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Genelec 4430A

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GENELEC

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As part of its "AV Installation Speaker Series", Finnish manufacturer Genelec now also offers two fully IP-based models that receive both their power, and audio signals in Dante/AES67 format, via the network connection. This review of the Genelec 4430A will discuss the IP-based loudspeakers' possibilities as well as their easy set-up and operation.

Genelec is from Iisalmi, a city located in the centre of Finland, and has become well known for its studio monitors over the past decades and is one of the leading manufacturers worldwide. Over the years, further products for the HiFi consumer and home cinema market and for AV installations have been added. Common to all Genelec loudspeakers is a fully active mode of operation and a consistent implementation of acoustically relevant details such as integrated waveguides, optimised enclosure shapes and aerodynamically improved bass reflex ports. In addition, they include a whole range of electronic features for signal processing and for adapting the loudspeakers to the respective operating situation. Especially tailored for AV installations, Genelec presented its two new 4420A and 4430A models at this year's ISE in Amsterdam. The special feature of these two "Smart IP" loudspeakers: it is not only audio and control signals that are delivered via the network; the power supply too is provided via the network cable. The reason for this is obvious: there are usually plenty of network cables and connections in all areas of modern buildings, and the possibility of connecting a speaker there with just a simple network cable is temptingly simple. One may point out that this has long been possible with classic 100V loudspeakers. A fact that is correct in principle – except that such an approach requires completely separate cabling and associated central system technology. Genelec's "Smart IP" speakers do not require any of this. The electronics for an active 2-way operation including all filters, room adjustment, delay and level setting are already completely integrated, and the audio signal can be selected from one of the many signals in the network as required.

In terms of the enclosure and driver configuration, the two new 4420A and 4430A

The 4430A's simple connection panel with a network connector and an auxiliary input for balanced analogue signals.

A pair of 4430As in white with the typical Genelec die-cast aluminium enclosures with generously rounded shapes and a flow-optimised bass reflex port on the rear.

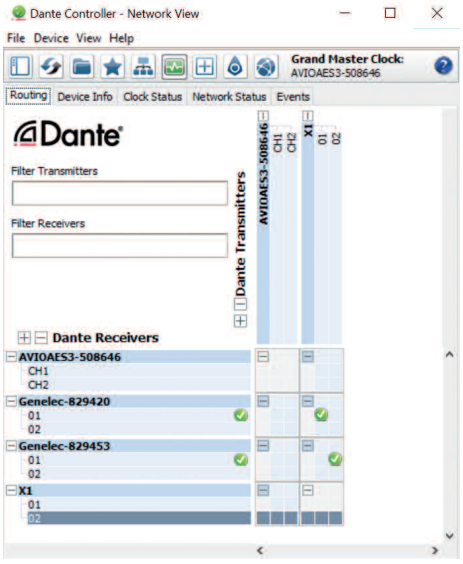

FIG. 01: Matrix with transmitters and receivers in the Dante controller. The two 4430As are fed here from the X1 notebook's Virtual Sound Card.

