SoundCheck®

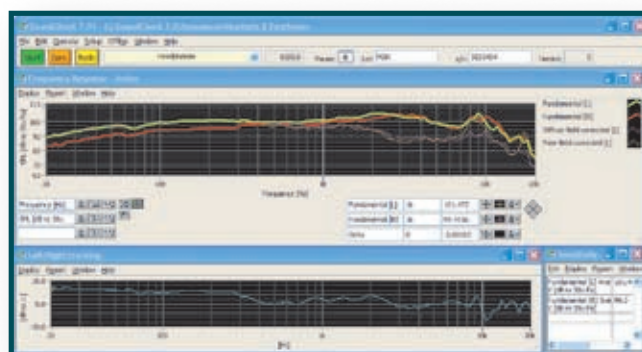## THE AUDIO TEST AND MEASUREMENT SYSTEM

LISTENINC

About Listen

Listen, Inc. has been a leader in audio test and measurement since 1995 when Steve Temme, a former Brüel & Kjær audio and telecom applications engineer, introduced SoundCheck®, the world's first widely available software and sound card based audio analyzer.

Initially, replacing audio measurement hardware with software and a sound card was a revolutionary idea, but the advantages were quickly accepted by the marketplace. A PC-based system eliminates proprietary hardware, expensive repairs and downtime. With optional regular software releases and hardware upgrades, the system expands and evolves over time to meet your changing needs, ensuring that it never becomes obsolete.

SoundCheck's initial focus was on production line testing, where the low cost compared to hardware-based systems was a competitive advantage. In order to meet the high throughput requirements of volume manufacturing, speed, repeatability and noise-immunity were priorities; proprietary algorithms to ensure fast and accurate testing have always been integral to SoundCheck. In recent years, SoundCheck has expanded far beyond its production roots with many features specifically designed for R&D testing. Its inherently flexible software platform makes it ideal for the engineering lab where the ability to develop custom tests is key. It incorporates the functionality of an audio analyzer, real time analyzer, voltmeter, signal generator and oscilloscope, as well as advanced analysis plug-ins to offer all the capability of an entire audio R&D laboratory in a single software package.

Over a decade since its inception, SoundCheck is no longer a new concept in audio measurement, but the standard in transducer test, and a product philosophy that other manufacturers imitate. SoundCheck has recently expanded beyond transducer measurement into audio electronic testing, with multi-channel analysis and algorithms specifically designed to meet the demands of this marketplace.

Steve Temme, Listen's founder and president, still directs product development, and his 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 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.

Headphone Diffuse Field Corrected Response

The SoundCheck System—
Built to Your Test Specifications

SoundCheck is an accurate and powerful software-based electro-acoustic and audio electronic measurement system. Its many data acquisition options and software modules, together with easy integration into both production and R&D test environments make it ideal for all your testing requirements from the engineering laboratory to the factory floor.

A typical SoundCheck system consists of a PC or laptop with SoundCheck software and an audio input device such as a professional audio sound card or data acquisition card. The system is configured to your specific application and budget requirements by selecting from a wide range of input devices, software modules and other accessories. SoundCheck's modular nature means you can order exactly what you need for today's test requirements, yet the system can easily be expanded to meet any future testing needs. This forwards compatibility removes the guesswork and risk from specifying a test system — you can be sure that it will be cost effective, both at the time of purchase and in the long run.

Flexible Software

System packages are available for both R&D and production line testing for most electro-acoustic and audio electronic applications, or you can build a custom system by selecting the basic program and adding individual modules. Additional modules can always be added at a later date and optional software upgrades ensure that your system never becomes obsolete. Whether you are testing loudspeakers, headphones, telephones, microphones, audio electronics, or other products, Listen can configure a system for your needs.

Flexible Hardware

Listen offers a selection of audio input devices including stereo and multi-channel PCI, PCMCIA, USB and Firewire sound cards, as well as high-precision data acquisition devices such as National Instruments PCI/PXI-4461 cards. SoundCheck can support any number of channels and any off-the-shelf data acquisition device, so you simply need to decide which offers the optimum accuracy and number of channels for your requirements — it couldn't be easier! All recommended sound cards and data acquisition cards are supplied fully tested and calibrated by Listen to ensure accurate, repeatable results.

