



December 6, 2004

Mr. Steve Miller
Skyfold – Autolift Wall System
325 Lee Ave., Baie d’Urfe (Montreal)
Quebec, Canada H9X 3S3

**Re: Skyfold Vertically Folding Electric Partitions Testing
Moody Gardens Convention Center
Galveston, TX
SMW Project # 04558**

Dear Mr. Miller:

This letter summarizes the results of the sound transmission tests performed on the Skyfold partitions at the Moody Gardens Convention Center on November 17, 2004.

Conformance to Standard

The tests were done in accordance with ASTM E 336-97 “Standard Test Method for Measurement of Airborne Sound Insulation in Buildings”. Due to set-up work taking place in the spaces on the day of testing, some deviations from the standard had to be made, so that the tests could be done in a timely fashion to allow Moody Gardens staff to resume their work in the spaces tested.

The standard indicates that if more than one sound source is used, they should each be driven by separate noise generators and amplified channels. The tests were done using one noise generator and one amplifier driving four (4) loudspeakers. Four loudspeakers were used instead of one in order to achieve the highest possible sound level capable of penetrating two partitions.

Test Environment

The source room used for the tests was Expo Hall A. See Sheet 1. With the Skyfold partition in place, this room was approximately 105 ft. long x 142 ft. wide x 37 ft. high. The space was carpeted, with operable bleachers recessed in each sidewall, and acoustic wall treatment above wainscot height on the (long) back wall (facing the Skyfold partition). The ceiling consisted of perforated metal panels suspended approximately 10 ft. below the underside of the roof structure, which was an exposed steel deck.

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The receive room was Expo Hall B. See sheet 1. The Skyfold partitions between Expo Halls B and C were in place during the tests. Therefore, Expo Hall B measured approximately 142 ft. wide x 120 ft. long x 37 ft. high, and with the two Skyfold partitions in place between Expo Halls A and B, and 129 ft. long with one Skyfold partition in place between Expo Halls A and B. This space had a concrete floor, and operable bleachers recessed in each sidewall. The ceiling consisted of perforated metal panels suspended approximately 15 ft. below the underside of the structure, which was an exposed steel deck. On the day of the tests several chairs (with upholstered seats and backs) were in the receive room.

Test Specimens

The specimens tested were the Skyfold partitions separating Expo Halls A and B. The partitions are electronically operated, and lowered in place before the tests by turning a key located in a control panel in the sidewall. Because of the large size of the hall, each Skyfold partition consists of two 71-ft. long pieces, for a total width of 142 ft. The height of the partitions is 24 ft. When the two parallel Skyfold partitions are in place, they are separated by 9 ft. Each partition consists of individual panels on either side of a structural skeleton, which yields an overall depth of 11-3/4" for each partition. The individual panels are 2' 2-1/4" high and 11' 9-1/4" in width (total 12 x 12 panels = 144 total panels, on both sides of the partition). There is a 5 ft. high gypsum board bulkhead between the underside of the structure and the Skyfold partition, which contains a 2'-11" deep "pocket" that houses the partitions once they are raised.

Tests were performed for two configurations: 1) with both Skyfold partitions between Expo Halls A and B in place, and 2) with only one partition in place, and the other stored. Due to the large size of the partitions, the tests were performed on areas of the partitions consisting of 2 panels wide and 4 panels high (8 total). Therefore the areas tested measured 23' 6-1/2" long x 8' 9" high. Two locations were chosen for each test: at the edge of the partitions where they meet the outer wall (1st and 2nd sets of panels), and at the center of the partitions (6th and 7th sets of panels).

The test specimens were constructed with a galvanized steel face sheet, honeycomb core, galvanized steel backer sheet and 1.5" of semi-rigid acoustical insulation. The specimens weighed approximately 7.1 lbs/sq. ft.,. There are acoustic seals at the floor and seals that engage the sidewalls. Both test specimens rested on carpet when in place.

Test Procedure

The sound sources used were four (4) EAW JB260 loudspeakers driven by a Crown MT1200 amplifier. Pink noise from an Ivie IE-20B Noise Generator was used as the source signal, which was input into a Mackie 1402 mixer, which fed the signal to the amplifier.

