

Evolution in Testing

This market update focuses on the latest product launches and solution updates announced over the past 12 months for audio test and measurement plus an overview of the main market trends for this critical segment, which continues to evolve and grow.

By
J. Martins



Keysight has launched a new portfolio of Smart Bench Essentials (SBE) lab bench instruments in 2021. These are targeted at remote access labs and teaching institutions that require a unified graphical interface with integrated data management and analysis, also allowing sharing instruments and data remotely with peers.

Audio test and measurement entails multiple applications that some manufacturers try to combine, while others target more effective tools for specific tasks, some more time sensitive, others completely data critical. Companies in this sector have perfected those strategies with new products and improvements to existing solutions over the past year, which was rich in announcements.

Our previous market update on this topic expanded our overview to more generic test bench and instrumentation solutions, in an effort to characterize the broader test and measurement (T&M) sector. The perspective enabled us to better understand how practices in education, research and development, and manufacturing are now adjusting to completely new methods, including the convergence with the latest generation of CAD, modeling, and simulation software tools. That's a trend that continues to gain strength, including for audio test and measurement.

Another of the notable trends we highlighted last year resulted from the fact that people are more connected than ever and that—with the effects of the global pandemic being particularly felt over the supply chain and restrictions in traveling—we have started to see a clear trend toward equipment and solutions that leverage connected resources,

collaboration, and even remote monitoring and supervision. And that's also an approach that manufacturers of audio test and measurement equipment are addressing, even if just barely starting the process.

Accelerated Consolidation

In 2021 we could see a clear trend for acquisitions and consolidation in the test and measurement segment, directly affecting some key names in the audio industry.

In 2021, Amphenol Corp., the global provider of high-technology interconnect, antenna, and sensor solutions, announced the acquisition of MTS Systems Corp. MTS was the company that had acquired PCB Group in 2016, becoming the owner of PCB Piezotronics and Larson Davis. Amphenol subsequently sold the test and simulation business of MTS to Illinois Tool Works (ITW), as part of the acquisition strategy.

PCB Piezotronics specializes in the design and manufacture of force, torque, load, strain, pressure, acoustic, and vibrations sensors. The pioneer of Integrated Circuit-Piezoelectric (ICP) technology, PCB's instrumentation is used for test, measurement, monitoring, and control requirements in many different industries. Also the result of

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multiple acquisitions and mergers—within MTS and before—PCB Piezotronics has four major divisions, all of which offer targeted sensor technologies. This includes PCB Piezotronics’ core business division with piezoelectric, ICP, and sensors; IMI Sensors, for industrial vibration, pressure sensors, and accelerometers; and Larson Davis, with its full line of noise and vibration measurement instrumentation, which includes sound level meters and outdoor noise monitoring systems.

Other PCB companies include Accumetrics digital telemetry systems; The Modal Shop, structural vibration and acoustic sensing systems and services for various applications; Endevo test and measurement solutions; and Modern Microstructures, a pure-play foundry specializing in the fabrication of custom microelectromechanical systems (MEMS) and thin-film devices.

Also in 2021, it was announced that the measurement-focused business group established by investment company Battery Ventures, which included Audio Precision, GRAS Sound & Vibration, and imc Test & Measurement, would be consolidated under a new identity and single brand: Axiometrix Solutions.

Combining a strong group of well-established brands that have served electronics, aerospace, automotive, and audiology industries for more than 35 years—each with a rich history and diverse roots in the US, Denmark, and Germany—Axiometrix is now a global business with locations in North America, Europe, and Asia. As the intended strategy confirms so far, the company’s three main product lines will continue to be reflected by its three industry-leading brands in each of their respective segments.

A group competing directly with Axiometrix that also followed a similar consolidation strategy was Hottinger Brüel & Kjær (HBK), the entity that resulted from the merger of Brüel & Kjær Sound and Vibration A/S (BKSv) with Hottinger Baldwin Messtechnik

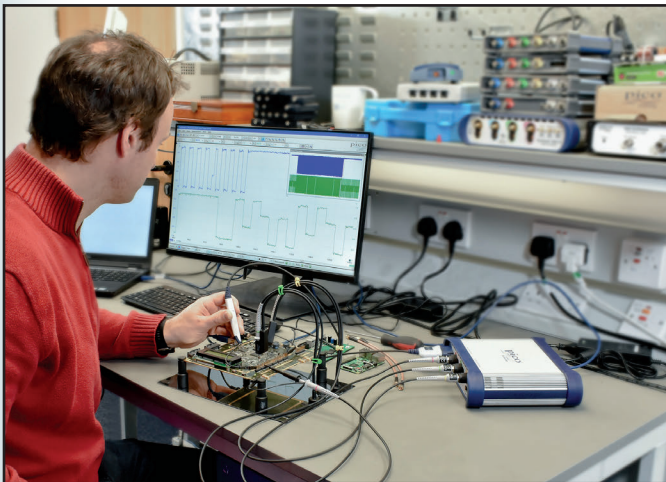
GmbH (HBM) in 2018. Both were already owned by UK-based investor Spectris plc, which decided to merge the respective businesses into HBK. The merger aims to redefine the concept of a complete solution, where the two companies will unite their expertise and provide an integrated offering, encompassing sensors, acquisition, preparation, evaluation, and engineering services. While other markets (familiar with the German company HBM Test and Measurement) might accept HBK, within the audio industry, the trend will be to refer to the resulting company simply as Bruel (no one knows how to say Kjær...). Both BKSv and HBM are leading brands in their respective disciplines. Bruel in sound, noise, and vibration, while HBM is focused on industrial control and weighing. What the combination will allow is an evolution toward the trends we mentioned earlier, with better software and data acquisition and evaluation solutions. To date, Bruel continues to do business with its own identity and website.

The Economics

Economic data available for the test and measurement market is very scarce and there is much less for the specific audio industry instrumentation market. Multiple studies characterizing the segment entail a wide variety of applications, from electronic test equipment and laboratory-specific solutions to data acquisition and scientific analysis, to a large variety of industrial and manufacturing solutions. This makes it difficult to understand the growth, which is the only common factor described in recent market research reports. According to one fairly recent study from Quince Market Insights, the global Test and Measurement Equipment market is estimated to be worth \$28 billion USD in 2021 and is projected to grow at least 4% annually in the next few years. Figures and trends that are confirmed by previous reports from Technavio.

And that growth is directly related to large investments in communications, such as 5G networks, data centers, and wireless networks, as well as automotive, aerospace, medical, electronics, and semiconductor sectors. Companies that are reportedly feeling the benefits of those investments include Rohde & Schwarz, which is supplying key testing technology for 5G; Yokogawa Test & Measurement in automotive power solutions, data, and production line testing; and some of the largest players such as Anritsu, Keysight, National Instruments, Teledyne LeCroy, and others. To get a sense of the market, suffice it to say that Tektronix (now part of conglomerate Fortive), a company that is much larger than any of the manufacturers of test equipment for the audio industry, doesn’t even make it to the top 10 of the largest companies in the market reports we analyzed.

And yet, Frost & Sullivan estimates the market opportunities just for electronic test and measurement to be worth much more. According to a pre-pandemic article by Frost & Sullivan, the electronic T&M market encompassing semiconductor automatic test equipment (ATE), radio frequency (RF) and microwave (MW) test equipment, digital test equipment, field testers, and data acquisition (DAQ) generates well over \$10 billion USD in revenue annually, and predictions for 2022 pointed to \$13.18



Offering another example of increasing flexibility in T&M, in 2021 Pico Technology expanded its PicoScope 6000E Series to address high-performance debugging and design verification requirements in advanced electronic systems, including a free-of-charge Software Development Kit that enables users to write their own application, with code examples and drivers for Windows, macOS, and Linux, and drivers to interface with NI LabVIEW and MathWorks MATLAB.

billion USD, with significant growth resulting from 5G, automotive technologies, and semiconductor ATE investments.

With audio and key sensor technologies increasingly a priority in the consumer, automotive, and industrial spaces, it becomes obvious that we will continue to see further opportunity for consolidation, while the transition to software and connected

systems will open opportunities also for new players.

Audio has become ubiquitous, from smartphones to the smart home, nearly all consumer products have audio features, and from development to manufacturing, requires reliable, efficient testing of loudspeakers, microphones, integrated components, and more.



Working together with Rohde & Schwarz, HEAD acoustics created a test solution that was able to successfully verify the communication quality of 5G (VoNR)-capable devices, using its hardware platform labCORE and measurement and analysis software ACQUA, with the latest generation CMX500 wideband radio communication tester from Rohde & Schwarz.

Company Resources

- Amphenol Corp. | www.amphenol.com
- Audio Precision | www.ap.com
- Axiometrix Solutions | www.axiometrixsolutions.com
- Brüel & Kjær | www.bksv.com
- GRAS Sound & Vibration | www.grasacoustics.com
- Hottinger Baldwin Messtechnik GmbH | www.hbm.com
- Illinois Tool Works Inc. | www.itw.com
- imc Test & Measurement GmbH, www.imc-tm.com
- Larson Davis, www.larsondavis.com
- PCB Piezotronics, Inc. | www.pcb.com
- Quince Market Insights | www.quincemarketinsights.com
- Spectris | www.spectris.com
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HEAD acoustics

New Generation of Artificial Heads with Advanced Types of Artificial Ears



The new HEAD acoustics HMS II.3 LN HEC artificial head emulates the acoustically relevant structures of the pinna and ear canal with an improved replication of the ear impedance, providing higher dynamic range.

Meeting the needs of current audio systems development, German audio and communication test and measurement specialist HEAD acoustics introduced a new and much improved design for its artificial heads paving the way for new era of communication and audio quality measurements. The new generation of artificial heads ensures a new level of realism, precision, and flexibility when coupled with HEAD acoustics' modular concept approach, meeting the most diverse of applications in the field of acoustic measurement technology.

The new generation of artificial head measurement systems is available in three base variants, including a low-noise artificial head with a human-like ear canal (HMS II.3 LN HEC), the standard low-noise artificial head model (HMS II.3-LN), and an artificial head focused on voice and audio quality testing (HMS II.3). The modular concept enables users to exchange different types of artificial ears as required, benefiting from anatomically correct artificial ears, and a fullband-capable two-way artificial mouth.