Flexible Accessories

SoundCheck works with all brands of audio test accessories. It is compatible with the equipment that you already own, and we can offer a complete turnkey system by combining SoundCheck with our own, and other manufacturers' ancillary equipment (see page 10).

Applications

Loudspeakers
> Consumer
> Professional
> Microspeakers

Microphones
> Capsules/MEMS
> Consumer
> Professional

Hearing Aids
> ITE
> BTE
> Directional

Telephones
> Cellphones
> Analog / Digital
> VoIP phones

Headphones
> Noise-cancelling

Headsets
> USB
> Bluetooth

Audio Electronics
> Amplifiers
> Pre-Amplifiers
> Mixing Consoles
> MP3 Players
> Digital Audio Devices

*SoundConnect™
Microphone
Power Supply*

Earphone test

SoundCheck – the Complete R&D Lab

SoundCheck is the most sophisticated audio test system on the market. Its measurement and analysis, post-processing, and statistical capabilities rival those of hardware audio analyzers costing many times the price. In addition, SoundCheck is more than just an audio analyzer – it is an entire R&D lab full of equipment. It contains software versions of all the instrumentation you would typically find in a laboratory — a spectrum analyzer, real time analyzer, signal generator, multimeter and oscilloscope, so you do not need additional hardware for your test development.

Accurate and Powerful

Front-end input devices such as high-end pro-audio sound cards and the National Instruments PCI/PXI-4461 data acquisition card offer a level of accuracy comparable to costly hardware-based systems, and the software's specially designed algorithms ensure precise results and in-depth analyses. SoundCheck leverages the computing power of your PC for fast data acquisition and analysis. This, together with the program's advanced post-processing capabilities, statistical tools and report-writing options, make it a powerful tool for the design process.

Full Control and Test Flexibility

SoundCheck is a test developer's dream. Programming knowledge is not required to write complex measurement sequences as tests are built in a flow-chart-like format from a series of steps using an intuitive point-and-click graphical interface. Every test parameter can be controlled by the user, and the interface can be set to display all controls at once for rapid test modification and development. Test steps control all functions, such as setting the hardware parameters, calibration, creating a stimulus, acquiring, analyzing and saving data and creating reports. SoundCheck features a comprehensive library of pre-programmed steps; each of these can be modified, and user-defined steps can be created and added to the library. Complete test sequences are assembled from individual steps, or subsequences containing several steps, making it fast and simple to build and modify tests. Test sequences can be saved so that an entire test can be carried out at the click of a mouse from setup, through analysis to report writing and archiving. Test steps, sequences and sub-sequences can be copied, modified, saved, exported and emailed, saving time and offering increased repeatability of test procedures.

Customer Profile:

*Boston Acoustics uses
SoundCheck in both its
R&D department and
on the production
line to ensure that its
loudspeakers sound
exactly as the
engineer intended.*

Compatible

Although SoundCheck is a complete stand-alone system, it is compatible with all brands of ancillary test equipment including head and torso simulators, artificial mouths and ears, microphones, amplifiers, telephone test interfaces, signal routers, etc. The system is also compatible with your future testing needs — new software releases and additional modules continually add new features, and upgrades are simple and inexpensive.
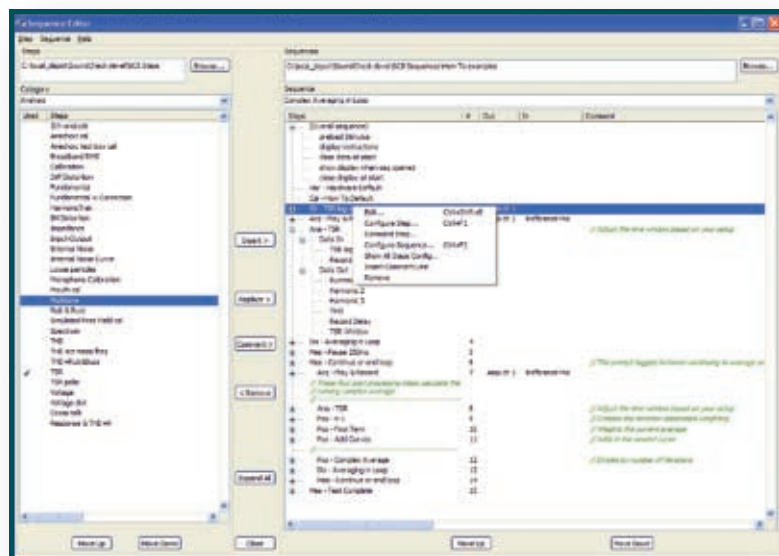
Compact and cost-effective

