# Integrated Audio Power ALC0180

## Audio Line integrated solution combining high-end Amplifier and Power Supply, 2x90W RMS, 1x180W Peak

# Features:

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- 2x90Wrms/4ohm @ 1% THD
- 1x180W/8ohm bridged mode @ 1% THD
- 2x50Wrms/8ohm @ 1% THD
- Residual noise <40uVrms unweighted
- 20Hz – 35kHz +/- 0.5dB ( -3dB @ 60kHz )
- Cross Talk 80dB @ 1kHz and 1W
- THD+N <0,05% up to 75Wrms/4ohm @ 6,67kHz
- +/- supply outputs for front end /crossover
- 8V stand by output for signal sensing circuit
- <1W stand by mode when delivering 150mW to signal sensing circuitry
- Over current protection
- Over temperature protection
- Over voltage protection
- 115/230VAC - jumper selectable
- Meets CISPR22 on conducted and radiated emissions

# Overview

### Overview:

The ALC180 is designed to meet the high requirements from manufacturers of state-of-the-art consumer and professional electronics, where audio performance and system integration is key. The ALC0180 comes as an open frame unit making it easy to integrate into a wide range of product from active speakers through to home audio products. The ALC0180 offers both stereo and bridged mono configuration for maximum flexibility.

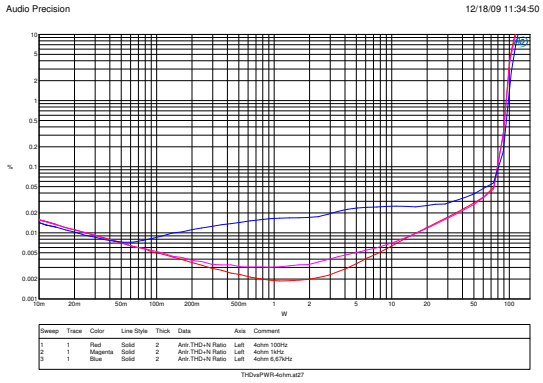
The module is based on a phase shift modulated topology with advanced protection circuitry. This topology shows very low distortion figures and because of its simplicity and robustness the finished products are very attractive both when it comes to functionality and cost.

A powerful switch mode power supply giving 180Wrms power with 360W peak output power for short periods of time to cover the reality of music.
The power supply is inherently designed for ultra low noise making it well suited to the demands of audio and consumer electronic products. It also delivers +/- supplies to an external PCB, for example a cross over board or pre amplifier board in a dual mono integrated amplifier.

The built in over current protection has two modes. During transients into the current limit threshold it allows constant output current but if this condition persists it goes into burst mode. This guarantees that the amplifier does not create audio holes during heavy listening but still effectively protects it during short circuiting. The thermal protection contains a sensor connected to the very tab of one of the output devices giving a very fast detection and shut down at over load.

### Audio performance:

The amplifier technology in this module range is a globally modulated self oscillating topology which controls the signal directly at the output. The flat, load independent frequency response, high bandwidth, low distortion, low noise and perfect transient response makes it suitable for the most demanding applications. This state of the art amplifier topology is combined with a robust, low EMI, ultra efficient power supply giving the total system an efficiency of around 85% at full power. With the built in standby supply it is an easy task to make it consume less than 1W in standby mode.



## Absolute maximum ratings

| | | |
|---|---|---|
| Mains voltage | 132/265 | VAC |
| Mains frequency range 85VAC - 265VAC | 45-65 | Hz |
| Input voltage DIS | +/-15 | V |
| Input signal, balanced | +/-10 | V |
| Input signal unbalanced (between either input and ground) | +/-10 | V |
| Maximum output current on VA+ | 300 | mA |
| Maximum output current on VA- | 300 | mA |
| Ambient temperature | -25 to +70 | °C |

## Recommended operating conditions

| | | |
|---|---|---|
| Mains voltage[1] | 115/230 | VAC |
| Mains frequency range 85VAC - 265VAC | 45-65 | Hz |
| Input voltage DIS | +8 | V |
| Ambient temperature | 0 to +55 | °C |

[1] *Settable with jumper*

## Electrical characteristics - Power supply/amplifier

Unless otherwise mentioned, the supply voltage is set at 230VAC during the measurements and the outputs are loaded with 4 ohm.

