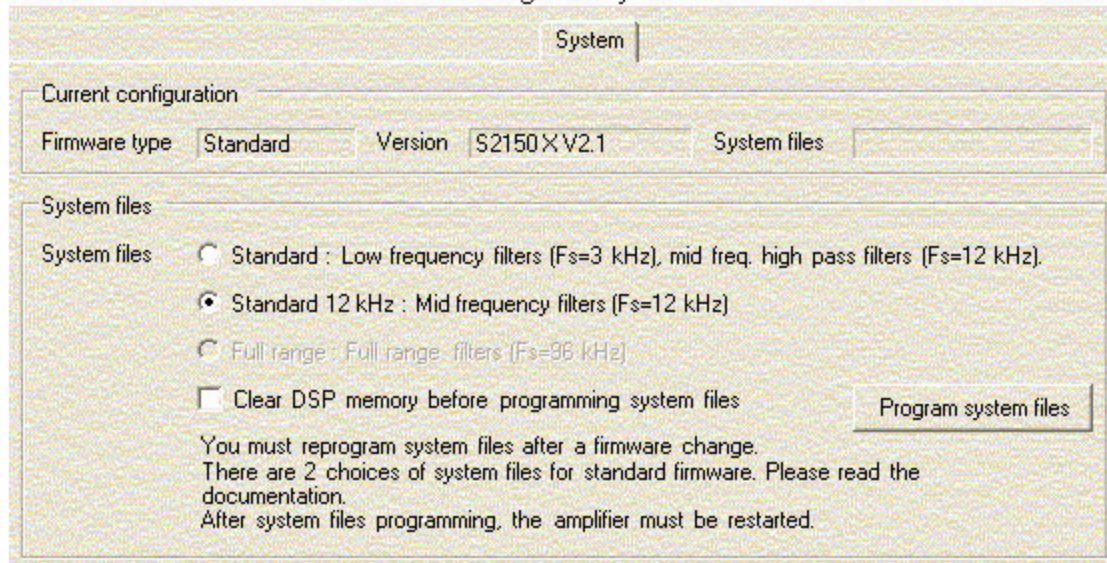


1. CONFIGURATION OF THE AMPLIFIERS

The programming of the midrange amplifier requires a stage in precondition: it is the change of system files in order to replace the $F_s=96$ kHz filter in S2150.

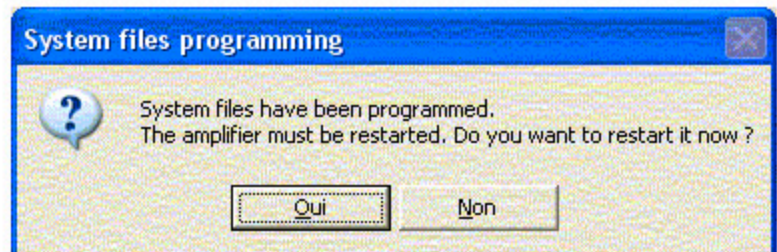
In the menu Remote control/Amplifier Midrange/System, choose the system files Standard 12 kHz and to click on Program system files.



The screenshot shows a software window titled 'System'. It contains a 'Current configuration' section with fields for 'Firmware type' (Standard), 'Version' (S2150XV2.1), and 'System files'. Below this is a 'System files' section with three radio button options: 'Standard : Low frequency filters ($F_s=3$ kHz), mid freq. high pass filters ($F_s=12$ kHz)', 'Standard 12 kHz : Mid frequency filters ($F_s=12$ kHz)' (which is selected), and 'Full range : Full range filters ($F_s=96$ kHz)'. There is also a checkbox for 'Clear DSP memory before programming system files'. A 'Program system files' button is located to the right. At the bottom, there is a warning message: 'You must reprogram system files after a firmware change. There are 2 choices of system files for standard firmware. Please read the documentation. After system files programming, the amplifier must be restarted.'

With the end of the programming, the amplifier must be started again.

Answer Yes, the new system files are now recorded in S2150.



It is not necessary to reprogram the firmware to pass from standard system files to standard system 12 kHz files.

The programming of the high-range amplifier also requires a stage in precondition: it is the change of firmware in order to use the filters $F_s=96$ kHz.

In the menu Remote control/Amplifier High/System to choose the firmware of the type S2150 Full range and version 2.1.

The amplifier must be alone without connection with the other amplifiers. Click on Program firmware.

Firmware programming


Firmware type: S2150 - Full range Firmware version: 2.1 Program firmware

When programming firmware, the amplifier to program must be the only Tact device connected to the computer. Do not use daisy chaining and disconnect other Tact devices.
 The amplifier must be set in programming mode : power off the amplifier, press and hold the Digital and Analog buttons on the front panel while you power on the amplifier. Hold the buttons until the display shows 'Programming mode'.

Put S2150 in programming mode by pressing the Digital and Analog buttons simultaneously.

Click Yes.

Firmware programming

 Is the Tact 2150 in programming mode ?

Oui Non

After the reprogramming of the firmware, it is necessary to reprogram the system files.

System files

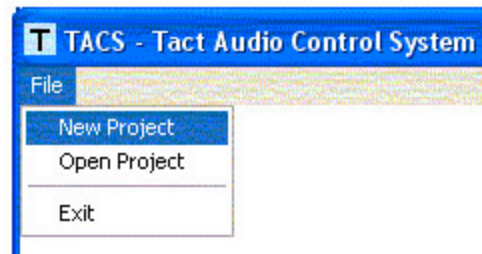
System files: ☐ Standard : Low frequency filters (Fs=3 kHz), mid freq. high pass filters (Fs=12 kHz) ☐ Standard 12 kHz : Mid frequency filters (Fs=12 kHz) ☒ Full range : Full range filters (Fs=96 kHz) ☐ Clear DSP memory before programming system files Program system files

You must reprogram system files after a firmware change.
 There are 2 choices of system files for standard firmware. Please read the documentation.
 After system files programming, the amplifier must be restarted.

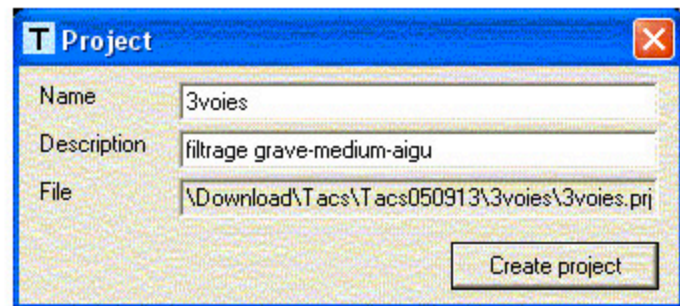
To click on Program system files then to start again the amplifier.

