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Westlab LABLINE twoeight

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Titelthema: Neues Line-Array Westlab LABLINE twoeight

Line-Array without Compromise

Westlab Audio LABLINE twoeight

Dirk Wedell, Dieter Michel

We have already reported on the young company Westlab Audio here. We recently tested a coaxial system and now we have the opportunity to report on the just completed line array. This leads us to consider what it is that we actually do here at PROSOUND. I'm referring to the 'Lamborghini problem'.

What exactly is the 'Lamborghini problem'?

Simply put, we write disproportionately often about expensive premium products, and products for average audio-technical consumers fall to the wayside. Some readers may not find this sympathetic but it can be justified. Progress always takes its own path, and often it's the same one. It starts in that a company presents an absolutely innovative device and tries to sell it at a premium price in order to finance the extremely high development costs associated with pioneering efforts. After a couple of years, middle class companies are producing similar kit, and in the end the device is available in all price categories, including the low end.

We at PROSOUND want to stay on top of the game, and inform our readers about the latest developments. Generally, we find this in the upper price segment, which is why there are so many Lamborghinis in this magazine and very few Opels, even though we are well aware of the market influence of the healthy middle class.

Back to West Lab Audio: The company is, of course, in the business to make money like everyone else. As a manufacturer you want to be able to boast a unique selling point or a feature to the potential customer, which is one of the reasons for the relatively long concept design phase. The experienced and imaginative speaker developer Chris Speth was simply given the greatest possible freedom of innovation, which in turn, requires a lot of time and money.

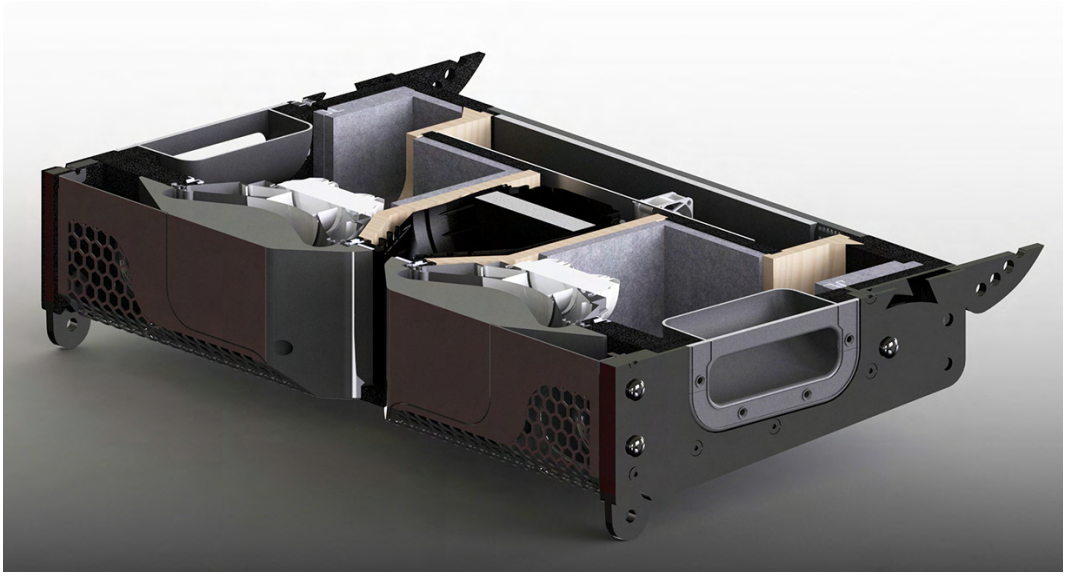
As a new company, one must firstly have the means to survive such a long development phase, but then the result is a top notch product that is even more marketable. For example: many people enjoy drinking a 10 year old single malt whisky. As a distiller, one can sell such a whisky for a good price, but you can't sell a single bottle until waiting 10 years to age the whisky.
As the saying goes, good things come to those who wait.