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Voltage range 115V setting | Full performance | 92[2] | - | 132 | VAC |
| Voltage range 230V setting | Full performance | 185[2] | - | 265 | VAC |
| Offset voltage | Open inputs | - | 5 | 40 | mV |
| Switching frequency | Idle | 440 | 460 | 480 | kHz |
| Switching residual | | - | 700 | - | mVpk |
| Idle consumption | Measured on the mains input | - | 8 | - | W |
| Efficiency | 1kHz, 2x50Wrms into 8 ohm | - | 84 | - | % |
| Recommended load SE mode | | 4 | - | - | Ω |
| Recommended load BTL mode | | 8 | - | - | Ω |
| Gain | f=1kHz | - | 22,7 | - | dB |
| Idle noise | A-weighted 20Hz<f<20kHz | - | 20 | - | µV |
| Upper BW limit (-3dB) | | - | 60 | - | kHz |
| Lower BW limit (-3dB) | | - | - | - | Hz |
| Output impedance | f = 100Hz | - | 3 | - | mΩ |
| Positive auxiliary supply fluctuation throughout the entire voltage range. | Amplifier loaded with 100W at 20Hz | 9,5 | - | 15 | VDC |
| Negative auxiliary supply fluctuation throughout the entire voltage range. | Amplifier loaded with 100W at 20Hz | -9,5 | - | -14,5 | VDC |
| Standby output voltage | | 7,0 | | 10,5 | VDC |

[2] *The Ableteс ALC0180 will operate at lower levels but the output power will be reduced. If the off-line voltage is too low the Ableteс ALC0180 switches off.*

## Electrical characteristics - Protection

Unless otherwise mentioned, the supply voltage is set at 115VAC/230VAC during the measurements.

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Over temperature threshold | Connected to the drain tab of the high side power FET | 100 | 105 | 110 | °C |
| Over current threshold | Measured when driving 0,5 ohm with 1kHz burst signal | - | 9 | - | A |
| Disable source current | Current needed to pull up the disable pin | - | - | 60 | µA |
| Disable threshold | Voltage at the disable pin for deactivation of the amplifier | 3 | - | 4 | V |
| Disable release threshold | Voltage at the disable pin for activation of the amplifier | 0 | - | 1,5 | V |
| Status output high | Logic circuit supplied with 4,7V zener regulator. | 4,5 | - | 4,9 | VDC |



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## Standby functionality

ALC0180 contains a standby converter which makes it consume <1W in standby mode. When ALC0180 is put in standby by raising DISABLE high the internal consumption leaves a minimum of 150mW for the user for detecting if there is an input signal present or if the remote control is sending a signal etc. The standby voltage present on Pin 1 of CON2 is loosely regulated to +8V.

## VA+ and VA-

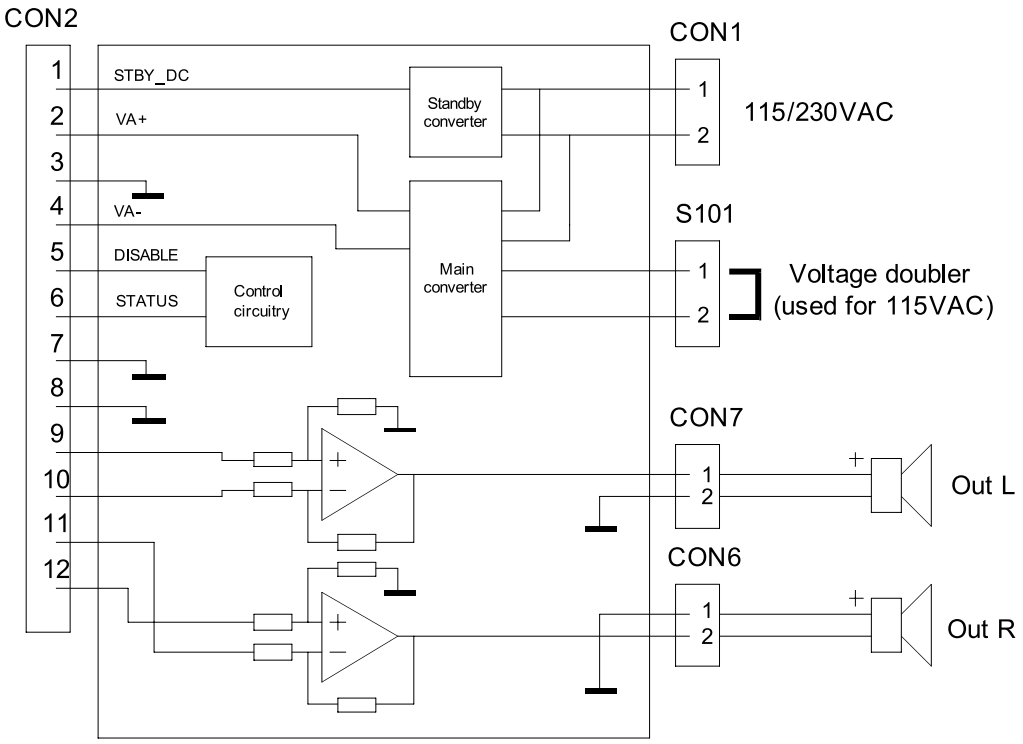
ALC0180 generates auxiliary supplies that can be used to supply a front end board. They can deliver approximately 6W of power which is enough for most applications. These outputs are non regulated meaning that they vary with mains voltage variations and load. However, this variation is only at low frequency and hence will cause no audible artefacts even when low cost OPAMPs are used. If this variation is unwanted they can be easily regulated to +/-5VDC or up to +/-8VDC.

