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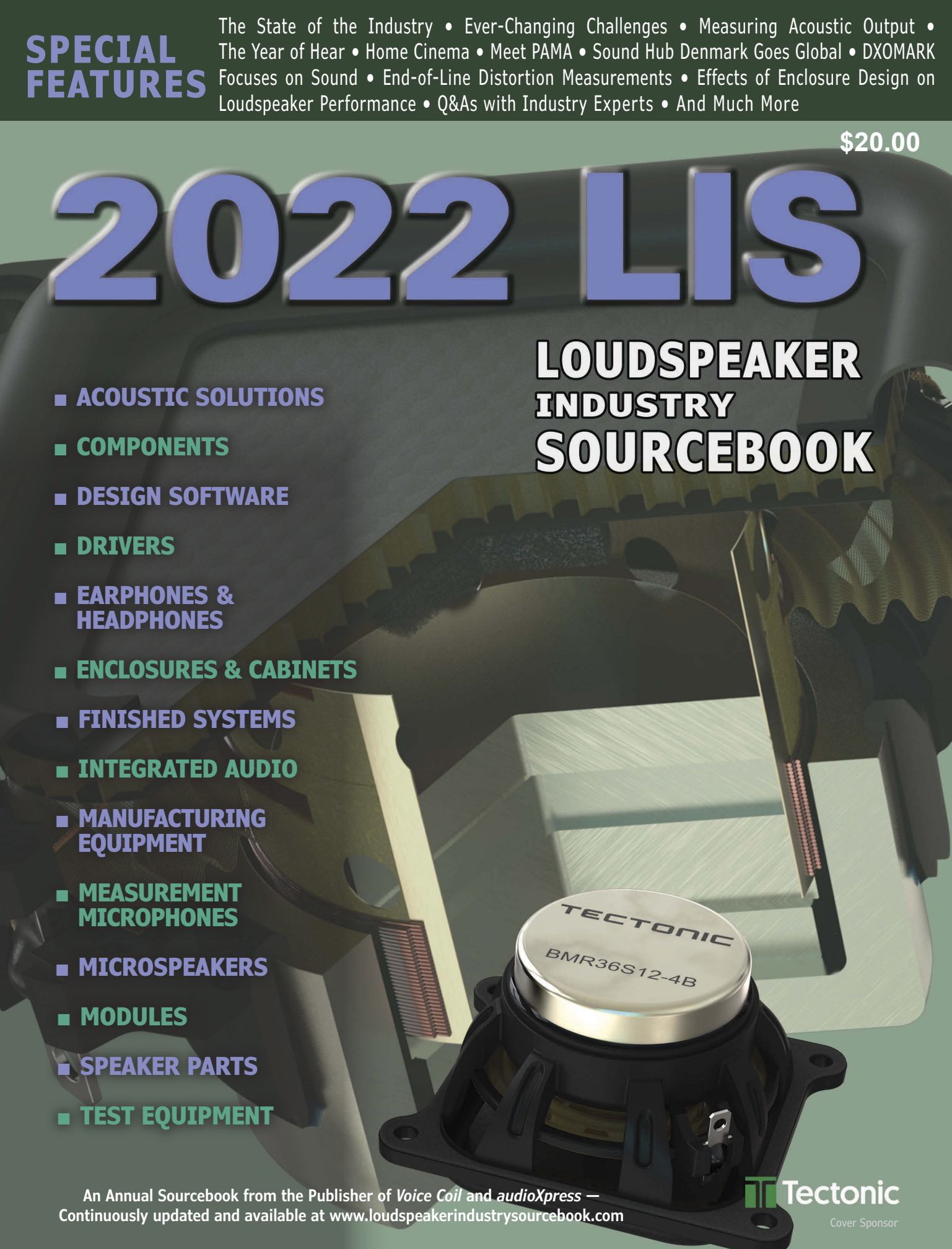

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Tectonic Audio Labs is a rapidly growing IP and Engineering company supplying and licensing BMRs across a wide range of markets including consumer electronics, unified communication, gaming, fitness, smart speakers/IoT and automotive.

—Tectonic Audio Labs

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2022

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Some companies did not complete a listing request, but their relevance in the loudspeaker industry should be noted. KCK Media Corp. is publishing these listings as a courtesy to contributors of the loudspeaker industry and is not responsible for any error or omissions to the directory listings/company information.

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Sourcing for Sustainability

We are living in interesting times. From an era of prosperity, excitement, and growth, suddenly the global economy and geopolitics have imposed new challenges, which naturally condition all industries. But the world has already shown multiple times that some things will not change, and one of those is our reliance on technology and connectivity. That's probably the reason why music is so universal, because it bonds the world together—and audio technology is the vehicle to create that connection. As noted in this issue, the volumes of speakers and related products sold every year continues to increase year after year due to that global connection. Even in times of a global health crisis, severe supply chain disruption and rising costs, the audio industry continues its pace of innovation and expansion. Audio touches more lives than it ever did globally, and speaker technology is now more intrinsically connected to our personal lives, being essential for entertainment, communication, and enhancement of our senses.

The Loudspeaker Industry Sourcebook (LIS) in its printed edition has been established for the past 26 years and helped create a solid connection between the many businesses and professionals that make up this industry. Now greatly reinforced with its online resources available and updated year-round.

As music connects the world, in this kindred society, LIS becomes the loudspeaker manufacturing professional's indispensable resource. Because as the past three years of the pandemic have served to show, contacts and knowledge are more important than ever, and it is imperative that the industry works together.

2022 is a time of appreciation for the many companies that helped sustain the industry during challenging times. It's painfully obvious that resilience and sustainability in our industry implies knowing our business partners and suppliers and valuing their skills, efforts, and contributions. The dynamics of audio manufacturing are continuously changing and technology innovations are changing product development and production, and inevitably sourcing. This is reflected in the pages of this industry publication and its directories, which are submitted online and compiled once a year to generate the printed edition. As the industry has evolved, the scope of the directory also continues to expand. And that dynamic is what makes it an essential reference resource for everyone working in R&D, manufacturing, sourcing, product management, technical support, marketing, or sales in the loudspeaker and related industries.

—The LIS Staff

The State of the Loudspeaker Industry 2022

In previous editions of the *Loudspeaker Industry Sourcebook* we have invited market research firms to share an overview of the market and the many trends that influence the loudspeaker and audio industries. This year, due to the unpredictability of the overall supply chain and market demand fluctuations over the past two pandemic years, we've decided to compile our own state of the industry review.

By
J. Martins

Unfortunately, in 2021/2022 we have yet to find any significant reports and market intelligence regarding the loudspeaker industry. In part, that is due to the fact that market research firms tend to focus on the most lucrative market research in the IT, telecom/mobile, and generic consumer electronics. And very few companies report sales volumes or turnover related to specific categories. But mostly, this has to do with those organizations simply being unable to collect relevant data under the constantly changing conditions of the past two years—where their existing groundwork research was suddenly made worthless.

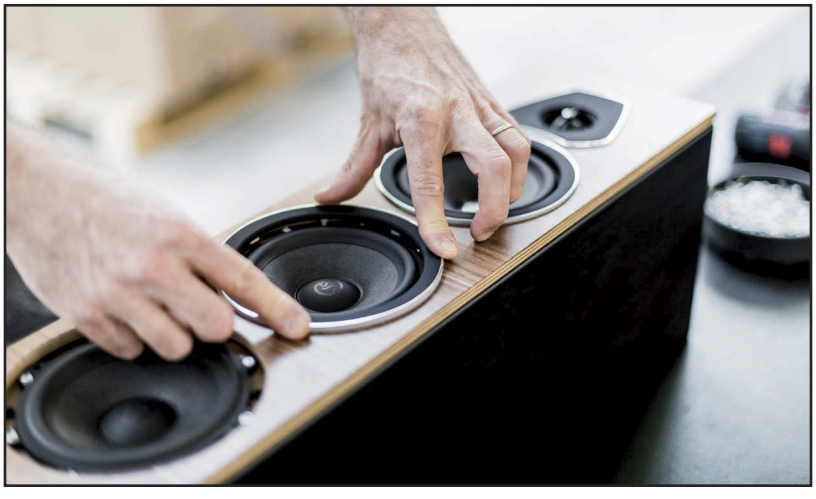
Since the beginning of the pandemic and all the major disruptions to the global economy that ensued, market research firms have been struggling to update their market intelligence and sustain their early projections and trend predictions, due to "a perfect storm of unprecedented circumstances."

After reviewing the few published reports that could be of interest to this article, we decided to discard quoting any of the published summary. A few of those market research organizations that follow the audio industry might have some real figures, but unfortunately nothing was made available and the very few "teasers" that have reached our desk are essentially repeats of 2019 data with projections, or simply meaningless figures of turnover/business volumes, market shares and percentage growth shares that do not correlate and cannot be cross-referenced with past data.

The Supply-Chain Hampering

Traditionally an organization that commissions and highlights existing market research, the Consumer Technology Association (CTA) reflects the same concerns I have expressed and has published forecasts that are also unusually conservative. In its latest published CTA Forecast about the US consumer technology industry, CTA projects more than $505 billion in retail sales revenue for the first time ever. That projection represents "a 2.8% revenue increase from 2021's impressive 9.6% growth over 2020," detailing strong demand for smartphones, automotive tech, health devices, and streaming services as the main driving forces.

Although conservative in its estimates, what the CTA doesn't say is that such projections do not reflect the unpredictability of actual manufacturing output, logistical challenges, and business volumes matching the demand. In large part, the strategic selection of those four technology segments also don't allow actual comparisons with previous



purely consumer electronics-oriented forecasts. It's an easy way to say a market is growing, when every year new market segments are added.

"The consumer technology industry has shown impressive resilience in the face of supply chain challenges that are affecting almost every sector of the economy," said Gary Shapiro, president and CEO, CTA. "The pandemic gave people more time to explore new tech that made their lives healthier, safer, and more convenient. We anticipate another year of growth for our industry based on the enormous demand we see from consumers for tech products and services."

The reality in 2022—not even taking into consideration the effects of growing inflation and the war in Ukraine—is that the projected growth in smartphone shipments, as an example, will strongly rely not on consumers' desire for new technology or manufacturers introducing major innovations, but on the fact that a few companies are actually able to ship more or less volume. Apple was a clear example of a winner in the category in the past two years, sustaining shipments during the pandemic, while other companies, such as Samsung, have been greatly affected by reduced manufacturing yields and distribution challenges.

And obviously, the spectacular growth in streaming entertainment per household created record revenue. The CTA predicts that total spending on streaming services and software is expected to reach $130 billion in 2022, up 6% over 2021. That's justifiably conservative.

For the only audio-specific category that is highlighted in the January 2022 CTA forecast, true wireless earbuds are mentioned, because it represents a predictably growing category. And yet, the CTA stated that it expected a rise of 3% from 2021 to 2022, reaching a projected $9.3 billion in shipment revenues this year. Again, I find that very conservative since that's the category more likely to see new product launches and innovations in 2022.

The "elephant in the room" for any market predictions is obviously the instability in the supply chain. No one had predicted that, as the effects of the pandemic spread continent by continent—and even country by country, depending on the policies adopted to control the virus—that we would see such large impacts on the overall globally connected economy.

As one country after another implemented restrictions, raw materials or simple components that have never been discussed as being possible breakpoints have caused major production disruptions and interruptions of the global logistics.

As the world entered 2022 with glimpses of hope that the pandemic effects would be much reduced, the virus continues to spread to unprepared regions of the world. China, the manufacturing hub for the world, remains largely unvaccinated and is currently imposing severe quarantines that are shutting down factories. And the heads of state in Russia decided to launch a war for territory, and invaded Ukraine, causing the world to impose major sanctions against one of the largest countries, which is also a major source for precious raw materials, oil, and natural gas. It seems like a rollercoaster that never ends.

As market research firm IHS Markit says in its latest report entitled "The Great Supply Chain Disruption: Why it Continues in 2022," these persistent supply chain challenges are without precedent. "The highly synchronized global supply chain system developed over the past 30 years is under strain like never before and resolving the disruption will be less a 'sprint' and more of a 'marathon' that runs well into 2022."

"What is unfolding in supply chains globally is not only disruptive, it is also historic," says Daniel Yergin, vice chairman, IHS Markit and editor of the report. "Moreover, the intense new focus on inflation adds to the urgency to understand what is ahead for supply chains in 2022."

Ups and Downs

No analysts had predicted that the PC product category would grow so spectacularly in 2020—to the point that in some countries even the depleted inventory gathering dust was almost liquidated by large retailers. But as the demand persisted with children forced to take online classes and parents working remotely, the industry was simply not ready to meet demand, or was launching items to market that were designed for the pre-pandemic reality.

Likewise, in consumer electronics, we have witnessed a veritable rollercoaster of demand and inverting product trends. As whole families had to share their households for months, each room in the house received more technology—and Wi-Fi coverage needed improvements. Not surprisingly, headphones became mandatory when everyone was chatting or watching content at the same time. And for many, the living room suddenly became the meeting point and shared entertainment center for the entire family, reimagined for multiple uses, from allowed leisure time to fitness activity. But obviously the audio industry was not able to readjust and launch products that suited that new reality in such a short time, and only at the end of 2021 some pandemic-age products started to reach the market. And it's highly unpredictable if the market demand will persist at the same level, will readjust, or again change drastically. Not an easy time for product managers.

The consequences for the brands that were most successful in supporting consumer needs during this time will be an interesting research topic. With the disruption in transportation and logistics, some brands with manufacturing hubs in China or India, have naturally prioritized those home markets to unload existing stock. While in the US, some major brands that hold a strong connection with consumers were unable to renew inventory and have remained very quiet for nearly two years.

And some products that had been rising stars in the years preceding the pandemic—such as small, portable, battery-operated speakers, or travel-oriented headphones—remained on the shelves, while gaming products and some classes of speakers gained a sudden boost as people remained at home.

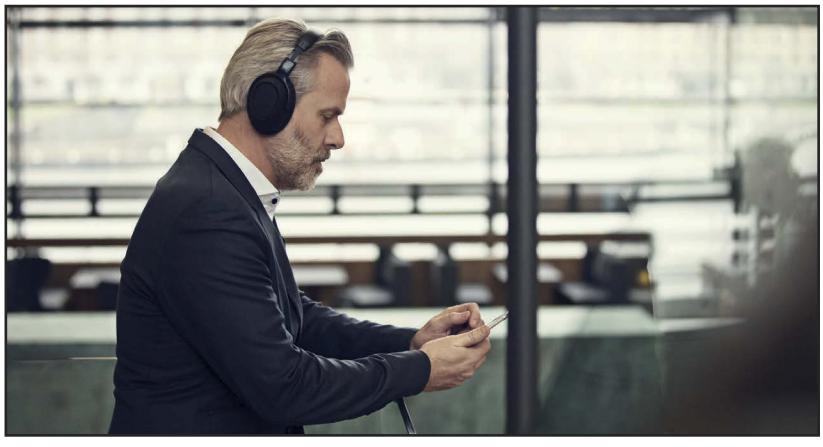
The effect on the audio industry of many companies finally being able to flood the market with products that they wished had been released in 2021/2022 is also difficult to predict. But we can expect some extreme variations in market shares for the foreseeable future, not based on strong market or great consumer appeal, but simply on availability.

More importantly, for the distribution channels, are the challenges of rising costs and the fact that brands have realized their need to connect directly with the consumer and explore online commerce channels. This is obviously good news

The new beyerdynamic SPACE Speakerphone offers captivating sound for music playback with the best speech intelligibility for calls and meetings. For the new SPACE speakerphone, beyerdynamic combined its experience in transducers, speaker designs and microphones to create a high-performance, portable speaker system that allows unlimited freedom and flexibility in the modern workday as well as in leisure time.

for those companies—such as Apple—that have built a strong, fully-owned online and physical retail channel. It is also great news for Amazon and many regional and local online retailers that are able to quickly get the orders and deliver the products without marking up the selling price.

Traditional dealerships and agents will need to rely on the perceived value of their services and refocus on installation and systems, not selling single items. But increasingly, it will mean working with brands that clearly differentiate by accommodating integration. An interesting dilemma for Sonos, as an example, which was simultaneously expanding to the residential integration channel (and even commercial installation), while also pursuing an interesting direct relationship with Ikea, creating unique products that in the end always reinforce its ecosystem.



The EPOS | Sennheiser ADAPT 660 series of adaptive ANC headphones for working professionals uses machine learning enhanced microphone performance to adjust for personal audio and call clarity in a unique UC optimized solution, certified for Microsoft Teams.

The speakerphone is a rising new class of products for work-from-anywhere. The image shows the EPOS EXPAND 80 Bluetooth Speakerphone that combines six adaptive, beamforming microphones that isolate voices from room reverb and ambient noise, with a superior speaker for rich, natural sound.

It is also an interesting dilemma for Amazon, a company that was exploring both its direct-to-consumer online channel (naturally), while attempting to grow vertically with the residential integration channel. It didn't go unnoticed that Amazon has remained very quiet since September 2020, when it announced its Echo family of devices for 2020, including the new Echo 4th Generation smart speaker.

In fact, already in the middle of 2022, we can confidently say that the whole smart speaker hype pretty much deflated during the pandemic, as no significant new products were launched. Explanations include the fact that Google and Amazon saturated the market with below-cost smart speakers that didn't need replacing, the fact that consumer already understood the limitations of voice assistants and are not exactly enthusiastic about it, or most importantly, the fact that there was simply no company able to sustain the furious pace of production and market flooding that was the norm until 2019. In that regard, by focusing on their language market, Chinese companies have been more consistent, even if their smart products and Chinese smart assistants basically serve completely different market needs, and, together with smartphones, serve to overcome very specific internal UI/language barriers to extend the (state promoted) digital transformation taking place.

Home Work and Gaming

Many product segments within the audio industry have largely benefited from people's realization of the value of home technologies and entertainment in the past two years. In general most audio products in all price segments benefited, as users reimagined new possible uses within their own (household and personal) reality.

As it happened in many other industries, the pandemic was also a time for the audio companies to reorganize and refocus their research and development efforts, accelerating ongoing trends.

In 2019, many companies including Microsoft, Crestron, Shure, Sennheiser, and many others were fully focused on building office infrastructures to serve the growing need for software-controlled meeting rooms and networked collaboration spaces. Following the demise of the (early) videoconference and telepresence solutions, thanks to the availability of cloud software solutions from Microsoft, Zoom (a different company then), Google, BlueJeans (now Verizon) and others that had replaced cloud-based

video meetings services from Cisco, Lifesize, or Polycom (and others that had already vanished), the sense was that this would be a very lucrative business, as all offices needed to be completely equipped or refurbished with these modern UC&C infrastructures.

To provide some background, we need to mention that this was also the time when coworking spaces became the next big thing, and WeWork, Inc. opened 756 locations in 38 countries and was getting ready for an IPO 2019, once valued at $47 billion. And in 2020, companies, such as WeWork crashed, the pandemic hit, and millions of office buildings suddenly closed.

Not everything was catastrophic for the audio industry. On the other hand, the empty buildings and cities also created an opportunity for many renovation and refurbishment contracts to take place. Many new important building installation projects were also accelerated in 2021, which largely benefited the commercial installation and systems integration industries.

But while unified communications and collaboration (UC&C) solutions have largely benefited from the fast transformations caused by the pandemic, first with work-from-home, followed in 2021 by work-from-anywhere, there have been clear winners and losers in the segment. Those companies highly invested in the corporate world and large office systems and infrastructure have suffered heavily since 2020, and mostly are only now restructuring their business plans to adjust to a new reality that they are still struggling to accept.

All the while, existing companies with a strong portfolio of personal products—including some incumbents that had recently reimagined their portfolio for collaboration and huddle spaces, have seen great business volumes, even if their reimagined product strategies couldn't match the demand. Many companies in that segment, simply weren't ready to sell direct-to-consumer and didn't establish an effective channel strategy to accommodate online sales, until very recently—when people are again getting back to offices and traveling.

A significant story that I need to mention in this segment, in 2018, the leading German microphone and headphone manufacturer Sennheiser Electronic decided to restructure its business and agreed to end its original joint venture with the Demant A/S group from Denmark, which had been manufacturing its Sennheiser Communications and gaming products.

In a brilliant presaging, in 2019, Demant announced that it would launch a new company brand and that it was firmly determined to dominate the gaming and enterprise headset space, and launched its new self-branded portfolio under the name EPOS.

While it kept manufacturing the existing Sennheiser Communications portfolio of products, co-branded as EPOS | Sennheiser, effectively the company entered 2020 with a major focus on a new generation of EPOS products, having identified that companies and employees already wanted highly effective audio and video solutions, benefitting from a mix of remote and office-based working. Incredibly, as Sennheiser exited the space in 2019, EPOS entered the global pandemic year with a strong focus on introducing new headsets optimized for work from anywhere, and entered the USB-C desktop microphone segment. In 2020 and 2021, EPOS managed to launch a continuous

Even headphones companies are tempted to explore the speakerphone market. Audeze expanded its transducer development efforts using planar magnetic technology to design Filter, a portable conference speakerphone equipped with intelligent voice processing that connects to virtually any digital source device over Bluetooth or USB and can be used with all conferencing software.

In 2022, LG Electronics introduced a new lineup of audio products for home theater, including new soundbar models that improve on performance with separate satellite speakers and subwoofers, providing exciting sound experiences for home cinema, music, and gaming. LG's audio lineup for 2022 is spearheaded by the premium LG S95QR Soundbar, with 9.1.5 channels of surround sound immersion, with five up-firing channels—three on the soundbar and two in the separate rear speakers—including the world's first center up-firing speaker.

Even pro audio companies are testing the waters in the emerging consumer categories and crossover speaker products. Mackie announced the CR StealthBar, a Bluetooth-enabled, compact desktop soundbar equipped to bring high-quality sound to small spaces. The Mackie CR StealthBar ($99) is USB-C and Bluetooth-enabled and features built-in sound presets designed to enhance the audio when watching movies, listening to music, or gaming.

stream of products that precisely matched what the market needed, while grabbing valuable market share from market leaders Poly, Jabra, and Bose.

The power of that pandemic disruption and sudden market changes was significant to many companies in the audio industry, even those that were apparently positioned in growing product segments, such as communication headsets. One such case is Poly, the company created from the merger of Plantronics and Polycom, which had not reacted fast enough to the technology trends, with users increasingly expecting the convenience of wireless, Bluetooth compatibility with any devices, and more importantly, the appeal of true wireless. As the offices remained closed throughout 2021 and entering 2022, because it mainly relied on its own corporate-focused distribution networked, Poly was not able to reach the consumer directly with its most appealing products—and it had many.

More than just a loudspeaker, the Dutch & Dutch 8c is a complete audio system for accurate music reproduction, including high-end DACs, amps, subwoofers and DSP, with a design that provides constant directivity from 100Hz upwards and ±0.5dB frequency response from 35Hz upwards, using a proprietary waveguide tweeter with an acoustic cardioid midrange, boundary-coupled bass drivers and active room matching.

Not surprisingly, the heads of Poly decided to take the offer from HP, Inc., which recently announced a definitive agreement to acquire the company. HP has been acquiring other companies in the audio space in order to expand its offer to growing market segments, and the Poly acquisition is intended to significantly reinforce its position as a leading global provider of workplace collaboration solutions as the office market resets.

And precisely as the true wireless earbuds product category became the fastest growing in the consumer space, and continues to be the focus of virtually every technology innovation in 2022, following the exit from the communication space, Sennheiser also decided to sell its consumer business to Sonova Holding AG, a Swiss hearing care solutions company.

With the timely investment, Sonova saw a unique opportunity to gain the muscle that will be required in the next few years to compete in the highly profitable "hearables" space. And included in the acquisition of the Consumer Division from Sennheiser were also other appealing consumer products such as the AMBEO soundbar, the most advanced design in this also fast growing segment. But it will be hard to predict what an audiology company such as Sonova will do in this consumer segment, currently evolving fast, as home-theater is increasingly merging with the gaming market.

Companies including LG Electronics, Creative, and Turtle Beach are betting strong on that convergence and are launching soundbars that will appeal first and foremost to the home-theater experience—including optional separate satellite speakers and subwoofers for those looking for an effective multichannel home cinema environment—while also serving the gaming experiences, benefiting from the large screen TVs and the connectivity that's available. As streaming services become ubiquitous, the "cinematic" experience is as much delivered by watching the latest Hollywood movies on Netflix, as it is playing the latest online games.

Not surprisingly, EPOS is one of the most determined incumbents in this emerging space, expanding its portfolio of high-end audio and video solutions. In 2022, together with new desktop soundbars used for communications and gaming,

all audio companies are betting strongly in fully integrated audio and video solutions, creating a new category already named "videobars."

Rising Speaker Categories

In this fast moving and unpredictable environment, it's hard to determine which products and form factors actually better reflect consumers' preferences or market trends. And in speakers, that's even harder, given that we are also seeing radical changes motivated by the evolution of streaming, wireless audio, spatial audio formats, and obviously, consumer lifestyle changes.

We can say that the high-end audio and luxury audio segments remain essentially unchanged, with very few opportunities for disruption resulting from the pandemic that cancelled all audio shows and vastly restricted show room listening sessions. But of course, manufacturers and designers were not dormant, and we are likely to see many novel designs already in 2022.

As characterized in *audioXpress'* Speaker Technology Market Update 2022, loudspeaker designers—those working on cost-no-object projects but also the higher volume hi-fi brands—can benefit from significant new materials and processes options, significant evolution in computer modeling and simulation tools, and a better understanding and application of acoustic metamaterials (which are also the result of more advanced simulation tools). Progress in those areas is positively influencing both the speaker driver and cabinet design, generating products that are beyond anything that was previously possible. We are highlighting a few examples with the selected images in this article.

But progressing from high-end, home-audio-oriented speakers, we also have a much more powerful set of digital signal processing technologies, both in the hardware and software components, complemented with a growing integration of the electronics, efficient amplifiers, feed-forward protection circuits, and even built-in sensors. And the new trend for 2022, both in the consumer and the professional audio segments is that the combination of those technologies is not necessarily only for smart speakers, as it was assumed just three years ago.

In 2022, fully active speaker designs with DSP are enabling much more efficient applications. In this case, it's not just the product per se that is superior or more efficient. It's the actual behavior of that speaker in its working environment that becomes much more consistent. And that's even before we add emerging technologies in active, real-time acoustic compensation and multiple arrays, which will soon be the key for really effective immersive audio installations. That trend is happening clearly in professional audio, and it will soon conquer also the consumer space.

Genelec launched the first model in its new Signature Series with the introduction of the two-way 6040R Smart Active Loudspeaker. Created in conjunction with celebrated Finnish industrial designer Harri Koskinen, the floor-standing 6040R is fashioned from die-cast aluminum, and delivers wide frequency response from a compact enclosure, free from resonances, and featuring Genelec's now-familiar Directivity Control Waveguide, which produces smooth uncolored reproduction both on- and off-axis, with improved imaging and minimal distortion.

For a complete overview of the key evolution in transducer technologies and topologies, we recommend reading *audioXpress'* Market Update 2021 on Speaker Technology, which covered the latest examples.

Another important factor to consider in the evolution of transducers and the overall speaker industry, also has to do with emerging use cases

In 2021, Meridian Audio launched its new flagship loudspeaker, the DSP8000 XE, announcing major advances in platform design, audio engineering and performance for the company's DSP digital active loudspeakers. Within the familiar shape of Meridian's high-end loudspeakers, the new DSP8000 XE combines a 5mm beryllium dome with silver voice-coil tweeter plus one midrange driver, and six long-throw woofers, in a fully integrated design with analog balanced and digital audio inputs, plus USB (Type C) supporting up to 24-bit/384kHz.

The Arion Audio range of speakers, designed, developed, and manufactured in Charlotte, NC, includes the Apollo, a five-piece loudspeaker system featuring separate full-range line source dipole towers and open-baffle woofer modules, complemented with advanced DSP room correction for perfect system-room integration.

that are changing designers' priorities and industry volumes. The first outstanding example being voice applications—not necessarily only to support voice interfaces and voice assistants in smart speakers or smart home products, but generically to deliver high-quality voice reproduction, such as in speakerphones, conferencing systems, and even hearing assist products.

Voice is inspiring many new loudspeaker manufacturers to consider alternative approaches in transducers and speaker design that wouldn't simply be viable in other traditional applications. This is benefiting those new speaker companies that are exploring planar magnetic, balanced mode radiator (Tectonic Audio Labs), flat core, and other topologies currently available from companies such as Klippel/Nuvoton, Dinaburg Technology, Resonado Labs, Trulli Audio, Fibona Acoustics, Earthquake Sound, and Mayht.

One last important reference of emerging trends is directly related to the power source. As speaker systems become increasingly active and fully integrated, the power source for the built-in amplification can be delivered by batteries when there's the need for mobility and portability, Power-over-Ethernet (PoE) for wired networked systems, and even new sources of energy harvesting, as Mayht recently demonstrated at CES 2022, using Powerfoyle solar cells from Swedish company Exeger to power a self-charging speaker. Having already experienced the effectiveness of the Exeger Powerfoyle surfaces on headphones that remain charged for daily use, I have no doubt that this will be an area of great interest for consumer electronics companies in general and obviously for all manufacturers of portable speakers.

I would also highlight the fact that the speaker industry in general remains highly motivated by a growing potentially addressable market, as consumers embrace more and more speakers in their daily lives, sometimes unknowingly.

Many new speaker manufacturers are thinking completely "out of the box" in their approach to new designs. Pictured is the bold Cell Alpha Triphonic Speaker design from Syng, a company lead by longtime Apple designer Chris Stringer. The Syng Cell Alpha speakers are designed for super spatial sound and to support a "groundbreaking new object-based sonic architecture." The spherical shape holds a pair of opposing subwoofers using a triaxial carbon fiber weaver diaphragm that generates directional audio using modal beamforming. In the meridian of the sphere we can see three high-frequency drivers directly coupled to the dispersion system, for a total of eight custom drivers.

Geographic and Economic Realities

The number of speakers sold every year continued to increase—considering all sizes and topologies. It's a cultural and social economic thing.

Since the iPod, the music industry migration to digital downloads, followed by massive piracy with MP3 files, and the rise of commercial music streaming services, the number of individuals on the planet who had access to and started to consume music increased exponentially, every year. Those numbers are clearly reflected in the 2021 IFPI Global Music Report: "Global Recorded Music Revenues Grew 18.5% in 2021," indicated that the number of people listening to music has never been greater. Asia is the world's fastest growing and largest market in number of consumers, while Latin America sees one of the highest annual growth rates globally, with streaming accounting for 85.9% of the market, one of the highest proportions in any region. Even in the Middle East and Africa streaming is a particularly strong driver, with a 95.3% share of the market and completely new consumers. Even in Europe and North America, streaming is motivating more people to listen to music.

In addition, the number of products that are able to play music also increased exponentially—and let's not even discuss headphones. Let's just consider that people listen to music on smartphones speakers (yes, I know...). They also listen on tablets (older people think it's fine and they don't know how to connect the Bluetooth speaker, plus the tablet goes with them wherever they go and the speaker doesn't...)

Millions of people listen to music on laptops, and they now have much better desktop speakers in their workplace, or they even use a soundbar and speakerphone, all new categories that didn't exist seven years ago. A lot more people are now listening to music on portable speakers, Bluetooth, Wi-Fi-connected speakers, and other compact wired/wireless speakers. As the size increases, the market discovered the new rising category of "party speakers," which are effectively an evolution of the Asian karaoke systems, now focused on providing a convincing "bass boom," matched with wireless connectivity.

Young couples now increasingly own one of those party speakers instead of a hi-fi system, because the LED lights are fun, and they already have a soundbar connected to the TV, and a small Bluetooth speaker (and one or two laptops, smartphones, and tablets). That's more speakers per household than traditionally would exist.

Party speakers are also battery powered now, and during the first two years of the pandemic a lot of parties would take place anywhere a group of people got together. Some brands of speakers, such as Danish sensation Soundbok, created a new market by anticipating the wireless Party mode, by recovering the almost-forgotten wireless SKAA technology that allows connecting a very large number of speakers to play the same sound. Of course, the source arrives via Bluetooth, because that is now the undisputed standard—and that's where Soundboks hit the jackpot.

That, and the battery packs...

Soundboks is a great example of a disruptive company, with products that were sold as consumer electronics, but basically stole the market from portable active PA speakers. The Danish company recently created its second product, which is basically half the size and weight of the original Soundboks, which required a reinforced dedicated backpack to be called portable. What is interesting is that all these speakers connect, and together they can become not only a PA system for a DJ or a party, but they can also fulfill many other sound reinforcement duties.

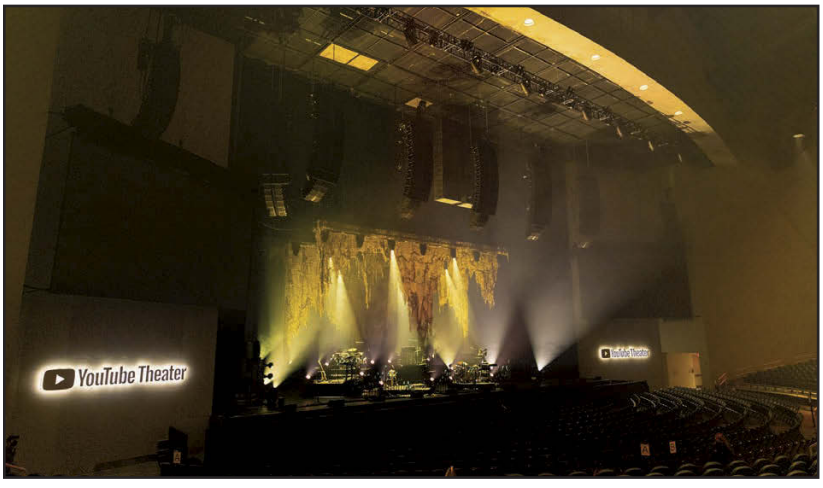
When Soundboks introduced its "Bluetooth-speaker-for-parties" that looked like a guitar speaker, no one could have guessed that this "portable" solution, loaded with battery-packs the size of a car battery (and as heavy) would sell 50,000 units. The company introduced its third-generation in 2021, improving the Bluetooth module and swapable smart battery packs, and leveraging three Infineon Merus Class-D amplifier modules and more advanced DSP. Already in 2022, the Danish company announced its second design in seven years with the Soundboks Go Speaker, a lighter model that is half the size.

Already in 2022, Meyer Sound introduced Panther, a new line array system that sets a new industry benchmark for a compact, lightweight, powerful, and energy-efficient sound reinforcement solution. Meyer Sound says Panther was engineered to meet rapidly evolving demands for large-scale touring and installed systems. Designed to fit stadium levels of performance, the new Panther line arrays are fitted with a new generation Class-D amplifier with a more efficient power supply that offers substantial savings on current draw from the previous generation flagship line array loudspeaker (LEO).

Harman and Mackie know this and are exploring the field from a professional audio perspective. In Europe, Adam-Hall and HK Audio are other examples of companies that are also exploring this new "portable" PA concepts, matched with wireless connectivity. I predict that we will soon also see an explosion of emerging audio brands that will move upward from the lifestyle space to conquer the portable PA category.

The Return of Big Sound

In the professional applications segments, changes have been dramatic for the past two years, with live performance, festivals, and night-life basically canceled and gradually reemerging irregularly as the situation improved in some regions of the world.



The world's official worldwide deployment of the new L-Acoustics L-ISA Processor II was a celebration of the 10th anniversary of Bon Iver's eponymous sophomore album. Not only did this exclusive two-day event mark the first concerts that the group had performed in more than a year and a half, the concerts benefited from this next-generation 3D audio processing engine to fill the YouTube Theater to create a full 7.1 spatially immersive experience to the 6,000-seat venue, using 68 L-Acoustics K2 and 54 Kara II enclosures surrounding the audience.
(Photo credit: Matthew John Benton)

The world's largest fixed L-ISA installation is at First Baptist Church Woodstock in Georgia.

But all that is about to change, with the post-pandemic entertainment boom and the return to large festivals, global touring, and many new higher-quality live music auditoriums. No one doubts that following the unexpected and unwelcome restrictions that cancelled live events, spectators will flock to the see shows again with even more enthusiasm.

And meanwhile, the professional audio industry—in particular the leading names in large-scale sound reinforcement systems—have used the pandemic retreat to perfect their latest-generation designs, matching two key requirements: sustainability and new immersive sound formats.

A perfect example of what's to come is the new touring industry standard, large-scale line array element that Meyer Sound designed and launched in 2022. The new Meyer Sound Panther flagship linear line array loudspeaker was engineered to meet rapidly evolving requirements of large visually-focused production scenarios, coupled with tighter safety regulations, that restrict the space and weight allowed for loudspeakers.

At the same time, environmental policies require greater energy efficiency and a smaller footprint for transport as more productions shift to a networked signal infrastructure. Responding to these demands, Panther's acoustic output is closer to the significantly larger and heavier LEO line array loudspeaker and occupies the slender form factor of the existing compact LYON line array loudspeaker. Not surprisingly, John Meyer, the founder and CEO of Meyer Sound, calls it the "most significant loudspeaker introduction in more than a decade."

Meyer Sound's continual investment in materials and design also means not only is the performance class-leading, but the price of the new loudspeaker is substantially lower than the previous generation and below the most direct competitor models when factoring in comparable amplification and processing. Entering production in February 2022, a Panther system was offered to UK rental company Major Tom Ltd., to use in Ed Sheeran's massive 2022 Mathematics Tour. Each show uses 14 hangs of Panther arrays in two rings with the three different horn dispersion configurations, combining 10 elements of the "L" long-throw versions and two of the "M" main versions. The eight outer arrays comprised 10 elements of the "L" versions, two "M" versions,

and two "W" wide-coverage versions. Controlled bass is supplied by six flown arrays of 1100-LFC low-frequency control elements configured in gradient arrays of 10 each. And a total of 20 Leopard elements are set around the circular stage as front fill, with stage bass supplied by six stacks of three 1100-LFC elements in gradient arrays.

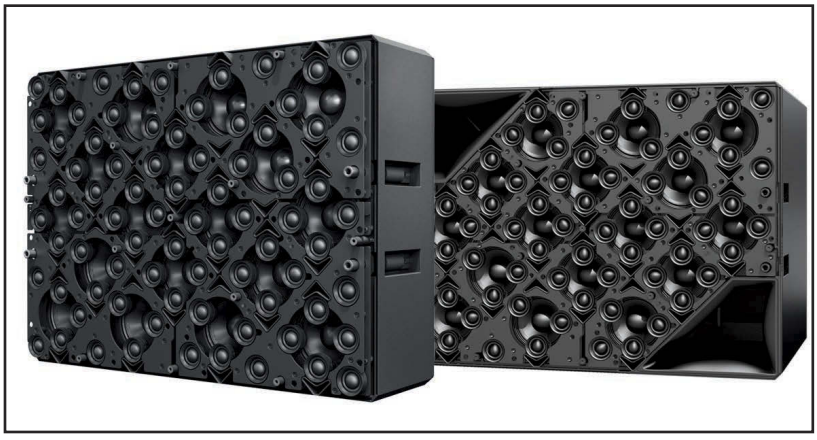
Another leading company in the global sound reinforcement market is L-Acoustics, recognized for pioneering the line source array and now focused on shaping the future of sound with its L-ISA Immersive Hyperreal Sound technology offering immersive audio experiences.

L-Acoustics sound systems can be heard around the globe in venues such as the Hollywood Bowl and the Philharmonie de Paris, at the world's top-grossing festivals (e.g., Coachella and Tomorrowland), and on every major global tour (e.g., Billie Eilish). But the focus for L-Acoustics throughout the difficult period of the pandemic was precisely in educating audio engineers, content creators, and even musicians to spatial audio/immersive sound production. In April 2021, L-Acoustics expanded the spatial/immersive sound possibilities for music creators with the launch of the L-ISA Studio software suite. A tool created for sound designers, producers, and mixing engineers, L-ISA Studio makes designing immersive audio mixes—whenever, and wherever—easier and affordable. This is obviously a great strategy for a company that leads the sound reinforcement market and wants to push the transition from standard left/right or left/center/right PA systems towards fully immersive multichannel systems, surrounding the audience.

Also in 2021, the French company extended spatial processing to a wider range of productions and venues, with its next-generation 3D audio processing engine, L-ISA Processor II. The new processor offers more power, performance, and flexibility, and is available in four different output configurations through a one-time, tiered license fee.

The company benefited from its global reach to win many flagship installations in some of the most prestigious auditoriums and locations, which required an increasing number of speaker/array channels to fully render the combination of multichannel and object-based audio formats.

Of course, L-Acoustics is no longer alone in this strategy and all major professional audio companies are now offering complete ecosystems for immersive sound. d&b audiotechnik was already a main contender in this space with its advanced Soundscape solutions, and is now accompanied by CODA, Adamson, Amadeus and others.



Holoplot's Matrix Array unique and patented technology represents a quantum leap in audio reproduction, allowing sound control with ultra-high precision over large distances. It uses wavefield synthesis for high-performance immersive sound reinforcement applications. With Holoplot's audio-beamforming technology, each array is able to generate one or multiple sound beams that can be steered vertically and horizontally in space as well as shaped to the geometries of the targeted audience areas. Thus, they project sound exclusively to where it is desired, while avoiding unwanted reflections and audible echoes. In addition, Holoplot Beam Optimization Algorithms ensure spectral uniformity, so the whole audience hears with the same broadband sound pressure level and with almost no SPL drop despite the long distances from the X1 Matrix Arrays to the back rows.

A new challenger in the new generation of sound reinforcement systems is also Holoplot, the Berlin, Germany-based audio company behind the X1 Matrix Array and 3D beamforming technologies. Following two years of delayed plans and extended preparation work, the company is gearing up to increase visibility and is on a mission to transform sound reproduction with its Matrix Array. Holoplot's software-driven, and hardware-enabled Matrix Array modules enable ultra-precise control over sound propagation and localization.

Holoplot's unique and patented technology allows sound control with ultra-high precision over large distances using wavefield synthesis (WFS) technology, a spatial audio rendering technique that places virtual sound sources in real space and virtualizes complete acoustic environments. Holoplot perfected the approach with compact modular speaker arrays that enable sound designers to recreate audio objects authentically, as if the original object would stand in front of the listener, and move them in real-time throughout space, even when only targeting the ear of an individual.

Together with new efforts in active acoustics, this will be one of the most important new technologies for sound reinforcement and professional audio in general. Live sound suffered strongly with the global COVID-19 pandemic, but the comeback is going to be massive. ***LIS***

Working Within the Ever-Changing World

By
Jann U. Evers
(Sales Director, Scan-Speak)

This is an aerial view of Scan-Speak, which was founded in Denmark in 1970, and produces state-of-the art high-end transducers.

For more than two years we have lived with a pandemic, and during those years we have had many, and at times, very heavy restrictions in our daily living. During long periods, we were forced to work from home or do nothing if our jobs weren't able to be done from home. Travelling was not an option. And visits to our customers, suppliers, and other partners were physically impossible. For extended periods of time, sports venues, restaurants, bars, nightclubs, and various music venues were fully closed and then only partially opened with very limited capacity.

At the beginning of 2020, the world almost came to a complete stop, and it looked as if our industry would take a hard hit, but then people adapted to the new situation. All of us learned to take advantage of tools we already had, but most of us had not used very much, and online meetings became a daily thing for most of us. Travel restrictions put an end to our business trips, and it also eliminated our holidays abroad, but once again people adapted and we learned to enjoy holidays at home. Staying at home so much we discovered many things could be improved in and around our homes, among these improvements were new audio/video gear, and people were able to purchase the new products from money available from not spending it on travelling, concerts, and restaurants.

What in the beginning seemed to be a challenge and a fight for survival, later changed within that same year to be very positive for sales—not only for Scan-Speak—but for a large part of the high-end audio industry. And as most of our customers also had success in their sales, we booked a growth beyond anything previously seen in Scan-Speak's history.

The Downside

But, things were not all positive. The huge sales growth caused logistical challenges that after more than a year-and-a-half still haunts us as there are global material shortages and a lack of production capacity with many of our key suppliers.

Also, having some of our supply chains on the opposite side of the world, and the congestion in the shipping industry significantly added to the problem, causing the lead times to grow longer and longer every passing month, until now we have been left with the longest lead times in our company's history. Not only were lead times increased, but very often confirmed delivery dates were not meet, causing many frustrations—both

with us and even worse for our customers, as we could not meet our promise deadlines.

We discovered (what we already expected) that China has been very successful in certain business areas and that they, in many cases, have completely out competed their Western counterparts. Because of that, some skills have been "un-learned" by their Western counterparts, and nobody remembers how to make certain parts. Complete industries have simply disappeared from the European map (e.g., production of magnets) as it has become habit to buy such components in China. This is giving China a de facto global monopoly.

Single-Sided Sourcing

Limited available sources are not healthy for any industry! Such single-sided sourcing has made us very vulnerable, especially in the crises situations that we currently have. Among the challenges our industry and many others face are the pandemic, manufacturing bottlenecks, the freight congestion caused by a single vessel sitting aground in the Suez Canal, random COVID-19 lockdowns, and delays in busy port areas where we immediately get hit by material shortages for one or the other reason, which in the end are caused by our own successes during decades of globalization and outsourcing.

So What Now?

The logical step would, of course, be to look for suppliers closer to "home" and certainly not "behind" any overseas vessels—and we did, but it was easier said than done. We were (of course) not the only company with such challenges so potential new suppliers were already fully booked several months ahead.

Further Complications

As if this wasn't enough, Russia's President Vladimir Putin decided to invade Ukraine and started a war. Even though the West stands united behind Ukraine, it might take a long while for Ukraine to win back its own territory. In the meantime, we worry for the people and will miss Ukraine's significant supplies to the global market.

In addition to destruction within Ukraine and growing concern for neighboring countries, there have also been several trade restrictions against Russia, which is causing increased energy costs and adding to global material shortages, as Russia used to be a major resource of the raw materials and energy used in several large sections of the world.

All Scan-Speak's products are developed, designed, and hand-built by its 50 dedicated staff at its facility in Videbaek, Denmark.

The major questions in all of this are:

- How do we deal with it and maintain our businesses?
- How do we secure reliable on-time deliveries for our production?
- Should we all try to go back to local sourcing and vertical integration to secure our businesses?
- What about the environment, does our current level of global sourcing comply with sustainability?
- How long can we continue pretending overseas shipping isn't a pollution issue?
- Is "the global village" concept really a good thing?
- Can we continue our current level of business?

As we contemplate these questions, I am pretty sure sourcing and sustainability will be two very important focus areas for most companies during the next couple of years, and my hopes are high that we can make the world a bit better in these areas if we stand together. ***LIS***

About the Author

Jann U. Evers has a background in electronics, graduated from Bang & Olufsen in 1983, and during the following decade he worked as electronics service technician. Jann also holds degrees in information technology, purchase and has a diploma in Business Administration - International Sales and Marketing. Since 1994, his work has been within the field of loudspeakers, as Purchase Manager, Product & Development Manager, VP of Operations and as Sales Director in various positions at Vifa-Speak, ArciTec Acoustic, Eltax, Tymphany, and Scan-Speak.

The New AES75 Standard

A Better Way to Measure the Acoustic Output of Loudspeakers

By
Roger Schwenke and Merlijn van Veen
(Co-chairs, AES SC-04-03-A Task Group)

"It's been a long time coming," sang Crosby, Stills, and Nash. Such sentiments certainly apply to the welcome arrival of a meaningful, industrywide standard for measuring and comparing loudspeaker maximum acoustic output.

