Features & Screenshots Of RPlusD

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RPlusD is now complete. The completed manual is posted in PDF format. In cases where the existing PDF docs have incomplete explanations, detailed explanations can be found in the respective help files. The program has an extensive help file for the various special function windows that describes each of the respective functions in detail when the help button is clicked.

In many cases documentation written for programs is not read. RPlusD has a series of videos that shows the basic functions of an earlier beta version of the program and are sufficient to allow users to learn how to use the *graphical user interface* (GUI).

This document has pictures of the various windows and a brief description of each function.

RPlusD runs in all current MS operating systems (including Vista) and requires a full duplex (play and record at the same time) sound card. The information regarding sound cards is in FAQ's and in the GettingStarted PDF document. Almost any sound card will work as well if the necessary functions are built into the sound card. The software will be as accurate with a low cost sound card as it will be with the best sound cards available. One does not require a high quality sound card to take accurate measurements because RPlusD uses the left channel to measure the response of only the sound card using a direct left out to left in connection. The response errors in the sound card are known and are removed from any measurements. This provides very close to 100 % accuracy in measurements.

The unique capability of RplusD is that of *EQ emulation*. This is allows the user to simulate EQing a system with 32 measurement microphones taking data in real time. It is much faster than doing it this way because the measurements are first taken then EQ emulation takes place in software and can be computed much more quickly than measurements can be repeated in real time. This feature makes RplusD the ideal tool for people who wish to use digital equalizers. It is the opinion of the author that DSP Eqing is a very effective way of improving sound quality of home theater systems in playing back dialogue. Popular Behringer EQ's are precisely emulated inside the software. The software provides a utility for setting any EQ to the EQ solution obtained using RplusD. There is no better way to EQ systems.
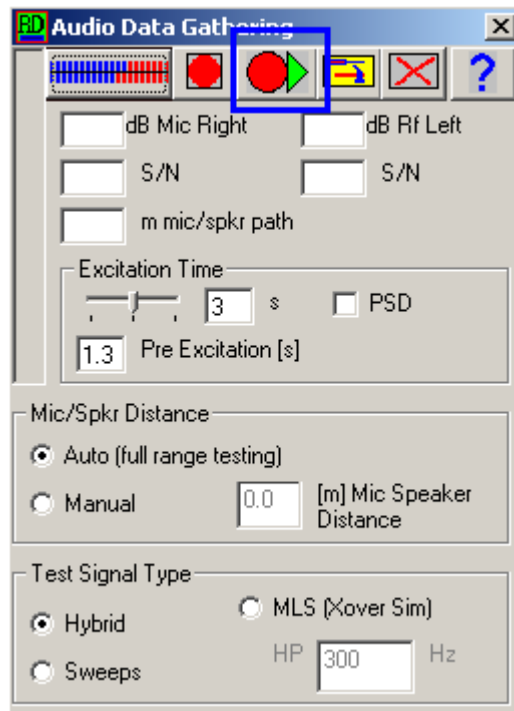
Feature List & Descriptions

Data Gathering

The Audio Data Gathering window is available from File->New->Normal Room/Speaker Measurement. The 'MLS (Xover sim)' button does not appear unless the enhanced package is bought at an additional cost above that of the basic program. This add on package is recommended for advanced users that want to do curve fitting, DSP crossover emulation or wireless measurements. Most new users that are uninitiated to audio measurements will benefit more from buying the consultation option that gets the program designer working with them rather than buying the add on package that provides the more sophisticated functionality.
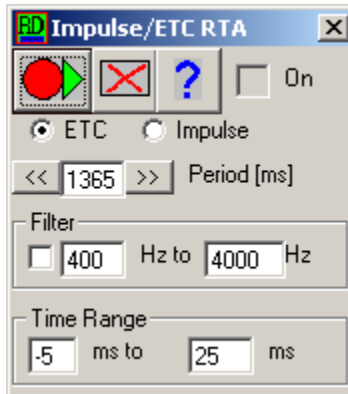
RPlusD provides sweep, MLS and a 'hybrid' measurement that combines an MLS signal at mid & high frequencies with a sweep for low frequencies. The hybrid signal is best for full range speaker measurements. The sweep is best for RT/60 measurements. The MLS signal is mainly used only for DSP crossover emulation measurements. RPlusD also has the option of auto ranging your mic speaker distance inside the software or allowing the user to type in a value. Subwoofer

measurements require the value to be typed in but full range measurements can normally make use of the Auto function quite well.

Audio Data Gathering Window

For users that wish to measure the time response in real time while placing absorbers a separate module is provided. This is available from File->New->ImpulseRTA. This feature provided pseudo real time impulse or ETC measurements to be taken to optimize absorber placement. This display can update as quickly as once every fraction of a second depending on the period settings.

Impulse RTA

Printing & Graphic Export

RPlusD has a JPEG export utility that is available for all users. This is a convenient feature for posting results on discussion groups. The *.jpg file exported is the same size as the graphic. The printing capability is provided for Add On Package licensees and commercial users. This feature uses a 3rd party component to generate exportable graphic from all mathematical graphic displays.
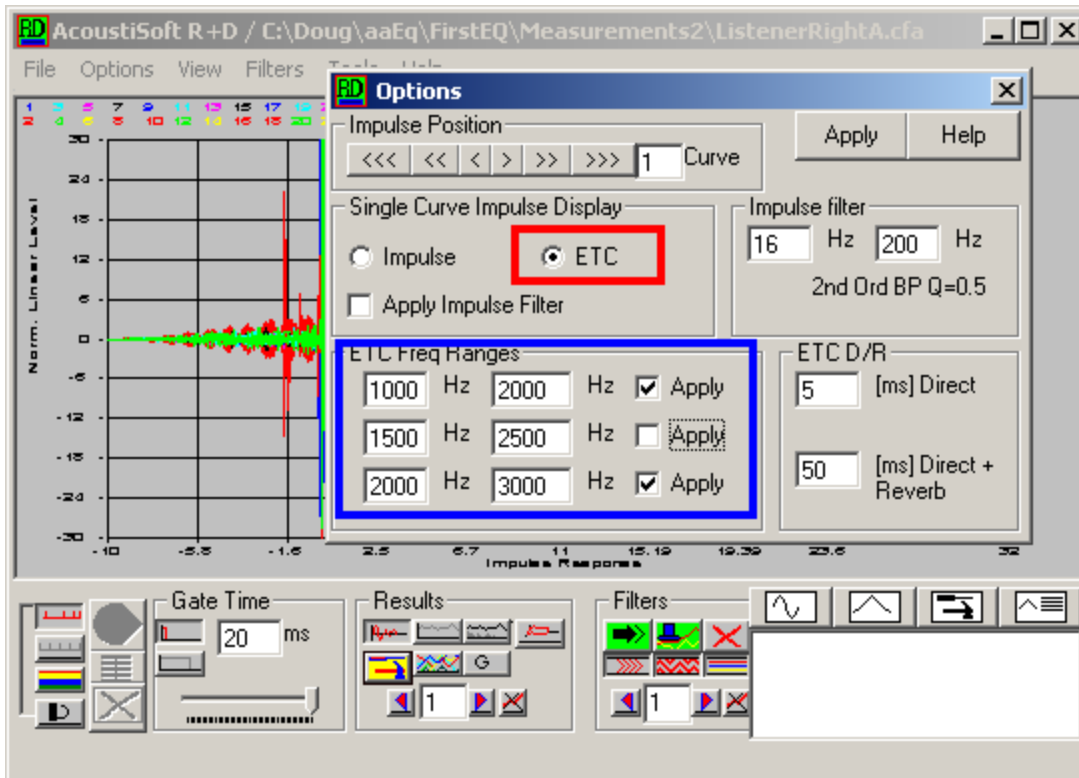
Time Measurements