## Rail pumping cancellation

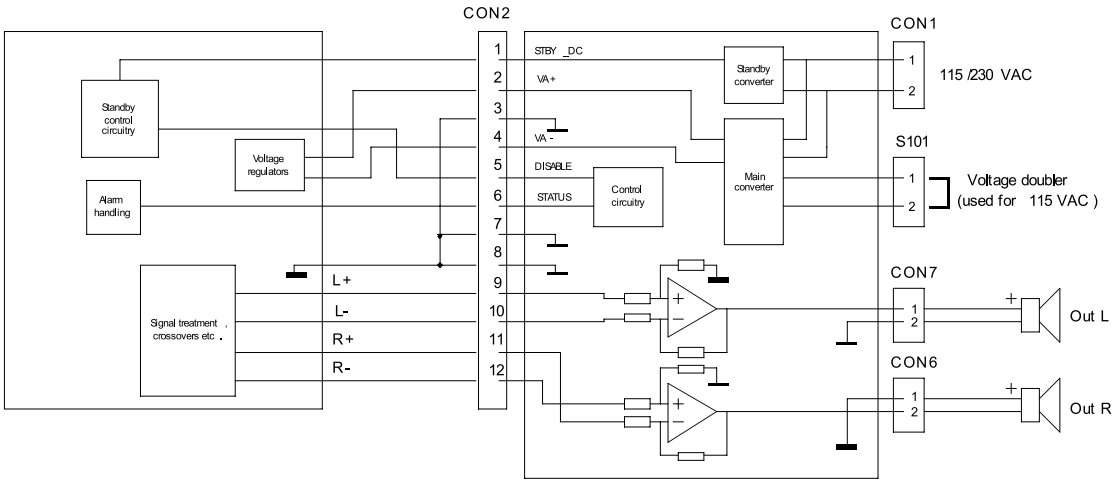
Single ended class d amplifiers are different from single ended class b amplifiers in that they cause what is called rail pumping. Every class d amplifiers contain a choke in the output filter. When for example an output signal which corresponds to 80% of the total supply voltage (between the positive and negative rails) is generated the audio output current is highly positive. The PWM pulse before the output filter is then positive 80% of the switch period and negative 20% of the switch period. Since the choke continues to drive this current during the time it is connected to the negative rail it works as a boost hence increasing the absolute value of the negative rail. When the output signal becomes negative this added energy is consumed, and the positive rail is boosted instead, but if the generated frequency is very low, the time during which the rails are boosted is long and therefore the rail voltage can increase significantly.

ALC0180 is protected if this should happen, by an over-voltage protection circuit, but a precaution has also been made to prevent that it happens. The inputs and outputs of the right channel are inverted. This means that it inverts the signal compared to the left channel. The right speaker has therefore to be connected with reversed polarity to the right output. The marking on the unit already incorporates this but if an oscilloscope is connected to the output of the right channel it has to be connected to the negative terminal in order to find the signal. Thanks to this it has been made sure that when one channel consumes current from the positive rail, the other is consuming from the negative rail. Since this is a low frequency behaviour and the bass of recordings is in 99% of the cases mixed identically onto both channels the rail pumping effect is cancelled. If ALC0180 is used to drive a two way speaker, rail pumping will occur. At nominal mains voltage there is no problem though to generate full span of power at 20Hz into 4ohm when only using one channel.

