SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J2629 MAY2011

Issued 2011-05

Standard Formats for Presenting Acoustical Data

RATIONALE

This is an initial release of a recommended practice to standardize the format and presentation of complex acoustical data, thereby making comparison(s) between sets of results easier.

INTRODUCTION

Acoustical test results for standardized SAE and ASTM test procedures as well as non-standardized vehicle test procedures can be presented in a number of formats and scalings, making comparison(s) of results difficult in many cases. This document addresses the need for a consistent format for the presentation of various acoustical material, part and vehicle interior noise test data.

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TO PLACE A DOCUMENT ORDER:
Tel: 877-606-7323 (inside USA and Canada)
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SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/J2629_201105

1. SCOPE

SAE developed this document at the request of automobile manufacturers to help compare products from multiple suppliers using standard data presentation formats. This document includes several preferred formats for presenting acoustical data on materials, components, systems, or vehicles. These formats cover the range of acoustical tests commonly conducted in the automotive industry. These tests follow SAE and ASTM test practices as well as vehicle specific test methods.

For each test, the details of samples and test conditions are entered into an electronic template together with the acoustical results data. These data are then linked to standard graphical display(s) for each test. All manufacturers and suppliers in this industry are encouraged to present data and results in these formats.

Although this practice was developed specifically for use in the automotive industry, the formats are useable in other industries and applications as well.

1.1 Purpose

This document establishes recommended practices and formats for reporting of common acoustical results.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1400 Laboratory Measurement for the Airborne Sound Barrier Performance of Automotive Materials and Assemblies

SAE J1637 Laboratory Measurement of the Composite Vibration Damping Properties of Materials on a Supporting Steel Bar

2.1.2 ASTM Publications

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM C 423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM E 1050 Standard Test Method for Impedance and Absorption of Acoustical Materials Using a Tube, Two Microphones, and a Digital Frequency Analysis System

ASTM C 384 Standard Test Method for Impedance and Absorption of Acoustical Materials by the Impedance Tube Method

ASTM E 756 Standard Test Method for Measuring Vibration-Damping Properties of Materials

3. DEFINITIONS

3.1 Modified Articulation Index

Modified Articulation Index (MAI) is calculated according to the following weighting factors and reference levels for respective 1/3 octave sound pressure measurements.

MAI200 = 3.33/100*(64 - dBL200)
MAI250 = 6.67/100*(69 - dBL250)
MAI315 = 10.83/100*(71 - dBL315)
MAI400 = 14.17/100*(73 - dBL400)
MAI500 = 15.00/100*(75 - dBL500)
MAI630 = 17.50/100*(75 - dBL630)
MAI800 = 21.67/100*(74 - dBL800)
MAI1000 = 24.17/100*(72 - dBL1000)
MAI1250 = 28.33/100*(70 - dBL1250)
MAI1600 = 38.33/100*(67 - dBL1600)
MAI2000 = 36.67/100*(65 - dBL2000)
MAI2500 = 31.67/100*(63 - dBL2500)
MAI3150 = 30.00/100*(60 - dBL3150)
MAI4000 = 25.83/100*(56 - dBL4000)
MAI5000 = 20.83/100*(51 - dBL5000)
MAI6300 = 8.33/100*(51 - dBL6300)

Where, for example at 200 Hz, 3.33 is the weighting factor, 64 is the reference level and dBL200 is the linear or unweighted noise level for the 200 Hz 1/3 octave band frequency at the measurement location.

Corresponding data for all 1/3 octave bands from 250 to 6300 Hz are used in the MAI calculation.

MAI = sum of MAI200 through MAI6300; usually expressed as a percent (100% or higher = perfect intelligibility).

NOTE: This metric uses weighting factors common to the automotive industry; but, which are slightly different than similar standards such as ANSI S3.5.

3.2 For all other definitions, see the respective test standards.

4. PROCEDURES

All data collected either from standard test methods or company specific test methods are to be presented in one of the following display formats. These formats include descriptions of the samples and test conditions, followed by a graphical display.

Each display format contains a unique template that must be used to enter test data as well as descriptions of the sample and the test facility. Instructions for use of these templates are on the SAE J2629 CD available from SAE. This information is then transferred to a one-page graphical display with pre-set axis sizes, scales, and legends.

5. TEST DATA

The template for each graphical display accepts data in the rectangular Cartesian coordinate system where the horizontal axis is the x- axis or abscissa and the vertical axis is the y- axis or ordinate. The range of independent variables (x-values) covers the conditions of greatest interest to the automobile manufacturers. The range of dependent variables (y-values) covers a wide dynamic range. In situations when dependent variables fall outside of the fixed dynamic range, data will appear on the graphical display at the top or bottom of the scale. However, the range selected for each display will generally prevent this from occurring.

Significant figures for data should be based on the accuracy inherent in the measurement system and as specified in the test method.

6. TEST SAMPLES

Depending on the type of test conducted, the test sample may be a flat material, a molded component, a sub-system or an entire vehicle. The template provides a data field to enter a description of the test sample. These details should describe the key physical characteristics and establish a baseline for comparisons to other samples included in the same graphical display. The user may add additional information beyond the items listed in the template.

7. TEST FACILITIES

The template requires details covering the test facility and test conditions, providing a reference to the source of the test data and to the engineer and/or technician who conducted the test. In some cases, these details may help explain differences in data between identical samples tested at different test facilities.