An estimate of the measurement signal to noise ratio and its levels are shown in this window each time the button boxed in blue is clicked to generate a measurement in the main Data Gathering Window pictured above.
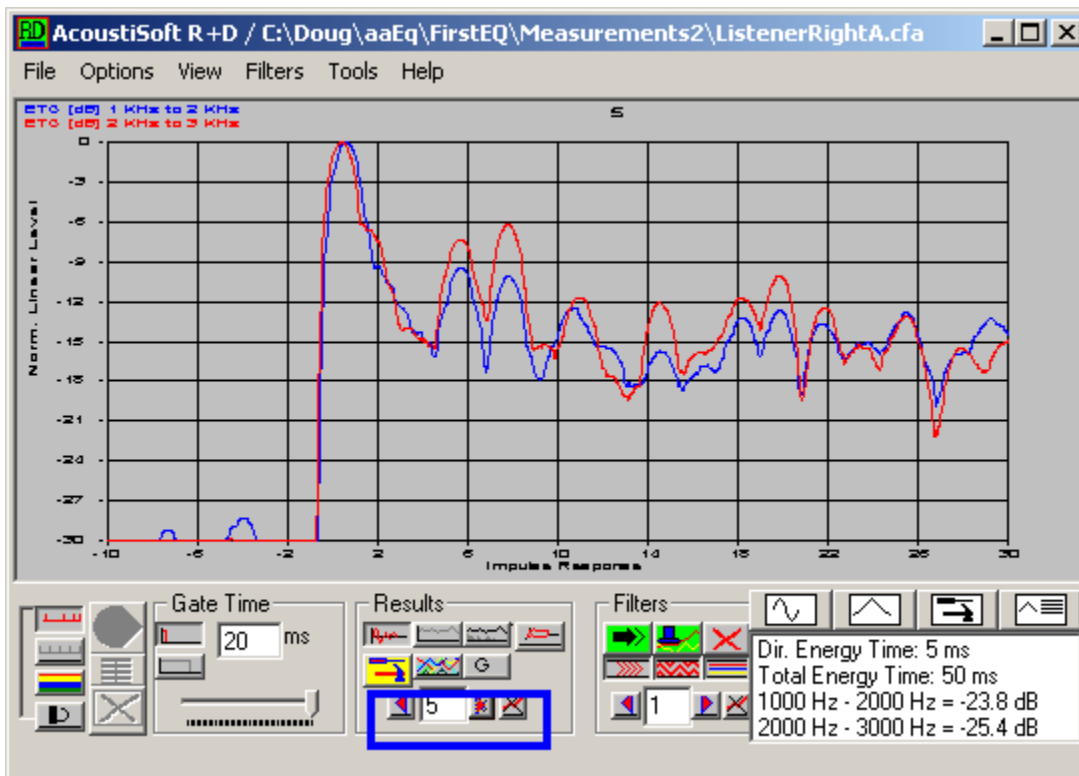

Impulse Response

The impulse response is not very useful for looking at reflection behaviour. The impulse is only useful for determining that the impulse response starts at t=0 ms and that the analyzer took a correct measurement, otherwise it is useless and causes beginners to draw erroneous conclusions. RPlusD has a full featured ETC curve set to look at reflections closely. To see this, select impulse response (boxed in red) then click the options box (boxed in blue). The options box below appears.
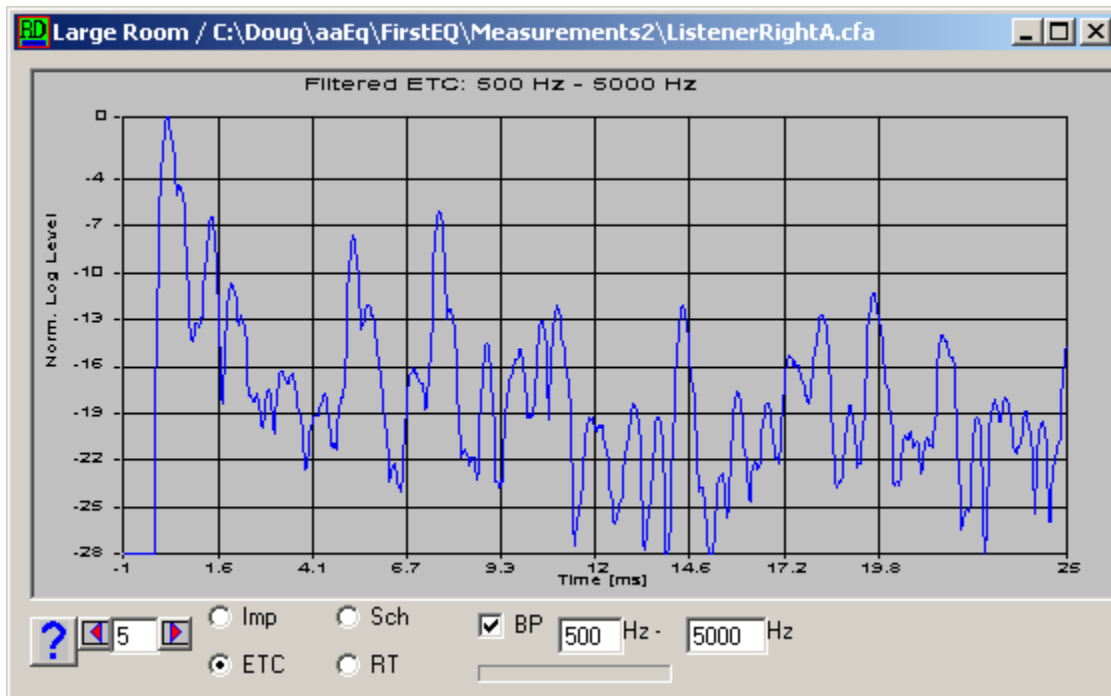
Time Display Options

The options selected that are boxed in blue and red make the single ETC curve the default time curve.

Single Curve ETC display

The band filtered ETC curves appear when the arrow keys are selected (boxed in blue in the Time Display Options figure above). A set of up to three band filtered ETC curves can be viewed for each of the measurements in the buffers. The default time here is 30 ms and this cannot be changed. This allows a more detailed view of the ETC curve to be viewed in the context of speaker radiation of different drivers. In the above measurement a two way speaker is used and the reflected energy from the HF driver is much greater than that from the LF driver.
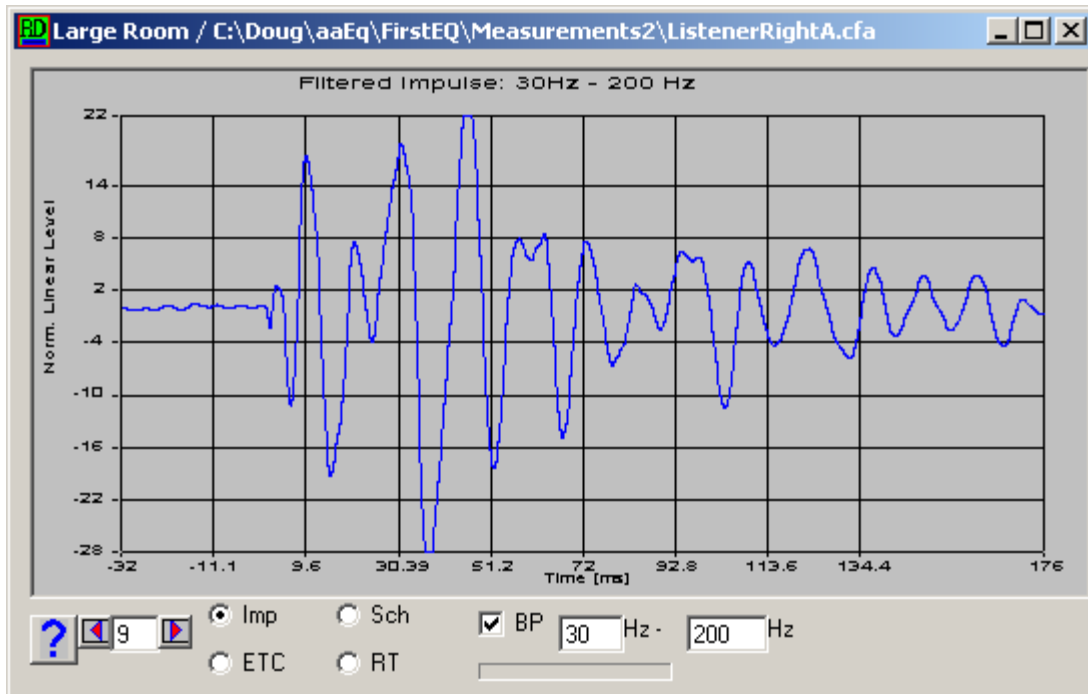
From the top menu the selection Tools->Large Room gives the following window. Experimenting with the frequency range selected gives varying degrees of detail in the display. Any time range or level range can be selected from this window using the mouse.

