Norsonic Acoustic Camera

Finding acoustical weak points in room dividing modular walls

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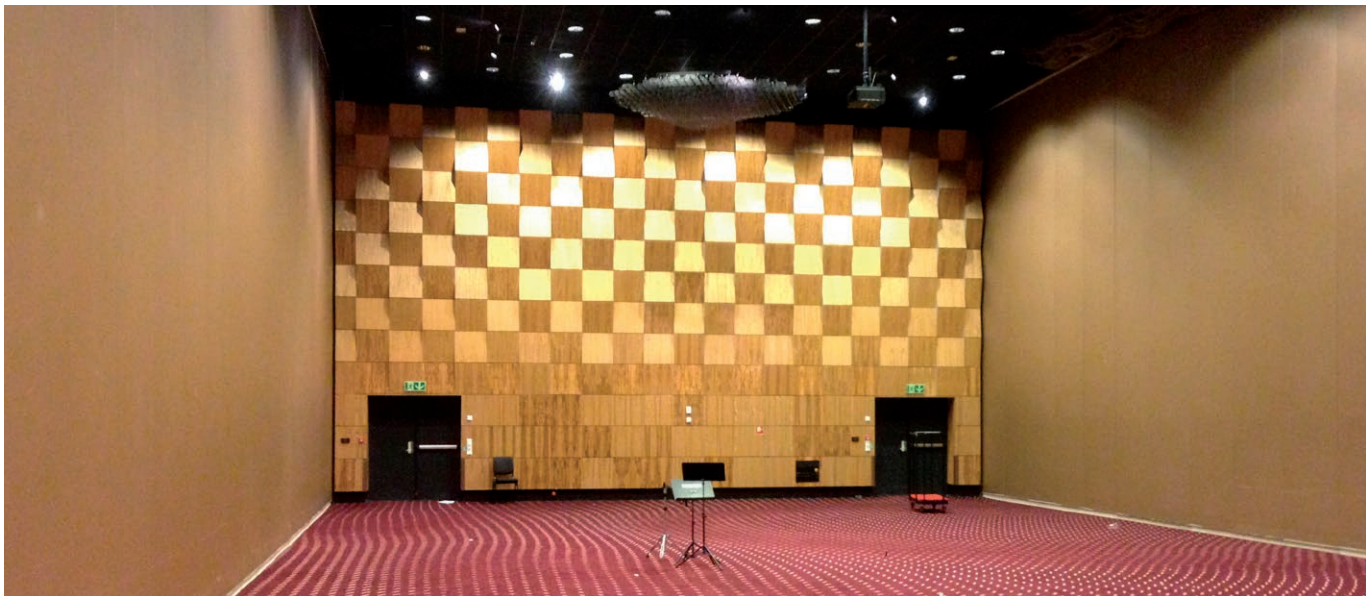


Measurements in a conference hotel in Trondheim, Norway, November 2014

These recordings were made with the Nor848A-0.4 40 cm acoustic camera with 128 microphones , now replaced by the Nor848B acoustic camera system.

Problem

A conference hotel is using modular walls to divide large halls into several smaller conference rooms. The rooms are divided by modular walls that provide several different opportunities for subdivision and multipurpose use of the large area spaces.

When measuring the sound insulation between adjacent rooms through the modular walls, the resulting value was found to be too low, and noise from one conference room could possibly disturb listeners at adjacent rooms. The dividing modular walls cover large areas, and are as high as 7 meters from bottom to top, which makes intensity measurements with hand held sound level meters difficult. The room dividers could have several weak points, which were not easily identifiable. It was thought that identifying and fixing the weak points in the individual modular walls would help increase the overall sound insulation capabilities of the entire wall element.

Measurements

The measurements were conducted with the Nor848-0.4 40 cm and 128 element acoustic camera. The camera was plugged into an external battery pack for easy transportation and mobility. The measurement procedure consisted of choosing two adjacent rooms divided by a modular wall of interest. One of the rooms was chosen to act as receiving room, where the acoustic camera was positioned. A noise source and omnidirectional loudspeaker generating white noise at high volume was positioned in the source room. The speaker was placed in one of the corners of the room furthest away from the dividing wall, in order to achieve as diffuse source noise field as possible.