For decades, those audio professionals charged with specifying loudspeakers have struggled with maximum acoustic output comparisons. Reading a sound pressure level (SPL) number on a datasheet often inspired more questions than answers regarding the test signals and procedures used for measurement. A datasheet might specify a standard test signal but be ambiguous about what procedure was used. Or it might specify a standard procedure but be ambiguous regarding the signal. This can be frustrating, because what matters to the end user is how the loudspeaker will perform with typical audio signals, and whether the numbers can be compared apples-to-apples with numbers from one datasheet to another.

Earlier this year, a solution arrived with the Audio Engineering Society's (AES) adoption and publication of AES752022: "AES standard for acoustics—Measuring loudspeaker maximum linear sound levels using noise." The standard details a procedure for measuring maximum linear levels of loudspeakers—whether multi-driver systems or individual transducers—using a test signal called MNoise. The standard includes a specific test procedure, equipment requirements, and proper setup instructions for the particular system under test (SUT). The linear sound levels are determined by incrementally increasing the MNoise signal playback level until a stop condition is reached: either an unacceptable change in the transfer function's magnitude or coherence. Or, in other words, when the acoustic output is no longer linearly proportional to the input signal.

Developing the New Standard

The new standard was developed by the AES SC-04-03-A Task Group, with more than 80 task group members representing—but not limited to—pro audio, consumer electronics, cinema exhibition, and post-production. Market verticals involved included sound rental companies, AV integrators, as well as loudspeaker and test equipment manufacturers.

Step 1: A Better Test Signal

With its wide dynamic range and full frequency range bandwidth, music is the most demanding program material for sound reinforcement systems, especially for loudspeakers. Of course, using a particular piece of recorded music may be useful for subjective evaluations, but this would be inappropriate as a standardized test signal. So, which signal would be most appropriate?

Multiple test signals exist that specify an RMS level as a function of frequency meant to simulate typical content for the purpose of measuring a loudspeaker's maximum sound levels. The ANSI/CEA2034A signal is one example.

But RMS level is not the only signal property that could cause a loudspeaker to saturate. If the peak-to-RMS ratio, or crest factor, of a signal is high, driver excursion limits may be reached. Or amplifier clipping may occur before nonlinearities due to RMS level. Also, most loudspeakers reproduce the entire audible range divided in two or more frequency bands (separated by crossovers) using multiple drivers. Therefore, the crest factor that an individual driver sees is almost never a signal's full bandwidth crest factor. Yet existing test signals, when they specify a crest factor, specify only a single full bandwidth value.

Multiple test signals exist that specify an RMS level as a function of frequency meant to represent music but, until now, none specify crest factor as a function of frequency.

In order to measure loudspeaker maximum linear sound levels meaningfully, a signal must be used wherein both the RMS level and the crest factor—as functions of frequency—approximate actual content. In this case, music. This was the challenge behind the genesis of MNoise.

MNoise: Derived from Music Analysis

MNoise was developed by Meyer Sound Laboratories, Inc. and made available to the industry in 2019. The project started with computer analysis of a wide range of music, including male and female pitched vocals, rapping, instrumental music with synthesized and amplified instruments, as well as acoustic instruments. Samples spanned all genres from Eastern and Western classical music to dance, rock, and jazz.

This exhaustive analysis revealed that music has an RMS level that reduces with increasing frequency, as shown in other simulated program content test signals. However, the peak levels of music do not reduce with increasing frequency. Therefore, music has a crest factor as a function of frequency which is significantly different than that of existing test signals. The analysis of a large variety of music and speech program has shown (unsurprisingly) that crest factor, without exception, rises with increasing frequency. In contrast, the crest factor of other standard—often filtered—noise signals as well as pink noise, changes minimally with frequency.

In other words, as with other noise-based test signals, MNoise exhibits a diminishing RMS level with increasing frequency. However, MNoise uniquely exhibits a relatively constant peak level as a function of frequency, so that the crest factor (peak-to-RMS ratio) rises with increasing frequency (**Figure 1**). This unique "music-like" attribute of MNoise led to its adoption as part of the new AES752022 standard.

Step 2: A Defined Test Procedure

The lion's share of the task group's efforts was focused on developing a test procedure that would lead to consistent and independently verifiable results. This involved some complexities in order to make the test applicable to all types of multi-driver loudspeaker systems as well as individual drivers.

Essentially, two variations of the same procedure are defined in the standard. The first is for systems that incorporate loudspeaker processing, amplification, as well as drivers into an integrated product supplied by one and the same manufacturer. These can have all processing, amplification, and drivers in the same loudspeaker enclosure ("active" or "self-powered" loudspeakers) or be a purpose-built, self-contained system with pre-configured processing and dedicated amplification located apart from the loudspeaker cabinets. In this scenario, the entire integrated system is considered the system under test.

The second variation adds extra steps for passive, externally powered (read: amplified) systems—those without dedicated processing and amplification—which often source these functions from third-party manufacturers. In such a scenario, the amplifier and the signal processor

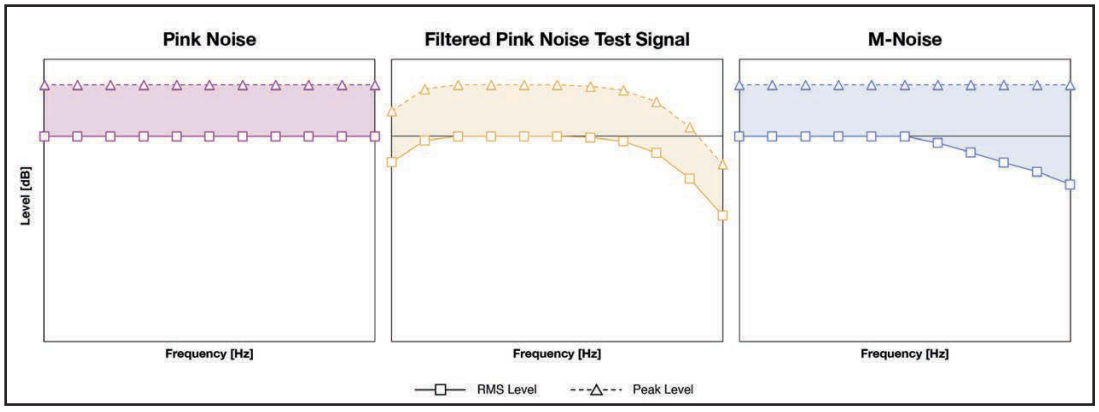


Figure 1: MNoise exhibits a diminishing RMS level with increasing frequency. However, MNoise uniquely exhibits a relatively constant peak level as a function of frequency, so that the crest factor (peak-to-RMS ratio) rises with increasing frequency.

(if applicable) are no longer part of the SUT. Instead, a "laboratory bench-to-pa-amplifier" and any applicable signal processing are now required upstream. The standard specifies requirements for such an amplifier that prevent it from affecting the SUT's performance. The standard also permits confining the test signal to the SUT's operating range by virtue of filtering upstream, applicable to testing within the operating range of, for example, single transducers. All filtering, including (but not limited to) use of factory presets, must be reported such that an audio professional with access to the same SUT can replicate the results.

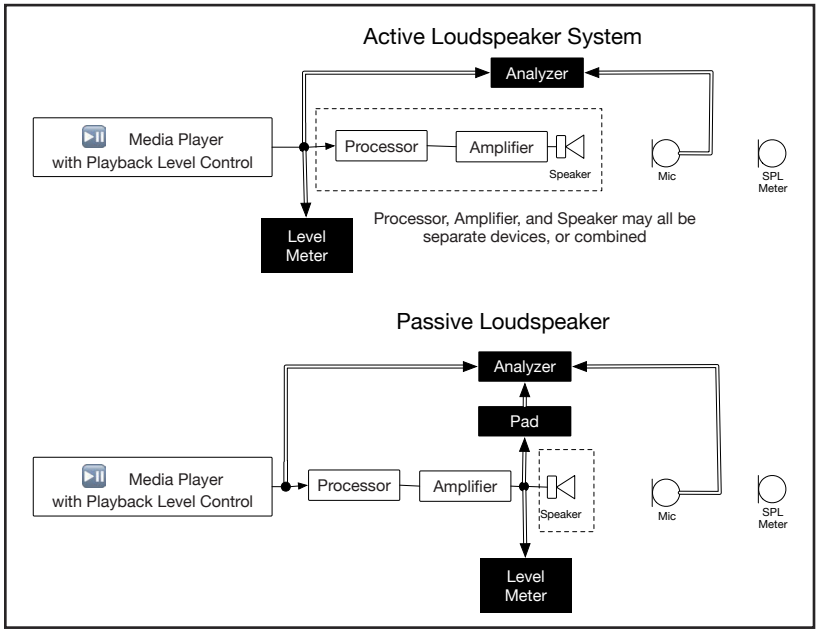


Figure 2: To accurately measure the onset of nonlinearity, a test signal must be used which has both the crest factor as well as spectrum—as a function of frequency—expected from real signals, as is the case with M-Noise.

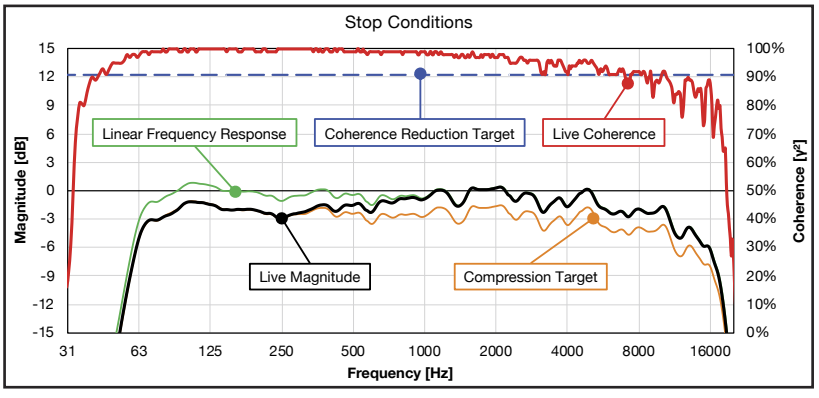


Figure 3: Coherence is a measure of the correlation between system input and output and can be determined from quantities already produced while calculating the transfer function. Once output no longer follows input in lockstep, or noncoherent distortion energy is added with increasing levels, the transferfunction magnitude or coherence will change.

Resources

AES75-2022: www.aes.org/publications/standards/search.cfm?docID=116

M-Noise and coherence test tracks free download link:
www.aes.org/standards/models/M-NoiseSignals-download.cfm

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Step 3: Defining Maximum Linear Sound Levels

The test procedure begins by playing MNoise at a low level, one which is expected to be reproduced linearly. Then, the playback level is increased nominally to confirm the signal is being reproduced linearly. Next, the playback level is increased gradually until a change in the transfer-function magnitude or coherence broaches predefined thresholds.

As the signal level is increased, peaks may be clipped, new frequency content—not part of the original signal—may be added, and other "nonlinear" effects may occur. To accurately measure the onset of nonlinearity, a test signal must be used which has both the crest factor as well as spectrum— as a function of frequency—expected from real signals, as is the case with M-Noise (**Figure 2**).

Traditional distortion measurements, while valuable, cannot be used with sounds that contain energy at all frequencies simultaneously. For this reason, the procedure also uses coherence. Coherence is a measure of the correlation between system input and output and can be determined from quantities already produced while calculating the transfer function. Once output no longer follows input in lockstep, or non-coherent distortion energy is added with increasing levels, the transfer function magnitude or coherence will change. In concert, these two quantities—the transfer function magnitude and coherence—provide a reliable, repeatable measure of the onset of nonlinearity and, therefore, define the corresponding maximum linear sound levels (**Figure 3**).

A Valuable New Tool

AES752022 is designed for use with "off-the-shelf" analyzers and measurement microphones readily available to most audio professionals. Because it is independently verifiable, this new standard provides audio consultants and other system specifiers a much more enforceable metric to use in project tenders and architectural specifications. We expect its value will be much appreciated in the years to come. ***LIS***

Among the ever-expanding list of dynamic innovations in the audio industry, the "melding" of health care, convenience, and entertainment is perhaps most exciting. The opportunities will only continue to expand and grow. The market to which these innovations will appeal cut across all age groups and demographics. Andrew Bellavia of Knowles has been in the thick of these developments and offers an excellent analysis of where we are and where we are going.

—Barry Vogel (CEO, Audio and Loudspeaker Technologies International Association)

The Year of Hear

By
Andrew Bellavia
(Director of Market Development—Performance Audio, Knowles Corp., and ALTI Business Advisory Board Member)

The year of 2022 will see proliferation of audio devices that take into account consumers' unique hearing response, and with good reason. For decades, audio companies have played the specsmanship game with increasing precision while ignoring the biggest variable—their customers' hearing ability. This article from Andrew Bellavia of Knowles Corp. shares how hearing changes with age, and how hearing personalization helps to deliver the best possible listening experience to a broader population.

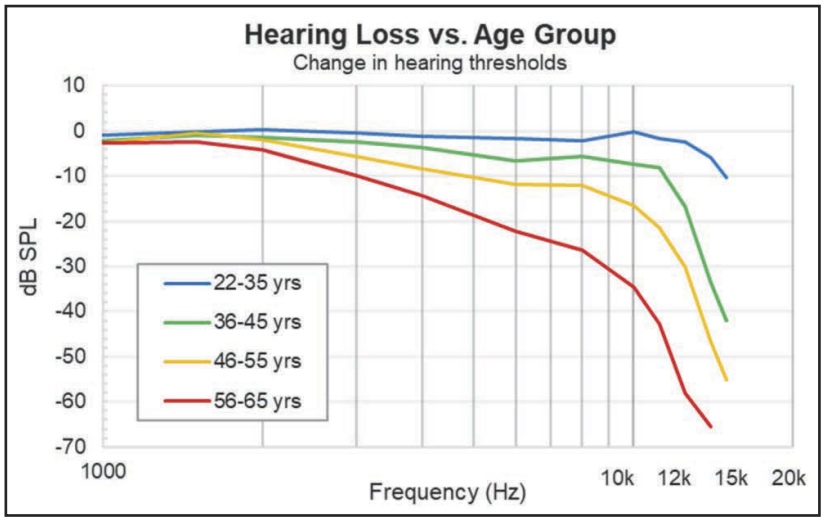
Photo by Jackson Simmer on Unsplash

It is not uncommon for advocates to say "designing for inclusion is designing for everyone." The meaning is often indirect, for example wheelchair-friendly curbs at intersection crossings also help parents with strollers. Given the prevalence of hearing loss, it becomes true more directly in that case. Technologies now exist to account for variations in hearing when designing an audio product. Those who adopt them will deliver a better experience for their customers. A better experience leads to stronger demand.

Pervasive Hearing Loss and the Perception of Audio Quality

According to the World Health Organization (WHO), more than 1.5 billion people live with some level of hearing loss [1]. Of those, about 70% are not "debilitated." That is approximately one billion people who might not even recognize their hearing loss yet lose an appreciation for hi-res music, become fatigued after multiple internet meetings, or have difficulty understanding dialogue while watching television.

Most hearing loss is a natural function of aging. It occurs so gradually that people are slow to recognize the decline. Since age-related hearing loss begins in the high treble, it affects the perception of music before one notices difficulty in understanding speech. Later, as degradation moves into the upper end of the vocal spectrum, speech in noise is also affected. Though the loud restaurant scenario is most often cited, people can also have difficulty understanding speech while watching television, especially when mixed in with music or other loud sounds. Internet meetings become tiring as the cognitive load associated with listening to the computer increases. All of these affect the customer experience in negative ways.



This graph was derived from "Behavioral Hearing Thresholds Between 0.125kHz and 20kHz using Depth-Compensated Ear Simulator Calibration," sponsored in part by the Hugh Knowles Research Center at Northwestern University.

Anker/Soundcore is one of a steady stream of popular earphone brands driving the trend of personalization software for consumer devices. (Source: Soundcore)

Today, people interact with and consume audio in a variety of settings and with multiple devices at home, in cars, and otherwise on-the-go [2]. It is now becoming possible to bridge the gap between audio quality and undiagnosed mild or moderate hearing loss in many of these products. This promises to improve quality of life while at the same time raising the perception of audio quality, with the potential to increase sales through better reviews and recommendations. It no longer makes sense to wrestle with every last decibel on the frequency response curve while leaving to chance what consumers will actually hear.

The Hearables/Hearing Aids Convergence Is Driving Personalization

It is logical that headphones and especially true wireless stereo (TWS) hearables would be the first to address hearing personalization. Listening through headphones is an individual experience with a long history. True wireless hearing aids have existed for decades. The first hearing aid that could be directly connected to a smartphone was introduced by GN in 2013 [3], more than a year before consumer hearable pioneers Earin and Bragi released products.

This is where the concept of in-ear personalization of streaming audio began. While hearing enhancement of live speech via over-the-counter (OTC) hearing aids is just getting started with the coming regulations in the US, hearing personalization of streaming audio, an unregulated feature, is racing ahead. It is the low-hanging fruit for improving enjoyment of music and other media. It also offers the benefit of clearer audio for calls and internet meetings.

In its latest "State of Sound Report," chip maker Qualcomm noted that when considering advanced features in TWS earphones, 60% of people deemed hearing personalization likely to have an impact on their purchasing decision [4]. The time and effort needed to implement personalization is going down as hearing app developers respond to this demand. Two examples of companies providing personalization software for consumer devices are Sonarworks and Mimi Hearing Technologies. There is now a steady stream of popular earphone brands driving the trend including Skullcandy (with

Mimi), 1More (with Sonarworks), Jabra, Apple, and Anker/Soundcore, to name a few.

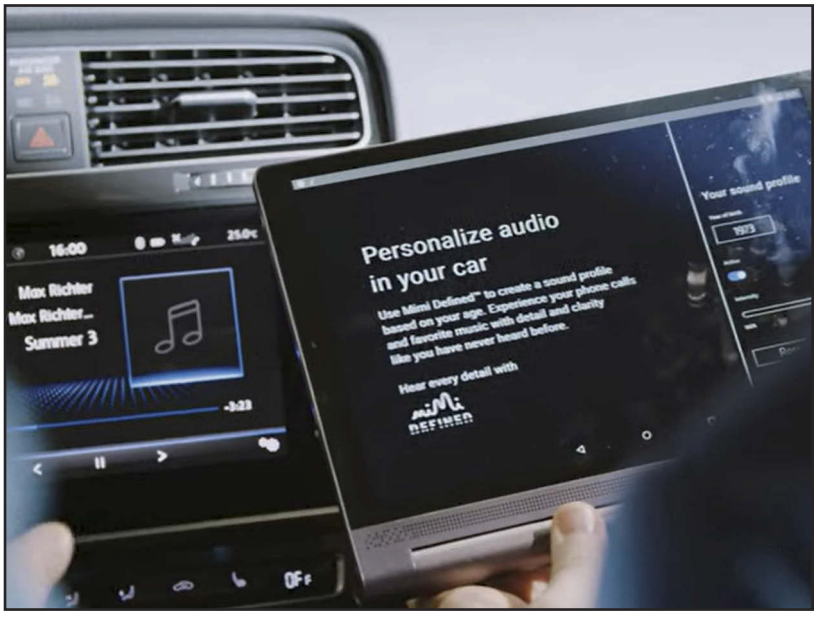
Given the rapidly maturing technology, it makes little sense to design for headphone audio quality without also designing for peoples' individual hearing responses. This is true for all headphones but especially those targeting Hi-Res Audio and soon, lossless. Hi-res loses its value when people cannot perceive the improvement over traditional low-quality digital music. Everyone in the hi-res ecosystem should benefit from greater adoption as personalized headphones grow in popularity.

Watch This

Understanding dialog when watching TV can be problematic at all levels of hearing loss, especially when speech is obscured by other sounds or music. Two methods are emerging for improving speech understanding. One is to build personalization directly into the TV as Philips has done with Mimi [5]. This is the least complex and most comfortable solution for a single person, but it is less than ideal when multiple people with different hearing abilities watch together. Another option is to build personalization features into an external soundbar. As Brent Butterworth describes in *Wirecutter*, a number of companies are taking this approach [6]. Rather than full personalization provided by a hearing test, they offer settings that enhance the vocals over other sounds. Some have a range of settings, which facilitate finding a mode that works for multiple viewers.

More severely hearing impaired people can really struggle with TV audio. The major hearing aid companies have reduced the problem by developing low-latency streaming devices that can even broadcast to multiple users. These tap the TV's secondary audio output to stream directly to one's hearing aids, providing personalized sound with independent volume control. Hearing aid systems are elegant because users can still hear their companions through the hearing aid microphones while the TV sound is also streaming. Unlike standard Bluetooth, the latency is low enough to permit receiving augmented audio from the hearing aids simultaneously with the direct TV sound.

The most promising option of all will come when the Bluetooth 5.2 broadcast mode is deployed. This will bring the same functionality as hearing aid streamers to the mass-market. (In fact it was the hearing aid industry that drove this development.) Incorporated into ordinary true wireless stereo (TWS) earphones with hearing



Mimi showcases its sound personalization technology in a Volkswagen car in Beijing. (Source: Mimi)

About the Author

Andrew Bellavia is director of market development at Knowles Corp. With a lifelong passion for audio and more than 30 years of experience in the space, Andrew is an advocate for innovations in hearing care and sound devices in both his professional and personal endeavors. For nearly 10 years, he has worked to bring Knowles' world-class acoustic solutions and balanced armature technology to market for innovators, leaders, and end-users in the hearing health, in-ear monitor, and premium sound markets.

References

[1] World Health Organization, "Deafness and hearing loss," April 2021, www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss

[2] NPR & Edison Research, "The Smart Audio Report, Spring 2020," April 2020, www.edisonresearch.com/the-smart-audio-report-2020-from-npr-and-edison-research

[3] "GN ReSound announces the world's first 'Made for iPhone' hearing aid," GN, October 2013

[4] Qualcomm "2021 State of Sound Report," September 2021, p. 18

[5] Techradar, "Philips OLED and Mini LED TVs will feature personalised audio," March 03, 2021 www.techradar.com/news/philips-4k-tv-sound-systems-can-now-be-calibrated-to-your-ears

[6] B. Butterworth, "Trouble Hearing TV Dialogue? The Right Soundbar Can Help," *Wirecutter*, March 2022.

[7] Radio Research Consortium, "The Percentage Of Listening To Radio From The Car Continues To Improve," November 2021, https://rrconline.org/the-percentage-of-listening-to-radio-from-the-car-continues-to-improve

[8] Volkswagen Group Culture, "Art & Tech in Beijing | The influence of AI on Mobility & Culture" (video) October 2018, www.youtube.com/watch?v=vJ1NqZsEcD0.

[9] Phys.org, "Algorithm finds personalized sound zones in cars for driver, passengers," September 2021 https://phys.org/news/2021-09-algorithm-personalized-zones-cars-driver.html.

personalization and ambient microphones, people with different hearing needs can watch TV together and converse at the same time. This will also apply in public venues (e.g., sports bars) where people will be able to receive and clearly understand the audio from any of the screens. As use cases for TWS earphones such as this one grow, the demand for personalization will grow with them.

Driving Adoption

Automobiles remain one of the top locations where people listen to the radio or streaming audio [7]. The quality of the sound system is an important purchase driver, with automakers sometimes going to great lengths to deliver a premium experience. The paradox is that the average consumers' hearing is often declining by the time they can afford a car with a premium sound system. Including hearing personalization restores the listening experience automotive sound system developers strive so hard to create. As early as 2018, Mimi demonstrated personalized sound in a car [8]. Since most driving is done solo, adding personalization, which can be disabled when there are passengers, could be the next big leap in perceived sound quality.

An intriguing future possibility is the creation of personal sound zones at each seat location. While research has been going on for some time, recent advancements in software algorithms are bringing the concept closer to reality [9]. Intended to allow each passenger to listen to their own audio stream, such a system could at the same time personalize the sound individually without affecting that of their neighbors.

Make Listening Personal

Very few consumers have the "perfect" hearing that audio engineers target. Everyone's hearing is unique so that everyone has a different experience when listening to the same gear. Providing a method of personalizing the audio to each person's hearing profile creates a more enjoyable experience. Not only is this a good thing from an accessibility point of view, but in today's world of instant feedback and internet reviews, it can also result in higher ratings and stronger demand. ***LIS***

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CRY Sound
DML Exciters
Lumi Audio
Trueanalog Strictly OEM
Zhuhai HiVi Technology Co., Ltd.

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Beach Dynamics
Biamp
Cadillac Audio
CJS Labs
COMSOL
Danville Signal Processing, Inc.
Dinaburg Technology
Eminence Speaker, LLC
FerroTec (USA)
Globe Plastics
GRAS Sound & Vibration
Knowles Corp.
Listen, Inc.
Loudspeaker Components
McKinney & Associates
Menlo Scientific, Ltd.
MISCO
Monaero Engineering
MSC Software Corp.
Pacific Audio Consulting
Parts Express
PCB Piezotronics
Peerless by Tymphany
Radian Audio Engineering
Resonado Labs
SOUND Product Strategy
Stetron International
Tectonic Audio Labs
True Technologies
Warkwyn

AUDIO & LOUDSPEAKER TECHNOLOGIES INTERNATIONAL (ALTI)

Audio & Loudspeaker Technologies International (ALTI), which was formerly known as ALMA International, is an association founded and operated by professionals in the audio and loudspeaker technologies industry for the benefit of its members and the industry at-large. ALTI members include audio and loudspeaker designers and engineers, business management and marketing professionals, as well as suppliers of test and measurement equipment, consultants, individuals, students, and educators who participate in the industry. ALTI welcomes a global membership and aids its members success by creating a positive atmosphere to promote technology and by encouraging business and commerce.

ALTI was founded in 1964 as the American Loudspeaker Manufacturing Association (ALMA). The association has undergone a constant evolution over the last 10 years to reflect its global membership and to promote the interdependency of all facets of the audio signal chain. Today, ALTI members include all technologies related to the audio industry, and all of the business related to that technology. ALTI is a launchpad for new products and technology.

ALTI'S MISSION STATEMENT:

ALTI is built for and by professionals in the Audio & Loudspeaker Technologies Industry to learn, to teach, to grow, and to get business done!

Home Cinema Evolvement

Innovation Never Stops

By
Tony Ostrom
(President, WiSA Association)

The consumer electronics (CE) industry began in the 20th century and has continued to grow astronomically, especially as online purchasing for CE-related products grew in popularity. In fact, the global consumer electronics e-commerce market is expected to reach nearly $511 billion in 2025. Now in our third year of a global pandemic, consumers are becoming increasingly used to having an on-demand, home cinema lifestyle, and therefore online retail purchasing is spiking.

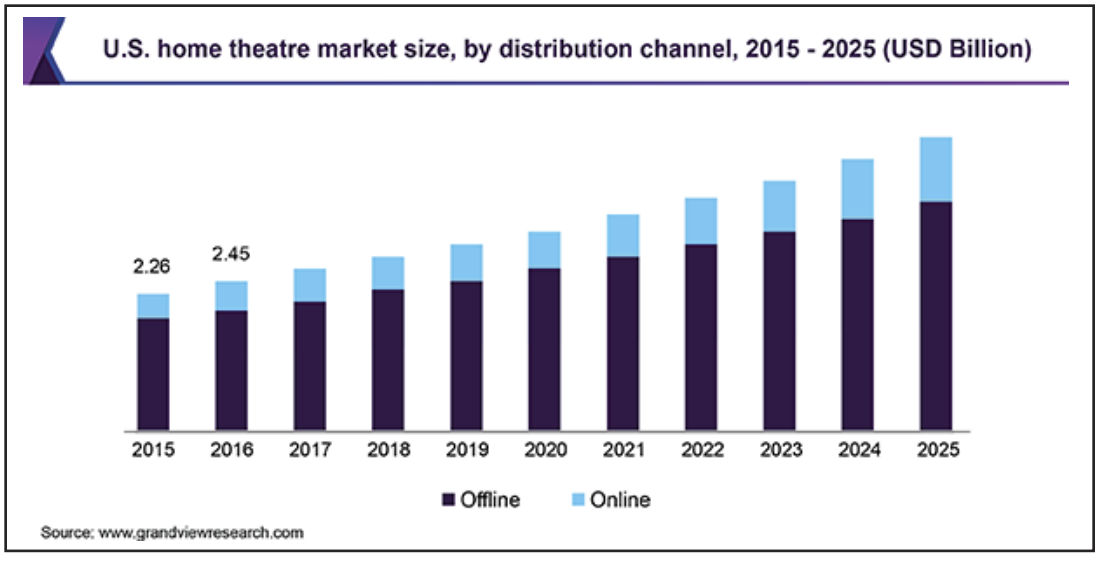
With this trend comes an increase in the number of smart homes on the market. It's predicted that there will be more than 77 million smart homes in the US in 2025. Although the onset of "smart home technology" began as early as 1975, the speed at which the industry continues to introduce new products and technologies is nothing short of incredible. And there's no indication that this will slow down anytime soon.

Trends with Consumer Behavior

While it's certainly changed our lives in a multitude of ways, COVID-19 has made a huge impact on consumer behavior when it comes to audio and video entertainment. Prior to the pandemic, individuals would leave their homes more often to partake in leisure activities (e.g., going to the gym or seeing a new film in theaters). Now, the focus for many people is on creating an atmosphere within the walls of their own homes to do things such as stream the latest movie or try a new video game.

The consumer electronics industry as a whole has always been agile when it comes to responding to consumer needs, but with the boom of the smart home and smart TV markets, it's critical for the industry to be even more in tune with consumer behavior in this digital age. Digital shoppers have access to unlimited amounts of information, including complex purchasing journeys and often endless reviews of the product they're considering.

Because of this, brands are presented with an opportunity to create, or completely redo, their products' websites and landing pages to serve consumers in the best way possible. For example, the Wireless Speaker and Audio (WiSA) Association announced its new website URL this year, www.wisatechnologies.com to serve as the primary site to promote WiSA products and expand



The US home theater market size continues to grow. (Image source: Grand View Research)

category marketing initiatives. WiSA is expanding its reach to cover more of the CE industry in an effort to be an all-encompassing one-stop-shop for technology, integration, certification and testing updates. The Association's overarching goal is to be the go-to solution for any and all spatial audio needs.

As people become more familiar with their own electronic devices or lack thereof, consumer electronics manufacturers, specifically for the home audio market, are given the opportunity to successfully market to new customers who are seeking to invest in, or upgrade, their home cinema.

Evolving Retail Landscape

Typically, the age of a home doesn't impact what can be done in terms of bringing in audio and visual upgrades. While the size and the layout of homes certainly vary, the CE market as a whole produces, on a regular basis, products of every size, shape, and price point so that every consumer has a reasonable, appealing option.

What remains at the forefront for consumers are dedicated demos before purchasing a product. Consumers want to know the differences between smart TVs, soundbars, and immersive, spatial audio systems from 5.1 to Dolby Atmos. Because of this, brands across the globe must remain diligent in providing what consumers want: uncomplicated setups, accessible demos, and innovative products.

While the internet can provide almost everything a consumer might need before making a purchase, it still doesn't completely make up for what people experience in person with their eyes and ears. Many retailers are responding to the need of in-person immersive product demonstrations by offering in-store experiences that feature entire system bundles that showcase the interoperability of products from several brands. For example, WiSA Association member Bang & Olufsen chose to launch an interactive Beohome Experience Store in Boston, MA, that's a part of its retail store. In addition, WiSA Certified Retailer, Electronic Express, offers in-store demonstrations of the Platin Milan WiSA Certified Speaker systems to enjoy immersive audio experiences in-store.

What's Next for the Consumer Electronics Industry?

Consumers crave immersive experiences because they simulate real life. With today's TVs, audio solutions and highly produced content, it's possible to have the pinnacle of immersive entertainment at home. It's up to the industry, though, to clearly define their offerings and present new products in a way that's accessible and not intimidating. Consumers are becoming more technologically savvy, so as long as user-friendliness and wireless setups are at the forefront for consumer electronics manufacturers and it's made clear through retailers, the sky's the limit. ***LIS***

About the Author

Tony Ostrom is president of the Wireless Speaker & Audio (WiSA) Association, an industry group dedicated to building the category of fully interoperable, high-resolution, multichannel wireless audio components and bringing them to consumers. His 25-year career in the consumer electronics industry has been focused on product planning and development, consumer research, go-to-market planning, technology integration, marketing and training.

Meet PAMA

By
Jennifer Shockley
(PAMA Executive Director)

PAMA looks forward to the return of in-person events, such as this gathering of PAMA member-company representatives at its 2019 retreat

The Professional Audio Manufacturers Alliance (PAMA) is the collective voice and forum for the leading manufacturers of professional audio products and the people who use them. PAMA member companies conduct business worldwide in support of high-quality audio across a wide range of industries—illuminating the state-of-the-art in technology and practice to enable audio professionals to elevate their craft and delight listeners and audiences. PAMA member companies come from a range of professional product categories, including wired and wireless microphones, headphones, interface, signal processing, digital audio networking, amplifiers, and loudspeaker systems.

Featuring some of the leading loudspeaker brands in pro audio, including Adamson, d&b audiotechnik, Harman/JBL, and QSC, all PAMA member companies participate in online and in-person dialog and initiatives. These opportunities provide networking among member executive teams and unique opportunities for dialog and interaction that builds community and supports a more robust industry for all stakeholders. "While PAMA member companies compete in the marketplace," says Chris Regan, PAMA Board of Directors chair and co-founder and president of PAMA member company RF Venue, "we can collaborate on common interests and work together to create a stronger industry to our mutual benefit, and to the benefit of our customers."

PAMA's Role in the Industry

Along with sharing the benefits of professional audio hardware and software in delivering high-quality audio, PAMA also monitors the industry and serves as an advocate on critical public policy, legislative, and intellectual property issues and trends; works to protect and grow the professional audio business through collaboration with trade associations and exhibitions; serves as a conduit to bodies engaged in standards, education and other technical pursuits; and ensures the longevity of the professional audio industry through outreach and recruitment of passionate individuals seeking employment opportunities.

PAMA draws on the collective voices of industry experts from its member companies to provide thoughtful leadership and informed commentary on timely issues. "Through shared insights on critical issues our customers face daily in their work," says Regan, "PAMA has become an influential and visible voice for the promotion of quality audio and a healthy audio industry."

Early in the pandemic, PAMA invited the founders of The Roadie Clinic to share their story and mission during PAMA's monthly membership meeting. Their mission, to "empower and heal roadies and their families by providing resources and services tailored to the struggles of the touring lifestyle," resonated with PAMA's membership, resulting in PAMA support of the clinic.

PAMA has since invited expert guests to address the membership in open online events. The sessions have covered a broad scope of topics ranging from emerging technologies to supply chain issues and business trends to interpersonal networking to hiring practices in the emerging post-pandemic marketplace. Archives of these thought-provoking, informative, and inspirational presentations are freely available for viewing on the PAMA website at www.pamalliance.org/events.

PAMA also promotes the industry with panel discussions at universities to develop opportunities for students to learn more about pro audio manufacturing jobs.

PAMA's diversity in membership has been reflected in these events where representatives of global manufacturing firms, joined by individuals from smaller entrepreneurial firms, provide inspiration from their own, typically nonlinear career paths along with valuable insights on the hiring process, making contacts, and job interview considerations.

Furthering that commitment to encourage future audio professionals, PAMA also awards pro audio scholarships annually for students focused on audio recording, production, and live event engineering. In cooperation with Shure, Inc., PAMA is currently administering the second annual Mark Brunner Professional Audio Scholarship in honor of the late Shure executive and past PAMA president.

"We're all looking for great employees," states Regan. "Nurturing the next generation of audio professionals and educating students regarding potential employment in manufacturing has become an important part of PAMA's role." For graduating students and seasoned professionals alike, PAMA's website includes a job board where member companies share open positions.

Building Relationships

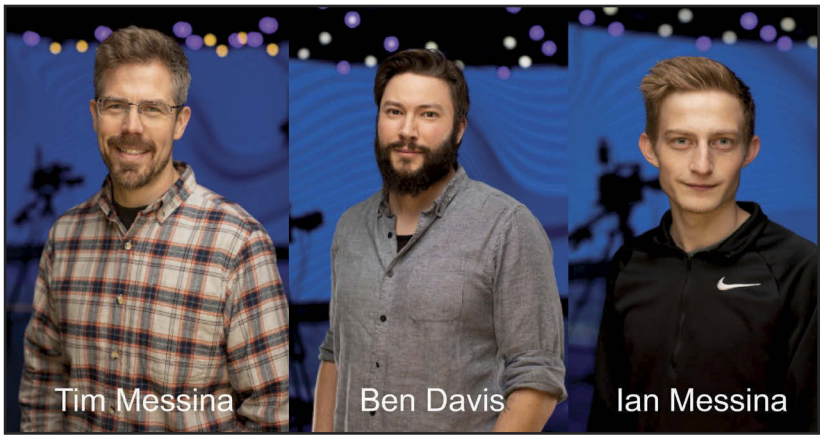
The professional audio industry is small relative to broad, consumer-targeted manufacturing. As such, it's traditionally been a community where friendships and collegial relationships are built across company boundaries. From the executive level through, management, marketing, engineering, product development and manufacturing, audio professionals understand the value of open communication and conversation on shared interests and concerns. PAMA exists to promote such dialog. "Not only does PAMA provide advocacy for quality audio, but also a forum for sharing insights on issues we all face as audio manufacturers," says Regan. "Stronger companies make for a stronger industry and PAMA helps make us stronger."

For example, PAMA member companies participate in research studies, where member companies collaborate to better understand global market trends and identify common-cause issues for the industry, the burning issues of the day and the macroeconomic conditions affecting pro audio manufacturing and sales.

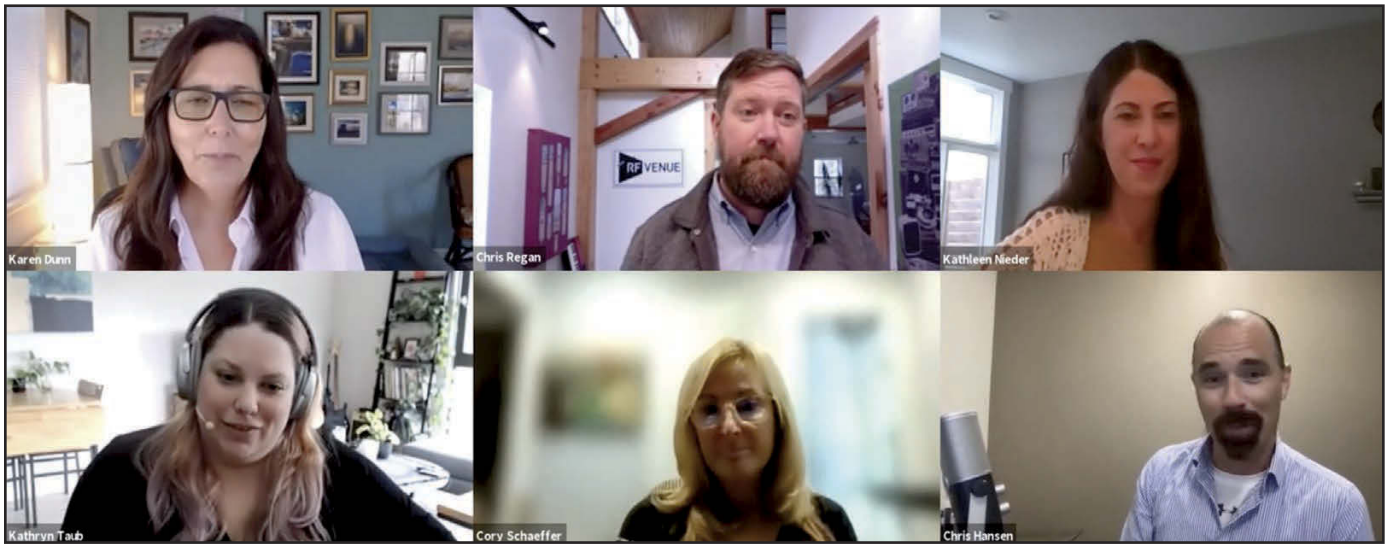
Chris Regan is PAMA's Board of Directors chair, and co-founder and president of PAMA member company RF Venue.

Recent Initiatives

In a recent initiative, PAMA worked with its members and industry trade organizations to address outdated language and terminology issues increasingly identified as discouraging a spirit of inclusivity within the professional audio community. PAMA surveyed its member



Tim Messina, Benjamin Davis, and Ian Messina from Events United and Studio Lab joined a 2021 PAMA virtual meeting to discuss the potential of eXtended Reality (XR) capabilities for the film and event industries, and XR's enabling technologies. The series of events, freely available for viewing on the PAMA website at pamalliance.org/events, has included Dr. Chris Kuehl, managing director of the corporate intelligence firm Armada; Chuck Wilson, longtime executive director for NSCA; Michael MacDonald, president of ATK Audiotek; Futuresource Consulting's James Kirby, market analyst, and Leon Morris, development manager; Michael Ross, vice president, partner marketing at Sweetwater Sound; and Mike Dias, director of sales for Earthworks Audio, executive director of the In-Ear Monitor International Trade Organization (IEMITO) and PAMA board member.



The Professional Audio Manufacturers Alliance (PAMA) career opportunity webinar panel for students of Berklee Boston in 2021 included (clockwise from top left): Karen Dunn, KMD Productions; Chris Regan, RF Venue/PAMA; Kathleen Nieder, Shure; Chris Hansen, Harman International; Cory Schaeffer, QSC; and Kathryn Taub, Audinate. The event was part of PAMA's ongoing outreach to audio students.

companies to gather feedback regarding problematic language (e.g., master/slave in clocking references and eliminating male/female in reference to connector topology) and solicited input on alternate, neutral terminology.

"The intent is for PAMA members to recommend adopting a framework within their organizations for the implementation of unified terminology across the industry, in the spirit of inclusivity and consistency," explained PAMA Board Chair-Elect and Inclusion Committee member Karam Kaul, vice president, global product line management professional audio at PAMA member company Harman International. "It comes down to treating each other with respect. PAMA worked in collaboration with Audinate and a few other member organizations, using an Audinate framework as a starting point, with additional added elements such as addressing the replacement of gender identification of connectors with the neutral designations plug/socket." The result is the PAMA document, "PAMA Recommendations for Neutral Nomenclature in Pro Audio," which can be downloaded at: tinyurl.com/PAMA-NN-Guidelines.

Looking Ahead

As PAMA approaches its 20th anniversary, the organization is actively recruiting new member companies to its ranks to increase its outreach globally. "PAMA is a highly collaborative organization," shares Regan. "Participation in PAMA has proven valuable for my company and that value grows with increased participation. PAMA membership is designed to accommodate any size company. We welcome a membership conversation with professional audio manufacturers and vendors who share our passion for audio quality, a healthy industry and better results for all our customers."

PAMA invites you to visit its website www.pamalliance.org to learn more about the organization, its member companies and Board of Directors, about becoming a PAMA member, and to explore the PAMA event video archives of membership meeting presentations and student career opportunity seminars. ***LIS***

About the Author

Jennifer Shockley is the executive director of PAMA and provides strategic guidance to the organization. She has 23 years of experience in association management, including legislative advocacy, grant writing, and survey development. She has obtained the prestigious Certified Association Executive (CAE) certification from the American Society of Association Executives. She always appreciates a good pop culture reference.

AUDIO ENGINEERS

AUSTRALIA
Audinate
DEQX

AUSTRIA
USound

BELGIUM
Donnet: Loudspeaker Repair

BRAZIL
Advanced Audio Technologies (AAT)
Attack do Brasil
Edgar Prudente da Silva
Newbox Industry & Commerce
Phix Electronics

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Integrated Audio Technologies
Io Audio Technologies
JJR Acoustics
Lipinski Sound
Meliti Acoustics
North Reading Engineering
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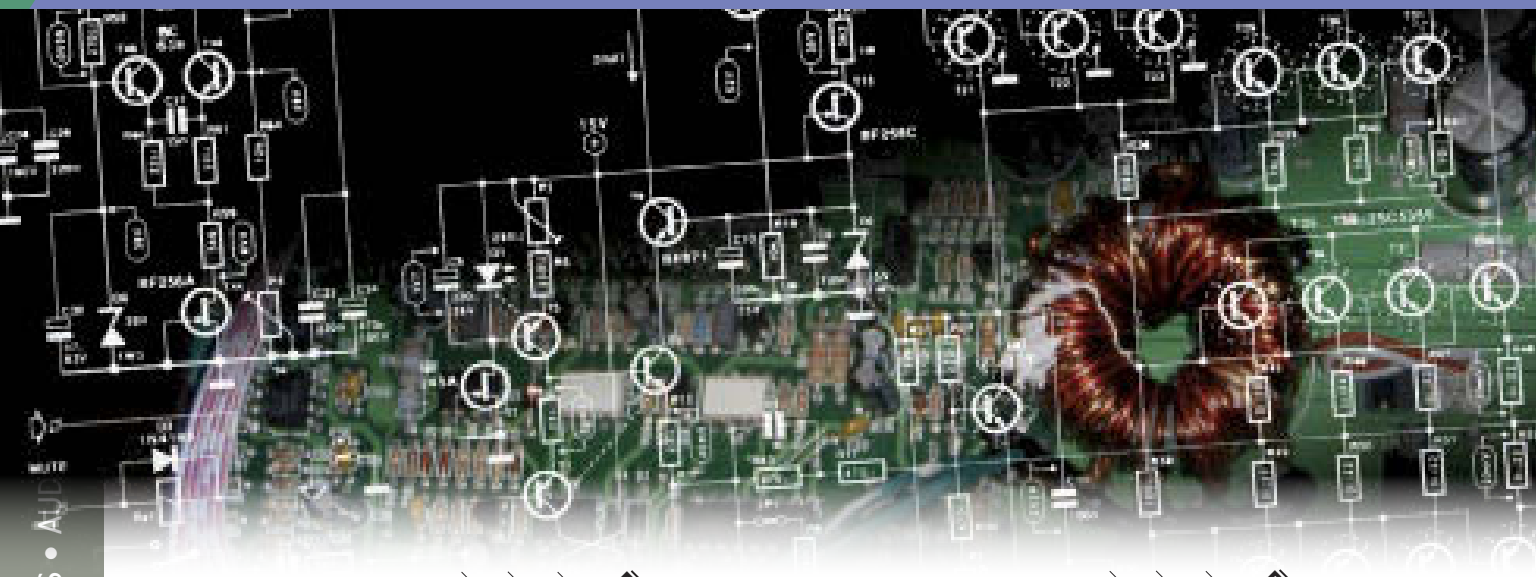

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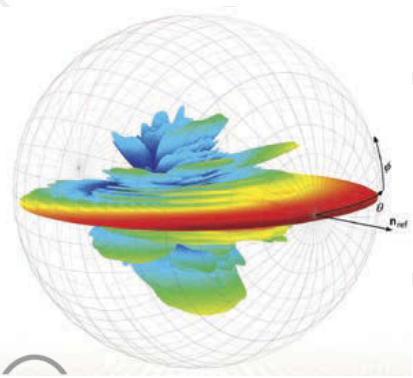

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Sound Hub Denmark Welcomes the Global Sound Industry

In Struer, Denmark, a peaceful town with a strong sound DNA and hometown for Bang & Olufsen—one of the most iconic Danish brands—we find Sound Hub Denmark. A powerhouse of sound for a better world that offers a unique international business and development environment, by promoting sound technology and innovation.

Welcome to Sound Hub Denmark and the Silicon Valley of Sound. Sound Hub Denmark is situated in Struer, City of Sound, Denmark. It is the world's first international sound technology and innovation hub, with the ambition to become a growth hub for the audio industry.

