Chapter 3. Importing Data Files

Several issues associated with importing files were highlighted in Chapter 2, during our discussion about complex transfer function of the driver. Market competitive forces encourage various organizations to offer attractively priced measurement systems, each one generating its own format of data.

It is therefore very important, that you know exactly what type of data, in what format and under what testing conditions it was recorded. Some examples are discussed below.

Some measurement systems (such as LMS - loudspeaker measurement system by Linear X) are based on the traditional frequency sweep between 10Hz and 100kHz. There is only one measurement microphone used in the tests, so the system records only the amplitude response (or more precisely the modules of the amplitude response). Phase response is not actually being recorded. Phase response is mathematically generated by Hilbert-Bode transform, much like SoundEasy does. The LMS also has the ability to add time delay to the phase response and a function called 'tail correction' to enter the ultimate low-end slope roll-off. All this enables the user to produce and export data files containing amplitude and phase response as if the data was recorded at say, 1 meter distance. The frequency steps are quite uniformly spaced across the whole frequency range and very little post-processing by SoundEasy is required.

Generally speaking, measurement systems based on gated FFT measurements (such as IMP - Impulse Response Measurement and Processing systems) have the ability to compare two pulses: (1) simulation pulse, generated by the amplifier and (2) reproduced and recorded response of the loudspeaker. The recorded time response is then transformed into the frequency domain using FFT process. The time delay between the two pulses will correspond to the distance between the loudspeaker and the test microphone so, the acoustical phase response maybe measured (not calculated). Sampling of loudspeaker response is performed at fixed time intervals. this process is reflected in the frequency domain as fixed frequency steps - amplitude and phase data are available at fixed frequency intervals. In order to attain good accuracy across the whole frequency range, the intervals may have to be different (smaller) at lower end of the frequency range an the two resulting plots combined into one global frequency / phase response. Some of the measurement systems provide the amplitude response data as true SPL level, while others provide this data as relative SPL level. You really need to know what type of data is being imported.

Direct Data Import

Direct data import does not engage Hilbert-Bode Transform function at all. Therefore, you are solely responsible for the quality of data you are going to use. Issues to consider are: is the imported data consistent over the frequency range of interest?, is the phase response measured correctly?, do I require minimum-phase data regardless what acoustic distance was used for measurements?.

The process is actually very simple. The example below (see Figure 3.1a) shows a microphone calibration file containing:

1. No header,
2. The first column is the frequency data,
3. The second column is the amplitude data and
4. The third column is the phase data

The first several lines of the imported file are shown on the right-hand display area of the dialogue box. This field is not editable **– it is intended for visual inspection**, so you can count the number of lines in the header of the file. This is quite important, as the header will be removed during the importing process. Secondly, You will need to nominate which of the data columns you wish to be imported. In the example below, column 1 (frequency), column 2 (amplitude) and column 3 (phase). Finally, please count the total number of columns and enter this number in the “Total Number of Columns” data field.

With the above information you are guiding the importing algorithm accurately. The format of the data can be both: decimal and exponential notation. When the importing algorithm has finished, you will be presented with a screen similar to the Figure 3.2.

Importing SPL Data from Measurement File

The first several lines of the imported file are shown on the right-hand display area of the dialogue box. This field is not editable **– it is intended for visual inspection**, so you can count the number of lines in the header of the file. This is quite important, as the header will be removed during the importing process. Secondly, You will need to nominate which of the data columns you wish to be imported. In the example below, column 1 (frequency), column 2 (amplitude) and column 3 (phase). Finally, please count the total number of columns and enter this number in the "**Total Number of Columns**" data field. With the above information you are guiding the importing algorithm accurately. The format of the data can be both: decimal and exponential notation. More often than not, the imported data file contains gaps between its data points. The missing points have to be mathematically inserted into the curve, so that the lines you see on the screen (and the actual data used by the program) are "continuous". This can be accomplished by pressing the "**Repair Amplitude**" or "**Repair Impedance"** buttons on the tab. The Data Import box has the following controls:

1. **Amplitude** – Use this button to import SPL/Phase data into SoundEasy
2. **Impedance** – Use this button to import Impedance/Phase data into SoundEasy
3. **Cancel** – Closes the dialogue box.
4. **Print** – Simply prints the screen.
5. **Correction Factors Group**
   - **Delay –** Enter additional delay in this field. The amplitude response will remain unchanged, but phase response will have added requested delay.
   - **Scale –** Use this field to add/subtract decibels to the imported data. Typically, when you import SPL data, that was measured at different distance than 1meter reference efficiency, or data that was measured at different power level, you would scale the imported data by a factor, that would display the curve at the reference efficiency level. For instance, the measurements were conducted with 1W power level, but at 0.25m distance. You would expect that measured SPL curve will be +12dB higher than the reference efficiency. For this case, enter –12dB in this field.
   - **Efficiency –** Enter the 1W/1m efficiency here.
6. **Import Small/Thiele from LMS** – Use this button to enter the small-signal parameters measured by LMS system.
7. **Imported Data Format Corrections Group**
   - **Erase Lines** – Enter number of lines, that need to be erased from the start of the file to the first data line. Typically, you would enter the number of lines in the header.
   - **Include Columns** – Check corresponding columns in the data file, that show relevant data.
   - **Total Number of Columns** – Enter total number of columns in the data file.

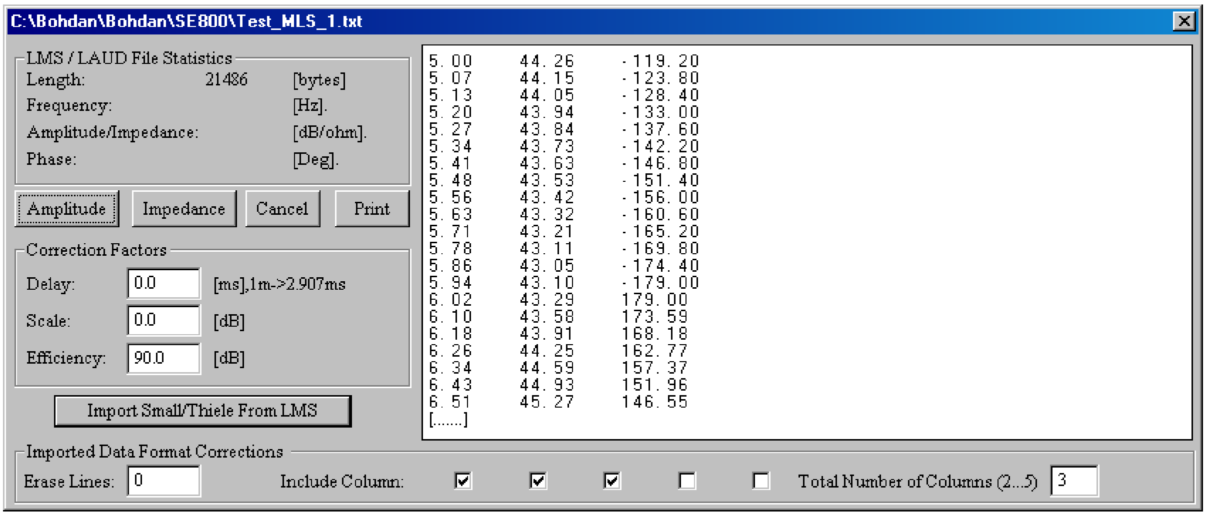


Figure 3.1. File importing dialogue box. The file does not have any headers.

The newly imported file will be displayed on the plotting screen. You may need to press "Repair Amplitude" button to smooth the imported data. **You may decide to rely exclusively on the imported measurement results, OR you may use Hilbert-Bode Transform to clean-up the imported data and create a better quality Transfer Function. We strongly recommend, that you do so.**

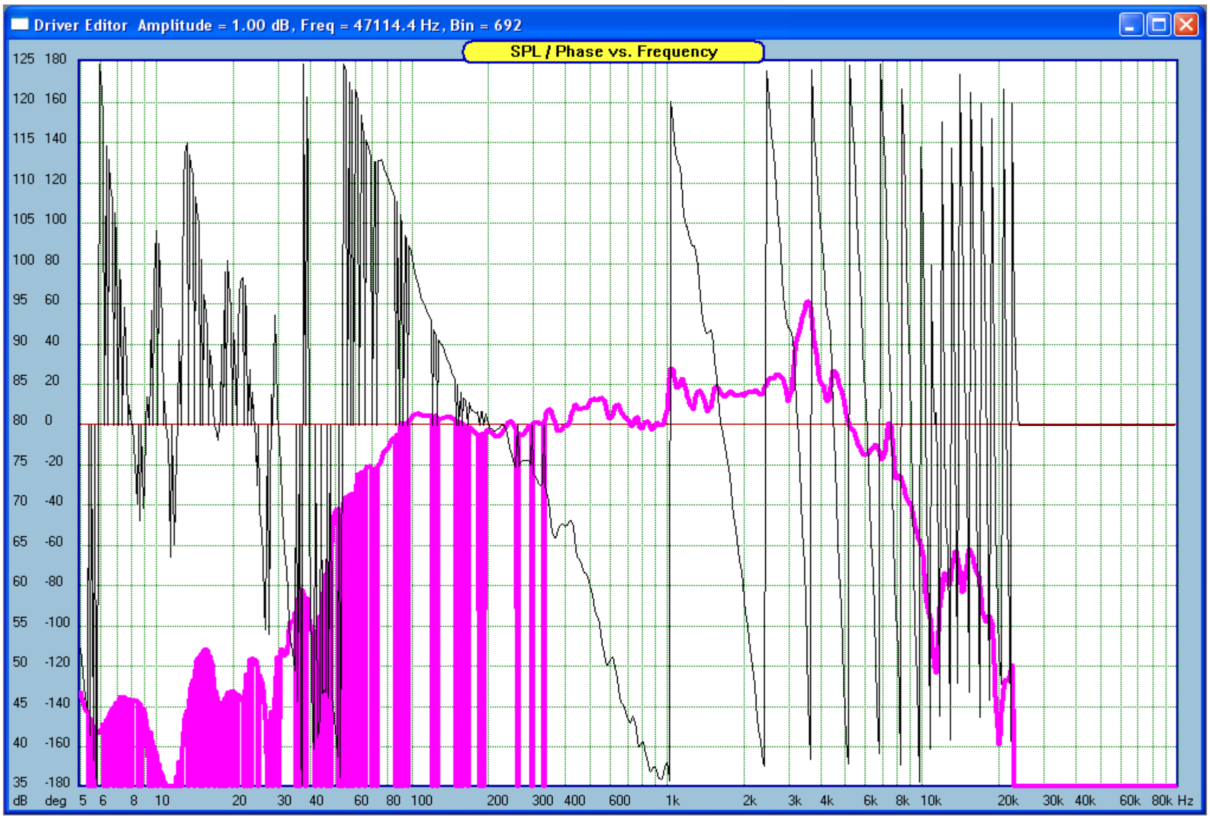


Figure 3.2. Measurement file imported into SoundEasy

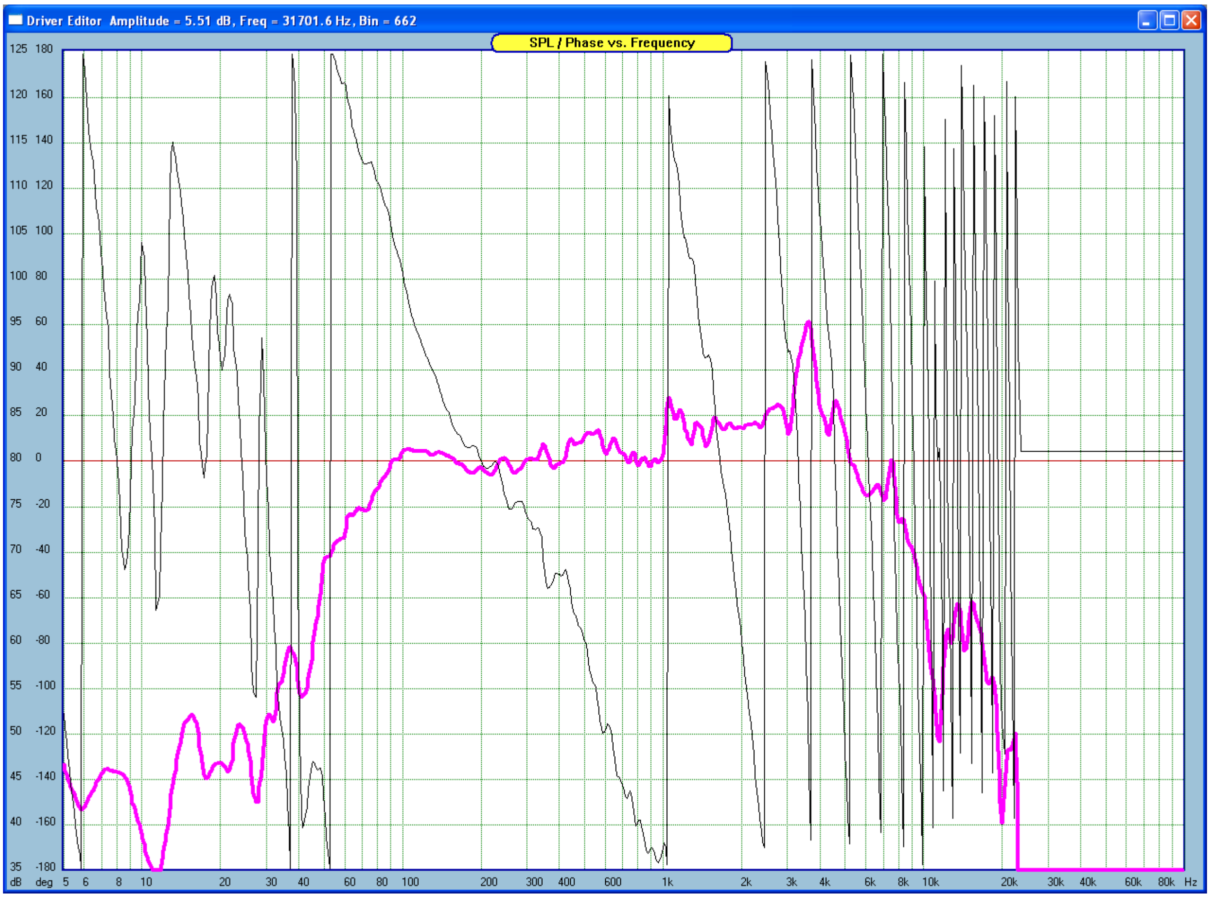


Figure 3.3. Measurement file imported into SoundEasy and **"Repaired".**

More often than not, the imported data file contains gaps between its data points – see Figure 3.2. The missing points have to be mathematically inserted into the curve, so that the lines you see on the screen (and the actual data used by the program) are “continuous”. This can be accomplished by pressing the “Repair Amplitude“ or “repair Impedance” buttons on the Editor screen – see Figure 3.3. **This is when the program actually calculates Complex Transfer Function from the imported data**. Please remember that measurement data is typically presented as modulus of the amplitude (in dBs) and phase (in deg). What is needed is the complex representation of the above – hence the need to calculate the Complex Transfer Function in rectangular coordinates: A+jB. You are now ready to use the imported data in all other program screens and functions. If you wish to confirm, that the process was indeed successful, please open the frequency response screen in crossover section. You can now plot driver’s amplitude and phase as seen on Figure 3.3.

