stage accompany

Stage Accompany

SA 1310 & 2310

Mono 31 & Stereo 31 band
Graphic Equalisers

User Manual
Version 1.0

stage accompany

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1 General Description

The SA 1310 & 2310 are 31 band "state of the art" graphic equalisers, offering ease of use combined with clean, transparant signal processing.

The level of the input signal can be adjusted between infinite attenuation and a gain of 6 dB by means of an input level potentiometer.

The equaliser section contains 31 faders (45 mm 1310; 30 mm 2310) that each control a constant bandwidth filter at ISO frequencies. The EQ section is equiped with a range switch, setting the maximum amplification or attenuation of each filter on 6 or 12 dB. The whole section can be bypassed with the EQ in/out switch.

The unit is also equiped with a selectable high pass filter. Its frequency range is continuously variable between 10 and 180 Hz.

Electronically balanced in and outputs on both XLR and jack formats ensure troublefree connection to other professional and semi-professional audio equipment.

Both EQ's are also available with transformer balanced in- and outputs as an option.

2 Connections

2.1 Mains Voltage and Fuses

Always be sure that you use a correctly grounded power supply. The Equaliser has a selectable voltage input and is a also provided with a mains filter. This filter reduces possible noise from the mains supply.

Before connecting the equaliser to the power supply, ensure that the value on the voltage selector switch at the rear side of the Equaliser corresponds with the actual voltage of the power supply. The integrated switch/voltage selector can be set to either 110 V (range 85 to 125 V) or 220 V (range 160 to 250 V) operation.

NOTE: Only use the switch or fuse holder if the Equaliser is **disconnected** from the power supply!

2.2 Audio Connections

The <INPUT> and <OUTPUT> connectors are located on the rear of the Equaliser and are of the standard XLR and Jack types. Input impedance is 40 kOhms as well in balanced as unbalanced modes. The output impedance is 50 Ohms in balanced mode and 25 Ohms in unbalanced mode.

The XLR <INPUT> and <OUTPUT> connectors are wired as follows:

pin 1 = ground (screening)
pin 2 = in phase signal (+ or "hot")
pin 3 = out of phase signal (- or "cold")

The jack type <INPUT> and <OUTPUT> connectors are wired as follows:

sleeve = ground (screening)
tip = in phase signal (+ or "hot")
ring = out of phase signal (- or "cold")

Unbalanced XLR connections can be made without loss of signal in the following way:

pin 1 = ground (screening)
pin 2 = in phase signal (+ or "hot")
pin 3 = connected to pin 1

Unbalanced jack connections are made automatically by means of the standard mono jack connector.

An unbalanced signal can be supplied to the <INPUT>, while the rest of the signal path can be balanced. In this case, the Equaliser automatically converts the signal from unbalanced IN to balanced OUT.

If input and/or output transformers are mounted, the connections are identical as with the electronic version. Exceptions are pin 1 of the XLR output connector and the sleeve of the jack output connector that are both not connected to ground.

The Equaliser is equipped with a powerfull output circuit, being able to supply +20 dBu (7.75 volts) to a 600 Ohms load or even +15 dBu (4.4 volts) to a 150 Ohms load. This means that in general, the SA 1310 & 2310 can drive about 100 paralelled inputs of, for example power amplifiers.

If the Equalsier is not switched on, the input will be connected through directly to the outputs, in which case the whole electronic circuit will be bypassed. The signal chain in which the Equaliser is connected thus remains intact if the EQ is switched off.

2.3 Ground Loops

To prevent from ground loops, the Equaliser is provided with a <GROUND LIFT> switch. Using this switch, the connection between system ground and mains ground can be broken (lifted).

3 Operation

3.1 Input level

The <INPUT LEVEL> potentiometer of the Equaliser can be used to select the optimum signal level inside the equaliser. This level can be monitored on the 11 segment led bar. The input gain can be varied between minus infinite and + 6dB. At center detent position, the input to output gain is 0 dB.

