RM2200D

Specifications

Version: 1.6.0

Table of Contents

Terms of Use - Legal Disclaimer

RM2200D

Specifications

Version 1.6.0, 19.03.2010

About this Book

How to Use this Book

The Navigation Tree

You can find the navigation tree on the left-hand-side of the PDF document. Via the entries of this tree you can directly reach the several chapters and sections of this document. Click onto the text or the  symbol of an entry to display its content.

If a chapter includes further sections, you will find a plus-symbol in front of the entry in the navigation tree. Either you can click onto this plus-sign or you double click the text or the symbol of the entry to make the sub-branches of the further sections visible.

Search

You can find an alphabetical ordered list of keywords at the end of the document. Please see the page numbers in this index to find the respective keywords in the document.

Moreover, you can use the search function of your PDF reader to seek for any words.

Links

Links are underlined to separate them from the rest of the text. These links can be a connection to other chapters or sections in the same document or to an URL (internet address).

- Same document: The hand symbol  appears if you move the mouse over the link.
- URL: The hand symbol with an additional  appears if you move the mouse over the link.

Please notice, that you need an active internet connection to be able to execute a link to an URL.

The Meaning of Advices in the Text

Warning 	The demands and advices in this fields should be followed **unconditional**, because otherwise hardware and software products, data bases, as well as persons may suffer a loss.
Important 	The demands and advices in this fields should be followed, because these contents are necessary for the proper operation of the DHD systems.
Note 	Recommendations and further information are marked as notes. Sometimes you will also find off-topic content in this field, which is related to the actual topic.
Tip 	Tips are helpful advices, which should make work with DHD systems easier.
Weblink 	In this fields you can find links to websites, which include for example an other manual or the possibility to download a driver for the respective DHD system. Please notice, that you need an active internet connection to be able to execute a link to an URL.
Download 	You can directly open and download a file if the respective link is marked as download link (file link).

General Information

digital reference level:	0 dBFS = digital full scale
analog reference voltage level:	0 dBu = 0.775 V (RMS)
system sampling frequency:	44.1 kHz, 48 kHz (internal or external)
default system sampling frequency:	48 kHz (internal)
headroom:	adjustable 0 dB ... 30 dB
headroom default setting:	9 dB, digital -9 dBFS = 0 dBint, analog 6 dBu = 0 dBint (0 dBint = DSP internal reference level)
maximum analog input level:	18 dBu or 24 dBu (depending on module type)
maximum analog output level:	18 dBu or 24 dBu (depending on module type)
output level default setting:	15 dBu = 0 dBint (0 dBint = DSP internal reference level)
input and master fader setting for measurements:	0 dB
analog source impedance for measurements:	< 40 Ohm
frequency range for measurements:	20 Hz ... 20 kHz (if not stated otherwise)

Note

Please read the RM2200D manual and the RM2200D list of modules for further information on the here listed I/O cards.

RM220-111 - Digital In/Out/GPIO Module, 8 ch.

Technical Specifications

Digital Inputs

input impedance:	110 Ohm (AES3/EBU) or 75Ohm (S/PDIF)
input sensitivity:	> 200mV
input sample rate converters (SRC):	yes (always active)
SRC input sampling frequency range:	28 kHz ... 100 kHz
SRC passband ripple:	< 0.02 dB
dynamic range (SRC off):	144 dB
THD+N (SRC on, 44.1kHz to 48kHz):	< -125 dBFS (-30 dBFS test signal)
	< -115 dBFS (-1 dBFS test signal)
max. input jitter:	> 40 ns
supported standards:	AES3/EBU or S/PDIF (switchable by configuration software)

Digital Outputs

output impedance:	110 Ohm (AES/EBU) or 75Ohm (S/PDIF)
output level:	3.4 V (into 110 Ohm load)
dynamic range (24 bit, dither off):	144dB
dither:	off, 16, 20, 24 bit (switchable by configuration software)
jitter:	< 2 ns (peak)
supported standards:	AES3/EBU or S/PDIF (switchable by configuration software)

General Purpose Inputs / Outputs (GPI/GPO)

4 GPIs (not isolated TTL-Inputs):	internal pull up resistor 10k ohms to 5 V for connecting of external push buttons against GND
	maximum voltage 5V DC when used with TTL input signal
4 GPOs (open collector, non isolated):	maximum rated current: 0,2A (resettable fuse), maximum peak switched voltage: 24 V DC

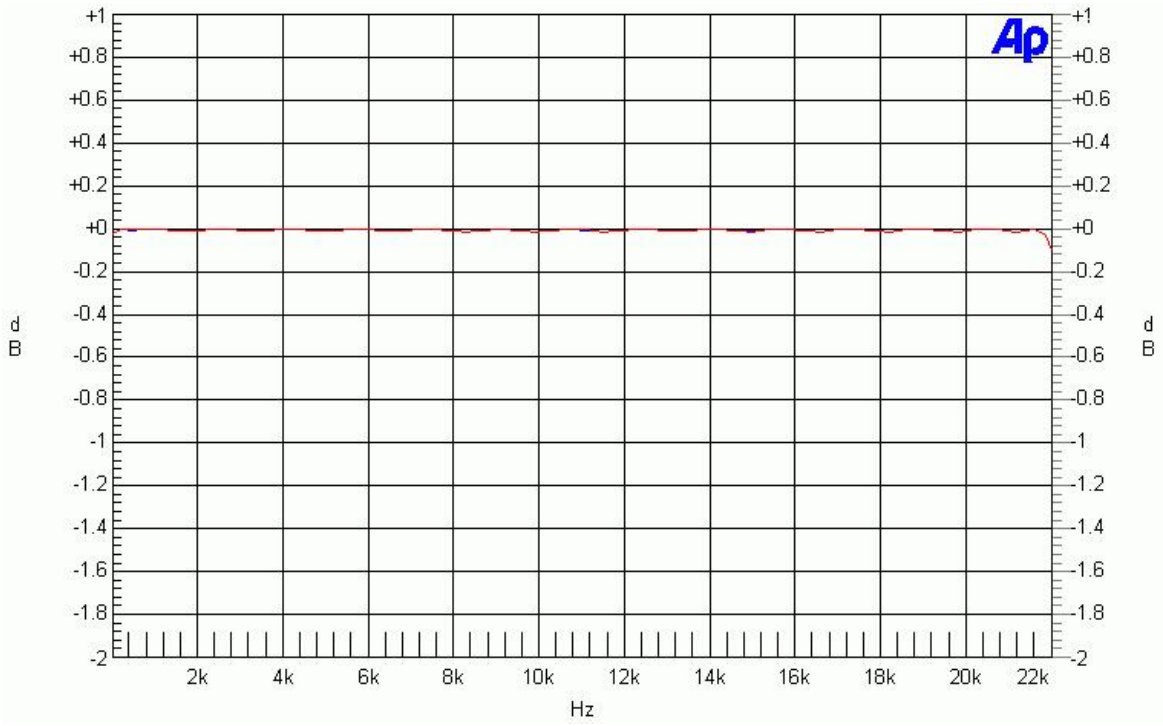
Further Information

power consumption:	0,9 W (typical)
connector style:	RJ45
printed circuit board (PCB) revision for this specifications:	r6

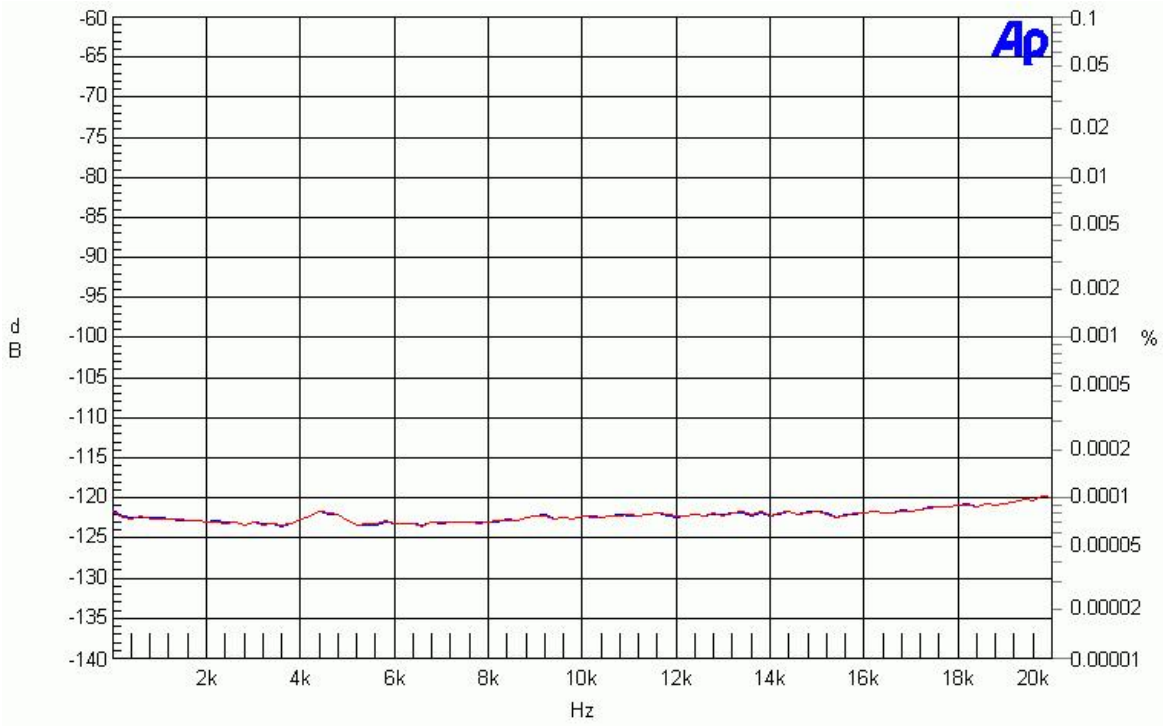
Note

All values are typical values, regarding the factory test limits, you can find in the log file example.

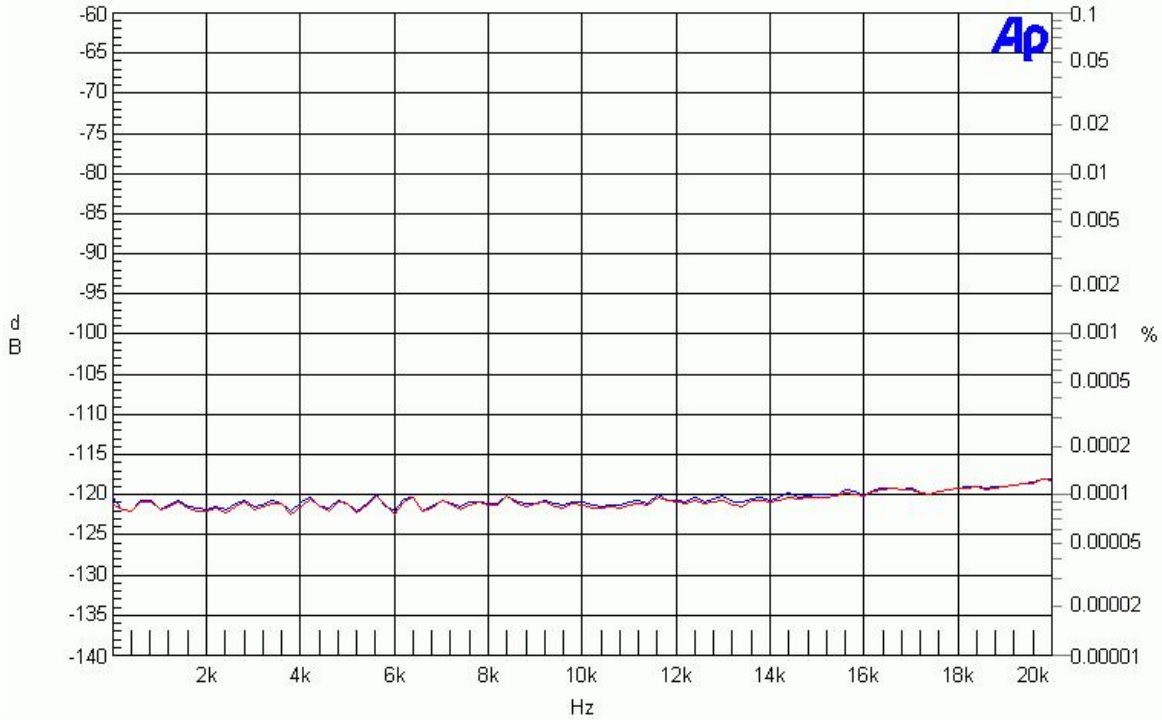
Measurement Plots RM220-111 SRC inputs



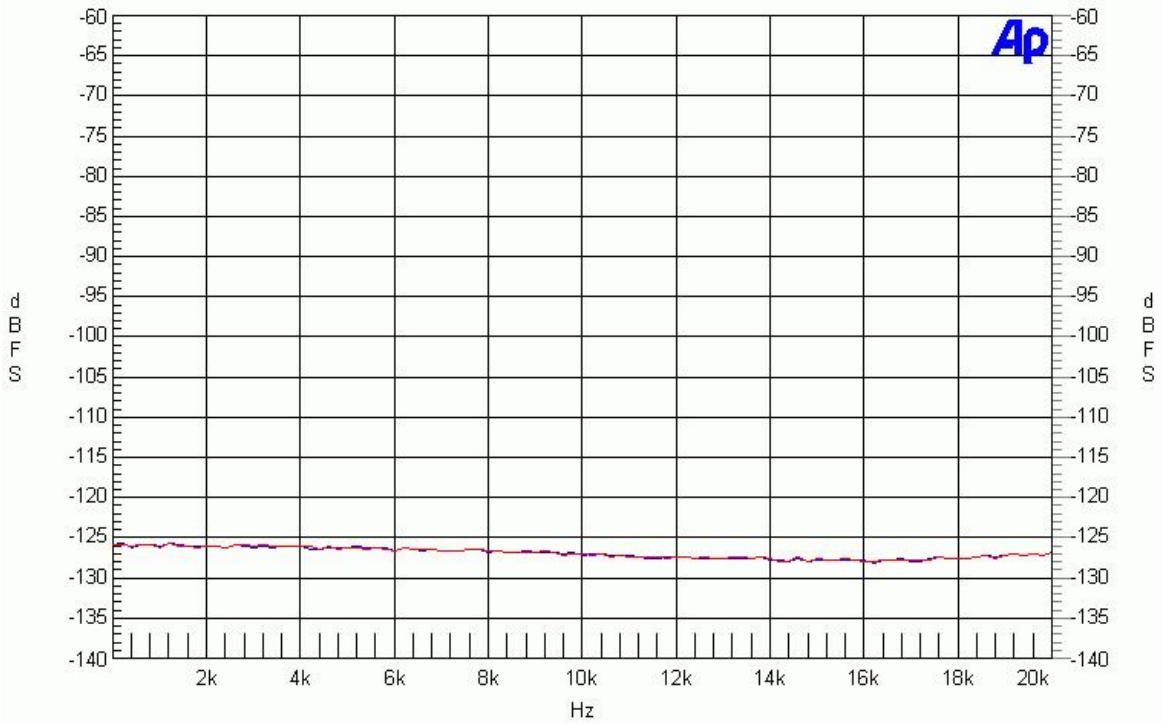
RM220-111 Frequency Response, SRC



RM220-111 THD+N @ -1 dBFS, SRC 48 kHz to 48 kHz



RM220-111 THD+N @ -1 dBFS, SRC 44.1 kHz to 48 kHz



RM220-111 THD+N @ -30 dBFS, SRC 44.1 kHz to 48 kHz

Log File Example

After manufacturing all inputs and outputs of every I/O card are measured. Hence, we can make sure that every module, leaving the production hall, is working correctly. During this process a log file is written. This file is saved by DHD for maintenance purposes.

In the following you can find a log file example of an RM220-111 module:

```
16-Jan-2007 14:21:29
*** Test RM220-111 R2  Production Code 3170 ***
open COM1
=== Test GPO1 ===
=== Test GPO2 ===
=== Test GPO3 ===
=== Test GPO4 ===
=== Test GPI1 ===
=== Test GPI2 ===
=== Test GPI3 ===
=== Test GPI4 ===
=== Test FS Input1 -> SYNC1 ===
=== Test FS Input1 -> SYNC2 ===
=== Test FS Input2 -> SYNC1 ===
=== Test FS Input2 -> SYNC2 ===
=== Test FS Input3 -> SYNC1 ===
=== Test FS Input3 -> SYNC2 ===
=== Test FS Input4 -> SYNC1 ===
=== Test FS Input4 -> SYNC2 ===
================================================
=== Test Input 1-2 SRC off AES/EBU (Pro) 44.1kHz ===
================================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=28.0,  R=28.0 Samples
SNR:  L=130.0 dB,  R=129.3 dB
Input Dynamic:  L=140.9 dB,  R=140.2 dB
================================================
=== Test Input 3-4 SRC off AES/EBU (Pro) 44.1kHz ===
================================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=28.0,  R=28.0 Samples
SNR:  L=130.2 dB,  R=129.3 dB
Input Dynamic:  L=141.1 dB,  R=140.2 dB
================================================
=== Test Input 5-6 SRC off AES/EBU (Pro) 44.1kHz ===
================================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=30.0,  R=30.0 Samples
SNR:  L=130.2 dB,  R=129.4 dB
Input Dynamic:  L=141.1 dB,  R=140.4 dB
================================================
=== Test Input 7-8 SRC off AES/EBU (Pro) 44.1kHz ===
================================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=29.0,  R=29.0 Samples
SNR:  L=130.1 dB,  R=129.3 dB
Input Dynamic:  L=141.1 dB,  R=140.3 dB
==================================
=== Test Output AES/EBU (Pro) 1-2 ===
==================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=29.0,  R=29.0 Samples
SNR:  L=129.2 dB,  R=126.6 dB
Output Dynamic:  L=140.1 dB,  R=137.5 dB
==================================
=== Test Output AES/EBU (Pro) 3-4 ===
==================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
```

```
Group Delay: L=30.0,  R=30.0 Samples
SNR:  L=127.1 dB,  R=126.4 dB
Output Dynamic:  L=138.1 dB,  R=137.4 dB
====================================
=== Test Output AES/EBU (Pro) 5-6 ===
====================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=30.0,  R=30.0 Samples
SNR:  L=127.1 dB,  R=126.2 dB
Output Dynamic:  L=138.1 dB,  R=137.2 dB
====================================
=== Test Output AES/EBU (Pro) 7-8 ===
====================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=29.0,  R=29.0 Samples
SNR:  L=129.3 dB,  R=126.2 dB
Output Dynamic:  L=140.3 dB,  R=137.2 dB
========================================
=== Test Output SP/DIF (Consumer) 1-2 ===
========================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=29.0,  R=29.0 Samples
SNR:  L=129.1 dB,  R=126.4 dB
Output Dynamic:  L=140.1 dB,  R=137.4 dB
========================================
=== Test Output SP/DIF (Consumer) 3-4 ===
========================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=30.0,  R=30.0 Samples
SNR:  L=127.1 dB,  R=126.3 dB
Output Dynamic:  L=138.1 dB,  R=137.3 dB
========================================
=== Test Output SP/DIF (Consumer) 5-6 ===
========================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=30.0,  R=30.0 Samples
SNR:  L=127.3 dB,  R=126.1 dB
Output Dynamic:  L=138.2 dB,  R=137.1 dB
========================================
=== Test Output SP/DIF (Consumer) 7-8 ===
========================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=29.0,  R=29.0 Samples
SNR:  L=129.2 dB,  R=126.3 dB
Output Dynamic:  L=140.2 dB,  R=137.3 dB
====================================================
=== Test Input 1-2 SRC on SP/DIF (Consumer) 48kHz ===
====================================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=78.0,  R=78.0 Samples
SNR:  L=93.8 dB,  R=93.8 dB
Input Dynamic:  L=104.7 dB,  R=104.7 dB
====================================================
=== Test Input 3-4 SRC on SP/DIF (Consumer) 48kHz ===
====================================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=77.7,  R=77.7 Samples
SNR:  L=100.8 dB,  R=100.8 dB
Input Dynamic:  L=111.8 dB,  R=111.8 dB
====================================================
=== Test Input 5-6 SRC on SP/DIF (Consumer) 48kHz ===
====================================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
```

```
Group Delay: L=79.2,  R=79.2 Samples
SNR:  L=105.7 dB,  R=105.7 dB
Input Dynamic:  L=116.7 dB,  R=116.7 dB
=====================================================
=== Test Input 7-8 SRC on SP/DIF (Consumer) 48kHz ===
=====================================================
-- Level 0dB --
Level(1kHz): L=-0.00 dB,  R=-0.00 dB
Polarity: (+)
Group Delay: L=78.8,  R=78.8 Samples
SNR:  L=102.8 dB,  R=102.7 dB
Input Dynamic:  L=113.7 dB,  R=113.7 dB
==============
=== EEPROM ===
==============
Updated Serialnumber = 100
************************
*** Test Succsessful ***
************************
16-Jan-2007 14:22:10
```

RM220-122C - Mic Line/Headphone/GPIO Module, 4 ch.