Importing Data with Hilbert-Bode Transform

In order to bring some consistency into the imported data, SoundEasy imports amplitude and phase information, but uses them only as templates. The Complex Transfer Function of the imported driver is derived entirely from the Hilbert-Bode transform. Importing and editing impedance files is identical as the frequency response files. It will therefore not be elaborated here.

The driver section of the program has a built in very powerful algorithm - The Hilbert-Bode transform. It allows you to quickly and accurately recreate phase response from the available amplitude response (this is the way the LMS system creates it's exportable phase data, so it really does not matter where the process is performed). The Hilbert-Bode transform really makes importing of the phase response irrelevant. the process of creating the true acoustic phase response with SoundEasy is instantaneous, this is why the imported phase response is only used as a template. Also, ANY POST-PROCESSING of the amplitude response on the Editor screen will make the imported phase invalid. The minimum phase systems have a unique relationship between amplitude and phase, this relationship is captured the Hilbert-Bode mechanism.

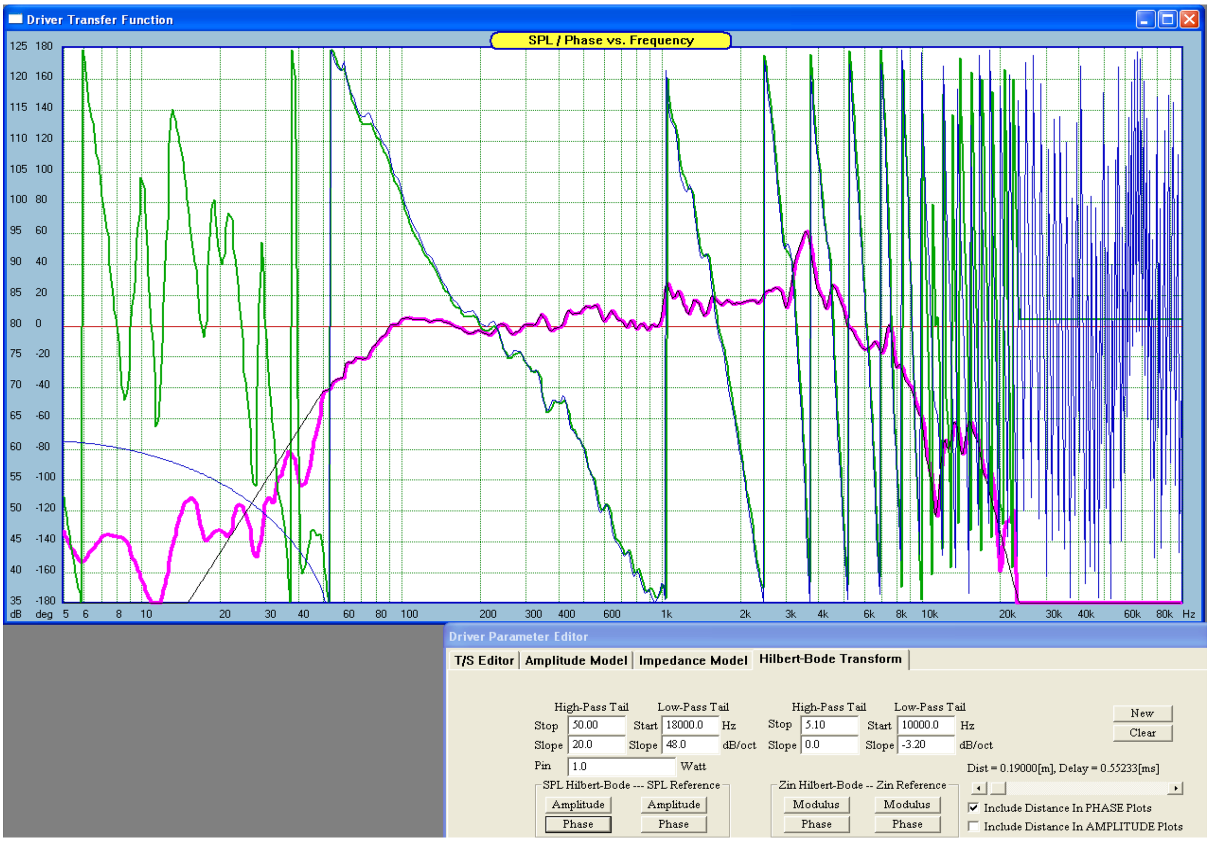


Figure 3.4. Hilbert-Bode Transform parameters

We recommend that you should become familiar with the data structure of the files produced by your measurement system. As the starting point you should examine the content of the file prior to importing it to SoundEasy. SoundEasy will import only ASCII files.

The transform is driven by editable parameters and they should be selected to obtain the **best match for phase and amplitude between measured signal and calculated transform over the widest frequency range**. Typically, good match can be obtained between 20Hz and 20kHz. Generally, you would select the parameters to provide initial match for amplitude response and then fine tune the parameters to provide the match for phase. Please note, that “Roll-off” parameters can be as high as +/- 100dB to +/- 120dB if the measured frequency response is highly irregular (resonant peaks) at the extremes of the measurement range. The program calculates phase using a Hilbert-Bode transform from any magnitude curve. This is known as a Minimum Phase response and it does not contain any delay or positional information. It is a phase response produced solely from the magnitude data curve. This is very convenient for SPL measurements since the distance from the source to the microphone is completely unimportant. The phase curve will have no excess delay. This eliminates the usual problem of removing the arrival delay from the path of the source to microphone. “A minimum phase system is one which is able to transfer input energy to its output in the least amount of time for a given frequency response”. Mathematically, you would calculate the phase response of a minimum phase system by taking the Hilbert-Bode Transform of its log magnitude response (i.e. magnitude expressed in decibels). This relationship is also reciprocal: the log magnitude response of a minimum phase system equals the Hilbert-Bode transform of its phase response. Because the Hilbert-Bode Transform requires an infinite integral over all frequencies, however, any numerical computation of minimum phase is necessarily an approximation. Understanding the characteristics of the phase transform and how it works can be very important if maximum accuracy is to be obtained. For some data curves, the transform can be run directly and will provide excellent results with little attention to the original magnitude data. In other cases, a far better result can be obtained by correcting certain areas of the magnitude curve before running the minimum phase transform. Typically, the regions which can cause problems are **at the ends** of the measurement bandwidth.

The transform must project the slope of the magnitude curve beyond the measured bandwidth. It does this by taking the last slope found as the curve reaches the low and high ends of the frequency range. It then assumes that: (1) the slope found at the low end will remain constant down to DC, and (2) the slope found at the high frequency limit will remain constant towards infinity. For this reason it is of fundamental importance that the slope of the magnitude curve at the high and low ends of the frequency range be approaching or already at their final asymptotic values Hilbert-Bode Transform Tab

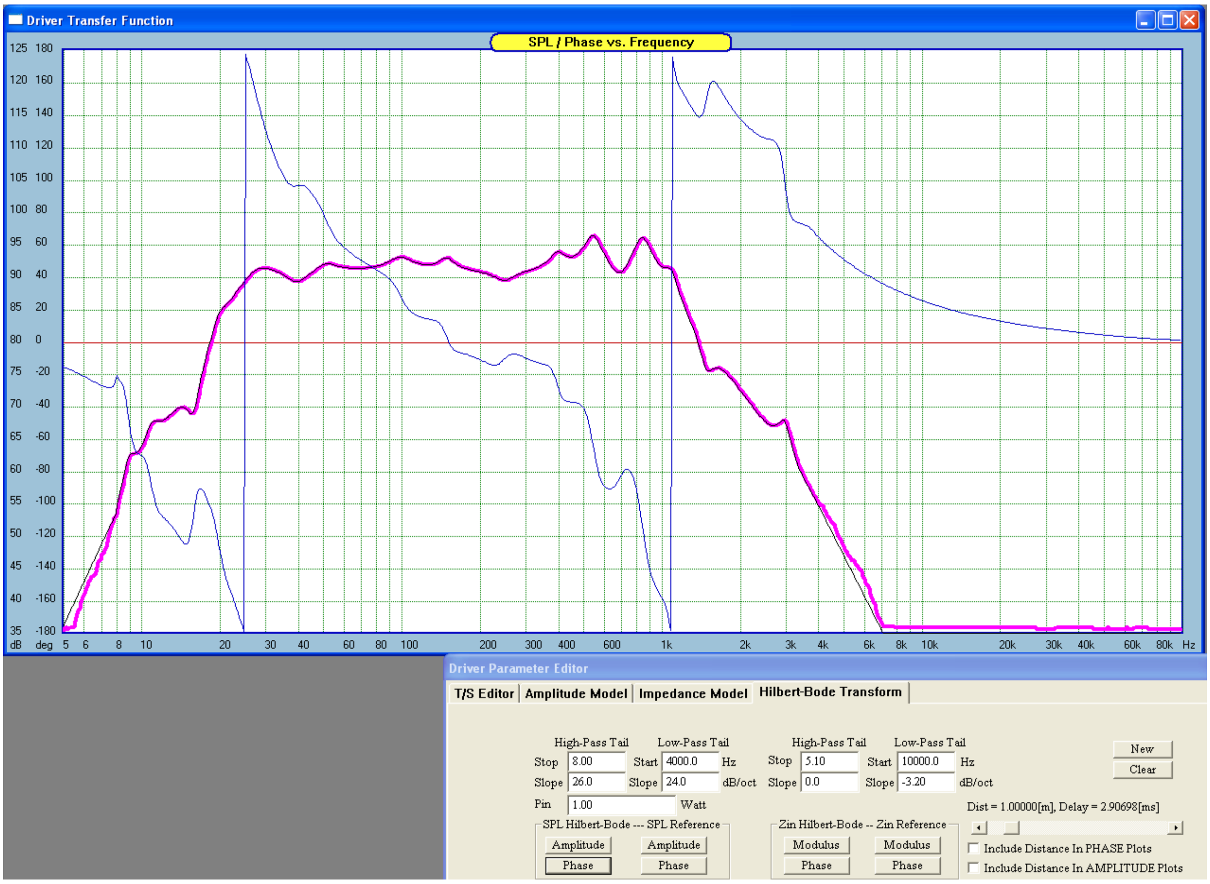


Figure 3.5.Example of Hilbert-Bode Transform

If you need to extend the measured SPL/impedance/phase curves beyond the measurement frequency range, the tool to use in this case, is the Hilbert-Bode. The transforms are driven by 4 editable parameters for each section and they should be selected to obtain the **best match for phase and amplitude between measured signal and calculated transform over the widest frequency range**. Typically, good match can be obtained between 20Hz and 20kHz. Generally, you would select the parameters to provide initial match for amplitude response and then fine tune the parameters to provide the match for phase. Please note, that "Roll-off" parameters can be as high as +/- 100dB to +/- 120dB if the measured frequency response is highly irregular (resonant peaks) at the extremes of the measurement range.

