Listen

Sound Measurements
Make Sound Products

Complete Audio Test in a Single Software Package

Loudspeakers & Microspeakers	Microphones	Headphones & Headsets
Wireless Devices	Smartphones & Tablets	Telephones
Hearing Aids	Audio Electronics	

SoundCheck

Audio Test and Measurement System

The SoundCheck® System

A SoundCheck® system from Listen includes everything you need to create and run audio tests on a wide range of devices – the software, the audio interface, additional test hardware, and test sequences.

The system is centered around the SoundCheck software. This powerful package controls and communicates with the measurement hardware, and includes all the stimuli, algorithms and analysis functionality needed to develop and run virtually any audio test. It is paired with hardware ranging from a simple, all-in one audio test box to sophisticated discrete components for a complete test system. In addition to Listen hardware, a range of 3rd party products and test accessories are fully supported within SoundCheck.

The modular software and many hardware options enable a customized solution for your specific test requirements and budget. Annual software updates ensure that the system evolves to keep pace with evolving test methods and requirements, and both software and hardware can be expanded at any time to meet future testing needs.

Applications

Loudspeakers & Microspeakers

Microphones
(inc. MEMS microphones)

Headphones & Headsets
(inc. noise-cancelling and Bluetooth)

Wireless Devices

Smartphones & Tablets

Telephones

Hearing Aids

Audio Electronics

One System, Many Configurations

SoundCheck offers the precision, power and flexibility needed for the R&D lab, as well as the speed, noise immunity, and automation required for the production line. Tests can be transferred from one to the other, or results emailed from a basic, low cost production line system to a fully-loaded laboratory-class system for additional analyses. This allows standardization on one test system globally, across your own facilities and your manufacturing partners, from R&D to through to end of line testing.

IN THE RESEARCH LAB

- Unlimited test flexibility with fully programmable test scripts

- Powerful test options with many stimuli, analysis and post-processing options

- High accuracy measurements with research-grade audio interfaces

- Sophisticated report-writing functionality

- Virtual Instruments (audio analyzer, real time analyzer, voltmeter, signal generator and oscilloscope)

- Compatible with other test equipment such as artificial ears and mouths, microphones, amplifiers, head and torso simulators, and telephone test interfaces

- Supports up to 64 channels

- Simple calibration

- Measures to industry standards

- Tests any type of audio device

ON THE PRODUCTION LINE

- Fast testing

- High immunity to background noise

- Easy to integrate and control via larger automated test platforms

- Compatible with automation software, barcode systems, and PLCs

- Automated or 'one-click' operation

- Compare results to pre-set limits or a reference standard

- Simple visual or audible pass/fail output or automatic sorting

- Test results can be written to databases (Microsoft Access, SQL, Oracle, etc.) or reports

- Full statistical capabilities for tracking important manufacturing parameters

- Cost effective configurations

Software Overview

The functionality of SoundCheck software can be broadly described in three parts: Test Sequences, Virtual Instruments and Data Analysis.

Test Sequences

Tests in SoundCheck are developed and saved as automated test sequences - a series of instructions or 'steps' that define the test parameters (e.g. stimulus, acquisition, analyses) and determine how the results are presented. This makes it quick and simple to create and modify tests while offering unlimited measurement flexibility.

Tests are quickly built from an extensive library of pre-defined steps using the simple point-and-click 'sequence editor' – text based programming is not required. User-defined steps can be added to the library, and custom
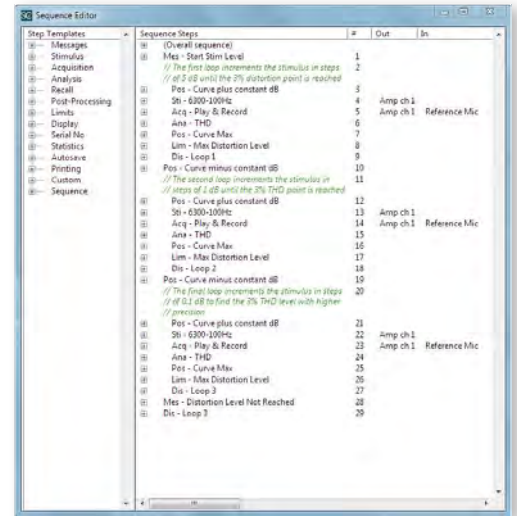

