

Test Report

SPONSOR: **Kirei**
San Diego, CA

Sound Absorption
RAL™-A21-424

CONDUCTED: 2021-07-21

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ON: Echo Star+ with 12mm EchoPanel Material (single continuous cloud)

TEST METHODOLOGY

Riverbank Acoustical Laboratories™ is accredited by the U.S. Department of Commerce, National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP) as an ISO 17025:2017 Laboratory (NVLAP Lab Code: 100227-0) and for this test procedure. The test reported in this document conformed explicitly with ASTM C423-17: "Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method." The specimen mounting was performed according to ASTM E795-16: "Standard Practices for Mounting Test Specimens During Sound Absorption Tests." A description of the measurement procedure and room specifications are available upon request. The results presented in this report apply to the sample as received from the test sponsor.

INFORMATION PROVIDED BY SPONSOR

The test specimen was designated by the sponsor as Echo Star+ with 12mm EchoPanel Material (single continuous cloud). The following nominal product information was provided by the sponsor prior to testing. The accuracy of such sponsor-provided information can affect the validity of the test results.

Product Under Test

Trade Name: EchoStar+
Material: EchoPanel
Manufacturer: Kirei

SPECIMEN MEASUREMENTS & TEST CONDITIONS

Through a full external visual inspection performed on the test specimen, Riverbank personnel verified the following information:

Test Specimen

Materials: Folded semirigid felt paneling held in coated steel brackets
Dimensions: Hexagonal silhouette, side length @ 455 mm (17.913 in.)
Quantity: 8
Geometry: Edges and center at minimum depth
Maximum depth at three (3) points corresponding to centroids of equally-sized constituent parallelograms
Thickness: Panel wall @ 12 mm (0.079 in.)
Projected depth @ 135 mm (5.3125 in.)
Overall Weight: 35.95 kg (79.25 lbs)

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Physical Measurements (per object)

Dimensions: 0.8 m (31.5 in) wide by 0.91 m (36.0 in) long
Thickness: 0.13 m (5.312 in)
Weight: 4.49 kg (9.9 lbs)

Test Environment

Room Volume: 291.98 m³
Temperature: 21.9 °C ± 0.1 °C (Requirement: ≥ 10 °C and ≤ 5 °C change)
Relative Humidity: 64.25 % ± 1.7 % (Requirement: ≥ 40 % and ≤ 5 % change)
Barometric Pressure: 99.4 kPa (Requirement not defined)

The total absorptive area (all exposed surfaces) of all sound-absorbing objects was 10.53 m² (113.33 ft²).
The array of objects covered 7.17 m² (77.19 ft²) of the horizontal test surface (total treated area).

MOUNTING METHOD

Type J Mounting: The specimen is an array of 8 spaced sound absorbing objects suspended atop an array of cables such that the closest face is located approximately 1.52 m (60.0 in.) from the horizontal test surface. This approximates the mounting method of a typical ceiling baffle installation. The objects were butted together at their edges to create a single cloud fixture, symmetrical along a centerline approximately parallel to the cables.