The "Hilbert-Bode Transform" tab has a built in very powerful algorithm - The Hilbert-Bode transform. It allows you to quickly and accurately recreate phase response from the available amplitude response. The Hilbert-Bode transform really makes importing of the phase response irrelevant. the process of creating the true acoustic phase response with SoundEasy is instantaneous, this is why the imported phase response is only used as a template. Also, ANY POST-PROCESSING of the amplitude response on the Editor screen will make the imported phase invalid. The minimum phase systems have a unique relationship between amplitude and phase, this relationship is captured the Hilbert-Bode mechanism. The program calculates phase using a Hilbert-Bode transform from any magnitude curve. This is known as a Minimum Phase response and it does not contain any delay or positional information. Because the Hilbert-Bode Transform requires an infinite integral over all frequencies, however, any numerical computation of minimum phase is necessarily an approximation. Understanding the characteristics of the phase transform and how it works can be very important if maximum accuracy is to be obtained. For some data curves, the transform can be run directly and will provide excellent results with little attention to the original magnitude data. In other cases, a far better result can be obtained by correcting certain areas of the magnitude curve before running the minimum phase transform. Typically, the regions which can cause problems are **at the ends** of the measurement bandwidth. The transform must project the slope of the magnitude curve beyond the measured bandwidth. It does this by taking the last slope found as the curve reaches the low and high ends of the frequency range. It then assumes that: (1) the slope found at the low end will remain constant down to DC, and (2) the slope found at the high frequency limit will remain constant towards infinity. For this reason it is of fundamental importance that the slope of the magnitude curve at the high and low ends of the frequency range be approaching or already at their final asymptotic values. The Transfer Function [HBT] dialogue box has the following controls:

1. **"New"** – use this button to restore default setting for this screen.
2. **"Clear"** – use this button to clear the screen.
3. **SPL Hilbert-Bode**
 - "Amplitude" – use this button to calculate transfer function and display it as amplitude
 - "Phase" – use this button to calculate transfer function and display it as phase.
4. **SPL Reference**
 - - Amplitude" – use this button to display amplitude of the imported data
 - "Phase" – use this button to display phase of the imported data
5. **Zin Hilbert-Bode**
 - "Modulus" – use this button to calculate transfer function and display it as modulus
 - "Phase" – use this button to calculate transfer function and display it as phase.
6. **Zin Reference**
 - - Modulus" – use this button to display modulus of the imported data
 - "Phase" – use this button to display phase of the imported data
7. **"Distance/Delay"** – use this slider to select appropriate distance between the transducers.
8. Check box to include the distance in amplitude calculations.
9. Check box to include the distance in phase calculations.
10. **High-Pass Tail and Low-Pass Tail group box** - The low-end slope and stop frequency, the high-end slope and start frequency. Enter the appropriate data as suggested above.

The Hilbert-Bode Transform is used for amplitude as well as for impedance transfer functions. You need to perform tail corrections for both types of curves. A very good example of using HBT with impedance curves is given in Chapter 16.

Importing the LMS Files.

One of the measurement systems, that could be used with SoundEasy is the LMS (Loudspeaker Measurement System) package created by Linear X. The LMS system has the ability to export captured data in several different formats. One of the formats, the **'*.dat'** files can be imported by SoundEasy.

The **'*.dat'** files produced by the LMS contain several different type of data. We are only interested in amplitude and phase information captured at frequencies from 1 Hz to 100 kHz. The LMS uses frequency sweep technique to supply test signal to the loudspeaker and the frequency response is recovered by a test microphone, positioned at some distance from the box. The frequency sweep test can be performed at different power levels and different microphone-loudspeaker distances. The common (and recommended standard) set-up would be Pin=1W, Mike Distance=1.0m. However, should your data be captured using some different set-up, the program offers you two editable fields (see Fig 3.6) to enter the parameters of the set-up. Negative "Delay" cancels phase reversals (effect of reducing the speaker-microphone distance). The "Scale" parameter will offset whole amplitude plot up (for positive number) or down (for negative number entered). Also, the reference efficiency of the driver needs to be entered on the main 'Editor' screen prior importing the LMS **'*.dat'** file. The correct usage of the LMS **'*.dat'** (frequency response) files can be very helpful and will reduce the amount of effort necessary to edit the frequency response of your driver. Once again, here is the recommended way:

Example: The task here is to import an LMS data file representing a system that has the following parameters:

1. Reference level SPL is 100.0 dB
2. Power into the system is 1.0 W.
3. Microphone-loudspeaker distance is 0.0 cm.
4. Amplitude data was recorder as SPL level, that is, the data is scattered around 100 dB value.
5. Data is collected using frequency sweep method.
6. The data covers frequency range from 20 Hz to 20 kHz.

When the dialogue box for importing the LMS files is opened, for this particular file, you need to enter the following.

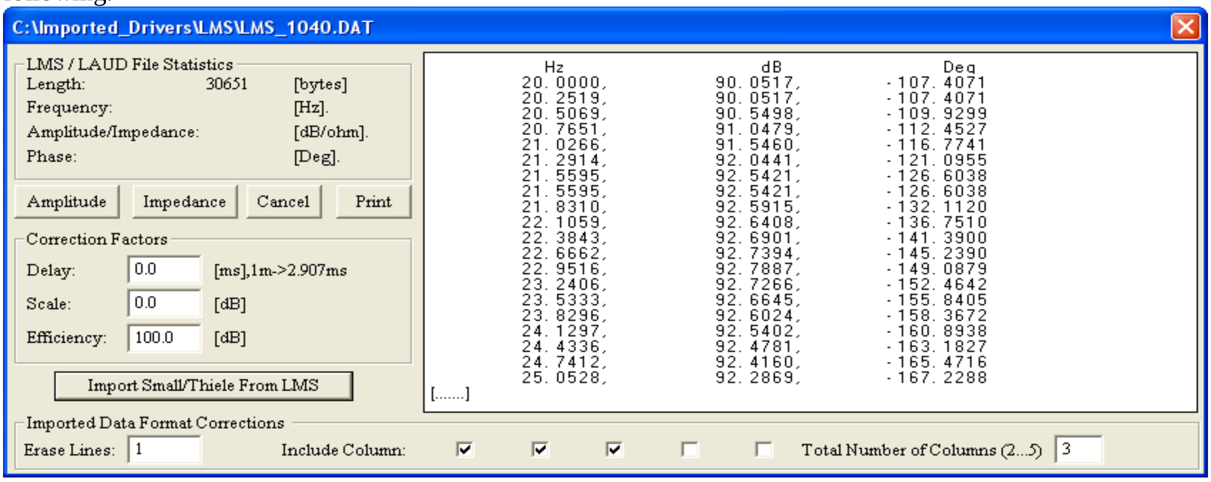


Figure 3.6. Typical import parameters for LMS SPL-type files.

Pressing the "Amplitude" button will activate the process and when finished, press “Repair Amplitude” button to clear the plots. The imported file is shown on Fig 3.8

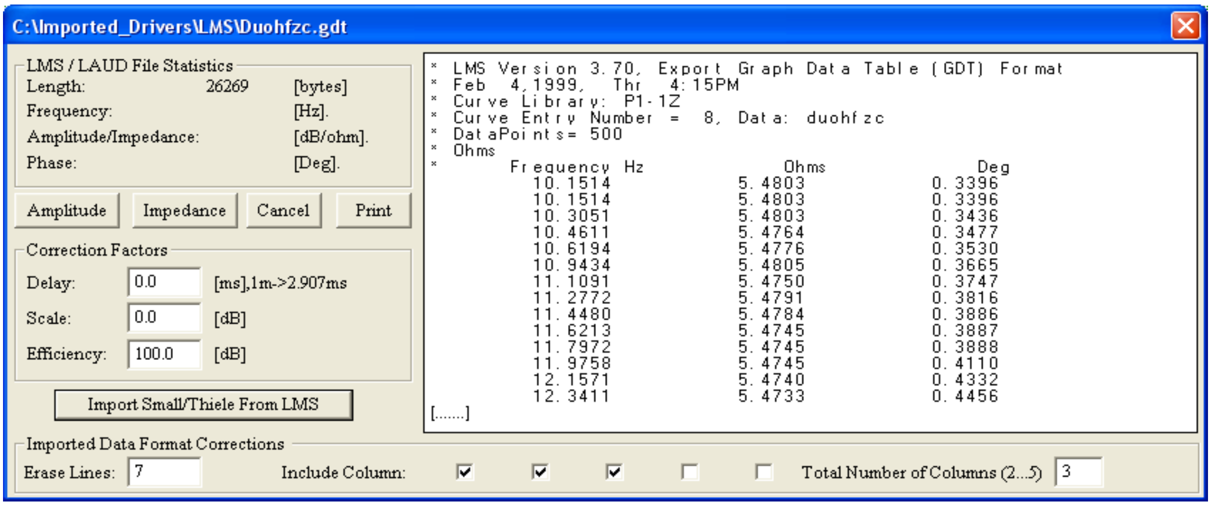


Figure 3.7. Typical import parameters for LMS, impedance-type files.

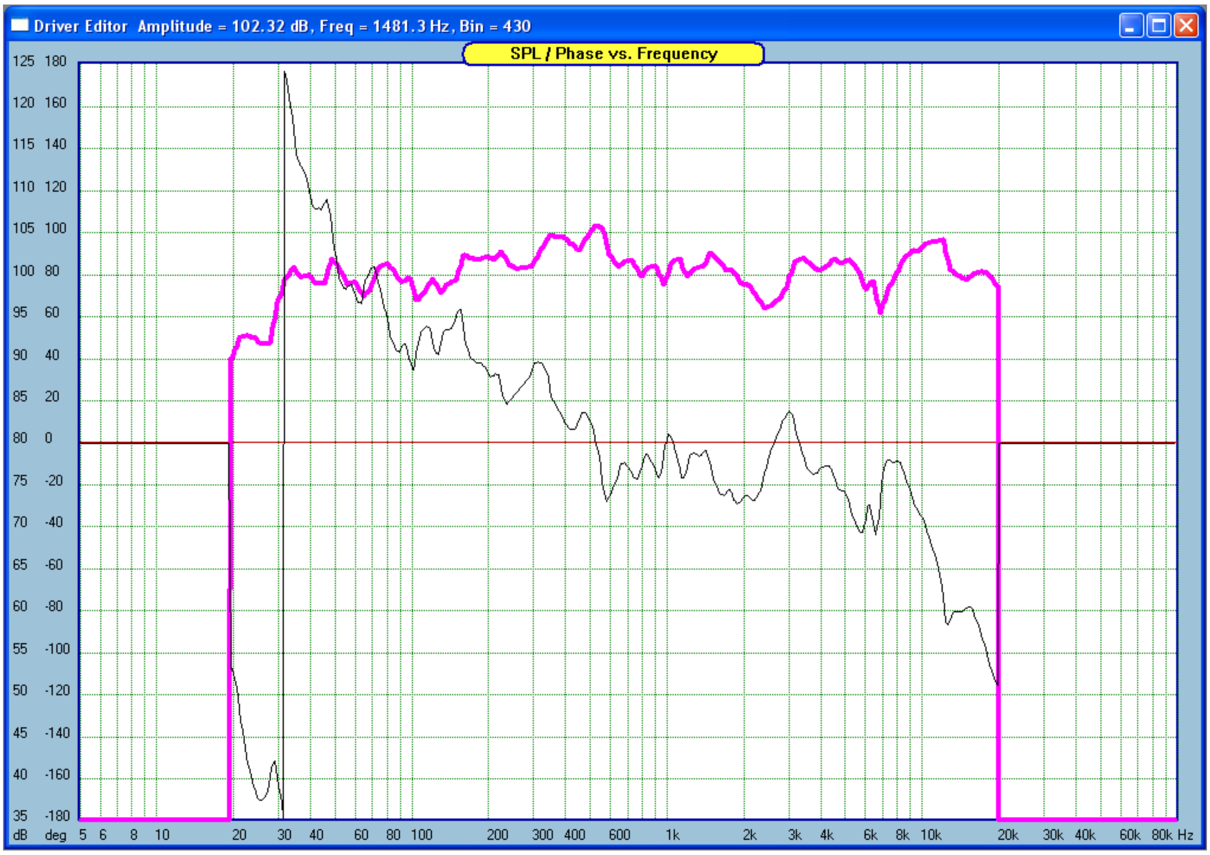


Fig 3.8. Imported LMS SPL file after “Repair Amplitude”.

Fig 3.9. Imported LMS Zin file after “Repair Amplitude”.

Importing the IMP file

If you have access to the Impulse Response Measurement and Processing system (IMP), you could make use of SoundEasy file importing capabilities and obtain the magnitude of the frequency response of the driver, as measured by the IMP system.

Example: The task here is to import an IMP data file representing a system that has the following parameters:

1. Reference level SPL is 90.0 dB
2. Power into the system is 0.065 W.
3. Microphone-loudspeaker distance is 25 cm.
4. Amplitude data was recorder as **SPL relative level**, that is, the data is scattered around 0 dB value – see below.
5. Data is collected using gated FFT method.
6. The data covers frequency range from 30 Hz to 20 kHz.

30.0007 -0.83 -130
45.0010 0.609 147.
60.0014 1.546 110.
75.0018 2.232 62.7
…..
255.006 1.110 -24............

As one can see, there is quite a lot of information, that is not included in the data file, but is necessary to be taken into account. Power into the system is 12dB below 1W and the test distance is 1/4 of the recommended 1 meter. Please remember, that the reference SPL (that is 1W/1m conditions) is 90dB.

Therefore, you would expect, that if, on the "Transfer Function" screen, the power is set to 1W and speaker-microphone distance to 1 meter, you would see the amplitude response plotted at the reference SPL level, regardless of the imported data test conditions. Also, if the power is set to 0.065W and microphone distance to 25cm, you would expect the plotted amplitude and phase curves to overlap the imported data on the "Transfer Function" screen. When the dialogue box for importing the IMP files is opened, for this particular file, you need to enter:

1. Delay = 0.00,
2. 2. Scale = 0.00 dB (do not scale this file),
3. 3. Efficiency = 90 dB (reference SPL level)

You could enter Delay = -0.7352 ms (because the microphone distance is 25 cm). This would reduce number of phase reversals on the imported curve, as you would cancel the acoustic path delay. The resulting phase curve would not be entirely smooth, due to digitization and different discrete frequency steps used by the IMP and SoundEasy. Pressing the "Amplitude" button will activate the process. You may notice, that at the lower end of the frequency range, the data is incomplete. To repair this section of the plot, press the "Repair" button. This function scans the data file starting from 10 Hz up, looking for the first non-zero data point. It will then link this data point with the second non-zero data point interpolating all of the program’s data between the adjacent, imported data points. The recovery process is however still not completed. The next step is to recreate data below 30Hz and above 20kHz.

