



New tools for Acoustic testing at construction sites

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www.built2spec-project.eu



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Acoustic health issues

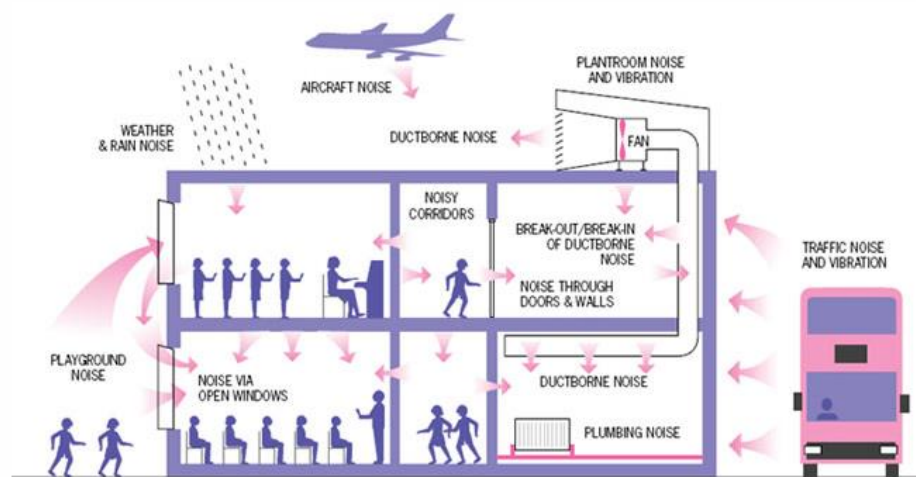
- 📱 Europeans perceive noise as one of the major environmental problems. It can affect people in both physiological and psychological ways, interfering with basic activities such as sleep, rest, study and communication.
- 📱 The [EU Green Paper Future Noise Policy](#) states that around 20 % of the EU's population suffer from noise levels that health experts consider to be unacceptable and the [World Health Organisation](#) (WHO) estimates that more than 30 % of the population in the EU is exposed to levels exceeding 55 dB(A) during the night.





Noise in buildings

Noise in buildings can be originated both from external sources and internal sources



Good **sound insulation performance** is a key requirement in actual buildings
Sufficient sound insulation between dwellings is important to protect against noise from neighbors and to provide privacy and possibilities for activities without causing annoyance.



Sound insulation measurement



Airborne sound insulation measurements are performed according to ISO 16283-1

This measurement requires:

- Trained personnel
- Expensive acoustic equipment
- Specific software to view the results



Built2Spec device is composed of an smartphone as an acoustic receiver and an Omnidirectional Parametric Array as a sound source.

Some of the benefits of this device are:

- Easier use
- More portable (lightweight)
- Cheaper equipment

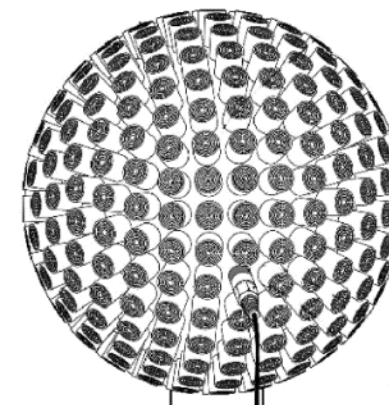


Omnidirectional Parametric Loudspeaker

- A new loudspeaker has been designed by FUNITEC (La Salle). This omnidirectional parametric loudspeaker is an alternative to conventional dodecahedron loudspeakers



Alternative



Hundreds of ultrasound transducers





Omnidirectional Parametric Loudspeaker

- 📱 **Omnidirectional sound sources** are required for lab and in situ building acoustics measurements (e.g., airborne sound insulation, sound absorption, ...)

ODL:
Omnidirectional
Dodecahedron
Loudspeaker



*(image from
www.cesva.com)*

- 📱 **Parametric array technology** could also be applied



- Based on ultrasound transducers
 - Can generate a very narrow beam of carrier ultrasonic waves which can be modulated with audible signals
 - Air non-linearity acts as a natural demodulator so audible sound can be perceived in a focused beam of narrow width.

