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2014 LIS

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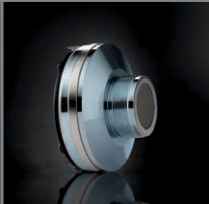
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Almost four decades ago, in 1975, Meir Mordechai founded Morel—inspired by his love of music and motivated by a dream—to create a loudspeaker that would capture the magic in music in the most natural way. His lifelong quest resulted in successive generations of speakers and audio drivers that consistently set new standards for superb sound quality. The Morel brand (the name derived from Mordechai Electro-acoustics) has become an annual recipient of “Best of” awards for home and mobile sound reproduction.

Over the years, Morel has developed an enviable reputation for technological innovation and design excellence. Morel drivers—including tweeters, midrange, and woofers—are utilized in some of the most demanding, high-end products around the globe. Morel products and sound systems are sold in the home hi-fi, home theater, and mobile audio markets in more than 55 countries worldwide.

Producing loudspeakers that deliver a magical feeling requires more than just advanced technology or the latest industrial tools. The human touch is an absolute necessity. Each Morel product is hand assembled and extensively tested to ensure that it meets the highest standards.

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Argument for Local Sourcing

By
Mark Beach

President, Beach Dynamics and Vice-President, Association for Loudspeaker Manufacturing & Acoustics (ALMA) International



You've poured your heart and soul into your design—bending the BL curve, calculating the compliance, massaging the membrane, and critiquing the crossover—now you're ready to go into production. But first, you have to determine where to manufacture: local or long distance?

There are several factors to consider including your customer location, production

costs, protection of intellectual properties, time to market, prototype development cost and time, quality control, counterfeiting, minimum quantities, customization, and more. To gain some insight, I interviewed several successful American manufacturers.

Sanders Sound Systems

Roger Sanders of Sanders Sound Systems has been advancing the art and science of loudspeakers, specifically electrostatics, for more than 40 years. The loudspeakers are developed, fabricated, and assembled under his watchful eye in his factory, which is nestled in Aspen, CO. When interviewed, Sanders stated, "Exotic speakers like Sanders Sound System's electrostatic speakers require highly skilled workers who take great care in their work and pay attention to the details. It takes a long time to find and train such workers. Even so, they must be closely supervised and extensive testing and quality assurance is required. This cannot be done by using workers in a foreign country. There simply is no substitute for having total control of production in one's own factory."

Orb Audio

Another American manufacturer is Orb Audio, which is operated under Will Christenson's



A magnet and a back plate are glued to the top plate and basket assembly.
(Photo courtesy of Eminence)

guidance. His business model is based on four values: high performance-high value, direct-to-customer sales, person-to-person customer support, and meticulous quality control. When queried about local manufacturing, Christenson stated two distinct advantages, "Manufacturing in the US has been a great experience for Orb Audio. The most apparent advantage is an engaged workforce. Everyone at Orb Audio, from the shop crew, to the packing and shipping department, to the sales team are passionate about audio and the product they are building. The end result is tight quality control and a top-to-bottom commitment to the company and the product. This advantage even translates to our outside vendors. The industrial supply and manufacturing shops in our area, while known for putting out high-quality products, are not your typical suppliers for speakers and accessories. By being local and cultivating personal relationships we are able to take advantage of their excess capacity and support a high-quality and unique product line."

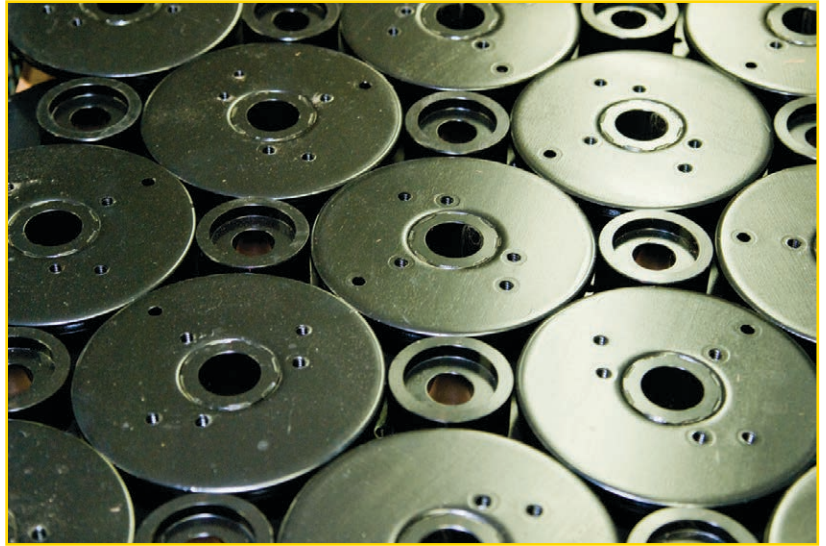
It is apparent that Orb has built a successful team that extends beyond its factory walls to include vendors, which results in a quick, flexible team that can accommodate customer requests. Christenson continued, "Another advantage of building here in the US is that Orb Audio is exceptionally accommodating to the customer. If the client needs a custom configuration or a tailored product for an unconventional installation, we identify those needs at the sales or concept level, and can complete the project in a span of days or weeks rather than the inherent delays seen with manufacturing overseas."

HUMAN Speakers

The advantages extend all the way to small cottage-industry artisans providing highly customized solutions. Huw Powell runs HUMAN Speakers in Lee, NH. The company specializes in a simple line of speakers, crafting the parts and each complete speaker by hand, usually to order, in its factory.

Powell stated, "It is to the designer's advantage to have immediate access to a factory with a stockroom, glues, and skilled employees in order to be able to develop a new product on an overnight basis if needed. Even suppliers in the Midwest can get prototype parts to New England in a matter of days, at a low cost. Flying a sample from China costs about \$150 and up."

Powell also provided an example of how local manufacturing enables highly customized



The top plate and core assemblies have been staked together, painted, and staged for final assembly. (Photo courtesy of Eminence)

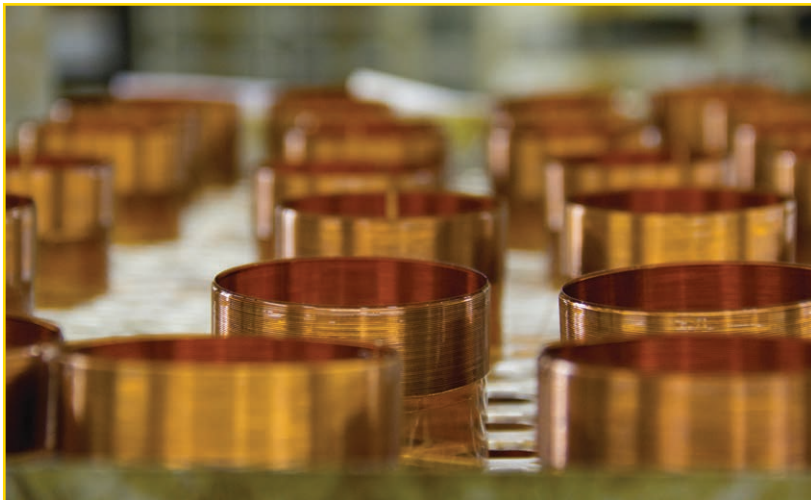
products, "I have a Canadian client working out of Thailand for whom I have made some custom versions of my 8" woofer, with the long-term goal being that he sends marble cabinets and electronics to me to build, test, and ship. The trans-global communication is incredibly difficult."

Eminence

The advantages are not limited to small- and mid-sized, audiophile-grade home audio companies. Eminence is a large manufacturer with a capacity of more than 10,000 loudspeakers per day and 200 employees providing OEM, musical instrument (MI), and pro sound loudspeakers.



A voice coil is being assembled. (Photo courtesy of Eminence)



A batch of voice coils is ready for the final baking process. (Photo courtesy of Eminence)

In 1966, founder Bob Gault located Eminence in Kentucky. He chose the location based on logistics. Eminence now ships to 90 countries. But, the advantages extend beyond logistics. Eminence maintains a customer base built over the last 48 years. Eminence's Cobi Stein carefully protects its biggest asset: customers. He stated, "Our philosophy on manufacturing in the US has not changed. We know the Eminence brand has come to be known for manufacturing quality loudspeakers at a great value, and we would not want to jeopardize our reputation to save a few dollars by manufacturing abroad." He added, "...my ultimate goal would be to ensure



Voice coils are inserted into the loudspeaker during the final assembly process. (Photo courtesy of Eminence)

each customer is a repeat customer. Therefore, making sure I stock products that are well made, offer a good value, and live up to the expectations of my customers would be priority #1. That is why we at Eminence take great pride in making our professional audio and musical instrument loudspeakers in the US. We know each product that leaves our facility has been carefully designed, built by hand, thoroughly tested, and is backed by our industry-leading seven-year warranty. A retailer can offer our products with complete confidence, enjoy significant margins, and know any support needed is just a phone call away." An aspect in common with the smaller manufacturers, Eminence has built a conscientious and extremely experienced team where some assemblers have more than 25 years of experience.

MISCO

Another major player is MISCO (Minneapolis Speaker Company). I spoke with Dan Digre, MISCO's President who shared his thoughts. "For the American manufacturer to compete with a low-price off-shore product, they need to understand what the true advantages are of 'Made in America' and make certain that they deliver on those. To me, those things are delivering high performance, value, and turn-key solutions."

Digre added "That means high-performance parts using state-of-the-art designs and materials—consistently, in every shipment. To us at MISCO that starts with engineering a product that truly provides the customer with 'the sound they want' and meeting the customers' objective. Once that objective is achieved and the customer approves the product, it means meticulous documentation of the material specifications, manufacturing processes, and critical and objective end-of-line testing. MISCO's work in the aerospace and medical industry has taught us the value of rigorous quality systems like ISO-9001 and the importance of employee development and retention. We want to make certain that every speaker a customer receives is exactly what they approved."

Digre continued, "That also means delivering value to the customer through excellent communications, convenient shipping logistics, inventory management systems, and most importantly the trust that MISCO stands behinds the commitments it makes to its customers. It all must be done at a fair price so our customers can succeed in supplying MISCO speakers to their customers and at the same time, we need to help our customers understand that the price they pay

for a product, is not the same as the cost of the product—especially once quality problems start to happen and real costs surface.”

“We must also provide turnkey solutions both in the form of product assembly—complete audio systems including speakers, wiring, enclosures, amplifiers and packaging, as well as providing engineering support to ensure the customer’s product is successful. MISCO prides itself in being more than just a product provider but rather we provide solutions to help our customers meet their objectives,” Digre said.

Digre summarized, “Lastly, the manufacturer must have a relentless focus on satisfying the customer’s needs not just for the immediate order, but looking ahead for years to come. MISCO focuses on long-term business objectives and customer/supplier relationships. Therefore, our claim to our customers: MISCO—For the sound you want. Perhaps that’s why we’re celebrating our 65th company anniversary this year!”

Materion

Another success story is Materion’s Electrofusion business unit, which produces Truextent brand genuine beryllium and other high-performance engineered materials useful for electroacoustic transducers as well as medical and scientific products. I spoke with Peter Andrews, Materion’s Senior Electroacoustics Engineer who provided some valuable insight.,

“The processes used for manufacturing these advanced acoustic materials and associated components are not only proprietary, but quite difficult to control en masse. Further, the safe production of beryllium components requires special controls that must be tightly integrated into the manufacturing machinery, processes, and training. These controls are expensive, making it prohibitive to establish satellite factories elsewhere, especially for just speaker products,” explained Andrews. Recently, Materion Electrofusion has manufactured replacement/upgrade diaphragm assemblies for professional compression drivers that outperform factory-original parts for several commercially available drivers. Since variances of as little as two thousandths of an inch can affect the high-frequency output of compression drivers, these assemblies require extreme precision and care in assembly. Andrews went on to say, “Manufacturing to the tight tolerances compression drivers require is a tall order, even more so because we are not making the motor and phase plug assemblies that could be matched to each diaphragm. It would be



Speakers in the final assembly area move down a conveyer system where technicians apply the edge treatment and attach the leads to the terminals. (Photo courtesy of Eminence)

very difficult to monitor this and keep the tools in alignment without direct control of the process. In-house assembly gives us the confidence that we can control these dimensions very tightly, even when direct measurement of the features is not practical in production.” In this example, it is not only controlling quality, it is the required precision that cannot be found in satellite factories elsewhere.

Made in the US

I found it fascinating to interview these successful American manufacturers. As I look back, the insight gained revealed several common threads: exemplary quality and excellent customer satisfaction achieved through a conscientious, dedicated team of builders delivering specialized and even highly customized products. So it seems with the right combination of quality and service, US manufacturers have the potential to succeed. *LIS*



Vance Dickason

President, Vance Dickason Consulting

Question 1: Do you believe there is a trend to bring back manufacturing/assembly to the US and other countries, at least regarding certain products where there is a need to protect their intellectual property (IP)?

There is definitely a strong trend to bring back manufacturing to the US. Many US manufacturers over time have discovered the total cost of doing business in China and other countries is considerably higher than the cost of the product. When the total cost of doing business overseas is considered, the higher wages in the US become less of an obstacle. Certainly protecting intellectual property can be part of that emphasis, but I don't think that is a compelling reason for most of the loudspeaker industry.

Question 2: Is the technology and the market place (choice of suppliers) evolving in such a way that it becomes viable for small start-ups to successfully enter the consumer audio market as we have seen with many fashion headphone brands?

Depending on who you talk to, 75% to 90% of all new start-up companies fail. I don't think technology will change this at all. Getting into the market is relatively easy, and technology is changing that. However, with a new business, marketing trumps technology as the determining factor for success.

Question 3: In the next five years, how do you think the following audio technologies will be impacted?

- **Bluetooth and streaming**

Bluetooth and streaming are currently having a great impact on low-cost audio products intended to work with smartphones. This will most likely continue with the possibility of these types of products moving upscale over the next five years.

- **Audio over IP (AoIP)/home networks**

SONOS products have been highly successful in the market, as witnessed by the huge number of competitors that are entering the AoIP market. As with Bluetooth, I expect this to creep into higher-end products within the next five years.

- **3-D printers**

The largest area in the audio market for this technology is rapid prototyping. This will continue to play a big role in manufacturing.

- **Wearable technologies**

It's difficult to say what will happen with this technology. My intuition is that it will catch on as a fad for a period of time. But in the long run, I'm not certain if people want or need peripheral devices attached to their bodies.

- **Mobile apps**

There seems to be an unquenchable thirst for new things to do with your smartphone. I don't foresee any change in mobile apps' popularity any time soon.

- **High-resolution audio (e.g., DSD, DXD, etc.)**

DXD, which is basically high-definition pulse code modulation (HD PCM), will likely become an important recording format for professionals. DXD can then be translated to any resolution playback format desired. So it makes sense since there will continue to be a constant quest for better fidelity in digital audio.

- **New composite materials**

New materials have been driving product development for years. I can't imagine this will change in the near future.

- **Virtual acoustics (e.g., active processing—Meyer Sound Constellation type)**

Active processing to alter room acoustics as a technology has been steadily improving. Its success and effectiveness in small listening rooms is still questionable, but it is starting to make an impact in larger venues.

Question 4: What was the most important technology that appeared in the audio industry during 2013?

I think the most important technology is probably low-cost DSP. This is starting to make a lot of mainstream low-cost powered speakers available to the public. *LIS*

Christopher J. Struck

CEO & Chief Scientist, CJS Labs



Question 1: Do you believe there is a trend to bring back manufacturing/assembly to the US and other countries, at least regarding certain products where there is a need to protect their intellectual property (IP)?

Yes, but it is either a weak trend or just at the beginning.

Question 2: Is the technology and the market place (choice of suppliers) evolving in such a way that it becomes viable for small start-ups to successfully enter the consumer audio market as we have seen with many fashion head-phone brands?

I do not believe the choice of suppliers has grown to that point yet. The lowest manufacturing cost is still, for the moment, the deciding factor for most companies.

Question 3: In the next five years, how do you think the following audio technologies will be impacted?

- **Bluetooth and streaming**

It is already here, but increased bandwidth may make this more prevalent.

- **Audio over IP (AoIP)/home networks**

AoIP is already here as well and, as with Bluetooth, increased bandwidth will make it even more prevalent.

- **3-D printers**

I think 3-D printers are the “go-to” prototyping tool of the present and the future.

- **Wearable technologies**

In the future, we will see more of these *a la* “Google Glass.” However, the regulatory response to these products is a major unknown and a bit of a risk.

- **Mobile apps**

Already the de facto technology trend, mobile apps are likely to remain so for the foreseeable future.

- **High-resolution audio (e.g., DSD, DXD, etc.)**

I think high-resolution audio requires a new twist to “jump the gap,” otherwise this technology will suffer the same fate as DVD-A and super audio compact discs (SACDs).

- **New composite materials**

New material is really the only true area of potential disruptive innovation for loudspeakers.

- **Virtual acoustics (e.g., active processing—Meyer Sound Constellation type)**

It is potentially very interesting for pro applications (particularly for small- to mid-sized venues), but it is unlikely to have significant impact or uptake in the consumer space. A conventional five-channel home theater setup is already well above the complexity threshold of the average consumer.

Question 4: What was the most important technology that appeared in the audio industry during 2013?

I think it was the iPhone5c being sellable in China, which goes to the heart of Question 1: The cost of manufacturing in China has risen as the middle class in China comes into its own and the people desire the same material consumer goods available in the West. In spite of the Chinese government’s moves to corner the worldwide rare earth minerals market, the consequences of the rise of the Chinese middle class will be much more profound, far-reaching, and long-lasting. *LIS*



Chris von Hellermann

Senior Director of Technology Management, Tymphany



Question 1: Do you believe there is a trend to bring back manufacturing/assembly to the US and other countries, at least regarding certain products where there is a need to protect their intellectual property (IP)?

It may be unwise to confidently state that there is a trend to bring manufacturing back to the US as there continues to be economic benefits of manufacturing in China. However, it can be said that the year-on-year government stipulated minimum hourly labor rate increase will put pressure on organizations to evaluate whether or not it makes financial sense to improve efficiencies of manufacturing within China, or even manufacture outside of China.

IP protection may well be the basis of a decision to manufacture outside of China; however, this concern may also be addressed by sourcing components or subassemblies from suppliers based in countries that protect IP rights.

Question 2: Is the technology and the market place (choice of suppliers) evolving in such a way that it becomes viable for small start-ups to successfully enter the consumer audio market as we have seen with many fashion headphone brands?

For products that rely on the integration of the latest ground-breaking technologies, it would seem that with the increasing complexity of technology integration, there is a corresponding decrease in the number of capable suppliers that have a proven ability to deliver on the new product introductions. This dynamic can provide additional challenges for start-ups when entering the product development cycle.

Question 3: In the next five years, how do you think the following audio technologies will be impacted?

- **Bluetooth and streaming**

There will continue to be growth in the Bluetooth audio market due to the ubiquitous adoption of Bluetooth in many devices.

- **Audio over IP (AoIP)/home networks**

Network audio is where we will see a wave of new products entering the marketplace with competing technologies. Due to higher bandwidth potential, Wi-Fi-based streaming may displace Bluetooth.

- **3-D printers**

With the costs of 3-D printers on the decline, and with increasing printing resolution capabilities, 3-D printers look to be on the edge of the tipping point for wide adoption.

- **Wearable technologies**

Wearable technologies are seen to be the next wave of products that may become sources for audio transmission. Due to their limited size, it would be a significant challenge to integrate audio systems, therefore the sales of audio devices based on Bluetooth and Wi-Fi connectivity would likely benefit this market segment growth.

- **Mobile apps**

There is evidence of an increasing expectation for wireless audio products to have accompanying mobile apps to control the audio systems. These applications can provide feature sets on products that would not be practical to implement

on the product itself due to the limited user interface (e.g., cloud content connectivity, content aggregation and playback, alarm, equalization or stereo operation).

- **High-resolution audio (e.g., DSD, DXD, etc.)**

There appears to be a great deal of debate with regard to the practicality and necessity of high-resolution audio distribution over the Internet. However, with the ongoing increase in available bandwidth, the argument of whether or not it is practical will likely become moot. Therefore, the question of necessity comes to the forefront. Given that network audio technologies are developing hardware that can support high resolution audio transfer, and a consumer is given a choice between high-resolution audio vs. the highly compressed lossy audio of other technologies, there will likely be a preference toward high-resolution audio.

- **New composite materials**

Some exciting new composites and laminates are being researched that offer improved performance—extended frequency response, lower distortion—for application in headphone transducers, high-frequency transducers, and full-range transducers. These new materials will be adopted into product designs as they become commercially viable, helping to improve the consumer audio experience.

- **Virtual acoustics (e.g., active processing—Meyer Sound Constellation type)**

It appears that virtual acoustics is gaining ground with the ever-increasing computational power of processors along with the reduction in costs. The increasing million instructions per second (MIPS) to dollar ratio help to make the complex computational task of virtual acoustics and active room correction a reality at reasonable costs, which has typically been the barrier for adoption in the past.

Question 4: What was the most important technology that appeared in the audio industry during 2013?

This is a very challenging question, and one that is difficult to answer with one single product. Having said that, I think the Bose Soundlink Mini was an important audio product introduction in 2013. The Bose Soundlink Mini has set the bar for audio performance from a compact design in the highly competitive Bluetooth audio market, with solid engineering in all the components that make up the system. Arguably, with the lossy codecs used for transmission, Bluetooth audio devices could easily be dismissed as audio systems. However, the Bose Soundlink Mini, with its high volume of sales, demonstrates that people do gravitate to good quality products. *LIS*

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Thomas Mintner

President, NTI Americas Inc.



Question 1: Do you believe there is a trend to bring back manufacturing/assembly to the US and other countries, at least regarding certain products where there is a need to protect their intellectual property (IP)?

This question addresses and leads to an entire series of complex issues, so it is not really one question and one answer. As many questions and issues arise as may be answered! But, the short answer is yes. There are a few more products being started or brought back, but that it is much more than a decision related only to IP protection.

It is also a question that may have different answers for the audio video (AV) industry than for the electronics industry as a whole. Companies with traditional AV-distinguishing products (e.g., loudspeakers) may. But many other companies could also be viewed as members of the IT, communications, or software industries—partially based on differences in how they produce (manufacture) their products. In that case, the answers are probably quite different for these among the different related industry segments.

In any case, while it is tempting to imagine large waves of so-called “onshoring” back to the US and Western Europe, the actual percentage is not likely to be large.

Although it is possible that rising labor and services costs for production in China could possibly push production to a new group of locations, the fact is that having some production in Vietnam for example, is not new. And moving some work to Vietnam or another area is a completely different proposition than moving back to the US or Europe.

Some of the production would have never left the US except for short-sighted US tax laws, which enables US corporations to hold most off-shore profits tax free at the off-shore location and still have the ability to leverage those funds in various ways for short-term uses around the world. As long as those tax laws remain, the fundamental manufacturing dynamic for the US will not change.

Similarly, overtly business-hostile regimes in most of Western Europe and in many of the so-called “blue states” in the US contributed to these decisions to relocate manufacturing.

While some tech businesses such as Google and Facebook can afford to do business anywhere, many practical and less glamorous companies will always seek friendlier manufacturing and headquarters locations.

Be Careful What You Wish For

Critical mass for smooth production of many types of electronics production has long ago been achieved in China and other Asian areas. While some might secretly hope for massive shrinkages there, that could not happen in Asia unless driven by forces and changes that would also harm the other manufacturing areas.

Those with actual and serious IP to protect either never fully committed to China or took various unusual steps in their production processes to mitigate the issue. Perhaps what some refer to as “IP protection” is a much broader and blatant issue, where entire designs have been stolen and put into production elsewhere. Variations include unauthorized production right in the facility—so called “third-shift” production—or cases where rejected product works its way back into the supply chain. For those that did not choose their partners wisely, the threat has existed from the beginning. The only reason it may be coming up now is if the same executives who blindly rushed production out the door to China are only now figuring out their real net costs.