According to this method, Chris Speth has developed a compact line array that we could test in an open-air setup. By now our readers are familiar with the grounds of former coal mine 'König Ludwig' where one can project a great distance into an open range. Any echoes come so late and are so quiet that they don't influence listening tests.

The equipment is always set up in a very similar way such that has become a type of listening habit for Dieter Michel and myself. We are well aware that you can't compare equipment when weeks have passed between listening tests, but I have the impression that it helps at least to have a similar environment.

The line array from Westlab Audio tested is called "LABLINE twoeight". It's a part of the Labline family that consists of the systems twofive, twosix and twoeight, making it the largest in a series of mid-sized line arrays. Just to be clear about the definitions of 'small' and 'mid-size': 'small' means simply that there are not two bass drivers or mid-bass drivers, and that the unit is perhaps less than 40cm wide. The larger systems can be fitted with double 15's and are only loosely related to this piece of gear.

The housing of this active system is a typical flat line array unit with dimensions 65.4cm x 25cm x 63.2cm including the system and rigging. The housing itself isn't quite that deep. Each unit weighs 33.6kg. The claimed power rating is 2100/2450W (RMS/Peak). However, these ratings have very little to do with normal use. No one will need to keep these values in mind and make sure they're not exceeded. A control unit takes over this duty. As I have often written, nowadays the specified technical data can't be read the way we used to. In 2015, practically all operating limits/specs are generated by a controller and the, what I like to call, 'natural' specs no longer come into play. The control unit is an independent external device (see below a brief summary of the controller).



Cutaway-view of a LABLINE twoeight array element

It's interesting to note in conjunction with the performance ratings, that the voice coil temperature that the controller works with can go up as high as 200°C at times, without serious risk of damage. The controller sets its own threshold value depending on the driver. In the past, the maximum voice coil temperature was limited to about 80°C, and still is with more conventional drivers.

As for the cooling of the electronics, the system works with an impressive five thermal modes! Up to a chip temperature of 60°C, the cooling is taken care of exclusively via the externally visible cooling fins of the electronic module; in other words pure convective cooling. Above 60°C a fan in the electronics chamber is activated and circulates the air within the chamber and thus transfers additional heat to the cooling mass. The heat dissipation is still via convective cooling is this mode. Because the fan is inside the electronics chamber the operating noise is practically imperceptible.

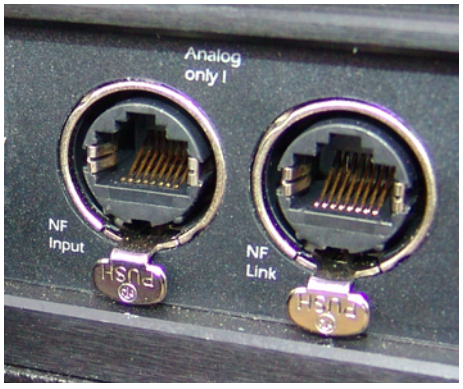
Should the temperature rise above 68°C, a secondary fan kicks in and draws in cool external air through a filter. In this mode the electronic module can usually be maintained at a safe operating temperature. Under unfavorable operating conditions (eg. – very high exterior temperature, direct sunlight on the module, etc.) a thermal limiter is activated when 80°C is reached. The amplifier power is then limited such that the nodule no longer generates more heat than can be dissipated by the cooling system. And if that doesn't help, if for example the ventilation openings are willfully blocked or other aberrant conditions arise, and the temperature rises to 90°C a thermal switch that shuts down the electronic module, is triggered.

At 133/139dB (Program/Peak), the specified sound pressure levels are very high. We will be able to test these in our open field scenario. The units have a usable frequency response of 45Hz-22kHz.

System Architecture

The Labline twoeight is a 3-way system with a somewhat unconventional set-up. Mid-bass is generated by a pair of 8-inchers with a soft suspension (roll), mids and highs come out of a 2" coaxial driver with two concentric ring membranes. All loudspeaker components are equipped with Neodymium magnets. The details of the acoustic concept of the Labline twoeight can be found in the box on the next double page.