In general, a higher internal signal level of the Equaliser results in a better signal to noise ratio. On the other hand, because of the dynamic nature of musical signals, care should be taken that the internal level does not exceed 20 dBu (clipping point and introduction of severe distortion).
In most cases, the optimum level can be found between 0 and +10 dBu, depending on the nature of the musical signal.

The maximum input level of the Equaliser is:

Input level setting:	Max. input dBu:
< -3	+23
0	+20
+3	+17
+6	+14

The clip led senses the signal level at all posssible positions where clipping may occur. The signal level led bar only senses the post equaliser signal level.
This means that it may be possible that the led bar indicates a relative low signal level while the clipping led indicates an overload. An example of this situation is when the input attenuator is set at -20 dB while the input level of the Equaliser is + 25 dBu. The led bar will show a normal signal level (25-20=+5 dBu) but the input circuit of the equaliser is overloaded and distorts the input signal. The clip led will in this case be lit to indicate the overload condition at the input.

3.2 EQ section

The EQ section contains 31 constant Q (bandwidth) filters. Each filter section has its own 45 (1310) or 30 mm (2310) slider with which the signal may be amplified or attenuated a maximum of 12 dB. The equaliser section can be bypassed with <EQ IN/OUT> switch.

Figure 3-1 shows the frequency response of all individual filters.

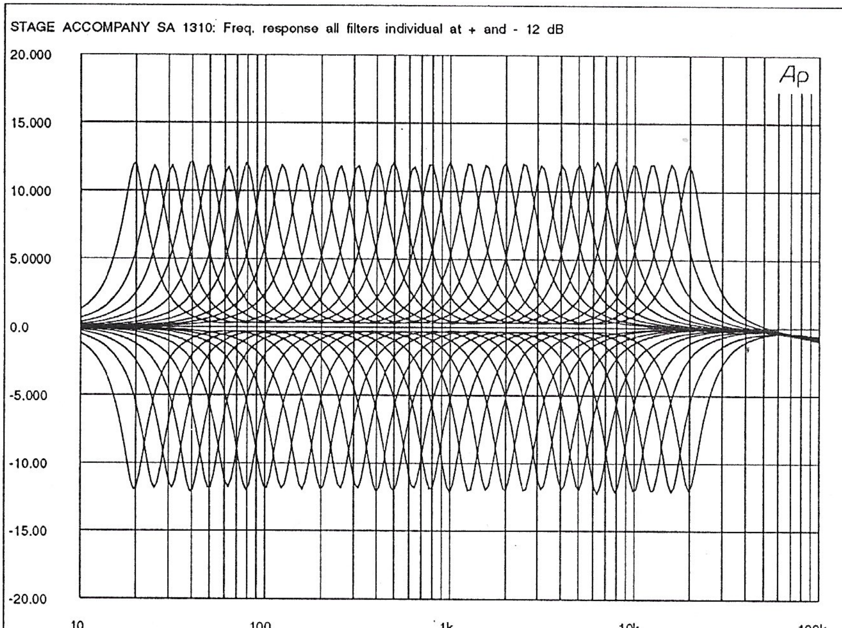

Figure 3-1. Frequency response of all individual filters (dB versus Hz).

Figure 3-2 shows the frequency response of the 1 kHz filter at +/-3, 6, 9 and 12 dB settings.

