PRODUCTION PARTNER

FACHMAGAZIN FÜR VERANSTALTUNGSTECHNIK

REVIEW FROM ISSUE **8 I 2021**

COMPACT PA SYSTEM WITH USW-112P SUBWOOFER

Meyer Sound Ultra-X20

COMPACT PA SYSTEM WITH USW-112P SUBWOOFER

Meyer Sound Ultra-X20

With the Ultra-X20, Meyer Sound presents a compact loudspeaker with a wide coverage angle for universal applications. Like its big sister, the X40, the X20 is also self-powered and features an integrated DSP system and Class D amplifier. In combination with the USW-112P that is also active, for low frequency extension, the X20 turns into a complete compact PA.

Copy and measurements: Anselm Goertz | Images: Meyer Sound

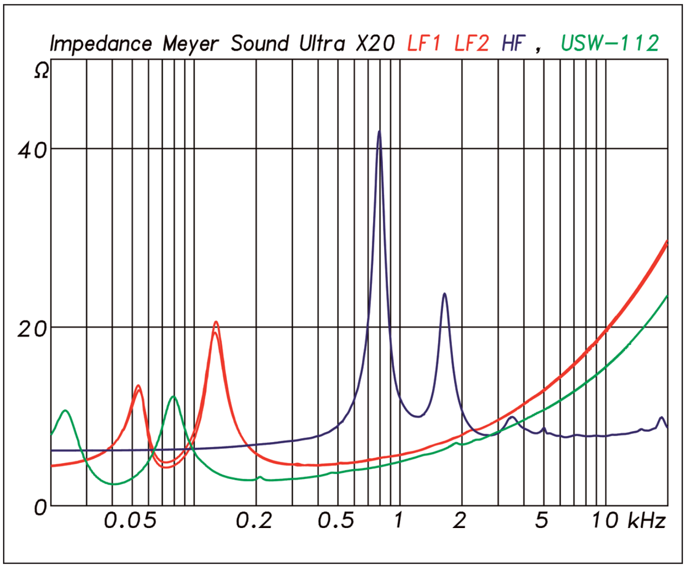
With the X20, following the X40, Meyer Sound adds another model to its Ultra series. The X20's concept and design are similar to that of the X40, albeit in a slightly smaller format. Measuring 484 × 189 × 220 mm (H x W x D) and weighing 12.3 kg, the X20 has less than a third of the X40's volume and half the weight. The concentric design with two 5" woofers and the centrally positioned mid-high horn is also identical. As is common with Meyer Sound, both drivers are developed and manufactured in-house. The concentric design, where both passbands share a common axis, prevents interference caused by angle-dependent time offsets throughout the crossover range that would otherwise be inevitable. The loudspeaker can be operated both in an upright or a horizontal orientation without limitation.

For our review, we received the X20 version with a 110 × 50-degree coverage angle. Alternatively, the models X22 with a 80 × 50-degree horn and the X23 with a 110 × 110-degree horn are also available. On the X20 and X22, the horn can be rotated if necessary. To do so, one simply removes the loudspeaker grille and loosens the four horn screws. The driver itself remains firmly inside the housing, such that one only has to remove the light horn and rotate it prior to reinsertion.

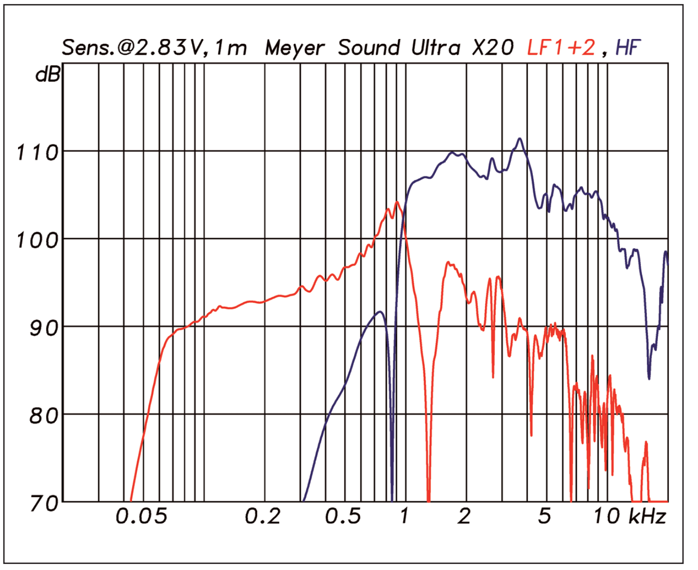
The X20 enclosure consists of an extruded aluminum profile with a removable front unit that houses the two 5" woofers and single HF driver. Both woofers are placed under a slight angle where one-third is occulted by the horn. The internal electronics are mounted to the rear wall that features a flat heat sink on the outside. The X20 does not require a cooling fan. To feed the audio signal, as is customary at Meyer Sound, two connection panels are available, featuring standard three-pin XLR receptacles or five-pin XLR receptacles. In the latter case, the RMS (Remote Monitoring System) signal for remote control and monitoring of the loudspeakers is transmitted over pins 4 and 5. Power is supplied via Powercon with loop-through outputs.

For deploying or mounting the X20, a rotating and swiveling MYA-X20 Yoke, a U-bracket, a top channel link, and a pole-mount adapter are available. They are attached to the loudspeaker via M8 threaded holes in the enclosure top and bottom.


Meyer
Sound



Impedance curve of the two woofers (red) (2 × 6 Ω) with a tuning frequency of 75 Hz and the HF transducer (blue, 8 Ω) in the USW-112P. The green curve shows the impedance curve of the USW-112P's 12" driver with a nominal impedance of 3 Ω and a tuning to approximately 41 Hz (Fig. 1)



Frequency response with sensitivity referred to 2.83 V / 1 m for the woofers (red) and the HF transducer. Since the woofers are two 4-ohm systems that were operated in parallel for the measurement, 6 dB must be subtracted from the value 1 W / 1 m (Fig. 2)

For wall mounting, standard wall brackets with four M6 screws can be attached to the X20 rear.