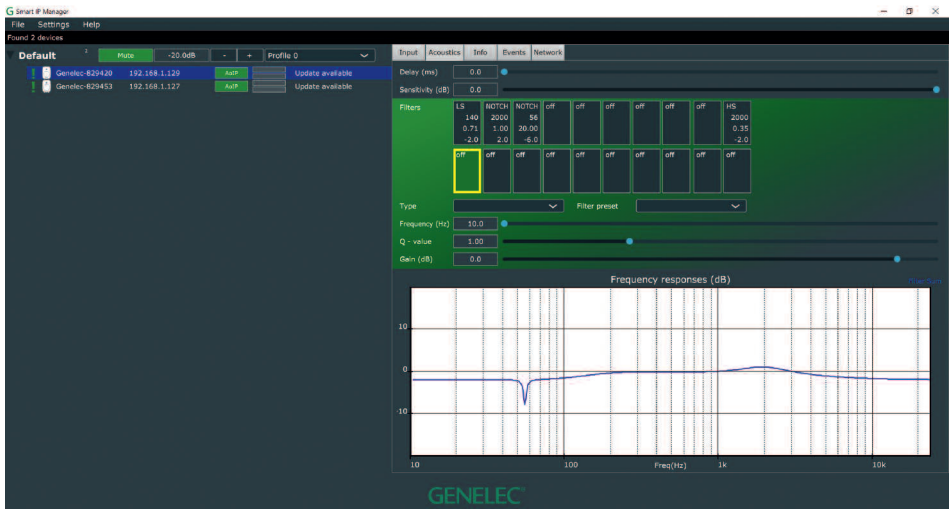

FIG. 02: Genelec's Smart IP Manager software allows the configuration of all IP-based speakers in the network.

Smart IP models correspond to the standard 4020C and 4030C installation models. The connection for the power cable has however been omitted; instead the speakers feature an additional network socket. The balanced analogue input with a Euroblock connector is also featured in the Smart IP models and offer a second option for signal feed in addition to the audio network. The 4430A model discussed here is equipped with a 3/4" dome tweeter and a 5" woofer. A 4" woofer is included in the slightly smaller 4420A. The two Class D power amplifiers' power for the tweeter and woofer is 50 W each for both models.

IP-based loudspeakers

The term 'IP-based loudspeaker' stands for the combination of three functions: powering of the speakers via the network using PoE (Power over Ethernet), configuration and monitoring of the speakers via the network using (in this case proprietary) software, and feeding of the audio signal through an audio network protocol (which in this case can be Dante, AES67 or ST2110-30).

Let us begin by taking a look at the power supply via PoE. PoE is defined using the IEEE standard 802.3. The basis of this process is a kind of phantom powering – to use a term from audio technology – where a DC voltage with a maximum of 57 V (usually 48 V) is transmitted decoupled by transformers together with the lines' data stream. There are two consumer classes with a maximum power consumption at the device: 12.95 W or 25.5 W. The latter is then called PoE+. The PoE direct voltage can be fed either via a PoE switch (end span) or via an intermediate injector (mid span). To prevent damage to non-PoE-enabled devices, the PoE source first checks whether a PoE-enabled device is located at the other end of the line using low voltage. It then waits for a signal to indicate to which power class (0 to 4) the device belongs. As data lines are often long and have only a small conductor cross-section, it is important to consider possible losses on the lines. Information on this can be found in the 4430A's manual.

The PoE supply of loudspeakers with higher power, such as the 4430A discussed here, is made possible by the fact that although music and speech signals contain high signal peaks, the RMS value and thus the average power consumed is significantly lower. The ratio of the peak value to the RMS value is measured by the crest factor, which for speech and music is usually 4 (12 dB) or higher. If, in an extreme case with such a signal, both of the 4430A's amplifiers would be fully driven into the peaks, then the sum power peak value would be 200 W for a short period. However, the average value would only be 12.5 W. With an estimated amplifier efficiency of 80 % plus a base load of 10 W, this would still fall exactly into the PoE+ power class. The corresponding buffers in the loudspeakers' power supply unit can absorb the short-term higher power demand. If only a simple PoE (without +) supply is available, the buffer in the power supply attempts to provide sufficient energy for high signal peaks for an equally short time span. The maximum level is restricted only when the average power consumption exceeds the 12.95 W that is possible with PoE.