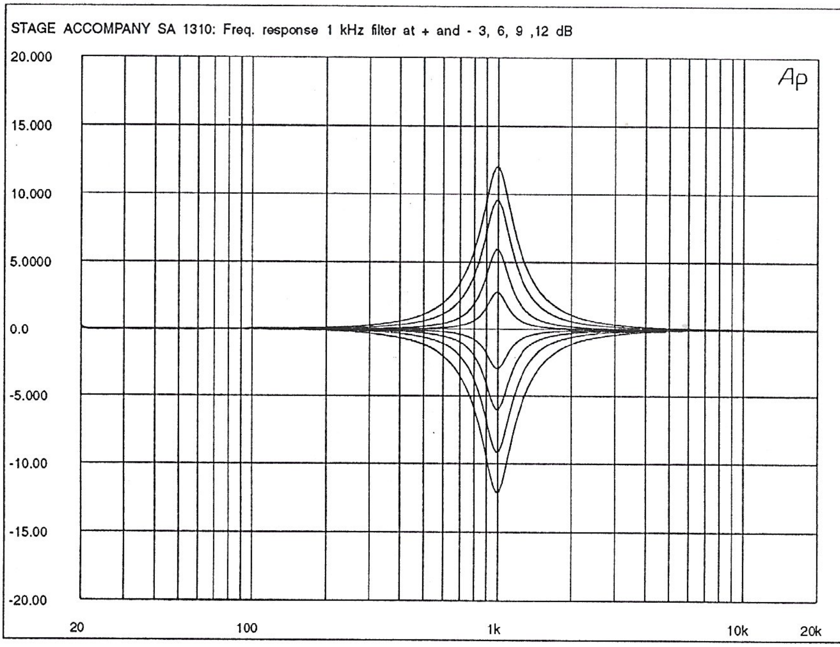

Figure 3-2. The frequency response of the 1 kHz filter at +/-3, 6, 9 and 12 dB settings (dB versus Hz).

Each filter has an 1/3 octave bandwidth which corresponds with a Q of 4.33.
The <RANGE> switch alters the slider range to +/- 6 dB. This makes small and accurate corrections possible. The filter curves (and thus the Q factor) are excactly the same as in the +/- 12 dB range.

Important when boosting certain frequencies is that the headroom at these given frequencies is reduced by the amount of gain. An example:
With all controls flat, the headroom with a signal level of 0 dBu is 20 dB. Setting the 1 kHz control at +12 dB, means that at 1 kHz, the headroom is reduced to 20 - 12 = 8 dB.

3.3 High Pass Filter

The High Pass Filter has a 12 dB/octave sloop (40 dB/decade) and its cutoff frequency is continuously variable between 10 Hz and 180 Hz.
Figure 3-3 shows the frequency response of the filter at 10, 70 and 180 Hz.
The filter can be bypassed with the <HIGH PASS IN/OUT> switch.

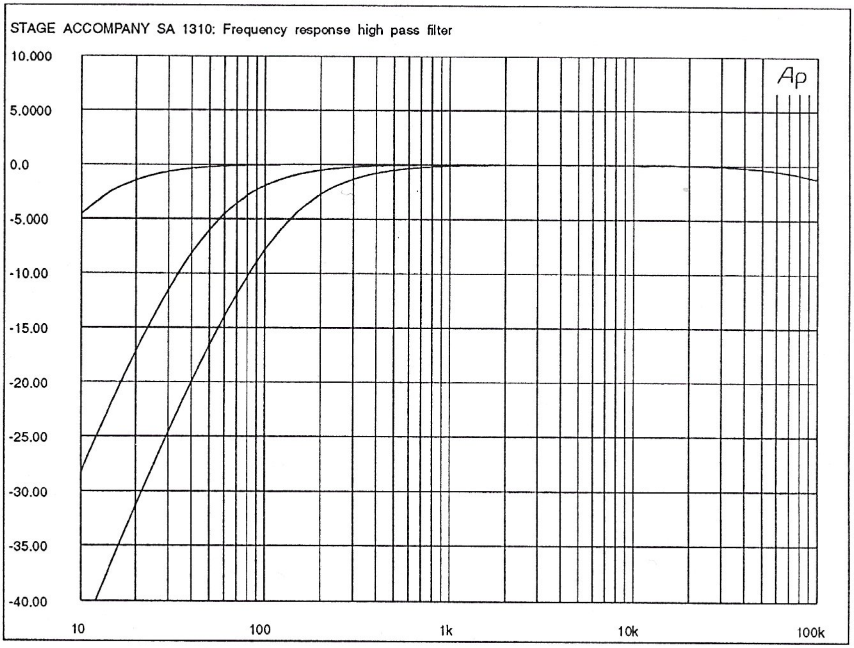

Figure 3-3. The frequency response of the low pass filter at 10, 70 and 180 Hz (dB versus Hz).

