Norsonic Acoustic Camera

Filming breakout noise from café and concert venue

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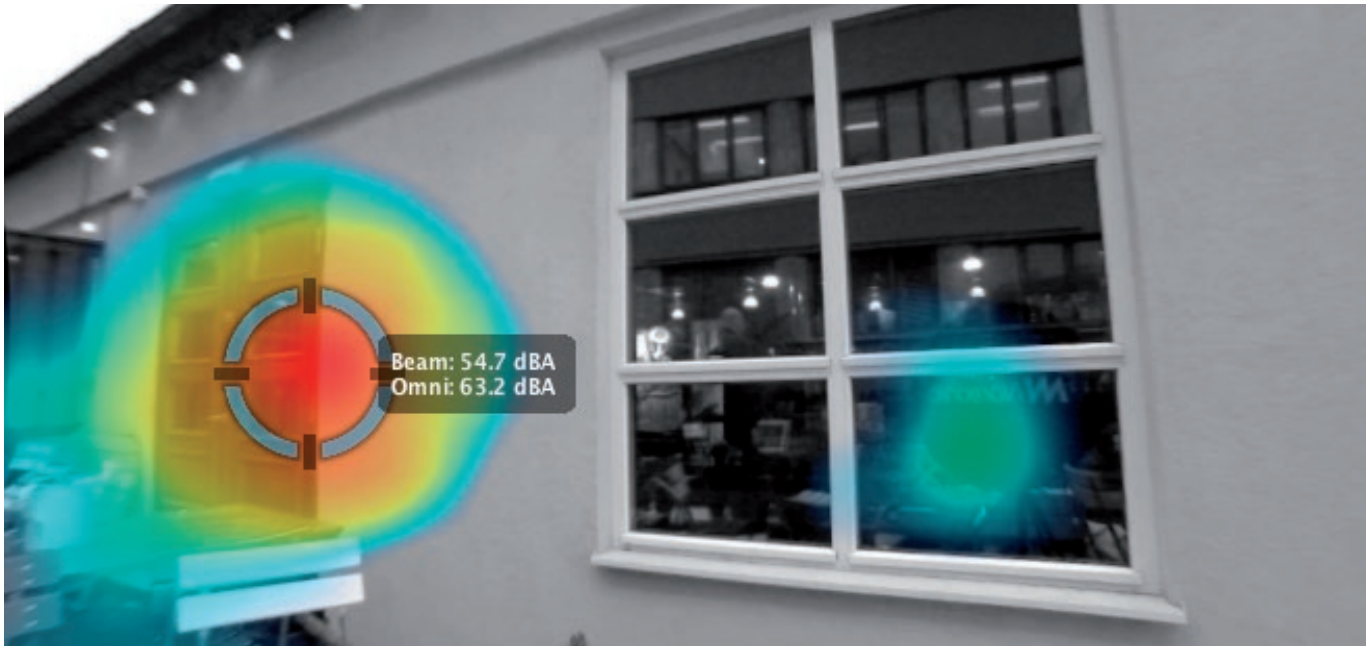


Measurements in bar and bistro in Oslo, Norway, March 2016

These recordings were made with the Nor848A-10 1.0 m acoustic camera system with 256 microphones, now replaced with Nor848B acoustic camera system.

Problem

A combined bar, bistro and concert venue in the city center has been renovated with a great emphasis on acoustic noise dampening. Nevertheless, the venue is still getting complaints from neighbours close by due to breakout noise from the location, especially during late night concerts. The establishment consists of a bar and bistro on the ground floor, with the concert venue on the floor above. The concert venue has several windows facing the outside street and neighbourhood buildings, and it was desirable to pin point any acoustic weaknesses in these windows. Also it was of interest to see if the wall itself needed additional measures, or if the main source contribution came from the windows alone.