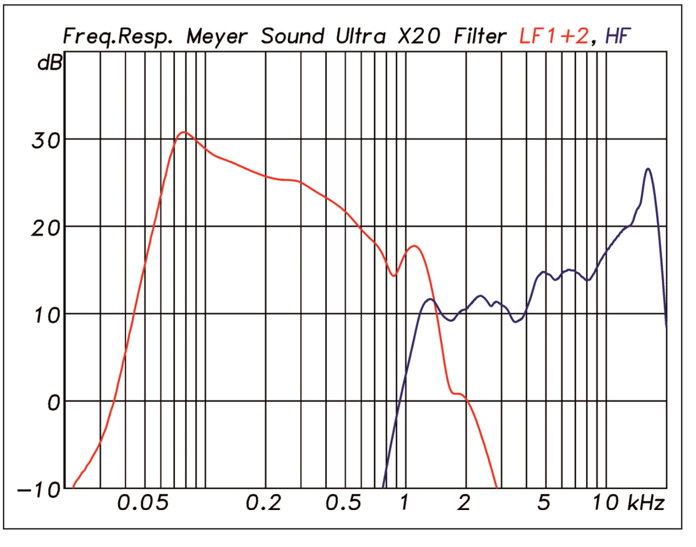
Basic measurements

Initially, for a first impression, both of X20's passbands were measured separately without electronics. The impedance curves for both 6-ohm nominal woofers show a minimum of 4.3 Ω at 75 Hz which coincides with the bass reflex port's tuning frequency. In the X20, each woofer is powered by its own amplifier channel and is processed with the same filters; therefore, with the same signal.

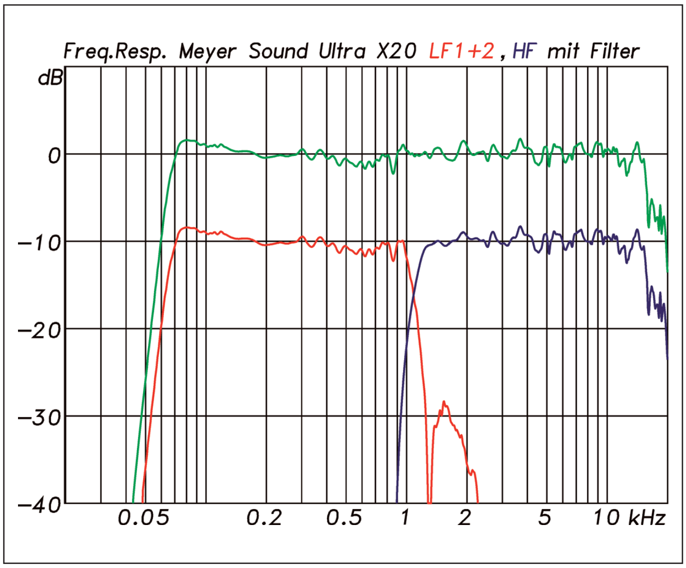
The frequency responses and sensitivity values measured for both passbands – without electronics – can be found in Fig. 2. Both woofers were driven in parallel by the measurement laboratory amplifier. If one wants to convert the sensitivity value of 2.83 V / 1 m to 1 W / 1 m, then 4.3 dB must be subtracted for the LF passband. For the 8-ohm tweeter, the 2.83 V / 1 m corresponds to the value for 1 W / 1 m. The frequency responses show that the crossover inevitably must take place at 1 kHz or just above when one wants to combine both passbands in a meaningful way.

Electronics and filters

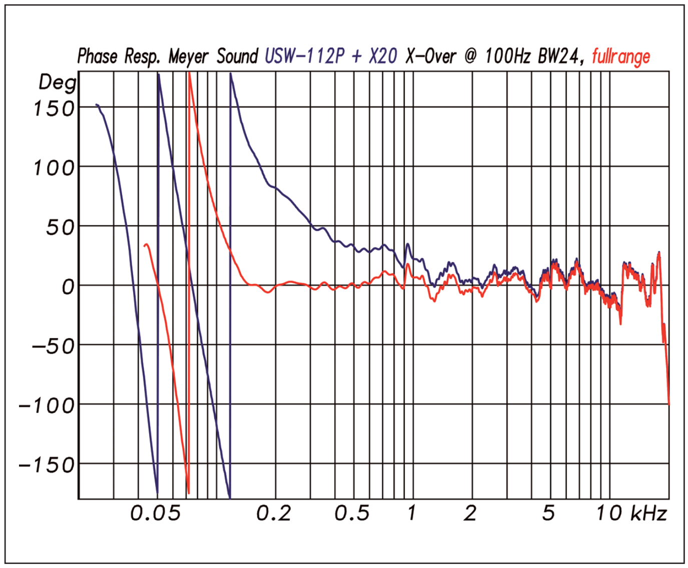
The X20's internal electronics consist of a three-channel Class D amplifier, a DSP system, a dedicated power supply as well as other peripherals. The power supply unit is designed for voltages ranging from 90 to 265 V. The amplifier's total peak power is stated as 860 W. As with the X40, the internal DSP system is used completely for individual passband equalization, the crossover, and loudspeaker protection. Fig. 3 shows the X20's DSP system's filter responses which consist of high- and low-pass filters as well as individual passband equalization. A combination of FIR and IIR



Filter reponses of the internal DSP controller for the LF (red) and HF (blue) ways (Fig. 3)

