Monitor Setup Guide

The right monitors. The correct setup.

GENELEC®

Contents

Introduction

We've put together this useful guide to help you understand the key principles of working effectively with reference monitoring loudspeakers, so you can achieve the best possible listening experience in your studio space.

At Genelec, we've spent over four decades creating the world's finest active loudspeakers. By helping audio professionals everywhere produce accurate, reliable mixes that translate consistently to other rooms and playback systems, we've set the global standard for music, film and broadcast reference monitoring.

We pride ourselves on localised production, and manufacture every one of our loudspeakers at our lakeside factory in the idyllic town of Iisalmi, Finland – the very place where our story began.

Our immense passion for sound quality is matched by our strong commitment to the health of the environment and our global community. We work tirelessly to reduce our carbon footprint, recycle waste, promote well-being, and manufacture with renewable energy and materials, following the highest environmental, social and industrial standards.

To get the most from this guide, we recommend you take the time to read it in full. We also encourage you to contact us with any questions that arise.

Thank you for choosing Genelec!

What is a reference monitoring loudspeaker?

A reference monitor is more than a good-sounding loudspeaker. It is a device used in the process of recording, mixing or broadcasting audio in any environment where accurate listening is needed.

As a professional tool, a reference monitor must reveal the truth about the audio signal being monitored. It should not add to, remove or mask anything contained in the audio.

With Genelec SAM Monitors and automated GLM calibration, a truthful reference can be set up in moments.

Selecting the correct monitors

Genelec recommends monitors based on the maximum Sound Pressure Level (SPL) you need – and listening distance affects that. When you need bass management, certain subwoofers exist to suit different monitor sizes.

Later in this document, we provide more details about monitor and subwoofer selection. Also, we recommend referring to our online model data and asking for detailed advice from your local Genelec dealer.

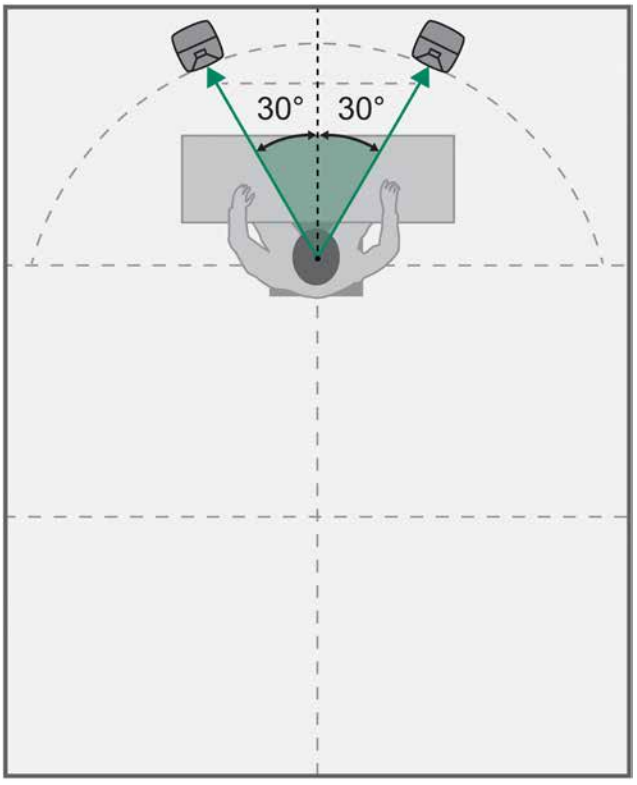
You can also contact us directly at **support@genelec.com**

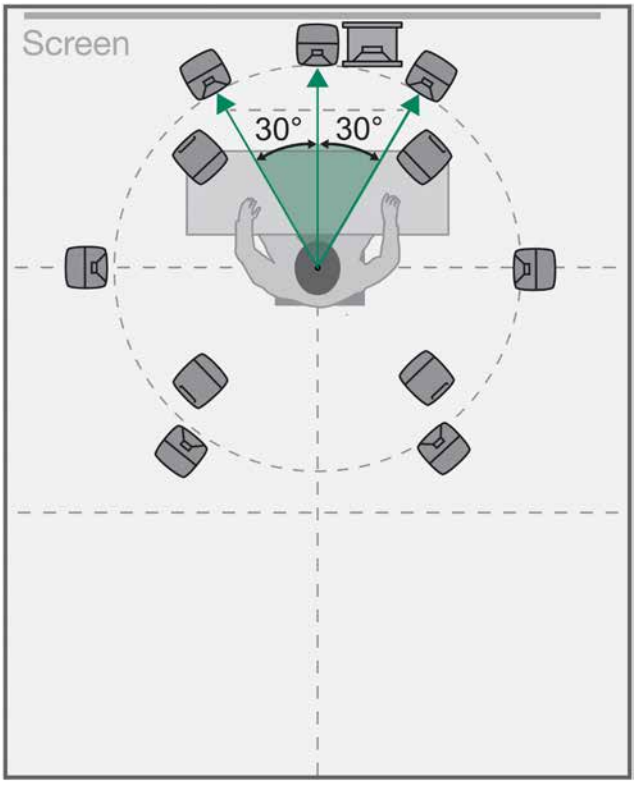
Identifying your listening area

A monitor should be placed in an optimal position in the room, a location offering minimum influence from the monitor's surroundings and the room. This is because, what we hear is limited not only by our listening ability and the monitor’s performance, but also by the room acoustics and how the monitor is positioned in the room.

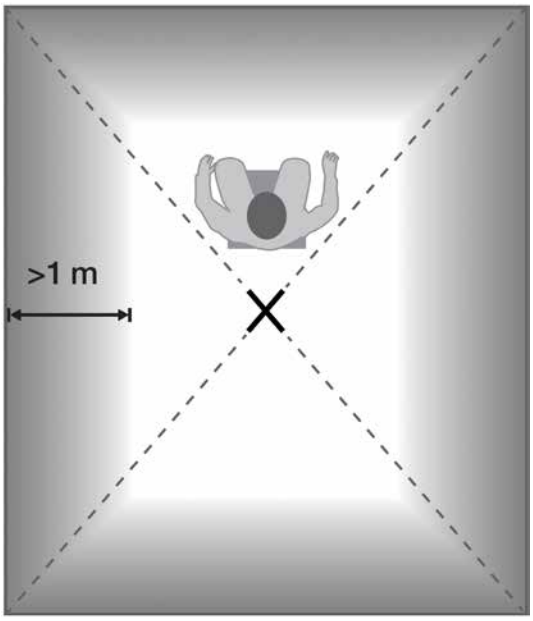
Divide your room into three equal-sized areas: front, centre and back.

For music productions, place your listening setup in the front area. The angle between the left and right monitors must be 60° degrees, ideally positioning the listener at the tip of an equilateral triangle. Each monitor should be aimed towards the listening position. For cinema audio production, place your listening setup in the back area. The illustrations below show examples of stereo and immersive audio monitoring setups.