New Beginnings

Certainly some companies realize there is more than one benefit from doing some or all of the work in the US or in Europe. In particular, products that rely on specialized markets are more likely to be profitable enough for this. They also may have complex requirements for function and technical support that make this type of manufacturing a wise choice.

On another positive note, there still seems to be room for exciting growth in the entertainment/audio/video/software industries. From Latvia to Tel Aviv and in the US from Manhattan to Austin, I have never seen a wider variety of small- and medium-sized companies bringing new media technologies to market.

Question 2: Is the technology and the market place (choice of suppliers) evolving in such a way that it becomes viable for small start-ups to successfully enter the consumer audio market as we have seen with many fashion headphone brands?

The fashion headphone fad was created and first maneuvered into existence by one very savvy old-school high-end hi-fi guy, not so much by the various front men/women you may see associated with these brands.

But there seems to be no doubt that good availability of a variety of high-quality and well-tested drivers and physical components from low-cost assembly areas have enabled these satisfactory but over-priced boutique brands. The larger lesson is that creative marketing can create successes, but it can also cost the fashion consumer a lot of money.

I have hope for other products for wireless delivery of high-quality audio. For example, some emerging speaker companies offer high-quality and good value products.

Question 3: In the next five years, how do you think the following audio technologies will be impacted?

- **Bluetooth and streaming**

This technology is significant, but the big impact of near-field connection and distribution is not necessarily limited to Bluetooth or to conventional streaming. Significant contributions are coming not only from program distribution, but from control and sensing channels (i.e., product and user awareness), which relates to wearable technologies.

In addition, this would seem to be precipitating at the intersections of different groups of products, such as autos and mobile devices, and autos with other autos or their infrastructure. It may take 10 years, but I believe some big innovations are out there.

- **Audio over IP (AoIP)/home networks**

Yes, it would seem that trends for further integration of audio and video into data are accelerating. Unlike in the past, there is already so much capability built into current technology that some of the change may come just from slight rearrangements rather than from completely new technology or standards. An example of this on the pro and broadcast side is AES67-2013.

- **3-D printers**

They are potentially useful, but I think 3-D printers are probably limited to prototype and engineering work for some time.

- **Wearable technologies**

This is definitely a possibility if delivered at low cost and without too much sacrifice to normal form and functions of the attachments/garments and the humans.

- **Mobile apps**

Sure, but it seems mobile apps are probably condemned

to become less fun and more workaday. Also how much more time and enthusiasm is really available in the day to stand around staring at your smartphone?

- **High-resolution audio (e.g., DSD, DXD, etc.)**

While DSD seems rather firmly established on the professional end for organizations interested in a more-or-less future-proof archiving format, beyond those limits there seems to be a fading awareness of the value of high-definition audio. We are to some extent the victim of our own successes as an industry, where much lossy audio is possibly “good enough” for the vast majority of people. Other culprits are the ubiquitous mobile devices themselves. How much difference can even the music lover hear when they are mostly using earbuds to listen to lossy files on the phone?

- **New composite materials**

Material science is one of the real drivers of innovation. There is no doubt that more than just laminate materials will have major contributions. Some of the most important of these will take more than five years, and I believe will probably be more in the areas of image display technology (e.g., flex displays, reflective and transmissive improvement, etc.) not audio.

- **Virtual acoustics (e.g., active processing—Meyer Sound Constellation type)**

I’m not an expert in this area, but I love the Constellation. Certainly just as in the past, the capability to do any given level of sophisticated audio work will probably gradually migrate down the chain to lower-cost and simpler systems.

Part of what makes these systems possible is audio that starts from perfectly consistent and high-quality output before the processing is ever invoked—as with the very high-quality small driver/amp systems used in the Meyer system. But it takes a lot of rather costly and nicely performing products for these systems. To migrate that into home or other cost-level environments, probably their DSP will have to merge with that of corrective DSP used to linearize and improve the performance of lower-cost amplifiers and speakers. Then the system costs may come down to cover cost-sensitive applications.

Question 4: What was the most important technology that appeared in the audio industry during 2013?

I can’t think as much of a particular single technology, but from a combined product and technology point of view, I think the recent introductions of the ultra-low-cost digital consoles (e.g., Behringer and what looks like its Midas “twin” and the Qu-16 Allen & Heath, etc.), which are aimed at venues and live applications are super significant because of their huge benefit-to-cost ratio, and because they probably will seal the fate and doom of a lot of large, heavy analog consoles still operating in the live sound area. *LIS*



Rich Taylor

Brand & Marketing Manager, Dayton Audio



Question 1: Do you believe there is a trend to bring back manufacturing/assembly to the US and other countries, at least regarding certain products where there is a need to protect their intellectual property (IP)?

Manufacturing decisions are always an issue of economics. Labor, raw materials, and transit costs are all considered when manufacturing a product. Using China as an example, in 2010 the monthly pay for general labor was an average 1,800 RMB (Chinese Yuan), which then equaled about \$265. Food and dormitory space were supplied for an additional small charge. In 2014, the average monthly pay is 3,000 RMB, which equals about \$492. Food and dormitories are normally free, and the room conditions have improved. The dormitories now include AC, hot water, and beds with mattresses for workers. Advances in Chinese manufacturing and the purchase of newer manufacturing equipment have also drastically improved over the years.

Selectively speaking, some companies may make the move back to the US, but I believe for the most part that China/offshore manufacturing remains the most logical business choice for the present. As the Chinese domestic consumer market grows, we may see less emphasis on Chinese factories geared to produce for export and more emphasis on their domestic market.

Regarding moves to protect IP, the strongest example of an IP owner with offshore manufacturing would be Apple. If it made business sense, the company would move back to the US to protect its IP, which it rigorously defends!

Question 2: Is the technology and the market place (choice of suppliers) evolving in such a way that it becomes viable

for small start-ups to successfully enter the consumer audio market as we have seen with many fashion headphone brands?

Oh yes, very much so. Obviously the biggest part of a start-up is funding. With online vehicles such as Kickstarter providing people with the opportunity to raise funds, the small guy with a good idea is being given ample opportunity to bring it alive and to market! How cool is that?

Question 3: In the next five years, how do you think the following audio technologies will be impacted?

- **Bluetooth and streaming**

It's everywhere. It's improving. And, it isn't going away. I believe we will continue to see advances in Bluetooth technology and the application of it in many product areas, especially audio.

- **Audio over IP (AoIP)/home networks**

Obviously, there will be wireless IP in the future. I also believe this area will improve and increase in popularity. The ability to address components via IP and customize settings and operation is what consumers in the future will want.

- **3-D printers**

Three-dimensional printing will mostly assist the manufacturer in prototyping. However, I can see it becoming an excellent way to support products in the future. For example, are you looking for the knob off your Marantz receiver from 2009? Simply load the 3-D file and print one out!

- **Wearable technologies**

Looking at this from an audio-only aspect, I can foresee many types of technology working with performers and product developers. This is an area that, in terms of product depth, can increase drastically. One only needs to look at how wearable technology has impacted the health care industry. The audio industry could use improvement as well, from how music is played to how it is listened to. Also, it seems that everyone wants to share every point of their lives with their friends and family, so we can only assume this area will increase

- **Mobile apps**

Mobile apps will continue to improve, offering more and more customization and control to audio and peripheral equipment.

- **High-resolution audio (e.g., DSD, DXD, etc.)**

I have limited knowledge of this field, but we can always hope there are improvements that provide better audio with less data loss.

- **New composite materials**

As we develop transducers and loudspeaker components, we continue to see improvements in material selection. We

do not foresee any “earthshaking” material changes, rather improvements to existing composites used in our product development.

- **Virtual acoustics (e.g., active processing—Meyer Sound Constellation type)**

Again, I have limited knowledge of this area of product development.

Question 4: What was the most important technology that appeared in the audio industry during 2013?

I found the Oculus Rift “Crystal Cove” Virtual Reality prototype to be quite amazing. Once this technology is harnessed with audio it will be an incredible device that can be used for gaming, manufacturing, and the health and medical fields. **LIS**

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Perceiving and Measuring Headphone Sound Quality

Do Listeners Agree on What Makes a Headphone Sound Good?

By
Dr. Sean Olive

Director of Acoustic Research, HARMAN International,
and President, Audio Engineering Society (AES)



Consumers are experiencing more of their audio content through headphones. In 2013, headphone sales were \$8.2 billion worldwide with premium headphones (\$100 or more) accounting for 90% of the growth.^[1] While consumers clearly want better quality sound from their headphones, the science behind what makes a headphone sound good and how to measure it is not well understood.

This article summarizes some of the recent scientific research, which we conducted at HARMAN International to improve our knowledge about the perception and measurement of headphone sound quality. The research focused on four questions:

- Do trained listeners agree on what makes a headphone sound good?
- Do listeners' headphone sound quality preferences vary according to their listening experience, age, or nationality?
- What is the preferred headphone target response?
- Can listeners' subjective ratings of headphone sound quality be predicted based on the headphones' acoustical performance?

What Makes a Headphone Sound Good?

To answer this question, we conducted a series of controlled listening tests where 11 trained listeners evaluated six popular circumaural (over-the-ear) headphones from different manufacturers and different price points based on overall preference, spectral balance, and comfort (see Resources). The blind listening test was conducted to ensure that non-auditory biases (e.g., brand, price, fashion, and celebrity endorsement) would not influence listeners' judgment of the sound. However, the headphones' tactile feel and weight remained part of the test.

Figure 1 summarizes the average preference ratings of the headphones. Listeners preferred the models that sounded neutral and spectrally well balanced. This data corresponded to a measured response that was both smooth and extended in frequency. In cases where the headphone's perceived spectral balance did not agree with its measured response (e.g., the HP4, a closed-back design), the headphone's fit and seal on the listeners' ear was the culprit. Headphone

measurements need to accurately capture this effect if they are to accurately predict how they sound.

Headphone Target Response

The current recommended target-response curves for headphones are diffuse-field (DF) or free-field (FF). Many headphone manufacturers and researchers are beginning to question the recommendation on the basis that it makes headphones sound too thin and bright (see Resources). Most stereo recordings are optimized to sound best through loudspeakers in rooms that produce neither DF nor FF responses, but something in between. A better approach may be to design a headphone with a target response that simulates the in-room response of an accurate loudspeaker calibrated in a reference listening room.

To test this idea, trained listeners rated the sound quality of two different headphones equalized to various target-response curves based on three different DF curves, a FF curve, and two new target responses based on a loudspeaker in a room (see Resources). The unequalized headphones were also included as a hidden reference.

Figure 2 plots the preference ratings of the different headphone target responses averaged across all listeners and programs. The two new target responses (Target 1 and Target 2) based on an accurate loudspeaker's in-room response were significantly preferred over both the DF and the FF options, and the original unequalized headphone (the Audeze LCD2). The experimental evidence suggests that a headphone's sound can be significantly improved when it simulates an accurate loudspeaker's in-room response.

Headphone Sound influences

The popularity of Beats By Dre headphones, particularly among young audio enthusiasts, has led many marketing departments to believe that headphone sound preferences may vary with age, listening experience, or even nationality. While these factors have, so far, not been found to influence decisions on loudspeaker sound or audio data compression, the hypothesis has never been tested for headphones (see Resources).

To that end, a virtual headphone test methodology was developed to enable different headphones to be measured and then virtualized through a calibrated replicator headphone (see Resources). In this way, the tests are truly double blind since potential tactile and other biases (e.g., brand, price, fashion, and celebrity endorsement) are removed from the test.

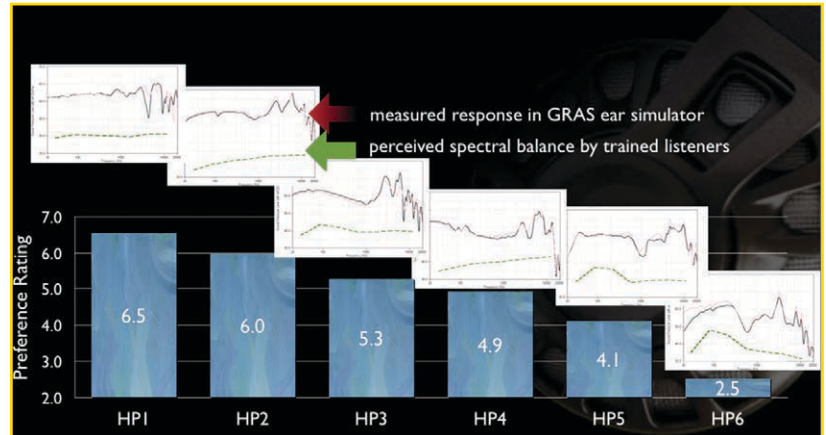


Figure 1: The mean preference ratings of six popular over-the-ear headphones are ranked based on ratings from trained listeners. The cascading graphs show the headphone's left and right frequency response with the average perceived spectral balance indicated by the dotted green line.

First, a validation study was conducted to determine if the virtual method produced similar subjective ratings to the standard method. The correlation between methods was sufficiently accurate ($r = 0.85$) to draw valid conclusions. Then, double-blind listening tests were conducted during which more than 200 listeners from Canada, Germany, China, and the US gave preference ratings for four different virtualized headphones. The headphones included two audiophile models (the Sennheiser Electronic HD800 and the Audeze LCD2), the popular Beats by Dre Studio Edition, and the replicator headphone equalized to the average preferred in-room response of a loudspeaker calibrated in the HARMAN reference listening room.

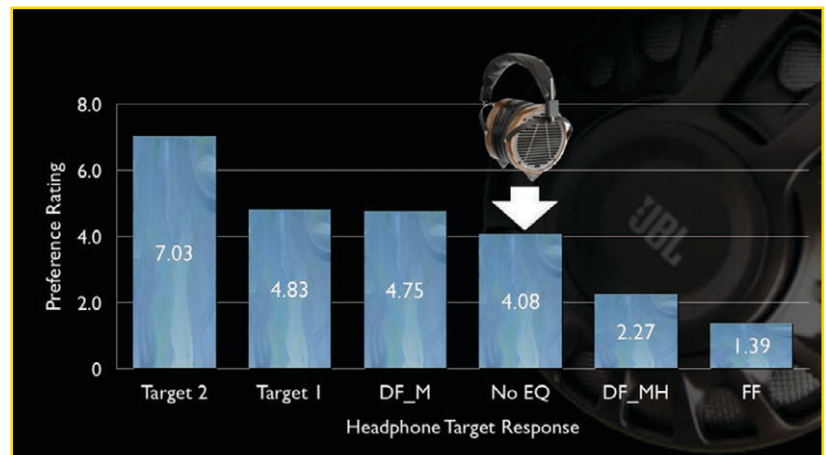


Figure 2: The mean preference ratings of different headphone target-response curves are simulated by applying EQ to the Audeze LCD2 headphone. Target 1 and Target 2 are based on the measured in-room response of an accurate loudspeaker in the HARMAN reference listening room. The No EQ category signifies the Audeze headphone with no EQ applied.

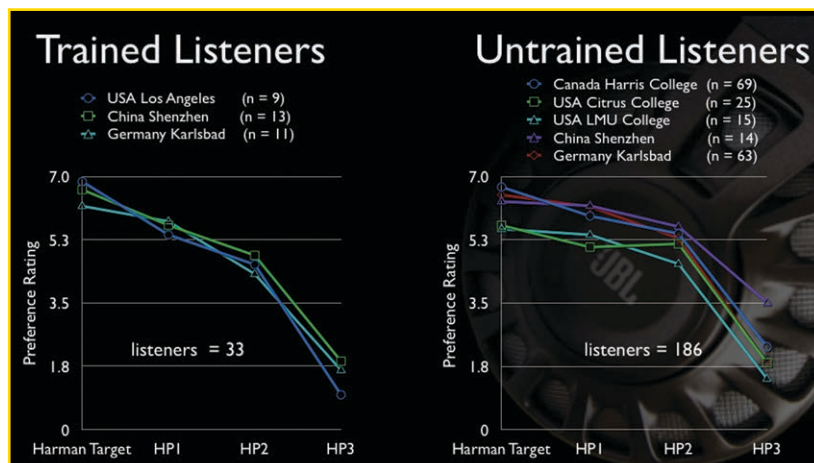


Figure 3: The mean preference ratings of three popular headphones (the HP1, the HP2, and the HP3) and one equalized to the HARMAN target response was provided by different groups of trained and untrained listeners.

Figure 3 shows the mean preference ratings for 218 listeners grouped according to their listening experience (trained vs. untrained), country of residence, and age (students vs. post-college listeners). Two conclusions can be drawn from this data. First, based on sound quality, the same headphones are preferred regardless of the user's listening experience, age, or country of residence. Second, the trained listeners tended to provide more discriminating and consistent ratings as a group compared to the untrained listeners. This behavior is consistent with previous studies that compared trained and untrained listeners.

Subjective Ratings of Headphone Sound Quality

So far, our studies have only focused on how the headphone's frequency response influences its perceived sound quality, without considering other factors (e.g., nonlinear distortion). While the research is ongoing, there are strong correlations between the headphone's frequency response and its overall perceived sound quality rating. The more preferred headphones tend to have frequency responses that are smooth, free of resonances, and approximate the target response an accurate loudspeaker measured in a reference listening room. It is also clear that frequency-response measurements must include leakage effects related to the headphone's fit to accurately predict listeners' sound quality ratings.

Scientific Evidence

Together, these studies provide scientific evidence that when brand, price, fashion, and celebrity endorsement are removed from subjective evaluations, listeners generally agree on what makes a headphone sound good. So far, this has been true regardless of users' listening training, age, or culture.

The more preferred headphones tend to have a smooth, extended frequency response that approximates an accurate loudspeaker's in-room response in a reference listening room. This new target frequency response could provide the basis for a new and improved headphone target-response curve. *LIS*

Reference

[1] Future Source Consulting, "Headphone Market to Exceed \$8 Billion in 2013," November 2013, <http://futuresource-consulting.com/2013-11-headphones.html>.

Resources

F. Fleischmann, A. Silzle, and J. Plogsties, "Identification and Evaluation of Target Curves for Headphones," presented at the 133rd AES Convention, October 2012.

G. Lorho, "Subjective Evaluation of Headphone Target Frequency Responses," presented at the 126th AES Convention, May 2009.

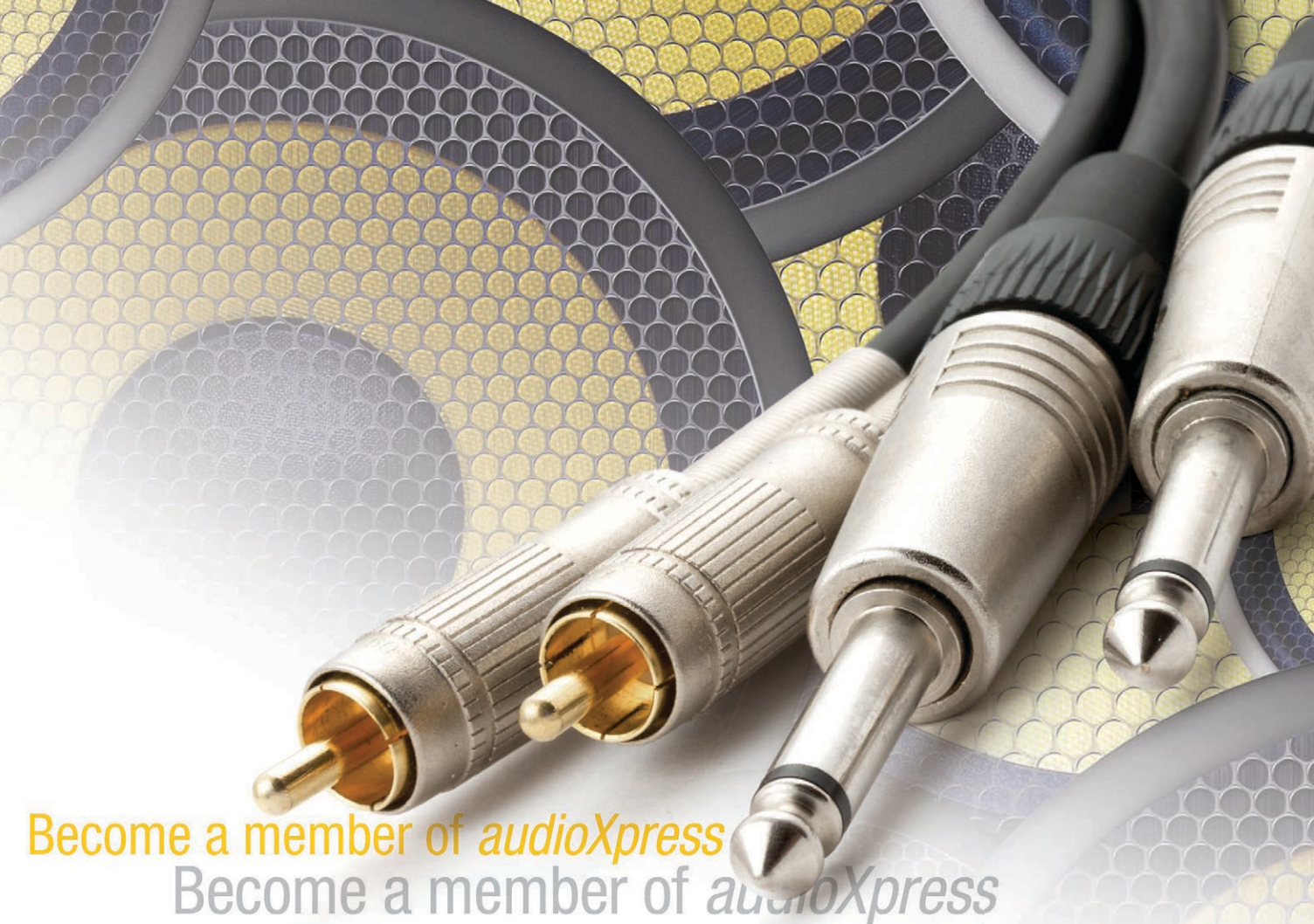
S. Olive, "Some New Evidence that Teenagers and College Students May Prefer Accurate Sound Reproduction," presented at the 132nd AES Convention, April 2012.

S. Olive and T. Welti, "The Relationship between Perception and Measurement of Headphone Sound Quality," presented at the 133rd Audio Engineering Society (AES) Convention, October 2012.

S. Olive, T. Welti, and E. McMullin, "Listener Preferences For Different Headphone Target Response Curves," presented at the 134th AES Convention, May 2013.

S. Olive, T. Welti, and E. McMullin, "A Virtual Headphone Listening Test Methodology," presented at the 51st AES International Conference, August 2013.

S. Olive, T. Welti, and E. McMullin, "Listener Preferences for In-Room Loudspeaker and Headphone Target Responses," presented at the 135th AES Convention, October 2013.



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Converged Audio Test

By
Bradley Price
Audio Precision

The demand for products that combine electronics and electroacoustical elements into a single integrated package is a trend that is accelerating as the audio industry continues to focus on key attributes that are driving sales (e.g., user convenience, consistent audio quality, and reasonable cost). Common integrated audio products include smartphones and tablets, stand-alone Bluetooth and network-connected speaker systems, and powered pro audio and consumer loudspeakers (including subwoofers).

The tools and goals of those who design, build, and test integrated audio devices are more varied than they were for earlier component systems. It no longer suffices to isolate products and engineering teams during analog, digital, and acoustic design and testing.

To address this challenge, Audio Precision has developed the APx series of analyzers, using a platform-based approach that we call “converged audio test” (see **Photo 1**). This article examines the audio test difficulties integrated products create when manufacturers and designers use disparate test systems, and proposes a converged approach to provide better more cost-effective results.

