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AUDIO
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Reflector Audio U.S.A powered studio monitor Square Two

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The latest product from the busy developers at Reflector Audio is the Square Two, or SQT for short. The compact, cube-shaped loudspeaker with a height width and depth of 32 cm (or just a bit over 12 inches) is basically a 2-way bass reflex speaker with a coaxial alignment of the two ways. This is particularly advantageous at short listening distances when the loudspeaker acts as a single source and the individual paths are not perceived as separate sources. As a fully active system, the SQT has all the usual standards and connections to be used in a wide range of applications from nearfield monitoring to midfield to mastering.

Assembly and electronics

In the low frequency range, the SQT is equipped with four 5" drivers from the Italian manufacturer Eighteen Sound. The drivers are located on a sub-baffle a little deeper in the housing and radiate through four openings on the front. The entire front of the box is designed as a kind of large horn, on the surface of which the openings for the woofers are arranged concentrically on the outside. This means that a large tweeter horn and the woofers have been arranged in a compact design with a common central axis.

The tweeter horn is equipped with a 1.4" driver from Faital. The bass reflex openings of the woofers are located on the bottom of the housing. In order to create the proper distance from the floor, the base plate has wide feet at the front and back.

High-quality components have also been used for the electronics, which are located on a plate in the back panel. The power amplifiers and the DSP system come from the renowned Dutch manufacturer Hypex. A two-channel Ncore module with 2 x 125 W power drives the four woofers, and a 100 W extension module, also from the Ncore series, supplies the tweeter. The DSP system is equipped with a Sigma DSP and, in addition to analog inputs of XLR and RCA connectors, also offers digital inputs in AES/EBU and S/PDIF format, each with a link socket and an optical Toslink input. Settings on the DSP system can be made using the Hypex software via a USB port. There are ten freely definable filters available to the user in the input, the settings of which can be saved in three setups. It should also be mentioned that despite the compact design, the electronics have their own inner housing that protects the circuit boards and components from excessive vibrations.

The front view of Square Two; In the middle is the large mid-high frequency horn, surrounded by the four bass drivers, which radiate through openings on the surface of the horn (Image: Anselm Goertz)

Measurements

The aim of the development was to achieve largely phase-linear playback and precise impulse behavior in addition to the usual properties of a studio monitor. How well this was achieved is shown in Fig.1 and Fig.2 with the frequency response and phase response of the SQT. In addition to the curve for the monitor as a whole, the frequency responses of the two paths LF (red) and HF (blue) are also shown in Fig.1. The separation occurs at 1 kHz. The corner frequencies (-6 dB) viewed overall are 40 Hz and 26 kHz. Things also look very positive when it comes to ripple in the frequency response, which is limited to ±1.3 dB with the SQT.

Phase linearity is achieved from approx. 200 Hz upwards. The small graphic on the phase response shows the step response of the SQT in the time domain, which shows a precise start of the jump without any upstream components and a uniform decay. The special feature is the type of filtering. The usual FIR filters are not used, but rather a clever combination of bell, shelf and all-pass filters, which enable a linear-phase progression. The filter functions and the frequency responses of the two paths without filters are shown in Fig.9. With a maximum of 15 BiQuad filters in each path, the complex construct can be easily implemented on the Hypex DSP platform. The perfect, resonance-free decay behavior of the SQT in the spectrogram in Fig. 3 completes the picture even further

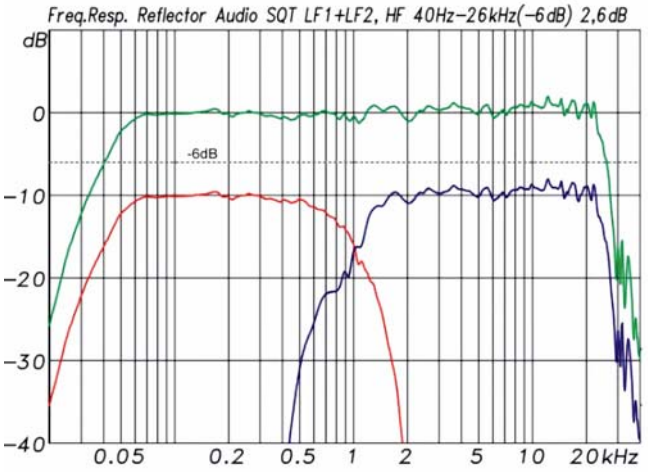
When it comes to maximum levels, one might at first glance suspect an imbalance between the low-frequency and high-frequency paths. However, a look at the sensitivity values of the two paths in Fig. 9 shows that the four small woofers achieve a fairly high sensitivity thanks to the special design with a kind of bandpass chamber in front. The maximum level measurement with sine burst signals from Fig. 4 then delivers a balanced curve at a high level with values of approx. 112 dB in a wide frequency range.

Below 100 Hz the achievable values drop continuously, so that at 50 Hz 100 dB can still be read. More is hardly possible mathematically if you assume 80 dB sensitivity at 2.83 V and a maximum output voltage of the power amplifier of approx. 30 Vrms (+20 dB to 2.83 V). Multitone measurement provides a slightly deeper insight. With a multi-tone signal that has a spectral distribution and a crest factor comparable to an average music signal, the loudspeaker is driven with increasingly higher levels, starting in the linear working range, with distortion and level loss (power compression) being evaluated depending on the frequency. Figure 5 shows the level loss that occurs mainly below 1 kHz in the woofers.