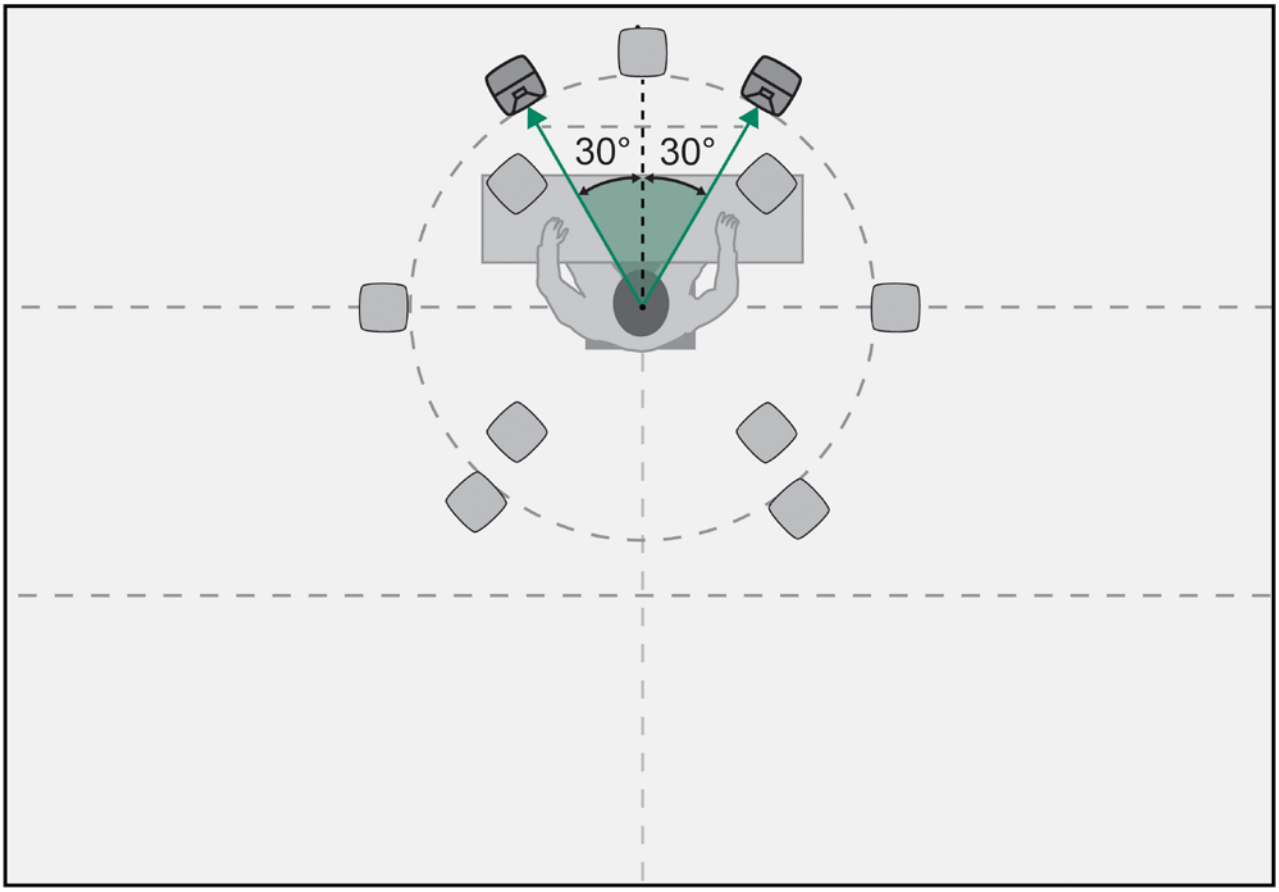


The side channels can vary from 90 to 110 degrees and the rear channels can vary from 130 to 150 degrees.

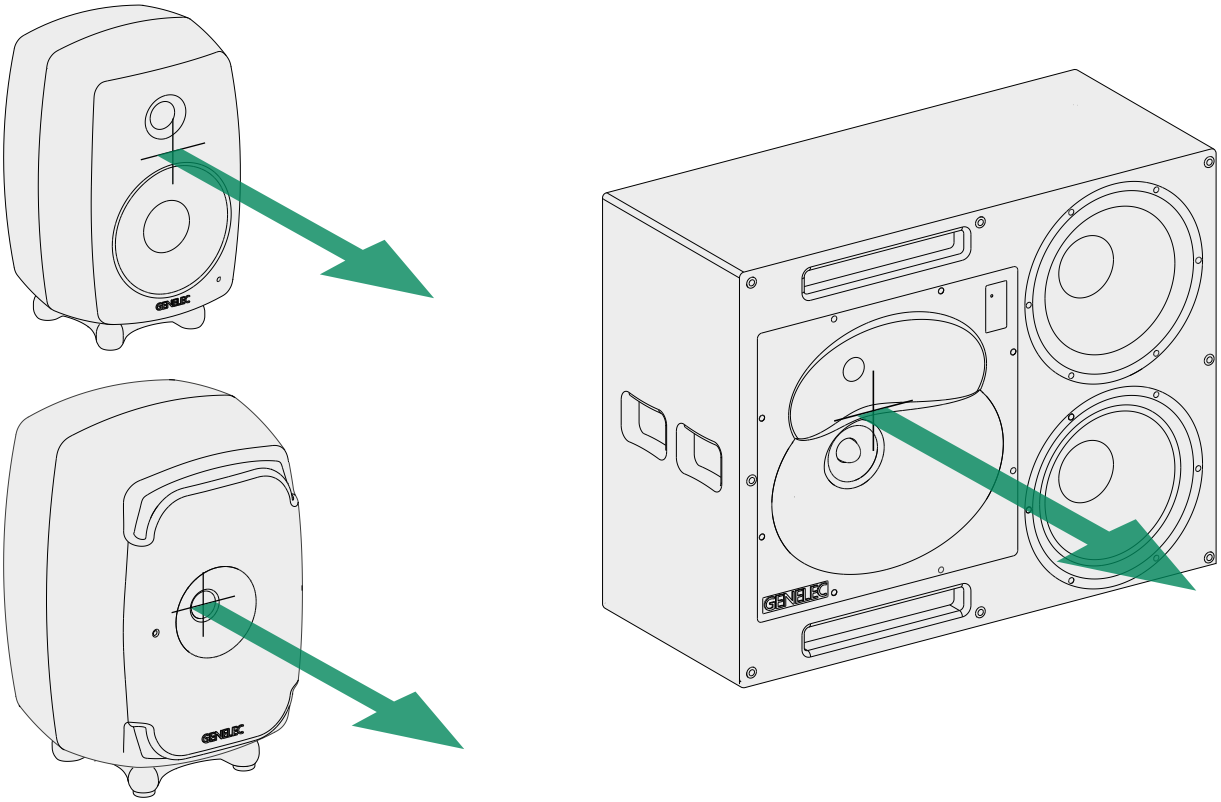


Acoustic resonances caused by room surfaces are called standing waves or room modes. Room modes cause sound pressure maxima to occur on the room surfaces and are audible as pronounced colourations. Place the listening position at least one metre from the walls to avoid these colourations. Also avoid placing the listening position in the exact centre of the room.

Find the left-right symmetry axis (central dividing line from front to back) of your room. Place the listening position and your setup symmetrically (centrally) on the line in relation to the left and right directions.

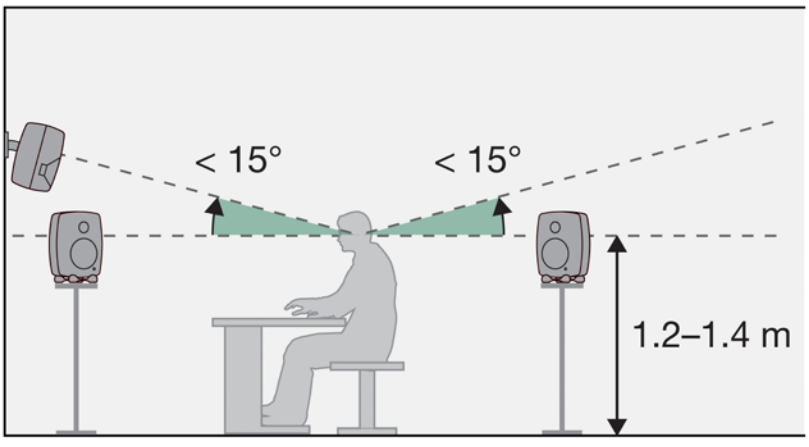


Acoustical axis

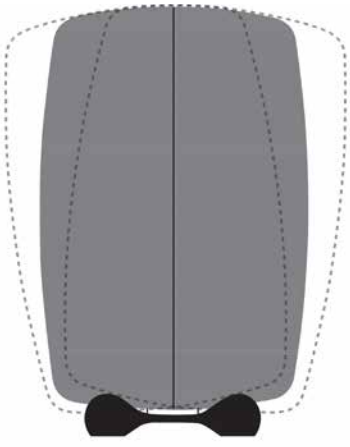


Acoustical axis of a 2-way monitor, 3-way monitor and point source monitor

The recommended height of the monitor acoustical axis is ear level, to ensure a balanced reproduction of the loudspeaker's frequency response at the listening position. The acoustic axis is ideally placed between 1.2 and 1.4 metres from the floor. Placing the monitors higher, with a slight tilt, reduces the effect of floor reflections at the listening position, however, do not lift the monitors so high that more than 15 degrees of tilt is required for aiming. Monitors should always be aimed towards the listening position. Monitor height at half the room height should usually be avoided, as at low frequencies the ceiling and floor can create sound-colouring resonances. With immersive systems, monitors are also placed above and below the listening level; always follow the monitor placement guidelines of the specific immersive monitoring system.



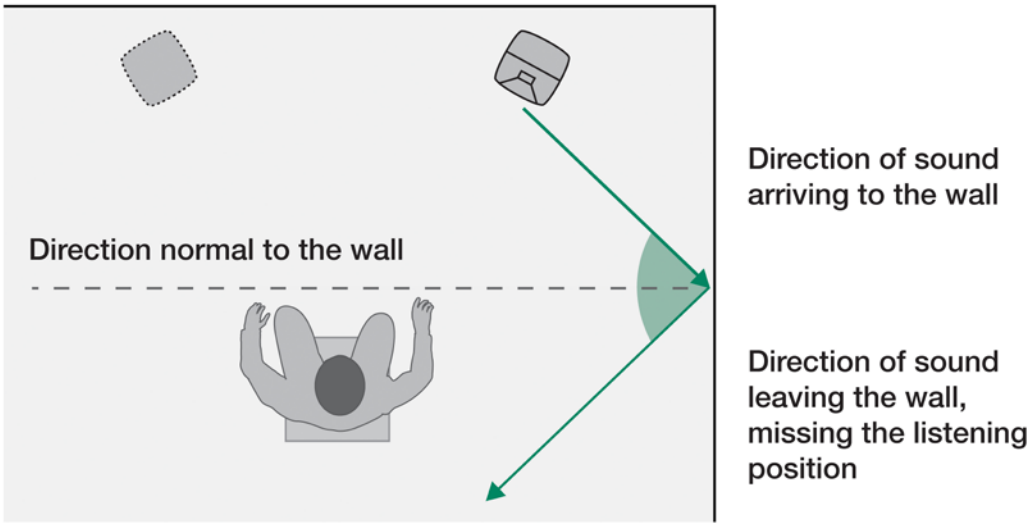
Monitor height (ITU-R BS.775-2 Recommendation)



Iso-Pod tilting

Monitor location and listening position

Sound is reflected by the walls, ceiling, floor and large objects. Sound level at the listening position increases when reflected sound arrives in phase with direct sound from the monitors. Conversely, sound level decreases when reflected sound arrives out of phase with direct sound. When room surfaces have not been designed to diffract sound, the reflecting sound reaches and departs from the wall at the same angle relative to the wall's surface. This is valid for medium and high frequencies. Avoid placing monitors in a way that will cause the nearby side walls, ceiling or floor to reflect sound towards the listening position.