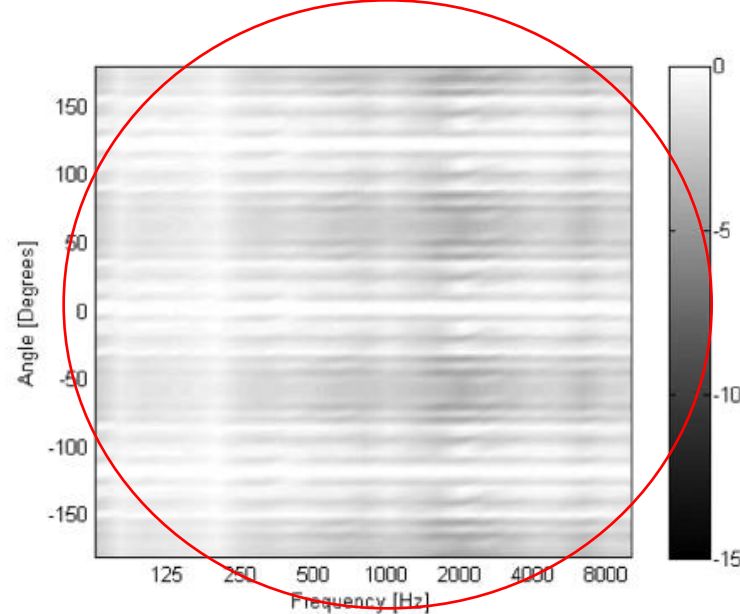
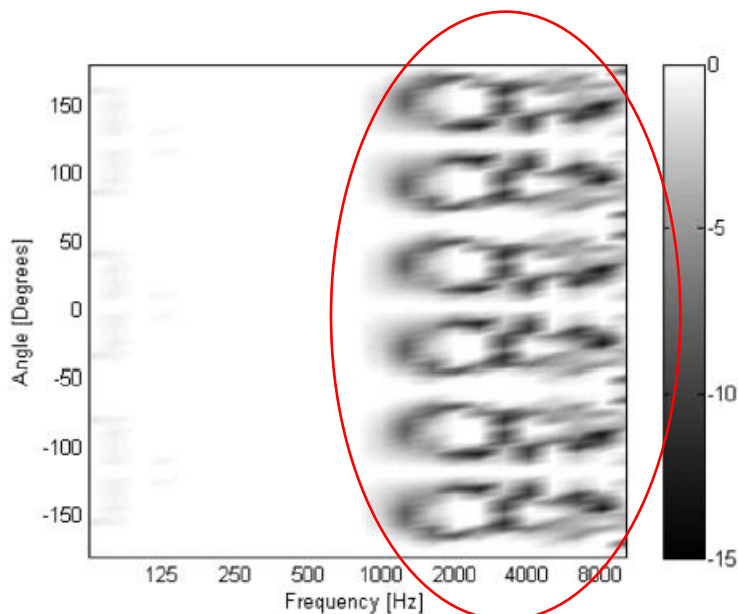


Omnidirectional Parametric Loudspeaker

Directivity

☹ Spatial comb filter

☺ Uniform directivity



Omnidirectional
Dodecahedron
Loudspeaker (ODL)

(image from www.cesva.com)

