Complete End-of-Line Speaker Test (with ePRB and eLP)

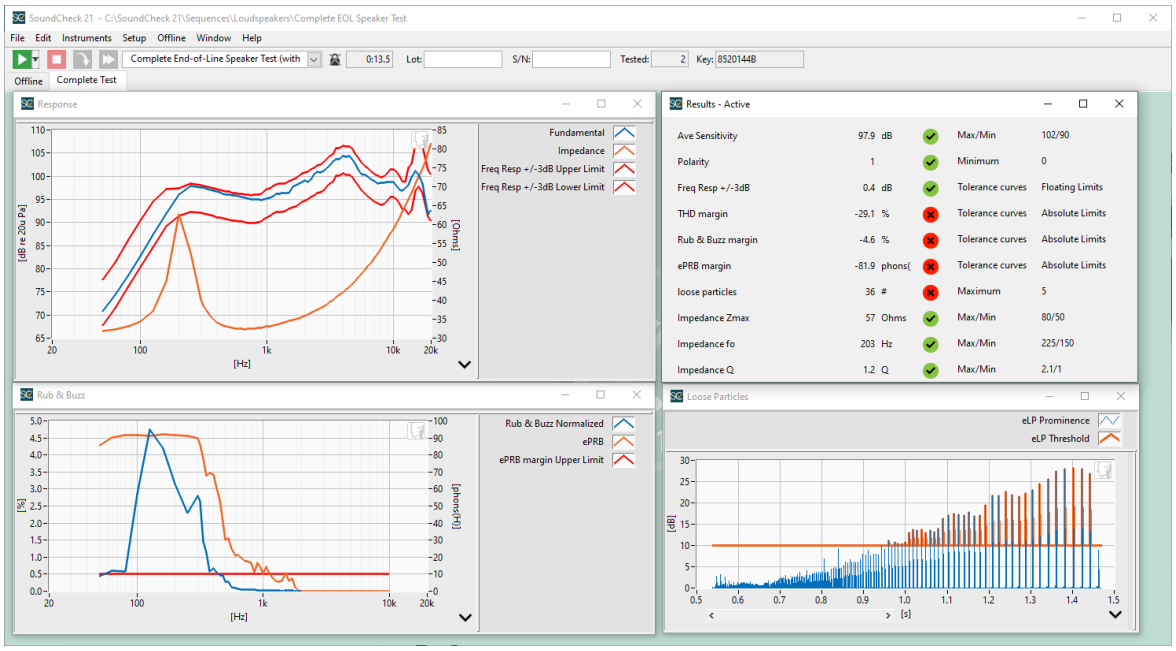
Introduction

This sequence is an example of the many types of tests that can be performed quickly and simultaneously on a loudspeaker production line. A stepped sine sweep (Stweep™) from 20 kHz to 50 Hz is played through the speaker under test and measured via two channels of the audio interface. A calibrated reference microphone is connected to one of the channels and an impedance reference built into the SC Amp or AmpConnect is connected to the other. A HarmonicTrak™ Analysis step analyzes the recorded waveform from the reference microphone and outputs Frequency Response, THD, Normalized Rub & Buzz, Perceptual Rub & Buzz (ePRB), Loose Particle Prominence and Threshold (eLP) and Polarity. A Post-Processing step calculates the Average Sensitivity from 100 – 10kHz.

A second Analysis step analyzes the recorded waveform from the impedance reference and outputs a curve of impedance versus frequency. A Post Processing step performs a curve fit of the impedance curve and calculates the max impedance (Z_{max}), precise resonance frequency (f_0), and the quality factor (Q) of the resonance peak. All measurements and parameters are tested against limits in Limit steps. All these limits can be adjusted to suit your own DUT.

The sequence begins with a prompt that gives the user the option to Recall example SoundCheck recorded waveforms from disk or make a new measurement. If the user chooses to Recall waveforms, the recorded waveforms are analyzed, and the user has the option of playing back the acoustic waveform from a monitor loudspeaker or from headphones so they can hear it as well as analyze it.

If the user chooses to make a new measurement, a Stweep from 20 kHz to 50 Hz at a user defined level is played out of a connected loudspeaker, and all the measurements and results of the device under test are displayed.



Final display for the *Complete End-of-Line Speaker Test (with ePRB and eLP)* sequence

ePRB: Based on our listening tests, a good starting point for setting an ePRB limit for the threshold of audibility is about 10 phons(H). In practical application, this value should be adjusted depending on the device under test. Varying amounts of distortion may be acceptable in a product depending on its characteristics, price point and target application.

eLP: A good starting point for eLP analysis are the default settings in the analysis step:

- Averaging Time: 5ms
- Prominence Threshold: 10dB
- Max Stim Freq.: 1kHz

A limit can then be placed on the eLP count value. The default eLP count limit in this sequence is 5.

The sequence includes three example waveforms for ePRB (good, borderline and bad speaker) and two example waveforms for eLP (many loose particles and no particles with background noise).