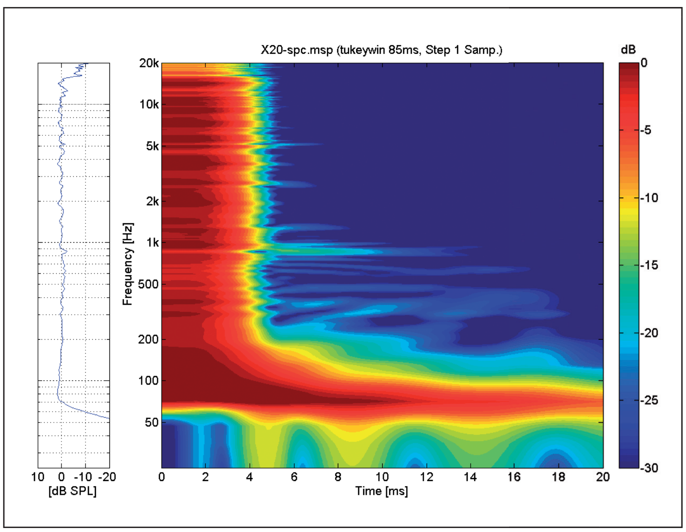


The X20's frequency response Overall LF (red) and HF way (blue) with controller and their combined response (green). It runs exemplary even with corner frequencies of 62 Hz and 16 kHz (-6 dB). The separation between tweeter and woofer occurs at 1.1 kHz (Fig. 4)



The X20's phase response (red) with a largely linear-phase curve from approximately 100 Hz upwards. The blue curve shows the phase response in combination with the USW-112P subwoofer and the corresponding filtering in the Galaxy controller (Fig. 5)

filters is used that can process the phase response as well as the amplitude response. Fig. 4 and Fig. 5 show how filters and loudspeaker combine. The X20's frequency response is exemplary, with corner frequencies at 62 Hz and 16 kHz (-6 dB) and ripple – using an unsmoothed (!) display – of just ±2 dB between 70 Hz and 15 kHz. The X20's filters also allow for a near linear phase response from 100 Hz upwards (Fig. 5). Only below 100 Hz can one observe steady phase rotations caused by acoustic and electrical high-pass



The X20's spectrogram A small resonance can be identified just below 1 kHz, everything else is perfect (Fig. 6)

USW-112P subwoofer with a 12" driver and a Class D amplifier delivering 1.2 kW peak power behavior that cannot be compensated for without introducing excessive latency, unacceptable in live sound reinforcement. The latency of the X20's entire electronics including AD/DA conversion is only 3.27 ms and therefore completely uncritical for all applications.

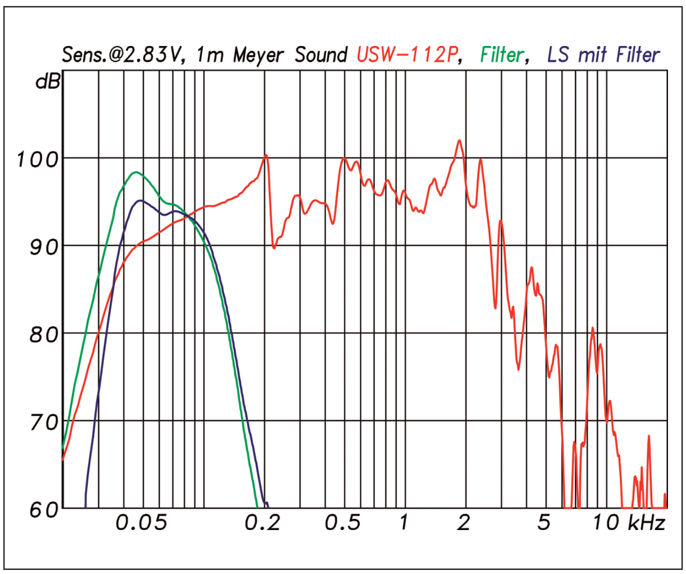
The X20's connections in the version with three-pin XLR; the X20-XP version also includes rain protection for the connections

USW-112P subwoofer

Complementing the X20, the Ultra Series includes the USW-112P (also a self-powered system) which is equipped with a 12" driver and driven by a Class D amplifier with 1.2 kW peak power. The in-house ST-312A driver with a die-cast aluminum basket and huge neodymium magnet is a 3-ohm nominal system. This unusual value was presumably chosen to make optimal use of the dedicated amplifier. This is where the in-house driver development and production advantage become apparent; everything can be optimally matched. The impedance curve of the 12" transducer housed in a bass reflex enclosure can be found in Fig. 1 together with those of the X20. The bass reflex port is tuned to 41 Hz which is also where the 2.4-ohm impedance minimum occurs. The relatively large bass reflex port at the cabinet bottom is coupled to the internal volume by a long tunnel that exits near the enclosure's rear wall.

The handy housing with dimensions of 597 × 343 × 305 mm and a weight of 20 kg, is made of multiplex. A solid handle can be found on a slanted surface in the back with a connection panel, like those of the X20, located – well protected – underneath. On one side, one can find a flush-mounted 35 mm pole cup that can support an X20 on top of a loudspeaker pole when the USW-112P is used horizontally.

Fig. 7 shows a summary of the USW-112P's measurement performance. At first, only the loudspeaker without internal electronics was measured, followed by the internal electronics' filter response, and then the combination of both. Thanks to the low tuning frequency, the subwoofer can already be used from 35 Hz upwards. For higher frequencies, the response is limited by a low-pass filter at approximately 110 Hz.