2. DEFINITION OF THE PROJECT

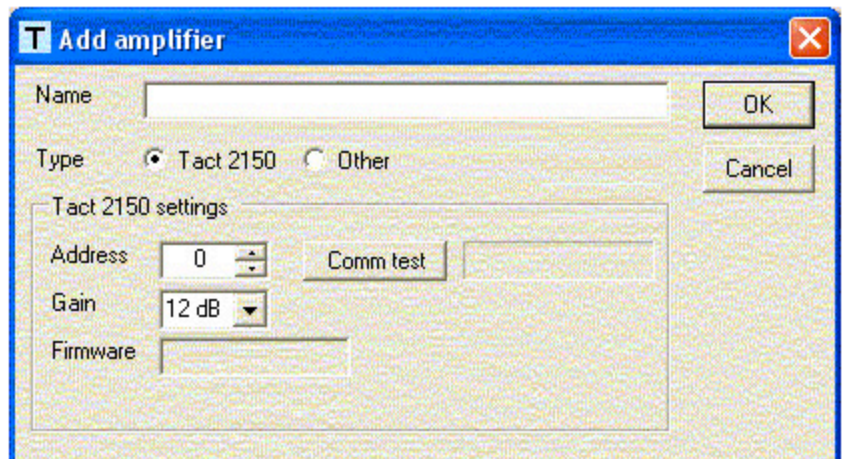
To create a new project: The project manages all the amplifiers, the RCS, the filters, etc..., it is thus necessary to give it a total name



And to give it a name (3voies in this example)

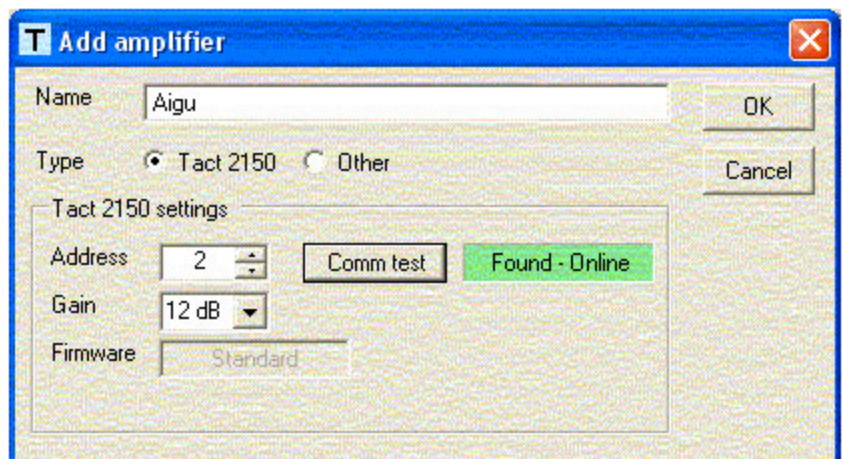


To declare the amplifiers in the Configuration/Project/Amplifiers menu while clicking on Add



Give a name to the first amplifier (High in the example) and to specify the address (2 in the example).

Then select Comm test to check for a good connection between the RS232 input of the amplifier and the COM port of the PC. A good communication results in Found - Online



Then add the midrange amplifier, then the low amplifier.

The amplifiers then appear in the list of the amplifiers.

Amplifiers				
Name	Type	Address	Firmware	Gain
Aigu	Tact2150	2	Unkno...	12dB
Medium	Tact2150	3	Unkno...	12dB
Grave	Tact2150	4	Standard	12dB

If the message Off/Not connected appears at the time of the test of communication,

Edit amplifier

Name:

Type: ☒ Tact 2150 ☐ Other

Tact 2150 settings:

Address: Off / Not connected

Gain:

Firmware:

it is necessary to check the parameter setting of the PC connection: port (here Com1) and speed (here 57600) in small Settings/General or the Configuration/General menu,

and configure the S2150 with same speed in small Comm (Baud Misses = 57600).

Communications

RCS 2.2X Serial Port: Speed:

2150 Amplifiers Serial Port: Speed:

Folders

RCS Project:

Measurement root folder: ☒ TACS project folder ☐ RCS project folder

Debug

☐ Save filter programming history

☐ Save amplifiers settings history

For the amplifier, it is necessary to declare the frequency band of the filter.

In the Configuration/Project/Frequency Range menu, click on Add.

Frequency range corresponds to the ranges (with the direction frequency band) of the system. A 3-way system will have the ways low, midrange and high.

Add frequency range

Name:

Source:

Default crossover settings

	Begin	End
Frequency	0 Hz	0 Hz
Order	0	0
Response	Linkwitz-Riley	Linkwitz-Riley

Measurement pulses

☒ Full range ☒ Midrange ☒ Sub

Give a name to the filter as well as the desired parameters (here high-pass 1400 Hz from order 4 Linkwitz type).

The parameters of filtering which one returns on this level are "generic" parameters, they are used at the time of the creation of a new filter for this frequency band but can be modified.

Add frequency range

Name:

Source:

Default crossover settings

	Begin	End
Frequency	1400 Hz	0 Hz
Order	4	0
Response	Linkwitz-Riley	Linkwitz-Riley

Measurement pulses

☒ Full range ☒ Midrange ☒ Sub

Add in the same way the midrange and then the low range.

For the mid/high ranges, it should be indicated that the Source, i.e. the digital output of the RCS, is Main. For a subwoofer connected to the Sub output of the RCS, it should be indicated that the Source is Sub.

In the case studied here where the three amplifiers are in series on the Main output of the preamplifier, it should be indicated that the Source of the low range is Main.

The three ways appear then in the list of the ranges.

Frequency ranges						
Name	Source	Start (Hz)	Order	End (Hz)	Order	
Aigu	Main	1400	4	-	-	
Medium	Main	130	8	1400	4	
Grave	Main	-	-	130	8	

This stage of the project, it is necessary to create the HP (speakers). In the menu Configuration/Project/Speaker components click on Add.