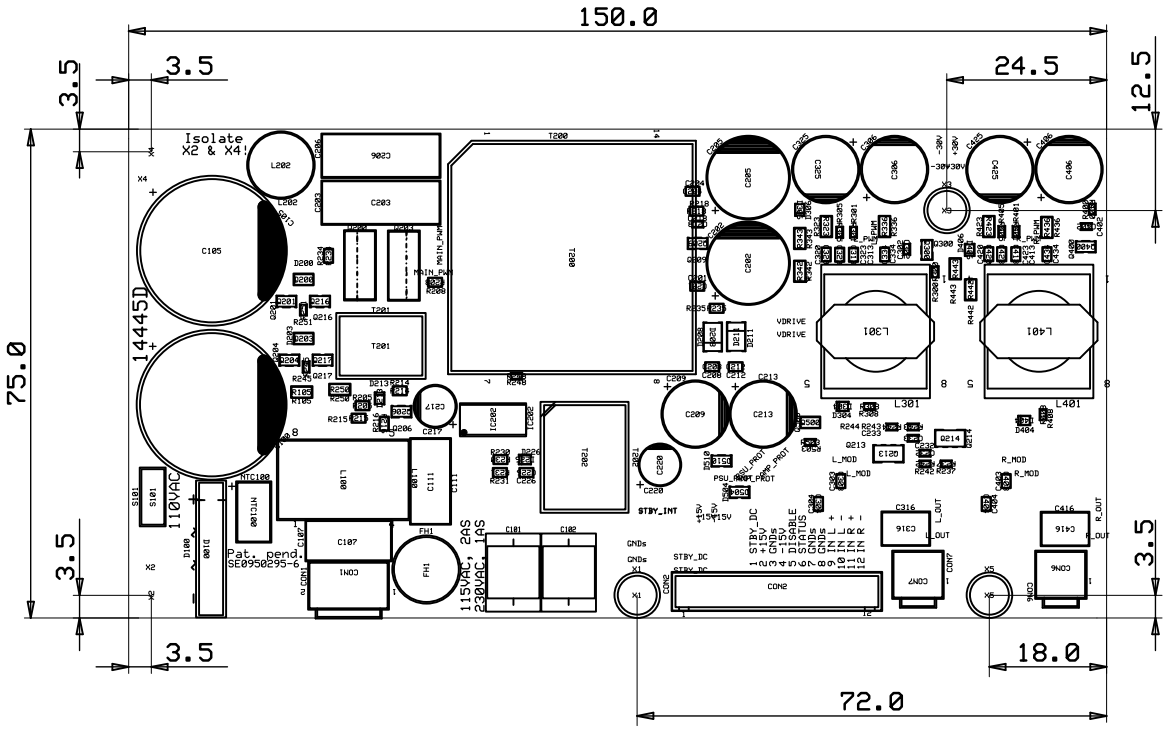
## Block diagram amplifier




## Block diagram amplifier with front end



## Mechanical outline




## Pinning diagram

| | | |
|---|---|---|
| 1 | STBY_DC | 10VDC when the unit is running and approximately 7,4VDC when the unit is in stand by mode |
| 2 | VA+ | Unregulated positive auxiliary supply, varies with load and AC input voltage between 9,5VDC and 15VDC |
| 3 | GND | Connected to the secondary side ground plane |
| 4 | VA- | Unregulated negative auxiliary supply, varies with load and AC input voltage between -9,5VDC and -15VDC |
| 5 | DISABLE | Puts the unit in stand by mode |
| 6 | STATUS | Status signal. Goes high during over temperature shutdown or over voltage shutdown. |
| 7 | GND | See 3. |
| 8 | GND | See 3. |
| 9 | IN_L+ | Positive input of the left channel |
| 10 | IN_L- | Negative input of the left channel |
| 11 | IN_R+ | Positive input of the right channel |
| 12 | IN_R- | Negative input of the right channel |



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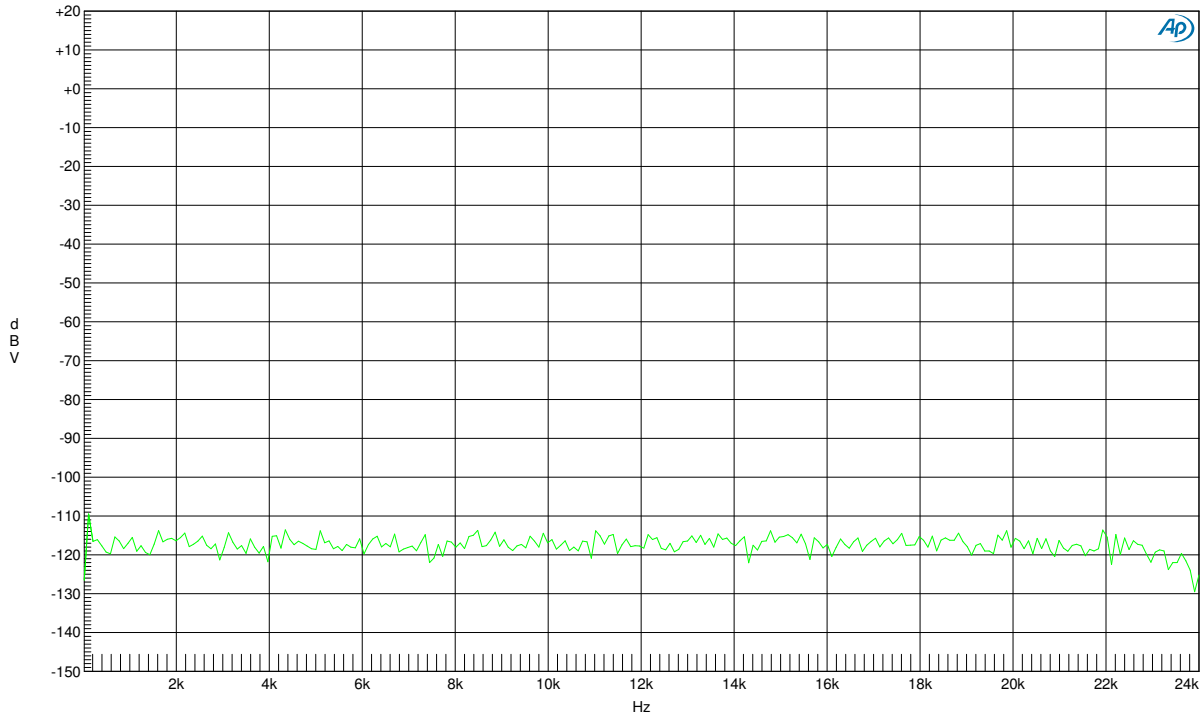
## Residual noise