Integrated Audio Products

With advancements in DSP, acoustics, power amplifier design, and materials science, a new generation of devices has hit the market with outstanding success. These devices leverage integrated design and manufacturing to provide a well-controlled experience, from operation to sound quality and appearance. Attributes can be completely customized to accommodate desired size, low-frequency extension, and maximum sound level produced, pushing these devices much closer to the boundaries of physical limitations. For the audio industry, the result has been an explosion of popular products and a redefinition of what it means to deliver high-quality pro and consumer audio systems.



Photo 1: Audio Precision's APx525 is a two-channel audio analyzer for R&D engineers and production technicians who want fast and easy audio testing capabilities.

Converged Audio Test

The integration that enables powerful and compact audio products requires a careful tuning of electronics and electroacoustic parameters that incorporates the know-how and expertise from multiple engineering disciplines. In the past, these disciplines and techniques were often kept separate from one another, but as the products integrate so do the engineering teams and the methods they use.

Converged audio test is the measurement side of this integration. It is the implementation of a single platform that is capable of capturing measurements and delivering results from all aspects of integrated audio devices, with native connectivity and tools (see **Photo 2**). This includes:

- Analog electronics testing, often incorporating wide-bandwidth for capturing the switching artifacts of Class-D amplifiers.
- Digital audio testing in various popular formats, containers, and delivery methods from chip-level I²S to Bluetooth, pulse-density modulation (PDM), and high-definition multimedia interface (HDMI).
- Electroacoustic measurements for loudspeakers and microphones, including perceptual audio testing for devices that handle voice communications.
- Performance verification from design through production, following a single line of trust and methodology that ensures quality, reduces time to market, and lowers costs incurred by re-designs, recalls, and returns.

A single test platform is ideal for converged audio test only if it provides a high degree of quality and flexibility. A “jack of all trades, master of none” approach is insufficient and in the long run, not cost effective. The audio test platform must deliver on several key promises.

Connectivity and Performance

A converged audio test system should directly connect to devices under test (DUTs) at all points without reliance on third-party intermediaries such as Bluetooth adapters, sound cards, or other converters. It must be able to outperform the DUT with respect to all tested parameters: noise, distortion, crosstalk, and flatness of frequency response. Finally, the system must be capable of operating with the range of signals produced by the DUT from the smallest to the largest, without damage or scaling issues. For audio, this often means covering a range in excess of 110 dB.

Trust and Reliability

The tester and key stakeholders must trust the system’s results. A dispute over test results between

a designer and a contract manufacturer (CM) wastes time and money in the short run, and over time, degrades the trust required for efficient operation. To ensure high levels of trustworthiness, the product designer and the CM should use a common test platform that enables a complete alignment of results. The devices in the platform must also be legitimately calibrated and traceable to international standards.

High Productivity and Sophisticated Measurements

To maximize efficiency and reduce errors, the system should be optimized for audio testing and not simply an amalgamation of general-purpose tools. Audio testing has specific requirements designed to accurately reflect the nuances of human hearing. The audio test system should support these realities with built-in measurements and well-tested algorithms that provide accurate and easily repeated results. Likewise, the system must provide transparency via sharing of test data and projects among team members and contractors to improve processes and products (see **Photo 3**).

Finally, professional-level technical support is a “must” for any system on which you rely, and can make crucial differences in the timely resolution of issues that would ultimately affect product delivery.

Integrated Audio Device Test Lifecycle

Integrated audio devices contain components and design elements that are handled by different teams at different points in the product’s lifecycle. This is



Photo 2: Audio Precision’s APx515 is a high-performance audio analyzer optimized for production tests. The APx515 has a typical THD+N of -106 dB, a one million point fast Fourier transform (FFT) with 24-bit resolution, and 192-kHz digital I/O.

especially true when CMs are used to assemble units and when components are obtained from multiple sources.

A typical integrated device development lifecycle includes many points at which tests should be conducted to verify performance and ensure proper design. Consider the following steps involved in creating a modern powered speaker system.

Step 1—The OEM's R&D team selects a driver.

The R&D team confirms the driver's specifications from the driver manufacturer, capturing Thiele-Small (T-S) parameters and inputting them into modeling software. A prototype enclosure is constructed to confirm predictions, including listening tests with actual driver samples.

Typical tests and techniques include:

- Capture data and calculate T-S parameters
- Test for driver Rub & Buzz
- Test enclosure for air leaks
- Check driver polarity
- Use standard audio parameters to measure a completed system's response:
 - Frequency response
 - Phase
 - Impedance
 - Distortion

A system dedicated to electroacoustic tests is typically used to measure these results. The test configuration, stimuli, and results must be captured for export to other test and reporting systems. Errors must be avoided when moving from one test setup

to another, ensuring that conditions and units are in complete alignment.

Step 2—The driver manufacturer performs production tests. Each loudspeaker driver is tested for essential parameters and an absence of defects prior to shipping to OEM or CM customers.

Typical tests and techniques include:

- Capture and compare selected T-S parameters to the "golden unit"
- Test for driver Rub & Buzz
- Check driver polarity

Both the driver manufacturer and the customer must agree on the test configuration, stimuli, and results to ensure acceptability. This agreement must be clear and verifiable, with tests that both parties can identically conduct.

Step 3—The OEM's R&D team designs the product. The OEM's R&D team designs a system that drives the loudspeaker and the enclosure. The system must also offer analog and digital input methods and will frequently employ DSP to manipulate the signal, using dynamic EQ and compression techniques to achieve the desired performance.

The design team must select ADCs and DACs, design or select a Class-D amplifier module, and design a power supply scheme that will avoid problems with crosstalk and noise. The entire system must be evaluated and adjustments must be iterated to achieve the best performance balance under simulated-use conditions.

Typical tests and techniques include:

- Test analog inputs prior to digital stages for common audio parameters
 - Frequency response
 - Total harmonic distortion plus noise (THD+N)
 - Intermodulation distortion (IMD)
 - Crosstalk
 - Dynamic range
- Test performance of ADCs
 - Connect directly to I²S lines
 - Residual noise
 - Distortion
- Test DSP performance
 - Connect directly to I²S I/O lines
 - Characterize programmed dynamic response (compression)
 - Test programmed frequency response
 - Test programmed phase and time delays
 - Distortion
- Test DAC performance
 - Connect directly to I²S inputs
 - Connect directly to analog outputs
 - Residual noise
 - Distortion

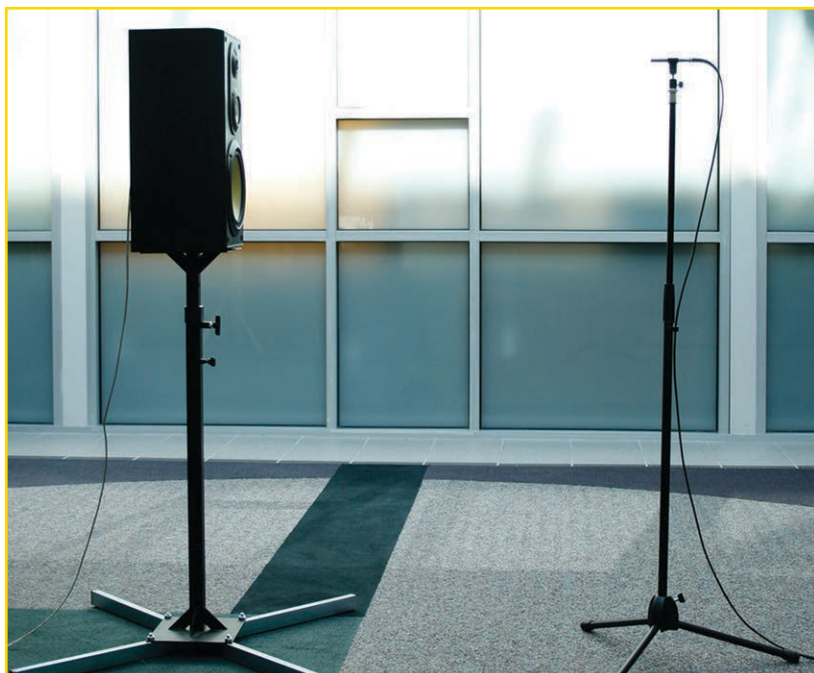


Photo 3: An Audio Precision microphone and speaker are shown.

- Test power amplifier
 - Connect directly to analog I/Os
 - Frequency response
 - THD+N
 - IMD
 - Power delivered to loads
- Check for system interference
 - Wideband (1 MHz) analog analysis of system noise to test for Class-D switching artifacts
- Test speech quality (if device involves telephony)
 - Configure complete speech path
 - Conduct perceptual objective listening quality assessment (POLQA) or perceptual evaluation of speech quality (PESQ) tests
- Test completed device
 - Verify that all user connections are valid and meet requirements:
 - Analog
 - Bluetooth (if present)
 - HDMI (if present)
 - S/PDIF (if present)
 - USB (if present)
- Test electroacoustic performance and define limits for production tests
 - Frequency response

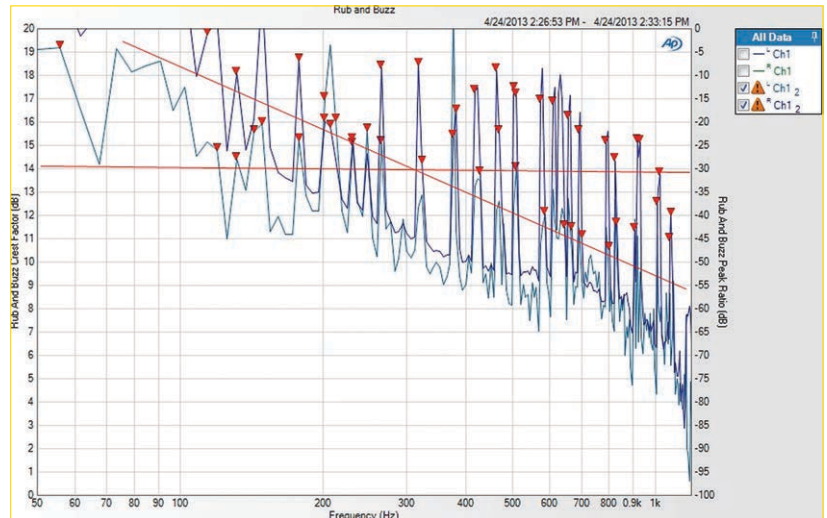


Figure 1: APx Rub & Buzz results show driver failure with both high crest factor and peak ratios.

- Distortion
- Rub & Buzz
- Air leaks

The tests are conducted and coordinated within a team whose members have diverse skills. Rapid,

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VOLUME 24, ISSUE 10

VOICE COIL

THE PERIODICAL FOR THE AUDIO INDUSTRY

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New Plan (Planot)
Invented by the Planot group, unique geometry, in a diaphragm triangle shape.

A Message from Ed Dell

Ed Dell, Inc. is in a wonderful transition... will have been acquired by the Elektor group... and our list of books and CDs. I am in fine health... it is in time to hand the reins to others... for a long time and my love for the press is undiminished. I am deeply pleased ab...



Photo 4: Audio Precision's APx525 analyzers provide typical THD+N at -108 dB (-110 dB with the AG52 option) offering high-quality analog performance.

clear communication and feedback about the DUT's performance is key to the timely delivery of the completed design with a minimum of errors. Accurate capture, interpretation, and manipulation of the results should not be impaired by layers of translation among the individual team members.

This process's ideal conclusion yields a "golden unit" product sample that meets or exceeds all expectations, and from which a set of results may be captured as a reference for production purposes. The audio test system should be capable of storing this data to define performance limits used in automated testing on the production line. Confidence in any "golden unit" must be unquestioned if it is to be of value (see **Figure 1**).

Step 4—The OEM performs incoming quality assurance (QA) on drivers for production. Once a product enters production, incoming drivers from a manufacturer are tested before they are assembled into an integrated product to reduce subsequent costly rework. This procedure should be completely automated for speed and error reduction.

Typical tests and techniques include:

- Capture and compare performance metrics to "golden unit"
 - Impedance
 - Selected T-S parameters
 - Frequency response
 - Rub & Buzz
 - Driver polarity

Again, the driver manufacturer and customer must agree on the test configuration, stimuli, and results to ensure acceptability. This is more easily accomplished when a common audio test platform is used, enabling for one-on-one result comparisons without ambiguity.

Step 5—The OEM performs a production test. Using a tested product design, the R&D team can pass acceptable performance limit data to production, where a subset of tests can be run to verify product performance. At this stage, complete automation that accommodates any user interactions becomes a critical component of test strategy.

Typical tests and techniques include:

- Test all user-accessible I/O pathways against defined limits
 - Analog inputs
 - Bluetooth (if present)
 - HDMI inputs/passthrough (if present)
 - S/PDIF (if present)
 - Headphone jacks (if present)
- Test electroacoustic performance against defined limits
 - Frequency response
 - Distortion
 - Rub & Buzz
 - Air leaks

The production test system must accurately capture the requirements developed during the R&D phases of each operation (e.g., analog signals, digital I/O and processing, and electroacoustic performance). Single-platform use can streamline and simplify this process, eliminating errors when generating and interpreting results from disparate systems.

The Product Lifecycle

The product lifecycle illustrates the breadth of test requirements demanded by today's integrated audio products. From classic analog electronics through digital processing and connectivity to acoustic output, the device must be tested at many different points during the development and production processes using different I/Os, measurement types, and speed requirements. When a truly converged test platform is present at each point and at each step, it can provide the depth necessary for R&D insights and the fast time to results demanded in production, each with high levels of confidence.

The idea of multifunction test platforms is not new outside the audio realm, but even then such systems often require extensive assembly and programming before any benefits of the single-platform approach may be realized. While flexible, such systems do not enforce the consistency that saves time and money over time.

The APx family of analyzers to provide a modular, scalable platform that covers nearly every audio format and measurement type. APx analyzers use a single, powerful software package that automatically recognizes and integrates every I/O module, providing proper configurations for each audio measurement type with advanced algorithms (see **Photo 4**). Guesswork is reduced to a minimum. All procedures may be completely automated, using the built-in test sequencer or via an application program interface (API) from external applications. The result is a system that scales in both scope and speed to cover modern integrated audio products from conception to delivery. *LIS*



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More Bang for the Buck

By
João Martins

audioXpress Editor-in-Chief

To provide useful insight about the speaker and audio industries in general, we have combined several market data sources, cross referencing that information with our own impressions from recent trade shows such as the International Consumer Electronics Show (CES) 2014, the National Association of Music Merchants (NAMM) Show 2014, and the Musikmesse and the Prolight+Sound 2014 shows in Frankfurt, Germany. The results may inspire industry confidence about future opportunities and the ability to leverage existing market trends.

The global audio market is proving to be relatively recession-proof as it goes through an important transition following the digital mobile revolution and the growth in personal and wireless devices. These changes are affecting all industry segments, from new consumer electronics to new market trends in professional audio. Basically, the traditional record industry's demise was followed by new opportunities in digital lifestyles and generalized growth in

a variety of live entertainment. This industry has shown strong signs of resiliency to market recession and global economic uncertainty and continued to grow in the last four years, despite some decline in traditional areas such as home audio separate components and Home Theater in a Box (HTiB) solutions. Even Blu-ray players and video games, which provided good sources of revenue for complementary audio systems, are now in decline.

However, new feature-rich streaming and wireless devices for the home, the boom in the soundbar category and Bluetooth/AirPlay speakers and devices have largely compensated for those decreases. There are also promising signs the network revolution will finally bring growth to the residential market, mainly with the expansion of wireless distributed speaker systems and home theater systems.

From home to mobile devices, the audio industry is expanding into new product segments while the continuous popularity of semi-professional equipment (e.g., DJ and home recording products) is producing an interesting marketing cycle that affects consumer categories (e.g., headphones/earphones) all the way up to a new generation of portable sound reinforcement solutions.

At the same time, the consumer appetite for new audio technologies implies important changes in the distribution channel and e-commerce is projected to continue rising during the next five years. According to the industry research firm IBISWorld, in the US, a recession-induced dip in disposable income resulted in a drop in industry revenue despite recent growth in the audio equipment retail market. Although new technology has made products more profitable, it has also increased the prevalence of online retailers.



Auris, a Santa Clara, CA-based startup with a passion for wireless technology, began with a Bluetooth receiver introduced on Kickstarter in 2012. The receiver sold more than 11,000 units in 17 countries. In 2013, Auris launched skye, another Wi-Fi receiver for music docks, and reached its \$65,000 Kickstarter funding goal on the first day. Auris is currently selling its new freeDa compact Bluetooth music receiver. (www.theauris.com)

According to IBISWorld industry analyst Deonta Smith, new technologies have bolstered and competed with the retail market since 2008. “On one hand, audio equipment quality has improved and the equipment is increasingly compatible with other electronics,” says Smith. “On the other hand, consumer electronics, cars, and other products have improved built-in audio systems, which have made audio equipment an increasingly discretionary purchase. Consequently, technology change is expected to support profitability for retailers with high-end or high-volume sales of audio equipment. Most of all, technology has brought about a rise in e-commerce and its prevalence has led to an influx of audio equipment e-tailers.”

Digital Music

Music is obviously the main cause for the recent market changes and the reason why it is important to examine the recent “Recording Industry in Numbers” (April 2014) market report and trends from the International Federation of the Phonographic Industry (IFPI).

According to the IFPI report, providing data for 50 territories, global digital revenues in 2013 totalled \$5.9 billion with subscription stream revenues more than tripling to \$1.1 billion in the last three years. Six of the top 10 markets saw growth in 2013, while in eight of the top 20 music markets, digital—including file downloads, streaming, and subscription services—is now the dominant revenue source. Digital revenues are also growing because of the increase of licensed services and the move to mobile. Latin America has the fastest digital growth in recent years, with revenues up 124% between 2010 and 2013.

According to Frances Moore, IFPI’s chief executive, “The broad picture that emerges is of an extremely diverse industry. Most of our major markets have stabilized, digital continues to grow, revenue streams have diversified, and we are starting to deliver on the huge potential in emerging markets.”

Overall, globally recorded music trade revenues declined by 3.9% in 2013. This was heavily influenced by the 16.7% decline in Japan, a market where physical format sales only now have started to decline. Excluding Japan, global revenues were essentially flat, declining by 0.1%. Europe saw growth for the first time in 12 years and the market also increased in value in North America and Latin America.

The US remains the leader of the top 20 markets and saw consolidation in 2013. The



Grain Audio’s Packable Wireless Speaker (PWS) system uses Waves MaxxAudio DSP technology to create a portable, Bluetooth-enabled speaker system that features proprietary loudspeakers and passive radiator transducers housed in an acoustically rich walnut cabinet. (<http://grainaudio.com>)

top six markets in Europe—France, Germany, Italy, Netherlands, Sweden, and the UK—all saw growth. There was strong digital growth in many emerging markets, while revenue from digital channels increased by 4.3% in 2013 and now accounts for 39% of the overall industry trade revenues. Downloads remain the biggest digital revenue source, accounting for 67% of the digital market in 2013.



Monster introduced its DNA Pro Wireless headphones at the Consumer Electronics Show (CES) 2014 in Las Vegas, NV, adding advanced wireless Bluetooth capabilities—embedded advanced audio coding (AAC) for iOS devices and APT-X for Android devices—active noise cancellation (ANC), USB digital audio, and a new buttonless touch-sensing user interface. (www.monsterproducts.com)

Subscription service revenues surged by 51.3% in 2013, surpassing the \$1 billion mark for the first time. Global revenues from subscription and advertising-supported streams now account for 27% of digital revenues, up from 14% in 2011. It is estimated that more than 28 million people worldwide now pay for a music subscription, up from 20 million in 2012 and just eight million in 2010.

Clearly, the audio industry needs to better support this consumer landscape, where music consumption is no longer dependent on physical media (e.g., CDs). The market's appetite for new generation headphones/earphones is strong, and there is still a large potential for high-quality downloads, high-resolution players, and music servers. Probably the most important and promising transition will be in the automotive industry, as the new in-car digital systems (e.g., Apple's already-promoted CarPlay concept) will show.

According to ABI Research, streaming music services have shown that there is a market for personalized radio and on-demand subscription-based services via PCs, laptops, and smartphones. Now these companies are turning their attention to cars and seeking ways to offer their services to motorists, moving into territory the traditional radio stations have held sacred for decades.

"FM broadcasting still dominates in-car listening today, but it is likely that this will gradually diminish in favor of streamed radio and

music services as an increasing number of cars become connected," comments Gareth Owen, ABI Research's principal analyst. This trend is already happening in some markets (e.g., the US). "It is now clear that digital radio via DAB/DAB+ and HD Radio is unlikely to ever become as widespread as FM on a global or even regional basis and so car OEMs will need to include FM receivers in their infotainment products for many years to come."

ABI Research forecasts that global shipments of streaming music-enabled automotive infotainment systems will exceed 66 million by the end of 2019, which represents around 93% of all connected car infotainment shipments.

A key advantage of streaming music services is that they can offer targeted advertising services for which advertisers will pay a premium fee. "Some players such as HARMAN's Aha Radio are already testing location-based advertising and Pandora recently started to run 15- and 30-s car-specific audio ads across all vehicle brands and automotive devices that have the Pandora app pre-installed," adds Owen. "This means advertisers can run car-specific campaigns, targeting listeners who are typically the most engaged with what is being broadcast."

Continuous Growth Forecasted

According to most market research studies, the global audio market is growing at almost 10% per year, and is estimated to reach a \$20 billion value by 2018, fuelled by technological developments, product innovation, and demand for high-quality content, according to the Global Industry Analysts research firm. A growth in audio equipment investments is attributed to several factors including recuperating income levels post recession; a widening consumer base in Middle East, Latin America, and Asia-Pacific; a growing number of technological developments in terms of Bluetooth- and Internet-compatible streaming and networking devices; and the popularity of music applications (e.g., iTunes Radio, Google Music, Spotify, iCloud, Pandora, and Deezer).

In the consumer space, home audio equipment represents the next largest market after television in the overall consumer electronics industry. Changing media consumption habits have resulted in a paradigm shift in the home audio equipment market toward speaker docks for audio playback (initially), followed by soundbars and wireless connectivity, as consumers want to remain connected on smartphones and tablets.

Europe still represents the largest regional market for home audio equipment in value and



Danish brand Audiovector successfully introduced a new range of high-end wireless streaming amplifier modules for its loudspeakers, promoting connectivity with any Bluetooth device. (<http://audiovector.com>)

volume. However, the US is expected to register the fastest growth in the global home audio equipment market, in value terms, reflecting a compounded annual growth rate of more than 3.1% during 2014. Asia-Pacific spearheads global growth in volume terms.

Asia-Pacific, the Middle East, and Latin America are all showing rapid growth. These regional markets are benefiting from extensive urbanization and increasing disposable income. Markets in developed countries are more mature with most households equipped with home audio systems, fueling the demand for electronic products and digital goods in particular. Consumers are demanding faster web connectivity to benefit from high-speed data streaming, Internet-only entertainment, and cutting-edge music storage equipment.

ABI Research expects the market for in-building wireless equipment and deployments to grow to more than \$8 billion in 2019, up from a forecasted \$4.4 billion for 2014 representing a 14% compound annual growth rate (CAGR). Worldwide home network penetration is expected to climb from 24.8% in 2013 to 33.2% by 2018. Growth is driven by the continued spread of broadband services and demand for multiscreen video services.

According to a study from Futuresource Consulting, the worldwide home audio market—comprising wireless speakers, speaker docks, AV receivers, integrated audio systems, and soundbars (units containing multiple speakers intended for TV use)—should have achieved a 10% growth in 2013 and continues to exert a positive force on the home consumer electronics segment. In 2013, according to Rasika Iyer, a research analyst at Futuresource Consulting, “home audio products shipped around 60 million units worldwide, with a trade value of \$7.3 billion. At a time when many segments of the consumer electronics (CE) industry seem to be driving with the brakes on, home audio represents an enormous opportunity for manufacturers and retailers alike.”

Wireless speakers and speakerbars/soundbars lead the charge, currently growing at 181% and 81%, respectively. The market is also witnessing a transition away from dedicated speaker docks to wireless speakers, with dock shipments expected to continue to quickly decline in 2013 (the decline was more than 20% in 2013).