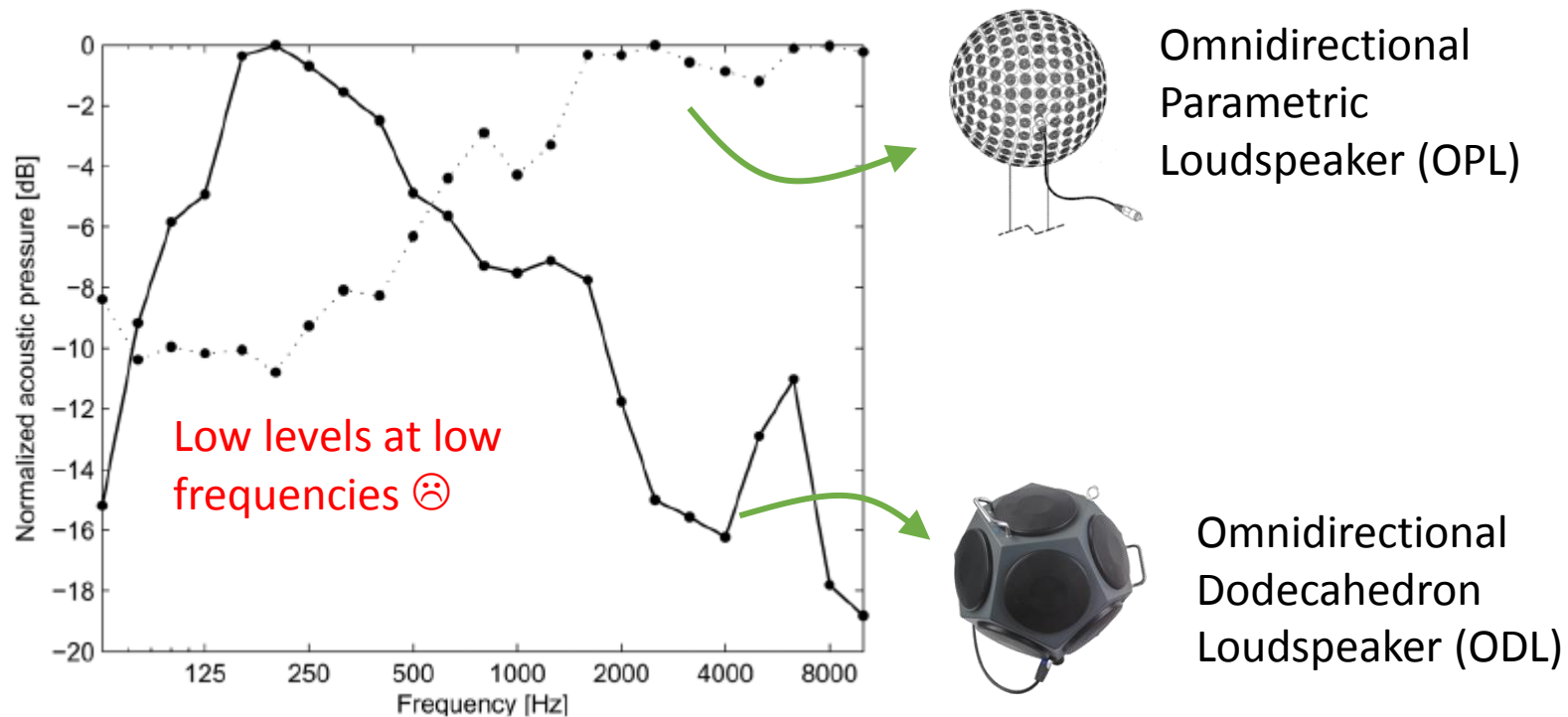


Omnidirectional
Parametric
Loudspeaker (OPL)



Omnidirectional Parametric Loudspeaker

Frequency response



(image from www.cesva.com)

