

Zen Projector Enclosures

Comparative Product Review

April, 2021



Competitive Review – Zen Indoor Projector Enclosures

April, 2021

Zen is a standalone indoor projector enclosure family, intended to muffle objectionable noise from video projectors in noise-sensitive locations such as digital cinema, conference halls, theatres and concert halls.

In response to requests from European customers for comparative noise attenuation performance data, Tempest purchased comparable enclosures from two European manufacturers, Vicom (Germany) and Audipack (Netherlands), and conducted a series of laboratory tests at an independent acoustic test house, as well as thermal and mechanical evaluation carried out at the Tempest facility in Sun Valley, California.

Both competitor enclosures were ordered specifically to house the Panasonic PT-RZ21K video projector, which is a well-accepted midrange (20,000 lumen) projector in the European market. All tests were conducted using a PT-RZ21K projector loaned for the purpose by Panasonic US, with the projector set to 100% light output. For all tests the projector was monitored remotely, and with one exception all temperature indications from the projector monitor were within safe operating limits.

Caveat Emptor! We have tried to be fair in reviewing the three products, but we encourage prospective users to conduct their own research and draw their own conclusions.

The Tempest Zen and Vicom enclosures both passed the thermal tests without difficulty, with Vicom running slightly cooler than Tempest.





However, in repeated test runs the Audipack enclosure caused the projector to overheat and shut down in less than ten minutes. While we could have disqualified it from further testing on this basis, we did continue with the review as a matter of interest.

Summary Findings:

- Audipack:** Poorly designed, poorly manufactured. Disqualified by unacceptable thermal performance.
- Vicom:** Well designed and well built, a solid and reliable touring box, but without suitable mounting, wiring or projector access for permanent installation. Good acoustic performance, best thermal performance.
- Zen:** Best acoustic performer, primarily designed for permanent installation, but with many options for rental operations. Only product with remote monitoring capability and variable fan speeds.

The following sheet is a general review of four comparable enclosures – the two Zen models are physically identical, with the same thermal and acoustic performance, but have different levels of equipment. The subsequent pages are acoustic test reports for the three enclosures, tested in anechoic and reverberant chambers.

Comparative Overview

	Audipack	Vicom	Zen	Zen +
				
For Projector Type (Panasonic)	PT-RZ21K	PT-RZ21K	PT-RZ21K	PT-RZ21K
Construction	Wood	Wood	Aluminum	Aluminum
Finish	Laminate	Spray Paint	Powder Coat	Powder Coat
Fire resistant Insulation	✗	✓	✓	✓
Acoustic Insulation Thickness	25mm	25mm	50-75mm	50-75mm
Build Quality	Poor	Good	Good	Good
Appearance	Poor	Good	Very Good	Very Good
Weight (Kg/lb)	57/126	100/220	70/154	70/154
Price	€€	€€	€€€	€€€
Rigging Hardware	✗	✗	✓	✓
Projector Service Access	✗	✗	✓	✓
Thermal performance	Fail ¹	Good	Good	Good
Acoustic performance	Fail ¹	Good	Very Good	Very Good
Fan Speed Control	1-speed	1-speed	4-speed	Variable Speed
Fan Control	Thermostat ²	Thermostat	Thermostat	DEC 4 Controller
Overtemp protection	✗	✗	✗	✓
Inlet Temp Monitor	✗	✗	✗	✓
User Interface Display	✗	✗	✗	✓
Remote monitoring Option	✗	✗	✗	✓
Inlet Air Filter	✗	✗	✓	✓
Installation wiring access	✗	✗	✓	✓
Top or Rear wiring ports	✗	✗	✓	✓
Port Glass	Glass	Plastic	Optical Glass	Optical Glass
Security Locks	✓	✗	✓	✓
Projector pan/tilt/roll Adjustment	✗	✗	✓	✓
Projector position lock	✗	✗	✓	✓
Projector Mount - Vibration Dampers	✗	✗	✓	✓
Portrait Versions Available	?	?	✓	✓
UST Versions Available ³	✗	✗	✓	✓
Documentation	✗	✗	✓	✓
Acoustic Test Data	✗	✗	✓	✓
Approvals: UL	✗	✗	✓	✓
Approvals: CE	✗	✓	✓	✓
Free Shipping in Europe ⁴	✗	✗	✓	✓

