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PRELIMINARY NOISE IMPACT



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Revisions

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1. Introduction

This report assesses the potential noise impact from the installation and operation of outdoor climate control machinery (e.g. air conditioning condensers, heat pumps, or refrigeration units) at Coporation Street, Cheetam Hill Roud, Miller Street, Manchester. The aim is to ensure compliance with local and national noise regulations and to propose mitigation strategies to reduce noise impact on nearby receptors.



Figure 1. Showroom location

2. Applicable regulations and Standards

This report is based on standard methods used to evaluate the acoustic impact of external mechanical plant equipment in commercial premises with consideration of the specific site location façade geometry and equipment type

The following data sources and calculation principles have been used to estimate sound propagation and evaluate potential noise exposure to pedestrians and nearby receptors

2.1 Manufacturer Data

Sound power and sound pressure levels for the Panasonic outdoor units were obtained from the official manufacturer datasheets for each model

- PANASONIC U 4LE2E8
- PANASONIC U 60PZH3E5
- PANASONIC CU Z25YKEA

Sound pressure levels are based on nominal 1 metre distance values as tested in controlled environments.

Values range between 46 dBA and 58 dBA depending on model and operating conditions.

2.2 Propagation Model

The basic formula for free field sound attenuation over distance has been used to estimate sound pressure level at pedestrian height.

Equation 1. Propagation model over a distance

$$L_2 = L_1 - 20 \log \left(\frac{r_2}{r_1} \right)$$

Where:

- **L_1** is the sound pressure level at reference distance **r_1** in dBA
- **L_2** is the sound pressure level at greater distance **r_2** in dBA
- **r_1** is the reference distance typically 1 metre
- **r_2** is the new distance for which the sound level is being estimated
- **$\log_{10}$** is the base 10 logarithm

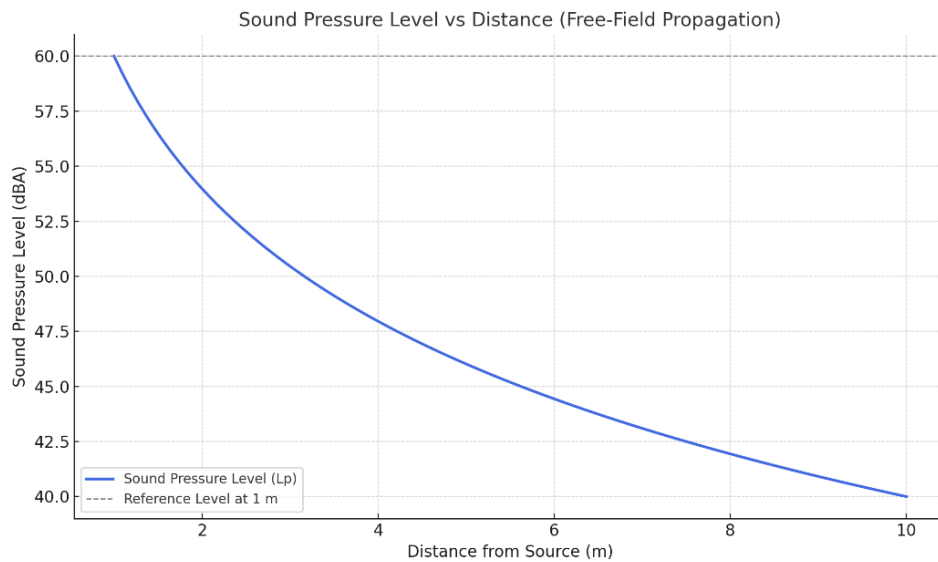


Figure 2. Propagation of pressure through air

2.3 Cumulative Sound Estimation

When more than one unit is operating simultaneously the total sound pressure level is calculated by logarithmic addition using the following formula:

Equation 2. Cumulative sound estimation

$$L_T = \sum_{i=1}^n 10 \log_{10} \left(10^{\frac{L_1}{10}} + 10^{\frac{L_2}{10}} + \dots + 10^{\frac{L_n}{10}} \right)$$

This accounts for multiple overlapping sources as present in this installation with up to 2 outdoor units mounted adjacently.