Technical Specifications

A/D Converter

input sensitivity:	-64dBu ... 18dBu
gain setting:	max. 70dB in 5 dB steps (0...50 dB analog gain) + 1dB steps (-20 ... +20 dB digital gain)
frequency response:	< 0.1 dB
input impedance:	approx. 8 kOhm
dynamic range:	107 dB (A-weighted)
THD+N:	< -104 dBFS (-30 dBFS) < -102 dBFS (-9 dBFS, +6 dBu) < -85 dBFS (-1 dBFS, +14 dBu)
equivalent input noise:	< -128dBu (150 Ohm source), < -127 dBu (200 Ohm source)
crosstalk:	< -110 dB (1 kHz)
phantom power 48V:	switchable per input channel, unloaded input: 48V +/- 10%
max. input level:	18 dBu (balanced)
common mode rejection:	> 60 dB
converter technology:	24 bit, oversampling sigma-delta

D/A Converter

max. output level (headphones, single ended):	15 dBu
output impedance:	approx. 17 Ohm
load impedance (outputs short circuit protected):	> 80 Ohm

D/A Converter

frequency response:	< 0.3 dB
THD+N:	< -106 dBFS (-30 dBFS)
	< -103 dBFS (-9 dBFS, +6 dBu)
	< -95 dBFS (-1 dBFS, +14dBu)
crosstalk:	< -110 dB (1 kHz)
dynamic range:	109dB (A-weighted)
DC offset voltage:	< 10 mV
converter technology:	24 bit, oversampling sigma-delta

General Purpose Inputs / Outputs (GPI/GPO)

2 not isolated analog control inputs to connect external potentiometers for level controlling:	connect 10k ohms linear potentiometer between wiper and GND (left detent), left open right detent of potentiometer
	Note: Do not supply any external voltage!
2 GPIs (not isolated TTL-Inputs):	internal pull up resistor 10k ohms to 5 V for connecting of external push buttons against GND
	maximum voltage 5V DC when used with TTL input signal
4 GPOs (electronic relay, isolated):	maximum rated current: 0,2A (resettable fuse), maximum peak switched voltage: 30V AC or DC

Further Information

power consumption:	3,5 W (typical)
connector style:	RJ45
printed circuit board (PCB) revision for this specifications:	r6

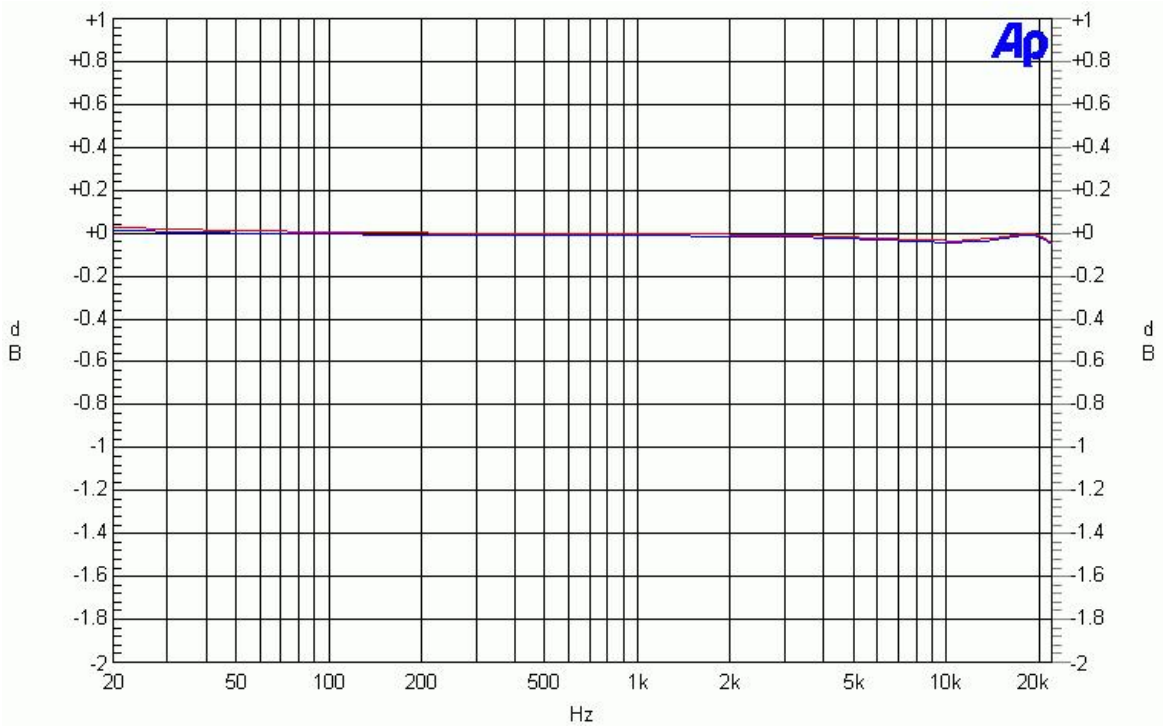
Note

All values are typical values, regarding the factory test limits, you can find in the log file example.

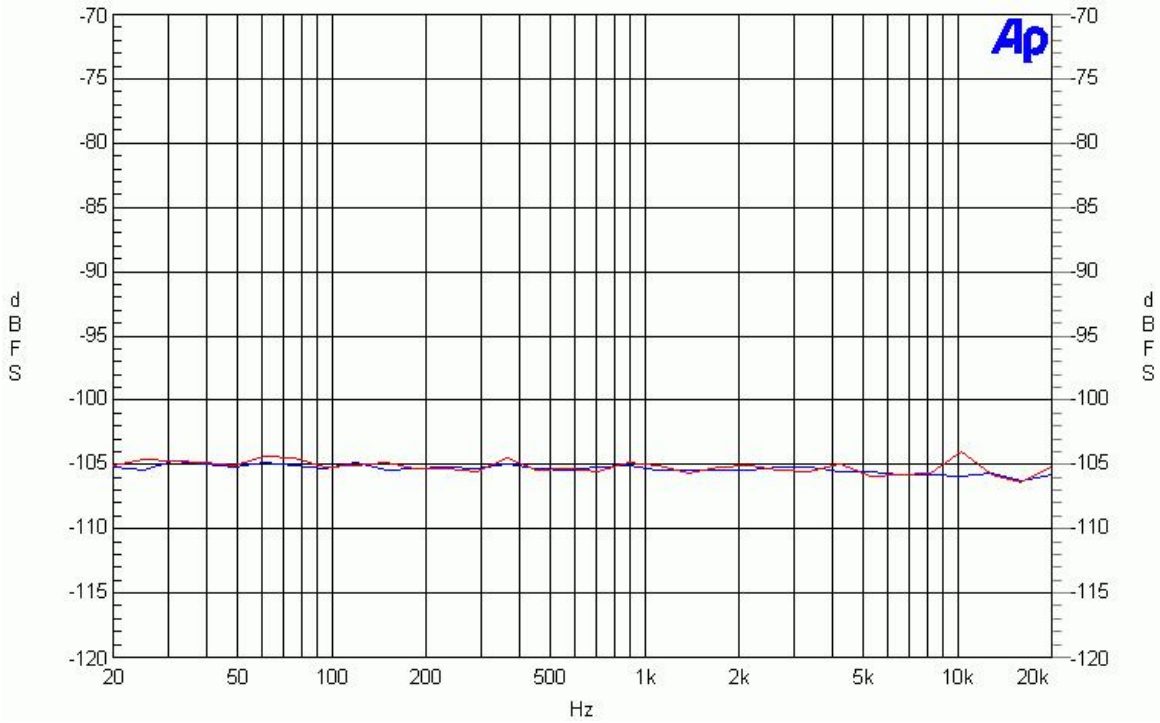
Warning

The wiring of microphone inputs of DHD microphone input modules is not designed to support operation with parallel external phantom power. Using it might result in damages of pre-amplifier or phantom power generator.

