

TEST REPORT

Report no.:
300-KLAB-23-011



**DANISH
TECHNOLOGICAL
INSTITUTE**

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Page 1 of 21
Init: KAMA/PGL
File no.: 218952
Enclosures: 1

Customer: Company: Panasonic Marketing Europe GmbH
Address: Hagenauer Str. 43
City: 65203 Wiesbaden
Tel.: +49 611 2350

Component: Brand: Panasonic
Type: Air to water heat pump (split)
Model: Outdoor unit: WH-UDZ09KE5
Indoor unit: WH-ADC0309K3E5
Series no.: Outdoor unit: 5624301068
Indoor unit: 5706600032
Prod. year: Outdoor unit: 2023.02
Component tested: August 2023

Dates:

Procedure: See objective (page 2) for list of standards.

Remarks: The unit was delivered by the customer. The installation and test settings were done according to the manufacturer's instructions.

Terms: This test was conducted under accreditation in accordance with international requirements (ISO/IEC 17025:2017) and in accordance with the General Terms and Conditions of Danish Technological Institute. The test results solely apply to the tested item. This test report may be quoted in extract only if Danish Technological Institute has granted its written consent.

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Division/Centre: Danish Technological Institute
Energy and Climate
Heat Pump Laboratory, Aarhus

Date: 2024.03.01

Signature:
Kamalathan Arumugam
B.Sc. Engineer (Acoustics)

Co-reader:
Patrick Glibert
Senior specialist



Test Reg. nr. 300



Objective

The objective of this report is to document the acoustical performance of the outdoor unit of the air-to-water heat pump with different heat pump settings and temperature conditions, stated on page 4.

The measurements of the sound power level were carried out according to EN 12102-1:2022 using the engineering method ISO 3743-1:2010. The method is briefly described in Appendix 1. For a more detailed description, please view the accreditation papers DANAK-300 (in Danish only).





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Test order, test conditions, and test results of the sound power measurements according to EN12102

		Temperature conditions		Heat pump settings				Test results	
Test N°	Test Name	Outdoor heat exchanger (dry/wet bulb) (°C)	Indoor heat exchanger (inlet/outlet) (°C)	Compressor speed (Hz)	Fan speed outdoor (RPM)	Heating capacity (kW)	Power input (kW)	Sound power level L _{WA} (dB re. 1pW)	Uncertainty (dB)
1	Rating capacity	7/6	30/35	69	660	9.00	1.90	63.5	1.6
2	Quiet mode level 3	7/6	30/35	48	480	6.15	1.25	58.1	1.8
3	Rating capacity	7/6	47/55	74	600	8.30	2.91	63.5	1.8
4	Quiet mode level 3	7/6	47/55	51	390	5.70	1.94	57.5	1.8
5*	Part load	7/6	47/55	26	450	2.70	0.90	56.5	1.6
6	Quiet mode level 3	2/1	30/35	55	570	6.20	1.48	59.5	1.6
7	Rating capacity	-7/-8	30/35	82	690	7.00	2.20	66.5	1.8
8	Quiet mode level 3	-7/-8	30/35	57	630	4.80	1.49	61.7	1.6
9	Rating capacity	-7/-8	47/55	80	730	6.00	2.90	68.0	1.8
10	Quiet mode level 3	-7/-8	47/55	56	630	4.10	1.95	63.0	1.6

*Applicable for ErP energy labelling.

The calculation of the uncertainty is described in Appendix 1.



Sound power level of 1/3 octave band frequency

		1/3 octave band frequency (Hz)																				
Test N°	Sound power level Lw A [dB]	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
1		45.1	46.3	46.3	46.8	52.8	52.6	55.3	53.3	53	53.2	52.2	52.2	51.2	49.8	48.1	47.1	45.2	42.4	40	37.2	34.6
2		45.6	34.4	36.7	43.7	45.6	50.7	52	47.7	47.8	45.8	43.8	44.6	42.9	40	38.3	40.3	33.3	31.1	39.7	33.1	23.5
3		41.9	44.1	54	45.6	48.9	56.7	54.8	54.3	51.8	51.5	50.6	50.4	50.3	47.6	45.9	46.9	42.8	39.7	37.8	36.8	34.2
4		38.4	30.7	35.7	46.6	41.4	53.2	47.9	48	45.6	43.9	42.4	41.4	44.8	37.8	36.1	38.5	35.1	33.3	39.3	35.1	29.3
5		38.5	35.2	42.1	44.6	45.2	45.9	48.9	46.1	43.5	47.7	44.1	43.9	41.6	38.8	38.8	37.8	40.2	37.6	40	34.1	26.3
6		43.6	42.8	41.8	44.1	47.1	50.3	49.6	52.3	49	48.4	47.6	47.3	46.2	44.5	43.2	42.7	38.3	36.5	38.9	33.8	26.3
7		46.1	46.1	50.5	48.2	52.7	55.8	55.1	62.1	54.1	54.8	53.3	54.7	53.4	50.9	49.7	49.6	46.4	43.4	41.9	38.5	34.7
8		45.4	45.5	44.5	46.7	49.7	51.1	51	52.2	51.8	52.2	50.7	50.8	49.8	47.8	46.7	44.8	42.4	39.6	38.9	34.9	31.8
9		50.6	47	53.9	51.3	54.4	59.7	55.5	62.3	56	56.5	55.1	55.6	55.1	52.8	51.2	51.1	47.9	45.3	42.4	41	37.8
10		44.6	44.3	45.6	52	53.1	53	52.5	53.6	52.5	52.9	51.2	51.2	50.6	48.1	46.1	43.9	41.2	38.3	38.7	34.2	30.1



Photo

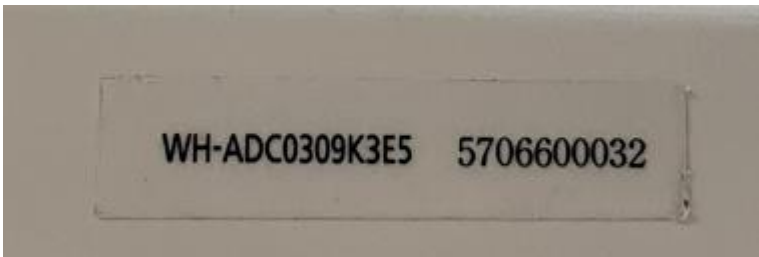
Rating plate (outdoor unit)

Outdoor unit





Rating plate (indoor unit)





Indoor unit




Detailed test results of sound power measurements

Test N° 1

Sound power levels according to ISO 3743-1:2010



Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms

Client:

Object:

Mounting conditions:

Panasonic Marketing Europe GmbH

Type: Air to water heat pump Model: WH-UDZ09KE5

The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.