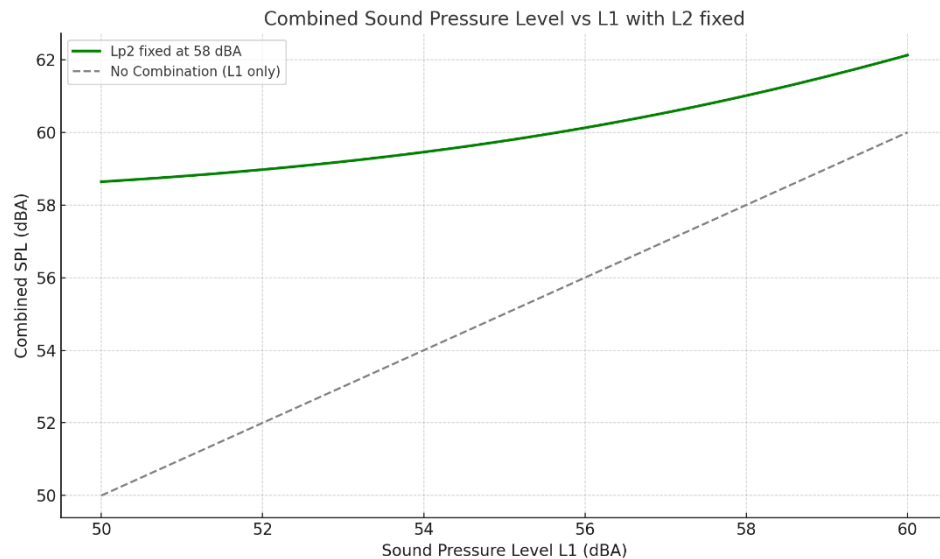


Figure 3 Combined sound pressure.

2.1 Transmission of sound through different media.

When sound waves travel through different media or barriers there is an energy loss in dB that can be measured with the following:

Equation 3. Energy loss in dB

$$L_{ptrans} = L_{pincid} - TL$$

Equation 4. Transmission loss

$$TL = 10 \log_{10} \left(\frac{1}{\tau} \right)$$

This accounts for transmission loss (TL) through a material.

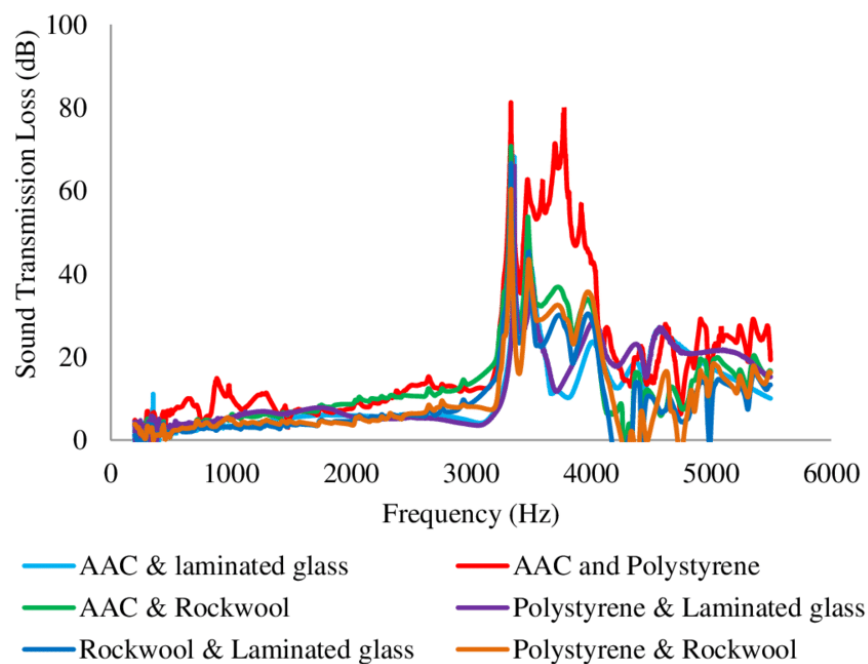


Figure 4. Transmission loss through different materials

2.2 BS 8233 2014 Guidance on Sound Insulation and Noise Reduction for Buildings

This standard offers internal and external noise level guidelines for various building types. Target external noise level for outdoor areas such as gardens or patios is less than or equal to 50 dB during the day and up to 55 dB in some cases. Indoor target for bedrooms at night is less than or equal to 30 dB for average noise and 45 dB for single events. Outdoor plant noise must not compromise residents ability to enjoy outdoor spaces or to sleep with open windows.