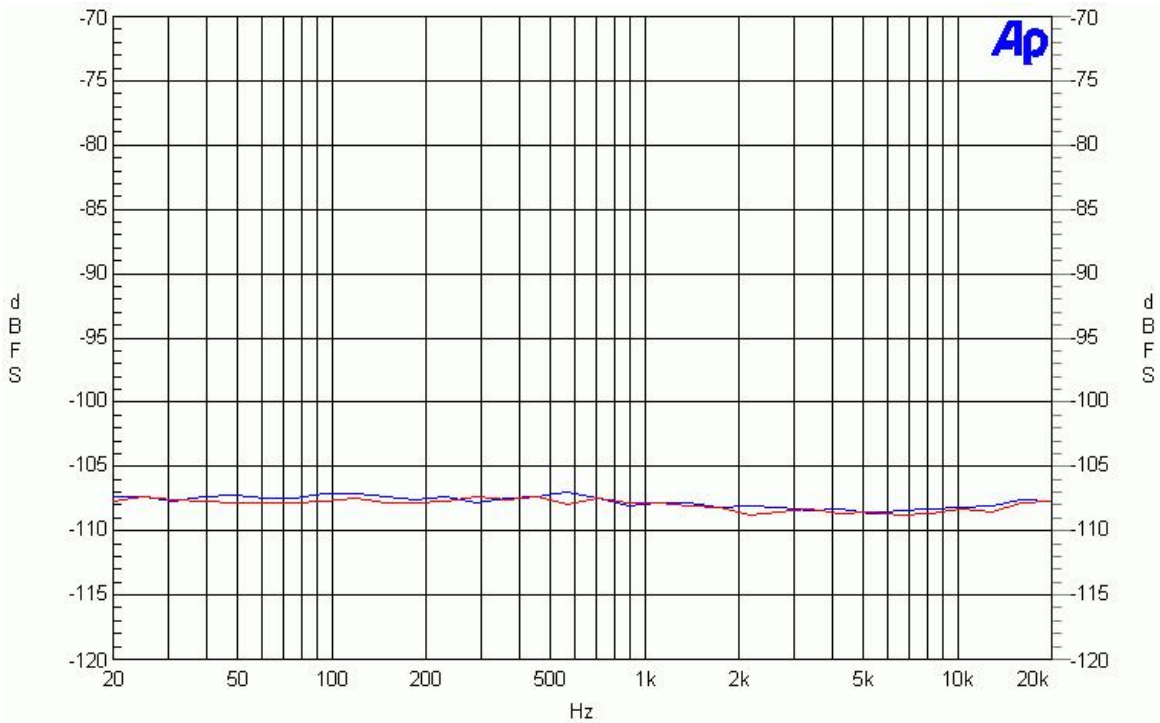
Measurement Plots RM220-122 Inputs



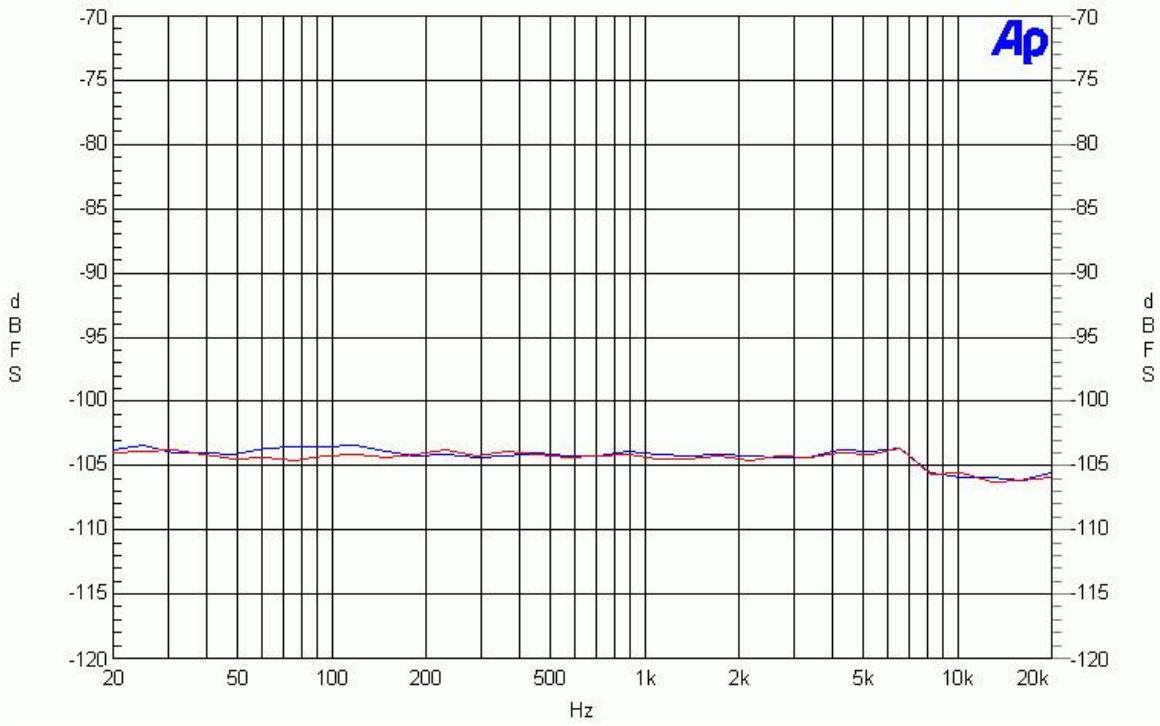
RM220-122C ADC Frequency Response



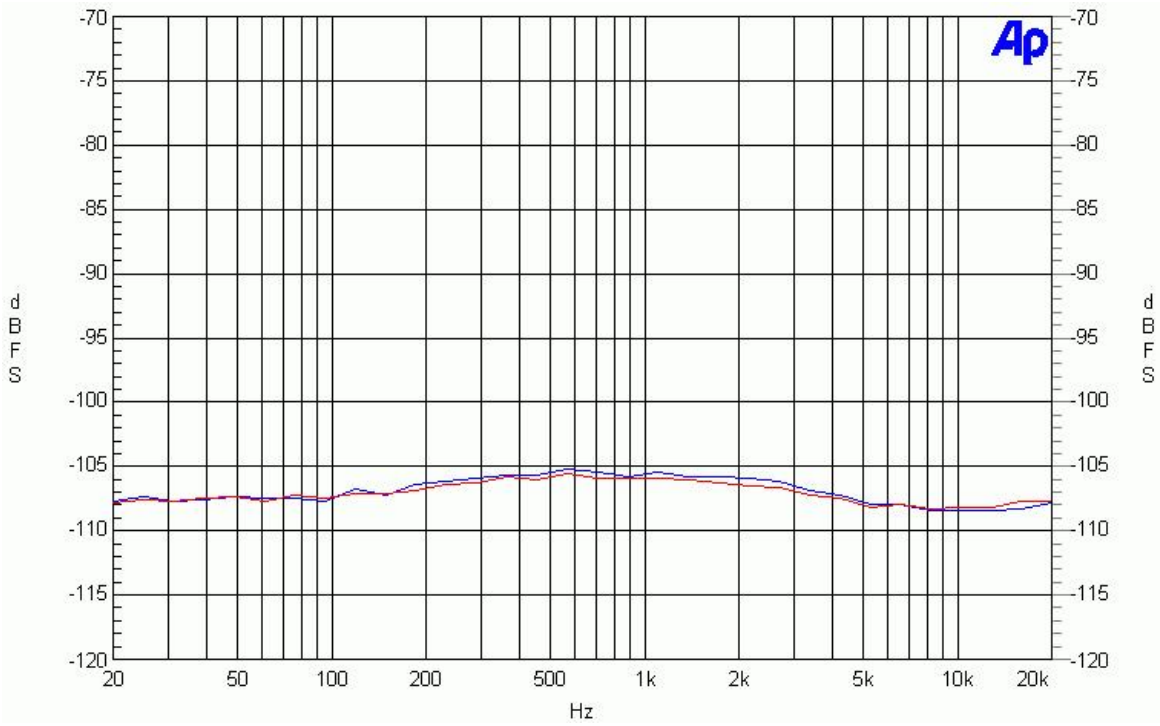
RM220-122C ADC THD+N @ -30 dBFS



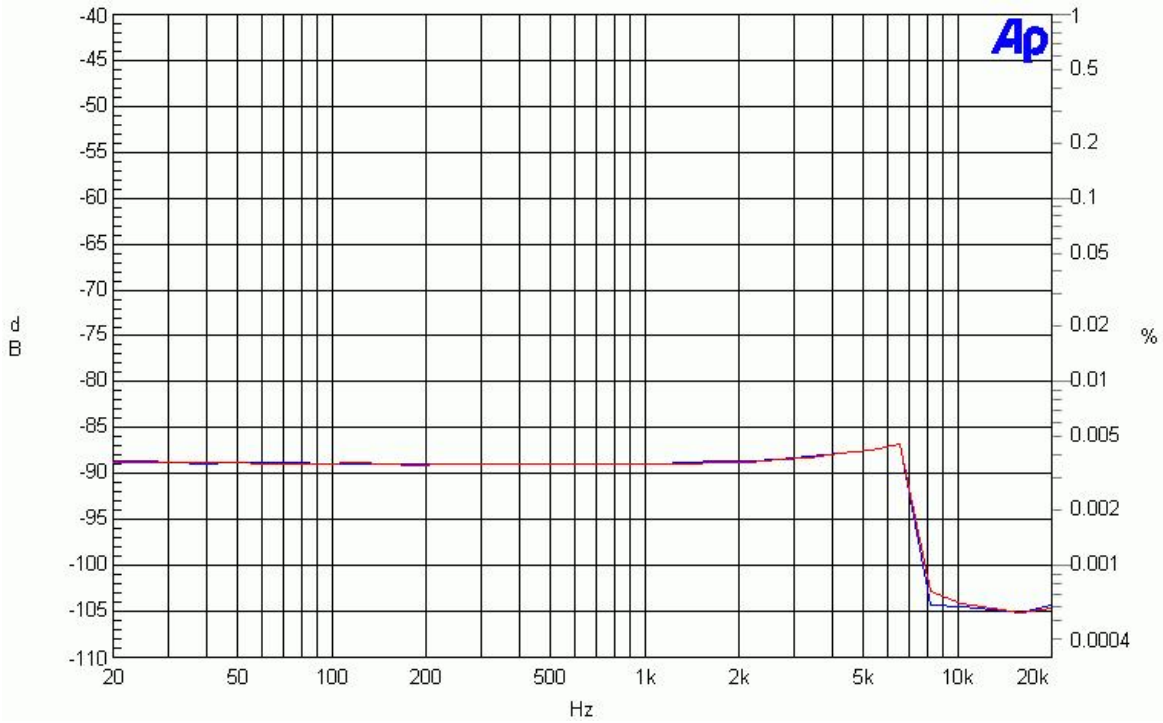
RM220-122C ADC THD+N(A) @ -30 dBFS



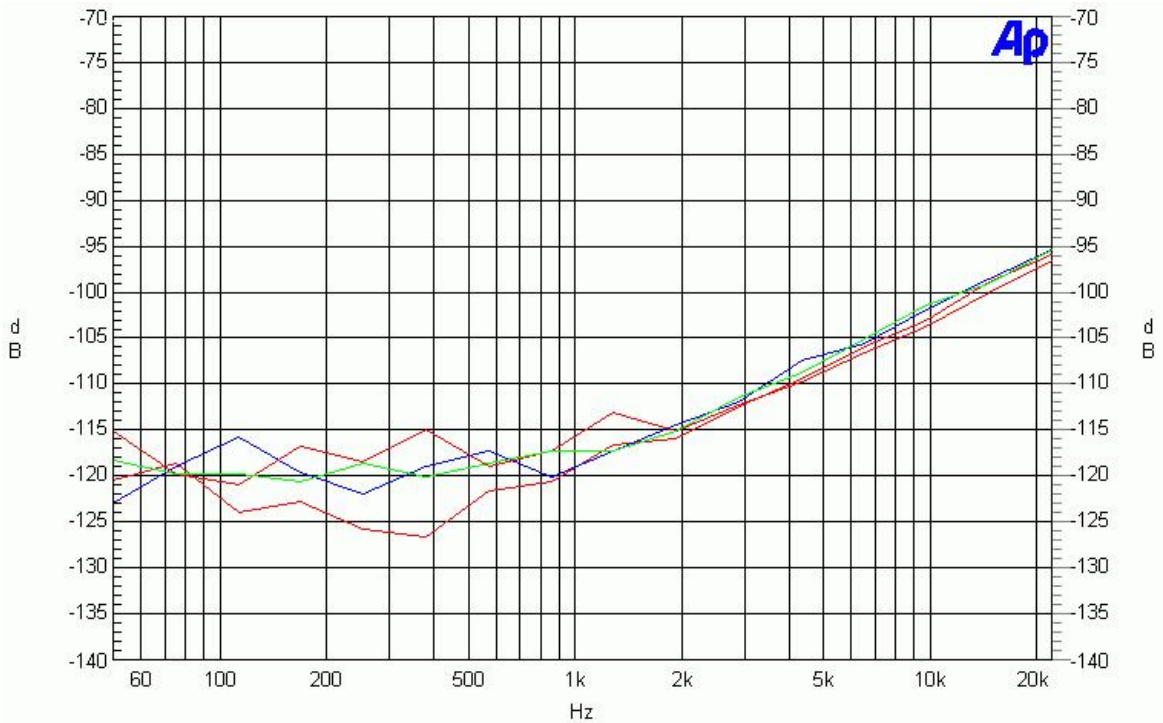
RM220-122C ADC THD+N @ +6 dBu



RM220-122C ADC THD+N(A) @ + 6 dBu

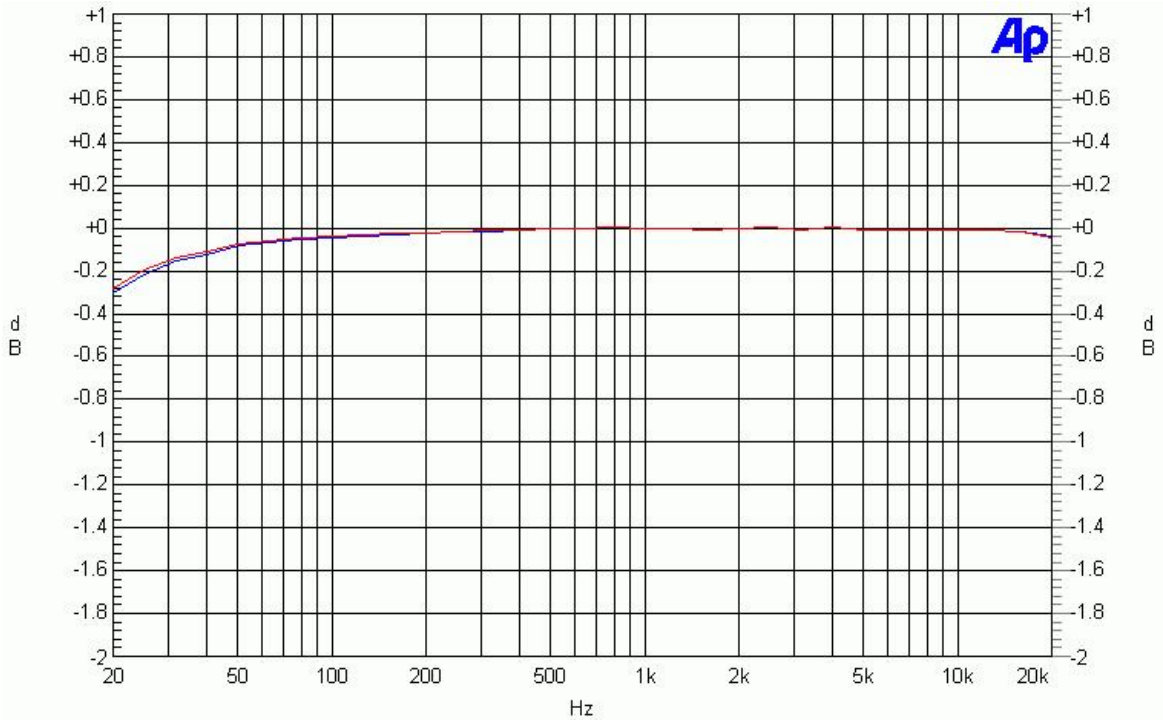


RM220-122C ADC THD+N @ +14 dBu

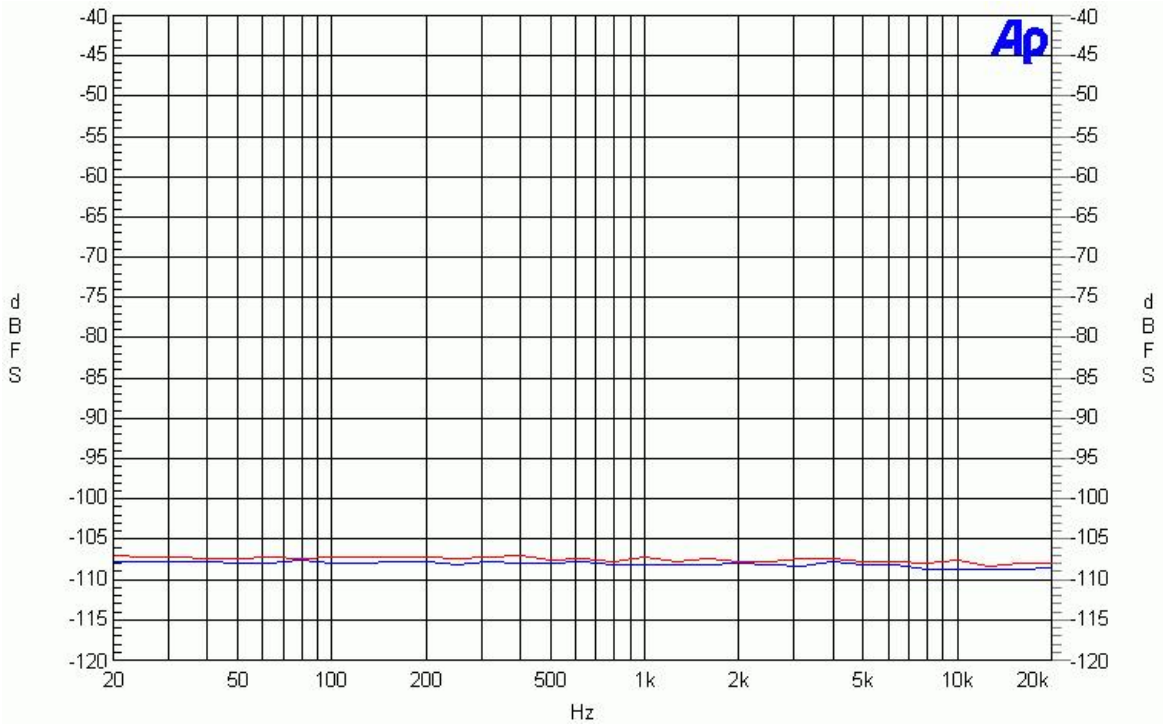


RM220-122C ADC Cross-Talk

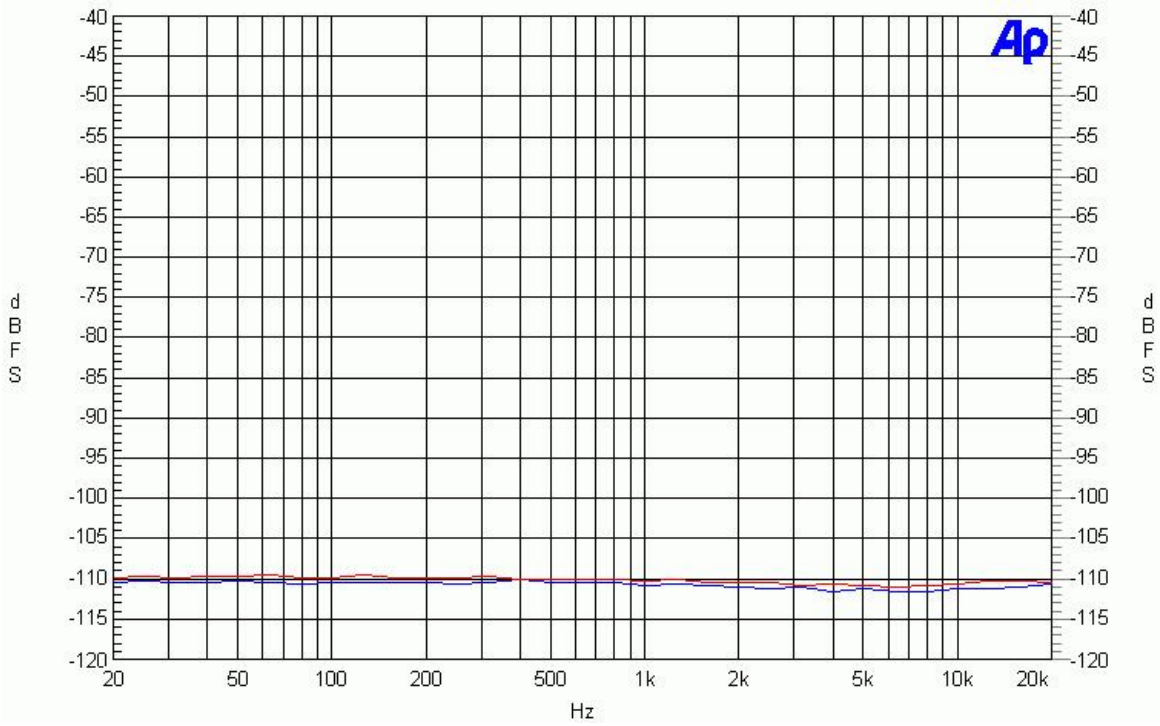
Measurement Plots RM220-122 Outputs



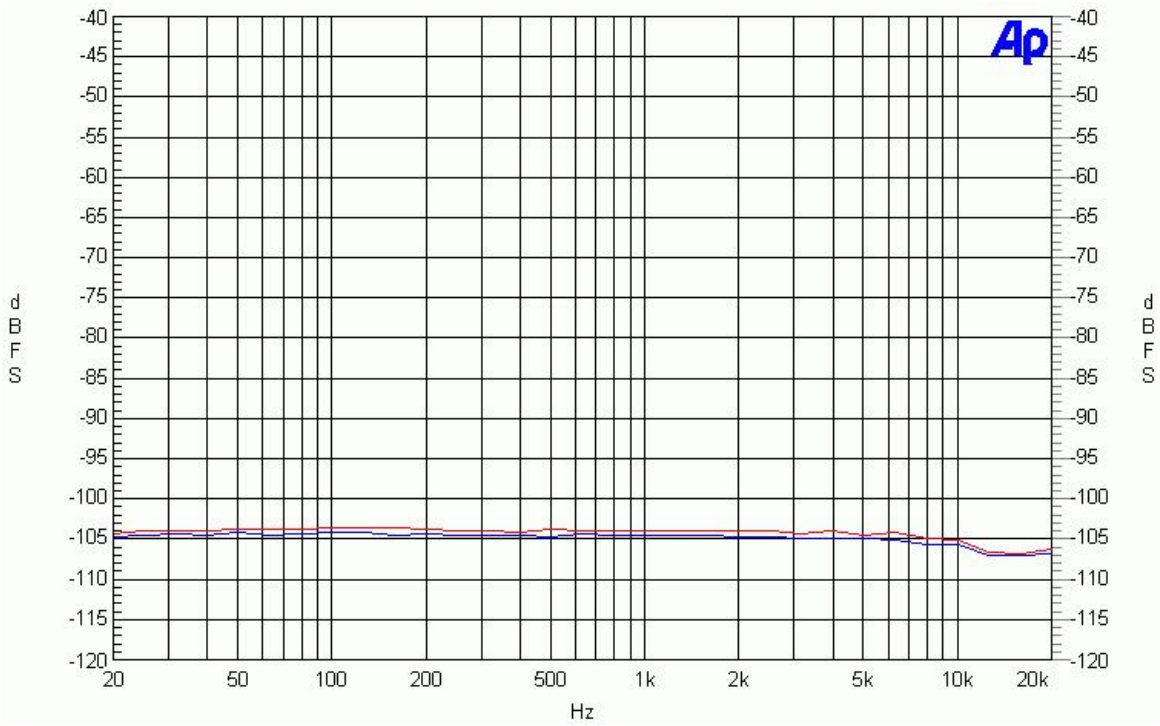
RM220-122C DAC Frequency Response



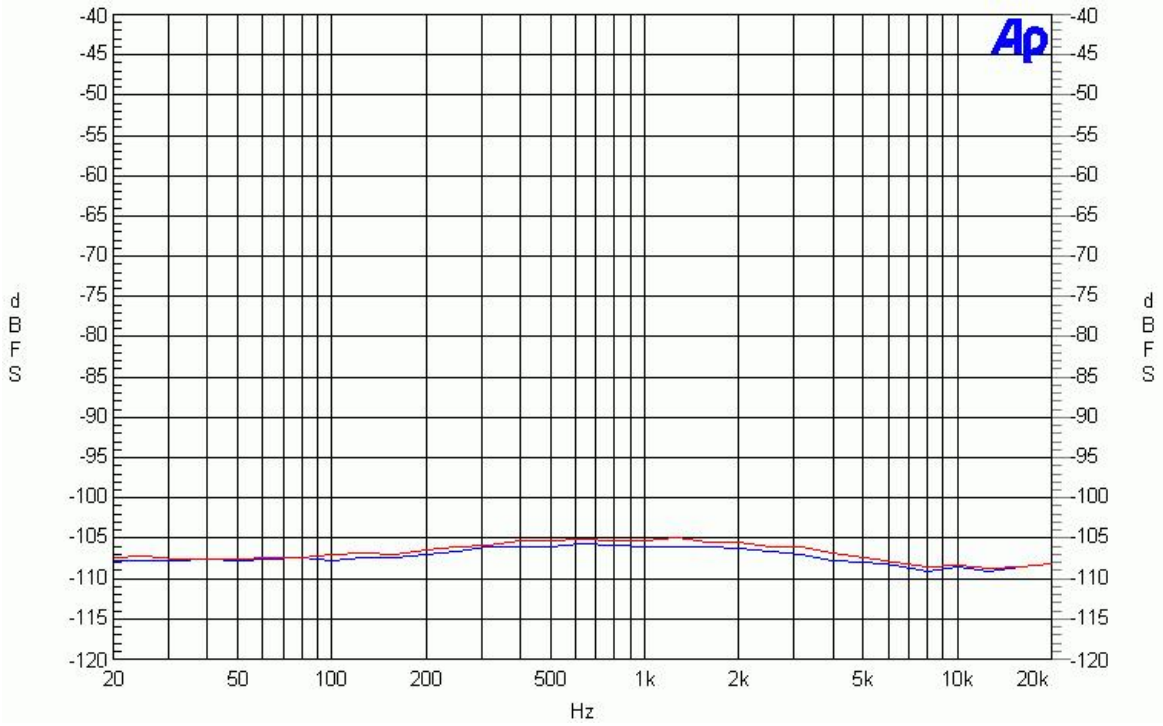
RM220-122C DAC THD+N @ -30 dBFS



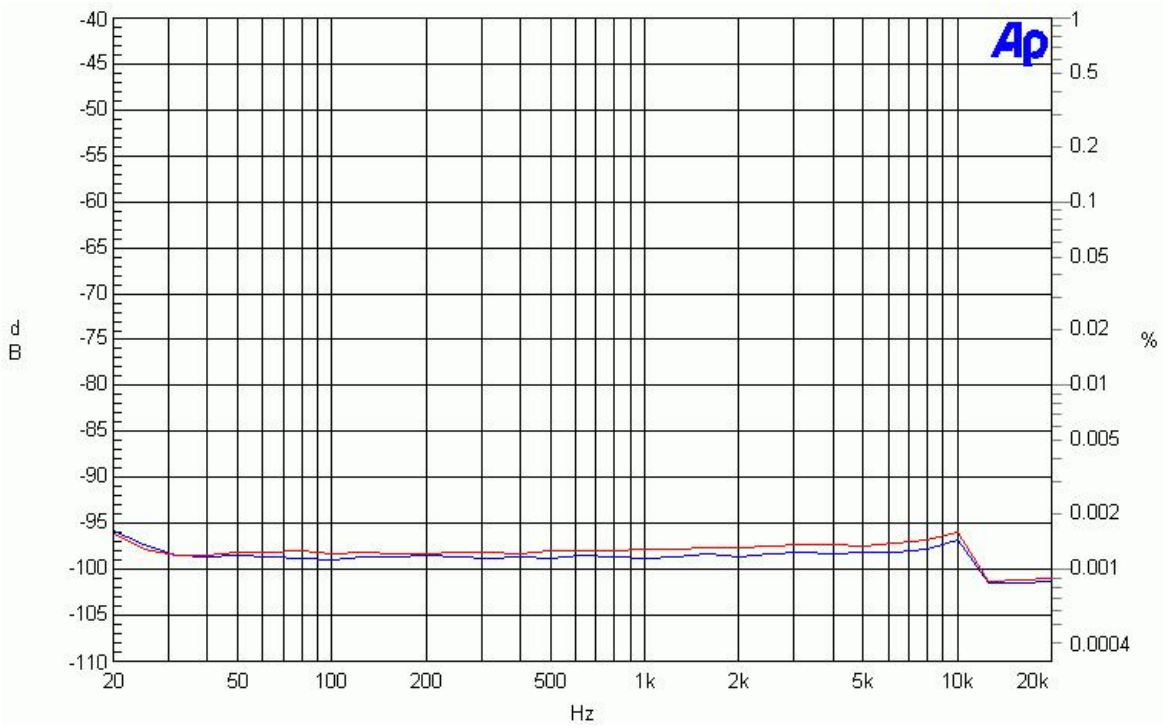
RM220-122C DAC THD+N(A) @ -30 dBFS



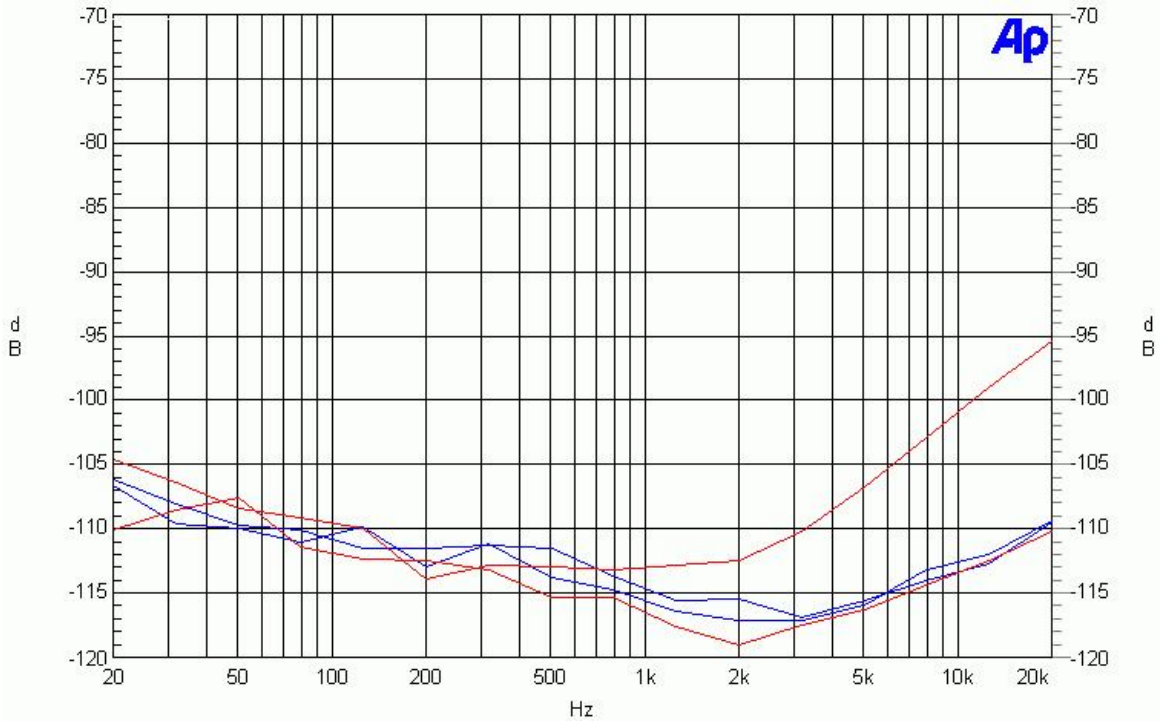
RM220-122C DAC THD+N @ +6 dBu



RM220-122C DAC THD+N(A) @ +6 dBu



RM220-122C DAC THD+N @ +14 dBu, 300Ohm



RM220-122C DAC Cross-Talk

Log File Example

After manufacturing all inputs and outputs of every I/O card are measured. Hence, we can make sure that every module, leaving the production hall, is working correctly. During this process a log file is written. This file is saved by DHD for maintenance purposes.