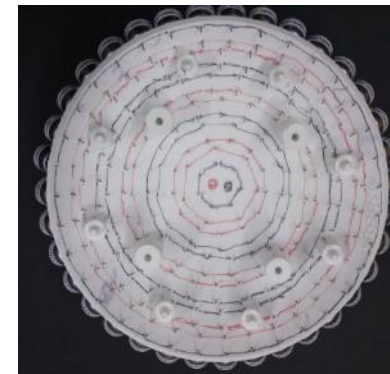


Omnidirectional Parametric Loudspeaker

- A prototype with rigid 3D printing has been built



6-pieces rigid 3D printed surfaces with inner structure





Omnidirectional Parametric Loudspeaker

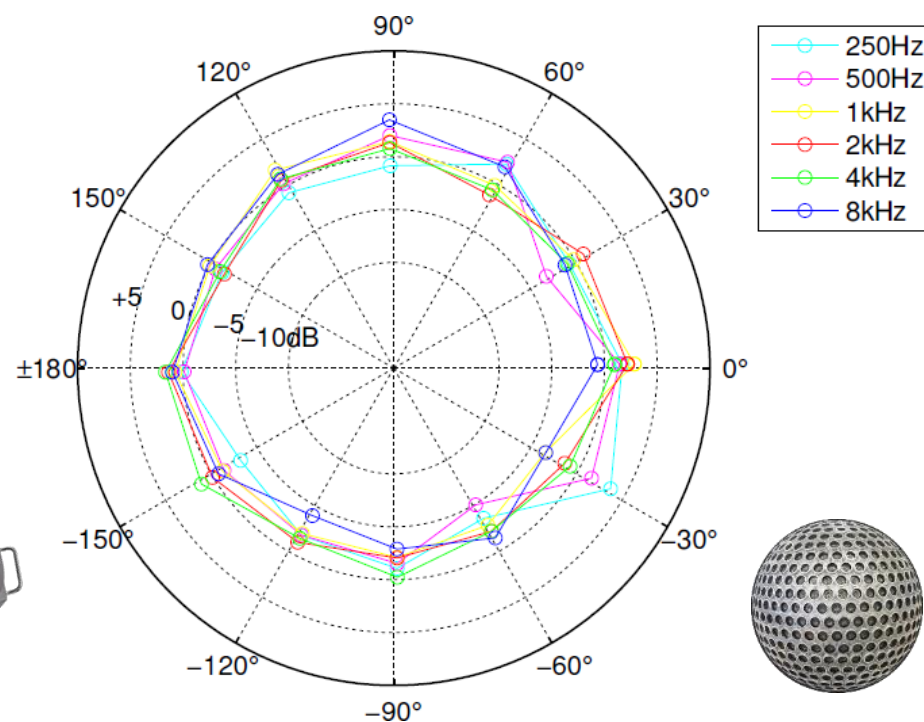
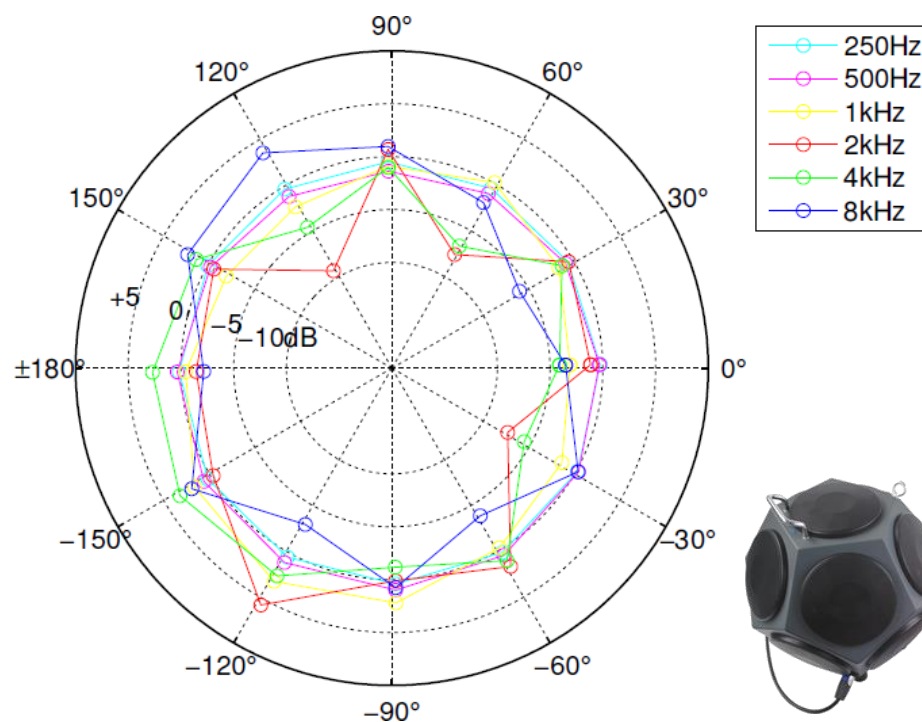
- Characterization of the OPL in the anechoic chamber (La Salle)





Omnidirectional Parametric Loudspeaker

- Characterization of the OPL in the anechoic chamber (La Salle)
 - Directivity index





Acoustic mobile app

EURECAT has developed the acoustic mobile app

The acoustic app allows the user to:

- Perform the acoustic measurements (STL Procedure)
- Generate the reports
- Perform the calibration
- Introduce the URL of the server (Location Service)
- Modify the number of iterations needed in each measurement (Configuration)