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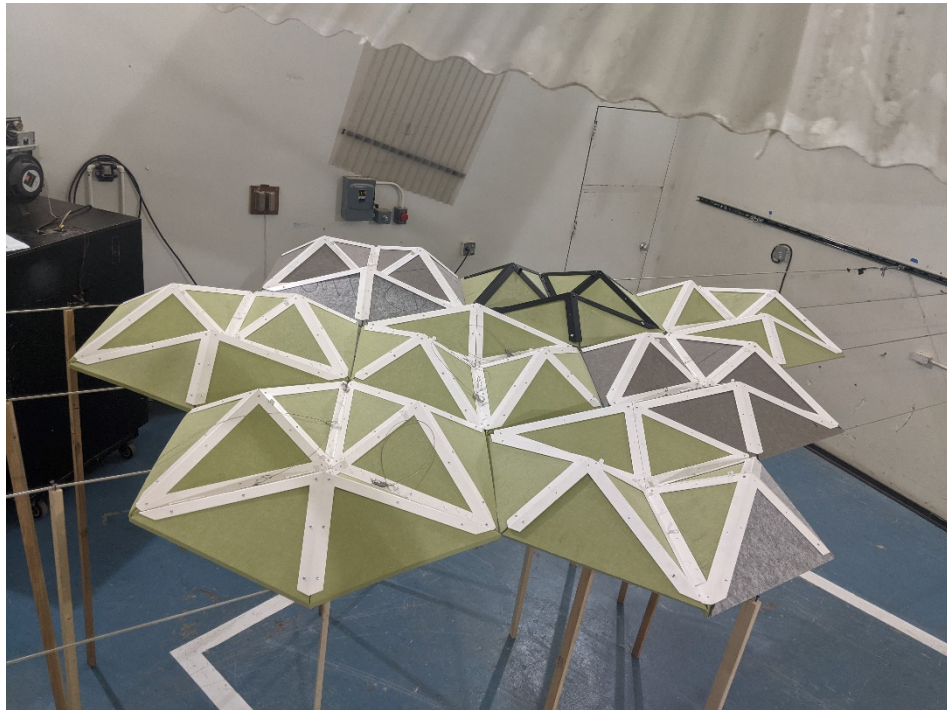


Figure 1 – Specimen mounted in test chamber



Figure 2 – Underside of installed specimen

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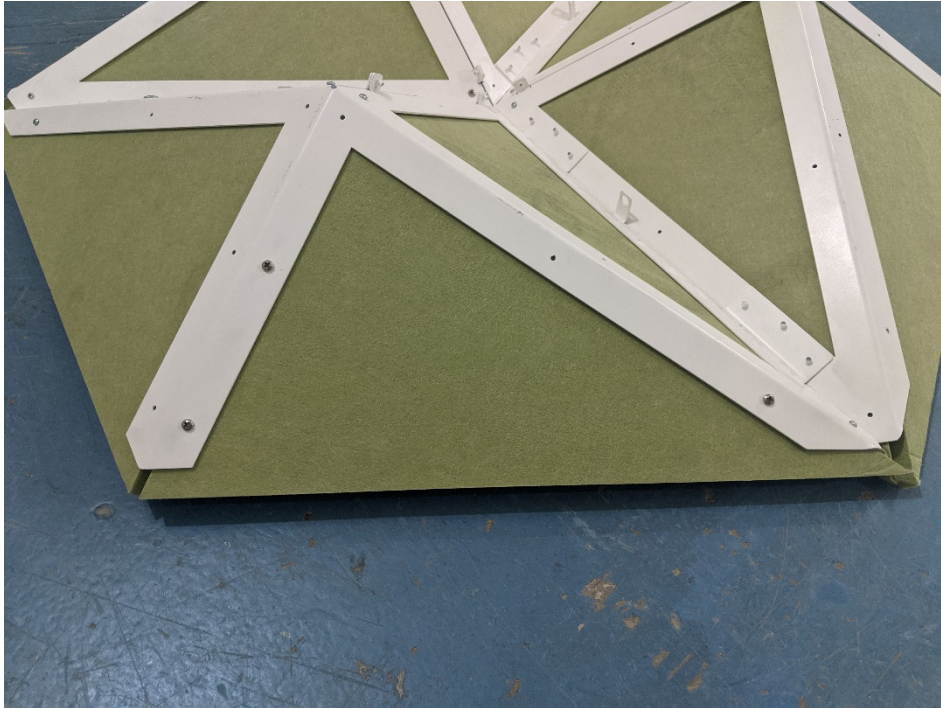


