LISTEN INC

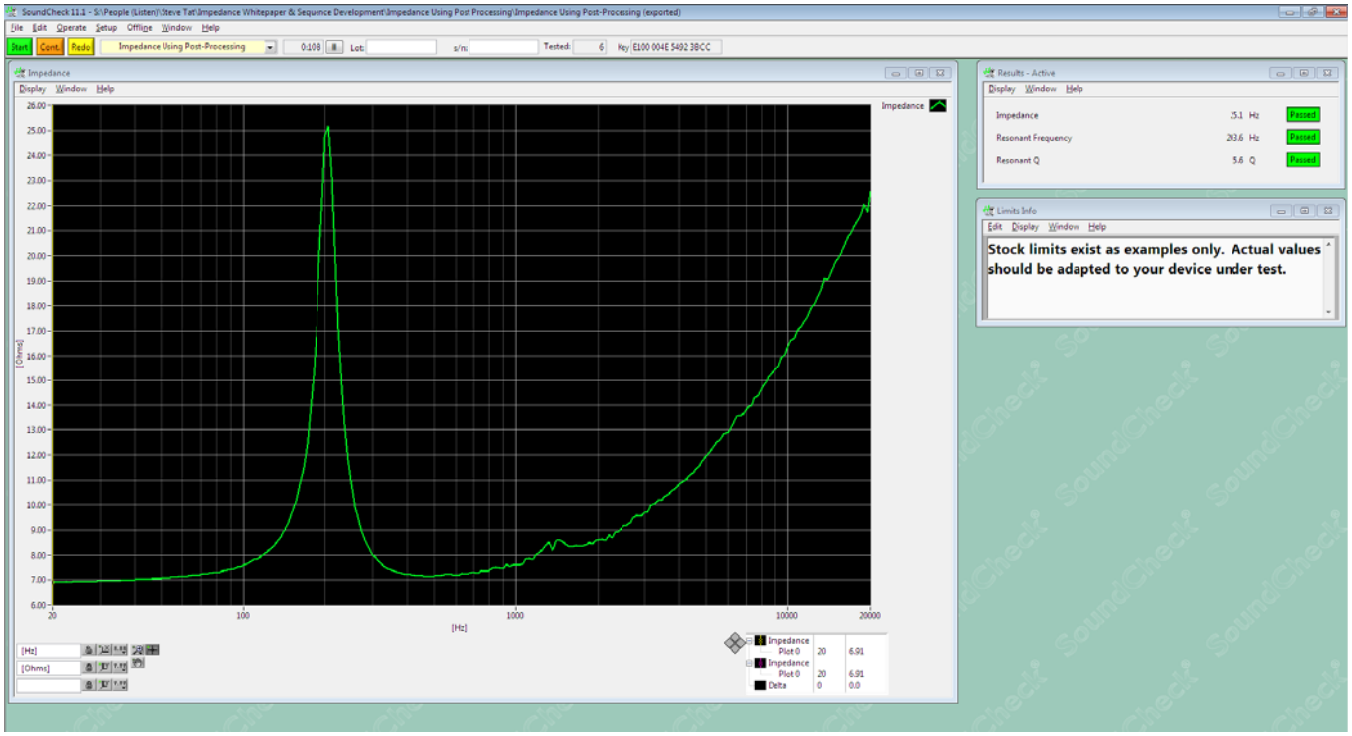
Transforming Sound into Knowledge

Sequence Note

Impedance Using Post-Processing

Introduction

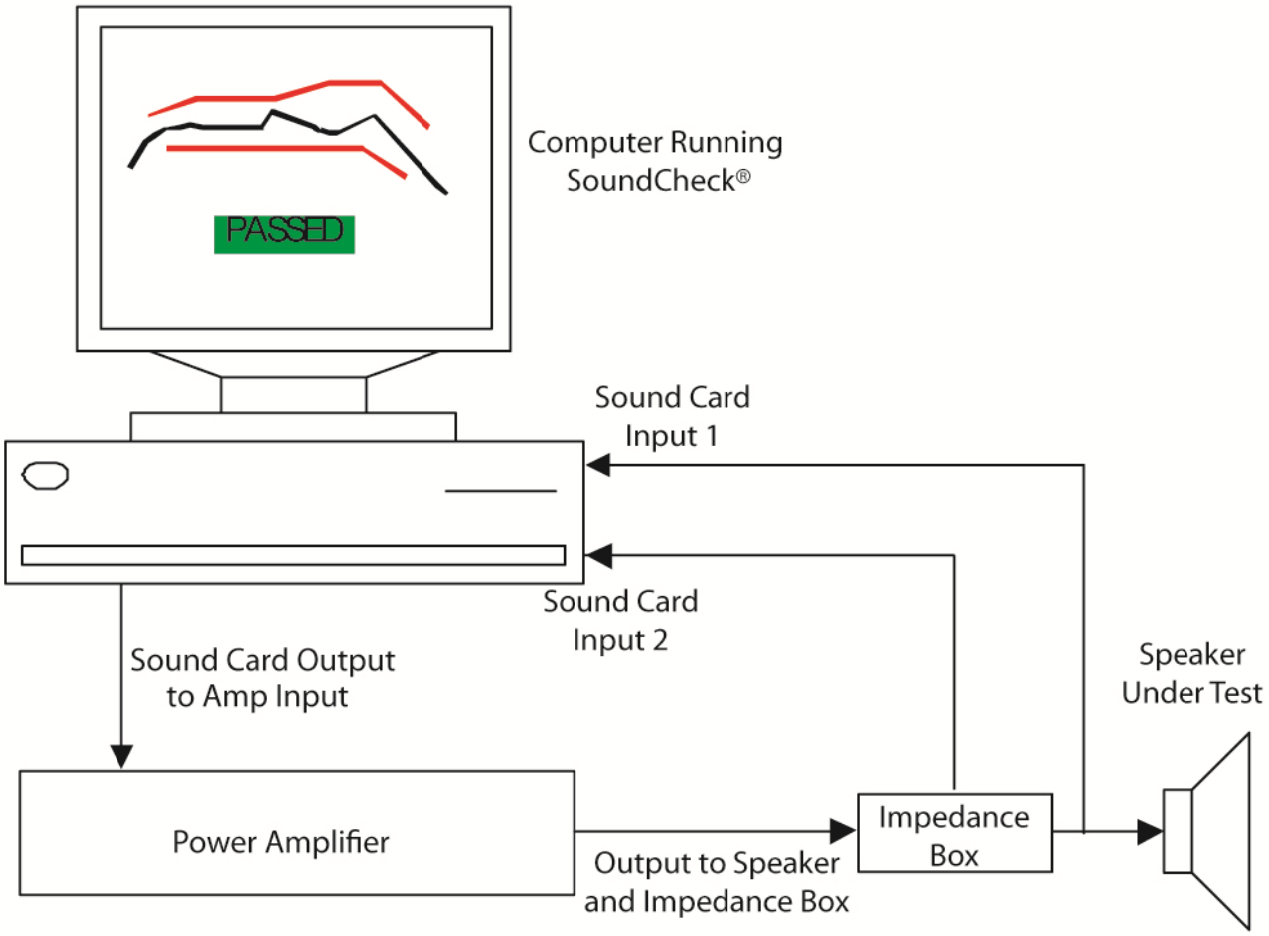
This sequence demonstrates an alternative to the traditional SoundCheck single channel impedance measurement method. A stepped sine sweep from 20 Hz to 20 kHz is played through the speaker while the signal across the loudspeaker terminals is recorded by Direct In 1 and the signal across the sense resistor (impedance box) is recorded by Direct In 2. A heterodyne analysis step is then applied to calculate the fundamental response from both inputs and a math post-processing step divides Fundamental A (speaker terminal voltage) by Fundamental B (voltage across sense resistor). A post-processing step corrects for the value of the reference resistor before displaying the final impedance curve. The curve is then post-processed to calculate resonance frequency, maximum impedance and Q of the resonance peak. A set of arbitrary limits steps are also provided to generate pass/fail results.



