Calibrating EASERA for Measuring Absolute Levels
By Charlie Hughes

One of the very few drawbacks I previously experienced when using EASERA (beta version 1.0.94 and earlier) was its seeming inability to correctly display the absolute level of a measurement in the View & Calc section. The Live section does not have this problem. From correspondence with SDA I am hopeful that this will not be an issue for future releases of the program.

Until then the procedure detailed in this paper will allow correct absolute levels to be displayed in View & Calc when doing swept-sine based measurements. This procedure assumes that EASERA is properly calibrated, both electronically and acoustically, for all of the inputs and outputs of the audio interface hardware being used. Before using this procedure please verify that EASERA is properly calibrated for your audio hardware.

The screen shots shown here are from beta version 1.0.94 and may look a bit different from version 1.0.60, the current release at this time. The most notable is the Calibration dialog box shown in Figure 2.

The first step is to set up EASERA for use as a Dual-Channel FFT as shown in Figure 1. This allows the second input to be used as a Reference Channel. This input should be connected to an output with the same level as the output that is used to drive the SUT (System Under Test). In the case of an EASERA Gateway both outputs are at the same level so the second one may be connected to the Reference Channel input.
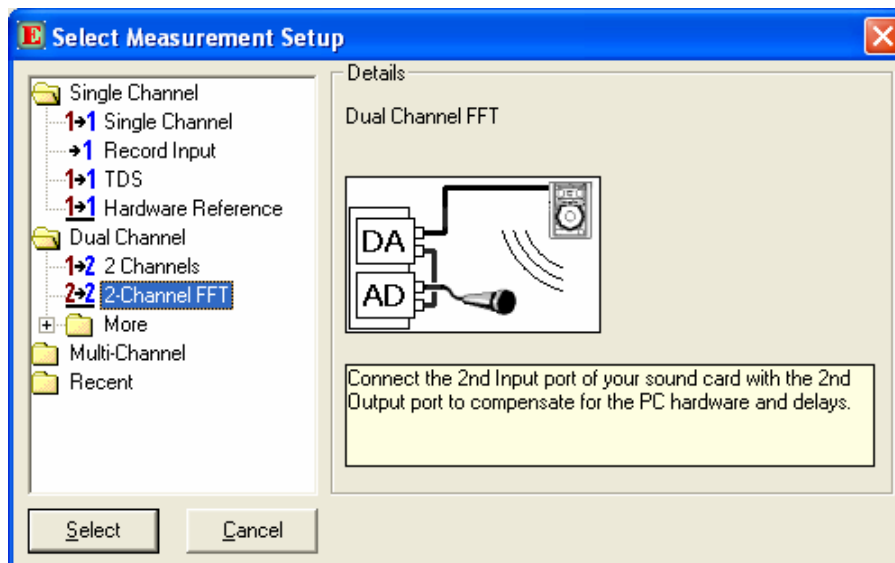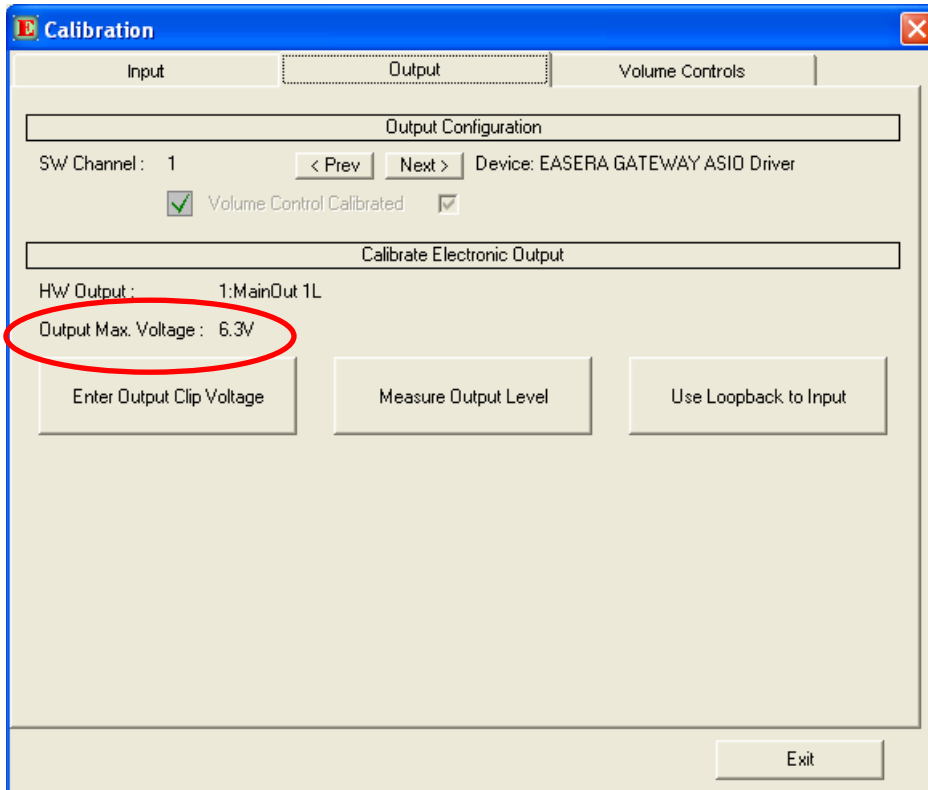