Turn your laptop into a LABTOP! If SoundCheck is installed on a laptop you can 'hit the road' with your test lab because, in addition to its audio analysis capabilities, it also replaces several pieces of laboratory hardware. Not only is this cost-effective, but it's perfect for when you have to jump on a plane to troubleshoot production line problems.

Advanced Report Writing Functions

Data can be output to customized SoundCheck reports, or can be exported to software packages such as Microsoft® Word or Excel and databases such as Microsoft Access, SQL or Oracle® for archiving, post-processing or report writing. SoundCheck can also be integrated into larger test applications using National Instruments' Test Stand™ or Active X® environments.

Hearing Aid test

SoundCheck's Sequence Editor for test configuration

Tweeter test

Loudspeaker test

SoundCheck – Fast and Reliable Production Line Test

SoundCheck is perfect for the production line as its advanced algorithms allow fast and repeatable testing even in high noise environments, and it integrates fully with automated production lines. It is more reliable than human listeners, and much simpler and less expensive than 'rack and stack' systems. A range of lower budget production line software packages offers the functionality required for a manufacturing environment at significantly less cost than a full R&D system.

Fast

SoundCheck's advanced algorithms allow extremely fast testing. For example, SoundCheck can carry out a full transducer analysis in as little as one second — including generating the stimulus, measuring all the necessary parameters, comparing the results to a reference standard, and displaying the result as a simple pass/fail message. Multi-channel software and hardware options enable many system parameters to be measured at once for rapid testing of multi-channel devices (e.g. mixing boards or surround sound systems) and batch testing.
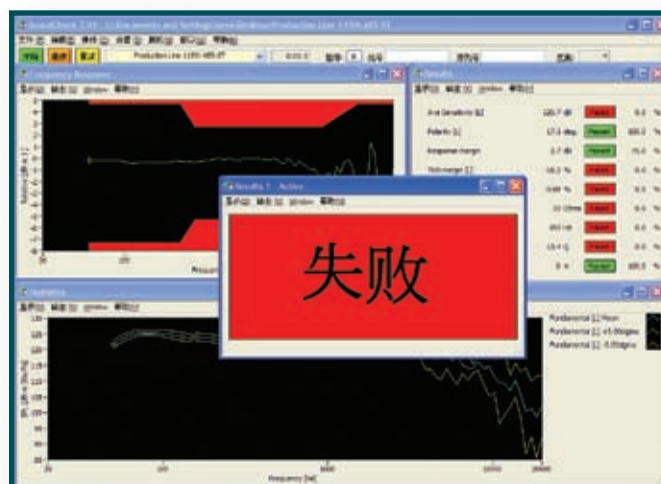
Repeatable

Specially designed filters and analysis algorithms distinguish between test signals and background noise to offer repeatable results in noisy manufacturing environments. In addition to measuring all faults that can be heard by human listeners (Rub & Buzz, loose particles, etc.), SoundCheck can also detect and quantify faults that cannot be heard by the human ear such as reverse polarity.

Easy to Use

Tests can be configured for 'one-click' or automated operation that will generate a pass/fail output, and various levels of password protection enable you to control who may access and modify test sequences. To further simplify manufacturing tests, a Chinese language option ensures that your overseas production staff or 3rd party vendors understand the on-screen instructions. This all adds up to a system that offers simple, error-free operation.