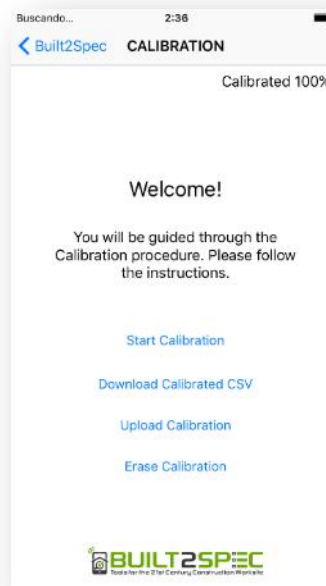
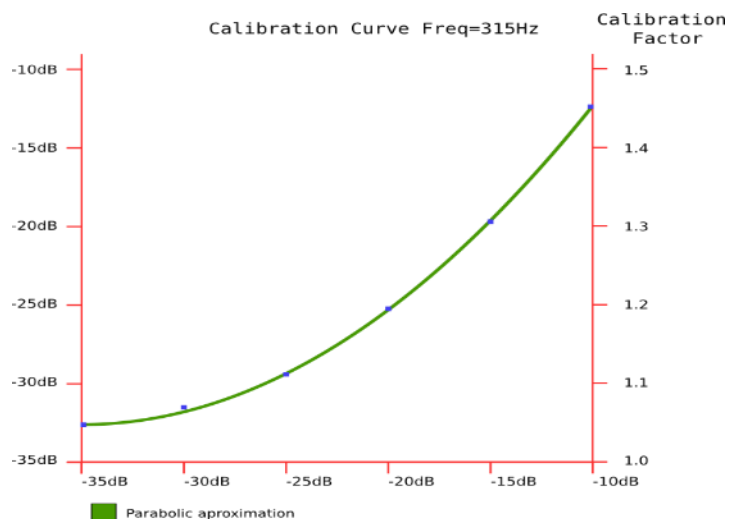
iOS device with EURECAT
acoustic app installed



Acoustic mobile app

Before performing any acoustic measurement, the mobile device and the external microphone must be calibrated.

This process is done in EURECAT facilities for each mobile device used. The calibration generates an Excel file with the calibration curves for each frequency band



A label shows if the system is calibrated or not

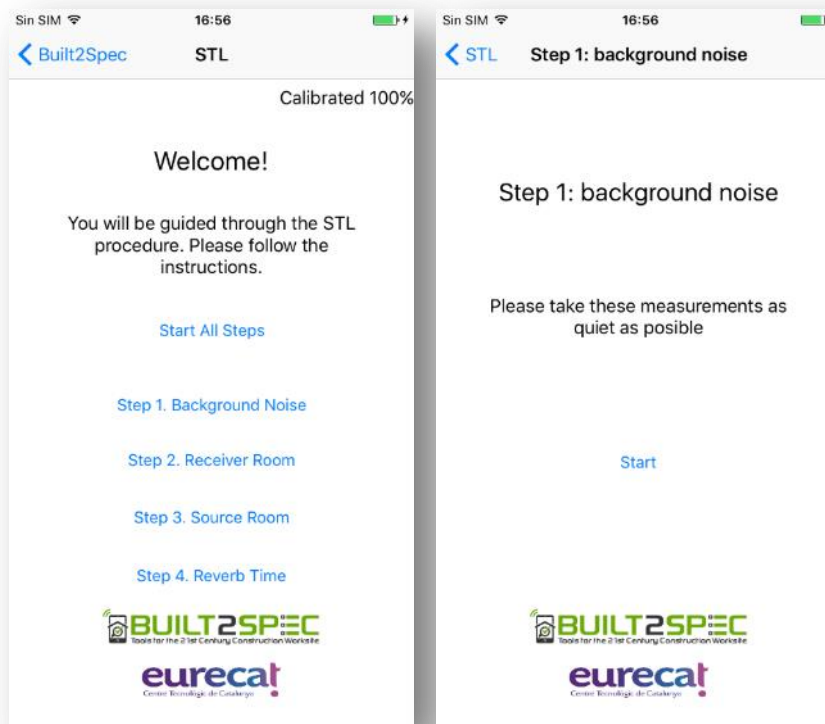
The calibration is loaded in a server and can be downloaded from an URL location



Acoustic mobile app

The acoustic software will guide the user through all the necessary steps that must be performed in order to obtain the sound Transmission Loss between two rooms