SoundCheck's sequence editor: Simple test development using a point-and-click interface

LabView code can even be integrated into a sequence to further extend its capabilities. A sequence may be as basic as 3 steps to simply play a test signal and acquire and display the response, or as complex as several hundred steps including calibration, logic, and calculations to measure a product to a specific test standard.

Fully-editable sample sequences are provided for basic tests in all application areas, and complex sequences can be purchased to meet specific test standards (e.g. TIA and EN-50332).

Test sequences are easily shared between SoundCheck systems, simplifying collaboration between multiple engineers, facilities and even partner companies.
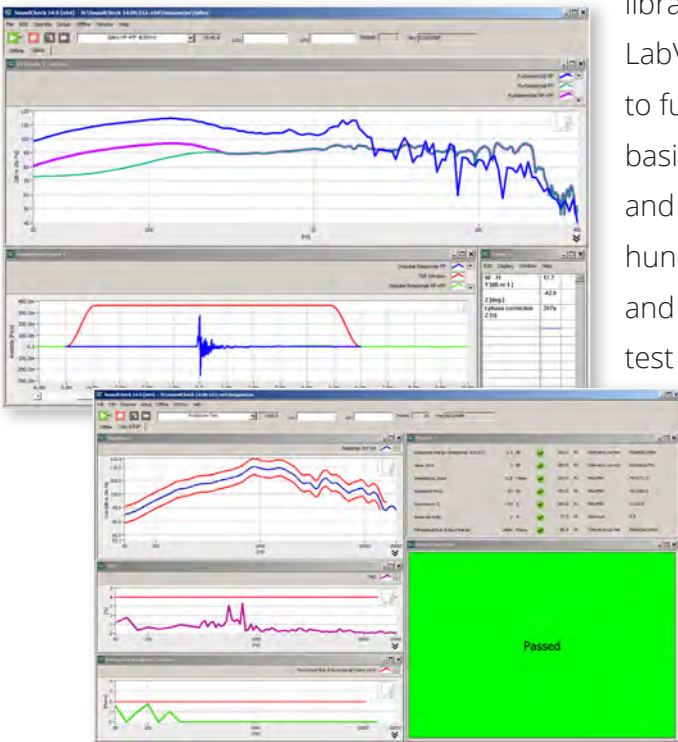

R&D (top) and production (bottom) test results in SoundCheck

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Virtual Instruments

SoundCheck includes a virtual real time analyzer, multimeter, signal generator, spectrum analyzer and oscilloscope. These offer the same functionality within the SoundCheck software as their conventional hardware counterparts. They can be used as stand-alone instruments as well as incorporated into test sequences, and their data can be recorded in real time and saved for later analysis. These virtual instruments remove the need for purchasing additional equipment and ensure that your instrumentation travels with your laptop.