When room dimensions agree with sound wavelengths, sound energy can accumulate to form resonances (standing waves), producing sound pressure maximums and minimums in the room. The location of a monitor affects how much these mode resonances can collect energy and how audible the resonances become. Adjusting the monitor location may reduce levels of problematic room mode resonances.

Accurate stereo imaging is achieved when reflections are similar for both the left and right monitors in a stereo pair. This can be achieved by doing three things: maintaining the same distances to the nearest side walls and the wall behind the monitors for left-right stereo pairs, placing the monitors at the correct (or same) height in the room relative to the listener, and placing the listening position on the left-right symmetry axis of the room. These actions make room reflections similar on the left and right side of the room, enabling accurate imaging.

When the listening position is unfavourably located relative to the room mode resonances, this can seriously affect low-frequency reproduction. If the listening position is at the null of a mode resonance, that frequency will reduce significantly in level and audio may appear to be missing. Moving the listening position forwards or backwards can avoid the null and may solve this problem.

Listening distance and Sound Pressure Level

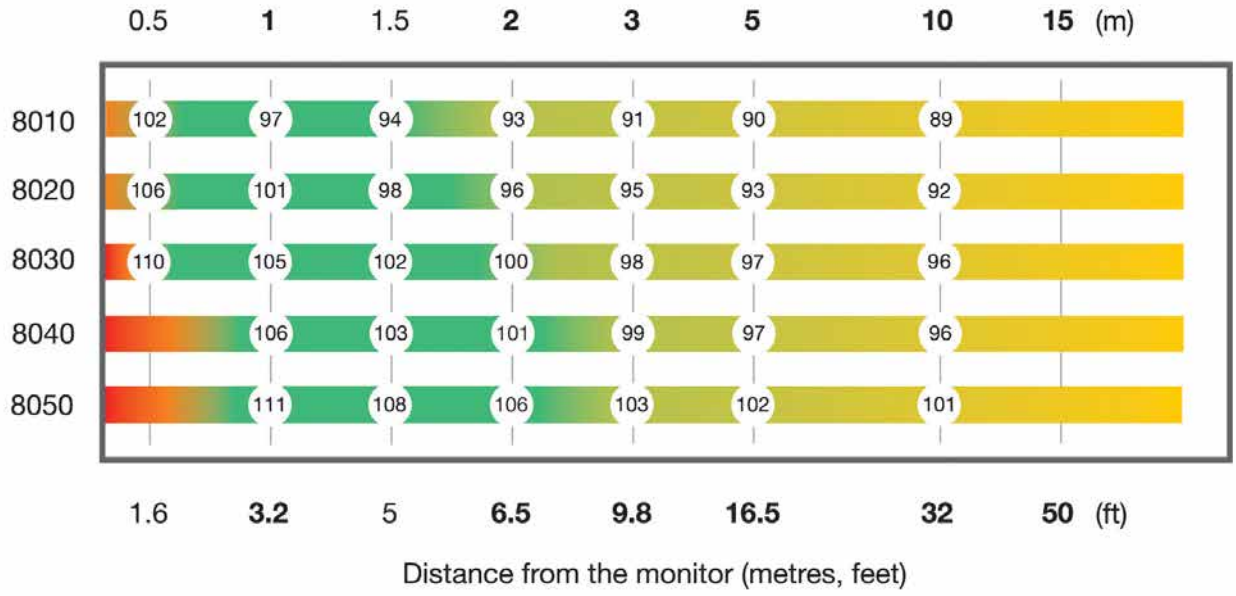
The distance between you and your monitors is crucial, both in terms of performance and the SPL delivered to the listening position. Use the table here to compare the SPL capabilities of different Genelec monitors.

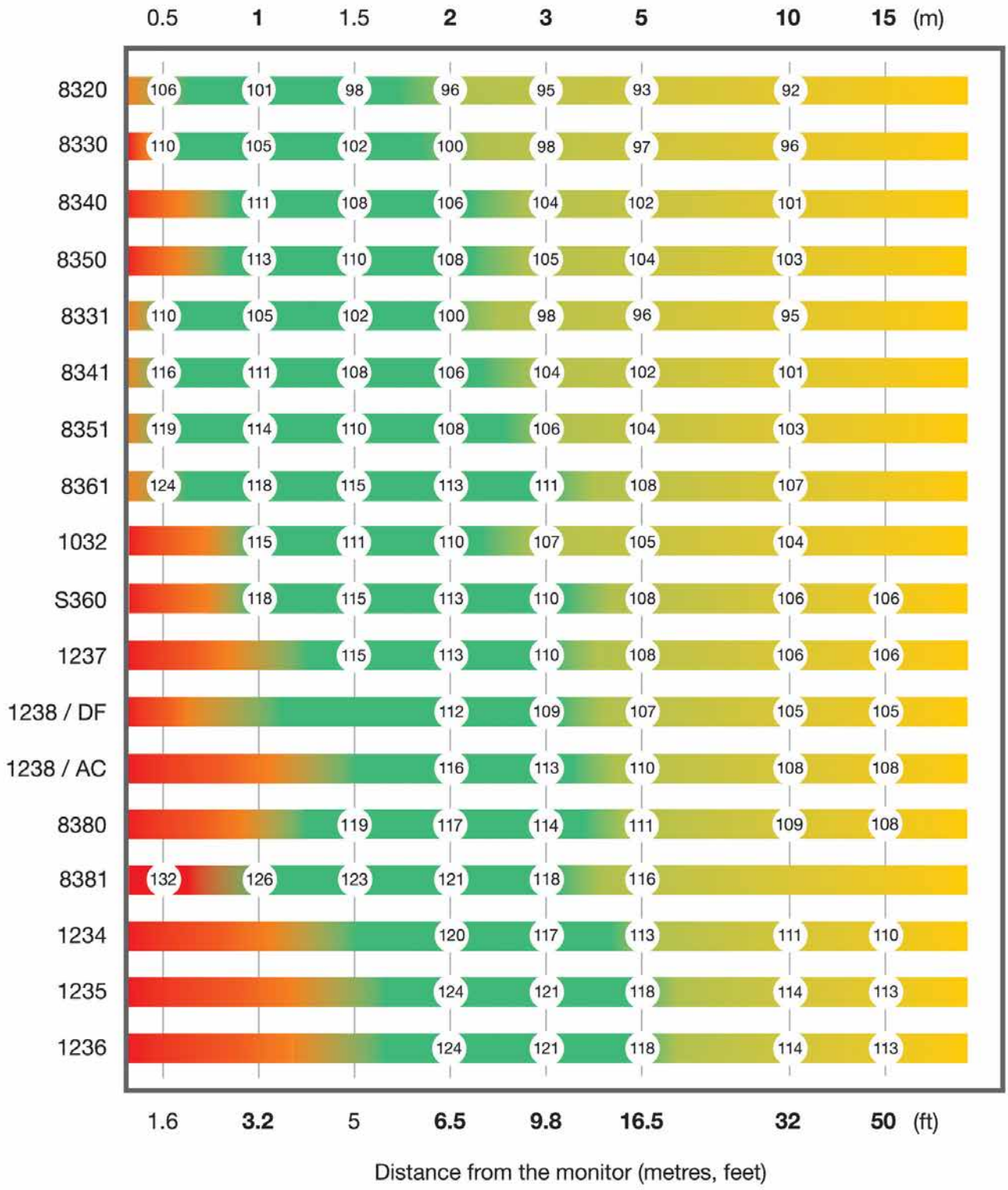
Listening Distances and SPL
The short-term Sound Pressure Level (SPL) listed takes into consideration the typical room volume and reverberation time for each monitor. If the reverberation time is longer, it will mainly affect the long-term SPL.

Not Recommended Distances
The distance to the monitor is too short and the summing of sound from multiple drivers doesn't happen in the way it was designed to.

(113) **Maximum short-term Sound Pressure Level**
This figure indicates the maximum at the given distance from the monitoring loudspeaker to the listening position. Maximum short-term sine wave Sound Pressure Level averaged from 100 Hz to 3 kHz, measured in half-space, on-axis. Peak levels are higher. This number tends to under-estimate headroom by 4 dB, based on typical immersive standards and audio content. For more detailed information, please contact Genelec.