By
Rie Kold Pripsø
(CCO, Sound Hub Denmark)

In the mid-Jutland region, surrounded by beautiful nature, the fjord, Struer is a city with a high quality of life. With more than 70 different living nationalities in the municipality, the City of Sound easily embraces guests and new inhabitants from all over the world.

Located in the original Bang & Olufsen red stone factory building with architecture dating back to 1946, we find Sound Hub Denmark, the world's first international sound technology and innovation hub—providing a focused, world-class workplace for start-ups, freelancers, and small and large corporations, working in the field of sound and acoustics.

Established in 2019, with the ambition to be a world-class powerhouse, Sound Hub fosters business acceleration in a professional co-working environment with in-house cutting-edge measurement, workshops, and test facilities. In fact, Sound Hub offers unique access to a complete range of resources and professionals as well as a network of highly specialized industry leaders, mentors, and institutions.

At the premises in Struer, companies and individuals will be able to get business acceleration and a community environment with easy access to excellent research facilities and highly specialized support from in-house professionals, industry leaders and universities.

Partners include leading global key players within the international audio industry, including Bang & Olufsen, Harman Lifestyle, GN Audio (Jabra), Roku, Scan-Speak, Dynaudio, Aalborg University, and Danish Sound Cluster. In surplus with many other established companies specializing in speaker drivers, audio test and measurement, audiology, and acoustics, which has already joined the ecosystem accompanying a vibrant group of startups, entrepreneurs, and researchers. All underlining Sound Hub Denmark's vision to be a global powerhouse for sound innovation—the world's best place to start and scale innovative sound businesses of tomorrow.

The Silicon Valley of Sound

Struer, now branding itself as the City of Sound, is located in a region of Denmark with a high concentration of innovative companies in many different competence areas, creating a thriving business community. All potentially relevant as the region offers an incredibly versatile and unique craft cluster of mechanics, electronics and hardware companies, supply partners, and professionals with complementary competencies to support the residents and members of Sound Hub Denmark.

Finding like-minded skilled people and an environment where innovation is nurtured, is a great reason to move to Denmark for a shorter or longer time-period. Companies look towards Denmark for a great work/life balance, affordable living conditions and good infrastructure with few traffic jams.

For decades, Denmark has attracted and developed countless audio, acoustic and sound enterprises. As a

"We attract international talents and the most promising ideas within sound to Denmark. We do that by forming an inspiring and collaborative sound tech community and ecosystem and nurture sound entrepreneurship in both education and business," Rie Pripsø, CCO of Sound Hub Denmark, pictured with Peter Petersen, CEO of Sound Hub Denmark.

country, Denmark holds a global leading position for the number of companies working in these domains. Although Denmark is a small nation of approximately 5.8 million people, the Danish sound industry alone currently involves more than 600 companies representing a turnover of +40 billion DKK and more than 30,000 employees. And the potential growth in this segment is just increasing with the fast pace of new technology introductions and digitalization.

In that perspective, Sound Hub Denmark aims to strengthen, underline, and further develop Denmark's profile in audio innovation. To establish the world's first sound technology and innovation hub in Denmark was just a natural step toward that goal.

The premises of Sound Hub Denmark count 3000m^2 of beautifully renovated facilities. Being a former residence of Bang & Olufsen, housing first a production site and then their R&D department, the building carries a sound history back to 1937. Inside, companies can find complete workshops to construct mechanical parts, assemble electrical modules, build prototypes and do functional tests, or even a painting cabinet with exhaust available to use.

The test and measurement facilities are second to none and include one of the world's largest privately owned 360° free-field electroacoustic measuring facilities, nicknamed The Cube, together with other semi-anechoic chambers and Listening Rooms with standardized acoustical properties, all equipped with relevant equipment to perform tests. There's also state-of-the-art headphone measurement systems and a complete assortment of equipment to determine audio specifications or design test sequences for production tests of any type of equipment or components. All made available to support sound innovation.

"The facilities of Sound Hub are ones that you would normally have to pay a lot of money to use. That this is available here, is very special," says Rok Gulic, Co-Founder & CEO of OLLO Audio (Slovenia).

In a dedicated, and heavily soundproofed Power Test Room, developers can test their designs to destruction, as a check of their ultimate power handling capacity, or just test them for extended periods. Dedicated Stress labs include climate chambers, UV and sun aging chambers, vibration, bump and transport tests, to ensure the robustness of your product. A Reverberation Chamber is also available to understand and test the acoustics impact of materials.

There's even facilities and accredited labs to ensure product compliance with standards and requirements. Compliance tests in the form of Accredited EMC tests, safety and HALT tests (highly accelerated life tests) are offered through EKTOS, an accredited test institute and electronic development company being located at the ground floor of the hub.

And Sound Hub Denmark establishes partnerships with many other companies that provide the latest evaluation tools and platforms in all the required test and measurement areas, including GOmeasure, GRAS Sound & Vibration, Audio Precision, Listen, GreenWaves, Loudsoft, and many more.

"Sound Hub lives up to its name by connecting people and companies from all over the audio industry. This has enabled us to engage with several of the world's leading audio brands."—Pauli Minaar, Founder & CEO of IDUN Audio (Denmark)

Get Matched and Collaborate

For the current residents and guests of Sound Hub Denmark, it is all about networking and collaboration, and sharing knowledge, building

"For the first time in our Active Noise Cancellation tests, thanks to the Quiet Room, we could reach the absolute theoretical minimum level in internal microphones. Thanks to Sound Hub for providing the opportunity for proper test environments," states Amir Farahani, Co-Founder & CTO of AVAtronics (Switzerland).

concepts, products, and services in a faster and more efficient way. With a global mindset, Sound Hub Denmark has created an international ecosystem, nurturing innovative sound business for a better world and society.

This unique international hub offers access to a wide range of complementary competencies. The hub provides access to in-house, cutting-edge acoustic test and measurement facilities, combined with world-class workshops and supporting professionals, creating a second to none ecosystem facilitated by partnerships—both locally and remotely—and the Sound Hub in-house team.

As an example, in 2019, AVAtronics SA, a company headquartered in Lausanne, Switzerland, working on a patented AI-Enhanced True Wideband active noise cancellation (ANC) technology, established a subsidiary in Sound Hub Denmark. Being one of the first international start-ups selected for the SoundTech Accelerator Program, one of the first to establish a Danish limited liability (ApS) company, and one of the first to make use of the Sound Hub sound labs, AVAtronics was able to quickly hire valuable employees in Denmark.

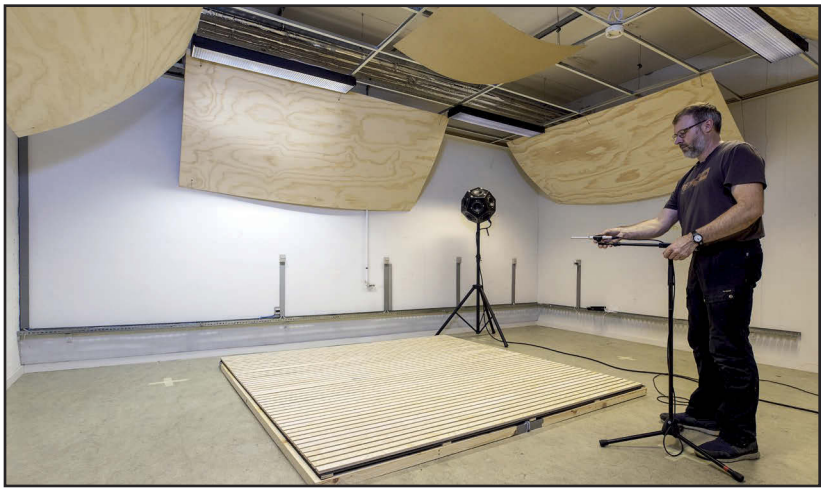
AVAtronics is running several ANC projects with customers and partners mainly in two application fields: in-seat ANC for transportation industry, and true wideband AI-enhanced ANC for true wireless stereo (TWS) and premium headphones industry. Since setting foot in Denmark, AVAtronics closed rounds of financing and is now being supported by multiple Swiss and Danish startup support organizations such as: Innosuisse, VentureKick, Innovaud, FIT, and Sound Hub Denmark.

Benefiting from the Sound Hub network, AVAtronics has had talks with several potential partners and clients in DK, which in the long-term helped AVAtronics to tune its strategy toward becoming a global ANC technology and service provider.

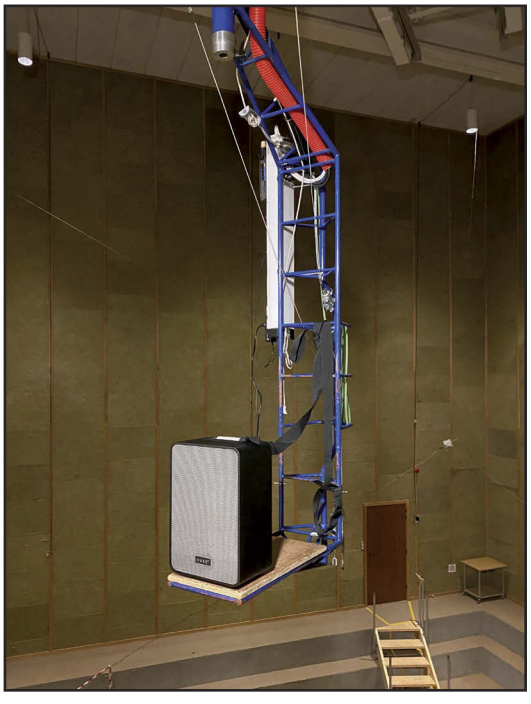
A Specialized Hub

The establishment of a dedicated hub for sound and acoustics speaks into the industry trend of the synergies that can be created when like-minded people meet and create meaningful clusters focusing on technological innovation within a specific field. In line with Sound Hub Denmark's primary mission to attract and support talent, foster incubation, and drive innovation, the hub concept connects entrepreneurs with companies, professionals, researchers, and investors.

To enable this concept, Sound Hub Denmark is formulated as three different spaces: a Coworking Space where you meet industry professionals and get inspired; a Makerspace where you ideate,



The Reverberation Chamber is deliberately designed to have a long reverberation time and a diffuse sound field with hard surfaces and reflectors in all directions. The 82m^3 room is useful for determining the sound absorption characteristics of surfaces used in building and for acoustic treatment. Peter Chapman from PC Sound & Acoustics is seen here conducting tests of acoustical panels.



The Cube is one of the world's largest privately owned 360° free-field electroacoustic measuring facilities, with 12m × 12m × 12m, ideal for speaker measurements.

With a very low noise floor for acoustical measurements, the Quiet Room is an ideal test facility to measure headphones and headsets, equipped with head and torso simulators and all associated measurement equipment.

develop, test, and produce; and a Learning Space providing access to knowledge and complementary skills.

A tailored approach is the core of Sound Hub Denmark's offering. One size is never a good fit, so every new relation starts with a dialogue to align on the ambition level and outcome of the membership, tenant or partnership relation. All startups and companies seeing a benefit of being residents, guests, users or contributors to the ecosystem are welcome.

The **Coworking Space** is all about networking, matchmaking and meeting other sound and audio professionals in-house and network partners. Inspiring talks, workshops, pitching events are a part of the activities. This on top of the informal talk in the open coworking area, in the hall ways in-between the private offices and 11 meeting rooms—or a quick chat in the kitchen area with a good cup of coffee. From large private office spaces to a simple fly-in/fly-out flex desk, the Coworking Space also provides a range of facilities, including reception, meeting rooms, conference area, catering, etc.

For any company involved in audio and sound related development, having in-house Listening Rooms is invaluable. At any moment companies can listen to and tune a speaker in one of the listening rooms meeting the IEC 268-13 standard, which means having standardized acoustical properties and relevant equipment to perform tests.

In the **Makerspace**, Sound Hub offers its world-class sound test and measurement facilities and equipment, which even includes a material library, samples of speaker units, connectors, or evaluation boards, offered in collaboration with partners of the house. Professional guidance and help is always available to get the best out of these sophisticated facilities and speed up the development process.

Consultants and other professionals can also be called in to conduct relevant tests to assist start-ups or other companies requiring assistance. Add to this, a unique craft cluster of skilled individuals and companies that can help you in bringing your product to market. A versatile cluster of highly skilled and specialized companies and professionals are located within a very small radius of the Sound Hub, available to engage in the development process from design to production.

Finally, gaining knowledge from co-workers, industry professionals, specialists, and researchers is a large part of the **Learning Space**. Through events, review sessions, training, and custom programs, anyone can benefit from a potential upgrade of its skill sets, reinforced teamwork, or learn about new potential partnerships and opportunities. Sound Hub also provides and facilitates access to the latest research and can initiate research projects with universities and other institutions upon request from industry partners.

The Future of Collaboration

The long list of contributing partners—from global corporations to highly specialized and thought after consultants—are the strongest asset of Sound Hub Denmark. And a clear indication of what an open and trustworthy ecosystem, with highly competent and dynamic engagement can do in nurturing sound innovation and supporting companies to reach their growth ambitions.

Several tailored membership options and programs are offered for interested startups and scale-ups with an interest in founding a company in Denmark—or in need of advice on product and business development and funding opportunities in the audio industry.

Sound Hub also facilitates grant opportunities and contact with investors through pitching events or through one-on-one matchmaking with business angels and venture funds. Sound Hub can even assist and act as mediators in a due diligence process.

Large organizations, working from large centralized locations are under pressure. Corporations are increasingly considering smaller and professionally relevant coworking spaces as an alternative to headquarter offices or even working from home (alone). A professional hub such as Sound Hub offers the ideal environment for a more efficient organization.

Some of the start-ups currently hosted in Sound Hub have people working from many different and remote locations; some only meet in person here, in Struer. Having the same focus, draws people with common interests – even if working on entirely different types of products. Sound Hub Denmark is designed for the future of work environments.

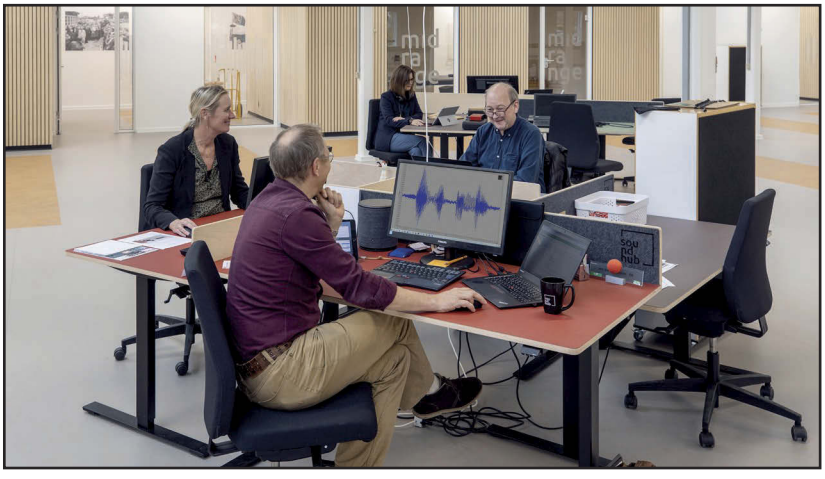
The Backbone of Innovation

Sound Hub is already attracting international talent and the most promising ideas in sound to Denmark. Over the past three years, the number of companies and individuals who have joined Sound Hub has steadily increased. All of them make use of sound but work in areas as diverse as fashion, healthcare, sustainability, room acoustics, noise cancellation, animation, toys and learning tools, music instruments, consumer electronics, streaming, chipsets, and more.

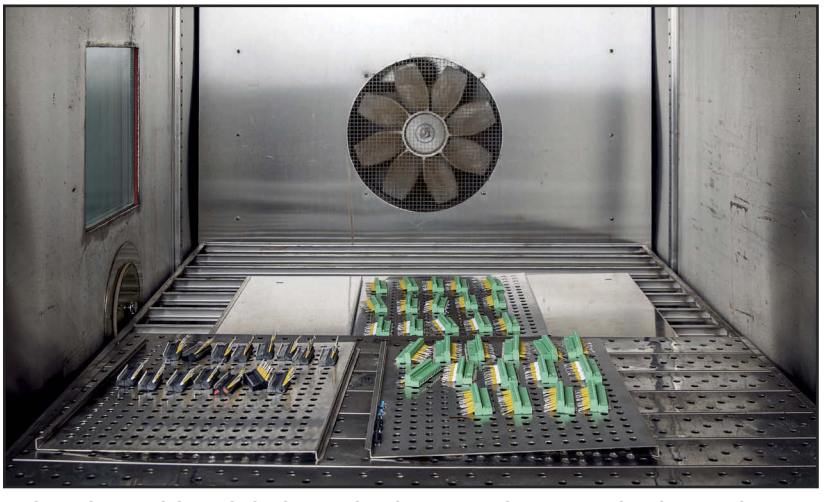
All the companies see the benefit of a dedicated hub. GOmeasure, a "one-stop-shop" for test and measurement equipment from world-leading manufacturers, decided to set up a division at Sound Hub Denmark in Struer—because "being surrounded by a wide range of companies specialising in sound, we can spot new opportunities." The legendary Danish loudspeaker manufacturer Dynaudio has joined the team at Sound Hub Denmark, "to benefit from the talents, network and facilities of an ecosystem dedicated to audio innovation."

Ole Wolff Electronics, a leading manufacturer of high-quality transducers and magnetics, has decided to join, "because we have a shared target group—the sound and acoustics industry—and see great business potential in the hub concentration of competencies. We expect potential synergy with Sound Hub Denmark, which is attracting a lot of innovative and exciting sound companies that will benefit from our solutions."

Six of the very first 17 international companies participating in the SoundTech Accelerator Program at Sound Hub Denmark have registered a legal entity in Struer, Denmark. Despite the diversity in their offerings, they all find Sound Hub Denmark and Struer to be the centre for sound innovation and perfect to start their journey. For more information, visit the Sound Hub website at www.soundhub.dk ***LIS***



Co-working spaces provide a collaborative and stimulating work environment.



Dedicated Stress labs include climate chambers, UV and sun aging chambers, and vibration, bump, and transport test areas, to ensure the robustness of products.

About the Author

Rie Kold Pripsø has a long history within product, brand, and marketing management from the international audio and sound industry. She has worked 21 years for Bang & Olufsen, of which 10 years has been within product management. Before joining Sound Hub, Rie was heading the brand partnership licensing business of in-car Bang & Olufsen audio toward the Harman group. Rie has profound knowledge of building corporate partnerships and business through value-adding collaborations. A competence amplified further by her skillset within brand management, marketing and procurement from the luxury audio industry. At Sound Hub Denmark, Rie is Chief Commercial Officer (CCO) with overall responsibility for corporate partnerships, sales, marketing, and community building.

DXOMARK Focuses on Sound

An engineer tests a speaker in DXOMARK's anechoic chamber.

Just because DXOMARK is a worldwide reference as an image quality expert is no reason for it to overlook sound. In 2018, the French independent laboratory went to great lengths to design a robust and repeatable audio protocol to test smartphones, and then adapted that protocol to loudspeakers.

Since the launch of the Speaker protocol a little over a year ago, DXOMARK engineers have evaluated close to a hundred wireless speakers, from entry-level products available for a few dozens of dollars to high-end models, such as the Bowers & Wilkins Formation Wedge, or the Devialet Phantom Opéra de Paris—and the results are not always what you'd expect!

Behind the Doors

Recently, the engineers opened their soundproof doors to let readers have a look (or rather, a listen) at what's hidden behind that highly sought-after DXOMARK Speaker score.

Although the Speaker testing suite found its roots in the previously developed protocol for smartphone speakers, it still required an additional 650 man-days to reach full potential. Primarily driven by the average consumer's use and habits around speakers, the team of sound engineers set up a complex combination of tests conducted in an anechoic chamber and in a purpose-designed apartment, both specifically designed for the protocol's needs.

"An anechoic chamber is very useful for conducting objective measurements and listening to specific audio cues. But when it comes to real-life use cases, testing an audio device in real-life environments remains crucial," said Justin Bacle, head of the Audio team at DXOMARK.

The Tests

As for tests themselves, they combine objective measurements and perceptual evaluations. The key point here is the difference between subjective and perceptual: while the former is, by definition, relative to each individual, the latter can, when correctly conducted, generate repeatable measures and robust results. At DXOMARK, this is achieved by a large number of precise questions posed using a specific lexical field, answered by trained and experienced sound engineers. Further, all tests are simultaneously conducted by two technicians, then independently checked by a third party.

Besides the objective measurements (e.g., frequency responses, distortion curves, dB SPL calibration, or directivity diagrams) carried out with specialized electronic gear, perceptual

evaluations rely on pretty special tracks. Unlike at most other testing companies, the sound tracks used for evaluation at DXOMARK are unique. In April 2020, DXOMARK commissioned a team of dedicated composers to produce perfectly tailored tracks containing all the sound cues required by the Speaker protocol. You can read more about how this project came to life and listen to those custom-made tracks in their dedicated article on www.dxomark.com.

Once obtained, all objective and perceptual results are mixed (using a proprietary algorithm) into a report, divided into five categories, each which reflects the speaker's performance in a specific audio domain.

Timbre focuses on the three main frequency ranges audible by humans (that is: bass, midrange, and treble), evaluating how harmoniously they're balanced between one another, and the quality of reproduction: Does midrange sound natural? Is treble aggressive? How deep is the low-end extension? **Dynamics** reveal how skilled the device is at reproducing the energy level of a sound source, taking into account attack, punch, and bass precision. **Spatial tests** measure the speaker's ability to immerse the listener into a wide stereo, evenly distribute 360° sound distribution, reproduce localizable sound sources, and realistically render distance. **Volume** deals not only with the maximum volume that the transducers are able to reach, but also with the overall intelligibility at minimum level, and with consistency of all the volume steps, from softest to loudest. Finally, the **Artifacts tests** study the speaker's skill at controlling sonic artifacts such as noise, distortion, or excessive compression.

Use Cases

However, those five big categories only represent the final, visible classification. In reality, to test a speaker, DXOMARK's engineers follow steps that are directly dictated by the most frequent use cases: Relaxing at home, a Friendly gathering, a Movie, a Party, Outdoors, in the Kitchen, in the Bathroom, and at Bedtime. These scenarios are broken down into several sub-scenarios and represent a different set of expectations from the previously mentioned categories (timbre, dynamics, etc.). To understand how DXOMARK evaluates a speaker's "recommendability" for a specific usage, let's dive into one of those scenarios.

The Relaxing at home evaluation, which takes place in the apartment's living room and lasts for about three hours and 40 minutes in total, is composed of three separate evaluations: one main scenario, one "closer" scenario, and a third one dedicated to podcasts.

Here is the testing living room in the purpose-designed apartment.

For the main configuration, the listener is positioned at 2.5 meters from the speaker, and the sound pressure level is set at 60dB SPL. In this scenario, tonal harmony and good dynamics at nominal volume are an important part of the experience, therefore, timbre and dynamic performances make up for more than 50% of the score. Specific characteristics are evaluated, such as the hi-hat's brightness, vocal presence and precision, the kick's depth and sharpness, the energy of the strings section, or bass decay. The rest of the score is divided between the device's spatial reproduction—How precisely can one locate the guitar solo? How right panned is the snare? How wide does the synth sound? How coherent is the perceived vocal distance?—and its ability to control sonic artifacts. No less than 29 tracks of all music genres are used in this subsidiary use case alone, for a setup time of 25 minutes, and an evaluation time of about one hour.

David Starck, one of the composers of DXOMARK's testing tracks, is shown at work.

The relaxing at home evaluation is composed of three separate evaluations: one main scenario, one "closer" scenario, and a third one dedicated to podcasts.

The "closer" configuration finds the listener only one meter away from the speaker. As a consequence, stereo width, and potential artifacts weigh a little heavier, since they both can be much more enjoyable—or problematic!—from a closer distance. As regards the podcast scenario, it logically mainly deals with midrange reproduction and vocal intelligibility.

By way of comparison, while the Movie use case also takes into account timbre, dynamics and artifacts control, it relies more heavily on the speaker's spatial performance. Indeed, in order to offer an enjoyable sound experience while watching movies, DXOMARK's sound crew considers it crucial that the speaker should be able to deliver a wide stereo with localizable sound sources, as well as a realistic distance rendering. As a result, monophonic speakers cannot qualify as suitable movie companions.

Going to bed is essentially a quieter time. Therefore, DXOMARK's Bedtime use case focuses on checking whether the tonal balance is maintained at softer listening levels, and if intelligibility is left intact when turning the volume way down—especially for highly dynamic content (i.e., audio exhibiting high volume variations), such as classical music or movies. In other words, before going to bed, timbre and (low) volume get the lion's share.

On the contrary, playing music outdoors is often meant as a shared experience. Whether it is intended for an early group yoga practice or for late pool parties, the speaker should be able to reach a fairly loud volume, deliver powerful bass… and be audible by everybody around, regardless of the listener's position around the speaker. This is why timbre, dynamic, and spatial attributes get an equal share in the Outdoor sub-score, with a particular consideration for the speaker's ability to evenly distribute sound all around, otherwise called "directivity." It is important to note that even when the speaker is portable, the DXOMARK protocol exclusively evaluates its audio performance. IP certification (waterproof, dust-tight, etc.) and promised battery life are not put to the test. That said, the engineers will still check whether there are playback differences when the device is plugged in an electric socket and when it's battery-operated.

The Party tests are also conducted in the anechoic chamber, but for other reasons. Because the target level must be set at 80 dB SPL, this is definitely not an ideal situation to (repeatedly) subject neighbors to! Note that some speakers struggle to reach that target volume, which consequently impairs their Party, and Volume, sub-scores.

Conclusion

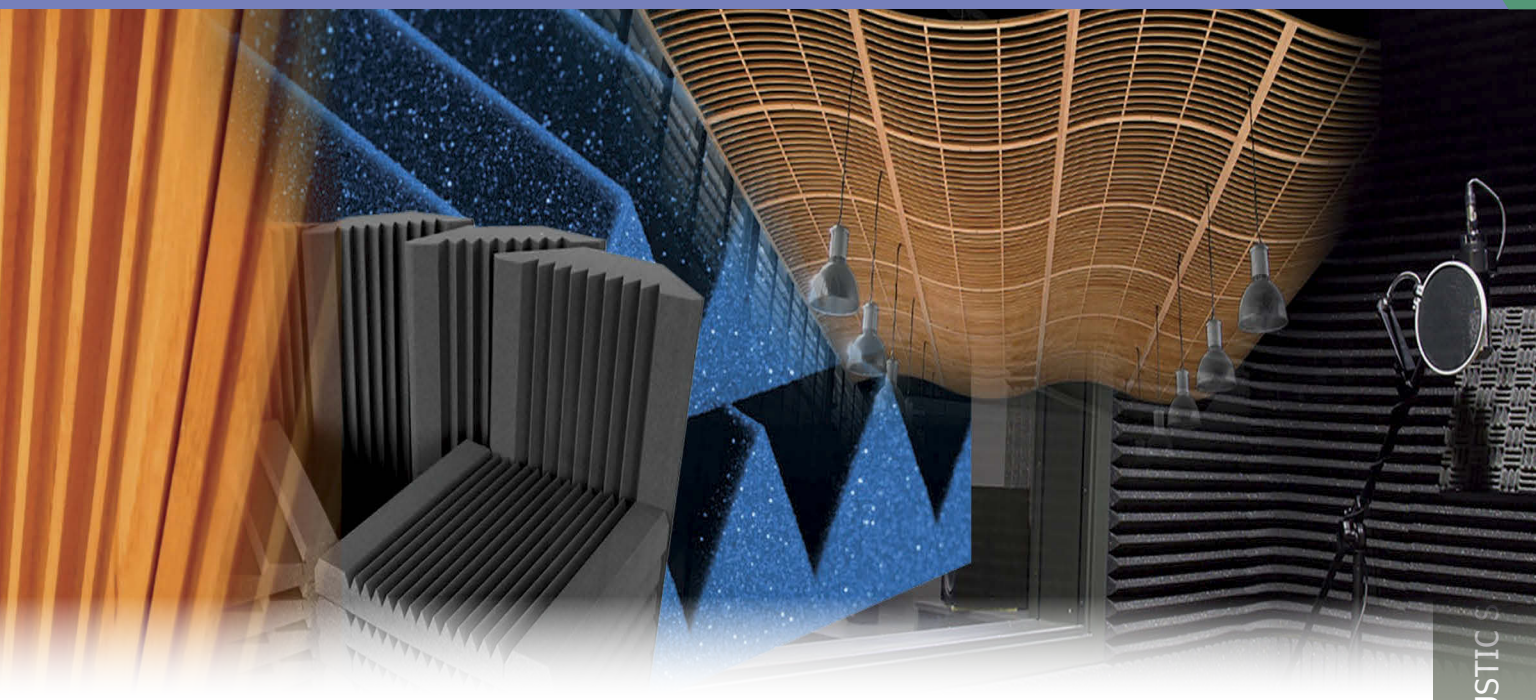
In conclusion, and as DXOMARK results consistently show, while a speaker can prove very well suited for a particular use case, such as partying, it can be relatively inadvisable in other scenarios—such as a kitchen sidekick, for example. This is why DXOMARK's Speaker score only gives a sense of the speaker's global audio performance, revealing all the nuances and use-case compatibilities in its full-fledged version. On the website dxomark.com, most of the reviews and scores resulting from the company's in-house tests, formerly exclusive to the manufacturers, are now made available to the public, as well as regular articles recommending the best speaker for each specific use case. And who knows, maybe in the future, we might also find home cinema and monitoring speaker reviews in there! ***LIS***

About the DXOMARK Audio Team

The DXOMARK Audio team is made up of 10 experienced sound engineers from all parts of the world who are passionate about the science of audio. Many of them have previously worked in the television, music, and movie industries. This article was written by Marie Georgescu de Hillerin, who writes audio articles and reviews for dxomark.com.

About DXOMARK

DXOMARK Image Labs is a private French engineering company located near Paris. The company specializes in Quality Evaluation of image, display, audio, and battery of professional and consumer electronics. DXOMARK has made the end-user experience of consumer electronics the focus of its scientific testing, which is done in 16 state-of-the-art multimedia laboratories at its headquarters. The company's international staff of 120 people includes scientists, engineers, and qualified technicians who are experts in their respective domains.



	Acoustic Consultancy Services & Design	Acoustic Doors	Acoustic Measurement	Acoustic Treatment Panels	Electroacoustical System Design	Home Theater Design	TV System Design	Multimedia and	Noise Control	Sound Booths	Sound Isolation	Theater and Concert Hall Design
AUSTRALIA												
Applied Measurement	•											
DEQX								•				
Lenard Audio	•					•	•					
Soundlabs Group					•							
BELGIUM												
Premium Sound Solutions						•						
The Innovators Lab Belgium (ILaB)	•					•	•	•				
BRAZIL												
Newbox Industry & Commerce	•	•	•	•		•	•	•	•	•	•	•
Phix Electronics	•						•	•			•	
CANADA												
Rutherford Audio, Inc.			•	•			•			•		•
Solen Electronique, Inc.			•								•	
Sziara Sound			•				•					
CHINA												
Junhao Wood Cabinet Factory						•	•	•				
Lumi Audio	•		•				•					
Trueanalog Strictly OEM			•			•	•				•	
Xiamen Great Sound Technology						•	•	•				
DENMARK												
Danesian Audio	•		•									
K & K Development			•									
Lyd by Dissing	•					•	•					
PointSource Acoustics	•		•			•						
FRANCE												
Florent Halgatte Consulting	•		•			•						

	Acoustic Consultancy Services & Design	Acoustic Doors	Acoustic Measurement	Acoustic Treatment Panels	Electroacoustical System Design	Home Theater Design	TV System Design	Multimedia and	Noise Control	Sound Booths	Sound Isolation	Theater and Concert Hall Design
Kartesian					•							
KYU Systems	•											
Seltech	•			•		•	•	•	•			
SIEA	•			•		•						
Supravox						•						
GERMANY												
Audio Technology Engineering (ATE)	•	•		•	•	•		•	•	•	•	•
Goya Acoustics	•			•								
Jobst-Audio	•			•		•						
Klippel GmbH				•		•						
Lautsprecher-Produktions-Gesellschaft (LPG)				•								
Mvoid Technologies GmbH	•			•		•				•		
Physical-Lab	•			•		•						
Soundsgood Pro Audio Solutions	•			•								
Voice Point	•	•		•	•	•	•	•	•	•	•	•
HONG KONG												
Deep Blue Design	•					•						
Eastern Asia Technology (HK), Ltd.						•						
miniDSP, Ltd.				•	•							
WCE Acoustics	•											
INDIA												
Arul Sound Wood Industries	•				•		•					•
Decibels Audio	•					•	•	•				•
GM Audio Technics	•			•	•							
Indiq Audio	•						•					
Power Electronics & Technologies	•						•					•
TurboSonic Pro Speakers						•						
IRELAND												
Crossover Filter App				•								
ISRAEL												
Thermoguide, Ltd.						•						
ITALY												
Outline, SRL												•
RCF	•											•
SpeakerLAB	•			•								
JAPAN												
Etani Electronics Co., Ltd.				•						•		•
LATVIA												
Acoustic Power Lab				•		•	•	•				•
MEXICO												
Aletheia	•										•	
Oldman Sound	•											
NETHERLANDS												
Aequo Audio						•						
Diluvite	•			•	•					•		
Kamperman Engineering	•			•						•		
Sound Projects	•											

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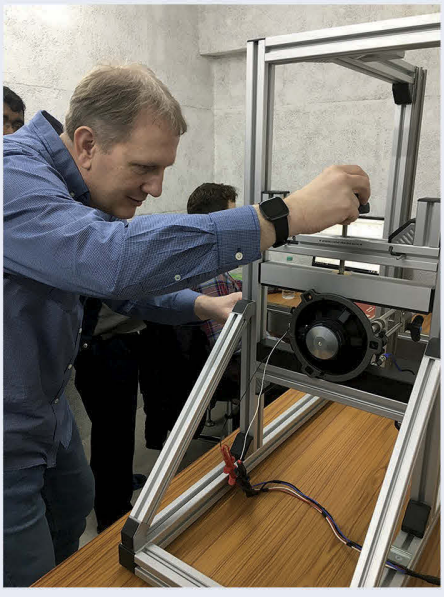

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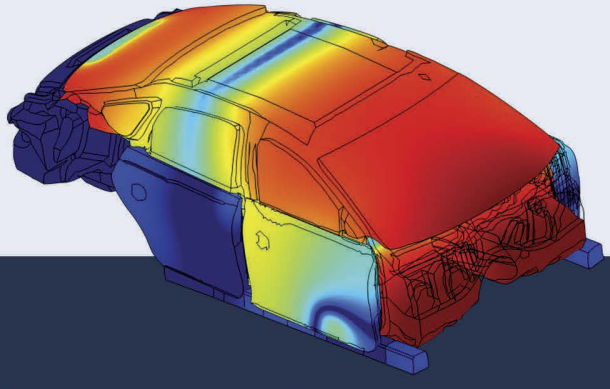

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NEW ZEALAND											
Asona	•	•		•		•	•	•			•
NORWAY											
SEAS Fabrikker			•								
PORTUGAL											
Jocavi Acoustic Panels				•						•	
Vicoustic	•	•	•	•	•	•	•	•	•	•	•
ROMANIA											
SC Poweraudio	•		•		•			•			•
SPAIN											
Brusi Acoustics	•		•								
Sottovoce Audio	•				•						
Tecnare/Exel Acoustics					•						
SWITZERLAND											
Acustronics Sound-Light-Systems			•								
TAIWAN											
AV Leader Corp.			•		•	•					
Kingstate Electronics Corp.	•		•								
Vansonic Enterprise Co., Ltd.					•	•	•				
Yung International, Inc.						•	•				
THAILAND											
Clarasonic (Thailand) Co., Ltd.										•	
UKRAINE											
MAG Audio	•		•								
UNITED KINGDOM											
Audiolux	•	•			•	•	•	•		•	•
CE Electro-Acoustics	•										
DBS Audio					•						
EuroTec International			•		•				•		
Interfacio, Ltd.					•						•
Node Audio Research					•	•					•
Spectral Measurement	•		•		•						
Tectonic Elements, Ltd.	•										
UNITED STATES											
Acoustic Fields	•	•	•	•		•		•	•	•	•
Acoustics First Corp.	•		•	•		•		•	•	•	•
Adrian Acoustics				•							
American Bass USA	•							•		•	
AtlasIED								•		•	
Audio Precision, Inc.			•								
B&H Foto & Electronics Corp.				•				•		•	
Barefoot Sound					•						
BASSBOSS											•
Beach Dynamics	•	•	•	•				•	•	•	
Broad Bridge Audio, LLC									•	•	
Campanella Associates & Acculab	•		•			•		•		•	•
Carl Tatz Design	•	•	•	•				•	•	•	
Creative Sound Solutions, LLC	•		•								

	Acoustic Consultancy Services & Design	Acoustic Doors	Acoustic Measurement	Acoustic Treatment Panels	Electroacoustical System Design	Home Theater Design	TV System Design	Multimedia and Noise Control	Sound Booths	Sound Isolation	Theater and Concert Hall Design	
D. L. Adams Associates	•					•		•	•		•	•
Dayton Audio	•											
Dragonfire Acoustics	•						•	•				
DTV Installations									•			
ETS-Lindgren	•	•	•	•					•	•	•	
Excelsior Audio Design & Services						•						
Front End Audio				•					•		•	
Full Compass Systems		•	•	•					•			
GGEC America, Inc.			•									
HDSound	•						•					
HEAD acoustics			•									
Hearing Components (Comply Memory Foam Tips)									•		•	
Hendrick Manufacturing									•			
HX Audio Lab	•		•			•			•		•	•
Intelligent Audio Products				•								
J&F Wood Products				•								
JP Electronics Design	•		•			•	•	•				
Meliti Acoustics	•	•	•	•		•	•	•	•	•	•	•
Meyer Sound Laboratories				•		•						
MSC Software Corp.			•						•			
NedLab	•											
NTi Audio			•									
OAP Audio							•					•
ORCA Design & Manufacturing Corp.				•								
Parts Express			•						•	•	•	
Portland Audio Lab						•						
PR Audio			•									
PUI Audio						•	•					
RealTraps, LLC	•			•								
Redco Audio				•								
San Antonio Home Theater Pros	•						•	•				
Scantek			•						•			
SensaSound USA						•	•					•
SoundKinetics	•								•			
Soundoctor			•									
Sounds Unique						•						
Speaker Clinic	•		•									
Stetron International	•		•									
Studio Six Digital			•									
SVS, Inc.											•	
Sweetwater Sound		•		•					•		•	
T&T Shanghai Tianai Acoustics Co., Ltd.						•						
THX, Ltd.							•					•
TMI Engineering	•	•	•	•		•	•	•	•	•	•	•
True Technologies	•		•			•						
US Enclosure Co.	•	•		•					•	•	•	
Vintage King Audio				•					•		•	
Warkwyn	•		•									
Westlake Audio	•											
Wired 4 Sound, Inc.	•			•			•	•	•		•	•
Wisdom Audio							•					
VIETNAM												
Sound Corp.							•	•				

AMP, DSP, NETWORK, AND WIRELESS MODULES

	Amplification Modules	Digital Signal Processing	Network Connectivity	Wireless Connectivity
AUSTRALIA				
DEQX	•	•	•	•
Eclipse Audio		•		
Soundlabs Group	•			
BELGIUM				
APEX	•	•	•	
The Innovators Lab Belgium (ILaB)		•		
BRAZIL				
Advanced Audio Technologies (AAT)	•			
AMCP Eletrônica	•			
Attack do Brasil	•	•		
Magna Audio	•			
Newbox Industry & Commerce	•	•	•	•
CANADA				
Harbottle Audio Co.	•	•		
Solen Electronique, Inc.	•	•	•	•
Sonavox	•	•	•	•
Space-Tech Lab, Ltd.	•	•		•
CHINA				
Eastech Holding, Ltd.			•	•
Fountek Electronics Co., Ltd.	•	•		•
GoerTek Co., Ltd.	•	•	•	•
Hansong (Nanjing) Technology	•	•	•	•
MYIR Tech, Ltd.	•	•	•	•
Pana Sound, Ltd.	•	•		•
Shenzhen Horn Audio Co., Ltd.	•	•	•	•
Telefield	•	•	•	•
Tonewinner (Guangzhou) Electronics	•		•	
Tonly Electronics Holdings	•	•	•	•
Tristar Electronics	•	•	•	•
Vistron Audio Equipment	•	•	•	•
DENMARK				
ICEpower	•	•	•	
Pascal	•			
Purifi Audio	•			
FRANCE				
Amplitude Audio	•	•	•	•
IDEA	•			
SIEA	•	•	•	•
GERMANY				
Ascendo Immersive Audio		•	•	
Audio Technology Engineering (ATE)	•	•	•	•
AudioChiemgau	•	•	•	•
Fraunhofer Institute for Digital Media Technology		•	•	•
Klippel GmbH	•	•		
MAAT		•		
Wolf von Langa	•			
HONG KONG				
Eastern Asia Technology (HK), Ltd.	•			•
INNacoustic	•	•	•	•
miniDSP, Ltd.	•	•	•	
OCVACO Electronic, Ltd.	•	•	•	•
PlastoForm	•	•	•	•
INDIA				
GM Audio Technics	•	•	•	
SFT Technologies				•

	Amplification Modules	Digital Signal Processing	Network Connectivity	Wireless Connectivity
ISRAEL				
Alango Technologies, Ltd.		•		•
ITALY				
Axiomedia	•	•		•
Outline, SRL		•		
Powersoft	•	•	•	
JAPAN				
Etani Electronics Co., Ltd.	•	•		
S'NEXT Co., Ltd.	•	•		
NETHERLANDS				
Aequo Audio	•	•	•	
ELTIM audio	•			
Hypex Electronics	•	•		
PHILIPPINES				
Dai-ichi Electronics Manufacturing Corp.	•	•	•	•
SWEDEN				
Bohmer Audio	•	•	•	•
SWITZERLAND				
Archwave			•	
TAIWAN				
AV Leader Corp.		•		•
ChiaPing Enterprise		•		•
Jetvox Acoustic Corp.	•	•	•	•
Meiloon Industrial Co., Ltd.	•	•	•	•
Merry Electronics	•	•	•	•
Palm Garden Enterprises Corp.	•	•	•	•
Taiwan Solidex Corp.				•
TOONG IN Electronic	•	•	•	•
Turbo Tide Electronics Co., Ltd.	•	•	•	•
UKRAINE				
MAG Audio	•			
UNITED KINGDOM				
EuroTec International	•	•		
MJ Acoustics	•			•
Profusion	•	•	•	•
Resolute Audio	•	•	•	•

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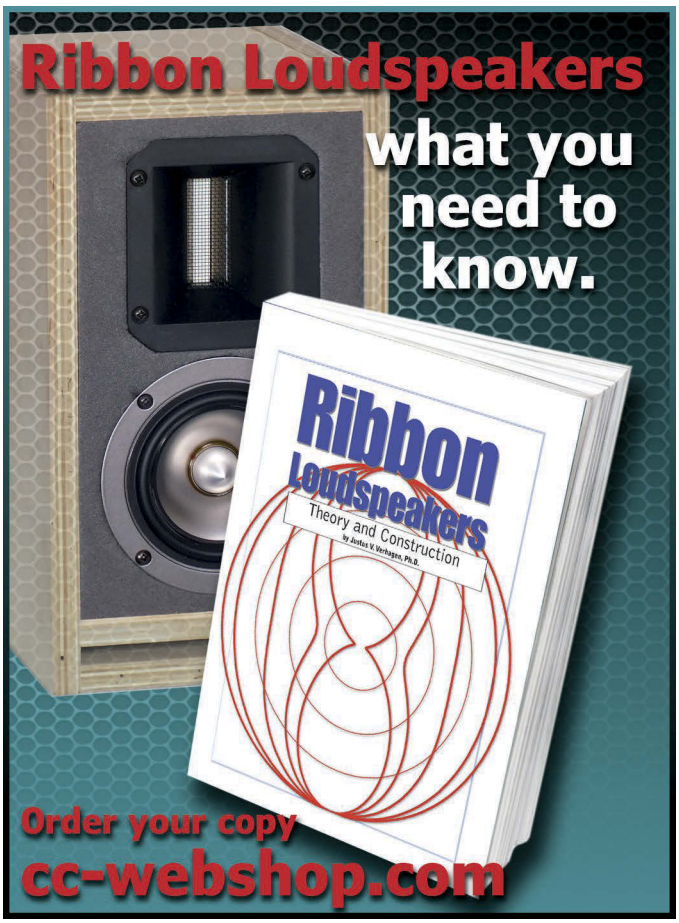
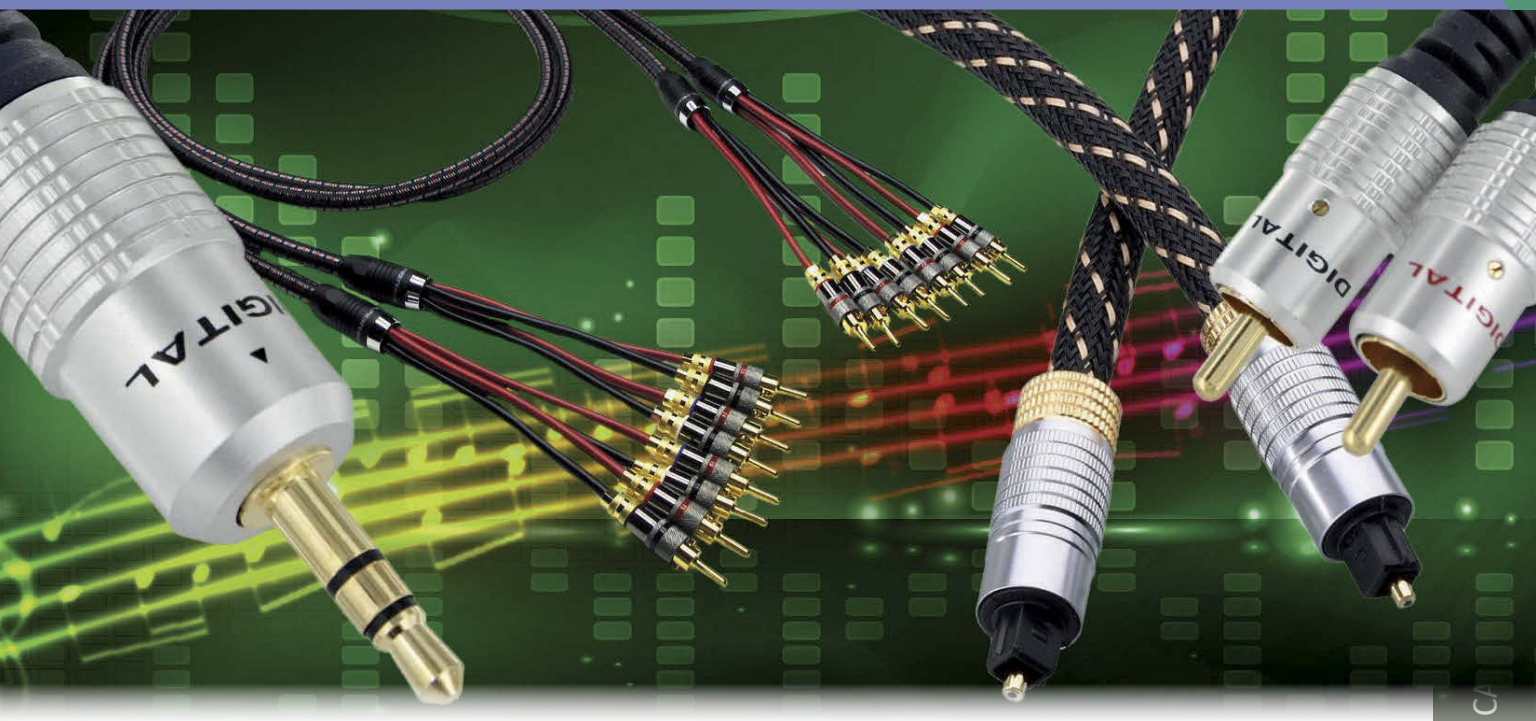
UNITED STATES				
Area 52 R&D	•	•		
AtlasIED		•	•	
Audio Advisor, Inc.	•			
Axiim	•	•	•	•
Benchmark Media Systems	•	•		
Danville Signal Processing, Inc.	•	•	•	•
Digmoda	•	•		
Dragonfire Acoustics	•	•	•	•
DSP Concepts		•		
Eagle Acoustics	•	•	•	•
Emerald Physics	•	•		
Fortemedia		•		
Full Compass Systems	•	•		
Globe Audio Design	•	•	•	
JL Audio	•	•		
Kramer Electronics	•	•	•	•
Lectrosonics			•	•
Linea Research USA	•	•		
Linear Tube Audio	•			
Linkplay				•
Meyer Sound Laboratories		•		
MISCO	•	•		
North American Solidex	•	•		•
PowerPhysics	•	•		
Pro Flix Sales	•	•	•	•
RCF USA	•	•	•	
RIVA Audio	•		•	•
SensaSound USA	•	•	•	
Senzar Acoustics, Inc.	•	•		
Sonion		•		•
Sound Audio Manufacturing, LLC	•	•		•
SpeakerPower	•	•	•	•
US Enclosure Co.	•	•	•	•
Vintage King Audio	•			
VTech	•	•	•	•
Weltronics Corp.	•	•	•	•
Wired 4 Sound, Inc.	•	•	•	•
VIETNAM				
Sound Corp.	•	•		•
Sun Technique	•	•	•	•