4 Various Settings and Related Graphs

This chapter contains a number of frequency plots to give you an impression of the curves that correspond with various settings of the Equaliser's sliders.

Figure 4-1 is printed to illustrate the terms “Q-factor” and “constant Q”.

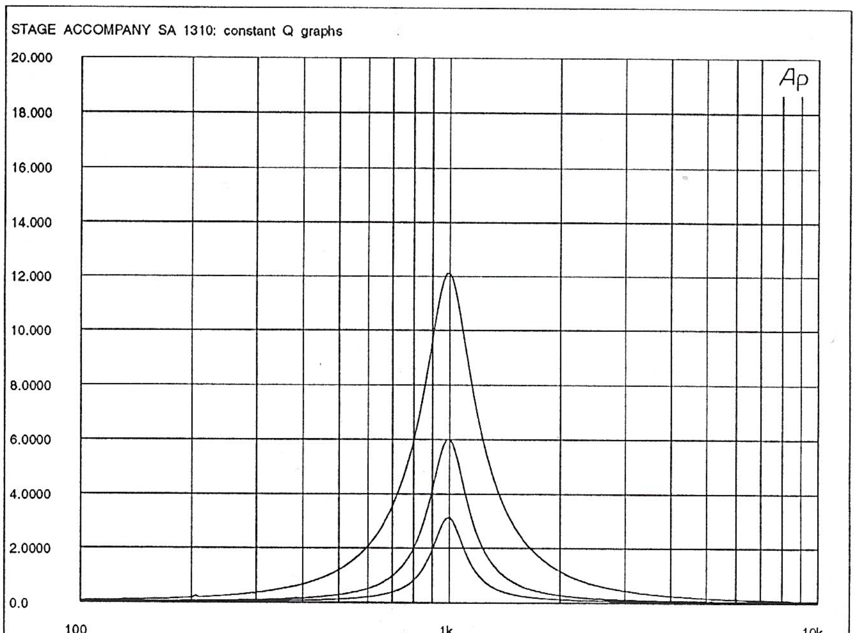

Figure 4-1. “Q-factor” and “constant Q” (dB versus Hz).

The Q factor of a certain filter is defined as being the center frequency of that filter divided by its bandwidth (-3 dB points). In formula form:

$$Q=Fc/B$$

The -3dB points of each filter in the Equaliser can be found by multiplying or dividing the center frequency of that filter by 1.122. So for the 1 kHz filter, the -3 dB points are 1122 and 893 Hz. The bandwidth is 1122-892=230 Hz. So the Q factor is 1000/230=4.33.

A constant Q equaliser design means that the Q factor (and thus the bandwidth) is essentially independent from the chosen gain of that filter. Looking at figure 4-1, the Q factor at 12 dB gain is 4.3, while at 6 dB gain, the Q is 3.0. The Q has become a fraction smaller which is the natural consequence of the fact that the actual response of the filter is added to the original signal, which alters the final filter curve slightly. At gains smaller than 3 dB, it is even not possible to define a Q-factor because -3dB points can no longer be found.
Still, these results are excellent compared to conventional equaliser designs, in which the Q-factor can alter between 2 and 7 for 6 and 12 dB fader settings.

Figure 4-2 shows the interaction between neigbouring faders.
The first part of the curve shows the sliders of the 200 Hz and 250 Hz filters both in the +12 dB position. Note that the gain between the two center frequencies is (more than expected) almost 18 dB.
The second part of the curve shows the 2kHz slider at +12 dB and the 2.5 kHz slider at -12 dB. Note here that maximum and minimum amplitudes only reach 6 dB.
This interaction between the filters is not a deficiency of the design but a natural result of the overlap of the individual filters. If you look at the response of the 1 kHz filter in figure 3-2, you will note that the gain at the first neighbouring frequency (800) Hz is still 6 dB. If the 800 Hz and the 1kHz filter are both set to +12 dB, each filter will apply some gain to 800 Hz signals: +12 dB from the 800 Hz filter and +6 dB from the 1kHz filter, resulting in + 18 dB total gain around that frequency.
The interaction could be reduced by choosing a higher Q for each filter, but in that case the equaliser would not be a 1/3 octave design.