Comprehensive pass/fail test on the production line (Chinese language version)

No Downtime

The SoundCheck platform virtually eliminates test system downtime as all the hardware components — a PC and a professional audio sound card — are easy to purchase and inexpensive to maintain. Should problems occur, your own staff can to get the line back up and running using standard off-the-shelf parts. Optional remote diagnosis via the Internet enables immediate assistance from a Listen support engineer.

Integrated with your Production Line

SoundCheck is compatible with automation software and communicates with hardware such as barcode systems and PLCs, using RS-232, IEEE-488, Bluetooth, FireWire, USB, and TTL interfaces. SoundCheck can be controlled by other programs through LabVIEW or by any programming language that supports ActiveX commands (VB.NET, C#, C++, Java etc.), so it is fully compatible with most test platforms. All test results can be recorded in SoundCheck or output to other software for full statistical process control. Within an automated environment, tests can be configured to start when the device under test is in place, and failed devices automatically removed from the production line.

Database and Statistical Capabilities

Tests can be configured for multiple data output options. These may include a comparison to reference standards with a PASS/FAIL indication for the production line operator, customized SoundCheck reports, or writing of complete test results to databases such as Microsoft® Access, SQL or Oracle® for archiving, data-mining or report writing. SoundCheck also features an extensive statistical analysis toolbox which includes Gage R&R, max, min, mean, standard deviation, yield, Cpk, and Best Fit to Average.

Cellphone test

Loudspeaker test

The Global Solution

SoundCheck makes it easy for the production line to carry out the same tests as the R&D lab – this ensures that consumers are hearing exactly what the design engineer intended.
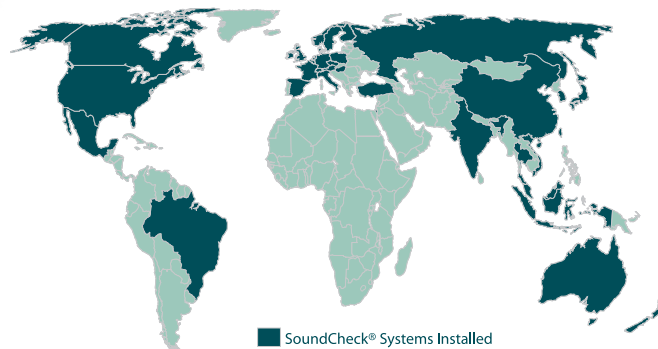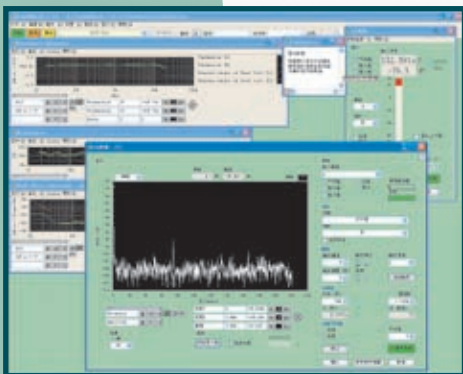
Since there is no expensive and complex hardware, SoundCheck is affordable for production applications. It is fast and offers full integration with automated production lines. Most importantly, its advanced algorithms ensure that testing remains reliable, even in high noise environments.

SoundCheck also offers the accuracy and flexibility demanded by R&D. It includes an entire laboratory full of instrumentation including a spectrum analyzer, real time analyzer, signal generator, multimeter and oscilloscope. The operator has full control over all test parameters and SoundCheck's advanced analysis and post processing capabilities extend far beyond those of conventional R&D hardware. Soundcheck installed on a laptop is effectively a complete laboratory-quality audio test station in a briefcase, making it perfect for on-site vendor audits or production line troubleshooting.

The same measurement sequences can be configured differently for R&D and production use. For example, an R&D test may allow the operator to modify the input parameters and output a full and detailed analysis of the results, whereas the production version can be pre-configured to only allow 'one-click' operation to output a simple pass/fail result to the operator and write the full test results to a database. Companies can therefore develop highly sophisticated tests for internal use, and share a production version of the test sequence with their manufacturing facilities or third party vendors. This facilitates global quality control, wherever the manufacturing takes place.