Date of test:

22-08-2023

Operating conditions:

Static pressure:

Air temperature:

Relative air humidity:

Test room volume:

Area, S, of test room:

A7/W35, Compressor speed: 69[Hz], Fan speed: 660[rpm], Heating capacity: 9.0 [kW], Power_input: 1.90 [kW], Water flow rate: 1530 [l/h], dp_water: 480 [mbar]

201.8 kPa

7.0 °C

84.0 %

102.8 m³

138.9 m²

Room:

Room 2

Reference box:

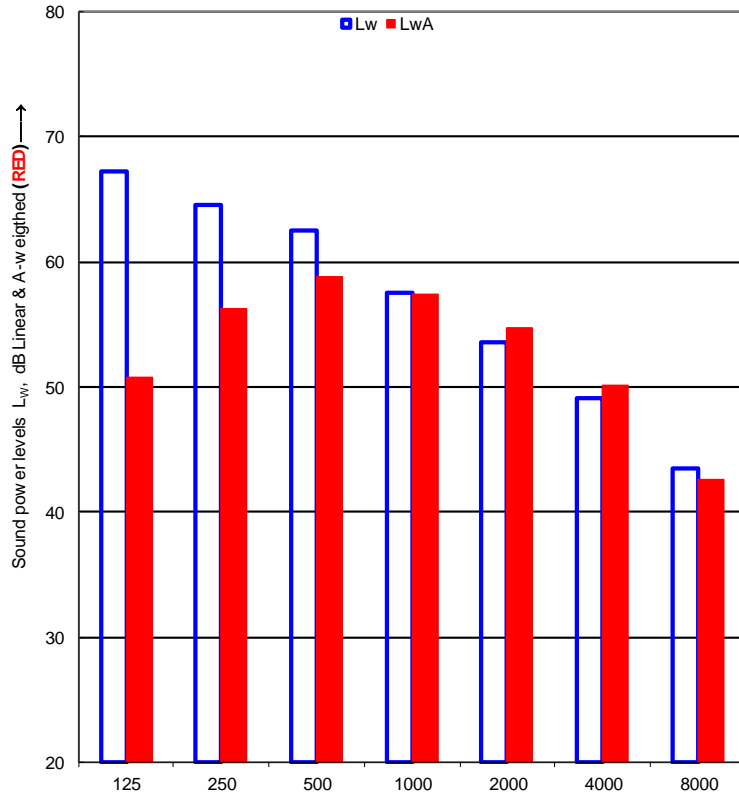
L1: 0.9 m

L2: 0.4 m

L3: 0.8 m

Volume: 0.3 m³

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	64.2	
125	62.4	67.2
160	59.7	
200	57.7	
250	61.4	64.5
315	59.2	
400	60.1	
500	56.5	62.5
630	54.9	
800	54.0	
1000	52.2	57.5
1250	51.6	
1600	50.2	
2000	48.6	53.5
2500	46.8	
3150	45.9	
4000	44.2	49.1
5000	41.9	
6300	40.1	
8000	38.3	43.4
10000	37.1	



Sound power level L_w(A):

63.5 dB [re 1pW]

Name of test institute:

No. of test report:

DTI

300-KLAB-23-011




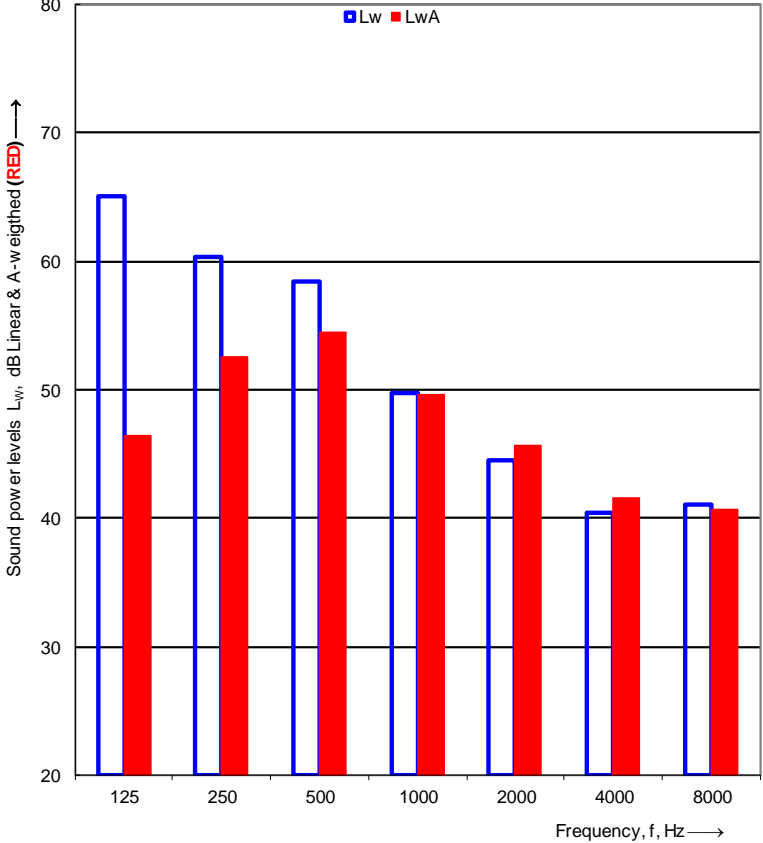
Date:

22-08-2023

Measurements are in full conformity with ISO 3743




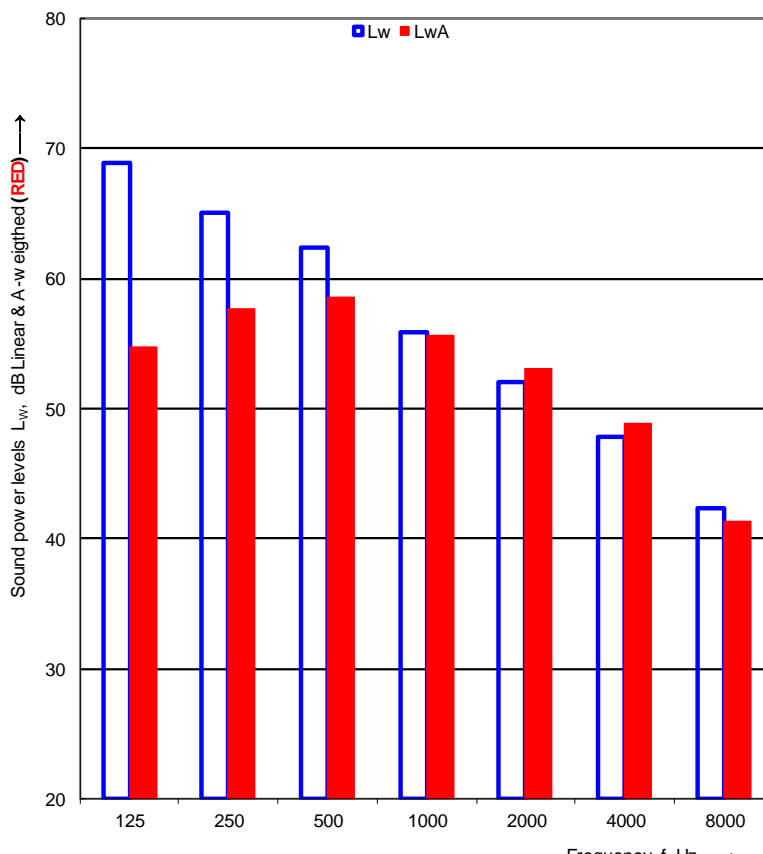


Test N° 2

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:		Panasonic Marketing Europe GmbH		Date of test: 22-08-2023																																																																			
Object:		Type: Air to water heat pump Model: WH-UDZ09KE5																																																																					
Mounting conditions:		The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:		A7/W35, Compressor speed: 48[Hz], Fan speed: 480[rpm], Heating capacity: 6.15 [kW], Power_input: 1.25 [kW], Water flow rate: 1080 [l/h], dp_water: 400 [mbar]																																																																					
Static pressure:		101.8 kPa		<u>Reference box:</u>																																																																			
Air temperature:		7.0 °C		L1: 0.9 m																																																																			
Relative air humidity:		84.0 %		L2: 0.4 m																																																																			
Test room volume:		102.8 m³		L3: 0.8 m																																																																			
Area, S, of test room:		138.9 m²		Volume: 0.3 m³																																																																			
Room:		Room 2																																																																					
<table border="1"><thead><tr><th>Frequency f [Hz]</th><th>L_w 1/3 octave [dB]</th><th>1/1 oct [dB]</th></tr></thead><tbody><tr><td>100</td><td>64.7</td><td></td></tr><tr><td>125</td><td>50.5</td><td>65.0</td></tr><tr><td>160</td><td>50.1</td><td></td></tr><tr><td>200</td><td>54.6</td><td></td></tr><tr><td>250</td><td>54.2</td><td>60.4</td></tr><tr><td>315</td><td>57.3</td><td></td></tr><tr><td>400</td><td>56.8</td><td></td></tr><tr><td>500</td><td>50.9</td><td>58.4</td></tr><tr><td>630</td><td>49.7</td><td></td></tr><tr><td>800</td><td>46.6</td><td></td></tr><tr><td>1000</td><td>43.8</td><td>49.8</td></tr><tr><td>1250</td><td>44.0</td><td></td></tr><tr><td>1600</td><td>41.9</td><td></td></tr><tr><td>2000</td><td>38.8</td><td>44.5</td></tr><tr><td>2500</td><td>37.0</td><td></td></tr><tr><td>3150</td><td>39.1</td><td></td></tr><tr><td>4000</td><td>32.3</td><td>40.4</td></tr><tr><td>5000</td><td>30.6</td><td></td></tr><tr><td>6300</td><td>39.8</td><td></td></tr><tr><td>8000</td><td>34.2</td><td>41.0</td></tr><tr><td>10000</td><td>26.0</td><td></td></tr></tbody></table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	64.7		125	50.5	65.0	160	50.1		200	54.6		250	54.2	60.4	315	57.3		400	56.8		500	50.9	58.4	630	49.7		800	46.6		1000	43.8	49.8	1250	44.0		1600	41.9		2000	38.8	44.5	2500	37.0		3150	39.1		4000	32.3	40.4	5000	30.6		6300	39.8		8000	34.2	41.0	10000	26.0					
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Sound power level L_w(A):		58.1 dB [re 1pW]																																																																					
Name of test institute:		DTI		Date: 22-08-2023																																																																			
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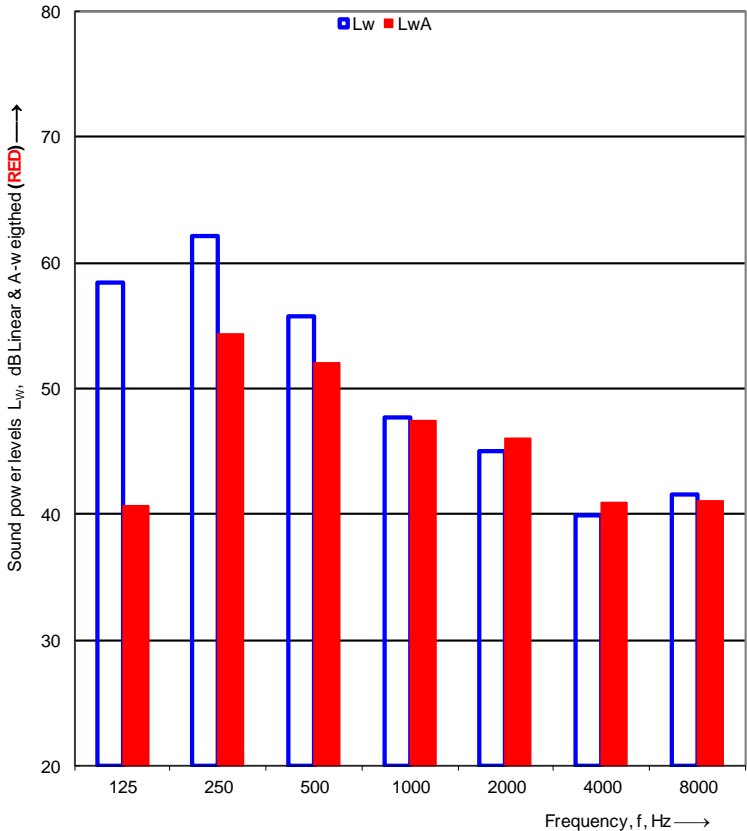