2.3 World Health Organization WHO Environmental Noise Guidelines for the European Region 2018

These international guidelines focus on the health effects of environmental noise. They recommend daytime noise levels below 53 dB and night time levels below 45 dB for general community well-being.

2.4 Building Regulations Part E Resistance to the Passage of Sound

While this regulation does not directly govern external noise sources it sets standards for sound insulation within buildings. It becomes relevant when climate machinery is located near windows, walls or roof areas where structure borne sound could enter residential or office spaces.

3. Description of the equipment.

The proposed climate control system for the premises located at the junction of Corporation Street Cheetham Hill Road and Miller Street in Manchester includes the installation of three Panasonic outdoor units for heating and cooling

The specific models are as follows

- PANASONIC U 4LE2E8
- PANASONIC U 60PZH3E5
- PANASONIC CU Z25YKEA

These machines will be installed on the **building façade above the main entrance doors** as shown in the attached elevation drawing.

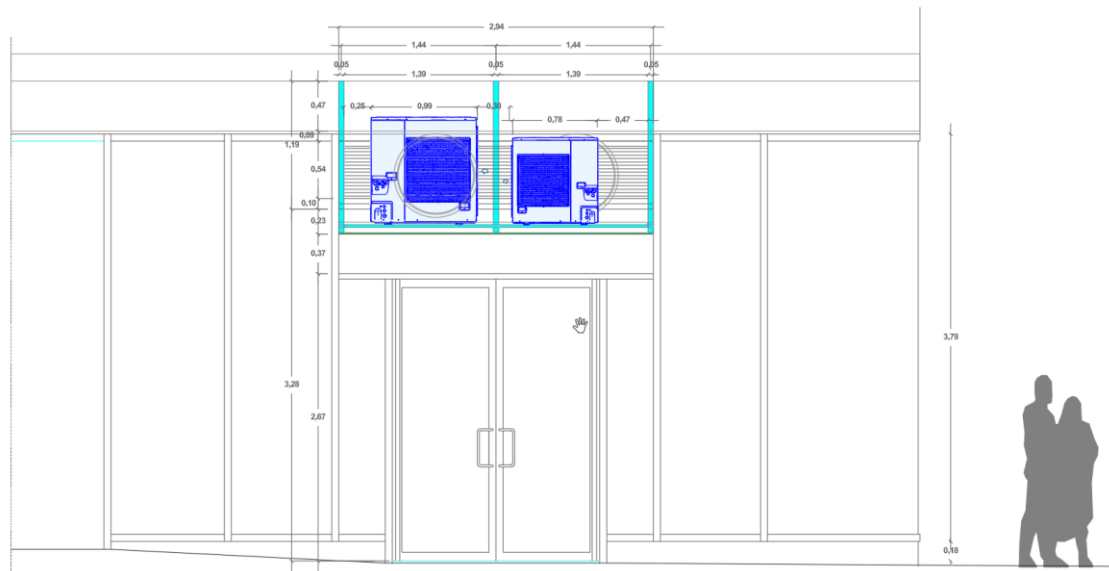


Figure 5. Elevation from the façade

The units will be supported by a metal frame positioned between two structural columns at a mounting height of approximately **3 to 3,8 m** above ground level. The installation is recessed into a façade opening with a horizontal span of approximately 2.94 metres and a vertical clearance above pedestrian head height.