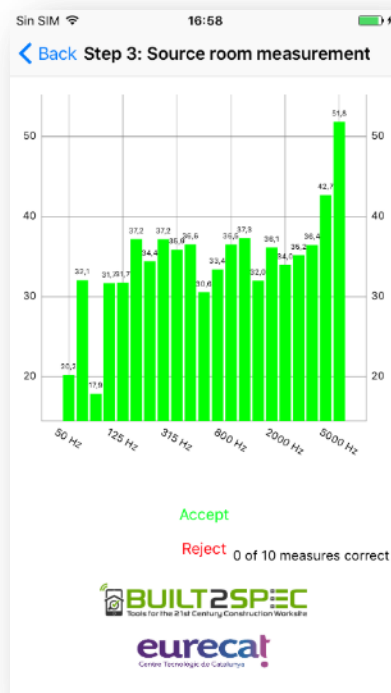
The user can perform the different measurement steps separately and save them in an unique file





Acoustic mobile app

The acoustic measurements can be done either with pink noise or sweep sines



Configuration Settings

Please write here the http service for uploads and configure the services.

Server URL

STL Iterations: 3

SPL Sweep Mode ☒

[Save Configuration](#)

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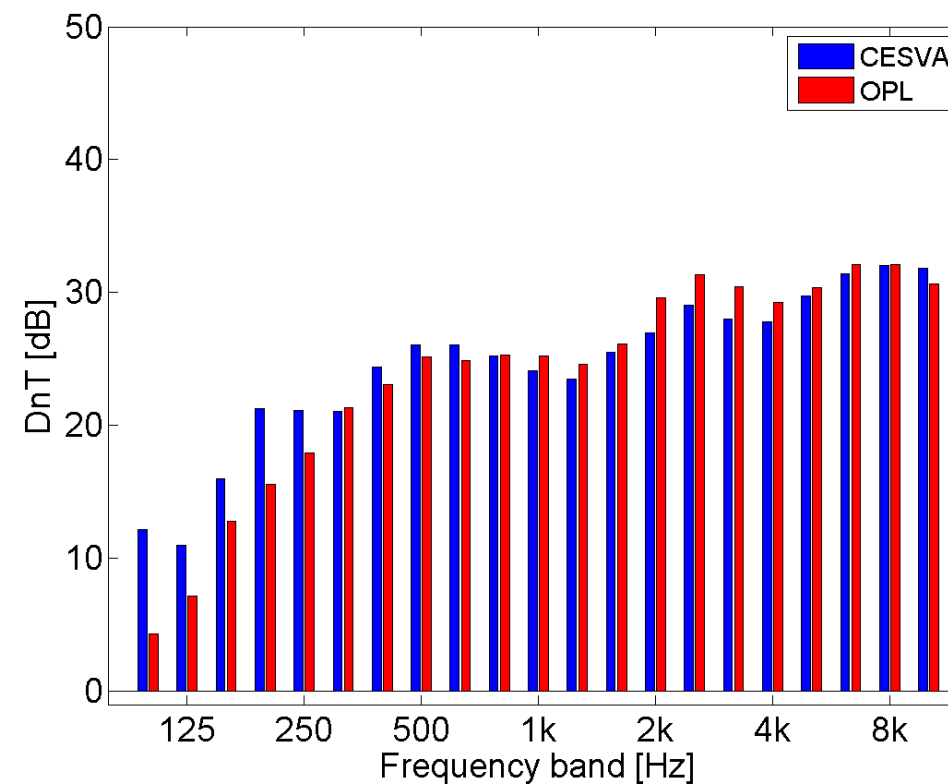
The link with VRM app allows to include the properties of the rooms in the report