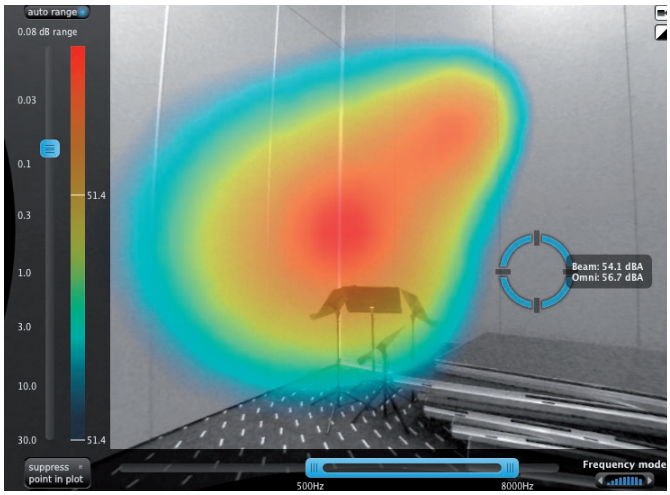
Due to the large size of the modular walls, the camera was pointed to different areas of the walls, and several measurements were made. The individual measurements could then be examined further in post-processing analysis. Due to the source being used at high volume in the sending room, cracks and gaps in the modular walls would appear as small noise sources at specific location on the walls when recording with the acoustic camera in the receiving room.

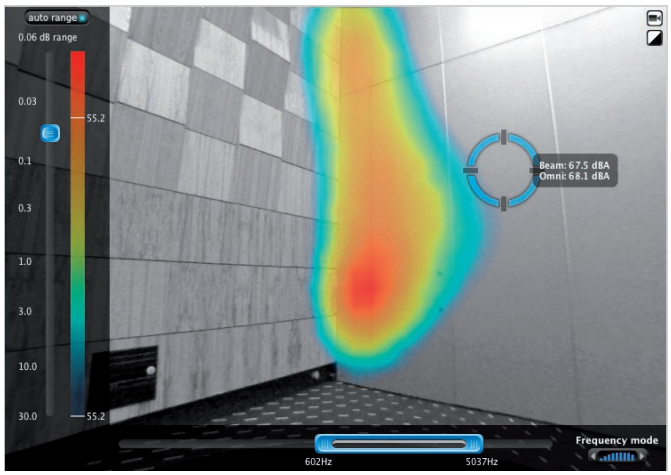
Results

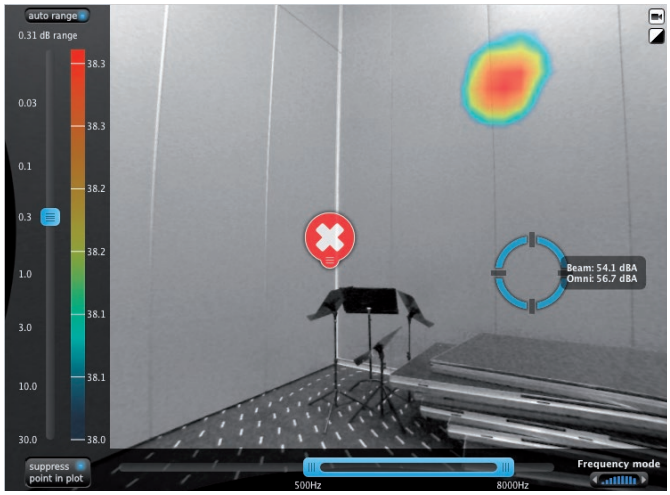
The acoustic camera was able to locate several weak spots on the walls, even though the range where differences could be discovered were for certain areas below 0.05 dB.

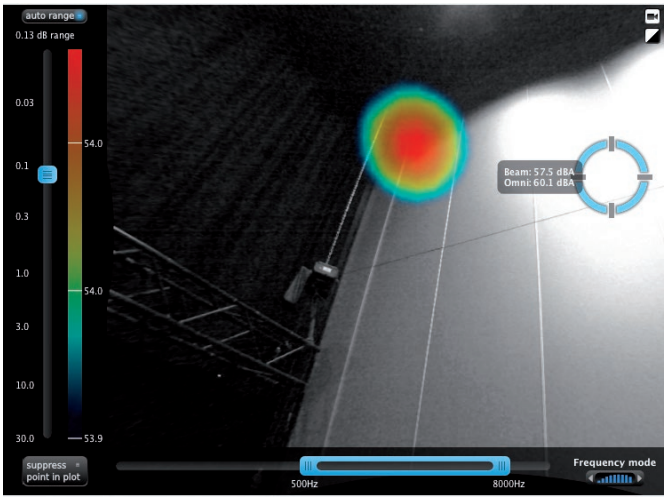
The measurement system's virtual microphone feature was also very helpful during live measurements. With this function you can scan and listen to the desired spots in the image, and also filter the listening function to desired frequency range. This made it possible to scan along edges and hear differences in frequency from different points. A change in frequency may indicate a sound leakage. Also by using the spectrogram function to get a visual representation of the spectrum of frequencies as they varied with time, one could further indicate a leakage at various parts of the walls.