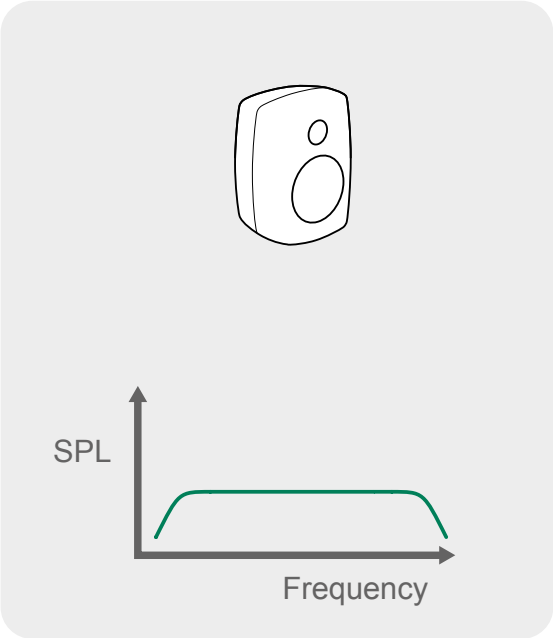
Reverberant sound dominates
At these distances, the reverberant sound in the room has a higher level than the direct sound from the monitor. This balance progressively increases as the distance from the monitor increases. The monitor can be used at these distances, but the sound character is strongly affected by the reverberation characteristics of the room, and this has a progressively increasing effect on the sound colour and stereo imaging accuracy.

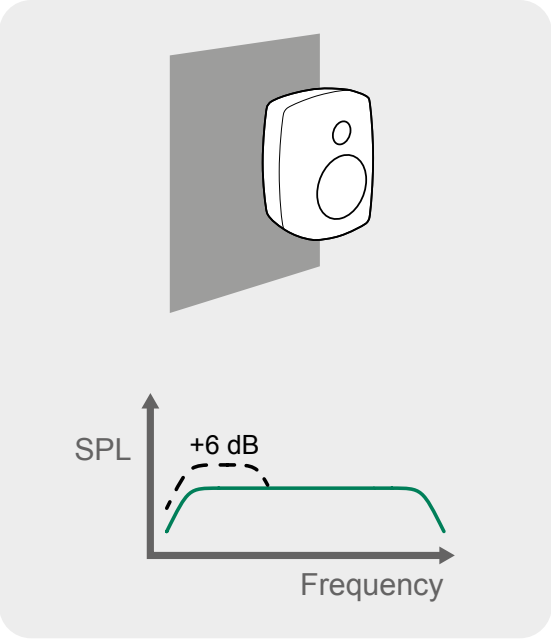


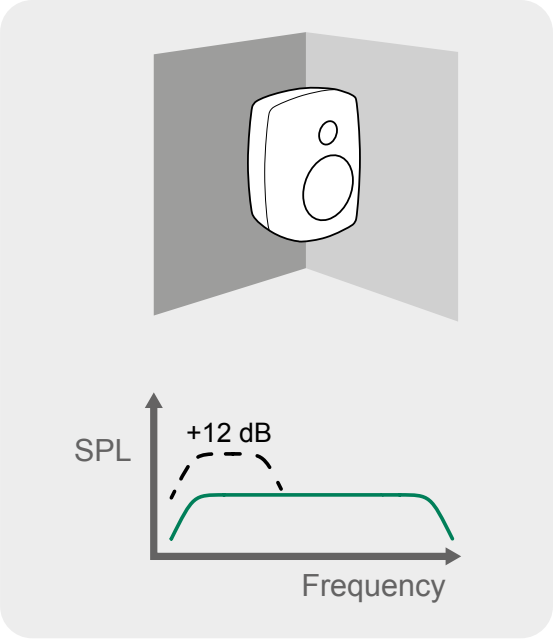

0.5 1 1.5 2 3 5 10 15 (m)
8320 106 101 98 96 95 93 92
8330 110 105 102 100 98 97 96
8340 111 108 106 104 102 101
8350 113 110 108 105 104 103
8331 110 105 102 100 98 96 95
8341 116 111 108 106 104 102 101
8351 119 114 110 108 106 104 103
8361 124 118 115 113 111 108 107
1032 115 111 110 107 105 104
S360 118 115 113 110 108 106 106
1237 115 113 110 108 106 106
1238 / DF 112 109 107 105 105
1238 / AC 116 113 110 108 108
8380 119 117 114 111 109 108
8381 132 126 123 121 118 116
1234 120 117 113 111 110
1235 124 121 118 114 113
1236 124 121 118 114 113
1.6 3.2 5 6.5 9.8 16.5 32 50 (ft)
Distance from the monitor (metres, feet)

Boundary loading in room

A monitor radiates low-frequency sound in all directions. Because of this, sound level increases when sound radiation is limited by nearby walls. Every additional wall close to the monitor doubles the sound pressure level. A monitor with a free-space (no walls) flat frequency response produces 6 dB more level at bass frequencies when placed against a wall. In a corner (two walls), this wall gain can increase to 12 dB. Having three close boundaries (e.g. in a corner by the ceiling), the gain can increase up to 18 dB.



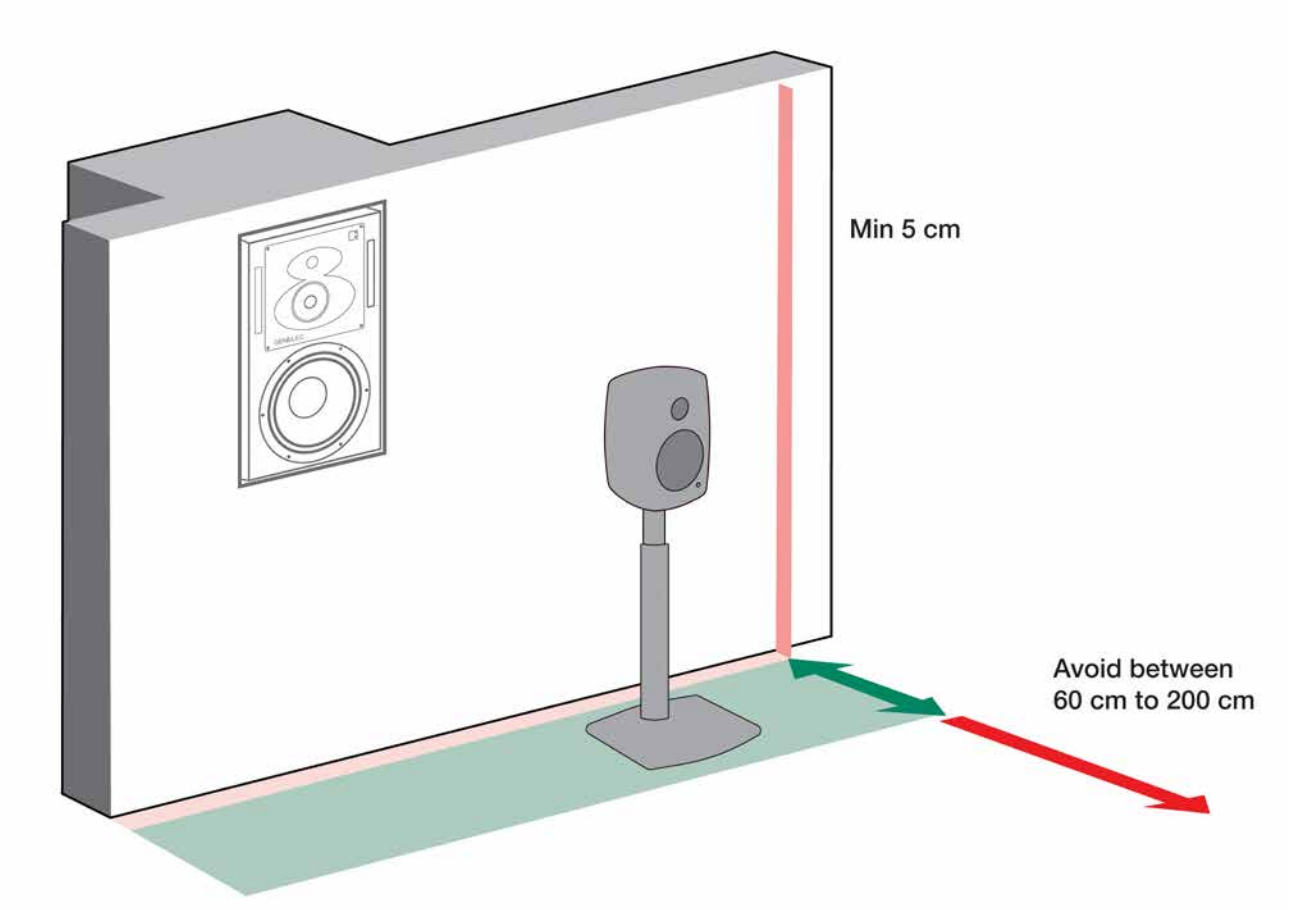




Back wall cancellation

Sound reflecting from the wall behind a monitor is significant at low frequencies. Reflected sound can cancel woofer output, making the bass output appear too quiet or even missing. To avoid this, push the monitors close to the back wall. The distance measured from the monitor front to the wall behind the monitor should preferably be less than 0.6 metres (2 ft) to eliminate low frequency cancellation. However, a monitor needs a minimum clearance of 50 mm (2 in) to the wall to ensure full output from a rear bass reflex port. Alternatively, pull the monitor sufficiently far from the wall, making the wall reflections so dense in frequency and low in level as to reduce the effect of the reflections.