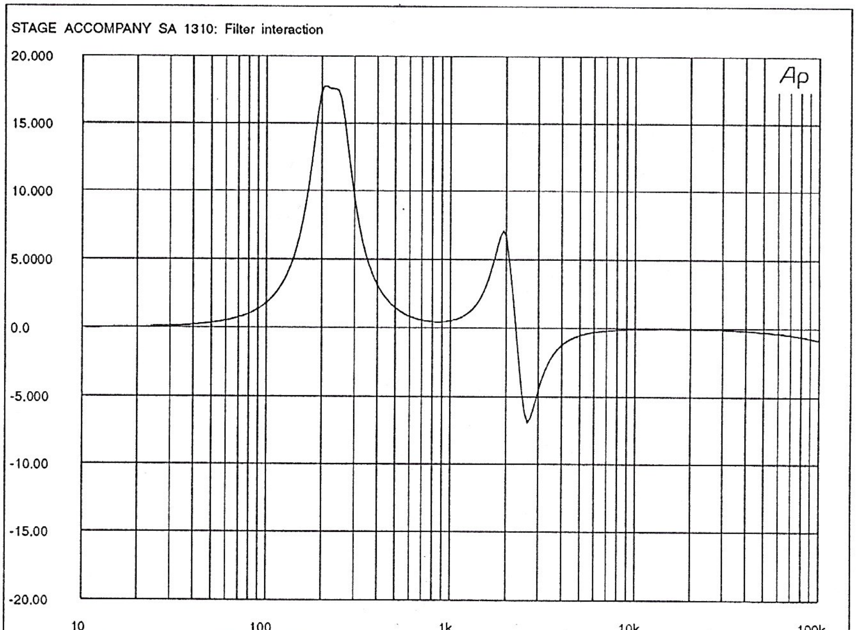

Figure 4-2. The interaction between neigbouring faders (dB versus Hz).

Figure 4-3 shows that the combined response of all filters gives an overall gain of +/- 20 dB. This figure also shows that the final frequency response of the filters is flat within 3 dB.

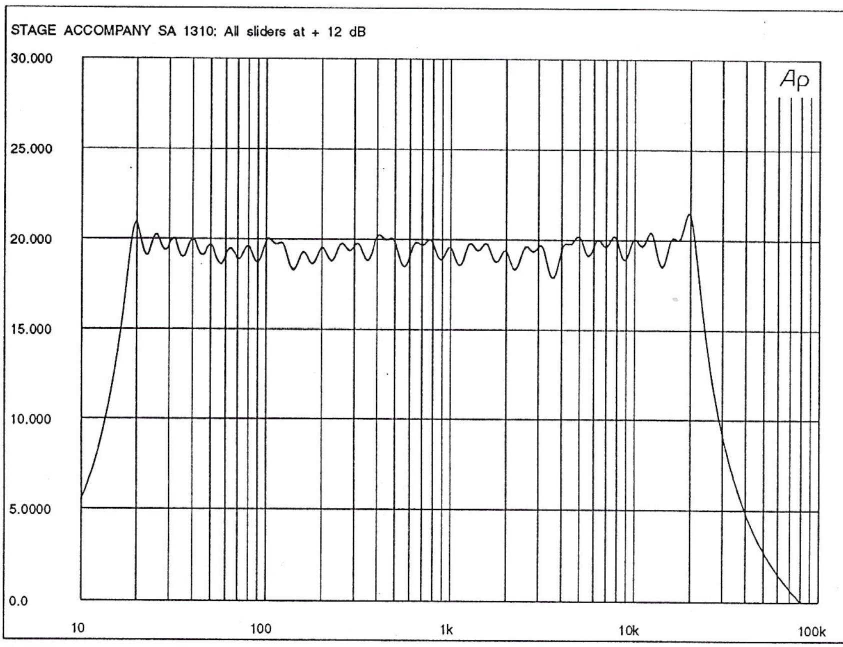

Figure 4-3. The combined response of all filters (dB versus Hz).