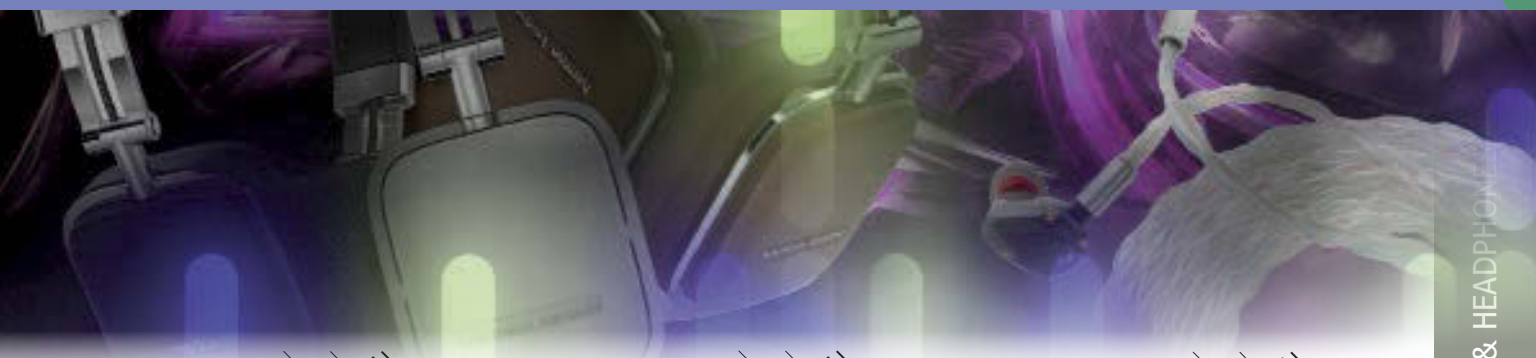


	Cables	Connectors	Wire Channel
AUSTRALIA			
Soundlabs Group	•	•	
Stones Sound Studio	•	•	
BRAZIL			
Attack do Brasil	•	•	
Newbox Industry & Commerce	•	•	•
CANADA			
Canadian Speaker Works	•	•	
Rutherford Audio, Inc.	•		
Solen Electronique, Inc.	•	•	
CHINA			
BSWA Technology Co., Ltd.	•	•	•
Sound Technology Development, Ltd.	•	•	•
Sun Technique Electric Co., Ltd.	•	•	•
DENMARK			
Duelund Coherent Audio	•		
estron a/s	•	•	
Jantzen Audio Denmark	•		
GERMANY			
CORDIAL GmbH Sound & Audio Equipment	•	•	
HiFi-Tuning	•	•	
Klippel GmbH	•		
Mundorf EB GmbH	•	•	
Soundsgood Pro Audio Solutions	•	•	
Voice Point	•	•	•
Wolf von Langa	•	•	•

	Cables	Connectors	Wire Channel
HONG KONG			
dB Enterprises		•	
WCE Acoustics	•	•	
HUNGARY			
Bayz Audio	•		
INDIA			
Power Electronics & Technologies	•	•	
IRELAND			
Crossover Filter App	•		
ITALY			
Axiomedia	•	•	
Yter Laboratorium	•		
JAPAN			
Etani Electronics Co., Ltd.	•	•	
Furutech Co., Ltd.	•	•	
S'NEXT Co., Ltd.	•	•	
MEXICO			
Aletheia	•		
NETHERLANDS			
Crystal Cable	•	•	
Diluvite	•	•	
ELTIM audio	•	•	
Good Hifi VOF		•	
SWEDEN			
Audio Pro, AB	•		

	Cables	Connectors	Wire Channel
SWITZERLAND			
Ghielmetti AG	•		
Vovox AG	•	•	
TAIWAN			
AV Leader Corp.	•	•	•
Bennic and Company	•		•
Huey Tung International	•	•	
Yung International, Inc.	•	•	•
THAILAND			
Van den Hul	•	•	
UKRAINE			
MAG Audio	•	•	
UNITED KINGDOM			
Arya Audio Labs	•		
EuroTec International	•	•	•
GRAS Sound & Vibration UK	•	•	
Hi-Fi Collective	•	•	•
MJ Acoustics	•		
Revolver Audio	•		
UNITED STATES			
A. Schulman, Inc.		•	
American Bass USA	•	•	
Audio Advisor, Inc.	•	•	
Audio Connection	•	•	•
Avanti Audio	•	•	
B&H Foto & Electronics Corp.	•	•	
Belden, Inc.	•	•	
Blackmore Mobile	•	•	
Broad Bridge Audio, LLC	•		
Cardas Audio	•	•	•
Carvin Audio	•	•	
CE Distribution	•	•	•
Controlled Thermal Processing, LLC	•	•	•
DH Labs Silver Sonic	•		
DTV Installations	•	•	•
Earthquake Sound Corp.	•		
Elektrisola	•		•
Fingerprint Audio	•		
Front End Audio	•	•	
Full Compass Systems	•	•	
GR Research	•	•	
GRAS Sound & Vibration	•	•	

	Cables	Connectors	Wire Channel
HAVE, Inc.	•	•	•
Herman Pro	•	•	
Hosa Technology, Inc.	•		
Io Audio Technologies	•	•	•
JL Audio	•	•	
Kimber Kable	•	•	
Kramer Electronics	•	•	
Kubala-Sosna Research	•	•	
Lamart Corp.	•	•	•
Madisound Speaker Components	•		
Morrow Audio	•	•	
Nordost	•	•	
Parts Express	•	•	•
PowerPhysics	•		
Pro Flix Sales	•	•	
ProCo Sound	•	•	
PRV Audio Brazil	•		
Radio Design Labs (RDL)	•	•	•
Redco Audio	•	•	•
Revolution Power	•	•	
Roderick Loudspeaker Service	•	•	
Schurter Electronic Components	•	•	
Sommer Cable America, Inc.	•	•	
Sound Pure	•	•	
Soundoctor	•	•	
Stillwater Designs | KICKER	•		
Straight Wire, Inc.	•	•	•
SVS, Inc.	•	•	
Sweetwater Sound	•	•	
Tonian Laboratories	•		
Transparent Audio, Inc.	•	•	
TRS Inovations, Inc.	•	•	
TSG Audio	•	•	
US Speaker	•	•	
VH Audio	•		
Vidsonix Design Works	•	•	
Westlake Audio	•	•	•
Wired 4 Sound, Inc.	•	•	•
Wireworld Cable Technology	•	•	
Yandas Music	•	•	
Zu Audio	•		
zZounds Music	•	•	
VIETNAM			
Sound Corp.	•	•	•



	Earphones	Headphones
AUSTRALIA		
Stones Sound Studio		•
AUSTRIA		
USound GmbH	•	•
BELGIUM		
The Innovators Lab Belgium (iLaB)		•
BRAZIL		
Harman of Brazil	•	•
Newbox Industry & Commerce	•	•
CANADA		
Focal North America		•
ORA Graphene Audio, Inc.	•	•
Solen Electronique, Inc.	•	•
CHINA		
Able-One Technology, Ltd.	•	•
Cosonic Acoustic Technologies Co., Ltd.	•	•
Dongguan Chao Tai Sponge Co., Ltd.	•	•
Dongguan Sunwe Electronic	•	•
Eastech Holding, Ltd.	•	•
Enkor Electronics Co., Ltd.		•
Gettop Acoustic Co., Ltd.	•	•
GoerTek Co., Ltd.	•	•
Grand Will Enterprise Co., Ltd.	•	•
Lumi Audio		•
Pana Sound, Ltd.	•	•
Shenzhen Horn Audio Co., Ltd.	•	•
Shenzhen R-Foam Technology	•	•
Sound Technology Development, Ltd.	•	•
Tonly Electronics Holdings	•	•
Vormag Electronics Co., Ltd.	•	•
Weide Electronics Co., Ltd.	•	•
Zhongshan K-Mate General Electronics Co., Ltd.	•	•
FRANCE		
Seltech	•	
HONG KONG		
BDNC (Holding), Ltd.		•
dB Enterprises	•	•
Eastern Asia Technology (HK), Ltd.	•	•
Fujikon Industrial Holdings, Ltd.	•	•
INNacoustic	•	•
Neutek International	•	•
OCVACO Electronic, Ltd.	•	•
WCE Acoustics	•	•

	Earphones	Headphones
ISRAEL		
Alango Technologies, Ltd.	•	•
ITALY		
RCF, SpA		•
JAPAN		
Etani Electronics Co., Ltd.	•	
Furutech Co., Ltd.	•	•
S'NEXT Co., Ltd.	•	•
NETHERLANDS		
Diluvite		•
PHILIPPINES		
Dai-ichi Electronics Manufacturing Corp.	•	•
SOUTH KOREA		
Suntel Co., Ltd.	•	•
SWEDEN		
Audio Pro, AB		•
Oxeon AB/Textreme		•
SWITZERLAND		
Ghielmetti AG	•	
TAIWAN		
AV Leader Corp.	•	•
ChiaPing Enterprise	•	•
Cotron Corp.	•	•
Dongguan Sheng-Yang Electronics	•	•
Fortune Grand Technology Inc.	•	•
Huey Tung International Co., Ltd.	•	•
Jetvox Acoustic Corp.	•	•
Kingstate Electronics Corp.	•	•
Merry Electronics	•	•
Palm Garden Enterprises Corp.	•	•
TOONG IN Electronic Corp.	•	•
Turbo Tide Electronics Co., Ltd.	•	•
Yung International, Inc.	•	•
THAILAND		
Clarasonic (Thailand) Co., Ltd.	•	•
Sanit Audio Engineering Co.		•
UNITED KINGDOM		
Electroacoustic Design Ltd.		•
Profusion, Ltd.		•
UNITED STATES		
1MORE	•	•

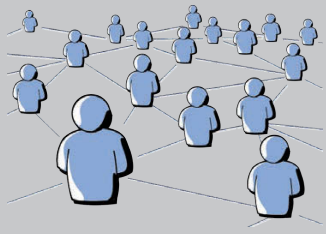
	Earphones	Headphones
American Bass USA	•	•
American Music & Sound	•	•
Audio Advisor, Inc.	•	•
Audio Connection	•	•
AValive		•
B&H Foto & Electronics Corp.		•
BeStar Technologies, Inc.	•	•
Blackmore Mobile		•
Broad Bridge Audio, LLC	•	•
Christensen Audio, LLC		•
Dekoni Audio	•	•
Dragonfire Acoustics	•	•
Earthquake Sound Corp.	•	•
Echobox Audio, LLC	•	•
ESS Laboratories, LLC		•
ESTec America	•	•
Front End Audio, LLC		•
Full Compass Systems, Ltd.	•	•
GraphAudio	•	•
HAVE, Inc.		•
Hearing Components (Comply Memory Foam Tips)	•	•
Materion		•
Pacific Audio Consulting	•	•
Parts Express	•	•
Peerless by Tymphany (HK), Ltd.		•
PreSonus Audio Electronics, Inc.		•
Pro Flix Sales		•
Puro Sound Labs		•
RBH Sound	•	•
Revolution Power	•	
SAATI	•	•
Shure, Inc.	•	•
Sonion	•	•
Sound Pure, LLC		•
Sound Sources Technology, Inc.	•	•
Stillwater Designs | KICKER	•	•
Tectonic Audio Labs		•
US Enclosure Co.	•	•
Vintage King Audio		•
VTech	•	•
W.L. Gore & Associates	•	•
Western Electric		•
Yandas Music	•	•
Zu Audio		•
zZounds Music, LLC		•

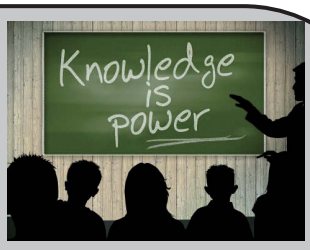
	Baffles		Finished Cabinets			Sub-Assemblies						Materials				Panels		Rigging
	Ceiling Speaker Plates	In-Wall Plates	Box Arrays (PA)	Boxes	Stands	Bulk Molding Compound	Carpet	Hardwood	MDF (Fiberboard)	Other	Paper/Paper Pulp	Plastic	Plywood	Veneer	Wound Geometric Tubes			
AUSTRALIA																		
Stones Sound Studio																•	•	
BELGIUM																		
Donnet: Loudspeaker Repair	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Premium Sound Solutions	•			•						•		•						
BRAZIL																		
Advanced Audio Technologies (AAT)				•														
Attack do Brasil			•	•		•		•	•	•						•		•
Newbox Industry & Commerce	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•
CANADA																		
Canadian Speaker Works				•	•													•
Divergent Technologies			•	•	•													
Harbottle Audio Co.	•	•	•	•						•			•			•		
Planet10-HiFi				•														
Solen Electronique, Inc.	•	•		•	•													
Sonavox	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Studio Reference Monitors				•														
Sziara Sound				•	•			•	•					•		•		
CHINA																		
Bozhen Acoustic Co., Ltd.				•														
Dongguan Chao Tai Sponge																•		
Eastech Holding, Ltd.			•	•	•													
GoerTek Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Hansong (Nanjing) Technology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Junhao Wood Cabinet Factory	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Kadeton Audio	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Lumi Audio	•	•		•	•				•			•						
OBE Pro Audio Co., Ltd.																		•
Renyi Castings						•	•	•	•	•	•	•	•	•	•			•
Shenzhen Horn Audio Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Shenzhen R-Foam Technology																•		
Sound Technology Development, Ltd.																•	•	
Star Audio	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sun Technique Electric Co., Ltd.																•	•	
Telefield	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Tonewinner (Guangzhou) Electronics			•	•	•	•	•	•	•	•	•	•	•	•	•			•
Tonly Electronics Holdings	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Tristar Electronics	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Trueanalog Strictly OEM				•	•			•	•		•			•				
Vistron Audio Equipment	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Vormag Electronics Co., Ltd.																•		
Xiamen Great Sound Technology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
DENMARK																		
Kvart & Bølge				•														
FRANCE																		
Amplitude Audio	•	•		•														

	Baffles		Finished Cabinets			Sub-Assemblies								Materials			Panels		Rigging
	Ceiling Speaker Plates	In-Wall Plates	Box Arrays (PA)	Boxes	Bulk Molding Compound Stands	Carpet	Hardwood	MDF (Fiberboard)	Other	Paper/Paper Pulp	Plastic	Plywood	Veneer	Wound Geometric Tubes					
KYU Systems			•	•									•		•	•			
Seltech				•															
GERMANY																			
Audio Technology Engineering (ATE)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
Soundsgood Pro Audio Solutions	•	•	•	•	•	•		•	•	•									
Voice Point	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Wolf von Langa		•	•	•	•			•	•	•			•	•		•	•		
HONG KONG																			
Beautiful Enterprise Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
dB Enterprises																	•		
Fujikon Industrial Holdings																•			
INNacoustic	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Neutek International																•			
Ocean Star Electronics (HK) Co., Ltd.	•	•	•	•	•		•	•	•			•	•	•	•				
PlastoForm	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
HUNGARY																			
Bayz Audio										•						•			
INDIA																			
Arul Sound Wood Industries			•				•	•	•				•			•			
GM Audio Technics			•	•															
Laysant Audio	•	•	•	•	•			•	•				•	•		•	•		
INDONESIA																			
Premiere Wood Manufacturing (PWM)	•	•	•	•	•			•	•	•		•	•	•		•	•	•	
ITALY																			
Axiomedia				•	•		•									•			
JAPAN																			
Etani Electronics Co., Ltd.				•															
MEXICO																			
Aletheia			•	•	•				•	•									
NETHERLANDS																			
Aequo Audio	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
Diluvite	•	•		•	•	•		•	•	•	•	•	•	•		•	•		
Metaxas & Sins	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Sound Projects			•	•															•
Stage Accompany			•	•	•														
PHILIPPINES																			
Dai-ichi Electronics Manufacturing Corp.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
POLAND																			
Sveda Audio				•	•														
ROMANIA																			
SC Poweraudio			•	•															
SOUTH AFRICA																			
Paks Acoustics				•	•			•	•				•	•		•			
SPAIN																			
SEP Audio			•	•									•						•
Sottovoce Audio				•	•														
Tecnare/Exel Acoustics			•	•	•														•
SWEDEN																			
Audio Pro, AB																•	•		

	Baffles		Finished Cabinets			Sub-Assemblies								Materials			Panels		Rigging
	Ceiling Speaker Plates	In-Wall Plates	Box Arrays (PA)	Boxes	Stands	Bulk Molding Compound	Carpet	Hardwood	MDF (Fiberboard)	Other	Paper/Paper Pulp	Plastic	Plywood	Veneer	Wound Geometric Tubes				
TAIWAN																			
Huey Tung International	•	•	•	•	•	•	•		•			•							
Meiloon Industrial Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
TOONG IN Electronic	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
Turbo Tide Electronics Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
Vansonic Enterprise Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Yie Feng Technology Enterprise Co., Ltd.												•							
Yung International, Inc.			•	•	•				•			•		•					
THAILAND																			
Clarasonic (Thailand) Co., Ltd.										•						•			
UNITED KINGDOM																			
Bishopsound			•	•	•				•					•					
EuroTec International	•		•	•								•							
Hi-Fi Collective						•	•	•	•	•	•	•	•	•	•				
Hill Acoustics										•									
MJ Acoustics				•				•							•				
UNITED STATES																			
3M (Industrial Adhesives & Tapes Division)																•			
A List Wood Works, Inc.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Acry-Tech Coatings, Inc.																•			
Adrian Acoustics	•	•	•	•	•			•	•	•			•	•					
American Bass USA	•	•	•	•	•														
Area 52 R&D				•					•	•			•	•					
Audio Connection								•											
AvileTech				•															
Cadillac Audio			•	•									•						•
Campanella Associates & Acculab										•									
Carvin Audio			•	•															
Danley Sound Labs			•	•	•														
Dayton Audio				•															
Dekoni Audio																•			
Eagle Acoustics			•	•	•		•		•			•							•
Emerald Physics	•	•																	
Eminence Speaker			•	•															
Fulcrum Acoustic				•															
Full Compass Systems	•	•					•											•	
GGEC America, Inc.				•			•	•	•			•	•	•					
Globe Plastics	•	•		•		•				•		•							
Inlow Sound				•				•			•		•	•					
Intelligent Audio Products		•	•	•	•		•		•	•			•	•				•	
J&F Wood Products	•	•	•	•	•		•	•	•	•			•	•		•		•	
Levister Audio				•															
Lowell Manufacturing Co.	•	•		•															
Meliti Acoustics	•	•																	
Midwest Audio Club				•	•			•	•				•	•					
OAP Audio			•	•									•						
Parts Express	•	•	•	•	•		•		•					•					
Portland Audio Lab	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Precision Sound Products										•									
Quest Engines										•									
Rapid Die & Molding	•	•														•		•	
RBH Sound	•	•		•					•	•		•							
RCF USA			•					•				•	•						
REDCATT			•	•					•			•	•	•					
Roderick Loudspeaker Service							•									•			

	Baffles: Ceiling Speaker Plates	Baffles: In-Wall Plates	Finished Cabinets: Box Arrays (PA)	Finished Cabinets: Boxes	Sub-Assemblies: Bulk Molding Compound	Sub-Assemblies: Stands	Sub-Assemblies: Carpet	Sub-Assemblies: Hardwood	Sub-Assemblies: MDF (Fiberboard)	Sub-Assemblies: Other	Sub-Assemblies: Paper/Paper Pulp	Sub-Assemblies: Plastic	Sub-Assemblies: Plywood	Sub-Assemblies: Veneer	Sub-Assemblies: Wound Geometric Tubes	Materials	Panels	Rigging
SAATI																•		
Shinjitsu Audio				•		•			•					•				
SoCal Sound Shop				•		•												
Sound Anchors						•												
Sound Sources Technology	•	•		•		•		•										
SpeakersAndAmps.com				•		•												
SSI Manufacturing, Inc.				•		•				•				•				
Studio Electric, LLC				•		•			•	•					•			
T&T Shanghai Tianai Acoustics Co., Ltd.				•		•												
TMI Engineering											•							
TRS Inovations, Inc.	•	•		•			•		•		•			•		•		
TSG Audio				•		•												
United Gasket Corp.	•	•					•					•				•		
US Enclosure Co.	•	•		•		•				•		•			•			•
US Speaker				•		•												
VH Audio				•														
Vidsonix Design Works				•						•								
VTech	•	•		•		•		•		•		•		•		•		•
Wired 4 Sound, Inc.																		•
Yandas Music				•		•												
VIETNAM																		
Sound Corp.	•	•		•		•		•		•		•		•		•		





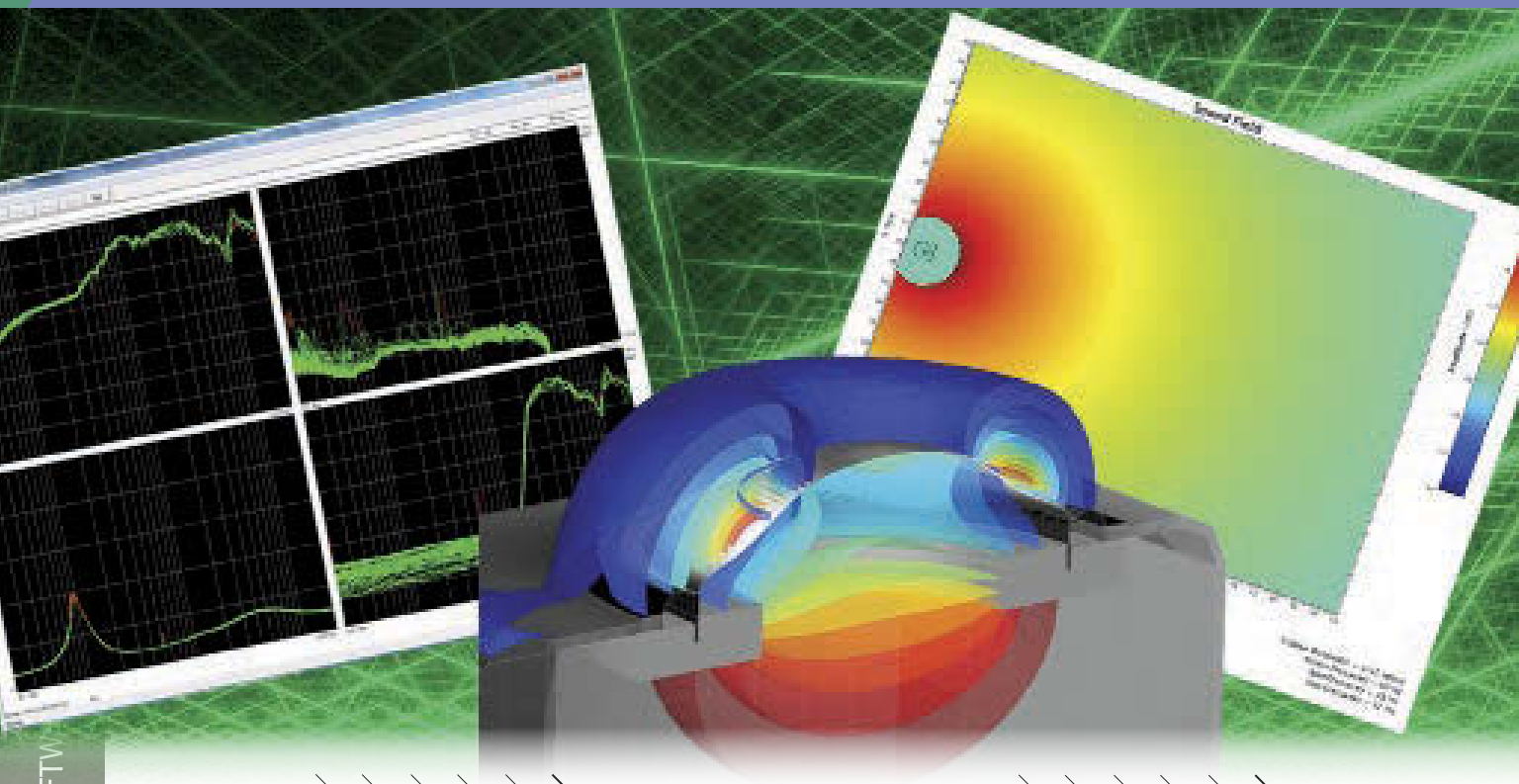
ALTI
ASSOCIATION
Audio & Loudspeaker Technologies International

Proudly serving the loudspeaker and associated audio technology industry since 1961

In today's world, your customers are bombarded with ads and opportunities every minute of every day. The more touchpoints your business has, the better. ALTI has developed a suite of Member Benefits that help our Members to stand out! Stay connected! Continually grow! And most are FREE with your Membership! *https://altiassoc.org.* Get connected!

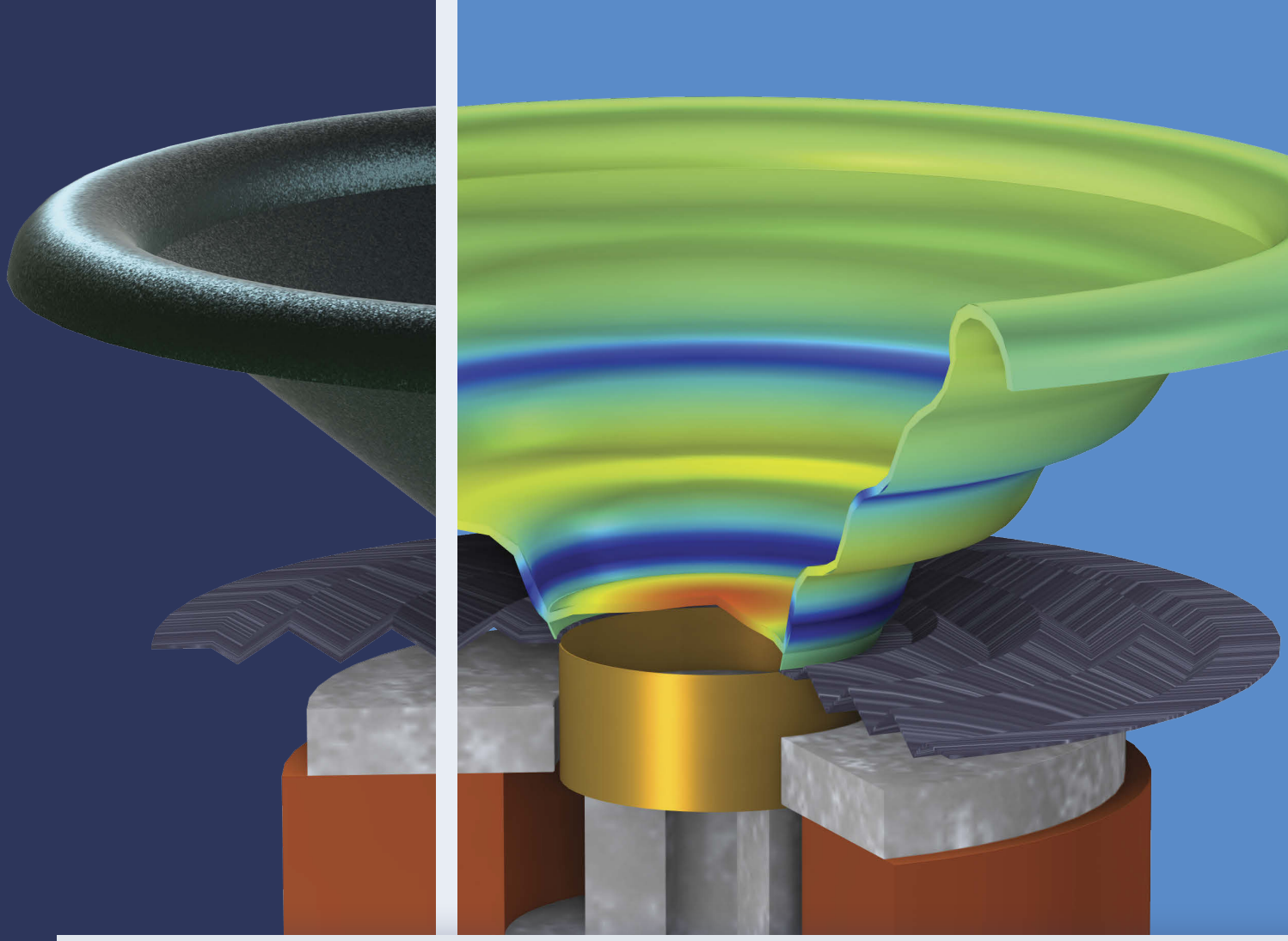
	Enclosure Stuffing					Grille Assemblies			Hardware			
	Enclosure Grilles	Fiberglass	Foam	Synthetic	Wool	Fabric Suppliers	Foam Suppliers	Perforated Metal Suppliers	Corners	Handles	Name Plates	Fasteners & Other
AUSTRALIA												
Soundlabs Group	•		•	•	•	•	•	•				•
Stones Sound Studio	•											
BRAZIL												
Newbox Industry & Commerce	•	•	•	•	•	•	•	•	•	•	•	•
Phix Electronics	•	•	•	•	•	•	•	•	•	•	•	•
CANADA												
Canadian Speaker Works	•						•	•		•	•	
Reference 3A	•					•						
Solen Electronique, Inc.	•	•	•	•	•	•		•				•
Tortech Sound	•											
CHINA												
GoerTek Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•
Hansong (Nanjing) Technology	•	•	•	•	•	•	•	•	•	•	•	•
Junhao Wood Cabinet Factory						•	•	•				
Kadeton Audio	•	•	•	•	•	•	•	•	•	•	•	•
Lumi Audio								•				
OBE Pro Audio Co., Ltd.	•								•	•		
Renyi Castings									•	•	•	•
Sound Technology Development, Ltd.	•	•	•	•	•	•	•	•	•	•	•	•
Sun Technique Electric Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•
Trueanalog Strictly OEM											•	
Xiamen Great Sound Technology						•	•	•				
FRANCE												
KYU Systems	•		•		•	•	•	•	•			
Seltech		•	•	•	•	•	•	•				
GERMANY												
Audio Technology Engineering (ATE)	•	•	•	•	•	•	•	•	•	•	•	•
Hubert Stüken GmbH									•			
Voice Point	•	•	•	•	•	•	•	•	•	•	•	•
Wolf von Langa	•		•	•		•					•	
HONG KONG												
Beautiful Enterprise Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•
INNacoustic	•	•	•	•	•	•	•	•	•	•	•	•
Neutek International	•	•	•	•	•							
Ocean Star Electronics (HK) Co., Ltd.	•											
INDIA												
Arul Sound Wood Industries	•	•	•	•	•	•	•	•	•	•	•	•
GM Audio Technics			•									
Laysant Audio	•										•	
ITALY												
Axiomedia						•	•		•	•	•	

	Enclosure Grilles	Enclosure Stuffing: Fiberglass	Enclosure Stuffing: Foam	Grille Assemblies: Synthetic Wool	Grille Assemblies: Fabric Suppliers	Grille Assemblies: Foam Suppliers	Grille Assemblies: Perforated Metal Suppliers	Hardware: Corners	Hardware: Handles	Hardware: Name Plates	Hardware: Fasteners & Other
NETHERLANDS											
Diluvite								•			
Good Hifi VOF				•		•					
PHILIPPINES											
Dai-ichi Electronics Manufacturing Corp.	•	•	•	•	•	•	•	•	•	•	•	•
SOUTH KOREA											
SOtM Audio						•	•	•	•	•	•	•
SWEDEN											
Audio Pro, AB	•	•	•	•	•	•		•	•			•
TAIWAN											
Shining Jins Enterprise Co., Ltd.										•		•
Taiwan Solidex Corp.	•										•	
Vansonic Enterprise Co., Ltd.						•	•	•				
Yie Feng Technology Enterprise Co., Ltd.	•		•				•					
UKRAINE											
MAG Audio	•											
UNITED KINGDOM											
EuroTec International	•	•	•	•		•	•	•				
Hi-Fi Collective									•	•	•	•
UNITED STATES											
A List Wood Works, Inc.	•	•	•	•	•	•	•	•	•	•	•	•
A. Schulman, Inc.	•											
Accurate Perforating Co., Inc.	•							•				
Acry-Tech Coatings, Inc.												•
Adrian Acoustics	•	•	•	•	•	•	•					
American Bass USA	•								•	•	•	•
C.P. Moyen		•	•	•	•							
Carvin Audio									•	•		•
CE Distribution									•	•	•	•
Dayton Audio	•											
Dynavox Electronics									•	•		
Eminence Speaker	•	•	•	•	•	•	•	•	•	•	•	•
Foam Speaker Grilles	•						•					
Full Compass Systems	•	•	•	•	•	•	•	•	•	•	•	•
Globe Plastics	•								•	•		
Hendrick Manufacturing								•				
J&F Wood Products	•	•	•	•	•	•		•	•	•		•
Lowell Manufacturing Co.	•							•				
Meliti Acoustics	•	•	•	•	•	•	•					
Meniscus Audio Group			•	•								
MetalEX	•							•				
ORCA Design & Manufacturing Corp.					•							
Precision Sound Products												•
Quest Engines												•
RBH Sound	•											
SAATI	•	•	•	•	•							
SpeakerAddict	•	•	•	•	•	•		•	•	•		•
TRS Inovations, Inc.	•	•	•	•	•	•	•	•	•	•	•	•
United Gasket Corp.			•	•	•	•	•					
US Enclosure Co.	•	•	•	•	•	•	•	•			•	
US Speaker									•	•	•	•
Vidsonix Design Works	•							•				
VIETNAM											
Sound Corp.	•	•	•	•	•	•	•	•	•	•	•	•



	Acoustic Analysis	Box Design	Crossover Optimizer	Network Design	CAE or CAD
AUSTRALIA					
Audinate	•	•	•	•	•
Audiosoft	•	•	•	•	
DEQX	•		•	•	
Eclipse Audio			•		
Stones Sound Studio	•	•	•		•
BELGIUM					
Donnet: Loudspeaker Repair	•	•	•		
BRAZIL					
Newbox Industry & Commerce	•	•	•	•	•
CANADA					
Solen Electronique, Inc.	•	•	•		
Space-Tech Lab, Ltd.	•				
CHINA					
BSWA Technology Co., Ltd.	•				
Eastech Holding, Ltd.	•	•			•
GoerTek Co., Ltd.	•	•	•	•	
Hansong (Nanjing) Technology	•	•	•	•	•
Junhao Wood Cabinet Factory		•			
Kadeton Audio		•			•
Pana Sound, Ltd.	•	•	•	•	
Sound Technology Development, Ltd.	•	•	•	•	•
Star Audio		•			
Sun Technique Electric Co., Ltd.	•	•	•	•	•
Trueanalog Strictly OEM		•			•
Xiamen Great Sound Technology		•			

	Acoustic Analysis	Box Design	Crossover Optimizer	Network Design	CAE or CAD
DENMARK					
K & K Development	•				
Loudsoft, Ltd.	•	•	•		
FRANCE					
KYU Systems	•		•	•	•
Seltech	•	•	•	•	
SIEA	•	•	•	•	•
GERMANY					
Audio Technology Engineering (ATE)	•	•	•	•	•
Klippel GmbH	•	•		•	•
Mvoid Technologies GmbH	•				•
R&D Team Software Development	•	•	•	•	
Soundsgood Pro Audio Solutions	•	•			•
Voice Point	•	•	•	•	•
HONG KONG					
Beautiful Enterprise Co., Ltd.	•	•	•	•	•
INNacoustic	•	•	•	•	
Ocean Star Electronics (HK) Co., Ltd.	•	•			•
INDIA					
GM Audio Technics	•				
TurboSonic Pro Speakers					•
IRELAND					
Crossover Filter App			•		
ISRAEL					
Coby Speakers	•	•	•	•	•



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	Acoustic Analysis	Box Design	Crossover Optimizer	Network Design	CAE or CAD
ITALY					
Audiomatica	•				
SpeakerLAB	•				•
JAPAN					
Etani Electronics Co., Ltd.	•	•			•
LATVIA					
Acoustic Power Lab	•		•		
Sonarworks	•				
PHILIPPINES					
Dai-ichi Electronics Manufacturing Corp.	•	•	•	•	•
SINGAPORE					
Virtins Technology	•				
SOUTH KOREA					
SOtM Audio		•			
Suntel Co., Ltd.	•	•	•	•	•
SPAIN					
Brusi Acoustics	•	•		•	
SEP Audio	•	•	•	•	•
SWEDEN					
Audio Pro, AB	•	•	•	•	
Bohmer Audio	•		•		•
IJData	•	•	•	•	•
SWITZERLAND					
Archwave				•	
TAIWAN					
Kingstate Electronics Corp.	•				•
Vansonic Enterprise Co., Ltd.		•			

	Acoustic Analysis	Box Design	Crossover Optimizer	Network Design	CAE or CAD
UNITED KINGDOM					
Electroacoustic Design, Ltd.	•	•	•		•
EuroTec International					•
Hill Acoustics	•	•	•		•
PACSYS, Ltd.	•				
Spectral Measurement	•				
UNITED STATES					
A List Wood Works, Inc.		•			
Audio Precision, Inc.	•				
Community Professional Loudspeakers	•	•	•	•	•
COMSOL	•				•
Danville Signal Processing, Inc.	•		•	•	
Digmoda			•		
Dragonfire Acoustics	•	•	•		•
HEAD acoustics	•				
Hottinger Bruel & Kjaer Sound & Vibration North America	•				
HX Audio Lab	•	•	•	•	•
Listen, Inc.	•				
Meliti Acoustics	•	•	•	•	•
MSC Software Corp.	•		•		•
NedLab		•	•	•	
Parts Express	•	•			
Portland Audio Lab	•	•			
QA Genesis				•	
Scantek	•				
Soundoctor	•		•		
Speaker Clinic		•	•		•
Studio Six Digital	•				
True Technologies	•				
Warkwyn	•	•	•		
VIETNAM					
Sound Corp.		•	•	•	•

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Lenard Audio		•		•
Stones Sound Studio	•	•		•
BELGIUM				
Donnet: Loudspeaker Repair	•	•	•	•
Premium Sound Solutions	•	•		
BRAZIL				
Advanced Audio Technologies (AAT)		•		
AMCP Eletrônica		•		
Attack do Brasil				•
Audiopax Audio Systems		•		
Harman of Brazil	•	•	•	•
Magna Audio		•		
Newbox Industry & Commerce	•	•	•	•
CANADA				
Acora Acoustics Corp.		•		
Canadian Speaker Works				•
Divergent Technologies		•		
Eastporters Audio Video		•		
Focal North America	•	•		•
Harbottle Audio Co.		•	•	•
LMH Loudspeakers	•	•		•
Newform Research, Inc.		•		•
Planet10-HiFi		•		
Reference 3A		•		•
Solen Electronique, Inc.	•	•		•
Sonavox		•		
Space-Tech Lab, Ltd.		•		
Studio Reference Monitors				•
StudioLAB		•		
CHINA				
Audiostar Electronics Co., Ltd.	•	•		•
B.W. Audio Guangzhou Co., Ltd.				•
DML Exciters		•		
Eastech Holding, Ltd.	•	•	•	•
Enkor Electronics Co., Ltd.		•		
Fountek Electronics Co., Ltd.	•	•		•
GoerTek Co., Ltd.	•	•		
Hansong (Nanjing) Technology	•	•	•	•
Junhao Wood Cabinet Factory	•	•	•	
Lumi Audio		•		•

	Car Audio	Home Audio	Marine Audio	Pro Audio
OBE Pro Audio Co., Ltd.				•
Shenzhen Horn Audio Co., Ltd.	•	•		
Sonos, Inc.		•		
Sound Technology Development, Ltd.		•		•
Sun Technique Electric Co., Ltd.	•	•		•
Telefield		•		
Tonly Electronics Holdings	•	•		
Tristar Electronics		•		
Trueanalog Strictly OEM	•	•	•	•
Vistron Audio Equipment		•		
Weide Electronics Co., Ltd.		•		
Xiamen Great Sound Technology	•	•	•	
Zeng Ben Industrial	•	•		•
Zhongshan K-Mate General Electronics Co., Ltd.		•		
Zhuhai HiVi Technology Co., Ltd.	•	•		•
DENMARK				
Dynaudio		•	•	•
ICEpower	•	•		•
Kvart & Bølge		•		
Lyd by Dissing		•		
Pascal				•
FINLAND				
Genelec Oy		•		•
FRANCE				
Crista Technologies		•		
KYU Systems				•
Seltech	•	•		•
Supravox		•		•
T&T Acoustic Speakers		•		
Waterfall Audio		•		•
GERMANY				
Ascendo Immersive Audio		•		•
Audio Technology Engineering (ATE)	•	•	•	•
AudioChiemgau		•		
Eton GmbH	•	•		
HiFi-Tuning		•		•
ic audio			•	•
Lautsprecher-Produktions-Gesellschaft (LPG)	•			
Mvoid Technologies GmbH	•	•		•
Quint Audio				•
Scherer Audio		•		

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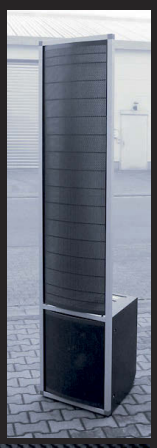

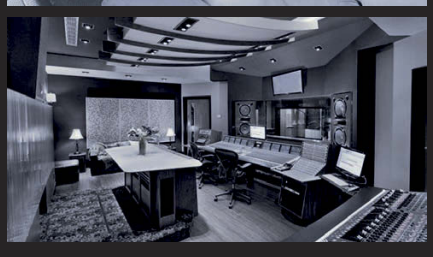

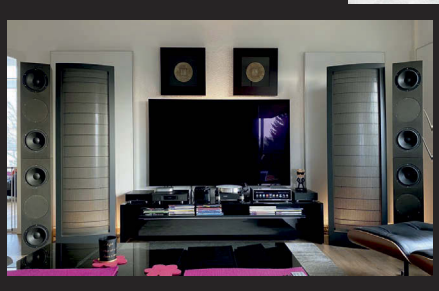
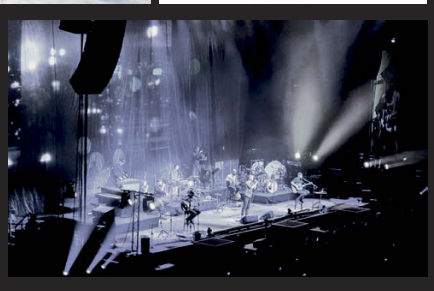

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Beautiful Enterprise Co., Ltd.		•		
dB Enterprises	•	•	•	•
Eastern Asia Technology (HK), Ltd.	•	•	•	•
Fujikon Industrial Holdings	•	•	•	
INNacoustic	•	•		
miniDSP, Ltd.	•	•		•
Ocean Star Electronics (HK) Co., Ltd.		•		•
PlastoForm		•		
WCE Acoustics		•		
HUNGARY				
Bayz Audio		•		•
INDIA				
Decibels Audio		•		
GM Audio Technics				•
Indiq Audio		•		
Laysant Audio	•	•		
Power Electronics & Technologies		•		•
INDONESIA				
SB Acoustics		•		
IRELAND				
Crossover Filter App	•	•	•	•
ISRAEL				
Coby Speakers	•	•	•	•
Morel, Ltd.	•	•		
ITALY				
Powersoft				•
JAPAN				
Etani Electronics Co., Ltd.	•	•		•
MEXICO				
Aletheia		•		
NETHERLANDS				
Aequo Audio		•		
Diluvite	•	•	•	•
ELTIM audio		•		•
Metaxas & Sins		•		•
Sound Projects				•
NEW ZEALAND				
Theophany Loudspeakers		•		
NORWAY				
Griffin Audio AS				•
SEAS Fabrikker		•		
PHILIPPINES				
Dai-ichi Electronics Manufacturing Corp.	•	•	•	•
POLAND				
Sveda Audio		•		•
ROMANIA				
SC Poweraudio				•

	Car Audio	Home Audio	Marine Audio	Pro Audio
SOUTH KOREA				
Suntel Co., Ltd.	•	•		•
SPAIN				
DAS Audio				•
SEP Audio				•
Sottovoce Audio		•		•
SWEDEN				
Audio Pro, AB	•	•		•
SWITZERLAND				
Lange Loudspeakers		•		•
TAIWAN				
AV Leader Corp.				•
Bennic and Company	•	•	•	•
Cotron Corp.		•		
Huey Tung International	•	•		•
Kingstate Electronics Corp.	•	•		
Meiloon Industrial Co., Ltd.	•	•	•	
TOONG IN Electronic		•		
Turbo Tide Electronics Co., Ltd.		•		
Vansonic Enterprise Co., Ltd.	•	•	•	
UKRAINE				
MAG Audio				•
UNITED KINGDOM				
Amina Technologies, Ltd.		•	•	
Arya Audio Labs	•	•		•
Compbass		•		•
Electroacoustic Design, Ltd.	•	•	•	•
EuroTec International	•		•	•
Fane International				•
Ferguson Hill Studios		•		•
MJ Acoustics		•	•	•
Node Audio Research		•		
Precision Devices				•
Tectonic Elements, Ltd.	•	•		•
UNITED STATES				
Aempyrean	•	•		•
Ambiance Acoustics		•		•
American Bass USA	•			
American Music & Sound	•	•	•	•
Amina Technologies Ltd. (USA)	•	•	•	
Analysis Audio USA		•		
Area 52 R&D		•		•
Arion Audio		•		
Audio Houze	•			
Audioengine		•		
AvileTech				•
B&H Foto & Electronics Corp.		•		•
Barefoot Sound				•
BASSBOSS				•
Benchmark Media Systems		•		
Blackmore Mobile		•		•
Broad Bridge Audio, LLC		•		
Cadillac Audio				•
Carvin Audio		•		
CE Distribution			•	