All acoustic reflections from the wall located behind the loudspeaker can be eliminated by creating an acoustically sealed recess in the wall and installing the monitor in the recess so that the monitor front baffle is flush with the wall. This method is called flush mounting.

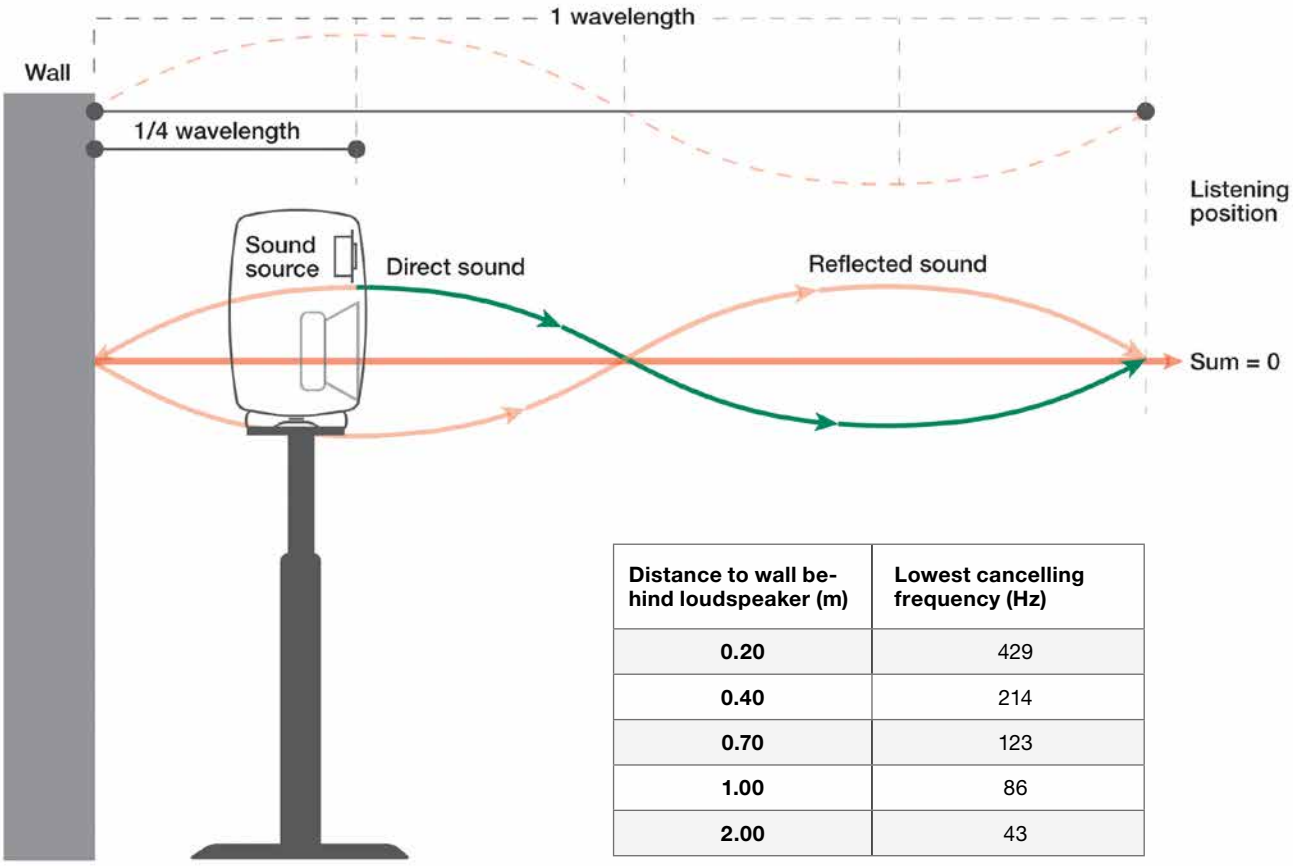


Read more about flush mounting:

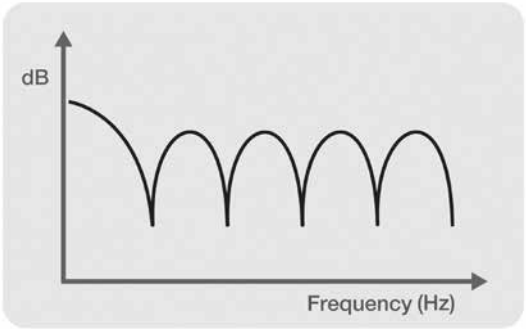
www.genelec.com/flush-mounting →

When there is some distance between the monitor and the wall, sound takes some time to travel to the wall and then back to the monitor. At the frequency where this total distance is equal to one quarter of the sound wavelength, the reflection is out of phase with the sound output of the monitor – and reflected audio cancels the audio from the monitor, reducing the monitor output.

At this frequency, the sound level is reduced. How much level reduction occurs depends on how much sound the wall reflects. Note that cancellation will also happen at higher frequencies where reflected sound is out of phase with the sound output of the monitor.



Distance to wall behind loudspeaker (m)	Lowest cancelling frequency (Hz)
0.20	429
0.40	214
0.70	123
1.00	86
2.00	43



Wall reflections can generate a set of cancellations at multiple frequencies (often called comb filtering). Equalisation of the monitor does not help here, because the level of reflected sound is related to the output of the loudspeaker. If the loudspeaker output level changes, the reflected sound level also changes.

Wall reflections can be eliminated by flush mounting the monitor within the wall, which extends the front baffle of the monitor. Flush mounting requires creating an acoustically sealed recess in the wall and installing the monitor in this recess so that the monitor front baffle is flush with the wall. Remember that low-frequency boost should be compensated for when the monitor is flush mounted.

Another solution is to place the monitor very close to the wall. This raises the lowest frequency of the cancellation such that the monitor has already become forward-directing, preventing the cancellation from occurring. Remember that low-frequency boost should be compensated for when the monitor is mounted close to the wall.

Another possible solution is to move the monitor to a considerable distance from the wall. This moves the cancellation frequencies down, making cancellations dense and narrowband, so that the lowest cancellation frequency falls below the cut-off of the monitor. In addition, when the monitor is moved away from the walls, it also moves closer to the listener, increasing direct sound level and reducing reflected sound level.

Yet another solution is to modify the wall and make it very absorptive. The amplitude of the reflected sound becomes small and does not cancel direct sound significantly anymore. Please note that absorbing low frequencies efficiently may require substantial absorbents.

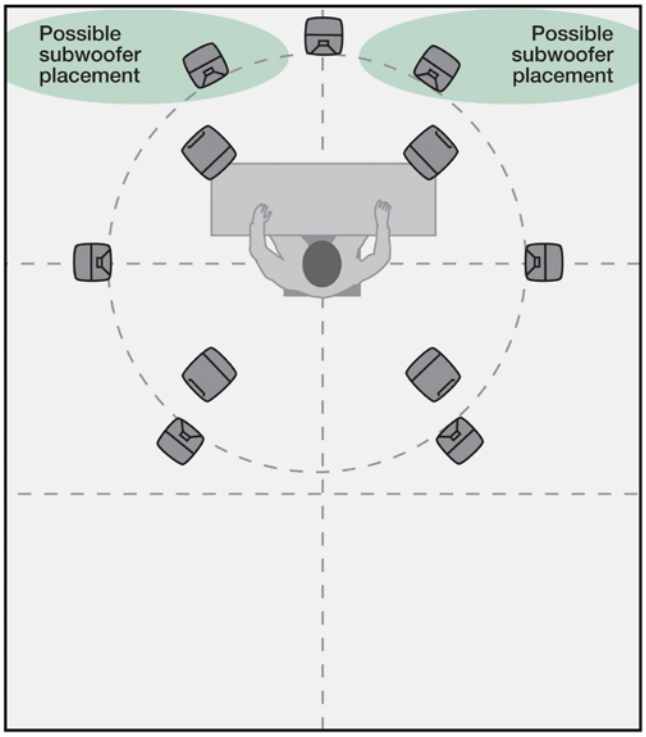
Placement of subwoofers

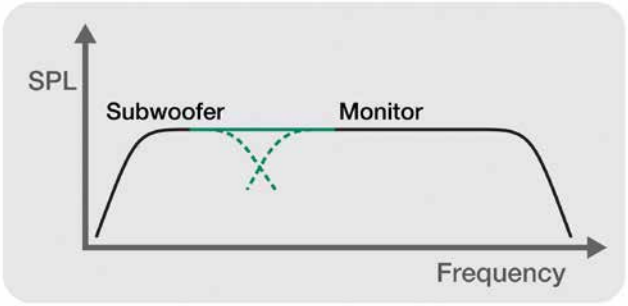
Placing a subwoofer by a wall or in a corner maximises the subwoofer output, however, the flattest frequency response is usually achieved using a subwoofer location where room mode resonances are not significantly excited.

