

This is written for ETF but works similarly for the BARE software. You may test and calibrate your system in ETF and there should be no need to recalibrate with BARE.

In this test, ETF will be used with a full duplex (Simultaneous Play/Record) sound card. The test signal will be generated by the sound card as well as recorded by the sound card. This test is necessary. Please go through it - it will only take a few moments to ensure that ETF will work correctly and accurately for you.

Before starting this procedure, please take note of the following important points.

1. It is important to note the danger that MLS and Sweep based test signals can be to both human hearing and small high frequency drive units. Always use acceptable SPL levels - normally below 90 dB to keep both ears and tweeters safe from damage. These sound levels are more than loud enough to give very accurate measurement results.
2. ETF can not work in any correct way if the microphone inputs on the sound card are used in place of line inputs. The sound card must have stereo line in and stereo line out capability. Any Windows sound card that meets this requirement will work very well with ETF and these tests will prove it.
3. The "3 D effects" or other special effects may be enabled on your sound card. These options should be disabled before any measurements with ETF are attempted. Click on the multimedia icon in the Windows Control Panel to gain access to these settings.
4. If you are using a laptop, use the battery power to eliminate the power supply noise from interfering with measurements.

This help topic provides a set of step by step instructions required to configure ETF for a particular computer/sound card, to take a first measurement, and to verify measurement accuracy. ETF5.x will give nearly perfect results with any sound/game card that is capable of full duplex stereo sampling at 44.1 KHz or 48 KHz. A highly stable threaded DLL written in C for audio data gathering ensures reliable, robust, & noise free measurements. Note: When using the U24 sound card set the buffer to 44.1 KHz.

Step 1: Connections for test kit Pro

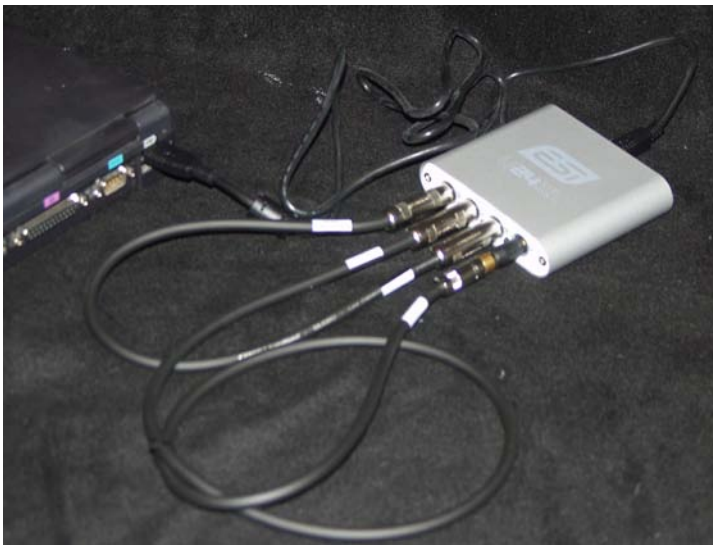
Be sure that your sound card has the proper connections. To be sure that the sound card is working properly and giving accurate measurements, a measurement of the actual sound card will be the first measurement.



Once the U24 is plugged in you will need to install software in many cases. In some cases it will be done automatically for you, as it is a plug and play device—YOU SHOULD TRY THIS FIRST. However, a software disc is provided for you. If you have any problems please refer to the U24 manual.



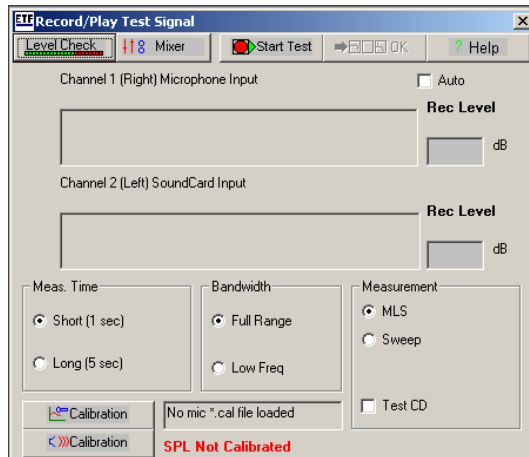
Next plug in the short cable for the left inputs and outputs of the soundcard as shown.