An exception is the frequency range around 100 Hz. This is exactly where the impedance curve of the woofers has reached its maximum, which means that the power amplifiers are only lightly loaded and can deliver more voltage. Obviously, the limitation is done by the clip limiters or the current limitation of the power amplifiers. At the same time, the distortion values also increase. Figure 6 shows the maximum level that can be achieved with this measurement, which in this case is defined by reaching the distortion limit of -20 dB (10%). The power compression limit of 2 dB has not yet been reached here. The values measured are an average level Leq of 105 dB and a peak level Lpk of 118 dB. Both values are comparatively high for a compact monitor, so you don't have to hide when compared to larger and more expensive models.

From the measurement laboratory

... the following measurements of frequency response, radiation behavior and distortion values are taken under reflection-free conditions. The class 1 measuring room allows measuring distances of up to 8 m and offers free field conditions from 100 Hz upwards. All measurements with the exception of the interference level measurement are carried out with a G.R.A.S. 1/4" 46BF measurement microphone at 96 kHz sampling rate and 24 bit resolution with the WinMF audio measurement system. Measurements below 100 Hz are carried out as combined near-field and far-field measurements. A G.R.A.S. is used to measure the interference level. 1/2" 40AF measurement microphone with high sensitivity and low noise is used.



01 Frequency response on axis measured at a distance of 4 m. The red and blue curves show the course for the LF and HF path separately, the green curve for the monitor as a whole. The lower and upper corner frequencies (-6 dB) are 40 Hz and 26 kHz, respectively. At just 2.6 dB, the ripple in the frequency response is very low.

Directivity

Due to the structure and the square front panel of the SQT, the radiation behavior is identical in the horizontal and vertical planes. There is therefore only one isobar diagram in Fig. 7, which shows a relatively narrow radiation behavior above 2 kHz. Above 600 Hz, the opening angle is initially around 120° and then narrows to around 90° from 1 kHz onwards. From 2 kHz upwards, the -6 dB isobars narrow further to approximately 50°. The Spinorama graphic in Fig. 8 shows this behavior very clearly. The question of whether this is good or bad cannot be answered in this way. It would be better to speak of appropriate or inappropriate for the listening situation. Due to the narrow beam angle, freedom of movement is somewhat restricted, at least at short listening distances, but on the other hand there are also fewer annoying reflections from the surroundings and fewer diffuse field components from the room. As the following listening test also showed, a distance of 3-4 m from the listening position to the monitors is ideal for the Square Two.

Listening test

The listening test again took place in an anechoic room, which allows for good comparison and shows the loudspeaker purely without room influences. What was already apparent in the measurement results came to light here clearly. With very good tonal neutrality, the Square Two plays dynamically and powerfully despite its compact dimensions. The bass range doesn't seem underrepresented either. The tweeter is also very nice, reproducing even difficult material with fine resolution and precision without any sharpness.

Electronics on the back of the Square Two with analog and digital inputs in all formats (Image: Anselm Goertz)

The setup for auditioning in an anechoic room. The absorbers on the floor reduce the floor reflection, which is disturbing in this otherwise reflection-free environment without a diffuse field. (Image: Anselm Goertz)

Conclusion

With the new Square Two model, the Latvian manufacturer Reflector Audio has achieved a major breakthrough in the highly competitive market segment of compact studio monitors. With the courage to come up with unusual concepts, the developers at Reflector Audio designed a coaxial arrangement consisting of a large horn together with four 5" woofers that radiate via bandpass chambers in the edge areas of the horn. Less unusual is the filter concept, which enables linear-phase playback from 200 Hz upwards without resorting to FIR filters. The results can be heard and seen in every respect. The measured values are consistently good, and the Square Two were very impressive in the listening test. The solid and well-made case and the consistently high-quality components round off the good impression.

SQT electronics with Hypex Ncore power amplifiers and Hypex DSP system (Image: Anselm Goertz)

Profile Reflector Audio Square Two

Frequency range: 40 Hz – 26 kHz (-6 dB)

Ripple: 2.6 dB (100 Hz - 10 kHz)

hor. Beam angle: 64 degrees (–6 dB ISO 1 kHz – 10 kHz)

hor. STDEV (standard deviation): 16 degrees (-6 dB Iso 1 kHz - 10 kHz)

Ver. opening angle: 64 degrees (–6 dB ISO 1 kHz – 10 kHz)

ver. STDEV: 16 degrees (–6 dB ISO 1 kHz – 10 kHz)

Max. useful volume: 112 dB (3% THD 100 Hz – 10 kHz)

Bass capability: 104 dB (10% THD 50 – 100 Hz)

Maximum level in 1 m (free field) with EIA-426B signal at full scale: 105 dB Leq and 118 dB Lpk

Pair deviations: 0.35 dB (max value 100 Hz – 10 kHz)

Interference level (A-bev.): 27 dBA (10 cm)

Dimensions / Weight: 320 × 345 × 325 mm (W × H × D) / 19.4 kg

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For price and availability please contact
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