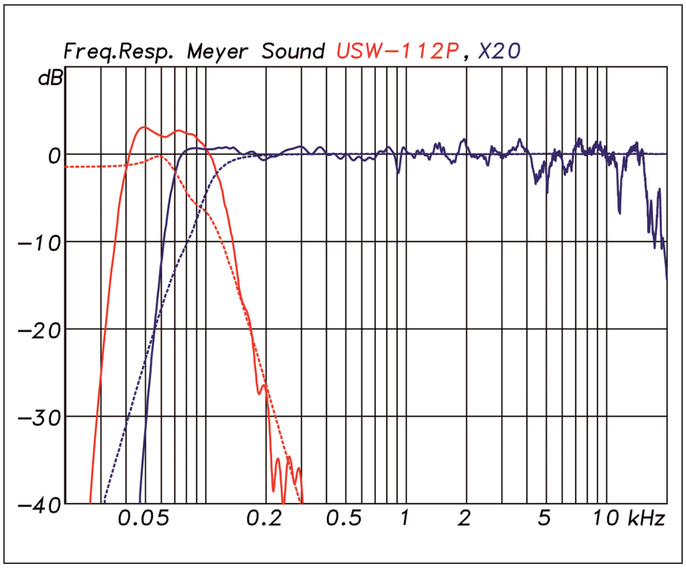


The USW-112P subwoofer's sensitivity and frequency response without the internal electronics (red), the filter response (green) and as an overall result for the subwoofer with electronics (blue, Fig. 7)

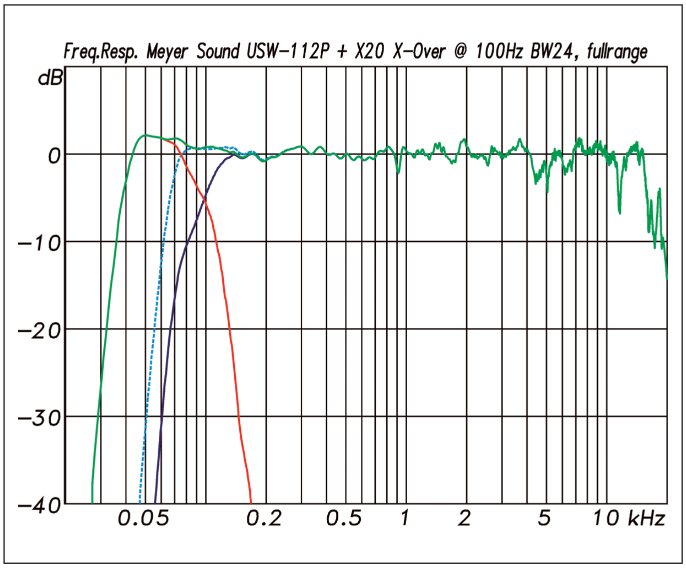
Combinations with the Galaxy 408

The X20's internal filtering is designed in such a way that even full-range operation without an additional subwoofer is possible, at least to some extent. When a subwoofer is added for low frequency support, a high-pass filter should be used to relieve the X20's 5" woofers, as unnecessary limitation can occur early on. For the X20/USW-112P combination, it appears Meyer Sound does not aspire to support their usual approach of connecting the subwoofers simply in parallel where they complement the full-range loudspeakers correctly without additional filters. Therefore, an additional controller is needed to combine both loudspeakers properly.

Meyer Sound's portfolio includes the Galileo Galaxy 408 and 816, with four or eight inputs and eight or 16 outputs respectively, for this purpose which can be used for loudspeaker management. Input signals are fed analogue, digitally in AES3 format with sample rate conversion, or via the



Combined frequency responses X20 (blue) and USW-112P (red) and the simple filter functions set for combination in the Galaxy controller (dashed, Fig. 8)



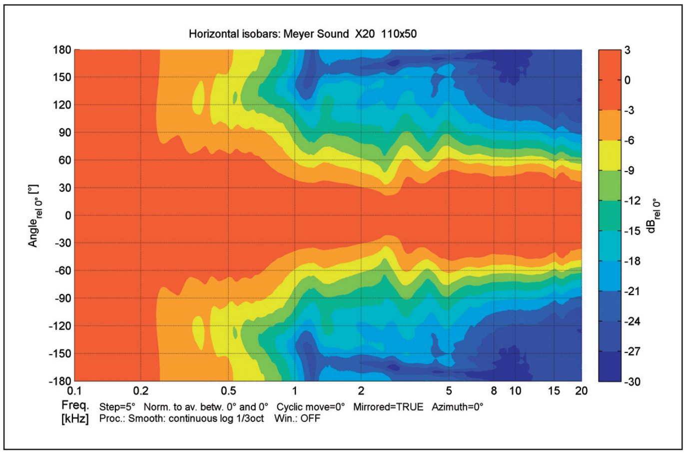
Additional octave The X20 and USW-112P in combination with a 4th order X-Over filter at 100 Hz. For comparison, the light blue curve shows the X20 in full-range mode without subwoofer. With the subwoofer, one gains an additional octave in the bass range (Fig. 9)

audio network. Meyer Sound uses the open-source AVB format. The Galaxy processors are also Milan certified which guarantees smooth interaction with other Milan certified devices.

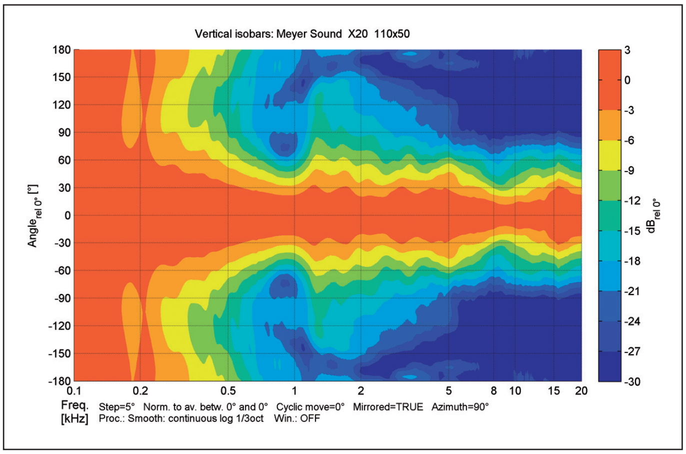
We were supplied a Galaxy 408 along with the test system which can be operated and configured via the network using the Compass control software. The alignment in the

Variable coverage The horns' orientation can be easily rotated by 90 degrees

Three coverage versions of the X20 in 110 x 50, 80 x 50 and 110 x 110 degree dispersion anglesw



The X20's horizontal isobars in the 110 × 50 setting (Fig. 10)



The X20's vertical isobars in the 110 × 50 setting (Fig. 11)

measurement lab succeeded quick and easy with just a few settings. For the crossover, fourth-order high- and low-pass filters at 100 Hz were used. Two minor parametric EQ filters were applied for a rather cosmetic adjustment of the frequency response and an all-pass filter for phase alignment throughout the crossover range. Fig. 8 shows the resulting individual frequency responses of the X20 and USW-112P as well as their initial responses.