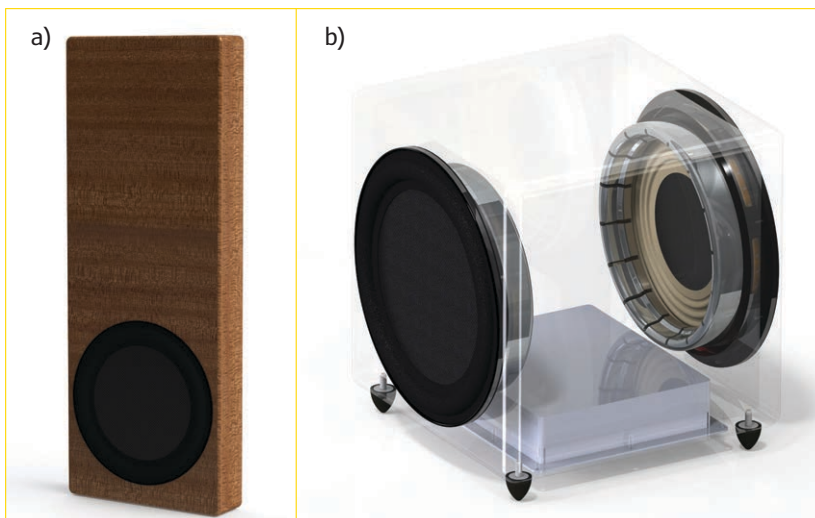
According also to Iyer, the “highly fragmented and increasingly competitive” headphones market is anticipated to continue to grow until 2017, “as



Wireless technologies are inspiring new concepts. French company AwoX created the StriimLIGHT, an LED light bulb with a built-in 10-W speaker, Bluetooth, and Wi-Fi. (www.awox.com)

the market saturates at one set of headphones per 6.6 audio devices in use, including smartphones, tablets, and home audio systems. However, the worldwide retail value is forecast to grow 5% CAGR from 2013 to 2017, due to further increases in the average selling price, with the demand for premium over-ear headphones expected to continue growing more quickly than the market.”

While in-ear headphones continue to dominate the headphones market in volumes, the more



Prescient Audio, an American loudspeaker technology company, made headlines during the Consumer Electronic Show (CES) 2014 with its patented TD-12 subwoofer and full line of ThinDrivers (a). Claiming the most radical loudspeaker design development in 90 years, the TD-12 is a high-performance, 600-W (1,000-W,) loudspeaker that repositions the components from the traditional location behind the loudspeaker to the speaker’s perimeter (b). The design minimizes depth without sacrificing performance quality. (www.prescientaudio.com)



Philips was honored with the prestigious 2014 International Consumer Electronic Show (CES) Innovations Design and Engineering Award for its Fidelio E5 wireless surround cinema speakers. The speakers were deemed a “Best of Innovations” in the Home Theater category. The E5 is an elegant home cinema audio solution for consumers who want high-definition surround sound without the wires, using near-field communication (NFC) for one-tap pairing of devices, aptX, and advanced audio coding (AAC) Bluetooth streaming. (www.philips.nl)

expensive on-ear and over-ear segments, are also growing, especially in the US and Europe. Also, new headphones with microphones will continue to grow, reaching 41% of shipments in 2017, fueled by smartphones, business users, and commuters.

Going Wireless

According to the latest studies from the Consumer Electronics Association (CEA), nearly one in five (16%) consumers own a portable wireless speaker. Currently, one in 10 consumers owns a wireless multi-room audio (MRA) product, but nearly half of non-owners (44%) indicate an interest in owning one. Portable wireless speakers (e.g., Bluetooth speakers) are also poised for growth, as 28% of consumers plan to purchase a related product in the next two years. Additionally, 91% of wireless MRA product owners and 85% of portable wireless speaker owners would recommend their products to someone else.

In fact, portable speakers represent an important accessory for consumers who use smartphones or tablets. According to ABI Research, this segment is expected to grow from more than 47 million units in 2013 to nearly 61 million by 2018, reaching more than 50% of the market by the end of 2018.



JBL Professional’s LSR 3 Series of affordable studio monitors leverages the unique technology developed for its flagship M2 Master Reference Monitor and includes the patent-pending Image Control Waveguide. The range was expanded in 2014 with the LSR310S Powered Studio Subwoofer, delivering an impressive low-frequency response below 27 Hz. (www.jblpro.com)

ABI Research Practice Director Sam Rosen states “The digital speaker market is particularly intriguing because it parallels two growing markets—mobile devices and digital music services. As these markets evolve and consumer behavior changes, it is quite possible our forecast with a 5.3% CAGR from 2013 to 2018 could prove to be rather conservative. Most notably, the wireless portable speaker market could be poised for much stronger growth than our current 22.9% forecast.”

Primary listening locations for wireless audio solutions are the living/family room (47%) and the bedroom (28%), but 25% of consumers say their primary listening area is a different room in the home.

With the growth of affordable wireless audio devices, industry analysts also predict an important opportunity to associate smartphone contracts with premium streaming services (e.g., Spotify) with audio hardware provided for home and car use, which is something Yamaha, Pioneer, and Sonos already provide.

Feature phones, smartphones, and tablets shipped more than 1.9 billion units combined in 2013, according to ABI Research. However, the quality of an audio experience holds many opportunities for technology advancements, from high-definition voice delivery to new smart audio accessories that complement the new generation wearable devices.

According to ABI Research’s Senior Practice Director Jeff Orr, “As users customize and personalize their mobile device, they increasingly want a better audio experience.” New-generation mobile devices will rely on dedicated audio processors to address a broader range of usage environments, such as adapting in near real-time to current conditions. The company also predicts aftermarket audio headset revenues will grow more than 50% to reach \$1.4 billion annually in 2019.

The big innovation for mobile devices is the emergence of smart audio accessories that bring audio closer to the user and “deliver on the promise of the wearables market with an immersive computing experience that is both fun and useful,” adds Orr.

The emergence of numerous Bluetooth products will continue to bolster the wireless speaker market. Currently accounting for 82% of wireless speakers, it is expected to continue to be a popular choice in the next few years. With the continuous Bluetooth Smart (4.X) expansion and the development kit availability for sophisticated



Fohhn Audio’s Linea Focus is an active mini line array system with beam-steering capability for speech and music. The speakers’ vertical sound inclination angle can be adjusted between $\pm 40^\circ$, in precise 0.1° steps. The vertical beam width can be adjusted between 0° and 90° . (www.fohhn.com)

implementations as introduced by Apple’s recent series of “i” devices, there is no question this technology will continue to attract consumers.

As noted in the Futuresource study, “Driving this is the fact that consumers can connect wireless speakers to smartphones for music listening, while at the same time not having to



Duran Audio was the pioneer in vertical array speakers with its Digital Directivity Control (DDC) and advanced Digital Directivity Synthesis (DDS) beam-steering Axys Intellivox solutions. HARMAN Professional acquired the Dutch company in 2013. (www.duran-audio.com)



Sennheiser's LSP 500 PRO wireless PA system received an iF Product Design award, impressing the international jury of experts from the International Forum Design with its combination of form and function. (www.sennheiser.com)

part with their smartphones; contrary to speaker docks, where the consumer cannot use the phone when it is docked."

And more than Bluetooth, Wi-Fi is promising to change the convenience in audio for consumers. There is no question that this wireless networking technology is going to dominate many application categories, not only in home-audio speakers but also in car or even semi-pro applications. It has

already begun happening with musician's wireless systems and is being adopted in portable PA solutions and music controllers.

With spectrum being reinforced for Wi-Fi around the world (1 and 5 GHz, and others), the ubiquity of wireless LAN solutions for many applications, including streaming audio, will continue to drive double-digit sales growth rates, as projected by the Wi-Fi Alliance. Wi-Fi's importance in the audio industry is set to continue fostering growth in many new product areas and applications, while the emergence of multi-gigabit point-to-point wireless will soon enable high-quality audio streaming in tandem with uncompressed HD video and more. With industry anticipation of the wireless gigabit (WiGig) 60-GHz technology, the Wi-Fi Alliance predicts an explosion in wireless connectivity applications, including integration with existing Wi-Fi solutions.

According to ABI Research, the yearly Wi-Fi shipments will reach almost 3 billion in 2016, growing at a compound annual rate of 14%. The consumer electronics category led Wi-Fi sales growth at nearly 42%.

Wireless speakers offer the convenience of portability, and multi-room audio based on Wi-Fi solutions, as already demonstrated by brands such as Sonos, Sony, Bose, and Samsung and many others. Dozens of brands are also expected to launch multi-room solutions in 2014.

From Consumer to Professional Audio

While we can clearly identify several disruptive technologies in the consumer audio space, it is more difficult to spot the existing trends pushing the professional audio speaker industry forward. The pace of innovation is more diverse but fragmented, sometimes clearly drawing from consumer technologies, many other times being the source for new fashions and lifestyle trends.

As we could clearly see from trade shows (e.g., the NAMM and Musikmesse/Prolight+Sound 2014), the music industry continues to draw talent and introduce pop culture phenomena, which in turn inspire consumer brands to hire famous musicians and producers. But while musicians, DJs, and producers voluntarily endorse the technologies needed for their work, they charge consumer brands to use their names. Still, the audio industry seems to have rediscovered the celebrity effect to engage with new generation of consumers (e.g., Beats by Dr Dre).

At CES 2014, we saw how a famous name—Studio Mastered Sound (SMS) Audio, the brand



DEVA is Powersoft Audio's radical new speaker concept. The design combines audio messaging, video capturing, a microphone, a presence detector, a twilight switch, temperature/humidity/pressure measurement, and LED lights in a battery-powered, solar-power rechargeable solution. (www.powersoft-audio.com)

promoted and owned by rapper 50 Cent, and The House of Marley audio range, created by Bob Marley's family—can help gain access to retail stores, but the inspiration comes from technology and function as much as style and lifestyle. Using the technology they've admired from studio, club, and stage environments, celebrities can be a powerful marketing asset for the new digital generation.

But apparently even well-recognized pro audio brands need to leverage those relationships with artists in more meaningful ways. A good example is Australian brand Audiofly's endorsement by famous DJ Tiesto in its Club Life headphone series, shortly after he helped promote AKG's Tiesto Signature Headphone range.

In other product categories (e.g., recording interfaces, studio monitors, and DJ gear), the endorsement/sponsorship equation seems to be more effective and less expensive, following the tradition from musical instrument (MI) manufacturers.

For other professional audio categories, sales are generated more by the well-proven combination of a constant flow of technology innovation, product updates, and well-targeted marketing.

In the pro audio industry, every driver and speaker components manufacturer needs to find its own way to innovate materials, construction, and design. For decades, pro audio manufacturers have simply wanted better-sounding, more efficient and less expensive components for their products.

The interesting thing seems to be the way different market segments address those equations. Some designers and brands clearly target exclusive, less price-sensitive market niches, while others aim for high-volume sales—if their marketing works the way they intended, which seldom occurs. That is why it's interesting to look at the different approaches from leading brands with regard to speaker applications.

From the speaker component manufacturer's perspective, most of the companies respond to their customer requests by designing more-or-less customized solutions, and implementing their different levels of technology innovations and exclusive processes. They use those OEM requests to fine tune their market priorities and define market trends. The "consultancy" process often results in the introduction of standard products based on the more efficient designs as soon as the exclusive agreements allow it. As



K-array's Anakonda KAN200 is the first bendable loudspeaker. It can be wrapped around poles or mounted to uneven surfaces. Each element is 2 m (6.6') in length, and can be daisy-chained to form one seamless sound line. (www.k-array.com)

Andrew Richardson, FitalPRO's sales manager, says, "Tomorrow's standard product is today's custom product."

That is the main reason—together with the rare introduction of disruptive new materials (e.g., beryllium or neodymium)—why the audio industry moves in cycles. Often some brands emerge and evolve depending on the success of those well-received design achievements, and they are soon challenged by another brand and or competitive product.



Marshall Headphones, the Swedish company that licensed the famous British brand for consumer products, introduced the Stanmore Bluetooth speaker/guitar amplifier concept in 2013. (www.marshallheadphones.com)



The VOX SoundBox Mini is marketed as a grab-and-go mobile media player with optional battery power and instrument input for guitar, bass, and keyboard, plus integrated effects. (www.voxamps.com)

It appears the latest speaker production trends are related to the pace of various market segments. The consumer audio market is currently “crunching” new—although not necessarily very sophisticated—designs and concepts at fast pace, while the pro audio segments is moving in slower and larger four-to-five-year product cycles.

Live sound solutions, for instance, clearly show four main areas of recent expansion: large-size PA solutions for auditoriums, stadiums, and arenas where line arrays and line source systems dominate; portable PA solutions, preferably active; medium compact installation or event-oriented systems; and small-size installation oriented speakers.

In all those application areas, loudspeaker requirements have risen over the past few years with regard to weight, size, power, handling, accessories, scalability, flexibility, and sound. All these requirements are now equal-influencing factors that need to be considered since they are expected by demanding users.

Of course, meeting the performance specifications and requirements for specific markets requires a strong focus during development because they involve complex tests and performance and regulatory verifications. It is an area where recent computer design, simulation, and analysis tools, together with better quality

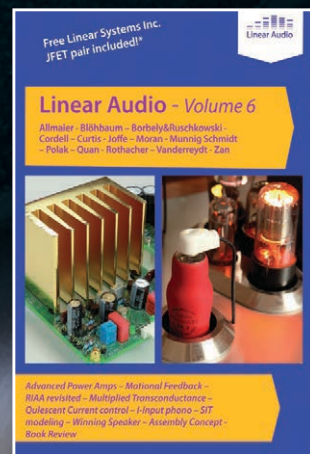
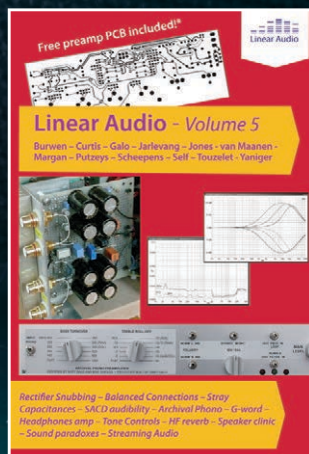
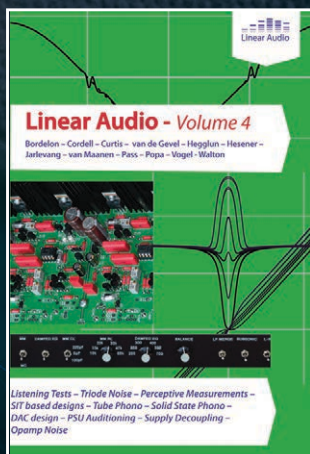
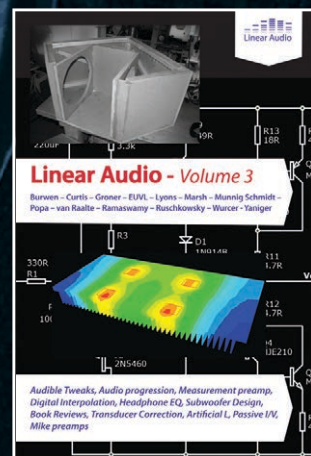
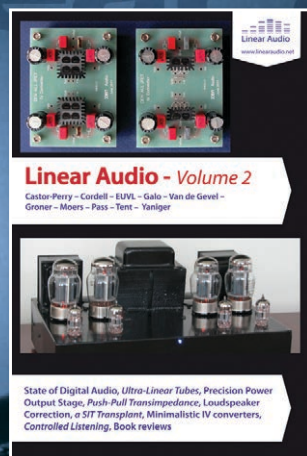
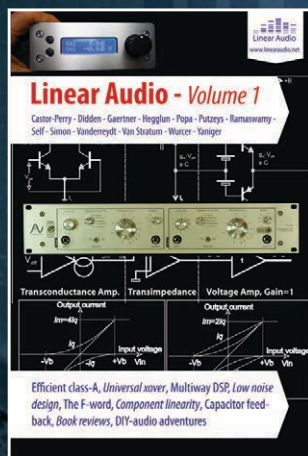
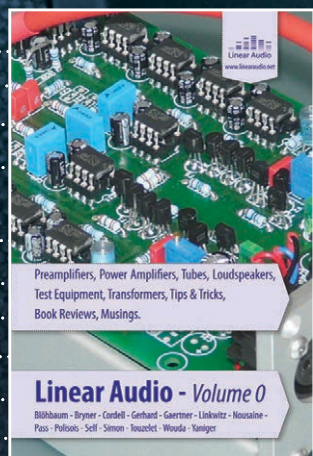
control and test and measurement solutions, are helping to accelerate with the introduction of more sophisticated solutions.

A prime example of how those factors have created a new market trend is the prevalence of line source and line array solutions for professional audio applications. They were recently complemented by the resurgence of vertical active speaker arrays, which combine sets of high-performance drivers with Class-D amplifiers and specially developed multichannel DSPs for beam-steering capability. Algorithms and software audio tools help predict, configure, and control different coverage needs by combining several speakers in a network. The Netherlands-based Duran Audio (recently acquired by HARMAN Professional) successfully used this formula to create Digital Directivity Synthesis (DDS). Other leading manufacturers in the pro audio arena (e.g. Fohhn Audio from Germany and Renkus-Heinz from California) have also found success using these tools.

Italian company K-array with its Anakonda KAN200, which claims to be the first bendable loudspeaker ever to be produced, is a recent example of radical innovation and new application concepts for pro audio speakers. In practice, a flexible speaker array, enabling sound in nonconventional places (indoor and outdoor, portable and installation) opens the possibility of wrapping the speakers around poles or mounting it to uneven surfaces. Each element is 2 m (6.6') in length, and can be daisy-chained using the integrated NL4 connectors to form one seamless sound line over 64 m (200') in length. The speaker's dedicated presets enables it to be used either on its own or combined with K-array subwoofers.

K-array does not seem to have stopped there and is currently promoting many other advanced solutions. The ultra-slim Kobra Series 3-D array loudspeakers are 100 and 50 cm in length, respectively, enabling vertical and horizontal line-array configurations. The ultra-compact Python passive speaker features 3" drivers with variable beam functionality housed in a sturdy stainless steel chassis. The new Tornado is a miniature 2" point source multipurpose loudspeaker designed for high-quality distributed systems. K-array also designed the miniature-range Piccolo, with two 3.6" mid- to high-range speakers and a compact subwoofer that practically disappears in any room.

Another innovative example comes from Powersoft, a reputed Italian manufacturer better known for its Class-D amplifier catalog.



Linear Audio

is an incredible series of bookzines dedicated to technical audio and perception. Each book offers everything from tutorials to circuit and system design, to test reports and book reviews. Volume 6 is now available and ships with a free JFET pair!*

*Courtesy of Linear Systems, Inc. while supplies last.

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The Firenze-based company recently introduced a new speaker concept called DEVA, which combines audio messaging, video capturing, a microphone, a presence detector, a twilight switch, temperature/humidity/pressure measurement, and LEDs. The solution enables uninterrupted use powered by a single internal rechargeable battery connected with a latest-generation solar panel can quickly recharge the battery even in low-light conditions. An ideal solution for outdoor applications, the DEVA can connect to a configure/control device such as a tablet or smartphone, or to a network-connected PC via Ethernet, Wi-Fi, or GPRS. The market has still to absorb all the potential from this new design.

Resources

ABI Research Future Immersive Computing Research Service, "Automotive Infotainment Research Service," 2014, www.abiresearch.com.

——, "Audio Advancements for Mobile Devices," 2014, www.abiresearch.com.

——, "Set-Top Box and Home Networks, First Screen Video Devices, and Wearables," 2013, www.abiresearch.com.

American Audio Visual (American AV), www.aavevents.com.

The British Audio-Visual Dealers Association, <http://bada.co.uk>.

Companies and Markets, "Home Audio Equipment: A Global Strategic Business Report," www.companiesandmarkets.com/Market/Consumer-Goods/Market-Research/Home-Audio-Equipment-A-Global-Strategic-Business-Report/RPT649067.

The Consumer Electronics Association (CEA), "Consumer Perspectives on Wireless Multi-Room and Portable Audio Solutions," 2014, www.ce.org and declareinnovation.com.

Custom Electronic Design & Installation Association (CEDIA), www.cedia.net.

Global Industry Analysts, www.strategyr.com.

IBISWorld, "The Retail Market for Audio Equipment in the US," 2013, www.ibisworld.com.

InfoComm International, www.infocomm.org.

International Federation of the Phonographic Industry (IFPI), "Recording Industry in Numbers," 2014, www.ifpi.org/global-statistics.php.

R. Iyer, "The Futuresource Worldwide Home Audio Market Report," Futuresource Consulting, 2013, www.futuresource-consulting.com.

——, "The Audio Headphones Market Overview," Futuresource Consulting, 2013, www.futuresource-consulting.com.

Wi-Fi Alliance, www.wi-fi.org.

Sennheiser has come up with another remarkable speaker concept, the LSP 500 PRO wireless PA solution. The LSP 500 PRO, which has already received the prestigious iF Design Award, combines up to three receivers for wireless microphones, three wired microphone inputs, USB input, integrated USB player/recorder, a Bluetooth streaming interface as well as an AUX input and output. If more than one loudspeaker is used, one can be defined as the master and connected with the other speakers (the slaves) via a wireless UHF link, using a tablet via Wi-Fi for source and program control.

The LSP 500 PRO System's integrated active speaker design also uses dual batteries (hot-swappable during live operation), opening up a completely new category in portable applications (PA) such as corporate events.

Bluetooth Guitar Speakers

As we have seen in the PA market, speakers are being connected with IP networks, wired and wireless, gaining extra functionalities when remotely controlled by mobile devices, such as tablets. In pro audio, wireless networking is the big thing, enabling audio engineers to actually move around auditoriums and judge the results of their work, even during a live concert.

For musicians, this means extra freedom on the stage, with wireless in-ear monitors or traditional wedge monitors connected to networks, enabling personal mixing for everyone on the stage. It is a trend that originated as soon as Apple's iPad became available, much in the same way it helped revolutionize home entertainment systems and home automation in general.

Now, with mobile devices and touchscreens in the hands of virtually everyone on earth, the audio industry is starting to merge software control using tablets and smartphones with new product categories.

In 2011, the market saw the first iPad-controlled audio mixers—mixing consoles that completely replaced the physical knobs with a touchscreen. Mackie DL1608 and the Line 6 StageScape were among the first, but many others followed. Currently, every single DSP, audio processor, amplifier, mixing console, and even large-sound reinforcement system is remotely controlled—and sometimes, uniquely controlled—by an iPad.

Now, a new guitar amplifier category has also been created, which can be described as Bluetooth speakers integrated in guitar combos or perhaps guitar amplifiers with wireless capabilities.

We think this new product category truly changes the audio landscape. First because it's a new Bluetooth speaker marketed to musicians and sold through music retailers, which can also appeal to demanding consumers. Second, they are truly the first Bluetooth speakers that actually sound nice at higher volumes (even if they come with integrated distortion effects).

One of the first examples was the Marshall Stanmore Bluetooth stereo speaker. However, it was not made by the famous British guitar amplifier brand. It was made by the Swedish company that licenses the brand for the consumer Marshall Headphones lifestyle products. A truly remarkable and well-designed product, it was followed by the Line 6 AMPLiFi, a multispeaker configuration with built-in DSP for tones and effects, in a powerful 150-W model or portable 75-W version. Both Line 6 AMPLiFi models offer a Bluetooth-enabled option for streaming.

Line 6 (a company acquired by Yamaha in 2013) targets the AMPLiFi to the musician market. However, Line 6 also promotes a configuration in which the custom guitar speaker serves as a subwoofer (hence, the difference in sound). With the AMPLiFi, the iOS AMPLiFi Remote app must be used to access a library of amplifier and effect models, which are also available through the integrated online community.