Notes

1 - The Audipack unit tested failed after seven minutes - projector over-temperature (with thermostat set below room temperature)

2 - For some reason the Audipack thermostat was located in the air INLET and therefore did nothing at all

3 - UST versions - depends on lens type - contact Tempest

4 - Tempest Euro DAP pricing includes shipping



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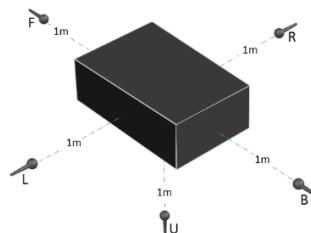
Date: 08-Apr-21

- Description:**
1. Enclosure/Projector installed on an isolated table and placed in the center of the chamber.
 2. Microphones were placed horizontally in all four (4) cardinal directions and below at a distance of 1 m from the enclosure/projector.
 3. Microphone heights were aligned with the center of the enclosure/projector.
 4. Positions reference the orientation from the test unit (i.e. "right" is the right side of the projector when facing forward, etc.)
 5. The projector used was a Panasonic RZ21K WUXGA projector, at 100% light output.
 6. All equipment and operational modes of the equipment were as communicated by the Client

AUDIPACK - ANECHOIC CHAMBER											
Frequency	Ambient	Projector (Panasonic PT-RZ21K)					Projector in Audipack Enclosure				
		SOUND PRESSURE LEVEL (dB)					SOUND PRESSURE LEVEL (dB)				
		R	F	L	B	U	R	F	L	B	U
20	19.4	20.5	24.0	25.5	33.5	25.2	26.4	26.9	27.6	23.9	30.9
25	17.8	30.1	25.4	33.2	30.3	25.6	31.5	29.1	37.2	27.3	36.4
31.5	13.6	23.7	20.0	27.0	26.5	22.8	30.9	26.5	30.1	22.1	31.3
40	17.3	23.2	22.1	23.5	25.1	25.3	33.5	29.7	25.7	26.5	34.2
50	12.2	22.0	21.9	22.7	25.1	23.5	31.4	30.1	29.0	28.5	31.9
63	16.3	28.3	24.8	25.0	26.0	27.8	31.2	29.1	28.0	27.1	31.8
80	15.0	21.7	24.2	25.3	26.6	26.1	30.9	29.0	28.1	25.9	30.7
100	7.3	26.1	29.0	29.0	30.0	32.1	30.3	32.4	33.6	36.3	33.5
125	8.0	28.4	32.7	31.8	33.4	36.2	33.8	44.1	46.3	50.9	43.0
160	1.6	31.4	33.4	34.1	36.2	39.3	36.6	34.0	35.8	45.0	38.8
200	-1.5	35.9	34.8	39.2	38.7	44.3	31.1	28.0	28.0	32.8	35.3
250	-1.2	36.3	35.4	40.4	40.1	46.3	24.5	24.4	23.8	24.3	35.6
315	-1.7	32.5	36.0	39.5	35.6	40.5	16.2	16.5	13.6	15.2	25.2
400	-1.1	29.8	35.7	38.5	36.9	38.7	12.7	12.3	12.0	14.3	25.2
500	-0.4	33.4	36.9	38.9	37.8	41.8	11.4	14.0	13.3	14.9	24.1
630	-0.1	33.0	36.5	37.7	36.3	42.2	11.6	13.3	14.2	14.2	20.2
800	0.6	30.6	35.0	38.5	35.7	39.3	10.3	9.8	10.2	9.9	15.4
1000	1.3	32.7	34.0	38.9	36.5	37.3	9.1	6.9	5.5	6.0	13.8
1250	1.9	28.6	32.0	37.9	35.4	37.0	6.0	5.3	3.7	4.5	13.2
1600	3.9	27.7	31.9	35.0	33.1	32.7	4.1	3.2	5.2	6.7	6.9
2000	3.4	25.5	28.1	33.0	31.2	30.0	4.5	3.7	4.7	4.3	6.7
2500	4.3	27.0	29.3	33.7	34.3	36.9	5.1	4.2	4.5	4.8	6.5
3150	5.2	23.0	28.4	31.5	31.2	32.5	6.1	4.9	5.4	5.7	6.1
4000	6.2	15.0	23.0	25.7	25.4	22.0	7.0	5.7	6.3	6.8	6.8
5000	7.0	12.1	18.4	21.9	23.5	18.5	7.8	6.5	7.2	7.6	7.7
6300	7.6	10.7	14.7	21.4	19.9	15.9	8.4	7.0	7.8	8.2	8.2
8000	7.9	9.8	11.5	17.9	16.4	13.2	8.8	7.2	8.2	8.5	8.5
10000	8.0	9.8	9.8	15.8	16.9	12.4	8.9	7.3	8.3	8.6	8.6
12500	8.0	9.4	11.1	12.8	15.1	9.9	9.0	7.4	8.4	8.6	8.6
16000	8.1	9.7	9.5	13.3	17.6	10.0	9.1	7.4	8.4	8.7	8.7
20000	8.7	12.2	12.9	24.1	25.1	12.9	9.3	7.5	8.6	8.9	8.9
dBA	17.0	39.9	43.1	46.7	45.1	42.0	27.30	29.41	31.11	36.24	33.34
dBA (Avg)	17.0	44.01					32.53				