The controller drives the 3-way with the transition frequencies 720Hz and 6.28 kHz. Please don't laugh about the decimal places on the second figure. There are FIR-Filters involved



RJ45-connections are no longer exotic any more. Replacement for a forgotten cable can be purchased in the next computer store. That's not so easily done with an XLR-Cable.

that can truly work with such precision. The horizontal coverage angle is 100°. The vertical coverage angle of a single element is 10° which is typical for this type of loudspeaker which is used in an array where the vertical coverage angle can be very low.

The housing itself is a fairly complex construction that is separated into several chambers that contain the loudspeaker and wave guide components for each driver. These individual functional areas and the amplifier electronics are separate from one another. Chris Speth is especially pleased with this set up as it provides incredible rigidity for the enclosure, but to perfect the construction additional struts have been installed.

This brings us back to the discussion of how a controller/speaker should be built. Wouldn't it be possible to eliminate the effects of resonances and vibrations with the controller? On paper, modern controllers could probably achieve this, but these effects are generally quite complex and defeating them would draw resources that could be put to better use. Therefore Chris Speth's credo is: the mechanical construction of the speaker should support the controller and not unnecessarily draw computing power.

In this section we address a variety of data. There is one specification, however, that often gets overlooked; truck space. This specification is made up of the following factors:

- The number of necessary elements
- The number of additional required accessories (racks)
- The efficiency of the system
- The weight of the system

The power output ratings of the power amplifiers are extremely high - in the range of kilowatts. Thanks to the high efficiency of these amplifiers convection cooling is sufficient despite the high power. Forced cooling is only necessary with adverse environment conditions (high ambient temperature, direct solar irradiation).
The picture on the left shows a complete bass module. The yellow grid covers the cool air intake. The power modules of the array elements are similarly built. The yellow connector below is a True1 that can be plugged and unplugged even under load. The speakers do not have power switches, they are always on, so to say, and are activated by plugging the True1 in. This way, it cannot happen that one of the elements in an array is inadvertedly NOT switched on.

Perhaps some of you have noticed the connector for the power supply. It's the new powerCON TRUE1 screw/lock connector from Neutrik. The assembled cables are available from Cordial. The powerCON TRUE1 is a waterproof and locking device connector with a load capacity of 16A. It replaces the standard IEC connector where a very tough, locking connection is required to ensure a secure link. The powerCON TRUE1 can also be connected and disconnected under load.

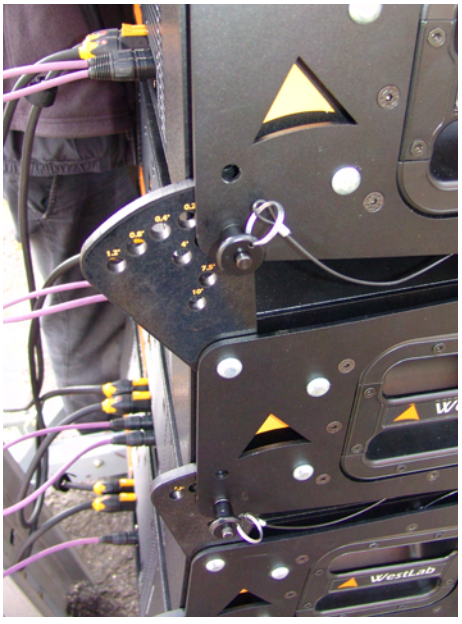
The signal connections are made using Cat. 7 cables with Neutrik Ethercon RJ45 patch plugs with a housing similar to an XLR connector, which have been specially fabricated for the leasing industry. Just about every firm in the industry is working with this type of signal cable and I've heard a lot about it. It seems that the developers are also very interested in this connection system due to the beneficial properties of twisted-pair cables for analog audio.

Operation and Sound

Those who listen to and measure a PA system in the open have to concede that nature and the environment will do whatever they want. For that reason, I will first describe the external conditions.

We always shoot in the same direction and the set-up is always essentially the same or at least very similar for all of our tests. On testing day, the weather was dry but it was windy. The wind came out of the west, blowing directly at our system. We agreed that the wind wasn't strong enough to call off the test, but it must be mentioned just to note that conditions weren't ideal. In addition, there were disruptive noises from the excavation of a mine heap behind the system. This noise was, at least, slightly dampened by the wind. Enough about the environmental factors.