5 SA 1310 & 2310 technical specifications

Total equaliser

Maximum input level:	+23 dBu
Input impedance:	40 kOhms (balanced and unbalanced)
CMRR:	> 70 dB, 10 Hz - 10 kHz (see figure 5-1)
	> 60 dB @ 20 kHz
Frequency response:	10 Hz - 20 kHz, - 0.1 dB
	10 Hz - 100 kHz, - 3 dB (see figure 5-2)
THD:	< 0.01%, 10 Hz - 20 kHz (see figure 5-3)
	< 0.008%, @ 1 kHz, + 20 dBm into 600 Ohms
	< 0.02%, @ 20 kHz, + 20 dBm into 600 Ohms
IMD:	< 0.01%, 2 - 20 kHz, (see figure 5-4)
TIM	< 0.005% @ 15 kHz
S/N ratio:	> 94 dB, 10 Hz - 20 kHz (see figure 5-5)
Dynamic range:	> 116 dB; A-weighted, EQ section in
	> 118 dB; A-weighted, EQ section out
Slew rate:	> 7,5 V/us
Output impedance:	25 Ohms each leg
Maximum output level:	20 dBu, @ 600 Ohms; THD <0.05%
	15 dBu, @ 150 Ohms; THD <0.05%

Filter section:

Filter type:	constant Q, Q-factor 4.33 (5%) at 12 dB boost/cut
Maximum boost/cut:	12 dB (+/- 0.3 dB) at ISO center frequencies: 20, 25, 31,5, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1k, 1k25, 1k6, 2k0, 2k5, 3k15, 4k0, 5k0, 6k3, 8k0, 10k, 12k5, 16k, 20k
Range:	Switchable: +/- 12 or +/- 6 dB range
High pass filter:	12 dB/octave, 10 Hz - 180 Hz

General

Mains voltage:	100-120 volt or 220-240 volt nominal, selectable at the rear
Power consumption:	30 Watts (1310); 60 Watts (2310)
Weight:	5 kg (1310); 7.8 kg (2310)
Housing:	19 - inch rack mount, 2 units high, 11 inches deep (1310) 3 units high, 11 inches deep (2310) (without connectors)
Dimensions (h x w x d):	88 x 483 x 280 mm (1310) 132 x 483 x 280 mm (2310) (without connectors)

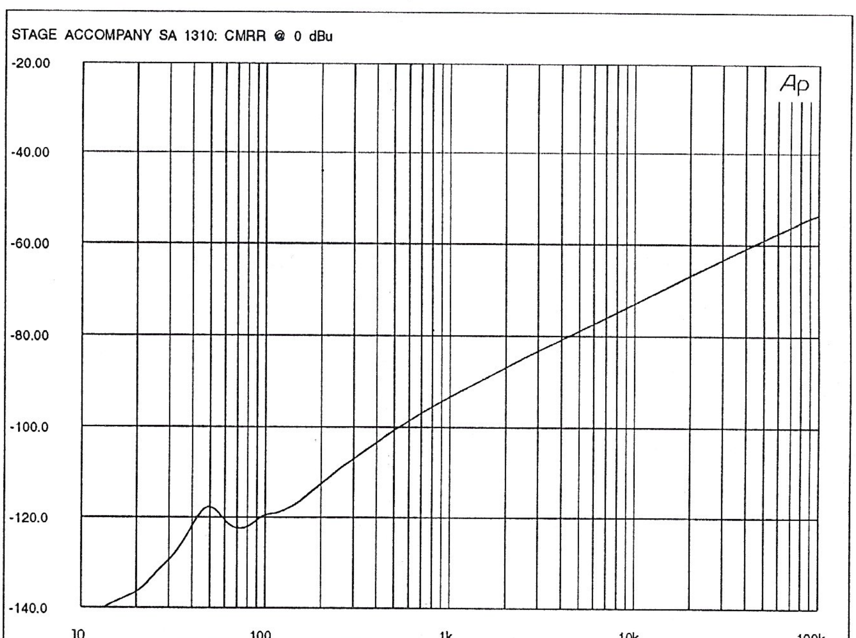

Figure 5-1. Common Mode Rejection Ratio (dB versus Hz).