Microphone Locations

- R 1m right of unit under test
- F 1m in front of unit under test
- L 1m left of unit under test
- B 1m behind unit under test
- U 1m below unit under test



**TEST ABANDONED AFTER 7 MINUTES
DUE TO PROJECTOR SHUT-DOWN FOR
OVER-TEMPERATURE CONDITION**



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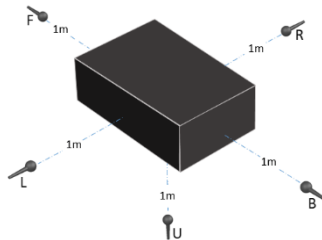
Date: 09-Apr-21

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1. Enclosure/Projector installed on an isolated table and placed in the center of the chamber.
 2. Microphones were placed horizontally in all four (4) cardinal directions and below at a distance of 1 m from the enclosure/projector.
 3. Microphone heights were aligned with the center of the enclosure/projector.
 4. Positions reference the orientation from the test unit (i.e. "right" is the right side of the projector when facing forward, etc.)
 5. The projector used was a Panasonic RZ21K WUXGA projector, at 100% light output.
 6. All equipment and operational modes of the equipment were as communicated by the Client

AUDIACK - REVERBERANT CHAMBER											
Frequency	Ambient	Projector (Panasonic PT-RZ21K)					Projector in Audipack Enclosure				
		SOUND PRESSURE LEVEL (dB)					SOUND PRESSURE LEVEL (dB)				
		R	F	L	B	U	R	F	L	B	U
20	27.8	24.6	34.9	37.2	41.9	31.1	27.3	37.0	34.9	40.3	30.4
25	24.8	29.5	29.9	31.9	33.6	33.3	36.1	36.5	37.6	36.8	39.1
31.5	22.6	33.1	32.3	35.8	34.5	29.5	35.8	36.3	38.2	35.0	33.0
40	24.4	35.2	33.7	35.6	30.3	34.4	45.4	38.1	40.4	32.6	44.0
50	25.9	36.7	35.4	33.9	29.5	37.6	42.3	39.2	40.8	30.1	42.8
63	23.5	28.2	31.2	31.8	34.0	32.0	28.8	36.3	32.9	35.5	39.2
80	16.4	30.9	33.6	26.5	32.0	32.1	41.9	41.1	32.3	40.2	44.7
100	16.2	34.2	37.6	35.7	37.2	35.5	37.0	37.9	37.8	37.3	39.3