Set up is a part of the operation of the system. It comes with cases and is pulled up out of them. The rigging is typical for modern equipment; everything that



Setting the curving-angles

is needed is connected to the system so one doesn't forget anything. An external controller is needed to run the system but that's really it. I find it practical that the controller is not integrated into the loudspeaker housing, because it can be used for other applications. The controller has standard XLR inputs. My first test is to stroll around the 'edges'. Starting from the front, I walk the length of the system practically underneath it, and check for sudden changes. These would indicate sidelobes, often in small frequency bands and with high Q.
But nothing happens, the system simply appears to be gone. Take a step or two further away and it's at full strength again. I continue walking to the back and hear almost nothing but then the distant echoes become perceptible. It's almost absurd. I'm standing 2 meters away from the array and hear echoes from houses 200 meters away.

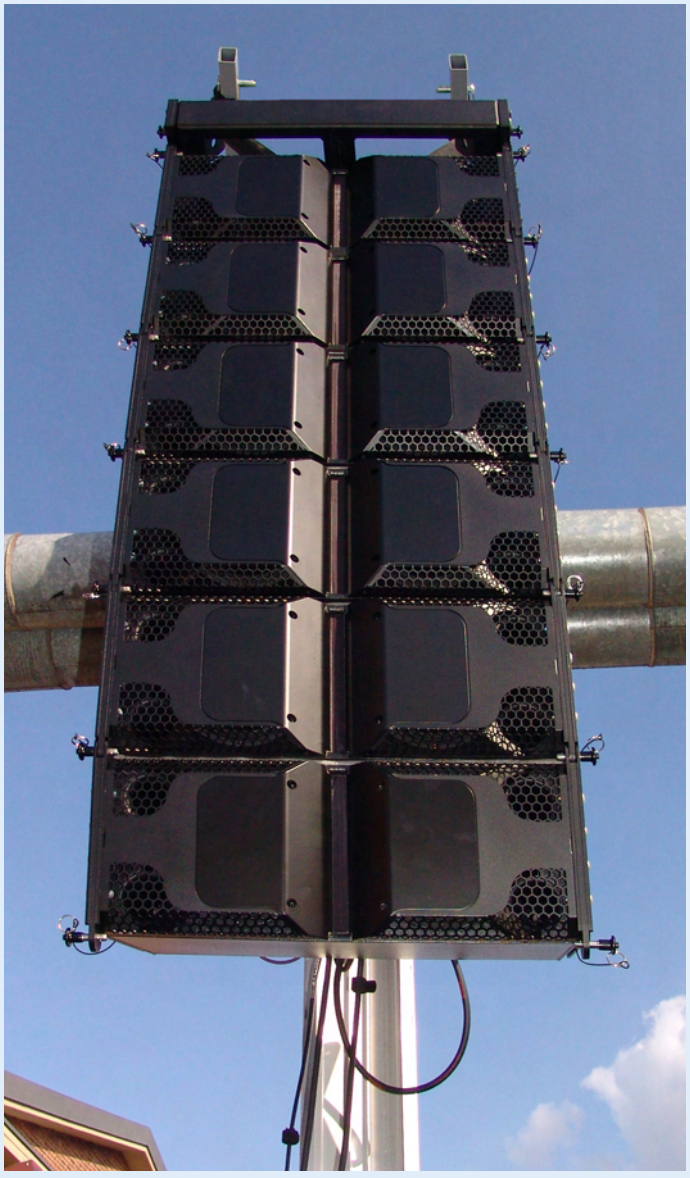
At first I walked axially from the front of the array hanging over me and then back again. Now I take about two steps to the side of the line array and walk back and forth as before. Again, I don't hear any anomalies. This is already a good sign. If the system were to behave badly, it would be most obvious here. It just stops, and that's it.