Audio Precision A-A FFT SPECTRUM ANALYSIS 05/25/09 14:58:00



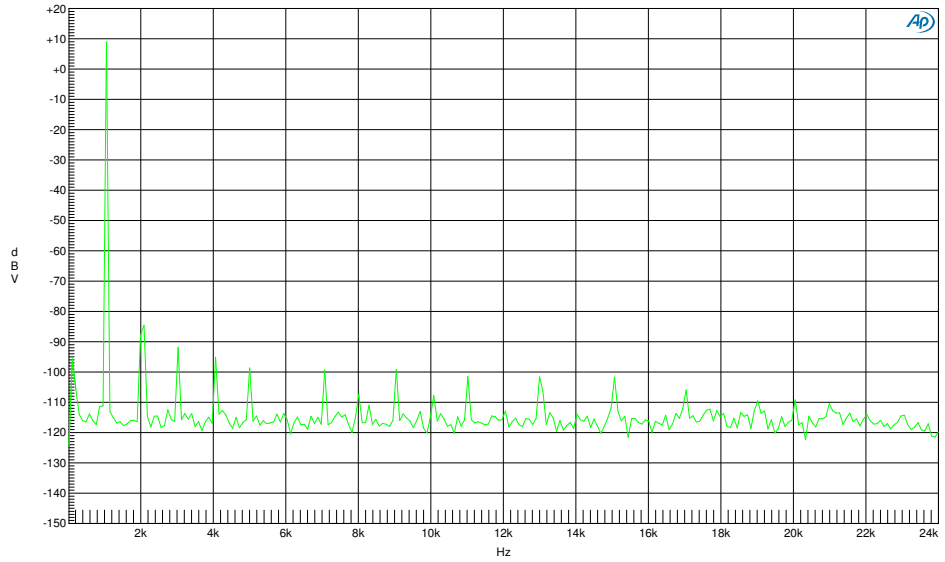

| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Green | Solid | 2 | Fft.Ch.1 Ampl | Left | FFT idle noise |

Requires DSP. Analog Analyzer input is A-D converted and analyzed with the FFT Digital analyzer. Signal source may be Generator or external. Click "Sweep Spectrum/Waveform" swap button to switch between frequency and time displays.

A-A FFT noise.at27

## Residual noise

Audio Precision A-A FFT SPECTRUM ANALYSIS 05/25/09 14:59:50

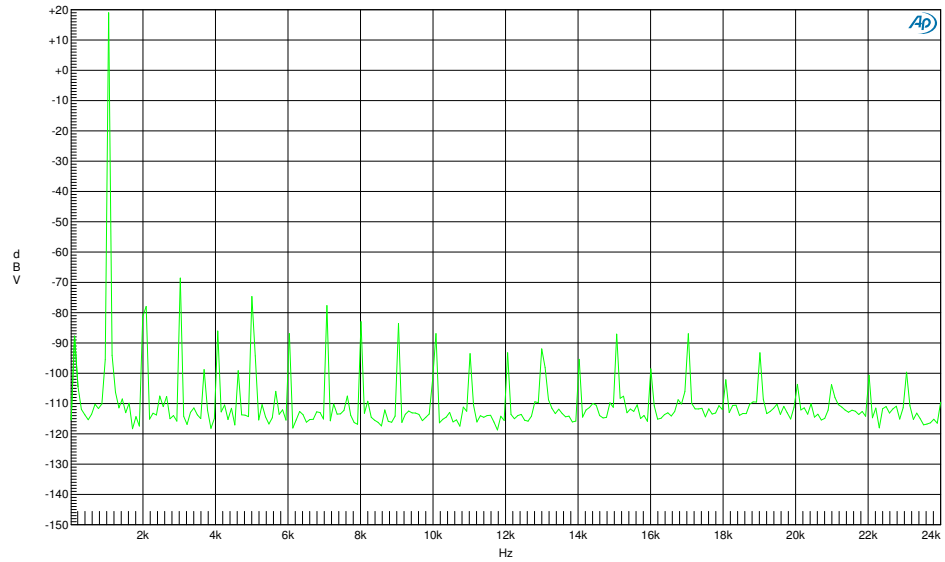



| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Green | Solid | 2 | Fft.Ch.1 Ampl | Left | 1W 1kHz 4ohm bcd |

Requires DSP. Analog Analyzer input is A-D converted and analyzed with the FFT Digital analyzer. Signal source may be Generator or external. Click "Sweep Spectrum/Waveform" swap button to switch between frequency and time displays.

A-A FFT noise.at27

Audio Precision A-A FFT SPECTRUM ANALYSIS 05/25/09 15:01:27




| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Green | Solid | 2 | Fft.Ch.1 Ampl | Left | 10W 1kHz 4ohm bcd |

Requires DSP. Analog Analyzer input is A-D converted and analyzed with the FFT Digital analyzer. Signal source may be Generator or external. Click "Sweep Spectrum/Waveform" swap button to switch between frequency and time displays.