Acoustic tests : La Salle

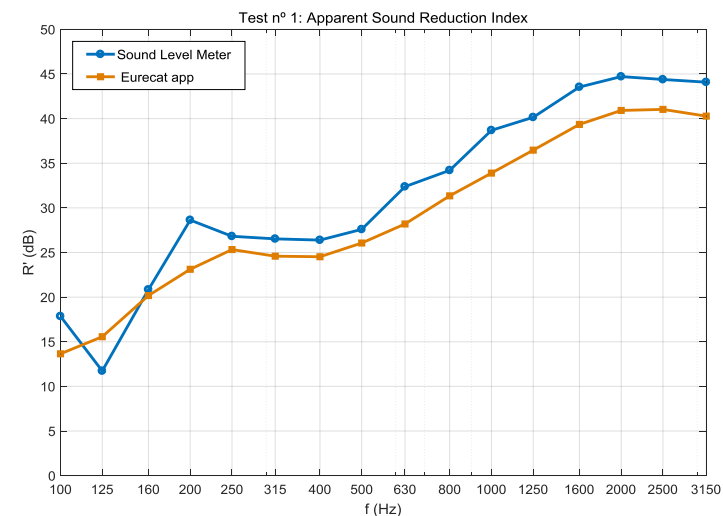
- Measuring airborne sound insulation in Barcelona (La Salle)





Acoustic tests: Montgat

- Measuring airborne sound insulation in residential buildings in Montgat (Barcelona)

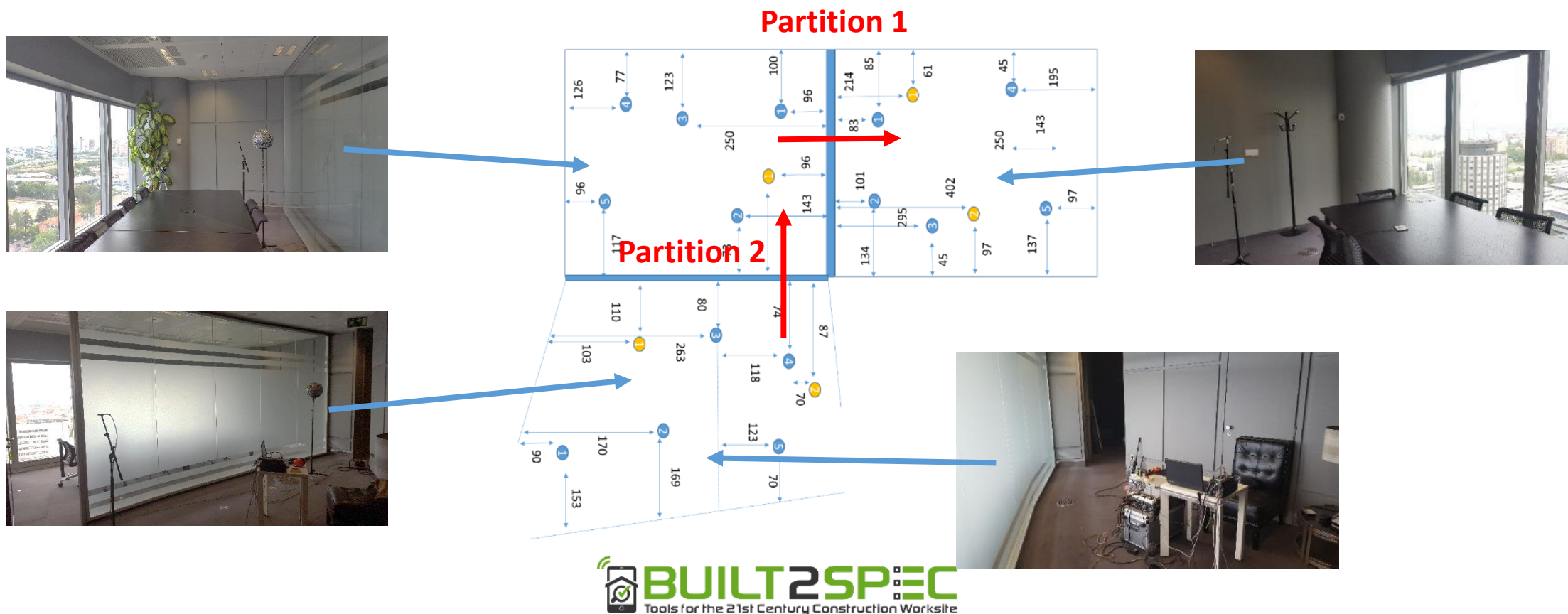


Measurement method		A-weighted sound reduction index
Sound Meter	Level	33,33 dBA
Eurecat App		31,8 dBA