Then plug in the short right cable that is labeled “right U24 in” and “mic pre out”. Using the adapter provided, plug the “mic pre out” terminal into the right output on the U24 as shown to the left.

Step 2: set up for loop through test

Run ETF, select "New Measurement" from the main file menu. Select "Normal Transfer Function". The form below appears.



Data Gathering Form.

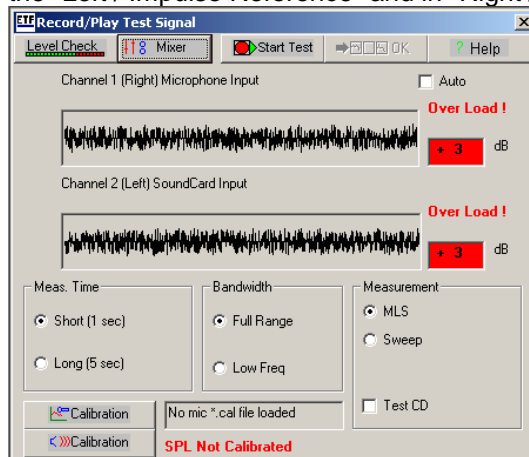
Make sure the "Test CD" checkbox is left unchecked, as shown. This will enable ETF to operate in full duplex sound card operation. The sound card will play the test signal and record data from the line inputs.

Step 3: Level check

Click "Level Check"

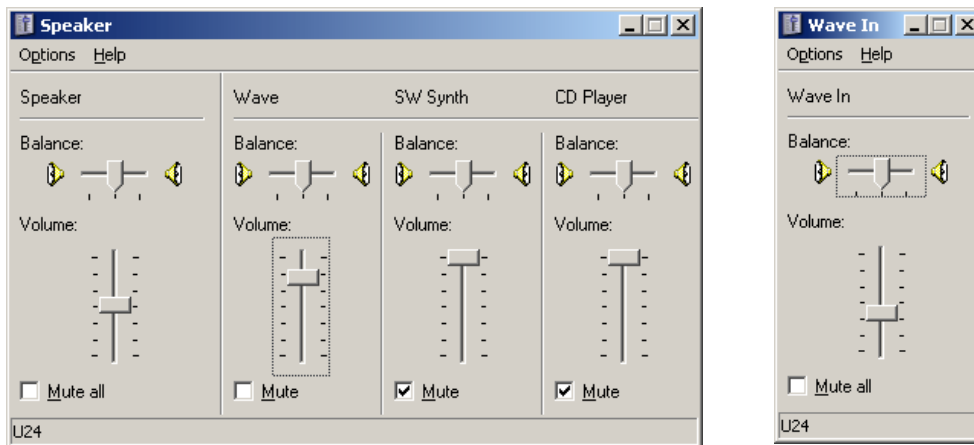
ETF has automatically queried your sound card to find its capabilities for playback and recording. It determines a hardware sampling frequency of the sound card so that ETF measurements are accurate and noise free.

This button can be used as a quick check of connections. ETF will play and record a 1 second white noise tone burst. When this operation is finished a wave will get drawn in the "Left / Impulse Reference" and in "Right / Impulse Measurement" graphs.



Levels should be set between -10 dB and 0 dB with proper connections and correct mixer settings. This example shows an overload, and the mixer needs to be adjusted.

To adjust the levels
Click "Mixer" Set the mixer up as shown in mixer.

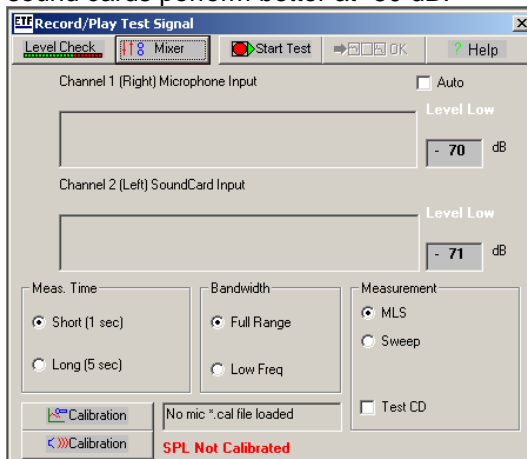


Above is the Speaker controls. Everything should be muted except the wave and speaker out. The second box is the input controls. It is VERY important to access these input controls by selecting options on the top left hand portion. Then you will select record and you will have whatever input options are available for your soundcard. Here everything should be muted except the wave in or line in (depending on computer, hardware and software).