A-A FFT noise.at27



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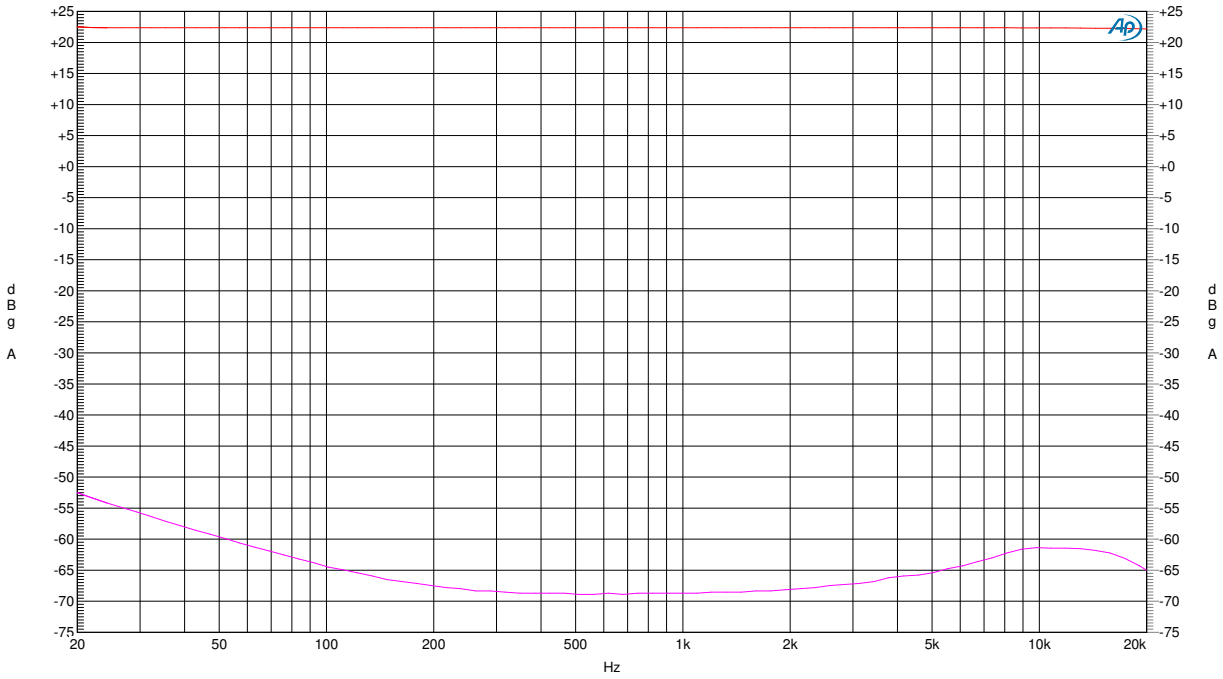
## Crosstalk 10W 4Ω

Audio Precision 05/25/09 15:18:22

Audio Precision 12/18/09 11:05:51

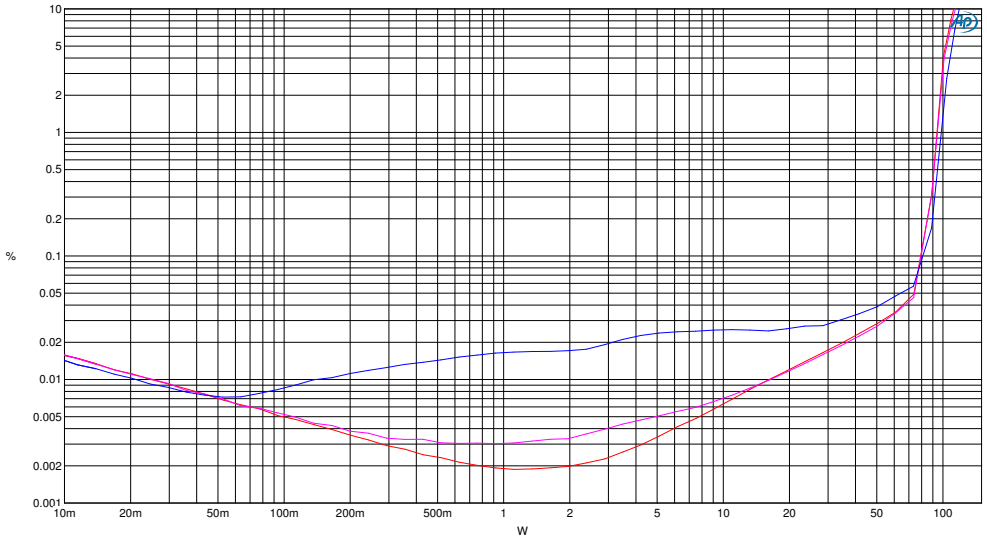



| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Red | Solid | 2 | Anlr.Level A | Left | Left channel 10W 4ohm |
| 1 | 2 | Magenta | Solid | 2 | Anlr.Level B | Right | Right channel input gnd |