Add speaker component

Name:

Nominal frequency range:

Power handling (these values are used to limit the amplifier's output power)

Maximum input (W): ☒ RMS ☐ Peak

Nominal impedance (Ohms):

Crossover (you may need to apply a high-pass filter for safe operation)

Minimum frequency (Hz):

Slope (dB/octave):

Give a name to the loudspeaker of the high range (475PB in this example) and click OK.

Edit speaker component

Name:

Nominal frequency range:

Power handling (these values are used to limit the amplifier's output power)

Maximum input (W): ☒ RMS ☐ Peak

Nominal impedance (Ohms):

Crossover (you may need to apply a high-pass filter for safe operation)

Minimum frequency (Hz):

Slope (dB/octave):

Also add the loudspeakers of mid and low ranges.

The loudspeakers appear then in the list of the loudspeakers.

Name	Freq. range	Impedance	Max power
475PB	800-21k	8 ohms	35 W
10PE26	130-4k	8 ohms	250 W
18LX60	20-130	8 ohms	600 W

It is then necessary to define the routing of the ranges to frequency/amplifier/HP. In the Configuration/Project/Router menu click on Add.

Choose the Frequency range, the amplifier (to amplify) and the

Add routing info

Frequency range:

Processor channel:

Amplifier:

Amplifier channel:

Speaker model:

loudspeaker (speaker model).
Click OK.

Then click on Copy in order to copy the parameter settings of the left channel to the right channel.

Add in the same way routing for the mid and low ranges.

Routing thus
defined appear in
the list of Routing.

Routing				
Frequency Range	Proc. ch	Amplifier	Amp ch	Speaker
Aigu	Left	Aigu	Left	475PB
Aigu	Right	Aigu	Right	475PB
Medium	Left	Medium	Left	10PE26
Medium	Right	Medium	Right	10PE26
Grave	Left	Grave	Left	18LX60
Grave	Right	Grave	Right	18LX60

3. DEFINITION OF THE FILTERS AND PROGRAMMING OF THE AMPLIFIERS

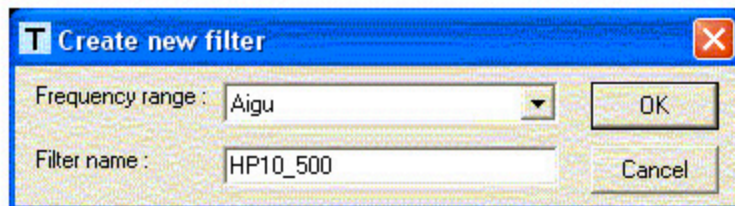
It is now necessary to create the filters, which will be programmed in the amplifiers.

These filters will include the correction of each range.

We will begin with measurement the response of the lows. The aural signal is in general insufficient to allow this measurement. We thus will add the high range filtered by high-pass.

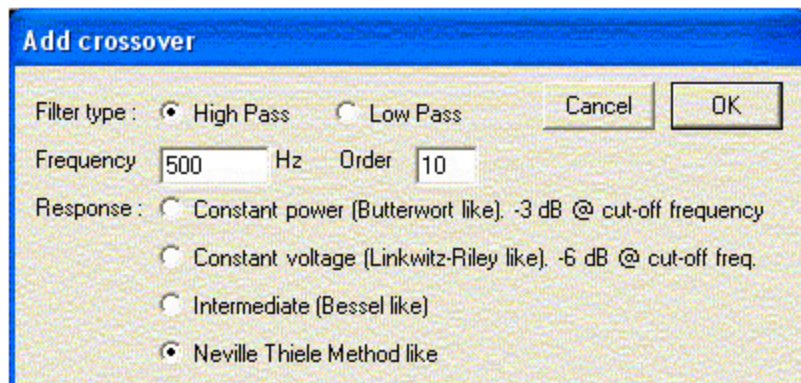
In the Crossovers/Design menu click on Create new filter

Choose in Frequency range of the high range and give it a name (HP10_500 in the example).



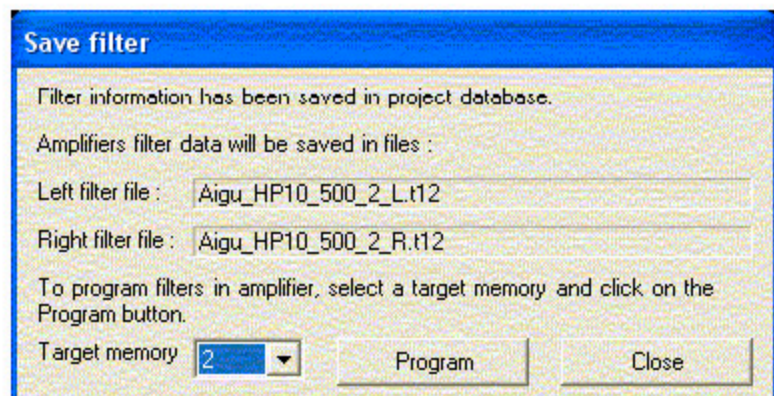
Remove the default filter by selecting it and then clicking on Delete.

Click on Add and define the filter that aims to avoid clipping during measurement from the low+high unit.



Select OK.

Click on the Save filter button so recording this filter and informing the number of the key associated memory (here Target memory = 2).

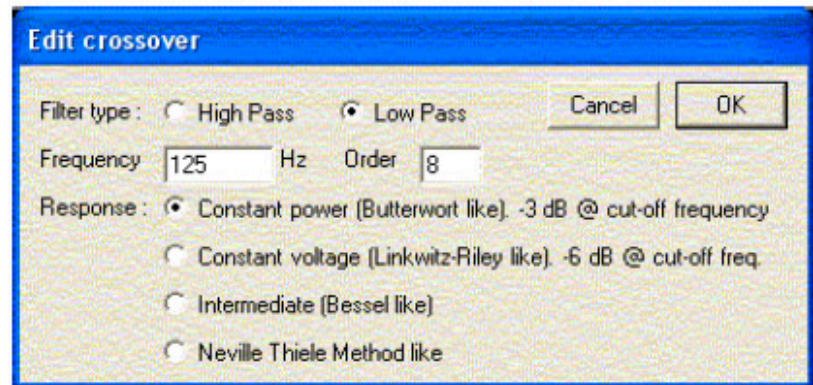


Click on Program in order to reveal the programming screen.