Data Analysis

SoundCheck offers extensive options for analysis of measured and stored data. A wide array of functions is available directly in the program, avoiding the need for any third-party solution. SoundCheck can analyze, re-analyze, graph, display and report on any saved test data. Its analysis capabilities range from simple arithmetic functions to waveform analysis, statistics, batch processing and time-frequency analysis. It can even analyze data imported from other test systems.
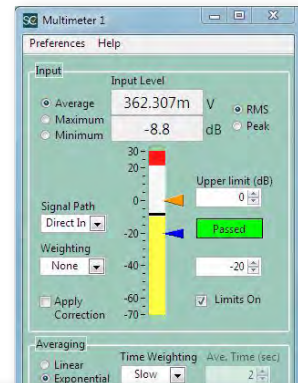
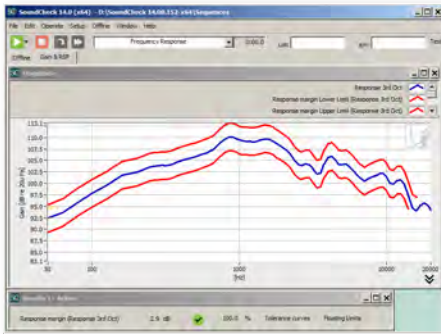SoundCheck Virtual Instruments: Multimeter, Real Time Analyzer and Signal Generator
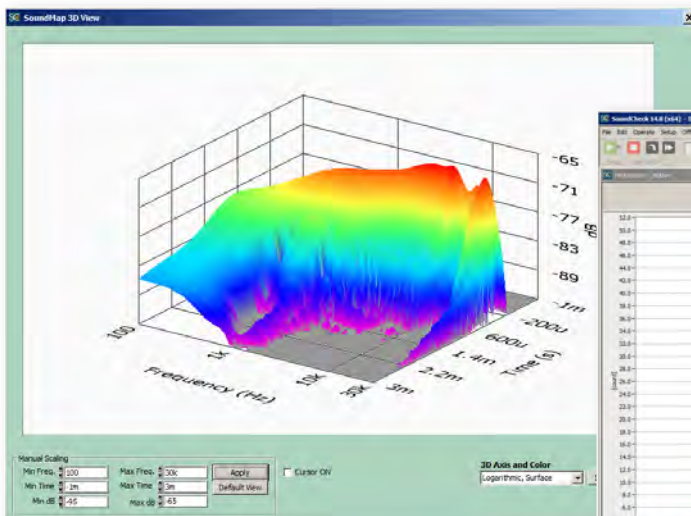
Loudspeaker 3D waterfall plot (Wigner-Ville) in SoundCheck
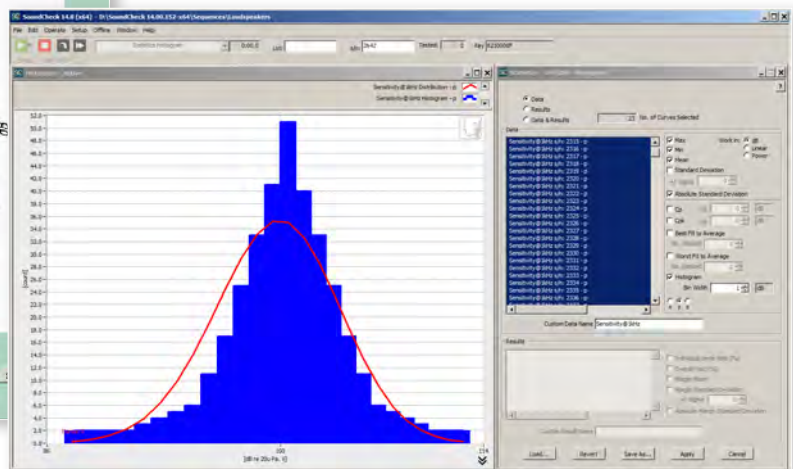
Production Histogram for loudspeaker sensitivity

Measurements

SoundCheck is so flexible that its limitations are defined only by your own creativity. Its measurement capabilities include:

Frequency response with floating limits and calculated pass/fail margin

Frequency Response

SoundCheck offers many frequency response options, ranging from simple sine sweeps for testing basic transducers, to using the Real Time Analyzer for measuring frequency response with broadband stimulus signals such as speech. Transfer function analysis allows for direct input versus output comparison and is very useful in electronics testing. SoundCheck's sophisticated Time Selective Response module allows simulated free field measurements for accurate results without an anechoic chamber.
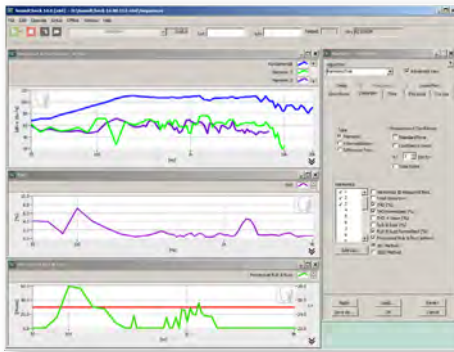
Harmonics, THD, and Perceptual Rub & Buzz distortions

Distortion

SoundCheck's complete set of distortion algorithms characterize any device and detect all manufacturing defects. These range from traditional measurements (e.g. THD, Rub & Buzz) to cutting edge perceptual distortion metrics. Many of these measurements can be calculated from a single sine sweep, providing superior accuracy alongside minimal test times. Distortion measurements include Harmonic Distortion (THD, THD+N), Rub & Buzz, Loose Particle Detection, Intermodulation Distortion, Non-coherent Distortion and Perceptual Distortion Measurement.
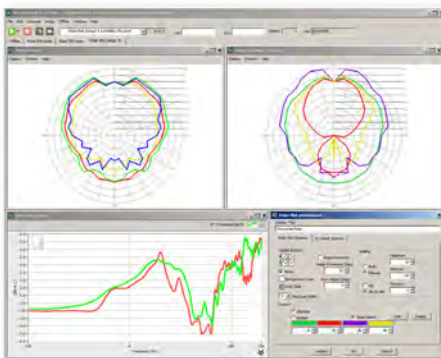
Horizontal and vertical polar plots with directivity index

Phase (polarity)

SoundCheck allows accurate measurements of the DUT's phase response when measuring with sine waves, or relative phase using transfer function analysis. It can also calculate phase-derived measurements such as polarity and group delay.

Polar Plot

SoundCheck measures a device's directional characteristics by acquiring data at different angles either manually or via an automated turntable. Directional data can then be displayed on a polar plot and used to calculate directivity index.

Thiele-Small Parameters

SoundCheck features pre-programmed Thiele-Small equations and test sequences for the three commonly-used methods: added mass, known volume and known driver mass. A simple curve fit algorithm automatically extracts the F_0,Q and Z-max values, and the standard Thiele-Small equation can be adapted using the post-processing equation editor for analysis using different models.
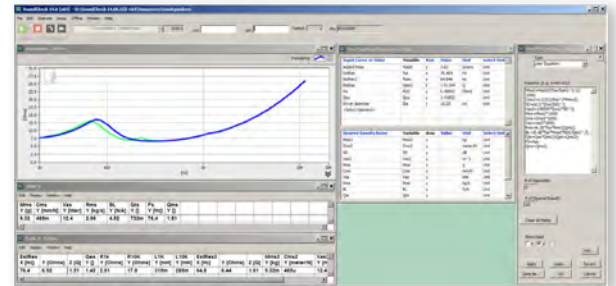
Thiele-Small parameters with equation editor for added mass method

Time Frequency Analysis

Detailed signal analysis is carried out simultaneously in both the time and frequency domain, which is ideal for impulse response analysis and detection of loose particles and Rub & Buzz in loudspeakers. Time frequency analyses are also valuable for identification of transient effects such as drop out in digital devices including VoIP and Bluetooth headsets. SoundCheck's Time Frequency analysis options include Waterfall plots, Cumulative Spectral Decay (CSD), Wigner-Ville, Short Term Fourier Transform (STFT) and Wavelet analyses.
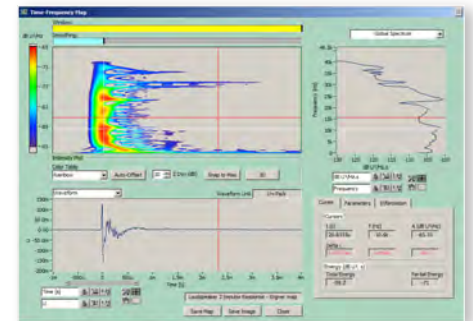
Time-energy contour map of a loudspeaker with corresponding 2D views