Large Room Tools ETC display

This window provides other tools for looking at reverberation time and schroeder plots as well. RPlusD uses the two measurement method for measureing RT/60. For a measurement of RT/60 in RPlusD two measurements are taken with the mic in each position. The software can store up to 32 measurements and therefore measure RT/60 from up to 16 individual mic positions. The two measurement technique gives much better signal to noise ratio for each RT/60 measurement than the single mic method. The ability to average results from various mic positions in the room gives greater accuracy as well. See the help content (blue question mark in window picture above above) for specifics on how to measure RT/60.
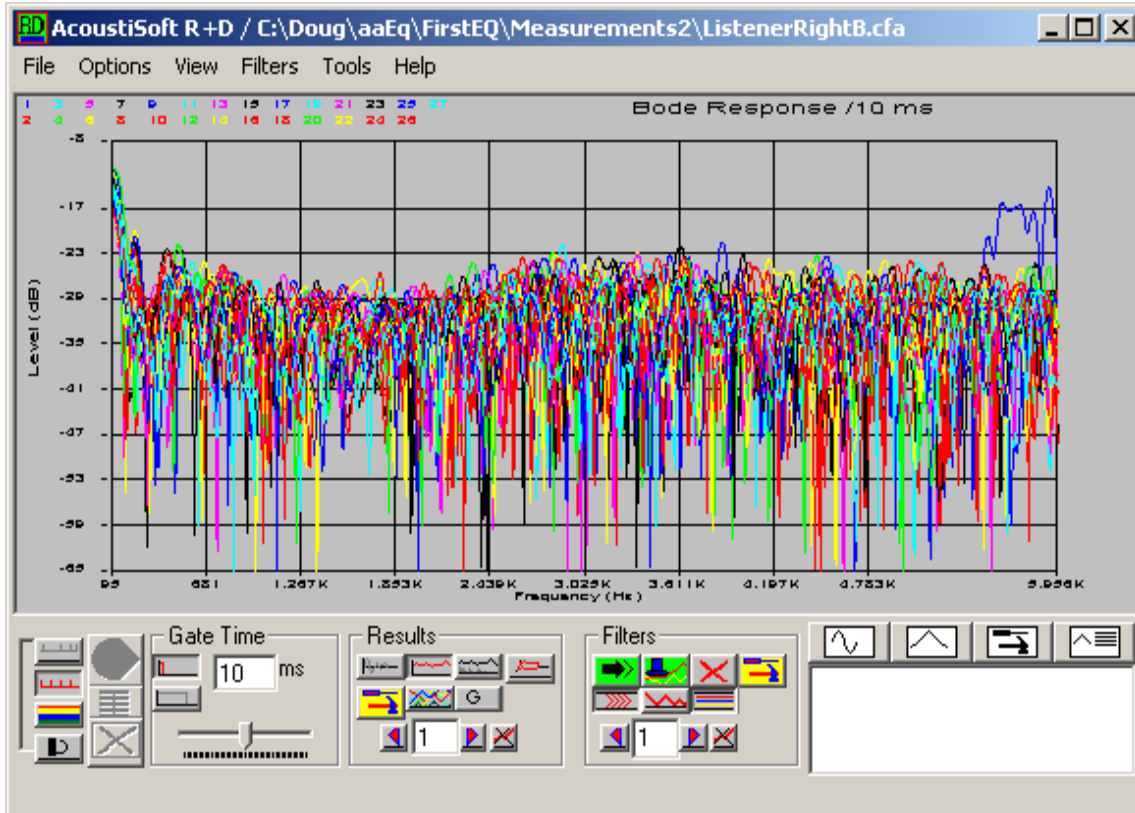
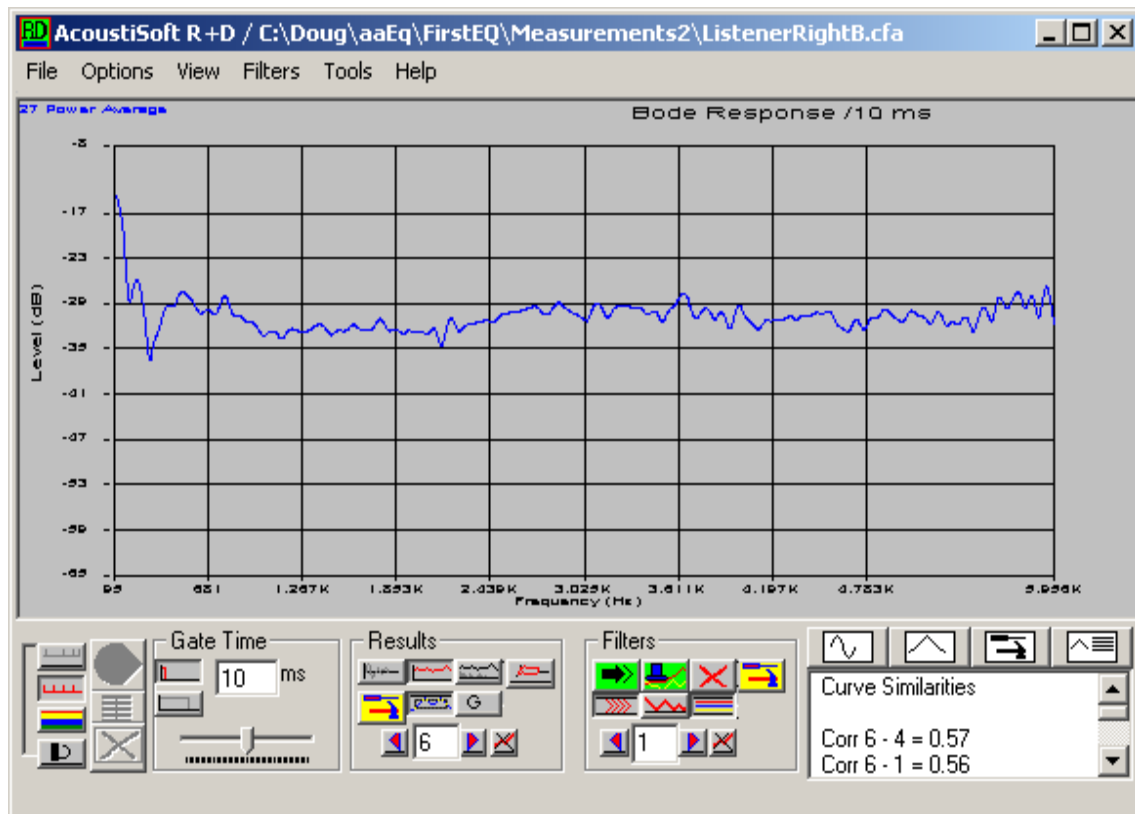A low frequency impulse may be viewed from this window as well.