The transmission of the audio signal to the Smart IP loudspeakers is based on the Dante standard. An Audinate UltimoX2 module is built into the loudspeaker, which, in addition to the usual Dante standard, also allows transmission according to AES67 or ST2110-30. Signal routing in the network is ensured in the familiar way using Audinate's Dante controller software (Fig. 01). All devices with a Dante interface can be connected to the Dante network and, as in the example below, so can computers with a "Dante Virtual Sound Card". A prerequisite for this is that all devices operate with the same sampling rate and are connected to the network via cable. Although Wi-Fi connections can be used for the configura-

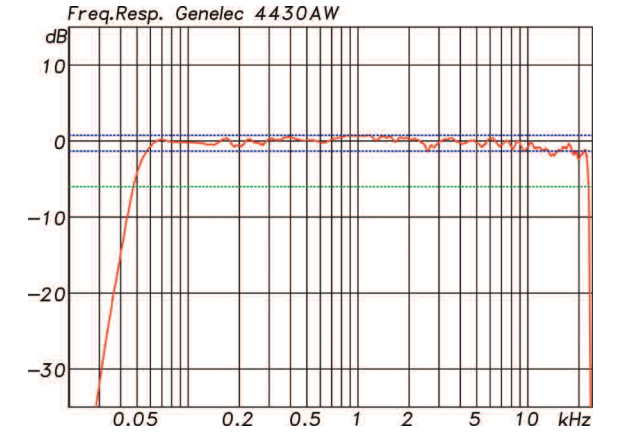

FIG. 03: The 4430A's perfect frequency response with a frequency range (-6 dB) from 47 Hz to over 20 kHz. The fluctuation of the curve between 100 Hz and 10 kHz is only ±1 dB.

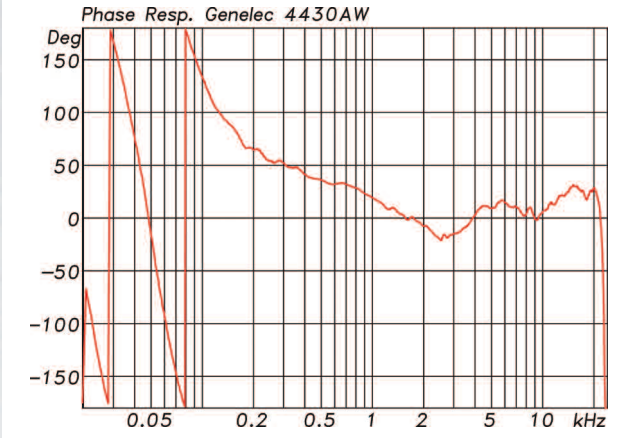

FIG. 04: The 4430A's phase response with a largely linear phase response from 200 Hz upwards.

tion of the Dante controller, they do not allow the transmission of audio signals.

Software and configuration

The setting and monitoring of the specific loudspeaker functions is handled by Genelec's proprietary Smart IP Manager software. The software is primarily intended for use during installation. In addition to acoustic adjustment, it also enables the creation of setups and the integration of the system into general building control and automation. This allows the end user to easily set-up access to the volume, zone selection and signal routing. Fig. 02 shows the software interface with the small test setup, consisting of two 4430As. In the left half, one can see an overview of all Smart IP speakers inside the network. In the right half, settings can be made for the selected speakers. In Fig. 02, these are gain, delay and a selection of up to 20 filters, which can be used to adapt the speaker to the respective environment.

Application

If one thinks of IP-based loudspeakers primarily in terms of small ceiling or wall speakers, as typically found in building installations or in home networks, one will not initially associate them with special acoustic qualities and good measurement values. In the case of the 4430A, however, one would be mistaken. Here, we are talking about real studio monitors of corresponding quality, which have been extended with a Dante interface and PoE+ supply. This inevitably leads to the question: for what kind of applications were such relatively high-priced loudspeakers designed? One would not be using PoE-powered monitors in a studio environment and a Dante interface would not be absolutely necessary given short distances and easy assignment of speakers to sources.