If you decide to use Hilbert-Bode Transform you may consider the following

In order to avoid rapid and unrealistic amplitude/phase changes at 30Hz and 20kHz, you should edit the amplitude response (using Editor screen) around those frequencies by extending the pink curve 3-4 frequency steps below and above the currently "repaired" curve. Try to create a round "knee" in this transition areas, so that when the algorithm extends the amplitude response automatically, the imported and recreated sections of the amplitude response add smoothly. The imported data has now been prepared sufficiently to be processed by the "Transfer Function" screen. SoundEasy and IMP files are not directly compatible. The sample frequencies of both systems are also different. SoundEasy, in order to obtain high accuracy of the design, requires recovering of the driver complex transfer function within 1Hz to 100kHz.

Importing CLIO Files.

Third measurement system, that could be used with SoundEasy is the CLIO system. Much of what has been discussed previously is also applicable to importing the CLIO **"*.txt"** files. **You need to make sure, that the correct type of data is exported from the CLIO system - see below.**

Freq	dB spl	Phase
205.18	55.87	-33.86
206.94	55.98	-34.02
208.71	56.08	-34.11
210.50	56.17	-34.19
212.30	56.24	-34.43
214.12	56.29	-34.69
215.96	56.33	-35.22

The file converter dialogue box offers the same data fields and as before, you must enter SPL level. The other two fields (Delay and Scale) are optional - see Fig 3.1. Negative "Delay" cancels phase reversals (effect of reducing the speaker-microphone distance). The "Scale" parameter will offset whole amplitude plot up (for positive number) or down (for negative number entered). When the dialogue box for importing the CLIO files is opened, for this particular file, you need to enter:

1. Delay = 0.00,
2. Scale = 20.00 dB (this file was scaled up),
3. Efficiency = 90 dB (reference SPL level).

Importing S/T parameters from CLIO

In addition to importing amplitude and impedance data from CLIO measurement system, SoundEasy is also capable of importing Small/Thiele parameters. The CLIO import dialogue box includes additional button, “CLIO TS”, which activates importing process. An example of CLIO file with these parameters is given below. Currently, the following parameters are imported: Re, Fs, Qms, Qes, Qts, Bl, Vas, DbSpl, D (diameter), L1K (inductance at 1kHz), Ms, L10K (inductance at 10kHz). These are sufficient to invoke “Enclosure Design” screen and model the enclosure. The process will only be successful if the correct type of file is imported. Fig 3.10

MANUFACTURER : EMINENCE   MODEL : PS15CV

- IMPEDANCE -

Freq	Ohm	Phase
10.0	7.14	36.7
11.2	7.56	39.6
12.6	8.08	42.3
……..		
15848.9	73.68	54.5
17782.8	79.22	54.6
19952.6	85.22	54.7

- PARAMETERS -

Re : 5.08 [ohm]
Fs : 43.40 [Hz]
F1 : 28.18 [Hz]
F2 : 64.94 [Hz]
Zm : 65.21 [ohm]
D : 330.00 [mm]
Qms : 4.23
Qes : 0.36
Qts : 0.33
Bl : 21.99 [N/A]
L1K : 2.04 [mH]
L10K : 0.88 [mH]

Ms   : 124.76 [g]
Vas : 110.10 [l]
DbSpl: 97.94 [dB]
Cms : 0.11 [mm/N]
Ma   : 0.00 [g]
FsMa : 0.00 [Hz]
V   : 124.60 [l]
FsKnV: 59.57 [Hz]
Ras : 1.10 [Kohm]
Rat : 13.02 [Kohm]
Cas : 7.88E-07 [m^5/N]
Mas : 17.05 [Kg/m^4]

Fig 3.10 - CLIO S/T data file

Importing data from DAAS 32 System

Importing data files generated by DAAS-32 system is accomplished by selecting “Import” + “DAAS 32” menu options from the main screen menu. Please note, that there will be 5 files required to fully characterize the driver. They are :

1. .AMP – file containing SPL data
2. .PHA – (acoustical phase) file containing SPL phase data
3. .IMP – file containing input impedance modulus
4. .PHE – (electrical phase) file containing impedance phase data and
5. .TS – file containing a subset of Small/Thiele data.

The DAAS 32 dialogue box shown on Figure 3.11 has 5 buttons (2 in SPL box, 2 in Impedance box and 1 for TS parameters) that need to be activated each time you import appropriate file. The only other parameter required to be entered in the DAAS 32 import dialogue box is the “Efficiency” data. SoundEasy will automatically store imported data in its memory. As before, you can modify imported data during import by entering “Delay” or “Scale” parameters in the dialogue box.

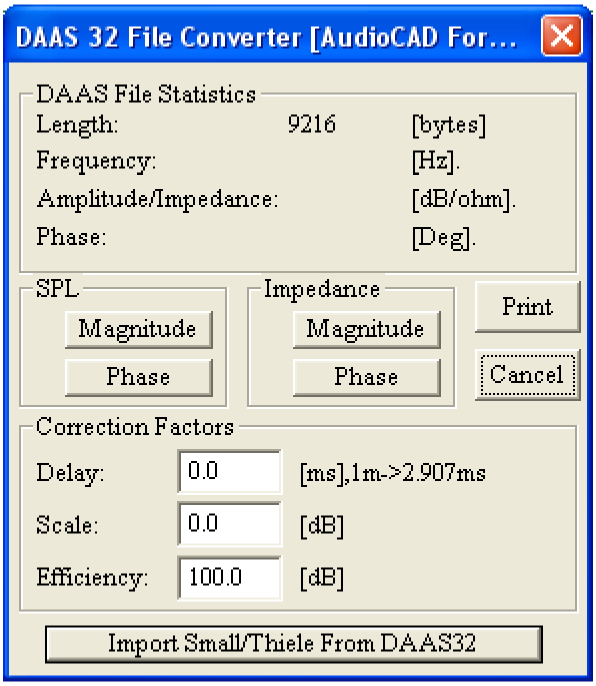


Figure 3.11 DAAS file importing dialogue box.

The process is simple and when completed, you need to run Transfer Function process to generate a full set of driver functions needed for other processing modules. Once again, the imported phase data should be used as a template for generating drivers Complex Transfer Function.

Exporting SPL/Impedance data files

SoundEasy can be used to export SPL/Phase and Impedance/Phase data after the Hilbert-Bode transform has been performed. The SPL file has file extension ".txt" and the first column is the frequency, followed by corresponding SPL value and finally phase value – see below.

```
5.00     39.84     44.92
5.07     40.29     44.80
5.13     40.75     43.64
5.20     41.20     42.48
5.27     41.65     41.30
5.34     42.10     40.11
5.41     42.56     38.91
5.48     43.01     37.70
```

The Impedance file has file extension ".imp" and the first column is the frequency, followed by corresponding impedance modulus value and finally phase value – see below.

```
5.00     7.97     31.37
5.07     8.01     31.74
5.13     8.05     32.12
5.20     8.09     32.50
5.27     8.14     32.88
5.34     8.18     33.27
5.41     8.22     33.66
5.48     8.27     34.05
5.78     8.47     35.66
5.86     8.53     36.07
```

There is no header in those files.

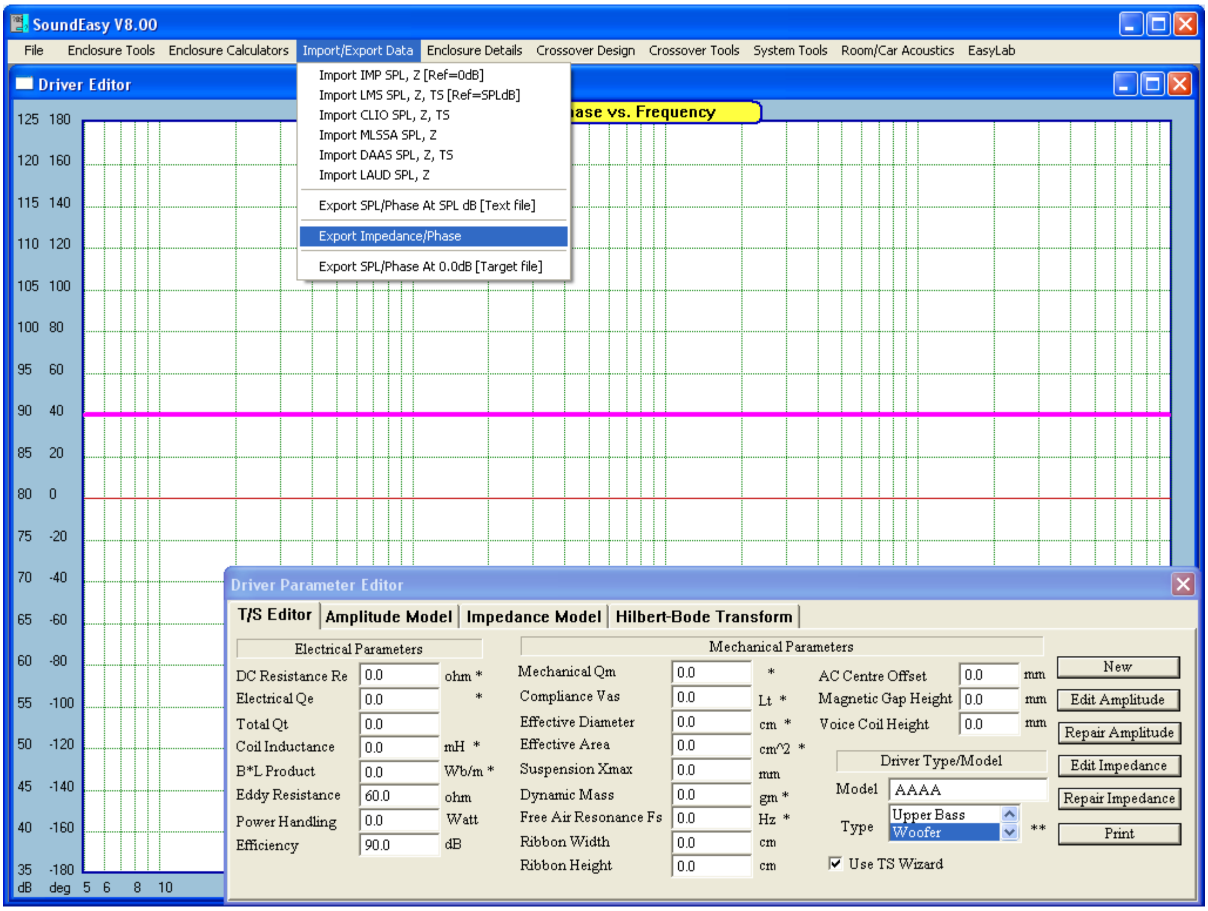


Figure 3.12. File Export Menu.

Exporting Data

SoundEasy exports SPL and Zin impedance data into ASCII files. The SPL data can be exported in two ways:

1. **With SPL normalized to 0.0dB** – This option requires, that you select "**Export SPL/Phase At 0.0dB [Target file .trg]"** from the main menu. Target-type files can be later used as target response for Optimizers and Super-Components.

2. **With SPL exported at SPL level** – This option requires, that you select **"Export SPL/Phase At SPL dB [Text file .txt]"** from the main menu. This type of file will be also exported from measurement system.

You can export the following curves:

1. SPL / Phase and Zin / Phase from Hilbert-Bode Transform screen.
2. SPL / Phase and Zin / Phase from CAD frequency domain plotting screen.
3. SPL / Phase and Zin / Phase from CAD optimizer frequency domain plotting screen.
4. SPL / Phase and Zin / Phase from System frequency domain plotting screen.
5. SPL / Phase and Zin / Phase from Enclosure Design frequency response plotting screen.
6. SPL / Phase from raw MLS/ESS measurements plotting screen.

Before a curve can be exported, it must be obviously plotted first. Therefore, you would first open, for instance, CAD frequency domain plotting screen. Then you need to plot SPL / Phase curves and finally, select exporting option: export as a target OR export as a text file.

In the "txt" and ".trg" SPL file has file the first column is the frequency, followed by corresponding SPL value and finally phase value – see below.

```
5.00    -53.43    -36.65
5.07    -52.97    -36.93
5.13    -52.52    -37.21
5.20    -52.06    -37.50
5.27    -51.61    -37.79
5.34    -51.15    -38.09
5.41    -50.70    -38.40
5.48    -50.24    -38.71
5.56    -49.79    -39.03
5.63    -49.33    -39.34
5.71    -48.88    -39.67
5.78    -48.42    -39.99
5.86    -47.97    -40.32
5.94    -47.51    -40.64
6.02    -47.06    -40.97
```

Importing SPL files as Polar Plots Data

SPL ASCII files created with various measurement systems can be imported as Horizontal or Vertical polar plots as well. The thing to remember, is that the imported SPL may have been created on different frequency grid than SE screen frequency grid, so it needs to be re-mapped.

Here is rather obvious procedure to import an “xxxxx.frd” file into the program and assigning it as “0 deg” polar plot. We start with importing “raw” SPL data.