Low Frequency Impulse

Frequency Response Measurements

RPlusD has a variety of frequency response measurement types that comprise the standard set of response types included in the functionality of audio analyzers.
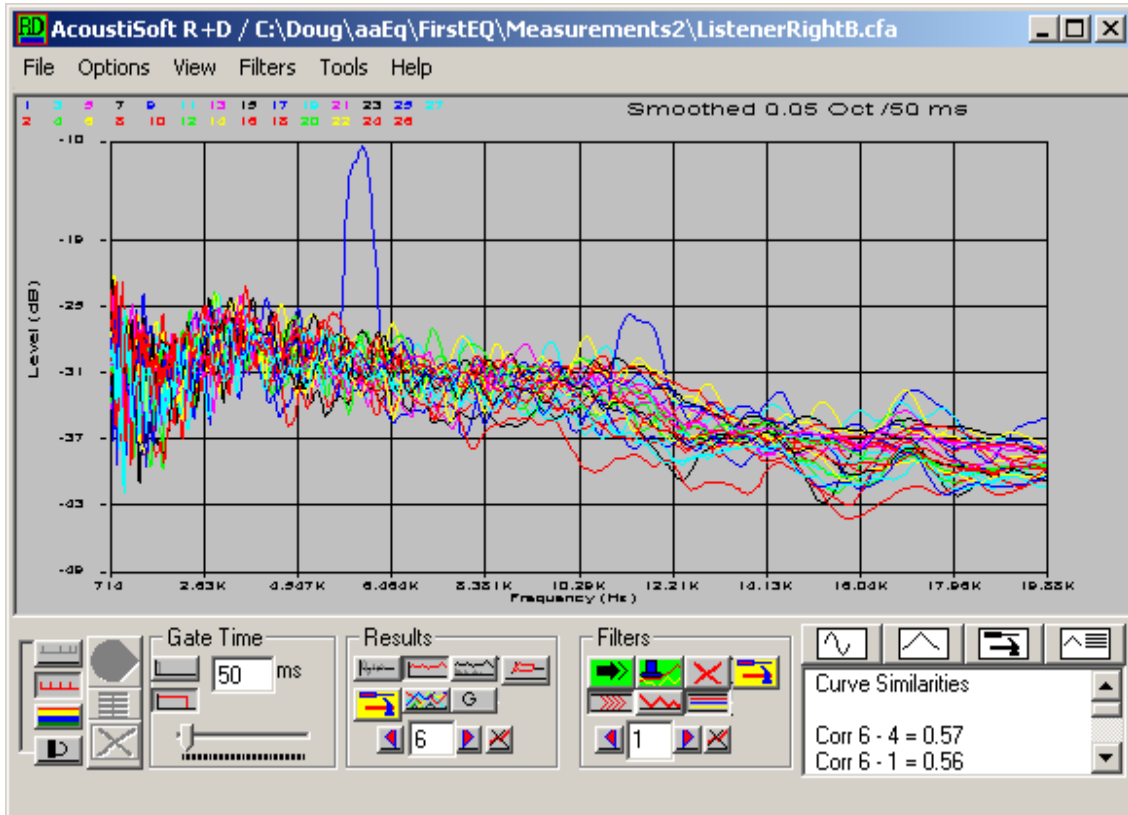
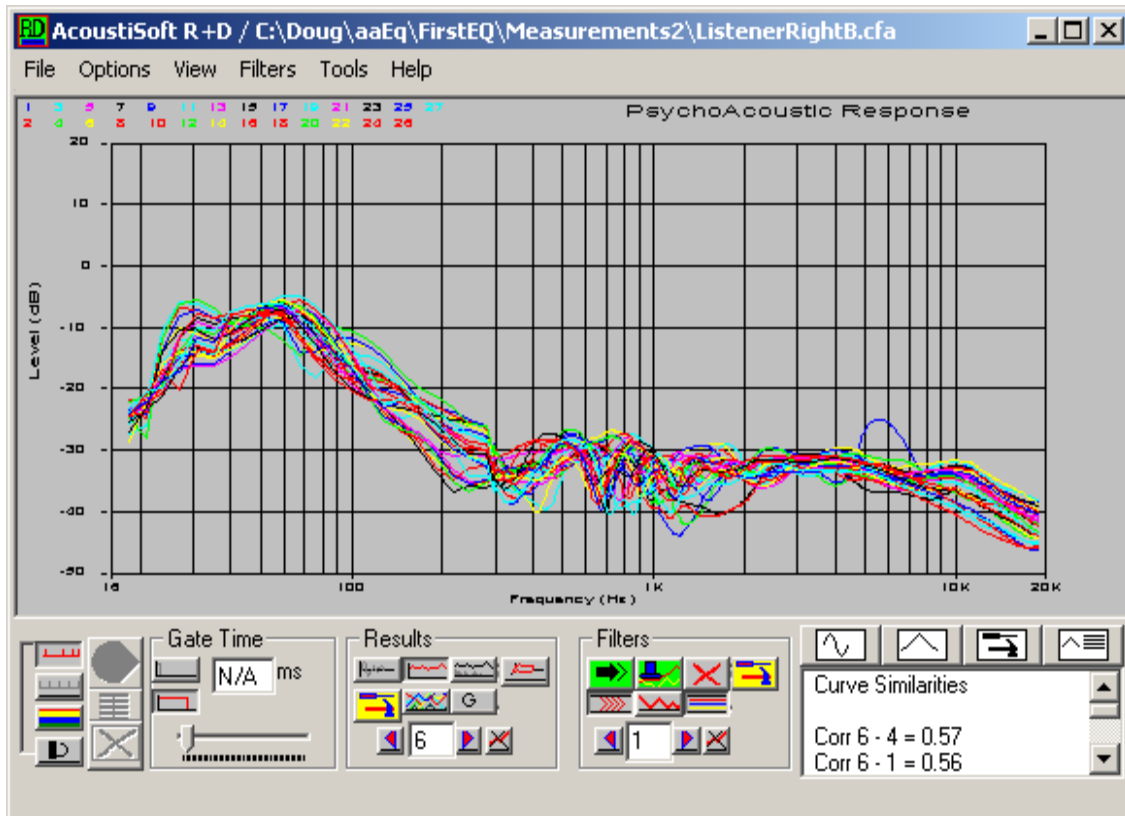Bode (unprocessed) Frequency Response

Averaged Bode Response

The Bode response is an un-smoothed response and often shows too much detail and that detail is usually due to reflections. Curve smoothing using a moving average gaussian window produces the smoothed result in the fractional octave displays and filters out the affect of reflections.
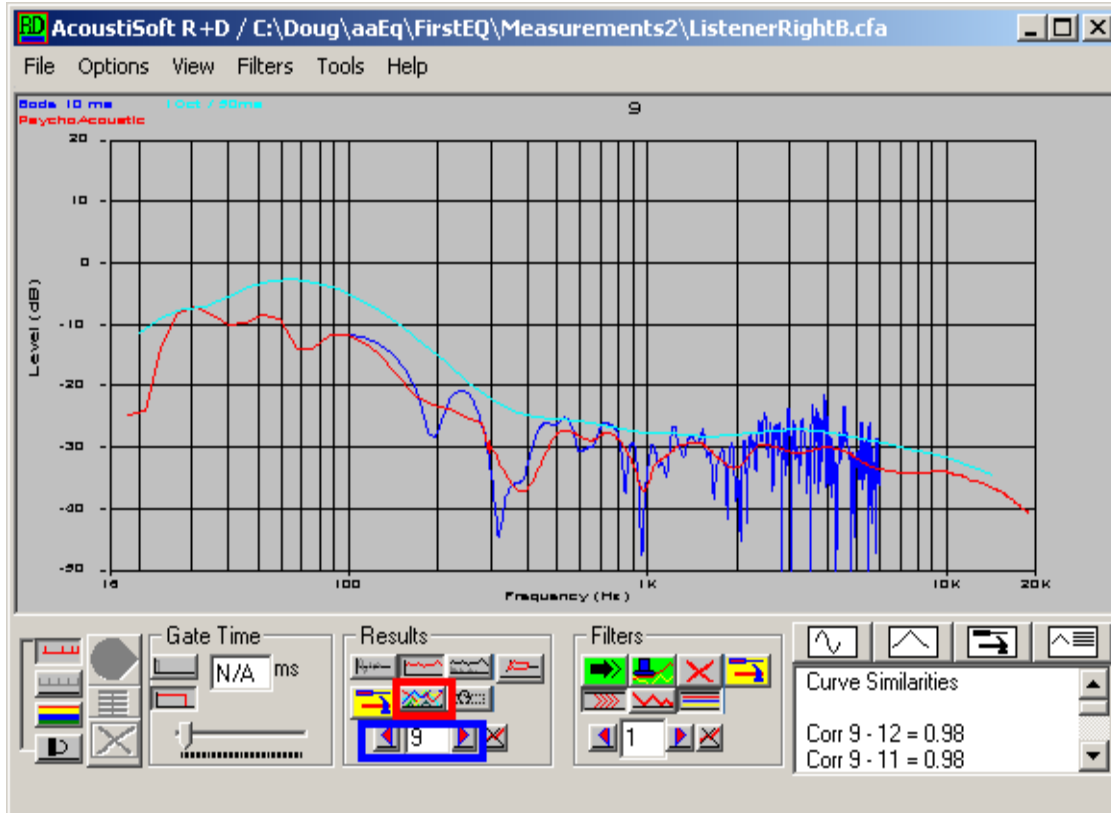

Fractional Octave Response - (1 oct - 1/20 oct resolution)
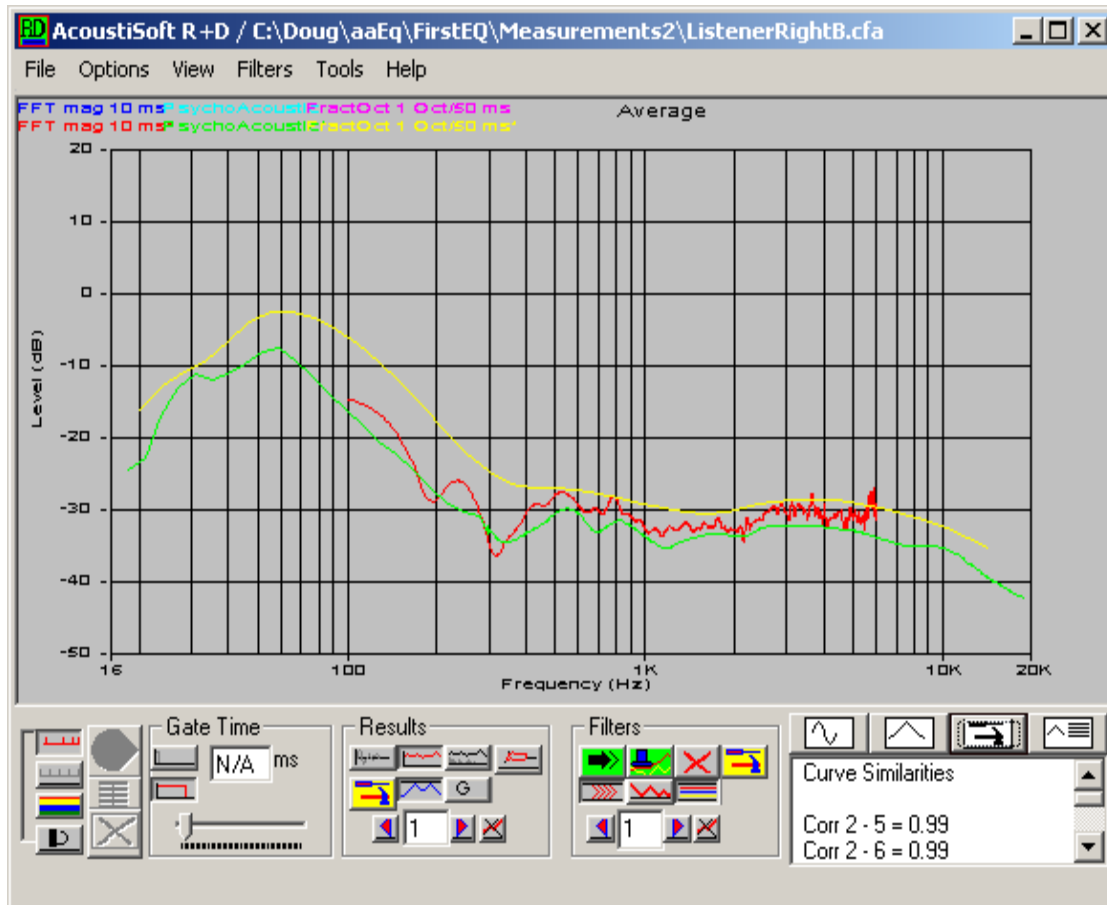
Psychological Response