In the following you can find a log file example of an RM220-122 module:

```
20-Feb-2007 13:54:26
*** Test RM220-122 R3  Production Code 3166 ***
open COM1
=== Voltage VCC3 = 3.3 V ===
=== Voltage VCC2+ = 12.1 V ===
=== Voltage VCC2- = -12.0 V ===
=== Phantom Power Voltage V48 = 48.6 V ===
=== Test GPO1 ===
=== Test GPO2 ===
=== Test GPO3 ===
=== Test GPO4 ===
=== Test GPI1 ===
=== Test GPI2 ===
=== Test Analog Control Input ACI1 ===
=== Test Analog Control Input ACI2 ===
=== Phantom Power Mic1 A=45.2 V, B=45.2 V  ===
=== Phantom Power Mic2 A=46.2 V, B=46.0 V  ===
=== Phantom Power Mic3 A=45.2 V, B=45.2 V  ===
=== Phantom Power Mic4 A=46.0 V, B=46.0 V  ===
====================
=== Test A/D 1-2 ===
====================
-- Level 0dB --
Level(1kHz): L=-0.73 dB,  R=-0.79 dB
Polarity: (+)
Group Delay: L=82.6,  R=82.6 Samples
SNR:  L=85.0 dB,  R=86.2 dB
-- Dynamic -60dB --
Level(1kHz): L=-60.72 dB,  R=-60.80 dB
SNR:  L=29.8 dB,  R=30.0 dB
Input Dynamic:  L=100.7 dB,  R=101.0 dB
-- Input Balance --
CMR @ 1kHz:  L=-76.5 dB,  R=-80.8 dB
====================
```

```
=== Test A/D 3-4 ===
====================
-- Level 0dB --
Level(1kHz): L=-0.74 dB,  R=-0.73 dB
Polarity: (+)
Group Delay: L=82.6,  R=82.6 Samples
SNR:  L=85.4 dB,  R=85.9 dB
-- Dynamic -60dB --
Level(1kHz): L=-60.71 dB,  R=-60.75 dB
SNR:  L=30.6 dB,  R=30.7 dB
Input Dynamic:  L=101.5 dB,  R=101.7 dB
-- Input Balance --
CMR @ 1kHz:  L=-69.8 dB,  R=-88.1 dB
====================
=== Test D/A 1-2 ===
====================
-- Input Level 0dB --
Level(1kHz): L=-2.40 dB,  R=-2.41 dB
Polarity: (+)
Group Delay: L=82.6,  R=82.6 Samples
SNR:  L=84.8 dB,  R=85.4 dB
-- Dynamic +20dB Gain --
Level(1kHz): L=17.64 dB,  R=17.60 dB
SNR:  L=75.6 dB,  R=75.6 dB
Output Dynamic:  L=106.5 dB,  R=106.6 dB
====================
=== Test D/A 3-4 ===
====================
-- Input Level 0dB --
Level(1kHz): L=-2.42 dB,  R=-2.43 dB
Polarity: (+)
Group Delay: L=82.6,  R=82.6 Samples
SNR:  L=85.8 dB,  R=85.9 dB
-- Dynamic +20dB Gain --
Level(1kHz): L=17.59 dB,  R=17.61 dB
SNR:  L=75.5 dB,  R=75.8 dB
Output Dynamic:  L=106.5 dB,  R=106.7 dB
============================
=== Test Mic Gain A/D 1-2 ===
============================
-- Gain +5.0 dB --
Level(1kHz): L=-55.34 dB,  R=-55.33 dB
SNR:  L=32.3 dB,  R=32.0 dB
-- Gain +10.3 dB --
Level(1kHz): L=-49.91 dB,  R=-49.89 dB
SNR:  L=37.6 dB,  R=37.3 dB
-- Gain +12.3 dB --
Level(1kHz): L=-47.98 dB,  R=-47.99 dB
SNR:  L=39.5 dB,  R=39.5 dB
-- Gain +20.3 dB --
Level(1kHz): L=-39.99 dB,  R=-40.00 dB
SNR:  L=47.6 dB,  R=47.4 dB
-- Gain +25.3 dB --
Level(1kHz): L=-34.90 dB,  R=-34.94 dB
SNR:  L=52.6 dB,  R=52.5 dB
-- Gain +28.1 dB --
Level(1kHz): L=-32.11 dB,  R=-32.15 dB
SNR:  L=55.3 dB,  R=55.2 dB
-- Gain +35.4 dB --
Level(1kHz): L=-24.83 dB,  R=-24.85 dB
SNR:  L=62.2 dB,  R=62.2 dB
-- Gain +40.1 dB --
Level(1kHz): L=-19.91 dB,  R=-19.90 dB
SNR:  L=66.6 dB,  R=66.9 dB
-- Gain +45.4 dB --
Level(1kHz): L=-14.64 dB,  R=-14.64 dB
SNR:  L=71.0 dB,  R=71.1 dB
-- Gain +50.0 dB --
Level(1kHz): L=-10.14 dB,  R=-10.13 dB
SNR:  L=74.0 dB,  R=73.8 dB
-- Equivalent Input Noise at +50 dB: Ch1=-127.0 dBu, Ch2=-126.8 dBu--
============================
=== Test Mic Gain A/D 3-4 ===
============================
-- Gain +5.0 dB --
Level(1kHz): L=-55.32 dB,  R=-55.34 dB
SNR:  L=33.4 dB,  R=33.1 dB
-- Gain +10.3 dB --
Level(1kHz): L=-49.88 dB,  R=-49.91 dB
SNR:  L=38.6 dB,  R=38.5 dB
-- Gain +12.3 dB --
```

```
Level(1kHz): L=-47.94 dB,  R=-47.99 dB
SNR:  L=40.6 dB,  R=40.6 dB
-- Gain +20.3 dB --
Level(1kHz): L=-39.96 dB,  R=-39.99 dB
SNR:  L=48.6 dB,  R=48.4 dB
-- Gain +25.3 dB --
Level(1kHz): L=-34.89 dB,  R=-34.92 dB
SNR:  L=53.6 dB,  R=53.5 dB
-- Gain +28.1 dB --
Level(1kHz): L=-32.10 dB,  R=-32.13 dB
SNR:  L=56.2 dB,  R=56.2 dB
-- Gain +35.4 dB --
Level(1kHz): L=-24.78 dB,  R=-24.83 dB
SNR:  L=63.0 dB,  R=63.1 dB
-- Gain +40.1 dB --
Level(1kHz): L=-19.84 dB,  R=-19.90 dB
SNR:  L=67.4 dB,  R=67.5 dB
-- Gain +45.4 dB --
Level(1kHz): L=-14.57 dB,  R=-14.62 dB
SNR:  L=71.7 dB,  R=71.7 dB
-- Gain +50.0 dB --
Level(1kHz): L=-10.06 dB,  R=-10.12 dB
SNR:  L=74.4 dB,  R=74.5 dB
-- Equivalent Input Noise at +50 dB: Ch3=-127.4 dBu, Ch4=-127.5 dBu--
==============
=== EEPROM ===
==============
Updated Serialnumber = 62
************************
*** Test Succsessful ***
************************
20-Feb-2007 13:55:43
```

RM220-222B - Analog In/Out/GPIO Module, 4 ch.

Technical Specifications

A/D Converter

max. input level:	18 dBu (balanced)
input impedance:	approx. 10 kOhm
frequency response:	< 0.1 dB
THD+N:	< -108 dBFS (-30 dBFS)
	< -108 dBFS (-9 dBFS, +6 dBu)
	< -95 dBFS (-1 dBFS, +14 dBu)
crosstalk:	< -110 dB (1kHz)
dynamic range:	110dB (A-weighted)
common mode rejection:	> 60 dB
converter technology:	24 bit, oversampling sigma-delta

D/A Converter

max. output level (phones, single ended):	18 dBu (balanced)
output impedance:	approx. 25 Ohm
minimum load (outputs short circuit protected):	600 Ohm
frequency response:	< 0.1 dB
THD+N:	< -106 dBFS (-30 dBFS)
	< -104 dBFS (-9 dBFS, +6 dBu)
	< -90 dBFS (-1 dBFS, +14 dBu)

D/A Converter

crosstalk:	< -90 dB
dynamic range:	109dB (A-weighted)
DC offset voltage:	< 10 mV
common mode rejection (output impedance):	> 60 dB
common mode rejection (output voltage):	> 40 dB
converter technology:	24 bit, oversampling sigma-delta

General Purpose Inputs / Outputs (GPI/GPO)

4 GPIs (not isolated TTL-Inputs):	internal pull up resistor 10k ohms to 5 V for connecting of external push buttons against GND maximum voltage 5V DC when used with TTL input signal
4 GPOs (open collector, non isolated):	maximum rated current: 0,2A (resettable fuse), maximum peak switched voltage: 24 V DC

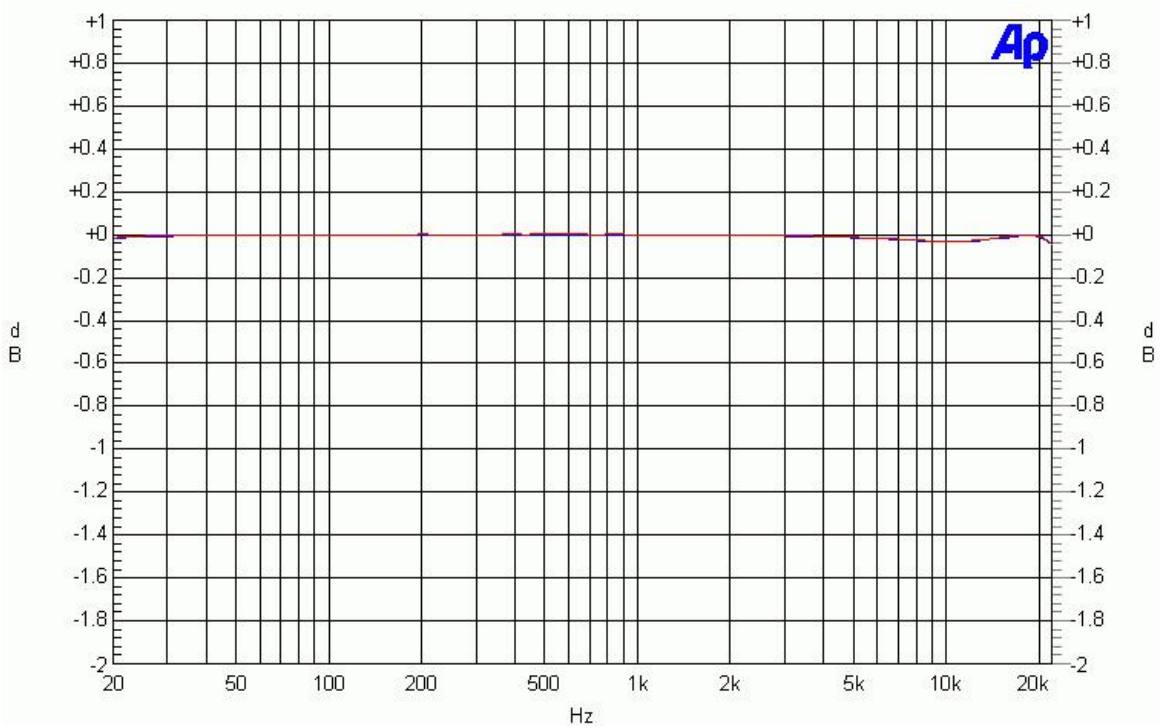
Further Information

power consumption:	2,4 W (typical)
connector style:	RJ45
printed circuit board (PCB) revision for this specifications:	r7

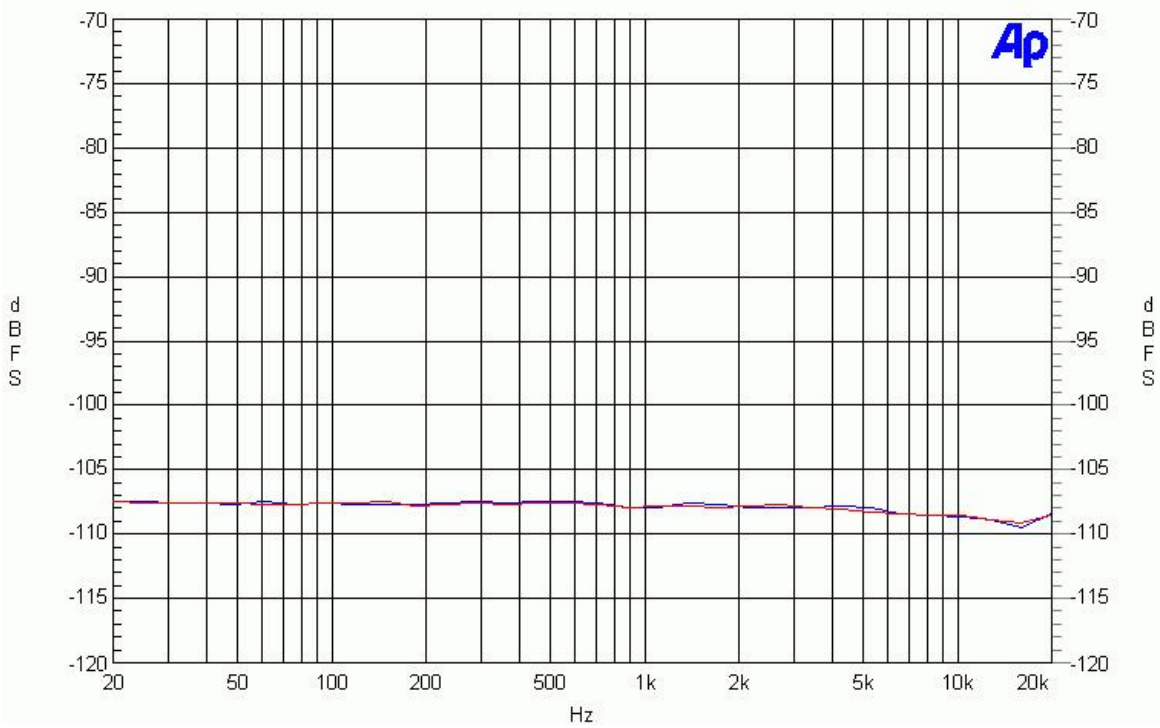
Note

All values are typical values, regarding the factory test limits, you can find in the log file example.