According to the company, the new anatomically correct artificial ear design available in the human-like ear canal (HEC) model is able to better reproduce the ear canal geometry and the human ear impedance. The low-noise occluded ear simulators feature an impedance response matched to that of the human ear, while the built-in highly sensitive microphones provide a best-in-class dynamic range. The very low inherent noise of 16 dB SPL(A) makes the head-and-torso simulator the ideal choice for measuring close-to-the-ear and in-ear audio and communication equipment. Due to the maximum sound pressure level of 148 dB SPL, the artificial head is also suitable

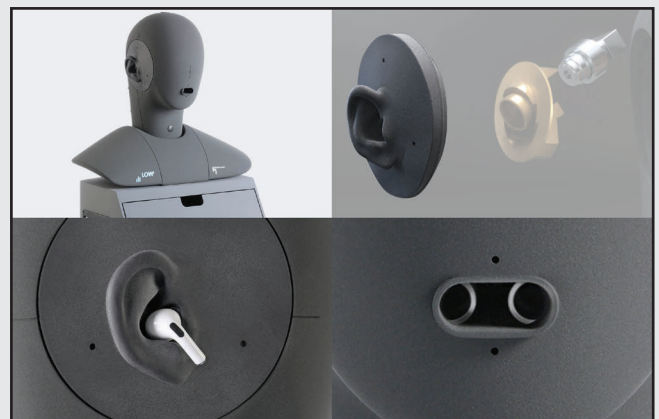
for measurements of far-to-the-ear transducers in hands-free systems, in-car communication systems, or smart speakers. The head-and-torso simulator provides geometric and acoustic characteristics according to the ITU-T P.58 recommendation, and thus replicates all acoustically relevant structures of the human anatomy.

In addition, numerous detailed refinements and an extensive range of accessories help to make life easier for acoustics engineers. While the low-noise occluded ear simulators of the artificial head simulate the receiving direction, a two-way mouth loudspeaker reproduces the complete spectrum of the human voice, allowing for narrowband, wideband, super-wideband and fullband measurements. And with the new HMS II.3 LN HEC, users can create aurally accurate voice and audio recordings for evaluation using HEAD acoustics' measurement and analysis software ACQUA.

The HMS II.3 artificial head can also be equipped with an artificial nose (AN-HMS), enabling acoustic measurements of audio and communication devices where a nose ensures secure hold of augmented reality glasses and virtual reality headsets. Users can also mount all artificial head variants on the height-adjustable tripod HMT III or on the torso box HTB VI.

HEAD acoustics' newly developed artificial ear with HEC is now standardized as Type 4.4 artificial ear in Recommendation ITU-T P.57. The HEAD acoustics HEC artificial ear not just fulfills the Type 4.4 artificial ear requirements, it is also the first ITU-T standardized artificial ear to meet the low-noise requirements for artificial ears as defined in the new Chapter 7 of Recommendation P.57.

www.head-acoustics.com



The HMS II.3 LN HEC realistically emulates all the acoustically relevant structures of the human ear and enables exchanging ear simulators and pinnae quickly and easily.

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Audio Measurement and Analysis Flexibility with ACQUA 5 Software

The well-established ACQUA measurement and analysis environment from HEAD acoustics recently received the first iteration of the new generation 5 software. ACQUA's significantly reworked software structure provides even greater flexibility for voice and audio quality evaluation, while paving the way for future expansions. Designed for the requirements in applications as diverse as communication systems, Bluetooth, ANC headphones, and smart speakers, ACQUA now supports faster hardware configuration, perceived loudness analysis, and MDAQS audio quality evaluation.

In combination with HEAD acoustics' labCORE audio interface, the software forms a precise, automated and flexible system for R&D, conformance tests, and quality control of devices and systems.

ACQUA includes a multichannel analysis system for diagnosis of acoustic and/or electric transmission paths up to 192kHz. With the measurement and analysis software, users can gather and evaluate measurement data in a simple and quick manner via measurement descriptors (Single Measurement Descriptor or SMD). These SMDs are pre-defined, adaptable, and embedded in the database structure. And all telecommunication-specific tests comply with international standards (e.g., ETSI, ITU, 3GPP, GCF, PTCRB, and GSMA). These core features make ACQUA a reliable foundation for a complete measurement chain: From the generation of complex excitation signals through the automated conduct of measurements and the analysis of measurement signals to secure storage and documentation.

ACQUA 5 introduces the new "Workplace Settings" window that enables users to collect and configure hardware items, select and define calibration, and combine assignments. The user can define and configure his local workplace, including the use of head-and-torso simulator (HATS), microphones, loudspeakers, and radio testers. All properties for a single hardware item are found in

one single place, considerably streamlining working with ACQUA. Assignments of equalizations, calibrations, and corrections are distinctive, and hardware setups are easily verifiable.

The analysis possibilities with the software have also been extended with new loudness calculations for speech communication, according to Recommendation ITU-T P.700, which enables subjectively perceived loudness analysis, not just the traditional loudness rating calculations. The new psychoacoustic-based loudness calculation allows a much more realistic calculation of the speech loudness perceived by the user. Even non-LTI systems, such as AGC and compression schemes, can be evaluated. This provides an excellent analysis of all measures integrated by manufacturers targeting the increase of the subjectively perceived loudness without producing excessive sound pressure levels.

Another new feature is the full integration of Multi-Dimensional Audio Quality Score (MDAQS) evaluation, previously available in beta. MDAQS provides unique audio quality evaluation parameters for all types of audio equipment ranging from headsets to loudspeaker arrangements. With ACQUA 5, the new perceptual-based audio quality measure is integrated in the company's analysis portfolio for the first time.

Also extremely important for current applications, ACQUA 5 addresses the fact that often more than one HATS is used in laboratories. Either these are used for different purposes or more than just one HATS is used for the measurements (e.g., with in-car-communication systems or interfering talkers in smart home applications). Consequently, the DRP/ERP correction can now be configured for each HATS individually.

A variety of additional improvements are found in ACQUA 5, ranging from SMD handling to scripting possibilities up to more optimized database features.

www.head-acoustics.com



HEAD acoustics' ACQUA measurement and analysis software enables users to optimize voice and audio quality in all kinds of products and markets.



ACQUA, in combination with HEAD acoustics' labCORE audio interface, forms a precise, automated and flexible system for R&D, conformance

Echo Test + Measurement

Specifically Made for Audio Testing!

Nestled in a quaint building in downtown Santa Barbara, CA, Echo Test + Measurement is a little company with a big impact on audio test and measurement for consumer electronics. Founded in 1978 by Milo Street as Street Electronics, the company had early success in building text-to-speech cards for the Apple II and licensing custom DSP hardware and software to large computer and semiconductor companies (Analog Devices, HP, Sony, Motorola, Rockwell, and AKM).

From the 1990s through the first two decades of the 21st century, Echo Digital Audio established itself as one of the premiere pro audio sound card suppliers with the Mia, Gina, Layla (PCI-based) and AudioFire (Firewire) sound card lines.

Echo expanded from its earlier work in speech compression, to music synthesis, game audio, and music recording, building hardware for every major type of audio transport technology: Bluetooth, FireWire, USB, Ethernet, and PCI, among others.

During the later years of this successful run as a sound card company, a growing number of DIY audio enthusiasts and bloggers started performing measurements of audio equipment at home using free PC software, and sharing their experiences online. The same thing happened with a few very large consumer electronics companies that started using the AudioFire sound cards for production line testing. This eventually led to a collaboration to design and make a sound card-based system dedicated to test and measurement, leading to the first Echo AIO products in 2014.

Since 2014, Echo Digital Audio has fleshed out the AIO Test System, changed the company name to Echo Test + Measurement, and shipped more than 25,000 units to

consumer electronics manufacturing plants all over the world. Echo has now completely transitioned to a test and measurement company and no longer offers traditional audio sound cards.

“With over 40 years of sound card expertise, we found ourselves in a unique position to make a significant impact on custom test and measurement systems for consumer audio manufacturing. Now, instead of spending many man-hours to configure audio sound cards to work properly as audio test systems, you can plug-and-play an Echo AIO Test System and use the time saved to make more and better products!,” states Milo Street, Echo Test + Measurement CEO and hardware guru.

With its deep history and expertise in sound card interfaces, Echo has taken all the DIY-ishness out of creating a test system based on sound card technologies.

So what sets the Echo AIO Test System apart from traditional sound cards?

According to Kris Jackson, VP of Sales for Echo Test + Measurement, “Echo products have been renowned for decades for audio performance, longevity, and reliability. Since 2014, we have built on that legacy to deliver accurate, proven, and cost-effective audio test hardware. Today, Echo provides audio test solutions for mass production to some of the best-known consumer electronics companies in the world.”

Echo AIO uses test industry standard connections and interfaces, such as IEPE microphone connections on BNC connectors with CCP power, and TEDS readers built into each channel. Output options include line level, headphone, and power amplifiers on EuroBlock connectors with added sense resistors built in for making impedance measurements. There is even a 10-channel TDM bus module for making chip level (I^2S) measurements. Other available options include battery simulation, GPIO inputs and outputs, and Pressure, Temperature, and Humidity sensors (unique to Echo). All these features that come standard on Echo AIO are costly add-ons to traditional sound card-based test setups.

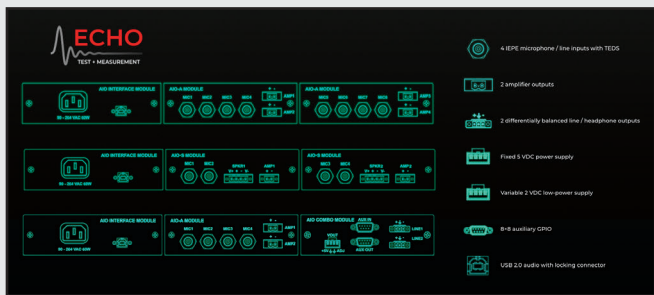
The AIO Test System also enables the user to control all parameters of the hardware using three different methods. First, by using the AIO Control Panel application, a simple to use hardware setup and control app. Second, through the AIO Command-Line application that allows hardware configuration under program control in a test sequence. And finally using the AIO Interface Library, a dynamic library with a standard C-language interface allowing complete control of the AIO from any programming language.

The Echo AIO test system is modular, allowing for greater flexibility and system expansion. Two AIO modules can be fitted in a chassis. Maximum analog channel count is



Echo Test + Measurement has created a robust, affordable, and comprehensive hardware platform that is USB 2.0 audio class compliant, so it can be used to build bespoke test systems that are especially suitable for high-volume testing and verification applications.

currently eight analog mic/line inputs by four outputs (line, headphone, or amplifier). Maximum digital channel count is 10x10 (TDM). Combining an analog module and a TDM



With affordable audio interface solutions that are proven and reliable, Echo Test + Measurement uses the slogan “bench quality and factory tough!”

module in the same chassis achieves a system maximum of 14 inputs by 12 outputs.