How the combined system performs is shown in the measurements of Fig. 9; both loudspeakers combined perform well and one gains an additional entire octave in the bass range by adding the subwoofer. For comparison, Fig. 9 also shows the X20 by itself. In addition to extending the frequency response, this alignment also significantly reduces the burden on the X20's woofers, thereby increasing sound level reserves. More on this in the paragraph on maximum SPL measurements.

Directivity

The X20's isobar measurement was initially carried out with the standard 110 × 50 horn orientation. Fig. 10 and 11 show the graphs for the horizontal and vertical planes. The promised 110° in the horizontal plane is completely retraceable and preserved except for some small irregularities between 1 and 5 kHz. Vertically, the -6 dB isobars are somewhat wider than the nominal 50°; however, from about 800 Hz onwards, the desired narrow coverage angle is achieved despite the relatively small horn. Even at the highest frequencies, near 20 kHz, no relevant narrowing can be detected in either plane. Without knowing the X20, one could infer a significantly larger loudspeaker from these isobars.

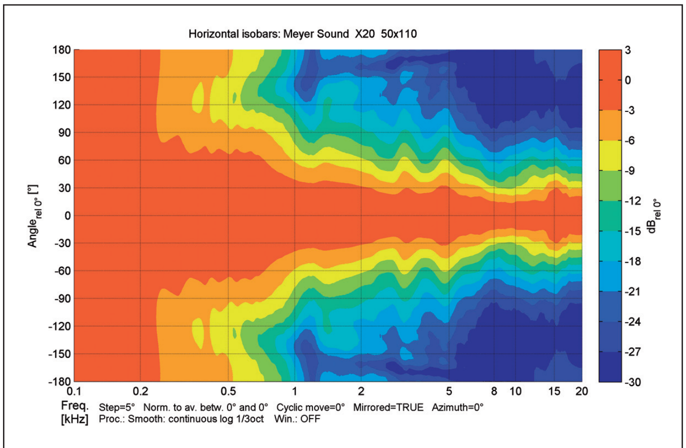
When the HF horn is rotated by 90°, the measurements yield the isobars shown in Fig. 12 and 13. The goal for coverage angles that are now horizontally narrow and vertically wide is achieved as well; although, the isobars' progression, due to the HF horn dimensions, is somewhat less even than with the significantly larger X40. Also, both woofers within their operational frequency range inevitably constrain the vertical isobars such that the 110° is no longer completely achieved. However, this can be considered an acceptable compromise for the rotated horn orientation.

The isobar graphs for directivity are complemented with a Spinorama diagram of the X20 with 110 × 50 horn orientation. The Spinorama that is also available for the 50 × 110 orientation provides a near identical picture, so there is no need to show it here. But, what hides behind the rather unusual term "Spinorama"?

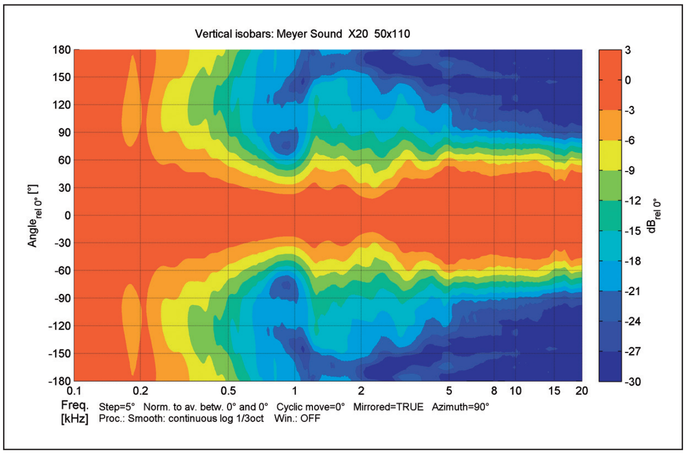
The Spinorama is based on a loudspeaker's frequency response measurements in an anechoic environment. In addition to an on-axis reference measurement which usually corresponds to the central axis, measurements are taken in the horizontal and vertical planes in 10-degree steps along a circular orbit around the loudspeaker. These measurements are available from data already captured during the isobar acquisition process and require no additional effort. When a complete balloon is measured, for example for EASE data, all necessary data is obviously included as well.

The evaluation and presentation of the measurements are then carried out for the following categories:

- On-axis
- Listening window
- Early reflections
- Sound power



The X20's horizontal isobars in the 50 × 110 setting (Fig. 12)



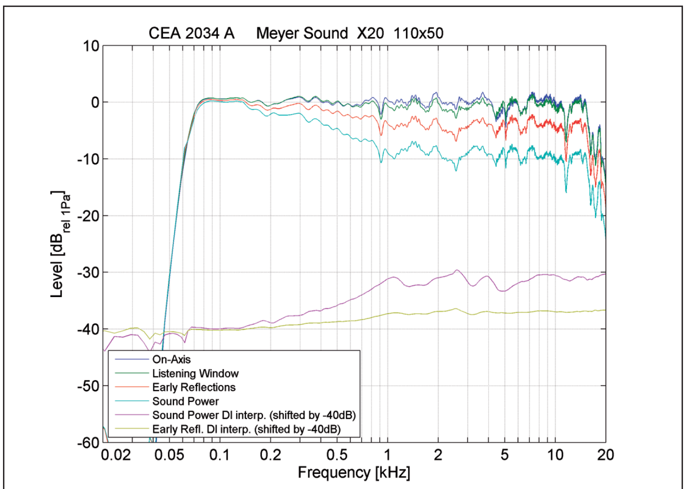
The X20's vertical isobars in the 50 × 110 setting (Fig. 13)

The on-axis measurement only considers the frequency response along the main propagation axis. The listening window frequency response is averaged from a total of nine measurements.