The situation, however, is completely different when it comes to public or semi-public spaces, where more than just a simple sound system is required. This can be the case in upscale restaurants and shops, where sound reinforcement not only creates background noise, but is instead part of the concept itself. Anyone who appreciates good food and drink, and is prepared to pay a little more for it, will not be happy with music blaring from the ceiling, and a store that wants to identify itself by relying on a special multi-sensory design will also need high-quality sound reinforcement. It is precisely this type of application that also Genelec targets. For this purpose, the topic is explained in detail in the two-part German webinar "Akustik in der Gastronomie – Verstehen und Einsetzen" ("Acoustics in Restaurants - Understanding and Using") by Eric Horstmann (Regional Business Development Manager at Genelec) with the support of architect and building acoustician Benjamin Christian Koziczinski and the room acoustics expert Karlheinz Stegmaier. For example, on the one hand, a restaurant space should not be too reverberant, as this will cause the noise level to rise rapidly and will make communication noticeably more difficult. On the other hand, a completely "dry" room acoustically would not be the solution either, as it quickly seems too sterile and tends to convey the atmosphere of an open-planed office. Although the reproduced music may not be in the foreground, it can provide a certain basic mood. With the limited use of (acoustic!) masking, it can also contribute to the creation of privacy. Again, this needs to be adapted to the room's acoustic conditions. In any case, the prerequisite for this is a high-quality and uniform sound reproduction that can be adjusted as required and, if possible, also includes zones. As one can already see from these few examples, a large field of activity exists here.

Measurement values

Despite all discussions about the significance of measurement values for loudspeakers, it can clearly be said that a loudspeaker that delivers

good measured values across all disciplines is a reliable tool in any case and provides the basis for a good overall sound reinforcement result. This is exactly what Genelec has achieved, as the following results from the measurement laboratory impressively demonstrate. Let us begin with the frequency response in Fig. 03, as this curve hardly needs any further comment. With a fluctuation margin of just ±1 dB, the response is almost perfect. The lower corner frequency is 47 Hz and thus within the usual range for a speaker of this size. The upper corner frequency just below 24 kHz is a result of the sampling rate of 48 kHz set during the measurement.

The corresponding phase response is illustrated in Fig. 04. Above 200 Hz, the curve is largely linear in phase, which is achieved by using a special phase EQ (FIR filter) in the DSP. Below 200 Hz, the phase then rotates by 360° twice, due to the bass reflex cabinet's high-pass behaviour as well as due to the additional electrical high-pass filter. In theory, compensation would also be possible here, but this would result in the filter latency being too long.

The spectrogram from Fig. 05 continues with the previous impression. There are virtually no resonances here. The increase of the group delay causes a longer reverberation only at the lower end of the transmission range. However, this cannot be avoided owing to the principals involved.

If we continue with the measurement results for the isobar diagrams, then the curves in Fig. 06 and Fig. 07 show a very even response with an opening angle of 100°-120° horizontally and 100° vertically above 1 kHz. The unavoidable interference range in the vertical axis at the transition from woofer to tweeter at 2.9 kHz is very narrow and is unlikely to be noticeable in practice.

The topic of maximum levels is an interesting one. For the distortion measurements performed for this purpose, the two common methods with sine bursts and with a multitone signal were used. The sine burst measurement determines which level is possible at a defined maximum distortion value depending on the frequency. Measurements are made at a frequency at which the level is increased until the distortion limit is reached. The level is increased in steps of 1 dB. The frequency steps are 1/12 octave. Fig. 08 shows the 4430A's result with the red curve (measured from 40 Hz to 10 kHz for a maximum of 3% distortion) and the blue curve (from 40 Hz to 300 Hz for a maximum of 10% distortion). On the basis of this measurement, possible weaknesses in certain frequency ranges could be easily identified. However, they do not exist here. The curves run completely evenly without weaknesses and are primarily limited by the internal limiter. The 10% curve also separates only briefly from the 3% curve, as higher distortion values than 3% occur only below 100 Hz, if at all. Regardless of this, the level values achieved are of a magnitude that is common for a monitor of this size. Restrictions caused by the PoE power supply cannot be identified.