8. TEST FORMATS

Graphical displays have been prepared to cover the following test formats. For each test type, the graphical display has a fixed length and scale for each axis.

8.1 Vehicle Level Testing of Materials, Components and Systems on the Road or Chassis Dynamometer

- Vehicle Road Test Data – A-weighted Sound Pressure Level versus Engine Speed, shown per Figure 1.
- Vehicle Dyno Test Data – A-weighted Sound Pressure Level versus Engine Speed, shown per Figure 2.
- Vehicle Road Test Data – A-weighted Sound Pressure versus 1/3 Octave Frequency, shown per Figure 3.
- Vehicle Dyno Test Data – A-weighted Sound Pressure versus 1/3 Octave Frequency, shown per Figure 4.
- Vehicle Road Test Data – Modified Articulation Index versus Engine Speed, shown per Figure 5.
- Vehicle Dyno Test Data – Modified Articulation Index versus Engine Speed, shown per Figure 6.

8.2 Material and Component Testing in the Laboratory

- Sound Transmission Loss per SAE J1400, shown per Figure 7.
- Random Incidence Sound Absorption per ASTM C 423, shown per Figure 8. Note that sound absorption values for frequencies beyond those valid for ASTM C 423 are shown for reference only.
- Normal Incidence Sound Absorption per ASTM E 1050 (1/3 octave or narrow band), shown per Figures 9A and 9B.
- Composite Vibration Damping per SAE J1637 (temperature), shown per Figure 10.
- Composite Vibration Damping per SAE J1637 (frequency), shown per Figures 11A and 11B.

9. NOTES

9.1 General Comments

These SAE data formats are recommended for presentations to automobile manufacturers and for use by acoustic integrators, interior integrators, tier I suppliers, and other material suppliers. This SAE practice provides the best means for a user to then compare data on competitive materials, components, systems, or vehicles.

These data formats are to be used for data collected according to the commonly used test formats and test procedures listed in Section 5. The data collected from these tests, however, should not be considered as the only data that can be presented to an automobile manufacturer or other user. Additional data from other tests may also be presented using a format selected by the supplier or the user. In all cases, this additional information should be a supplement to the formats described in this document and not a replacement.

To avoid duplication of effort in presenting data, test facilities are encouraged to supply data to their test requestors using these formats. These formats can then be readily used in presentations to automobile manufacturers or to other users. This will also minimize errors generated when data is converted from one format to the SAE recommended format.

In the future, revisions to these formats will be made to meet the needs of the users, which include both vehicle manufacturers and suppliers. In addition, additional data formats may be added as new test practices are developed.

For questions or problems on the use of the SAE J2629 CD, SAE may be contacted at CustomerService@sae.org.

PREPARED BY THE SAE ACOUSTICAL MATERIALS COMMITTEE

APPENDIX A - INFORMATION FOR THE SAE J2629 CD

A.1 MINIMUM SYSTEM REQUIREMENTS

A.1.1 The following minimum system and software requirements are required to use the SAE J2629 CD:

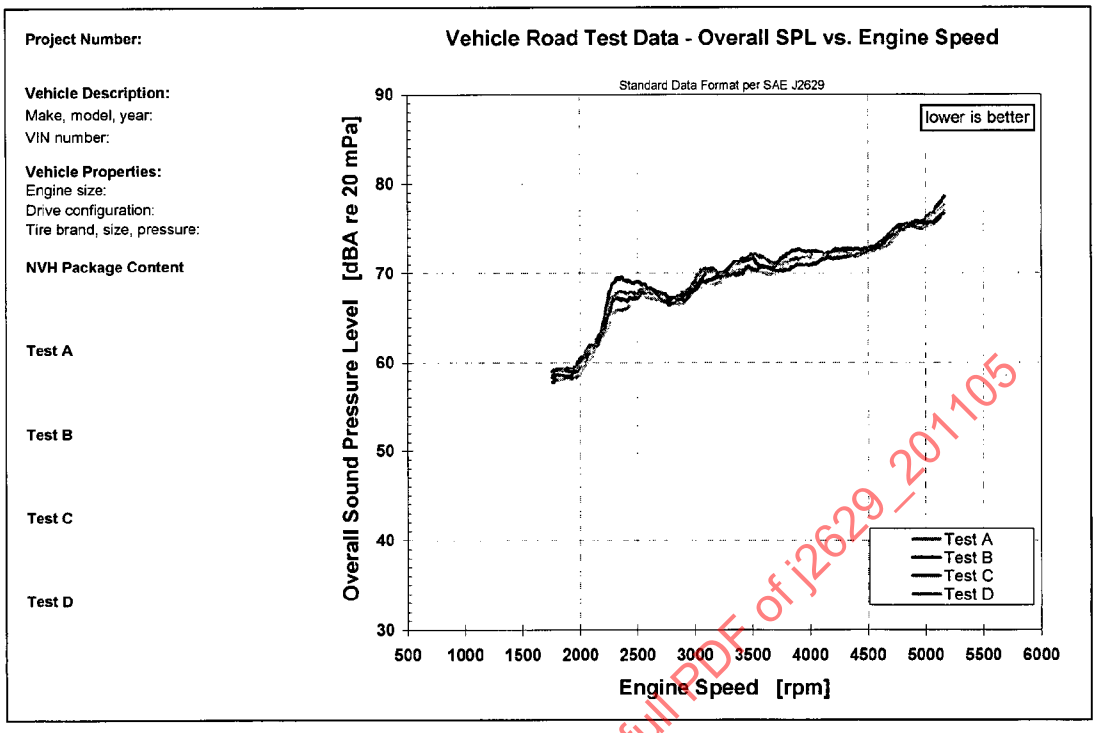
PC capable of running Microsoft Excel 97 or newer;
128 megabytes of memory or greater;
CDROM or DVD drive;
Microsoft Excel 97 or newer