The psychological response uses a varying gate time. The curve is composed from measurements that have the gate time change dependent on frequency. Long gate times are used at lower frequencies. The gate time is reduced as frequency is increased until the gate time becomes 5 ms at approximately 200 Hz. At frequencies above 200 Hz the data is smoothed to provide a 1/3 octave resolution. This gives a better indication of overall frequency response as heard be a listener. The other measurements are better used to identify specific system pathologies such as resonances.

When all three types of responses are calculated they can be viewed as individual curves when the average button is not clicked (boxed in red) when the arrow keys are clicked (boxed in blue).
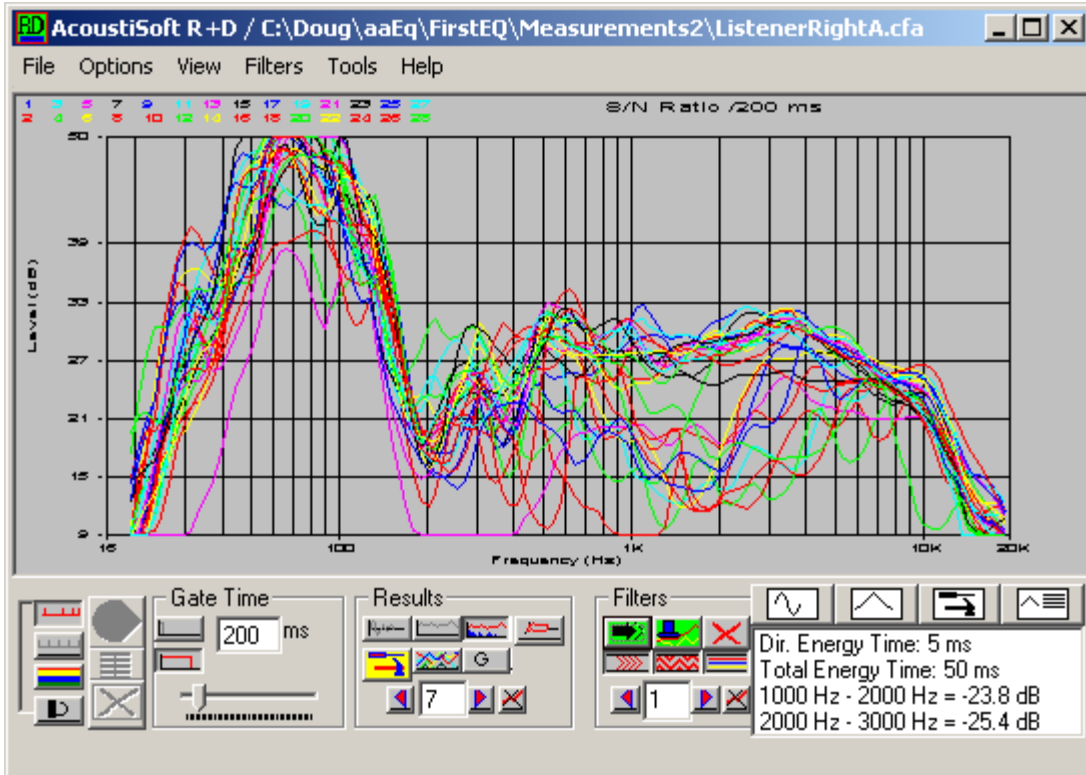
Single Curve Response

The average of all responses may also be shown. Notice that this shows 6 curves. This feature is normally used when the internal EQ emulator is used, which it is not here. The filtered and unfiltered curves are identical in this case because filtering is not used. The filtered curves overlay the unfiltered and are shown with an asterisk on their display label. This display is seen when the arrow keys in the Results frame are clicked with the average button enabled.
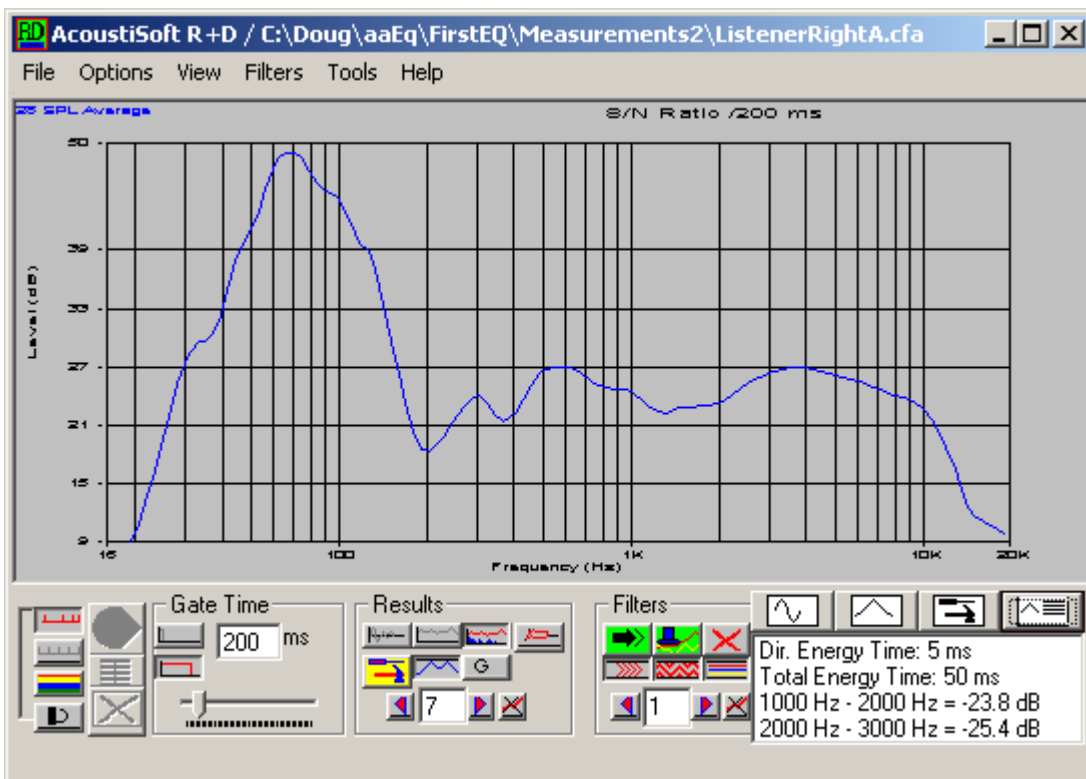
Averaged Response