The four loudspeakers were separated by 4 ft each and placed 15 ft. from the Skyfold partition,. The 60° coverage angle of the loudspeakers allowed a uniform distribution of sound level across the partition area tested.

A Bruel & Kjaer 2260 Type 1 Sound Level Meter was used for the source and receive sound pressure level measurements. The meter was calibrated with a Bruel & Kjaer 4231 Calibrator that emits a 1000 Hz tone at 94 dB. The meter was calibrated at regular intervals during the measurements, and the sensitivity deviated by no more than 0.01 dB throughout the tests.

A manual sweeping method was used to measure the source room sound level (L1), receive room sound level (L2) and background sound pressure levels. In each case, the meter was positioned 1 m (3.3 ft.) from the wall, and swept by walking back and forth forming an S-pattern across the test specimen starting at about an 8 ft. height, and finishing at about a 3.5 ft. height from the floor. The duration of the measurements was 60 seconds for all tests. The source (L1), receive (L2) and background noise levels were measured twice for each test. The average of the two sets of measurements was used in the analyses.

Test Results

The NR (Noise Reduction) values were computed in third-octave bands from 125 Hz to 400 Hz. These values allowed us to calculate the NIC (Noise Insulation Class which are given in the following table:

Test Configuration	@ Edge of Partition	@ Center of Partition
	NIC	NIC
One Skyfold Partition	46	46
Two Skyfold Partitions	60	62

The complete NR values, as well as the NIC graphs for each test are appended.

The results indicate that, for the case of one Skyfold partition in place, there was no difference between the edge and center conditions. This indicates that there was the same amount of flanking sound transmission at the edge of the wall than at the center joint between the 6th and 7th sets of panels.

In the case of the two partitions, there is a difference of 2 points between the edge and center conditions, indicating that there was slightly more flanking transmission along the edge of the 2nd Skyfold partition (the one closest to Expo Hall C), then there was at the center of the partitions.

The results for the two-partition configuration reflect the lower limit of NIC ratings that these two partitions can achieve in the field when both are in place, since the receive room sound pressure levels were less than 5 dB from the background noise levels in the third-octave bands above 400 Hz.

The results for the single partition test reflect the lower limit of the NIC rating achievable in the field by this partition, since the background noise was within 5 dB of the receive room sound levels in the 1000Hz and 1250 Hz bands.

During the tests for the single Skyfold partition at the center condition, sound leakage between the vertical joints of the panels was evident subjectively. This is due to a small gap between the 6th and 7th set of panels, where the two large 71-ft. pieces of the partition meet. There was no significant sound leakage evident between the horizontal joints of the panels, or at the seals along the wall and floor.

The NIC ratings achieved indicate that a 14 to 16 NIC point improvement was provided by the 2nd Skyfold partition, located 9 ft. away and parallel to the first Skyfold partition. Subjectively, an improvement of 10 NIC points is perceived as reducing the sound level through the partition by one-half. Therefore, the double Skyfold partition configuration provided more than twice the sound isolation of the single Skyfold partition.

Summary

The tests revealed that a single Skyfold partition achieved field ratings of **NIC 46**, for both the edge and center conditions.

Double Skyfold partitions, spaced 9 ft. apart achieved field ratings of **NIC 60** at the edge of the partition, and **NIC 62** at the center of the partition.