Test N° 3

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client: Panasonic Marketing Europe GmbH		Date of test: 21-08-2023																																																																					
Object: Type: Air to water heat pump Model: WH-UDZ09KE5																																																																							
Mounting conditions: The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																							
Operating conditions: A7/W55, Compressor speed: 74[Hz], Fan speed: 600[rpm], Heating capacity: 8.3 [kW], Power input: 2.91 [kW], Water flow rate: 915 [l/h], dp_water: 415 [mbar]																																																																							
Static pressure: 102.1 kPa		<u>Reference box:</u>																																																																					
Air temperature: 7.0 °C		L1: 0.9 m																																																																					
Relative air humidity: 84.0 %		L2: 0.4 m																																																																					
Test room volume: 102.8 m³		Room: Room 2	L3: 0.8 m																																																																				
Area, S, of test room: 138.9 m²		Volume: 0.3 m³																																																																					
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Sound power level L _w (A):		63.5 dB [re 1pW]																																																																					
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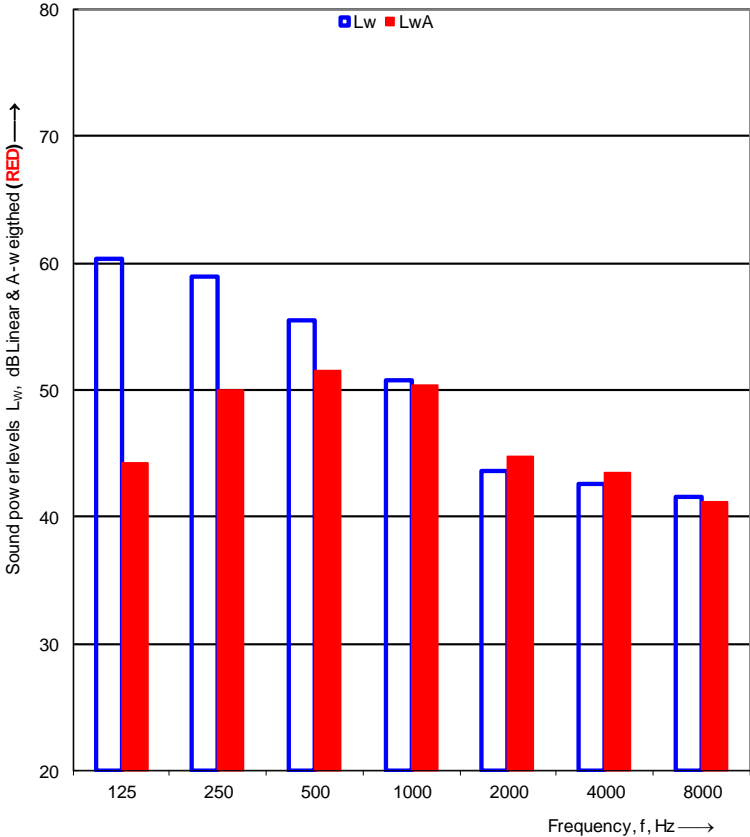


Test N° 4

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:		Panasonic Marketing Europe GmbH		Date of test: 22-08-2023																																																																			
Object:		Type: Air to water heat pump Model: WH-UDZ09KE5																																																																					
Mounting conditions:		The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:		A7/W55, Compressor speed: 51[Hz], Fan speed: 390[rpm], Heating capacity: 5.7 [kW], Power_input: 1.94 [kW], Water flow rate: 630 [l/h], dp_water: 468 [mbar]																																																																					
Static pressure:		101.8 kPa		<u>Reference box:</u>																																																																			
Air temperature:		7.0 °C		L1: 0.9 m																																																																			
Relative air humidity:		84.0 %		L2: 0.4 m																																																																			
Test room volume:		102.8 m³		L3: 0.8 m																																																																			
Area, S, of test room:		138.9 m²		Volume: 0.3 m³																																																																			
		Room: Room 2																																																																					
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8000	36.2	41.6																																																																					
10000	31.8																																																																						
		Sound power level L_w(A): 57.5 dB [re 1pW]																																																																					
Name of test institute:		DTI		Date: 22-08-2023																																																																			
No. of test report:		300-KLAB-23-011																																																																					
Measurements are in full conformity with ISO 3743																																																																							