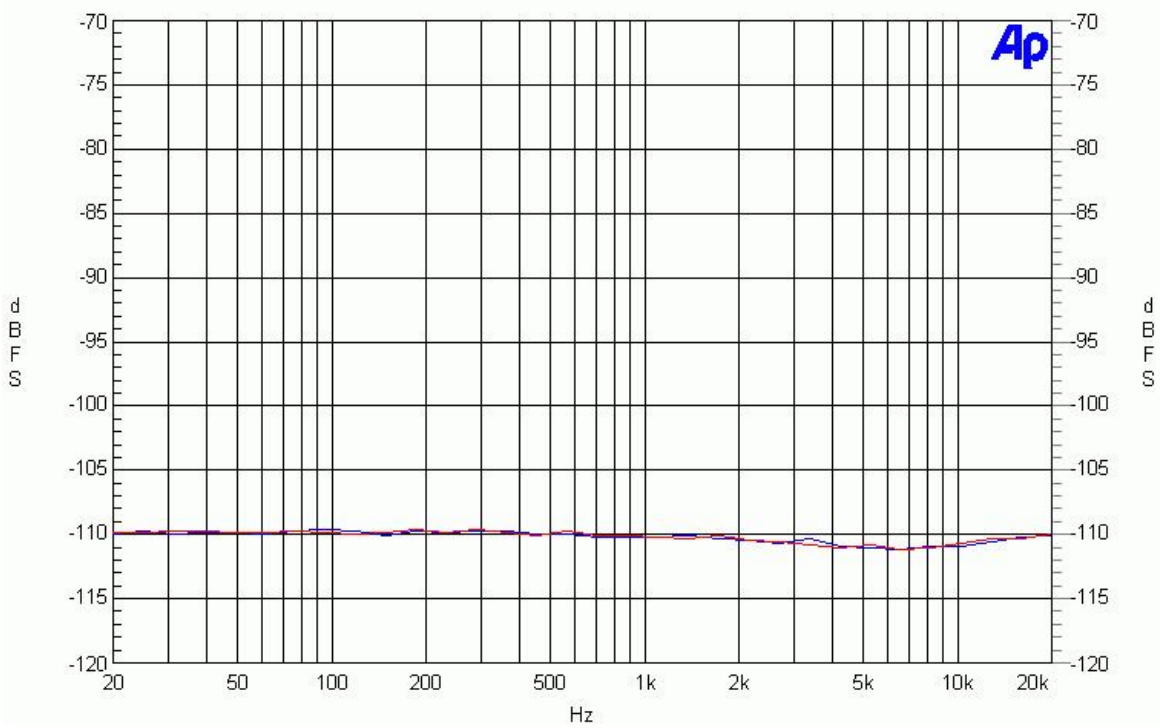
Measurement Plots RM220-222 Inputs



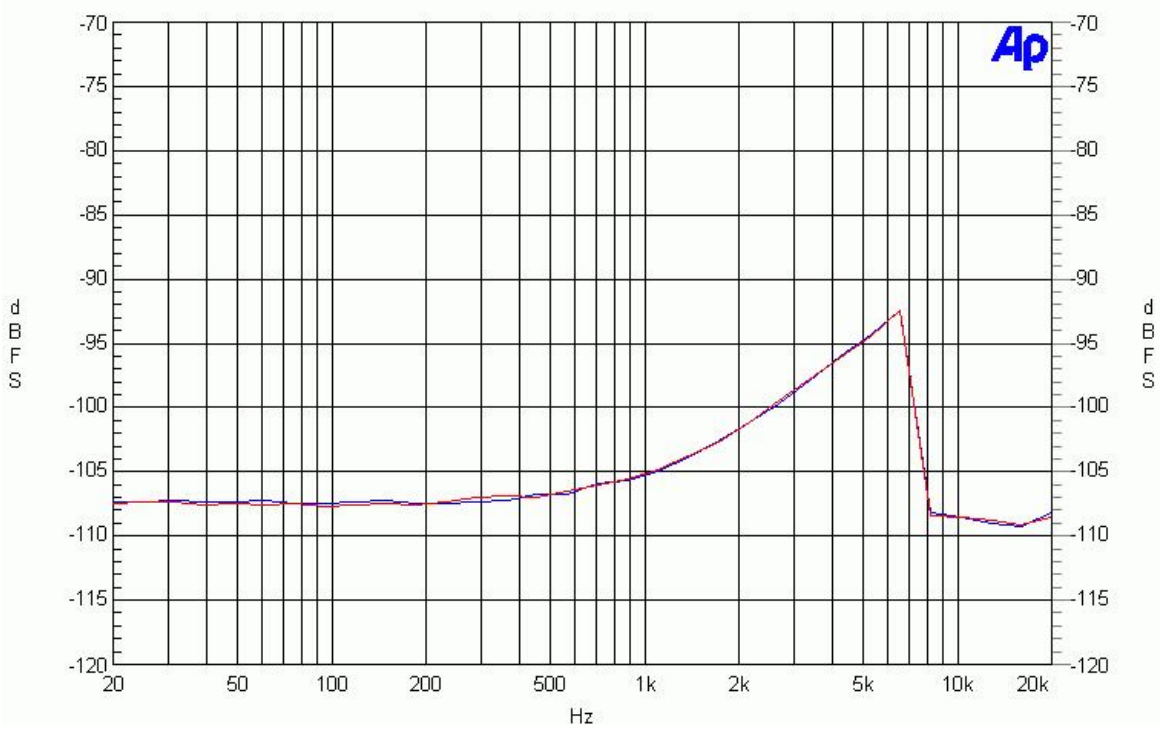
RM220-222 ADC Frequency Response



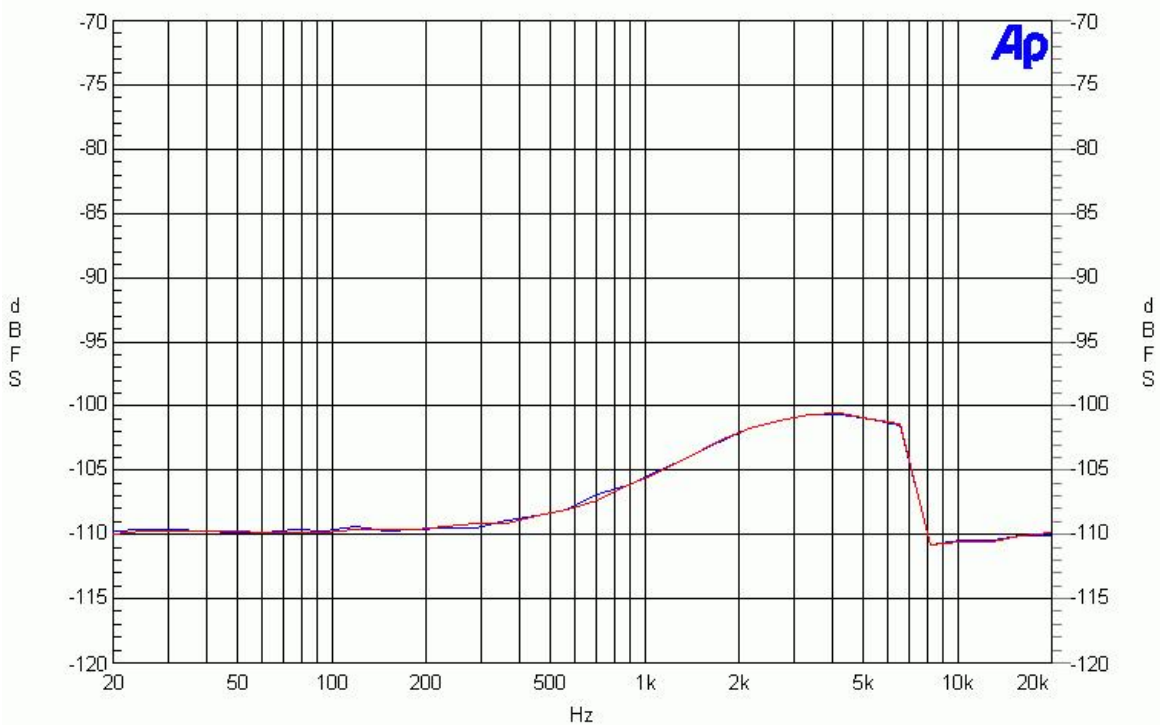
RM220-222 ADC THD+N @ -30 dBFS



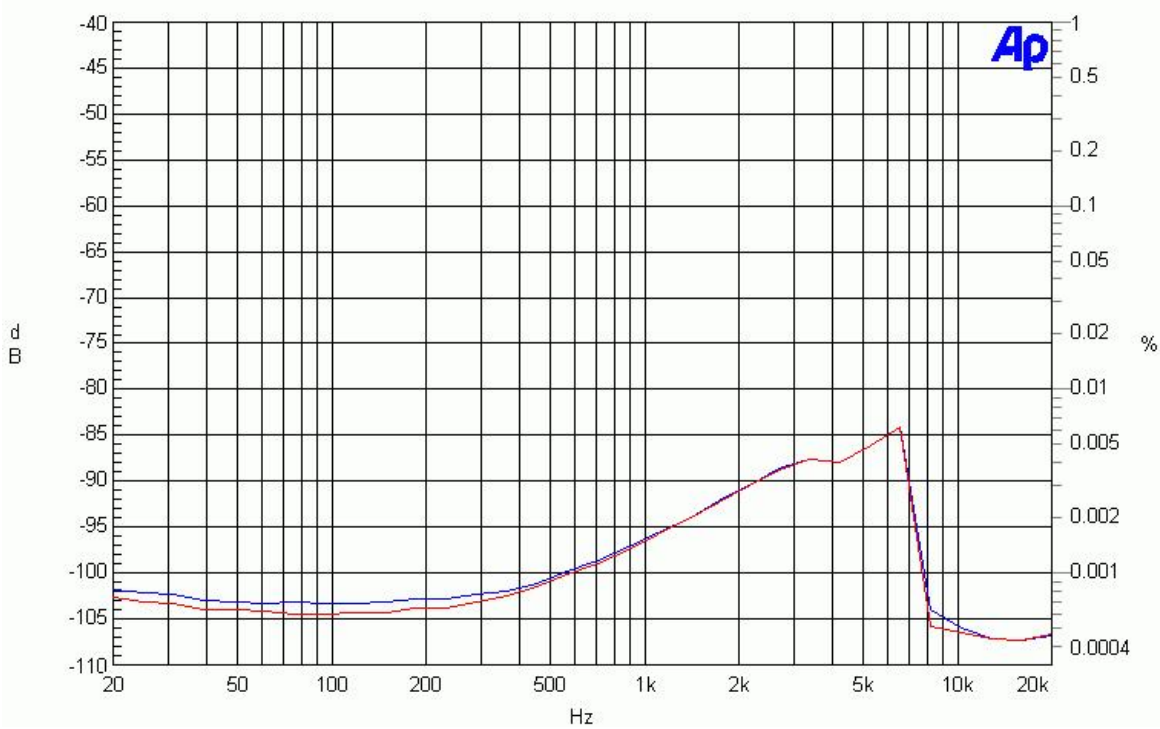
RM220-222 ADC THD+N(A) @ -30 dBFS



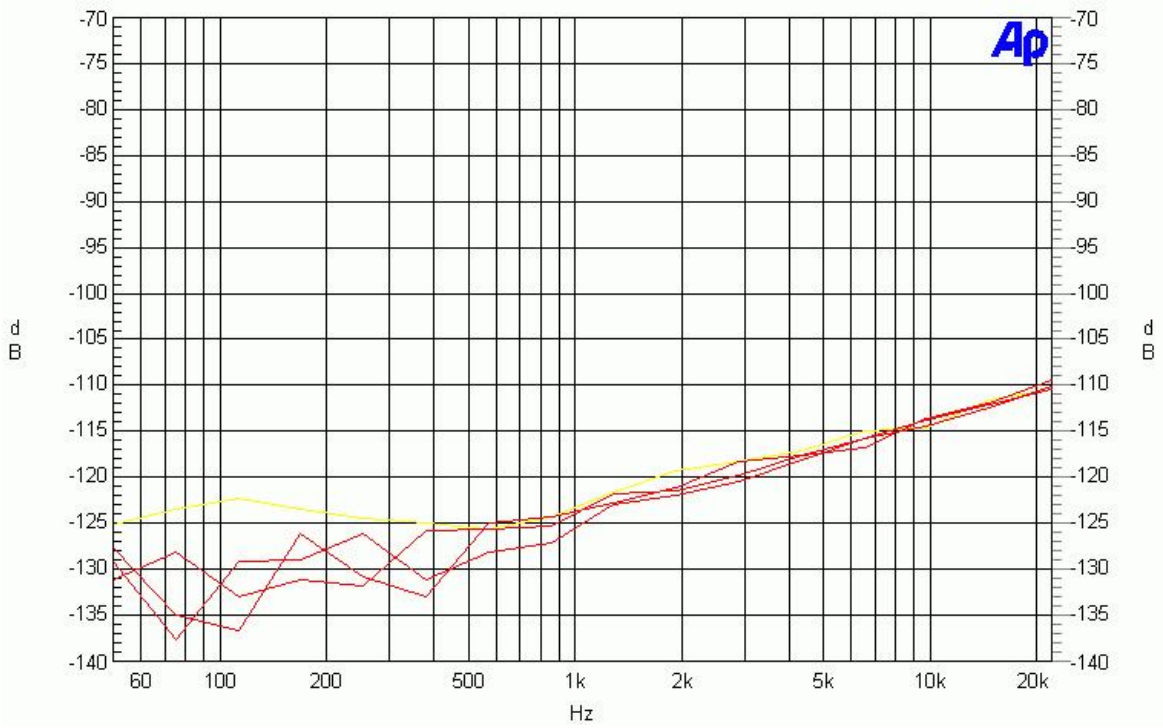
RM220-222 ADC THD+N @ +6 dBu



RM220-222 ADC THD+N(A) @ +6 dBu

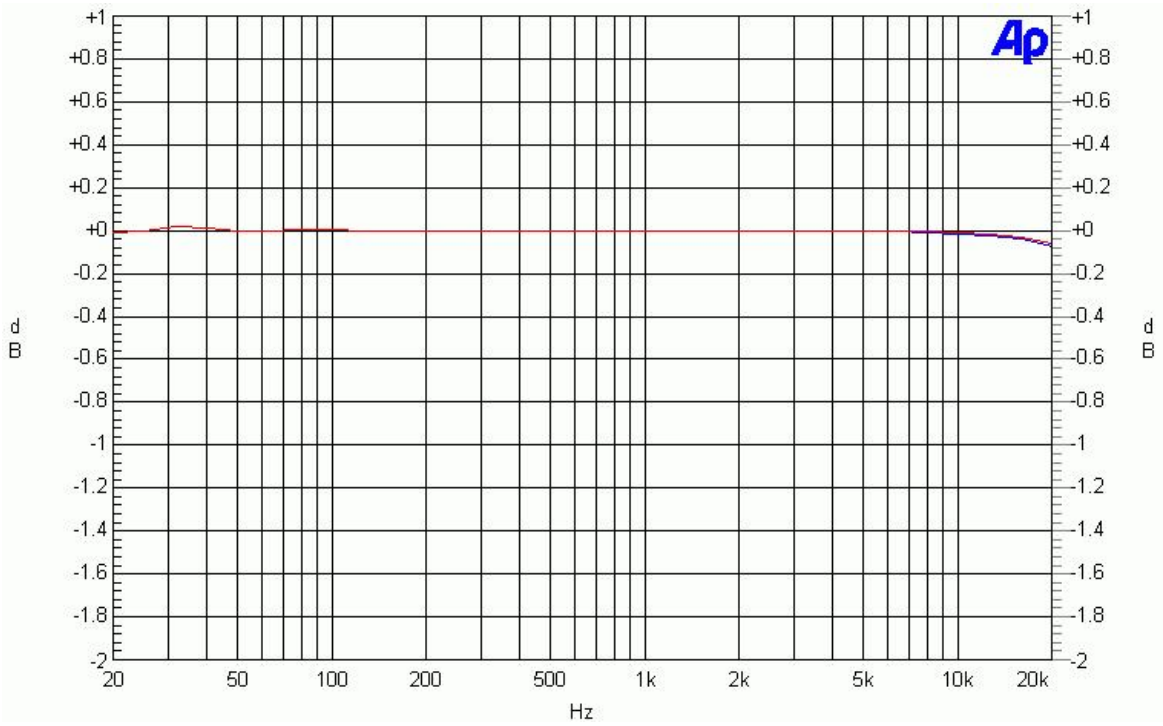


RM220-222 ADC THD+N @ +14 dBu

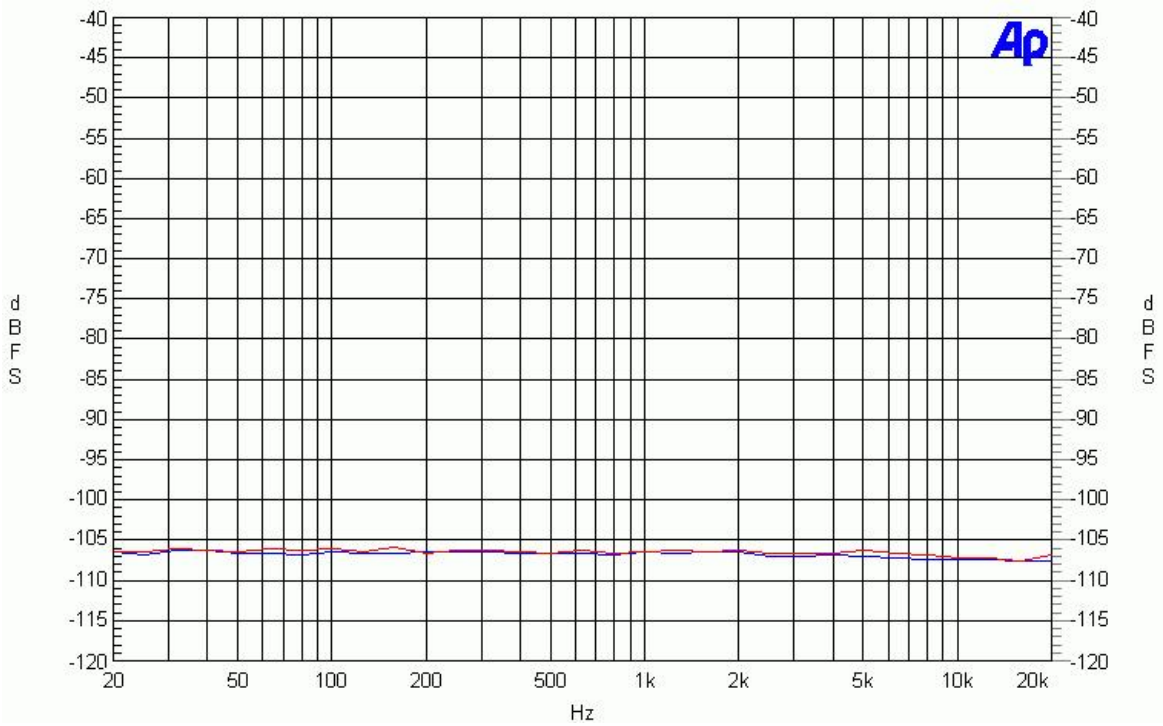


RM220-222 ADC Cross-Talk

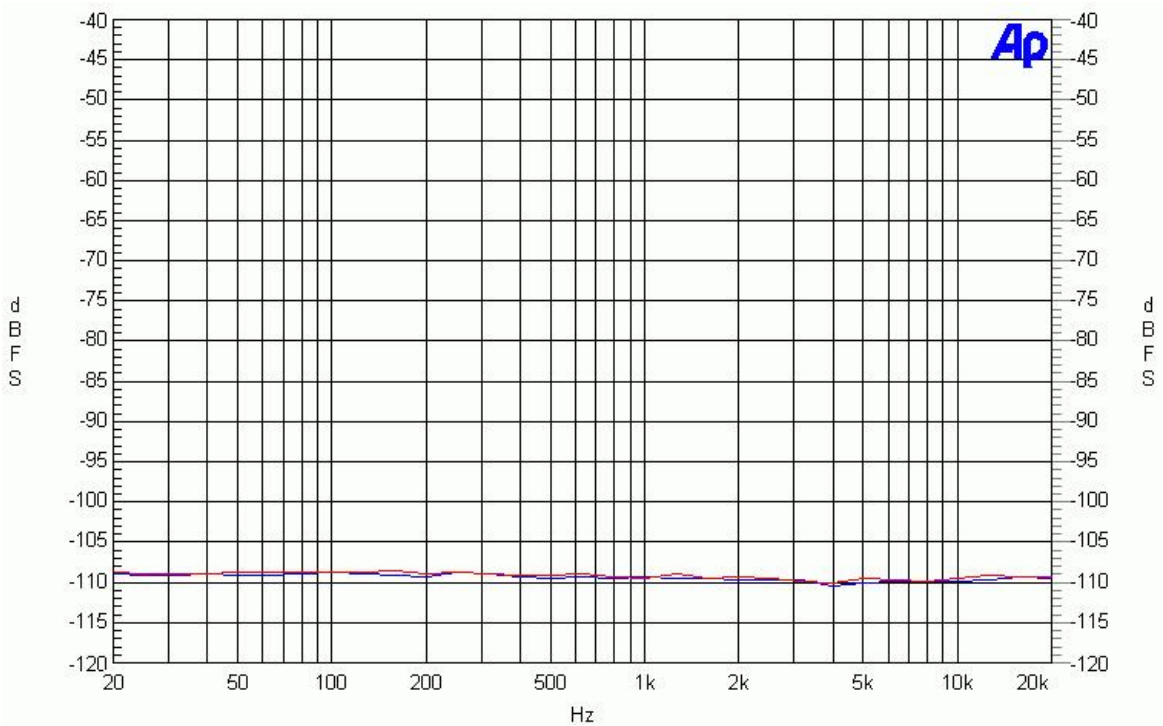
Measurement Plots RM220-222 Outputs



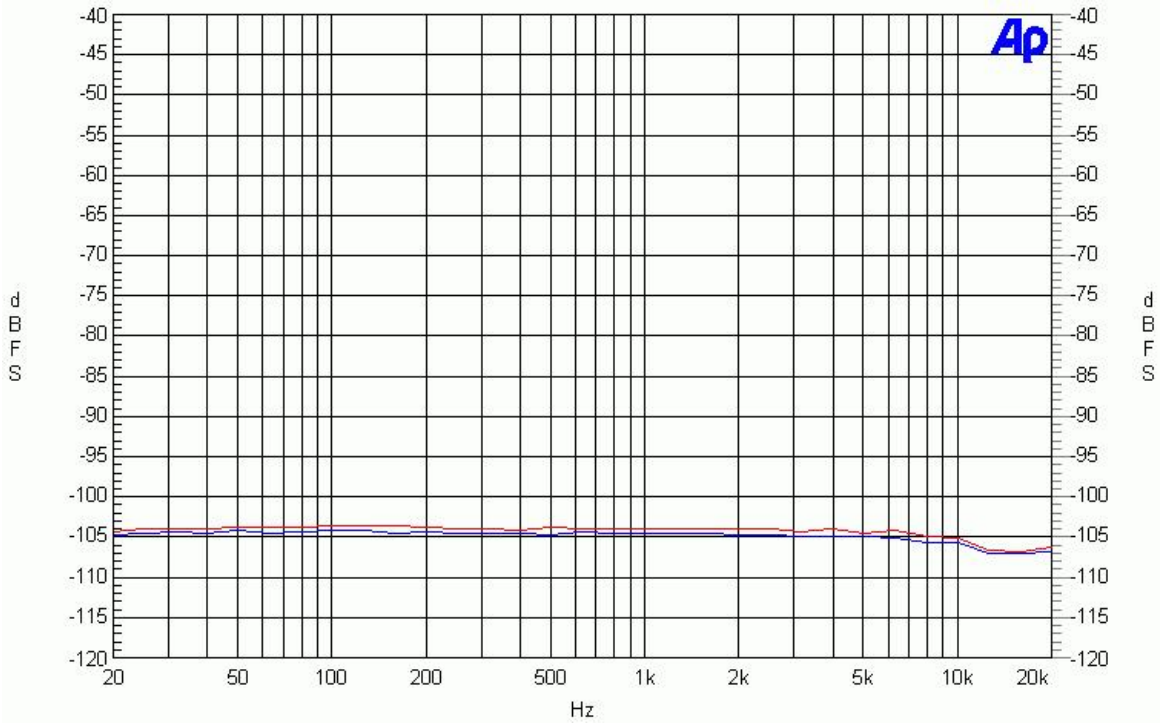
RM220-222 DAC Frequency Response



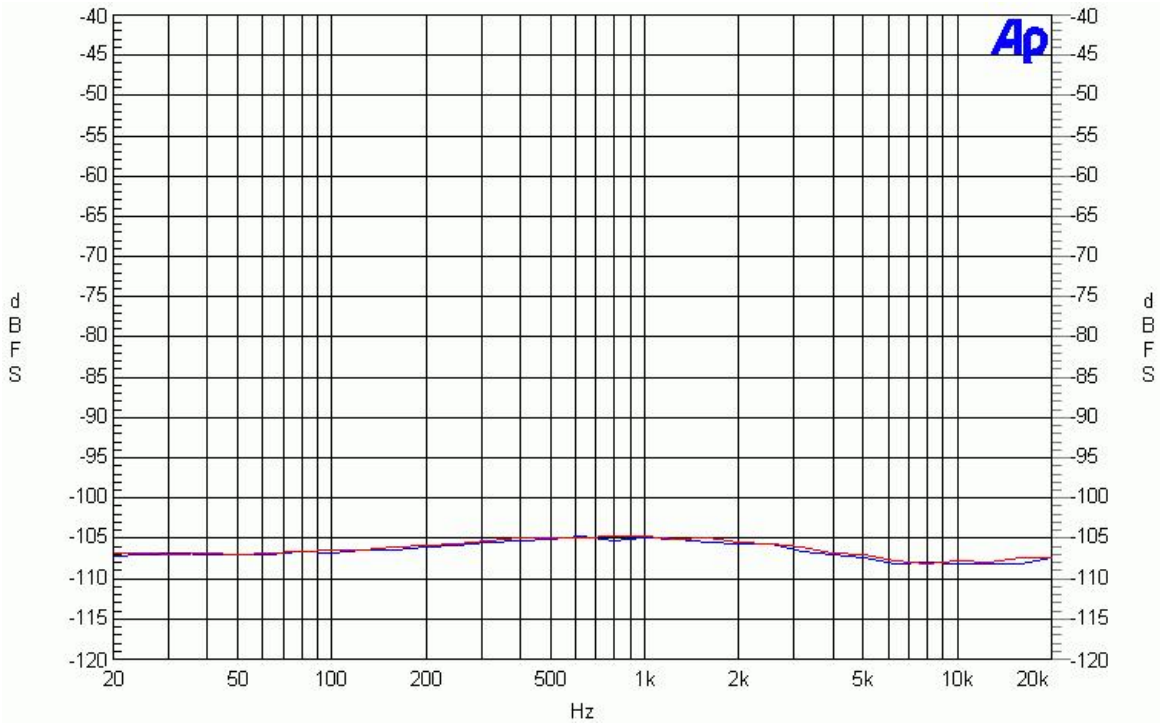
RM220-222 DAC THD+N @ -30 dBFS



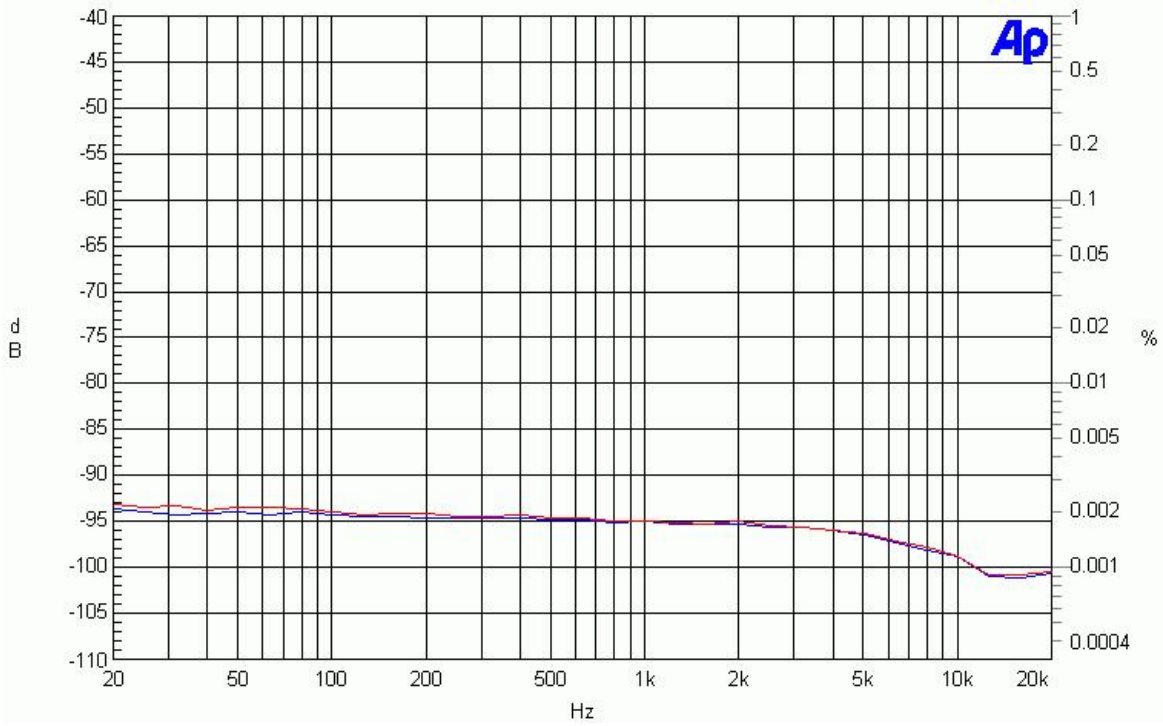
RM220-222 DAC THD+N(A) @ -30 dBFS



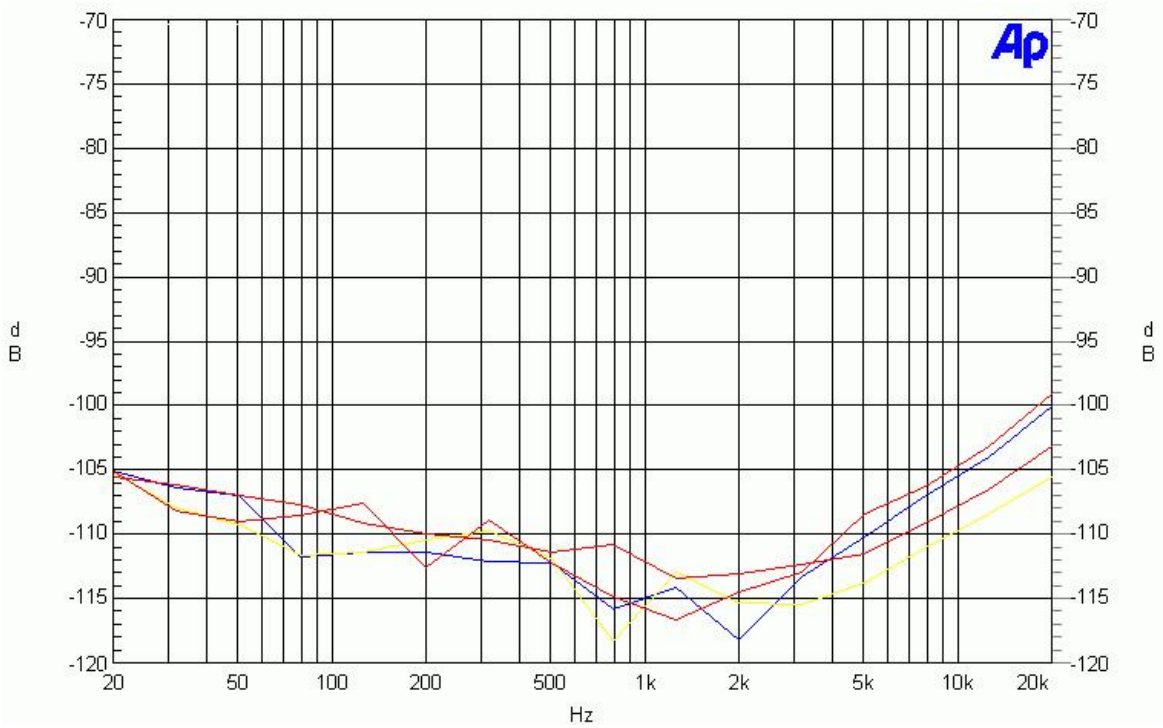
RM220-222 DAC THD+N @ +6 dBu



RM220-222 DAC THD+N(A) @ +6 dBu



RM220-222 R7 THD+N @ +14 dBu



RM220-222 DAC Cross-Talk

Log File Example

After manufacturing all inputs and outputs of every I/O card are measured. Hence, we can make sure that every module, leaving the production hall, is working correctly. During this process a log file is written. This file is saved by DHD for maintenance purposes.

In the following you can find a log file example of an RM220-222 module:

```
04-Apr-2005 10:40:08
*** Test RM220-222 R2  Production Code 3090 ***
open COM1
=== Test GPO1 ===
=== Test GPO2 ===
=== Test GPO3 ===
=== Test GPO4 ===
=== Test GPI1 ===
=== Test GPI2 ===
=== Test GPI3 ===
=== Test GPI4 ===
=== Voltage VCC2+ = 12.2 V ===
=== Voltage VCC2- = -12.2 V ===
=== Voltage VCC3 = 3.3 V ===
====================
=== Test A/D 1-2 ===
====================
-- Level 0dB --
Level(1kHz): L=-0.17 dB,  R=-0.18 dB
Polarity: (+)
Group Delay: L=81.6,  R=81.6 Samples
SNR:  L=87.6 dB,  R=87.8 dB
-- Dynamic -60dB --
Level(1kHz): L=-60.16 dB,  R=-60.18 dB
SNR:  L=31.4 dB,  R=31.4 dB
Input Dynamic:  L=102.4 dB,  R=102.4 dB
-- Input Balance --
CMR:  L=-57.7 dB,  R=-68.6 dB
====================
=== Test A/D 3-4 ===
====================
-- Level 0dB --
Level(1kHz): L=-0.16 dB,  R=-0.17 dB
Polarity: (+)
Group Delay: L=81.6,  R=81.6 Samples
SNR:  L=87.7 dB,  R=87.6 dB
-- Dynamic -60dB --
Level(1kHz): L=-60.13 dB,  R=-60.17 dB
SNR:  L=32.4 dB,  R=32.1 dB
Input Dynamic:  L=103.4 dB,  R=103.1 dB
-- Input Balance --
CMR:  L=-61.0 dB,  R=-52.6 dB
====================
=== Test D/A 1-2 ===
====================