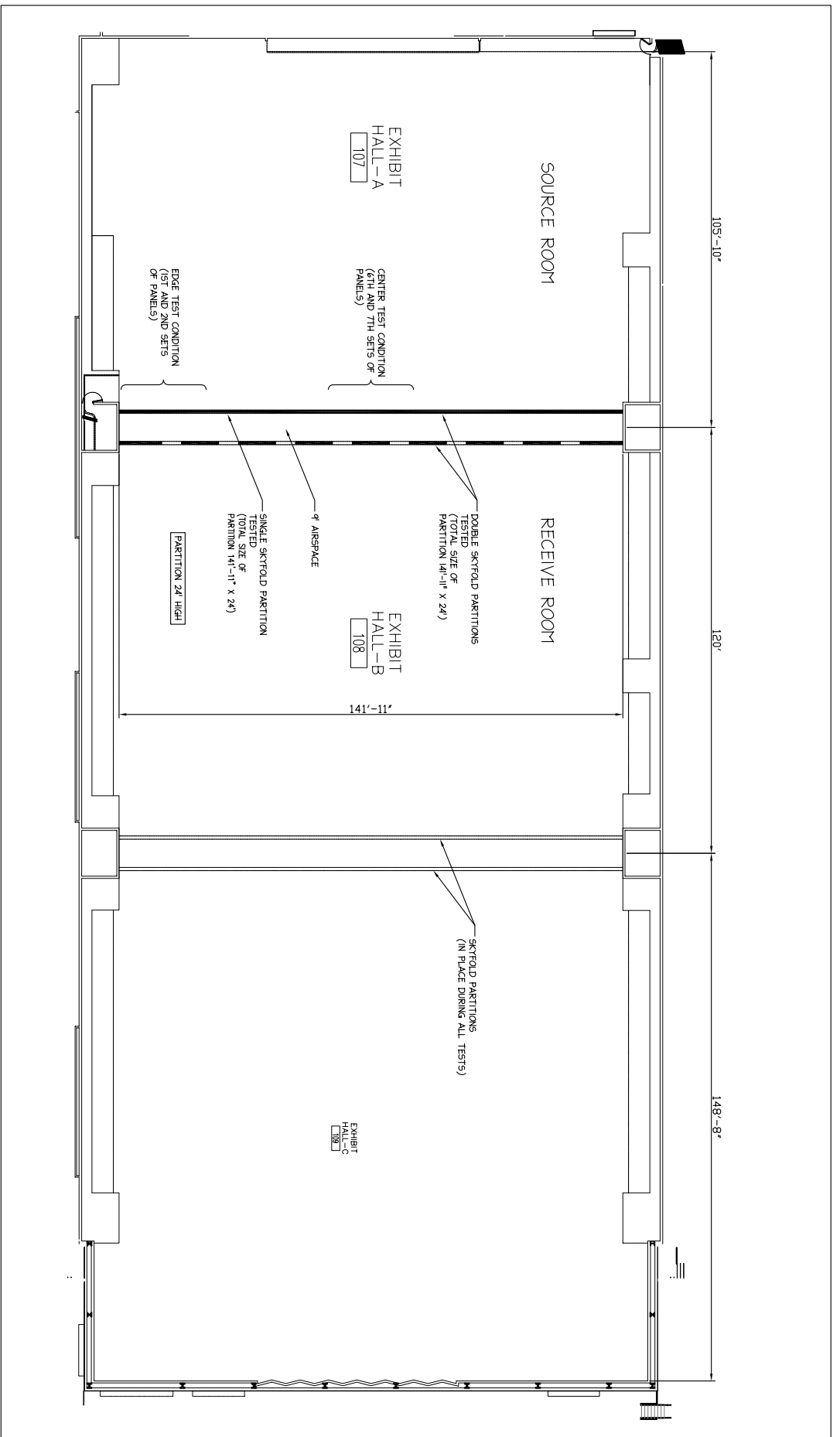
Sincerely,
SHEN MILSOM & WILKE, INC.



Pierre Germain, M.A.Sc.
Associate



Dennis Paoletti, FAIA
Principal



PROJECT :
SKYFOLD PARTITION TESTING
MOODY GARDENS CONVENTION CENTER

TITLE :
NIC TEST LAYOUT

JOB NO. :
04558

SCALE :
NTS

SHEET #
1

BY :
PG

DATE :
12/06/04

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 415-391-7610 FAX: 415-391-0171