Impedance

SoundCheck can measure the electrical impedance of loudspeakers and headphones using a unique high-accuracy single channel method (included in AmpConnect and SC Amp), a conventional simple reference resistor method, or conventional two channel measurement method. Resonance characteristics such as Q, Zmax and F_0 can also be derived from the impedance curve.
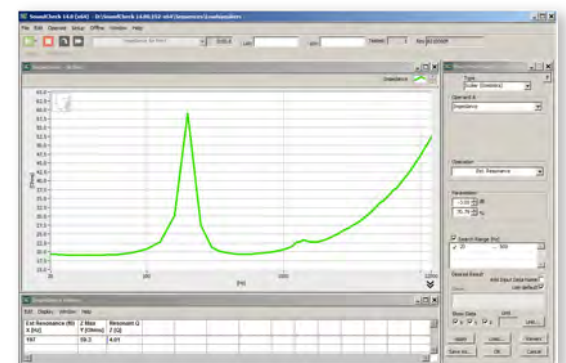
Impedance measurement and curve fit to extract estimated resonance f_0, Zmax, & Q

Measure to International Standards

SoundCheck tests devices to many international standards. Pre-written test sequences are available for TIA-810, TIA-920, ANSI/IEC Hearing Aid standards, Lync/Skype testing, Hearing Aid Compatibility (HAC), EN-50332 (Max SPL of portable devices), and more.

Hardware

Listen's cost-effective audio test hardware is fully integrated with its SoundCheck software for a system that is easy to set up, calibrate and maintain. All hardware products are compact and rugged to withstand demanding environments, and most are rack-mountable.

USB Controlled Integrated Hardware

AmpConnect ISC

AmpConnect ISC combines an audio interface, impedance box, amplifier, microphone power supply and digital I/O card in a single unit to simplify setup and minimize errors. This is the most cost-effective approach for most loudspeaker, headphone and microphone tests.

Audio Interfaces

AudioConnect

AudioConnect is a professional audio interface offering 2 digital and 2 analog channels in and out, SCM microphone power, headphone amplifier and USB hub.

AudioConnect 4x4

AudioConnect 4x4 is a high precision audio interface offering 4 digital and 4 analog channels in and out, high signal to noise ratio, wide frequency response and a user-defined sampling rate up to 200kHz.

Audio Test Amplifier

SC Amp

SC Amp is the world's only dedicated audio test amplifier, with features such as integrated impedance measurement, fixed gain to reduce calibration errors, and DC voltage offset support. It offers low distortion and a low noise floor.
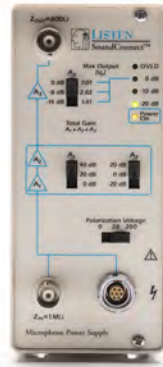
Microphone Power Supplies

SoundConnect

SoundConnect is a single channel microphone power supply with an excellent signal to noise ratio. It powers one SCM/electret microphone and is also available with a 200V polarization option.

SoundConnect 2

SoundConnect 2 is a TEDS compatible dual channel microphone power supply with low self-noise and a wide frequency response. It powers 2 SCM/electret or IEPE microphones or accelerometers, and is available with a 200V polarization option.

Audio Test Microphones

SCM

SCM measurement microphones are robust, accurate, stable, and offer excellent directional response in both near and far field. They are available in 2 lengths.

# DC Power Supply and Current Monitor

DC Connect

DC Connect enables measurement of voltage and current consumption in portable electronic devices, measuring resistance, capacitance, and inductance as well as current or voltage synchronized with an audio stimulus.