-- Input Level 0dB --
Level(1kHz): L=0.29 dB,  R=0.31 dB
Polarity: (+)
Group Delay: L=81.6,  R=81.6 Samples
SNR:  L=86.9 dB,  R=86.9 dB
-- Dynamic +20dB Gain --
Level(1kHz): L=20.32 dB,  R=20.31 dB
SNR:  L=74.7 dB,  R=74.9 dB
Output Dynamic:  L=105.7 dB,  R=105.9 dB
-- Output Balance --
CMR:  L=-67.0 dB,  R=-95.1 dB
====================
=== Test D/A 3-4 ===
====================
-- Input Level 0dB --
Level(1kHz): L=0.30 dB,  R=0.33 dB
Polarity: (+)
Group Delay: L=81.6,  R=81.6 Samples
SNR:  L=86.7 dB,  R=86.6 dB
-- Dynamic +20dB Gain --
Level(1kHz): L=20.31 dB,  R=20.36 dB
SNR:  L=75.5 dB,  R=75.3 dB
Output Dynamic:  L=106.5 dB,  R=106.3 dB
-- Output Balance --
CMR:  L=-98.7 dB,  R=-60.2 dB
```

```
==============
=== EEPROM ===
==============
Updated Serialnumber = 40
************************
*** Test Succsessful ***
************************
04-Apr-2005 10:40:40
```

RM220-223 - Analog In/Out/GPIO Module, 4 ch.

Technical Specifications

A/D Converter

max. input level:	24 dBu (balanced)
input impedance:	approx. 10 kOhm
frequency response:	< 0.1 dB
THD+N:	< -109 dBFS (-30 dBFS)
	< -110 dBFS (-20 dBFS, +4 dBu)
	< -90 dBFS (-1 dBFS, +23 dBu)
crosstalk:	< -110 dB
dynamic range:	112dB (A-weighted)
common mode rejection:	> 60 dB
converter technology:	24 bit, oversampling sigma-delta

D/A Converter

max. output level (phones, single ended):	24 dBu (balanced)
output impedance:	approx. 25 Ohm
minimum load (outputs short circuit protected):	600 Ohm
frequency response:	< 0.15 dB
THD+N:	< -109 dBFS (-30 dBFS)
	< -110 dBFS (-20 dBFS, +4 dBu)
	< -85 dBFS (-1 dBFS, +23 dBu)

D/A Converter

crosstalk:	< -90 dB
dynamic range:	112dB (A-weighted)
DC offset voltage:	< 10 mV
common mode rejection (output impedance):	> 60 dB
common mode rejection (output voltage):	> 40 dB
converter technology:	24 bit, oversampling sigma-delta

General Purpose Inputs / Outputs (GPI/GPO)

4 GPIs (not isolated TTL-Inputs):	internal pull up resistor 10k ohms to 5 V for connecting of external push buttons against GND maximum voltage 5V DC when used with TTL input signal
4 GPOs (open collector, non isolated):	maximum rated current: 0,2A (resettable fuse), maximum peak switched voltage: 24 V DC

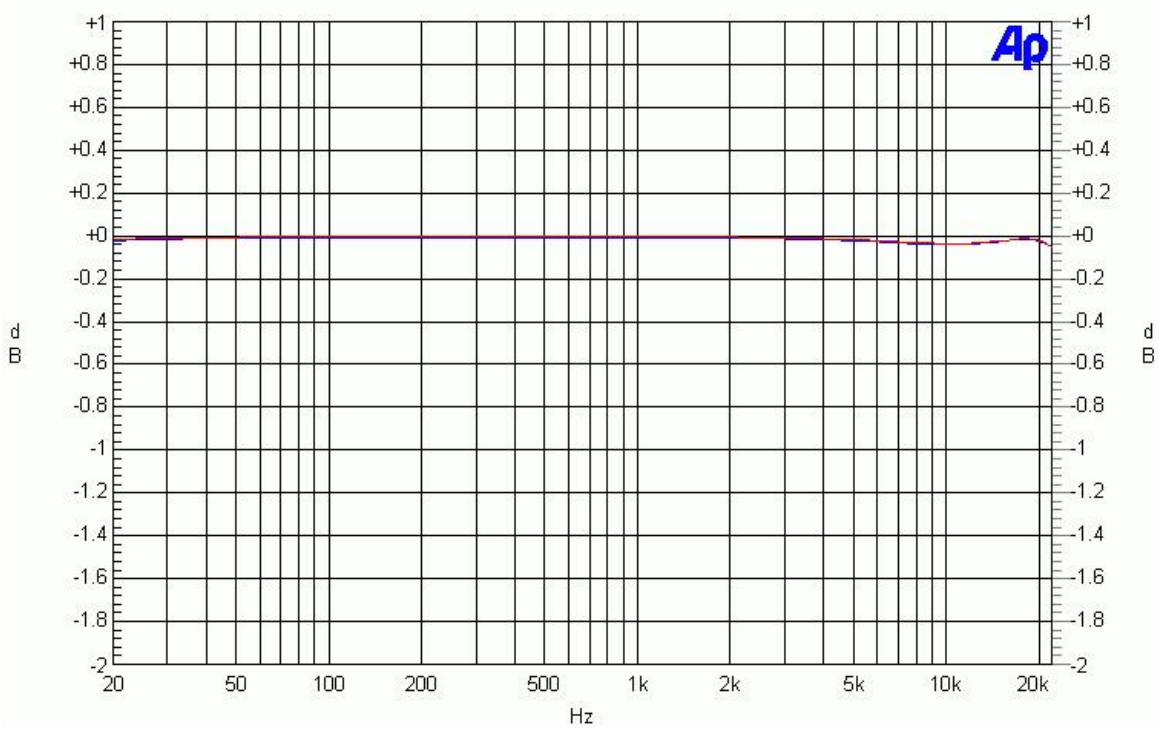
Further Information

power consumption:	2,4 W (typical)
connector style:	RJ45
printed circuit board (PCB) revision for this specifications:	r7

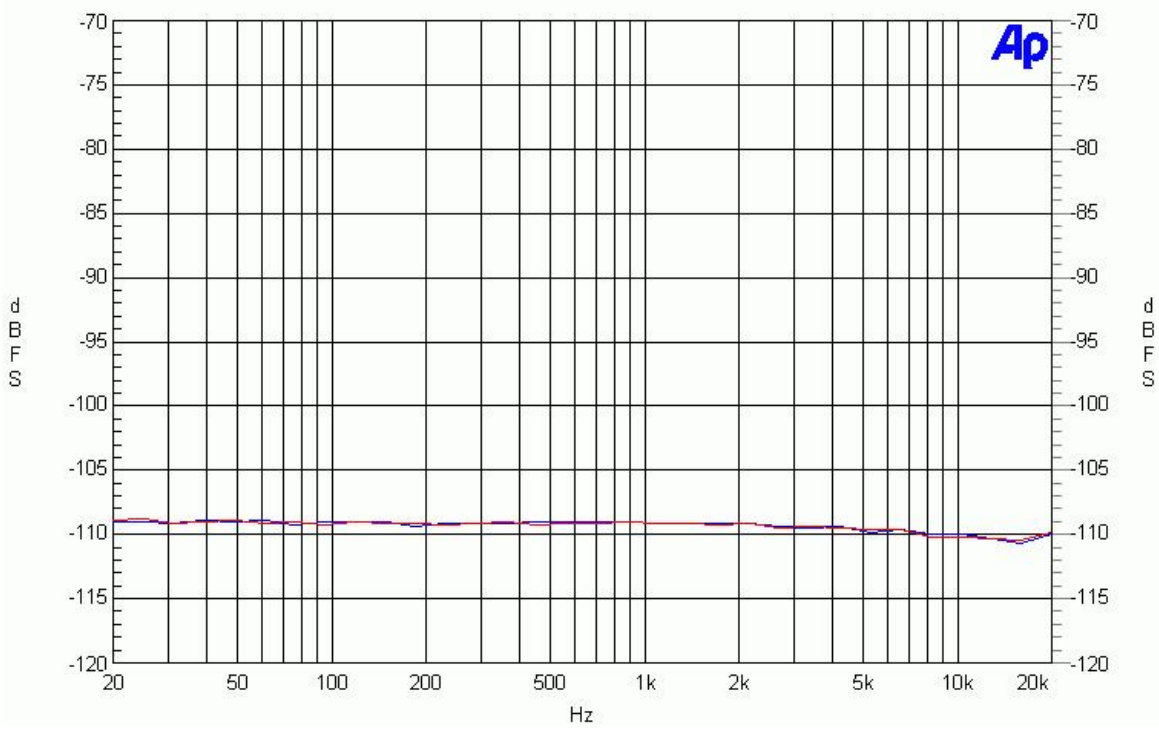
Note

All values are typical values, regarding the factory test limits, you can find in the log file example.