Hardware Requirements

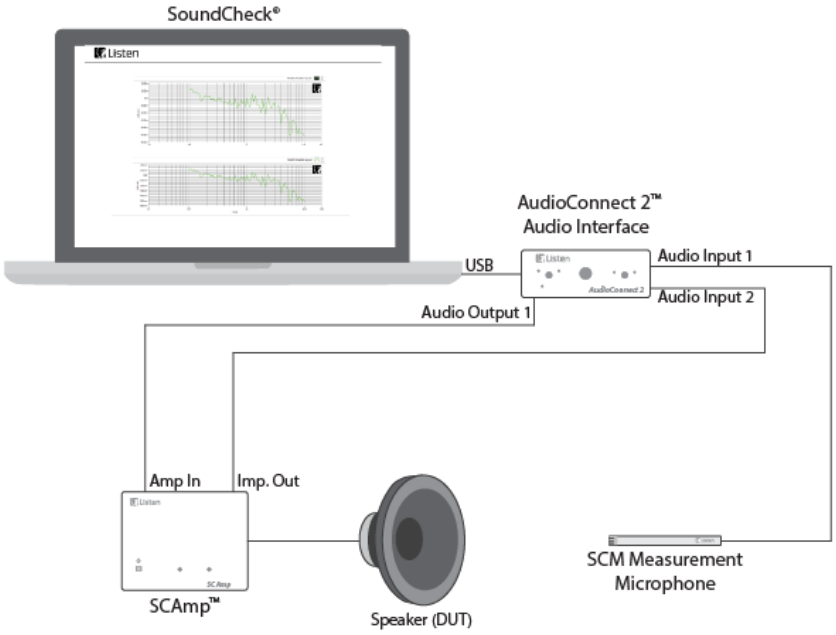
- Reference Microphone – Listen SCM-4 or similar
- Audio Interface – Listen AudioConnect 2 or similar
- Power Amplifier – Listen SC Amp, AmpConnect or similar

Hardware Setup & Calibration

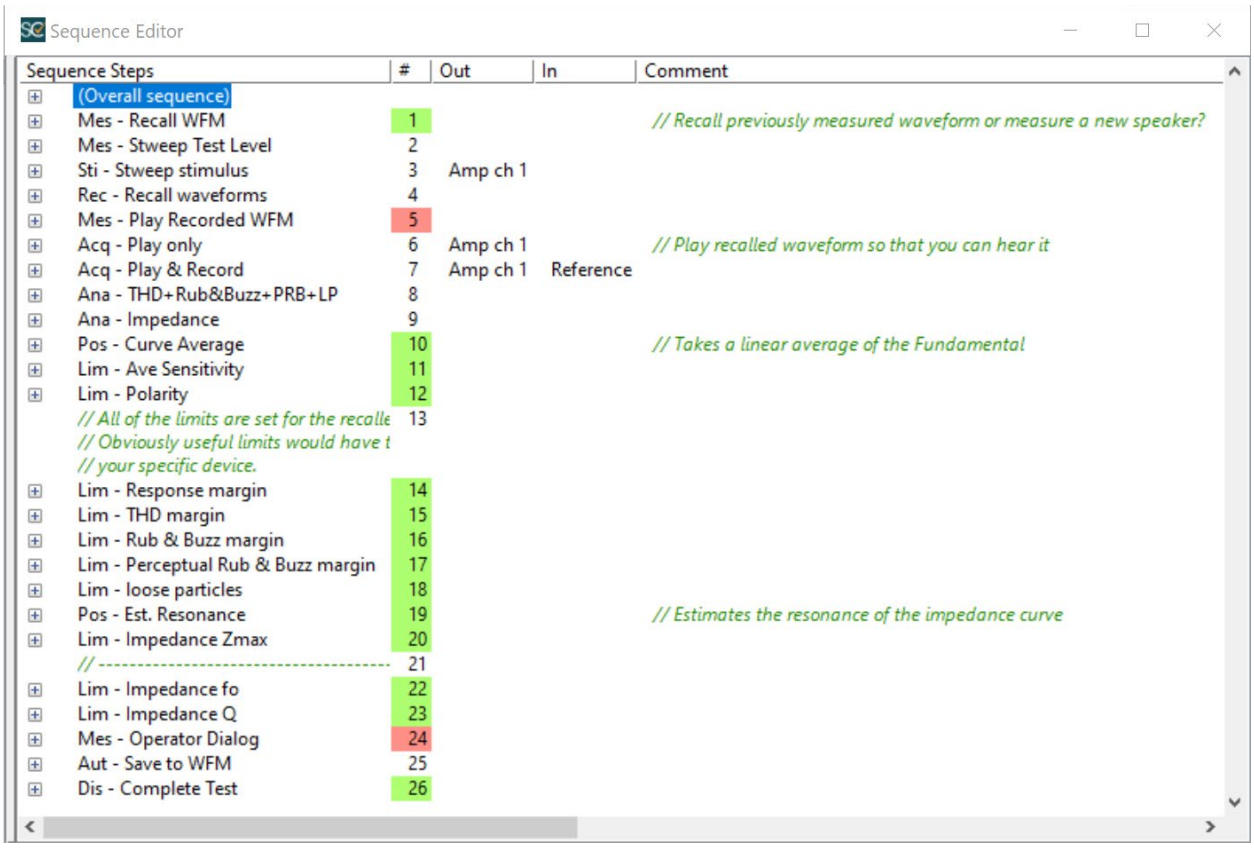
1. Calibrate the amplifier as instructed in the SoundCheck manual.
2. Calibrate the reference microphone as instructed in the SoundCheck manual.
3. Connect output 1 of your audio interface to the input of the amplifier.
4. Connect the output of the amplifier to your loudspeaker.
5. Position your reference microphone in the nearfield of the loudspeaker under test and connect it to the microphone power supply.
6. Connect the mic to input 1 of your audio interface
7. Connect the impedance sense out from the SC amplifier to input 2 or use AmpConnect or measure across a reference resistor between the power amplifier and loudspeaker.

You are ready to start the sequence.

System Diagram



Sequence Logic



Sequence Release Notes		
Version	**Release**	**Comments**
1	August 2022	Initial release for ePRB written in SC20.
2	May 2023	Updated to SC21. eLP analysis and example data added.