I walk a little further away from the system, about where the hardcore fans of a rock band would be. My path is again forward and back, and sideways. The sound is homogenous throughout this test. Now I start the search for anomalies at a longer distance. It doesn't surprise me that I don't hear any irregularities out here. All is well.
To be fair, I must note that this system is a top end system on the international scene, and there shouldn't be any surprises with this type of testing. With such systems, anomalies in the sound distribution are simply not acceptable. Therefore, these results are nothing unusual, but rather the norm in the realms of top-level systems.

The gusty winds that were constantly changing directions were interesting. One could hear the wind, which is why we turned up the volume a bit. This adjustment in volume reached the far end of the listening zone well. The speakers came through clearly, and would allow even higher levels in which the wind's influence is still apparent but without a significant loss of transmission quality.

My impression that the speakers 'assert themselves well' is of course nonsense from an engineering standpoint. The loudspeakers have no ability to adjust for windy conditions, but this is what I experienced and there's no other way to express it. Somehow, at this distance, I had the feeling that the sound reached me light-footed and in springy jumps. It was very enjoyable. I'll just leave it at that. If something can't be expressed in words there's no point in trying, but maybe PROSOUND readers know what I mean anyway.

Of course, I also pulled out my little CD collection and listened to all of the critical tracks. I think word has gotten out about some of what I listen to:
1. Sisters of Mercy – More. Here the metallic hits should not be too hard or too soft, and toward the end of the piece they should not be distorted by the vocals or guitars or from the cymbals themsel-



Acoustical Concept

At first glance, the new line array has a unique appearance. More specifically, the eye pauses on the front panels of the array elements and one thinks, 'Aren't there usually holes there on other loudspeakers where the sound comes out?' The front surface of this new line array actually consists of more solid metal than perforated grill. We all know the loudspeaker developer Chris Speth well enough to know that this wasn't something he accidentally overlooked. Rather, the almost uninterrupted metal surface is part of a more thoroughly considered concept which can be confirmed with a more in-depth exploration of the acoustic construction.

Let's start with the immediately apparent exterior appearance, specifically the almost completely closed front surface of the array. The midrange is of extreme importance for the drive of a loudspeaker system and the desired speech intelligibility. In order to achieve this under all circumstances, Chris Speth avoided two compromises that one finds occasionally in other systems:
Firstly, for the middle-high frequencies a planar wave driver in a 2-way coaxial configuration is used, that has the advantage that it steps in as low as about 300 Hz. With the separate high frequency way, no compromises have to be made in the two highest octaves (which is usually the case with a classic 2" driver configuration) to reach an upper cut-off frequency above 16 kHz.
In the coaxial driver there are two concentric ring-diaphragms with a 3.5" voice coil to drive the midrange and a 1.75" voice coil for the high frequencies. The integrated wave guide transforms the sound energy flux generated by the ring-diaphragm to a rectangular 125,6mm x 19mm sound outlet. This opening acts as a diffraction slot for a adjacent horn contour that defines the 100° horizontal radiation angle.