Listen offers a Chinese language version of SoundCheck, and sales and support centers in China, Taiwan, and other Asian and European countries offer local language training and support.

With the software's different language options and the use of the internet to transfer data, the possibilities are endless. Test sequences can easily be shared with overseas facilities and vendors. If production line problems occur, test results can be emailed as .WAV files to the R&D lab for more detailed analysis and evaluation. This minimizes expensive production line downtime as there is no need to ship the faulty product back to the engineers for in-depth analysis, or fly the engineers out to the production line! It is even possible for a manager to observe, in real time, the test data from a production line on another continent.

■ SoundCheck® Systems Installed

SoundCheck systems are used around the world

Service and Support

We understand that whether you are in a production or R&D environment, you are likely to be pushing test and measurement to new limits. At Listen we are dedicated to customer support, and we always welcome your feedback. We offer customer support in a variety of ways:

:: By phone
:: By email
:: At our online user forum via **www.listeninc.com**
:: Using remote desktop sharing
:: Online — optional remote diagnosis via the Internet enables faster and more cost-effective troubleshooting, product training and test sequence development.
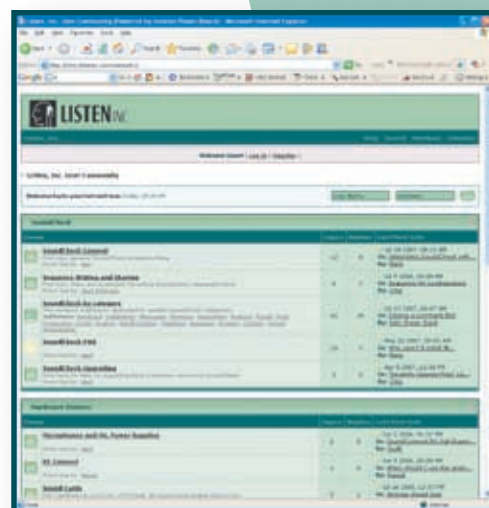
Training classes are regularly scheduled at our Boston office and at other convenient locations around the country. These can be supplemented with customized on-site training. Our worldwide network of sales and engineering representatives also assists with installation and training on a local basis.

User forums on the Listen website

Test Development Services

If you don't have the time or resources to develop and customize tests, Listen's experienced acoustic engineers can analyze your requirements and write a SoundCheck test sequence for you. All you need to do is upload it to your system and you are ready to begin testing.

Summary of Capabilities

(see spec. sheet for full details)

Test Signals	Analysis	Post-Processing	Reports & Storage
Sine	Oscilloscope	Polar plots	Excel
Noise	Multimeter	Directivity index	Word
Multitone	Spectrum analyzer	Complex arithmetic	HTML
2-tone (IM)	Real time analyzer	Thiele-Small parameters	Oracle
Composite Source Signal (CSS)	Distortion – Harmonic	Smoothing	SQL
Artificial speech (P50)	– IM	n^{th} octave synthesis	Access
Toneburst	– Difference frequency – Non-coherent	Group delay	Text
Log chirp (Farina method)	Transfer function	Minimum phase	Statistics (Cpk, best fit to average)
MLS	Impulse response	Windowing (time and frequency)	
TDS	Time-frequency analysis	Matlab scripts	
Arbitrary using .wav files	Impedance	Loudness rating	
	Power	Weighting functions	
	Phase	Reverberation time	

Turnkey Systems

You can source a complete test solution from Listen – we offer additional products of our own, and have teamed up with other suppliers to offer a wide range of test equipment to use with SoundCheck. This includes:

Additional software: SoundMap™, a Time-Frequency Analysis program, has many applications including 3D waterfall plots of loudspeaker and microphone impulse responses, loose particle detection in loudspeakers and analysis of drop-outs in digital devices such as Bluetooth headsets and VoIP telephones.
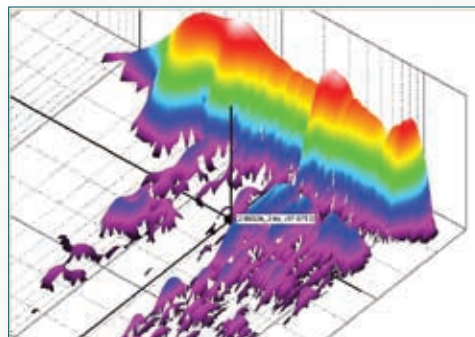
Test Sequences: We offer a selection of pre-written test sequences for testing to industry standards. Many basic sequences are included in the software or may be downloaded from our website. Other more complex sequences, such as testing to TIA standards and hearing aid standards, can be purchased from Listen.

