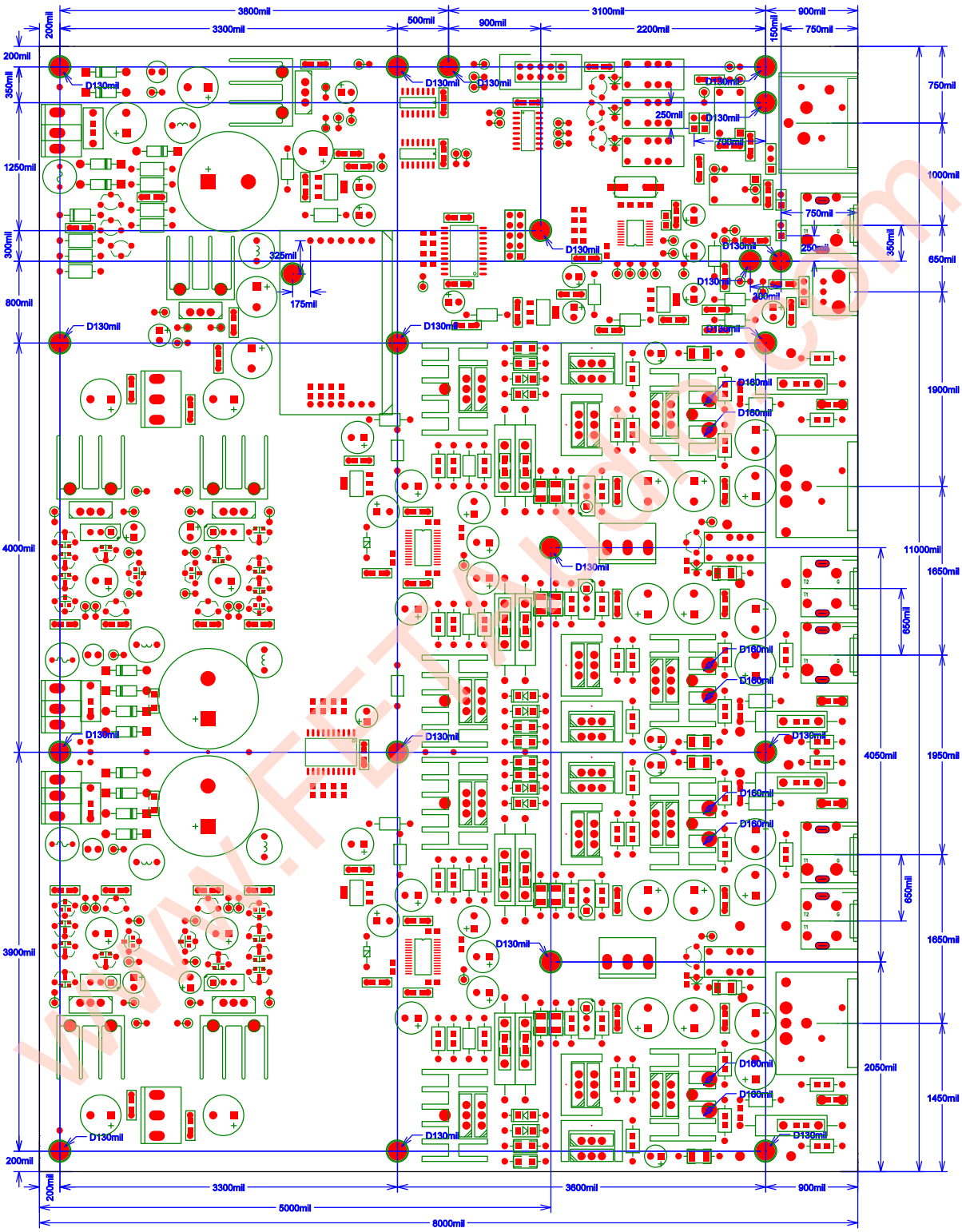
View from rear side

All dimension in mil;
1mil = 1/1000 inch
1 inch = 25.4mm

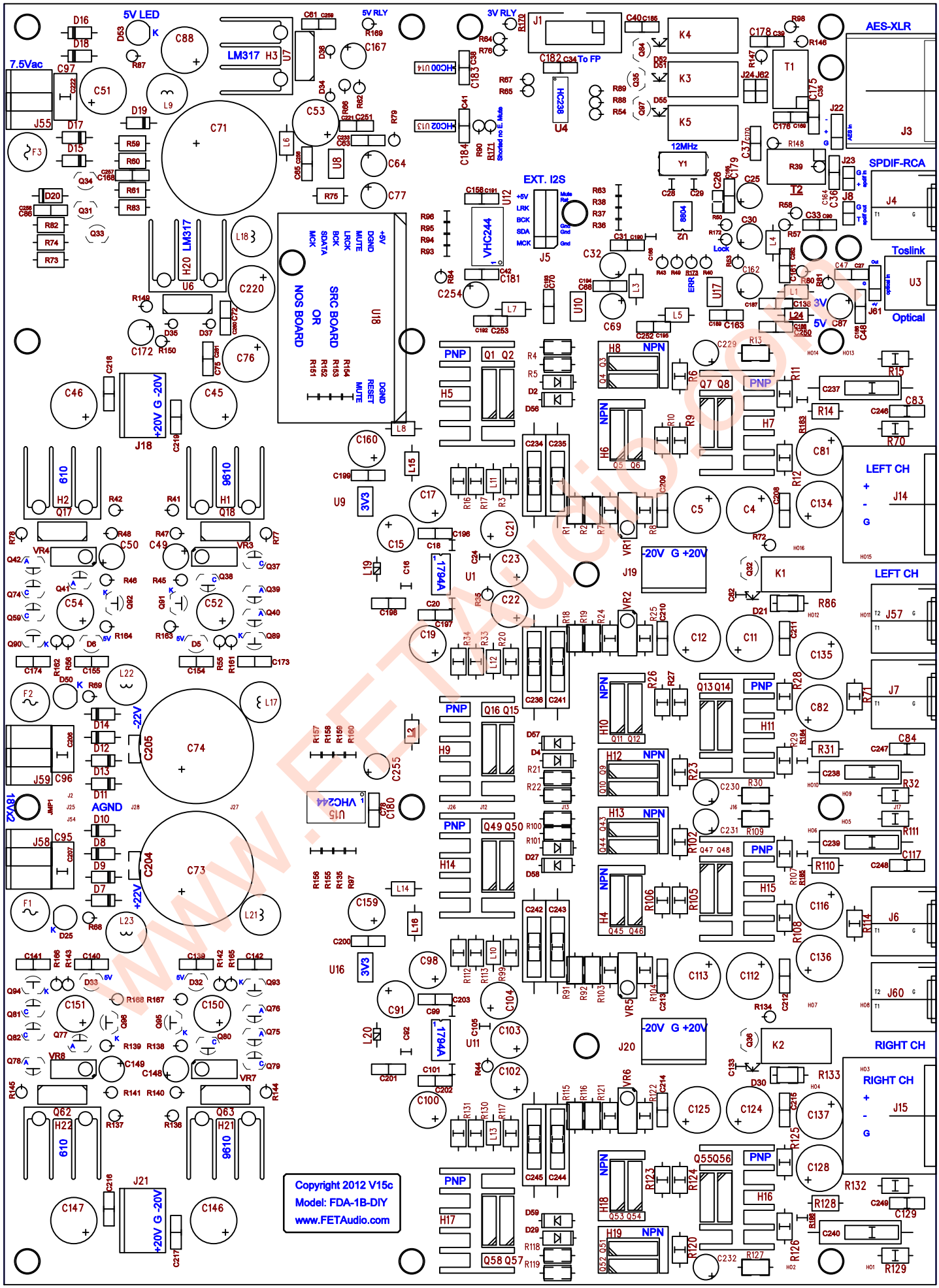
For RJ45, I2S input; reserve for expansion



pcb in green color



WM15c-DIY2.pcb - Fri Apr 06 10:57:31 2012



I2S Daughter Board