	Car Audio	Home Audio	Marine Audio	Pro Audio
Clear Lake Audio				•
CommonSense Audio		•		•
Creative Sound Solutions, LLC		•		
Danley Sound Labs				•
Dayton Audio		•		
dBTechnologies				•
DC Audio	•			
Digital Audio Labs				•
Digmoda		•		•
Dinaburg Technology	•	•	•	•
Eagle Acoustics	•	•	•	•
Earthquake Sound Corp.	•	•	•	•
Emerald Physics		•		
Eminence Speaker				•
ESS Laboratories	•	•		
ESTec America	•	•	•	
Fluid Audio				•
Fulcrum Acoustic				•
Gauss Loudspeaker		•		•
GGEC America, Inc.	•	•	•	•
Globe Audio Design		•		•
GoldenEar Technology		•		
Halford Loudspeakers		•		•
Io Audio Technologies	•	•	•	•
JJR Acoustics	•	•	•	•
JL Audio	•	•	•	
Levister Audio		•		
Linea Research USA				•
Lipinski Sound		•		•
Meliti Acoustics	•	•		•
Meyer Sound Laboratories		•		•
MISCO		•		•
NHT Audio		•		
North American Solidex		•		•
OAP Audio		•		•
ORCA Design & Manufacturing Corp.	•	•		
Parts Express	•	•		•
Pazandeh Audio Designs		•		•
Peerless by Tymphany	•	•		•
Performance Audio				•
Phoenix Engineering		•		
Portland Audio Lab	•	•	•	•
PranaFidelity		•		
Precison Transducer Engineering (PTE)		•		•
Pro Flix Sales				•
Purist Sonics		•		•
RBH Sound		•		
RCF USA				•
REDCATT		•		•
RIVA Audio		•		
Rock The Boat			•	
RSL Speaker Systems		•		
Salk Sound		•		
SensaSound USA		•		
Senzar Acoustics, Inc.		•	•	•
SG Custom Sound		•		•
Shinjitsu Audio		•		•
SoCal Sound Shop	•	•	•	•
Sound Audio Manufacturing, LLC	•	•	•	•
Sound Lab		•		
Sound Sources Technology	•	•		
Soundfield Audio		•		
Sounds Unique	•	•		•
SpeakerPower		•		•
SpeakersAndAmps.com	•	•		•
SSI Manufacturing, Inc.		•		•
Studio Electric, LLC		•		•
T&T Shanghai Tianai Acoustics Co., Ltd.	•	•	•	•
TitanAudio		•		•
Tonian Laboratories		•		•
TRS Inovations, Inc.	•	•	•	•
TSG Audio	•	•		•
US Speaker	•	•		•
Vidsonix Design Works	•	•	•	
VTech		•		•
Weltronics Corp.		•		
Westlake Audio		•		•
Wired 4 Sound, Inc.		•		•
Wisdom Audio		•		
Yandas Music				•
Zu Audio		•		
VIETNAM				
Sound Corp.		•		•
Sun Technique	•	•	•	•

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• Sheet Metal Process and Plastics Molding/ Injection
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US Sales Office: 2019 Whitby Drive Orlando, Florida 32839, USA Mobile: +1-321-666 5122
Factory: Binh Chuan 34 Street, Binh Chuan Ward, Thuan An Town, Binh Duong Province, Vietnam
Telephone: +84-909016277 Email: oem@soundcorp.vn
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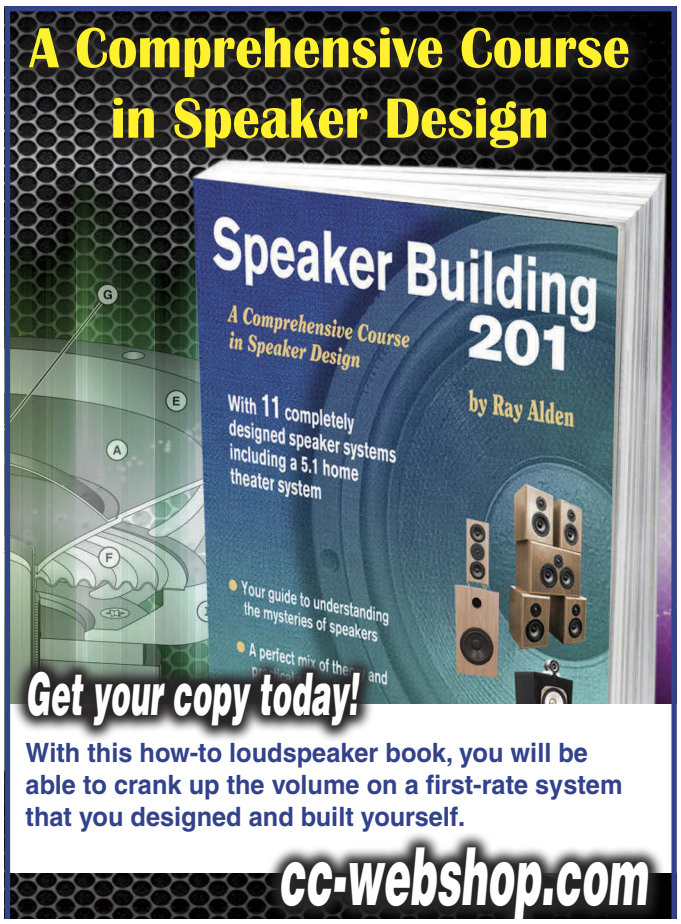
	Amplifiers	DSP (Digital Signal Processing)	High-Power Amplifier Modules	Marine Audio Solutions	Soundbars	Subwoofer Plate Amps	Wireless
AUSTRALIA							
DEQX	•	•	•	•			•
Eclipse Audio		•					
Lenard Audio	•						
Soundlabs Group	•		•			•	•
Stones Sound Studio	•	•	•			•	•
BELGIUM							
Donnet: Loudspeaker Repair				•	•	•	
The Innovators Lab Belgium (ILaB)		•					
BRAZIL							
Advanced Audio Technologies (AAT)	•		•			•	•
Attack do Brasil	•	•	•				
Harman of Brazil	•	•	•	•	•	•	•
Magna Audio	•				•	•	
Newbox Industry & Commerce	•	•	•	•	•	•	•
CANADA							
Harbottle Audio Co.	•	•	•			•	
Rutherford Audio, Inc.	•		•				
Solen Electronique, Inc.	•	•	•		•	•	•
Sonavox	•	•	•		•	•	•
Studio Reference Monitors	•	•					
Tortech Sound	•						
CHINA							
DML Exciters	•	•	•	•	•	•	•
Eastech Holding, Ltd.	•	•	•	•	•	•	•
Enkor Electronics Co., Ltd.					•		
Fountek Electronics Co., Ltd.	•	•	•				•
Gettop Acoustic Co., Ltd.	•	•	•				•
GoerTek Co., Ltd.	•	•	•		•	•	•
Hansong (Nanjing) Technology	•	•	•		•	•	•
Lumi Audio	•		•			•	•
MYIR Tech, Ltd.		•					•
OBE Pro Audio Co., Ltd.	•	•				•	
Pana Sound, Ltd.	•	•	•	•	•	•	•
Shenzhen Horn Audio Co., Ltd.		•			•	•	•
Sound Technology Development, Ltd.	•		•		•	•	•
Sun Technique Electric Co., Ltd.	•	•	•	•	•	•	•
Telefield	•	•	•		•	•	•
Tonewinner (Guangzhou) Electronics	•		•			•	
Tonly Electronics Holdings		•			•		•
Tristar Electronics	•	•	•		•	•	•
Vistron Audio Equipment	•	•	•		•		•
DENMARK							
ICEpower	•	•	•			•	
Kvart & Bølge	•						•
Pascal			•				
Purifi Audio	•		•				
FRANCE							
Amplitude Audio	•	•					•
IDEA	•		•				
KYU Systems	•	•	•	•		•	
SIEA	•	•	•				•
GERMANY							
Audio Technology Engineering (ATE)	•	•	•	•	•	•	
AudioChiemgau	•	•	•		•		
ic audio				•			•
Klippel GmbH	•	•					
Physical-Lab	•	•				•	
Voice Point	•	•	•	•	•	•	•
Wolf von Langa	•		•				

	Amplifiers	DSP (Digital Signal Processing)	High-Power Amplifier Modules	Marine Audio Solutions	Soundbars	Subwoofer Plate Amps	Wireless
HONG KONG							
Beautiful Enterprise Co., Ltd.	•	•	•		•	•	•
Eastern Asia Technology (HK), Ltd.	•	•	•	•	•	•	•
Fujikon Industrial Holdings		•			•		•
INNacoustic	•	•	•		•	•	•
miniDSP, Ltd.	•	•				•	
OCVACO Electronic, Ltd.		•					•
PlastoForm	•		•		•	•	•
WCE Acoustics					•		•
INDIA							
Arul Sound Wood Industries	•	•					
Laysant Audio					•		
Power Electronics & Technologies	•		•			•	
TurboSonic Pro Speakers						•	
INDONESIA							
Premiere Wood Manufacturing (PWM)	•	•	•	•	•	•	•
ISRAEL							
Alango Technologies, Ltd.		•					•

	Amplifiers	DSP (Digital Signal Processing)	High-Power Amplifier Modules	Marine Audio Solutions	Soundbars	Subwoofer Plate Amps	Wireless
Coby Speakers	•	•	•	•	•	•	•
Thermoguide, Ltd.	•		•		•	•	
ITALY							
Axiomedia	•	•	•			•	
Outline, SRL	•	•		•			
Powersoft	•	•	•	•			
JAPAN							
Etani Electronics Co., Ltd.	•	•	•		•	•	•
NETHERLANDS							
Aequo Audio	•						
ELTIM audio	•		•				
Hypex Electronics	•	•	•			•	
Stage Accompany	•	•	•				
PHILIPPINES							
Dai-ichi Electronics Manufacturing Corp.	•	•	•		•	•	•
SPAIN							
Tecnare/Exel Acoustics	•	•					



	Amplifiers	DSP (Digital Signal Processing)	High-Power Amplifier Modules	Marine Audio Solutions	Soundbars	Subwoofer Plate Amps	Wireless
SWEDEN							
Audio Pro, AB		•	•		•	•	•
Bohmer Audio	•	•	•			•	•
TAIWAN							
AV Leader Corp.		•			•	•	•
ChiaPing Enterprise		•					•
Jetvox Acoustic Corp.		•					•
Kingstate Electronics Corp.	•				•		•
Meiloon Industrial Co., Ltd.	•		•		•	•	•
Merry Electronics		•					•
Palm Garden Enterprises Corp.		•					•
TOONG IN Electronic		•			•	•	•
Turbo Tide Electronics Co., Ltd.		•			•	•	•
Yung International, Inc.	•					•	•
UNITED KINGDOM							
EuroTec International	•		•	•			
Ferguson Hill Studios	•	•	•				•
Kleio Audio	•						
MJ Acoustics			•			•	
Revolver Audio	•						
Tectonic Elements, Ltd.	•						
UNITED STATES							
Area 52 R&D	•	•	•			•	
Arion Audio	•						
Audio Advisor, Inc.	•						
Avel Lindberg	•						
Axiim	•	•	•	•	•	•	•
Barefoot Sound	•	•	•				
Benchmark Media Systems	•	•					
Broad Bridge Audio, LLC	•				•		
Cadillac Audio			•				
Carvin Audio	•	•					•
CE Distribution	•		•				
CommonSense Audio	•						
Danville Signal Processing, Inc.	•	•	•	•		•	
Dayton Audio	•	•	•		•	•	•
DC Audio	•		•				
Digital Audio Labs	•	•					
Digmoda	•	•	•			•	
DMSI	•	•	•				
Dragonfire Acoustics	•	•	•	•	•	•	•
DTV Installations	•		•		•	•	•
Eagle Acoustics	•			•	•		•
Earthquake Sound Corp.	•		•			•	
Emerald Physics	•	•				•	
Fortemedia		•					
Fulcrum Acoustic		•					
Globe Audio Design	•	•	•			•	
JL Audio	•	•	•	•		•	•
Kramer Electronics	•	•	•			•	•
Lectrosonics							•
Linea Research USA	•	•	•				
Linear Tube Audio	•		•				
MISCO	•	•	•		•		
North American Solidex	•	•				•	•
OAP Audio	•	•	•				
Parts Express	•	•	•		•	•	•
Peerless by Tymphany	•	•	•		•		•
PowerPhysics	•	•	•			•	
Pro Flix Sales	•						
Radio Design Labs (RDL)	•		•				
RBH Sound	•					•	
RCF USA	•	•	•				
RIVA Audio	•	•	•		•	•	•
SensaSound USA	•					•	
Senzar Acoustics, Inc.	•	•	•		•	•	
Sound Audio Manufacturing, LLC	•	•	•	•		•	
SpeakerAddict	•	•	•	•		•	
SpeakerPower	•	•	•			•	•
SpeakersAndAmps.com	•	•	•	•		•	
Stillwater Designs | KICKER	•	•	•	•			•
TRS Inovations, Inc.	•	•	•	•	•	•	•
TSG Audio	•	•	•		•	•	
US Enclosure Co.	•	•	•		•	•	•
US Speaker	•						
Vidsonix Design Works				•			
VTech	•	•	•		•	•	•
Weltronics Corp.	•	•	•				
Western Electric	•						
Wired 4 Sound, Inc.	•	•			•		•
Wisdom Audio		•			•		
VIETNAM							
Sound Corp.	•	•	•		•	•	•

	Adhesive Dispensers	Conveyors	Curing Ovens	Lead Out Wire Termination	Production Line Equipment	Magnetizers/Demagnetizers	Ultrasonic Assembly Equipment
AUSTRALIA							
Applied Measurement						•	
Proactive Group						•	
Stones Sound Studio						•	
BRAZIL							
Attack do Brasil	•	•	•	•	•	•	•
Newbox Industry & Commerce						•	
CHINA							
OBE Pro Audio Co., Ltd.	•	•	•	•	•	•	
Sound Technology Development, Ltd.	•	•	•	•	•	•	•
Sun Technique Electric Co., Ltd.	•	•	•	•	•	•	•
DENMARK							
K & K Development						•	
Loudsoft, Ltd.						•	
GERMANY							
Klippel GmbH						•	
ViscoTec Pumpen- u. Dosiertechnik GmbH	•						
Wolf von Langa							•
INDIA							
Cruxweld Industrial Equipment, Ltd.						•	
Lakshmi Metal Coils							•
JAPAN							
Etani Electronics Co., Ltd.						•	
SPAIN							
Tecnare/Exel Acoustics						•	
SWEDEN							
Audio Pro, AB						•	
SWITZERLAND							
Kisling	•						
Megatec		•		•	•	•	•
TAIWAN							
Hurray Co.	•					•	
THAILAND							
Clarasonic (Thailand) Co., Ltd.	•	•	•				
UNITED KINGDOM							
EuroTec International	•	•	•	•	•	•	•
GRAS Sound & Vibration UK						•	

	Adhesive Dispensers	Conveyors	Curing Ovens	Lead Out Wire Termination	Production Line Equipment	Magnetizers/Demagnetizers	Ultrasonic Assembly Equipment
Hill Acoustics					•		
Silcoms, Ltd.		•					
UNITED STATES							
3M (Industrial Adhesives & Tapes Division)	•		•				
Acoustic Design, Inc.						•	
Adrian Acoustics		•			•		
Alliance, LLC						•	
Astro Machine Works, Inc.					•		•
Bostik	•						
C.P. Moyen	•						
Cotronics Corp.	•						
DELO Industrial Adhesives	•				•		
Delta H Technologies			•				
Dragonfire Acoustics						•	
Dukane Northeast Technical Center					•		•
Dymax Corp.	•						
Dynavox Electronics						•	
Eberhard Manufacturing Co.	•				•		
Elektrisola				•			
Ellsworth Adhesives	•						
EXACT Dispensing Systems	•				•		
Fisnar	•						
Fluid Metering	•				•		
Glenro, Inc.			•				
Global Finishing Solutions			•				
Hernon Manufacturing	•	•	•		•		
Hottinger Bruel & Kjaer Sound & Vibration North America					•		
Huntsman Advanced Materials	•				•		
Integrated Dispensing Solutions	•				•		
Krayden	•						
LEWCO		•	•				
Metzgar Conveyors		•					
Nordson EFD	•				•		
NTi Audio					•		
Parts Express	•						
PRV Audio Brazil					•		
Sealant Equipment	•						
The Eraser Co.					•		
The Hose Co.					•		
Uni-Pak Corp.		•					
Valley Design Corp.					•		•
Valves Only	•				•		
Wisconsin Oven			•				

MEASUREMENT MICROPHONES

	Consumer	Field Mics	Lab Instruments	Measuring Mics	Professional
AUSTRALIA					
DEQX				•	
Røde Microphones	•			•	•
AUSTRIA					
Austrian Audio			•	•	
BRAZIL					
Newbox Industry & Commerce	•	•		•	•
CANADA					
Solen Electronique, Inc.	•	•		•	
CHINA					
BSWA Technology Co., Ltd.		•	•	•	•
CRY Sound		•	•	•	•
Lumi Audio	•	•		•	
Shenzhen Horn Audio Co., Ltd.	•	•			
Sound Technology Development, Ltd.					•
Sun Technique Electric Co., Ltd.	•	•	•	•	•
Tonly Electronics Holdings	•	•			
DENMARK					
DPA Microphones		•		•	•
Jantzen Audio Denmark	•				
K & K Development				•	
FRANCE					
KYU Systems			•	•	
Seltech			•		

	Consumer	Field Mics	Lab Instruments	Measuring Mics	Professional
GERMANY					
Klippel GmbH			•	•	
Microtech Gefell GmbH			•	•	•
Voice Point	•	•	•	•	•
HONG KONG					
miniDSP, Ltd.				•	
WCE Acoustics	•				•
INDIA					
GM Audio Technics				•	
ISRAEL					
Audio Pixels, Ltd.		•	•		•
JAPAN					
Etani Electronics Co., Ltd.		•	•	•	
LATVIA					
Sonarworks				•	
SINGAPORE					
Virtins Technology	•		•	•	•
SOUTH KOREA					
Suntel Co., Ltd.	•	•	•	•	•
SWEDEN					
Audio Pro, AB			•	•	

Whatever your testing challenge, GRAS has the right solution

Capture reliable data–the first time, every time

A superior line of standard and custom products is available dedicated to your loudspeaker testing:

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- Frequency response
- Rub and buzz
- THD
- Speech intelligibility

GRAS Sound & Vibration

www.GRASacoustics.com

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Audio precision

www.ap.com

	Consumer	Field Mics	Lab Instruments	Measuring Mics	Professional
TAIWAN					
AV Leader Corp.	•	•	•	•	•
Kingstate Electronics Corp.	•				
UNITED KINGDOM					
DBS Audio				•	
EuroTec International			•	•	•
GRAS Sound & Vibration UK		•	•	•	
Spectral Measurement			•	•	•
UNITED STATES					
ACO Pacific, Inc.		•	•	•	•
Audio Precision, Inc.			•	•	
Audix	•			•	•
AValive	•				•
B&H Foto & Electronics Corp.	•				•
Behringer				•	•
Dayton Audio	•	•	•	•	•
Earthworks	•	•	•	•	•
Front End Audio	•	•	•	•	•
Full Compass Systems	•	•			•
GRAS Sound & Vibration	•	•	•	•	•

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- Best in class THD performance
- Low noise floors (down to 5.5 dBA)
- High dynamic ranges

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AN AMPHENOL COMPANY

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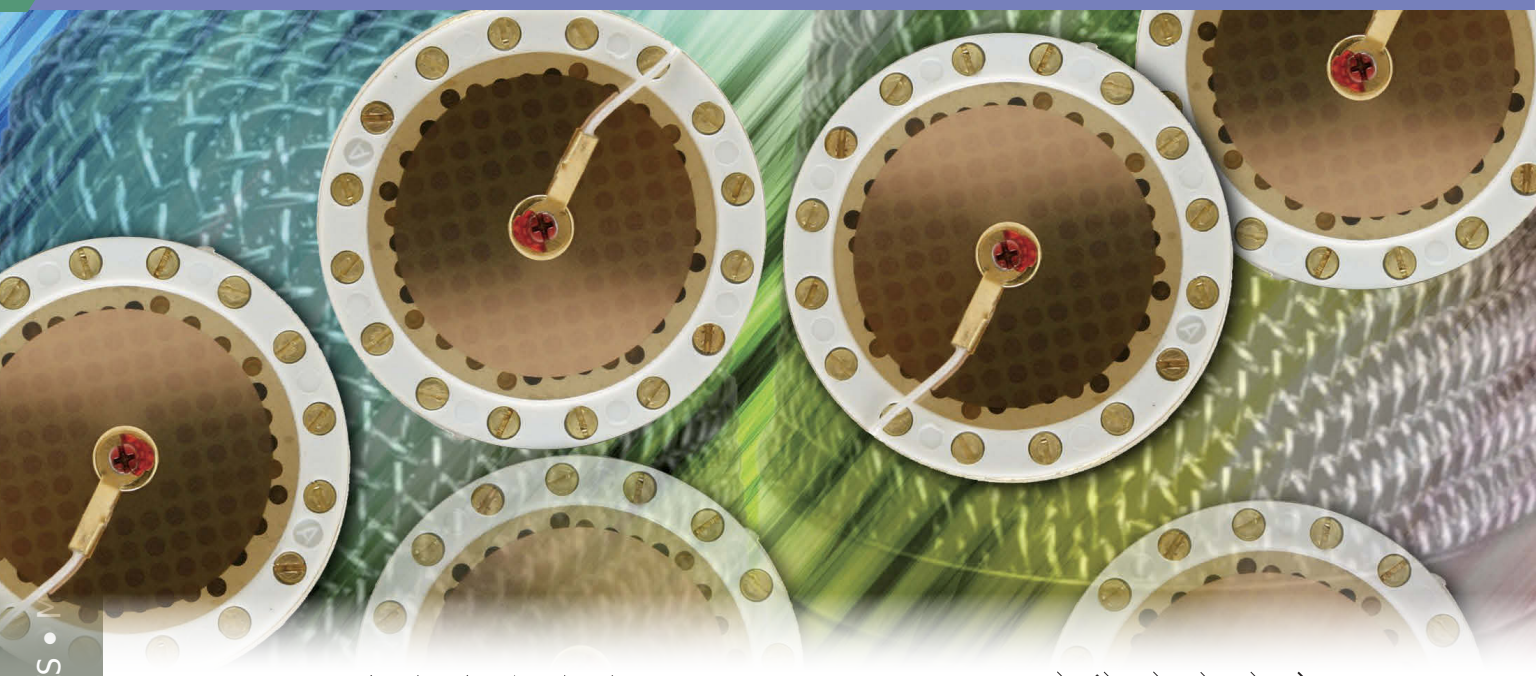
	Consumer	Field Mics	Lab Instruments	Measuring Mics	Professional
Hottinger Bruel & Kjaer Sound & Vibration North America				•	•
iSEMcon	•	•	•	•	•
JLI Electronics	•	•	•	•	•
Lectrosonics				•	•
Listen, Inc.				•	
NTi Audio			•	•	•
Parts Express	•	•	•	•	•
PCB Piezotronics	•	•	•	•	•
PreSonus Audio Electronics				•	
Scantek		•	•	•	•
Sound Pure	•				•
Speaker Clinic				•	
Studio Six Digital			•	•	
Sweetwater Sound	•				•
Vintage King Audio	•			•	•
Wired 4 Sound, Inc.	•	•		•	•
Yandas Music	•				•
zZounds Music					•
VIETNAM					
Sound Corp.	•				•

MIC CAPSULES



	Dynamic Capsules	ECM	LDC	MEMS	True Condenser
AUSTRALIA					
Røde Microphones	•	•	•		•
AUSTRIA					
Austrian Audio	•	•	•		•
USound				•	
CHINA					
BSWA Technology Co., Ltd.		•			
Gettop Acoustic Co., Ltd.	•	•		•	
GoerTek Co., Ltd.	•	•		•	
MicW Audio	•	•	•		•
Shenzhen Horn Audio Co., Ltd.	•	•			
Sound Technology Development, Ltd.	•				
Sun Technique Electric Co., Ltd.	•	•	•	•	•
Tonly Electronics Holdings	•	•			
DENMARK					
DPA Microphones	•	•			
FRANCE					
KYU Systems		•		•	
Seltech		•		•	
GERMANY					
Fraunhofer Institute for Digital Media Technology				•	
Microtech Gefell GmbH	•				•
HONG KONG					
INNacoustic	•	•		•	
ISRAEL					
Audio Pixels, Ltd.				•	
JAPAN					
Etani Electronics Co., Ltd.					•

	Dynamic Capsules	ECM	LDC	MEMS	True Condenser
SOUTH KOREA					
Suntel Co., Ltd.	•	•	•	•	•
SWEDEN					
Audio Pro, AB	•	•			
TAIWAN					
AV Leader Corp.	•	•	•	•	•
Kingstate Electronics Corp.		•		•	
UNITED KINGDOM					
Electroacoustic Design, Ltd.	•	•		•	
EuroTec International	•	•			•
GRAS Sound & Vibration UK					•
UNITED STATES					
ACO Pacific, Inc.		•			
AValive	•	•	•	•	•
B&H Foto & Electronics Corp.	•	•	•	•	•
Front End Audio	•	•	•	•	•
GraphAudio					•
GRAS Sound & Vibration	•	•	•	•	
Hottinger Bruel & Kjaer Sound & Vibration North America					•
JLI Electronics	•	•			
Josephson Engineering					•
Microphone-Parts.com			•		•
Pro Flix Sales	•	•	•	•	•
Shure	•				•
Sound Pure	•	•	•	•	
Stetron International		•			
Sweetwater Sound	•	•	•	•	•
Vintage King Audio	•	•	•	•	•
Yandas Music	•	•	•	•	•

	Cell Phone	Laptop	Tablet/MID
AUSTRIA			
USound	•	•	•
CANADA			
Solen Electronique, Inc.	•	•	•
CHINA			
DML Exciters	•	•	•
Dongguan Yuonyunn Membrane Co.	•	•	•
Gettop Acoustic Co., Ltd.	•	•	•
GoerTek Co., Ltd.	•	•	•
Grand Will Enterprise Co., Ltd.	•	•	•
M-Sound Electronics Co., Ltd.			•
Pana Sound, Ltd.	•	•	•
Shenzhen Horn Audio Co., Ltd.	•	•	•
Sound Technology Development, Ltd.	•	•	•
Sun Technique Electric Co., Ltd.	•	•	•
Tonly Electronics Holdings	•	•	•
Wavecor		•	
YunQi Science Technology Development	•	•	•
FRANCE			
Seltech	•	•	•
GERMANY			
Voice Point		•	•
HONG KONG			
dB Enterprises	•	•	•
Eastern Asia Technology (HK), Ltd.		•	•
INNacoustic	•	•	•
WCE Acoustics	•	•	•
LIECHTENSTEIN			
Oerlikon Surface Solutions AG	•	•	•

	Cell Phone	Laptop	Tablet/MID
SOUTH KOREA			
Bujeon Components Co., Ltd.	•	•	•
Suntel Co., Ltd.	•	•	•
SWEDEN			
Oxeon AB/Textreme	•	•	•
TAIWAN			
AV Leader Corp.	•	•	•
Fortune Grand Technology, Inc.	•	•	•
Huey Tung International	•	•	•
Kingstate Electronics Corp.	•	•	•
THAILAND			
Clarasonic (Thailand) Co., Ltd.	•	•	•
UNITED KINGDOM			
Electroacoustic Design, Ltd.	•	•	•
UNITED STATES			
Adafruit Industries	•	•	•
BeStar Technologies	•	•	•
Broad Bridge Audio, LLC	•	•	•
Dayton Audio	•	•	•
Dragonfire Acoustics	•	•	•
GGEC America, Inc.	•	•	•
GraphAudio	•	•	
Parts Express	•	•	•
Peerless by Tymphany		•	•
Resonado Labs		•	•
Sound Sources Technology	•		
Stetron International		•	•
The Digital PCH	•	•	•
Trade Moon	•	•	•

	Acoustic Materials	Finished Goods
AUSTRALIA		
Stones Sound Studio	•	•
AUSTRIA		
USound	•	•
BELGIUM		
Donnet: Loudspeaker Repair	•	•
BRAZIL		
Attack do Brasil	•	•
Magna Audio		•
Newbox Industry & Commerce	•	•
CANADA		
Canadian Speaker Works		•
Excelitas Canada		•
LMH Loudspeakers		•
Planet10-HiFi		•
Reference 3A		•
Solen Electronique, Inc.	•	•
Sonavox	•	•
Studio Reference Monitors		•
Sziara Sound	•	•
CHINA		
Audiostar Electronics Co., Ltd.	•	
B.W. Audio Guangzhou Co., Ltd.		•
DML Exciters	•	•
Eastech Holding, Ltd.	•	•
Enkor Electronics Co., Ltd.		•
Fountek Electronics Co., Ltd.		•
GoerTek Co., Ltd.	•	•
Hansong (Nanjing) Technology	•	•
Junhao Wood Cabinet Factory	•	•
Kadeton Audio	•	
Lumi Audio		•
M-Sound Electronics Co., Ltd.		•
OBE Pro Audio Co., Ltd.	•	•
Pana Sound, Ltd.		•
Shenzhen Horn Audio Co., Ltd.	•	•
Sonos, Inc.		•
Sound Technology Development, Ltd.	•	•
Star Audio	•	•
Sun Technique Electric Co., Ltd.	•	•
Telefield	•	•
Tonewinner (Guangzhou) Electronics	•	
Tonly Electronics Holdings	•	•
Tristar Electronics	•	•
Trueanalog Strictly OEM	•	•
Vistron Audio Equipment	•	•
Vormag Electronics Co., Ltd.	•	
Xiamen Great Sound Technology	•	•
Zhuhai HiVi Technology Co., Ltd.		•
FRANCE		
Applications Acoustiques de Composites (AAC)		•
Audax		•
Kartesian	•	•
KYU Systems	•	
Seltech	•	
GERMANY		
Audio Technology Engineering (ATE)	•	•
Soundsgood Pro Audio Solutions		•
Wolf von Langa	•	•
HONG KONG		
BDNC (Holding), Ltd.	•	
Beautiful Enterprise Co., Ltd.		•
dB Enterprises	•	•
Eastern Asia Technology (HK), Ltd.	•	•
Fujikon Industrial Holdings	•	•
INNacoustic	•	•
Ocean Star Electronics (HK) Co., Ltd.		•
PlastoForm	•	•
WCE Acoustics	•	•
INDIA		
GM Audio Technics	•	•
Power Electronics & Technologies		•
INDONESIA		
SB Acoustics	•	•
ISRAEL		
Coby Speakers	•	•

	Acoustic Materials	Finished Goods
Morel, Ltd.		•
RH Sound Technology, Ltd.	•	
MEXICO		
Aletheia		•
NETHERLANDS		
Aequo Audio	•	
Diluvite	•	•
ELTIM audio	•	
Stage Accompany	•	•
NORWAY		
SEAS Fabrikker		•
PHILIPPINES		
Dai-ichi Electronics Manufacturing Corp.	•	•
ROMANIA		
SC Poweraudio		•
SOUTH AFRICA		
Paks Acoustics	•	•
SWEDEN		
Audio Pro, AB	•	•
SWITZERLAND		
Lange Loudspeakers		•
TAIWAN		
AV Leader Corp.	•	•
Huey Tung International	•	•
Kingstate Electronics Corp.		•
Meiloon Industrial Co., Ltd.	•	•
Shining Jins Enterprise Co., Ltd.	•	
Taiwan Solidex Corp.		•
TB Speaker	•	•
Vansonic Enterprise Co., Ltd.	•	•
Yung International, Inc.	•	•
THAILAND		
Clarasonic (Thailand) Co., Ltd.	•	•
UKRAINE		
MAG Audio		•
UNITED KINGDOM		
EuroTec International	•	•
Fane International		•
Ferguson Hill Studios		•
MJ Acoustics		•
Precision Devices		•
Revolver Audio		•
Tectonic Elements, Ltd.		•
Volt Loudspeakers		•
UNITED STATES		
A Brown		•
A List Wood Works, Inc.		•
A. Schulman, Inc.	•	

	Acoustic Materials	Finished Goods
Adrian Acoustics	•	•
Area 52 R&D		•
Arion Audio		•
Arnold Magnetic Technologies/Precision Thin Metals	•	
Audio Connection		•
Audioengine		•
Barefoot Sound		•
Broad Bridge Audio, LLC	•	•
Campanella Associates & Acculab		•
Danley Sound Labs		•
DC Gold Audio		•
Digmoda		•
Dynavox Electronics		•
Earthquake Sound Corp.		•
Eminence Speaker		•
Fulcrum Acoustic		•
GGEC America, Inc.	•	•
Hearing Components (Comply Memory Foam Tips)	•	
Io Audio Technologies		•
J&F Wood Products	•	•
JL Audio		•
Lowell Manufacturing Co.		•
Materion	•	
Meliti Acoustics	•	•
MISCO		•
Monaero Engineering		•
MSC Software Corp.	•	
North American Solidex		•
OAP Audio		•
ORCA Design & Manufacturing Corp.	•	
Parts Express	•	•
Pierce Audio Products	•	•
Portland Audio Lab	•	
PQN Audio		•
PranaFidelity		•
Rapid Die & Molding	•	
RCF USA	•	•
SoCal Sound Shop		•
Sound Sources Technology		•
SpeakersAndAmps.com		•
SSI Manufacturing, Inc.		•
Stetron International		•
Stillwater Designs | KICKER		•
Studio Electric, LLC		•
SVS, Inc.		•
T&T Shanghai Tianai Acoustics Co., Ltd.	•	•
Tectonic Audio Labs	•	•
Tone Tubby, Inc.		•
TSG Audio		•
United Gasket Corp.	•	
US Enclosure Co.	•	•
US Speaker		•
VTech	•	•
Westlake Audio		•
VIETNAM		
Sound Corp.	•	•

	Air Motion Transformer (AMT)	Compression Drivers: Midrange	Compression Drivers: Tweeters	Compression Drivers: Woofers	Electrostatic	Full Range	Horns
AUSTRALIA							
Soundlabs Group				•		•	•
Stones Sound Studio						•	
BELGIUM							
Donnet: Loudspeaker Repair	•	•	•	•	•	•	•
Premium Sound Solutions						•	•
BRAZIL							
Attack do Brasil				•			
Newbox Industry & Commerce	•	•	•	•		•	•
BULGARIA							
Oberton				•		•	
CANADA							
Kravchenko-Audio						•	•
ORA Graphene Audio, Inc.						•	
Planet10-HiFi						•	
Solen Electronique, Inc.				•		•	•
Space-Tech Lab, Ltd.					•	•	•
Studio Reference Monitors				•		•	•
CHINA							
Audiostar Electronics Co., Ltd.							•
B.W. Audio Guangzhou Co., Ltd.				•			
Bozhen Acoustic Co., Ltd.				•			•
Dayun						•	
DML Exciters	•	•	•	•	•	•	•
Dong Guan Dalang Queen Voice Electronics				•			•
Eastech Holding, Ltd.	•	•	•	•	•	•	•
Enkor Electronics Co., Ltd.					•		
Fountek Electronics Co., Ltd.						•	•
Grand Will Enterprise Co., Ltd.					•	•	
Haoyin				•		•	
LaVoce Co., Ltd.				•		•	•
LiangYin				•		•	
Mpio				•		•	

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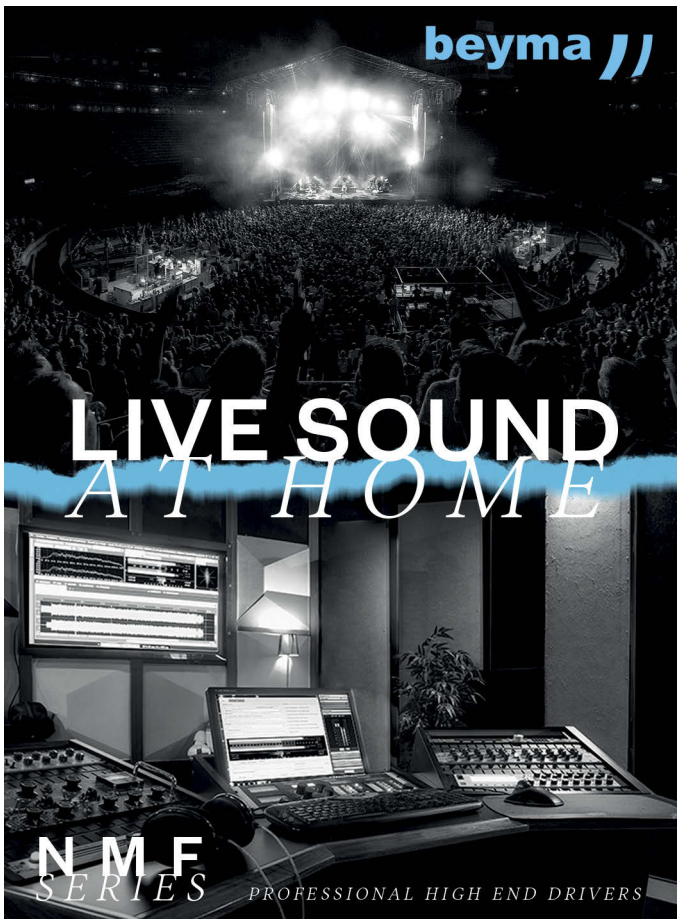
	Air Motion Transformer (AMT)	Compression Drivers: Midrange	Compression Drivers: Tweeters	Compression Drivers: Woofers	Electrostatic	Full Range	Horns	
M-Sound Electronics Co., Ltd.					•		•	•
OBE Pro Audio Co., Ltd.					•		•	
Pana Sound, Ltd.		•	•		•		•	•
Qikang					•		•	
Sound Art Electronic					•		•	
Sound Technology Development, Ltd.					•		•	•
Sun Technique Electric Co., Ltd.					•	•	•	•
Wavecor							•	
Yuesheng Electronic					•		•	
YunQi Science Technology Development					•		•	
Zhuhai HiVi Technology Co., Ltd.							•	
DENMARK								
Puriti Transducer Technology							•	
Scan-Speak							•	
FRANCE								
Audax					•		•	•
Kartesian		•	•		•		•	•
KYU Systems					•		•	•
PHL Audio							•	
Seltech							•	
Supravox							•	•
Waterfall Audio						•		

	Air Motion Transformer (AMT)	Compression Drivers: Midrange	Compression Drivers: Tweeters	Compression Drivers: Woofers	Electrostatic	Full Range	Horns	
GERMANY								
BMS Speakers GmbH					•		•	•
ic audio					•		•	•
Iris Strassacker Lautsprechershop					•		•	
Lautsprecher-Produktions-Gesellschaft (LPG)							•	
Physical-Lab							•	
Voice Point		•	•	•	•	•	•	•
Wolf von Langa		•	•		•		•	•
HONG KONG								
BDNC (Holding), Ltd.							•	
dB Enterprises							•	
Eastern Asia Technology (HK), Ltd.						•	•	
Fujikon Industrial Holdings		•	•	•	•	•	•	•
Ocean Star Electronics (HK) Co., Ltd.							•	
WCE Acoustics						•	•	•
HUNGARY								
Bayz Audio							•	
INDIA								
Audiotone Professional					•		•	
Dakshin Speaker Manufacturing Private, Ltd.					•		•	•
GM Audio Technics					•		•	•
TurboSonic Pro Speakers						•	•	

	Air Motion Transformer (AMT)	Electrostatic Tweeters	Electrostatic Midrange	Electrostatic Woofers	Compression Drivers	Full Range	Horns
INDONESIA							
SB Acoustics					•	•	
ISRAEL							
Coby Speakers						•	•	•
Morel, Ltd.						•	
ITALY							
ABM Bobine					•	•	
Audioxplus, SRL					•	•	
Axiomedia					•	•	•
B&C Speakers					•	•	•
Ciare					•	•	•
Eighteen Sound					•		•
FaitalPRO					•	•	•
LaVoce Italiana					•	•	•
Professional Audio					•	•	•
RCF					•	•	•
Sica Altoparlanti					•	•	•
NETHERLANDS							
Audio Components						•	
Diluvite						•	
ELTIM audio			•			•	•
Good Hifi VOF			•				



SICA loudspeakers ®

Made in Italy

The ability to develop custom-tailored products, together with high quality schedules and short processing times are key factors in SICA's workflow. These, together with highly engineered assembly lines, that merge precision and quality with the typical creativity of the *made in Italy*, enabled SICA to expand into the international markets, establishing a relevant presence in the five continents.

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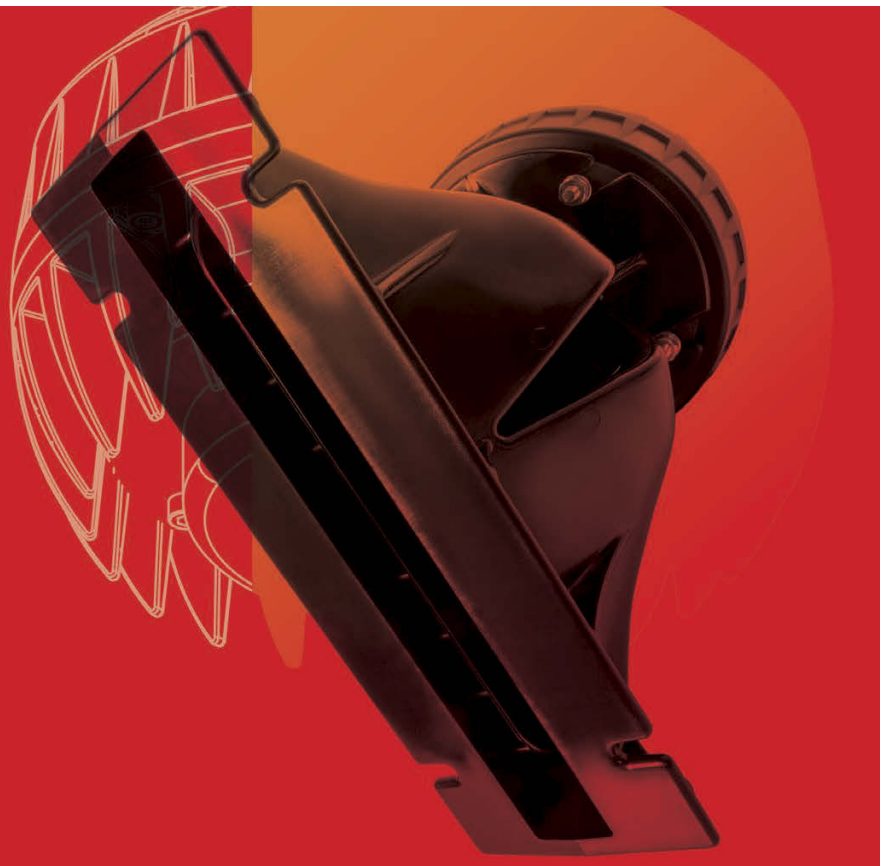
	Air Motion Transformer (AMT)	Compression Drivers: Midrange	Compression Drivers: Tweeters	Compression Drivers: Woofers	Electrostatic	Full Range	Horns	
NORWAY								
SEAS Fabrikker							•	
SPAIN								
Acustica Beyma					•		•	•
SWEDEN								
Audio Pro, AB					•	•	•	
SWITZERLAND								
Lange Loudspeakers					•			•
TAIWAN								
AV Leader Corp.		•	•	•		•	•	
Chien Yuan Electronic Co. (CYE)							•	
Dongguan Sheng-Yang Electronics					•		•	
Glass Acoustic Innovations Technology (GAIT)							•	
Hakken Enterprise							•	
Hi-Tech Sound System Co., Ltd.		•	•	•		•	•	
Huey Tung International					•	•	•	•
Ruhwa Electronic Co., Ltd.					•		•	
TB Speaker							•	
THAILAND								
A-TON Industrial					•		•	
Clarasonic (Thailand) Co., Ltd.							•	

WG148-464

Our **DCX464** dual-diaphragm coaxial compression driver is the engine driving tomorrow's loudspeaker arrays. To direct that power to the furthest seats, we now offer the ME148 waveguide: B&C's first vertical array waveguide optimized for the extra octaves present in our coaxial compression drivers. Precise vertical control from below 500Hz to beyond 18kHz, with user-defined horizontal control, depending on the appropriate expansion flare.

made in Italy



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HiVi OEM / ODM Department
Address: No. 1, South Dongcheng Road, Liangang Industrial Zone, Zhuhai, Guangdong, 519045, P. R. China
Tel: +86-756-6268133 Fax: +86-756-6268068 Website: www.hivi.com E-mail: sales@hivi.com

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	Air Motion Transformer (AMT)	Compression Drivers: Midrange	Compression Drivers: Tweeters	Compression Drivers: Woofers	Electrostatic	Full Range	Horns	
UKRAINE								
MAG Audio					•		•	•
UNITED KINGDOM								
Arya Audio Labs		•	•	•	•		•	
Bishopsound					•		•	
Celestion					•		•	•
Compbass					•			
Electroacoustic Design, Ltd.					•		•	•
EuroTec International					•	•	•	•
Fane International					•		•	•
MJ Acoustics						•		
Precision Devices					•		•	
Volt Loudspeakers							•	
UNITED STATES								
Acoustic Design, Inc.					•			•
American Bass USA					•	•	•	•
American Music & Sound						•		
Analysis Audio USA		•	•					
Beyma America		•	•		•	•	•	•
Broad Bridge Audio, LLC		•	•				•	
Cadillac Audio					•			•
CE Distribution					•		•	•
CommonSense Audio							•	
Danley Sound Labs							•	•

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Thinking big
is getting smaller

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The Tetracoil family welcomes its latest members.
Driven by a brand new 2x2" dual gap motor providing exceptional power handling, linearity and cone control, as well as a dramatically reduced distortion, the NTLW2000 series extends the unmatched performances of the Tetracoil technology to 10", 8" and 6" formats.

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10NTLW2000, **8NTLW2000** and **6NTLW2000**
are here to set new standards.

make a difference
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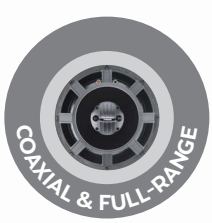
Innovation, performance and reliability make Celestion the drivers of choice for a growing number of big-name PA brands. So when you need superior quality compression drivers or professional loudspeakers, check out about the speakers the pros use.