Cross-talk 10W.at27

## THD vs PWR @ 4 ohm one channel driven

Audio Precision 12/18/09 11:34:50

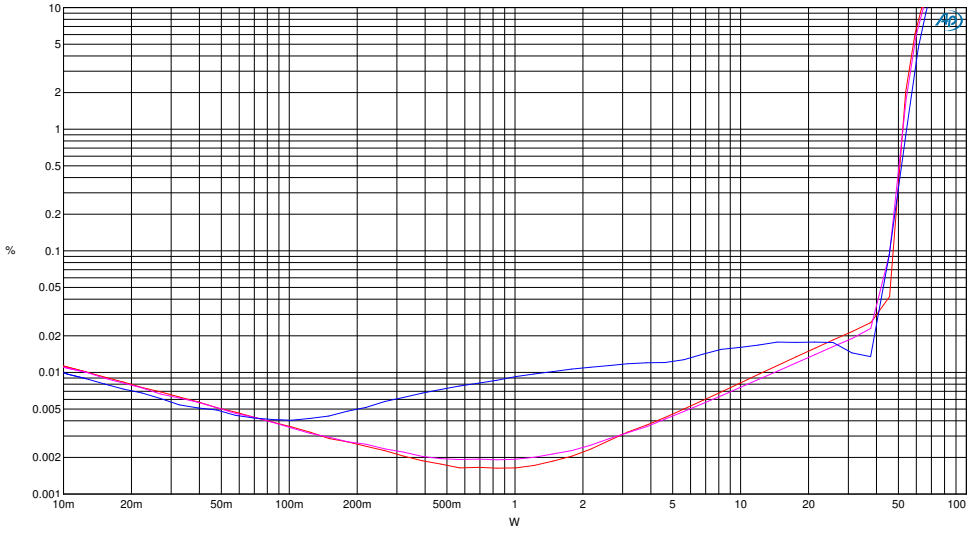



| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Red | Solid | 2 | Anlr.THD+N Ratio | Left | 4ohm 100Hz |
| 2 | 1 | Magenta | Solid | 2 | Anlr.THD+N Ratio | Left | 4ohm 1kHz |
| 3 | 1 | Blue | Solid | 2 | Anlr.THD+N Ratio | Left | 4ohm 6,67kHz |

THDvsPWR-4ohm.at27

## THD vs PWR @ 8 ohm one channel driven

Audio Precision 12/18/09 11:37:18

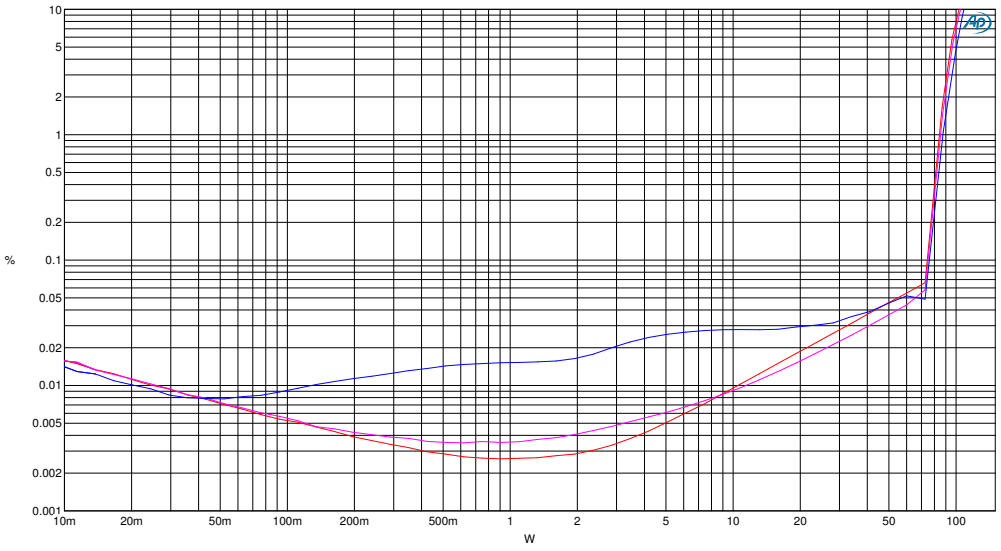



| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Red | Solid | 2 | Anlr.THD+N Ratio | Left | 8ohm 100Hz |
| 2 | 1 | Magenta | Solid | 2 | Anlr.THD+N Ratio | Left | 8ohm 1kHz |
| 3 | 1 | Blue | Solid | 2 | Anlr.THD+N Ratio | Left | 8ohm 6,67kHz |