Even more meaningful in practice is the multitone measurement, which uses a test signal with a spectrum that corresponds to that of a medium music signal. At 12 dB,

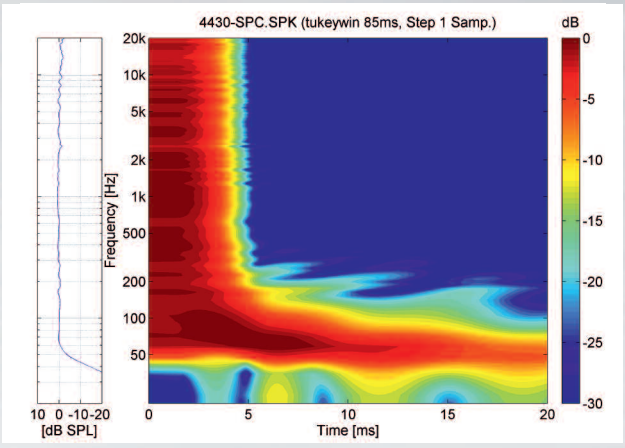

FIG. 05: The 4430A's spectrogram shows perfect decay behaviour.

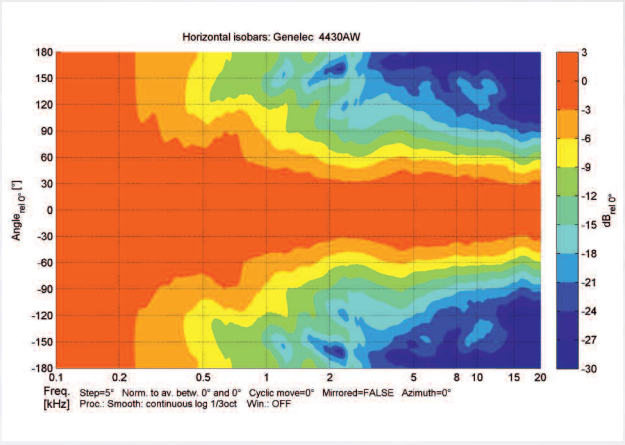

FIG. 06: Horizontal isobars with an opening angle (-6 dB) of 100-120° above 1 kHz.

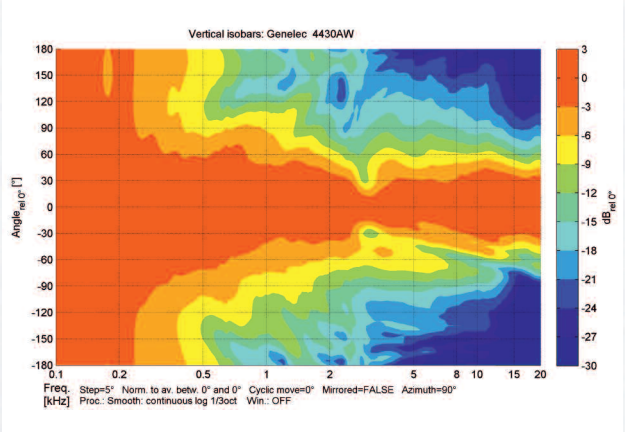

FIG. 07: Horizontal isobars with an opening angle (-6 dB) of about 100° above 2 kHz.

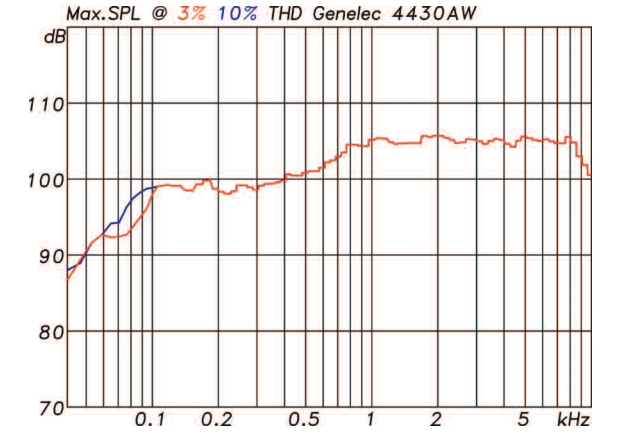

FIG. 08: Maximum level measured with sine burst signals for a maximum distortion of 3% (red curve) and of 10% (blue curve). Apart from a small range below 100 Hz, the distortion does not rise above 3% before the limiter intervenes.