Figure 3 – Individual specimen panel, detail of brackets and felt panel material

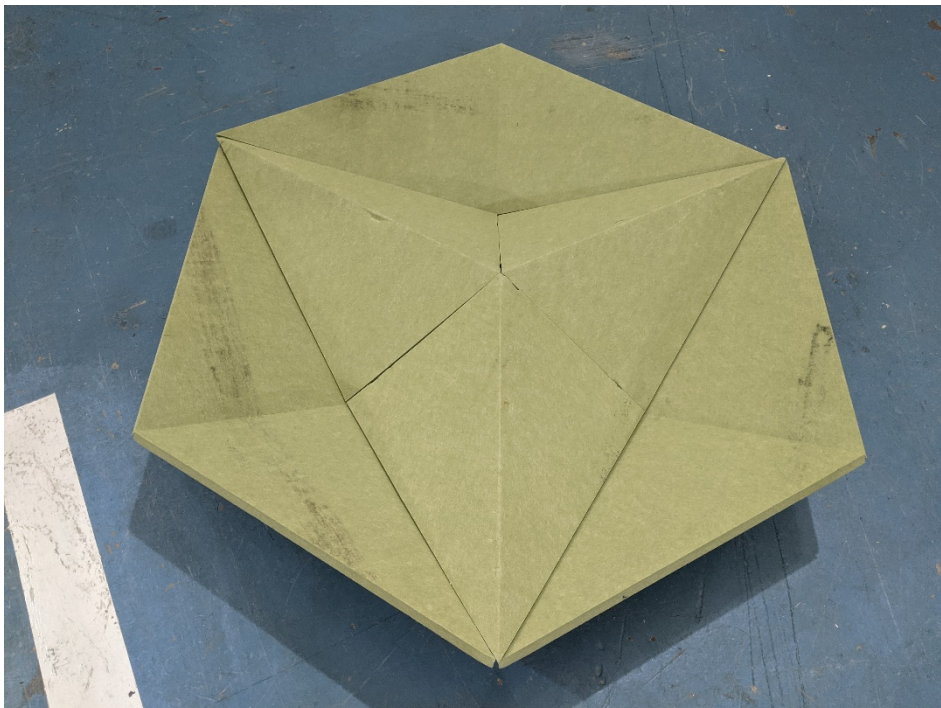


Figure 4 – Panel face oriented toward horizontal test surface; detail of geometry

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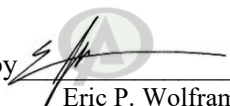
TEST RESULTS

Note: There is currently no standardized method for calculating Absorption Coefficients from spaced object absorbers. The sound absorption performance of spaced object absorbers should not be compared directly with specimens tested as a single rectangular area (e.g. mounting types A, E, etc.).

1/3 Octave Center Frequency (Hz)	Total Absorption		Absorption per Object	
	(m ²)	(Sabins)	(m ² / Object)	(Sabins / Object)
100	1.23	13.28	0.15	1.66
** 125	1.57	16.90	0.20	2.11
160	2.01	21.69	0.25	2.71
200	2.70	29.02	0.34	3.63
** 250	2.84	30.60	0.36	3.83
315	3.60	38.71	0.45	4.84
400	4.27	46.00	0.53	5.75
** 500	4.94	53.20	0.62	6.65
630	5.01	53.93	0.63	6.74
800	5.55	59.69	0.69	7.46
** 1000	5.79	62.32	0.72	7.79
1250	6.13	66.01	0.77	8.25
1600	6.51	70.04	0.81	8.76
** 2000	6.88	74.02	0.86	9.25
2500	7.11	76.56	0.89	9.57
3150	7.08	76.22	0.89	9.53
** 4000	7.12	76.61	0.89	9.58
5000	7.18	77.30	0.90	9.66