125	14.7	40.2	37.8	39.8	38.2	38.0	39.7	36.3	39.4	35.8	37.4
160	14.8	41.7	44.2	41.8	43.6	42.1	39.0	39.0	40.0	38.1	36.3
200	9.1	48.3	50.3	49.8	49.8	46.0	39.1	40.3	40.7	38.0	39.6
250	13.6	49.1	48.9	49.7	48.9	44.2	40.4	41.4	39.6	39.6	39.5
315	10.0	46.8	47.9	48.2	47.2	40.8	32.7	33.9	32.5	32.6	29.3
400	9.7	45.5	45.4	46.1	45.2	44.3	33.4	34.1	32.5	31.5	33.3
500	8.9	45.9	47.0	46.4	47.5	44.3	30.7	31.9	32.7	30.5	30.8
630	7.7	44.2	44.8	45.1	45.2	41.9	28.9	26.3	26.9	29.9	24.1
800	6.9	44.7	46.0	45.6	45.8	43.1	24.6	25.1	25.4	24.8	22.1
1000	4.9	43.6	43.8	45.1	44.0	40.1	21.8	23.8	22.6	22.6	19.6
1250	3.7	42.7	43.3	44.7	43.1	39.8	21.0	20.0	20.1	20.1	17.8
1600	4.8	40.3	41.2	41.7	41.2	36.8	16.3	16.3	16.8	16.4	12.8
2000	4.4	40.0	41.0	42.3	40.9	35.0	15.2	15.4	16.2	15.2	12.6
2500	4.8	40.9	37.9	42.0	42.3	39.6	12.0	11.7	12.2	11.8	11.7
3150	5.6	36.6	35.5	38.4	38.3	35.2	10.6	9.7	10.4	9.9	10.3
4000	6.5	29.4	30.4	32.7	31.4	25.7	8.6	7.6	8.4	8.4	8.3
5000	7.6	24.3	25.2	28.5	27.7	20.3	9.2	8.1	9.0	9.0	8.7
6300	8.2	21.0	21.8	26.7	25.2	17.6	9.7	8.5	9.6	9.5	9.2
8000	9.2	16.6	17.1	22.9	20.7	16.7	11.1	10.1	10.8	10.9	10.7
10000	9.2	14.3	14.4	20.2	20.1	15.1	10.8	10.0	10.9	10.6	10.7
12500	9.1	11.8	13.4	16.5	17.7	12.2	10.3	9.1	10.1	9.9	9.9
16000	11.1	12.4	12.9	15.3	18.7	12.2	11.2	10.2	11.4	10.8	10.9
20000	10.4	16.1	16.5	24.6	27.5	13.9	10.7	9.3	15.6	9.7	9.9
dBA	19.2	52.9	53.4	54.2	53.8	50.3	37.9	38.4	38.0	37.3	36.9
dBA (Avg)	19.2	53.1					37.7				

Microphone Locations

- R 1m right of unit under test
- F 1m in front of unit under test
- L 1m left of unit under test
- B 1m behind unit under test
- U 1m below unit under test



**TEST ABANDONED AFTER 8 MINUTES
DUE TO PROJECTOR SHUT-DOWN FOR
OVER-TEMPERATURE CONDITION**



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Description:

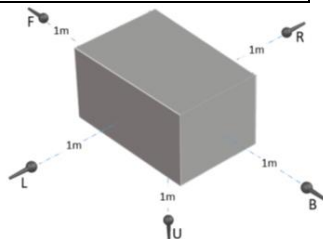
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4. Positions reference the orientation from the test unit (i.e. "right" is the right side of the projector when facing forward, etc.)
5. The projector used was a Panasonic RZ21K WUXGA projector, at 100% light output.
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VICOM - ANECHOIC CHAMBER											
Frequency	Ambient	Projector (Panasonic PT-RZ21K)					Projector in Vicom Enclosure				
		SOUND PRESSURE LEVEL (dB)					SOUND PRESSURE LEVEL (dB)				
		R	F	L	B	U	R	F	L	B	U
20	19.4	20.5	24.0	25.5	33.5	25.2	25.0	25.5	26.1	22.6	29.2
25	17.8	30.1	25.4	33.2	30.3	25.6	29.8	27.5	35.2	25.8	34.5
31.5	13.6	23.7	20.0	27.0	26.5	22.8	29.3	25.1	28.5	20.9	29.6
40	17.3	23.2	22.1	23.5	25.1	25.3	31.7	28.1	24.3	25.1	32.4
50	12.2	22.0	21.9	22.7	25.1	23.5	29.7	28.5	27.4	27.0	30.2
63	16.3	28.3	24.8	25.0	26.0	27.8	29.5	27.5	26.5	25.6	30.1
80	15.0	21.7	24.2	25.3	26.6	26.1	29.2	27.4	26.6	24.5	29.1
100	7.3	26.1	29.0	29.0	30.0	32.1	28.7	30.6	31.7	34.3	31.7
125	8.0	28.4	32.7	31.8	33.4	36.2	32.0	41.7	43.8	48.1	40.7
160	1.6	31.4	33.4	34.1	36.2	39.3	34.6	32.1	33.9	42.5	36.7
200	-1.5	35.9	34.8	39.2	38.7	44.3	29.4	26.4	26.5	31.0	33.4
250	-1.2	36.3	35.4	40.4	40.1	46.3	23.2	23.1	22.5	23.0	33.7
315	-1.7	32.5	36.0	39.5	35.6	40.5	15.4	15.6	12.8	14.4	23.8
400	-1.1	29.8	35.7	38.5	36.9	38.7	12.0	11.7	11.4	13.5	23.9
500	-0.4	33.4	36.9	38.9	37.8	41.8	10.7	13.2	12.6	14.1	22.8
630	-0.1	33.0	36.5	37.7	36.3	42.2	11.0	12.6	13.4	13.5	19.1
800	0.6	30.6	35.0	38.5	35.7	39.3	9.7	9.3	9.7	9.4	14.6
1000	1.3	32.7	34.0	38.9	36.5	37.3	8.6	6.5	5.2	5.7	13.1
1250	1.9	28.6	32.0	37.9	35.4	37.0	5.7	5.0	3.5	4.2	12.5
1600	3.9	27.7	31.9	35.0	33.1	32.7	3.9	3.0	5.0	6.3	6.6
2000	3.4	25.5	28.1	33.0	31.2	30.0	4.3	3.5	4.5	4.1	6.4
2500	4.3	27.0	29.3	33.7	34.3	36.9	4.8	4.0	4.3	4.5	6.2
3150	5.2	23.0	28.4	31.5	31.2	32.5	5.8	4.6	5.1	5.4	5.8
4000	6.2	15.0	23.0	25.7	25.4	22.0	6.6	5.4	6.0	6.4	6.4
5000	7.0	12.1	18.4	21.9	23.5	18.5	7.4	6.2	6.8	7.2	7.2
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20000	8.7	12.2	12.9	24.1	25.1	12.9	8.8	7.1	8.2	8.4	8.4
dBA	17.0	39.9	43.1	46.7	45.1	42.0	25.83	27.82	29.43	34.28	25.99
dBA (Avg)	17.0	44.01					29.95				

Microphone Locations

- R
- F
- L
- B
- U

1m right of unit under test
 1m in front of unit under test
 1m left of unit under test
 1m behind unit under test
 1m below unit under test





