Listen

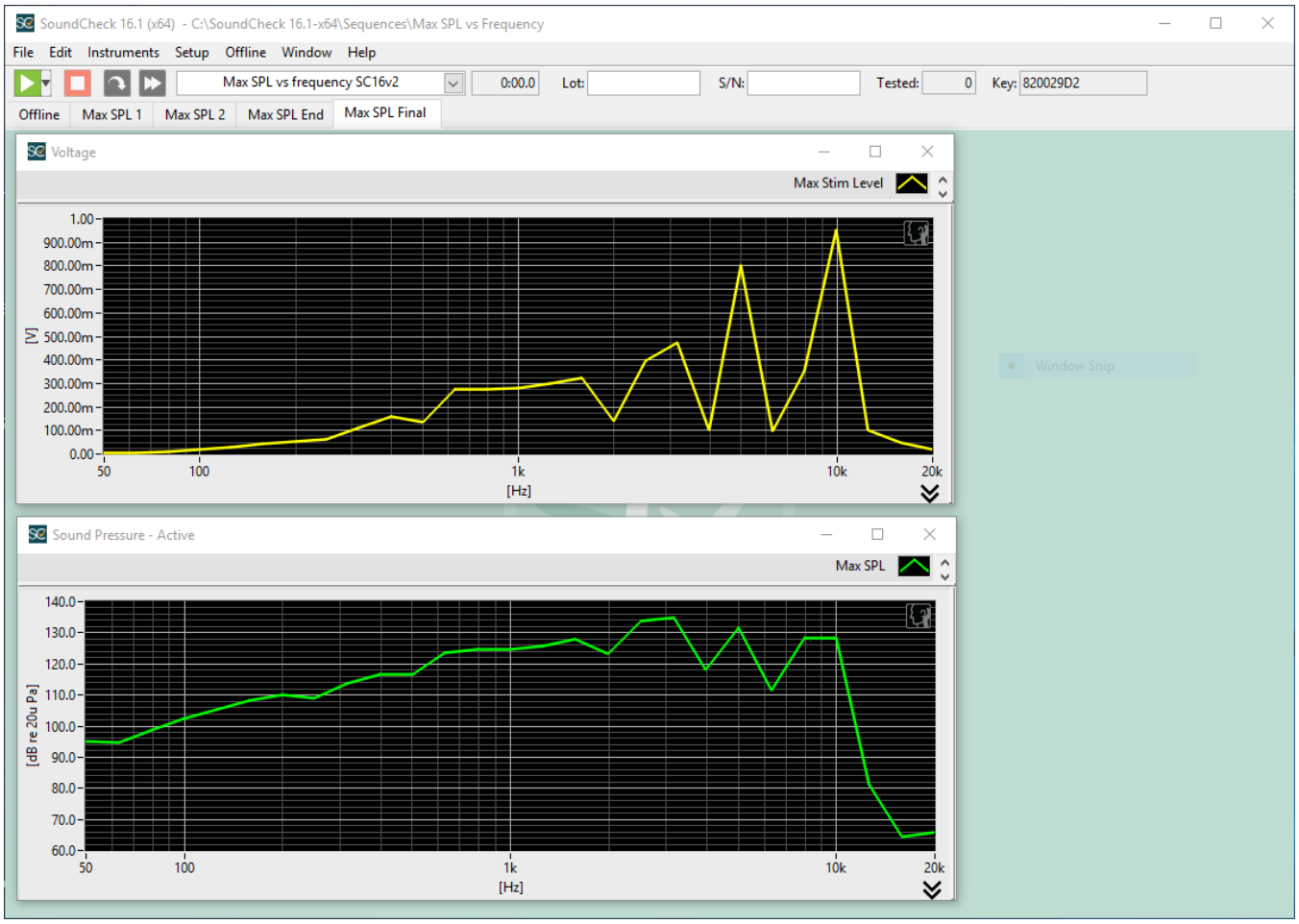
Transforming Sound into Knowledge

Sequence Note

Max SPL vs Frequency Sequence

Introduction

The purpose of this sequence is to characterize the Max SPL of a transducer by setting limits on specific metrics (THD, Rub & Buzz, Perceptual Rub & Buzz or Compression) and then driving the transducer at a series of discrete frequencies, increasing the stimulus level until the limit is achieved. The sequence begins by asking the user to input a limit value for the metric of interest (it is suggested that only one metric at a time be tested) and a stimulus start frequency. The sequence then plays the stimulus start frequency in a loop, increasing the level +3dB with each loop iteration until the limit is exceeded. The stimulus level is then adjusted -3dB and the sequence continues to a second loop which increases the stimulus level +0.5 dB with each loop iteration until the limit is exceeded. At this point, the limit results are saved to an Excel file, the stimulus frequency is incremented by a constant multiplication step and the process is repeated until the loop repetition value is satisfied. Every time the main loop is completed, the individual SPL and Stimulus Level x-y pairs are concatenated to master curves. At the end of the sequence, the Max SPL and Stimulus Level curves are autosaved in .dat format