	Air Motion Transformer (AMT)	Compression Drivers: Midrange	Compression Drivers: Tweeters	Compression Drivers: Woofers	Electrostatic	Full Range	Horns	
Dayton Audio					•		•	•
DC Gold Audio							•	
Dinaburg Technology							•	
Dragonfire Acoustics		•		•		•	•	
Dynavox Electronics					•		•	•
Earthquake Sound Corp.					•		•	•
Eminence Speaker					•	•	•	•
ESS Laboratories						•		
ESTec America		•	•	•	•	•	•	•
Gauss Loudspeaker					•		•	•
GGEC America, Inc.					•		•	•
Hartley Loudspeakers, Inc.							•	
Io Audio Technologies		•	•	•	•	•	•	•
JJR Acoustics							•	
Knowles Electronics							•	
Loudspeakers Plus					•		•	•
MISCO					•		•	
NedLab							•	
North American Solidex					•		•	•
NOU Audio							•	
Parts Express		•	•		•	•	•	•
Peerless by Tymphany					•		•	
PUI Audio					•		•	•
Radian Audio Engineering		•	•	•	•	•	•	•
RBH Sound			•					

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64 ohm fullranges for Line Arrays

2" FR055WA05

3¼" FR084WA03

True full-range designs with on-axis output to beyond 20 kHz
Copper cap on center pole to reduce voice coil inductance
Black anodized alu cone for better heat transfer
Vented polymer chassis reducing audible distortion
Vented voice coil former for reduced distortion and compression
Heavy-duty black fiber glass voice coil bobbin
Large motor with 22 mm voice coil diameter
Low-loss suspension for better reproduction of details
Black motor parts for better heat transfer to the air
Conex spider for better durability under extreme conditions
Gold plated terminals
Delivered with foam gasket attached

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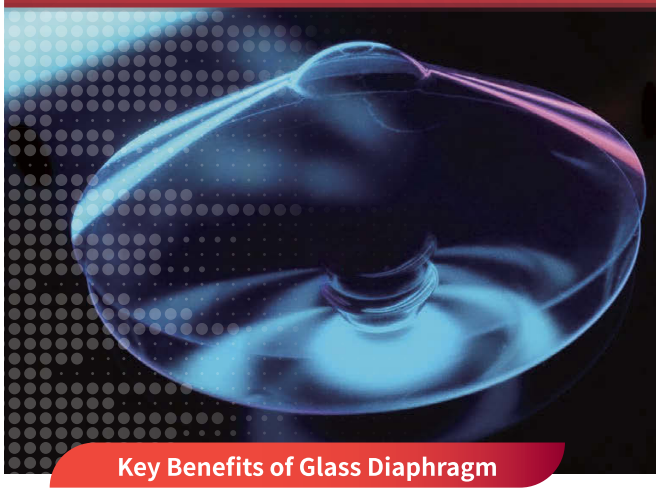
	Air Motion Transformer (AMT)	Compression Drivers: Midrange	Compression Drivers: Tweeters	Compression Drivers: Woofers	Electrostatic	Full Range	Horns
REDCATT					•	•	•
Resonado Labs						•	•
Sanming Sound					•		•
Shinjitsu Audio					•		•
Simply Speakers					•		
SoCal Sound Shop					•		•
SpeakerAddict					•	•	•
SpeakersAndAmps.com					•		•
Stetron International							•
Stillwater Designs | KICKER					•		•
SVS, Inc.							•
T&T Shanghai Tianai Acoustics Co., Ltd.					•		•
Tectonic Audio Labs							•
Tonian Laboratories							•
TSG Audio					•	•	•
US Speaker					•		•
Vidsonix Design Works							•
Westlake Audio							•
Yandas Music					•		
VIETNAM							
Sound Corp.					•		•
Sun Technique		•	•	•	•	•	•



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02 Waterproof
03 Outstanding sound quality
04 High stiffness
05 Proper damping
06 Ultra-Thin Speaker

MORE INFO

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	Midrange						Tweeters								
	Cone	Dome	Electrostatic	Planar	Ribbon	Paging Horns	Piezo	Planar	Siren/Voice Warning	Cone	Dome	Electrostatic	Ribbon	Woofers	
AUSTRALIA															
Soundlabs Group	•	•					•				•	•		•	•
Stones Sound Studio	•	•			•	•	•				•	•		•	•
BELGIUM															
Donnet: Loudspeaker Repair	•	•	•	•	•		•	•	•	•	•	•	•	•	•
Premium Sound Solutions	•	•					•		•	•	•	•		•	•
BRAZIL															
Attack do Brasil															•
Newbox Industry & Commerce	•	•	•		•		•		•		•	•	•	•	•
BULGARIA															
Oberton	•								•						•
CANADA															
Canadian Speaker Works															•
Kravchenko-Audio					•				•			•			•
Newform Research, Inc.						•								•	
ORA Graphene Audio, Inc.															•
Planet10-HiFi															•
Reference 3A												•			•
Solen Electronique, Inc.	•	•							•		•	•		•	•
Space-Tech Lab, Ltd.	•	•									•	•		•	•
Studio Reference Monitors	•											•			•
CHINA															
Audiostar Electronics Co., Ltd.															•
B.W. Audio Guangzhou Co., Ltd.															•
Bozhen Acoustic Co., Ltd.						•								•	•
Dayun	•	•	•	•	•						•	•	•	•	•
DML Exciters	•	•	•	•	•		•	•	•	•	•	•	•	•	•
Dong Guan Dalang Queen Voice Electronics							•								•
Eastech Holding, Ltd.	•	•	•	•	•		•	•	•	•	•	•	•	•	•

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OEM SPEAKERS & DRIVERS M–Z

	Midrange					Paging Horns		Siren/Voice Warning		Tweeters				Woofers
	Cone	Dome	Electrostatic	Planar	Ribbon	Piezo	Planar	Cone		Dome	Electrostatic	Ribbon		
Enkor Electronics Co., Ltd.	•	•								•	•			•
Fountek Electronics Co., Ltd.													•	•
Grand Will Enterprise Co., Ltd.							•							
Haoyin	•	•	•	•	•					•	•	•	•	
LaVoce Co., Ltd.	•	•								•	•			•
LiangYin	•	•	•	•	•					•	•	•	•	•
Mpio	•	•	•	•	•					•	•	•	•	•
M-Sound Electronics Co., Ltd.		•			•					•	•		•	
OBE Pro Audio Co., Ltd.														•
Pana Sound, Ltd.	•	•	•			•	•		•	•	•		•	•
Qikang	•	•	•	•	•					•	•	•	•	•
Sonos, Inc.	•	•								•	•			•
Sound Art Electronic	•	•	•	•	•					•	•	•	•	•
Sound Technology Development, Ltd.	•	•				•	•			•	•			•
Sun Technique Electric Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Wavecor	•	•								•	•			•
Yuesheng Electronic	•	•	•	•	•					•	•	•	•	
YunQi Science Technology Development	•	•	•	•	•					•	•	•	•	•
Zhuhai HiVi Technology Co., Ltd.		•								•	•		•	•

D8404/552000

Ellipticor 84 mm Dome Midrange

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	Midrange					Paging Horns		Siren/Voice Warning		Tweeters				Woofers
	Cone	Dome	Electrostatic	Planar	Ribbon	Piezo	Planar	Cone	Dome	Electrostatic	Ribbon	
DENMARK														
Audio Technology ApS	•													•
Hiquphon										•				
Purifi Audio	•	•												•
Puriti Transducer Technology	•									•				•
Scan-Speak	•	•								•				•
FRANCE														
Audax	•	•								•	•			•
Kartesian	•	•	•							•	•			•
KYU Systems	•			•				•						•
PHL Audio	•									•				•
Seltech	•	•	•				•	•	•	•	•			•
Supravox	•									•	•			•
Waterfall Audio														•
GERMANY														
Audio Technology Engineering (ATE)	•													•
BMS Speakers GmbH	•			•				•	•					•
ic audio						•								

LA PASSION DU HAUT-PARLEUR

AUDAX

HAUT-PARLEUR - LOUDSPEAKER - LAUTSPRECHER

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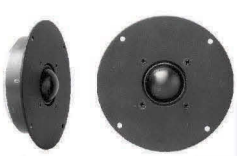

PR170M0

Dome tweeters, Midranges, Woofers

Tweeter Line : 1" - 1 1/4", Soft and Metal Domes, ...
Prestige Series : Die Cast Chassis, HDA Cones ...
References Series : Die Cast Chassis, Paper and Carbon Cones, ...
Classic Series : Stamped Steel Chassis, Paper, Fiberglass, Kevlar Cones, ...
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	Midrange					Paging Horns		Siren/Voice Warning		Tweeters				Woofers
	Cone	Dome	Electrostatic	Planar	Ribbon	Piezo	Planar	Cone		Dome	Electrostatic	Ribbon		
Iris Strassacker Lautsprechershop										•	•	•	•	•
Lautsprecher-Produktions-Gesellschaft (LPG)	•										•			•
Physical-Lab											•			
Voice Point	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Wolf von Langa	•	•									•			•
HONG KONG														
BDNC (Holding), Ltd.	•	•						•		•	•			•
dB Enterprises	•									•				•
Eastern Asia Technology (HK), Ltd.	•	•								•	•			•
Fujikon Industrial Holdings	•	•	•	•	•	•		•	•	•	•	•	•	•
Ocean Star Electronics (HK) Co., Ltd.	•	•								•	•			•
WCE Acoustics	•	•	•	•	•	•	•	•	•	•	•			•
HUNGARY														
Bayz Audio								•						
INDIA														
Audiotone Professional														•
Dakshin Speaker Manufacturing Private, Ltd.	•	•	•	•	•	•	•			•	•	•	•	•
GM Audio Technics	•	•								•				•
TurboSonic Pro Speakers	•	•	•	•	•									•
Venus Paper Cones	•									•				•
INDONESIA														
Premiere Wood Manufacturing (PWM)								•						
SB Acoustics	•	•					•			•	•		•	•
ISRAEL														
Coby Speakers	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Morel, Ltd.	•	•									•			•
ITALY														
ABM Bobine	•	•	•	•	•					•	•	•	•	•
Audioxplus, SRL	•	•								•	•			•
Axiomedia	•	•									•		•	•
B&C Speakers	•										•		•	•
Ciare														•
Eighteen Sound														•
FaitalPRO	•	•								•	•			•
LaVoce Italiana	•	•								•	•			•
Powersoft														•
Professional Audio	•	•								•	•			•
RCF														•
Sica Altoparlanti	•	•	•	•	•					•	•	•	•	•
NETHERLANDS														
Audio Components		•									•			•
Diluvite	•	•								•	•			•
ELTIM audio	•	•									•		•	•
Good Hifi VOF	•									•	•			•
Stage Accompany								•					•	•
NORWAY														
SEAS Fabrikker	•	•									•			•

	Midrange					Paging Horns		Siren/Voice Warning	Tweeters					Woofers
	Cone	Dome	Electrostatic	Planar	Ribbon	Piezo	Planar		Cone	Dome	Electrostatic	Ribbon		
SOUTH KOREA														
Bujeon Components Co., Ltd.							•							
SPAIN														
Acustica Beyma	•									•		•	•	
SWEDEN														
Audio Pro, AB	•	•		•	•		•	•		•	•		•	•
SWITZERLAND														
Lange Loudspeakers											•			•
TAIWAN														
AV Leader Corp.	•	•	•	•	•	•	•	•		•	•	•	•	
BESTON Technology Corp.				•	•			•					•	
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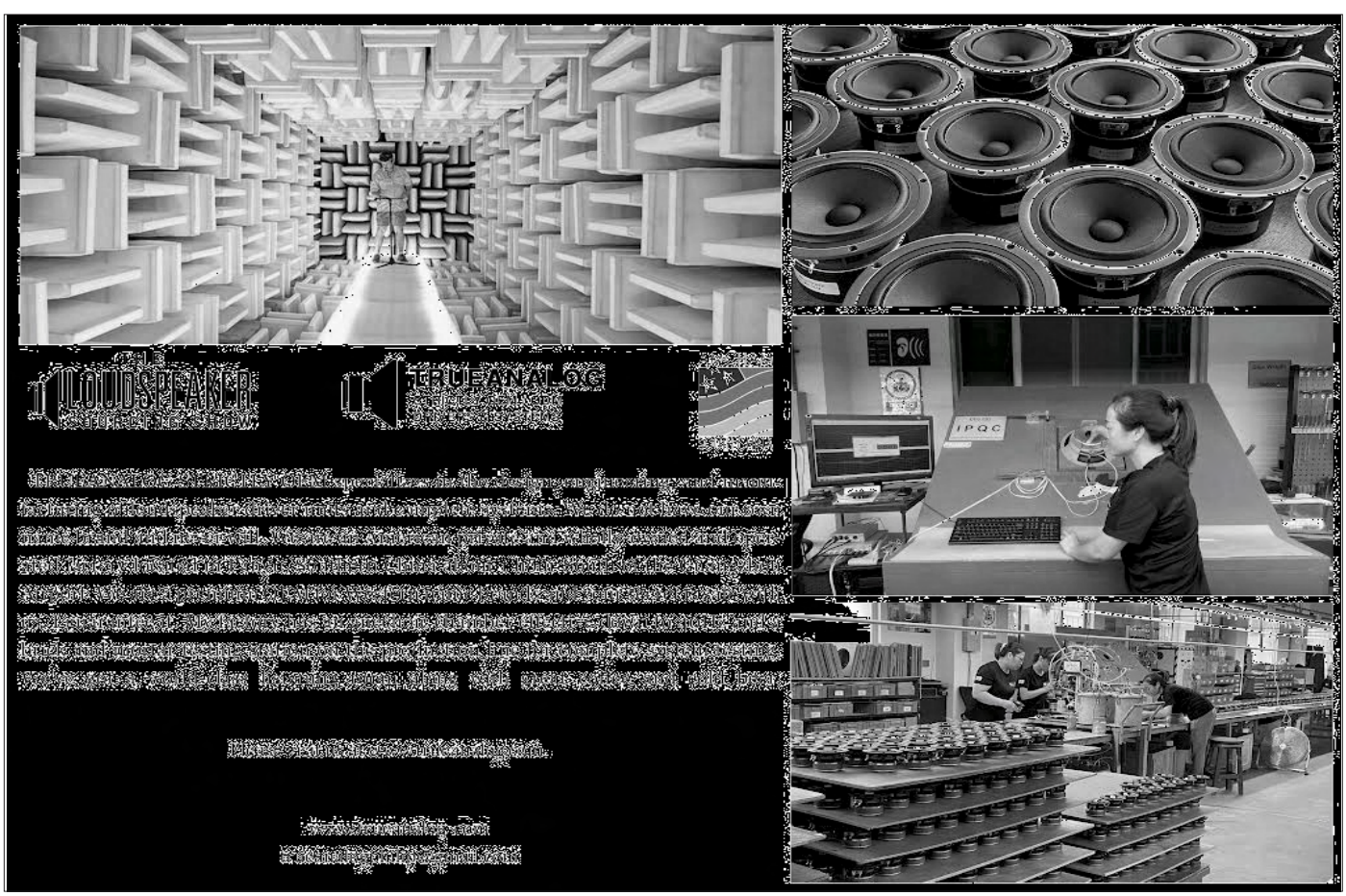
Kingstate Electronics Corp.							•		•					
Ruhwa Electronic Co., Ltd.			•	•	•					•	•	•	•	•



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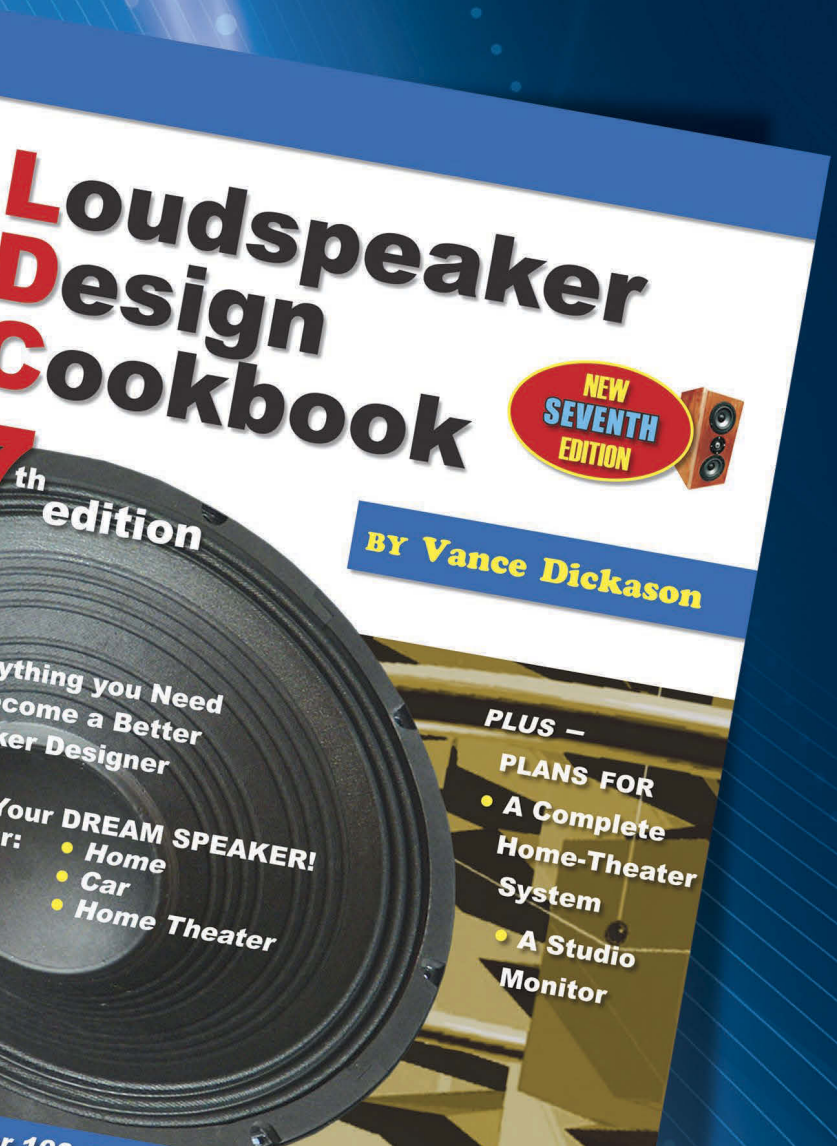

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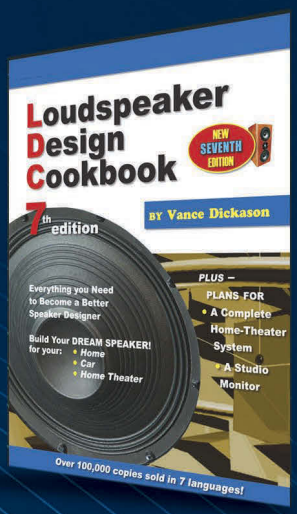

	Midrange						Tweeters							
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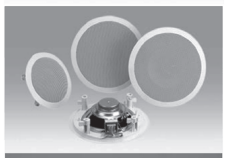

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	Midrange					Paging Horns		Siren/Voice Warning		Tweeters				Woofers
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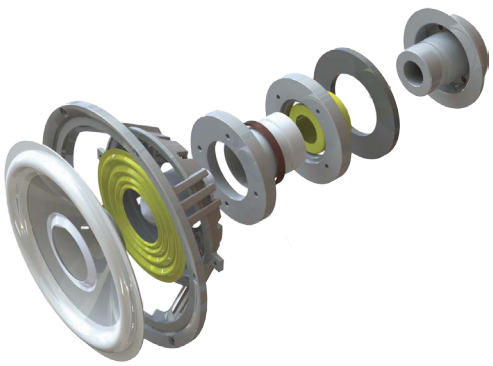

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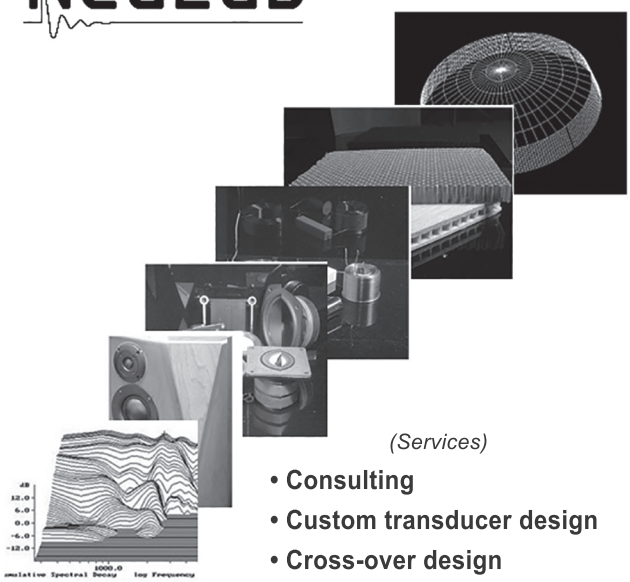

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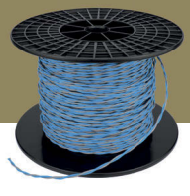

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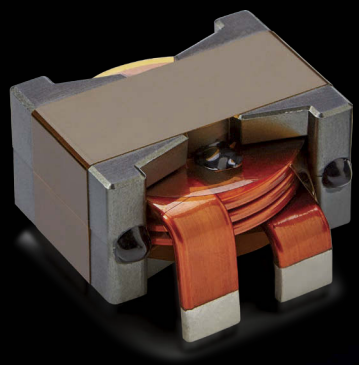

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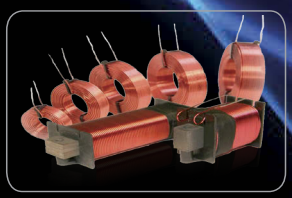

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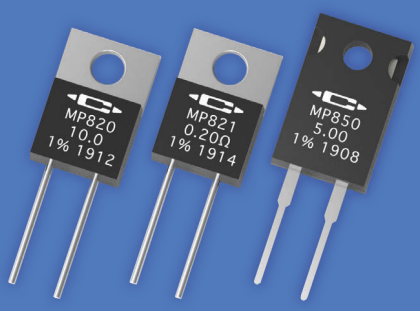

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Power rating is based on a +25°C case temperature. The thermal mounting issues are the same as with power semiconductors.

Resistor Style	Model No.	Power Rating at +25°C Case Temp.	Resistance Range	Comments
TO-220 Style Package	MP820	20 Watts	10 Ω to 10K	Metal Mounting Tab
	MP821	20 Watts	0.02 Ω to 9.99 Ω	Metal Mounting Tab
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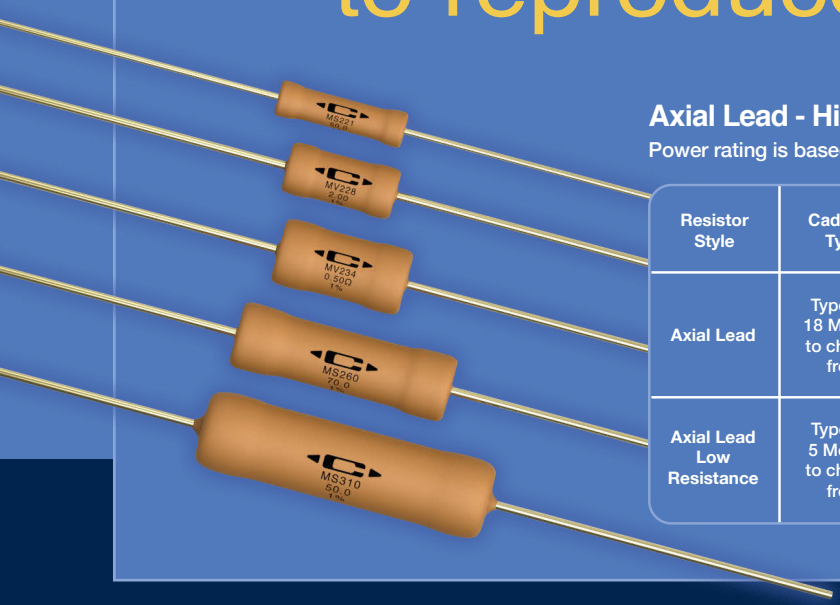

Axial Lead - High Power *with Non-Inductive Design*

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Resistor Style	Caddock Type	Power Rating	Resistance Range	Comments
Axial Lead	Type MS 18 Models to choose from	0.5 Watt up to 22 Watts	20 Ω up to 30 Meg	These non-inductive resistors are about as inductive as a straight piece of wire the length of the resistor body. Standard tolerance 1%
Axial Lead Low Resistance	Type MV 5 Models to choose from	1.5 Watts up to 10 Watts	0.10 Ω up to 50 Ω	Low Resistance with EXTREMELY low inductance. Standard tolerance 1% (5% and 10% available)

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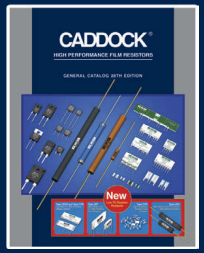

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	Passive Components														
	Attenuators	Capacitors		Driver Protection Devices	Inductors		Plugs & Jack Dishes	Resistors	Solder	Terminal Plates	Transformers	Electronic Crossover Nets	Finished Passive Crossover Nets	Wire & Wiring Harnesses	
		Ceramic	Electrolytic Non-Polar	Film	Air Core	Iron Core									
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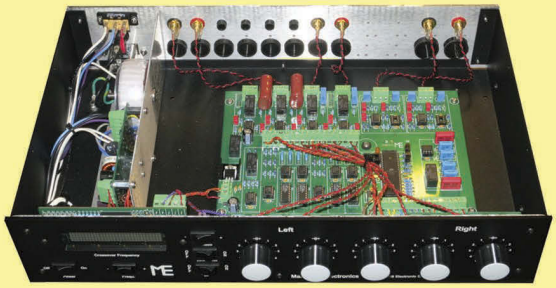

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Metallized Polypropylene Flim Fast Capacitors™
-First to use the "Fast Capacitors"™
-First to use bi-axially oriented metabolized polypropylene film
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-Widest range of values, from 0.01uf to 330uf
-Widest range of voltages, from 250Vdc to 630Vdc
Metallized Teflon™ Film - 0.22uf to 10uf, 1300Vdc
Silver Metallized Polypropylene Film - 0.10uf to 56uf, 700Vdc
Teflon™ Film & Foil - 0.033uf to 0.82uf, 1000Vdc
Polypropylene Film & Tin Foil - 0.01uf to 8.2uf, 100Vdc to 1200Vdc
Metallized Polypropylene Can Type - 22uf, 33uf, 51uf & 100uf, 630Vdc
Metallized Polyester Film - 1.0uf to 47uf, 160Vdc
Non-Polar Electrolytic .5% DF - 10uf to 330uf, 100Vdc
Polarized Electrolytic - .33uf to 33000uf, 63Vdc to 450Vdc

SOLEN INDUCTORS

Perfect Layer Hexagonal Winding Air Core
-First to use Perfect Layer Hexagonal winding technique
-First to use Hepta-Litz seven strand insulated wire
-First to use H49-Litz forty-nine strand insulated wire
-Zero distortion air core, lowest dc resistance
-Widest range of values 0.05mH to 85mH
-Wide range of wire diameters, from 0.8mm (20awg) to 3.1mm (8awg)

SOLEN RESISTORS

Wire wound 10w 5% - 0.5 ohm to 82 ohm
Metal Oxide Link 10w 5% non inductive - 1 ohm to 47 ohm
AchrOhmiC 16w 2% MIL Spec non inductive - 0.5 ohm to 82 ohm

SOLEN TUBES

-Electro Harmonix -Genalex Gold Lion
-Mullard -Sovtek -Tesla JJ -Tung-Sol

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	Adhesives & Glues					Cone Additives & Other Treatments					Cone & Suspension Components										
											Cones		Domes			Spiders	Surrounds			
	Acrylic Adhesives	Epoxy	Infra-Red Cure	Instant Adhesives	Water & Vinyl Based	Damping	Fire Resistance	Lacquers	Waterproofing	Wet Lock	Composite	Paper Pulp	Plastic	Aluminum/Titanium/Metal	Fabric/Mylar/Resin/Soft	Phenolic & Other Domes		Fabric	Foam	Rubber	
ARGENTINA																					
Laufer Speaker Electronics							•		•			•	•	•	•	•	•	•	•	•	•
AUSTRALIA																					
Soundlabs Group							•		•												
BELGIUM																					
Donnet: Loudspeaker Repair							•		•	•	•	•	•	•	•	•	•	•	•	•	•
BRAZIL																					
Attack do Brasil	•	•	•	•	•							•	•	•	•	•	•	•	•	•	•
Newbox Industry & Commerce												•	•	•	•	•	•	•	•	•	•
CANADA																					
ORA Graphene Audio, Inc.												•	•	•	•	•	•	•	•	•	•
Reference 3A	•	•		•								•						•			•
Solen Electronique, Inc.							•				•										
CHINA																					
Audiostar Electronics Co., Ltd.				•																	
BOWI Industry Co., Ltd.												•	•	•	•	•	•	•	•	•	•
Dayun							•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Dong Guan Dalang Queen Voice Electronics												•	•	•	•	•	•	•	•	•	•
Dong Guan Yen Lung Electronics Co., Ltd.												•	•				•				
Guangzhou Istaray Trading Co., Ltd.												•	•	•		•	•		•	•	•
Haoyin												•	•	•	•	•	•	•	•	•	•
LiangYin												•	•	•	•	•	•	•	•	•	•
Lumi Audio												•	•	•	•	•	•	•	•	•	•
Mpio												•	•	•	•	•	•	•	•	•	•

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	Adhesives & Glues					Cone Additives & Other Treatments					Cone & Suspension Components										
											Cones		Domes			Spiders	Surrounds			
	Acrylic Adhesives	Epoxy	Infra-Red Cure	Instant Adhesives	Water & Vinyl Based	Damping	Fire Resistance	Lacquers	Waterproofing	Wet Look	Composite	Paper Pulp	Plastic	Metal	Aluminum/Titanium/Metal	Fabric/Mylar/Resin/Soft	Phenolic & Other Domes		Fabric	Foam	Rubber
Ningbo Xiangyang Telecommunication Component											•	•	•	•	•	•	•	•	•	•	•
Qikang											•	•	•	•	•	•	•	•	•	•	•
Shenzhen Gonna Electronic Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sound Art Electronic											•	•	•	•	•	•	•	•	•	•	•
Sound Technology Development, Ltd.	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•
Sun Technique Electric Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Tianyi Electronic Co., Ltd.											•	•	•	•	•	•	•	•	•	•	•
TopOne Loudspeaker Cone Co., Ltd.												•									
Vormag Electronics Co., Ltd.		•																			
Yuesheng Electronic						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
YunQi Science Technology Development						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
DENMARK																					
Jantzen Audio Denmark						•															
FRANCE																					
Applications Acoustiques de Composites (AAC)						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Kartesian											•	•	•	•	•	•	•	•	•	•	•
KYU Systems	•	•	•	•	•	•					•	•	•	•	•	•		•	•	•	•
Seltech						•	•	•	•	•											
GERMANY																					
Centrotec Composites						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
dB Enterprises						•			•												
Dr. Kurt Müller											•	•	•	•	•	•	•	•	•	•	•
Henkel Corp.	•	•	•	•	•																
Hubert Stüken GmbH														•	•						
Propex Fabrics GmbH											•		•						•		
Voice Point	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Wolf von Langa	•	•									•	•					•	•	•	•	•
HONG KONG																					
BDNC (Holding), Ltd.											•						•				
WCE Acoustics											•	•	•	•	•	•	•	•	•	•	•
HUNGARY																					
Viktorsound											•	•	•	•	•	•	•	•	•	•	•
INDIA																					
Audiotone Professional											•	•	•					•	•	•	•
Dakshin Speaker Manufacturing Private, Ltd.											•	•	•	•	•	•	•	•	•	•	•
TurboSonic Pro Speakers						•			•												
Venus Paper Cones						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Wizard India Private, Ltd.											•	•	•			•	•	•	•	•	•
INDONESIA																					
SB Acoustics												•			•	•		•		•	•
ISRAEL																					
RH Sound Technology, Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

	Adhesives & Glues					Cone Additives & Other Treatments					Cone & Suspension Components									
											Cones			Domes			Spiders	Surrounds		
	Acrylic Adhesives	Epoxy	Infra-Red Cure	Instant Adhesives	Water & Vinyl Based	Damping	Fire Resistance	Lacquers	Waterproofing	Wet Lock	Composite	Paper Pulp	Plastic	Aluminum/Titanium/Metal	Fabric/Mylar/Resin/Soft	Phenolic & Other Domes		Fabric	Foam	Rubber
ITALY																				
ABM Bobine						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Boxal											•	•	•	•	•	•	•	•	•	•
OEB, SRL											•	•						•	•	•
Professional Audio											•		•	•	•		•	•	•	•
LIECHTENSTEIN																				
Oerlikon Surface Solutions AG															•	•				
MALAYSIA																				
Eternal Power						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Shu Kae Industrial	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
U-Sonics Power Cone											•	•	•	•	•	•	•	•	•	•
NETHERLANDS																				
Audiofriends											•	•	•	•	•	•	•	•	•	•
Diluvite	•	•				•					•	•	•	•	•	•	•			
Good Hifi VOF		•			•										•	•	•		•	•
Stage Accompany											•	•					•	•	•	•
Teijin Aramid						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

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	Adhesives & Glues					Cone Additives & Other Treatments					Cone & Suspension Components										
											Cones			Domes			Spiders	Surrounds		
	Acrylic Adhesives	Epoxy	Infra-Red Cure	Instant Adhesives	Water & Vinyl Based	Damping	Fire Resistance	Lacquers	Waterproofing	Wet Lock	Composite	Paper Pulp	Plastic	Aluminum/Titanium/Metal	Fabric/Mylar/Resin/Soft	Phenolic & Other Domes		Fabric	Foam	Rubber
NORWAY																				
Soundcare							•							•						
PHILIPPINES																				
Dai-ichi Electronics Manufacturing Corp.											•	•	•	•	•	•	•	•	•	•
SOUTH KOREA																				
Suntel Co., Ltd.											•	•	•	•	•	•	•	•	•	•
SWEDEN																				
Audio Pro, AB						•					•	•	•	•	•	•	•	•	•	•
Oxeon AB/Textreme											•						•			
SWITZERLAND																				
Kisling	•	•		•																
TAIWAN																				
AV Leader Corp.							•	•	•	•	•									
Chien Yuan Electronic Co. (CYE)							•	•	•	•	•	•	•	•	•	•	•	•	•	•
Dongguan Sheng-Yang Electronics							•	•	•	•	•	•	•	•	•	•	•	•	•	•
Glass Acoustic Innovations Technology (GAIT)											•			•	•		•			

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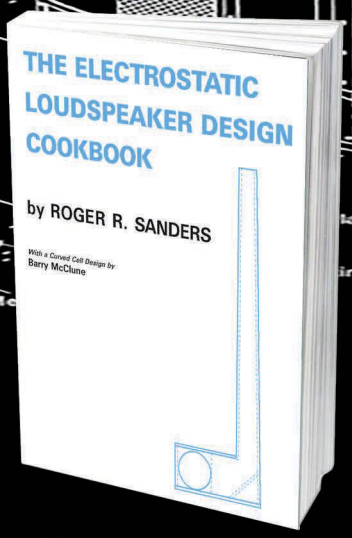

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	Adhesives & Glues					Cone Additives & Other Treatments					Cone & Suspension Components										
											Cones			Domes			Spiders	Surrounds		
	Acrylic Adhesives	Epoxy	Infra-Red Cure	Instant Adhesives	Water & Vinyl Based	Damping	Fire Resistance	Lacquers	Waterproofing	Wet Lock	Composite	Paper Pulp	Plastic	Aluminum/Titanium/Metal	Metal	Fabric/Mylar/Resin/Soft	Phenolic & Other Domes		Fabric	Foam	Rubber
Pierce Audio Products		•										•	•		•				•	•	•	•
Quick Draw & Machining															•	•						
Radian Audio Engineering												•	•	•	•	•	•	•	•	•	•	•
Rapid Die & Molding												•	•	•	•	•	•	•	•	•	•	•
REDCATT																•		•				
Roderick Loudspeaker Service	•	•		•	•								•			•			•	•	•	•
RTP Co.		•		•			•		•													
Sherwood Industries																					•	•
Shinjitsu Audio						•																
Simply Speakers	•	•		•	•				•	•		•	•						•	•	•	•
State Of The Art (SOTA) Applications	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
TRS Inovations, Inc.	•	•		•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
United Gasket Corp.						•															•	•
US Enclosure Co.						•					•								•			
Vidsonix Design Works										•												
Western Electric												•										

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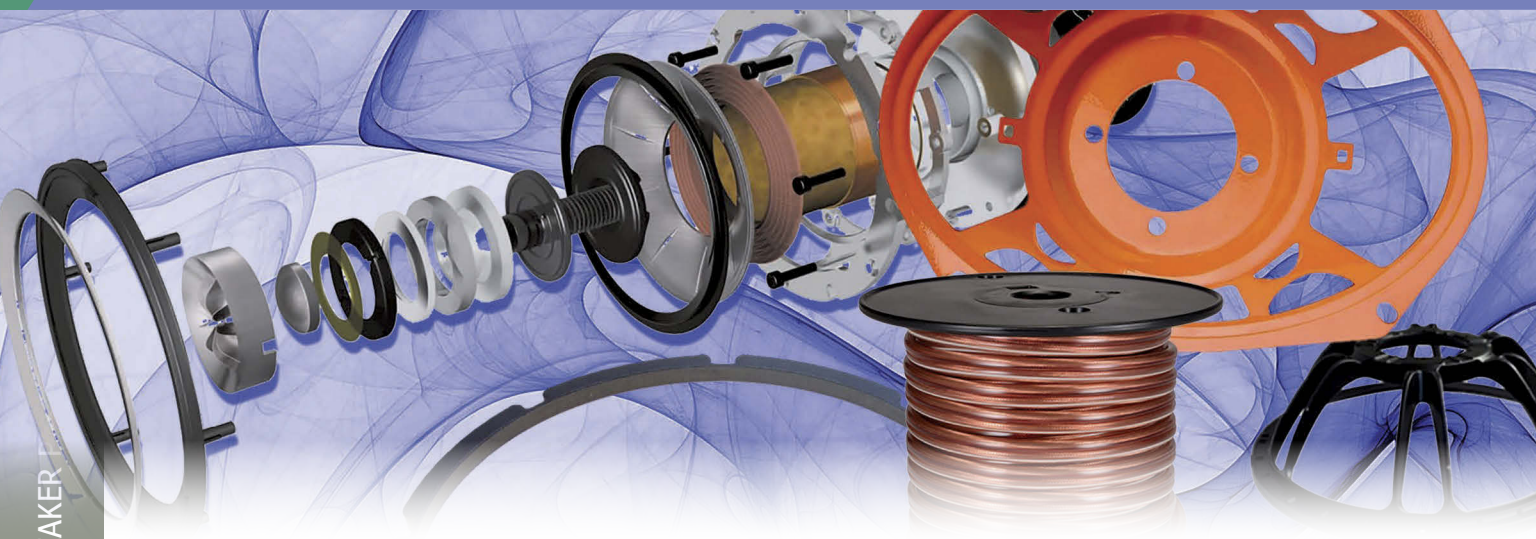
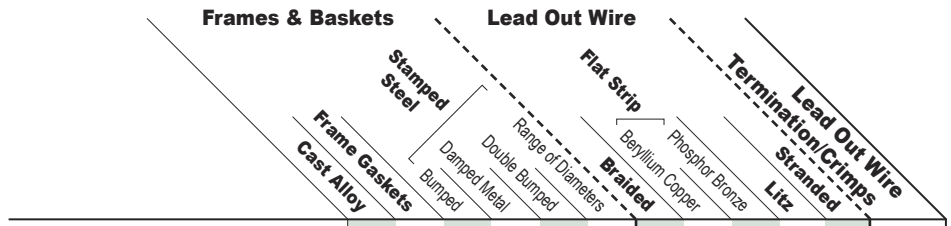


	Frames & Baskets						Lead Out Wire					
	Cast Alloy	Frame Gaskets	Stamped Steel	Damped Metal	Bumped	Range of Diameters	Double Bumped	Braided	Flat Strip	Beryllium Copper	Phosphor Bronze	Litz	Stranded	Termination/Crimps	Lead Out Wire
BELGIUM															
Donnet: Loudspeaker Repair								•	•	•	•	•		•	
BRAZIL															
Attack do Brasil												•	•		
Newbox Industry & Commerce	•	•	•	•	•	•		•	•	•	•	•	•		•
CANADA															
Canadian Speaker Works	•											•	•		
Reference 3A	•							•							•
CHINA															
BOWI Industry Co., Ltd.	•	•	•	•	•	•		•	•	•	•	•	•		•
Lumi Audio	•	•	•	•	•	•									
Ningbo Xiangyang Telecommunication Component	•	•	•	•	•	•									
Renyi Castings	•	•	•	•	•	•									
Sound Technology Development, Ltd.	•		•	•				•	•	•	•	•	•		•
Sun Technique Electric Co., Ltd.	•	•	•	•	•	•		•	•	•	•	•	•		•
Zhuhai HiVi Technology Co., Ltd.	•														
DENMARK															
Duelund Coherent Audio								•	•	•					
estron a/s												•	•		•
FRANCE															
Kartesian	•	•													
KYU Systems	•	•								•					
Seltech		•													
GERMANY															
Hubert Stüken GmbH	•	•	•	•	•	•									
Voice Point								•	•	•	•	•	•		•
Wolf von Langa		•						•				•	•		
HONG KONG															
Eastern Asia Technology (HK), Ltd.	•	•	•	•	•	•									
WCE Acoustics												•			

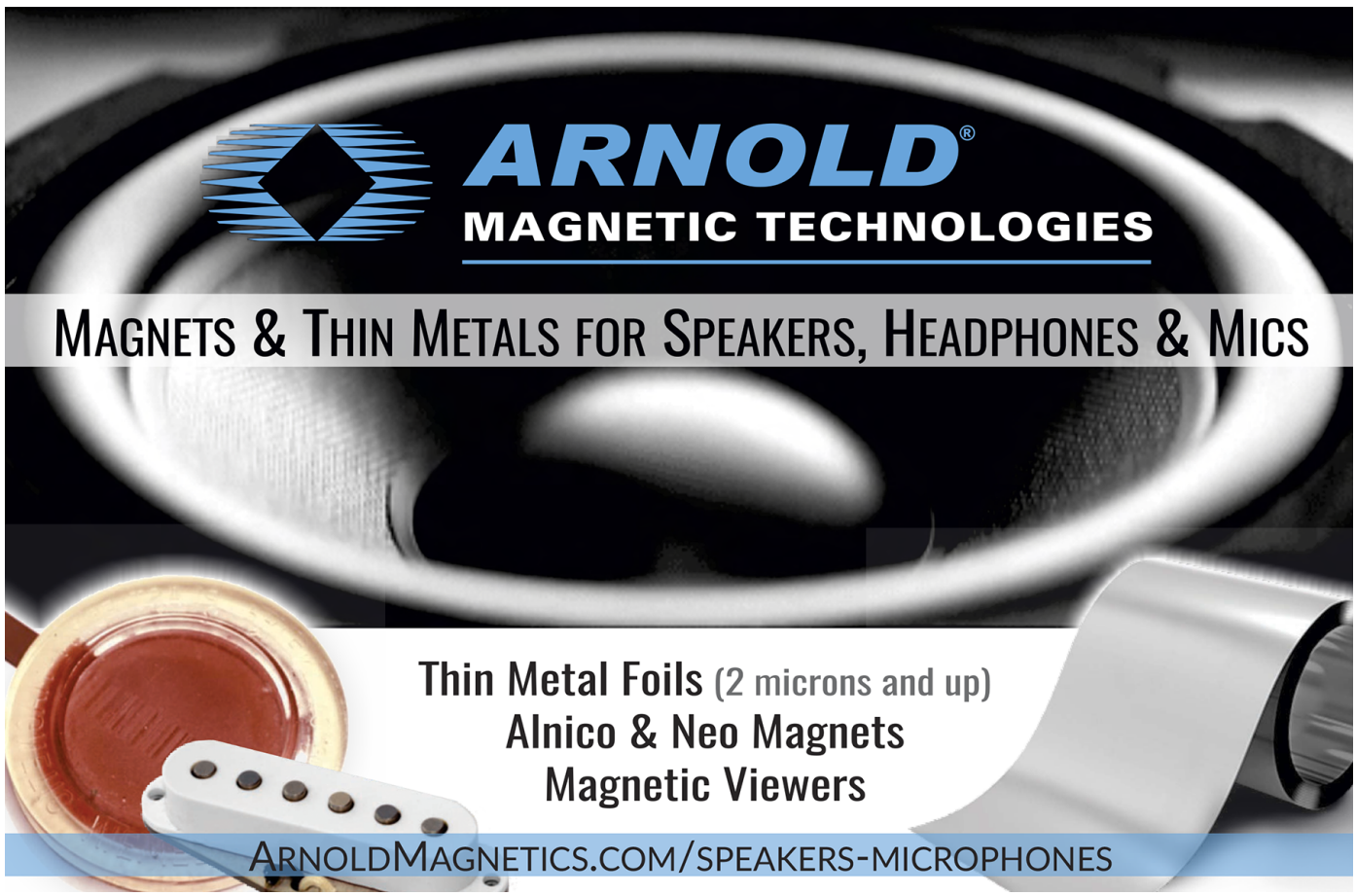
	Frames & Baskets						Lead Out Wire					
	Frame Gaskets		Stamped Steel				Flat Strip			Braided		
	Cast Alloy		Bumped	Damped Metal	Double Bumped	Range of Diameters	Beryllium Copper	Phosphor Bronze		Litz	Stranded	Lead Out Wire Termination/Crimps
INDIA												
Audiotone Professional							•	•	•	•	•	•
Dakshin Speaker Manufacturing Private, Ltd.	•	•	•	•	•	•						
Vidyut Teletronics							•				•	
Wizard India Private, Ltd.	•	•										
INDONESIA												
SB Acoustics			•	•	•	•				•		
ISRAEL												
Coby Speakers	•	•	•	•	•	•	•	•	•	•	•	•
RH Sound Technology, Ltd.							•	•		•	•	•
ITALY												
ABM Bobine							•	•	•	•	•	•
Axiomedia							•	•	•		•	
Boxal							•	•	•	•	•	•
FaitalPRO	•	•									•	•
Professional Audio	•	•	•	•	•	•	•	•	•	•	•	•



	Cast Alloy	Frame Gaskets	Bumped	Damped Metal	Double Bumped	Range of Diameters	Braided	Beryllium Copper	Phosphor Bronze	Litz	Stranded	Lead Out Wire
JAPAN												
Furutech Co., Ltd.											•	
MALAYSIA												
U-Sonics Power Cone	•	•	•	•	•	•						
NETHERLANDS												
Diluvite	•		•	•	•	•						
Stage Accompany	•	•								•		
PHILIPPINES												
Dai-ichi Electronics Manufacturing Corp.	•	•	•	•	•	•						
SWEDEN												
Audio Pro, AB	•	•	•	•	•	•	•	•		•		•
TAIWAN												
Huey Tung International	•	•	•	•	•	•	•	•			•	
Maeden Innovation Co., Ltd.							•			•	•	•
Yie Feng Technology Enterprise Co., Ltd.		•										
THAILAND												
A-TON Industrial	•	•	•	•	•	•	•	•	•	•	•	•
UNITED KINGDOM												
EuroTec International	•	•	•	•	•	•	•	•	•			•
UNITED STATES												
A. Schulman, Inc.	•											
American Bass USA	•	•	•	•	•	•	•	•	•	•	•	•
Cardas Audio							•	•	•	•	•	•
Dynavox Electronics	•	•	•	•	•	•	•			•	•	
Elektrisola							•	•	•	•	•	•
Herman Pro							•	•	•	•	•	•
Materion								•				
NedLab	•	•										
New England Wire Technologies							•	•	•	•	•	•
North Reading Engineering	•	•	•	•	•	•	•	•	•	•	•	•
Pierce Audio Products	•	•	•		•	•						
Quick Draw & Machining	•			•	•	•						
Radian Audio Engineering	•	•	•	•	•	•						
Rapid Die & Molding	•	•	•	•	•	•						
RDS Wire & Cable							•	•	•	•	•	•
Redco Audio											•	
Roderick Loudspeaker Service		•					•			•	•	•
Simply Speakers							•					
Standard Wire & Cable Co.							•	•	•	•	•	•
TRS Inovations, Inc.	•	•	•	•	•	•						
United Gasket Corp.		•										
Western Electric							•				•	
Whitmor Wirenetics							•	•	•	•	•	•
VIETNAM												
Sound Corp.		•	•	•	•	•						