The software also provides an indicator of signal to noise ratio of the measured set of curves as an average or viewed individually from the arrow keys inside the Results frame as with all frequency response measurements.
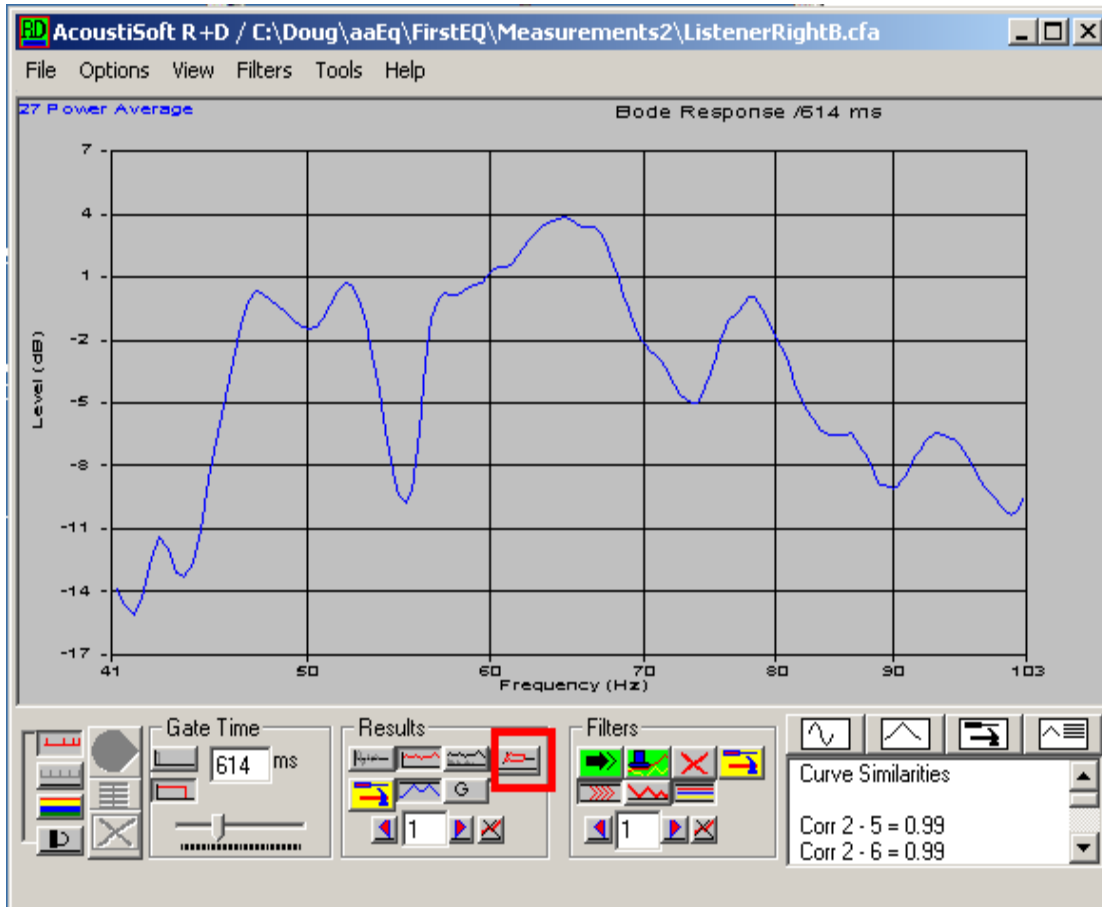
Estimated Measurement Signal To Noise (all curves)

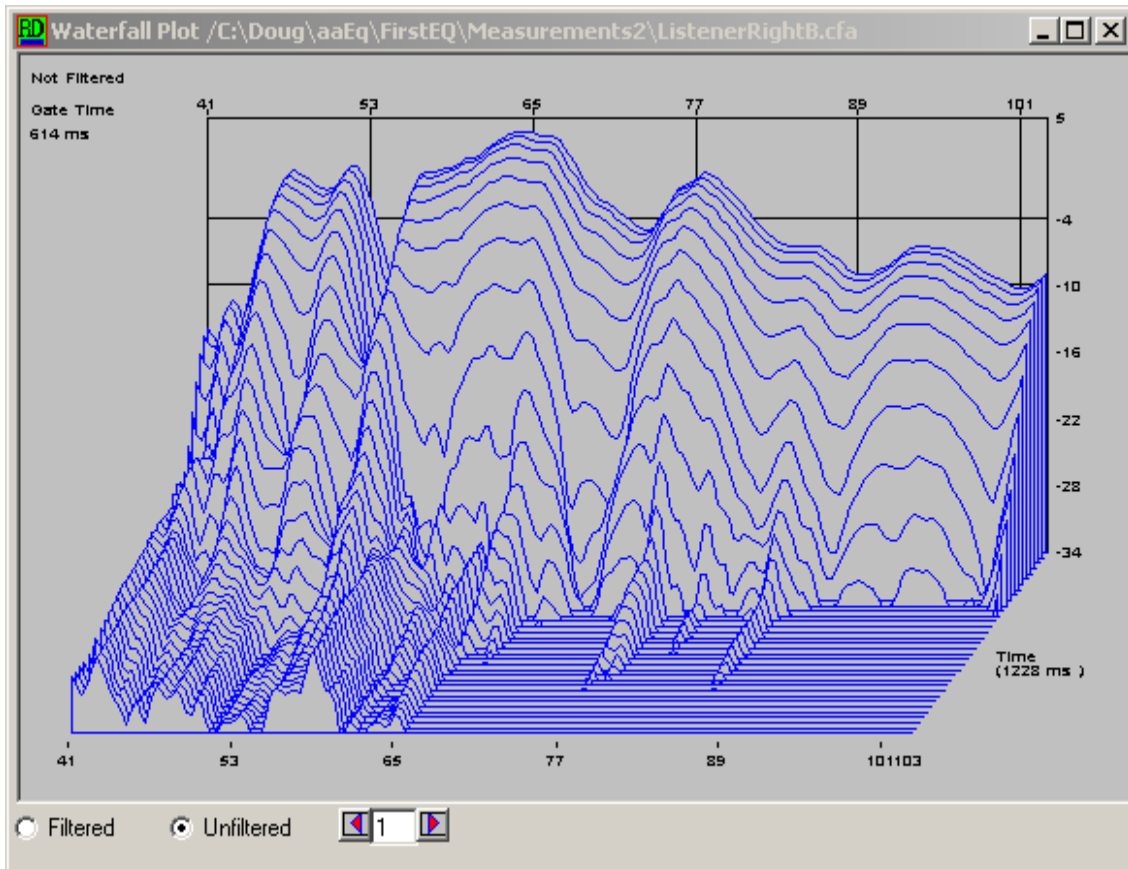Estimated Measurement Signal To Noise (Average)

The waterfall display averages all curves to produce a clean waterfall display with an absence of

dips. The user selects an area of the frequency response with the mouse that contains about 10 peaks to display as below.

Averaged Bode (unsmoothed) Response

Clicking the button boxed in red generates a nice looking waterfall display. The trick is to grab a frequency region on the display with about 10 peaks, the software does the rest. This takes a few minutes because the software caculates the waterfall display for each measurement then displays an average. This provides a much better picture of room decay then a waterfall of only one measurement.
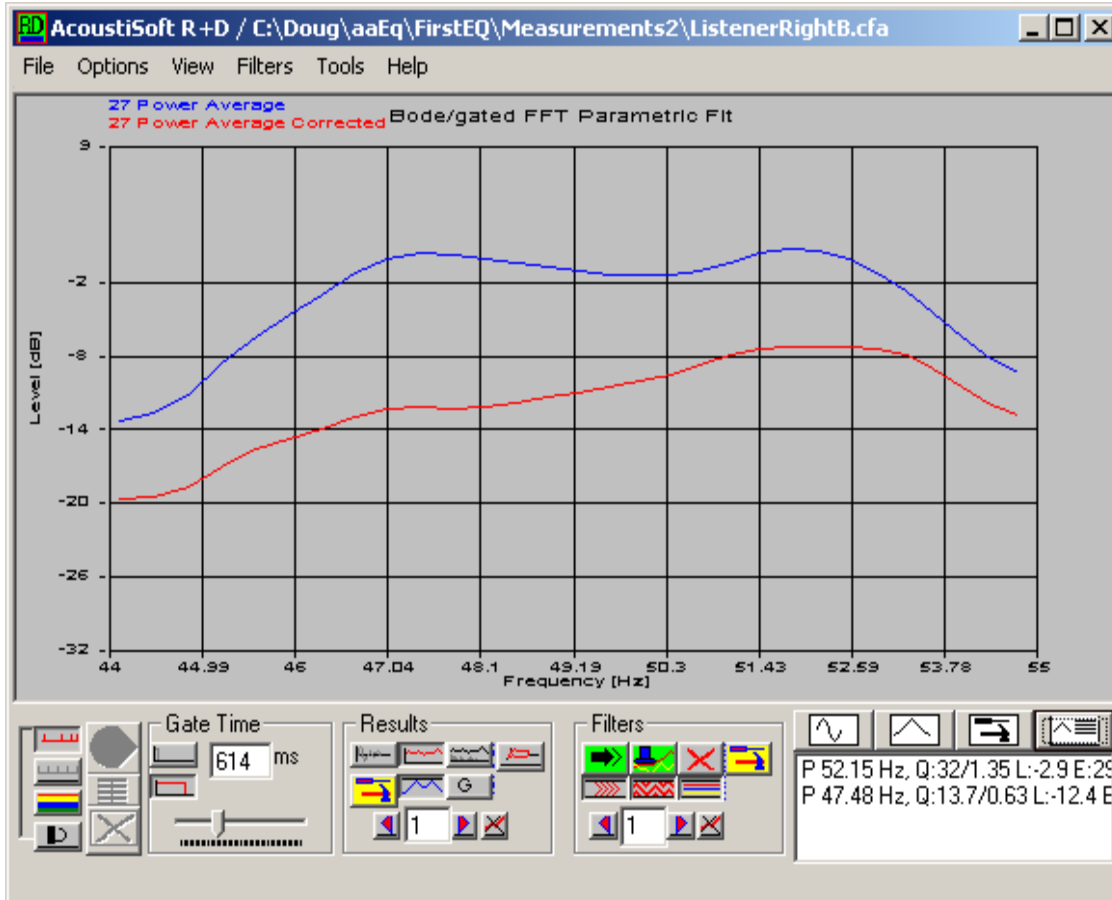
Averaged / waterfall