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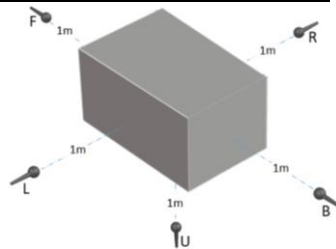
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31.5	22.6	33.1	32.3	35.8	34.5	29.5	33.7	34.2	35.9	32.9	31.1
40	24.4	35.2	33.7	35.6	30.3	34.4	42.7	35.9	38.0	30.7	41.4
50	25.9	36.7	35.4	33.9	29.5	37.6	39.8	36.9	38.4	28.3	40.3
63	23.5	28.2	31.2	31.8	34.0	32.0	27.0	34.2	31.0	33.4	36.9
80	16.4	30.9	33.6	26.5	32.0	32.1	39.4	38.6	30.4	37.9	42.0
100	16.2	34.2	37.6	35.7	37.2	35.5	34.8	35.7	35.6	35.1	37.0
125	14.7	40.2	37.8	39.8	38.2	38.0	37.3	34.2	37.0	33.7	35.2
160	14.8	41.7	44.2	41.8	43.6	42.1	36.7	36.7	37.6	35.8	34.1
200	9.1	48.3	50.3	49.8	49.8	46.0	36.7	37.9	38.3	35.7	37.3
250	13.6	49.1	48.9	49.7	48.9	44.2	38.0	38.9	37.3	37.2	37.2
315	10.0	46.8	47.9	48.2	47.2	40.8	30.7	31.9	30.6	30.6	27.6
400	9.7	45.5	45.4	46.1	45.2	44.3	31.4	32.0	30.6	29.7	31.3
500	8.9	45.9	47.0	46.4	47.5	44.3	28.9	30.0	30.8	28.7	29.0
630	7.7	44.2	44.8	45.1	45.2	41.9	27.2	24.7	25.3	28.1	22.7
800	6.9	44.7	46.0	45.6	45.8	43.1	23.1	23.6	23.9	23.4	20.8
1000	4.9	43.6	43.8	45.1	44.0	40.1	20.5	22.4	21.3	21.3	18.4
1250	3.7	42.7	43.3	44.7	43.1	39.8	19.7	18.8	18.9	18.9	16.7
1600	4.8	40.3	41.2	41.7	41.2	36.8	15.3	15.3	15.8	15.4	12.0
2000	4.4	40.0	41.0	42.3	40.9	35.0	14.3	14.5	15.2	14.3	11.9
2500	4.8	40.9	37.9	42.0	42.3	39.6	11.3	11.0	11.5	11.1	11.0
3150	5.6	36.6	35.5	38.4	38.3	35.2	9.9	9.2	9.8	9.4	9.7
4000	6.5	29.4	30.4	32.7	31.4	25.7	8.1	7.2	7.9	7.9	7.8
5000	7.6	24.3	25.2	28.5	27.7	20.3	8.6	7.6	8.4	8.5	8.2
6300	8.2	21.0	21.8	26.7	25.2	17.6	9.1	8.0	9.0	8.9	8.6
8000	9.2	16.6	17.1	22.9	20.7	16.7	10.4	9.5	10.1	10.3	10.1
10000	9.2	14.3	14.4	20.2	20.1	15.1	10.2	9.5	10.3	10.0	10.1
12500	9.1	11.8	13.4	16.5	17.7	12.2	9.7	8.5	9.5	9.3	9.4
16000	11.1	12.4	12.9	15.3	18.7	12.2	10.5	9.6	10.7	10.1	10.2
20000	10.4	16.1	16.5	24.6	27.5	13.9	10.1	8.7	14.7	9.1	9.3
dBA	19.2	52.9	53.4	54.2	53.8	50.3	35.6	36.1	35.7	35.1	34.7
dBA (Avg)	19.2	53.1					35.5				

Microphone Locations

- R 1m right of unit under test
- F 1m in front of unit under test
- L 1m left of unit under test
- B 1m behind unit under test
- U 1m below unit under test





WESTERN ELECTRO - ACOUSTIC LABORATORY

A division of Veneklasen Associates, Inc.

T E S T I N G • C A L I B R A T I O N • R E S E A R C H

25132 Rye Canyon Loop Santa Clarita, California 91355 Tel: (661) 775-3741 Fax: (661) 775-3742 www.weal.com

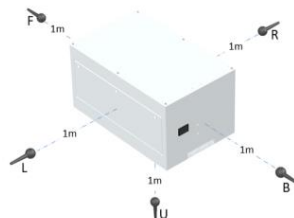
Date: 08-Apr-21

- Description:**
1. Enclosure/Projector installed on an isolated table and placed in the center of the chamber.
 2. Microphones were placed horizontally in all four (4) cardinal directions and below at 1 m from the enclosure/projector.
 3. Microphone heights were aligned with the center of the enclosure/projector.
 4. Positions reference the orientation from the test unit (i.e. "right" is the right side of the projector when facing forward, etc.)
 5. The projector used was a Panasonic RZ21K WUXGA projector, at 100% light output.
 6. All equipment and operational modes of the equipment were as communicated by the Client