The AIO Test System is also cross-platform and supports Windows, Mac, and Unix-based systems. It supports WASAPI and CoreAudio drivers in addition to ASIO (recommended).

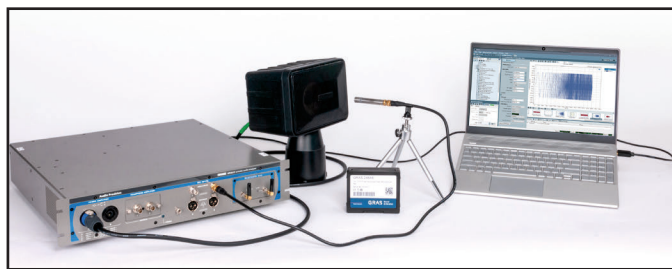
Finally, these solutions from Echo work with any audio test software that interfaces to the mentioned audio drivers, including LabVIEW, MatLab, APx500 Flex, Soundcheck, ARTA, and others. Users can also write their own interface using common C languages and the Dynamic Library. In effect, compatibility and ease of interfacing makes Echo AIO an attractive choice for adding to existing systems or building completely new testing environments.

And the company intends to expand the range further through 2022.

www.echotm.com

Audio Precision

APx v7 Audio Measurement Software Updates



Audio Precision (AP) has released the latest update to its APx500 audio measurement software, version 7, adding new enhancements suited to a wide range of audio test applications. In parallel with release 7.0, Audio Precision also introduced APx500 software subscriptions, offering APx users an alternative in how they license APx software, and access nearly any software version and option.

With the new APx500 software version 7.0, Audio Precision is adding support for GRAS SysCheck2-capable microphones, including the newly announced 246AE 1/2" CCP free-field microphone, and the 246AO pre-polarized pressure field microphone. The combination of SysCheck2 and APx enables the user to verify the accuracy of the entire signal chain without physical access to the microphone or potential disruption of the test setup.

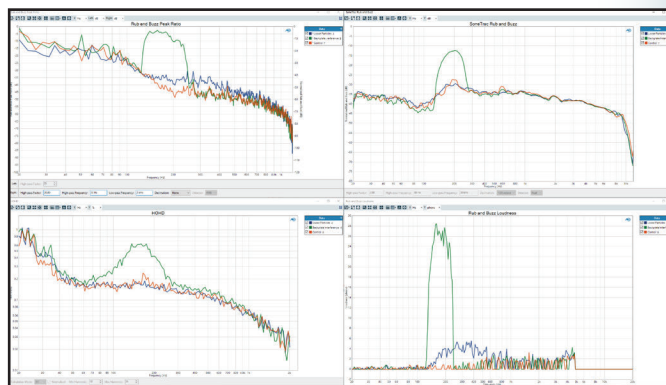
Developed by GRAS Sound & Vibration—which like Audio Precision is now also part of Aximetric Solutions—SysCheck2 is a system designed to actively verify whether the sensitivity of a microphone has drifted since its last calibration. In the first collaborative effort by the GRAS and Audio Precision engineering teams, APx500 release version 7.0 enables an APx user, in conjunction with an APx517B, APx1701, or GRAS 12Bx power module, to run SysCheck2 and receive a pass/fail indication for each connected SysCheck2-capable microphone, without the need

of a calibrator or physical access to the microphone.

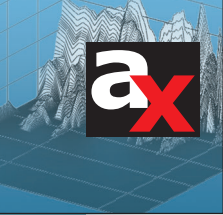
From a microphone in production test fixture to an array of microphones in an anechoic chamber, the combination of SysCheck2 and APx enables the user to verify the accuracy of the entire signal chain without physical access or potential disruption of the test setup.

Rub & Buzz Detection

In mid-2021, AP released the APx500 audio measurement software, version 6.1. With this update, AP added new measurement results, options, and test signals for production test of loudspeakers, headphone drivers, and microphones. For speaker designers and manufacturers the new APx software introduced new options for Rub & Buzz, SoneTrac, High-Order Harmonic Distortion, and Rub & Buzz Loudness defect detection methodologies.



In APx500 Measurement Software Version 6.1, Audio Precision introduced multiple Rub & Buzz (upper left) defect detection methodologies, including also SoneTrac (upper right), High-Order Harmonic Distortion (lower left), and Rub & Buzz Loudness (lower right).



Previously available in APx software, the Rub & Buzz method uses high-pass tracking filters to remove the fundamental signal and detect defects as excursions in the residual waveform's crest factor or peak ratio. SoneTrac is a Bose-developed method to improve Rub & Buzz measurement that filters the residual signal and ratios it to the RMS of the total signal to reduce the noisiness of the measurement result. High-Order Harmonic Distortion (HOHD) is a classic method for Rub & Buzz detection. It uses the total harmonic distortion (THD) ratio but only of harmonics above the 10th, 10-35, 20-200, etc., which is a simple way to account for frequency masking effects. Finally, Rub & Buzz Loudness applies a psycho-acoustic loudness model to the residual signal to calculate the perceived level of the Rub & Buzz based on well-established models of the human perception of sound.

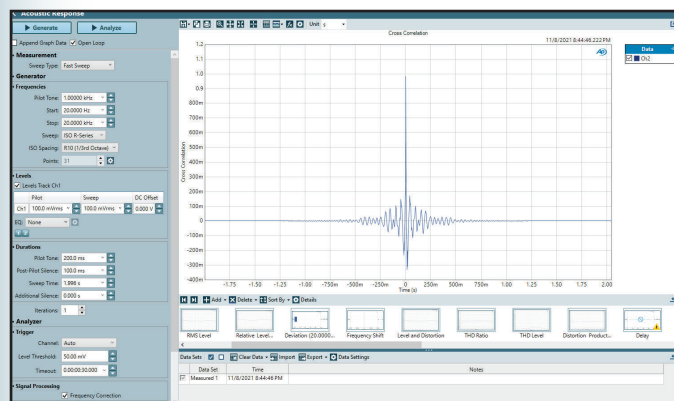
To support the addition of the HOHD and Rub & Buzz Loudness measurements, AP introduced the Fast Sweep signal with APx500 release version 6.1. Fast Sweep, as its name implies, is an extremely fast stepped frequency sweep with no input or output ranging between steps, continuous transition between steps to minimize transient effects, and has a total sweep time that rivals the speed of a logarithmically swept sine (chirp) signal.

A few of the advantages of the Fast Sweep are the lack of transient ripples at low or high frequencies, the ability to sweep from low-to-high or high-to-low frequency, the support for measuring harmonics above the 20th, and precise control of the number of discrete points used in measurements.

New APx Version 7.0 Software Features

With release 7.0, APx software now enables the use of Fast Sweep in open-loop testing scenarios, such as the testing of smart speakers. Fast Sweep is the primary stimulus signal used when utilizing either HOHD or Rub & Buzz Loudness measurements.

Suited to anyone performing spectrum analysis, v7.0 brings several distinct improvements to the Fast Fourier Transform (FFT) analysis capabilities of APx software: Arbitrary lengths, windowless analysis, and level triggering. By allowing arbitrary



With release 7.0, APx software now enables the use of Fast Sweep in open loop testing scenarios, such as the testing of smart speakers. Fast Sweep is the primary stimulus signal used when utilizing either High Order Harmonic Distortion (HOHD) or Rub & Buzz Loudness measurements.

FFT/DFT (Discrete Fourier Transform) lengths, users can now always find a combination of transform buffer and sample rate to arrive at convenient frequency resolution. With windowless analysis (where “Window” = None - move to bin center), engineers can perform synchronous, windowless FFT analysis on non-synchronous signals.

Power users who prefer Bench Mode, and those performing real-time adjustments on the devices under test (DUTs), will benefit from the enabling of Transfer Function in Bench Mode. In v7.0, these Bench Mode-oriented customers now have access to the Transfer Function measurement, and the complex frequency response function for a device, including the magnitude and phase (or real and imaginary components), using any broadband signal (e.g., speech, music, or noise).

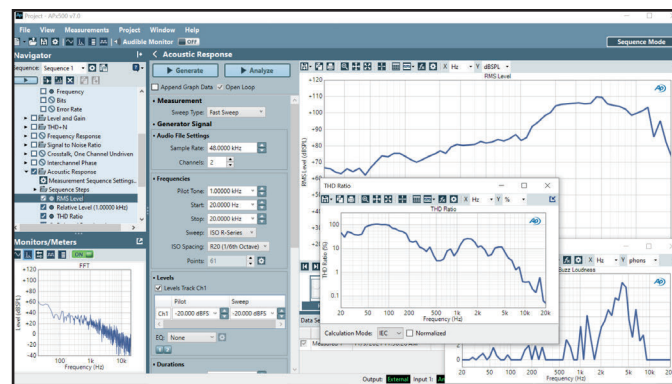
Software Subscriptions

To provide APx users greater flexibility in how they access APx500 measurement software, Audio Precision is introducing software subscriptions as an alternative to perpetual software licenses. While a perpetual software license—which grants a permanent, non-exclusive and non-expiring right to use the software—will still ship with each new analyzer, software subscriptions provide another path for existing APx users to access the latest software release and associated enhancements.

The new subscription models grant a time-limited (1-, 3-, or 5-year periods) license to use the software and provide access to all versions and all options (excluding PESQ and POLQA). When the subscription expires, the analyzer reverts to the software version and options for which it was previously licensed.

For users and organizations that prefer to retain perpetual licenses, software upgrades (SW-UPG), software maintenance (SW-MAINT), and extensions (SW-EXT, sold with new analyzers only) remain available, but only include software options purchased for a given analyzer. New hardware-based analyzers are always sold with a perpetual license, however APx500 Flex can be purchased with either a perpetual license or a subscription.

www.ap.com



Acoustic Response measurement using Open Loop Fast Sweep in APx500 version 7.0.

SysCheck2 Intelligent Acoustic Sensor System

Danish measurement microphone specialists GRAS Sound & Vibration, now a part of Aximatrix Solutions, announced two new microphones with SysCheck2 functionality allowing for remote-controlled health check of an entire measurement chain. The new microphones are the GRAS 246AE 1/2" CCP Free-field Standard SysCheck2 Microphone Set, and the GRAS 246AO 1/2" CCP Pressure Standard SysCheck2 Microphone Set, both featuring self-verification.