The smaller VOX SoundBox Mini is presented as a grab-and-go mobile media player with optional battery power and instrument input for guitar, bass, and keyboard, plus integrated effects. The VOX SoundBox Mini can also be used with a microphone input for vocalists. It features proprietary Acoustage sound technology in a rugged, die-cast aluminum casing for use anywhere. Available in black, ivory, orange, and green, it is one of those "in the middle" concepts that is probably not very appealing to people other than musicians.

To be fair, we should also mention that Roland was among the first in this market with its Roland Cube Lite with built-in iOS interface. Unfortunately, this small practice amplifier was marketed as such, apparently looking to appeal more to conservative music teachers. Its design does not appeal to a wider audience.

Finally, another remarkable example is IK Multimedia's iLoud portable stereo speaker. Combining the features of a studio monitor and a wireless speaker, rechargeable battery operation (10-h normal usage), and the flexibility of Bluetooth and wired operation, the iLoud clearly appeals to musicians and the mobile generation. According



IK Multimedia's iLoud portable stereo speaker combines the features of a studio monitor and a wireless speaker. The speaker offers rechargeable battery operation (10 h) and the flexibility of both Bluetooth and wired operation. With the performance of a hi-fi speaker, the iLoud delivers 40 W of power and sounds louder than comparable-sized speakers, with a low-frequency extension down to 50 Hz, using a time-aligned two-way system with DSP processing. (www.ikmultimedia.com)

to IK Multimedia, iLoud is marketed to those "wishing to compose, record, and mix anywhere from a mobile music rig." iLoud combines the performance of a hi-fi speaker with 40 W of portable power and a low-frequency extension down to 50 Hz. It uses a time-aligned two-way system with DSP processing and was designed for iPhone/iPad processing and recording, making it a truly portable creation tool. Any consumer who compares its performance against any Bluetooth speaker would not hesitate to buy it, just for pure music listening. *LIS*

Finished Systems (OEM/ODM) & Integrated Audio Products

By
Mike Klasco

(Menlo Scientific, United States)

The audio business has dramatically changed over the years. The home sound system's legacy has been a receiver and speakers. Consoles with a turntable, amplifier, and speakers were marketed to the audio-unsophisticated in the 1950s and 1960s. However, those with audio knowledge purchased hi-fi gear, not consoles. KLH and a few others were market leaders, inducing decent all-in-one turntable audio systems in the late 1960s. But for the last 50 years the "default" serious audio system has been a receiver and speakers.

Perhaps the large flat-screen TVs that shifted the focus away from sound, or maybe people just didn't have space in their living rooms for five channels, let alone six or seven bookshelf speakers. The home theater in a box (HTiB) did not change the configuration, but it began the consumer quest for a single vendor to package all the electronics and speaker systems.

Space and budget did not permit a quality solution for surround sound. Then, the soundbar was introduced, providing an "instant audio" solution. Even earlier than the soundbar came the popular powered subwoofer, which was a precursor to combining enclosure, driver, and electronics. Today, all this is further refined by signal processing and wireless capabilities. Now the "integrated amplified speaker solution" (i.e., the soundbar) dominates audio retail sales. Even wireless capabilities are needed by OEM/ODM vendors as most subwoofers are wireless (no audio cable connection) for plug-in-the-wall outlet and play operation.

Many traditional speaker factories are fading. One-stop shops can supply the enclosure, drivers, and electronics, that have already been tested and boxed. You can sum this up with one word: soundbars, which are dominating the supply chain. To meet the demand, some electronics vendors have moved into integrated solutions. Some speaker vendors have also expanded, merged with electronics vendors, or simply outsource the speakers for inclusion into their finished products. In any case, the typical audio engineer is selecting a finished package or at least picking and choosing from a select menu provided by the integrated solutions provider. *LIS*

Integrated Audio Vendors

Ace International Electronics

Unit 2308, 23th Floor Riley House, 88 Lei Muk Rd.,
Kwai Chung (New Territories Hong Kong)
(P) 852-24230223
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- ACE manufactures a range of Bluetooth speakers, docking stations, and Bluetooth soundbars. The Waves Maxx is offered for signal processing

ADX

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adxaudio.com

China Office

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Futian District, Shenzhen, Guangdong, China

- The ADX team has decades of accumulated industry knowledge related to design, materials, production techniques, construction, marketing, service, and sound. ADX is the original innovator of the top-selling soundbars in the US. Its design and engineering teams are based in the US and China. Its products include soundbars, wireless subwoofers, and other integrated audio products.

Ailipu

Block A2, Lanbao Industrial Park, Ditang Rd.,
Shajing Town, Baoan District, Shenzhen, China

Shingle Bashan, Sandmen County, Taizhou City,
Zhejiang Province, China, 317101
Robin Lee, Sales Manager/Marketing Dept.
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sales@speakerailipu.com
www.szailipu.com

- Ailipu offers a range of ODM products including Bluetooth soundbars, full-size soundbars, subwoofers (wired and wireless), and other powered speaker audio products. Signal processing is provided by the Waves Maxx algorithms for EQ, bass processing, spatial processing, and so forth.

Beautiful Enterprise Co., Ltd.

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Central, Hong Kong,
Anthony Kwok
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www.beautiful.com.hk

- Beautiful Enterprise is a large (more than 5,000 employees) and well-established company that manufactures docking stations, Bluetooth speakers, soundbars, and other integrated audio electronics. The company outsources its speakers.

Eastech (Eastern Technology Holdings, Ltd.)

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www.eastech.com

- Eastech is a large public vertically integrated audio electronics manufacturer with more than 3,500 employees who work with several well-known audio customers. Eastech has a comprehensive portfolio of technology licenses, including DTS and Dolby, which simplifies the task of adding these higher-end features to OEM and ODM products.
- Eastech includes a large-scale wood enclosure factory, an injection molding factory, and an affiliated cone manufacture. The company also offers electronics manufacturing and extensive OEM and ODM design capabilities. It operates

a large headphone and earphone operation. Eastech recently established New Premier Sound Group (PSG) to provide western management and engineering resources for upscale customers with competitive pricing.

ESTec Systems Corp.

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Korean Head Office
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Korea
(P) 055-370-2200
www.estec.co.kr:40002/eng

- Established in 1971 as a joint Korean venture between LG and Foster, ESTec is now an independent company but still has some affiliation with Foster. ESTec has factories in China, Korea, and Vietnam. Aside from integrated electronics, ESTec also makes automotive audio speakers.

GGEC

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Dave Cox, Vice President Business Development
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Hong Kong Subsidiary
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www.ggtec.com

- GGEC is one of China's oldest and largest speaker companies. In recent years, GGEC went public and acquired several audio electronics factories. Now GGEC offers a full range of soundbars, powered subwoofers, Bluetooth speakers, and related products.

Hansong Technology, Ltd.

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- Hansong is a sophisticated audio manufacturer focused on electronics and wireless. The company outsources its speakers. Hansong is known for its advanced signal processing, amplifier design, subwoofer plate amplifiers, Bluetooth and AirPlay docking stations, advanced high-definition multimedia interface (HDMI) capabilities and other popular products.

Meiloon Industrial Co., Ltd.

23121 Verdugo Drive, Suite 204, Laguna Hills, CA 92653
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info@meiloon.com
www.meiloon.com

- Meiloon was founded in 1973 and it is now a leading ODM/OEM manufacturer for high-end audio systems and loudspeakers. For the past 35 years, Meiloon's manufacturing capacity has included four sizable factory parks in Taiwan and China (Suzhou and Guangdong), and it has established global sales and service offices throughout the world. Starting in 2003, Meiloon expanded its product lines into video- and optical-related business areas with the goal to serve as the only source for high-end audio and visual display areas. Meiloon was listed on the Taiwan Stock Exchange (TSE) in 2001 under TSE code 2477.

Merry Electronics Co., Ltd.

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Charlie Yang, Sales Manager
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www.merry.com.tw

- Merry Electronics is a long-established Taiwan public company with factories in north and south China. The company manufactures microspeakers, microphone elements, earphones, headphones, and Bluetooth products. Merry Electronics's greatest strength is in its soundbars and Bluetooth docking stations and other integrated audio electronics.

Solidex Audio Corp.

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- Founded in 1997, Solidex Audio specializes in the development of high-quality loudspeakers for various industrial and consumer sectors. Solidex Audio has its own factories in China as well as strategic partnerships with several manufacturers to provide a range of capabilities and products for OEM and ODM clients. Solidex Audio can build to any specification and performance level while keeping costs low. It can also produce many audio components and finished systems (e.g., high-power subwoofers utilizing ferrite and/or neodymium magnet structures, car audio subwoofers, component systems, and automotive OEM, amplifiers). Solidex also makes complete home theater systems finished in fine lacquers, vinyl wrap, aluminum, and painted enclosures. Its electronic subwoofers amplifiers utilize traditional A/B circuitry and more advanced Class-H and Class-D digital designs.

STI Technology, Ltd.

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- STI Technology is an affiliate of Telefield. It specializes in high-end and shorter run boutique audio projects, as well as pro-consumer and pro-sound products such as mixers.

Telefield, Ltd.

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- Telefield manufactures docking stations, Bluetooth

speakers, receivers, soundbars, and even telephones. It is an established quality operation whose strength is electronics and outsources its loudspeaker requirements. Telefield employs more than 5,000 people.

Tristar Electronic Co., Ltd.

No. 24A Dongxing Ave. South, Zhenxingwei, Tangxia Town, Dongguan, Guangdong, China 523710
Michael Tang, Sales Manager
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(P) 86-769-87926702
www.tristar-audio.com

- Tristar is a medium-size manufacturer specializing in soundbars. The company also produces powered speakers such as near-field studio monitors.

Tymphany

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Room 1307-1308 Dominion Center, 43-59 Queens Rd. East, Wanchai, Hong Kong

China Factory
Premium Loudspeaker (HuiZhou) Co., Ltd.
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Tymphany USA
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www.tymphany.com

- Tymphany is one of the first speaker manufacturers to recognize the integrated audio systems market and grow its capabilities in this direction. Tymphany provides a unique combination of western management and global engineering. The company is a leader in integrated audio electronics, including docking stations, and Bluetooth speakers. It also manufactures the Peerless speaker product line.

High-Power Amplifier Modules

These modules are popular for use in amplified speakers (e.g., pro-consumer and pro-sound powered sound reinforcement speakers). Often these manufacturers offer a switching power supply and sometimes DSPs.

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- Abletec provides a full product range of switching power supplies and amplifier modules.

Hypex Electronics BV

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- Hypex Electronics supplies power amplifiers, digital processing, and conversion to the professional, consumer, and live audio industries.

ICEpower

ICEpower America, Inc.
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www.icepower.bang-olufsen.com

- ICEpower was founded by Dr. Karsten Nielsen in a joint venture with Bang & Olufsen in 1999 based on the results of Dr. Nielsen's PhD work at the Technical University of Denmark. ICEpower is a fast-growing, scientifically based innovation house specializing in audio power conversion solutions. The company offers a full range of amplifier modules for consumer audio to pro-sound and high-end autosound (e.g., the Aston Martin).

PowerPhysics, Inc.

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- PowerPhysics manufactures amplifier modules, power supplies, and DSP modules.

Test and Measurement Instrumentation

By

Mike Klasco

(Menlo Scientific, United States)

The 2013 *Loudspeaker Industry Sourcebook (LIS)* put the spotlight on acoustic test and measurement instrumentation. Our focus was on hardware- and software-integrated test solutions for measurement of speaker drivers and speaker systems rather than room tuning (i.e. one-third octave analyzers) or residential home auto EQ systems. For the 2014 *LIS*, we have expanded our coverage to include testing complete speakers and speaker parts. Now spiders, cones, magnets, and voice coil testers as well as power burn-in test systems are included. **LIS**

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www.e-speakers.com

- Audiomatica's Clio acoustic analyzer is a cost-effective high-performance analyzer for speakers and microphones. The Clio 10 FW system includes the FW-01 interface as hardware and runs Clio 10 standard software or Clio 10 QC. Compatibility is ensured from Windows XP up to Windows 8.1 enabling gesture controls.
- The companion hardware QCBox Model 5 Amplifier&Switching unit enhances and simplifies laboratory and production testing. Many measurements are possible with its wide bandwidth of more than 80 kHz.
- Three measurement techniques are provided. The MLS & LogChirp analysis uses pseudo-random noise or logarithmic chirps as stimuli and sinusoidal sweeps up to 1/192th of octave resolution with simultaneous harmonic and Rub & Buzz detection. The linearity and distortion function measures the nonlinear behavior of speakers or electronics.
- Beyond measured results, users receive sophisticated post-processing tools for Thiele-Small (T-S) parameters with laser, waterfall

plots to evaluate sound decay as 3-D or color graphs, directivity analysis for loudspeaker characterization as maps, circular or waterfall-like plots, and 3-D balloons. The analyzer provides automation for turntables (e.g., LinearX and Outline) and robots (ELF) as well as export to EASE.

Audio Precision

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- Audio Precision (AP) has offered audio test equipment since 1984. It is best known for testing electronics from Blu-ray players, Bluetooth, amplifiers, digital formats, and more. Some of its instrumentation (e.g., the 2700) provides comprehensive loudspeaker measurements for lab and production line testing. The 2700 series offers a range of test signals (e.g., chirp, MLS, etc.) and synchronous averaging for accurate results in noisy production environments. Designed for audio engineers who need high performance, low distortion, and flexibility in their audio analyzers, it is not just limited to speaker testing. The 2700 also tests electronics. The 2700 series' typical total harmonic distortion (THD) is less than or equal to 115 dB at 2 VRMS.
- The APx525 analyzer can also be used to make acoustic measurements. Its two analog and digital channels are suitable for measuring speakers

and electronics. If more channels are required, consider the APx526, the APx585, or the APx586 instruments with four-, eight-, and 16-input channels, respectively.

Brüel & Kjær Sound & Vibration Measurement A/S (B&K)

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US Headquarters: Brüel & Kjaer North America, Inc.
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(P) 770-209-6907
www.bkhome.com

- For speaker engineers, B&K offers the PULSE Electroacoustics Type 7907, a versatile platform for the evaluation of electroacoustic transducers. This includes a range of analysis capabilities required by any audio engineer working within the R&D field of acoustical designs. The PULSE Electroacoustics Type 7907 can be used for transducer pre-qualification, benchmarking, sample testing, and quality assurance, including linear and nonlinear system analysis.
- PULSE determines frequency and directional response and distortion measurements. Intelligent transducer correction compensates for amplitude response of microphones and ear simulators as well as speakers and mouth simulators. PULSE also determines Thiele-Small (T-S) parameters based on simple impedance, added volume, added mass, or noncontact laser method. Additionally PULSE provides advanced display facilities (e.g., 3-D display, contour display, polar plot, etc.).

Dayton Audio

705 Pleasant Valley Drive, Springboro, OH 45066
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info@daytonaudio.com
www.daytonaudio.com

- OmniMic V2 is an entry-level system that can measure a speaker or sound system's frequency or impulse response. The OmniMic test track CD provides signal generation. The measurement is matched to the test signals provided on the specified tracks. Two signal types are available: "pseudo noise" and "sine sweep."

Dr. Kurt Müller (DKM) GmbH & Co., KG

Krefelder Straße 150, D-47839 Krefeld/Hüls, Germany
Matthias Ringpfeil

ringpfeil@kurtmueller.com
(P) +49 2151-73 290/(F) +49 2151-73 29 10
www.kurtmueller.com

- The FDZ-Tester is an ideal tool for production and incoming control/QC inspection of spider and cone compliance. The easy-to-use functions have been designed for simplicity and can be operated with minimal instruction. For more detailed analysis, the FDZ-Tester can be linked to a computer via USB, enabling an unlimited number of stiffness curves to be plotted and compared.

DRA Laboratories

4587 Cherrybark Court, Sarasota, FL 34241-9213
dra@mlssa.com
(P) 941-866-0632
dra@mlssa.com
www.mlssa.com

- MLSSA is a popular acoustic analyzer based on an International Society of Automation (ISA) standard desktop computer card. The MLSSA version 10WI V. 9 runs under Windows XP for analysis-only measurements stored on a disk.
- Many other new software features were added to MLSSA and MLSSA SPO (for T-S parameter measurements). MLSSA and SPO both include quality control PASS/FAIL functions for high-speed automated production line testing of loudspeakers and drivers.

ETANI Electronics Co., Ltd.

1-10-15, Ohmori-Honcho, Ohta-ku, Tokyo 143-0011, Japan
Mizue Watanabe
watanabe@etani.co.jp
(P) +81-3-5763-1391
www.etani.co.jp/eng

- ETANI offers a variety of measurement systems and analyzers for testing loudspeakers, microphones, and headphones. Comprehensive test capabilities include Rub & Buzz analysis. The Loudspeaker Test System S-255 uses DSP technology and its PC-based operation ensure cost-effective, accurate, and stable analysis in near real-time. Measurement functions include SPL frequency response, total harmonic distortion (THD), second- and third-harmonic distortion, abnormal noise (Rub & Buzz), impedance, polarity, phase frequency response, and sensitivity. All these test factors can be measured in one sweep and under different voltage settings, in a few sweeps.
- The S-280 T-S parameter analyzer uses a bare

loudspeaker to measure T-S parameters. T-S parameters use a laser displacement sensor to measure the loudspeaker cone's displacement under test. The S-280 T-S Parameter Analyzer eliminates the need for added mass or mounting in a sealed box to add stiffness for measurement.

Gold Line

P.O. Box 500, West Redding, CT 06896
sales@gold-line.com
(P) 203-938-2588
www.gold-line.com

- The TEF25 is the descendent of the Crown Techron TEF (time, energy, and frequency) analyzers. The TEF 25 USB preamplifier combines the portability of a small USB preamplifier with the traditional TEF20 analyzer's accuracy, in an affordable package. The TEF25 comes with the SoundLab SLUPG1 software upgrade, which enables you to run all TEF20 programs including older versions and new V. 6 modules of the TDS, the MLS, the RTA, the PEQ, the PLR, and the SLX. The SLPPS60, a new post-processing module, is available in V. 6.

K & K Development, ApS

Naverland 31, 1 tv, DK-2600 Glostrup, Denmark
(P) +45-4342-2294/+45 4468 2294
kk-dev@kk-int.dk
www.kkd.dk

- K & K Development provides its P630 series test and measuring systems for production testing and product development (e.g., loudspeaker units, loudspeaker systems, headphones, telephone handsets, and microphones). The program ranges from high-performance and high-speed test systems to small, low-price test systems. Powered by multicore processors, a range of parameters can be measured at the same time in parallel. System multiplexing enables users to work on two different test systems simultaneously. A multichain function enables unlimited test sequencing.
- The software is split into three modes: Unskilled Operator, Engineer Setup, and R&D Engineer. A test return in Unskilled Operator mode displays as approve/reject or as a full graph. Measured data for further statistical analysis can be simultaneously stored.

Keyence

West Coast Office
879 West 190th St., Suite 1020, Gardena, CA 90248

Bryan Franz, Area Product Sales Manager, High Precision Measurement Division
BFranz@keyence.com
(P) 888-539-3623/(F) 630-285-1316
www.keyence.com

- Keyence, a Japanese company with worldwide locations, develops and manufactures sensing equipment. The Keyence LK-G5000 uses a laser to provide motion analysis, avoiding the added mass and intrinsic error of using accelerometers. Excursion limits and linearity, breakup modes, rocking, and other transducer characteristics can be viewed and quantified.

Klippel GmbH

Mendelssohnallee 30, 01309 Dresden, Germany
(P) +49-351-251-3535
info@klippel.de
www.klippel.de

- KLIPPEL provides measurement instruments for designing and manufacturing loudspeaker drivers, audio systems, microspeakers, and more.
- The KLIPPEL QC System is dedicated to fast testing of loudspeaker drive units and complete systems for the assembly line or for incoming goods inspection. In addition to the typical tests, it also offers unique features for voice coil testing, large-signal measurements, sensitive Rub & Buzz testing production noise immunity, air leak noise detection, root cause analysis, and more.
- The KLIPPEL R&D System is a universal tool for transducer and system development. It provides acoustical, electrical and mechanical measurements, nonlinear and thermal diagnostics, distortion measurements, numerical simulation, and digital auralization. It evaluates speakers under normal working conditions both at low and high amplitudes and detects the cause of distortion. This system enables the designer to optimize the driver and system with consideration to cost, weight, and size to develop transducers that offer more output at higher quality.
- The SCANNING VIBROMETER System is an add-on to the R&D System. It measures mechanical vibration and cone geometry at a high precision. The system performs a vibration and radiation analysis predicting the total sound pressure output and the directivity pattern. A unique decomposition technique reveals the modes of vibration, which support or reduce the acoustical output. This provides practical improvements in cone design.

Liberty Instruments, Inc.

677 Harriet St., Winona, MN 55987-3315

Kim Girardin

kmgrdn@luminet.net

(P) 507-458-4597

www.libinst.com

- Liberty Instruments's PRAXIS performs high-quality audio measurements of loudspeakers, electronics, vibrating systems, and rooms. PRAXIS utilizes high-quality Windows-based digital soundcard hardware for versatility, compatibility, and portability. The PRAXIS AudPod is a compact, portable audio interface and license key that enables PRAXIS's entire feature set and capabilities. Because PRAXIS with the AudPod can calibrate for accurate measurements using PC Audio hardware, you can transfer the measuring system between computers without removing covers or uninstalling cards. Use high-quality sound cards when higher sample rates (up to 192 kHz) or 24-bit measurements are needed.

LinearX Systems, Inc.

17801 NE 230th St., Battle Ground, WA 98604

Chris N. Strahm

chris@linearx.com

(P) 360-666-2405/(F) 360-666-9205

www.linearx.com

- The LX700 modular signal-processing system was designed to cover many measurement application market segments, including lab R&D and production QC/QA testing. The software includes a macro programming script capability, enabling users to create custom-automated test programs for production-line testing. The LX700 module family will be expanded over time to include analog, digital, and mixed-mode measurements, analog/digital automation control, signal multiplexers, spectrum analyzers, signal generators, impedance analyzers, amplifiers, and various metering and DSP development tools. Numerous measurements can be performed including spectral analysis, distortion analysis, arbitrary waveform, and signal generation.
- After 20 years of production, the LX500 has replaced the LMS. Designed for maximum flexibility in permanent and portable applications, the LX500 is powered by a single 12-VDC source. The LX500's small size and light weight enables it to fit in a briefcase, placed on a desktop, or installed in a permanent engineering lab or a production QC environment. Featuring frequency domain, time

domain, and dual-domain versions, the LX500 supports an array of different measurement types, techniques, and methods.

- The LX500's features include dual analog oscillators, triple multifunction inputs, a precision noise generator, a programmable filter, extensive bandwidth/weighting filters, a phase meter, high-resolution digital signal generator/spectrum analyzers, digital I/O control, and comprehensive Windows application software.

Listen, Inc.

580 Harrison Ave., Suite 3W, Boston, MA 02118

Neil Rubado, North American Sales Manager

(P) 617-556-4104

nrubado@listeninc.com

www.listeninc.com

Listen offers complete systems for testing electroacoustic and audio electronic devices including loudspeakers, headphones, microphones, micro-electrical mechanical system (MEMS) devices, phones, MP3 players, and more.