A single subwoofer is usually placed along the wall in front of the listening position, slightly off-centre from the room's left-right symmetry axis. This achieves neutral output and good integration of low-frequency output with the loudspeakers on the same wall.

Two subwoofers may produce an even flatter frequency response. Output levels of subwoofers intended to work together are usually set the same and the combined output is aligned with the level of the main monitoring system.

Genelec active subwoofers cross over at 85 Hz by default. Lower frequencies are reproduced in the subwoofer, and higher frequencies are reproduced by the monitors.



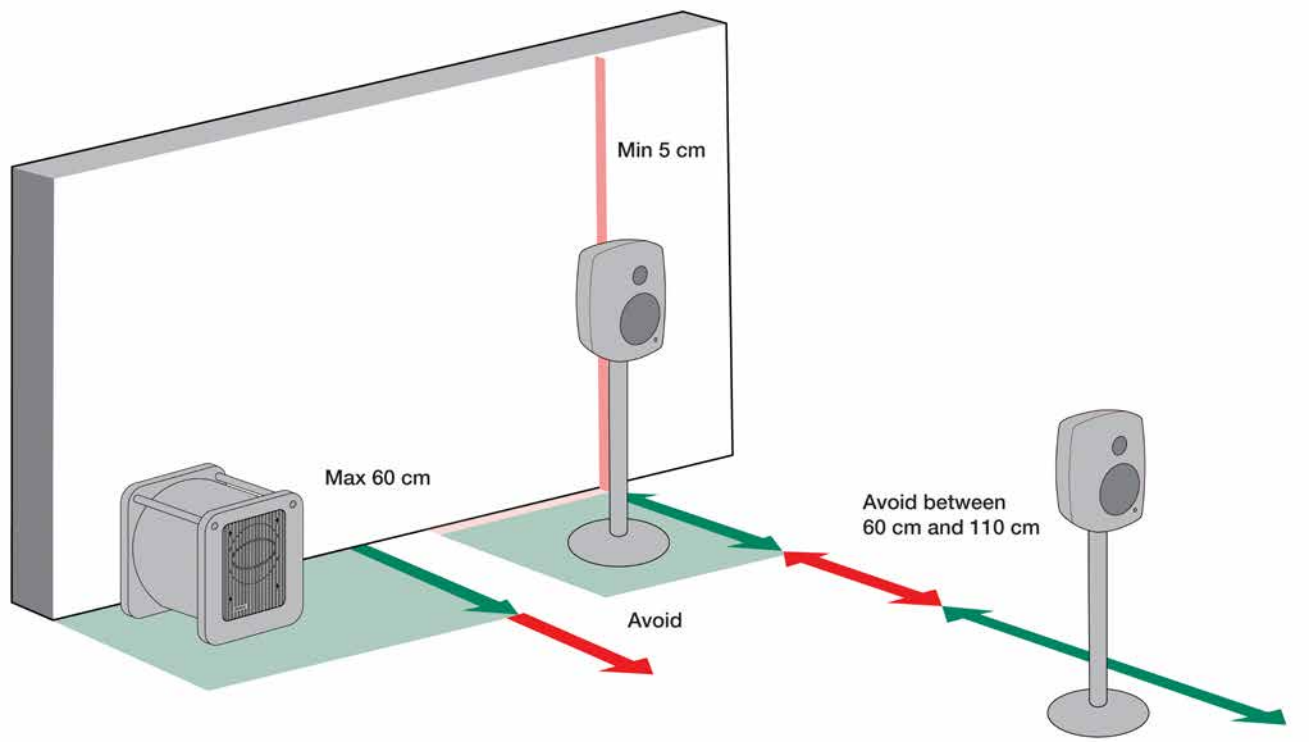


Genelec Smart Active Monitoring (SAM) subwoofers allow the crossover frequency to be selected in the range of 50 to 120 Hz. The crossover frequency should be selected to allow monitors and subwoofers to output a significant amount of sound and combine well, supporting each other so that the subwoofers do not affect sound localisation.

Subwoofer phase is adjusted in line with the loudspeakers at the crossover to maintain sound level at the crossover frequency range. More details are available in our subwoofer operating manuals.

The Low Frequency Effects (LFE) channel bandwidth is 120 Hz and LFE content is reproduced by the subwoofer.

When bass management is used and a subwoofer reproduces the low frequencies of the main channels, this relaxes the recommended distances of the monitors from the walls behind them, allowing the monitors to be placed more freely relative to walls. The recommended distances are shown in the illustration.



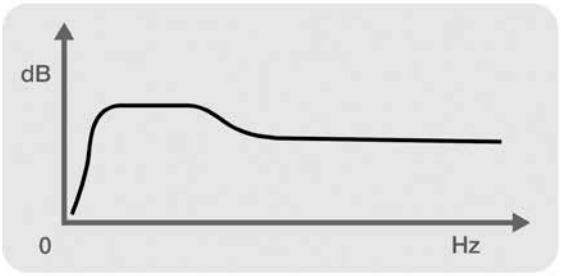
Monitoring system calibration

The monitoring room significantly affects sound quality. Its walls, ceiling and floor – and any large objects in the room, like mixing consoles, tables, equipment racks and furniture – reflect audio, causing changes to the sound and imaging. Acoustic calibration minimises room influences, retrieves a flat and neutral frequency response and enhances the precision of imaging.

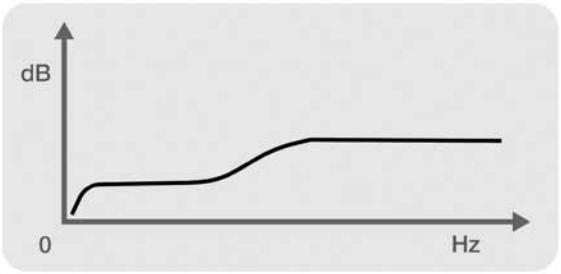
Genelec active monitoring systems have room response adjustments to compensate for room influences and retrieve a flat frequency response at the listening position. DIP switch tone controls in monitors and subwoofers enable manual adjustment, while Smart Active Monitoring (SAM) systems can calibrate automatically using Genelec Loudspeaker Manager (GLM).

To measure the room response, place the measurement microphone at ear height in the listening position (typical height 1.2 to 1.4 m). Ensure that monitors are at their intended locations. We recommend each monitor be at an equal distance from the listening position. Take a frequency response measurement. Adjust the tone control DIP switches to retrieve the same flat frequency response for all monitors. For level calibration, first set the rotary input sensitivity control on all monitors fully clockwise. Then, adjust each level control so that all monitors produce the same sound level at the listening position. SAM Monitoring systems can align level and time of flight automatically.