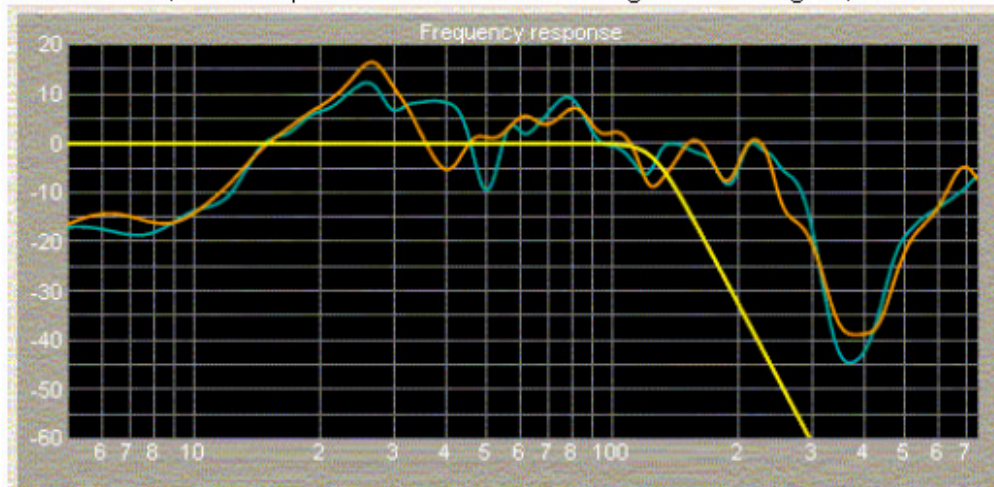
unit filtered without the midrange and the measurement of the midrange alone. These measurements will be used for the correction of the low, mid and high frequencies.

TACS makes it possible to control the RCS in order to carry out measurements. With the TCS here used, this measurement is carried out with the Tact software.

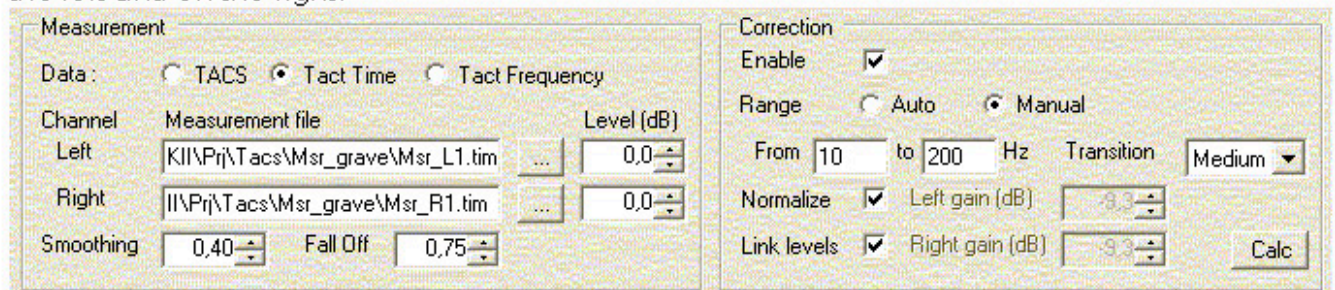
In the Crossovers/Design menu click on Create new filter, choose the low range and give it a name (LP8_125 in the example). Click on Edit to check the filter proposed by default. It is possible to choose the type of filter, the frequency of transition, the order of the filter and the type of response curve. Click OK.

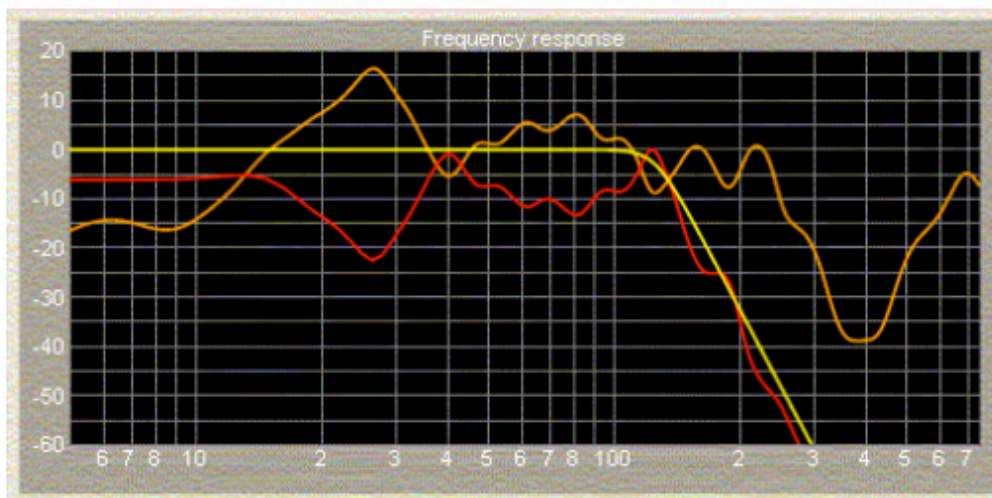


In the Crossovers/Design/Correction menu click on Tact time and choose the files of measurements of the filtered low range (+ high filtered). For the low, set the parameters of smoothing Smoothing=0,40 and Fall Off=0,75.



Click on Enable Correction and choose a Manual range between 10 and 200Hz. Normalize the filter with Link levels selected in order to have the same level on the left and on the right.





The yellow curve represents the target i.e. the final response curve that one wishes to obtain.

The orange curve is the response of the the left channel.

The red curve is the response curve of the filter that will be programmed in the amplifier.

Click Save filter, choose Target memory 1 then click on Program and Program filters.

We now will create the filter of the midrange.

In the Crossovers/Design menu click on Create new filter, choose the midrange and give it a name (BP_125_1400 in the example).

The filters are of the Butterworth type for the high-pass one (as for the low-pass one of the low range) and of the Linkwitz type for the low-pass one (as for the high-pass one the high range).