- At the heart of Listen's test system is the SoundCheck software, a powerful and flexible package that offers high accuracy for the R&D lab and high speed and excellent noise immunity for the production line. This is paired with appropriate hardware such as Listen's AmpConnect ISC, an all-in-one hardware box containing audio input, an amplifier, a microphone power supply, data I/O, and an impedance measurement system. Listen also offers a range of discrete audio input devices, amplifiers, power supplies, and interfaces (digital, MEMS, etc.), as well as audio test accessories (e.g., microphones, artificial ears, etc.). Fully customizable pre-written sequences for testing various devices are available to simplify test configuration.
- For production line users, the SoundCheck system offers a simple setup with various levels of operator control. All quality-related parameters—both acoustical and electrical—are simultaneously measured for high-throughput testing. Unique measurement algorithms maintain measurement accuracy even in noisy environments. Results can be presented as a simple pass/fail indication or a detailed failure mode analysis and can be exported to other programs for additional processing, statistical control, or reporting. Innovative new measurement algorithms (e.g., the CLEAR algorithm for perceptual Rub & Buzz measurement) help maximize yield while rejecting faulty products.
- For the R&D laboratory, SoundCheck offers

complete user-control over all aspects of test development and hardware selection, a wide choice of measurement methods, and a selection of customizable test signals (including customer-selected music and speech). Test sequences are easily developed with SoundCheck's unique point and click interface, and SoundCheck can be easily incorporated into existing test programs that utilize ActiveX controls or National Instruments's LabVIEW development environment. Analysis tools include a fast Fourier transform (FFT) analyzer and an optional real-time analyzer (RTA), as well as many pre-programmed post-processing routines including T-S parameters, curve fitting to determine resonances, arithmetic operations, curve smoothing, and statistical functions.

- Various packages and pricing options—along with the ability to add modules to the system at a later date—ensure that a system can be configured for any budget. Regular software updates guarantee that the measurement system becomes more powerful over time, keeping up with latest measurement trends and techniques.

Loudsoft, Ltd.

Agern Alle 3, 2970 Horsholm, Denmark
Dorit Larsen
dl@loudsoft.com
(P) +45-4582-6291
www.loudsoft.com

- Peter Larsen's software for loudspeaker design is complemented by Loudsoft's FINELab acoustic analyzer system. Loudsoft FINE hardware (USB) includes a built-in 25-W power amplifier, a full system calibration, and a microphone.
- The FINE R&D Anechoic FFT can take measurements in rooms with acoustic auto delay, sound pressure level (SPL), frequency, phase, and impedance responses at the same level. It also measures total harmonic distortion (THD) and second to ninth harmonics in percentage and decibel. The results can be displayed as cumulative decay spectrum (CSD) waterfall plots, with 1/12-, 1/6-, 1/3-, 1/2-, and 1/1 octave smoothing. Thiele-Small (T-S) parameters at correct level—fixed mass, delta mass, and added box—can be measured and the measurement files can be shared to FINE QC and all Loudsoft software. The system is Windows 7, 64-bit compatible.
- The FINE QC system uses USB interface, high-speed testing with CHIRP, and different response limits (adaptive). The software enables online tests for sensitivity SPL, polarity, T-S parameters, simultaneous SPL and impedance, and automatic

daily average, and it automatically finds "golden" average driver. The hardware has a built-in 25-W amplifier and 48-V phantom power.

NTI Americas, Inc.

P.O. Box 231027, Tigard, OR 97281
Tom Mintner
(P) 503-684-7050
ntisales@ntiam.com
www.ntiam.com

NTi Audio

Im alten Riet 102, 9494 Schaan, Liechtenstein
Berno Nigsch
(P) +423-239-60-60/(F) +423-239-60-89
info@nti-audio.com
www.nti-audio.com

- The FLEXUS FX100 is a comprehensive professional audio analyzer dedicated to research, design lab, service, and end-of-line testing. FX Control software enables user-built instrument panels for any application in the factory or lab. Individual application programs are also available for microphone and loudspeaker production testing, including a polar plot option. Measurement capabilities provide fast glide sweeps, time-windowed fast sweeps, detailed stepped sweeps, a continuous meter mode, and FFT analysis. The FX100 is well suited for accurate and fast testing of audio and acoustic devices. On-board DSPs, in combination with sophisticated calculation algorithms, ensure real-time acquisition of all measurements in parallel. Multichannel FFT with a 192-kHz sampling rate presents a detailed analysis of the audio frequency spectrum. FFT graph panels may be customized to simultaneously show one or more traces in the same panel. Detailed R&D measurements are supported with frequency, amplitude, time, and table sweeps, which may be triggered by internal or external signals. The FX100 is also available with an AES/SPDIF option for digital audio testing.
- The XL2 analyzer is a single-channel hand-held audio and acoustics analyzer featuring a range of measurements useful for loudspeaker and other audio work. The analyzer includes an FFT spectrum analyzer, octave and 1/3 octave RTA with optional 1/6, 1/12, and true-peak fractional octave RTA modes. It also functions as an auto-nulling, auto-ranging total harmonic distortion plus noise (THD+N) analyzer and audio analyzer with -105-dB residuals, as well as a level meter, a frequency counter, and a spectrum analyzer for electrical audio signals. Test setups

may be stored and recalled, and all the results can be logged onto a memory card. Using the options, production-like response templates, and pass/fail limits can be implemented. The XL2 analyzer can also perform sequential procedures including user prompts. An oscilloscope mode, delay time and polarity testing, reverberation time measurement, and optional STIPA speech intelligibility testing are also included. Optional packages with extended functions (e.g., noise percentiles, room noise curves, and many other higher-level functions useful for field measurements are also available.

- The MR-PRO analog generator produces sine waves, stepped sweeps, glide tones, white and pink noise, and polarity and delay test signals. It stores user-defined signals for special tests and measures the impedance of connected devices. The MR-PRO also includes a loudspeaker impedance meter mode and a 70-/100-V equivalent power measurement mode.

Onsoku Electronic Corp.

18-25 Takadanobaba 3-Chome Shinjuku-Ku Tokyo
169-0075 Japan

Yutaka Yamazumi, Sales
y-yamazumi@onsoku.co.jp
(P) 81-3-5386-4701/(F) 81-3-5386-4717
www.onsoku.co.jp

- The Onsoku 205A measures and tracks voice coil temperature. The device can be configured as a power burn-in tester.

Polytec-North American Headquarters

16400 Bake Parkway, Irvine, CA 92618
info@polytec.com
(P) 949-943-3033/(F) 949-679-0463

- Polytec's motion analysis instruments use a laser to quantify excursion limits and linearity, breakup modes, rocking, and other transducer characteristics.

Prism Media Products, Inc.

US National Sales Office, Test and Measurement
7701 Marble Canyon Drive, Fort Worth, TX 76137
Doug Ordon
dougordon@hotmail.com
(P) 817-514-4900/(F) 817-514-4901

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- Microspeaker testing and evaluation of mobile audio devices
- Convenient northeast (Boston vicinity) location

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SCIENTIFIC

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sales@prismsound.com

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Principle Office

21 Pine St., Rockaway, NJ 07866

(P) 973-983-9577/(F) 973-983-9588

West Coast Office

17952 Sky Park Circle Building, 45 Suite A, Irvine,
CA 92614

(P) 949-861-3350

- The dScope Series III is a comprehensive and powerful measurement system for analog and digital audio generation and analysis, including digital audio carrier parameters, acoustic transducers, and Windows sound devices. With the analyzer's real-time interactive measurements and unique Smart FFT capability, 40-plus performance metrics can be measured and analyzed in real-time including distortion, noise, crosstalk, frequency response, gain, signal-to-noise ratios (SNRs) of odd/even harmonics, and dynamic range.

Sigma Electronics Technology

115, 58 Bungil, Seojeon-ro, Jeonpodong, Jin-gu,
Busan, Korea

Sean Baek

(P) +82-51-805-1718

sigma@sigmaeltec.co.kr

www.sigmaeltec.co.kr

- Sigma Electronics's SG-3622A measures voice coil temperature. Versions ST-3000 and SG-3000 can be used as a burn-in tester with voice coil temperature over time to failure.

Smith and Larson Audio

P.O. Box 56443, Virginia Beach, VA 23456

(P) 301-442-7235

sales@woofertester.com

www.woofertester.com

- The Woofer Tester Pro is an integrated electrical and acoustic measurement system that combines the features of the Woofer Tester 2, the Speaker Tester, and the high-power test port. The Woofer

Tester Pro is powered from a laptop's USB, which enables portability.

- The Speaker Tester adds acoustic measurement features required for speaker analysis and room design to the electrical measurements of the Woofer Tester 2.

Tonwel Co., Ltd.

No. 28 Xi Yi Road, Jiang Shan Town, Ningbo, China
315191

(P) 86-574-88160000/(F) 86-574-88160208

contact@tonwel.com

www.tonwel.com

- Tonwel's primary business is speaker manufacturing. However, the company also has a group that develops and builds test systems to determine the resonance frequency of loudspeaker cones, displacement laser excursion measurement testers, and cone and spider compliance testers.

True Technologies, Inc.

8309 West Ridge Drive, Pleasant Prairie, WI 53158

(P) 1-262-694-2573

rtrue@true-technologies.com

www.true-technologies.com

- The Loudspeaker Component Measurement System (LCMS) is a tool used in QC and design of loudspeaker drivers. It enables the user to measure the force vs deflection characteristic of parts (e.g., cones, spiders, domes, etc.) to determine if they meet the specifications or if they are appropriate for use in a particular driver design. Measurements of completed drivers are also possible. The BL vs. coil location for a motor/coil combination can also be measured by adding a constant current source. Database features including pass/fail limits and statistical analysis algorithms make the LCMS a powerful tool for loudspeaker and component manufacturers.
- True Technologies also offers LifeTest, a system specifically designed to power and life test loudspeaker transducers, active and passive systems, power amplifiers, and essentially anything that has electrical current flowing through it. Up to 24 channels can be tested on a single PC.

Wireless Audio

By

Mike Klasco

(Menlo Scientific, United States)

Wireless audio refers to audio signals that travel without wires. While the definition is simple, the implications of wireless audio is profound. Wireless audio provides features and conveniences that used to be impossible to consider even with the most elaborate wired systems.

Wireless audio uses an RF transmitter to convey an audio signal to a radio receiver (i.e., streaming). The audio data signal, along with other non-audio data, is broadcast as a radio wave. The signal may be directly broadcast from a transmitter to a receiver (e.g., Bluetooth) or through another device (e.g., a router or Wi-Fi) but the end result is the same.

As wireless audio continues to grow in popularity, it has been possible for us to compile a directory solely based on wireless audio. As with the other *Loudspeaker Industry Sourcebook (LIS)* focus categories, we have included brief profiles on each listing. We touch on Bluetooth providers for using smartphones as an audio server to whole-house audio wireless to Bluetooth speakers and Bluetooth for telephony. The companies listed here offer specialties that range from wireless ICs to modules to board-level offerings to software/firmware to finished products. The wireless RF solutions range from proprietary, often in the 2.4-and 5.6-GHz range, to industry standards (e.g., various Bluetooth protocols). **LIS**

Apple, Inc.

1 Infinite Loop, Cupertino, CA 95014
(P) 408-996-1010
www.apple.com

- Apple's AirPlay streams music, information about the music, song titles, artist names, album names, elapsed and remaining time, and album artwork. AirPlay technology is built into speakers, receivers, and stereo systems. It is available from manufacturers such as Bowers & Wilkins, Denon, iHome, JBL, and Marantz. AirPlay connects to home networks but doesn't offer multizone operation.

Audience, Inc.

Headquarters North America and Europe
331 Fairchild Drive, Mountain View, CA 94043
(P) 650-254-2800
www.audience.com

- Audience provides advanced voice and audio processors for mobile products. Its products provide voice quality for clear conversations in noisy settings, higher accuracy and performance for speech recognition, and enhanced audio for multimedia recording and playback, including mobile video and music.

Cirrus Logic, Inc.

800 West 6th St., Austin, TX 78701
(P) 512-851-4000

- Cirrus Logic offers analog and digital signal processing components. The company now offers portable audio ICs with a new line of voice processors for mobile applications with its integrated SoundClear technology. Its applications include Bluetooth over-the-ear, full duplex Bluetooth speakers/speakerphones, and headphones. SoundClear enhances voice recognition accuracy in smartphones, tablets, and wearables by improving voice quality, eliminating background noise, and delivering clear communications in a range of environments.
- Cirrus Logic's SoundClear technology features single/dual microphone noise suppression and acoustic echo cancelation for narrow and wideband audio content. Cirrus Logic provides manufacturers with a complete hardware and embedded software product.

CSR, PLC

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(P) +44 1223 692000/(F) +44 1223 692001

Auburn Hills, MI, US Office
1740 Opdyke Court, Auburn Hills, MI 48326
(P) 248-409-1400
www.csr.com

- CSR is a pioneering designer and developer of silicon and software for the consumer electronics (CE) market. CSR's product focus includes ICs used in wireless headsets, speakers, docks, soundbars, wireless subwoofers, and automotive infotainment. CSR provides innovative solutions for the auto industry with the integration of smartphones and in-vehicle systems. The company offers its own CVC signal processing. Its most recent products include Bluetooth plus Wi-Fi functionality.

DTS, Inc.

US Headquarters
5220 Las Virgenes Road, Calabasas, CA 91302
(P) 818-436-1000
www.dts.com

- Whole-house audio solutions require software/firmware/hardware packages, and they are targeted by many audio marketing teams as the "next big thing." Development of this integrated solution for most audio engineering teams is daunting, especially with the limited engineering budgets most companies provide.
- DTS believes it has addressed this opportunity with its Play-Fi technology. Play-Fi is accessed on Apple's iOS through a Play-Fi app and directly integrated into Android phones, tablets, and Windows PCs. Play-Fi can also be embedded into almost any stand-alone speaker, TV, AVR, or portable player with hi-fi lossless wireless audio. Play-Fi provides whole-home, multi-room synchronization over 802.11n Wi-Fi. Play-Fi connected products are seamlessly interoperable.

Eastern Asia Technology (HK), Ltd. (Eastech)

54 Hoi Yuen Rd., Kwun Tong, Kowloon, Hong Kong
Steven Willenborg, President
steven.willenborg@kyetek.com
www.kyetek.com

- Eastech's PSG group offers a range of wireless products for portable audio and home theater uses and is introducing whole-house audio platforms.

Fortemedia, Inc.

810 E Arques Ave., Sunnyvale, CA 94085
(P) 408-861-8088
sales@fortemedia.com
www.fortemedia.com

- Fortemedia is an established signal-processing provider for wireless communications/telephony for full-duplex and related telephony applications.

NowSpeak Technologies, Ltd.

Unit 16, The Enterprise Centre, Boxbridge
Business Centre, Alton Rd., Farnham, Surrey GU10 5EH UK
Allan Davison, Commercial Director
allan.davison@nowspeak.com
(P) +44-1252-714835
info@nowspeak.com
www.nowspeak.com

- NowSpeak provides solutions for speech processing (e.g., voice recognition, text to speech, and speech prompts) car kits, and over-the-ear Bluetooth.

Primax Electronics, Ltd.

No. 669, Ruey Kuang Rd., Neihu, Taipei, Taiwan, 114
(P) +886-2-2798-9008
www.primax.com.tw

- Primax is a wireless module developer that offers Bluetooth earphones and wired and wireless headphones. The company also recently bought the majority share of audio OEM/ODM Tymphony.

Qualcomm, Inc.

5775 Morehouse Drive, San Diego, CA 92121
(P) 858-587-1121
www.qualcomm.com

- The Qualcomm AllPlay, a smart audio module that is a product of Qualcomm Connected Experiences, enables audio equipment manufacturers to differentiate wireless speakers, AV receivers, soundbars, and other audio products. AllPlay is a Wi-Fi system-on-a-chip (SoC) with a flexible I/O architecture. The smart audio module offers a minimalist footprint designed to support embedded and discreet audio accessory uses. It also simultaneously delivers wireless audio for the mass consumer and the high-end audiophile with low-latency streaming across as many as 10 different audio zones. The AllPlay media player offers cross-brand, cross-platform compatibility,

while supporting advanced use cases that include multizone and party mode synchronization.

Rubidium, Ltd.

7 Hasadna St., Raanana 43000 Israel
(P) +972-9-7451412
info@rubidium.com
www.rubidium.com

- Rubidium provides speech-processing solutions for embedded applications, such as text to speech (TTS), automatic speech recognition (ASR), speech compression, and biometric speaker identification. Rubidium has more than 16 years experience in developing and implementing speech recognition, speech synthesis, and other embedded speech-processing products.

Sensory, Inc.

735 S.W. 20th Place, Suite 220, Portland, OR 97205
Steve Collard
scollard@sensoryinc.com
(P) 503-546-6378
www.sensoryinc.com

- Sensory designs speech technologies that feature voice recognition and synthesis, biometric passwords, musical instrument digital interface (MIDI)-like music synthesis, text-to-speech, and interactive robotic controls.

Singer Technology (Shenzhen) Co., Ltd.

Head Office
7th Floor, Xinhaofang Building, 10188 Shennan Blvd., Nanshan District, Shenzhen, China
York Luo
yorkluo@163.com
(P) +86-755-3690-2225/(F) +86-755-3690-2226
www.singmate.com

- Singer develops Bluetooth equipment and supplies modules.

Summit Semiconductor

Corporate Headquarters
22867 N.W. Bennett St., Suite 200, Hillsboro, OR 97124
(P) 503-615-7700/(F) 503-615-4232
sales-america-EV@summitsemi.com
http://summitwireless.com

- The Summit Wireless Audio IC is a highly integrated audio solution for home theater surround digital audio fidelity. The Wireless Audio IC also provides ease of setup. However, it does not support multi-zone audio.

Wireless Speaker and Audio (WiSA) Association

1140 East Arques Ave., Suite 500, Sunnyvale, CA 94085
WiSA Administrator
admin@wisaassociation.org
(P) 408-616-6360
www.wisaassociation.org

- WiSA is an industry association dedicated to providing interoperability between wireless speakers and audio components.

Witron Technology, Ltd.

Hong Kong Office
Flat C-5, 11th Floor, Wing Hing Industrial Building, 14 Hing Yip St., Kwun Tong, Kowloon, Hong Kong
Nelson Shin, Deputy Managing Director
ns@witrontech.com
(P) 852-5171-7495
www.witrontech.com

- Witron Technology develops and supplies Bluetooth modules to several factories and brands.



The NEW ALMA is all about you!

- **NEW website** with more content, easier to use. (June, 2014)
- **NEW focus** on the business side of the Loudspeaker industry in addition to our technical focus.
- **NEW opportunities** to promote our members and their business through articles, company news, profiles, and more at no charge!
- **NEW ALMAgrams** newsletter published bimonthly along with bulletins to keep you up to date and informed.
- **NEW technologies focus** that will impact the future of the Loudspeaker industry.
- **NEW Winter Symposium** expanded with more content more networking, more value in January, 2015 in Las Vegas. Go to www.almainternational.org and click on the events tab for more information.

"ALMA is *The Source* of standards, news, networking, and education for technical and business professionals in the acoustics, audio, and loudspeaker industry."

Teach. Learn. Grow. Get involved. "The Source" wants you!

Email management@almainternational.org or call Barry Vogel at 602-388-8669

AAC-Applications Acoustiques de Composites
FRANCE
OEM Speaker Assembly, Speaker Parts

ACO Pacific, Inc.
UNITED STATES
Measurement Microphones, Mic Capsules, Test Equipment

AcousTex Fabrics
UNITED STATES
Enclosures & Cabinets, Enclosure Parts, OEM Speaker Assembly, Speaker Parts

Acoustic Development International
UNITED STATES
Finished Systems (OEM/ODM) & Integrated Audio, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers

Acoustic Power Lab
LATVIA
Consultants & Designers, Earphones & Headphones, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Test Equipment

Acoustics First Corp.
UNITED STATES
Enclosure Parts, OEM Speaker Assembly, Test Equipment

Acoustics Lab
MALAYSIA
Consultants & Designers, Earphones & Headphones

Acoustone Corp.
UNITED STATES
Enclosure Parts, OEM Speaker Assembly, Speaker Parts

Acustica Beyma, S.L.
SPAIN
OEM Speakers & Drivers

Advanced Audio Technologies
BRAZIL
Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Passive Components/Crossovers/Wiring, Speaker Parts

Advanced Transduction
UNITED STATES
Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Test Equipment

Aempyrean, Inc.
UNITED STATES
Consultants & Designers, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers

Aesthetic Audio, LLC
INDIA
Finished Systems (OEM/ODM) & Integrated Audio, Passive Components/Crossovers/Wiring, Speaker Parts

Akustik Perfekt
GERMANY
Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Aletheia AV
MEXICO
Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, Passive Components/Crossovers/Wiring

Alta Audio
UNITED STATES
Finished Systems (OEM/ODM) & Integrated Audio

AMCP Electronics
BRAZIL
Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, Speaker Parts

American Bass USA
UNITED STATES
Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

AMS Audio Enterprises, Inc.
UNITED STATES
Cables & Connectors, Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Anaview
UNITED STATES
Finished Systems (OEM/ODM) & Integrated Audio, Speaker Parts

AntiCable Audio Co., Inc.
UNITED STATES
Cables & Connectors, Passive Components/Crossovers/Wiring

AUDAX
FRANCE
OEM Speaker Assembly, OEM Speakers & Drivers

Audia Media Group
UNITED STATES
Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Audio Labs
MALAYSIA
Consultants & Designers, Earphones & Headphones, Engineering Software

Audio Nirvana Speakers
UNITED STATES
Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts

Audio Opportunities, Ltd.
CANADA
Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts

Audio Precision
UNITED STATES
Engineering Software, Measurement Microphones, Test Equipment

Audio Pro, AB
SWEDEN
Cables & Connectors, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Audio-Concept (G.C.)
CANADA
Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, Mic Capsules, OEM Speaker Assembly

Audiofly Pty., Ltd.
UNITED STATES
Cables & Connectors, Consultants & Designers, Earphones & Headphones, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, Speaker Parts

Audiomarin, SNC
ITALY
Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio

Audiomatica, S.R.L.
ITALY
Cables & Connectors, Consultants & Designers, Engineering Software, Test Equipment

Audiophil GmbH
GERMANY
Consultants & Designers, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio

Audiophiles Engineering
UNITED STATES
Consultants & Designers, Enclosures & Cabinets, Engineering Software, Passive Components/Crossovers/Wiring

Audiostar Electronics Co., Ltd.
CHINA
Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts

Audiovista
THAILAND
Cables & Connectors, Consultants & Designers, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Audioxplus, S.R.L.
ITALY
Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts

Auratron Systems
UNITED STATES
Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, Passive Components/Crossovers/Wiring, Speaker Parts

Avuio Netherlands, BV
NETHERLANDS
Consultants & Designers, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly

Avtex International

UNITED STATES

Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Axiomedia

ITALY

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Microspeakers, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

B&C Speakers, S.p.A.

UNITED STATES

OEM Speaker Assembly, OEM Speakers & Drivers

B.W. Audio Guangzhou Co., Ltd.

CHINA

Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers

Bamberg Engineering

UNITED STATES

Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, Passive Components/Crossovers/Wiring

Beach Dynamics, Inc.

UNITED STATES

Consultants & Designers, Test Equipment

BeStar Technologies, Inc.

UNITED STATES

Consultants & Designers, Earphones & Headphones, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers

BESTON Technology Corp.

TAIWAN

OEM Speakers & Drivers

Bishopsound

UNITED KINGDOM

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts

BMS Speakers GmbH

GERMANY

OEM Speakers & Drivers

Bob Young and Associates

UNITED STATES

Consultants & Designers

Bogen Communications, Inc.

UNITED STATES

Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts

Böhmer Audio, AB

SWEDEN

Consultants & Designers, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, Test Equipment

Brüel & Kjær Sound & Vibration

Measurement A/S

UNITED STATES

Cables & Connectors, Engineering Software, Manufacturing Equipment, Measurement Microphones, Test Equipment

BSWA Technology Co., Ltd.

CHINA

Cables & Connectors, Consultants & Designers, Engineering Software, Measurement Microphones, Mic Capsules, Test Equipment

Canadian Speaker Works

CANADA

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Canare Corp.

UNITED STATES

Cables & Connectors

Carvin Corp.