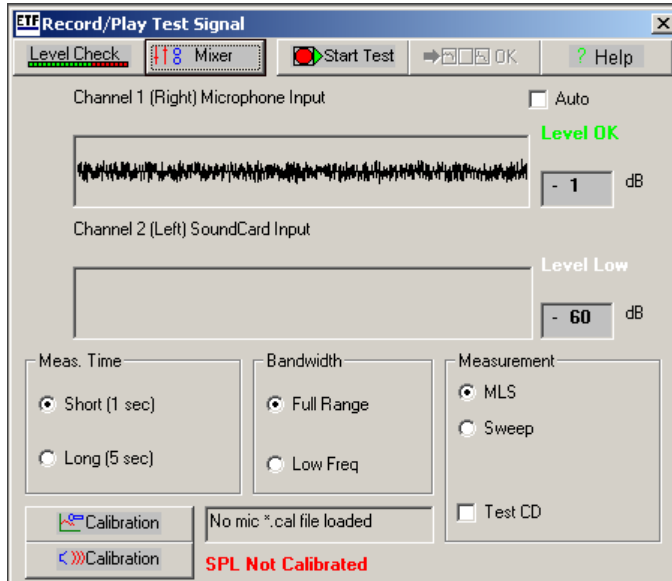
ETF compensates for the tone control changes and always shows the correct frequency response result.

Step 4: duplex card check

Disconnect the line inputs from the outputs, repeat the level check. Levels should be low for a broken connection. This will show that there is no parasitic signal path between the inputs and outputs. A level lower than -30 dB is acceptable. Many low cost sound cards perform better at -50 dB.



Try breaking only the left connection, do a level test. Try breaking the right loop connection repeat level check. For correct operation the disconnected channel will show low levels. (Note: the standard kit does not allow for disconnect of the left channel—so test disconnecting the right only here)



Step 5: start loop though test

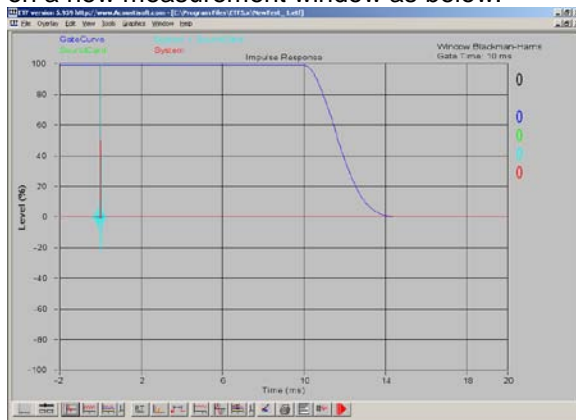
Click "Start Test"

ETF will play & record a white noise tone burst through the sound card. When this operation is through the wave editor graphs will show the resulting measurement levels if the Auto Analyze box is checked.

Step 6: analyze loop through

Click "Analyze", if you did not have auto analyze checked.

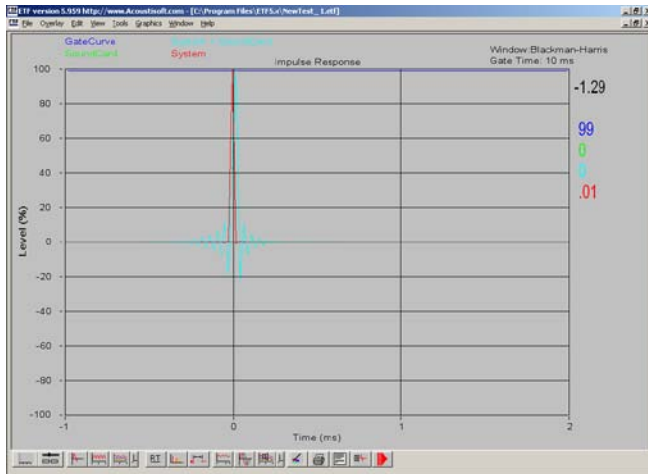
The analyze button will generate an analysis of the test in a few seconds and display it on a new measurement window as below.