Design: ☒ Left & Right ☐ Left only ☐ Right only

Frequency range: Medium

Filter name: BP_125_1400

Filter type: Mid freq (<2 kHz, Fs=12 kHz)

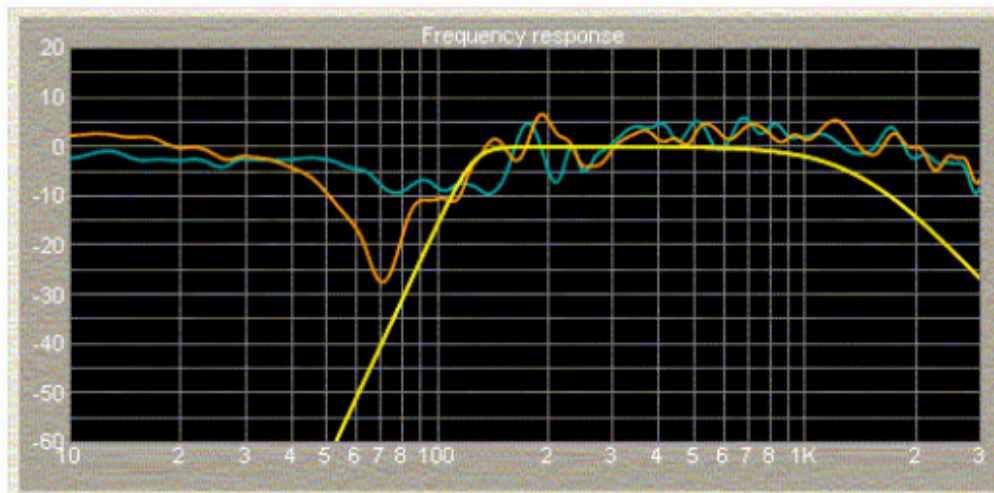
Crossover elements

Type	Freq.	Order	Response
HighPass	125	8	Butterworth
LowPass	1400	4	LinkwitzRiley

Add Edit Delete

In the Crossovers/Design/Correction menu click on Tact time and choose the files of measurements of the midrange alone.

For the midrange, use the parameters of smoothing Smoothing=0,40 and Fall Off=0,60.



Click on Enable Correction and choose a Manual range between 70 and 3kHz. Normalize the filter with Link levels selected in order to have the same level on the left and on the right. In addition the gain of measurement is adjusted (-6dB) in order to have a mean level of the measurement of approximately 0dB in the range of use of the HP.

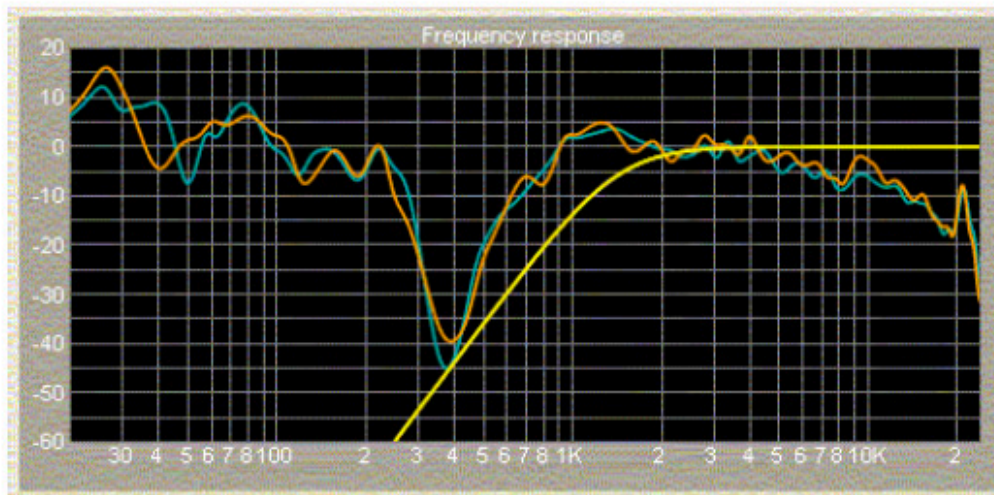
Measurement				Correction			
Data :	<input type="radio"/> TACS <input checked="" type="radio"/> Tact Time <input type="radio"/> Tact Frequency			Enable	<input checked="" type="checkbox"/>		
Channel	Measurement file			Range	<input type="radio"/> Auto <input checked="" type="radio"/> Manual		
Left	<input type="text" value="I:\Prj\Tacs\Msr_medium\Msr_L1.tim"/> ...		Level (dB)	From	to	Hz	Transition
Right	<input type="text" value="\Prj\Tacs\Msr_medium\Msr_R1.tim"/> ...		-6,0	70	3000		Medium
Smoothing	<input type="text" value="0,40"/>		Fall Off	Normalize	<input checked="" type="checkbox"/> Left gain (dB) <input type="text" value="-6,7"/>		
			<input type="text" value="0,60"/>	Link levels	<input checked="" type="checkbox"/> Right gain (dB) <input type="text" value="-6,7"/>		
				<input type="button" value="Calc"/>			

Select Save filter, choose Target memory 1 then click on Program and Program filters.

We now will create the high range filter. In the Crossovers/Design menu click on Create new filter, choose the high and give it a name (HP4_1400 in the example). Select a full range filter with minimal phase.

Frequency range	<input type="text" value="Aigu"/>
Filter name	<input type="text" value="HP4_1400"/>
Filter type	<input type="text" value="Full range (Fs=96 kHz, Min phase)"/>

In the Crossovers/Design/Correction menu, click on Tact time and to choose the files of measurements of the high filtered (+ low filtered). For the high one, the default smoothing is increased with the parameters Smoothing=0,30 and Fall Off=0,75.



In order to limit the correction in the extreme highs, low-pass of order 2 with 10kHz is added.

Click on Enable Correction and choose a Manual range between 600 and 18kHz.

Normalize the filter with Link levels selected in order to have the same level on the left and on the right.

Type	Freq.	Order	Response
HighPass	1400	4	LinkwitzRiley
LowPass	10000	2	Butterworth

Measurement				Correction			
Data :	<input type="radio"/> TACS <input checked="" type="radio"/> Tact Time <input type="radio"/> Tact Frequency			Enable	<input checked="" type="checkbox"/>		
Channel	Measurement file			Range	<input type="radio"/> Auto <input checked="" type="radio"/> Manual		
Left	KII\Prj\Tacs\Msr_grave\Msr_L1.tim	...	Level (dB) 2,0	From	600	to	18000 Hz
Right	II\Prj\Tacs\Msr_grave\Msr_R1.tim	...	Level (dB) 2,0	Transition	Medium		
Smoothing	0,30	Fall Off	0,75	Normalize	<input checked="" type="checkbox"/>	Left gain (dB)	-5,2
				Link levels	<input checked="" type="checkbox"/>	Right gain (dB)	-5,2
				<input type="button" value="Calc"/>			

To save the filter, choose Target memory 1 then click on Program and Program filters.