SysCheck2 is a GRAS-patented technology for verifying measurement chain integrity. It is a tool that allows remote, rapid health checks on microphones, channel gain, and cable integrity, which enables users to quickly validate their calibration with a single click and no physical interaction. The technology is easy to set up with standard cables making it adaptable for any test setup.

The verifications are made on each SysCheck2-enabled microphone connected to a CCP power module with transducer electronic data sheet (TEDS) support and measurement software with a single click. It also provides on-demand environmental data regarding temperature, barometric pressure, and humidity.

SysCheck2 functionality adds value to production line setups, where it will help reduce downtime as well as increase efficiency and data reliability. It is essential for test setups when microphones are placed in dangerous or hard-to-reach locations as well as for distributed measurement setups where many microphones need to be validated in a short period of time.

Users of Audio Precision APx analyzers who want an integrated solution that is easy to set up and provides end-to-end self-verification will benefit from SysCheck2 seamless integration to AP's analyzers for a plug-and-play solution.



The new GRAS 246AE 1/2" CCP Free-field Standard microphone and the GRAS 246AO 1/2" CCP Pressure Standard, both featuring SysCheck2 self-verification.

In the first collaborative effort by the GRAS and AP engineering teams, full SysCheck2 functionality is ready for use out of the box when connected to APx500 release v7.0 Measurement Software with GRAS 12BA, 12BB, or 12BE (coming soon) power modules and an Audio Precision APx series analyzer, or with an Audio Precision APx series analyzer with CCP and TEDS read/write capability.

GRAS also offers full functionality by way of providing a software development kit (SDK). This makes all features easily accessible with a suitable CCP-based power module, analyzer and data acquisition system, depending on the software platform.

New SysCheck2 Microphones

Coinciding with the introduction of SysCheck2, GRAS released two microphone sets: the new GRAS 246AE measurement microphone for general use, and the new GRAS 246AO model, more targeted for audiology applications. Both are 1/2" CCP microphone sets, which are improved versions of GRAS 46AE and GRAS 46AO—with the added SysCheck2 functionality. GRAS 246AE and GRAS 246AO can both be accessed with many data acquisition systems and offer seamless plug-and-play operation with Audio Precision's APx data acquisition and Siemens Simcenter Testlab software.

The GRAS 246AE with SysCheck2 is a 1/2" free-field microphone set and, as such, is optimized for all acoustic applications where the location of the main sound source is known, and the microphone can be pointed directly at it ensuring 0° incidence. It is ideal for general acoustic testing and conforms to IEC 61094 WS2F and IEC 61672 Class 1.

The GRAS 246AO microphone with SysCheck2 is a 1/2" high-precision pressure microphone suitable for laboratory work and ideal for production line testing in coupler setups for test of hearing aids, earphones, headphones and headsets. It conforms to IEC 63181.

www.grasacoustics.com



An externally polarized condenser measurement microphone cannot work on its own. It needs to be connected to hardware that can act as an interface between the raw signal output and the data acquisition unit or measurement device. GRAS Sound and Vibration added six new power modules to power CCP or LEMO measurement microphones with seamless integration of microphone sensitivity via TEDS. The GRAS 12BE, 12BC, 12BF, and 12BD microphone power modules have the ability to take advantage of the latest GRAS SysCheck2-enabled microphones.

NTi Audio

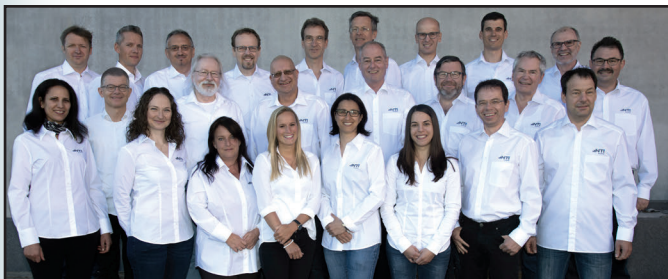
A Growing Ecosystem of Reliable Measurement Solutions

NTi Audio AG has been successfully growing, even during the difficult circumstances of the global pandemic. The company continues to expand its range of leading test and measurement solutions, including software development for its core products. In the company's recently expanded headquarters in Schaan, Liechtenstein, NTi Audio is seeing expanded development, production and sales activity, and the company received ISO14001 certification for its operations, underscoring its commitment to sustainability, with products that are as durable and as easy to repair as possible.

Among the reasons for the company resilience, its user-friendly and reliable product range continues to cover the demands in acoustics, audio, noise, and vibration applications, while more and more acoustics professionals are choosing to rely on NTi Audio for its calibrated and certified solutions, with worldwide support.

Since the company's founding, in 2000, following a management buyout from Neutrik of the existing Test Instruments department, NTi Audio established a strong reputation in the field of acoustic measurement technology with solutions that clearly met the needs of professionals globally. As an example, NTi Audio developed an entire software package for quality control of loudspeakers, which was based on a new, patented process for the automatic detection of audible defects. This decision helped NTi become a leading provider of quality control systems in the loudspeaker industry, with thousands of devices in daily use. The company also evolved its developments to meet acoustic measurements using portable audio measurement devices, originally by integrating a method for determining speech intelligibility in its first portable sound level meter, the Acoustilyzer and its successor, the XL2 handheld analyzer, which helped propel NTi Audio in acoustic, noise and vibration measurement applications.

The XL2 Audio and Acoustic Analyzer became a tool for acoustics experts as NTi expanded its support for professional Environmental Noise measurements and Room and Building Acoustics, with a complete ecosystem of calibrated hardware and certified software solutions.



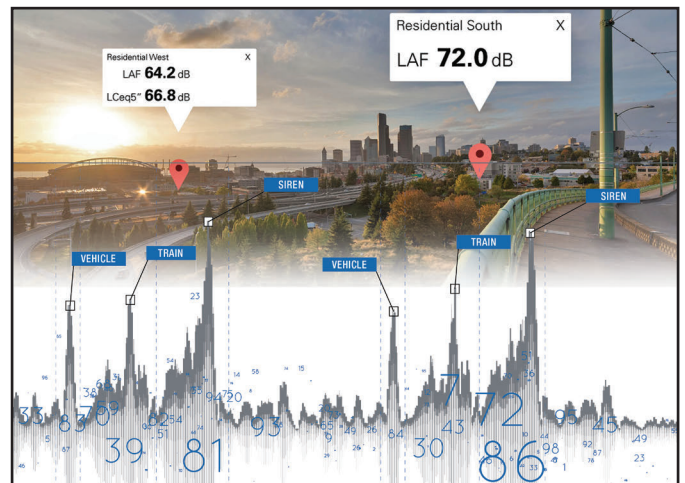
The NTi Audio team photo in 2020, celebrating 20 years of the company's founding, following a management buyout from Neutrik.

NTi Audio's most popular product, the XL2 Analyzer is a powerful Sound Level Meter supporting calibration according to the international IEC61672 standard. Each XL2 calibration is recorded with an individually numbered certificate, listing all relevant information about the tested sound level meter, and specifies the measuring equipment used during the test. The document also contains the detailed measurement results and an assessment of the test.

In order to reliably maintain the accuracy of a measuring system, periodic calibration is necessary. Many standards and quality systems require regular, documented calibration of the measuring equipment used; usually in a one-year cycle. NTi Audio offers this service, both at its headquarters in Schaan and at its international branches worldwide. Users can conveniently register a measuring device online for calibration and the website guides them to the nearest NTi Audio calibration center and provides information on costs and duration of service and transport.

AI for Noise Classification

NoiseScout is a complete noise monitoring solution from NTi Audio, which is also seeing increasing international adoption. Noise levels are recorded onsite by the XL2 Sound Level Meter and are available for remote monitoring and download. NoiseScout is aimed at both short-term noise assessments and long-term monitoring applications, with results displayed in a web browser and measurement data presented online in charts and dashboards. Multiple noise level meters can be monitored simultaneously within a map view, thus providing localized geographic visualization for all noise levels at a glance.



NoiseScout, the complete noise monitoring solution from NTi Audio, is now able to sample and compare sounds using AI and find pattern matches.

To assist in identifying the cause of a noise level alarm, NoiseScout now provides a text description of the content of the .wav files that are recorded during an alarm event. This is achieved using AI analysis and Noise Classification, which NTi Audio recently implemented. The AI-generated text indicates the possible cause of the alarm, and reduces the necessity to listen to the actual .wav file.

The .wav files of audio samples from intervals where levels were high are compared to a library of classified sound samples with a pre-trained audio event classifier that predicts audio events based on a dataset on the NTi Audio internal servers. The functions of this classifier form the central part of the newly implemented AI system. These functions use pattern matching to determine the closest matches between the current audio sample and the library.

The result is then weighted according to the sound pressure levels within the .wav file. Each pattern is assigned to predefined classes, and the class labels of the closest matches chosen. A score value is assigned to each match. The score is a measure of the accuracy and precision of a best-match classification aggregated across the whole .wav file. Scores are higher when there is less background noise. The text description and associated score are displayed when the score is greater than 20.

This AI analysis and Noise Classification assist in identifying the cause of noise level alarms, reducing the necessity to listen to the actual .wav file, and thereby saving time. Of course, the .wav files are still available for a more in-depth analysis.

New M2340 Class 1 Measurement Microphone

In 2021, NTi Audio announced a valuable new 1/2" measurement microphone option for the XL2. The new M2340 model is a development of the existing M2230, and is also a Class 1 measurement microphone, optimized for a flat, free-field response. In addition, the M2340 features self-verification circuitry and consumes significantly less power than the M2230. The M2340 contains the preamplifier and is an ideal omnidirectional solution for noise monitoring.

All microphones from NTi Audio for the XL2 Analyzer include an electronic datasheet. The Automated Sensor Detection (ASD) of the XL2 automatically reads this datasheet, and recognizes the microphone model, sensitivity, and calibration data. This ensures accurate measurement results.

But thanks to the System Self-test (Charge Injection Check—CIC) in the new M2340 microphone, the whole system used for measurements can be periodically verified and documented remotely. This is important in particular for stand-alone, remote-controlled measurement stations, which are usually employed

for long-term level monitoring. Any damage to the monitoring microphone overtime can be detected using this self-test feature.

With the Remote Measurement interface, the XL2 makes all commands to control the M2340 and to query the measured values available to the user, while the monitoring system (e.g., NoiseScout) handles recording of the reference spectrum, regular verification and generating appropriate alarms in case of a significant level change or error.