Figure 1 – Dual Channel FFT setup

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Figure 2 – Maximum Output Voltage of the audio hardware

The next step is to examine the calibrated Maximum Output Voltage. If the hardware outputs (and inputs) have not yet been calibrated do it before proceeding further. The Maximum Output Voltage for my EASERA Gateway (with the front panel attenuator fully on) is 6.3 V. This is seen in Figure 2. As mentioned before, this is the Calibration dialog box for beta version 1.0.94. Earlier versions may look a bit different but the Maximum Output Voltage info should still be there.

This voltage needs to be converted to a dB level with a reference of 1 V. This reference is used because EASERA internally "normalizes" a measurement as if 1 V was present at the output of the audio hardware regardless of what the voltage really was. The equation for converting this Maximum Output Voltage to dB is

$$dB = 20 * log \ (Max. \ Voltage \ / \ Reference \ Voltage)$$

For our example this works out as follows.
$$dB = 20 * log \ (6.3 \ / \ 1)$$
$$dB = 20 * 0.7993 \qquad = 15.99 \ dB$$

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This Maximum Output Level is used in the final step of process. It needs to be entered as the External Input Gain of the Reference Channel. This is shown circled in red in Figure 3. The only other item that has to be done is to enter the level of the Digital Output Gain as the External Output Gain of the Reference Channel. This is also shown in Figure 3 circled in blue.
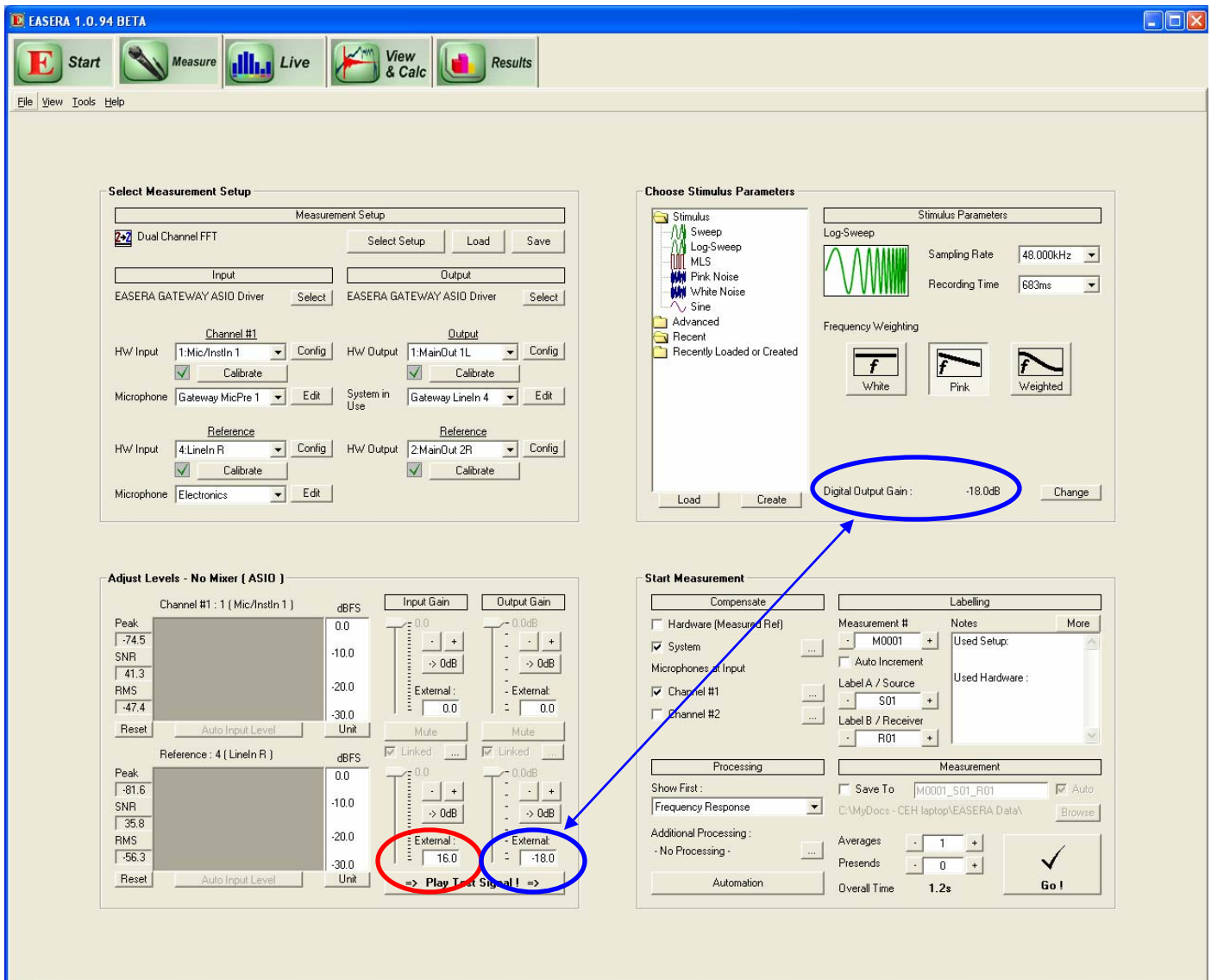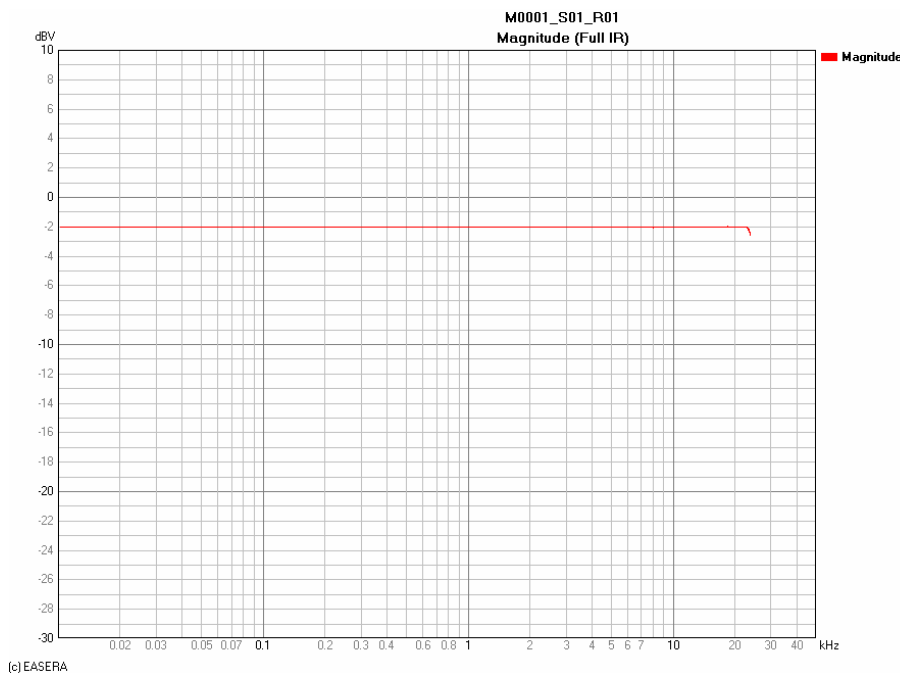

Figure 3 – Calibration values entered into the Reference Channel of the Dual Channel FFT

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If the level of the Digital Output Gain (DOG) is changed the new level must be entered into the External Output Gain of the Reference Channel for the display to remain calibrated for absolute level. Similarly, if the attenuator on the front panel controlling the output level is altered the output is no longer calibrated within EASERA.