A.1.2 Instructions to use the SAE J2629 CD:

1. Insert CD in computer drive.
2. Click on INSTALL to install program titled SAE J2629 data formats.
3. Select the desired data format from the available menu.
   a. Random Incidence Sound Absorption per ASTM C 423
   b. Normal Incidence Sound Absorption per ASTM E 1050 (1/3 octave or narrow band)
   c. Sound Transmission Loss per SAE J1400
   d. Composite Vibration Damping per SAE J1637 (10-1000 Hz)
   e. Composite Vibration Damping per SAE J1637 (100-10 000 Hz)
   f. Composite Vibration Damping per SAE J1637 (temperature)
   g. Vehicle Dyno Test Data – dBA versus 1/3 Octave Band Frequency
   h. Vehicle Dyno Test Data – dBA versus Engine Speed
   i. Vehicle Dyno Test Data – MAI versus Engine Speed
   j. Vehicle Road Test Data - dBA versus 1/3 Octave Band Frequency
   k. Vehicle Road Test Data – dBA versus Engine Speed
   l. Vehicle Road Test Data – MAI versus Engine Speed
4. Click on the tab titled INFO and enter descriptions of the test sample and test conditions in the following fields (in white data entry fields).
   a. Subtitle
   b. Description of each sample, with physical properties
   c. Test conditions and information
   d. Other details in appropriate text fields
5. Click on the tab titled DATA and enter test data as x and y coordinates in the appropriate columns (highlighted in gray).

6. When all data have been entered, click on the tab titled VIEW GRAPH to view the graphical display.
7. Click on the tab titled VIEW DATA to view the test information and data.
8. Revisions to the graph may be made by returning to the tabs INFO or DATA.
9. Any of these displays can be printed or copied into a presentation.
10. When all data are complete, save the file to a hard drive or a floppy disk with a unique file name.
11. For questions or problems using the SAE J2629 CD, SAE may be contacted at CustomerService@sae.org.

The graphical display can be printed as a separate sheet or can be inserted in a PowerPoint presentation using the commands Copy and Paste Special from the MS Excel application. See Figures 1 - 11.



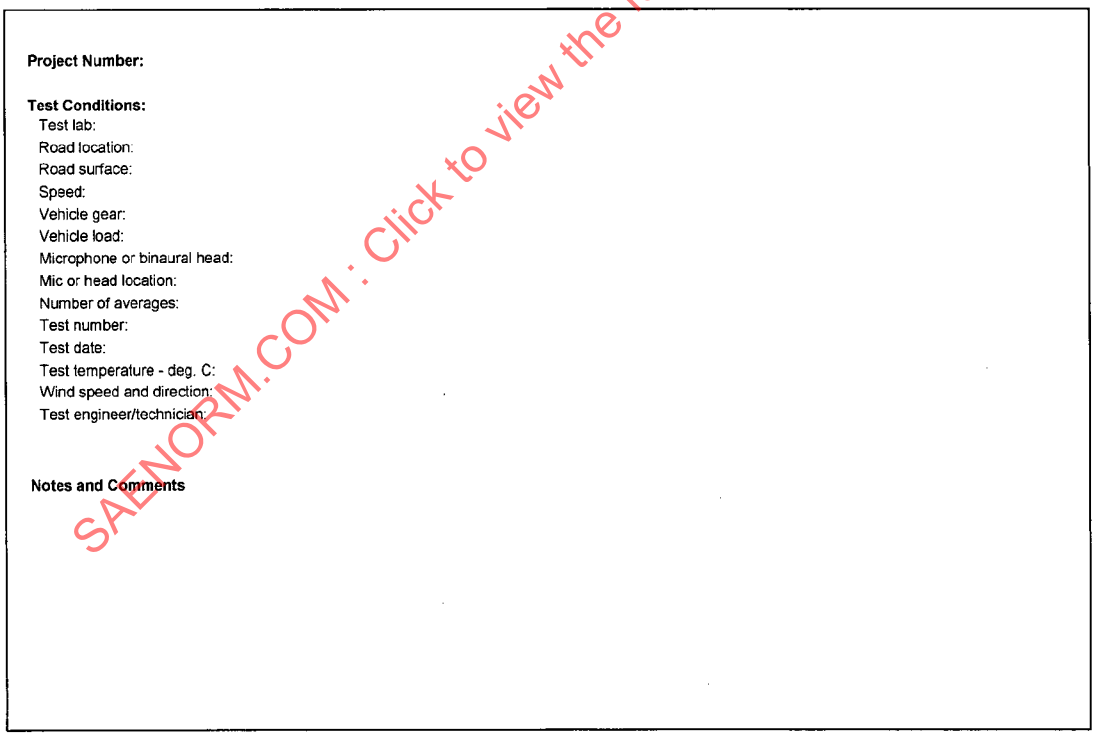


FIGURE 1 - VEHICLE ROAD DATA - A-WEIGHTED SOUND PRESSURE LEVEL VS. ENGINE SPEED

Project Number:

Vehicle Description:
Make, model, year:
VIN number:

Vehicle Properties:
Engine size:
Drive configuration:
Tire brand, size, pressure:

NVH Package Content

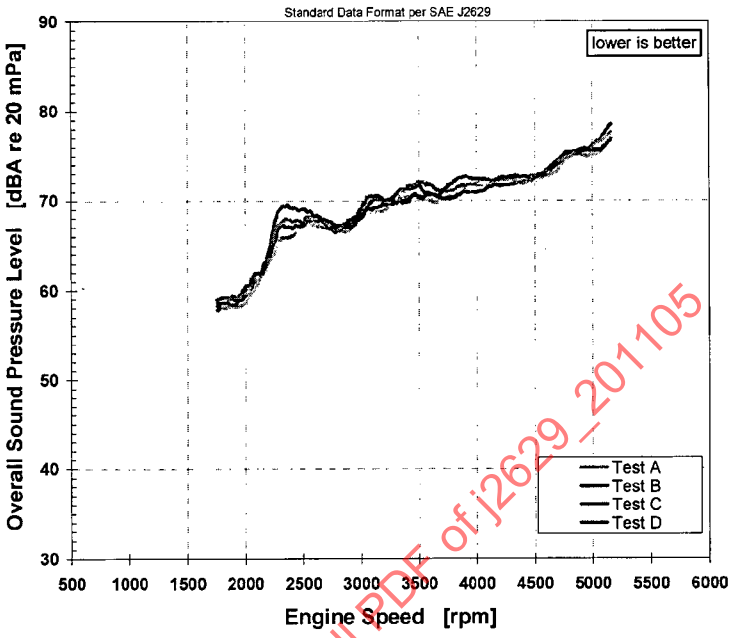
Test A

Test B

Test C

Test D

Vehicle Dyno Test Data - Overall SPL vs. Engine Speed



Project Number:

Test Conditions:
Test lab:
Rolls Turning (Frt, Rr, All):
Roll surface:
Speed:
Vehicle gear:
Vehicle load:
Microphone or binaural head:
Mic or head location:
Number of averages:
Test number:
Test date:
Test engineer/technician:

Notes and Comments

FIGURE 2 - VEHICLE DYNO DATA - A-WEIGHTED SOUND PRESSURE LEVEL VS. ENGINE SPEED

Project Number

Vehicle Description
Brand, model, year:
VIN number:

Vehicle Properties
Engine size:
Drive configuration:
Tire brand, size, pressure:

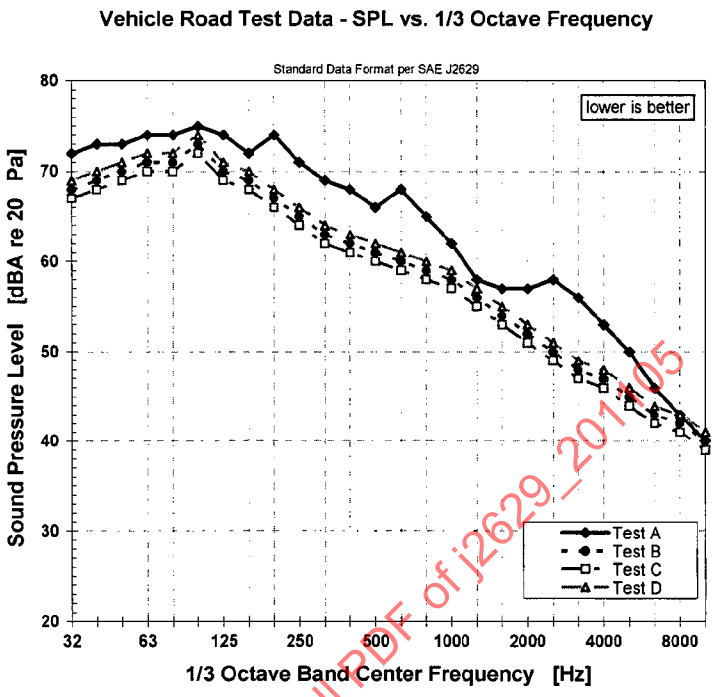
NVH Package Content

Test A

Test B

Test C

Test D



Project Number

Test Conditions
Test lab:
Road location:
Road surface:
Vehicle speed:
Vehicle gear:
Vehicle load:
Microphone or binaural
Mic or head location:
Number of averages:
Test number:
Test date:
Test temperature - deg. C:
Wind speed and direction:
Test engineer/technician:

Notes and Comments

Freq	Test A	Test B	Test C	Test D
31.5	72.0	68.0	67.0	69.0
40	73.0	69.0	68.0	70.0
50	73.0	70.0	69.0	71.0
63	74.0	71.0	70.0	72.0
80	74.0	71.0	70.0	72.0
100	75.0	73.0	72.0	74.0
125	74.0	70.0	69.0	71.0
160	72.0	69.0	68.0	70.0
200	74.0	67.0	66.0	68.0
250	71.0	65.0	64.0	66.0
315	69.0	63.0	62.0	64.0
400	68.0	62.0	61.0	63.0
500	66.0	61.0	60.0	62.0
630	68.0	60.0	59.0	61.0
800	65.0	59.0	58.0	60.0
1000	62.0	58.0	57.0	59.0
1250	58.0	56.0	55.0	57.0
1600	57.0	54.0	53.0	55.0
2000	57.0	52.0	51.0	53.0
2500	58.0	50.0	49.0	51.0
3150	56.0	48.0	47.0	49.0
4000	53.0	47.0	46.0	48.0
5000	50.0	45.0	44.0	46.0
6300	46.0	43.0	42.0	44.0
8000	43.0	42.0	41.0	43.0
10000	40.0	40.0	39.0	41.0