1. Go to "Polar Plots" dialogue box

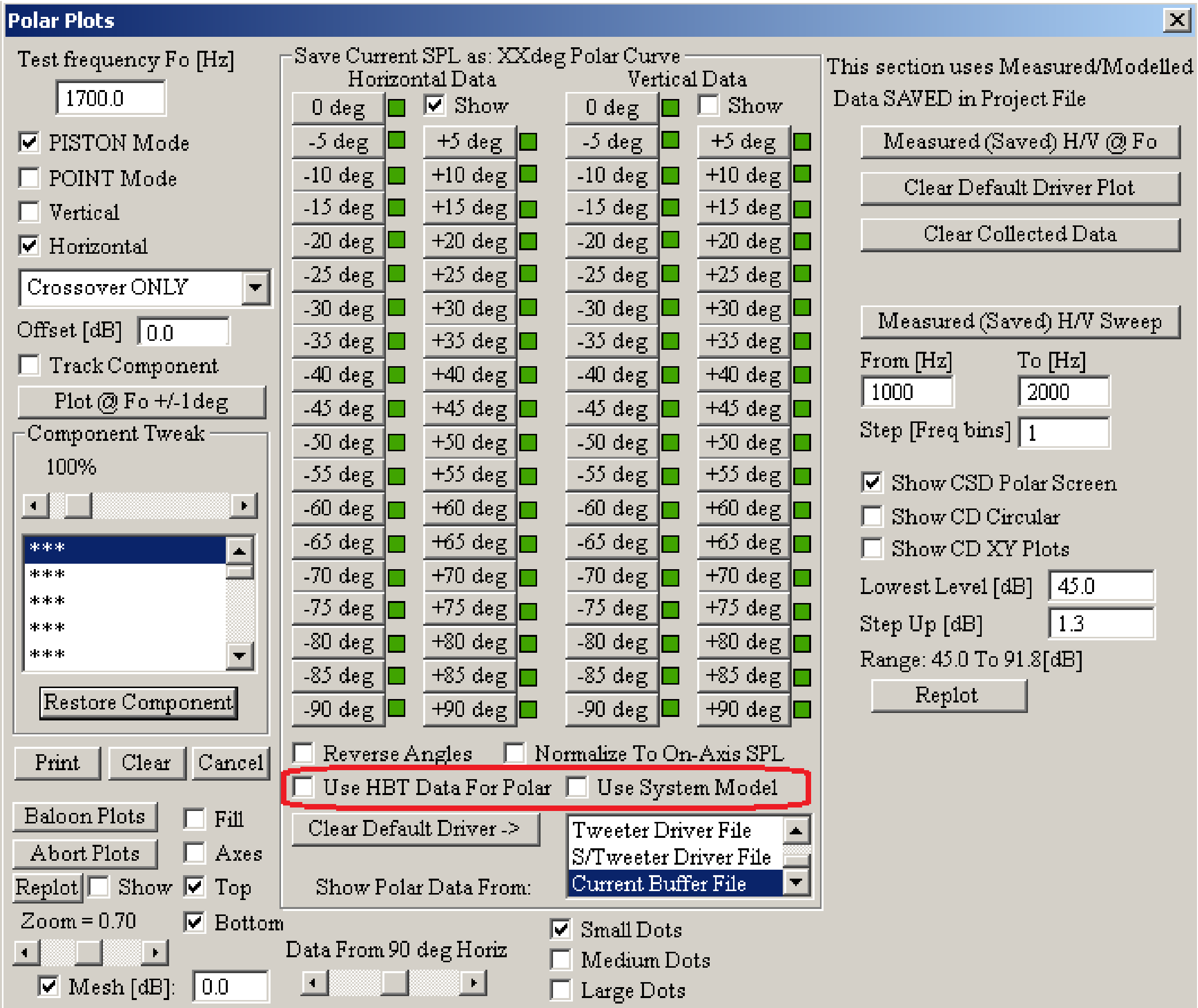


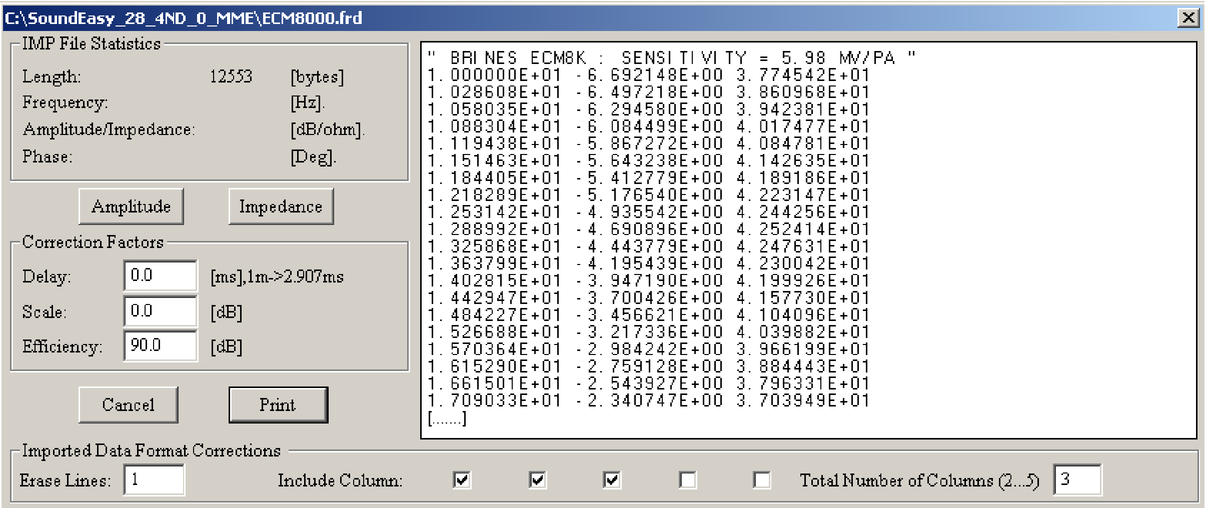
Figure 3.13. Polar Plots control box

Uncheck the "Use HBT data for Polar Plots" box. This will direct the program to use raw SPL data, rather then HBT-generated data.

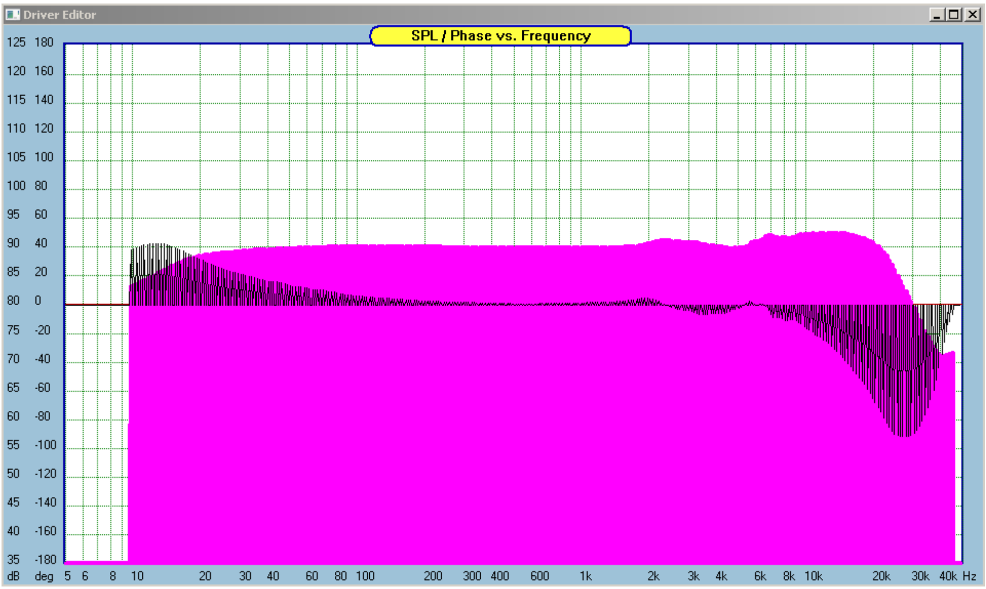
Uncheck the "Use System Model" box. This will direct the program to use measured/imported data for polar plots, rather then modeled data.

2. Import your SPL data using a suitable menu selection from "Import/Export Data" menu.

When the importing dialogue box appears, please make sure, that the correct selections are made for your imported file. You must be able to see the imported SPL/Phase curve on the screen where it is supposed to be.



First line is erased, and three columns are imported. Subsequently, the imported SPL/Phase is shown below.



Now, press the "**Repair Amplitude**" on the T/S Editor box. This will re-map the imported frequency grid and data onto SE screen frequency grid.

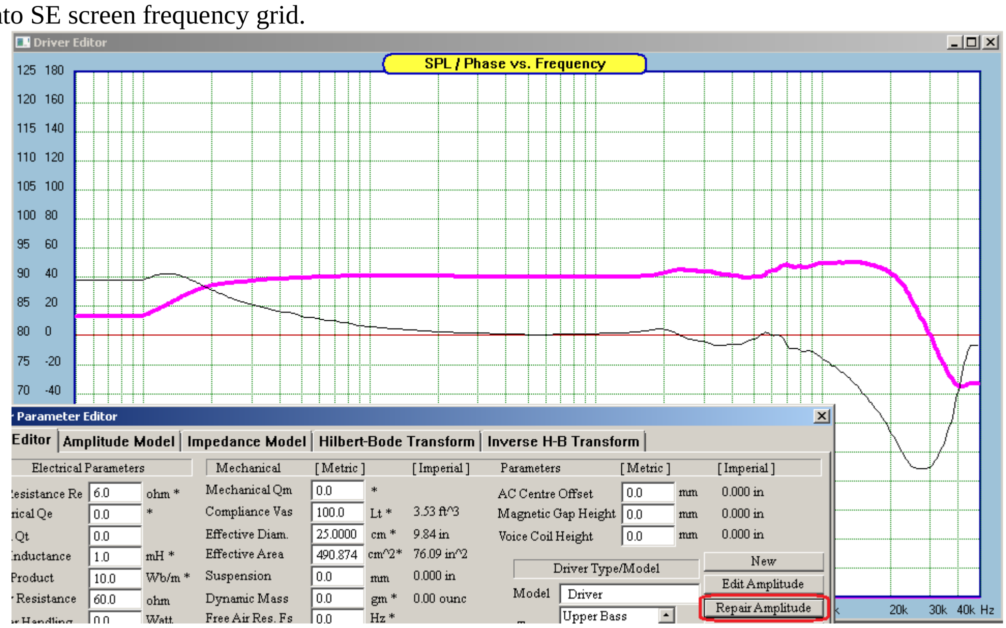


Figure 3.14. Repaired imported SPL

3. Go to Polar Plots dialogue box and assign the newly imported SPL to one of the 180 Horizontal or Vertical angles.

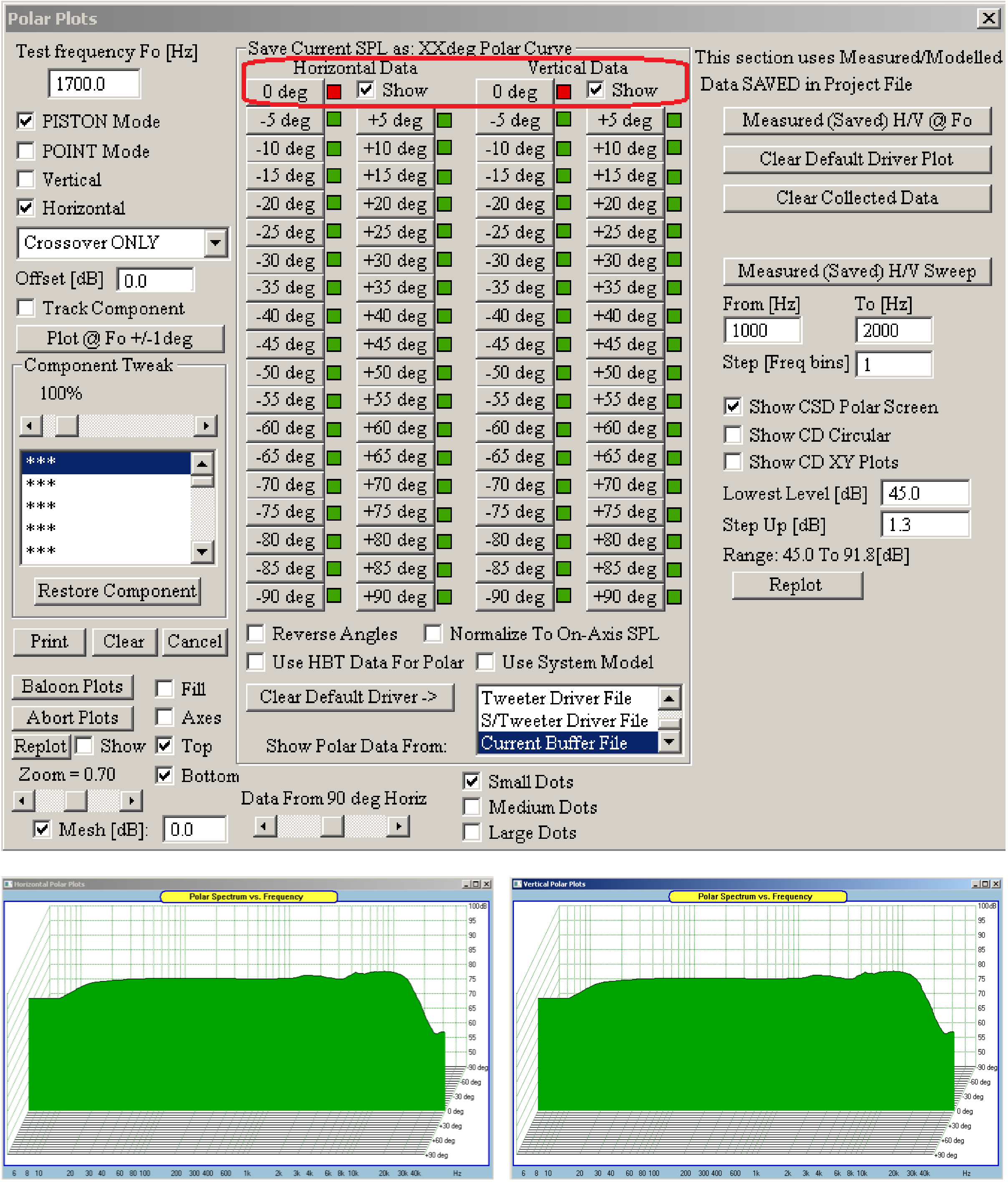


Figure 3.15. Imported SPL curve assigned to Horizontal and Vertical polar plots at 0deg.