4. TIME ALIGNMENT

Software TACS associated with the RCS makes it possible to measure the response of the loudspeakers.

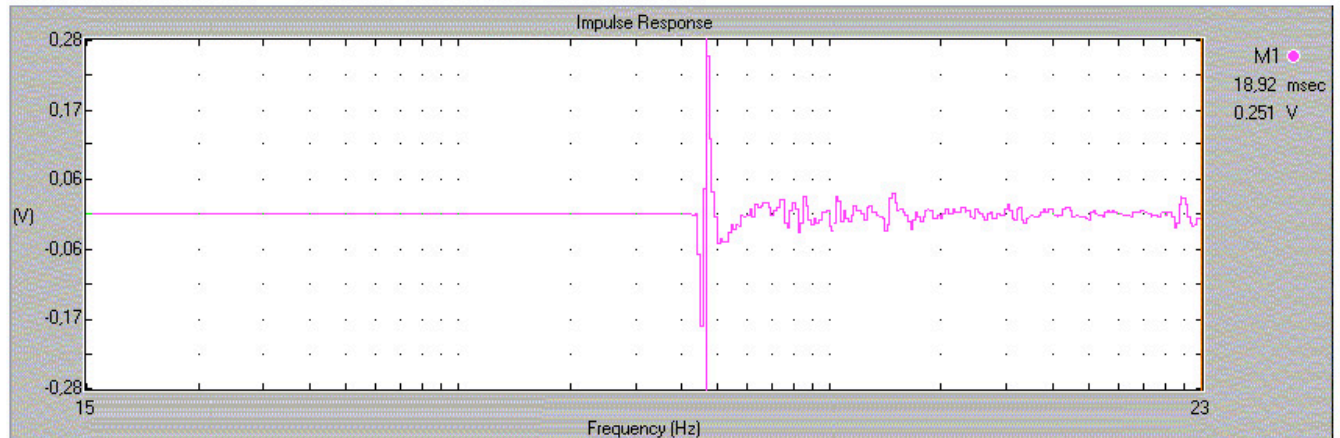
With the TCS, the Tact software was used.

Measure the response of the high filtered only.

In the Dual Domain screen, load the Msr_L1.tim file in Buff #1 and Msr_R1.tim in Buff #2.

Display the first impulse response.

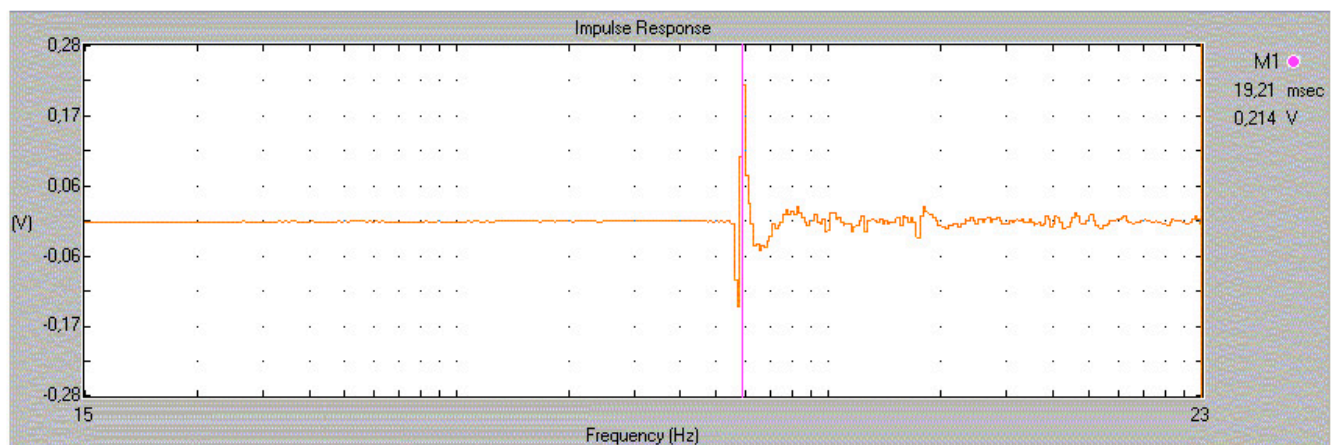
Select Marker M1 = Buff #1 and click on max M1.



The peak of high the left channel is here at 18,92 ms.

Display buffer 2.

Select Marker M1 = Buff #2 and click on max M1.



The peak of high the right channel is at 19,21 ms.

Then measure the response of midrange.

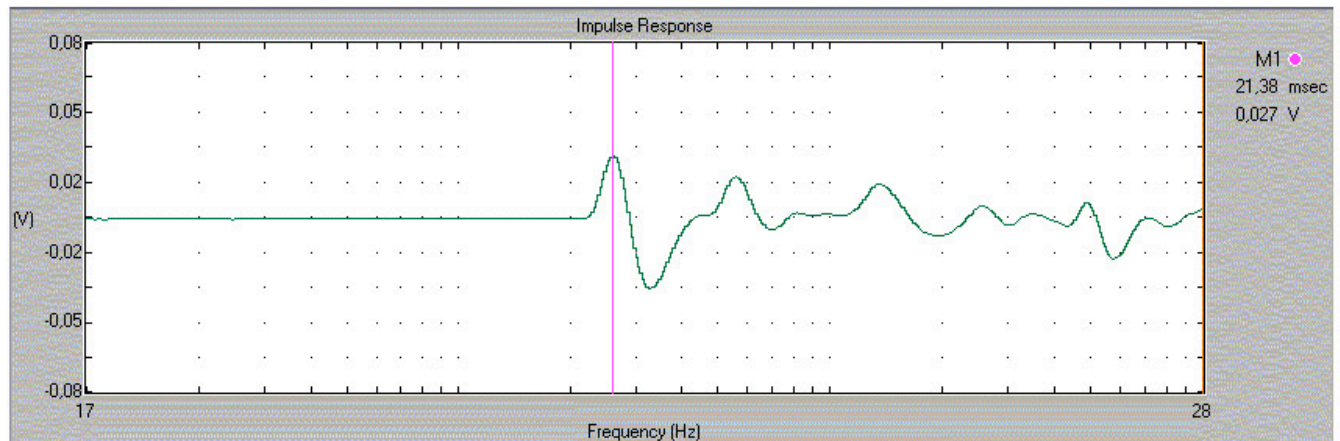
In order to obtain a sufficient noise level to allow measurement, the high range is also activated.