Step 7: sound card evaluation

Click "Co-Ordinates"

Change the Co-Ordinates on the graph to "-1 ms - > 2 ms" and the graph should appear as below.



Good Sound Card Measurement

If the sound card impulse response should look very similar to the above. The result should be free of noise (smooth & flat after approximately 0.5 ms. Sound card tests should look similar to "good soundcard.etf", included in the download.

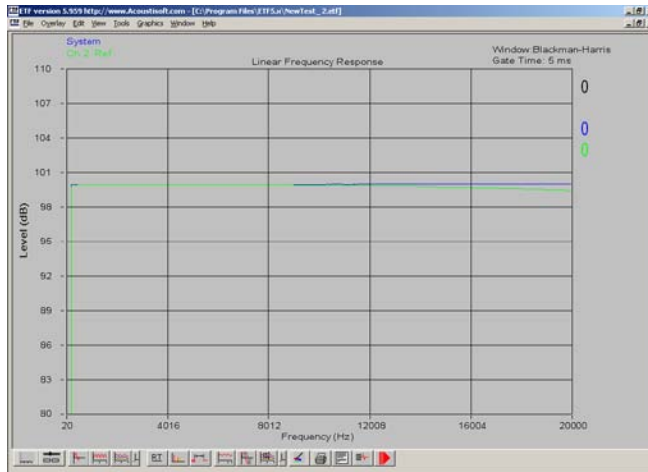
Poor Sound Card Measurement

The noise in this measurement indicates software resampling. The sound card actually records at 48 KHz but resamples to give the 44.1 KHz test (ETF was set at 44.1 KHz). Changing the sample frequency in ETF to 48 KHz clears the noise because it eliminates the need for internal software resampling. The sample rate can be changed from the main menu, go to "Tools" -> "Sound Card Buffer Setting".

ETF shows each channel impulse as having a peak maximum at level 100. In some cases, a disconnected line will leave the sound card in a situation where enough crosstalk between the inputs and outputs of the sound card will allow a signal to get through and an impulse response to be shown that looks very acceptable. Verify correct loop through results by viewing the frequency response graphs.

Good Result in Frequency Response

The blue line (system) is perfectly flat at 100 dB (not easily seen here) although the actual sound card response is not perfect (green line). The actual measurements taken with this card will be close to perfect because ETF5.x compensates for the sound card when used in Two Channel operation.



Step 8: Connecting the microphone

Congratulations: ETF is now ready to take a room measurement. Now you need to connect your computer to the microphone, mic pre amp, and one input connection on the stereo system you are testing. You will also need to load the file from the provided floppy disc as the mic calibration file.

First, remove the connector used for the loop through test on the right channel. Then connect the terminal label *mic pre out* to the output on the microphone preamp. There is also a dedicated cable for connecting the microphone to the mic pre amp. Last connect right output of the sound card to an available input on the stereo you are testing. We've provided an 8.5 meter cable, but understand some installations may require an additional extension cable.



You will now need to again test the levels. Turn on the stereo to a moderate volume. Press level check. The left channel should be fine. Using an SPL meter (we recommend the Radio Shack analog SPL meter, adjust the volume of the stereo until the level check is outputting approximately 80 to 85 db at the listening position. Once you have this, then adjust the mic pre amp volume (the red knob shown above) until the levels on the ETF are back between -1 and -10 dB. Once you have accomplished this you can take a full measurement.

Step 10

Click "Start Test". Click "Analyze" when done and a new measurement is created. Click "Parameter Adjust" on the new window.

You will notice that each Parameter Adjust pop up window has a help button. Use the help button on the pop up window to get an explanation of each control. The pop up control is different for each type of measurement shown.

Click on the other forms of measurements to view linear frequency response, RT-60 response, waterfall plots (for low frequency only), and ETC (energy time curves). In all of these you may adjust parameters.

Step 11

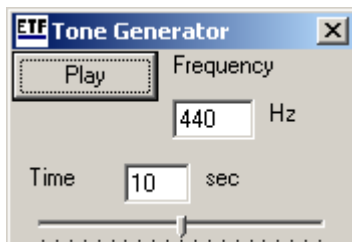
Try a measurement with the "Low Freq." option selected in the Audio Form. And you may also try the sweep measurements. We have found the sweep measurements to be the most accurate and recommend using them whenever possible. You may have to adjust levels between MLS and sweep measurements. Simply perform a level check and adjust accordingly.