Pro-Audio Sound Cards and Data Acquisition Devices: SoundCheck will work with any professional sound card or data acquisition card. We have partnered with several manufacturers to offer a range of stereo and multi-channel cards to meet all applications and budgets.
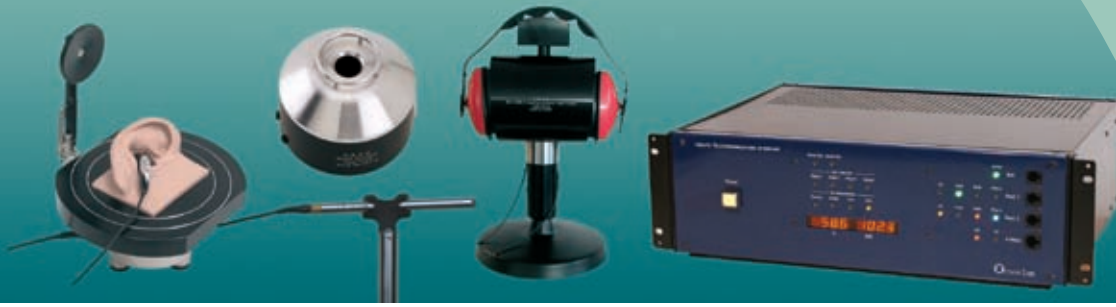
Measurement Microphones: Listen's SCM measurement microphone is a robust, free-field microphone with a flat frequency response and high sensitivity. It is suitable for R&D or production line use. Listen can also supply measurement microphones from other manufacturers.

Microphone Power Supplies: Listen's SoundConnect can power SCM, B&K and G.R.A.S. measurement microphones and extends the dynamic range of your measurement system. It ensures good amplification linearity with a minimum of noise and distortion. Listen also offers microphone power supplies from other manufacturers including portable battery-operated units.

DC power supply and current monitor: Listen's DC Connect™ is a USB controlled precision DC power supply and current monitor. It enables high resolution dynamic measurements of voltage and current consumption in portable electronic devices such as hearing aids, microphones, cell phones, PDAs and other battery powered electronic devices.

SoundMap™, Listen's Time-Frequency Analysis program

Amplifiers: Amplifiers are a critical part of many measurement configurations. Listen offers a selection of amplifiers that have been chosen for their high reliability, durability and excellent performance.

Other Test Fixtures: Listen can supply turntables, head and torso simulators, artificial ears, mouths, calibrators and other test fixtures from several test and measurement companies.

Production Line Accessories: Footswitches, cables and additional production accessories such as barcode scanners are also available from Listen.

SoundCheck Offers Everything You Need

:: Designed and supported by audio testing experts
:: A common test platform for R&D and production
:: Customized to your requirements
:: Fast and accurate, even in high-noise environments
:: Integrates with your existing test platform and hardware
:: Easy and flexible test development
:: Compact and portable
:: Low purchase and maintenance costs
:: No downtime – no proprietary hardware
:: Unlimited number of channels available

More information on all Listen products can be found at **www.listeninc.com**.

If you did not receive a full technical specification sheet with this brochure, please ask your Listen sales engineer, or download it from **www.listeninc.com**. Please see our website for a full list of system packages.