Final Display for *Impedance Using Math Post-Processing* sequence

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System Diagram – Discrete Components



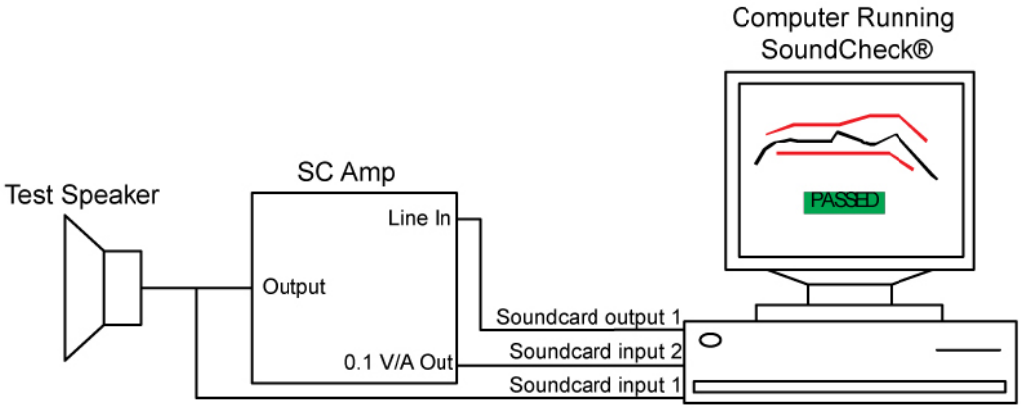
Hardware Setup and Calibration (Discrete Components)

1. Calibrate the amplifier as instructed in the SoundCheck manual
2. Connect Output 1 of the sound card to the input of the amplifier
3. Connect the output of the amplifier to the “connect to amplifier” side of the impedance box
4. Connect the loudspeaker to the “connect to speaker” side of the impedance box
5. Connect Input 1 of the sound card across the terminals of the speaker under test. Use a balanced cable with a ¼” TRS plug or XLR at the sound card and a ¼” TS (or dual banana, alligator clips, etc.) at the speaker - wired for “floating” ground (no shield connection at speaker) for this connection.
6. Connect the output of the impedance box to Input 2 of the sound card. Use a balanced cable (1/4” TRS) for this connection.

You are now ready to start the sequence.

Note: *When first opening the sequence, you may be prompted to add calibrated signal channels named “Speaker” and “Sense Resistor”. These channels should be linked to Direct in 1 and Direct in 2 respectively.*

System Diagram – SC Amp



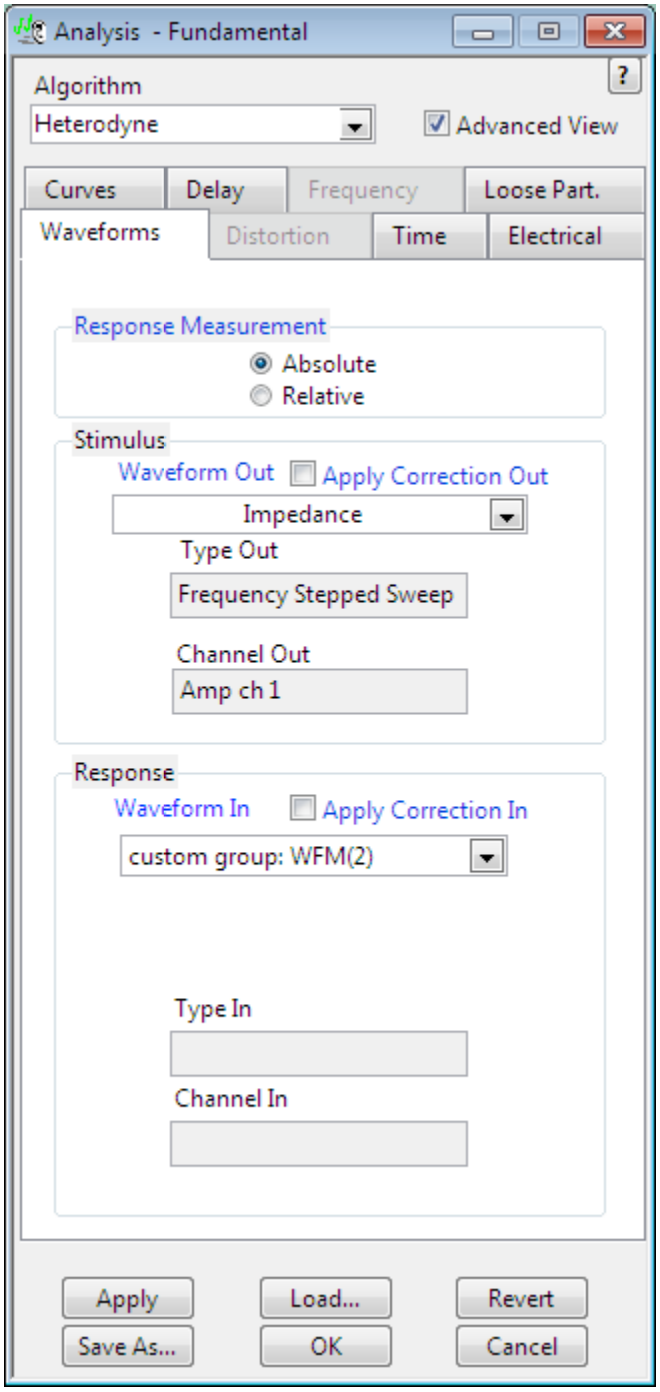
Hardware Setup and Calibration (SC Amp)