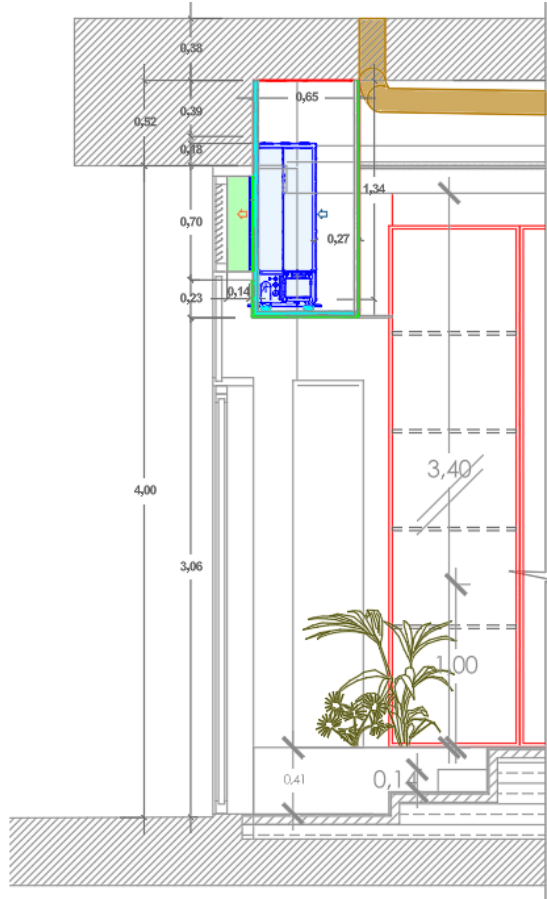


Figure 6. Side elevation from the façade

3.1 Unit specifications

The **U 4LE2E8** is a multisplit system designed to serve multiple indoor evaporators. It has a sound power level around 65 dBA and an approximate sound pressure of 55 dBA at 1 metre.

The **U 60PZH3E5** is a commercial heat pump capable of providing efficient heating and cooling even at low ambient temperatures. It's sound power level is around 68 dBA with a sound pressure level of up to 58 dBA depending on fan speed and operating mode.

The **CU Z25YKEA** is a compact residential style unit suitable for small commercial applications with a lower sound power level of approximately 57 dBA and a typical sound pressure of 46 dBA at 1 metre.

3.2 Unit placement and use

The configuration places 2 units adjacent to each other side by side and another on the other door behind a structural beam and just below a façade panel.

This arrangement creates a partially enclosed alcove which may contribute to some natural noise reflection or absorption depending on materials used

Operating hours will be limited to the shop opening times estimated between 8h in the morning and 17h in the evening with no expected overnight operation

Due to the location of the units on the street façade additional care will be taken to assess potential noise propagation toward the public pavement area and any residential windows in direct line of sight within nearby buildings

4. Noise mitigation measures

To minimise the potential impact of noise generated by the proposed Panasonic outdoor units mounted above the entrance doors several mitigation measures will be applied. These measures are designed to protect both pedestrians passing near the shopfront and residents in nearby buildings.

4.1 Selection of Low Noise Equipment

All selected units have been chosen for their relatively low noise emissions especially the CU Z25YKEA which is specifically designed for small commercial or residential use with a sound pressure level as low as 46 dBA at 1 metre.

Fan speeds on all units can be adjusted or set to silent mode during low load periods to reduce acoustic output.

4.2 Acoustic Barriers and Enclosures

A custom acoustic louvre or horizontal baffle system will be installed in front of the units to reduce direct sound radiation toward the street and residential windows.

This can be achieved using perforated metal screens or timber slats with integrated acoustic absorbent lining such as mineral wool with weather protection.

The barrier will be designed to maintain airflow efficiency while attenuating mid and high frequency fan noise by approximately 5 to 8 dB.

