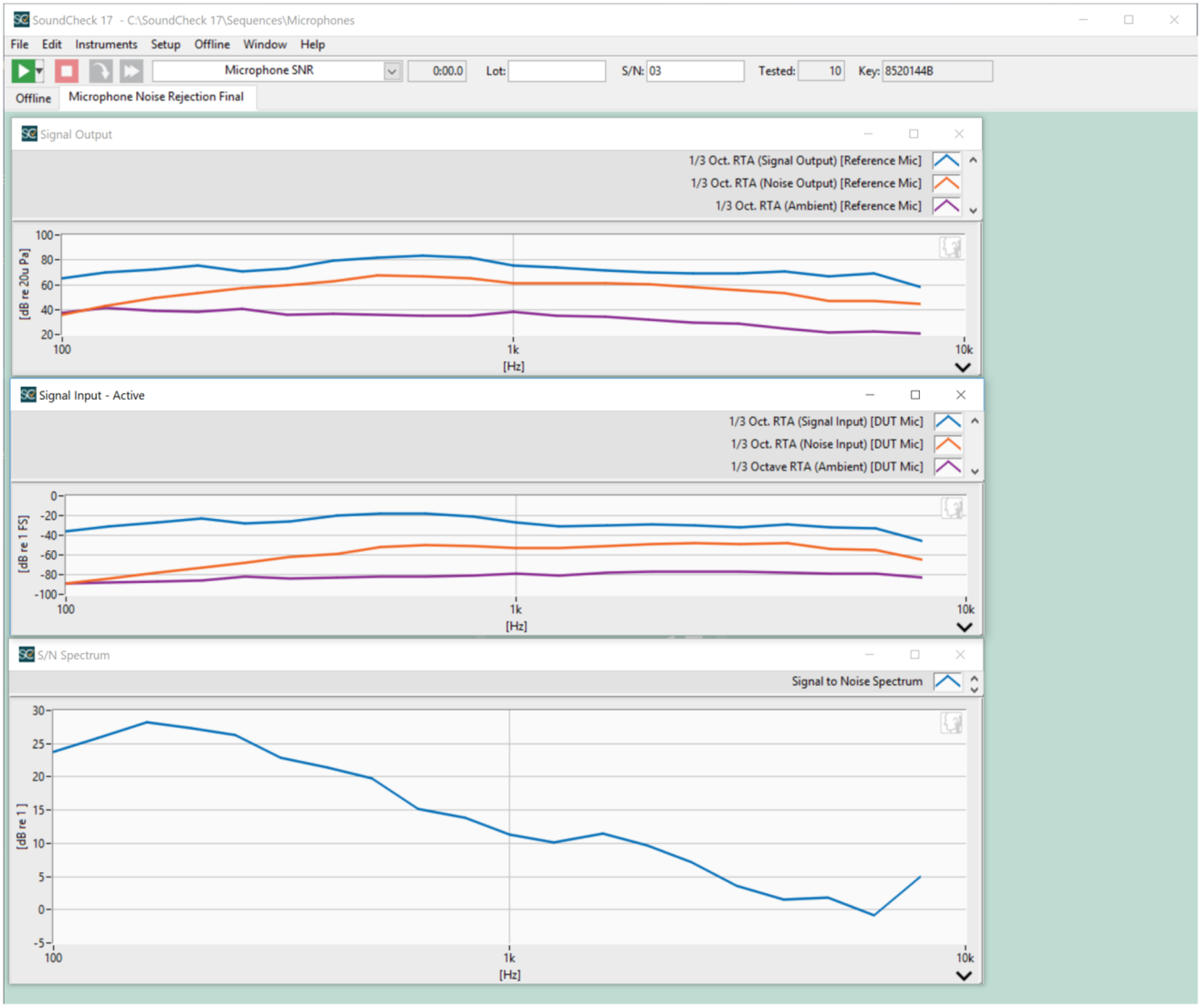
Sequence Note

Microphone SNR Sequence

Introduction

The purpose of this sequence is to characterize a microphone's ability to passively and/or actively reject noise in the user's environment. Unlike traditional microphone SNR measurements which calculate a ratio based upon a reference signal and the microphone's noise floor, this method utilizes a signal (speech played from a mouth simulator) and noise (background noise played from two or more equalized source speakers) captured by both a reference microphone and the DUT microphone.