4. Repeat the above process of importing the SPL files for all other angles of interest.

If you wish to import SPL data, but pre-process the data using HBT functionality, the process is very similar. The data can be imported into current driver file or into current project file (Current Buffer File option).

1. Go to "Polar Plots" dialogue box

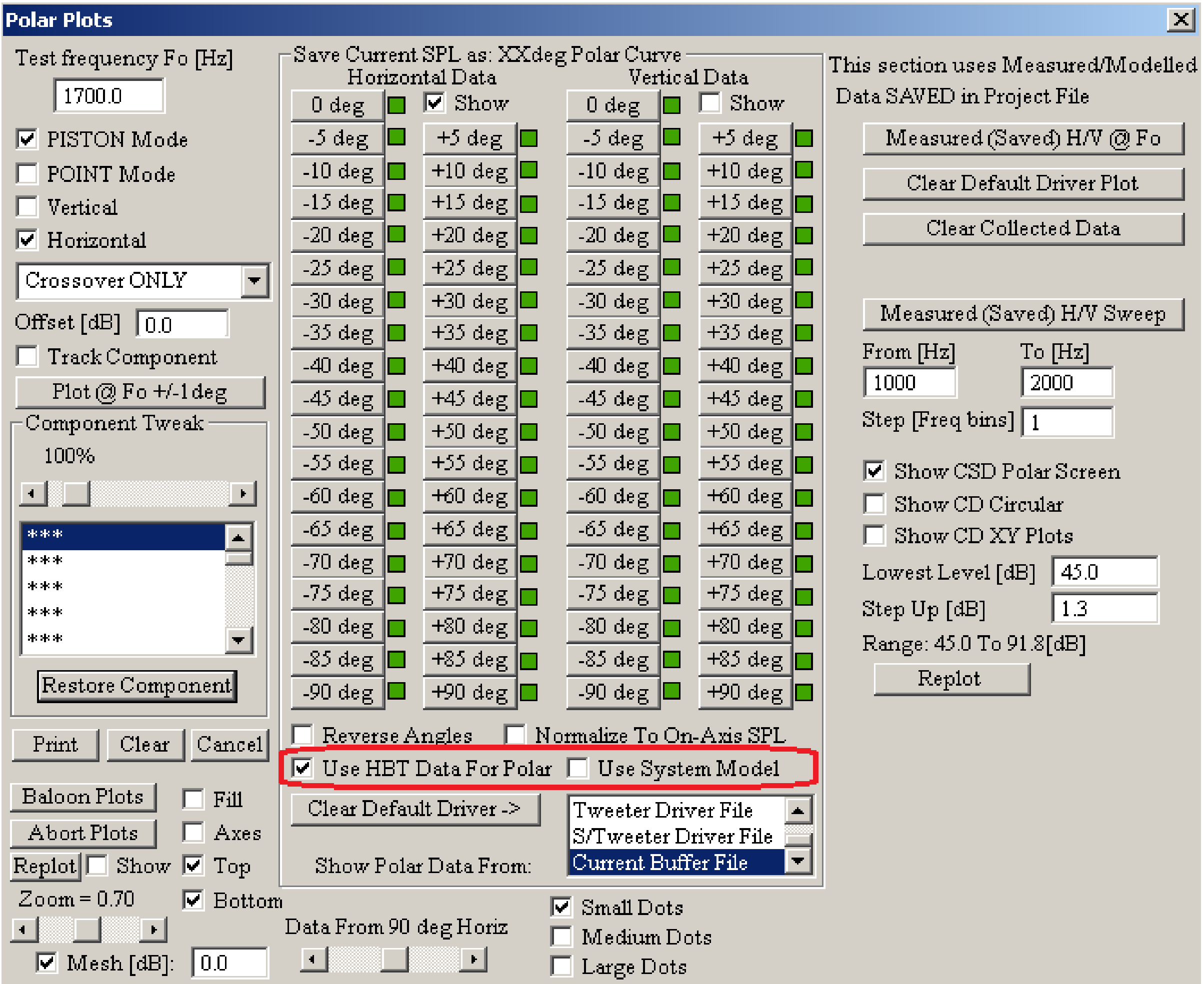


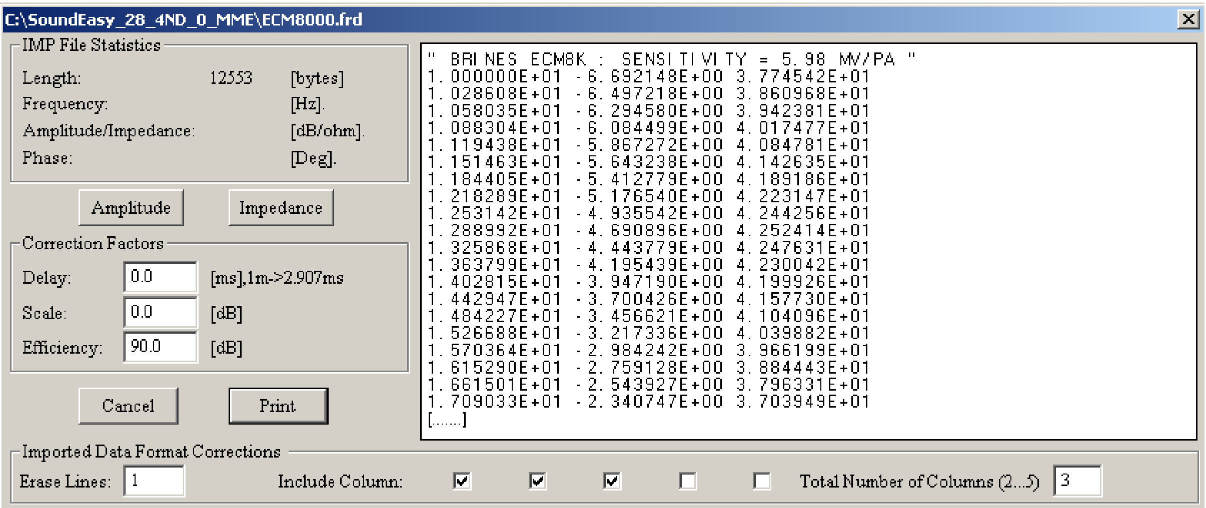
Figure 3.16. Polar Plots control box

Check the "Use HBT data for Polar Plots" box. This will direct the program to use HBT-generated SPL data, rather then raw import data.

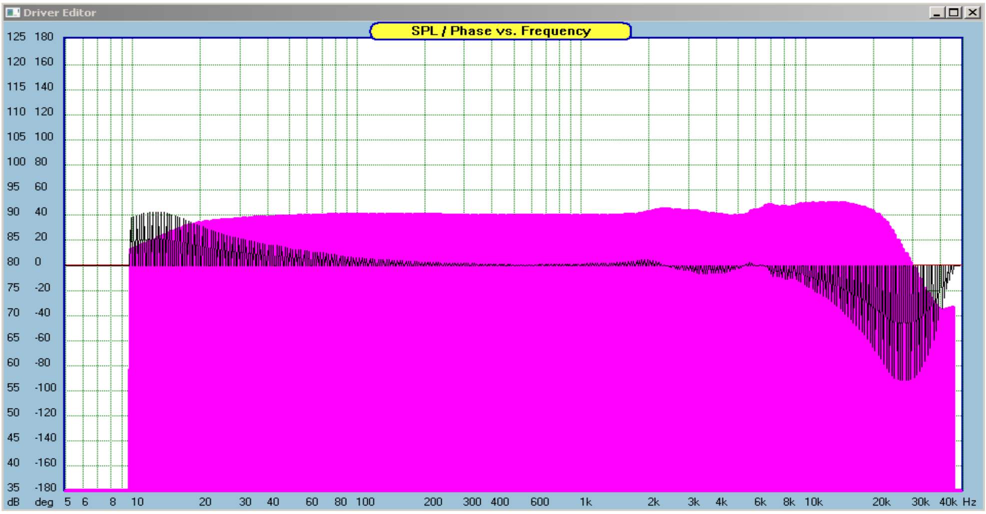
Uncheck the "Use System Model" box. This will direct the program to use measured/imported data for polar plots, rather then modeled data.

1. Import your SPL data using a suitable menu selection from "Import/Export Data" menu.

When the importing dialogue box appears, please make sure, that the correct selections are made for your imported file. You must be able to see the imported SPL/Phase curve on the screen where it is supposed to be.



First line is erased, and three columns are imported. Subsequently, the imported SPL/Phase is shown below.



Now, press the "**Repair Amplitude**" on the T/S Editor box. This will re-map the imported frequency grid and data onto SE screen frequency grid.

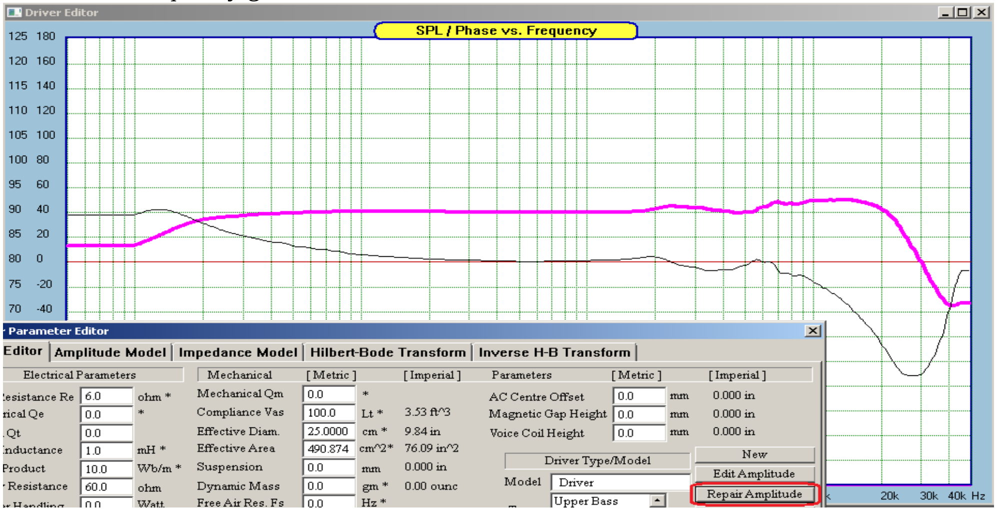


Figure 3.17. Repaired imported SPL

Next, goto HBT TAB, select HBT parameters (for example, as shown below) and Plot HBT SPL/Phase.

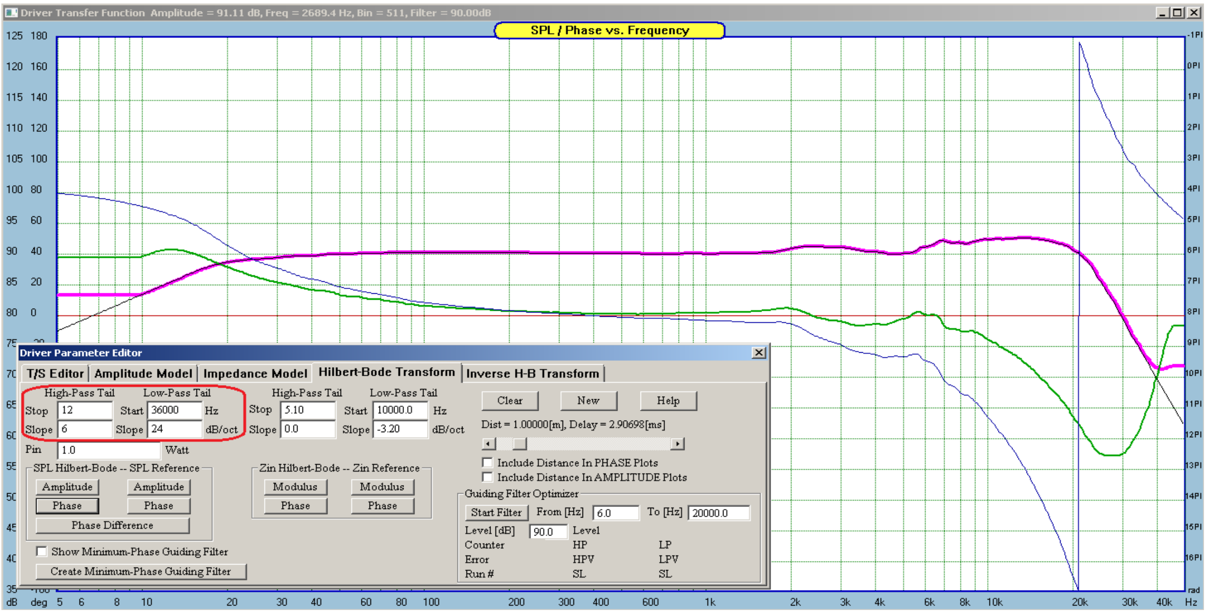


Figure 3.18. Imported SPL processed via HBT.