UNITED STATES

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

Celestion (UK Head Office)

UNITED KINGDOM

OEM Speakers & Drivers

Celestion (US Sales Office)

UNITED STATES

OEM Speakers & Drivers, Speaker Parts

Centrotherm Systemtechnik GmbH

GERMANY

Cables & Connectors, Consultants & Designers, OEM Speaker Assembly, Speaker Parts

CGN Audio Labs

UNITED STATES

Consultants & Designers, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

Chorus Audio Group

ISRAEL

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Citadel (Bulk Molding Compounds, Inc.)

UNITED STATES

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts

CJS Labs

UNITED STATES

Consultants & Designers

Clarasonic

THAILAND

Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts, Test Equipment

Coby Speakers

ISRAEL

Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Creative Sound Solutions

CANADA

Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Crista Technologies

FRANCE

Finished Systems (OEM/ODM) & Integrated Audio

Crystal Acoustics

UNITED STATES

Earphones & Headphones, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers

Dai-ichi Electronics Manufacturing Corp.

PHILIPPINES

Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, OEM Speakers & Drivers, Speaker Parts

Danville Signal Processing, Inc.

UNITED STATES

Consultants & Designers, Earphones & Headphones, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Passive Components/Crossovers/Wiring

Dayton Audio

UNITED STATES

Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

dB Technologies

UNITED STATES

Finished Systems (OEM/ODM) & Integrated Audio

DC Audio

UNITED STATES

OEM Speakers & Drivers

Decibel Eng. Ind.

BRAZIL

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

DEQX Pty., Ltd.

AUSTRALIA

Consultants & Designers, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, Test Equipment

Digital Audio Labs

UNITED STATES

Finished Systems (OEM/ODM) & Integrated Audio

Dimensions Acoustiques-Supravox

CANADA
OEM Speakers & Drivers

Dynakit, Inc.

UNITED STATES
Finished Systems (OEM/ODM) & Integrated Audio, Passive Components/Crossovers/Wiring

Dynavox Electronics, Inc.

UNITED STATES
Cables & Connectors, Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Eastern Asia Technology (HK) Ltd.-

Premier Sound Group

CHINA
Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Eighteen Sound

ITALY
OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

Electro Mavin

UNITED STATES
Cables & Connectors, Enclosure Parts, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

Elkhorn Acoustics, LLC

UNITED STATES
Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones

ELP Corp.

ITALY
Cables & Connectors, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers

eMagineFactory, LLC

UNITED STATES
Consultants & Designers, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio

Eminence Speaker, LLC

UNITED STATES
Engineering Software, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

Enkor Electronics Co., Ltd.

CHINA
Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers

ESS Labs, LLC

UNITED STATES
Earphones & Headphones, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

ETANI Electronics Co., Ltd.

JAPAN
Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, Test Equipment

ETS-Lindgren

UNITED STATES
Consultants & Designers, Test Equipment

EuroTec International, Ltd.

TAIWAN
Cables & Connectors, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

EuroTec International, plc

UNITED KINGDOM
Cables & Connectors, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Excelsior Audio Design & Services

UNITED STATES
Consultants & Designers, Engineering Software

Faital, S.p.A.

UNITED STATES
Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts, Test Equipment

Fane International

UNITED KINGDOM
Consultants & Designers, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Fantasy Motorsports

UNITED STATES
Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, Microspeakers, OEM Speaker Assembly

Ferrotec (USA) Corp.

UNITED STATES
Speaker Parts

Fisher Radio Corp.

UNITED STATES
Cables & Connectors, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

Fluid Metering, Inc.

UNITED STATES
Manufacturing Equipment

Foam Speaker Grilles

UNITED STATES
Enclosure Parts

G.R.A.S. Sound & Vibration

UNITED STATES
Cables & Connectors, Measurement Microphones, Test Equipment

Geometric Consulting

UNITED STATES
Consultants & Designers, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly

Gingko Audio, Inc.

UNITED STATES
Cables & Connectors, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Global Audio Source, Inc.

UNITED STATES
Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Globe Audio Design, Inc.

UNITED STATES
Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, Speaker Parts

Globe Plastics

UNITED STATES
Enclosures & Cabinets, Enclosure Parts, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts

GM Audio Technics, Ltd.

INDIA
Consultants & Designers, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Green Acoustics

SWEDEN
Consultants & Designers, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio

Grund Audio Design

UNITED STATES
Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

Haiyun Electronics Co., Ltd.

CHINA
Speaker Parts

Halford Loudspeakers

UNITED STATES
Finished Systems (OEM/ODM) & Integrated Audio

Hartley Loudspeakers, Inc.

UNITED STATES
OEM Speakers & Drivers

Hill Acoustics, Ltd.

UNITED KINGDOM
Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Microspeakers, OEM Speakers & Drivers, Test Equipment

Hiquphon

DENMARK
OEM Speakers & Drivers

Hisco Precision Converting, Inc.

UNITED STATES
Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Speaker Parts

Huey Tung International Co., Ltd.

TAIWAN

Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Hypex Electronics, BV

UNITED STATES

Finished Systems (OEM/ODM) & Integrated Audio, Speaker Parts

iCapture ApS

DENMARK

Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts

IDeA

FRANCE

Earphones & Headphones, Finished Systems (OEM/ODM) & Integrated Audio

Inlow Sound

UNITED STATES

Consultants & Designers, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio

Innova Engineering, Inc.

INDIA

Consultants & Designers, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, OEM Speaker Assembly, OEM Speakers & Drivers

Integrated Audio Technologies, LLC

UNITED STATES

Consultants & Designers

iSEMcon GmbH

GERMANY

Measurement Microphones

J.A. McKinney & Assoc., LLC

UNITED STATES

Consultants & Designers

Jantzen Audio Denmark

DENMARK

Cables & Connectors, Enclosures & Cabinets, Enclosure Parts, Passive Components/Crossovers/Wiring

JBL Selenium

UNITED STATES

OEM Speaker Assembly, OEM Speakers & Drivers

JLI Electronics, Inc.

UNITED STATES

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Measurement Microphones, Mic Capsules

JP Electronics Design

UNITED STATES

Consultants & Designers

Kadeton Audio Co., Ltd.

CHINA

Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly

KBL Systems

NETHERLANDS

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Kinetic Audio International, Ltd.

UNITED STATES

Consultants & Designers, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Klippel GmbH

GERMANY

Test Equipment

Kludge Audio

UNITED STATES

Consultants & Designers

Kmaxima Group

TAIWAN

Cables & Connectors, Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Kravchenko-Audio

CANADA

Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers

Kwanasia Electronics Co., Ltd.

CHINA

Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, Speaker Parts

Kyu Systems

FRANCE

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Lamart Corp.

UNITED STATES

OEM Speaker Assembly, Speaker Parts

Levister Audio

UNITED STATES

Finished Systems (OEM/ODM) & Integrated Audio

Linn Audio Loudspeakers

UNITED STATES

Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers

Lipinski Sound

UNITED STATES

Cables & Connectors, Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio

Listen Audio Systems, Inc.

UNITED STATES

Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Listen, Inc.

UNITED STATES

Engineering Software, Measurement Microphones

Lorantz Audio Services Pty., Ltd.

AUSTRALIA

Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

LOUDSOFT, Ltd.

DENMARK

Consultants & Designers, Engineering Software, Manufacturing Equipment, Measurement Microphones, Test Equipment

Loudspeakers Plus

UNITED STATES

Cables & Connectors, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

Lowell Manufacturing Co.

UNITED STATES

Enclosures & Cabinets, Enclosure Parts, Passive Components/Crossovers/Wiring

Macpherson Audio

UNITED STATES

Consultants & Designers

Maeden International, Ltd.

TAIWAN

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Passive Components/Crossovers/Wiring, Speaker Parts

MAG

UKRAINE

Cables & Connectors, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Magnet, Ltd.

UKRAINE

Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Marchand Electronics, Inc.

UNITED STATES

Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Martin Sound Products

UNITED STATES

Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Materion Electrofusion

UNITED STATES

Speaker Parts

Megatec, AG

SWITZERLAND

Manufacturing Equipment, Test Equipment

Meniscus Audio Group, Inc.

UNITED STATES

Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Consultants & Designers, Engineering
Software, Finished Systems (OEM/ODM)
& Integrated Audio, Passive Components/
Crossovers/Wiring

RBH Sound

UNITED STATES

Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

RCF

UNITED STATES

Enclosures & Cabinets, OEM Speakers & Drivers

REFERENCE 3A

CANADA

Cables & Connectors, Finished Systems (OEM/ODM) & Integrated Audio

Renkus-Heinz, Inc.

UNITED STATES

Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio

Revolver Audio, Ltd.

UNITED KINGDOM

Cables & Connectors, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly

Rocking Class Electronics

UNITED STATES

Finished Systems (OEM/ODM) & Integrated Audio, Passive Components/Crossovers/Wiring

Role Audio

UNITED STATES

Finished Systems (OEM/ODM) & Integrated Audio

S.S. Electronics

INDIA

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

SAE

THAILAND

Consultants & Designers, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, OEM Speaker Assembly, OEM Speakers & Drivers, Test Equipment

Sanming Sound

UNITED STATES

OEM Speakers & Drivers

Satcab, SA

PORTUGAL

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

SB Acoustics

INDONESIA

Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers, Speaker Parts

Scan-Speak A/S

DENMARK

OEM Speakers & Drivers

Sea Galleon International, Ltd.

CHINA

Manufacturing Equipment, OEM Speaker Assembly, Passive Components/Crossovers/Wiring, Speaker Parts

Shenzhen Tekzone Loudspeaker Co., Ltd.

CHINA

Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Test Equipment

Sherwood Industries, Inc.

UNITED STATES

Speaker Parts, Test Equipment

SIEA

FRANCE

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Speaker Parts, Test Equipment

Simply Speakers

UNITED STATES

Enclosure Parts, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Smith and Larson Audio

UNITED STATES

Consultants & Designers, Engineering Software, Measurement Microphones, Test Equipment

Solen Electronic, Inc.

CANADA

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Solidex Manufacturing Group, LLC

UNITED STATES

Earphones & Headphones, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

Solvay

UNITED STATES

Enclosures & Cabinets, Enclosure Parts, OEM Speaker Assembly

Sonic Craft, Inc.

UNITED STATES

Cables & Connectors, Enclosure Parts, OEM Speaker Assembly, Passive Components/Crossovers/Wiring

Sound Lab, Inc.

UNITED STATES

Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers

Sound Sources Technology, Inc.

UNITED STATES

Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Sound Technology Development, Ltd.

CHINA

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Soundcare, A/S

NORWAY

Enclosures & Cabinets

SoundKinetics, Inc.

UNITED STATES

Consultants & Designers, Engineering Software

Sounds-Good Audio Solutions

GERMANY

Cables & Connectors, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, Mic Capsules, OEM Speaker Assembly

Speaker Art

UNITED STATES

Consultants & Designers, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly

Speaker Clinic

UNITED STATES

Consultants & Designers, Engineering Software, Test Equipment

SpeakerAddict

UNITED STATES

Cables & Connectors, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

SpeakerLAB, S.R.L.

ITALY

Cables & Connectors, Consultants & Designers, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Test Equipment

SPOORT.NU

NETHERLANDS

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Standard Audio Systems, AB

SWEDEN

Consultants & Designers

Stones Sound Studio

AUSTRALIA

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Studio Electric

UNITED STATES

Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly

Studio Reference Monitors

CANADA

Consultants & Designers, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts

Sun Technique Electric Co., Ltd.

CHINA

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Supergauss Produtos Magneticos, Ltd.

BRAZIL

Enclosures & Cabinets, Speaker Parts

Suzuki Kanshi (Thailand) Co., Ltd.

THAILAND

Speaker Parts

Sveda Audio

POLAND

Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, Speaker Parts

TC Sounds

UNITED STATES

OEM Speakers & Drivers

Tectonic Elements, Ltd.

UNITED KINGDOM

Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speakers & Drivers

tg-acoustics

NETHERLANDS

Consultants & Designers, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, Passive Components/Crossovers/Wiring

the BEE

NETHERLANDS

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

The Canadian Loudspeaker Corp.

CANADA

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

The Eraser Company, Inc.

UNITED STATES

Manufacturing Equipment

Tortech Engineered Sound Products

CANADA

Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, Measurement Microphones, Mic Capsules, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Transducer Lab

UNITED STATES

Consultants & Designers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Trax Audio

UNITED STATES

Consultants & Designers, Enclosures & Cabinets, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Trent Engineering

INDIA

Cables & Connectors, Consultants & Designers, Earphones & Headphones, Enclosures & Cabinets, Enclosure Parts, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, Measurement Microphones, Mic Capsules, Microspeakers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

True Technologies, Inc.

UNITED STATES

Consultants & Designers, Earphones & Headphones, Engineering Software, Test Equipment

Tymphony

UNITED STATES

Earphones & Headphones, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers

UKD, Ltd.

UNITED KINGDOM

Finished Systems (OEM/ODM) & Integrated Audio

Under Cover

UNITED STATES

Finished Systems (OEM/ODM) & Integrated Audio

UpTone Audio, LLC

UNITED STATES

Passive Components/Crossovers/Wiring

Vance Dickason Consulting

UNITED STATES

Consultants & Designers

Vertek/XTC

UNITED STATES

Consultants & Designers, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Vidyut Teletronics, Ltd.

INDIA

Cables & Connectors, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Volt Loudspeakers, Ltd.

UNITED KINGDOM

Consultants & Designers, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring

Warkwyn Associates, Inc.

CANADA

Consultants & Designers, Engineering Software, Measurement Microphones, Test Equipment

Wavecor, Ltd.

CHINA

OEM Speakers & Drivers

WebMagnetics, Inc.

UNITED STATES

Consultants & Designers, Speaker Parts

Wellmax Co., Ltd.

TAIWAN

Cables & Connectors, Earphones & Headphones, Speaker Parts

Westlake Audio

UNITED STATES

Cables & Connectors, Finished Systems (OEM/ODM) & Integrated Audio

Wizard India Private, Ltd.

INDIA

Enclosures & Cabinets, Enclosure Parts, Finished Systems (OEM/ODM) & Integrated Audio, OEM Speaker Assembly, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts

Wolf von Langa

GERMANY

Cables & Connectors, Consultants & Designers, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, OEM Speakers & Drivers, Passive Components/Crossovers/Wiring, Speaker Parts, Test Equipment

Woods Engineering

SPAIN

Consultants & Designers, Engineering Software, Measurement Microphones, Test Equipment

Zhuhai HiVi Technology Co., Ltd.

CHINA

Consultants & Designers, Enclosures & Cabinets, Engineering Software, Finished Systems (OEM/ODM) & Integrated Audio, Manufacturing Equipment, OEM Speaker Assembly, OEM Speakers & Drivers, Speaker Parts, Test Equipment

	Wire Channel Connectors Cables		
AUSTRALIA			
Stones Sound Studio	•		
BRAZIL			
Advanced Audio Technologies	•		
Decibel Eng. Ind.	•	•	•
CANADA			
Canadian Speaker Works	•	•	
REFERENCE 3A	•		
Solen Electronique, Inc.	•	•	
The Canadian Loudspeaker Corp.	•		
CHINA			
BSWA Technology Co., Ltd.	•	•	•
Sound Technology Development, Ltd.	•	•	•
Sun Technique Electric Co., Ltd.	•	•	•
DENMARK			
Jantzen Audio Denmark	•	•	
FRANCE			
Kyu Systems	•	•	
SIEA	•		
GERMANY			
Akustik Perfekt	•	•	
Centrotherm Systemtechnik GmbH		•	
Sounds-Good Audio Solutions	•	•	
Wolf von Langa	•		
INDIA			
Power Electronics & Technologies	•	•	
S.S. Electronics		•	
Trent Engineering		•	
Vidyut Teletronics, Ltd.	•		•
ISRAEL			
Chorus Audio Group	•	•	•
ITALY			
Audiomatica, S.R.L.	•		
Axiomedia	•	•	
ELP Corp.			•
SpeakerLAB, S.R.L.			•
NETHERLANDS			
KBL Systems	•	•	•
SPOORT.NU	•	•	•
the BEE		•	
PORTUGAL			
Satcab, SA			•

	Wire Channel Connectors Cables		
SWEDEN			
Audio Pro, AB	•		
TAIWAN			
EuroTec International, Ltd.	•	•	
Kmaxima Group		•	
Maeden International, Ltd.	•	•	•
Wellmax Co., Ltd.	•		
THAILAND			
Audiovista	•	•	
UKRAINE			
MAG	•	•	•
UNITED KINGDOM			
Bishopsound	•	•	
EuroTec International, plc	•	•	
Revolver Audio, Ltd.	•	•	
UNITED STATES			
AMS Audio Enterprises, Inc.	•	•	
AntiCable Audio Co., Inc.	•	•	
Audia Media Group	•		
Audiofly Pty., Ltd.	•		
Brüel & Kjær Sound & Vibration Measurement A/S	•		
Canare Corp.	•	•	
Carvin Corp.	•	•	
Citadel (Bulk Molding Compounds, Inc.)		•	
Dynavox Electronics, Inc.	•	•	
Electro Mavin		•	
Fantasy Motorsports	•	•	•
Fisher Radio Corp.	•		
G.R.A.S. Sound & Vibration	•		
Gingko Audio, Inc.	•		
Hisco Precision Converting, Inc.			•
JLI Electronics, Inc.	•		
Lipinski Sound	•		
Loudspeakers Plus		•	
New Millennium Acoustics	•		
Orb Audio, LLC	•		
Parts Express	•	•	
Sonic Craft, Inc.	•	•	
SpeakerAddict		•	
Westlake Audio	•		

DEQX Pty., Ltd.
Lorantz Audio Services Pty., Ltd.
Stones Sound Studio

Advanced Audio Technologies
Decibel Eng. Ind.

Audio Opportunities, Ltd.
Audio-Concept (G.C.)
Canadian Speaker Works
Kravchenko-Audio
Peter Duminy-Loudspeaker Research & Design (DLC)
Planet_10 hi-fi
Primrose Audio Design, Inc.
RAW Acoustics
Solen Electronique, Inc.
Studio Reference Monitors
The Canadian Loudspeaker Corp.
Warkwyn Associates, Inc.

B.W. Audio Guangzhou Co., Ltd.
BSWA Technology Co., Ltd.
Ocean Sound Technology, Ltd.
Sound Technology Development, Ltd.
Sun Technique Electric Co., Ltd.
Zhuhai HiVi Technology Co., Ltd.

iCapture ApS
LOUDSOFT, Ltd.

Kyu Systems
SIEA

Akustik Perfekt
Audiophil GmbH
Centrotherm Systemtechnik GmbH
Physical Lab
Wolf von Langa

GM Audio Technics, Ltd.
Innova Engineering, Inc.
Power Electronics & Technologies
S.S. Electronics
Trent Engineering

Chorus Audio Group

Audiomarin, SNC
Audiomatica, S.R.L.
Audioxplus, S.R.L.
Axiomedia
SpeakerLAB, S.R.L.

Acoustic Power Lab

Acoustics Lab
Audio Labs

Aletheia AV

Avvio Netherlands, BV
KBL Systems
Millon Loudspeakers
SPOORT.NU
tg-acoustics
the BFF

Midgard Audio

Satcab. SA

Woods Engineering

Böhmer Audio, AB
Green Acoustics
Standard Audio Systems, AB

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Maeden International, Ltd.

Audiovista
SAE

Magnet, Ltd.

Bishopsound
Fane International
Hill Acoustics, Ltd.
Precision Devices, Ltd.
Tectonic Elements, Ltd.
Volt Loudspeakers, Ltd.

Advanced Transduction
Aempyrean, Inc.
Audia Media Group
Audio Nirvana Speakers
Audiofly Pty., Ltd.
Audiophiles Engineering
Auratron Systems
Avtek International
Bamberg Engineering
Beach Dynamics, Inc.
BeStar Technologies, Inc.

Bob Young and Associates
 Carvin Corp.
 CGN Audio Labs
 Citadel (Bulk Molding Compounds, Inc.)
 CJS Labs
 Danville Signal Processing, Inc.
 Dayton Audio
 eMagineFactory, LLC
 ETS-Lindgren
 Excelsior Audio Design & Services
 Fantazy Motorsports
 Geometric Consulting
 Global Audio Source, Inc.
 Globe Audio Design, Inc.
 Hisco Precision Converting, Inc.
 Inlow Sound
 Integrated Audio Technologies, LLC
 J.A. McKinney & Assoc., LLC
 JLI Electronics, Inc.
 JP Electronics Design
 Kinetic Audio International, Ltd.
 Kludge Audio
 Lipinski Sound
 Listen Audio Systems, Inc.
 Macpherson Audio
 Marchand Electronics, Inc.
 Menlo Scientific, Ltd.
 Minnetonka Audio Software, Inc.

MISCO
NedLab
New Millennium Acoustics
North Reading Engineering
NSMT Loudspeakers
Orb Audio, LLC
Pacific Transformer Corp.
Pazandeh Audio Designs
Planot, LLC
PR Audio
Psychoacoustics
RBH Sound
Smith and Larson Audio
SoundKinetics, Inc.
Speaker Art
Speaker Clinic
Studio Electric
Transducer Lab
Trax Audio
True Technologies, Inc.
Vance Dickason Consulting
Vertek/XTC
WebMagnetics, Inc.