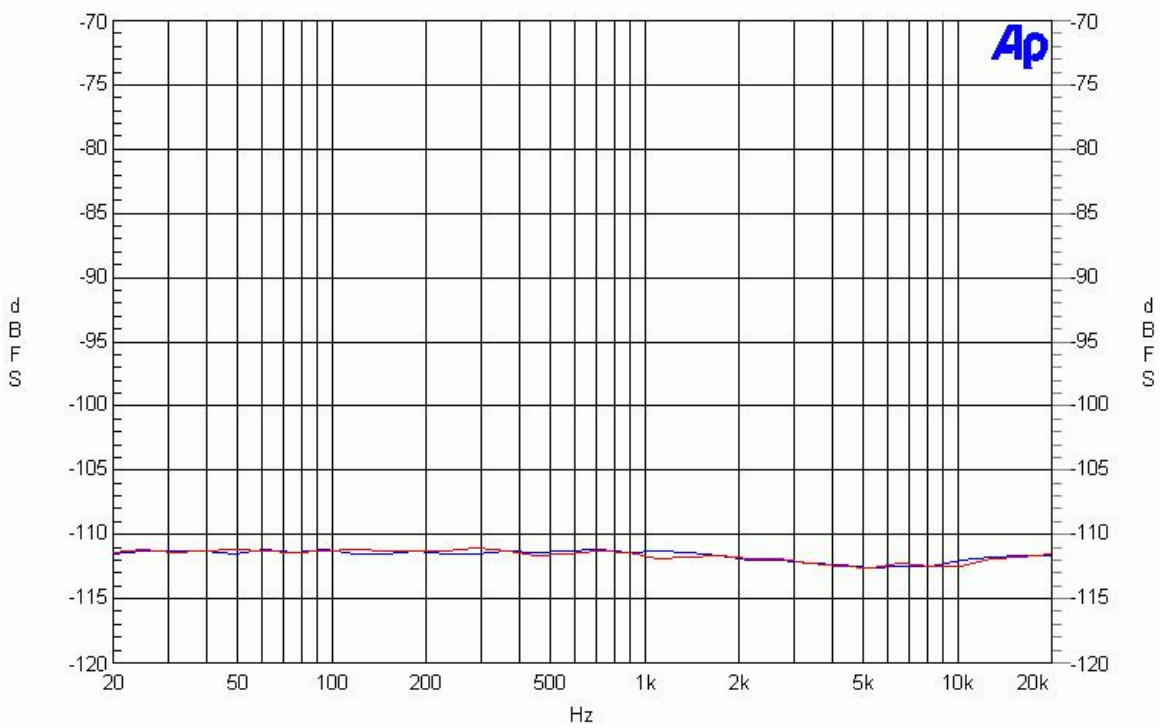
Measurement Plots RM220-223 Inputs



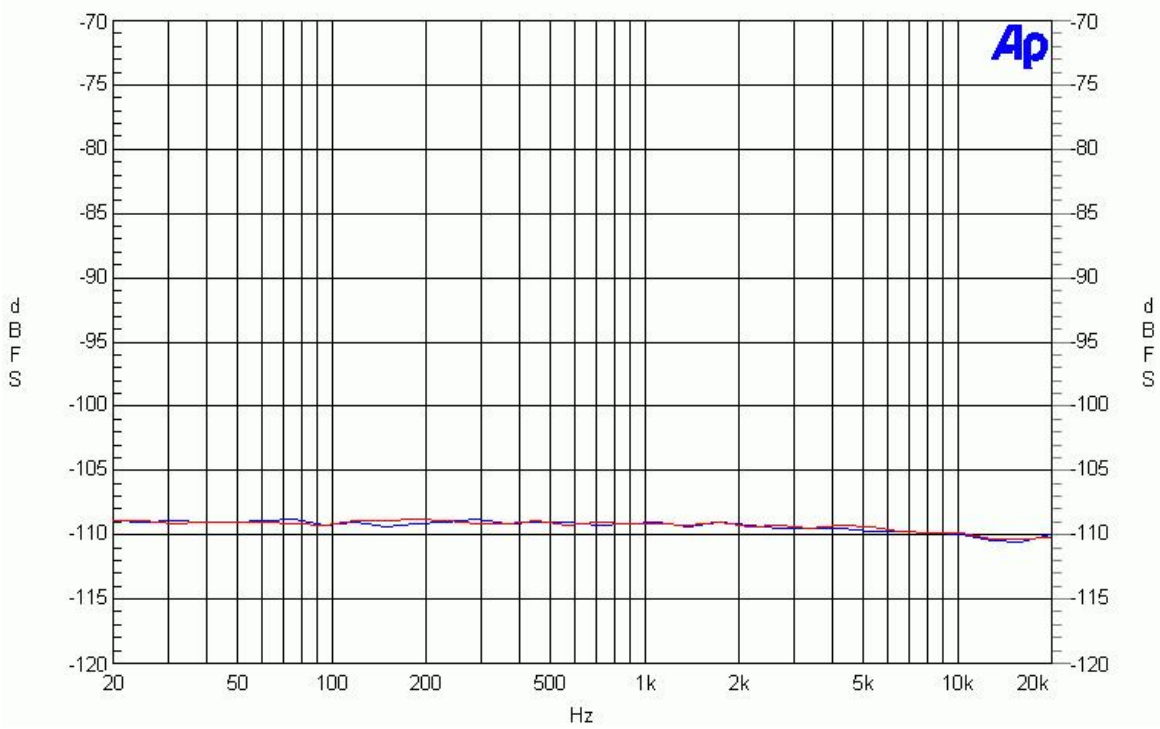
RM220-223 ADC Frequency Response



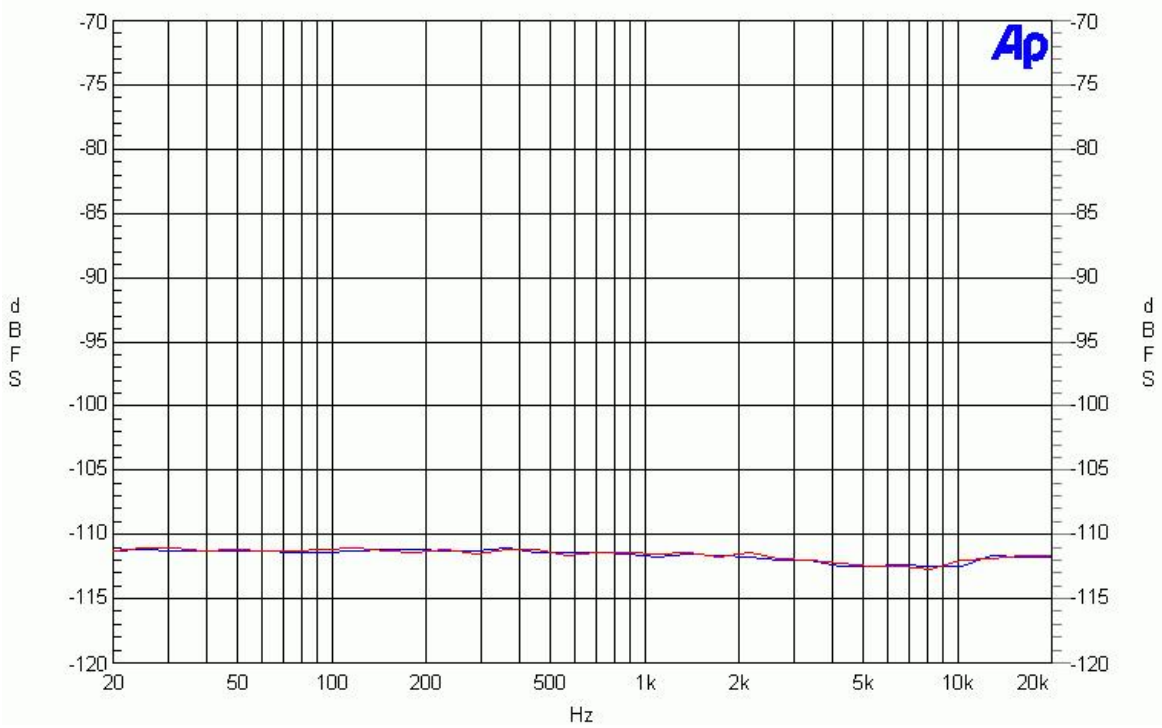
RM220-223 ADC THD+N @ -30 dBFS



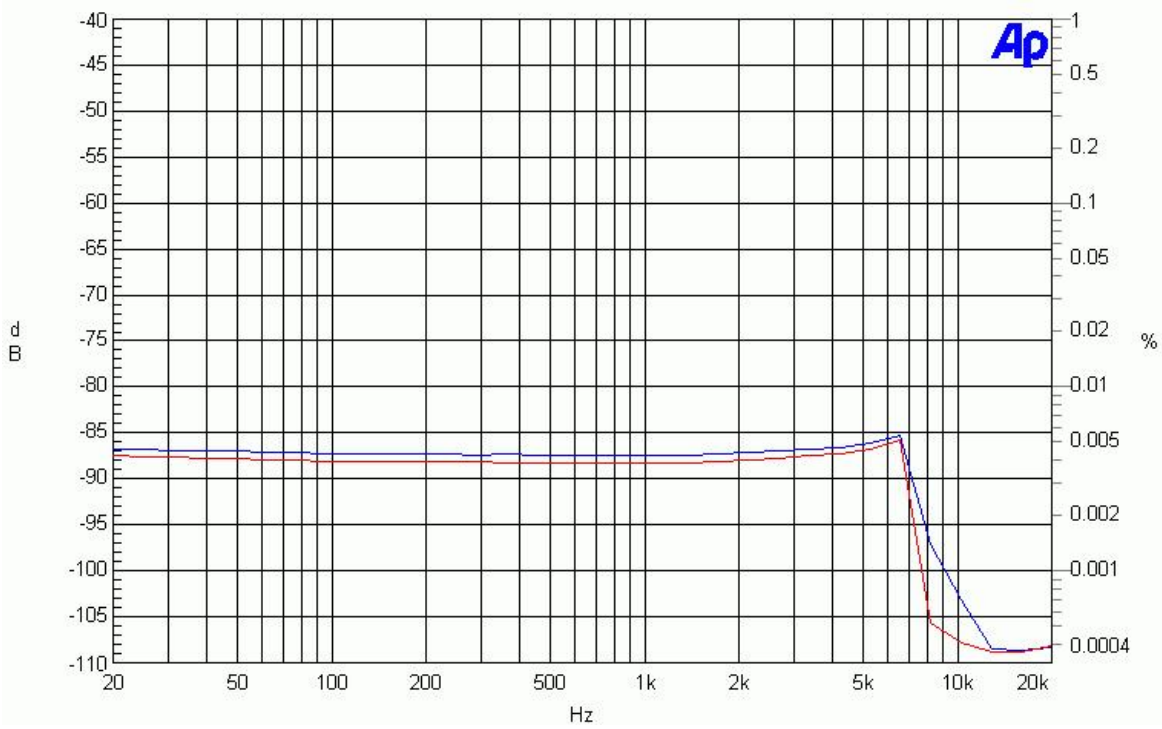
RM220-223 ADC THD+N(A) @ -30 dBFS



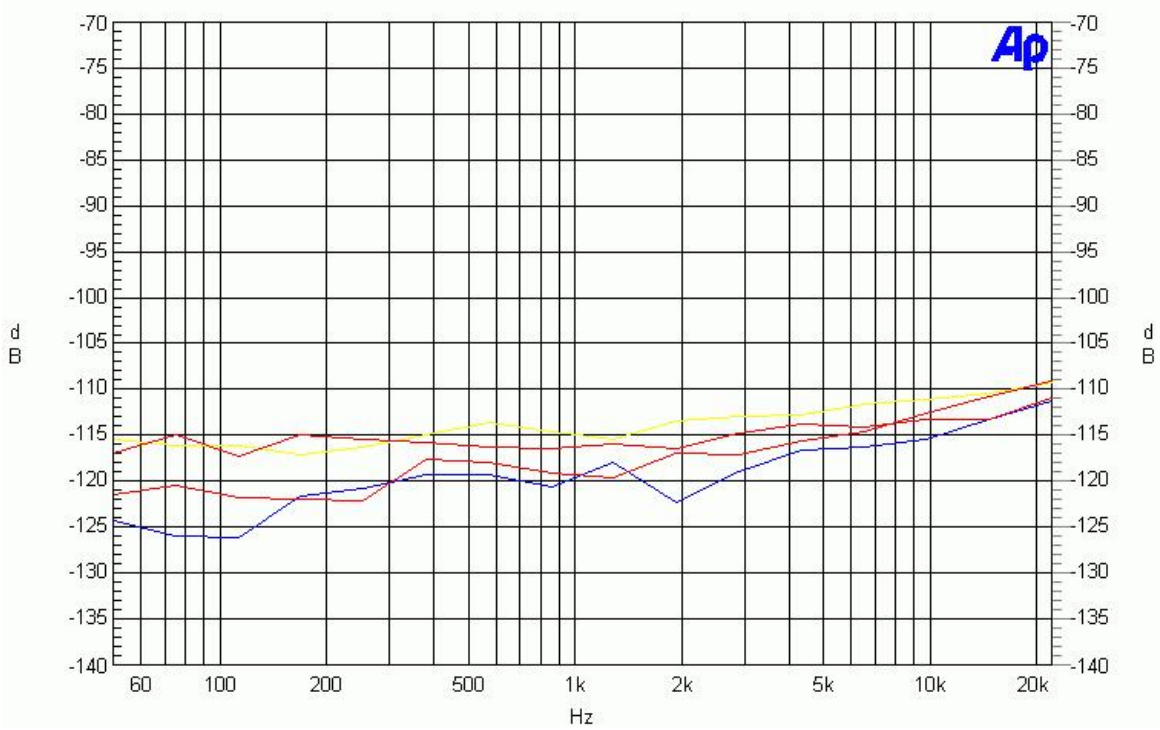
RM220-223 ADC THD+N @ +4 dBu



RM220-223 ADC THD+N(A) @ +4 dBu

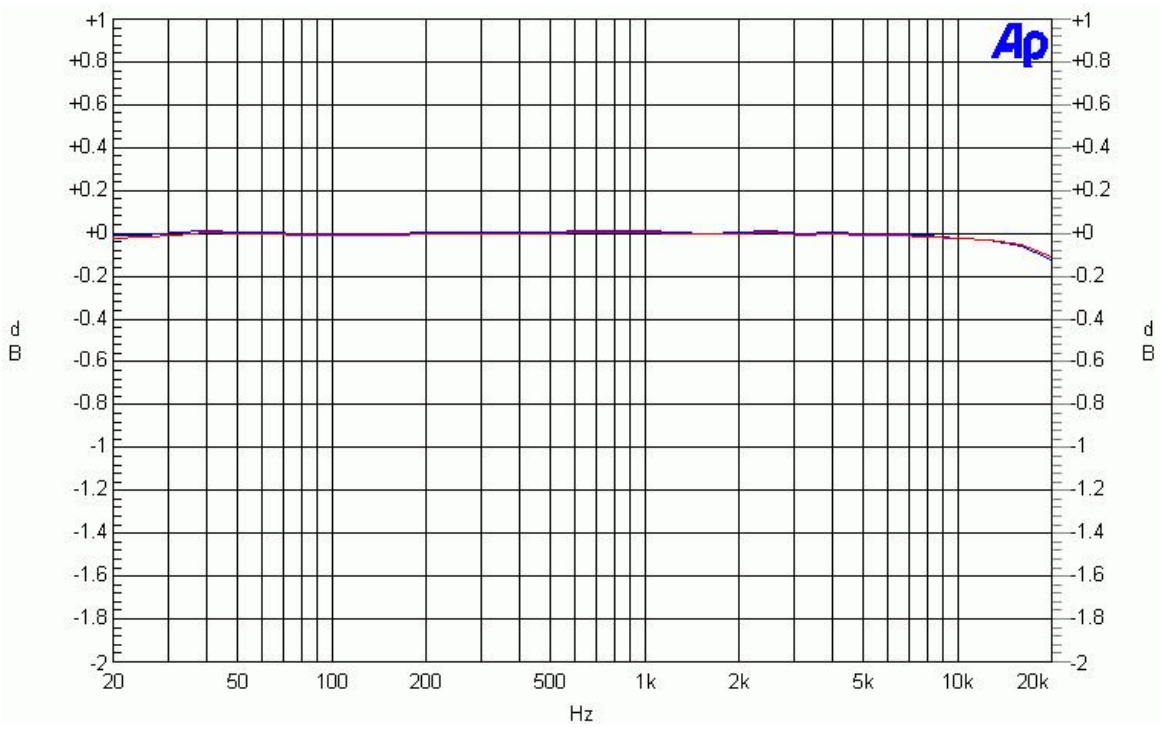


RM220-223 ADC THD+N @ +23 dBu

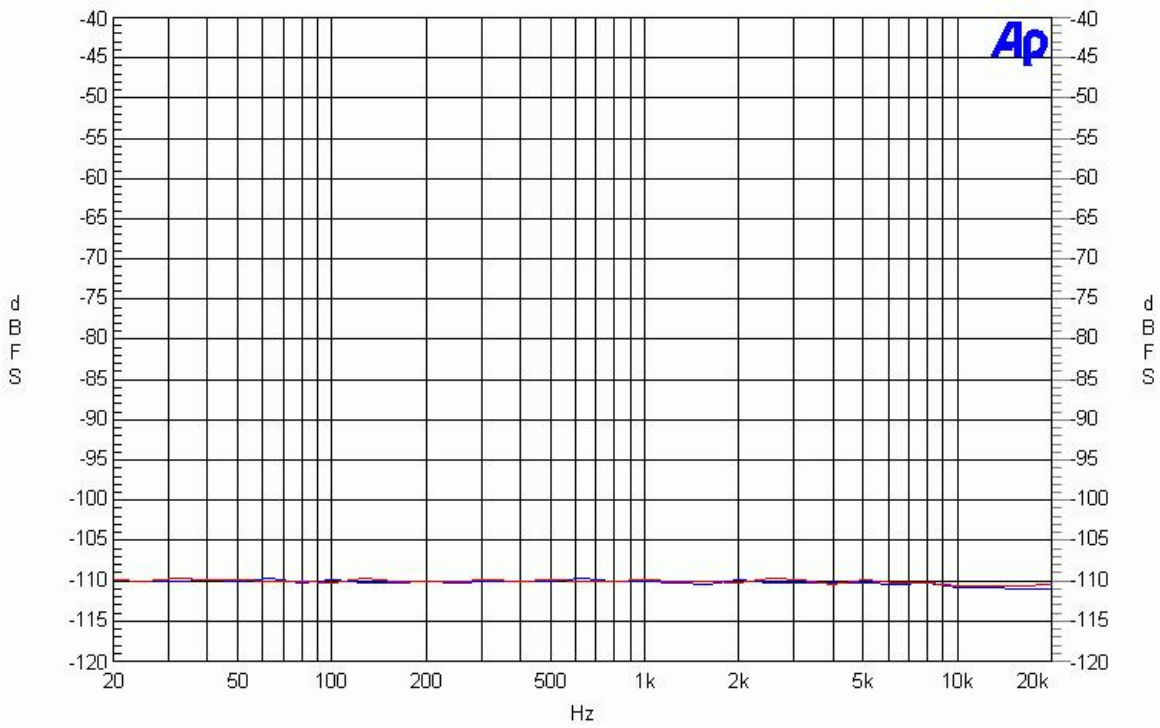


RM220-223 ADC Cross-Talk

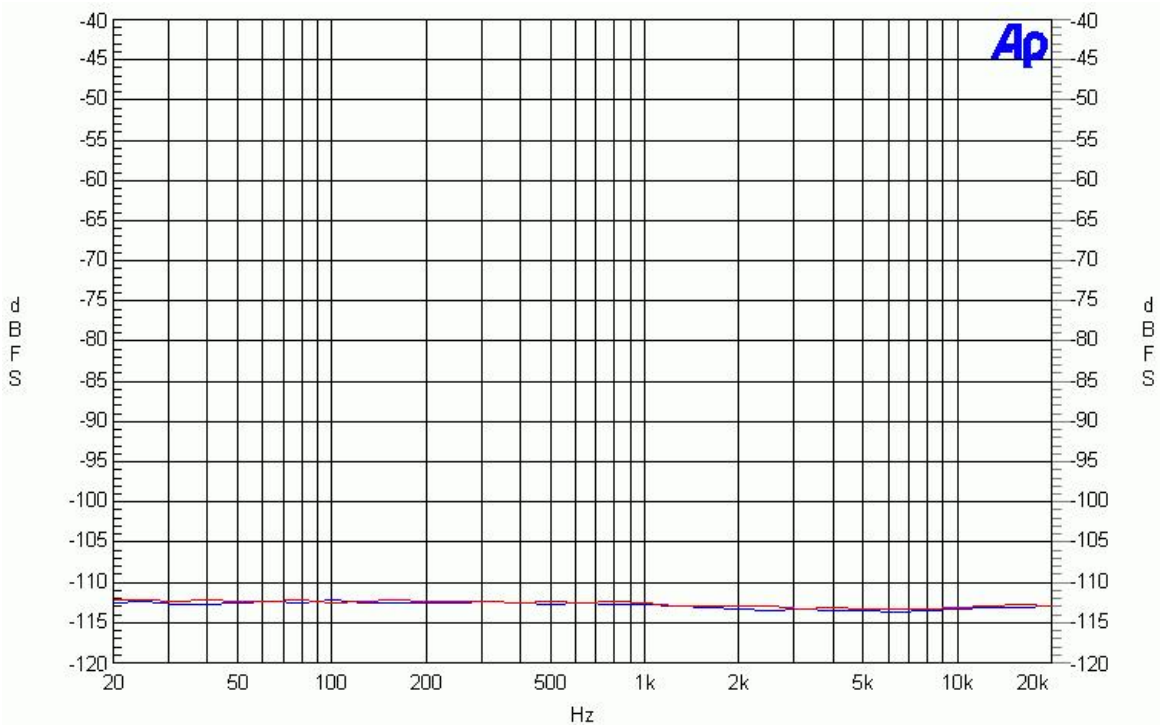
Measurement Plots RM220-223 Outputs



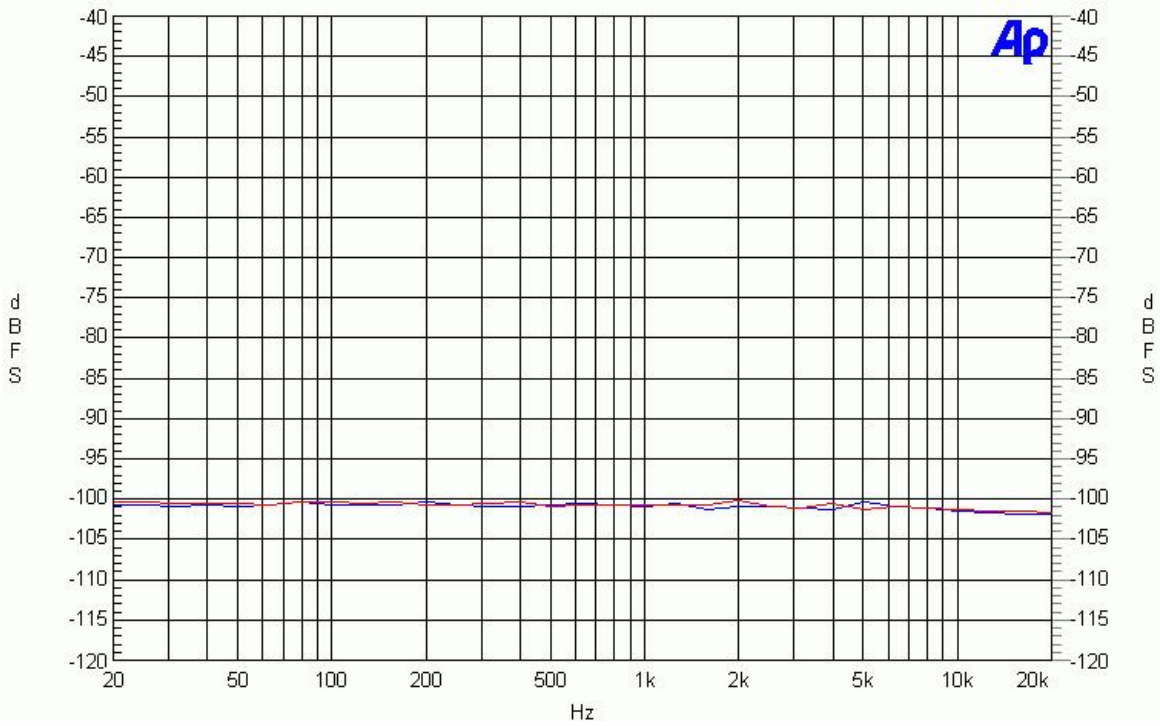
RM220-223 DAC Frequency Response



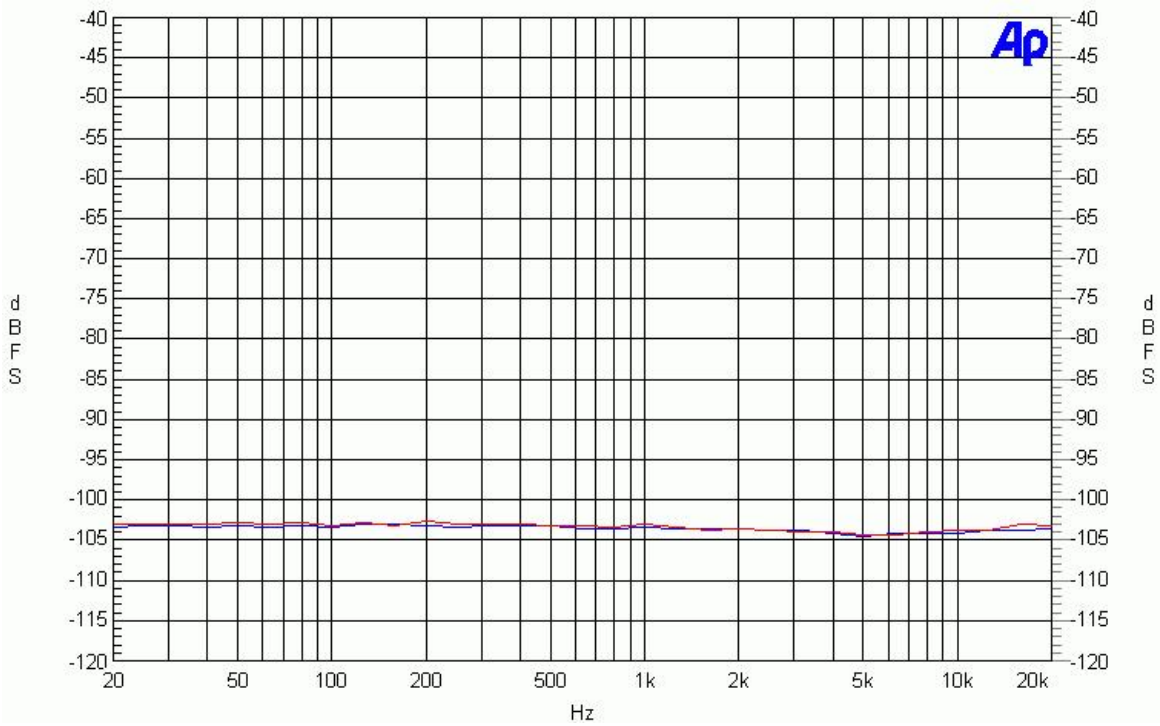
RM220-223 DAC THD+N @ -30 dBFS



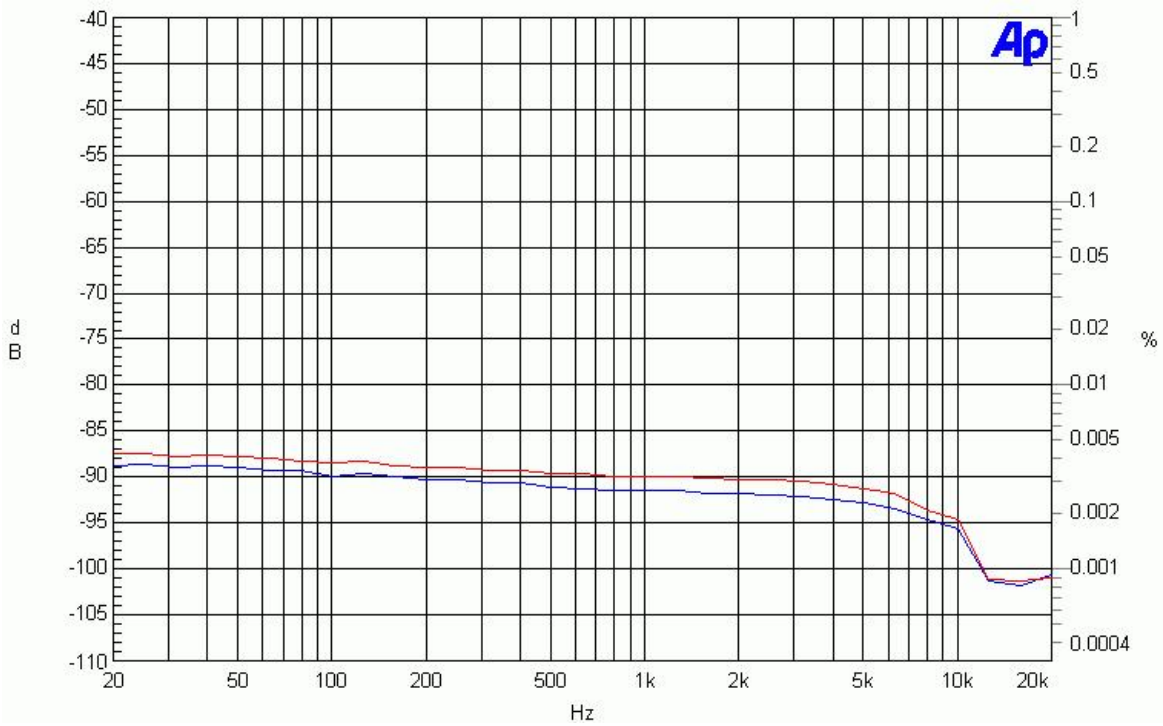
RM220-223 DAC THD+N(A) @ -30 dBFS



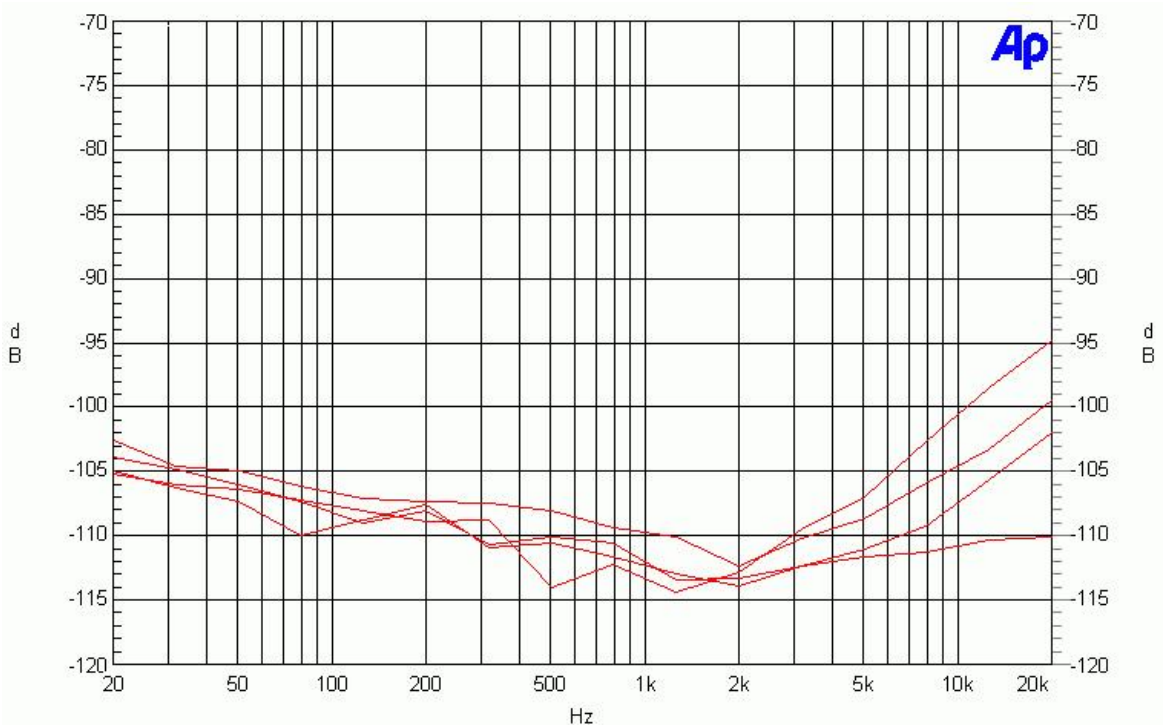
RM220-223 DAC THD+N @ +4 dBu



RM220-223 DAC THD+N(A) @ +4 dBu



RM220-223 DAC THD+N @ -1 dBFS



RM220-223 DAC Cross-Talk

Log File Example

After manufacturing all inputs and outputs of every I/O card are measured. Hence, we can make sure that every module, leaving the production hall, is working correctly. During this process a log file is written. This file is saved by DHD for maintenance purposes.

In the following you can find a log file example of an RM220-223 module:

```
22-Mar-2007 11:51:52
*** Test RM220-223 R3  Production Code 7309 ***
open COM1
=== Test GPO1 ===
=== Test GPO2 ===
=== Test GPO3 ===
=== Test GPO4 ===
=== Test GPI1 ===
=== Test GPI2 ===
=== Test GPI3 ===
=== Test GPI4 ===
=== Voltage VCC15+ = 14.5 V ===
=== Voltage VCC15- = -14.0 V ===
=== Voltage VCC3 = 3.3 V ===
====================
=== Test A/D 1-2 ===
====================
-- Level 0dB (Input max. 15 dBu) --
Level(1kHz): L=2.76 dB,  R=2.75 dB
Polarity: (+)
Group Delay: L=63.4,  R=63.4 Samples
SNR:  L=83.1 dB,  R=83.3 dB
-- Level 0dB (Input max. 18 dBu) --
Level(1kHz): L=-0.49 dB,  R=-0.51 dB
Polarity: (+)
Group Delay: L=63.3,  R=63.4 Samples
SNR:  L=83.9 dB,  R=83.9 dB
-- Level 0dB (Input max. 21 dBu) --
Level(1kHz): L=-3.26 dB,  R=-3.28 dB
Polarity: (+)
Group Delay: L=63.3,  R=63.3 Samples
SNR:  L=84.2 dB,  R=84.2 dB
-- Level 0dB (Input max. 24 dBu) --
Level(1kHz): L=-6.61 dB,  R=-6.62 dB
Polarity: (+)
Group Delay: L=63.3,  R=63.3 Samples
SNR:  L=84.3 dB,  R=84.6 dB
-- Dynamic -60dB --
Level(1kHz): L=-60.52 dB,  R=-60.49 dB
SNR:  L=36.9 dB,  R=37.1 dB
Input Dynamic:  L=107.8 dB,  R=108.1 dB
-- Input Balance --
CMR:  L=-49.2 dB,  R=-60.5 dB
====================
=== Test A/D 3-4 ===
====================
-- Level 0dB (Input max. 15 dBu) --
Level(1kHz): L=2.77 dB,  R=2.76 dB
Polarity: (+)
Group Delay: L=63.4,  R=63.4 Samples
SNR:  L=86.1 dB,  R=86.3 dB
-- Level 0dB (Input max. 18 dBu) --