Microphone SNR Final Display

First a recording of the baseline ambient noise in the test environment is made and a 1/3 octave RTA spectrum is calculated from the recording. Next, the speech signal (mouth simulator) and noise signals (Left and Right speakers) are played consecutively and recorded separately using the reference microphone. A 1/3 octave RTA spectrum is calculated from each recorded time waveform. Next the same measurements are repeated using the DUT microphone. The resulting RTA spectra are then post processed to produce a signal gain spectrum and a noise gain spectrum which are then used to derive the SNR spectrum of the DUT mic. For best accuracy, the Signal and Noise spectra should be at least 5 dB above the ambient noise floor of the measurement environment.

Requirements

Software

- SoundCheck Plus – Version 17 or later
- Module 2005 – RTA
- Module 2013 –EQ a WAV File

Hardware

- Head and Torso Simulator – B&K 4128C or equivalent or
- Mouth Simulator – B&K 4227 or equivalent
- Reference Microphone – Listen SCM-3 microphone or equivalent – p/n 4002
- Audio Interface – Listen AudioConnect 4x4 or equivalent – p/n 4051
- Power Amplifier – Listen SCAmp or equivalent (to power mouth sim) - p/n 4060
- Powered source speakers (2) – If passive, add 2 extra channels of amplification

Calibration Setup

The example sequence contains two unique Signal Paths (Left and Right) which are not likely in your existing Calibration setup. Before continuing with Hardware setup and calibration, these signal paths should be added to your Calibration.

1. Open the example sequence.
2. You should encounter a message informing you that the Left and Right Signal Paths do not exist in your Calibration.
3. Select the option to add them to Calibration
4. Respond Yes when asked if you want to add the calibrated device files to your Calibration.

