

## Triggered Record Using WAV File and 6 Mic Array

### Introduction

This sequence allows you to measure a playback system without analog inputs using a 6 microphone array. Specifically, the sequence is designed to measure an in-car audio system. A stimulus WAV file is created in SoundCheck and transferred to the device under test (DUT) where it is played back and the response captured by SoundCheck using a triggered record function. The 6 recordings are batch analyzed to produce individual fundamental curves and the curves are post-processed to produce a single power average curve from which an average sensitivity value is calculated.

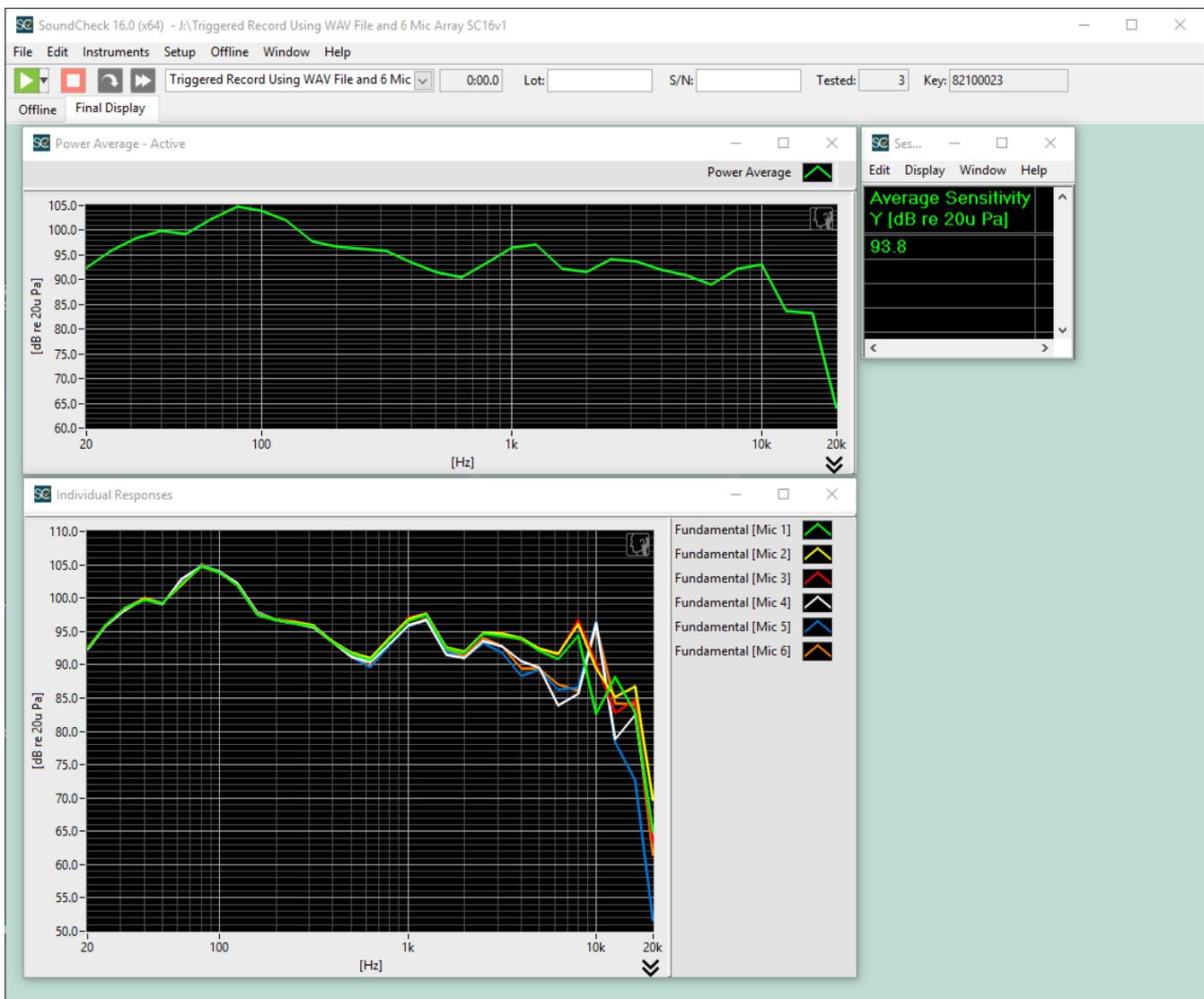


Figure 1: Final Display for *Triggered Record* sequence

The default stimulus WAV file may be customized in the stimulus editor. The default stimulus is a stepped sine sweep from 20 kHz to 20 Hz with R10 (1/3 octave) resolution. The stimulus can be saved as a WAV file from the memory list and also during the sequence run, if desired. This file will have the same sample rate and bit depth as the audio interface (in this case, 44.1kHz, 24 bit). By default, the WAV file is automatically normalized to 0 dB FS in the autosave step, so the stimulus level is not important.

- The parameters of the sweep in the stimulus step are used when creating the WAV file.
- The duration of this stimulus must be considered in the “**Time**” field of the acquisition step. (See Acquisition Step below)