Other Test Hardware & Accessories

Listen offers a selection of ancillary products from other vendors to complete your test system. These include:

- MEMS Microphone Interfaces: DCC-1448 (for R&D) and PQC-3048 (for QC)

- Digital Serial Data Audio Interface: PIO-9216

- Bluetooth Interfaces: BTC-4148 (for R&D) and BQC-4148 (for QC)

- Audio interfaces ranging from professional grade soundcards to high precision multi-channel interfaces

- Impedance boxes

- Foot switches

- Reference speakers

- Turntables

- Head and torso simulators

- Telephone interfaces

- Artificial mouths

- Artificial ears

- Production line tablet/ smartphone test chambers
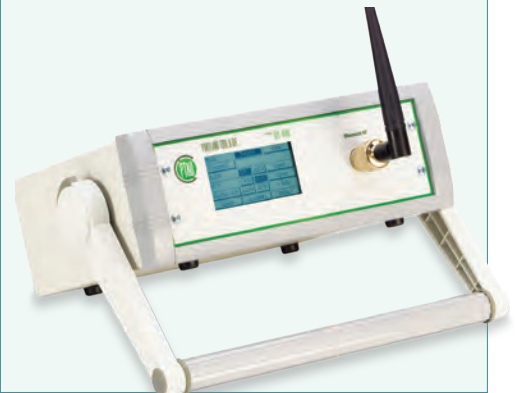
SoundCheck Packages

Customize your SoundCheck system to meet your requirements and budget – select a base package and add additional modules.

SoundCheck Basic: A basic production line package for simple sine-based measurements such as frequency response, sensitivity, and harmonic distortion. This package runs test sequences but cannot be used to create them.

SoundCheck Plus: In additional to all SoundCheck Basic functionality, the Sequence Editor and the Signal Generator, Multimeter, and Scope-FFT virtual instruments are included. It is ideal for transducer measurements.

SoundCheck Advanced: A powerful tool for R&D testing with the Real Time Analyzer, Time Selective Response (for performing simulated free field

measurements), Polar Plot, and Equation Editor, as well as everything in the Plus package.

SoundCheck Complete: The most comprehensive SoundCheck system available, including nearly all the available modules for SoundCheck - everything in the Advanced package plus IM Distortion, Multi-tone, Transfer Function, Zwicker Loudness, Waveform Filter and more.

SoundCheck ONE (Package includes AmpConnect hardware): A low cost complete system with limited flexibility for production testing of loudspeakers, microphones, and headphones.

Please see our website for a side-by-side comparison of these packages and a full module list.

Listen, Inc. | 1995-2015 | 20 Years Of Innovation

1995
Stweep
The "Stweep" is a stepped sine wave where an integer number of cycles is used at each frequency step. This offers smooth transitions between frequencies, resulting in less transducer settling time and faster, more accurate measurements.

1995
Rub & Buzz
The first algorithm to identify Rub & Buzz by measuring over 200 high order harmonics individually and simultaneously. This allows the specific type of fault to be identified.

1996
Normalized Distortion Measurement
Listen was the first to measure Normalized Distortion at the actual measured frequency, removing the influence of a non-flat frequency response on the percentage distortion calculation relative to the fundamental.
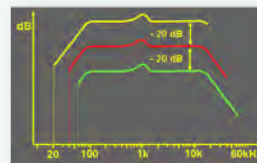
1997
Sequence Editor
The Sequence Editor changed the way that audio tests are written. The simple point-and-click interface enables test sequences to easily be created, run over and over again, saved, exported, modified and more.
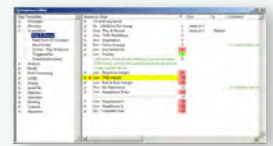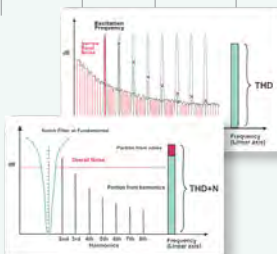
Listen, Inc.
Founded: 1995
President:
Steve Temme