- On-Axis
- ±10°, ±20°, ±30° horizontal
- ±10° vertical

The early reflection's mean response considers sound radiated towards surfaces in the loudspeaker's vicinity that may emit early reflections. It is averaged over a total of 26 measurements.

- Floor: -20°, -30° und -40° vertical
- Ceiling: +40°, +50° +60° vertical
- Front: 0°, ±10°, ±20°, ±30° horizontal
- Side walls: ±40°, ±50°, ±60°, ±70°, ±80° horizontal
- Rear wall: 180°, ±90° horizontal



The X20's Spinorama in the 50 x 110 setting (Fig. 14)

The sound power frequency response corresponds to the sound power level emitted by a loudspeaker.

The two additional traces shown below represent the respective differences between the listening window and early reflections' responses versus sound power.

SPDI = sound power directivity index

ERDI = early reflections directivity index

In Fig. 14, both traces are offset so that the gridline at -40 dB corresponds with a value of 0 dB.

Spinorama: practical coverage

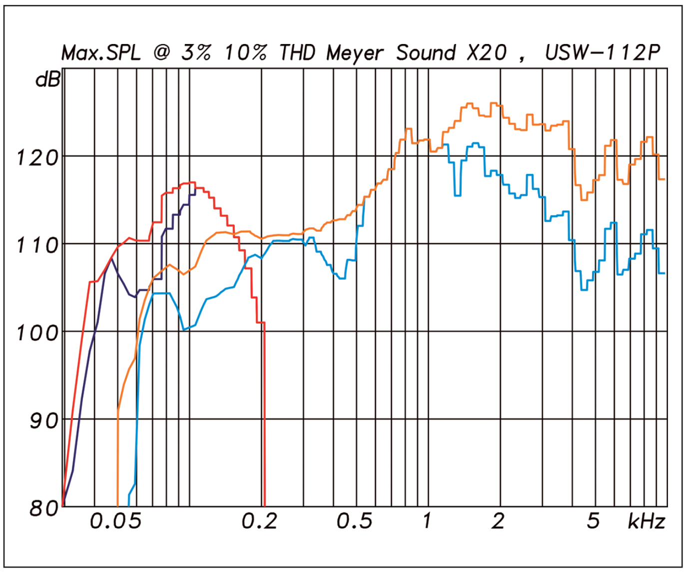
The listening window trace should resemble the on-axis trace as close as possible which means that the frequency response changes only slightly within the listening window's coverage range. Early reflections are inevitable in most situations, except from outdoor sound reinforcement. The most important thing here is that their strength does not suddenly change from one frequency to the next; in other words, sometimes strong and sometimes weak. For the trace this means: it lies, depending on the loudspeaker's coverage angle, less or more distant below the on-axis response and its shape progresses in a similar manner. The same applies to the sound power trace which provides information about how much the entire room is excited by sound and what the direct sound to total sound level ratio is. Towards lower frequencies where the loudspeaker radiates increasingly more omnidirectional, all four traces converge.

According to the small overview that explains how to interpret a Spinorama, the X20 exhibits near ideal behavior. The listening window trace overlaps the on-axis trace almost perfectly while the early reflection and sound power traces run parallel to the former two with a -3 and -9 dB offset respectively from 1 kHz upwards. Below 1 kHz, they approach the on-axis response at a constant slope. Altogether, this guarantees a consistent listening impression within the nominal coverage range and uniform excitation of early reflections and the diffuse field.

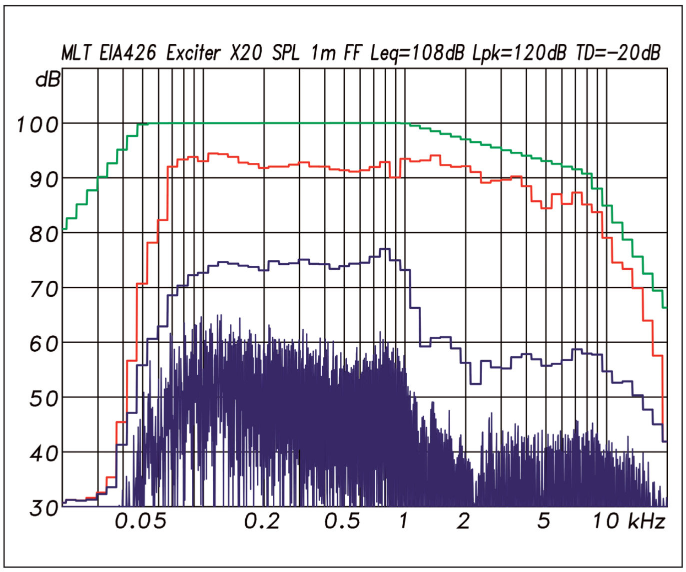
Maximum SPL measurements

The sine burst method was used during the first pass of determining the maximum sound level. The X20 and the USW-112P were measured each in separate series of measurements. For the USW-112P, 683-milisecond long signal bursts were used whereas 171-milisecond long bursts were used for the X20. The rationale for longer bursts at lower frequencies is the higher frequency resolution from a larger FFT size (fourfold). Fig. 15 shows the 3% and 10% distortion maxima for both the X20 as well as the USW-112P subwoofer. Being a subwoofer, the latter was measured only up to 200 Hz. In both cases, the 3% and 10% traces partially overlap because the 10% THD limit was never reached in the first place; a limiter in the device already intervened beforehand. However, where the HF transducer enters, the X20 traces clearly separate because compression drivers with their relatively high second-order distortion (k_2), already reach 10% THD prior to limiter intervention.