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	Headphones	Earphones
UNITED STATES		
American Bass USA	●	●
Audia Media Group	●	●
Audiofly Pty., Ltd.		●
Avtek International	●	●
BeStar Technologies Inc.		●
Crystal Acoustics	●	●
Danville Signal Processing, Inc.		●
ESS Labs, LLC		●
Fantasy Motorsports	●	●
Hisco Precision Converting, Inc.	●	●
JLI Electronics, Inc.	●	●
Orb Audio, LLC		●
Parts Express		●
RBH Sound	●	●
Solidex Manufacturing Group, LLC		●
True Technologies, Inc.	●	●
Tymphony		●

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	Acoustic Analysis	Crossover Design	Box Design	Network Optimizer	CAE or CAD
Sound Technology Development, Ltd.	●	●	●	●	●
Sun Technique Electric Co., Ltd.	●	●	●	●	●
Zhuhai HiVi Technology Co., Ltd.	●	●	●		●
DENMARK					
iCapture ApS	●	●			●
LOUDSOFT, Ltd.	●	●	●		
FRANCE					
Kyu Systems	●			●	●
SIEA	●	●	●	●	●
GERMANY					
Akustik Perfekt	●	●	●	●	●
Audiophil GmbH	●	●	●	●	●
Physical Lab	●	●	●	●	●
R&D Team Software Development	●				
Sounds-Good Audio Solutions	●	●	●		●
Wolf von Langa		●		●	●
INDIA					
GM Audio Technics, Ltd.	●	●	●		
Innova Engineering, Inc.				●	

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	Acoustic Analysis	Crossover Design Box Design	Network Optimizer	CAE or CAD
S.S. Electronics	•	•	•	•
Trent Engineering		•		
ISRAEL				
Chorus Audio Group	•	•	•	
Coby Speakers	•	•	•	•
ITALY				
Audiomatica, S.R.L.	•			
Axiomedia		•	•	
ELP Corp.		•	•	
Professional Audio, SNC	•	•	•	•
SpeakerLAB, S.R.L.	•	•		•
JAPAN				
ETANI Electronics Co., Ltd.	•	•		
LATVIA				
Acoustic Power Lab	•		•	
MALAYSIA				
Audio Labs	•	•	•	•
NETHERLANDS				
Auvio Netherlands, BV		•		
KBL Systems	•	•	•	•
Millon Loudspeakers	•	•	•	•
SPOORT.NU	•	•	•	•
the BEE	•	•	•	
NORWAY				
Midgard Audio	•	•	•	•
PORTUGAL				
Satcab, SA		•	•	•
SPAIN				
Woods Engineering	•			
SWEDEN				
Audio Pro, AB	•	•	•	•
Böhmer Audio, AB	•			
Green Acoustics	•			
THAILAND				
Audiovista	•	•	•	•
Clarasonic	•			•
SAE	•			
UKRAINE				
MAG	•	•	•	•
UNITED KINGDOM				
BishopSound		•	•	•
Fane International	•	•	•	•
Precision Devices, Ltd.	•	•	•	•

UNITED STATES

	Acoustic Analysis	Crossover Design Box Design	Network Optimizer	CAE or CAD
Advanced Transduction	•			•
Aempyrean, Inc.	•			
American Bass USA	•	•	•	•
Audio Media Group	•	•	•	•
Audio Precision	•			
Audiophiles Engineering	•	•	•	•
Avtek International	•	•	•	•
Brüel & Kjær Sound & Vibration Measurement A/S	•			
Citadel (Bulk Molding Compounds, Inc.)				•
Crystal Acoustics		•		
Danville Signal Processing, Inc.			•	
Dayton Audio	•	•		
eMagineFactory, LLC				•
Eminence Speaker, LLC		•		
Excelsior Audio Design & Services	•			
Fantasy Motorsports	•	•	•	•
Gingko Audio, Inc.	•	•		
Global Audio Source, Inc.			•	•
Grund Audio Design	•	•	•	•
Hisco Precision Converting, Inc.				•
Listen Audio Systems, Inc.	•	•	•	•
Listen, Inc.	•			
Martin Sound Products		•		
Meniscus Audio Group, Inc.	•	•		
New Millennium Acoustics	•	•	•	•
North Reading Engineering	•		•	
Parts Express	•	•	•	
Pazandeh Audio Designs		•	•	
Psychoacoustics	•	•	•	
RBH Sound	•	•	•	•
Smith and Larson Audio	•	•	•	•
SoundKinetics, Inc.	•			
Speaker Art			•	
Speaker Clinic	•	•	•	•
True Technologies, Inc.	•	•		

2014 Loudspeaker Industry Sourcebook

FINISHED SYSTEMS (OEM/ODM) & INTEGRATED AUDIO

	OEM/ODM (Finished Systems)		Integrated Amplified Speaker Solutions						
	Home Audio	Car Audio	Pro Audio	Amplifiers	DSP (Digital Signal Processing)	High-Power Amplifier Modules	Subwoofer Plate Amps	Soundbars	Wireless
GERMANY									
Akustik Perfekt									
Audiophil GmbH									
Sounds-Good Audio Solutions									
Wolf von Langa									
INDIA									
Aesthetic Audio, LLC									
GM Audio Technics, Ltd.									
Innova Engineering, Inc.									
Power Electronics & Technologies									
S.S. Electronics									
Trent Engineering									
Wizard India Private, Ltd.									
INDONESIA									
SB Acoustics									
ISRAEL									
Chorus Audio Group									
Coby Speakers									
Morel, Ltd.									
ITALY									
Audiomarin, SNC									
Audioxplus, S.R.L.									
Axiomedia									
ELP Corp.									
Outline, S.R.L.									
Professional Audio, SNC									
SpeakerLAB, S.R.L.									
JAPAN									
ETANI Electronics Co., Ltd.									
LATVIA									
Acoustic Power Lab									
MEXICO									
Aletheia AV									
NETHERLANDS									
Auvio Netherlands, BV									
KBL Systems									
Millon Loudspeakers									
SPOORT.NU									
tg-acoustics									
the BEE									
NORWAY									
Midgard Audio									

FINISHED SYSTEMS (OEM/ODM) • FINISHED SYSTEMS (OEM/ODM) & INTEGRATED AUDIO • FINISHED SYSTEMS

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FINISHED SYSTEMS (OEM/ODM) & INTEGRATED AUDIO

	OEM/ODM (Finished Systems)			Integrated Amplified Speaker Solutions						
	Home Audio	Pro Audio	Car Audio	DSP (Digital Signal Processing)	High-Power Amplifier Modules	Subwoofer Plate Amps	Soundbars	Wireless		
THAILAND										
Audiovista	•	•		•	•					
Clarasonic	•	•								•
SAE	•	•	•							
UKRAINE										
MAG				•	•	•	•	•	•	•
Magnet, Ltd.				•						
UNITED KINGDOM										
Bishopsound				•	•	•		•	•	
EuroTec International, plc	•						•			
Fane International		•		•	•	•				
Hill Acoustics, Ltd.		•		•						
Precision Devices, Ltd.				•						
Revolver Audio, Ltd.		•		•						
Tectonic Elements, Ltd.						•				
UKD, Ltd.		•		•						
UNITED STATES										
Acoustic Development International	•	•	•				•			
Advanced Transduction		•	•							•
Aempyrean, Inc.	•	•	•				•			
Alta Audio		•								
American Bass USA	•		•	•	•	•	•	•	•	•
AMS Audio Enterprises, Inc.		•	•	•				•	•	•
Anaview				•		•	•	•	•	•
Audio Media Group	•	•	•	•	•	•		•		
Audio Nirvana Speakers	•	•	•	•						
Audiofly Pty., Ltd.				•						
Auratron Systems		•	•							
Avtek International		•	•	•	•	•	•	•	•	•
Bamberg Engineering		•								
Bogen Communications, Inc.		•	•	•	•					
Carvin Corp.			•	•	•	•				•
CGN Audio Labs		•	•							
Citadel (Bulk Molding Compounds, Inc.)		•	•				•			
Crystal Acoustics		•			•	•			•	
Danville Signal Processing, Inc.				•	•				•	
Dayton Audio	•	•	•	•		•	•	•	•	•
dB Technologies				•						
Digital Audio Labs		•		•	•	•				
Dynakit, Inc.		•		•						
Dynavox Electronics, Inc.	•	•	•	•			•	•	•	
Elkhorn Acoustics, LLC		•								
eMagineFactory, LLC	•	•	•							
ESS Labs, LLC		•	•							
Faital, S.p.A.			•							
Fantazy Motorsports	•	•	•	•	•	•	•	•	•	•
Fisher Radio Corp.		•		•						

FINISHED SYSTEMS (OEM/ODM) & INTEGRATED AUDIO

OEM/ODM (Finished Systems)	Integrated Amplified Speaker Solutions							
	High-Power Amplifier Modules				Subwoofer Plate Amps			
	DSP (Digital Signal Processing)				Soundbars			
	Home Audio	Pro Audio	Car Audio	Wireless	Home Audio	Pro Audio	Car Audio	Wireless
Geometric Consulting								
Ginkgo Audio, Inc.								
Global Audio Source, Inc.								
Globe Audio Design, Inc.								
Grund Audio Design								
Halford Loudspeakers								
Hisco Precision Converting, Inc.								
Hypex Electronics, BV								
Inlow Sound								
Kinetic Audio International, Ltd.								
Levister Audio								
Linn Audio Loudspeakers								
Lipinski Sound								
Listen Audio Systems, Inc.								
Loudspeakers Plus								
Marchand Electronics, Inc.								
Martin Sound Products								
Meniscus Audio Group, Inc.								
MISCO								
NedLab								
New Millennium Acoustics								
North Reading Engineering								
NSMT Loudspeakers								
Orb Audio, LLC								
Pacific Transformer Corp.								
Parts Express								
Pazandeh Audio Designs								
Precision Transducer Engineering (PTE)								
Psychoacoustics								
QSC Audio Products, LLC								
RBH Sound								
Renkus-Heinz, Inc.								
Rocking Class Electronics								
Role Audio								
Solidex Manufacturing Group, LLC								
Sound Lab, Inc.								
Sound Sources Technology, Inc.								
Speaker Art								
SpeakerAddict								
Studio Electric								
Trax Audio								
True Technologies, Inc.								
Tympany								
Under Cover								
Vertek/XTC								
Westlake Audio								

	Adhesive Dispensers	Curing Ovens	Lead Out Wire Termination	Magnetizers/Demagnetizers	Production Line Equipment	Ultrasonic Assembly Equipment
PORTUGAL						
Satcab, SA	•	•		•		
SWEDEN						
Audio Pro, AB					•	
SWITZERLAND						
Megatec, AG		•		•	•	•
THAILAND						
Audiovista				•		
Clarasonic	•		•		•	
UKRAINE						
MAG					•	•
UNITED KINGDOM						
Fane International	•	•	•	•	•	•
Hill Acoustics, Ltd.					•	
Precision Devices, Ltd.	•	•	•	•	•	•
UNITED STATES						
American Bass USA	•	•		•	•	•
Audio Media Group	•		•		•	•
Brüel & Kjær Sound & Vibration Measurement A/S					•	
Dynavox Electronics, Inc.						•
Fantasy Motorsports	•	•	•	•	•	•
Fluid Metering, Inc.	•					
Hisco Precision Converting, Inc.	•				•	
Nordson EFD	•				•	
North Reading Engineering	•		•			•
The Eraser Company, Inc.					•	

MEASUREMENT MICROPHONES

	Consumer	Lab Instruments Field Mics	Measuring Mics	Professional
AUSTRALIA				
DEQX Pty., Ltd.		•		•
Stones Sound Studio	•	•	•	•
BRAZIL				
Decibel Eng. Ind.	•	•	•	•
CANADA				
Audio-Concept (G.C.)			•	•
Canadian Speaker Works				•
Peter Duminy-Loudspeaker Research & Design (DLC)			•	•
Solen Electronique, Inc.	•		•	•
Tortech Engineered Sound Products				•
Warkwyn Associates, Inc.			•	
CHINA				
BSWA Technology Co., Ltd.		•	•	•
Shenzhen Tekzone Loudspeaker Co., Ltd.			•	
Sound Technology Development, Ltd.				•
Sun Technique Electric Co., Ltd.	•	•	•	•
DENMARK				
LOUDSOFT, Ltd.				•

	Consumer	Lab Instruments Field Mics	Measuring Mics	Professional
FRANCE				
Kyu Systems			•	•
GERMANY				
iSEMcon GmbH				•
Physical Lab		•		•
Sounds-Good Audio Solutions				•
INDIA				
GM Audio Technics, Ltd.				•
S.S. Electronics				•
Trent Engineering			•	
ISRAEL				
Chorus Audio Group				•
ITALY				
Professional Audio, SNC			•	•
SpeakerLAB, S.R.L.			•	•
JAPAN				
ETANI Electronics Co., Ltd.		•		•
NETHERLANDS				
KBL Systems		•	•	•
SPOORT.NU	•	•	•	•
the BEE	•		•	•

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PORTUGAL Satcab, SA	•		•		•
SPAIN Woods Engineering				•	
SWEDEN Audio Pro, AB				•	•
THAILAND Audiovista SAE		•	•	•	•
UKRAINE MAG					•
UNITED KINGDOM Bishopsound Fane International Hill Acoustics, Ltd. Precision Devices, Ltd.	•			•	•

	Consumer	Lab Instruments	Field Mics	Measuring Mics	Professional
UNITED STATES ACO Pacific, Inc. Advanced Transduction American Bass USA Audia Media Group Audio Precision Audiofly Pty., Ltd. Bogen Communications, Inc. Brüel & Kjær Sound & Vibration Measurement A/S Dayton Audio Elkhorn Acoustics, LLC Fantazy Motorsports G.R.A.S. Sound & Vibration Gingko Audio, Inc. JLI Electronics, Inc. Listen, Inc. New Millennium Acoustics North Reading Engineering NTi Audio Parts Express Smith and Larson Audio	•	•	•	•	•

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PORTUGAL Satcab, SA			
UNITED KINGDOM Hill Acoustics, Ltd.			
UNITED STATES Acoustic Development International BeStar Technologies, Inc. Dayton Audio Fantazy Motorsports NedLab Parts Express Solidex Manufacturing Group, LLC Sound Sources Technology, Inc.			

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	Finished Goods	Acoustic Materials
AUSTRALIA Stones Sound Studio	●	●
BRAZIL AMCP Electronics Decibel Eng. Ind. PRV Audio Brazil	●	●
CANADA Audio Opportunities, Ltd. Audio-Concept (G.C.) Canadian Speaker Works Kravchenko-Audio Planet 10 hi-fi Solen Electronique, Inc. Studio Reference Monitors The Canadian Loudspeaker Corp.	●	●
CHINA Audiostar Electronics Co., Ltd. B.W. Audio Guangzhou Co., Ltd. Eastern Asia Technology (HK) Ltd. -Premier Sound Group Enkor Electronics Co., Ltd. Kadeton Audio Co., Ltd. Kwanasia Electronics Co., Ltd. M-Sound Electronics Co., Ltd. OBE Pro Audio Co., Ltd. Ocean Sound Technology, Ltd. Sea Galleon International, Ltd. Shenzhen Tekzone Loudspeaker Co., Ltd. Sound Technology Development, Ltd. Sun Technique Electric Co., Ltd. Zhuhai HiVi Technology Co., Ltd.	●	●
DENMARK iCapture ApS	●	
FRANCE AAC-Applications Acoustiques de Composites AUDAX Kyu Systems	●	●
GERMANY Akustik Perfekt Centrotherm Systemtechnik GmbH Sounds-Good Audio Solutions	●	●
INDIA Innova Engineering, Inc. Power Electronics & Technologies S.S. Electronics Trent Engineering Vidyut Electronics, Ltd. Wizard India Private, Ltd.	●	●

	Acoustic Materials	Finished Goods
ISRAEL Coby Speakers	●	●
ITALY Audioplus, S.R.L. Eighteen Sound Professional Audio, SNC		● ● ●
MEXICO Aletheia AV		●
NETHERLANDS Auvio Netherlands, BV KBL Systems Millon Loudspeakers SPOORT.NU tg-acoustics the BEE		● ● ● ● ● ● ●
NORWAY Midgard Audio	●	●
POLAND Sveda Audio		●
PORTUGAL Satcab, SA		●
SWEDEN Audio Pro, AB Böhmer Audio, AB	● ●	● ●
TAIWAN EuroTec International, Ltd. Huey Tung International Co., Ltd. Kmaxima Group	● ● ●	● ● ●
THAILAND Audiovista Clarasonic SAE	● ● ●	● ● ●
UKRAINE MAG	●	●
UNITED KINGDOM Bishopsound EuroTec International, plc Fane International Precision Devices, Ltd. Revolver Audio, Ltd. Volt Loudspeakers, Ltd.	● ● ● ● ● ●	● ● ● ● ● ●
UNITED STATES AcousTex Fabrics Acoustic Development International Acoustics First Corp. Acoustone Corp. Advanced Transduction	● ● ● ●	● ● ● ●

	Acoustic Materials	Finished Goods
Aempyrean, Inc.		•
American Bass USA	•	•
AMS Audio Enterprises, Inc.		•
Audia Media Group	•	
Audio Nirvana Speakers		•
Avtek International		•
B&C Speakers, S.p.A.		•
Bamberg Engineering		•
BeStar Technologies, Inc.		•
Bogen Communications, Inc.		•
Carvin Corp.		•
CGN Audio Labs		•
Citadel (Bulk Molding Compounds, Inc.)	•	
Crystal Acoustics	•	•
Dayton Audio		•
Dynavox Electronics, Inc.		•
Eminence Speaker, LLC		•
ESS Labs, LLC		•
Faital, S.p.A.	•	
Fantasy Motorsports	•	•
Geometric Consulting		•
Globe Plastics	•	
Grund Audio Design		•
JBL Selenium		•
Kinetic Audio International, Ltd.		•
Lamart Corp.	•	
Linn Audio Loudspeakers		•
Listen Audio Systems, Inc.	•	•
MISCO		•
NedLab	•	
New Millennium Acoustics	•	•
North Reading Engineering	•	•
NSMT Loudspeakers		•
Orb Audio, LLC		•
Parts Express	•	•
RBH Sound		•
Solidex Manufacturing Group, LLC		•
Solvay	•	
Sonic Craft, Inc.	•	
Sound Sources Technology, Inc.		•
Speaker Art		•
Studio Electric		•
Transducer Lab		•
Trax Audio		•
Tymphany	•	•
Vertek/XTC	•	•

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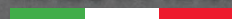
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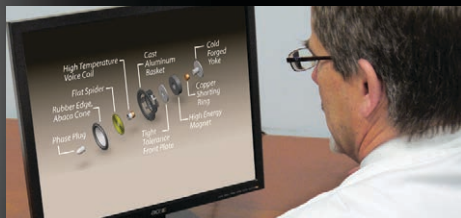


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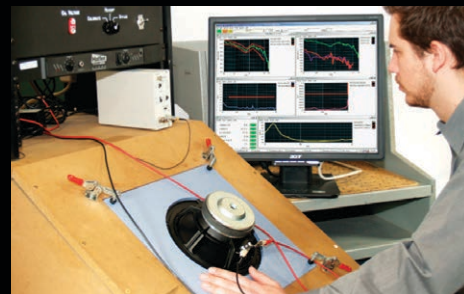
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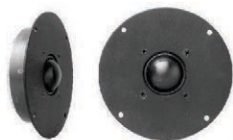
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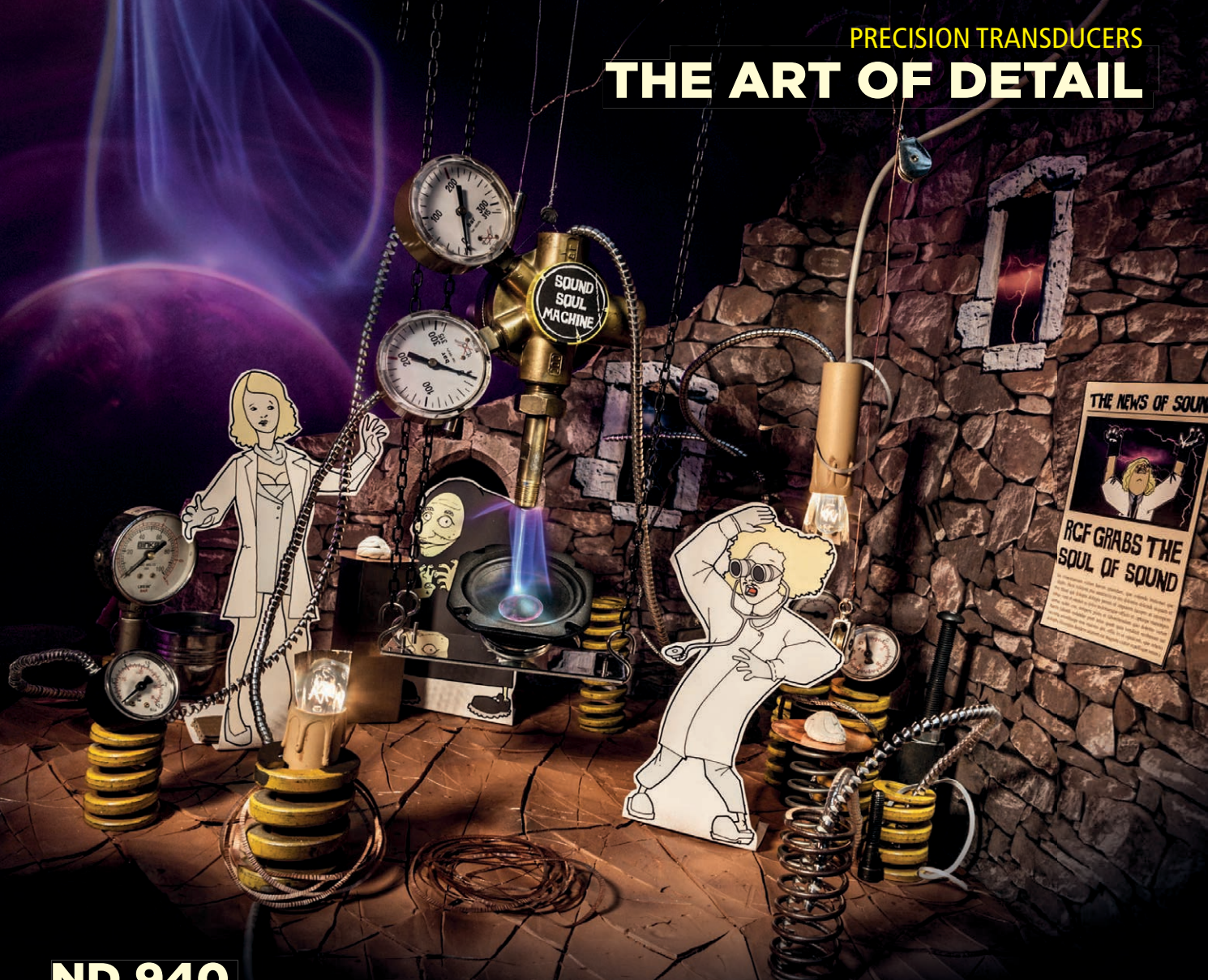


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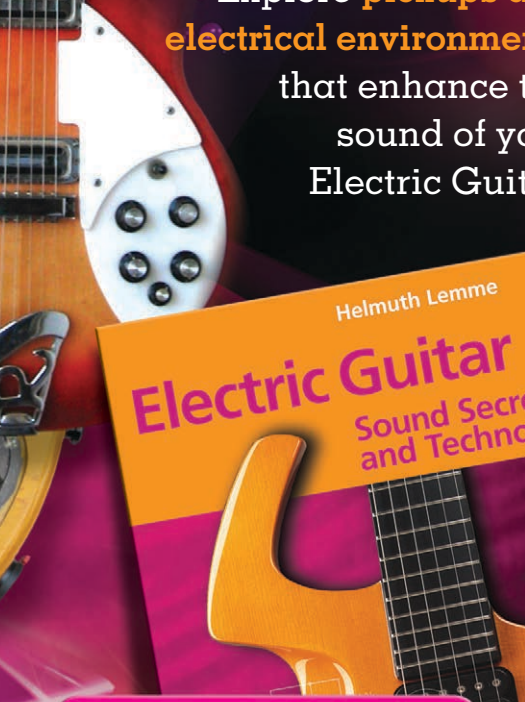
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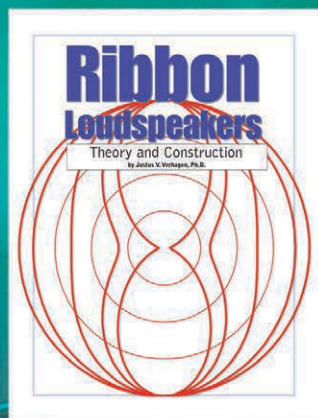
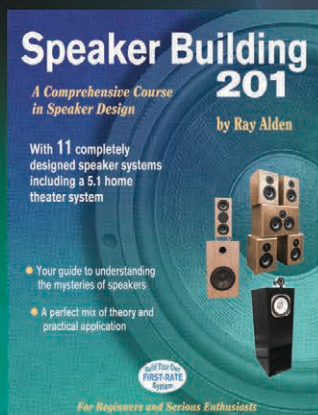
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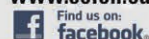
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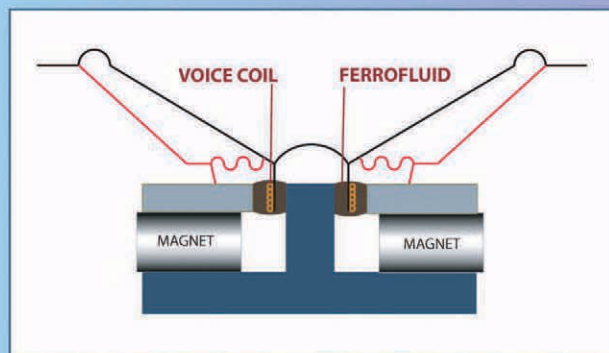
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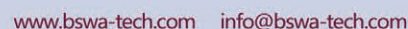
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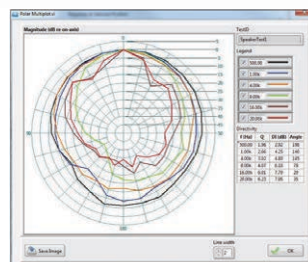
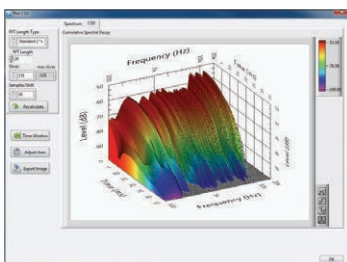
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