Low-noise circuitry has a low impedance and therefore consumes more power. The new NTi M2340 measurement microphone achieves a good compromise between power consumption and low noise. According to NTi Audio, compared to the M2230, the current consumption has been reduced by 66% to 0.8mA in the M2340. The noise floor increases by only 1dB, while the maximum processable sound pressure level has been increased by 1dB. This makes the M2340 most suitable for power-saving applications such as long-term measurement stations.

Software Improvements for XL2

NTi Audio's ongoing customer-driven policy of regularly introducing free functional updates to the handheld XL2 continues to increase the value for this already comprehensive and powerful portable solution. All XL2 Sound Level Meter owners received added support for the System Self-test (CIC) function of the new 1/2" M2340 Measuring Microphone.

Another innovation in the area of outdoor monitoring was the integration of the correction values for horizontal sound incidence when using the M4261 Measuring Microphone together with the WP61 Weather Protection kit. This means that in addition to the proven WP30 for 1/2" microphones (type M230 and M2340), a solution is now available that fits the M4261 Class 2 microphone.

The newly introduced support of the ANSI/ASA S12.2-2019 standard for noise curve measurements provides a solution for another field of application. This update is especially useful for users in the American and Asian regions that want to analyze noise in offices, etc.

And the XL2 Vibration Meter also recently received an update with an optimization of the automatic naming of recorded wave files. This is useful when analyzing data, as it makes it easy to detect, for example, overdrive during the measurement, and prevent undetected incorrect data.

Finally, if the Extended Acoustic Pack option is activated on the XL2, users are given the choice to select an A-weighted level, limited to the frequency range 20...200 Hz. This level can be used, for example, as an indicator of low-frequency sound at open-air events.

www.nti-audio.com



New NTi Audio M2340 Class 1 measurement microphone for the XL2



All XL2 Sound Level Meter owners continue to receive free functional updates that increase the value of this portable measurement solution.

Klippel

The New Klippel SCN Near Field Add-On (SCN-NF)

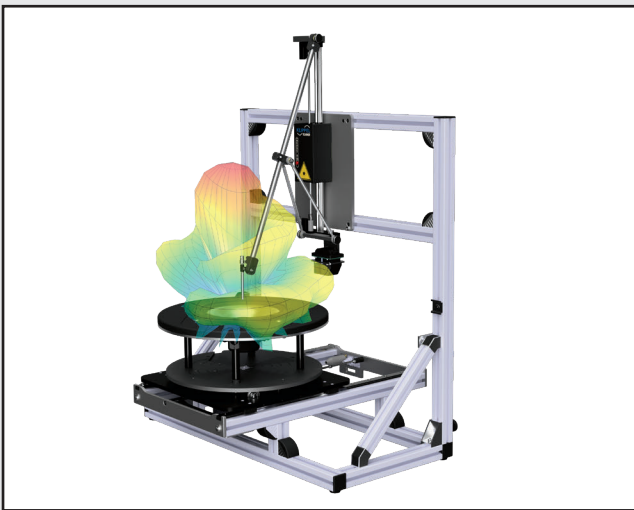
In 2021, Klippel released its new SCN Near Field Add-On (SCN-NF), which accurately performs all the most relevant transducer measurements on a single hardware platform.

The hardware add-on (SCN-NF) upgrades the popular Klippel Vibration Scanner hardware (SCN) to a Multi-Scanning Workbench for scanning with other useful sensors (e.g., microphones, probes, and magnetic sensors). Acoustic directivity scans can be done in normal (non-anechoic) rooms using the holographic Near Field Scanning (NFS) technology, while the large Near-Field Scanner (“Carousel”) allows both full- and half-space measurements, and the Multi-Scanning Workbench is focused on half-space configuration (using a round baffle).

This new powerful addition to the Klippel Scanning Vibrometer is a smart alternative to using an anechoic chamber, and the fastest way to get full directivity holographic measurements, extrapolate SPL to any point in 3D half-space and obtain balloon, contour, polar, and sound power plots.

The radiated direct sound into half-space is determined with high accuracy based on acoustic holographic methods also used in the Klippel NFS Near Field Scanner System, allowing the most relevant transducer measurements can now be done on the same hardware, in an average office room.

The SCN-NF adds 2pi acoustical measurement capabilities to the same Scanning Vibrometer platform used for laser scan diaphragm vibration. The SCN hardware is extended with a microphone in addition to the existing laser sensor. Automated axis control ensures repeatable, precise and fast positioning



SCN Scanning Vibrometer with the SCN Near Field Add-On. A round baffle allows removing acoustic shortcut and edge diffractions, reducing baffle vibrations to almost zero, and exploiting symmetry to speed up testing, among other benefits.

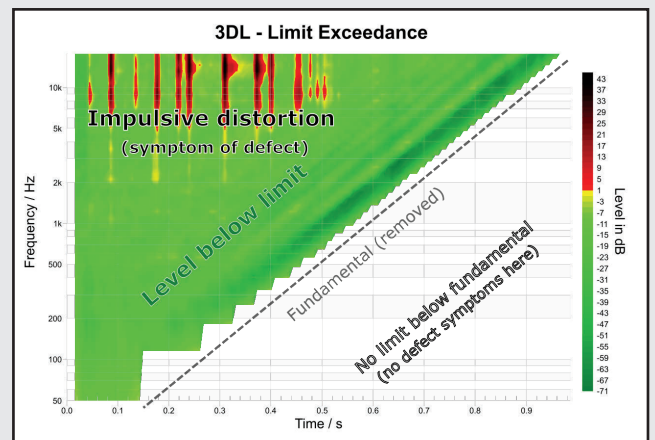
of the microphone and laser sensors, in combination with a round baffle for measuring transducers up to 10” (30cm) in diameter, or compact (smart) speakers.

Holographic measurements use a model based on spherical wave components, weighted by spherical harmonics and frequency dependent coefficients, providing a full solution for the acoustic wave equation. For this holographic model, multiple near-field sound pressure measurements are performed on the plane surrounding the sound source and used as boundary values. This holographic model then describes the radiated acoustic wavefield of the measured sound source in a tridimensional format. The multifunctional measurement device supports the IEC 60268-21 and IEC 60268-22 standards.

Klippel New dB-Lab Version 212

The Klippel dB-Lab software is offered in dedicated versions serving each application area. The latest major software update to its R&D and Quality Control (QC) platforms is an important expansion of the available tools in particular for speaker measurements, and brings many small but useful tools and updates to existing modules. The main software platform dB-Lab 212 now provides a shared sensor management with support for Klippel Multi-Scanning Workbench (formerly SCN) hardware, providing directivity, sound power, and room correction. The new MTON module offers comprehensive measurement of distortion, while the new linear simulation module LSIM complements the available simulation tools with more options for speaker and enclosure design.

For Quality Control, the Klippel QC software has also been upgraded with a new automation control interface and multichannel support for any Windows or ASIO audio interface, as well as wave-file-based open-loop testing.



Detected loose particle failure in 3D spectrogram limit surface; limit area defined by harmonic order of chirp signal.

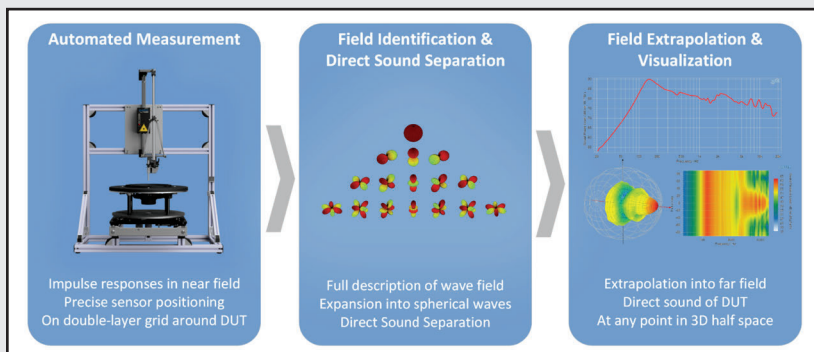
The updated software includes more flexible options for testing and synchronization and for smart or stand-alone audio devices.

Using the new Automation API software interface, complex test scenarios can be implemented and controlled. This API is the successor of the long existing IO-Monitor interface, which is still supported. It can be integrated easily in popular script languages (e.g., Python). The before-mentioned sensor management routine is available for Klippel analyzers, sound-card-based interfaces, digital audio devices and wave file analysis. Sensor files can be shared with R&D software and result charts are correspondingly scaled and labeled.

2022 Updates

Already in 2022, Klippel has released a first minor software update (free of charge) for the Klippel Analyzer System introducing new features for both the dB-Lab 212 and QC7 (R&D and QC) applications. The Time Frequency Analysis (TFA) module is dedicated to the analysis of waveform signals from Klippel test data or any imported .wav file in time and frequency domain and now it received a major revision and feature update. In addition to the spectrogram analysis options based on Short-Time Fourier Transform (STFT), wavelet or auditory filter banks with superior time resolution, this powerful post-processing tool now also provides an interactive bandpass filter and playback function for subjective distortion analysis and diagnostics. Replacing the obsolete PLAY module, the TFA can now load even long .wav files in order to obtain signal characteristics and pick a time range for detailed analysis. Overall performance and usability were improved.

Now officially released, the QC 3D Spectrogram Limits (3DL) is an offspring of the TFA, dedicated to the particular requirements of QC testing. This add-on for the chirp-based Sound Pressure Task (SPL) of the Klippel QC software uses the auditory filter bank shared with the TFA to generate a



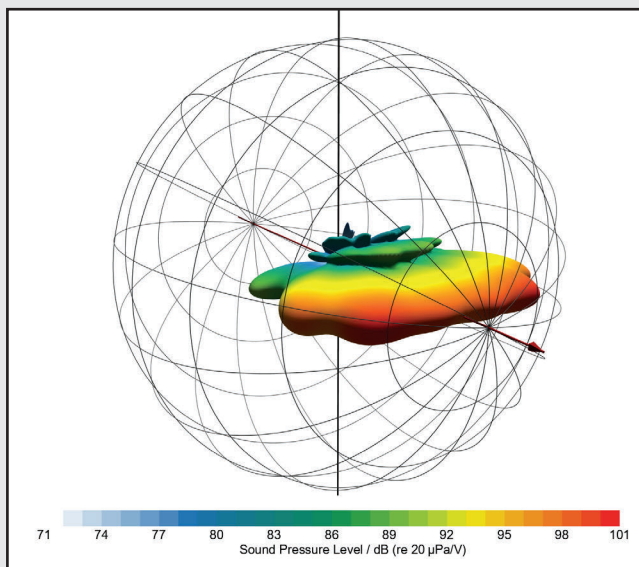
Methods and results using holographic measurements with the Klippel Multi-Scanning Workbench.

time-frequency plot of the measured DUT response. Applying automatically generated “3D spectrogram limits” based on golden reference DUTs reveal the signature of any irregular distortion and abnormal sound caused by loudspeaker defects. Any values exceeding the limit threshold are highlighted clearly in the spectrogram. In addition to the well-established Rub & Buzz measurement in the time domain (impulsive distortion, IEC 60268-21), the 3DL provides new benefits, such as detecting abnormal behavior anywhere in the spectrum, identifying external (uncorrelated) disturbance, detailed defect root cause analysis, as well simplified Rub & Buzz filter settings.