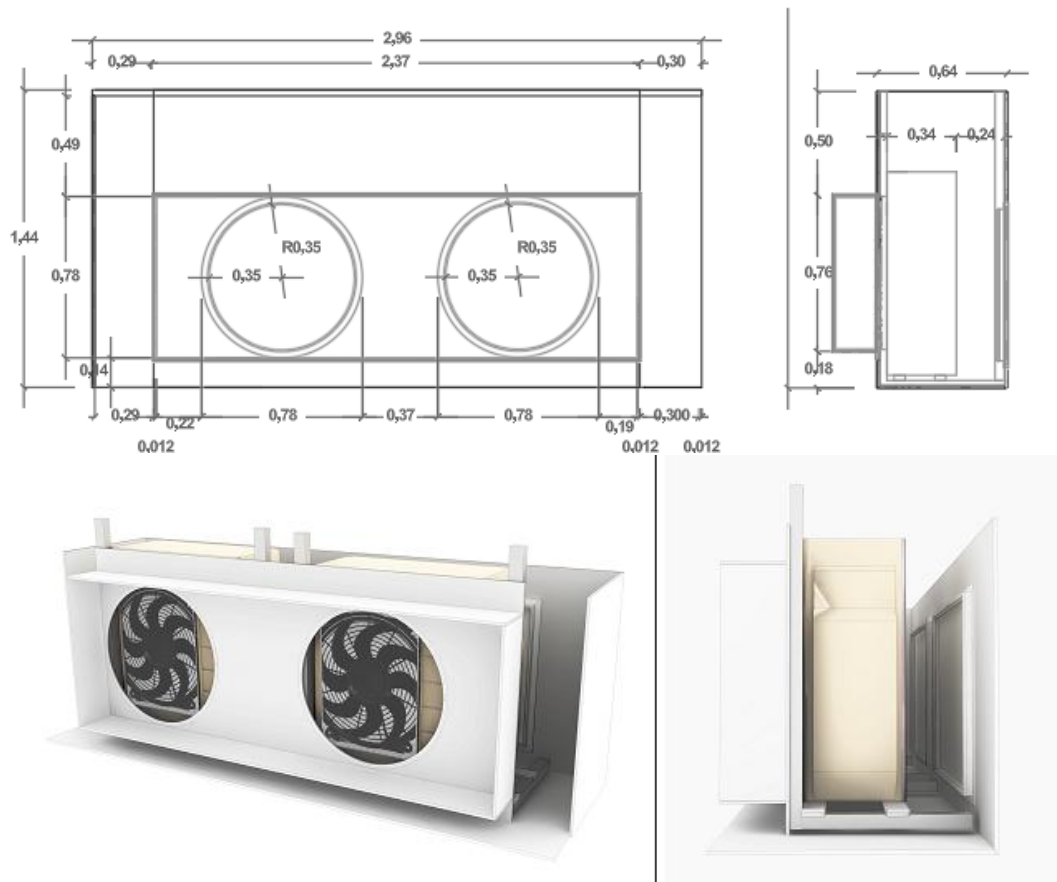


Figure 7. Design of the enclosure

4.3 Anti Vibration Mounts

All units will be installed using anti vibration mounts or pads to eliminate structure born sound transmission through the façade and into the building frame. This is especially important for elevated installations where vibrations can travel into upper floors or shop interiors. Flexible connections will also be used for refrigerant and electrical lines to reduce mechanical coupling.

4.4 Limited Operating Hours and Modes

Operation will be restricted to shop opening hours only between 8h in the morning and 17h in the evening. The systems will include different mode function to automatically reduce fan speed and compressor noise during periods of low needs even before full shutdown. This ensures no impact on local residents during sensitive nighttime hours.

4.5 Maintenance and Cleaning

Regular cleaning of filters coils and fan blades will be scheduled to maintain equipment efficiency and avoid increased noise due to dust blockage or fan imbalance. Loose components or rattling panels will also be checked during maintenance routines to prevent tonal or impulsive noise.

5. Calculations

5.1 Cumulative Sound estimation

Where the 2 units are adjacent, we have to take into consideration the cumulative sound waves pressure, with the following formula:

$$L_T = \sum_{i=1}^n 10 \log_{10}(10^{\frac{L_1}{10}} + 10^{\frac{L_2}{10}} + \dots + 10^{\frac{L_n}{10}})$$

Where the 2 adjacent units are the U-4LE2E8 (55 dB) and U-60PZH3E5 (58 dB).

$$L_T = 10 \log_{10} \left(10^{\frac{55}{10}} + 10^{\frac{58}{10}} \right) = 59,76 \text{ dB}$$

5.2 Distance and Height Considerations

The units are positioned at a height of over 3 metres which significantly reduces the sound pressure level experienced by pedestrians at ground level due to natural sound dispersion.