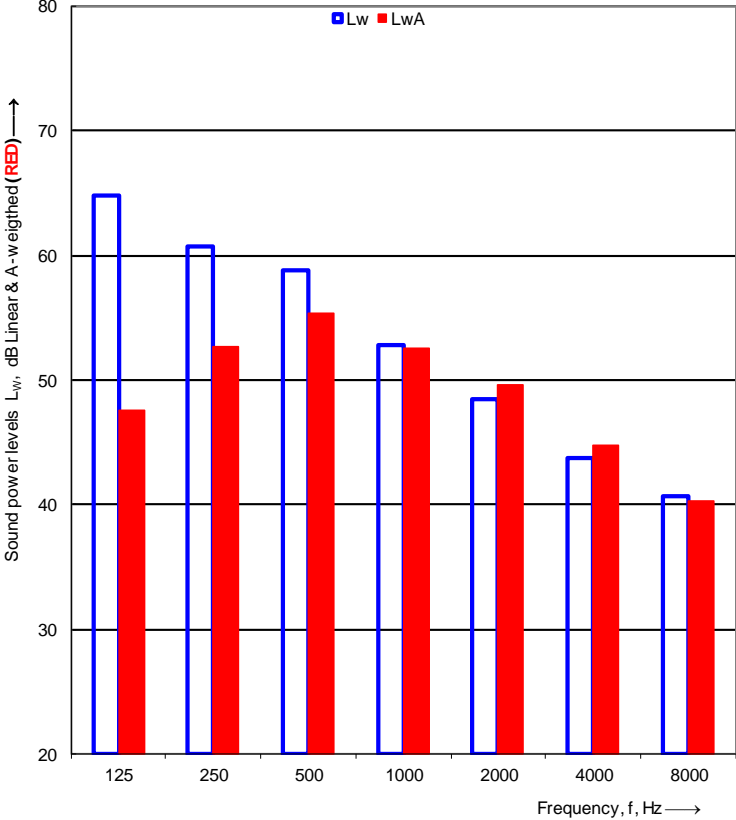


Test N° 5

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:	Panasonic Marketing Europe GmbH			Date of test:	21-08-2023																																																																		
Object:	Type: Air to water heat pump Model: WH-UDZ09KE5																																																																						
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																						
Operating conditions:	A7/W55, Compressor speed: 26[Hz], Fan speed: 450[rpm], Heating capacity: 2.7 [kW], Power_input: 0.90 [kW], Water flow rate: 480 [l/h], dp_water: 480 [mbar]																																																																						
Static pressure:	102.1 kPa			Reference box:																																																																			
Air temperature:	7.0 °C			L1:	0.9 m																																																																		
Relative air humidity:	84.0 %			L2:	0.4 m																																																																		
Test room volume:	102.8 m³	Room:	Room 2	L3:	0.8 m																																																																		
Area, S, of test room:	138.9 m²			Volume:	0.3 m³																																																																		
<table border="1"><thead><tr><th>Frequency f [Hz]</th><th>L_w 1/3 octave [dB]</th><th>1/1 oct [dB]</th></tr></thead><tbody><tr><td>100</td><td>57.6</td><td></td></tr><tr><td>125</td><td>51.3</td><td>60.3</td></tr><tr><td>160</td><td>55.5</td><td></td></tr><tr><td>200</td><td>55.5</td><td></td></tr><tr><td>250</td><td>53.8</td><td>58.9</td></tr><tr><td>315</td><td>52.5</td><td></td></tr><tr><td>400</td><td>53.7</td><td></td></tr><tr><td>500</td><td>49.3</td><td>55.5</td></tr><tr><td>630</td><td>45.4</td><td></td></tr><tr><td>800</td><td>48.5</td><td></td></tr><tr><td>1000</td><td>44.1</td><td>50.7</td></tr><tr><td>1250</td><td>43.3</td><td></td></tr><tr><td>1600</td><td>40.6</td><td></td></tr><tr><td>2000</td><td>37.6</td><td>43.6</td></tr><tr><td>2500</td><td>37.5</td><td></td></tr><tr><td>3150</td><td>36.6</td><td></td></tr><tr><td>4000</td><td>39.2</td><td>42.6</td></tr><tr><td>5000</td><td>37.1</td><td></td></tr><tr><td>6300</td><td>40.1</td><td></td></tr><tr><td>8000</td><td>35.2</td><td>41.6</td></tr><tr><td>10000</td><td>28.8</td><td></td></tr></tbody></table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	57.6		125	51.3	60.3	160	55.5		200	55.5		250	53.8	58.9	315	52.5		400	53.7		500	49.3	55.5	630	45.4		800	48.5		1000	44.1	50.7	1250	43.3		1600	40.6		2000	37.6	43.6	2500	37.5		3150	36.6		4000	39.2	42.6	5000	37.1		6300	40.1		8000	35.2	41.6	10000	28.8					
Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]																																																																					
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Sound power level L _w (A):		56.5 dB [re 1pW]																																																																					
Name of test institute:	DTI			Date:	21-08-2023																																																																		
No. of test report:	300-KLAB-23-011																																																																						
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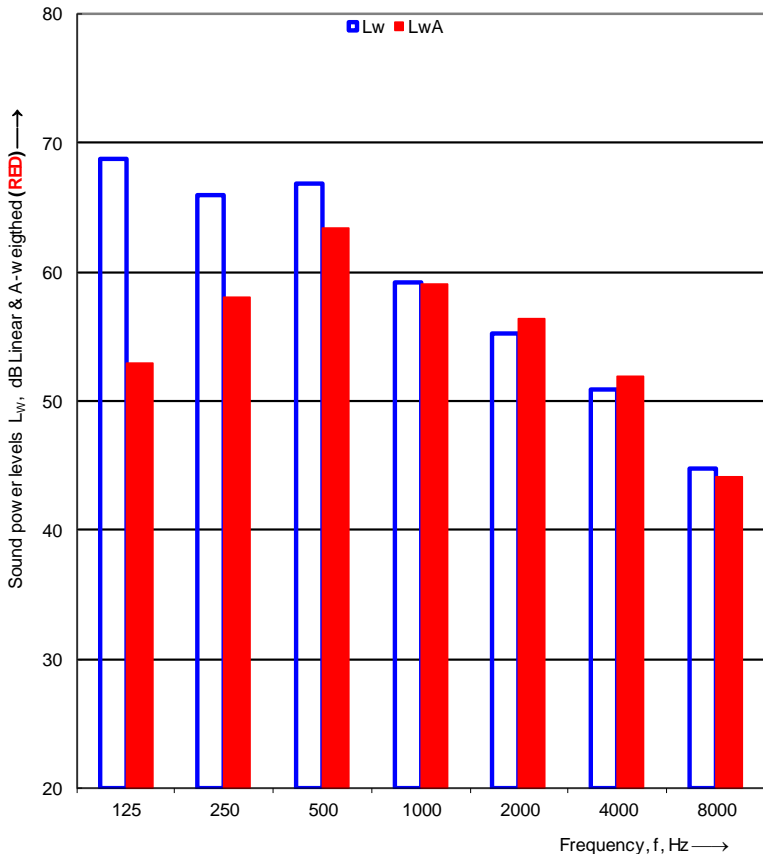