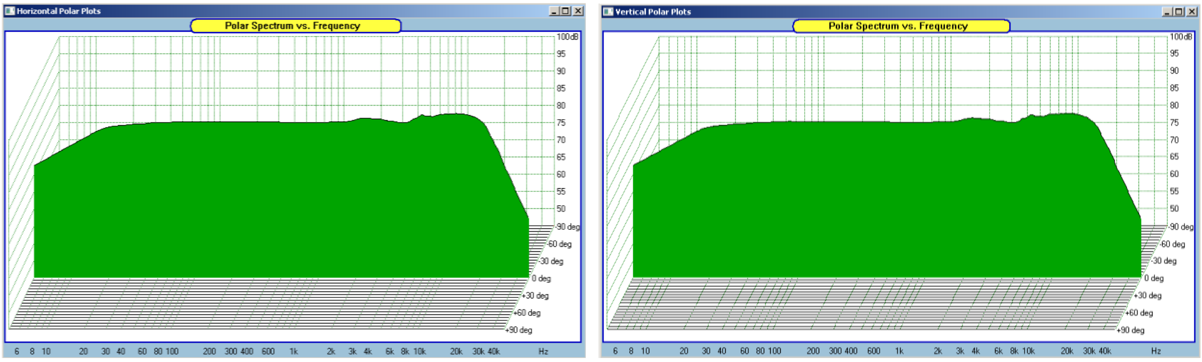
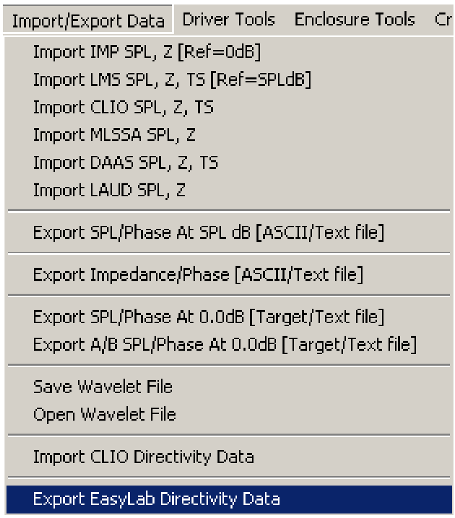


Figure 3.19. Imported and HBT processed SPL curve assigned to Horizontal and Vertical polar plots at 0deg.

4. Repeat the above process of importing the SPL files for all other angles of interest.

Exporting ANSI-CTA-2034 Directivity Data

Once directivity data for all horizontal and vertical angles has been collected, it may be exported as “*.TXT” files, thus becoming accessible to other loudspeaker programs. Please select the **Export EasyLab Directivity Data** option from the **Import/Export Data** main menu – as shown below.



A standard file loading dialogue box will be opened. From here, you can navigate to the required directory and then you can enter Root File Name.

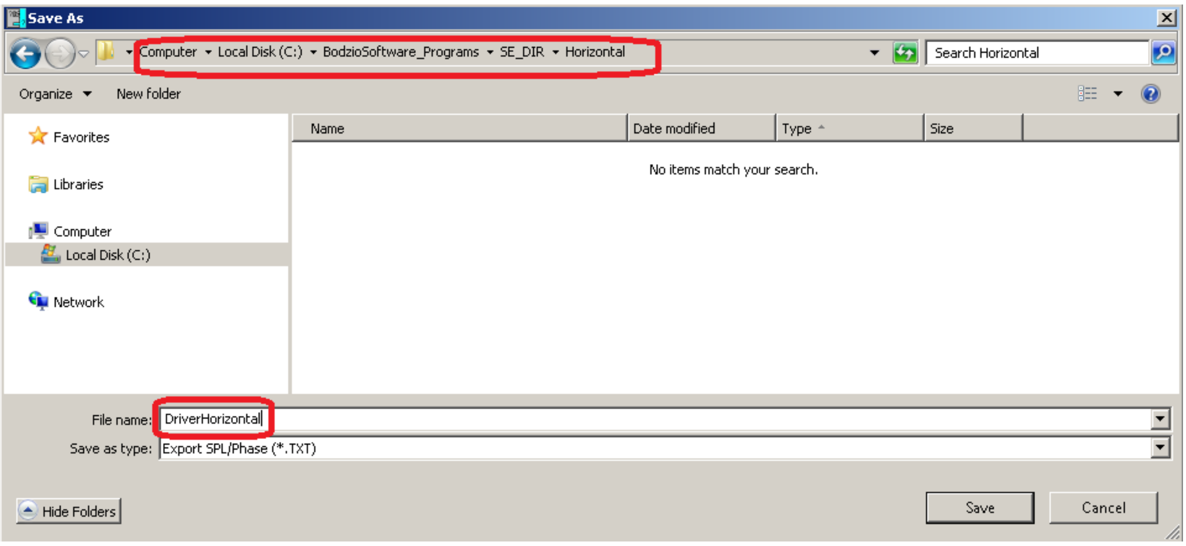


Figure 3.20 Editing Root File Name for exporting directivity data.

In the example above, the subdirectory “**Horizontal**” was created before, and the Root File Name was chosen as **DriverHorizontal**. This process needs to be repeated separately chosen for horizontal and vertical measured data. The format of the file names saved automatically into the selected directory follows CLIO file convention:

Filename<SPACE>deg<SPACE>Angle*100.TXT

For instance, for the Root File Name “**MyDriver**”, the data saved for -15deg angle will be saved in:

MyDriver deg -1500.TXT file

Next, press **Save** button and this will open a selection dialogue box. There is some useful information displayed for you to check, like Path Name and Root File Name chosen previously.

You will also be required to choose between exporting horizontal OR vertical measurement data, either from Driver File or Project File. Then press **Export** button and you can watch **Exporting Angle** progress, along with **Frequency, SPL and Phase** data being stored in each file.

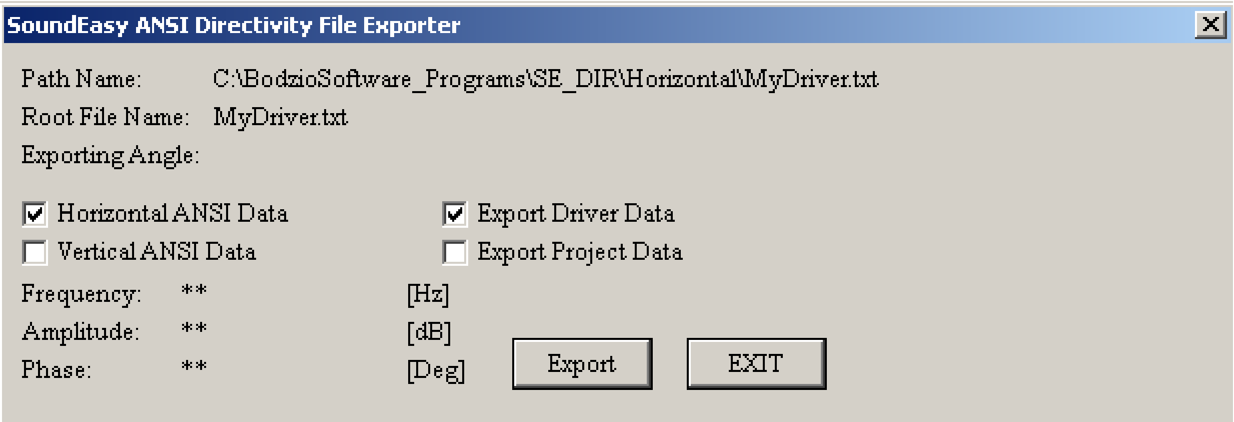
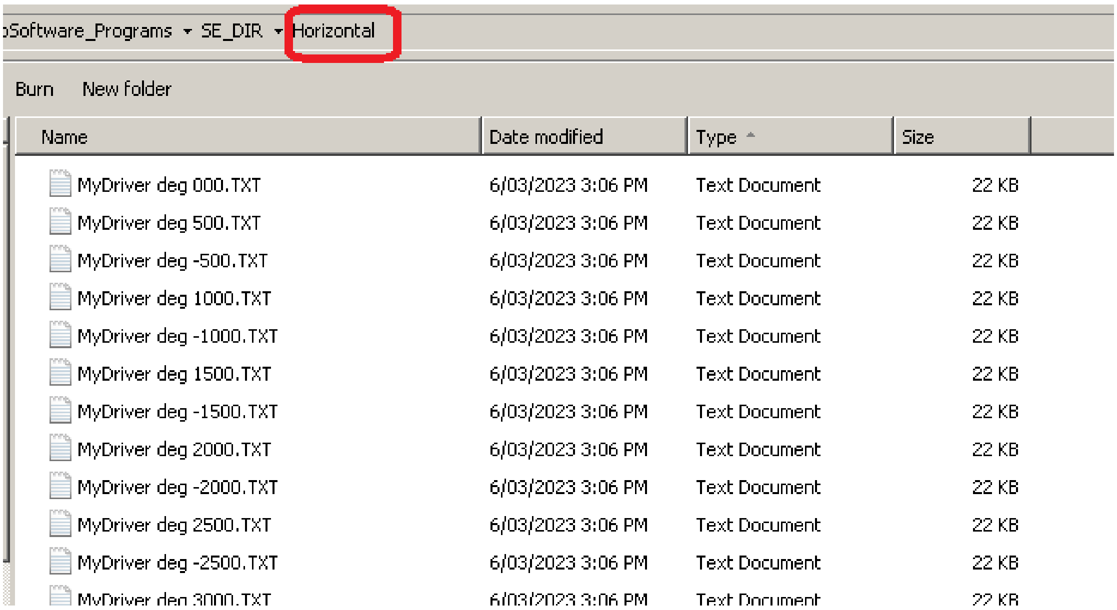


Figure 3.21 Exporting Directivity data.

When completed, press EXIT button to close the dialogue box. Subdirectory **Horizontal** in now filled with all data files collected from horizontal driver measurements.



Please note, that a data header was also automatically inserted into each file – see below. This is to inform other users of the file about each column of data.

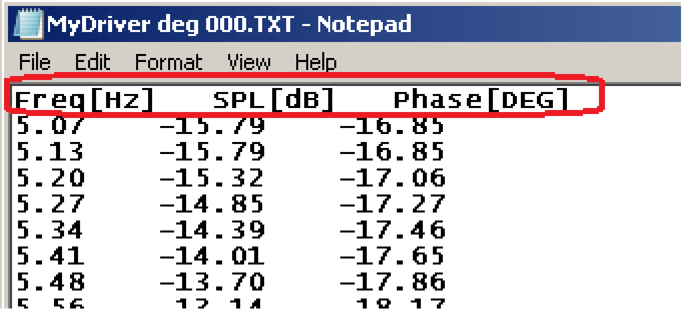


Figure 3.22. Frequency, SPL and Phase data columns saved in data file.

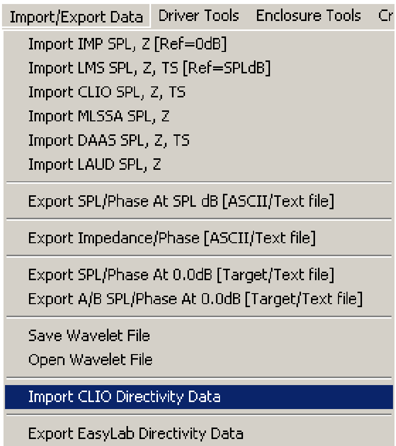
When importing this file back into SoundEays, this header will have to be automatically removed. See next chapter.

Importing ANSI-CTA-2032 Directivity Data From TXT file

The importing process is based on syntax of CLIO-style data files, saved in TXT format. For instance, for the Root File Name "**MyDriver**", the data for -15deg angle was saved in:

MyDriver deg -1500.TXT file

Please select the **Export CLIO Directivity Data** option from the **Import/Export Data** main menu – as shown below**. Step 1**.



This will open a standard file selection dialogue box, which allows you to navigate to the required subdirectory and select **the first file** to be imported.