ZEN - ANECHOIC CHAMBER											
Frequency	Ambient	Projector (Panasonic PT-RZ21K)					Projector in Tempest Zen 210.L Enclosure				
		SOUND PRESSURE LEVEL (dB)					SOUND PRESSURE LEVEL (dB)				
		R	F	L	B	U	R	F	L	B	U
20	19.4	20.5	24.0	25.5	33.5	25.2	19.82	22.42	25.61	22.95	29.62
25	17.8	30.1	25.4	33.2	30.3	25.6	26.23	29.75	36.51	37.82	40.43
31.5	13.6	23.7	20.0	27.0	26.5	22.8	25.23	19.97	26.76	24.81	30.07
40	17.3	23.2	22.1	23.5	25.1	25.3	27.8	26.53	28.92	24.5	28.32
50	12.2	22.0	21.9	22.7	25.1	23.5	26.29	25.64	26.66	25.21	27.9
63	16.3	28.3	24.8	25.0	26.0	27.8	30.08	27.4	28.49	29.24	32.5
80	15.0	21.7	24.2	25.3	26.6	26.1	25.64	25.04	24.97	26.25	29.66
100	7.3	26.1	29.0	29.0	30.0	32.1	25.25	25.94	21.96	26.93	29.43
125	8.0	28.4	32.7	31.8	33.4	36.2	27.39	26.82	26.48	27.34	29.37
160	1.6	31.4	33.4	34.1	36.2	39.3	30.04	28.69	30.49	26.61	28.44
200	-1.5	35.9	34.8	39.2	38.7	44.3	30.42	25.64	33.8	26.84	30.27
250	-1.2	36.3	35.4	40.4	40.1	46.3	26.34	25.98	27.35	23.95	25.61
315	-1.7	32.5	36.0	39.5	35.6	40.5	22	22.88	25.81	19.58	20.11
400	-1.1	29.8	35.7	38.5	36.9	38.7	19.93	20.71	21.57	17.78	18.61
500	-0.4	33.4	36.9	38.9	37.8	41.8	25.85	19.32	20.15	16.92	23.99
630	-0.1	33.0	36.5	37.7	36.3	42.2	16.83	14.44	18.11	13.27	17.39
800	0.6	30.6	35.0	38.5	35.7	39.3	11.01	8.54	14.52	10.42	12.15
1000	1.3	32.7	34.0	38.9	36.5	37.3	11.61	5.37	13.34	9.38	9.68
1250	1.9	28.6	32.0	37.9	35.4	37.0	8.5	4	10.31	6.67	8.06
1600	3.9	27.7	31.9	35.0	33.1	32.7	6.44	3.86	7.96	6.44	5.62
2000	3.4	25.5	28.1	33.0	31.2	30.0	5.24	3.36	5.52	5.97	4.77
2500	4.3	27.0	29.3	33.7	34.3	36.9	5.72	4.06	5.35	6.3	5.3
3150	5.2	23.0	28.4	31.5	31.2	32.5	6.11	4.99	5.86	5.95	5.72
4000	6.2	15.0	23.0	25.7	25.4	22.0	6.84	5.54	6.44	6.55	6.65
5000	7.0	12.1	18.4	21.9	23.5	18.5	7.53	6.31	7.02	7.27	7.34
6300	7.6	10.7	14.7	21.4	19.9	15.9	8.22	6.9	7.49	7.78	7.87
8000	7.9	9.8	11.5	17.9	16.4	13.2	8.38	7.03	7.77	8.08	8.13
10000	8.0	9.8	9.8	15.8	16.9	12.4	8.52	7.21	7.91	8.18	8.22
12500	8.0	9.4	11.1	12.8	15.1	9.9	8.52	7.23	7.95	8.15	8.21
16000	8.1	9.7	9.5	13.3	17.6	10.0	8.62	7.13	8.03	8.2	8.22
20000	8.7	12.2	12.9	24.1	25.1	12.9	8.88	7.17	8.24	8.41	8.4
dBA	17.0	39.9	43.1	46.7	45.1	42.0	27.69	25.18	28.26	24.34	22.40
dBA (Avg)	17.0	44.01					26.09				

Microphone Locations

- R 1m right of unit under test
- F 1m in front of unit under test
- L 1m left of unit under test
- B 1m behind unit under test
- U 1m below unit under test





WESTERN ELECTRO - ACOUSTIC LABORATORY

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TESTING • CALIBRATION • RESEARCH

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Date: 09-Apr-21

- Description:**
1. Enclosure/Projector installed on an isolated table and placed in the center of the chamber.
 2. Microphones were placed horizontally in all four (4) cardinal directions and below at a distance of 1 m from the enclosure/projector.
 3. Microphone heights were aligned with the center of the enclosure/projector.
 4. Positions reference the orientation from the test unit (i.e. "right" is the right side of the projector when facing forward, etc.)
 5. The projector used was a Panasonic RZ21K WUXGA projector, at 100% light output.
 6. All equipment and operational modes of the equipment were as communicated by the Client