A measurement connecting the EASERA Gateway output #1 to the input #1 was made using this procedure. This is displayed in Figure 4 as a level (dBV) and in Figure 5 as a voltage. This agrees very well with the voltage measurement taken using a digital multi-meter shown in Figure 6.

When a properly calibrated microphone is used for acoustical measurements while employing this procedure, the correct absolute SPL is displayed in View & Calc.

Figure 4 – Measurement displayed with correct absolute level, -2.0 dBV
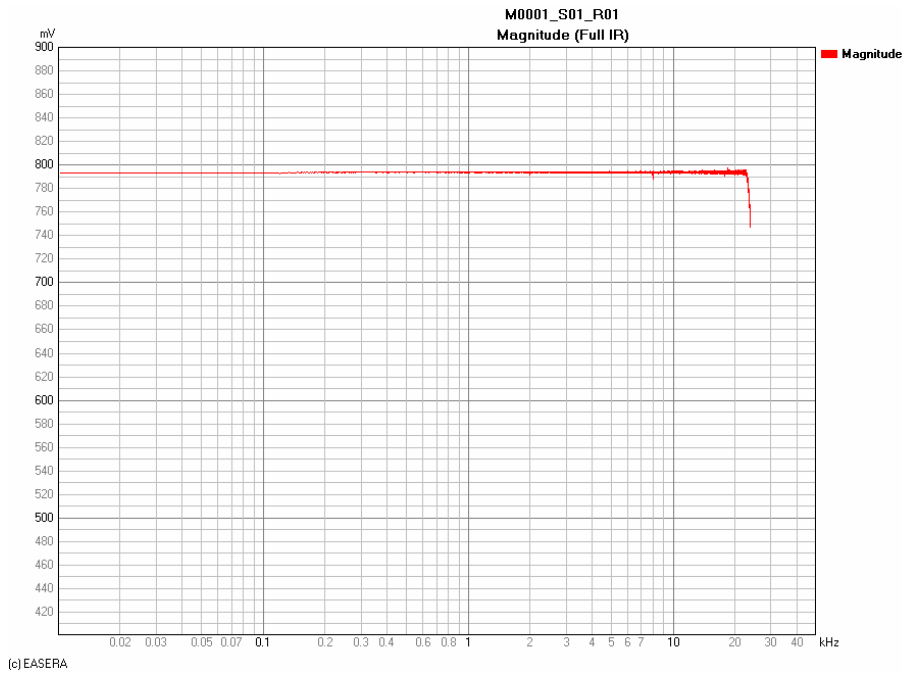
Figure 5 – Measurement displayed with correct absolute voltage, 794 mV

Figure 6 – RMS voltage at 1 kHz measured with a digital multi-meter

When switching to Live, input Channel #1 will display the same levels as View & Calc. However, the channel used as the Reference Channel will not display the correct absolute levels in Live. This is due to the External Gain settings entered for the Reference Channel that was used to calibrate the View & Calc measurement of Channel #1.

This procedure can be used in the Single Channel mode if desired. The correction/calibration values shown previously entered into the External Gains for the Reference Channel should be entered in the single Measurement Channel in this case. The only disadvantage of doing this in Single Channel mode is that, as noted above, the levels of this channel will not display the correct absolute levels in Live due to the External Gain settings used to calibrate the View & Calc measurement.

If doing multi-channel measurements it is strongly recommended to use the Dual-Channel FFT mode. It is much easier to enter the correction/calibration values into the External Gain (both input & output) of the Reference Channel once, than to enter the same values multiple times into each Measurement Channel. More work will be required if the DOG is changed and must be re-entered into each of the Measurement Channels External Gains when using the Single Channel mode.

It should be noted that this procedure calibrates EASERA to display the RMS level of the measured quantity. This is because the Maximum Output Voltage used from Figure 2 is the RMS value. If one desires to have the absolute peak level displayed simply add 3 dB to the calculated Maximum Output Level and enter that as the External Input Gain of the Reference Channel.

If the need arises to recalibrate EASERA remember to change the External Gain back to 0. If other values are entered EASERA may not be properly calibrated.

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