	Magnetic Assemblies							Voice Coil Components								
	Back Plates	Magnets		Magnetic Fluids	Pole Pieces	T-Yokes Top Plates	Bobbins/Formers	Collars	Magnet Wire	Polyimide Tape for Collars	Voice Coil Assemblies			Amplifiers		
		Alnico	Ferrite	Neodymium							Flat Wire	Round Wire	Voice Coil Stacks	Powered Speakers	Amplifier for Subwoofer	Plate Amplifier
ARGENTINA																
Laufer Speaker Electronics								•				•	•	•		
AUSTRALIA																
Soundlabs Group															•	
Stones Sound Studio																•
BRAZIL																
Newbox Industry & Commerce	•	•	•	•	•	•	•			•		•	•	•	•	•
CANADA																
Canadian Speaker Works	•			•			•	•								
Reference 3A													•			
Solen Electronique, Inc.				•						•					•	•
Studio Reference Monitors															•	
Tortech Sound															•	
CHINA																
Audiostar Electronics Co., Ltd.								•	•	•	•	•	•	•		
BOWI Industry Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Changzhou Xiantong Magnetic Materials Co., Ltd.		•	•	•												
Dongguan Mingyang Electroacoustic Products Co., Ltd.								•	•			•	•	•		
Lumi Audio															•	•
Ningbo Xiangyang Telecommunication Component								•	•	•	•	•	•	•	•	•
OBE Pro Audio Co., Ltd.															•	•
One Magnet Electronic Co., Ltd.		•	•	•												
Pana Sound, Ltd.															•	•
Shenzhen Gonna Electronic Co., Ltd.								•	•	•	•	•	•	•	•	•
Sound Technology Development, Ltd.	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sun Technique Electric Co., Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

	Magnetic Assemblies							Voice Coil Components								
	Back Plates	Magnets		Magnetic Fluids	Pole Pieces	T-Yokes Top Plates	Bobbins/Formers	Collars	Magnet Wire	Polyimide Tape for Collars	Voice Coil Assemblies				Amplifiers	
		Alnico	Ferrite	Neodymium							Flat Wire	Round Wire	Voice Coil Stacks	Powered Speakers	Amplifier for	Subwoofer Plate Amplifier
Tianyi Electronic Co., Ltd.		•		•	•		•									
Tonly Electronics Holdings																•
Trueanalog Strictly OEM	•					•	•									
Vistron Audio Equipment																•
Vormag Electronics Co., Ltd.		•		•	•					•						
Zeng Ben Industrial						•	•									
Zenith Audio Electronics Co., Ltd.										•		•	•	•		
FRANCE																
Kartesian				•	•		•	•				•	•			•
KYU Systems	•				•	•	•	•		•		•			•	•
GERMANY																
Audio Technology Engineering (ATE)								•		•		•	•	•	•	•
Voice Point	•	•		•	•	•	•									
Wolf von Langa								•				•	•	•		
HONG KONG																
Eastern Asia Technology (HK), Ltd.												•	•	•	•	•
WCE Acoustics	•	•		•			•	•	•	•	•	•	•	•		•



	Magnetic Assemblies							Voice Coil Components								
	Back Plates	Magnets: Alnico	Magnets: Ferrite	Magnetic Fluids: Neodymium	Pole Pieces	T-Yokes Top Plates	Bobbins/Formers	Collars	Magnet Wire	Polyimide Tape for Collars	Voice Coil Assemblies: Flat Wire	Voice Coil Assemblies: Round Wire	Amplifiers: Voice Coil Stacks	Amplifiers: Powered Speakers	Amplifier for Subwoofer Plate Amplifier	
INDIA																
Audiotone Professional								•				•	•	•		
Dakshin Speaker Manufacturing Private, Ltd.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Lakshmi Metal Coils													•			
Power Electronics & Technologies															•	•
TurboSonic Pro Speakers				•								•	•	•		
Vidyut Teletronics										•	•	•	•			
Wizard India Private, Ltd.			•				•									
INDONESIA																
SB Acoustics	•		•	•		•	•	•				•	•	•		
ISRAEL																
Coby Speakers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
RH Sound Technology, Ltd.								•	•	•	•	•	•	•	•	•
Thermoguide, Ltd.															•	•
ITALY																
ABM Bobine								•	•	•	•	•	•	•	•	•
Axiomedia			•												•	•

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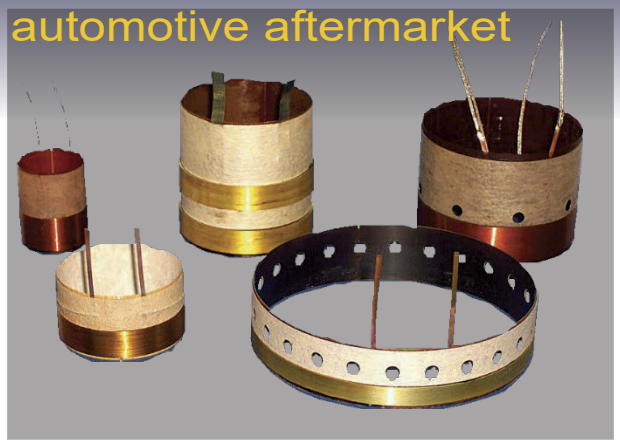

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	Magnetic Assemblies							Voice Coil Components								
	Back Plates	Magnets		Magnetic Fluids		Pole Pieces	T-Yokes Top Plates	Bobbins/Formers	Collars	Magnet Wire	Polyimide Tape for Collars	Voice Coil Assemblies			Amplifiers	
		Alnico	Ferrite	Neodymium								Flat Wire	Round Wire	Voice Coil Stacks	Powered Speakers	Subwoofer Plate Amplifier
Boxal									•	•	•	•	•	•	•	•
FaitalPRO	•			•	•			•	•					•		
OEB, SRL													•	•		
Powersoft																•
Professional Audio	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
MALAYSIA																
Shu Kae Industrial									•	•	•	•	•	•	•	•
NETHERLANDS																
Diluvite	•					•	•	•								
ELTIM audio																•
Hypex Electronics															•	•
Stage Accompany	•			•	•		•	•	•							
Teijin Aramid									•	•	•	•	•	•	•	•
PHILIPPINES																
Dai-ichi Electronics Manufacturing Corp.									•	•	•	•	•	•	•	•
POLAND																
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	Magnetic Assemblies							Voice Coil Components								
	Back Plates	Magnets		Magnetic Fluids		Pole Pieces	T-Yokes Top Plates	Bobbins/Formers	Polyimide Tape for Collars	Magnet Wire	Voice Coil Assemblies			Amplifiers		
		Alnico	Ferrite	Neodymium					Collars		Flat Wire	Round Wire	Voice Coil Stacks	Powered Speakers	Amplifier for	Subwoofer Plate Amplifier
SOUTH AFRICA																
Paks Acoustics	•	•	•	•		•	•									
SOUTH KOREA																
Suntel Co., Ltd.								•	•	•	•	•	•	•	•	•
TAIWAN																
Huey Tung International	•	•	•	•	•	•	•	•		•		•	•	•	•	•
Kingstate Electronics Corp.															•	
Po Yun Enterprises Co., Ltd.								•	•	•	•	•	•	•	•	•
Shining Jins Enterprise Co., Ltd.	•					•	•									
THAILAND																
A-TON Industrial	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
FSK (Thailand) Co., Ltd.								•			•					
UNITED KINGDOM																
Bishopsound															•	•
EuroTec International	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•
Precision Devices	•		•	•	•	•	•	•		•		•	•			
Volt Loudspeakers													•			

	Magnetic Assemblies							Voice Coil Components								
	Back Plates	Magnets		Magnetic Fluids		Pole Pieces	T-Yokes Top Plates	Bobbins/Formers	Polyimide Tape for Collars	Magnet Wire	Collars	Voice Coil Assemblies			Amplifiers	
		Alnico	Ferrite	Neodymium								Flat Wire	Round Wire	Voice Coil Stacks	Powered Speakers	Subwoofer Plate Amplifier
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Alliance, LLC	•	•		•	•		•									
American Bass USA	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
Area 52 R&D	•			•	•		•	•							•	•
Arnold Magnetic Technologies/ Precision Thin Metals		•		•	•											
Cadillac Audio	•				•		•	•							•	•
CE Distribution											•					
CommonSense Audio															•	
Dayton Audio															•	•
DMSI															•	
Dragonfire Acoustics													•	•	•	•
Dynavox Electronics	•	•		•		•	•	•	•	•				•		•
Elektrisola								•	•	•	•	•	•	•	•	•
FerroTec (USA)					•											
Lamart Corp.												•				
Materion								•								
MISCO															•	
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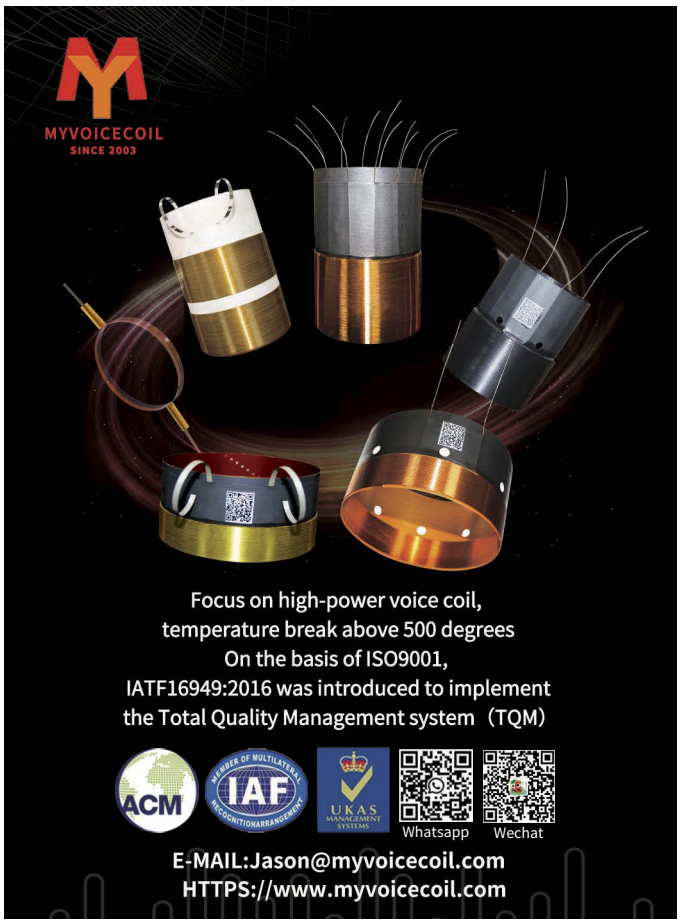
	Back Plates	Magnets		Magnetic Fluids	Pole Pieces	T-Yokes Top Plates	Bobbins/Formers	Collars	Magnet Wire	Polyimide Tape for Collars	Voice Coil Assemblies				Amplifiers	
		Alnico	Ferrite	Neodymium							Flat Wire	Round Wire	Voice Coil Stacks	Powered Speakers	Amplifier for Subwoofer Plate Amplifier	
Precision Converting—HISCO											•	•	•	•		
Precision Econowind								•	•	•	•	•	•	•		
PRV Audio Brazil				•	•										•	
Radian Audio Engineering	•	•		•	•	•	•									
Radio Design Labs (RDL)															•	•
RBH Sound																•
RCF USA															•	
Roderick Loudspeaker Service					•							•	•	•		
Senzar Acoustics, Inc.															•	•
Simply Speakers					•											
Sound Sources Technology															•	•
SpeakerAddict																•
SpeakersAndAmps.com															•	•
Transducer Lab	•			•	•	•	•									
TRS Inovations, Inc.												•	•		•	•
US Enclosure Co.															•	•
Vidsonix Design Works				•	•											
Whitmor Wirenetics									•							
VIETNAM																
Sound Corp.															•	•



	Accelerometers	Anechoic Chambers	Audio Analyzers	Gaussmeters	LCR Bridges	MLS	Multimeters	Oscilloscopes	Resistance Bridges	Signal Generators	Sine/Square Wave Oscillators	Speaker Parts	Speaker Turntables	Spectrum Analyzers: 1/3 Octave	Spectrum Analyzers: FFT	Spectrum Analyzers: Heterodyne	Spectrum Analyzers: TDS	Stroboscopes	Test Mics	Testing Cabinets	Turns Counters
AUSTRALIA																					
DEQX				•																	
Røde Microphones																			•		
Soundlabs Group								•			•										
Stones Sound Studio	•			•		•		•	•			•	•	•		•			•	•	
AUSTRIA																					
Austrian Audio				•															•		
BELGIUM																					
Donnet: Loudspeaker Repair		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
BRAZIL																					
Attack do Brasil	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•		•	•	
Newbox Industry & Commerce	•	•	•		•	•	•	•		•		•	•	•	•				•	•	•
CANADA																					
Solen Electronique, Inc.				•										•	•				•		
Space-Tech Lab, Ltd.				•				•			•	•	•	•	•						
Sziara Sound																				•	
CHINA																					
BSWA Technology Co., Ltd.	•													•	•						
CRY Sound		•	•					•	•		•	•		•	•	•	•		•		
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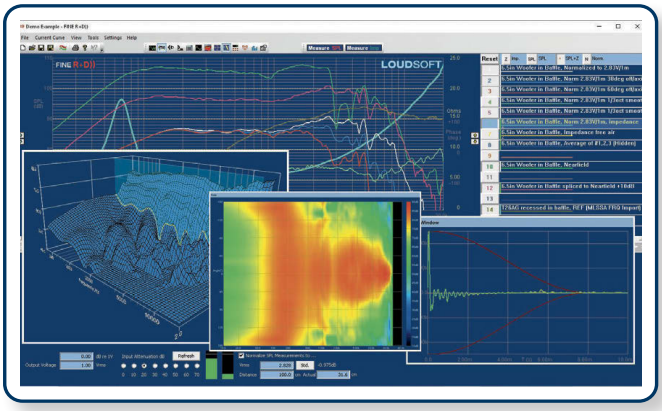
- Crossover Measurements 10 ~ 100kHz
- Auto-save Time= Change window +smooth
- Bluetooth measure w Delay compensation
- FINE Hardware3: 25W amp + GRAS mics



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- Amplifier & Crossover Measurements
- Bluetooth measure w Delay compensation
- FINE Hardware3: 25W amp +GRAS mics

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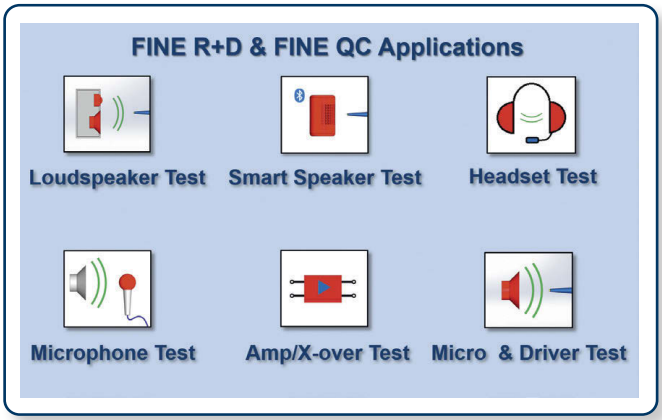

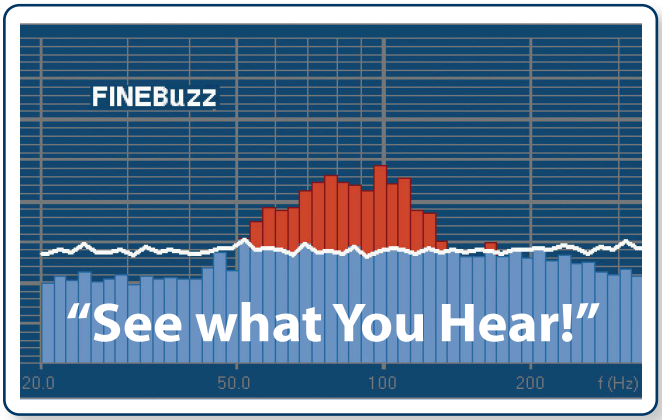

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	Accelerometers	Anechoic Chambers	Audio Analyzers	Gaussmeters	LCR Bridges	Multimeters	MLS	Oscilloscopes	Resistance Bridges	Signal Generators	Sine/Square Wave Oscillators	Speaker Turntables	Speaker Parts	Spectrum Analyzers	1/3 Octave	FFT	Heterodyne	TDS	Stroboscopes	Test Mics	Testing Cabinets	Turns Counters
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Sound Technology Development, Ltd.		•	•					•			•	•	•	•	•	•	•	•		•		
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DENMARK																						
DPA Microphones																				•		
K & K Development			•								•	•										
Loudsoft, Ltd.			•			•					•				•	•				•	•	
PointSource Acoustics		•	•				•	•			•	•	•		•	•			•	•		
FRANCE																						
KYU Systems			•		•	•								•		•				•	•	
GERMANY																						
Fraunhofer Institute for Digital Media Technology																					•	
Klippel GmbH			•	•		•					•		•	•	•	•	•			•		
Mvoid Technologies GmbH			•																			
Physical-Lab	•	•	•																	•		
Rohde & Schwarz			•				•	•							•	•	•	•				•
Wolf von Langa				•			•				•		•								•	
HONG KONG																						
dB Enterprises			•																			
ISRAEL																						
Coby Speakers	•	•	•	•	•	•	•	•	•	•	•	•	•						•	•	•	•
RH Sound Technology, Ltd.					•		•	•	•	•		•										
ITALY																						
Audiomatica	•		•		•	•	•		•	•	•				•	•		•		•		
Axiomedia					•																	
Outline, SRL														•								
SpeakerLAB			•																			
JAPAN																						
Etani Electronics Co., Ltd.		•	•				•	•			•			•	•	•				•	•	
LATVIA																						
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Stage Accompany							•														•	
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Virtins Technology	•		•		•	•	•	•			•	•		•	•	•	•	•		•		
SWEDEN																						
Audio Pro, AB	•		•		•										•	•		•				
Bohmer Audio			•			•					•	•			•	•		•				
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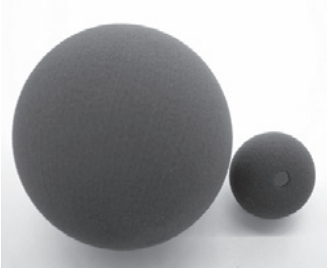

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GRAS Sound & Vibration UK		•																			•	•
Hill Acoustics		•																				•
Spectral Measurement		•	•				•				•	•		•		•	•	•	•		•	•
UNITED STATES																						
ACO Pacific, Inc.													•								•	
Adafruit Industries	•								•	•												
Alliance, LLC				•																		
Allied Electronics, Inc.			•						•	•			•									
Amplitrex Audio Products			•																			
Audio Advisor, Inc.														•								
Audio Precision, Inc.			•										•								•	
Audix																					•	
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Behringer																					•	
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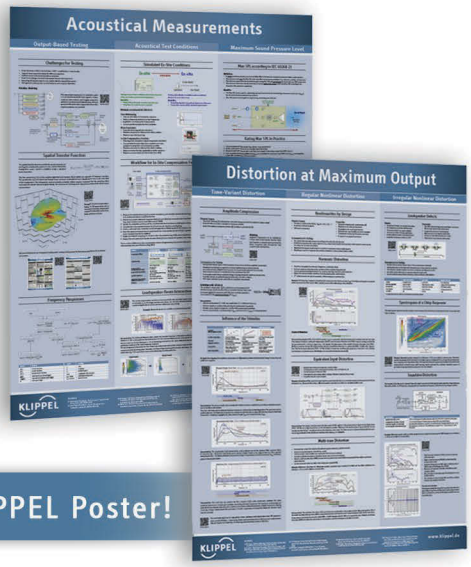

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Echo Test + Measurement				•																		
ETS-Lindgren			•											•		•	•	•	•			
Fotronic Corp.		•		•		•		•	•			•		•		•	•	•	•	•		
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IK Multimedia																					•	
JJR Acoustics		•	•	•			•	•	•	•	•	•	•	•		•	•				•	
Kramer Electronics														•								
Listen, Inc.				•			•	•	•					•		•	•	•	•		•	
Markertek Video Supply		•		•				•	•					•								
Meniscus Audio Group		•											•									
Meyer Sound Laboratories				•																		
NedLab		•			•			•					•	•		•						
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Parts Express				•				•												•		
PCB Piezotronics	•	•		•																•		
Performance Audio				•								•								•		
Phoenix Engineering													•									
PRV Audio Brazil														•								
Radio Design Labs (RDL)				•		•					•	•	•			•	•	•	•			
Redco Audio								•				•			•							
Scantek	•															•	•					
Smith and Larson Audio				•		•					•	•	•							•		
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TEquipment						•		•	•			•										
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Vidsonix Design Works				•																		
Vintage King Audio						•			•			•								•		
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VIETNAM																						
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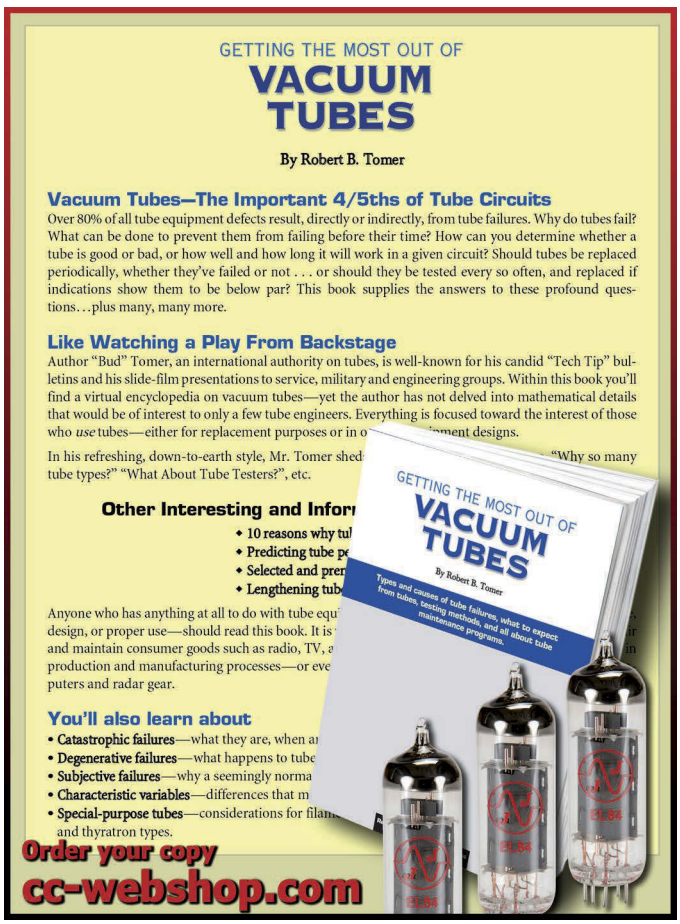

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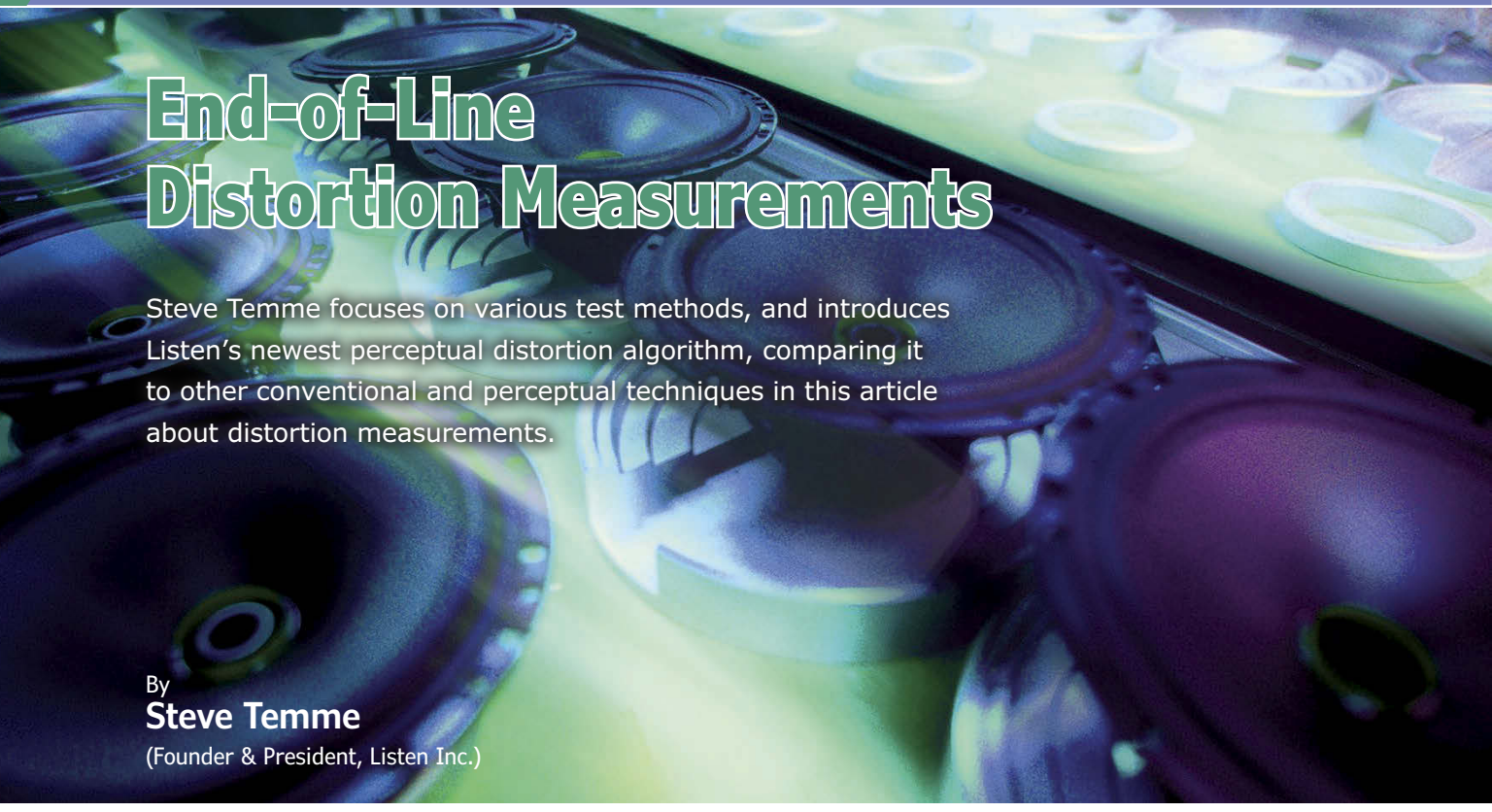

End-of-Line Distortion Measurements

Steve Temme focuses on various test methods, and introduces Listen's newest perceptual distortion algorithm, comparing it to other conventional and perceptual techniques in this article about distortion measurements.

By
Steve Temme
(Founder & President, Listen Inc.)

It is important to catch speakers with Rub & Buzz and transient distortion defects at the end of the production line, as such defects sound harsh and quickly give the impression of poor quality. These manufacturing-induced distortion defects are easy to screen for, but what exactly should you be measuring? In this short guide to end-of-line distortion measurement, we discuss various test methods, and introduce Listen's newest perceptual distortion algorithm, comparing it to other conventional and perceptual techniques.

What Causes Rub & Buzz and Loose Particles

Rub & Buzz and Loose Particle faults are pretty much exclusively introduced during the manufacturing process. Rub & Buzz is usually caused by small aberrations in the manufacturing process that make some parts rub or rattle when the speaker is operated, such as off-center voice coils, poorly glued surrounds, or incorrectly trimmed lead wires. This can be a random manufacturing issue with one product, or a drift in production line characteristics over time. Loose particles are caused when foreign particles, such as glue or magnet fragments, become trapped in the gap behind the diaphragm or dust cap during the manufacturing process.

Conventional Detection Methods

Although Rub & Buzz, and Loose Particles sound different to the trained ear than they do to the average consumer, both manifest themselves as an annoying vibration sound that may be more prominent at certain frequencies and worse at higher output levels. Despite this similarity, the detection methods are very different.

Rub & Buzz is a periodic distortion effect. Conventionally, it is measured using Higher Order Harmonic Distortion (HOHD) analysis, examining typically the 10th order harmonic and above. These harmonics contribute most significantly to Rub & Buzz as their separation from the fundamental frequency makes them less masked and more easily detected by the ear. There are several widely used measurement methods. A high-pass filter algorithm is common, but has its limitations as it combines all the harmonics into an overall metric, and does not distinguish between periodic and transient distortion. Other methods sequentially measure individual harmonics using a tracking filter that moves from one harmonic to the next. While this technique provides accurate and detailed information on each harmonic, it is not fast enough for use on automated production lines.

The most sophisticated methods utilize advanced algorithms to measure each harmonic

discretely and simultaneously. This offers two significant benefits. First, the individual harmonic analysis offered by this technique reveals much about the failure mode, enabling a deeper analysis of the failure mechanism. The user's complete control over which harmonics are analyzed enables the test to be highly customized to highlight the manufacturer's specific production line issues.

Second, the advanced filtering in algorithms—such as Listen's HarmonicTrak (**Figure 1**)—exclude the noise between the harmonics, which means that in addition to its extremely fast analysis speed, it is also highly immune to background noise—an important characteristic for production line use.

Even more advanced than this is the Normalized Rub & Buzz measurement. This is really an enhancement to the method just described. With normalization, the harmonic levels are first compared to the fundamental level at their measured frequency, then their ratio is plotted at their excitation frequency (**Figure 2**). This removes the effect of the frequency response from the distortion, which makes it easier to see the peaks in the distortion response, and simpler to set limits as the frequency response of each speaker is eliminated—both significant advantages for production line use.

Perceptual Detection Methods

HOHD detection methods have been around for decades, and work well. Any manufacturer with an emphasis on product quality likely already uses one of the techniques mentioned above on their production line. However, such methods detect all faults whether they are audible or not. This ensures that only good products are shipped, but since not all harmonic distortion faults are audible, either due to their frequency or masking by other frequencies, products that actually sound good may be rejected, therefore decreasing the yield.

Perceptual Rub & Buzz metrics enable identification of only the audible faults. If just these are rejected, yield is improved with no negative impact to your customers. Generally speaking, perceptual metrics use a combination of psychoacoustic models and other measurement techniques to arrive at a single number for distortion loudness in Phons, although the implementation and specific filtering models vary (**Figure 3**). This is a relatively new development, with the first perceptual metric launched in 2011, and others more recently. Such algorithms are not without their challenges. Many suffer repeatability issues and sensitivity to background noise, and

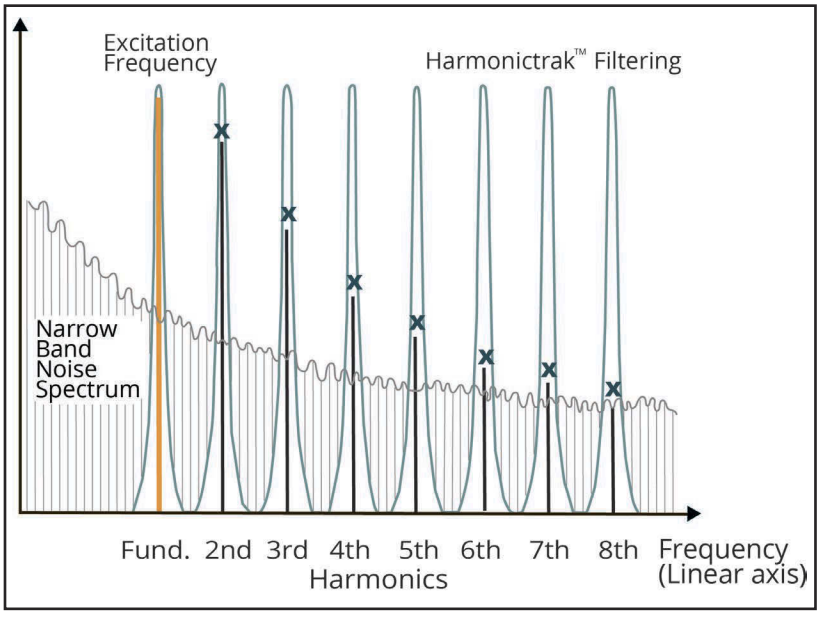

Figure 1: Demonstration of how the Harmonictrak algorithm filters and isolates the harmonics to measure them discrete and simultaneously.

the common remedy for this—longer test signals or expensive test chambers—is not conducive to rapid production line testing.

Listen's new enhanced Perceptual Rub & Buzz (ePRB) algorithm overcomes the limitations of earlier implementations, making it a truly viable end-of-line perceptual test. This product is the result of years of original research covering both perceptual filtering and noise reduction techniques.

There are two main differences between Listen's ePRB and other perceptual algorithms. First, it is significantly more repeatable due to the advanced noise filtering techniques. Most perceptual algorithms can correctly distinguish varying levels of perceptual distortion, with the

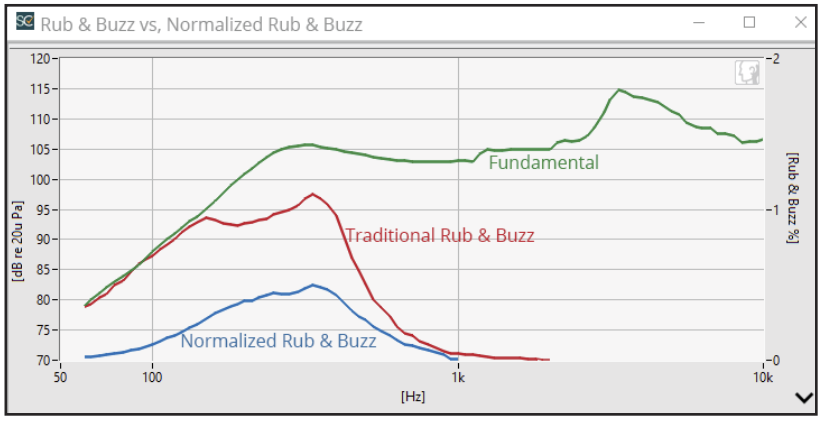

Figure 2: Comparison of traditional and normalized Rub & Buzz distortion

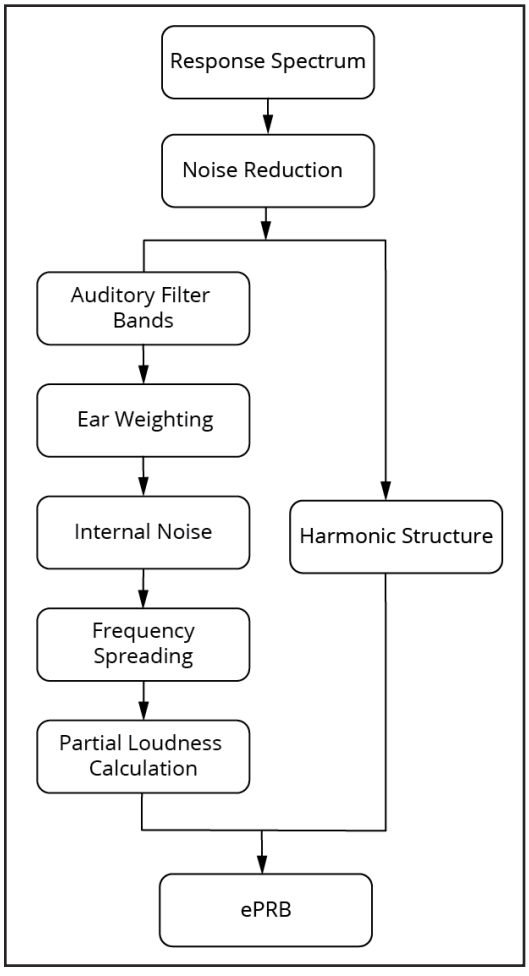

Figure 3: Perceptual Rub & Buzz Detection Algorithm

average response of multiple measurements giving a clear picture (**Figure 4**). However, it can be seen that the only one of the three algorithms that offers close correlation between multiple sweeps is the new ePRB algorithm. For production line use, where there is only one sweep, such repeatability is critical for setting limits and ensuring the integrity of the results. Second, the advanced perceptual filtering algorithms result in much closer correlation with human hearing and, for audible defects, conventional methods.

End-of-Line Metrics

Finally, let's discuss how these various algorithms each add value in an end-of-line test. To maximize yield and profitability from the line without compromising quality, there are three measurements that you should make: Perceptual Rub & Buzz, Normalized Rub & Buzz distortion, and Loose Particles. Here's why.

Perceptual Rub & Buzz can be considered the "Should I ship it?" metric. If the device passes this test, even though it fails conventional Rub & Buzz, the defects are inaudible so will not affect customer perception. Basing pass/fail decisions on this, rather than conventional Rub & Buzz metrics, can increase yield.

Traditional Rub & Buzz measures all incidences of higher-order harmonic distortion, whether audible or not, provided that you use a technique such as HarmonicTrak, which measures each

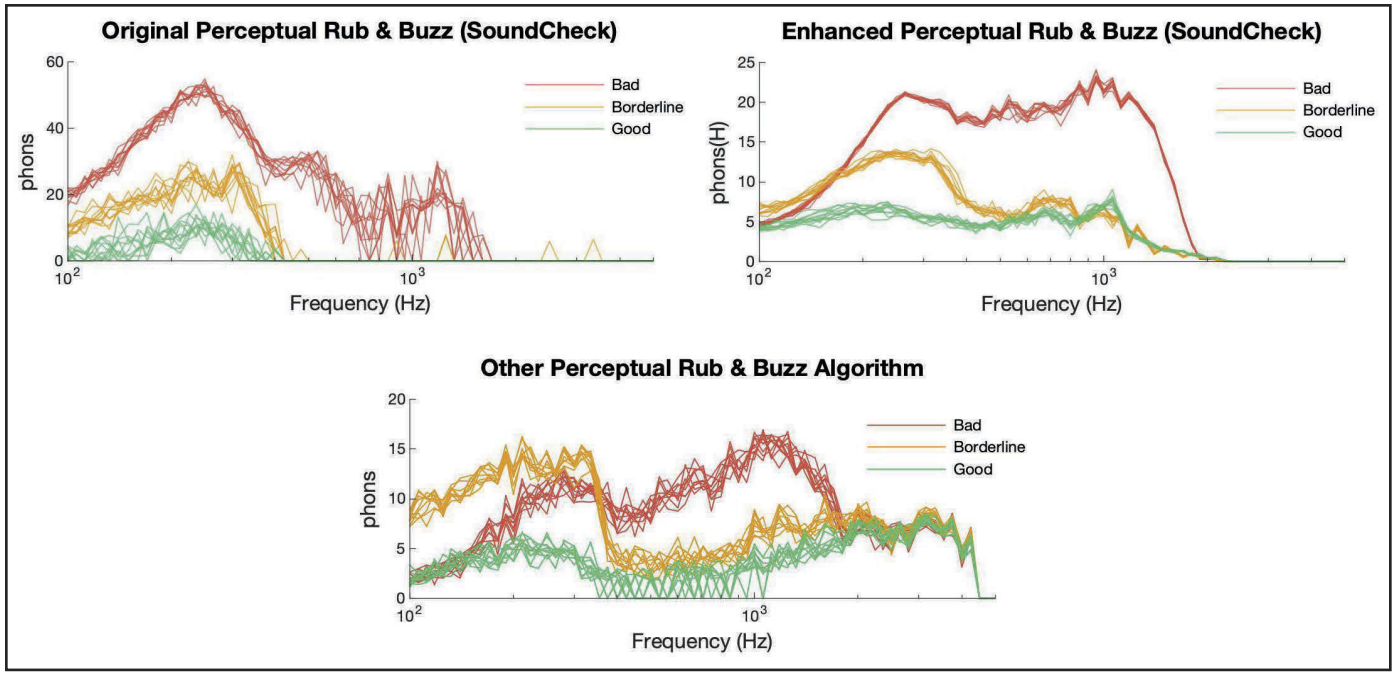

Figure 4: Comparison of three different perceptual Rub & Buzz algorithms, SoundCheck's original 2011 algorithm (the first of its kind), SoundCheck's new 2022 algorithm, and a recent algorithm from a different manufacturer

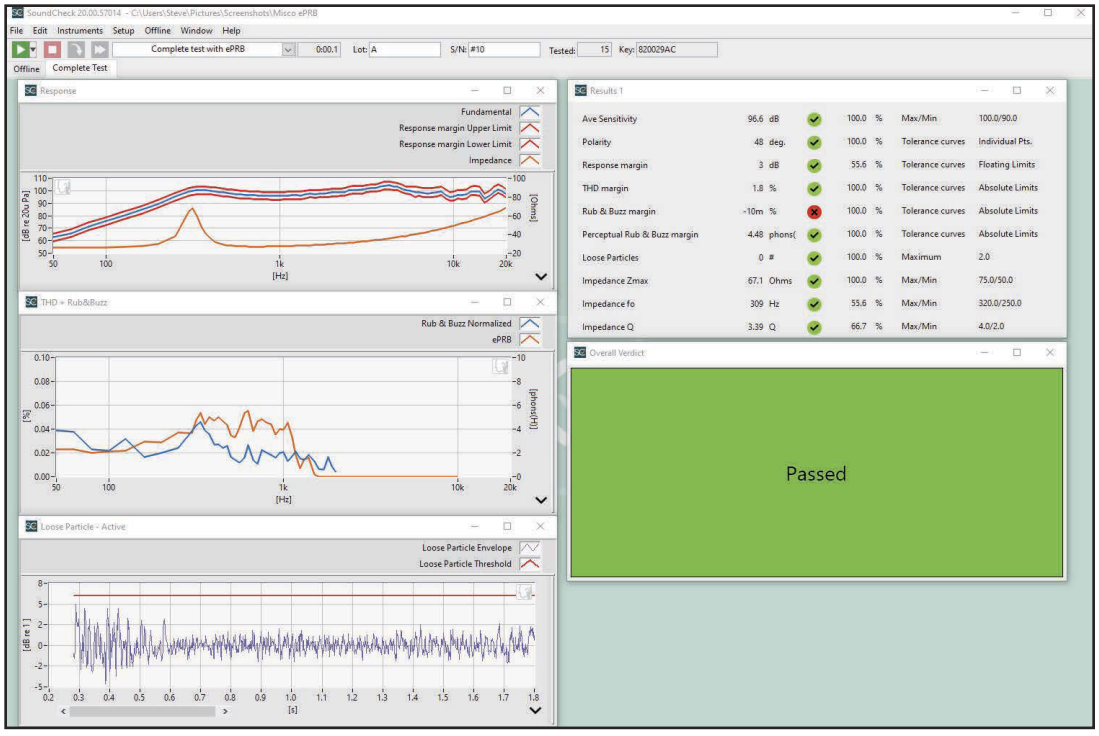

Figure 5: Complete end-of-line loudspeaker test demonstrating how a speaker may pass Perceptual Rub & Buzz metrics and overall test, while failing conventional Rub & Buzz because it is not audible

harmonic discretely and offers valuable information to understanding the distortion you might be hearing. Normalized Rub & Buzz measurement is preferred because it normalizes the result to remove the effect of the frequency response, making it more accurate and easier to set limits.

Examination of the exact harmonics reveals much about the cause of the distortion. For example, even-order harmonics are an indication of an asymmetrical nonlinearity, such as the voice coil not being centered in the magnetic gap. Odd-order harmonics are an indication of a symmetrical nonlinearity, such as clipping or reaching speaker cone and spider excursion limits. High levels of harmonic distortion in the 10th to the 15th order range usually indicate a rubbing voice coil.

Distortion at the 50th harmonic and above is frequently caused by voice coil lead wires hitting the cone. Careful selection of the analyzed harmonics can reveal production line issues and enable early correction before waste occurs. Trends can also be monitored over time, so that production line adjustments can be made if something is drifting out of specification.

Let's not forget loose particles. As we explained earlier, the random clicking, popping or rattling noises made by these trapped particles cause transient, rather than periodic distortion. This means that they're not identified using the same methods as Rub & Buzz, but rather by using time-envelope analysis of the waveform. Like conventional Rub & Buzz, this is a valuable metric for identifying where problems are occurring on the production line before they become serious enough to cause audible defects.

One of the really convenient things about these measurements is that all of them, along with other end-of-line measurements such as frequency response, total harmonic distortion (THD), polarity, impedance, and more can be made simultaneously using the same stepped sweep test signal. This means that a complete array of measurements (**Figure 5**), including both conventional and perceptual distortion metrics, can be made in as little as one second, ensuring rapid throughput for high volume production lines. In other words, perceptual distortion can be added to your end-of-line test with no change in your existing setup, and no increase in test time. ***LIS***

About the Author

Steve Temme is founder and President of Listen, Inc., manufacturer of the SoundCheck audio test system. Steve founded the company in 1995, and for the past 25 years the company has remained on the cutting edge of research in audio measurement, regularly introducing new measurement techniques, algorithms, and hardware to enable testing of all kinds of devices ranging from basic transducers to complex audio systems. In recent years, Listen's product development focus has been on creating the algorithms, interfaces and test methods to measure today's many and varied wireless and cloud-communicating devices. Prior to founding Listen, Steve worked for many years as an acoustic test and measurement applications engineer at Brüel & Kjær, and also as a loudspeaker design engineer at Apogee Acoustics. He holds a BSME from Tufts University, has authored numerous papers on acoustic testing, and has lectured extensively throughout the world.

The Sight of Sound

Revealing the Effects of Enclosure Design on Loudspeaker Performance

L-Acoustics crafts sound systems for arenas and concert halls. To accelerate the evolution of its bass reflex speaker designs, the company simulated the effects of enclosures and vents on the speakers' acoustic output and quality.

By
Alan Petrillo
(COMSOL)

Photo 1: Many event venues rely on L-Acoustics to deliver high-quality sound. Pictured are a few examples of stages around the world that use the company's equipment.

A live event is most memorable when the audience feels like part of the show. Whether it is a symphony, an opera, a football game, or a music festival, the energy of the crowd should meld with the performance into one powerful experience. Connecting with the audience is the goal of every performer, but of course, they cannot do it alone.

What we see and hear in a performance venue is brought to us by many hidden people, from stagehands to set designers. And even as our eyes focus on stages and sets, there is a lot of essential equipment that we may not see—but we sure can hear.

L-Acoustics is a global company dedicated to conveying the aural power of live performance. While the typical concertgoer or sports fan most likely has not heard of L-Acoustics, they have likely heard from the company's loudspeakers, amplifiers, and signal processing devices. Based in France, L-Acoustics has supplied sound systems to more than 10,000 venues in 80 countries, and its equipment has been used by half of the top 20 music festivals worldwide (**Photo 1**).

Great performance is rooted in relentless dedication to craft. L-Acoustics must also constantly hone and refine its products to work in harmony with all of these varied performance spaces. For instance, the size and shape of speaker enclosures can have a big impact on sound quality. To ensure that audiences are able to lose themselves in the sound of a performance, L-Acoustics engineers use simulation to help reveal the effect that enclosure and vent design has on acoustical output and linearity.

Just as live performers show us the precise physical movements that create their music, multiphysics simulation now lets L-Acoustics "see" the forces shaping the sound of its bass reflex speaker units.