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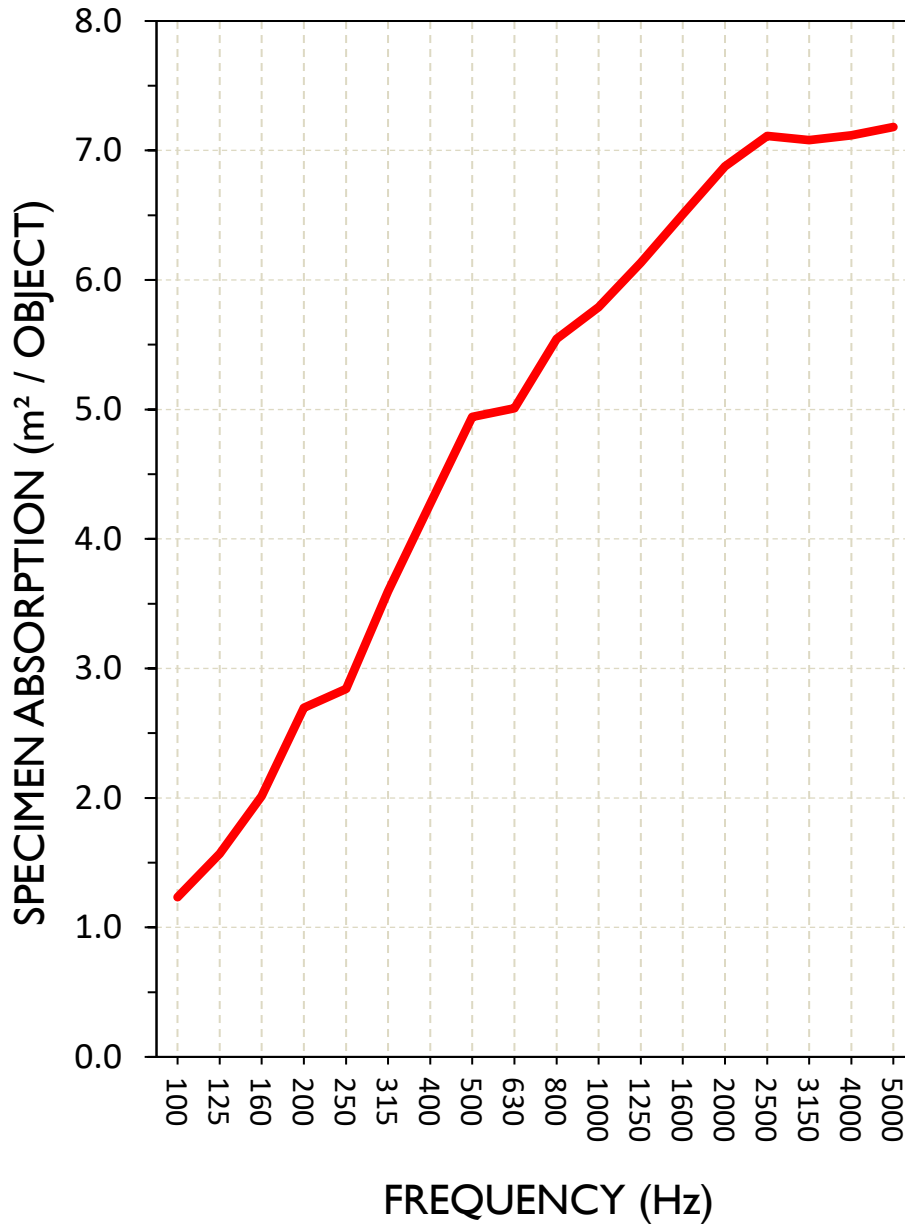
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SOUND ABSORPTION REPORT

Echo Star+ with 12mm EchoPanel Material (single continuous cloud)



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APPENDIX A: Extended Frequency Range Data

Specimen: Echo Star+ with 12mm EchoPanel Material (single continuous cloud) (See Full Report)

The following non-accredited data were obtained in accordance with ASTM C423-17, but extend beyond the defined frequency range of 100Hz to 5,000Hz. These unofficial results are representative of the RAL test environment only and intended for research & comparison purposes.