1995
HarmonicTrak™ Algorithm
HarmonicTrak was the first algorithm to measure the fundamental and its harmonics in parallel to dramatically decrease measurement time when using a stepped sine stimulus.
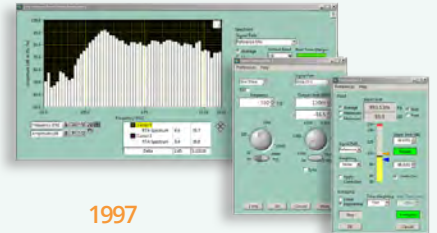
1995
First to use SoundCards
SoundCheck was the first test system to communicate with PC audio devices via the Windows Multimedia Interface. This enabled a sound card to be used as the audio interface, significantly reducing the overall cost of the test system.
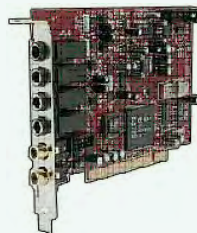
1997
Virtual Instruments
Listen was the first to include a signal generator, multimeter, oscilloscope, RTA, spectrum analyzer, in their software. These offer all the functionality of their hardware counterparts and can be used alone or in test sequences.

About Listen

Listen is a world leader in audio and electroacoustic test and measurement. Founded in 1995, the company has pioneered electroacoustic measurement techniques for 20 years and sets the standard in the marketplace with powerful and innovative test methods and algorithms, fast and flexible testing, and excellent service and customer support.

Listen invests heavily in R&D, regularly presenting papers on new measurement techniques at conferences and refining its algorithms to remain at the cutting edge of measurement technology. In addition to its own research and development, the company listens to its customers and solicits regular feedback, which is incorporated into its product development plan, to ensure that products evolve to meet the increasingly diverse needs of our customer base.

Listen's team of experienced audio and software engineers, sales and support personnel and distributors are all experts in their field. This guarantees that when you buy a test system from Listen you are not simply buying a software package – you are buying a system designed, built, supported and sold by audio measurement experts.
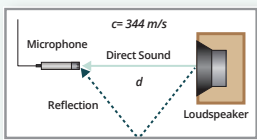
**Founder/President:
Steve Temme**

### 2001
Log TSR Measurement
SoundCheck featured the first commercial implementation of Log TSR measurement method – just weeks after Angelo Farina's landmark paper on the subject. This technique is extensively used for making fast measurements.

2005
Non-Coherent Distortion with Music
Measuring non-coherent distortion with music enables analysis under real world conditions. The transfer function is examined to analyze what part of the response is not coherent with the stimulus.
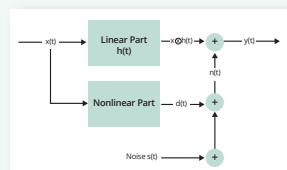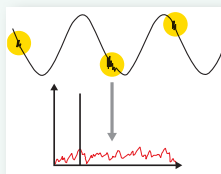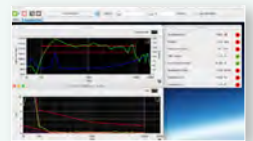
2009
AmpConnect
AmpConnect, Listen's all-in-one hardware box, offers customers easy setup with little room for error, and a lower cost than buying components separately.
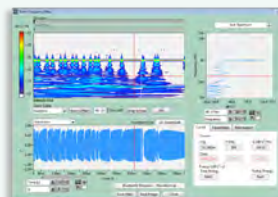
2015
Audio Measurement for Mac OS
SoundCheck is the first commercial audio test system available for Mac OS.

1995 2015 — TWENTY YEARS OF INNOVATION — Listen Inc.

2005
Loose Particle Detection
The first company to identify loose particles by exciting them with a stimulus around or below the resonant frequency, and applying time envelope analysis.

2007
Time Frequency Analysis
Listen was the first to offer a complete time frequency analysis package, combining CSD, Wigner-Ville and Wavelet transforms into one easy-to-use module.