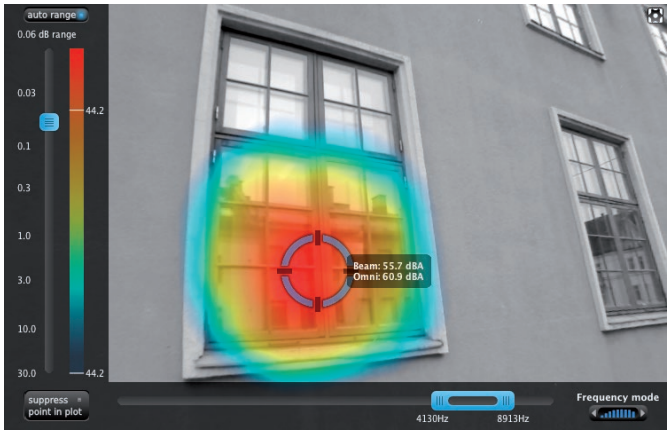
Measurements

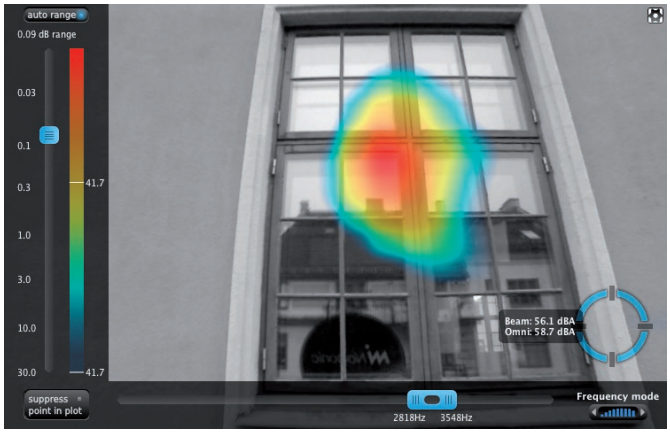
The 1.0 m Nor848A-10 with 256 microphones was used for the recordings. The camera was plugged into an external battery pack for easy transportation and mobility. In addition to measuringing the wall and windows of the concert venue, a wall between the café and a patio area on the ground floor was also of interest.

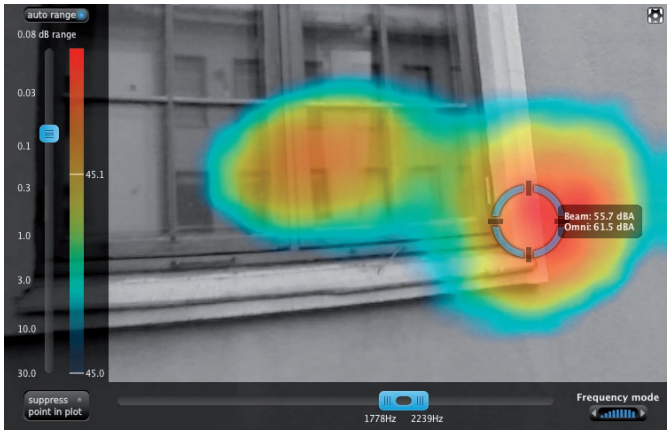
The camera was placed outside pointing at the facade of interest, with the audio system inside of the music venue playing white noise at volumes up to 100 dBA. The room inside would then act as a sending room, and the outside as the receiving room. In order to get close enough to the windows of the concert venue, a truck mounted crane was hired, with both camera and operator around 7 m above ground during measurements.

Results

Since the measurements were conducted around noon during a normal weekday, the city traffic was a constant source of background noise, especially during the recordings on the concert venue facade. Cars and trams driving past at regular intervals made it challenging to get a window of opportunity with relative quiet measuring conditions. However since all analysis can be done in post processing, you only needed a window of 5-10 seconds of proper measurement conditions to get the recording needed.