1/3 Octave Band Center Frequency (Hz)	Total Absorption		Absorption per Object	
	(m ²)	(Sabins)	(m ² / Object)	(Sabins / Object)
31.5	0.93	9.99	0.12	1.25
40	-0.33	-3.53	-0.04	-0.44
50	0.01	0.08	0.00	0.01
63	0.89	9.57	0.11	1.20
80	1.39	14.97	0.17	1.87
100	1.23	13.28	0.15	1.66
125	1.57	16.90	0.20	2.11
160	2.01	21.69	0.25	2.71
200	2.70	29.02	0.34	3.63
250	2.84	30.60	0.36	3.83
315	3.60	38.71	0.45	4.84
400	4.27	46.00	0.53	5.75
500	4.94	53.20	0.62	6.65
630	5.01	53.93	0.63	6.74
800	5.55	59.69	0.69	7.46
1000	5.79	62.32	0.72	7.79
1250	6.13	66.01	0.77	8.25
1600	6.51	70.04	0.81	8.76
2000	6.88	74.02	0.86	9.25
2500	7.11	76.56	0.89	9.57
3150	7.08	76.22	0.89	9.53
4000	7.12	76.61	0.89	9.58
5000	7.18	77.30	0.90	9.66
6300	7.35	79.12	0.92	9.89
8000	7.23	77.84	0.90	9.73
10000	7.03	75.71	0.88	9.46
12500	6.93	74.61	0.87	9.33

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APPENDIX B: Instruments of Traceability

Specimen: Echo Star+ with 12mm EchoPanel Material (single continuous cloud) (See Full Report)

<u>Description</u>	<u>Model</u>	<u>Serial Number</u>	<u>Date of Certification</u>	<u>Calibration Due</u>
System 1	Type 3160-A-042	3160-106968	2021-07-01	2022-07-01
Bruel & Kjaer Mic And Preamp A	Type 4943-B-001	2311428	2020-09-30	2021-09-30
Bruel & Kjaer Pistonphone	Type 4228	2781248	2020-08-12	2021-08-12
EXTECH Hygro 639	SD700	A.103639	2020-12-18	2021-12-18

APPENDIX C: Revisions to Original Test Report

Specimen: Echo Star+ with 12mm EchoPanel Material (single continuous cloud) (See Full Report)

<u>Date</u>	<u>Revision</u>
2021-07-26	Original report issued
2021-10-21	Page 5, 7: Added Sabins per Object values based on 8 objects (originally excluded) -EPW

END

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ON: Echo Star+ with 12mm EchoPanel Material (single continuous cloud) (See Full Test Report for Details)

Appendix D to ASTM C423 Sound Absorption Test

Non-standard calculation of equivalent NRC Rating and Absorption Coefficients from spaced absorbers

At this time, ASTM C423 does not provide a standard method for determining absorption coefficients of spaced object absorbers. Tests of a set of sound absorbing objects spaced apart from each other will yield higher absorption rates than a specimen joined together as a single patch (A-Mount or E-Mount). For this reason it is unfair to provide NRC or absorption coefficient ratings for specimens that consist of a spaced set of absorbers. Despite this, the architectural industry has expressed great demand for a simple "single number" rating for these treatments. Likewise, acoustical consultants desire equivalent absorption coefficient data for use in acoustical modeling software. The following is an attempt to appease these demands until ASTM develops a standard method for calculation. Several alternate non-standard calculation methods are provided. Riverbank Acoustical Laboratories prefers method 1. Rating titles for these methods are prepended with the word "Apparent". These rating names and their associated acronyms are provided by RAL and shall not be misconstrued as originating from any current standard.

Method 1) Apparent Sound Absorption Coefficient calculated from extended test specimen envelope

The total sound absorption yielded by the specimen is divided by the surface area of the test surface covered by the suspended objects, including intermediate spaces, with additional added area to allow theoretical extrapolation for larger arrays. Apparent sound absorption coefficients, and subsequently the Apparent Noise Reduction Coefficient (A*NRC) and Apparent Sound Absorption Average (A*SAA) ratings, are calculated using this extended surface area based on the methods described in ASTM C423-17. This may be the most accurate method for comparing object arrays to ceiling tile products.

Because the test specimen is composed of a single continuous cloud, no array spacing can be inferred, thus rendering this method not applicable.