Job Name: Skyfold Partition Testing

Job Number: 4558

Measurement Date: Nov 17 2004

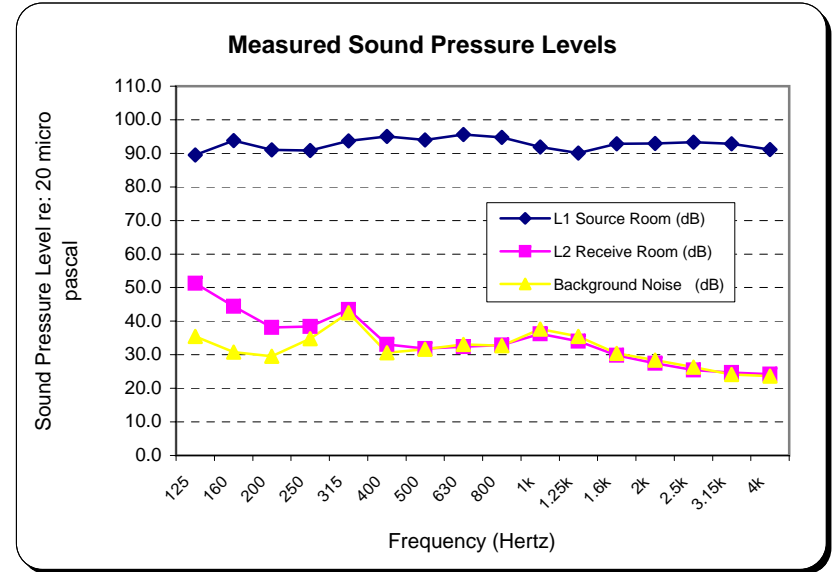
Source Room: Expo A

Receive Room: Expo B

NIC Test 1 Double Skyfold Partitions @ Center



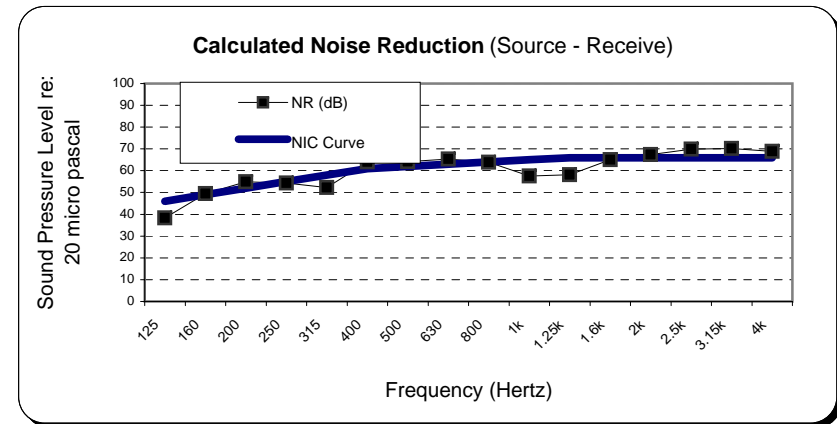
Octave Band (Hz)	L1 Source Room (dB)	L2 Receive Room (dB)	Background Noise (dB)	Corrected L2 (dB)	NR (dB)
125	89.5	51.3	35.5	51.3	38
160	93.8	44.4	30.8	44.4	49
200	91.0	38.1	29.6	36.1	55
250	90.8	38.5	34.8	36.5	54
315	93.7	43.4	42.5	41.4	52
400	95.1	33.0	30.6	31.0	64
500	94.0	31.8	31.6	29.8	64
630	95.7	32.4	33.1	30.4	65
800	94.7	32.9	32.6	30.9	64
1k	91.8	36.2	37.6	34.2	58
1.25k	90.1	34.0	35.4	32.0	58
1.6k	92.9	29.8	30.4	27.8	65
2k	92.9	27.4	28.4	25.4	67
2.5k	93.4	25.5	26.3	23.5	70
3.15k	92.9	24.7	24.2	22.7	70
4k	91.1	24.2	23.7	22.2	69