Level(1kHz): L=-0.49 dB,  R=-0.50 dB
Polarity: (+)
Group Delay: L=63.4,  R=63.4 Samples
SNR:  L=86.4 dB,  R=86.4 dB
-- Level 0dB (Input max. 21 dBu) --
Level(1kHz): L=-3.25 dB,  R=-3.27 dB
Polarity: (+)
Group Delay: L=63.3,  R=63.3 Samples
SNR:  L=86.5 dB,  R=86.5 dB
-- Level 0dB (Input max. 24 dBu) --
Level(1kHz): L=-6.60 dB,  R=-6.61 dB
Polarity: (+)
Group Delay: L=63.3,  R=63.3 Samples
SNR:  L=85.8 dB,  R=86.2 dB
-- Dynamic -60dB --
Level(1kHz): L=-60.47 dB,  R=-60.51 dB
SNR:  L=37.1 dB,  R=37.2 dB
Input Dynamic:  L=108.1 dB,  R=108.2 dB
```

```
-- Input Balance --
CMR:  L=-55.7 dB,  R=-55.1 dB
====================
=== Test D/A 1-2 ===
====================
-- Level 0dB (Input max. 15 dBu) --
Level(1kHz): L=-2.46 dB,  R=-2.49 dB
Polarity: (+)
Group Delay: L=83.4,  R=83.4 Samples
SNR:  L=85.1 dB,  R=84.9 dB
-- Level 0dB (Input max. 18 dBu) --
Level(1kHz): L=0.62 dB,  R=0.58 dB
Polarity: (+)
Group Delay: L=83.4,  R=83.4 Samples
SNR:  L=87.9 dB,  R=87.4 dB
-- Level 0dB (Input max. 21 dBu) --
Level(1kHz): L=3.43 dB,  R=3.40 dB
Polarity: (+)
Group Delay: L=83.4,  R=83.4 Samples
SNR:  L=86.3 dB,  R=86.1 dB
-- Level 0dB (Input max. 24 dBu) --
Level(1kHz): L=6.04 dB,  R=6.01 dB
Polarity: (+)
Group Delay: L=83.4,  R=83.4 Samples
SNR:  L=86.5 dB,  R=85.8 dB
-- Dynamic +20dB Gain --
Level(1kHz): L=20.66 dB,  R=20.59 dB
SNR:  L=73.8 dB,  R=72.6 dB
!!! SNR Fehler (Limit  75.0 dB)
Output Dynamic:  L=104.8 dB,  R=103.5 dB
-- Dynamic +20dB Gain --
Level(1kHz): L=20.66 dB,  R=20.59 dB
SNR:  L=77.5 dB,  R=77.6 dB
Output Dynamic:  L=108.4 dB,  R=108.6 dB
-- Output Balance --
CMR:  L=-62.1 dB,  R=-85.7 dB
====================
=== Test D/A 3-4 ===
====================
-- Level 0dB (Input max. 15 dBu) --
Level(1kHz): L=-2.44 dB,  R=-2.50 dB
Polarity: (+)
Group Delay: L=83.4,  R=83.4 Samples
SNR:  L=86.4 dB,  R=85.6 dB
-- Level 0dB (Input max. 18 dBu) --
Level(1kHz): L=0.62 dB,  R=0.57 dB
Polarity: (+)
Group Delay: L=83.4,  R=83.4 Samples
SNR:  L=89.4 dB,  R=87.7 dB
-- Level 0dB (Input max. 21 dBu) --
Level(1kHz): L=3.45 dB,  R=3.39 dB
Polarity: (+)
Group Delay: L=83.4,  R=83.4 Samples
SNR:  L=88.8 dB,  R=87.8 dB
-- Level 0dB (Input max. 24 dBu) --
Level(1kHz): L=6.05 dB,  R=5.99 dB
Polarity: (+)
Group Delay: L=83.4,  R=83.4 Samples
SNR:  L=87.4 dB,  R=87.0 dB
-- Dynamic +20dB Gain --
Level(1kHz): L=20.64 dB,  R=20.60 dB
SNR:  L=41.6 dB,  R=70.2 dB
!!! SNR Fehler (Limit  75.0 dB)
Output Dynamic:  L=72.6 dB,  R=101.2 dB
-- Dynamic +20dB Gain --
Level(1kHz): L=20.64 dB,  R=20.60 dB
SNR:  L=77.6 dB,  R=77.7 dB
Output Dynamic:  L=108.6 dB,  R=108.7 dB
-- Output Balance --
CMR:  L=-67.8 dB,  R=-74.4 dB
==============
=== EEPROM ===
==============
New Serialnumber = 3820
************************
*** Test Succsessful ***
************************
22-Mar-2007 11:52:54
```

Index

A

D

F

H

I

M

O

R

S

T