Step 12

Tone Generator.

Both ETF and BARE have a built in Tone Generator. This is under the file menu and can be very useful in determining where certain "hot spots" in the room are. Once you have found a particular frequency that is above the normal level, set the tone generator to this frequency and to a duration that is long enough for you to make a pass around the room with an SPL meter and determine the highest peaks.

This is not a very useful tool for high frequencies as the peaks and nulls are closely spaced, rather it should be used for 500 Hz and below.



The Tone generator window is shown left:

Pressing play will play this tone for the duration specified.

BARE:

In order to successfully acquire an measurement for the PARC you must follow these steps:

1. Connect cables to take a measurement
2. Turn the pre-amp to the input you are using and set the volume very low
3. Using the level-check gradually raise the volume until you are at approximately 80 db, using a Radio Shack SPL or other SPL meter.
4. Place the microphone in the listening position
5. Again using the level check adjust the mic-pre volume until you have appropriate levels on both right and left channel (see step 3 in the general section for more detail on this)
6. At the bottom of the BARE screen select "Calibrate SPL"
7. Select Calibrate and then enter the SPL value from your SPL meter in the box. Select OK and you will get a message SPL calibrated.

THE ORDER OF THE ABOVE STEPS IS VERY IMPORTANT TO GETTING AN ACCURATE AND REPRODUCIBLE MEASUREMENT.

Using BARE to calculate Q factors Manually.

After acquiring a measurement display the psychological response.



In this picture the yellow line shows the peak at 200 Hz. This is also displayed in the top right corner precisely as 200.29 Hz. The peak is at 93.11 Hz. This is above our calibrated normal point of 88 Hz.



In these two pictures we have placed our cursor on the left point that is closest to 3 dB below the peak value, thus 90.28 db which corresponds to 192.15 Hz. On the right picture we placed our cursor on the right point that is closest to 3 db below the peak value or 90.07 db. To calculate the Q factor for this peak we use the following formula:

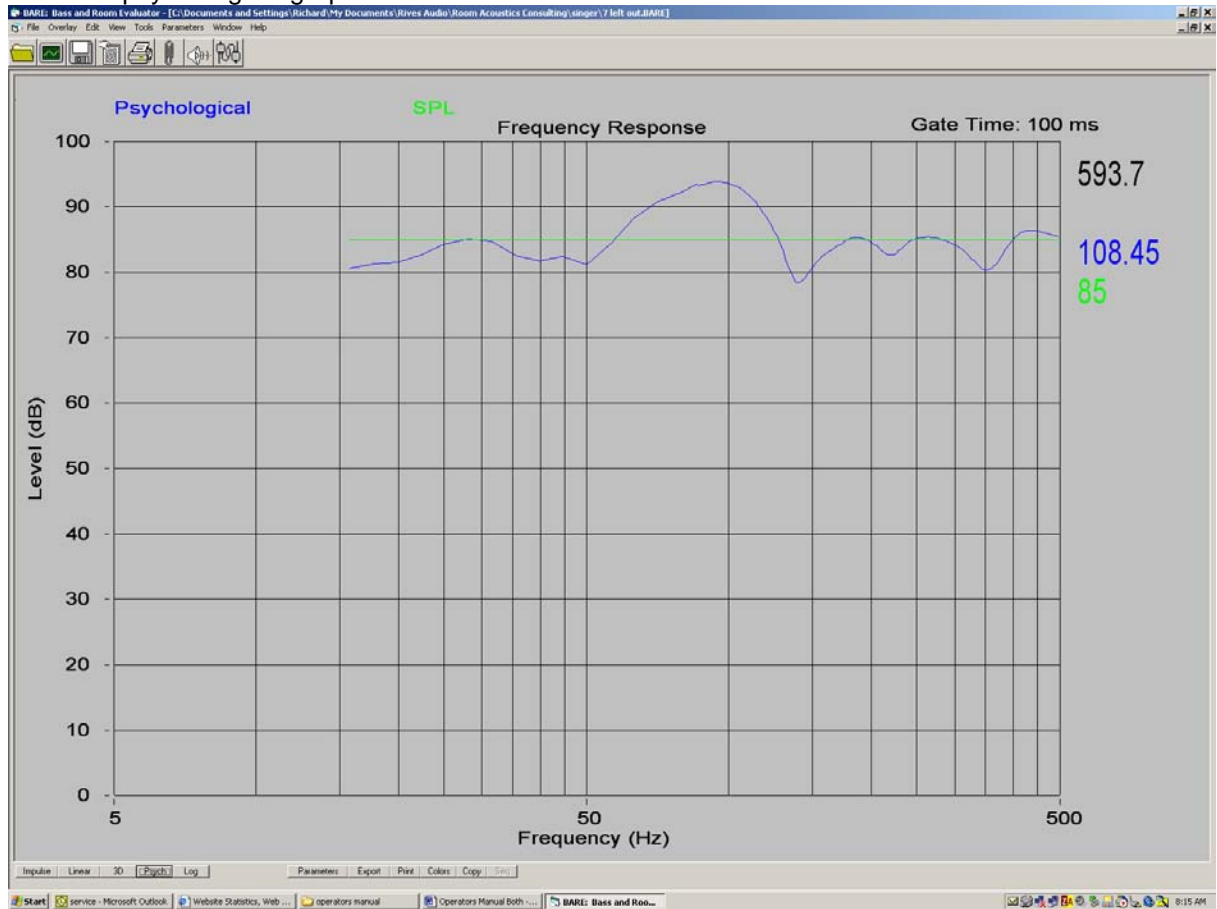
$Q = F_{\text{center}} / (F1 - F2)$ Where F1 and F2 are the right and left points 3 db down from the center point.