Total Deviation **30** Must be < 32

Deviation Per Octave **0** 1 = non compliance
0 = compliance

NIC Rating **62**



Job Name: Skyfold Partition Testing

Job Number: 4558

Measurement Date: Nov 17 2004

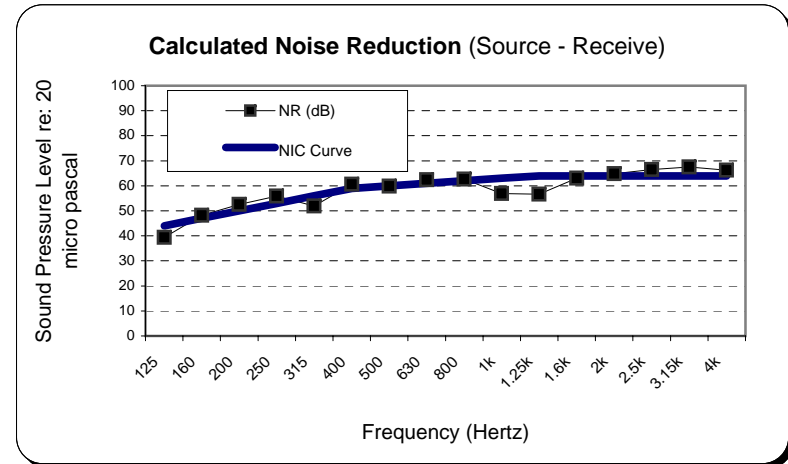
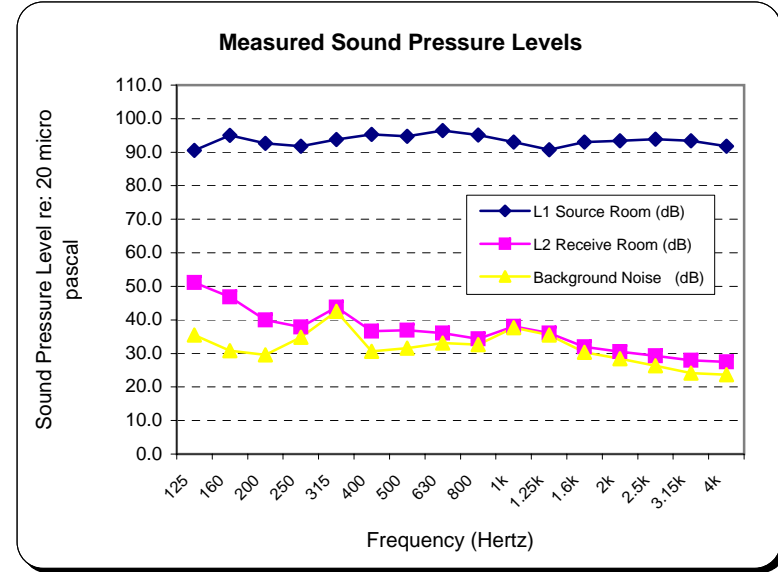
Source Room: Expo A

Receive Room: Expo B

NIC Test 2 Double Skyfold Partitions @ Edge



Octave Band (Hz)	L1 Source Room (dB)	L2 Receive Room (dB)	Background Noise (dB)	Corrected L2 (dB)	NR (dB)
125	90.5	51.1	35.5	51.1	39
160	95.1	46.9	30.8	46.9	48
200	92.6	40.0	29.6	40.0	53
250	91.8	37.9	34.8	35.9	56
315	93.7	43.8	42.5	41.8	52
400	95.3	36.6	30.6	34.6	61
500	94.7	36.9	31.6	34.9	60
630	96.5	36.1	33.1	34.1	62
800	95.1	34.4	32.6	32.4	63
1k	93.0	38.0	37.6	36.0	57
1.25k	90.8	36.1	35.4	34.1	57
1.6k	93.0	32.0	30.4	30.0	63
2k	93.4	30.6	28.4	28.6	65
2.5k	93.8	29.3	26.3	27.3	67
3.15k	93.4	27.9	24.2	25.9	67
4k	91.8	27.5	23.7	25.5	66