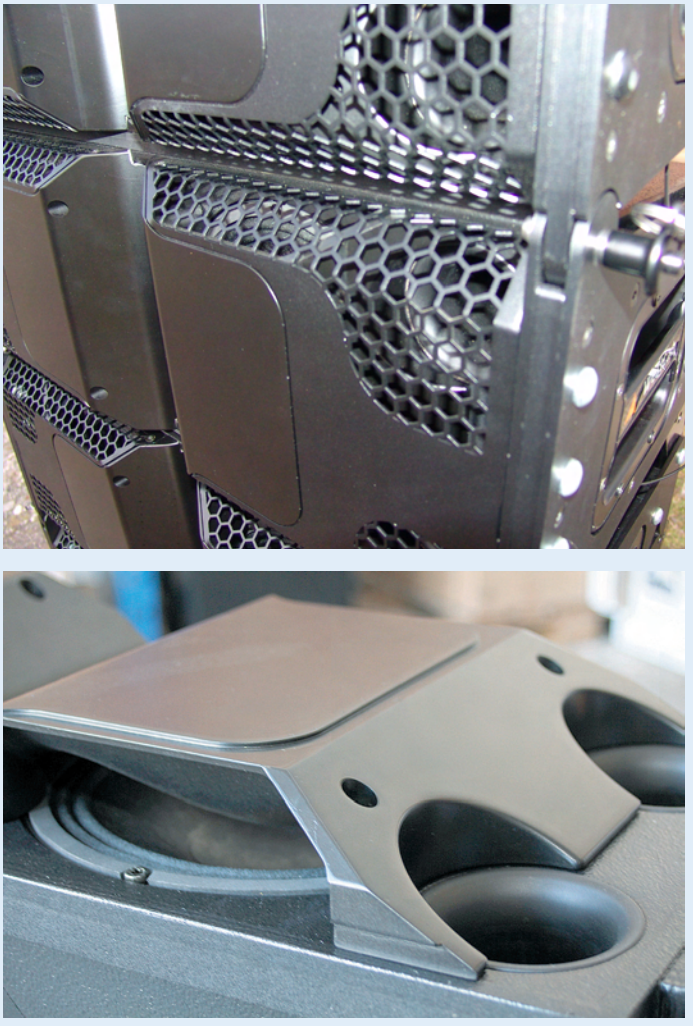
The use of this coaxial mid-/high-frequency driver has two advantages: Through the separate midrange way the driver can be engaged at a very low frequency. In doing so, Chris Speth doesn't actually use the lowest octave from 300 to 600 Hz, but rather at 720 Hz in order to minimize distortion.
Secondly, the high frequency way is relieved of mid-range duties, which has the invaluable advantage of allowing the high-frequency driver to be configured exclusively for a frequency range above 6 kHz. The ring shape of the high frequency diaphragm can handle this quite easily, which can drastically reduce problems in the frequency range dominated by mass control operation of the diaphragm assembly (above the mass breakup frequency) that is typical of compression drivers.
This results in a very low distortion sound, that one can't identify as coming from a compression driver. Users with applications in theatres, for musicals, and open-air classical will be very pleased. For these applications in particular, a high priority is placed on quality sound and an additional challenge constists of the requirement that one shouldn't be aware that loudspeakers are being used at all.

According to Chris Speth, in order to maintain the advantages of the coaxial driver, the wave guide has to be designed without compromise. This results in a horn contour that is not interrupted by sound outlets from the throat to the outer edge of the wave guide, which has been designed for the best possible radiation of mids and highs above 720 Hz.

What happens below the cut-off frequency? Remarkably, the mids below 720 Hz are not even directly radiated! One would normally see this as problematic but in this case it's not.
At 720Hz, the highest frequency that the cone loudspeakers have to reproduce, the acoustic wavelength is about 48 cm. As a rule of thumb, the membrane of a cone loudspeaker moves

purely piston-like up to the frequency, in which the wavelength is approximately equals the diameter of the membrane (piston-range). For the 8" transducer working to the set cut-off frequency of 720 Hz this is precisely the case.
In the Labline twoeight, the membranes of the 8" drivers move piston-like up to the cut-off frequency and in addition they work, similar to the diaphragm of a compression driver, onto a phase plug.
The result is that the sound is radiated only in the desired way, and no unwanted sound paths are formed between the membrane and the metal covering. Here the intended sound emission is through the two relatively narrow slots on the upper and lower edges of the array elements that are covered with perforated metal.
Incidentally, the phase plugs for both the 8-inch driver and the outer contour of the mid/high-frequency horn are formed in a single 3D injection mold. The sound path from the center of the membrane to the upper or lower slot is about 10 – 12 cm, and therefore not larger than a quarter of a wavelength at the highest operating frequency (720 Hz /4 = 12 cm). The gap between the cone membrane and the phase plug is considerably smaller.
In other words the entire assembly functions as a pressure chamber. In the neighboring array elements the situation is exactly the same. This explains the rubber seals between the individual array elements. The sound pressure is very high at the connection points. Without the rubber seals the pressure chamber formed by adjacent array elements would not be airtight and the radiated sound would be reduced.
In addition the open area of the slots and the volume of the pressure chamber are dimensioned such that an acoustic low-pass function is created roughly at the cut-off frequency. Therefore the mid-bass transducers are acoustically attenuated above 720 Hz, so that the FIR filter doesn't have to work as hard and so requires less latency.