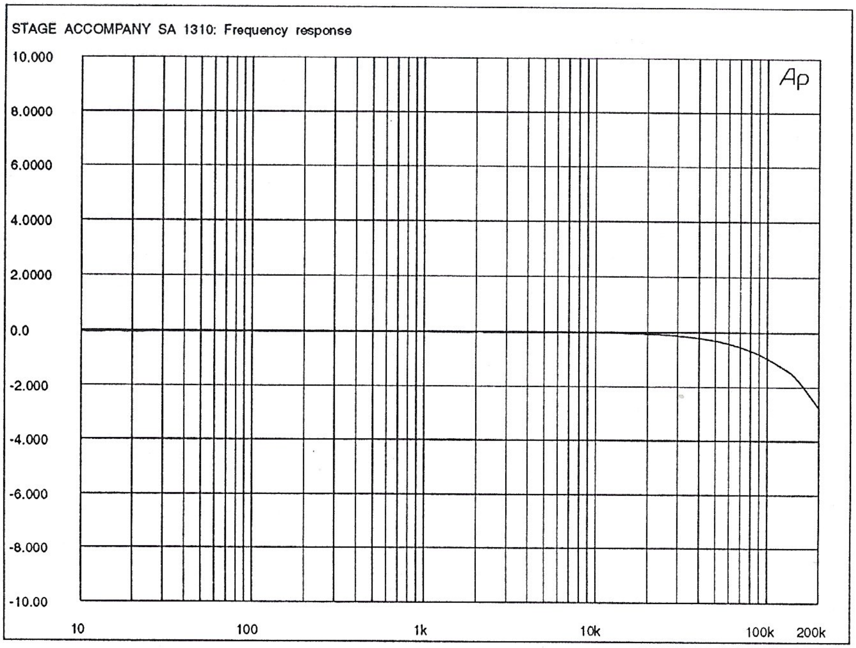

Figure 5-2. Frequency range (dB versus Hz).

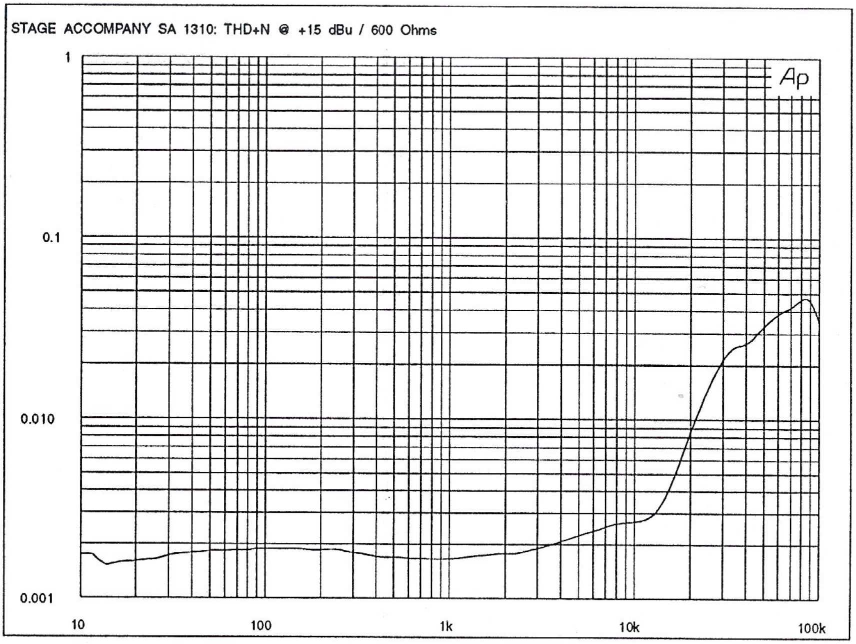

Figure 5-3. Total Harmonic Distortion (% versus Hz).