Put a time of 35ms on the high amplifier in order to identify the impulse of the midrange clearly.

In the Dual Domain screen, load the Msr_L1.tim file in Buff #3 and Msr_R1.tim in Buff # 4.

Display buffer 3.

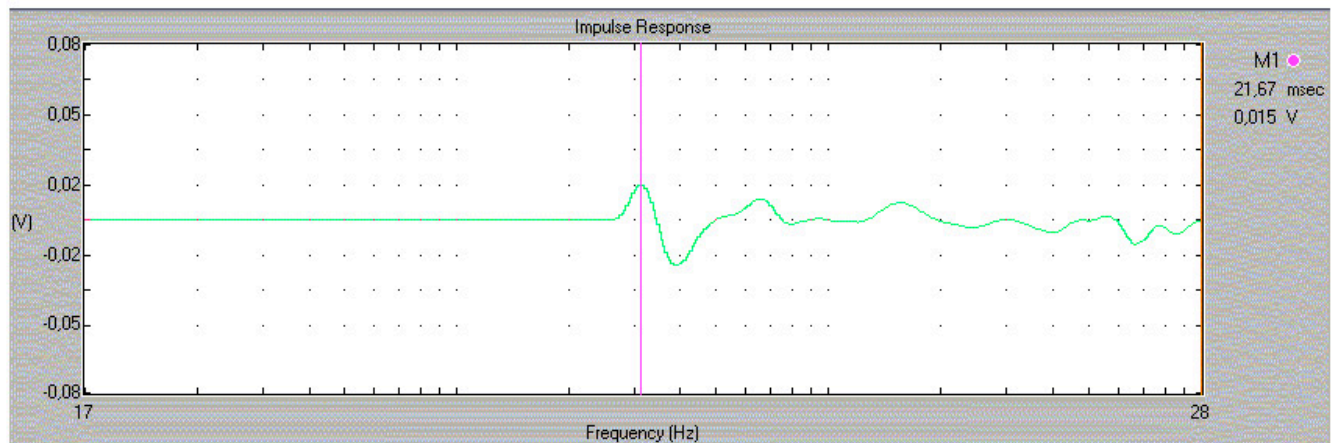
Select Marker M1 = Buff #3 and click on max M1.



The peak of the impulse of the left midrange is here at 21,38 ms.

Display buffer 4.

Select Marker M1 = Buff #4 and click on max M1.



The peak of the impulse of the right midrange is at 21,67 ms.

Then measure the response of the low range.

In order to obtain a sufficient noise level to allow measurement, the high range is also activated.

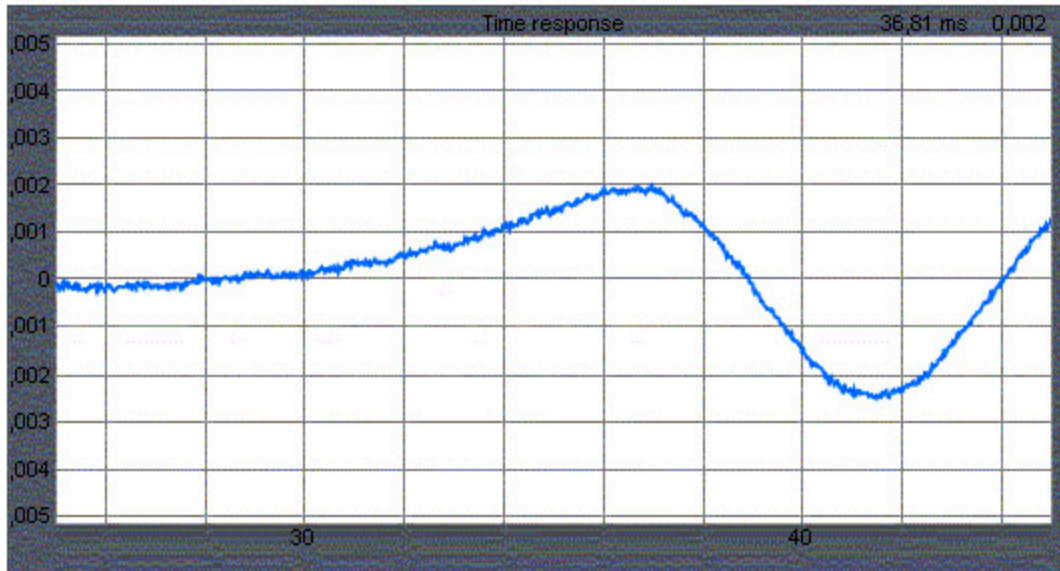
Put a time of 35ms on the amplifier of high range in order to identify the impulse of the low range clearly.

In the Dual Domain screen, load the Msr_L1.tim file in Buff #5 and Msr_R1.tim in Buff #6.

Display buffer 5.

Modify the scale of time in order to allow the impulse of the low-range to appear.

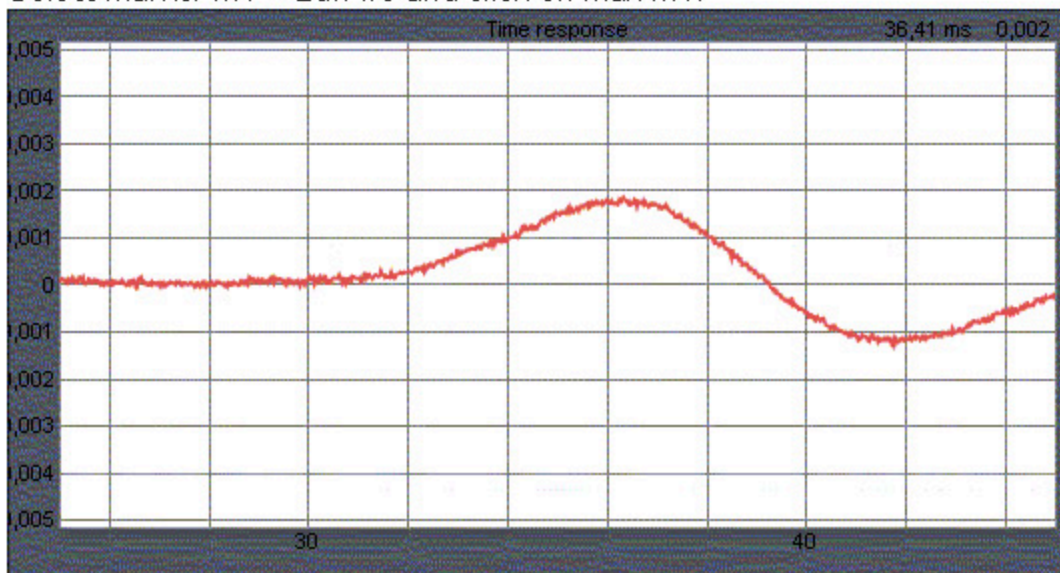
Select Marker M1 = Buff #5 and click on max M1.