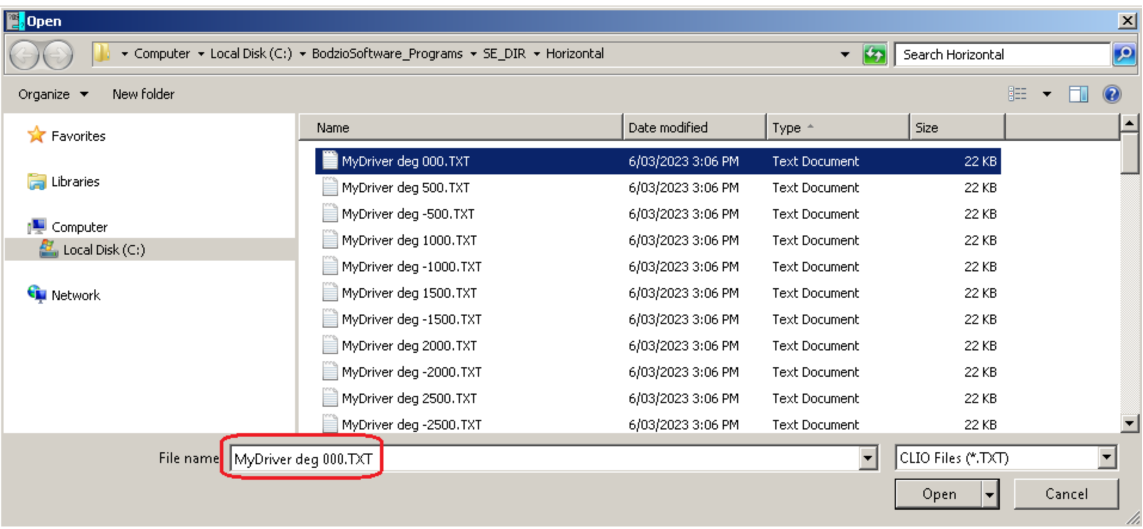
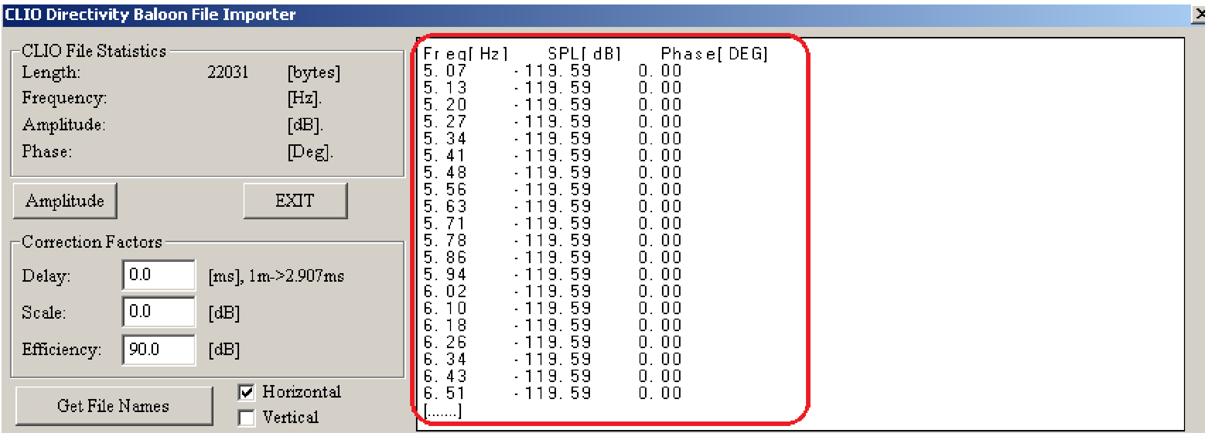


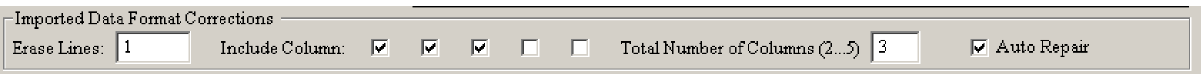
Figure 3.23 Selecting the first directivity data file to be imported.

Remainder: Both types: horizontal and vertical data files should be located in separate subdirectories. Now, press the **Open** button to invoke the CLIO Directivity Data importing control box.

The data from the first file that was selected, **MyDriver deg 000.TXT** is now displayed for you to ensure, that you have indeed the correct file, format and data to be imported.



Please note, that the header of the data file needs to be disregarded for importing purposes, so the following selections need to be made to eliminate it from importing process:



Also, the **Auto Repair** check box is selected, because the file being imported could have been created for different frequency grid that is currently selected in SoundEasy program. Select **Horizontal** check box and then press **Get File Names** button. Now, the names of all files from the previously selected subdirectory will be displayed on the screen, and the file names are also transferred to the **Horizontal Files** list box.

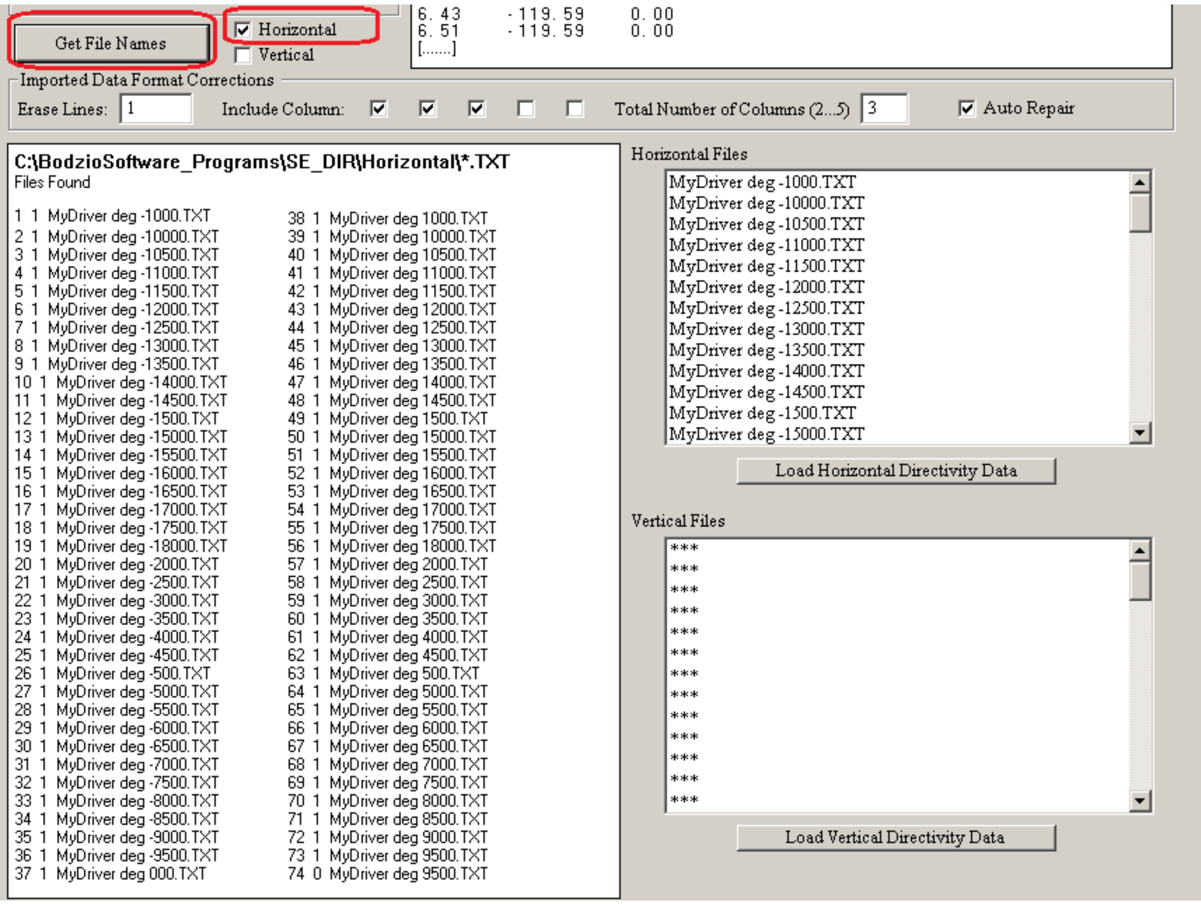


Figure 3.24. Importing Horizontal Directivity Data.

Next, press the **Load Horizontal Directivity Data** button, and that will load all files from the selected subdirectory into the program. The progress will be displayed above the list box.

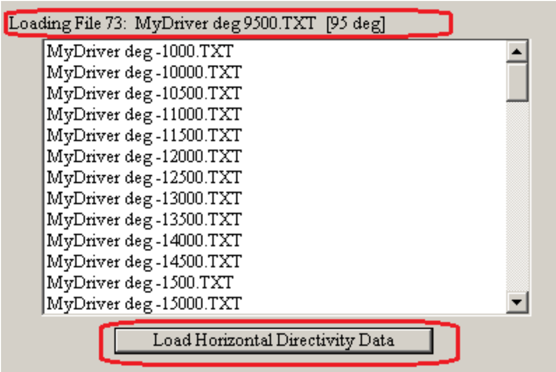
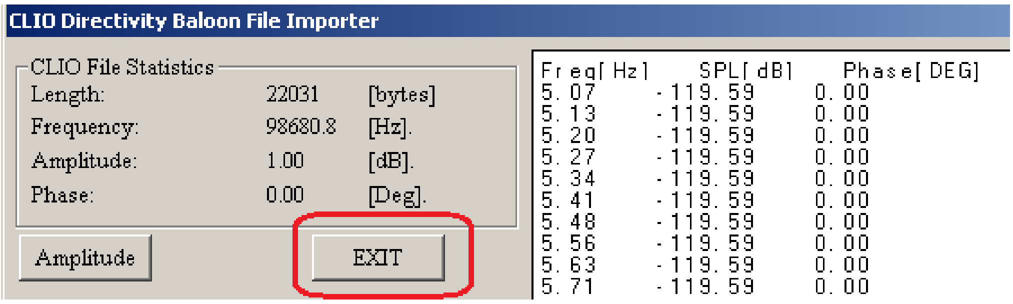
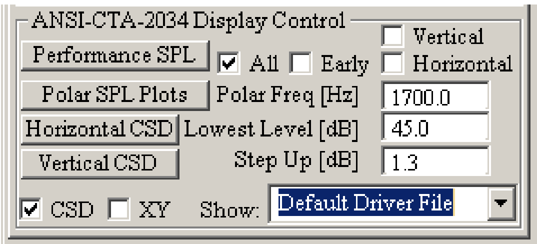


Figure 3.25. Loading Horizontal Directivity data from TXT file.

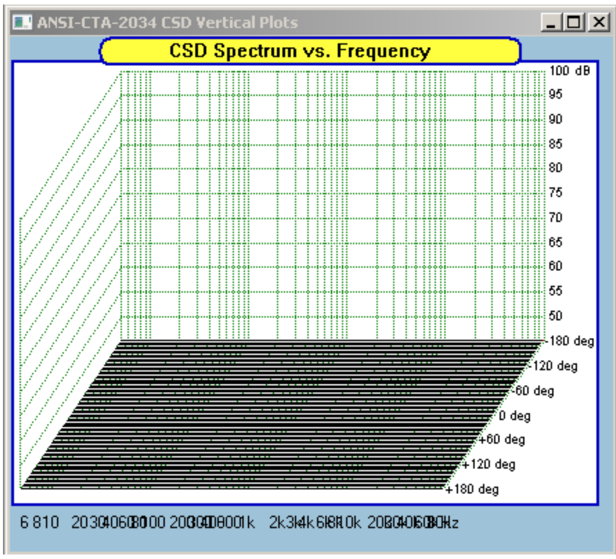
When the process is completed, press the **EXIT** button.

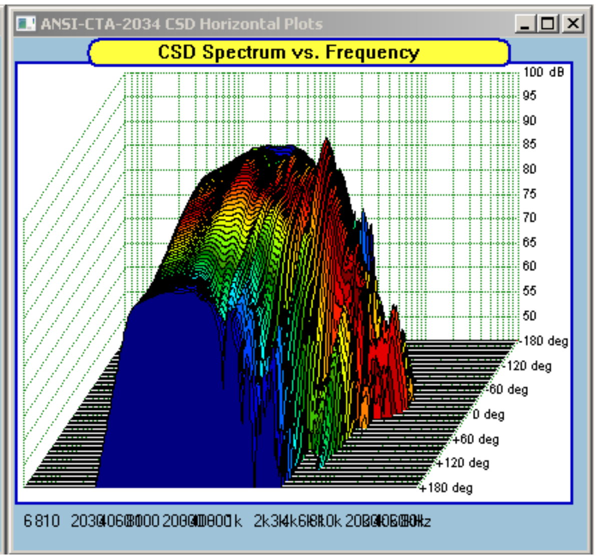


We are now in the position to view the imported data, therefore, please go to the **Measurement Systems** and select **MLS Turntable** TAB. Then select **Default Driver File** to be shown.



If everything went we,, you should see the following data being displayed in the MLS Turntable associated screens





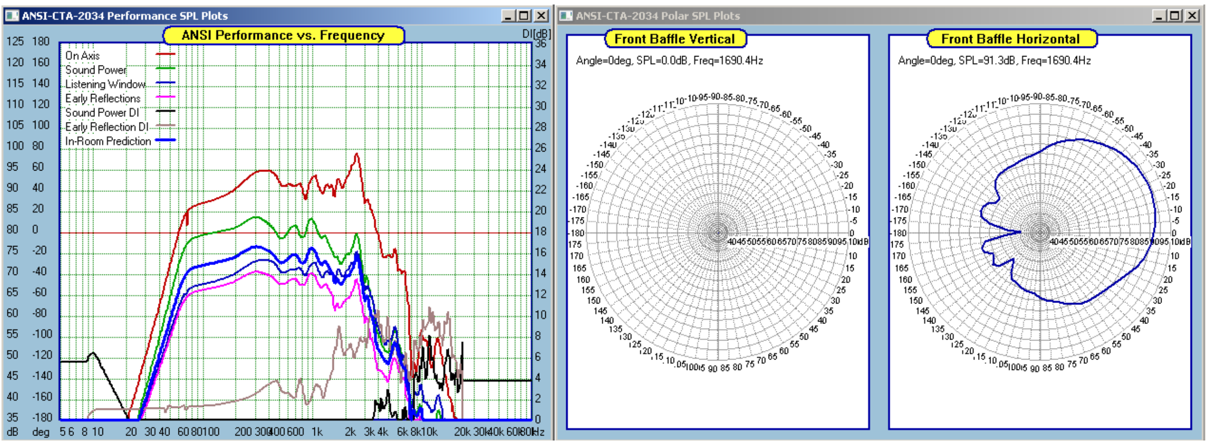


Figure 3.26. Imported Horizontal Directivity Data displayed in the MLS Turntable screens.

In order to import Vertical Directivity Data, please repeat this process from **Step 1** indicated before. The vertical data files need to be stored in different subdirectory.

When both: horizontal and vertical data has been imported into the driver file, the file should be saved for future use.