FIGURE 3 - VEHICLE ROAD DATA - A-WEIGHTED SOUND PRESSURE LEVEL VS. 1/3 OCTAVE FREQUENCY

Project Number

Vehicle Description
Brand, model, year:
VIN number:

Vehicle Properties
Engine size:
Drive configuration:
Tire brand, size, pressure:

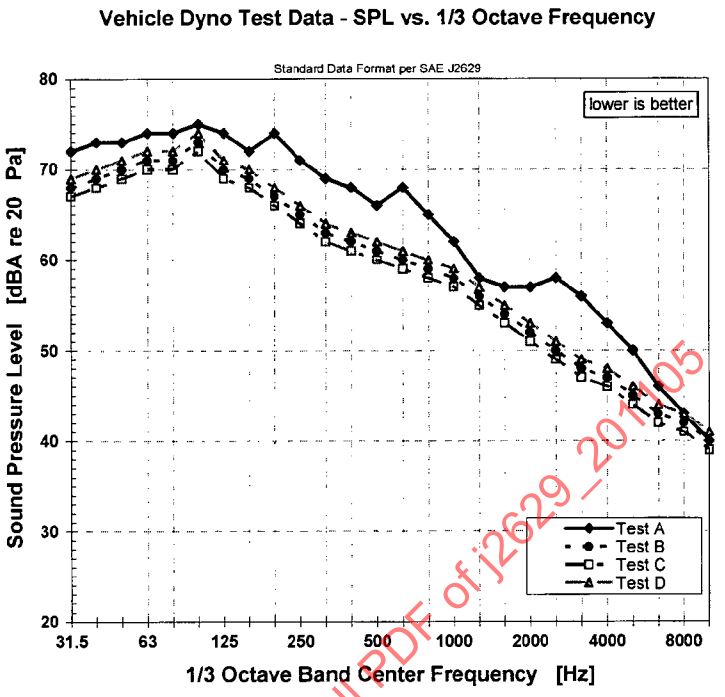
NVH Package Content

Test A

Test B

Test C

Test D



Project Number

Test Conditions
Test lab:
Road location:
Road surface:
Vehicle speed:
Vehicle gear:
Vehicle load:
Microphone or binaural
Mic or head location:
Number of averages:
Test number:
Test date:
Test engineer/technician:

Notes and Comments

Freq.	Test A	Test B	Test C	Test D
31.5	72.0	68.0	67.0	69.0
40	73.0	69.0	68.0	70.0
50	73.0	70.0	69.0	71.0
63	74.0	71.0	70.0	72.0
80	74.0	71.0	70.0	72.0
100	75.0	73.0	72.0	74.0
125	74.0	70.0	69.0	71.0
160	72.0	69.0	68.0	70.0
200	74.0	67.0	66.0	68.0
250	71.0	65.0	64.0	66.0
315	69.0	63.0	62.0	64.0
400	68.0	62.0	61.0	63.0
500	66.0	61.0	60.0	62.0
630	68.0	60.0	59.0	61.0
800	65.0	59.0	58.0	60.0
1000	62.0	58.0	57.0	59.0
1250	58.0	56.0	55.0	57.0
1600	57.0	54.0	53.0	55.0
2000	57.0	52.0	51.0	53.0
2500	58.0	50.0	49.0	51.0
3150	56.0	48.0	47.0	49.0
4000	53.0	47.0	46.0	48.0
5000	50.0	45.0	44.0	46.0
6300	46.0	43.0	42.0	44.0
8000	43.0	42.0	41.0	43.0
10000	40.0	40.0	39.0	41.0

FIGURE 4 - VEHICLE DYNO DATA - A-WEIGHTED SOUND PRESSURE LEVEL VS. 1/3 OCTAVE FREQUENCY

Project Number

Vehicle Description
Vehicle Brand, Model, Year:
VIN number:

Vehicle properties
Engine Size:
Drive Configuration:
Tire brand, size, pressure:

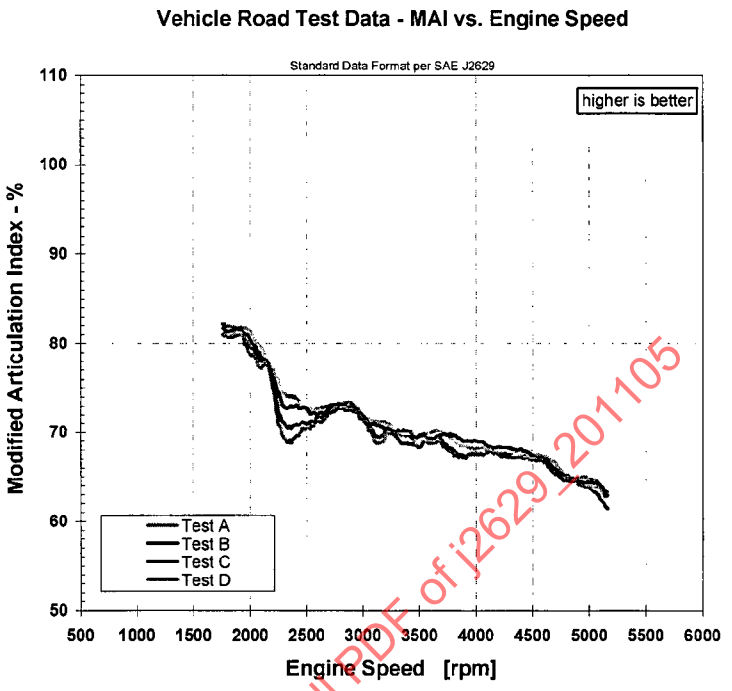
NVH package content:

Test A

Test B

Test C

Test D



Project Number

Test Conditions
Test lab:
Road location:
Road surface:
Vehicle speed:
Vehicle gear:
Vehicle load:
Microphone or binaural head:
Mic or head location:
Number of averages:
Test number:
Test date:
Test temperature - deg. C:
Wind speed and direction:
Test engineer/technician:

Notes and Comments

FIGURE 5 - VEHICLE ROAD DATA - MODIFIED ARTICULATION INDEX VS. ENGINE SPEED

Project Number

Vehicle Description
Vehicle Brand, Model, Year:
VIN number:

Vehicle properties
Engine Size:
Drive Configuration:
Tire brand, size, pressure:

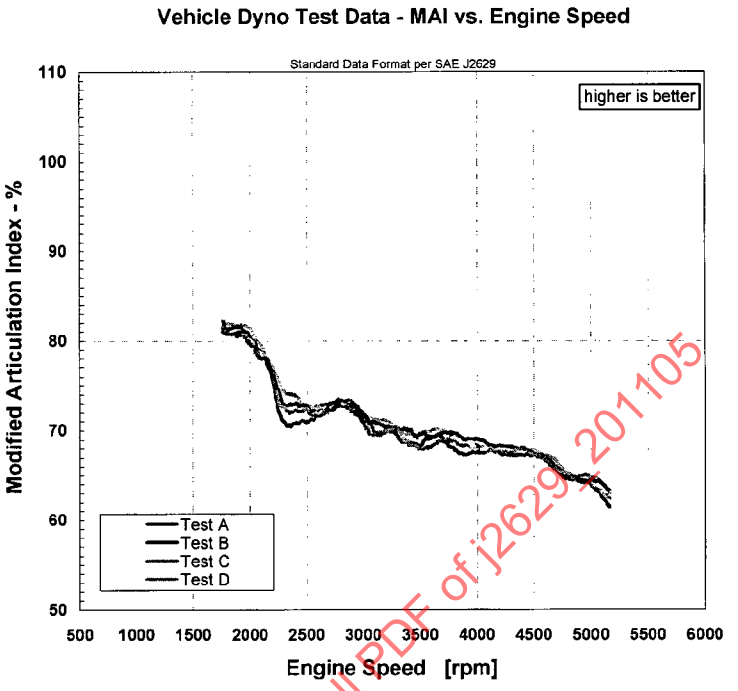
NVH package content:

Test A

Test B

Test C

Test D

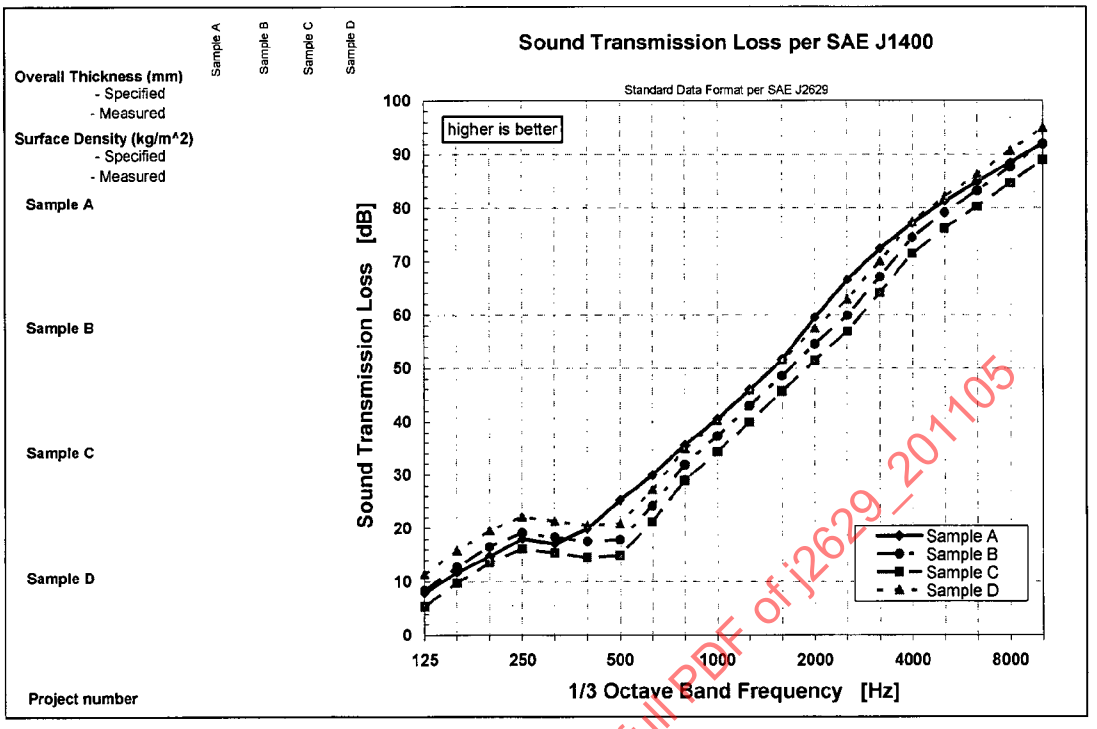


Project Number

Test Conditions
Test lab:
Rolls Turning (Frt, Rr, All):
Roller surface:
Vehicle speed:
Vehicle gear:
Vehicle load:
Microphone or binaural head:
Mic or head location:
Number of averages:
Test number:
Test date:
Test engineer/technician:

Notes and Comments

FIGURE 6 - VEHICLE DYNO DATA - MODIFIED ARTICULATION INDEX VS. ENGINE SPEED



Project number

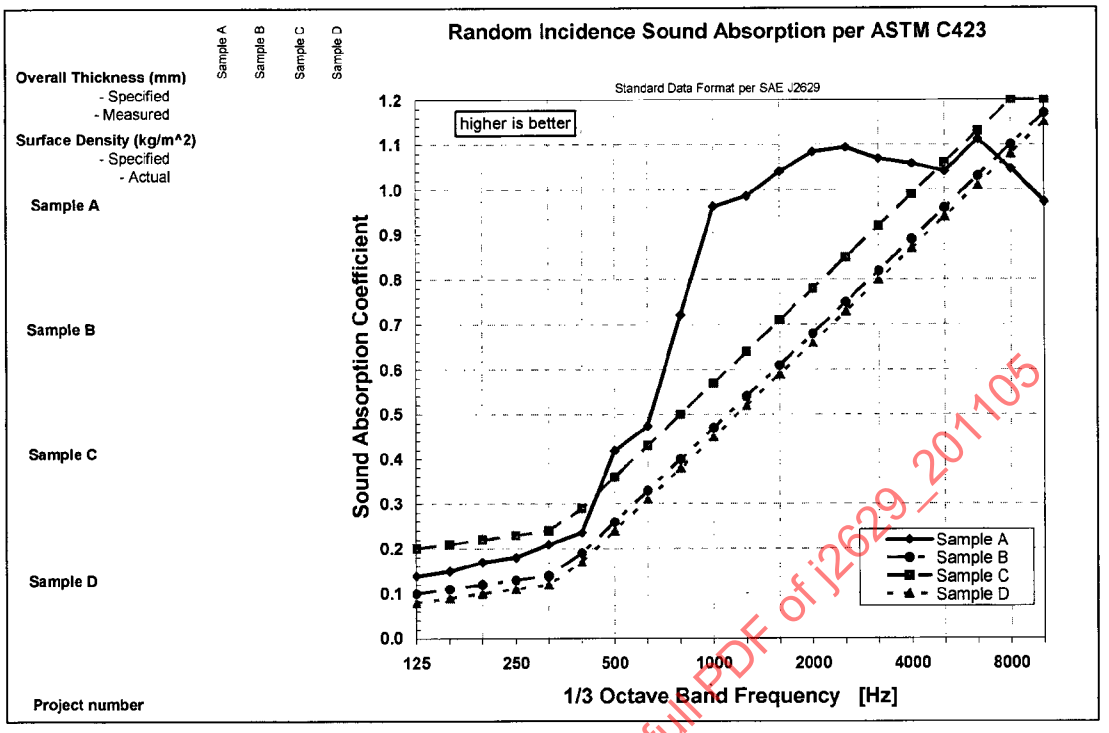
Test Description
Date tested:
Test location:
Ambient temp. [°C]:
Relative humidity [%]:
Atmospheric Pressure [kPa]:

Added Information
Other sample description:
SAE J1400 revision date:
Test engineer/technician:

Freq	Sample A	Sample B	Sample C	Sample D
125	8.0	8.4	5.4	11.4
160	11.8	12.8	9.8	15.8
200	14.8	15.6	13.6	19.6
250	18.1	19.2	16.2	22.2
315	17.1	18.4	15.4	21.4
400	19.9	17.6	14.6	20.6
500	25.3	17.9	14.9	20.9
630	30.0	24.2	21.2	27.2
800	35.6	31.9	28.9	34.9
1000	40.6	37.3	34.3	40.3
1250	45.9	43.0	40.0	46.0
1600	51.7	48.6	45.6	51.6
2000	59.5	54.5	51.5	57.5
2500	66.6	59.9	56.9	62.9
3150	72.5	67.1	64.1	70.1
4000	77.2	74.5	71.5	77.5
5000	81.3	79.2	76.2	82.2
6300	85.0	83.3	80.3	86.3
8000	88.5	87.7	84.7	90.7
10000	92.1	92.0	89.0	95.0