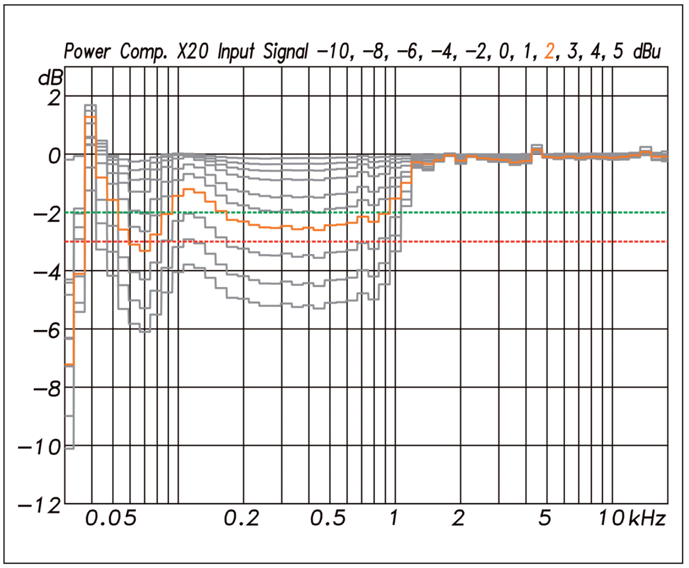
Fig. 16 shows the second maximum sound level measurement considering a sole X20 first. The stimulus used is a multi-sine signal with the spectral distribution of an average music signal (green trace) in accordance with EIA-426B and a 12 dB crest factor. Therefore, this kind of measurement reflects very realistic load conditions. The measured distortion value, induced by this signal, consists of both total harmonic distortion (THD) and intermodulation distortion (IMD). Together they are called total distortion (TD = THD + IMD). Referenced to 1 m distance under free field conditions, a time-averaged sound level L_{eq} of 108 dB and a peak sound level L_{peak} of 120 dB are achieved. Meyer Sound's published peak sound level of 123.5 dB is slightly higher which can be explained by the fact that the M-Noise test signal was used. It has a crest factor that rises with increasing frequency and therefore yields a few dB more peak sound level, especially in speakers with a powerful HF transducer. The distortion percentage for this measurement was -20 dB corresponding to 10%.



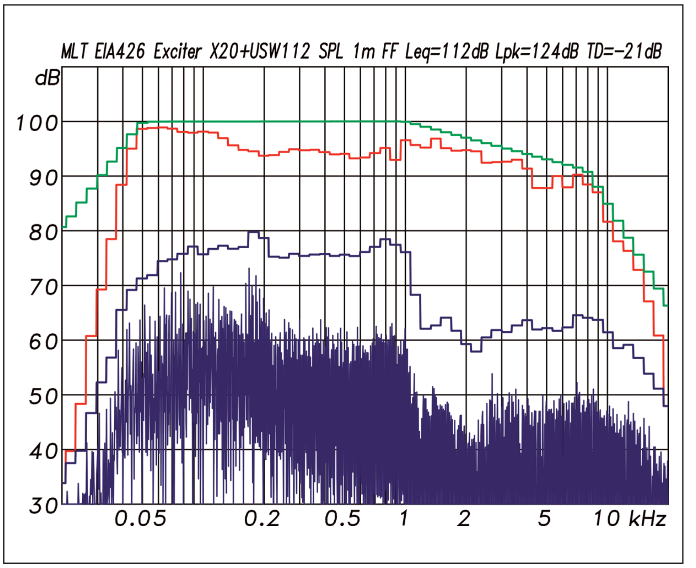
Maximum level of the X20 and the USW-112P for a maximum of 3% (light blue, blue) and 10% (orange, red) total harmonic distortions (THD, Fig. 15)



Multi-tone measurement of the X20 with an EIA-426B spectrum (green) and a crest factor of 12 dB. Referenced to a distance of 1 m under free field conditions, 108 dB is achieved as a time-averaged sound level and 120 dB as a peak sound level. The distortion occurs primarily in the operational range of the woofers which reach their limits first when combined with this much more powerful HF transducer (Fig. 16)



The X20's power compression Measurement with multi-sine signals starting with an average level $L_{eq\ of\ 98}$ dB (0 dB reference). For the further measurements, the input level was increased in 1 or 2 dB steps up to +15 dB. For the measurement in Fig. 16, a level setting corresponding to the orange curve was selected (Fig. 17)

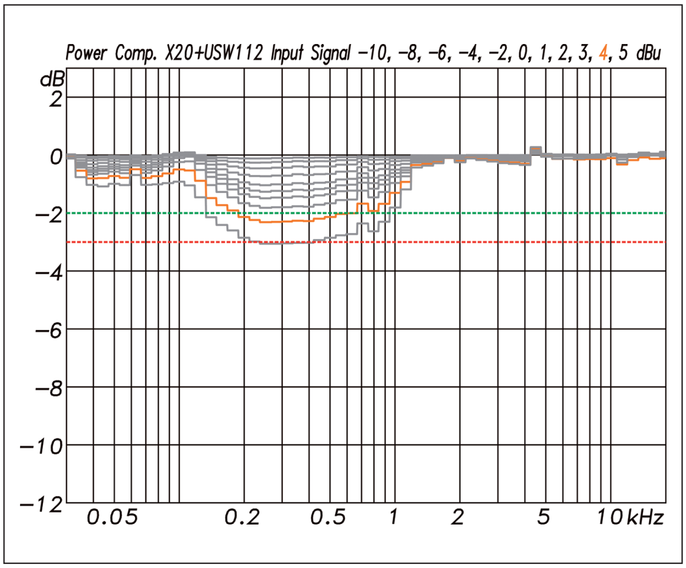


Multi-tone measurement of the X20 in combination with the USW-112P subwoofer with an EIA-426B spectrum and a crest factor of 12 dB. Referenced to a distance of 1 m under free field conditions, 112 dB is now achieved as a time-averaged sound level and 124 dB as a peak sound level (Fig. 18)