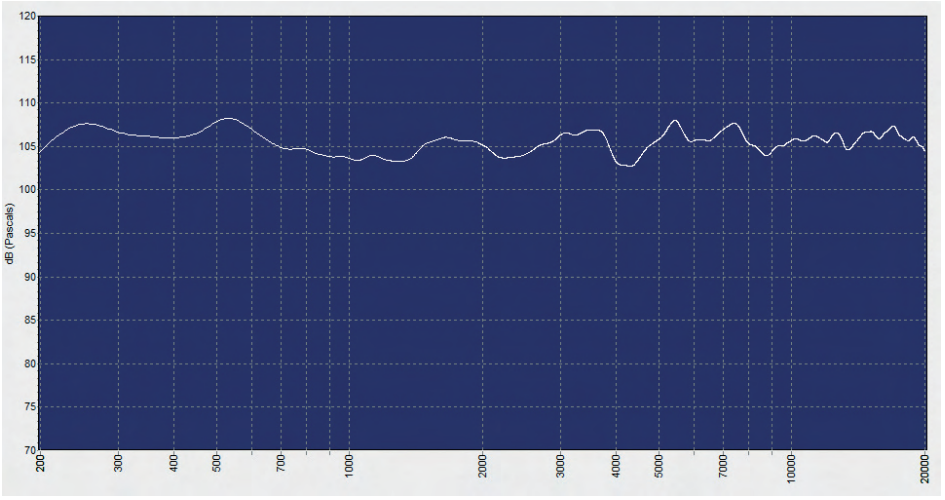
The whole thing works essentially such that the cone loudspeakers 'only' pump a volume of air, whereas the sound radiation is carried out by the narrow slots that have been carved into the continuous horn contours of the mid/high-frequency system.
In a line array, the mid-bass drivers are working almost exactly at the limit to which, due to the geometric arrangement, the mutual coupling of the elements creates a linear source instead of breaking up into individual point sources. The sound radiators (in this case the double-slot created between two neighboring array elements) should have a maximum spacing of half of a sound wave. With an upper cut-off frequency of 720 Hz this would be a distance of 0,25m, which corresponds to the mounting distance of the Labline twoeight array elements. Dimensions, cut-off frequencies, and functional range of the loudspeaker components have been perfectly matched to achieve maximum performance without compromise.



Array elements with and without front grill. In the lower image one can clearly recognize the phase plug for the 8“ cone loudspeaker. In an array, the sound outlet for mid-bass is created by two neighboring array elements, which have been sealed to one another for this purpose. Advantage: the horn contour for the mid/high-frequency horn is a continuous surface and is not interrupted by acoustic openings.

The bass reflex openings in this construction are placed at the outermost corners.
The entire construction of the array elements is set up such that a coaxial, or more precisely, a collinear configuration of loudspeaker ways for various frequency ranges results.

Firstly, this concept ensures, similar to a coaxial loudspeaker, very uncomplicated horizontal radiation characteristics and that the radiation pattern of an array comes close to that of an ideal linear source.
Secondly, as a result of this, the FIR equalization works for a larger horizontal coverage area, and not just in the exact direction where the measurement microphone was placed.