Good looking waterfall plots are always automatically generated provided the user grabs about 10 peaks or less on the frequency response display with the mouse before clicking the waterfall button. The software determines the noise and decides all limits automatically. Single waterfall displays can be viewed by clicking the arrows. Clicking "filtered" or "unfiltered" returns the display to its default averaged format. If an EQ is emulated then the waterfall plots before and after EQing can be quickly compared using an average of all measurements.
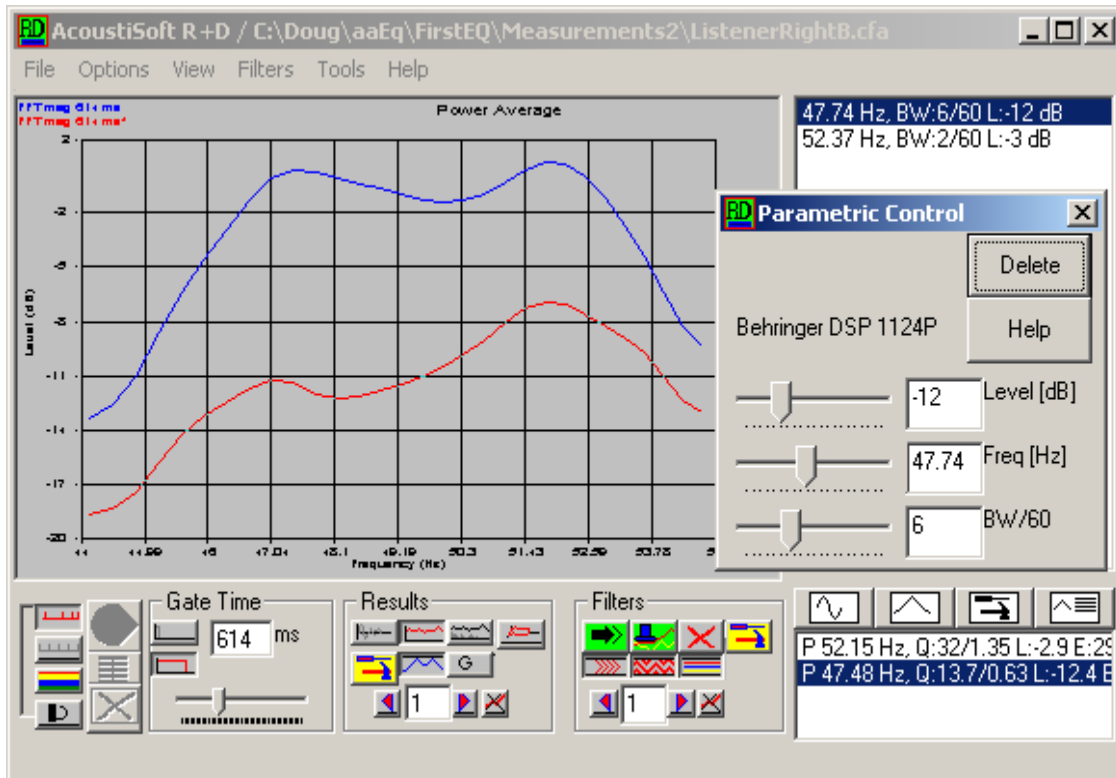
Equalization

The add on package provides curve fitting to speed up filter approximations. Users that do not purchase the add on feature still have access to a very powerful EQ emulator but filters must be set manually.

Curve Fitting (Requires add on enhancement package)

Curve fitting is done by selecting a portion of the response while holding the right mouse button down. Clicking on the two estimates of 52.15 Hz and 47.48 Hz from the above lower text box generates a set of filters to be applied to the measurements. These are shown in the larger upper text list shown in the figure below. These filters can also be manually generated from the 'Filters->New Filter' menu selection and their settings can be fine tuned manually.

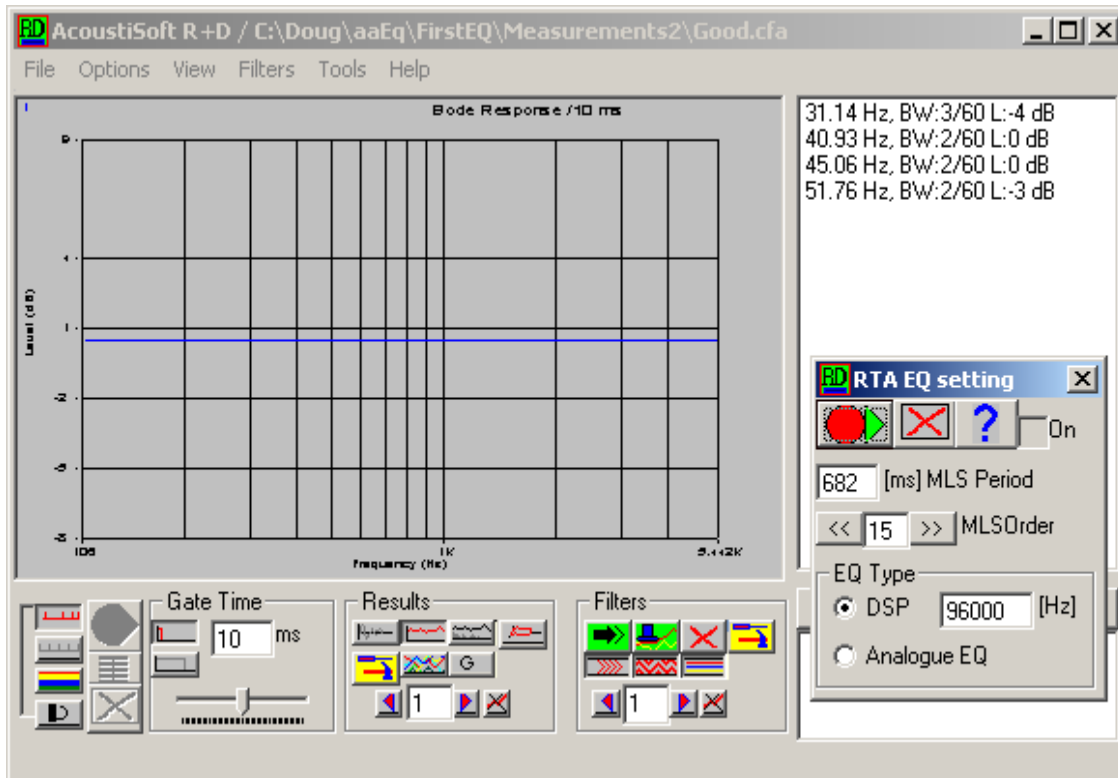Parametric Control for Behringer DSP 1124P Emulator

In this example the Behringer DSP 1124 is emulated and the control settings represent exact discrete control settings in the Behringer unit. This is an emulation and the red curve shows exactly what the Behringer EQ would do if that setting was selected. EQ emulation is one of the flag ship features of the software. With RPlusD you only measure once. The affect of the Behringer setting can be viewed from the averaged curves or from any individual curve. RPlusD requires that you measure and EQ only once - no need to remeasure after determining an EQ setting because RPlusD uses exact emulation of the hardware EQ internally.

This powerful feature lets you set an EQ to up to 32 measurements loaded in memory - much better than setting an EQ in real time !!

EQ Emulation Selection

Three Behringer units are emulated. This window is available from Filters->EQ Emulation. If a Behringer is not used an EQ can be set to Bristow Johnson or Classic. RPlusD provides a utility to set your particular EQ to the RPlusD solution by connecting it to your sound card and setting it while watching a display update in real time. The hardware EQ is set until its filters match the idea dilter response found in RPlusD using all of your measurements. The software provides a resampling utility to resample measurements to the sample rate used by a given equalizer. This is necessary for exact emulation.
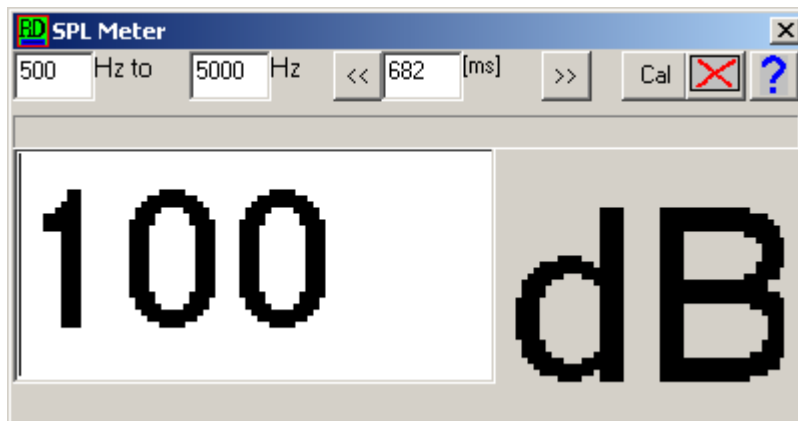
RTA for EQ setting

Using the above RTA EQ window from File->New->EQ RTA provides the capability of tuning the above display in real time while your EQ is adjusted until the response is flat. The external EQ is set to the ideal solution found in RPlusD when this is complete. This feature enables any EQ to be set precisely according to 32 measurements rather than set in real time to only one measurement.