Test N° 6

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:	Panasonic Marketing Europe GmbH			Date of test: 22-08-2023																																																																			
Object:	Type: Air to water heat pump Model: WH-UDZ09KE5																																																																						
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																						
Operating conditions:	A2/W35, Compressor speed: 55[Hz], Fan speed: 570[rpm], Heating capacity: 6.2 [kW], Power_input: 1.48 [kW], Water flow rate: 1110 [l/h], dp_water: 395 [mbar]																																																																						
Static pressure:	101.8 kPa			<u>Reference box:</u>																																																																			
Air temperature:	2.0 °C			L1:	0.9 m																																																																		
Relative air humidity:	83.0 %			L2:	0.4 m																																																																		
Test room volume:	102.8 m³	Room:	Room 2	L3:	0.8 m																																																																		
Area, S, of test room:	138.9 m²			Volume:	0.3 m³																																																																		
<table border="1"><thead><tr><th>Frequency f [Hz]</th><th>L_w 1/3 octave [dB]</th><th>1/1 oct [dB]</th></tr></thead><tbody><tr><td>100</td><td>62.7</td><td></td></tr><tr><td>125</td><td>58.9</td><td>64.7</td></tr><tr><td>160</td><td>55.2</td><td></td></tr><tr><td>200</td><td>55.0</td><td></td></tr><tr><td>250</td><td>55.7</td><td>60.7</td></tr><tr><td>315</td><td>56.9</td><td></td></tr><tr><td>400</td><td>54.4</td><td></td></tr><tr><td>500</td><td>55.5</td><td>58.8</td></tr><tr><td>630</td><td>50.9</td><td></td></tr><tr><td>800</td><td>49.2</td><td></td></tr><tr><td>1000</td><td>47.6</td><td>52.7</td></tr><tr><td>1250</td><td>46.7</td><td></td></tr><tr><td>1600</td><td>45.2</td><td></td></tr><tr><td>2000</td><td>43.3</td><td>48.4</td></tr><tr><td>2500</td><td>41.9</td><td></td></tr><tr><td>3150</td><td>41.5</td><td></td></tr><tr><td>4000</td><td>37.3</td><td>43.7</td></tr><tr><td>5000</td><td>36.0</td><td></td></tr><tr><td>6300</td><td>39.0</td><td></td></tr><tr><td>8000</td><td>34.9</td><td>40.7</td></tr><tr><td>10000</td><td>28.8</td><td></td></tr></tbody></table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	62.7		125	58.9	64.7	160	55.2		200	55.0		250	55.7	60.7	315	56.9		400	54.4		500	55.5	58.8	630	50.9		800	49.2		1000	47.6	52.7	1250	46.7		1600	45.2		2000	43.3	48.4	2500	41.9		3150	41.5		4000	37.3	43.7	5000	36.0		6300	39.0		8000	34.9	40.7	10000	28.8					
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		Sound power level L _w (A): 59.5 dB [re 1pW]																																																																					
Name of test institute:		DTI		Date: 22-08-2023																																																																			
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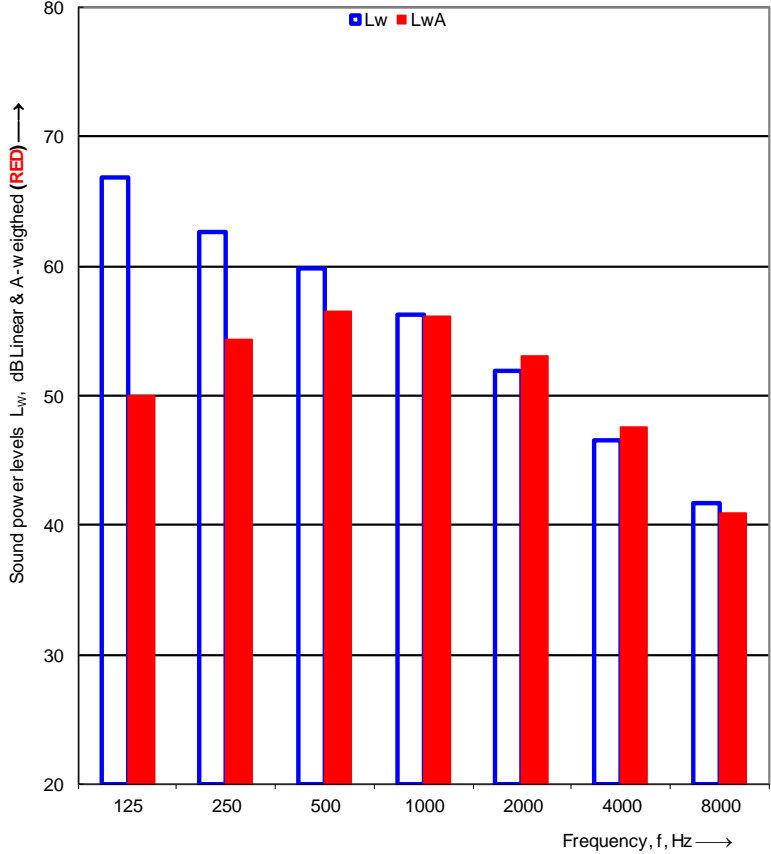
Test N°7

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:		Panasonic Marketing Europe GmbH		Date of test: 22-08-2023																																																																			
Object:		Type: Air to water heat pump Model: WH-UDZ09KE5																																																																					
Mounting conditions:		The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:		A-7/W35, Compressor speed: 82[Hz], Fan speed: 690[rpm], Heating capacity: 7.0 [kW], Power_input: 2.2 [kW], Water flow rate: 1220 [l/h], dp_water: 385 [mbar]																																																																					
Static pressure:		101.8 kPa		<u>Reference box:</u>																																																																			
Air temperature:		-7.0 °C		L1: 0.9 m																																																																			
Relative air humidity:		74.0 %		L2: 0.4 m																																																																			
Test room volume:		102.8 m³		L3: 0.8 m																																																																			
Area, S, of test room:		138.9 m²		Volume: 0.3 m³																																																																			
Room:		Room 2																																																																					
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Sound power level L_w(A):		66.5 dB [re 1pW]																																																																					
Name of test institute:		DTI		Date: 22-08-2023																																																																			
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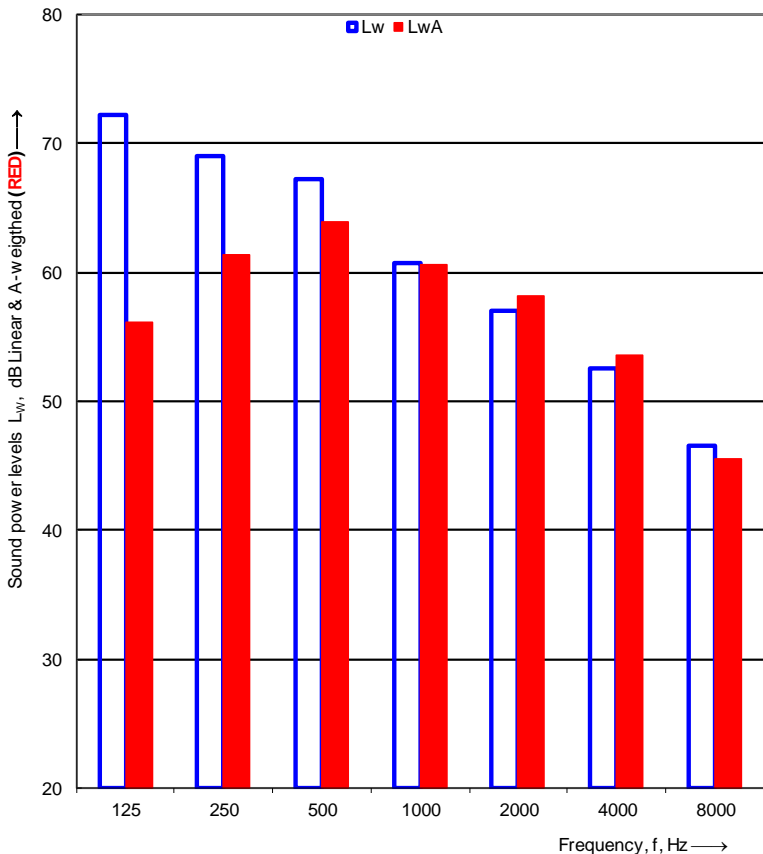