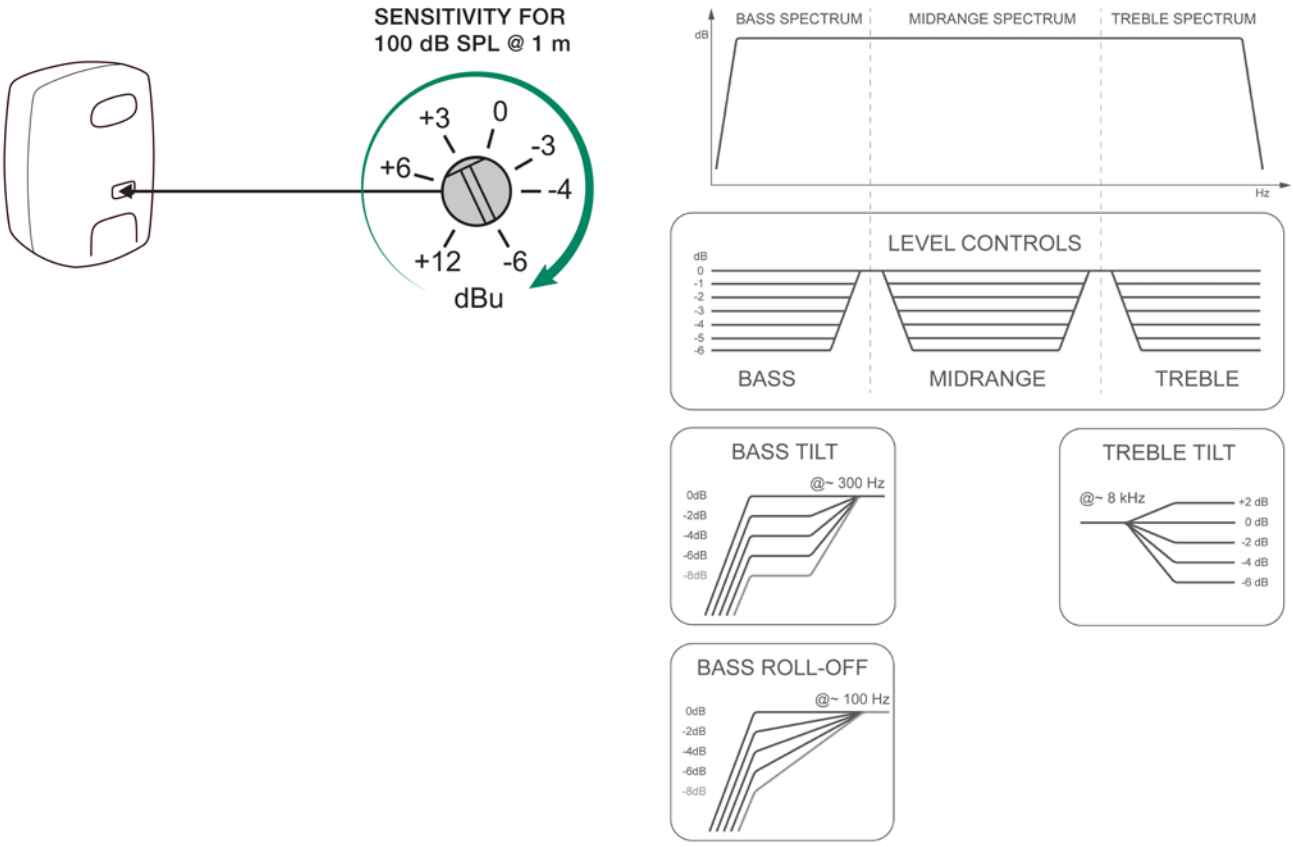
PERCEIVED IN-ROOM SOUND



RESULTING MIX

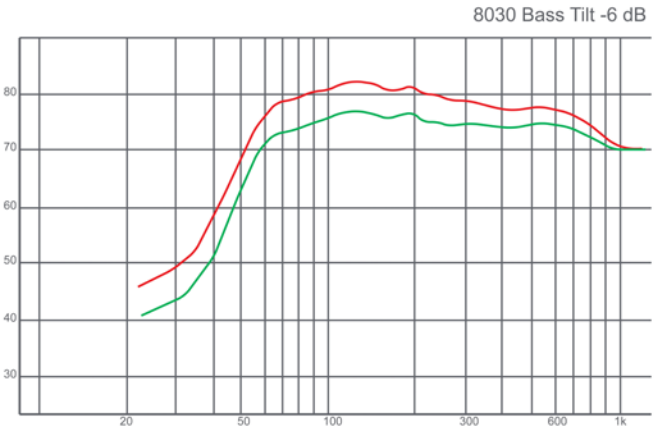


Monitoring with excessive bass level may result in a lack of bass in the final mix



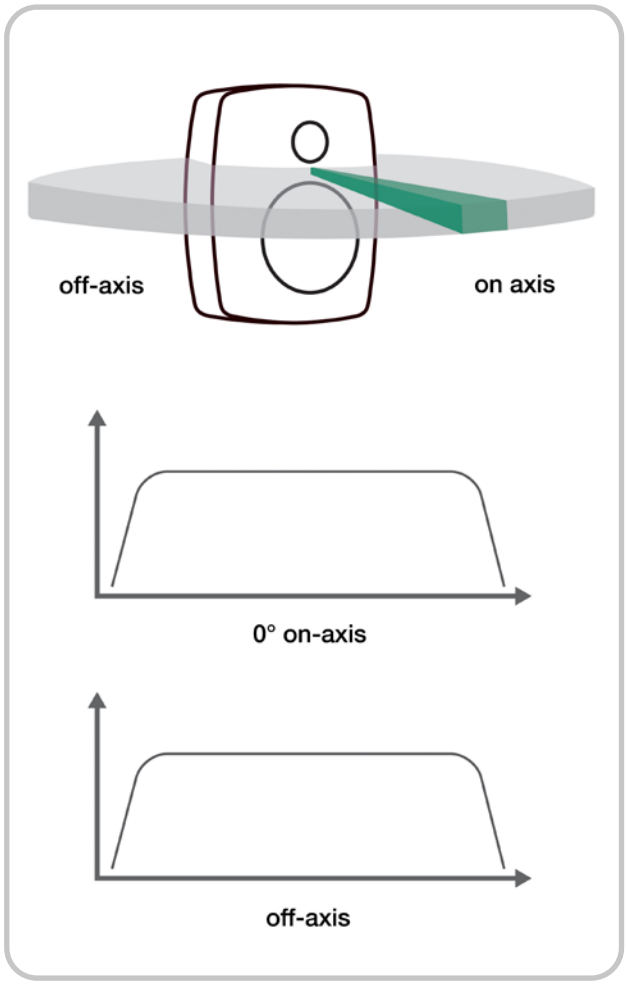
The diagrams above show the effect of different DIP switch options.
For more details refer to operating manuals.

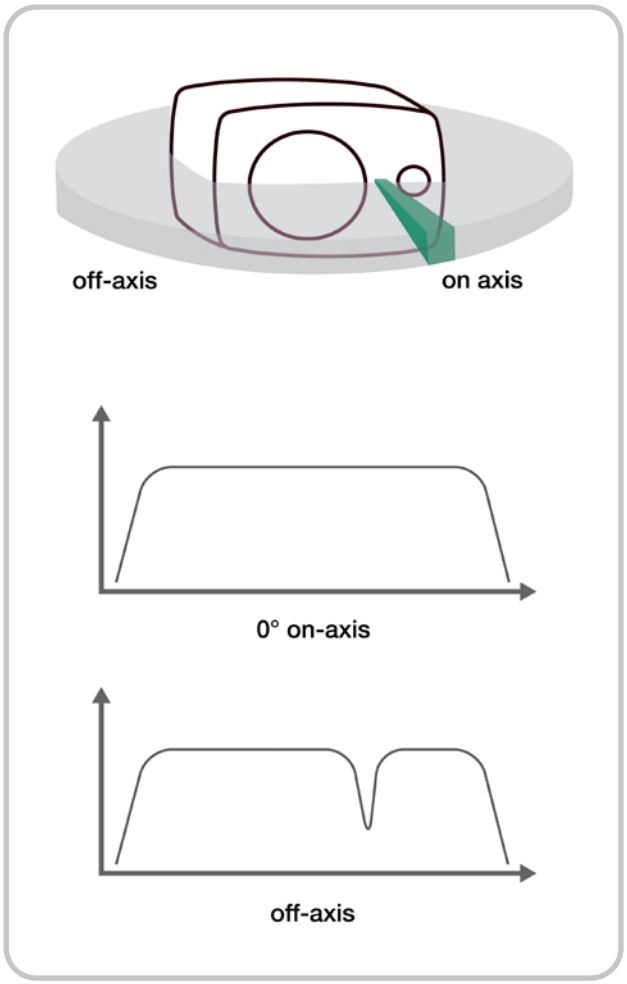
In the example on the right, the bass tilt control is used to compensate for a low frequency boost caused by a monitor being close to a wall.

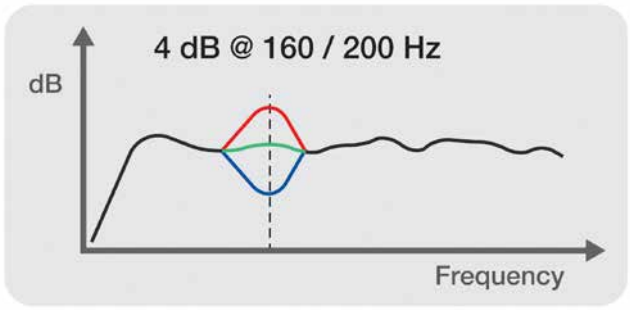


Measured in-room response with and without the bass tilt

We recommend two-way monitors be positioned vertically. Horizontal positioning will cause a loss of sound level close to the monitor crossover frequency when the listener moves sideways from the acoustical axis. The notch in response will shift depending on the listening position.







A table or mixing console in front of monitors may boost level at around 160-200 Hz. Certain Genelec monitors offer a desktop control DIP switch to compensate for this. With SAM Monitoring systems, GLM AutoCal compensates for this effect automatically. Table stands to lift the monitors above the surface also help.

Smart Active Monitoring (SAM™) system calibration

SAM Monitoring systems enable highly accurate monitoring and truthful audio reproduction in any room. All Genelec services, including GLM software needed for system calibration, are available on MyGenelec.

Genelec Loudspeaker Manager (GLM) software configures SAM Monitors and Subwoofers. Automatic calibration (AutoCal) in GLM adapts monitors to the room so they sound neutral and have the same level and delay at the listening position. This minimises colouration, makes acoustic images accurate and improves the sound stage, enabling the creation of mixes that translate consistently across rooms and reproduction systems.

While GLM AutoCal very quickly makes stereo systems accurate, it has even greater importance for immersive monitoring layouts. This is because it can calibrate high channel count monitoring systems reliably and precisely in just a few minutes – and because it supports subwoofers and multi-microphone position calibrations.

GRADE Room Acoustic Report

GLM's GRADE (Genelec Room Acoustic Data Evaluation) Report is the software's advanced acoustic analysis service showing every detail of the room acoustics after monitoring system calibration. GRADE Reports provide full details of the listening room frequency response, time of flight for audio, acoustic reflections in room and room reverberation. The report provides insights for improving acoustic treatment, system placement and optimisation, offering real data to help achieve the best possible monitoring accuracy. GRADE is especially beneficial for addressing complex acoustics in untreated or challenging rooms, helping to ensure monitoring rooms align with professional audio standards.