SPL Measurement

RPlusD provides an SPL measurement that can be taken with the software. It does require an initial calibration to a known SPL. This enables users to measure SPL differences between the frequency range selected. It is ideal for measuring losses through doors, etc.

SPL Display

Distortion

The software provides two types of distortion measurements. Text files can be exported showing the characteristics of the distortion. Distortion is a complex topic but beginner users can use the multitone distortion measurement to get a single distortion figure for their system in typical room conditions without doing the experiment in lab conditions. This is useful to compare different speakers and to measure the point of overload. Figures around 10 % are normal but a sudden increase in distortion with varying levels is indicative of overload conditions. Distortion itself is hardly audible but an access of it does signal an overload.

Correct measurements using the two tone method are difficult to obtain in typical situations and this feature is reserved for users with a sophisticated understanding of audio measurements.
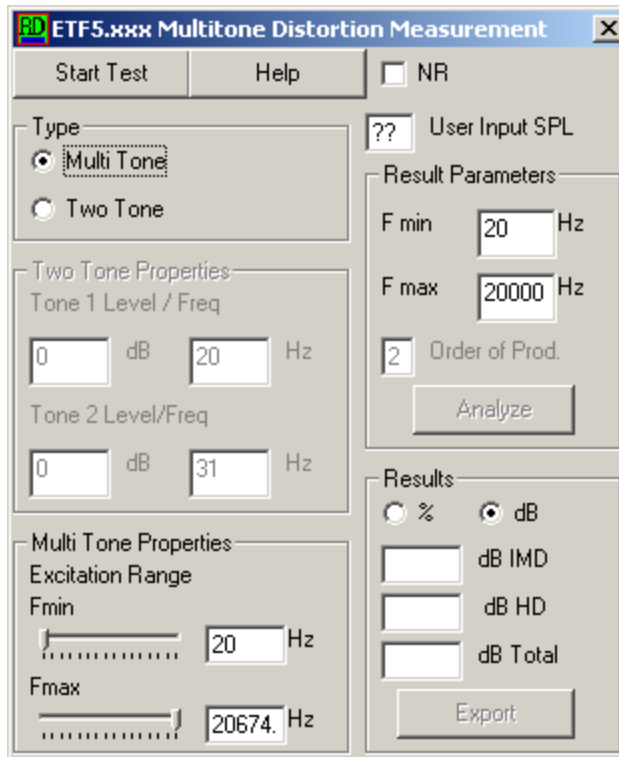

Two Tone Distortion Measurement

Multi Tone Distortion Measurement

The multitone distortion measurement excites the system with 10 computer selected tones and adds up the various distortion products. There are over 600 distortion products that are added to form the single distortion figure.

The multitone measurement was carefully designed to allow for slight sample rate errors in sound cards that are common. A 48 Khz sound card may actually sample at 47.99 KHz and this would reduce accuracy in less sophisticated multitone implementations.

Data can be exported in text format when either Two Tone or Multi Tone distortion measurements are used.

Connections to the system are identical to the standard connections used for room/speaker measurements.
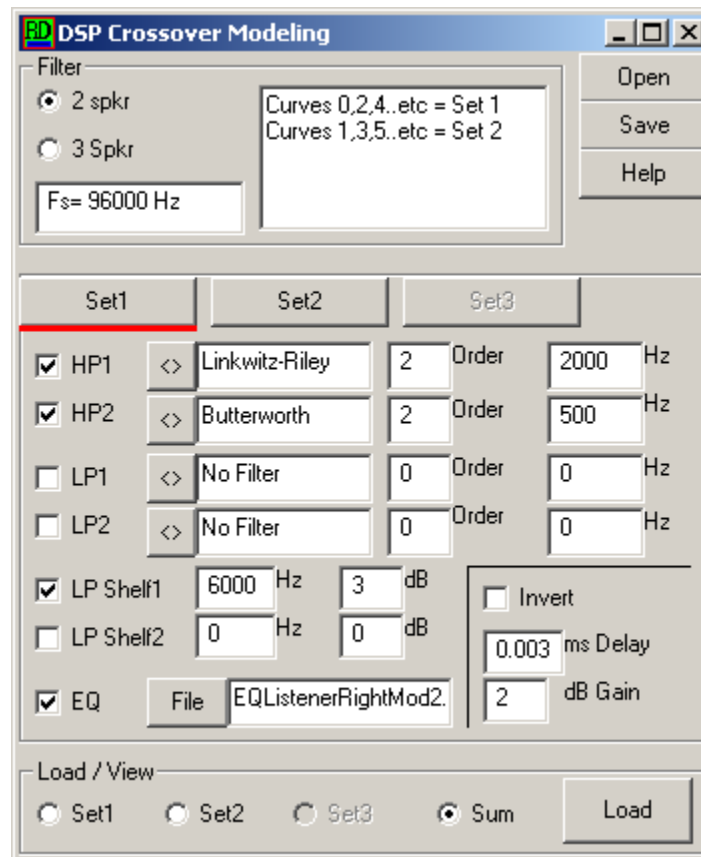
Distortion common in sound cards prevents this from having the accuracy required to measure electronic component distortion. This feature is ideal for measureing only loudspeaker distortion unless a very high quality sound card is used for the measurements.

This measurement is explained in greater detail from the help topic available from its own Help button.

Electronic Crossover Emulation & Setting

RPlusD provides a tool to set up electronic crossovers such as the Behringer DCX 2496 electronic crossover. This utility allows the emulation of a crossover through many independent mic positions and therefore gives a great capability in setting electronic crossovers for the best possible solution. It is a tricky but quick process. Users should attempt this only after gaining familiarity with how the software works in emulating EQ's for normal measurements.

All electronic crossovers will provide the same filter function but correction biquads have non standard Q's associated with them for various EQ's. There is not an industry accepted standard for Q. When the DCX 2496 emulation is selected its biquads are exactly emulated in the software.
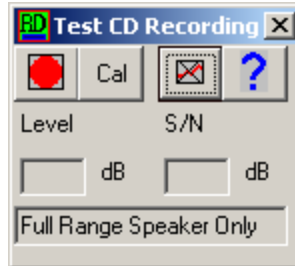

DSP XOver Emulation

Of course the EQ's found to work using this function can be set to any hardware EQ using methods described for the EQ RTA feature.

Test Signal CD

In some cases such as measurements of automotive sound systems, a connection between the computer and sound system is not possible. RPlusD provides a wireless method of obtaining the impulse response. It is not perfect and users should get some experience using it before trusting it completely. The limitations in accuracy are normally inconsequential when measuring sound system for automobiles because these measurements are examined using fractional octave measurements that filter out the artifacts associated with this method. In all other cases we recommend the conventional method from the Audio Data gathering Window requiring the computer be connected to the system under test.

This feature is only included with the enhancement add on package.

The test CD must be burned from our wave file created for this purpose. This required wave file can be generated from the main menu under Tools->Test CD Creation and can then be used to create a test CD from a CD burner.

Test CD Data Gathering

Test Microphone/Preamp Requirements

A stand or boom mount is necessary to use with a test microphone. High quality mic boom stands can commonly be purchased very cheaply from musical instrument stores - usually about $30.00 USD. The microphone must be held in a stable position for any test.

Many people have the RS SPL meter and this is fine for room acoustic based measurements. The more expensive calibrated microphones are only beneficial for equalization applied to mid and high frequencies. Almost all loudspeaker monitors can benefit from some equalization when it is done correctly such as in RPlusD software using many measurements

AcoustiSoft sells two microphone preamp combinations that have individually calibrated microphones. The lower priced mic/preamp requires that the user have a suitable sound card for use with the software. The higher priced unit has a sound card built in and plugs directly into a USB port. The higher priced unit is better for professionals because it has fewer cable connections required and is faster to connect. Check the web site for updated pricing.

MP-B model (requires sound card)

MP - B - USB (has direct USB connection & built in sound card)

Calibrated Microphone (includes clip for standard mic booms)

The same microphone is included in both the USB and non USB package.

RPlusD has a utility to convert any microphone calibration file to the type of file required by RPlusD in cases where another brand of calibrated microphone is to be used. This data must be supplied in the frequency domain.

This tool is available from the Tools menu selection on the main menu.