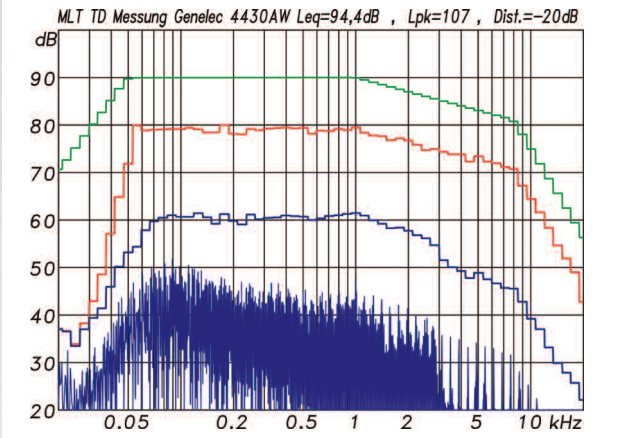

FIG. 09: Maximum level measurement with a multitone signal with an EIA-426B spectrum (green curve) and a crest factor of 4 (= 12 dB). Based on a distance of 1 m in free field and full space conditions, an average level Leq of 94.4 dB and a peak level Lpk of 107 dB are achieved. The total distortions (TD), consisting of total harmonic distortions (THD) and intermodulation distortions (IMD), then reach -20 dB (=10 %).

the test signal's crest factor (ratio of peak value to effective value) also comes quite close to a music signal that is not too strongly compressed. The multitone is composed of 60 sine signals with random phase and a frequency separation of 1/6 octave. An evaluation is easy when using an FFT measuring system: all elements not belonging to the excitation signal and thus the distortions are set in relation to the overall signal. Both total harmonic distortions (THD) and intermodulation distortions (IMD) are recorded first. Both together are also referred to as total distortions (TD). The distortion limit for this type of measurement was defined at 10%. Fig. 09 shows the corresponding signal spectrum (green), the reproduced overall signal (red) and its distortion components (blue) in 1/6 octave bands. With a total distortion of 10%, the 4430A achieves an average level of 94.4 dB and a peak level of 107 dB with this measurement method, both related to a distance of 1 m in free field under full space conditions. Both values can also be found in the 4430A's data sheet. The measurements were performed on a standard PoE+ switch, where the 4430A was the only PoE load.

Accessories and prices

There are several options and accessories for mounting or setting up the 4430A. It can be screwed directly onto a tripod with 3/8" thread without requiring any additional parts. With a weight of 5.1 kg, the speaker stands quite securely on a solid tripod, when this is not completely extended. A simple wall bracket with no angle adjustment is also included for wall mounting. Further accessories can be found in the extensive accessories catalogue, which also includes various swivel and tilt ceiling and wall mounts as well as truss clamps and stands.

The current list price for the 4430A is 906.00 € RRP incl. VAT. The smaller 4420A model is available for 785.00 € RRP incl. VAT.

Summary

With the Smart IP loudspeakers, Genelec is bringing two worlds together: that of simple IP technology loudspeakers and that of studio monitors. While one would initially suspect a certain incompatibility; it quickly becomes clear that the opposite is the case. The two 4430A and 4420A models are flawless studio monitors in terms of their acoustic and sonic characteristics. In addition, they are also IP-based speakers that can be easily powered via PoE+ and receive their audio signal from the widely-used Dante audio network. There are therefore no restrictions on either side.

The use of these two Smart IP speakers is therefore recommended wherever future-oriented modern AV systems require not only simple installation and operation, but also superior audio quality. This is the case in museums with sound and video installations as well as in sophisticated shops or restaurants. Further possible applications include small cinemas, home cinemas, hotel bars and many more. Provided that the room acoustics are acceptable, users will have a lot of fun with Genelec's Smart IP loudspeakers in all of these cases. // [12953]