Total Deviation 23 Must be < 32

Deviation Per Octave 0 1 = non compliance
0 = compliance

NIC Rating 60

Job Name: Skyfold Partition Testing

Job Number: 4558

Measurement Date: Nov 17 2004

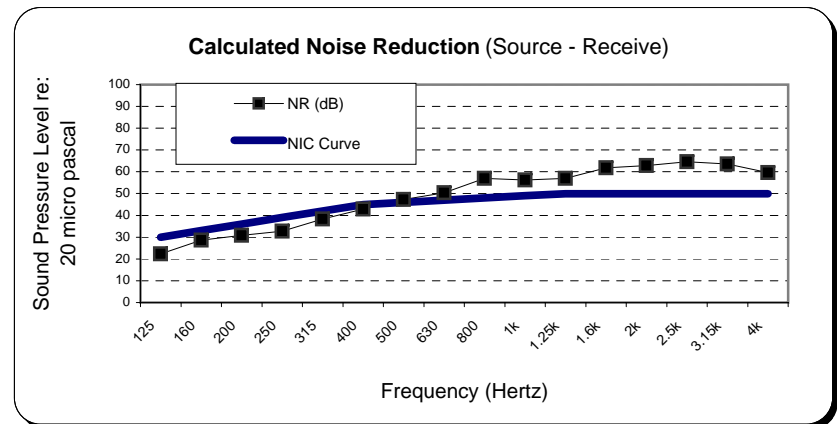
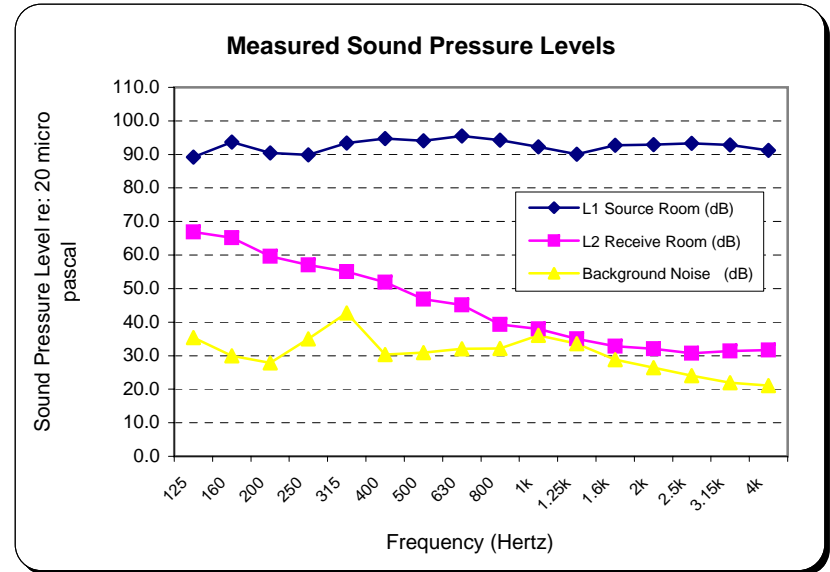
Source Room: Expo A

Receive Room: Expo B

NIC Test 3 Single Skyfold Partition @ Center



Octave Band (Hertz)	L1 Source Room (dB)	L2 Receive Room (dB)	Background Noise (dB)	Corrected L2 (dB)	NR (dB)
125	89.2	66.9	35.4	66.9	22
160	93.7	65.1	30.0	65.1	29
200	90.5	59.6	27.8	59.6	31
250	89.8	57.1	35.0	57.1	33
315	93.4	55.0	42.8	55.0	38
400	94.7	51.9	30.3	51.9	43
500	94.1	46.9	30.9	46.9	47
630	95.5	45.2	32.0	45.2	50
800	94.3	39.3	32.2	37.3	57
1k	92.3	38.0	36.0	36.0	56
1.25k	90.0	35.0	33.5	33.0	57
1.6k	92.7	32.8	28.8	30.8	62
2k	92.9	32.0	26.4	30.0	63
2.5k	93.3	30.7	24.0	28.7	65
3.15k	92.9	31.4	21.9	29.4	64
4k	91.2	31.6	21.1	31.6	60