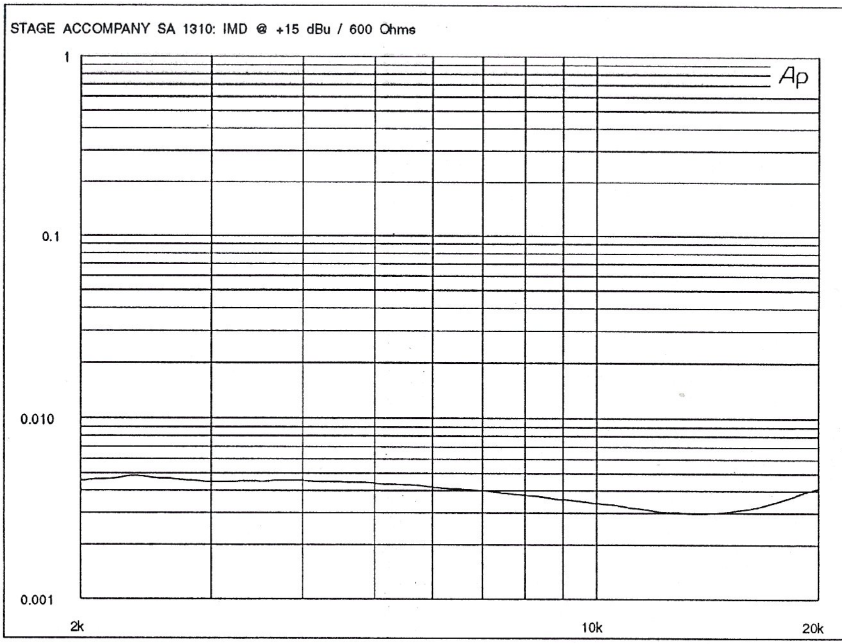

Figure 5-4. Intermodulation distortion (% versus Hz).

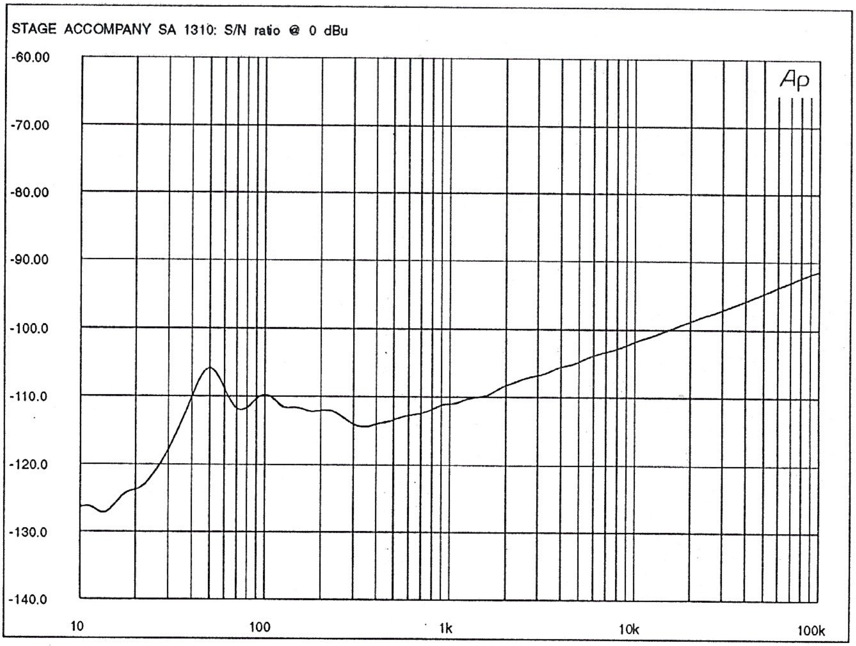

Figure 5-5. Signal to Noise ratio (dBu versus Hz).