1. Calibrate the amplifier as instructed in the SoundCheck manual
2. Connect Output 1 of the sound card to the line input of SC Amp
3. Connect the output of SC Amp to the speaker under test
4. Connect Input 1 of the sound card across the terminals of the speaker under test. Use a balanced cable with a ¼" TRS plug or XLR at the sound card and a ¼" TS (or dual banana, alligator clips, etc.) at the speaker - wired for "floating" ground (no shield connection at speaker) for this connection.
5. Connect the 0.1 V/A output of the SC Amp to Input 2 of the sound card. Use a balanced cable (1/4" TRS) for this connection.

You are now ready to start the sequence.

Note: *When first opening the sequence, you may be prompted to add calibrated signal channels named "Speaker" and "Sense Resistor". These channels should be linked to Direct in 1 and Direct in 2 respectively.*

Analysis Settings – Waveforms Tab



Requirements

Software:

- SoundCheck 11.1 or later (p/n 1000 – SoundCheck Basic or higher)
- Transfer Function Analysis Module PN 2021

Hardware:

- Soundcard
- Listen SC Amp (PN 4060) OR AmpConnect (PN 4042) OR discrete components (amplifier & impedance box (PN 4009 / 4010)
- Listen AmpConnect (PN 4042) or Crown D-45 PN 5600 (or similar)

Sequence Logic

Type	Step Name	#	Out	In	
	(Overall sequence)				
Sti	Impedance	1	Amp ch 1		
Mes	Sense Resistor Value	2			// Prompt operator to input value of sense resistor
Acq	Play & Record	3	Amp ch 1	Speaker	Sense Resistor
Ana	Fundamental	4			// Batch analysis of recorded time waveform group
Lim	Test for signal	5			// Applies limits for testing the presence of an input signal
Mes	No signal	6			
Pos	Curve division	7			// Divides V across speaker by V across sense resistor
Pos	Curve multiplied by constant	8			// Multiplies result of curve division step (step 6) by the value of the reference resistor and applies custom units (ohms)
Pos	Est Resonance	9			// Estimates the resonant frequency of the impedance curve
Lim	Impedance	10			// Applies a maximum impedance limit value
Lim	Resonant Frequency	11			// Applies an upper and lower limit to the resonant frequency value
Lim	Resonant Q	12			// Applies an upper and lower limit to the Q of the impedance curve
Dis	Impedance Using Math Post-Processing	13			// Display step

Further Sequence Development

Ways in which you could modify or further develop the sequence include:

- If more than 2 input channels are available, a microphone can be used to record and analyze the acoustic output of the device under test.