Total Deviation **29** Must be < 32

Deviation Per Octave **0** 1 = non compliance
0 = compliance

NIC Rating **46**

Job Name: Skyfold Partition Testing

Job Number: 4558

Measurement Date: Nov 17 2004

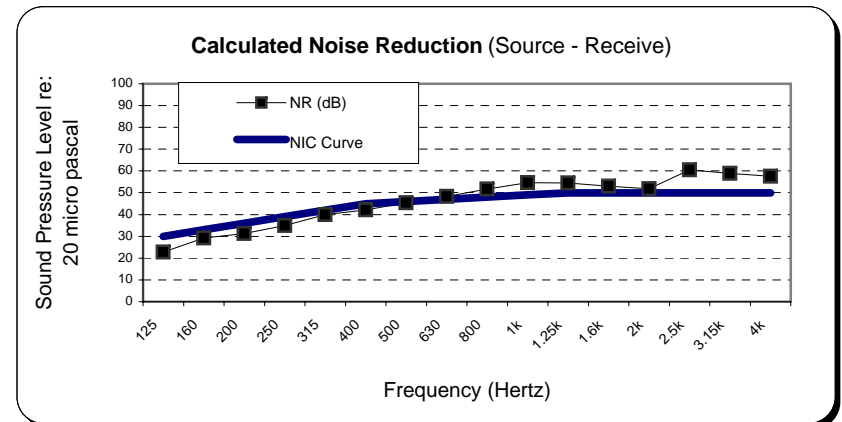
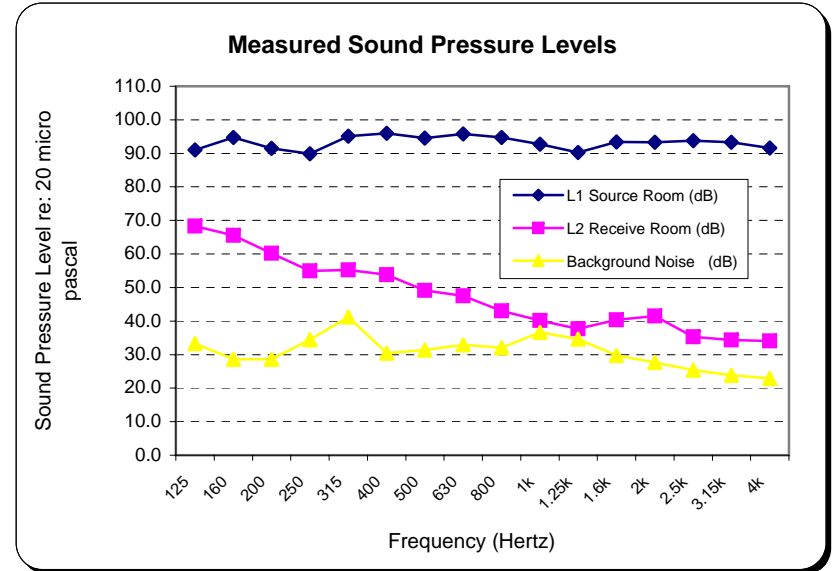
Source Room: Expo A

Receive Room: Expo B

NIC Test 4 Single Skyfold Partition @ Edge



Octave Band (Hertz)	L1 Source Room (dB)	L2 Receive Room (dB)	Background Noise (dB)	Corrected L2 (dB)	NR (dB)
125	91.0	68.3	33.3	68.3	23
160	94.7	65.5	28.6	65.5	29
200	91.5	60.2	28.7	60.2	31
250	89.9	54.9	34.5	54.9	35
315	95.1	55.3	41.2	55.3	40
400	96.0	53.8	30.5	53.8	42
500	94.5	49.1	31.4	49.1	45
630	95.8	47.5	32.9	47.5	48
800	94.7	43.1	32.1	43.1	52
1k	92.7	40.1	36.7	38.1	55
1.25k	90.2	37.7	34.7	35.7	54
1.6k	93.4	40.4	29.8	40.4	53
2k	93.3	41.5	27.7	41.5	52
2.5k	93.8	35.3	25.4	33.3	60
3.15k	93.3	34.4	23.8	34.4	59
4k	91.6	34.0	22.9	34.0	58



Total Deviation 25 Must be < 32

Deviation Per Octave 0 1 = non compliance
0 = compliance

NIC Rating 46