Selecting a SoundCheck System

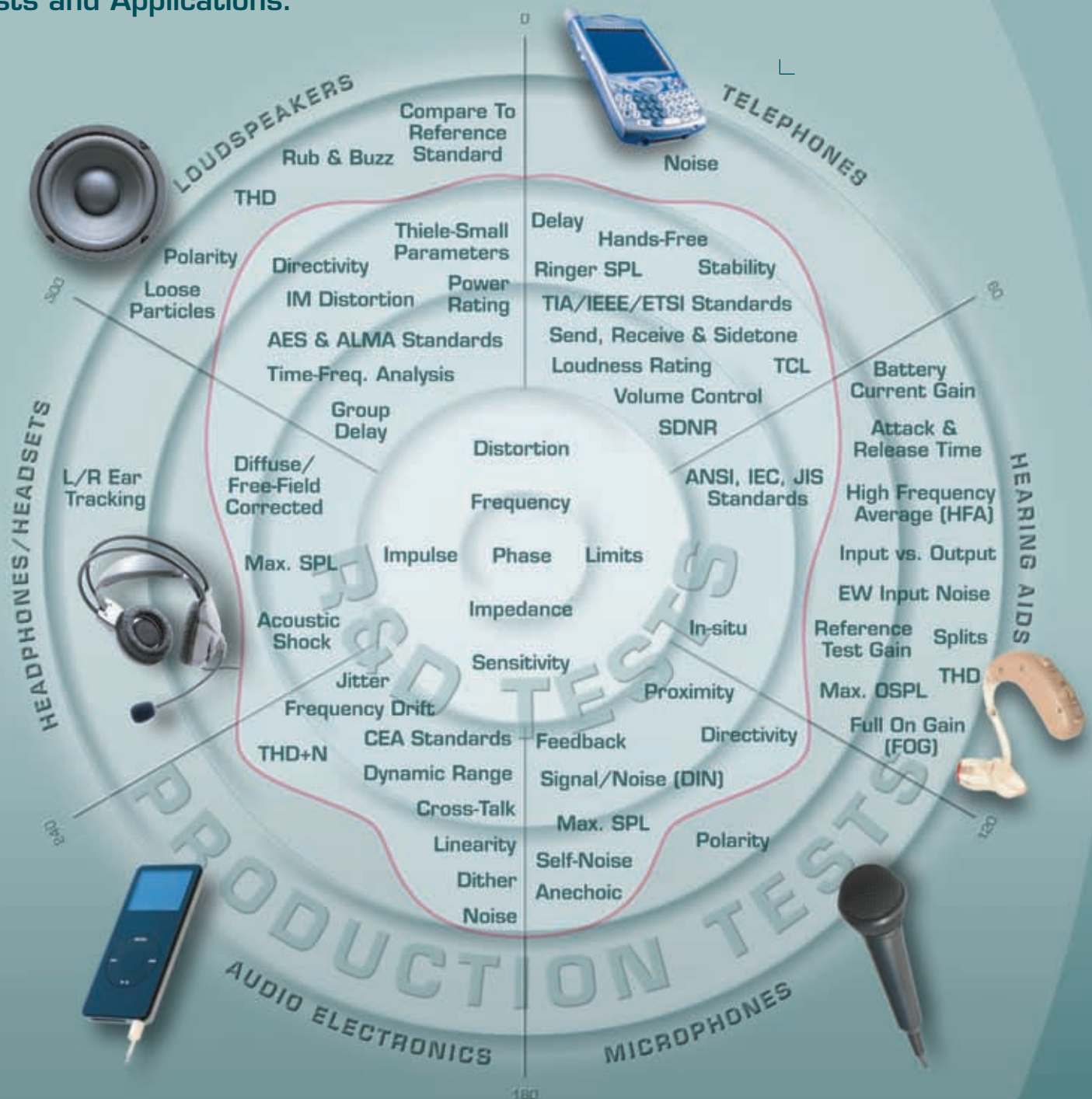Select basic software package based on application and QC or R&D requirements

↓

Select any additional software modules required

↓

Select data acquisition device based on your number of channels and accuracy requirements

↓

Add any hardware (e.g. microphone, amplifier, etc.)

↓

Add any special software sequences (e.g. TIA test sequences)

Tests and Applications:

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SoundCheck®

THE AUDIO TEST AND MEASUREMENT SYSTEM

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