Notes and Comments

FIGURE 7 - SAE J1400 SOUND TRANSMISSION LOSS



Project number

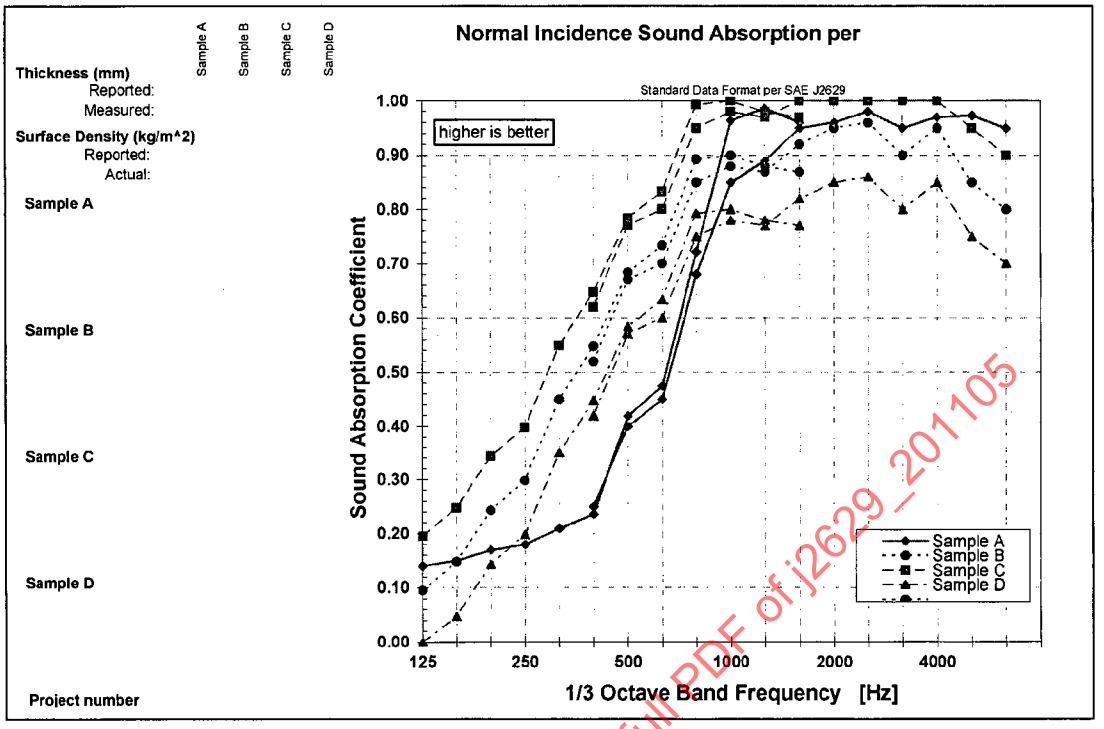
Test Description
Date tested:
Test location:
Chamber volume:
Test area size:
Segments per sample:
Ambient temp. [°C]:
Relative humidity [%]:
Atmospheric Pressure [kPa]:
Sealing of edges:
Tape
Angle iron
Other

Added Information
Other sample description:
Mounting condition:
Air gap:
Test engineer/technician:
ASTM C-423 revision date:

Notes and Comments

Freq.	Sample A	Sample B	Sample	Sample D
125	0.14	0.10	0.20	0.08
160	0.15	0.11	0.21	0.09
200	0.17	0.12	0.22	0.10
250	0.18	0.13	0.23	0.11
315	0.21	0.14	0.24	0.12
400	0.24	0.19	0.29	0.17
500	0.42	0.26	0.36	0.24
630	0.47	0.33	0.43	0.31
800	0.72	0.40	0.50	0.38
1000	0.96	0.47	0.57	0.45
1250	0.99	0.54	0.64	0.52
1600	1.04	0.61	0.71	0.59
2000	1.08	0.68	0.78	0.66
2500	1.09	0.75	0.85	0.73
3150	1.07	0.82	0.92	0.80
4000	1.06	0.89	0.99	0.87
5000	1.04	0.96	1.06	0.94
6300	1.11	1.03	1.13	1.01
8000	1.05	1.10	1.20	1.08
10000	0.97	1.17	1.20	1.15

FIGURE 8 - ASTM C 423 RANDOM INCIDENCE SOUND ABSORPTION



Project number

Test Description
Date tested:
Test location:
Test apparatus:
Large tube diameter:
High/low freq. limits:
Intermediate tube dia.:
High/low freq. limits:
Small tube dia:
High/low freq. limits:
Edge sealing method:
Ambient temp. [°C]:
Relative humidity [%]:
Atmospheric Pressure [kPa]:

Added Information
Other sample description:

Test engineer/technician:

Notes and Comments

Freq.	Sample A		Sample B		Sample C		Sample D	
125	0.140		0.095		0.195		0.000	
160	0.150		0.148		0.248		0.048	
200	0.170		0.243		0.343		0.143	
250	0.180		0.298		0.398		0.198	
315	0.210		0.450		0.550		0.350	
400	0.236		0.548		0.648		0.448	
500	0.419	0.400	0.684	0.670	0.784	0.770	0.584	0.570
530	0.475	0.450	0.734	0.700	0.834	0.800	0.634	0.600
800	0.722	0.680	0.893	0.850	0.993	0.950	0.793	0.750
1000	0.964	0.850	0.900	0.880	1.000	0.980	0.800	0.780
1250	0.986	0.890	0.880	0.870	0.980	0.970	0.780	0.770
1600	0.960	0.950	0.870	0.920	0.970	1.000	0.770	0.820
2000		0.960		0.950		1.000		0.850
2500		0.980		0.960		1.000		0.860
3150		0.950		0.900		1.000		0.800
4000		0.970		0.950		1.000		0.850
5000		0.973		0.850		0.950		0.750
6300		0.950		0.800		0.900		0.700
8000		0.940		0.760		0.840		

FIGURE 9A - ASTM E 1050 NORMAL INCIDENCE SOUND ABSORPTION - 1/3 OCTAVE FREQUENCIES