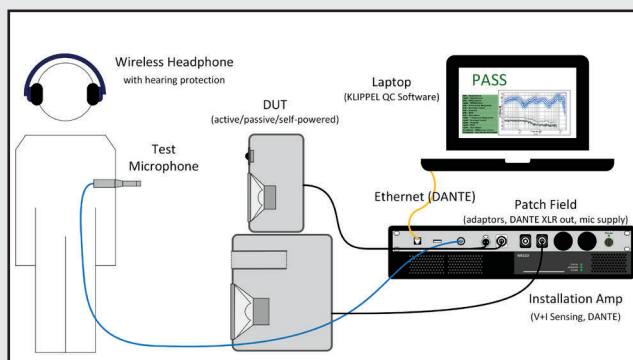
The QC Stand-alone Software version is dedicated to all testing applications that do not require the Klippel Analyzer Hardware. Together with the External Synchronization (SYN) trigger add-on, this solutions is highly suitable for any closed loop (third-party test frontend) and open-loop (.wav-file based) test scenario. It only requires any device running Windows and a Klippel USB license dongle.

In addition to output-based audio testing according to IEC 60268-21, the QC Stand-alone solution now also supports all remaining tasks of the QC software based on voltage and current measurements such as Impedance (IMP) for Thiele-Small (T-S) parameter testing and Motor + Suspension Check (MSC) for patented nonlinear parameter testing (e.g., voice coil offset). This allows creating powerful and yet price-efficient test setups using smart amplifiers with built-in voltage and current sensing, such as the Powersoft Mezzo series, using a Dante network connection for professional quality control in cost-sensitive applications (e.g., rental companies, service stations, etc.).

www.klippel.de



Balloon plot generated with the new NFS visualization in dB-Lab



Klippel QC Stand-alone Software setup example

Outline

New Speaker and Acoustic Measurement Solutions

Recognized globally for its innovation and manufacturing quality, Italian loudspeaker manufacturer Outline is a respected name in the global sound reinforcement industry. Founded in the northern Italian city of Brescia in 1973 by Guido Noselli, Outline's continued development of loudspeaker technology created numerous innovations and milestone designs in professional audio.

As a result of five decades of continuous research, Outline has produced the ET250-3D turntable, a "transversal" measurement instrument that provides the data for precise analysis of a loudspeaker's characteristics. Initially conceived for in-house use exclusively, the turntable design evolved to become an industry standard, in daily use by some of the world's largest technology companies and also by many loudspeaker manufacturers, as well as universities and research institutes throughout the world.

High-profile users include Apple, Google, Amazon, Microsoft, Intel, Lucasfilm, Dolby, MIT, and many more, where it is used on a daily basis to measure everything from antennae, solar panels, hearing aids, and smart devices to loudspeaker systems and transducers, mobile comms devices, microphones, domestic appliances, and even medical equipment.

The original turntable concept of a high-precision, computer-controlled turntable capable of placing significant loads with perfect accuracy in a measurement environment has now been further developed, with the creation of two new models to suit different speed and load requirements.

The Outline ET50-3D and ET250R2-3D turntables both feature a new Ergal aluminum hardware design, which achieves military-spec mechanical resistance while considerably reducing the overall weight. Additionally, both feature a wider choice of rotation speeds with enhanced maximum handling loads and a simple user interface with an input/output communications port based on TTL signals. However, the key to their accessibility, data acquisition, and control is the network interface, allowing remote control via standard Ethernet protocols—an area that Outline always pioneered for its speakers and line array systems.



Outline's ET System measurement turntables are available in the ET50-3D and the ET250R2-3D models to suit different speed and load requirements.

Each turntable has an individual IP address and the user simply connects this to an existing LAN to control it via the provided software or via one of several third-party measurement systems. Control libraries for Matlab and Python are available and both devices are controllable by any software with Ethernet control capabilities.

This facilitates automated polar measurements via seamless integration with various measurement software suites, including Audio Precision, Audiomatica's Clio, Listen Inc.'s SoundCheck, Klippel, NTi Audio, and ARTA. The combination of Outline hardware and the user's choice of control software enables precision placement of the object under test, with repeatability and accuracy of the test results.

As with all Outline products, the ET50-3D and the ET250R2-3D measurement turntables are engineered and manufactured to the highest standards, with the models capable of safely and accurately orienting loads of up to 200kg (440 lb.) and 1000kg (2200 lb.) respectively.

Globe Source Radiator

Designed in collaboration with the Department of Mechanical And Industrial Engineering at the prestigious Brescia University in Lombardy, and engineered in Italy by Outline, the new Globe Source Radiator (GSR) high-power omnidirectional sound source solution provides a vital tool for acoustic analysis. Complemented with the Outline NG01 noise generator that can be controlled with a radio remote control, and the portable Outline L3000 DSP amplifier, the



The Outline Globe Source Radiator (GSR) is a high-power omnidirectional sound source that helps eliminate diffractions, reflections, and other anomalies, which can compromise the accuracy of data measurements.

GSR offers a high-SPL solution for acoustics measurements in all environments, including large venues and spaces.

The Outline GSR is a high-power omnidirectional sound source that delivers a perfectly spherical and physically robust design, generating a homogeneous sound field from its specially shaped loudspeaker membranes to assure perfect isotropic directivity.

Numerous essential acoustic parameters may be derived from measurements made using it as a sound source. These include Clarity Indices (C50, C80), Intelligibility Indices (AICons, STI, RASTI, etc.), Reverberation Time (RT60), Early Decay Time (EDT),

Soundproofing Power, Impulse Response and Intensity (G), and others. The Outline GSR solution is also fully ISO10140, ISO354, ISO3382, and DIN 52210 compliant.

Crafted out of top-quality void-free birch ply and finished in super-tough polyurea coating technology, the robust spherical enclosure features an Ergal aluminum inner structure that houses 12 5" neodymium-magnet transducers and is the first such device to include a bass reflex design to extend its frequency response. The GSR's custom-designed transducers feature high power-to-size ratio Neodymium magnets with additional ferrofluid cooling, thus increasing thermal power dissipation and making it possible for the GSR to handle up to double the power of conventional loudspeakers.

Rated for 1000W RMS (4000W peak) total power handling, the Outline GSR is capable of producing a maximum SPL of over 130.3 dB, a figure far in advance of any other comparable product presently available and a remarkable output from a spherical loudspeaker only 31cm in diameter.

The GSR is also available as a part of a complete user-ready kit, comprising a GSR, NG01 Noise Generator, Outline's L3000 DSP compact amplifier plus all the necessary cables, a transportation bag, and a set of mounting accessories, providing a portable setup ready for immediate deployment. The Outline NG01 noise generator can be controlled with a radio remote control and delivers White or Pink noise with XLR balanced outputs. A dedicated self-powered subwoofer kit is also available and is suitable for applications where measurements of low frequency data are required.



The Outline GSR kit includes the NG01 Noise Generator and L3000 DSP compact amplifier.

www.outline.it/measurement

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Distortion Analyzer

Signal Generator

Bode Plot

Vibrometer

Sound Level Meter

Frequency Counter

Device Test Plan

LCR Meter

Data Logger



Virtins Technology
www.virtins.com

Ellisys

Advanced Bluetooth LE Audio Capture and Analysis Features

Ellisys, a leading worldwide provider of test and analysis solutions for Bluetooth, Wi-Fi, USB, Thunderbolt, and other wireless and wired communications technologies, supports the development of emerging Bluetooth LE Audio products, including controllers, stacks, and devices. Since the announcement of the Bluetooth LE Audio specifications in January 2020, the company's Bluetooth protocol analysis systems have been continuously expanded to support developers.

Ellisys Bluetooth test and analysis solutions are used by developers and test labs worldwide. The company's solutions include the Ellisys Bluetooth Qualifier (EBQ) platform, and several protocol analyzer tools supporting both Bluetooth radio types—Low Energy and Classic (BR/EDR). EBQ is a comprehensive compliance, validation, and development system for Bluetooth technology, targeting the behaviors of the lower communications layers, including implementation of nearly 2,000 test cases. Ellisys protocol analyzers include the ubiquitous Tracker, Explorer, and Vanguard systems, offering deep features sets designed to meet a variety of requirements.

Features supporting Bluetooth LE Audio specifications include the new tzero tracking technology for full and accurate capture of isochronous traffic on connected and broadcast links, an innovative auto-detection capability built into a test equipment grade integration of the power-friendly LC3 audio codec, and support for several new audio profiles.

LC3 and CNew Specs

The Low Complexity Communications Codec, or LC3, is particularly ideal for Bluetooth Low Energy as it provides a high degree of quality, even at its lowest data rates. Support available on all Ellisys Bluetooth analyzer models, includes detailed decoding for LC3 traffic, together with a new feature, based on an Ellisys-designed, test equipment grade LC3 codec, which allows for automatic determination of advertised LC3 configuration parameters.

Historically, test equipment implementations have required a complete and error-free capture of (wirelessly transmitted) audio codec configuration parameters to properly capture, characterize, and

replay audio. With this auto-detect innovation, even with otherwise critical configuration packets corrupted by interferences or low signal strength, LC3 audio is still recognized, understood, captured, and available for further analysis.