ZEN - REVERBERANT CHAMBER											
Frequency	Ambient	Projector (Panasonic PT-RZ21K)					Projector in Tempest Zen 210.L Enclosure				
		SOUND PRESSURE LEVEL (dB)					SOUND PRESSURE LEVEL (dB)				
		R	F	L	B	U	R	F	L	B	U
20	27.8	24.6	34.9	37.2	41.9	31.1	30.2	37.3	37.0	40.6	33.7
25	24.8	29.5	29.9	31.9	33.6	33.3	39.3	42.0	42.3	40.3	44.2
31.5	22.6	33.1	32.3	35.8	34.5	29.5	37.2	38.9	38.0	39.9	34.0
40	24.4	35.2	33.7	35.6	30.3	34.4	41.5	38.8	39.1	35.7	42.6
50	25.9	36.7	35.4	33.9	29.5	37.6	36.4	34.8	33.4	29.1	39.1
63	23.5	28.2	31.2	31.8	34.0	32.0	28.7	34.2	32.7	36.6	40.8
80	16.4	30.9	33.6	26.5	32.0	32.1	33.2	32.4	27.1	33.8	39.5
100	16.2	34.2	37.6	35.7	37.2	35.5	31.2	32.8	30.7	33.7	34.6
125	14.7	40.2	37.8	39.8	38.2	38.0	38.6	34.0	36.5	33.2	38.3
160	14.8	41.7	44.2	41.8	43.6	42.1	38.8	36.4	35.2	35.5	34.6
200	9.1	48.3	50.3	49.8	49.8	46.0	39.0	39.1	38.3	37.0	33.7
250	13.6	49.1	48.9	49.7	48.9	44.2	34.5	34.0	34.8	33.5	30.2
315	10.0	46.8	47.9	48.2	47.2	40.8	30.9	31.0	31.1	30.8	27.3
400	9.7	45.5	45.4	46.1	45.2	44.3	30.9	31.0	31.2	30.3	27.1
500	8.9	45.9	47.0	46.4	47.5	44.3	34.3	33.9	33.6	31.2	30.1
630	7.7	44.2	44.8	45.1	45.2	41.9	27.7	28.3	28.3	27.1	25.3
800	6.9	44.7	46.0	45.6	45.8	43.1	22.9	22.9	23.3	22.9	20.5
1000	4.9	43.6	43.8	45.1	44.0	40.1	21.9	21.1	21.5	21.8	20.0
1250	3.7	42.7	43.3	44.7	43.1	39.8	18.7	18.6	18.8	18.7	16.3
1600	4.8	40.3	41.2	41.7	41.2	36.8	16.6	15.7	16.2	16.1	12.8
2000	4.4	40.0	41.0	42.3	40.9	35.0	12.9	12.4	12.8	13.0	9.5
2500	4.8	40.9	37.9	42.0	42.3	39.6	10.7	10.3	10.6	11.5	10.5
3150	5.6	36.6	35.5	38.4	38.3	35.2	8.9	8.5	8.9	9.3	8.9
4000	6.5	29.4	30.4	32.7	31.4	25.7	8.8	7.9	8.7	8.7	8.7
5000	7.6	24.3	25.2	28.5	27.7	20.3	9.0	8.0	8.9	9.0	9.1
6300	8.2	21.0	21.8	26.7	25.2	17.6	9.3	8.0	8.7	9.0	9.1
8000	9.2	16.6	17.1	22.9	20.7	16.7	10.2	9.2	9.8	10.1	10.1
10000	9.2	14.3	14.4	20.2	20.1	15.1	10.1	9.3	9.8	10.1	10.2
12500	9.1	11.8	13.4	16.5	17.7	12.2	9.5	8.7	9.1	9.3	9.5
16000	11.1	12.4	12.9	15.3	18.7	12.2	10.1	9.1	9.5	9.7	10.1
20000	10.4	16.1	16.5	24.6	27.5	13.9	10.1	8.5	11.2	9.3	9.3
dBA	19.2	52.9	53.4	54.2	53.8	50.3	36.5	36.2	36.1	34.9	33.2
dBA (Avg)	19.2	53.1					35.6				

Microphone Locations

- R 1m right of unit under test
- F 1m in front of unit under test
- L 1m left of unit under test
- B 1m behind unit under test
- U 1m below unit under test