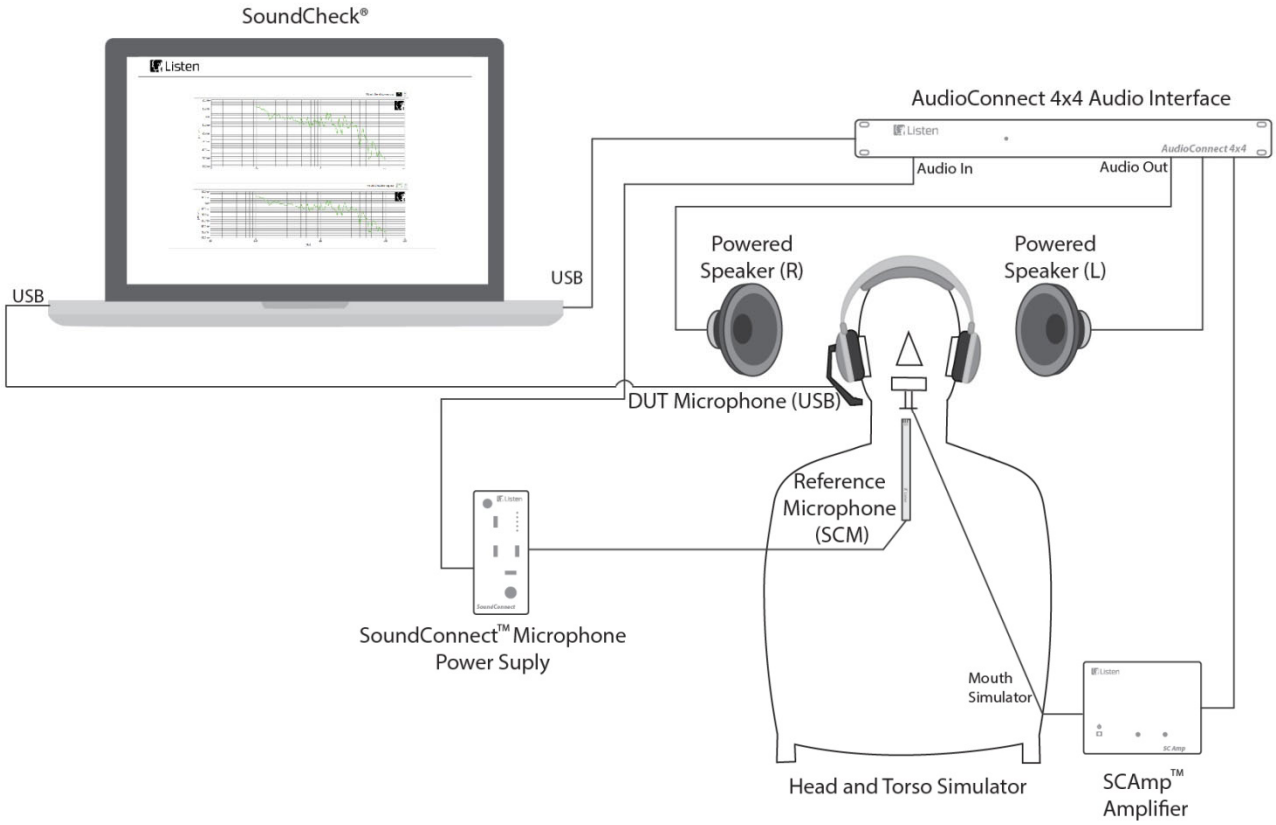
Hardware Setup & Calibration

1. Setup your hardware as shown in the system diagram below.
2. Calibrate the reference microphone as instructed in the SoundCheck user manual
3. Place the reference microphone at the HATS mouth reference point
4. Calibrate the mouth simulator using the Speaker Equalization calibration sequence as instructed in the SoundCheck user manual

5. With the reference microphone still located at the mouth reference point, calibrate the Left and Right source speakers using the Speaker Equalization calibration sequence as instructed in the SoundCheck user manual
6. Select the appropriate unity-cal file for your DUT mic Signal Path.
    a. Analog signal = unity cal (Read only)-in.dat (v/v)
    b. Digital signal (USB, Bluetooth, etc) = unity digital-in.dat or unity digital-in (AES17).dat (FS/FS)

You are now ready to run the sequence

System diagram



Sequence Logic

Type	Step Name	#	Out	In	
Sti	Speech WAV	1	Mouth Sim		// Speech Signal
Sti	Pub 1 WAV	2	Left		// Pub Noise WAV File
Sti	Pub 2 WAV	3	Right		// Pub Noise WAV File
Mes	Position ref mic at HATS MRP	4			
Acq	Record only	5		Reference Mic	// Record only - baseline noise in measurement environment (Ref Mic)
Ana	RTA Spectrum	6			
Acq	Play & Record	7	Mouth Sim	Reference Mic	// Signal (speech) output - measured through reference mic
Ana	RTA	8			
Acq	Play & Record	9	Left Right	Reference Mic	// Noise output - measured through reference mic
Ana	RTA	10			
Mes	DUT Placement	11			// Prompts user to place DUT mic at MRP
Acq	Record only	12		DUT Mic	// Record only - baseline noise in measurement environment (DUT Mic)
Ana	RTA	13			
Acq	Play & Record	14	Mouth Sim	DUT Mic	// Signal (speech) input - measured through DUT mic
Ana	RTA	15			
Acq	Play & Record	16	Left Right	DUT Mic	// Noise input - measured through DUT mic
Ana	RTA	17			
Pos	Curve Subtraction dB	18			// Calculates signal gain spectrum
Pos	Curve Subtraction dB	19			// Calculates noise gain spectrum
Pos	Curve Subtraction dB	20			// Calculates signal to noise spectrum
Pos	Reciprocal	21			
Dis	Microphone Noise Rejection Final	22			

Further sequence development

This sequence has been designed for simplicity and has been written for a stereo channel system, to be accessible to 100% of SoundCheck customers. Ways in which you could modify or further develop the sequence include:

- Add more speakers to the noise playback system. For example, by using the Listen ETSI ES 202 396-1 background noise calibration sequences.
- Use WAV files containing different types of environmental noise.