Final display for *Max SPL vs Frequency* sequence

Requirements

Software:

- SoundCheck Basic – Version 16 or higher

Hardware:

- p/n 4002 – Listen SCM 3 reference microphone or equivalent
- p/n 4050 – Listen Audio Connect audio interface/microphone power supply or equivalent
- p/n 4060 – Listen SCAmp audio test amplifier

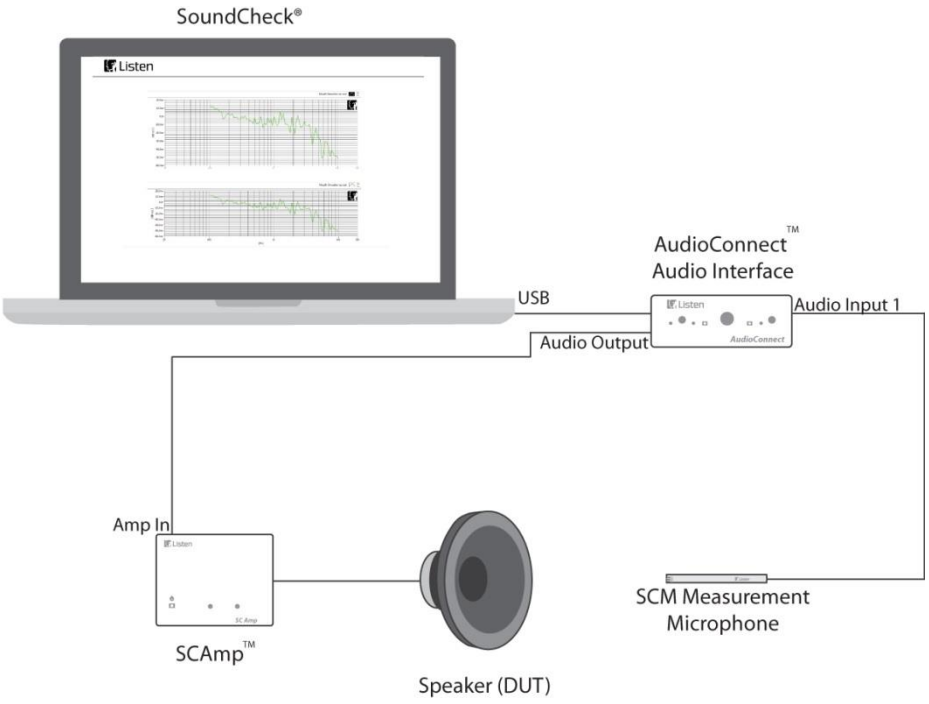
Hardware Setup & Calibration

Caution: Take care when setting the limits for the various metrics. You may damage your DUT if the limits are set too high. It is good practice to make a trial run with an artificially low limit and then increase the limit to a more practical value for subsequent testing

1. Connect your audio interface output 1 to the input of your amplifier
2. Connect the output of your reference microphone's power supply to input 1 of your audio interface
3. Calibrate your amplifier and reference microphone per the instructions in the SoundCheck user manual
4. Connect your DUT to the output of the amplifier

You are ready to start the sequence.