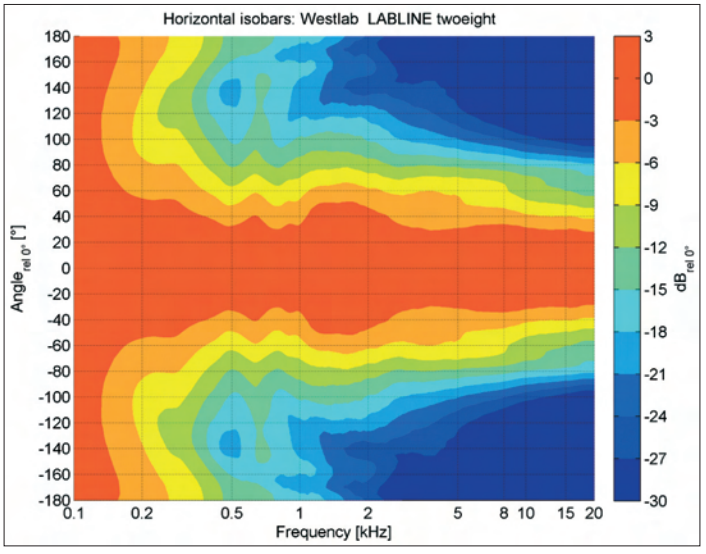


Given that this frequency response measurement was done with the depicted open-air-setup with non-vanishing influence of wind and not in the lab, terms like "ruler flat" are not completely pulled out of thin air. The precision of reproduction is reflected in the visible linearity here.

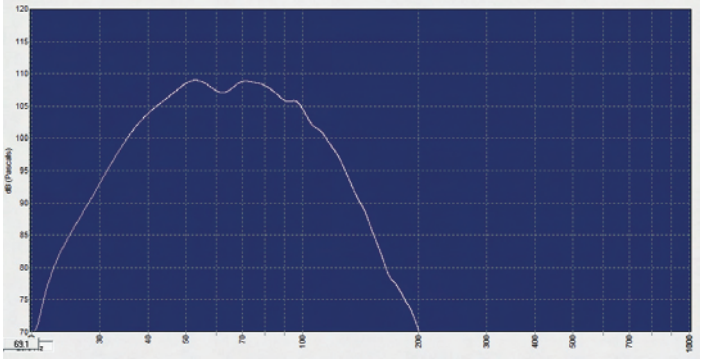
ves. 2. John Coltrane – Blue Train. Here, please direct your attention entirely to the cymbals when they can be heard clearly through the other instruments. The sound of the cymbals, which was recorded with tube-technology of the 50's, should remain soft and not start to sound metallic or become hissy at higher volumes.

3. Vocal track with two very similar female voices. The voices must be, and remain, individual and distinct. All of these tests are always done at a high volume.

At full PA volume, the test tracks must remain undistorted. Only very good transducers can achieve this, whether line array or 12/2 speakers.



The isobaric view shows the effectiveness of the different measures taken in order to control the horizontal coverage which stays in a range of around 100° relatively independent of frequency.



Frequency response of the subbass system

There's another piece that I used to test but have somehow neglected of late: 'Rome wasn't built in a Day' by Morcheeba. Right at the beginning, the singer is almost alone and there are a number of breathy 'H' sounds interspersed in the lyrics. One should hear this at a relaxed listening level and, how should I put this . . . absorb it. Then listen to the same spot again and again each time about 3dB louder. At some point the breathing noises turn into hissing and scratching. This is a simple test that can help determine the usable range of a system in one or two minutes. I had to break off the test as the volume became almost unbearable. In other words, the test worked, and the breathing noises were still very distinct at these levels.

Hence, the "LABLINE twoeight" has met all of the criteria necessary for inclusion in the upper ranks of the international market. That is all my tests can really determine, simply that this system is deserving of inclusion in these ranks. The tests say relatively little about the general sound characteristics, but they are comprehensible. Everything I write about the sound itself is subjective and dependent on my own personal tastes, and is therefore potentially dangerous. From a technical standpoint, this system is capable of sound pressure levels that are high enough that it deserves a positive rating as related to the truck space factor.

Summary

Actually, all highly rated systems should be very similar to one another. But, that isn't the case. These systems are very individual. For instance I noticed that the high frequency structures are exceptionally clear and graduated, which is very analytical but doesn't come across as cold. An orchestra or a typical 'two guitar' band is more like a vibrating body than a surface. But I'll avoid trying to describe something that can't really be put into words.

I have to tell you all where I've heard such an analytical but at the same time pleasant sound, albeit at a completely different level: 'Geithain'. I don't think I have to say more.