$$Q = 200.3 / (222.6 - 182.2)$$

$$Q = 4.96 \text{ or approximately } 5.$$

Using BARE to calculate all parameters automatically.

From the psychological graph shown below:



Select the auto-calculate button which is the right most icon at the top of the screen. When you do this you will get the following window.

The PARC should be linked via Com1 and set at 2400 baud.

Get Recommended Settings For Right Channel

Right Channel Frequencies	Q	Attenuation
1		
2		
3		

Get Recommended Settings For Left Channel

Left Channel Frequencies	Q	Attenuation
1		
2		
3		

Send to PARC

The PARC should be linked via Com1 and set at 2400 baud.

Get Recommended Settings For Right Channel

Right Channel Frequencies	Q	Attenuation
1		
2		
3		

Get Recommended Settings For Left Channel

Left Channel Frequencies	Q	Attenuation
1	88	1.7
2	16	1
3	29.6	1.5

Send to PARC

In the second picture you can see how the calculations are given. Those with 0 attenuation can be ignored. All others should be selected as shown.

Trouble Shooting:

No sound going through the external sound card:

1. If the sound card was installed correctly, this can still happen. It is usually caused by the computer defaulting to the internal sound card. With the external sound card plugged in, use your control panel, go to device manager and sound devices. Disable (but do not uninstall) your internal sound card.
2. Something is muted. Be sure to check both the play and record and insure nothing is muted.

The loop through gets sound on a channel that's not even plugged in.

1. Some internal sound cards are wired in mono, even though they are stereo cards. This is usually on the input line. This is unfortunate and there is little that can be done about this other than purchasing an external soundcard.
2. Many new computers have 3-D or other sound processing which transfers portions of the left to the right channel and vice-versa. These need to be turned off, disabled, or in some cases uninstalled for your measurements to work correctly.

I installed the drivers that came with ESI sound card, but they don't seem to work properly and the mixer is impossible to manipulate.

1. If you have Windows 2000 or XP, uninstall these drivers—or delete them entirely from your devices. Unplug the U24, shut the computer down. Reboot, plug in the ESI, and let windows install drivers automatically. You will see USB Audio device. This works properly with the U24 card.

I used the recommended settings from BARE, but it doesn't sound right.

1. Go back and do another BARE check with the PARC in the circuit. You should have a near flat response. If not you may need to adjust.
2. Many people find that flat is not what they like or are accustomed to. Back off on the attenuation settings by about 25%. This is subjectively usually preferred.