THDvsPWR-8ohm.at27

## THD vs PWR @ 4 ohm both channel driven

Audio Precision 12/18/09 12:14:43

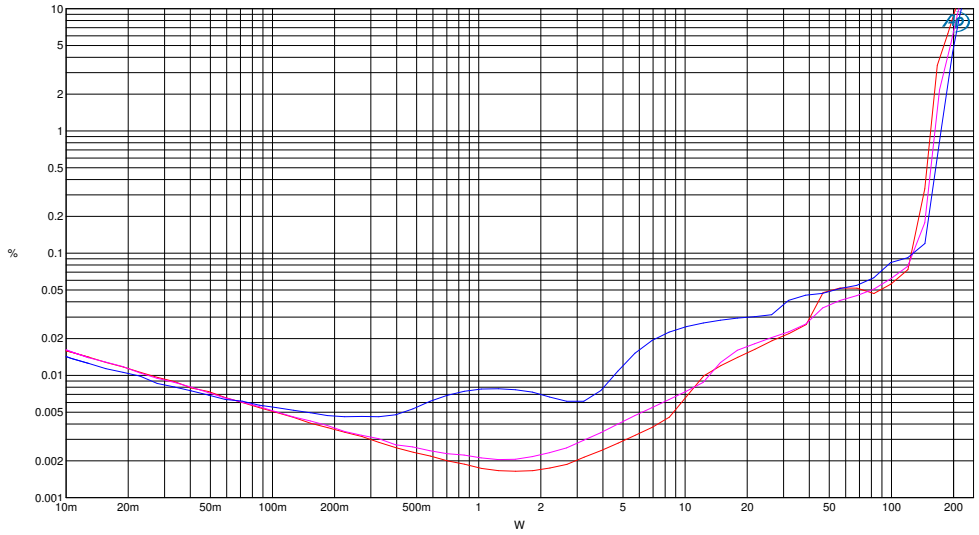



| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Red | Solid | 2 | Anlr.THD+N Ratio | Left | 4ohm both channels 100Hz |
| 2 | 1 | Magenta | Solid | 2 | Anlr.THD+N Ratio | Left | 4ohm both channels 1kHz |
| 3 | 1 | Blue | Solid | 2 | Anlr.THD+N Ratio | Left | 4ohm both channels 6,67kHz |

THDvsPWR-4ohm-both-ch.at27

## THD vs PWR @ 8 ohm BTL mode

Audio Precision 12/18/09 12:34:17




| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Red | Solid | 2 | Anlr.THD+N Ratio | Left | 8ohm BTL 100Hz |
| 2 | 1 | Magenta | Solid | 2 | Anlr.THD+N Ratio | Left | 8ohm BTL 1kHz |
| 3 | 1 | Blue | Solid | 2 | Anlr.THD+N Ratio | Left | 8ohm BTL 6,67kHz |

THDvsPWR-8ohm-btl.at27



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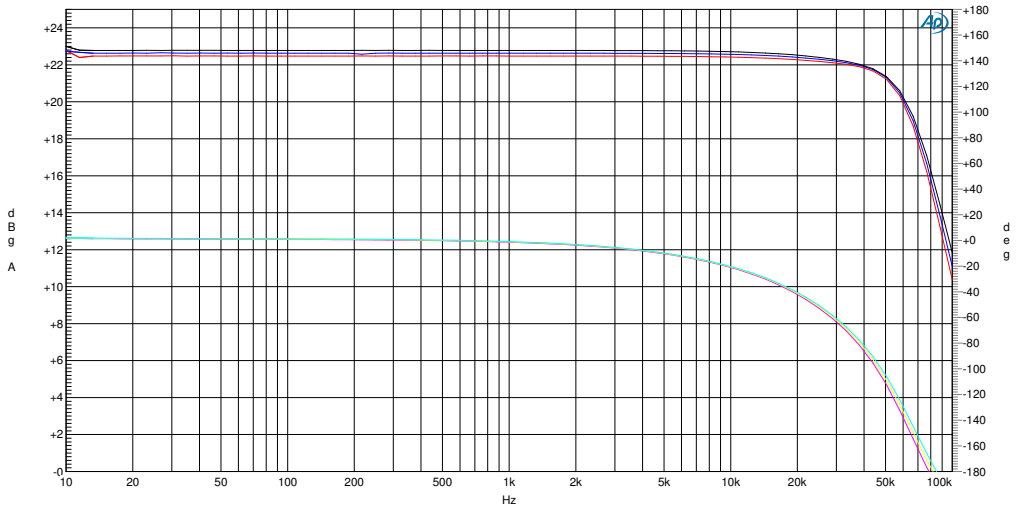
## Frq response

Audio Precision 12/18/09 12:37:54




| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Red | Solid | 2 | Anlr.Level A | Left | Gain 4ohm |
| 1 | 2 | Magenta | Solid | 2 | Anlr.Phase | Right | Phase 4ohm |
| 2 | 1 | Blue | Solid | 2 | Anlr.Level A | Left | Gain 8ohm |
| 2 | 2 | Yellow | Solid | 2 | Anlr.Phase | Right | Phase 8ohm |
| 3 | 1 | Black | Solid | 2 | Anlr.Level A | Left | Gain Open Load |
| 3 | 2 | Cyan | Solid | 2 | Anlr.Phase | Right | Phase Open Load |

Frq-response.at27