2010
Perceptual Rub & Buzz
Listen is the first company to offer perceptual Rub & Buzz measurement, a technique which only detects Rub & Buzz faults that would be heard by the human ear, increasing yields.

Listen

Listen, Inc.
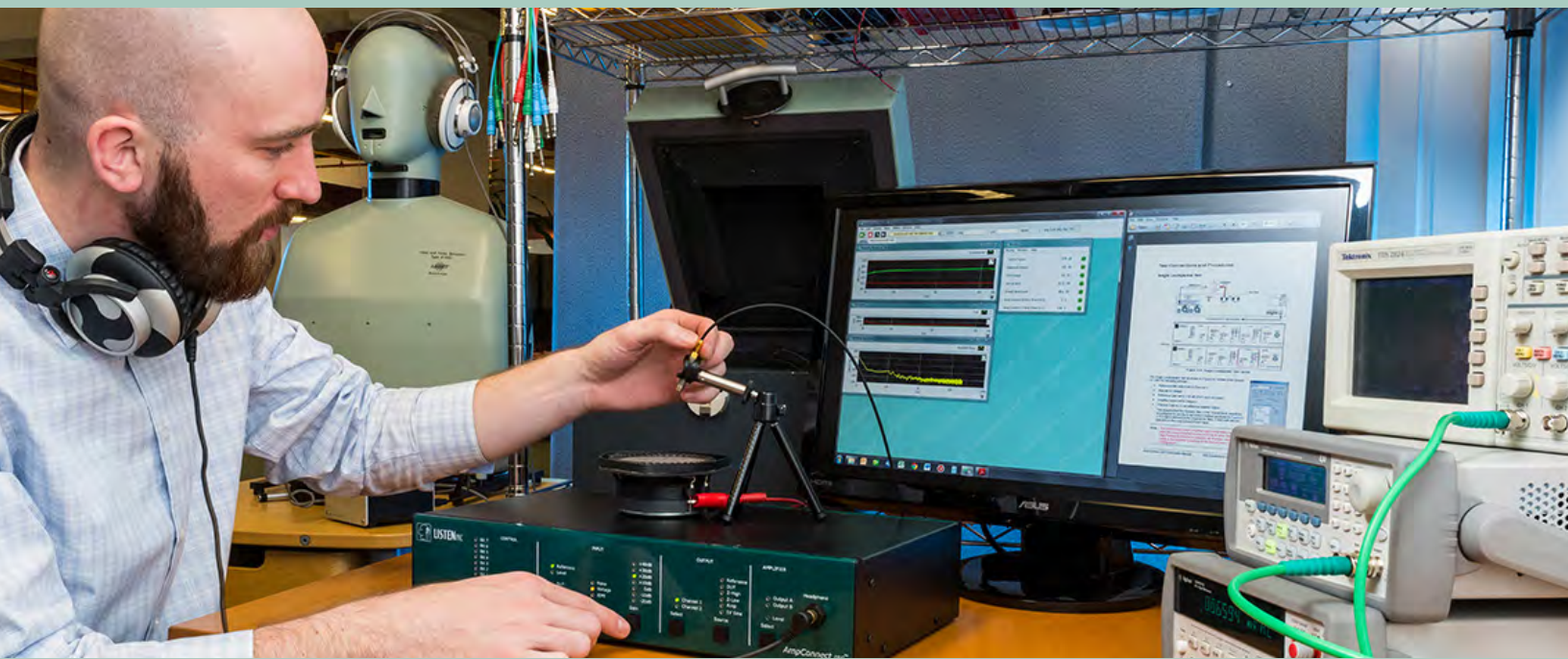580 Harrison Ave Ste, 3W
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Loudspeakers &
Microspeakers

Microphones

Headphones &
Headsets

Wireless
Devices

Smartphones
& Tablets

Telephones

Hearing
Aids

Audio
Electronics