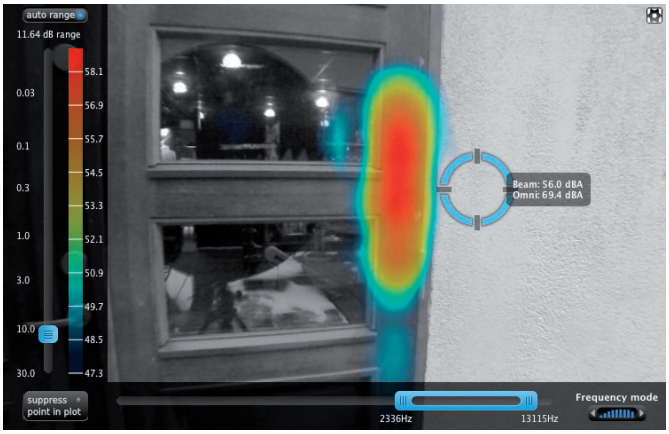


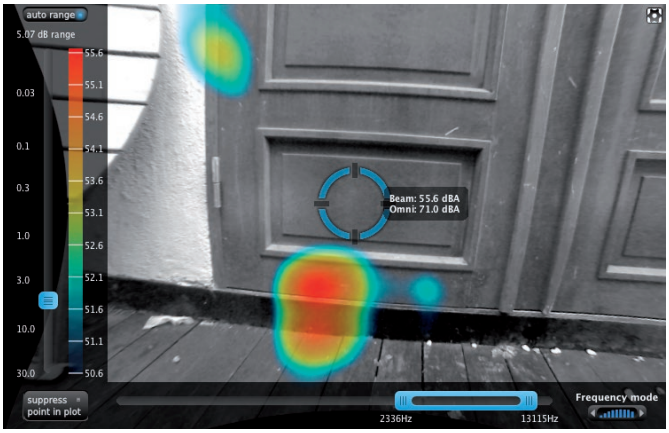


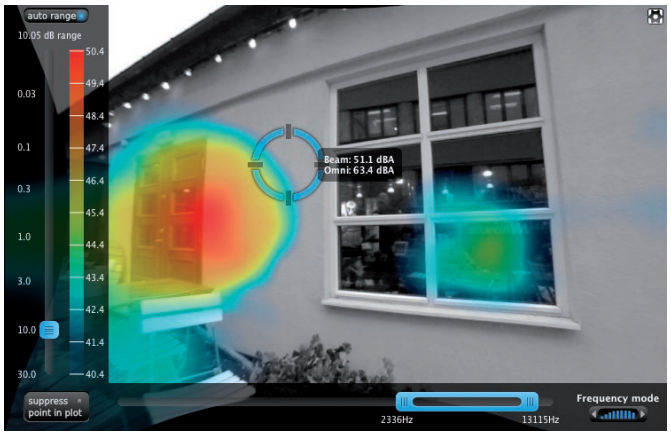


Seen in the pictures below are some of the measurements of the concert venue facade. As can be seen one could quickly rule out that any additional measures had to be taken on the wall itself, as the only sound leakage that could be seen came from the windows only. It was also possible to zoom in on different areas of interest, either at the site during a measurement, or at a later time in post-processing analysis to further locate weak spots.

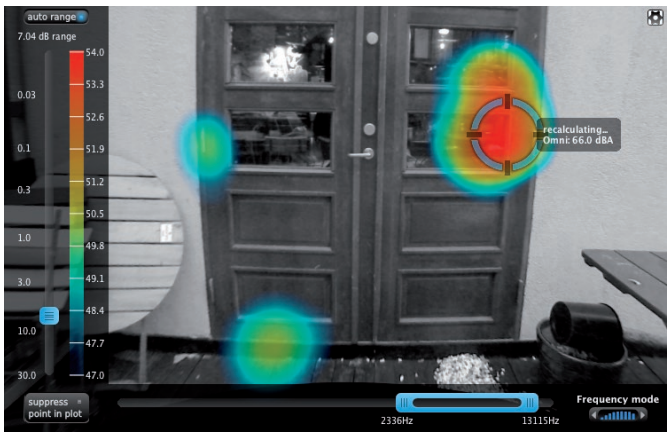
The second measurements were conducted on the patio outside the café on the ground floor. Here the measurement conditions were substantially easier, as the patio was shielded from the city traffic noise. Again the music system of the café emitting white noise was used as source. The wall between the café leading to the patio consists of both a door and several windows. The first step consisted in seeing what made the biggest noise contribution. As seen in the image below, where the dynamic range is set to 10 dB, the door had a noise contribution that was approximately 10 dB higher than the nearest window.







By focusing on the door only it was further possible to locate the exact position of, and zoom in on, those weaknesses as seen in the images below.



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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