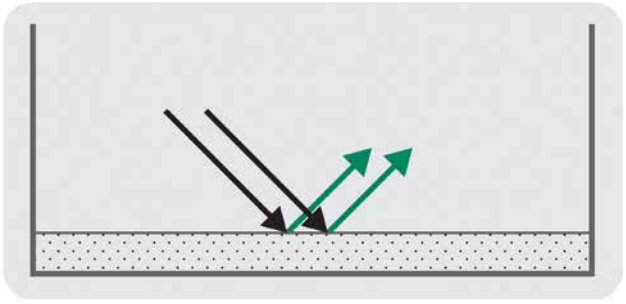
www.genelec.com/glm-grade →

www.my.genelec.com →

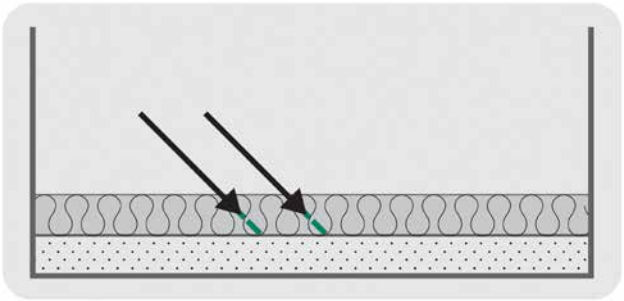
Acoustic treatment

Monitor calibration helps greatly but may not be fully sufficient to resolve all room acoustic problems. Audio monitoring rooms generally need suitable acoustic treatment to enable the highest quality monitoring. This section outlines ways to improve room acoustics, however, we always strongly recommend consulting with a professional acoustician.

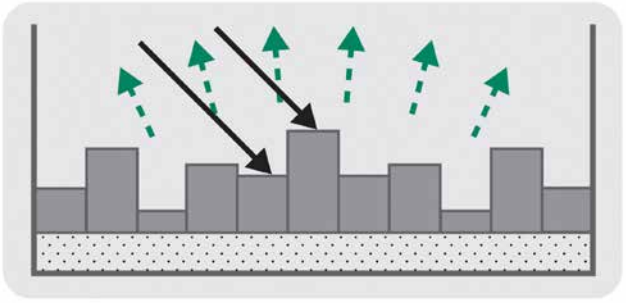
Wall surfaces, ceilings, furniture and floors can reflect, diffuse or absorb audio. Combinations of these acoustic effects are often used in treatment.



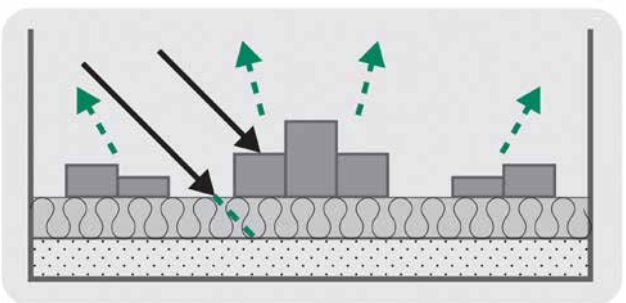
Hard surfaces such as glass, concrete, dry wall or MDF and furniture such as computer screens and production consoles reflect sound.



Soft materials such as rock wool, mineral wool, sofas, heavy curtains or thick carpets absorb sound. A thick layer of material is needed to absorb low frequencies.



Irregular surfaces scatter sound waves, causing diffusion. Diffusion is effective at mid and high frequencies. Diffusion is usually not effective at low frequencies.

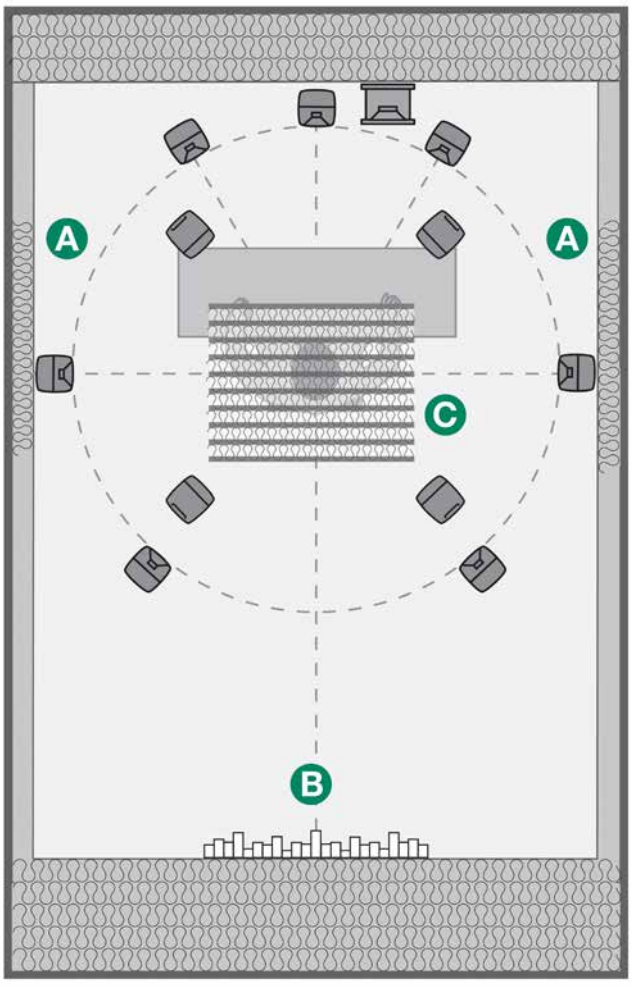


A combination of diffusive and absorptive surfaces can be effective in reducing the audibility of reflections.

Room acoustic improvements

Reflections arriving soon after direct sound are called early reflections. These first reflections can have a high level, while subsequent reflections will become quieter. Ideal control room design guides the first reflections away from the listening area, preventing early reflections from reaching the listening area.

Acoustic improvements in the monitoring room can make monitoring more accurate. In a small room (less than 25-30 m2 of floor area), absorption is usually the primary need, and diffusion is usually less beneficial.



A *Use a combination of absorption and diffusion on the side wall surfaces. Note that thin layers of porous absorbers only reduce high-frequency reflections.*

B *If the room is large enough, use diffusive and absorbing elements on the back wall.*

C *Use a combination of absorption and diffusion above the listening area to reduce acoustic reflections from the ceiling.*

Monitor performance table

Monitor	-6 dB LF Extension	Maximum SPL at 1 m [1]	Subwoofers for two channels
8010	67 Hz	96 dB	7040
8020 / 8320	56 / 55 Hz	100 dB	7050 / 7350
8030 / 8330	50 / 45 Hz	104 dB	7050 / 7350
8040 / 8340	41 / 38 Hz	105 / 110 dB	7360 / 7370
8050 / 8350	32 / 33 Hz	110 / 112 dB	7370
8331	45 Hz	104 dB	7360
8341	38 Hz	110 dB	7370
8351	32 Hz	113 dB	7370 or 7380 [2]
8361	30 Hz	118 dB	1–2 x 7380 [2]
1032	33 Hz	114 dB	7370 or 7380 [2]
S360	36 Hz	118 dB	1–2 x 7380 [2]
1237	32 Hz	118 dB	1–2 x 7380 [2]
1238 / DF	30 Hz	117 dB	1–2 x 7380 [2]
1238 / AC	30 Hz	121 dB	3 x 7380 or 1 x 7382 [2]
8380	29 Hz	122 dB	3 x 7380 or 1 x 7382 [2]
8381	20 Hz	126 dB	[4]
1234	29 Hz	121 dB	7382 [2]
1235	29 Hz	130 dB	2 x 7382 [3]
1236	17 Hz	130 dB	2 x 7382 [3]

[1] *Maximum short term sine wave acoustic output on axis in half-space, averaged from 100 Hz to 3 kHz at 1 m distance.*

[2] *Additional subwoofers of the same type may be required in a larger room with bass heavy material.*

[3] *Subwoofers are not necessarily required for a 1236 installation as these monitors are already full range. For immersive systems, subwoofers can be used to reproduce the LFE channel.*

[4] *Produces full audio bandwidth and does not support bass management. For immersive systems, subwoofers can be used to reproduce the LFE channel.*

Subwoofer	-6 dB LF extension	Maximum SPL at 1m*
7040	30 Hz	100 dB
7050	24 Hz	103 dB
7350	22 Hz	104 dB
7360	19 Hz	109 dB
7370	19 Hz	113 dB
7380	16 Hz	119 dB
7382	15 Hz	129 dB

** Maximum short-term sine wave acoustic output on axis in half-space, averaged from 30 Hz to 85 Hz at 1 m distance.*

Test signals

Various useful test signals can be downloaded from the Genelec website.

www.genelec.com/audio-test-signals →

Links

Various useful links to downloads available on the Genelec website.

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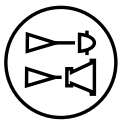

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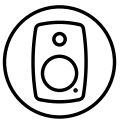

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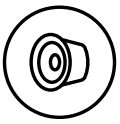

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