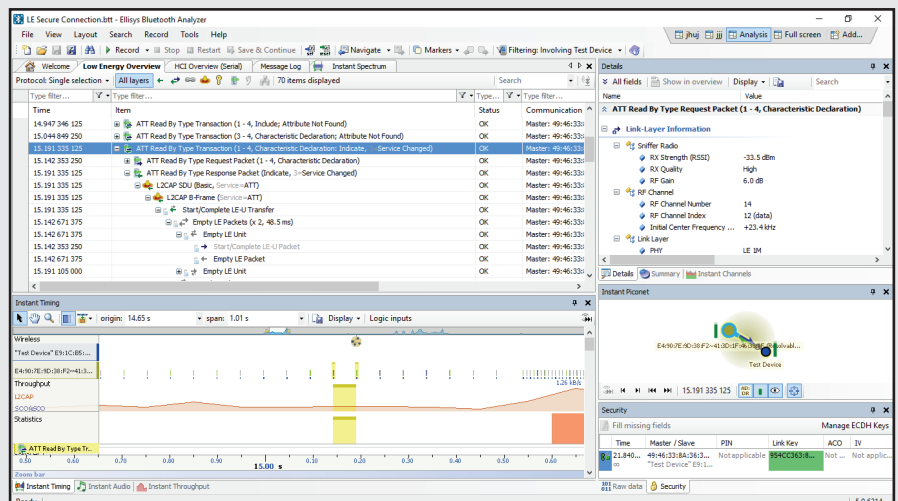
Additionally, Ellisys added support for several recently released audio specifications that define services and profiles that can operate over Bluetooth Low Energy atop its GATT protocol. These include:

- Audio Input Control Service (AICS)
- Volume Control Service (VCS)
- Volume Offset Control Service (VOCs)
- Basic Audio Profile (BAP)
- Audio Stream Control Service (ASCS)
- Media Control Service (MCS)
- Telephone Bearer Service (TBS)
- Coordinated Set Identification Service (CSIS)

Bluetooth 5.3 Specification

With the release of version 5.3 of the Bluetooth Core Specification in July 2021, Ellisys also released a new suite of validation tests, called the Quality Suite, that exceed the scope of qualification test requirements defined by the Bluetooth Special Interest Group (SIG).

This latest version of the specification adds several new core features, including power-saving enhancements, security updates, and channel selection improvements. With the initial release of the Quality Suite, Ellisys extended its



Ellisys Bluetooth Tracker Software

complement to nearly 2,000 tests. While adherence to the requirements defined in the latest Test Case Reference List (TCRL) from the Bluetooth SIG, goes a long way toward ensuring Bluetooth interoperability and performance goals,



the addition of the Quality Suite takes that a step further by covering test areas not defined by the TCRL. Many of these tests are implemented based on suggestions from the Ellisys customer base, and most focus on later-generation Bluetooth features.

Both test suites are available on the Ellisys Bluetooth Qualifier (EBQ) dual-mode radio controller development and qualification test system. The EBQ is available from stock to Bluetooth SIG-recognized test labs, known as Bluetooth Qualification Test Facilities (BQTF) and Bluetooth Recognized Test Facilities (BRTF), and to Bluetooth SIG member companies involved with radio controller and IP development. Ellisys protocol analyzer systems are available from stock either direct from Ellisys or from authorized distributors worldwide.

www.ellisys.com

QuantAsylum

Fourth Generation Audio Analyzer

QuantAsylum, the manufacturer of audio test and measurement equipment based in the Seattle, WA area, announced the release of the QA403 Audio Analyzer. This is the fourth audio analyzer released by the company since 2012 and shows the ability of its founder, Matt Taylor, to understand the needs of the industry, managing well the difficult circumstances of the disruptions in the supply-chain caused by the global pandemic. As with many other manufacturers, QuantAsylum was severely constrained by

silicon shortages in 2021, and expects that to continue through 2022. The design of the QA403 Audio Analyzer takes components constraints into consideration to minimize the risk.

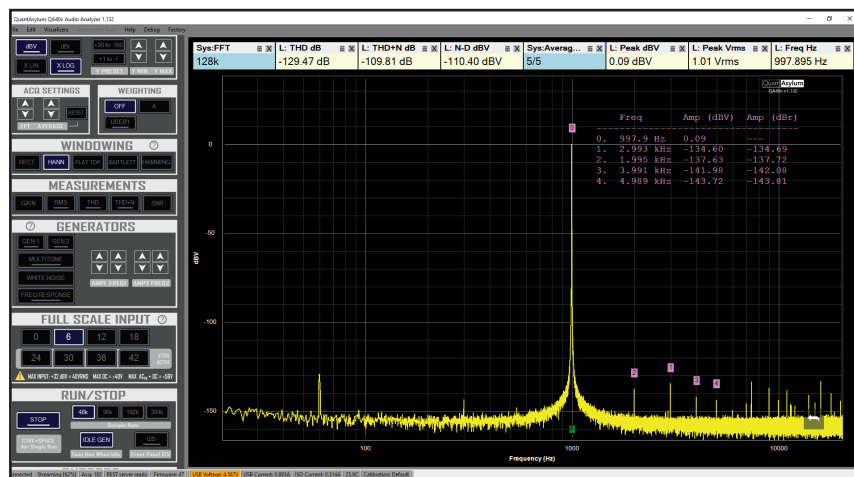
The new QuantAsylum QA403 design delivers up to +18dBV output (8Vrms, or 16Vrms balanced) in four ranges and accepts inputs up to +32dBV in eight ranges. Software is included and supports all common audio tests, including SNR, THD, THD+N, Frequency Response, RMS and amplitude measurements. The seamless environment means compact analysis without calibration in a USB-powered hardware package measuring just 177mm (W) x 44mm (H) x 97mm (D) or (7" x 1.75" x 4") and about 450 grams.

Front panel connectors include differential inputs and outputs and an expansion connector permitting I²S and I²C control of customer board-level hardware. Typical performance figures are about -110dB for THD+N, and -120dB for THD in loopback.

The target market for the product is companies wishing to put a programmable and cost-effective audio analyzer on more of their engineer's desks or in the factory. The software doesn't require a license, making it easy to move setups between home and work, or between the lab and the factory floor.

Following QuantAsylum's philosophy, programmability also makes it easy to write test applications in C# or Java or Python, or any language that can perform HTTP GET and PUTs. Additionally, built-in tests make it easy to perform a range of swept measurements quickly without any coding.

At the time of writing for this edition of *audioXpress*, shipping is expected to start in the second half of February 2022 and the company is taking orders placed on the website. The price is \$549 USD.



The QA403 software package allows quick access to common measurements with the main controls contained within a single graphical panel.

www.QuantAsylum.com

ZUMI Systems

Headphone Testing for Development and Production

ZUMI Systems, a company based in Sendai, Japan, has been focused on providing complete measurement hardware and software systems targeting the needs of product managers and production quality control at a competitive price. The company’s range of audio test systems are being used extensively in production testing with Tier One headphone factories in China.

ZUMI’s headphone test and measurement platform is based on a purpose built proprietary embedded system optimized for these demanding requirements. This platform allows ZUMI to design testing systems adapted to very specific products at a lower cost.

Since 2018, ZUMI delivered its latest generation HPA85 test system, a fully integrated measurement instrument for headphones and earphones, which can be easily configured for different form-factors and using different ear couplers and simulators. The system executes complete QC measurements in a short amount of time and can automatically process ANC measurements and trimming. Best of all, it does not require advanced training to use.

As ZUMI Systems intended, this self-contained test solution is proving to be easy to use for production line testing and quality control, as well as running standard tests for product development.

In Daily Use

Based on testimony from multiple brands and factories currently using the ZUMI HPA85 test system in China, the solution has now been widely proven with multiple product categories and volumes, and is also used for product development situations, such as the characterization of filters for frequency response and ANC optimization.

ZUMI Systems’ products are distributed by dB Enterprises,

operating from Hong Kong, and the company’s CEO David Lindberg chatted with some of the companies using the ZUMI HPA85 solution in China.

ONANOFF is a company based in Hong Kong, that focuses on essential, easy-to-use electronic accessories and lately is focused on headphones for children—a product category with very stringent requirements. Kieran Pollard, Brand Manager, chose ZUMI systems as its primary tool for development of wired, Bluetooth, and ANC feedback headphones and is now working on new hybrid ANC designs that have even more demanding specifications with which the HPA85 is able to meet, including testing prototypes for Bluetooth performance, battery life, and ANC feedback, feedforward, and hybrid profiles in a single system.

ONANOFF uses the ZUMI HPA85 at its headquarters in Hong Kong and at its factory partners. In those production operations, the systems benefit from the ability to log system activity and measurement data for analysis and quality control.

“ONANOFF is bringing a lot of new products to market every year. With ZUMI, I can personally switch on the system and be testing within 5 seconds. Apart from development tasks, it allows me to measure competitive products and produce measurements for marketing,” Pollard explains. “A good example of this would be earpad qualification. It is a headphone part that has key performance in acoustic, comfort and cosmetics. I can get a bunch of samples from our earpad vendors, discuss the cosmetic and comfort decisions with the



The ZUMI HPA85 headphone test system in use in a factory in China



Production line testing and quality control of headphones from ONANOFF



Testing planar magnetic headphones at TrueAnalog Strictly OEM in Guangzhou, China

industrial design team, and measure them in the lab for the acoustic seal.”

“We now use the ZUMI system across the factories we work with, because we can have a non-technical person trained to produce a frequency response curve and benchmark or compare samples in 20 minutes. It is convenient and easy to use.”

The only pending request from ONANOFF is for the system to have a connection for a (larger) external monitor, which is something that will soon be available, via USB.

Other ZUMI clients report the same ease of use and convenience and recommend it for use in production. Colin Ward of 1dBfs, a contracted engineering manager, uses it for

frequency response testing, and phase testing. “The ZUMI is a basic tool that is very easy to deploy in factories and get operators testing quickly. It’s easy to set up and use, delivers clear results—quick pass/fail criteria and understanding the errors if there are any—and is low cost. You do not need to be an engineer to use it or to even program things like parameters. In short, it is a useful tool that works very well in mass production applications.”

Another testimonial comes from Philip Richardson, the CEO of TrueAnalog Strictly OEM, a loudspeaker driver and system manufacturer based in Guangzhou, China. The company specializes in the design, engineering, and manufacturing of driver units and turnkey systems. The company has been using the ZUMI HPA85 for development and testing of a planar magnetic driver for headphones. Before production, TrueAnalog used it to customize the headphone drivers to customer specifications and now it uses more units for production line test and quality control. “ZUMI is well oriented for use by a production line worker that can press a button and go. What I like about it is that the microphones are built into the head unit and we can just slide the headphones on easily. We use it for frequency response, and I like that it gives us an immediate comparison of the left and right signal in a system that is color coded. Plus, we can add our tolerances so in production the operators just watch for the red or green light. We have to say that we are overall impressed with this unit. It makes our life easier.”

www.db-ent.com
www.zumisystems.com

Listen, Inc.