System Diagram



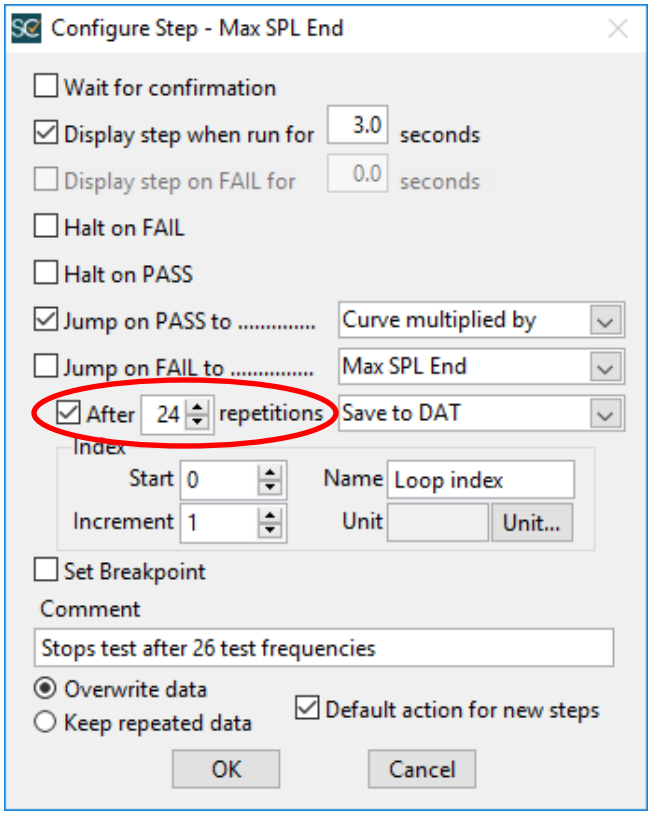
Additional Sequence Notes

- The sequence default settings will measure the DUT at 1/3 octave frequency resolution starting at 50 Hz and ending at 20 kHz (27 frequency points).

- Stimulus resolution is controlled by Step 7 **Stimulus Resolution Multiplier.** You can use different constant values in this step to produce different stimulus resolutions:

Stimulus Resolution	Constant value
1/3 octave (default)	1.259
1/6 octave	1.222
1/12 octave	1.059
1/24 octave	1.029

- If the frequency resolution is increased (or the frequency range is otherwise edited), the number of times the main loop in the sequence is applied needs to be adjusted accordingly. This value can be adjusted by right clicking on step #81 **Max SPL End** in the Sequence Editor and selecting the **Configure Step** option. The Step Configuration editor will open and you must edit the **After xx repetitions** value to reflect the new requirements.



Further sequence development

This sequence has been designed to be accessible to 100% of SoundCheck customers. Ways in which you could modify or further develop the sequence include:

- Headphone/earphone testing

Listen

Sequence Logic

Type	Step Name	#	Out	In	
Ser	Prompt for SN	1			
Mes	Enter Compression Limit	2			
Mes	Enter THD Limit	3			
Mes	Enter Rub & Buzz Limit	4			
Mes	Enter Perceptual Rub & Buzz Limit	5			
Mes	Logic Variable 1	6			// Create Logic variable y=1
Mes	Stimulus Resolution Multiplier	7			
Mes	Enter Start Frequency	8			// USER PROMPT FOR INITIAL TEST FREQUENCY
Mes	Initial Stimulus Level (dB)	9			
Pos	Curve Subtraction Lin	10			// Create Dummy variable with x & y coordinates
Pos	Change Start Freq Variable	11			// Gives Stim Frequency a dummy y axis for later
Pos	Curve division	12			// Strips the units from Stim Frequency's y axis
Pos	Curve multiplied by constant	13			// Increments the stimulus frequency.
Pos	Initialize Stim Level dB	14			// Initializes the Stim Level dB variable.
Com	comment	15			// Begin the measurement loop
Sti	Baseline Amplitude Sweep	16	Amp ch 1		
Acq	Play & Record	17	Amp ch 1	Reference Mic	
Ana	Fundamental	18			// Measure the baseline level
Pos	Curve Average	19			
Lim	FSD Limit	20			// Checks for sound card clipping
Mes	Clipping Sound Card	21			
Sti	Amplitude Sweep	22	Amp ch 1		
Acq	Play & Record	23	Amp ch 1	Reference Mic	
Ana	Max SPL Distortion	24			
Lim	FSD Limit	25			// Checks for sound card clipping
Mes	Clipping Sound Card	26			
Pos	Curve Average	27			
Pos	Curve Subtraction dB	28			// Compares current level to baseline
Pos	Curve minus constant dB	29			// Subtracts initial stimulus level from current
Pos	Curve Subtraction dB	30			// Compares the level and stimulus deltas
Lim	Compression	31			
Pos	Curve Average	32			
Pos	Curve Average	33			
Pos	Curve Average	34			
Lim	R&B	35			
Lim	THD	36			
Lim	Perceptual R&B	37			
Dis	Max SPL 1	38			// Exits the loop when one of the measurements fails
Pos	Curve plus constant dB	39			// Increments the stimulus level
Pos	Curve plus constant dB	40			// Increments the stimulus tracker in dB
Mes	Loop Step	41			

Pos	Curve minus constant dB	42			// Decreases the stimulus level by 3 dB
Pos	Curve minus constant dB	43			
Com	comment	44			// Begin finer resolution Loop
Acq	Play & Record	45	Amp ch 1	Reference Mic	
Ana	Max SPL Distortion	46			
Lim	FSD Limit	47			// Checks for sound card clipping
Mes	Clipping Sound Card	48			
Pos	Curve Average	49			
Pos	Curve Subtraction dB	50			// Compares current level to baseline
Pos	Curve minus constant dB	51			// Subtracts initial stimulus level from current
Pos	Curve Subtraction dB	52			// Compares the level and stimulus deltas
Lim	Compression	53			
Pos	Curve Average	54			
Pos	Curve Average	55			
Pos	Curve Average	56			
Lim	THD	57			
Lim	R&B	58			
Lim	Perceptual R&B	59			
Dis	Max SPL 2	60			// Exits the loop when one of the measurements fails
Pos	Curve plus constant dB	61			// Increments the stimulus level
Pos	Curve plus constant dB	62			// Increments the stimulus level tracker in dB
Mes	Loop Step	63			
Mes	Loop Step	64			
Pos	Curve multiplied by constant	65			// Convert stimulus level to linear
Lim	Stimulus Frequency	66			// Configures Stim frequency for auto-saving. Changes data type 'Value' to 'Result'.
Aut	Save Results to Excel	67			
Pos	Curve Multiplication	68			// Combines frequency and stimulus level
Pos	Curve Multiplication	69			// Combines frequency and SPL level
Lim	Logic Variable	70			
Pos	Curve multiplied by constant	71			// Records the first data point for Max stim level
Pos	Curve multiplied by constant	72			// Records the first data point for Max SPL
Pos	Set Variable to 0	73			// Ensures the previous two steps will only be run once
Mes	Loop Step	74			
Lim	Logic Variable	75			
Pos	Point Splicing	76			// Combines the first and second points for Max stim level
Pos	Point Splicing	77			// Combines the first and second points for Max SPL
Pos	Set Variable to -1	78			// Ensures the previous two steps will only be run once
Pos	Point Splicing	79			// Iteratively builds the Max stim level curve
Pos	Point Splicing	80			// Iteratively builds the Max SPL curve
Dis	Max SPL End	81			// Stops test after 26 test frequencies
Aut	Save to DAT	82			
Dis	Max SPL Final	83			