Method 2) Apparent Sound Absorption Coefficient calculated from total exposed surface area of specimen

The total sound absorption yielded by the specimen is divided by the total surface area of all exposed specimen faces (10.53 m² (113.33 ft²) total surface area). Apparent sound absorption coefficients, and subsequently the Apparent Noise Reduction Coefficient (A*NRC) and Apparent Sound Absorption Average (A*SAA) ratings, are calculated using this surface area based on the methods described in ASTM C423-17. This method shows the actual absorption occurring at the exposed surfaces but does not provide a fair comparison with materials mounted as a uniform patch (in A-mount or E-mount).

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Appendix D (continued)

Method 3) Apparent Sound Absorption Coefficient calculated from one face per object

The total sound absorption yielded by the specimen is divided by the projected hexagonal surface area of one large face for each object in the specimen (4.30 m² (46.32 ft²) total surface area). Apparent sound absorption coefficients, and subsequently the Apparent Noise Reduction Coefficient (A*NRC) and Apparent Sound Absorption Average (A*SAA) ratings, are calculated using this surface area based on the methods described in ASTM C423-17. This method is favored by some material manufacturers since it yields very high NRC figures, but does not provide a fair comparison with other ceiling tile or wall panel products. Riverbank Acoustical Laboratories recommends that results obtained from this method be used for research and comparison purposes only; such results should not be used for marketed claims of product performance.

Method 4) Apparent Sound Absorption Coefficient calculated from specimen envelope without extension

The total sound absorption yielded by the specimen is divided by the rectangular test surface area covered by the suspended objects, including intermediate spaces. Apparent sound absorption coefficients, and subsequently the Apparent Noise Reduction Coefficient (A*NRC) and Apparent Sound Absorption Average (A*SAA) ratings, are calculated using this surface area based on the methods described in ASTM C423-17.

Similarly to Method 1, no array spacing can be inferred from the test specimen, thus rendering this method not applicable.

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Appendix D: Data Note: See full test report for details of mounting position, spacing, and configuration, as these parameters greatly affect sound absorption performance.

Specimen Absorption (ft ²)			Method 1	Method 2	Method 3	Method 4
Freq. (Hz)	Sabins	Sabins / Object	Apparent Abs. Coefficient From Total Coverage Area (N/A)	Apparent Abs. Coefficient From Total Exposed Surface Area (113.33 ft ²)	Apparent Abs. Coefficient From One Face per Object (46.32 ft ²)	Apparent Abs. Coefficient From Unextended Envelope Area (N/A)
31.5	9.99	1.25		0.09	0.22	
40	-3.53	-0.44		-0.03	-0.08	
50	0.08	0.01		0.00	0.00	
63	9.57	1.20		0.08	0.21	
80	14.97	1.87		0.13	0.32	
100	13.28	1.66		0.12	0.29	
125	16.90	2.11		0.15	0.36	
160	21.69	2.71		0.19	0.47	
200	29.02	3.63		0.26	0.63	
250	30.60	3.83		0.27	0.66	
315	38.71	4.84		0.34	0.84	
400	46.00	5.75		0.41	0.99	
500	53.20	6.65		0.47	1.15	
630	53.93	6.74		0.48	1.16	
800	59.69	7.46		0.53	1.29	
1,000	62.32	7.79		0.55	1.35	
1,250	66.01	8.25		0.58	1.43	
1,600	70.04	8.76		0.62	1.51	
2,000	74.02	9.25		0.65	1.60	
2,500	76.56	9.57		0.68	1.65	
3,150	76.22	9.53		0.67	1.65	
4,000	76.61	9.58		0.68	1.65	
5,000	77.30	9.66		0.68	1.67	
6,300	79.12	9.89		0.70	1.71	
8,000	77.84	9.73		0.69	1.68	
10,000	75.71	9.46		0.67	1.63	
12,500	74.61	9.33		0.66	1.61	
Apparent NRC:				0.50	1.20	
Apparent SAA:				0.49	1.19	

Prepared by 
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