The peak of the impulse of the left low-range is located about 36,8 ms.

Display buffer 6.

Select Marker M1 = Buff #6 and click on max M1.



The peak of the impulse of the right low-range is located about 36,4 ms.

The impulse of reference is most distant; it is that of the left low-range located at 36,8 ms.

The other impulses are in advance and must be corrected by adding a time.

We thus add in the amplifier of high-range a delay of $36,8 - 18,92 = 17,88$ ms for the left channel and $36,8 - 19,21 = 17,59$ ms for the right.

For the mid-range amplifier, we add a delay of $36,8 - 21,38 = 15,42$ ms for the left channel and $36,8 - 21,67 = 15,13$ ms for the right channel.

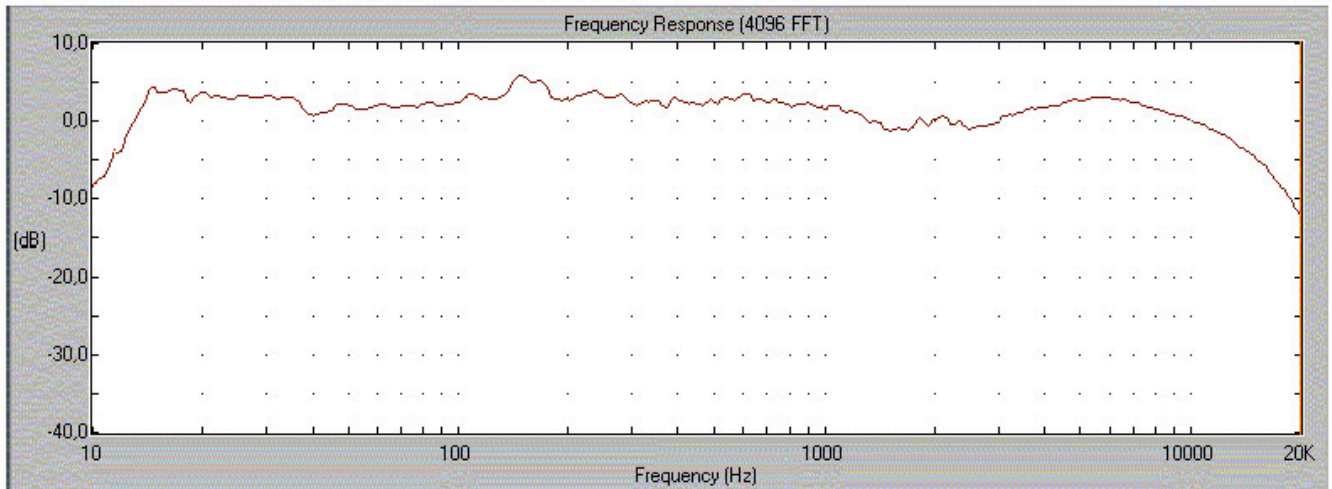
For the low-range amplifier, a delay of $36,8 - 36,4 = 0,4$ is added on the right channel.

5. ADJUSTMENT OF THE RELATIVE LEVELS.

With the adjustments:

Low = 0 dB, Mid = -5 dB and High = -12 dB

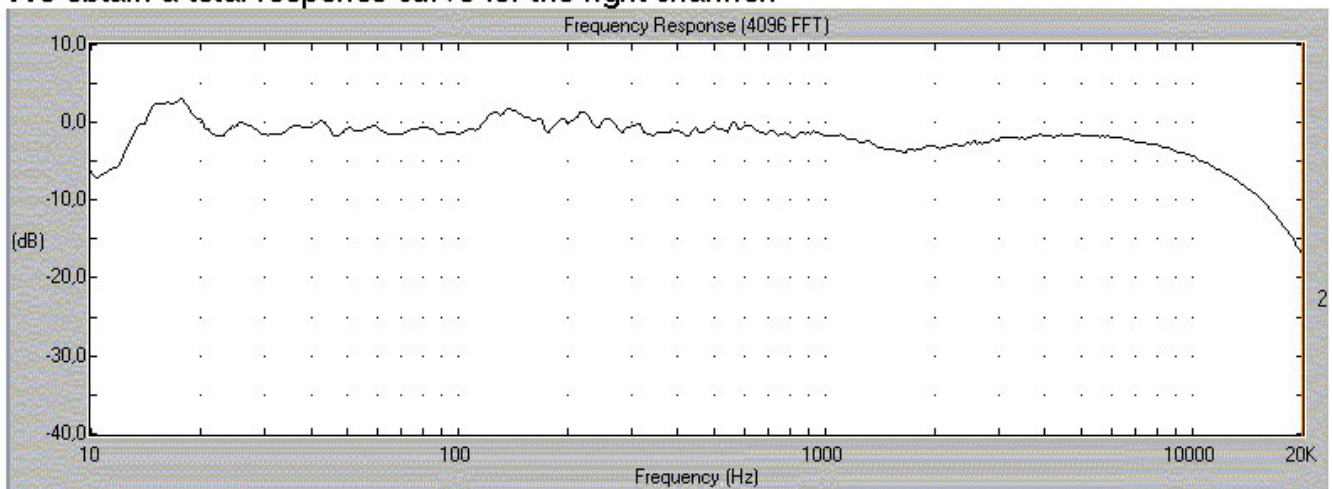
We obtain a total response curve for the left channel:



With the adjustments:

Low = 0 dB, Mid = -4 dB and High = -14 dB

We obtain a total response curve for the right channel:



It no longer is needed to do all the correction in the preamplifier.

6. HISTORY

Rev.0f.E1: Correct translation of Francis' and Frederic's names

Rev.0f.E0: Translated to English 25/11/05 by Tip Johnson

Rev.0f: Initial edition of the 28/09/05 by Francis Brooke

<http://francis.audio.monsite.wanadoo.fr/>