- The stimulus step must remain in the sequence and the stimulus settings cannot be changed without re-generating the WAV file with the updated parameters.
- The default stimulus WAV file used in this example is included in the sequence folder.
- Changing the sample rate or bit depth of your audio interface also requires re-saving the WAV file.

## Triggered Record Acquisition Step Settings

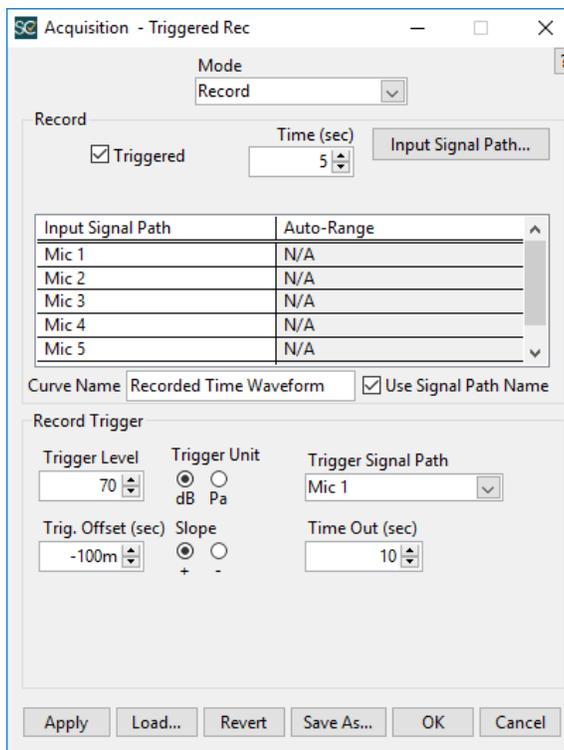


Figure 2: Acquisition Editor

- **Mode:** Record
- **Record type:** Triggered
- **Time (sec):** Must be set to slightly longer than the length of original stimulus sweep plus the Trig. Offset.
- **Input Paths:** Mics 1 through 6
- **Trigger Level:** Set level according to background noise and playback level from DUT. Default=70 dB SPL
- **Trigger Unit:** Set to dB or Pa according to your preference
- **Trigger Signal Path:** Default= Mic 1
- **Trigger Offset (sec):** Sets the amount of time that the Acquired Signal is shifted, relative to the point at which it is triggered. Default=-100 ms
  - **Slope:** For triggering on WAV files this should be set to positive. Default=+
- **Time Out (sec):** Amount of time acquisition will wait for trigger before stopping. Default=10s

## Initial Software Setup

When you first open this sequence, you will likely encounter a relink dialog (Figure 3). The purpose of this dialog is to let you know that the Signal Paths used in the sequence (e.g. Mic 1-6) are not present in your Calibration and you will be presented with two options.