New SoundCheck Updates and AmpConnect 621 Multichannel Audio Interface

In 2021, the SoundCheck 19 release of Listen, Inc.’s flagship audio test and measurement system added powerful advancements for users making multichannel measurements,



In 2021, Listen introduced important updates to SoundCheck and the new AmpConnect 621 Hi-Res Multichannel Audio Interface.

including a new multichannel RTA and WASAPI-exclusive mode. The inclusion of room acoustics measurements offers increased capability for those looking to evaluate devices in real-world situations. Many of these features also add value on the production line, minimizing setup time, reducing the chance of user-error, and ensuring smoother operation in automated situations. The SoundCheck 19 announcement also coincided with the availability of Listen’s new high resolution multichannel interface, AmpConnect 621.

In the updated software, the multichannel RTA feature allows displaying multiple channels or signal paths and the spectrum settings such as gain, octave band, weighting, averaging and time-weighting, all independently configured for each channel for complete measurement flexibility.

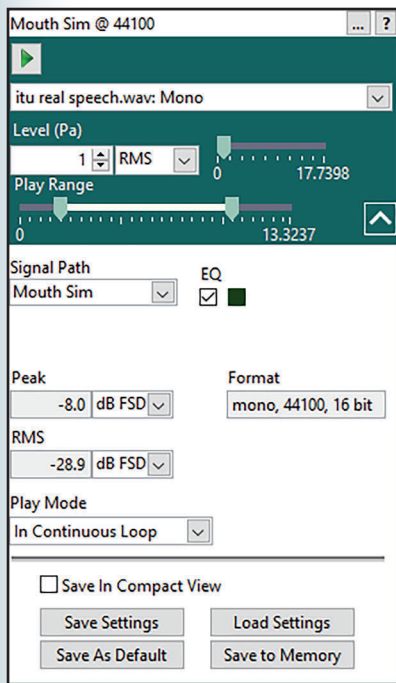
A power averaging calculation on the signal paths can be used for spatial and sound power measurements and all multichannel RTA functionality can also be used within a test sequence for automation. The ability to display multiple channels or signal paths presents a convenient view of many measurements across a wide range of applications. These include overlaying left and

right earphone responses to check for fit and seal, microphone array captures (e.g., in-vehicle cabin measurements), real-time adjustment of active noise cancellation filter, and more.

The new RT60 Room acoustics module in SoundCheck 19 offers extremely fast measurement of the reverberation time (signal decay time) and clarity (ratio of early reverberations to late reverberations) of any room or space. This functionality is useful for quantifying how speakers will interact with the acoustics of a particular type of room. The integration of the RT60 functionality within SoundCheck provides the user the assurance that measurements can be performed with calibrated signal paths.



The new AmpConnect 621 multichannel, multifunction, high-resolution audio test interface includes all the functionality required for audio testing in just one unit, including an amplifier, microphone power supply, line outputs, and digital I/O. And with a sample rate of up to 192kHz, it supports measuring high-resolution audio designs.



SoundCheck's new Signal generator

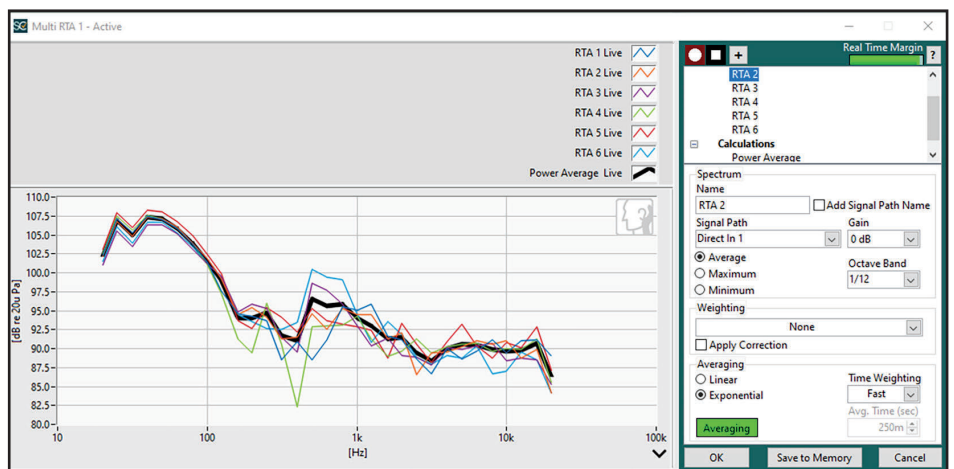
Another SoundCheck 19 enhancement is the option to use WASAPI-exclusive mode with Windows 10 audio devices. This advanced interface offers superior communication with audio devices, allowing SoundCheck to bypass the Windows audio engine, and send audio streams directly to the device. This delivers lower latency and ensures that sample rate conversion from the built-in Windows audio engine will not occur. It also enables SoundCheck to put an exclusive lock on the audio interface so that a measurement cannot be disrupted by system sounds. The ability to use multiple WASAPI devices simultaneously offers significant advantages for multichannel applications, particularly where the channel count requires multiple audio interfaces. WASAPI and ASIO devices can be combined to increase channel availability.

In both Windows and MacOS, SoundCheck now allows the Dock USB Controller Knob to be used to adjust the SoundCheck Signal Generator, simulating the feel and control of operation of a traditional manual analog signal generator. Used with other virtual instruments such as the RTA, spectrum analyzer and distortion meter, this offers a rapid way to identify defects by observing the response while manually fine-tuning the signal generator.

Listen AmpConnect 621

AmpConnect 621 is Listen's new high-resolution (up to 192kHz) multichannel audio interface, specifically developed for test applications such as automotive measurements with a six-microphone array, sound power measurements, or for measuring devices with multiple speakers (e.g., smartphones or soundbars). And it is also a great choice for measuring headphones and hearables.

The new AmpConnect 621 was designed with a clean front panel, with no buttons or control knobs, and showing only LED status indicators. It features six inputs, two line outputs, and one amplifier output. All inputs offer microphone power (SCM, IEPE and pre-polarized), to accommodate many types of couplers, accelerometers and reference microphones—even the new Brüel and Kjør 5128 high-resolution head-and-torso simulator.



Power Averaging shown on SoundCheck's new Multichannel RTA, introduced in SoundCheck 19, and now upgraded with real-time calculations

In addition, AmpConnect 621 also includes microphone power, full TEDS calibration support, impedance measurement and digital I/O in a single USB-connected unit. Designed for seamless integration with SoundCheck, it is controlled exclusively via the SoundCheck software. True plug-and-play makes configuration automatic and extremely fast whether it is a single installation or a large scale factory implementation; and there are no front panel buttons, eliminating the possibility of accidental changes to the settings.

Setup and configuration of AmpConnect 621 is extremely simple and fast with full plug-and-play functionality and TEDS support for automatic identification, configuration and calibration of microphones and accelerometers.

The two line level outputs plus a separate 50W amplifier route the output signal to any sources, powered or needing amplification, (e.g., artificial mouths, speakers, headphones, and automotive head units).

Impedance measurements using the amplifier output, along with output voltage monitoring, are performed entirely internally and do not require using any of the six external input channels, leaving them open for other measurements. This, along with digital I/O, simplifies operation as signals are all routed internally with no additional cabling required. The device connects to the computer with a single USB cable; the only additional cables required are those connecting the microphones and DUTs. This all-in-one approach offers improved ground loop immunity in comparison to discrete components.

As with Listen's other hardware products, AmpConnect 621 is built to last in production environments. The 2U rack-mountable unit is rugged with a new fingerprint-resistant matte finish.

SoundCheck 20 Introduces Perceptual Rub & Buzz Algorithm

Scheduled to be available by the time this edition of *audioXpress* is distributed, the new SoundCheck version 20 is the culmination of two years of original research by the Boston, MA-based audio measurement company and places this solution ahead of the industry in scope and depth of features. SoundCheck 20 contains a wealth of new features and enhancements for both production line and R&D users, particularly those making multichannel measurements. Significant developments include a new enhanced perceptual Rub & Buzz detection algorithm, which offers unrivaled repeatability and reliability.

The new enhanced perceptual Rub & Buzz (ePRB) algorithm is based on Listen's industry-standard 2011 Perceptual Rub & Buzz algorithm, with refinements that offer improved listener correlation and significantly better noise rejection. This makes limit setting easier and increases reliability, especially in production environments. This algorithm measures perceptual Rub & Buzz at the same time as all other end-of-line measurements with a single stepped sine wave stimulus, enabling this valuable analysis to be added to production line tests with no extension in test time.

Meanwhile, the multichannel RTA, initially introduced in 2020, was upgraded with real-time calculations such as curve addition, subtraction and averaging. This is useful

for real-time multichannel testing such as power averaging of in-car maximum SPL measurements, and viewing ANC attenuation in real time. Static and live curves can be shown simultaneously on the same axes or on multiple graphs.

Updated Signal Generator, POLQA, and Communication Testing

A redesigned signal generator offers a new user interface for easier operation, and additional functionality, particularly for users testing with WAV files such as speech and music. For example, the start and stop time of a .wav file can now be selected either using time, or an analog slider. This makes it fast and simple to review particular artifacts of a long waveform. Precise user determination of the delay between multiple signal generators enables phase to be accurately controlled and accounts for the distance between loudspeakers.

An optional Perceptual Objective Listening Quality Analysis (POLQA) module brings the POLQA algorithm right into SoundCheck, where it can be used for perceptual measurements of speech degradation in communication applications ranging from telephones to smart devices. It may be used to assess the impact of noise reduction algorithms, evaluate Bluetooth degradation due to packet loss, or to analyze distortions introduced into the audio path.

New stimulus steps and post-processing capabilities have also been included to support Doubletalk measurements on communications devices. These include a silence stimulus step, and RMS level versus time and histogram post-processing steps. A pre-written test sequence for measuring Doubletalk is also available. Written by telecoms expert John Bareham, this sequence categorizes Doubletalk performance to two international standards, ITU-T P.502 and ETSI TS 126 132.

www.listeninc.com



Comparison of Listen's new Enhanced Perceptual Rub & Buzz (ePRB) Algorithm (lower) with the original Perceptual Rub & Buzz (PRB) Algorithm (top)