A very useful function is the so called acoustic eraser, which is a functionality that enables source suppression in order to find interesting plotting points. Seen in the images below is a recording of two walls meeting at a corner. The coloring is smeared over a larger area than usual, which may indicate the presence of several sources of roughly equal strength located at close proximity to one another. Or in this case, a weakness or small gap in the walls located so closely that they initially may be interpreted as a single source. Seen in the bottom image, the acoustic eraser is enabled and is seen as a red circle with a white x and placed on a point in the image to suppress a source. By enabling the acoustic eraser, and dragging the point suppressor to the desired location, it was easy to locate the two individual points of interest. Further analysis could be conducted by placing the virtual microphone on the point of interest.





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0.1
0.3
1.0
3.0
10.0
30.0
54.0
54.0
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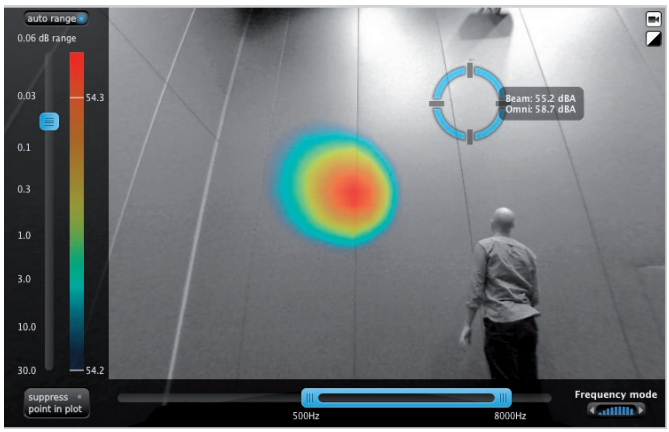
Beam: 57.5 dBA
Omni: 60.1 dBA
suppress
point in plot
500Hz
8000Hz
Frequency mode


auto range
0.06 dB range
0.03
0.1
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1.0
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54.3
54.2
Beam: 55.2 dBA
Omni: 58.7 dBA
suppress
point in plot
500Hz
8000Hz
Frequency mode

Nor848B Acoustic camera

The Norsonic acoustic camera is a module based approach to acoustic camera that gives the user both portability and great resolution for a wide range of measurement situations. The array dish is based on a hexagon shape, given it both its name, and the ability to combine several tiles into larger systems.

Acoustic beamforming arrays, commonly known as acoustic cameras, enable the user to visualise different sound sources at different frequencies and source strengths. The resolution and ability to resolve sound sources spaced closely apart, and at lower frequencies, is mainly decided by overall size and number of microphones of the equipment being used. Although image manipulation and deconvolution techniques on the beamformed results might give added resolution, in practise the properties of the array still influence the results. This size versus resolution criteria is the crux of the acoustic camera market. Users want something that is small, light weight, and portable, while at the same time having excellent resolution, and the ability to go low in frequency. This has been an impossible demand for a single system – until now.

Hextile - lightweight and portable

With a single Hextile, the user has a small, portable and lightweight acoustic camera that can be used for a wide range of measurement situations. The Hextile is a USB based acoustic camera, with a single USB cable for both power and data transfer – no extra battery cable needed. The array is made from robust and lightweight aluminium, has 128 MEMS microphones, and is less than 3 kg in weight while having a maximum diameter of 46 cm. The low frequency limit for the Hextile is 410 Hz.

Multitile - great solution

For users that require better resolution both in lower frequencies and overall, three single Hextiles can be combined to a larger Multitile system, consisting of 384 microphones with a maximum diameter of 96 cm. The low frequency limit for the Multitile is 220 Hz.

Multitile (LF mode) - low frequency measurements

For special low frequency applications below 1 kHz, it is also possible to utilise the Multitile in the low frequency configuration as the Multitile (LF mode). By placing the individual Hextiles further away, the maximum diameter of the complete array system is increased to 1.46 m, making it ideal for low frequency measurements. The Multitile (LF mode) is for low frequency measurements below 1 kHz, with a lowest frequency limit of 120 Hz.

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