Test N° 8

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:		Panasonic Marketing Europe GmbH		Date of test: 22-08-2023																																																																			
Object:		Type: Air to water heat pump Model: WH-UDZ09KE5																																																																					
Mounting conditions:		The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:		A-7/W35, Compressor speed: 57[rpm], Fan speed: 630[rpm], Heating capacity: 4.8 [kW], Power input: 1.49 [kW], Water flow rate: 1833 [l/h], dp_water: 440 [mbar]																																																																					
Static pressure:		101.8 kPa		<u>Reference box:</u>																																																																			
Air temperature:		-7.0 °C		L1: 0.9 m																																																																			
Relative air humidity:		74.0 %		L2: 0.4 m																																																																			
Test room volume:		102.8 m³		L3: 0.8 m																																																																			
Area, S, of test room:		138.9 m²		Volume: 0.3 m³																																																																			
		Room: Room 2																																																																					
<table border="1"><thead><tr><th>Frequency f [Hz]</th><th>L_w 1/3 octave [dB]</th><th>1/1 oct [dB]</th></tr></thead><tbody><tr><td>100</td><td>64.5</td><td></td></tr><tr><td>125</td><td>61.6</td><td>66.9</td></tr><tr><td>160</td><td>57.9</td><td></td></tr><tr><td>200</td><td>57.6</td><td></td></tr><tr><td>250</td><td>58.3</td><td>62.6</td></tr><tr><td>315</td><td>57.7</td><td></td></tr><tr><td>400</td><td>55.8</td><td></td></tr><tr><td>500</td><td>55.4</td><td>59.8</td></tr><tr><td>630</td><td>53.7</td><td></td></tr><tr><td>800</td><td>53.0</td><td></td></tr><tr><td>1000</td><td>50.7</td><td>56.3</td></tr><tr><td>1250</td><td>50.2</td><td></td></tr><tr><td>1600</td><td>48.8</td><td></td></tr><tr><td>2000</td><td>46.6</td><td>51.9</td></tr><tr><td>2500</td><td>45.4</td><td></td></tr><tr><td>3150</td><td>43.6</td><td></td></tr><tr><td>4000</td><td>41.4</td><td>46.5</td></tr><tr><td>5000</td><td>39.1</td><td></td></tr><tr><td>6300</td><td>39.0</td><td></td></tr><tr><td>8000</td><td>36.0</td><td>41.6</td></tr><tr><td>10000</td><td>34.3</td><td></td></tr></tbody></table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	64.5		125	61.6	66.9	160	57.9		200	57.6		250	58.3	62.6	315	57.7		400	55.8		500	55.4	59.8	630	53.7		800	53.0		1000	50.7	56.3	1250	50.2		1600	48.8		2000	46.6	51.9	2500	45.4		3150	43.6		4000	41.4	46.5	5000	39.1		6300	39.0		8000	36.0	41.6	10000	34.3					
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		Sound power level L_w(A): 61.7 dB [re 1pW]																																																																					
Name of test institute:		DTI		Date: 22-08-2023																																																																			
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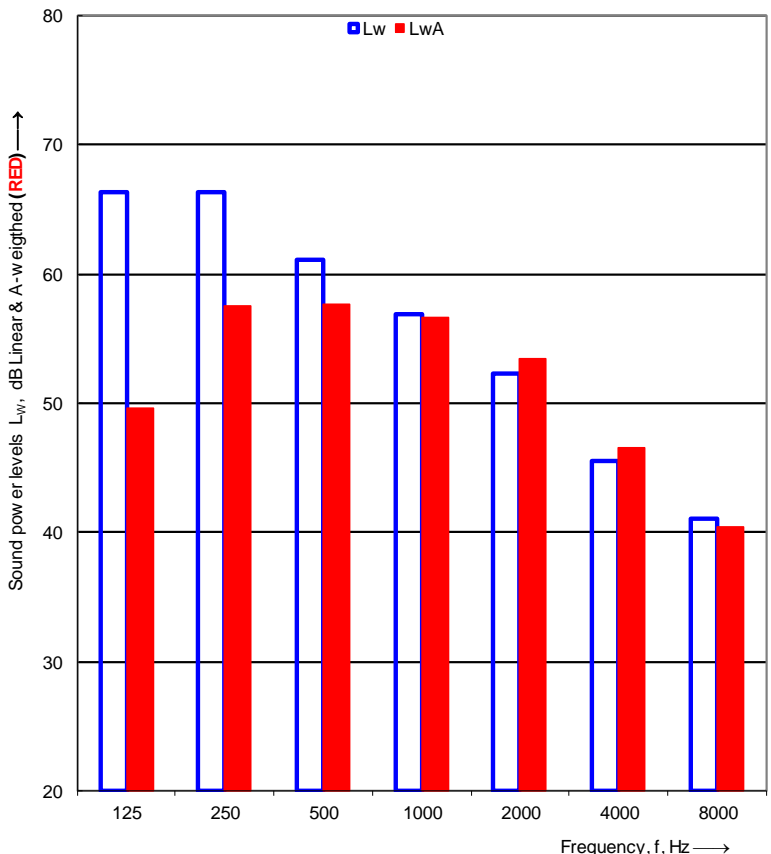