Acoustic tests: Madrid

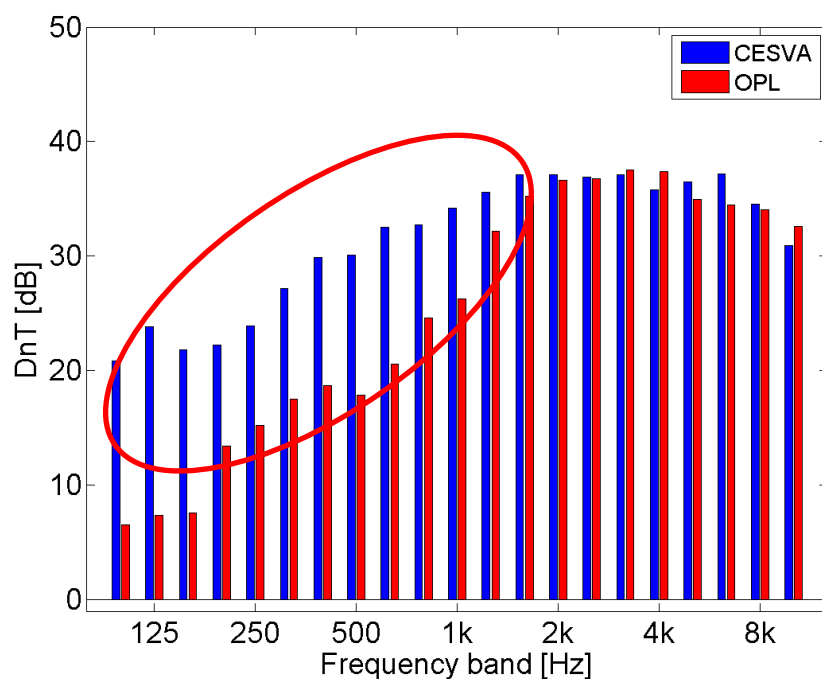
- Measuring airborne sound insulation in Madrid (OHL headquarters in Torrespacio)



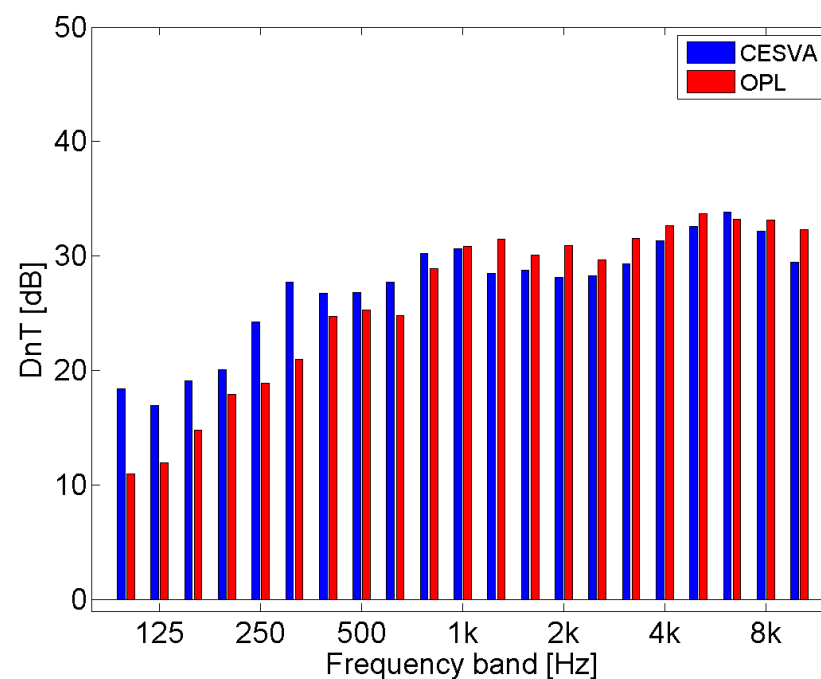


Acoustic tests

- Measuring airborne sound insulation in Madrid (OHL headquarters in Torrespacio)



Partition 1



Partition 2



Conclusions

New acoustic tools have been developed within the Built2Spec project: A novel loudspeaker and a mobile acoustic app.

The acoustic field tests performed show good correlation between the results obtained from the Built2Spec acoustic tools and the conventional tools. However, some differences are detected for high insulation walls at low frequencies.

More tests will be performed during this year to characterize the range of application of this set of tools



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