Considering a free field with no reflective surfaces, the formula for sound pressure is the following:

$$L_2 = L_1 - 20 \log \left(\frac{r_2}{r_1} \right)$$

Where:

- **L₁** is the sound pressure level at reference distance **r₁** in dBA
- **L₂** is the sound pressure level at greater distance **r₂** in dBA
- **r₁** is the reference distance typically 1 metre
- **r₂** is the new distance for which the sound level is being estimated
- **log₁₀** is the base 10 logarithm

Considering the units mounted at 4m and a 1,7m of ear height we can calculate the sound pressure knowing the highest the machines can output is 59,76 dB.

$$L_2 = 59,76 - 20 \log \left(\frac{4 - 1,7}{1} \right) = 52,53 \text{ dB}$$

This is a typical ambient urban background level and considered low to moderate in most environmental noise assessments. In practice the façade geometry surrounding buildings and any shielding from architectural elements such as canopies or ledges may reduce the actual noise level further. This attenuation is important for ensuring compliance with planning guidance and avoiding adverse impact on pedestrian comfort and residential amenity.

5.3 Transmission of sound through different media.

The standard formula for sound pressure level attenuation over distance in free field is the mentioned in the chapter above, however in this case we have to take into consideration that the machines are in an enclosure and the sound would scape mainly through the ventilation grilles for the fans. In this case we can apply the transmission loss of the barrier in dB (**TL**) through a material.

$$L_{ptrans} = L_{pincid} - TL$$

$$TL = 10 \log_{10} \left(\frac{1}{\tau} \right)$$

Where:

- τ is the sound transmission coefficient of a material

This coefficient depends on the frequency at which the sound is being emitted, and follows the energy conservation at a surface:

$$R + \alpha + \tau = 1$$

Where:

- τ is the sound transmission coefficient of a material
- α is the attenuation coefficient
- R is the reflected coefficient

If we assume that our enclosure, with the metal box and air grilles for the fans reflects 45% of the pressure incoming ($R = 0,45$) and absorbs a 5% of the energy ($\alpha = 0,05$) we have the following:

$$\tau = 1 - 0,45 - 0,05 = 0,5$$

These values are the typical values for air grilles and thin metal walls.

With the sound transmission calculated now we can calculate the transmission loss through the material:

$$TL = 10 \log_{10} \left(\frac{1}{0,5} \right) = 3,01 \text{ dB}$$

With this we can now know the L_{trans}

$$L_{trans} = 52,53 - 3,01 = 49,52 \text{ dB}$$

6. Conclusion

Based on the analysis carried out in this report, the installation of the three Panasonic outdoor units on the façade of the Cosentino showroom is expected to have a minimal noise impact at street level. The combined sound pressure level of the two main exterior units has been calculated at 59.76 dBA at 1 metre, and after accounting for vertical distance, geometric spreading, and partial enclosure effects, the estimated sound pressure at pedestrian ear height is approximately **49,52 dBA**.

This level is consistent with typical urban background noise conditions found in commercial areas (50-55 dB) such as Corporation Street and Cheetham Hill Road. Moreover, additional transmission loss through the enclosure structure and ventilation grilles further reduces the effective sound reaching public space.

The implementation of noise mitigation measures — including anti-vibration mounts, partial acoustic barriers, mode-based fan control, and limited operational hours — ensures that noise exposure remains well within acceptable standards. The units will not operate during nighttime hours, eliminating potential for sleep disturbance or evening nuisance.

Given the conservative assumptions, real-world attenuation due to building geometry, traffic masking noise, and shielding from nearby structures, the risk of noise disturbance to pedestrians and nearby residents is negligible.

The overall design and technical specifications demonstrate compliance with national guidelines and local acoustic expectations, and no further detailed BS 4142 assessment is deemed necessary unless specifically requested by Manchester City Council.