Test N° 9

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:		Panasonic Marketing Europe GmbH		Date of test: 25-08-2023																																																																			
Object:		Type: Air to water heat pump Model: WH-UDZ09KE5																																																																					
Mounting conditions:		The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:		A-7/W55, Compressor speed: 80[Hz], Fan speed: 730[rpm], Heating capacity: 6.0 [kW], Power_input: 2.9 [kW], Water flow rate: 660 [l/h], dp_water: 460 [mbar]																																																																					
Static pressure:		100.7 kPa		<u>Reference box:</u>																																																																			
Air temperature:		-7.0 °C		L1: 0.9 m																																																																			
Relative air humidity:		74.0 %		L2: 0.4 m																																																																			
Test room volume:		102.8 m³		L3: 0.8 m																																																																			
Area, S, of test room:		138.9 m²		Volume: 0.3 m³																																																																			
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No. of test report:		300-KLAB-23-011																																																																					
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Test N° 10

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:		Panasonic Marketing Europe GmbH		Date of test: 25-08-2023																																																																			
Object:		Type: Air to water heat pump Model: WH-UDZ09KE5																																																																					
Mounting conditions:		The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:		A-7/W55, Compressor speed: 56[Hz], Fan speed: 630[rpm], Heating capacity: 4.1 [kW], Power_input: 1.95 [kW], Water flow rate: 490 [l/h], dp_water: 472 [mbar]																																																																					
Static pressure:		100.7 kPa		<u>Reference box:</u>																																																																			
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Appendix 1

Unit specification

Type of unit: Mono air to water heat pump
Manufacturer: Panasonic
Size of the heat pump: 0.4 x 0.9 x 0.8m (W x L x H)
Year of production: 2023

Operating conditions and environment

The operating conditions of the unit during test fulfill the requirements for Class A.

The acoustic test chamber is a hard wall reverberant room (103 m^3) and equipped with relevant sound diffusing reflector panels. The acoustical test chamber fulfils the requirements of ISO 3743-1:2010 accuracy grade 2 (engineering grade).

The measurements of the average sound pressure levels in 1/3 octave frequency bands are carried out using three microphones in the test chamber. During the measurements, the microphones are traversed up and down for one meter in the arc of a quarter circle.





Measurement instruments

Id nr.	Manufacturer	Description	Calibration company
100864	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 1	Norsonic A/S, Norway
100865	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 1	Norsonic A/S, Norway
100866	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 1	Norsonic A/S, Norway
100867*	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 2	Norsonic A/S, Norway
100868*	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 2	Norsonic A/S, Norway
100869*	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 2	Norsonic A/S, Norway
100870	GRAS	Gras 40AE_26CA, ½" free field microphone, Roof monitor	Norsonic A/S, Norway
100873*	Brüel & Kjær	Acoustical calibrator, Brüel & Kjær 4231	Element Metech, Denmark
100859	Norsonic	Reference sound source, Norsonic Nor278 Room 1	RISE, Sweden
100872*	Norsonic	Reference sound source, Norsonic Nor278 Room 2	RISE, Sweden
100620*	Norsonic	Multi-channel measurement system Nor850	Norsonic A/S, Norway

* The instruments are used for the actual measurements for the calculation of the test results.

The other instruments are used for control measurements.
All microphones are equipped with windshields.



Test Procedure

The measurements of the emitted sound power level from the heat pump are carried out according to the following standard:

- DS/EN 14511:2022
- EN 12102-1:2022
- ISO/EN 3743-1:2010

The basic acoustic measurement standard DS/EN 3743-1 is a comparison method using a calibrated reference sound source. Two series of sound pressure measurements are made under exactly the same acoustic conditions, e.g., the same microphone positions, temperature, and air humidity. The calibrated sound power levels are known for the reference sound source at each frequency band, and they are used in the estimation of the acoustical correction factor for the calculation of the sound power emitted from the unit under test. The background noise levels are measured and used for relevant corrections.

The final total A-weighted sound power level is based on measurements and calculations in 1/3-octave levels, which then are summed into 1/1-octave levels. The A-weighted total sound power level is determined for the measured frequency range from 100 Hz to 10 kHz.

The actual microphone positions and correction values are saved in data files linked to the complete project documentation according to the DANAK-accreditation.

The complete measurement system is documented and regularly calibrated according to DANAK.

The detailed description of the measurement method is given in Danish in the quality database system "QA Web" at Danish Technological Institute, which is accessible by DANAK.





Measurement uncertainty

The uncertainty of sound power level in decibel is determined in accordance with ISO 3743-1, equation 22 $\sigma_{tot} = \sqrt{\sigma_{RO}^2 + \sigma_{omc}^2}$ where:

- σ_{RO} is the standard deviation of the reproducibility of the method
- σ_{omc} is the standard deviation describing the uncertainty associated with the instability of the operating and mounting conditions for the particular noise source during test.

σ_{RO} expresses the uncertainty in test results delivered by the different accredited test laboratories due to different instrumentation and implementation of measurement procedure as well different radiation characteristic of the noise source during test.

σ_{omc} expresses the uncertainty associated with the instability of the operating and mounting conditions for the particular noise source during test. The mounting and installation conditions in two DTI acoustical test chambers are well-defined in the test procedure. Possible instability of the operating conditions is monitored and assessed prior to each noise test.

The test uncertainty σ_{omc} is calculated according to ISO3743-1, Annex C, formula C.1 and is typically below 0.5dB or 1.0dB. However, the uncertainty is rounded up to the nearest 0.5dB or 1.0dB increment in the report. As pr. Table C.1 (accuracy grade 2), the uncertainty σ_{RO} is set to 1.5.

The expanded uncertainty U is calculated according to ISO 3743-1, equation 23:
 $U = k \sigma_{tot}$ where $k = 2$ for 95% confidence.

EXAMPLE 1: $\sigma_{tot}: \sqrt{1.5^2 + 0.5^2} = 1.6 \text{ dB}$ and $U(95\%) = 3.2 \text{ dB}$

EXAMPLE 2: $\sigma_{tot}: \sqrt{1.5^2 + 1^2} = 1.8 \text{ dB}$ and $U(95\%) = 3.6 \text{ dB}$

Note: The expanded uncertainty does not include the standard deviation of production which is used in ISO4871 for the purpose of making noise declaration for batches of machines.