1. Add the Signal Path to your calibration
2. Use an existing signal path, selected from a dropdown menu.

Unless your SoundCheck system is already configured for a 6 mic array, it is recommended that you add the Signal Paths to your calibration. Once you’ve configured the relink dialog, click OK to continue and when prompted, add the calibrated device files to your system. Finally, your Calibration Table View will open and you must assign Hardware Input Channels to the newly added Mic 1-6 Signal Paths.

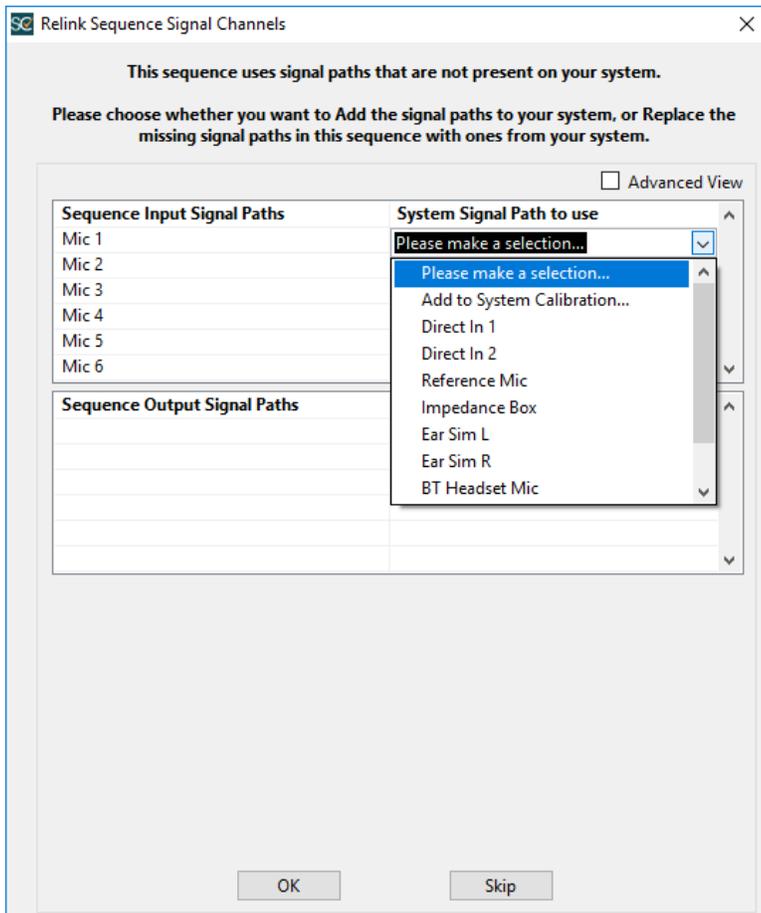


Figure 3: Relink Dialog

## Requirements

### Software:

- SoundCheck 16.0
  - p/n 1102 – SoundCheck Plus
  - p/n 2012 – Equation Editor
  - p/n 2024 – Eight channel acquisition

### Hardware:

- Playback system for WAV stimulus (in this case an in-vehicle audio system)
- p/n 4002 – Listen SCM 3 reference microphone or equivalent, quantity=6
  - See recommendations below for mic array configuration (Figure 4)
- p/n 4026 – Listen SoundConnect 2, 2 channel microphone power supply or equivalent, quantity=3
- Multi-channel audio interface (minimum 6 inputs) such as an RME Fireface UC or equivalent