Like a Laser for Sound: The L-Acoustics Vision

You might be surprised to find that many old and respected venues, from the Hollywood Bowl in California to Sakura Hall in Japan, feature sound systems made by a company that is less than 40 years old. Physicist Christian Heil launched L-Acoustics

in 1984, and in 1992, the company introduced its V-DOSC line source array technology, which quickly became the global standard for professional loudspeaker systems. A line source array projects sound in a remarkably focused, controlled way, comparable to the way that a laser directs light. A laser's potential power is inseparable from its precision, which is true of loudspeakers as well.

"We want to create a loudspeaker enclosure that is as linear as possible," says Yoachim Horyn, head of Acoustics Research at L-Acoustics. "We try to remove any amount of energy that is emitted at higher frequencies or harmonics, rather than the intended frequency. No matter how much we increase input power, we want the resulting sound to be the same, only louder." Distortion, however, is only part of the problem. Nonlinearities can emerge with a global loss of output at the emitted frequency.

Along with the engineering of the loudspeaker driver itself, the design of a speaker's housing or enclosure plays an important role in its performance. For example, a bass reflex enclosure design incorporates a vented opening called a Helmholtz resonator (**Figure 1**). By connecting the interior volume of the speaker housing to the outside air, a resonator can help recover part of the energy emitted inside the enclosure that would otherwise be lost. This boosts power, but it also introduces turbulence, which distorts the speaker's output and can also cause significant acoustic losses of up to several decibels. Despite this risk, the potential benefits of a resonator make it an important tool for L-Acoustics, which strives to fill massive spaces with sound.

"Our loudspeakers must perform at a very high level of output," says Yves Pene, an acoustical engineer on Horyn's team. "A resonator that is incorrectly designed could lose up to half of its potential output due to turbulence, so it is really important that we design the vent to work efficiently."

Cutting Wood, Sculpting Clay, and Filling Speakers with Smoke

"For several years, designing and testing vents have been a challenge for development teams," explains Horyn. "We had no way of predicting precisely the amount of loss created by an enclosure with a high level of air displacement." This meant that the team had to build and test wooden prototypes of every design adjustment to either the enclosure or the resonator vent (**Photo 2**). In some cases, they applied clay to quickly change the shape of a vent's opening or interior passages. This could be a slow process—and even a completed physical prototype would not give them all the data they needed.

"Measuring acoustic loss and distortion is interesting, but it does not always give you an insight on where the problems are," says Horyn. "Sometimes, the problems come from a part of the enclosure, or a part of the vent, that you would not expect. A wooden model does not show you exactly where the problems are." The L-Acoustics team came up with an interesting way to work around this problem. "Something we have done in the past is to make some of the panels in the box transparent. We would blow smoke into the loudspeaker to enable us to see the turbulence," Horyn says.

While a see-through panel could make a physical model more helpful, the prototyping process remained a major time sink. "When we design and build a mockup, it takes several weeks between drawing it and actual testing," explains Horyn. "And it would often take multiple iterations to arrive at our design."

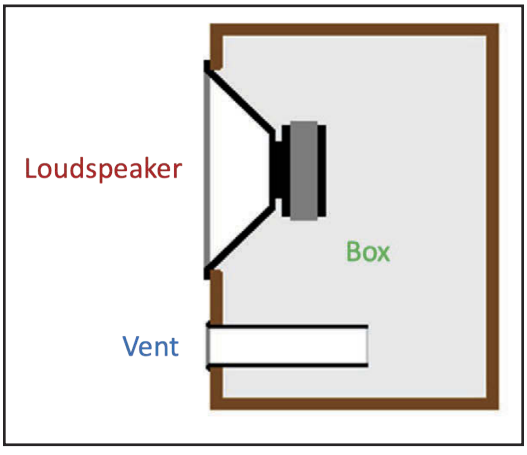

Figure 1: This is the schematic of the bass reflex speaker.

Photo 2: This is an outdoor measurement setup for a typical acoustic loss measurement. The arrow indicates position of microphone.

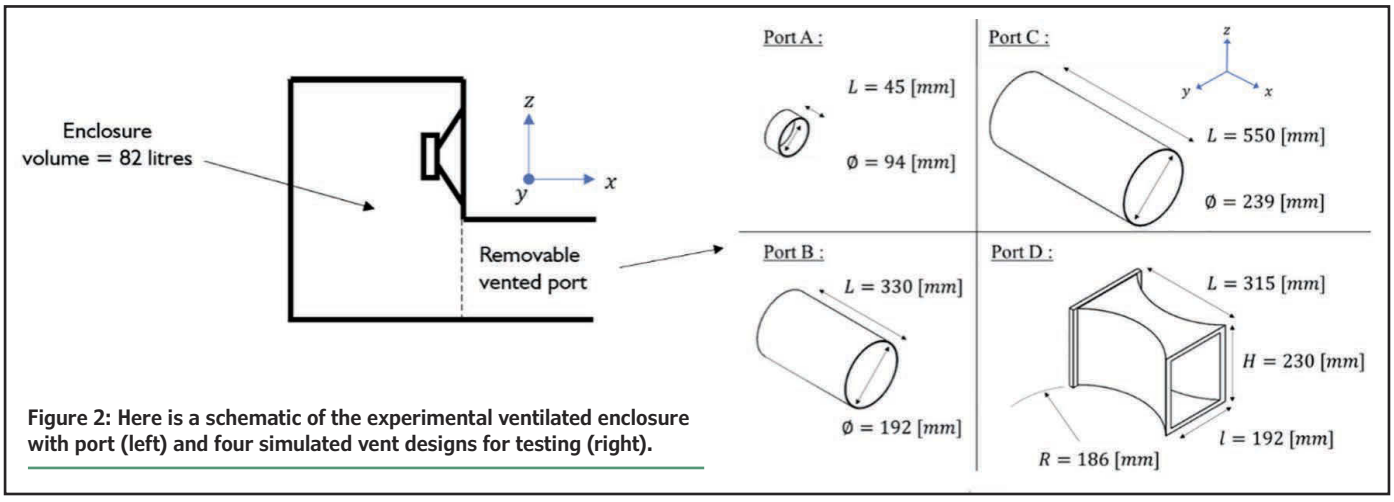

Figure 2: Here is a schematic of the experimental ventilated enclosure with port (left) and four simulated vent designs for testing (right).

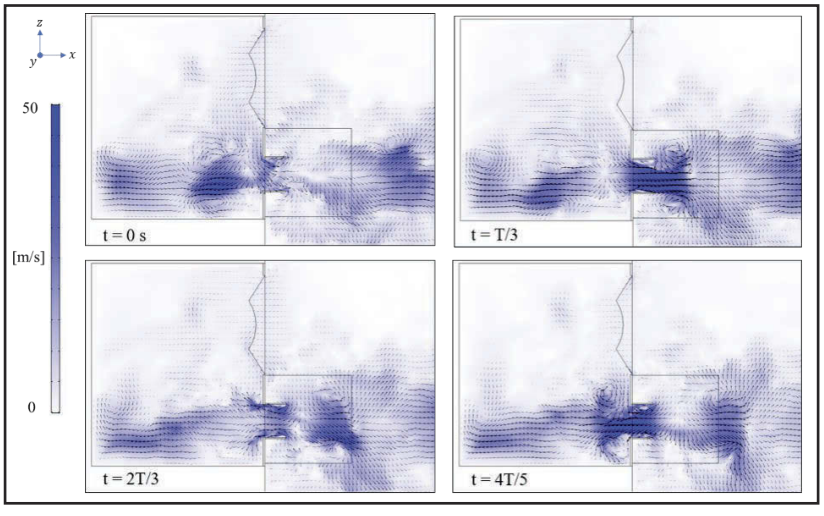

Figure 3: Velocity magnitude at resonance is shown for a vent design over a period of time.

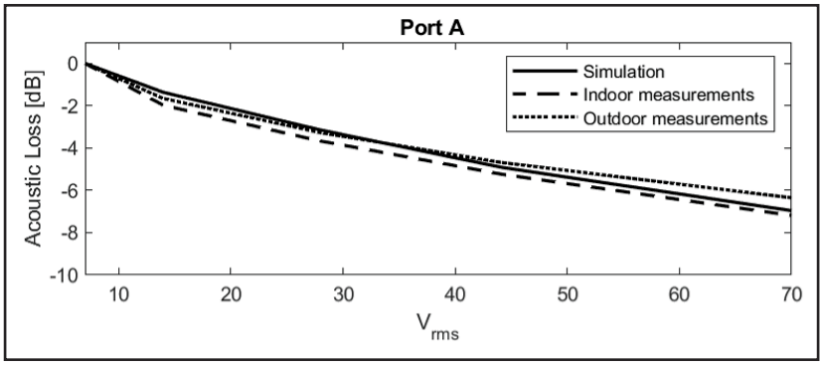

Figure 4: Comparison of simulated predictions of acoustic losses for an enclosure mounted with a port design are compared to measured physical prototype testing results.

References

[1] Y. Pene, Y. Horyn, and C. Combet, "Non-linear acoustic losses prediction in vented loudspeaker using computational fluid dynamic simulation," Audio Engineering Society, Paper 10359, 2020. www.aes.org/e-lib/browse.cfm?elib=20776

Simulation for Current and Future Projects

To help refocus the L-Acoustics team's efforts on acoustical engineering, rather than woodworking, Yves Pene turned to multiphysics simulation. His objective, as explained in a 2020 research paper presented to the Audio Engineering Society [1], was to model and predict nonlinear acoustic loss in vented port systems for a given loudspeaker, enclosure volume, and port design (**Figure 2**). The simulation incorporates the coupled effects of the loudspeaker driver's motion and the resulting fluid motion, including turbulence and related phenomena. Pene developed the model to test the effects of four different speaker vent designs (**Figure 3**) on a given speaker and enclosure.

To validate the simulation results, they followed up with experimental testing on a speaker enclosure with removable vents. These tests produced results that matched the simulation's predictions remarkably well: The predicted acoustic losses deviated less than 1dB from the actual measured values of live testing (**Figure 4**). "We were quite happy with the results," says Pene.

Pene's successful simulation project has revealed insights that could not be achieved with prototyping alone. Introducing simulation into the L-Acoustics R&D workflow also promises further benefits going forward. As explained in the team's research report, the simulation provided detailed velocity and vorticity mapping throughout the modeled enclosure and vent designs. This provided data on exactly how each part of the modeled surfaces can create turbulence and affect overall sound quality. This granular perspective revealed sources of distortion that the team had not previously considered.

For example, fluid motion mapping showed that a vent's location in the enclosure had an

unexpectedly large impact on overall flow. This suggested that the team should give more attention to a vent's placement as well as its shape. Simulation helped the team uncover this new direction for further research and refinement (**Figure 5**).

Before simulation, L-Acoustics engineers would typically wait weeks before seeing each physical model's test results. This meant that a significant amount of time could be spent modeling designs that, ultimately, would not be used. Now, as Horyn explains, "The simulation is used by our development team to test its ideas day to day, so we can predict the efficiency of a new design before building any prototypes." Pene adds: "Now we can build prototypes and be confident they will work properly on the first try."

Empowering More Engineers with Simulation at L-Acoustics

Yves Pene's use of simulation for bass reflex design brings team-wide benefits beyond this one project. Part of the Acoustics Research job is to make sure that the tools they develop can then be efficiently used by the development team. The Application Builder in COMSOL Multiphysics enables the team to build specialized user interfaces from their models, which can then be distributed widely throughout the company. "We are using the Application Builder more and more," says Horyn. "At the end of this project, the Acoustical Engineering team built a simple application based on Yves's multiphysics model. Users must define only the specific parameters they need for their project, as other necessary values are already in place."

The application is distributed to other team members through the COMSOL Server deployment product, which enables users to access and run simulations on their own. According to Horyn, "The app-building capability is very convenient, as it enables us to have more people using simulation at a reasonable cost."

Practice, Practice, Practice: The Never-Ending Pursuit of Performance

The best professional sound system is heard, not seen. However, the sensation of being enveloped by live music, as if the listeners and the performers are one, can be achieved through the efforts of many unseen people and their specialized tools—from microphones and amps to signal processors and loudspeakers that envelop the audience with sound. The acoustical engineers of L-Acoustics, like musicians, know that a great performance is built on perpetual practice; there is always more that can be done. Yoachim Horyn and Yves Pene (**Photo 3**), having implemented simulation for the analysis of their designs, are now using them to explore further refinements: "Great things are coming." ***LIS***

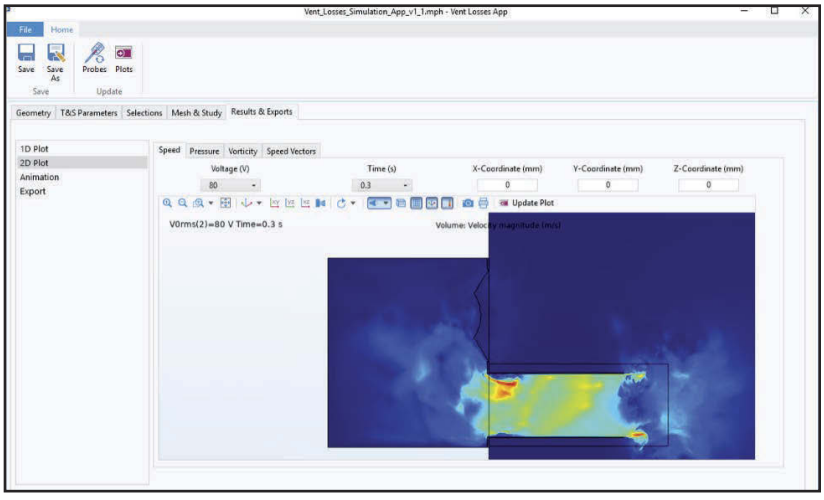

Figure 5: Here is a simulation application for the L-Acoustics R&D team.

Photo 3: Yoachim Horyn (left) and Yves Pene (right) of L-Acoustics

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www.myvoicecoil.com

Dongguan Sunwe Electronic Co., Ltd.
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http://sunwe.ecvery.com

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www.gettopacoustic.com

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M-Sound Electronics Co., Ltd.
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TurboSonic Pro Speakers
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www.morelhifi.com

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www.audiomatica.com

Audioxplus, SRL
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www.axiomedia.it

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www.boxal.it

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www.outline.it

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www.powersoft-audio.com

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www.professionalaudio.it

RCF, SpA
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www.rcf.it

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https://snext-final.com

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Soundcare AS
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Glass Acoustic Innovations Technology (GAIT)
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www.precision-devices.com

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www.profusionplc.com

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www.revolveraudio.co.uk

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www.silcoms.com/conveyor-chain-division

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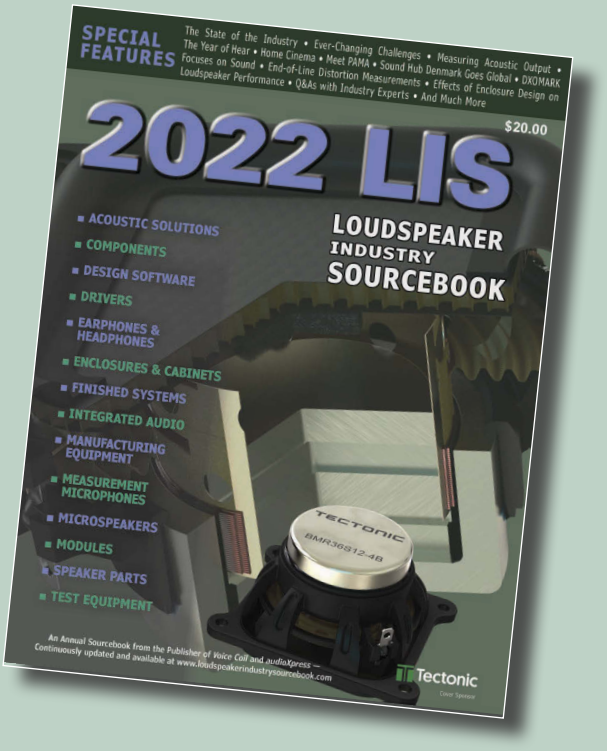

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Editor's Note: For the Questions & Answers interviews, we sent several notable industry professionals a list of questions and asked them to respond. The following content contains the questions and their responses.

Tim Boot

Director of Global Marketing, Meyer Sound

Question 1: How did your current business evolve in the past 12 months and what were the main trends and factors (good and bad) affecting your business?

Boot: The recovery from the pandemic is underway and the demand for live music events strengthens every day. Live music producers and music touring have become more nimble and artists are accommodating more varied venues and dynamic schedules as they plan their productions.

In the past year, we did a lot of listening to our global network of dealers and distributors and the larger pro audio community as needs evolved. In January, we announced our new flagship line array loudspeaker PANTHER, which was a direct response to what we heard. Even prior to the launch, PANTHER was met with incredibly positive responses, so we are excited to hear it in the field very soon.

Question 2: What are the perspectives for your business in the next 12 months?

Boot: Meyer Sound just launched the PANTHER large-format linear line array loudspeaker, and it is currently in production and already being shipped to customers. The first customer, UK-based rental company Major Tom, will deploy PANTHER on Ed Sheeran's 2022 tour—the first of many live events and installations with PANTHER to come. On top of that, we will have new software tools and updates available in the first half of the year, which will streamline workflows. In the coming months, we will be creating more targeted, intimate listening experiences for customers, including demo opportunities for PANTHER in key global markets. The prospects for the live event industry and Meyer Sound continue to strengthen for the foreseeable future.

Question 3: What were the most exciting developments, technology innovations, and trends happening in your field of interest over the last 12 months?

Boot: Our own developments in lightweight, high-power amplification as well as lightweight, high-excursion loudspeaker drivers is revolutionizing our approach to creating compact, high-performance loudspeaker systems. This allows productions of any scale to better balance the audio needs with visual, architectural, rigging, and logistical constraints.

We have found that being solution-oriented rather than strictly product-oriented helped us make changes quickly in response to rapidly changing situations. Our Constellation acoustic system, which celebrated its 15th anniversary in 2021, and Spacemap Go spatial sound design and live mixing tool both saw great success across various markets over the past 12 months.

Question 4: What technology innovations and trends do you consider to be the most promising in the audio industry for the next five years?

Boot: We have been longtime members of the Avnu Alliance and are firm believers in the value of the Milan AVB protocol as an open-source, time-sensitive network for replacing analog connections in the audio world. We have seen more pro audio manufacturers join the Avnu Alliance and certify their products to Milan standards. It is vital that we can guarantee that all our devices are working together seamlessly. Being able to lead the further development of Milan alongside other manufacturers has been a fantastic opportunity for Meyer Sound to help push the industry forward—including PANTHER, the first line array loudspeaker with a Milan Certified input—and we look forward to the growth in products using Milan that we will see in 2022 and beyond.

Question 5: How do you currently listen to music? Did your music listening habits change in the last 12 months?

Boot: Unfortunately, my listening habits have changed significantly over not just the past 12 months, but the past 24 months with far fewer live music listening opportunities. I'm enjoying more access to lossless streaming opportunities on personal listening devices, but I'm missing the true lossless experience of high-quality live music. ***LIS***

Charles Gauvin

VP Product & Engineering, Fluent.ai

fluent.ai™

Question 1: How did your current business evolve in the past 12 months and what were the main trends and factors (good and bad) affecting your business?

Gauvin: Following 2020, Fluent.ai was affected by COVID-19 in 2021. Like most companies, we have embraced working from home more than ever. There were a lot of video and audio meetings with partners and customers. Whenever possible, we have gathered as a team both inside and outside the office, and as restrictions start to ease, we interact with our outstanding team to adjust to the new workplace paradigm.

At CES 2022, we demonstrated a true wireless stereo (TWS) production-grade, natural speaking voice-command AI model (using Knowles technology) to replace every earbud/headset taping or app fumbling commands. This is useful while jogging, in subways, or at Starbucks when you need to enable/disable noise-cancelling or raise/decrease volume using just your voice, for example.

Voice is as natural as touching, in fact, when we shot our promo video for the TWS, the video shooter started uttering commands by himself, using natural speaking. It was great to see because we did not ask him to do this. Unfortunately, attendance at CES 2022 was much lower than previous years and until the last minute, we hoped more people and partners would have a chance to try and experience our TWS in action. It was positive for us, nonetheless.

Question 2: What are the perspectives for your business in the next 12 months?

Gauvin: In 2021, we saw a lot of interest with low power device companies and TWS. This is not really a surprise. With AI being more present and the need for electronic devices (pandemic, chip shortage, anyone?), these sectors are in high demand.

In 2022, we will continue to focus on our offline, very small footprint (CPU, RAM, and Flash) speech recognition AI models, work with current partners (e.g., DSP Concepts and Knowles), low power chip manufacturers, and customers to bring to life obvious and surprising use cases of voice control. We are convinced that, looking back, 2022 will eventually realize how important voice control gained momentum for Fluent.ai and for the industry in general.

Question 3: What were the most exciting developments, technology innovations, and trends happening in your field of interest over the last 12 months?

Gauvin: Smart speakers have brought much flexibility to common and daily tasks, such as light and ambiance control, fetching Internet information, and playing music especially because of voice commands. However, it is no longer necessary to be connected to the Internet to set a fan or a thermostat when using a voice to do so. What happens when there is no Internet or when the connection is slow?

AI natural speech recognition in edge devices is finding its place, increasingly, in everyday life scenarios. Who would have thought, 10 years ago, that voice control would control watches, thermostats, faucets, speakers, alarm clocks, earbuds, and more completely offline? This market is growing fast and speech recognition in edge AI devices is just starting and will soon quickly reach other markets (e.g., security, people with disabilities, medical, mechanic, telecom, etc.). The list of secure, offline use-cases is almost endless.

Question 4: What technology innovations and trends do you consider to be the most promising in the audio industry for the next five years?

Gauvin: As smart devices continue to improve on sound quality and interaction, adoption will continue to penetrate homes, wearables, and cars. There is no easier way to listen to music, news, and radio—and you can do it all using voice commands too. We live in an era where billions of devices are connected either through lower power or an outlet. We believe that voice commands will not only affect TV and music experiences but also provide better living experiences for children (games), elderly, and reduced mobility individuals (security, reach) when coupled with audio feedback—connected or not.

Innovations that I feel are most promising are the ones that will blend technology seamlessly with our visual landscape, as if it were natural, and make our life easier. For example, you can now get wall speakers that blend into the décor à la Samsung's Frame or you can buy a Bluetooth speaker wireless charging table combination. Hopefully, technology blending with furniture and buildings will declutter our visual and audio space. It is coming.

In the home entertainment space, I cannot wait to experience true immersive (3D audio, binaural/spatial, etc.), movies, TV shows, concerts, band recording, and so forth, where we will be able to turn our heads to focus on the protagonist, singer, or bass player. My current earbuds already offer this, but the content has not followed yet unfortunately—when it does, this will be another push to the streaming market.

Professional gaming is expanding everywhere. Gamers, pro or not, will soon be able to map voice commands to their game controllers or headsets without trading precious milliseconds of latency because this will happen offline. In fact, wherever a third hand is needed or desired, such as factories, mechanics, tool shops, gaming, and more, audio technology will bring a small revolution and increased performance.

Question 5: How do you currently listen to music? Did your music listening habits change in the last 12 months?

Gauvin: I am an avid music listener. For a few years already I have been able to verbally ask my smart assistant to start playing my favorite song in the living room's hi-fi or in the bedroom—I just ask my smart speaker whenever to play whatever, wherever.

It feels, at least to me, that voice and sound technology is finally converging at the same time as home control (that is another subject). Heck, my 86-year-old father-in-law uses his voice to get sports, weather, news, and listen to Frank Sinatra on his smart speaker. ***LIS***

Wolfgang Klippel

Founder and Director of R&D, Klippel

Question 1: How did your current business evolve in the past 12 months and what were the main trends and factors (good and bad) affecting your business?

Klippel: Klippel GmbH had an excellent business year in 2021, resuming the steady growths of the last few years and compensating for the turbulences in 2020. COVID-19 was a challenge and a chance to find new communication methods inside and outside the company. However, we missed the face-to-face chats at conferences, workshops, and especially the Klippel party—my personal highlight during the annual three-day lecture at the University of Technology in Dresden.

COVID-19 created a need for new measurement instruments to perform valid audio measurements away from the company lab and even at home offices. Our straightforward answer to this dilemma is the KLIPPEL Multi-Scanning Workbench launched last year. It adds the ground-breaking holographic sound field identification methods, introduced by our Near Field Scanner (NFS), to our popular laser scanning vibrometer robot (SCN). This versatile machine completely replaces the anechoic room and other non-portable equipment available only in the company labs. The workbench even fits in the smallest apartments (or office spaces) and makes daily engineering work more flexible and efficient.

Biology has also affected our company in another way: I have just celebrated my 65th birthday, and it is time to delegate some operative responsibilities to the younger generation. I am pleased to have accomplished this critical transfer in the last year together to our long-term colleague Benjamin Barth, who provides the right social, business, and engineering skillset required to steer Klippel GmbH into the future.

After sharing the CEO position for almost two years, Benjamin took over total management in October 2021. This gives me the freedom to do more research, education, and other projects that I have been looking forward to for a long time.

Question 2: What are the perspectives for your business in the next 12 months?

Klippel: In 1989 I learned that unexpected things can dramatically change our daily lives and perspectives in East Germany. The war in Ukraine is a disaster, killing people and universal human values in many ways. I thought that mutual business, agreements, diplomacy, and common sense would keep strange ideas, lies, and criminal actions under control. The reality is different. Of course, I expect an impact on our business, but I still hope that we will have peace in Europe when we celebrate the 25th anniversary of Klippel GmbH in fall 2022.

Question 3: What were the most exciting developments, technology innovations, and trends happening in your field of interest over the last 12 months?

Klippel: I am very proud that our KLIPPEL Controlled Sound (KCS) technology, implemented in the Nuvoton smart amplifier chip, has now successfully entered the market. That has been my ultimate goal since I started the first investigations into this technology during the 1990s. It was a fascinating time to learn more about loudspeaker nonlinearities and actively search for ways to compensate for them. The result is a powerful piece of software that empowers new speaker designs, which can save energy, natural resources, and consequently, cost.

It is the key to smaller speakers generating more output with high audio quality.

Question 4: What technology innovations and trends do you consider to be the most promising in the audio industry for the next five years?

Klippel: The combination of loudspeaker control algorithms running on DSP, power amplification, and electro-acoustical transduction into "smart transducer modules." These will simplify the generation of immersive sound systems and other 3D-audio applications. Most spatial processing will be distributed to low-cost DSPs, reducing the central processing load and the data transfer. Adaptive, nonlinear control can protect the transducer and compensate for nonlinear distortion and time-varying behavior caused by aging, temperature changes, and other influences. Finally, the loudspeaker becomes a truly linear, time-invariant system with a precisely pre-defined and stabilized performance independent of production variances! This dramatically simplifies the assembly of loudspeaker arrays of many different kinds. Additionally, self-testing implemented in the DSP detects deviations or malfunctions in real time. This trend starts with fixed professional installation for public address applications, conforms to creating personal acoustical zones in modern cars, provides adaptive directivity control in personal devices, and improves speaker-room interaction in consumer products.

Question 5: How do you currently listen to music? Did your music listening habits change in the last 12 months?

Klippel: I am still enjoying stereo reproduction via my well-proven Neumann studio monitors, through which I mostly play CDs and records. The older I get, the more I like live performances, especially if I can join the band. ***LIS***

Michael Rodriguez

Marketing Manager—North America, DAS Audio

D.A.S.

SOUND WITH SOUL

Question 1: How did your current business evolve in the past 12 months, and what were the main trends and factors (good and bad) affecting your business?

Rodriguez: As for good: There are huge expectations of industry growth after the COVID crisis. The number of live/virtual events and installations have accumulated during the pandemic, and we are very optimistic about our positioning.

As for the bad: The uncertainty about components availability and the current crisis in Europe keeps our customers and us in an unstable position.

Question 2: What are the perspectives for your business in the next 12 months?

Rodriguez: All our projections allow us to believe that 2022 will be a year of growth in terms of sales and as a brand. The products we are launching in the following month will allow us to grow "horizontally" in terms of market segments and "vertically" in terms of brand positioning and prestige.

Question 3: What were the most exciting developments, technology innovations, and trends happening in your field of interest over the last 12 months?

Rodriguez: Software capabilities are a crucial factor now, it allows our customers to have precise control over the behavior of sound, not only in terms of equalization but coverage and distortion control. Also, nowadays, we can predict the behavior of our systems before they are deployed, minimizing the work on site.

Question 4: What technology innovations and trends do you consider the most promising in the audio industry for the next five years?

Rodriguez: The marriage between Audio and Networking is intriguing to me, because it allows us to do things with technology that we have never been able to do before. I try to keep a close eye on the industry and it's exciting to work for a company that understands that evolution.

Question 5: How do you currently listen to music? Did your music listening habits change in the last 12 months?

Rodriguez: As a musician, I try to go to as many live events as I can. When I am in the office, I enjoy watching Music Content Creators on their platforms: Twitch, YouTube, Instagram Live, etc. The connection with their audience is genuine and these amazing musicians want to share their brand and music. ***LIS***

Bennett Prescott

Sales & Operations Director, B&C Speakers

Question 1: How did your current business evolve in the past 12 months and what were the main trends and factors (good and bad) affecting your business?

Prescott: The majority of our business is serving live audio and tour sound loudspeaker manufacturers. That industry was practically shuttered in 2020, and a fraction of its usual self in 2021—although at least some shows happened. For our direct customers the bad news ended up being less bad than we all feared, although I think gigging crew members bore the brunt of this slowdown. Our sales to our primary customer base had a significant downturn for most of the last 24 months, which of course affected our business dramatically. The only good news is that our sales to what I would call "DIY and Retail Enthusiasts" (for lack of a better term) increased significantly worldwide! Not by enough to offset the reduction in OEM sales, but enough to save all our distribution offices and customers from dire effects. So business was worse overall for sure, but not as bad as we feared it could be at the early stages of the pandemic, and now we're just fighting to get through this logistics and supply chain mess the world currently faces while all kinds of business seem to be off to a strong start in 2022.

Question 2: What are the perspectives for your business in the next 12 months?

Prescott: One of our main tasks is taking a more direct role in end-user sales of all our brands, which are now a significant enough market to warrant dedicated sales staff. For our OEM business, we're completely focused on trying to get our manufacturing beyond 100% capacity in both factories. Lead times have never been longer, and every day brings new surprises for incoming parts delays and quality problems, which make normal business operations impossible. We are adding a lot of staff to compensate, and to try to keep deliveries to our customers as predictable as possible.

Question 3: What were the most exciting developments, technology innovations, and trends happening in your field of interest over the last 12 months?

Prescott: Component transducers are always more of an evolution than a revolution, but the response to our latest coaxial compression driver has been even more positive than hoped. We are focusing more than ever on enhancing durability to increase maximum output, and on new designs, which allow ever denser packaging. I can't say anything specifically, but expect more than a few new products from B&C, Eighteen Sound, and Ciare this year, which will show a possible future for high output, lightweight, and compact professional speakers.

Question 4: What technology innovations and trends do you consider to be the most promising in the audio industry for the next five years?

Prescott: I really hope we can find a solution for either recycled or alternately sourced magnet material. The pro market requires something with the energy density of neodymium, but the materials used in these high temperature magnets have increased in cost 4× in the last 18 months. Costs are still low enough for Nd alloys that mining and production outside of China doesn't make sense, so our entire supply chain is beholden to a very few sources—which are not environmentally sustainable.

Question 5: How do you currently listen to music? Did your music listening habits change in the last 12 months?

Prescott: I consume most of my music in the car. Happy to say my stock stereo is pretty good these days. It's one of the few places where there's not much else I can be doing besides drive and listen, and usually I'm driving for hours, so I'll listen to the same new album a few times to get a feel for it. Of course I have a pretty high-quality set of speakers in my living room (and at my desk), but it's not often that I get to sit down and listen to even a few songs critically without interruption! At least the living room system gets a lot of use playing movies or, increasingly, episodes of *Octonauts* for my son. I certainly listen to a lot of background music while cooking or cleaning, and I sometimes listen on AirPods Pro while traveling, but mostly I read books while on trains or planes. The only difference in the last year is that iTunes has finally released an uncompressed feed of all my music, so I don't have to bother trying to find lossless versions of my favorite albums to keep from now until the end of time. ***LIS***

Carit Laursen

Head of Product Development & Technology, estron a/s

estron

Question 1: How did your current business evolve in the past 12 months and what were the main trends and factors (good and bad) affecting your business?

Laursen: The last 12 months have been affected by COVID-19. Most of our production for hearing aids and audio is running in Vietnam and was greatly influenced by the local restrictions, where our employees couldn't go to work because of the curfew. However, during late summer we were able to establish a setup, where our employees stayed and slept at the factory for a long period. This was completely voluntary, and it meant we were able to maintain nearly normal capacity. Demand also got higher. Customers started to order in higher quantities than ever before. Hiring new employees has also not been easy during COVID-19.

Question 2: What are the perspectives for your business in the next 12 months?

Laursen: We plan to expand heavily on all our sites. We have experienced an increasing demand for our hearing aids and audio solutions. Two-way communication is also expanding and the demand for products with integrated microphones is a must. On the downside, we can see that there is a trend toward true wireless stereo (TWS)—but we also see a demand and growth for cabled solutions, which is good for us. Especially, where a stable connection is in focus, we see that being dependent on Bluetooth (BT), battery milliwatt-hours is an obstacle for many people. People have also started using the audio output from their laptops much more during COVID-19 instead of using their mobile phones. Teams meetings and such have been a challenge. People have had to master many new things: connecting to the meeting, connecting to the projector, sharing screens, adjusting microphone levels, and many other things—and all within less than 2 minutes! So, they didn't want more complexity added such as a BT headset or something similar. They wanted to focus on the meeting topic instead.

Question 3: What were the most exciting developments, technology innovations, and trends happening in your field of interest over the last 12 months?

Laursen: That OTC is on the edge of being released. This is very exciting for us. We see our two primary business areas merge and can bring our extensive knowledge from both sides into play. We have more than 25 years' experience mastering miniature components, which is highly relevant to achieve the best possible quality.

Question 4: What technology innovations and trends do you consider to be the most promising in the audio industry for the next five years?

Laursen: OTC will challenge the Hearing Aid business model and will start a new disruptive innovation trend in hearing aids and audio listening. In this field, our more than 25 years' experience from both business areas is definitely an advantage.

Question 5: How do you currently listen to music? Did your music listening habits change in the last 12 months?

Laursen: More working hours at home instead of being at work meant that I spent time building playlists in YouTube, which I use as my current audio listening platform. It is convenient having a big TV screen for this and it is close to my desk at home. I love using my Custom In-Ear Monitors, when working from home, and of course having a T2 connection and Linum cable! The advantage is that my family can continue listening to music from the loudspeaker setup in the same room! ***LIS***

Steve Temme

President and CEO, Listen, Inc.

Listen

Question 1: How did your current business evolve in the past 12 months and what were the main trends and factors (good and bad) affecting your business?

Temme: I am sure that no one will dispute that these are challenging times! COVID-19, working from home, travel restrictions, global parts shortages, and the AKM fire, which temporarily wiped out one of the world's largest audio chip vendors, have all played a part in making it a tumultuous year or two. That said, there have been some bright spots. On an industry level, the demand for improvements in communications quality due to continued remote work has diversified measurement opportunities far beyond traditional telecommunication devices into other communication devices, such as smart speakers, Bluetooth speakers, headsets, microphones and more. We've thrived on the challenges of developing software features that enable these devices to be accurately measured, such as including the POLQA algorithm and expanding capabilities to facilitate the measurement of Doubletalk and other metrics required for communications standards.

Question 2: What are the perspectives for your business in the next 12 months?

Temme: I believe the next 12 months will continue to be a phase of continual re-adjustment based on changing global situations. Personally, I can't wait to get back visiting customers and attending events again! While I am sure things won't be the same as they were back in 2019, there is no substitute for visiting customers in their labs and production facilities where you can truly understand their measurement challenges. Of course, some of the activities that we invested over the past couple of years, such as the development of our online training courses, applications seminars, and popular video series, have been so well received that they are here to stay, even as we start to travel again.

Question 3: What were the most exciting developments, technology innovations, and trends happening in your field of interest over the last 12 months?

Temme: This is what I love about audio—there is always so much going on. In my specific area—audio measurement—the most exciting developments are in the area of perceptual measurement. Perceptual measurement metrics are extremely valuable for end-of-line tests as they offer significant impact on yield and waste reduction in a world of ever-shrinking margins. This has been a field of research for Listen, and for me personally, for more than 10 years now. We led the way with our first perceptual metric in 2011, but our recently launched enhanced Perceptual Rub & Buzz (ePRB) algorithm is the first time any perceptual metric has truly delivered the repeatability necessary for widespread end-of-line testing, and it has the potential to make a huge impact, worldwide. Outside of my own company, I am always fascinated by those innovations that will present interesting measurement challenges. Right now, many of these involve spatial and perceptual audio in applications, such as automotive infotainment sound zones and virtual and augmented reality hardware. Communications devices are also posing some interesting measurement challenges as they incorporate increasingly sophisticated digital signal processing in pursuit of higher quality audio.

Question 4: What technology innovations and trends do you consider to be the most promising in the audio industry for the next five years?

Temme: The convergence of the hearing aid market with the headphones, hearables, and wearable technology, along with industry deregulation presents some hugely promising opportunities for the audio industry and for healthcare as a whole. These devices will make hearing assistance more accessible and remove some of the stigma associated with conspicuous hearing aids, improving the quality of life for the world's aging population. This developing market is driving many exciting downstream developments throughout the audio industry, such as DSP, miniaturization, control, and of course, the development of new test and measurement methodologies that can cope with the complex signal paths and internal electronics that are inherent to these devices. Autonomous cars also present exciting opportunities, driving the advancement of spatial audio as they move toward being mobile offices and entertainment systems with sound zones, quality communications systems, and more. Lastly, I think robots that listen, talk, and move will present some exciting audio challenges as some creative acoustic designs will be necessary to overcome mechanical noise and vibration issues.

Question 5: How do you currently listen to music? Did your music listening habits change in the last year?

Temme: My proper "listening setup" is 100% vintage with—Apogee Diva full-range ribbon loudspeakers (that I helped design back in the early 1980s), a Luxman dual tone-arm turntable, Nakamichi tape deck, OPPO Digital CD player, Benchmark DAC, a behemoth of a Pass Labs X-350 amplifier, and other miscellaneous components. Naturally most of the content that I own is on CD or vinyl. Elsewhere in the house, I use Sonos and Dynaudio speakers with various streaming music sources, such as Tidal. Of course, we also have smart devices in every room, and although I don't particularly rate the sound quality or my kids' taste in music, and I am plagued with problems caused by my daughter sharing a name with one of the voice assistants, they do provide both entertaining and useful functionality. I have also amassed quite a collection of high-end headphones and earphones, although it's probably fair to say that I have spent more time measuring them than actually using them for my listening pleasure! ***LIS***

Roger Shively

Managing Director, R&D, JJR Acoustics

Question 1: How did your current business evolve in the past 12 months and what were the main trends and factors (good and bad) affecting your business?

Shively: We were already working on computer simulation modelling remotely for our customers with milestone meetings in-person, but went completely remote during the last two years. We also perform automotive vehicle sound tunings, which usually require a physical car at production milestones. We were also already prepared to do virtual tunings of computer models of cars for concept sound tunings, and we transitioned into doing remote tunings of actual vehicles. In some cases, travel was possible, under some extreme conditions, and tunings took place at the customer. Business development happened almost completely remotely through webinars and large video conference events.

Question 2: What are the perspectives for your business in the next 12 months?

Shively: Because we were able to work in the way we did during the last two years, and maintained our existing customer base, and because virtual events allowed us to broaden our reach remotely, our expectations are for a very good recovery from the last two years and return to meeting higher level financial goals.

Question 3: What were the most exciting developments, technology innovations, and trends happening in your field of interest over the last 12 months?

Shively: In Automotive Audio, immersive audio and personal sound zones have become very hot topics; and with Electric Vehicle development becoming mainstream, Active Noise Control and External Sound Synthesis have become extremely relevant for audio engineering in cars.

Question 4: What technology innovations and trends do you consider to be the most promising in the audio industry for the next five years?

Shively: In the next 5 years, we expect that the current level of electric vehicles in the market, which is ~4%, will be as high as 50%. Internal combustion engine vehicles are beginning to be phased out. Other trends are in the fully duplex audio busses, which now have processing that is deterministic and have predictive control. And the advent of improved speech recognition and voice control will make drastic changes to the in-vehicle interface.

Question 5: How do you currently listen to music? Did your music listening habits change in the last 12 months?

Shively: I listen in many ways: analog LP recordings, CD digital recordings, and more so in high-resolution digital formats. Streaming is becoming more common and increasing in quality. Playback is through TWS earbuds, headphones, through multichannel surround full-band speakers in rooms, and through wirelessly connected speaker systems. Nothing has changed in the last 12 months, but I expect there are more options for all of the ways I listen. ***LIS***

David Stokes

General Manager, OEM and Products, Tectonic Audio Labs

Question 1: How did your current business evolve in the past 12 months and what were the main trends and factors (good and bad) affecting your business?

Stokes: On the positive side, we've seen growing interest in personal audio zones, VR/AR/MR audio, and immersive audio products this past year, along with OEMs striving to provide improved audio experiences for users that have differentiated industrial designs and reduce costs.

These trends led to two key factors in our growth. First, there has been increased interest in the Balanced Mode Radiator (BMR), notably in the BMR's ability to provide full frequency wide-directivity output while maintaining superior intelligibility. By eliminating the tweeter and associated components, a BMR-based design can reduce system cost and still achieve performance targets. Fewer components needing to be sourced reduces supply chain risks, which is a significant added benefit. Second, our customers have utilized our audio system engineering expertise to develop sub-system modules.

And then for the not so positive, the impact of COVID-19, rising material costs, and supply chain disruptions have been challenging for our customers, which made it challenging for us. Through it all, Tectonic not only persevered, but expanded the business.

Question 2: What are the perspectives for your business in the next 12 months?

Stokes: Tectonic will continue adding differentiated value to our customers. We'll leverage our new technologies to reduce drive unit cost and expand our acoustic system design capabilities.

We also plan to introduce new BMRs, including the BMR-*k* drive units and the improved rectangular High Aspect Ratio Panel (HARP). The BMR-*k*, the next generation of BMR technology, delivers the same performance of the BMR at a lower cost. The HARP technology enables ultra-slim audio system designs, which gives an industrial designer the ability to expand product design parameters.

Question 3: What were the most exciting developments, technology innovations, and trends happening in your field of interest over the last 12 months?

Stokes: The pandemic's impact on virtual conferencing and the traditional conference room has been interesting. I'm not sure what the future conference room will look like, but I'm hearing more discussion about it.

From a Tectonic perspective, I'm highly interested in the evolution of personal audio zones, especially beam-steering technology products. One might think that the BMR's wide directivity wouldn't be a good fit for these types of applications. Partnering with Audioscenic on a project demonstrated this isn't the case. The BMR's stability provides a significant benefit to beam-steering machinery.

I'm also excited to see how the Klippel KCS will find a place in the market. We plan to take full advantage of it in future design.

Question 4: What technology innovations and trends do you consider to be the most promising in the audio industry for the next five years?

Stokes: We're seeing a greater adoption of the digital twin process within our customers' engineering teams. This is leading to better understanding of the BMR's capabilities and how best to optimize them within their products.

From an audio design perspective, Klippel's KCS can change the system's architecture for lower cost and with fewer components, while maintaining or improving performance. Distortion can be substantially reduced, greatly aiding echo canceler performance, or more compact, cost-efficient architectures can be implemented without compromising existing distortion performance.

Question 5: How do you currently listen to music? Did your music listening habits change in the last 12 months?

Stokes: I mostly listen to music through streaming services. I have discovered some wonderful artists through my kids sharing their lists with me. ***LIS***

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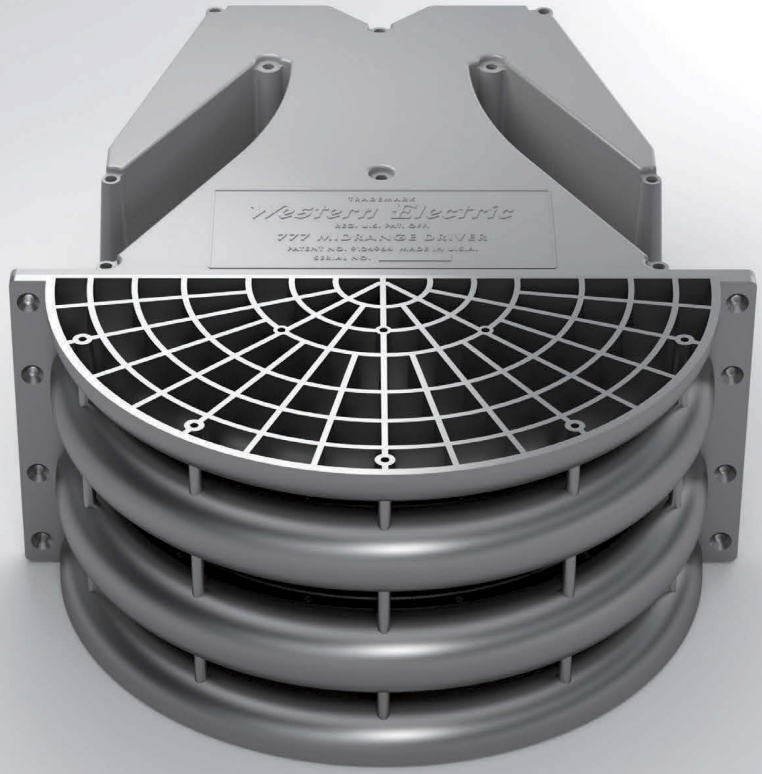

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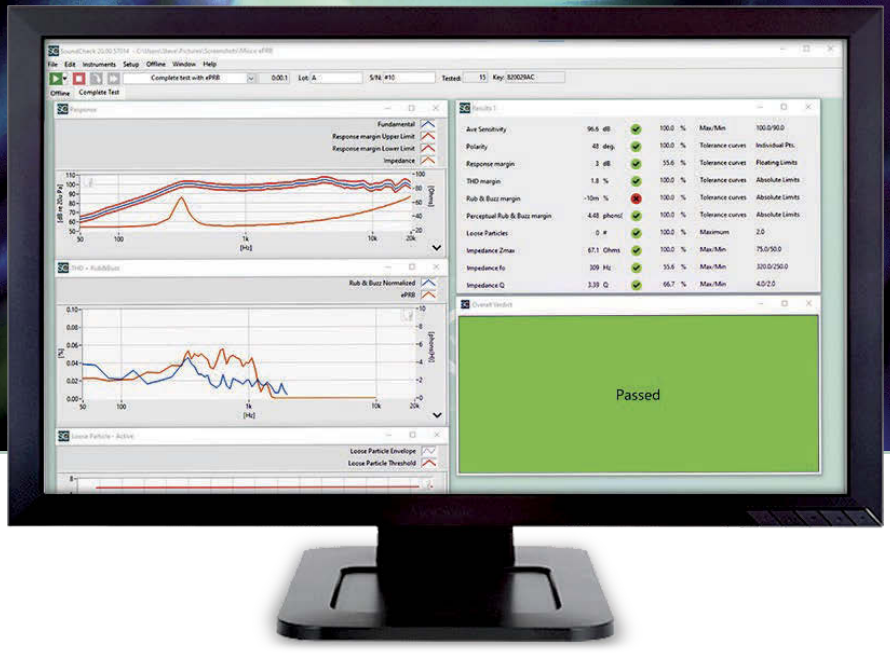

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