In addition to a distortion limit of 10%, power compression can also be evaluated as stop-condition for this measurement. To do this, one initially starts the measurement series at a low level within the loudspeaker's linear operating range where no power compression occurs. Starting from this value, the level is initially increased in 2 dB steps followed by 1 dB steps. At some point, whether for all frequencies or individual frequency bands only, the loudspeaker no longer tracks these level increases. The power compression limit values were defined to not exceed 2 dB for broadband and 3 dB for individual frequency bands.

Fig. 17 shows the power compression results for the X20. Relative to the departure point with a time-averaged sound level L_{eq} of 98 dB, the power compression limit value was exceeded at +12 dB (orange trace in Fig. 17). In pure mathematical terms, this should have yielded an L_{eq} of 110 dB; however, this was reduced to 108 dB by the power compression. Both criteria, i.e., the maximum total distortion value of 10% and maximum broadband power compression of 2 dB, complement each other here very well. The traces in Fig. 17 also clearly show that X20's performance limit, as expected, is determined by the small woofers which cannot match the HF transducer's maximum level.

Rigging accessories can be selected from a wide range of products



The X20's power compression plus subwoofer USW-112P with multi-sine signals starting with a time-average sound level $L_{eq\ of\ 98}$ dB (0 dB reference). For the further measurements, the input level was increased in 1 or 2 dB steps up to +15 dB. For the measurement in Fig. 18, a level setting corresponding to the orange curve was selected (Fig. 19)

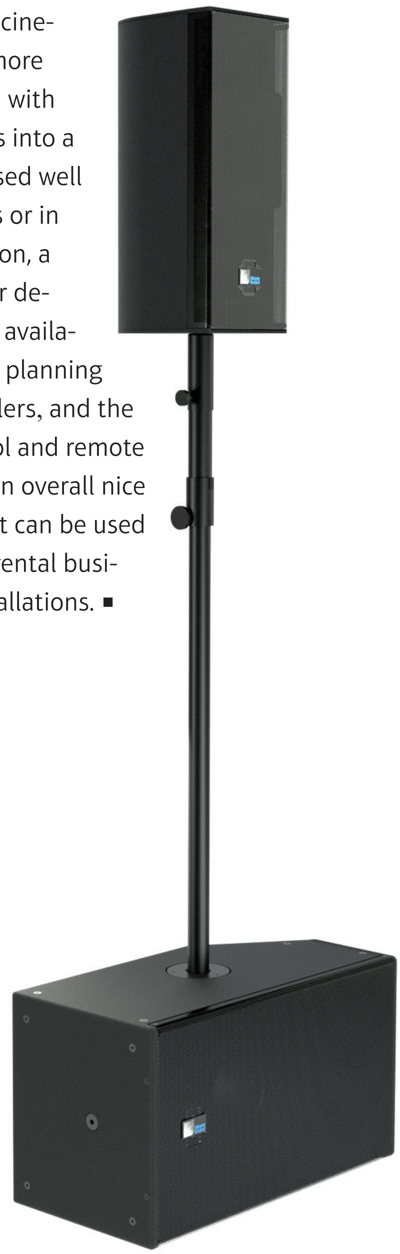
To relieve the woofers and extend the frequency range, the X20 can be combined with the USW-112P. In this setup, under identical stop-conditions, the attainable level rises by 4 dB to a time-averaged sound level L_{eq} of 112 dB and a peak sound level L_{peak} of 124 dB. The corresponding graphs can be found in Fig. 18 and Fig. 19. The X20's woofers' limitation continues to remain noticeable, but is now significantly less due to the high-pass filter in the signal path.

Listening test

The listening test took place with a stereo pair of X20s and USW-112Ps. At first, we listened solely to the X20s without support of the subwoofers. Given their size, it was almost surprising that the X20s did not exhibit the usual sound image associated with small loudspeakers which is always a little too thin. The sound reproduction was balanced and, depending on the program material, nothing was missing. If one looks at the frequency response once more, one will find the lower corner frequency (-6 dB) at roughly 65 Hz which already suffices for many applications. Completely different prospects present themselves in conjunction with a subwoofer where the X20 sonically transforms into a small and powerful PA. From a tonal point of view, the reproduction is, as expected, absolutely neutral; also, at higher levels it does not become obtrusive or colored. If one did not see the speakers during the listening test, based on the reproduction quality, the spatial resolution, and the sound image depth, one would think they were large hi-fi speakers. The difference being that these would probably not possess of the X20's and USW-112P's sound level reserves.

Summary

Without exception, the same that was said in the X40 review applies to the Ultra-X20 and its USW-112P subwoofer: The X20 by itself as well as combined with the USW-112P meets the highest demands in terms of measurements, sound, and quality. Despite its compact size, the X20 manages well without a subwoofer, making it ideal for theatres, cinemas, hotel bars, and many more applications. In combination with the subwoofer, the X20 turns into a solid small PA that can be used well as DJ monitor on club stages or in larger installations. In addition, a wide range of accessories for deployment and installation is available. Together with the MAPP planning software, the Galaxy controllers, and the Compass software for control and remote monitoring, this makes for an overall nice and very useful package that can be used very effectively both in the rental business as well as for fixed installations. ■



Combination with subwoofer for more sound level and another bass octave