## Microphone Array



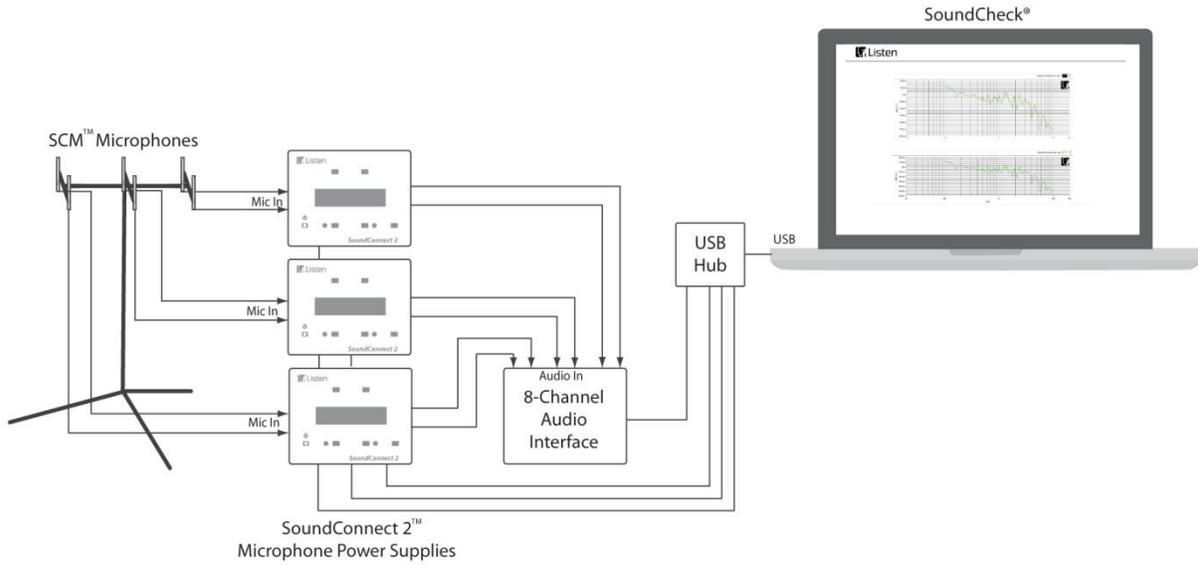
**Figure 4: Example Mic Array**

A set of six omnidirectional microphones is recommended, with a spacing of approximately 15cm between each microphone. This microphone array should be placed at the approximate intended location of the listeners head, at a slight angle, approximately 30°.

## Hardware Setup & Calibration

1. Connect the outputs of the mic power supplies to the inputs of the audio interface.
2. Connect the microphones to the power supplies and apply the appropriate bias type.
3. Calibrate the SCM 3 Reference Microphones as instructed in the SoundCheck manual.
4. Position the microphone array at the desired location in the vehicle.
5. Transfer the default stimulus WAV file to the system under test
  - a. Alternately, modify the stimulus and save it as a WAV file prior to transfer
6. Confirm the WAV file plays from the playback system.
7. Set the playback to the desired output level.
8. Start the SoundCheck sequence

System Diagram



## Sequence Logic

Type	Step Name	#	Out	In	
Sti	Stweep - 20k-20Hz R10	1	Direct Out 1		
Mes	Operator Numeric	2			// Prompts operator to select one of three sequence options
Lim	Single Value - Upper Only	3			// Logic for selecting sequence options
Lim	Single Value - Upper Only	4			// Logic for selecting sequence options
Rec	Recall waveforms	5			// Recalls example waveforms
Mes	Operator Dialog	6			// Prompts operator to save stimulus as a WAV file
Aut	Save to WAV	7			// Saves stimulus as a WAV file
Mes	Operator Message	8			// Prompts operator to transfer WAV to system under test and begin playback
Mes	Operator Message	9			
Acq	Triggered Rec	10		Mic 1	Mic 2 Mic 3 Mic 4 Mic 5 Mic 6
Pos	Frequency Shift	11			// Frequency shifts the Recorded Time Waveforms
Ana	Fundamental	12			// Batch analysis of Recorded Time Waveforms
Pos	Curve Average	13			// Creates an average of the 6 Fundamental curves
Pos	Average Sensitivity	14			// Calculates the average sensitivity of the Fundamental average curve
Dis	Final Display	15			

### Further sequence development

This sequence has been designed for simplicity. Ways in which you could modify or further develop the sequence include:

1. Edit the stimulus frequency range and/or resolution
2. Autosave your test data
3. Add analysis parameters such as THD, Rub & Buzz and Perceptual Rub & Buzz

### Additional Resources

Linked below is an article on the development and use of mic arrays for in-vehicle audio test.

<http://www.jjracooustics.com/blog/?p=238>