MiLyn, LLC
7012 Cedar St., Lubbock, Texas 79404
(877) 219 - 5616

Certified

Test Reports

The Insulation Properties of TruProtect™ in:

- Thermal Transfer
- Radiance
- Impact/Vibration
- Fire Spread
- Acoustics
- RF-EMF-EMI

Index

TruProtect™

Product Description

TruProtect is a patented, ASTM tested and USA made product that combines multiple layers of fiberboard and heavy aluminum foil. It is produced in 4’x8’, 2’x2’, 2’x4’ and 600mm x 600mm sizes and in various thicknesses. The product is lightweight, economical, fully recyclable and made from 95% recycled materials. It provides superior and proven insulating properties in the following areas:

- Thermal Transference
- Radiant Barrier
- Acoustics
- Vibration-Impact
- Fire Spread
- RF-EMF-EMP-EMI

Selected

Test

Reports

Certified copies of the following reports are available upon request.

Architectural Testing

ASTM C 1363-97 THERMAL PERFORMANCE TEST REPORT

Rendered to:

MILYN, LLC
5507 Tenth St.
Lubbock, Texas 79416

Report No: 56567.01-201-46
Test Date: 04/01/05
Report Date: 04/07/05
Expiration Date: 04/01/09

Test Sample Identification:

Series/Model: TruProtect
Type: Insulated Panel

Test Procedure: ASTM C 1363-97, *Standard Test Method for the Thermal Performance of Building Assemblies by Means of Hot Box Apparatus.*

Test Results Summary:

Thermal Resistance(Rs): 1.61 $(hr \cdot ft^2 \cdot F)/Btu$
Conductance (Cs): 0.62 $Btu/hr \cdot ft^2 \cdot F$

Test Sample Description

Overall Size: 48" wide by 80 1/2" high

Construction: Sample was a total of 0.53" thick, which consisted of Four (4) layers of corrugated fiber board. The interior and exterior exposed surfaces of the sample were faced with an aluminum foil wrap. An additional layer of aluminum foil was located in the center of panel. The corrugation layer thicknesses measured 3/32", 5/32", 3/32", and 5/32", respectively.

849 Western Avenue North
St. Paul, MN 55117
phone: 651-636-3835
fax: 651-636-3843
www.archtest.com

Report No.: 22182-0
Order No.: AE22182
Client Reference: P.O. # 110
Date: June 21, 2006

HEMISPHERICAL SPECTRAL REFLECTANCE
and
TOTAL EMITTANCE TEST REPORT

prepared for:

MILYN LLC
5507 10th Street
Lubbock, TX 79416

presented by:
Atlas Weathering Services Group
DSET Laboratories
45601 North 47th Avenue
Phoenix, AZ 85087-7042
Phone: 623-465-7356
FAX: 623-465-9409

This report contains 4 pages

Prepared by:

Kathleen R. Eoff
Senior Technician, Optics

Approved by:

Marge Awarski
Group Leader, Evaluations Services

HEMISPHERICAL SPECTRAL REFLECTANCE and TOTAL EMITTANCE TEST REPORT

1.0 INTRODUCTION

This report presents results of spectral reflectance and total emittance measurements on the following foil specimen coded:

TruProtect

2.0 TEST METHODS AND PROCEDURES

Reflectance

Hemispherical spectral reflectance measurements were performed in accordance with ASTM Standard Test Method E903 (1996). The measurements were performed with a PerkinElmer Lambda 950 Spectrophotometer utilizing an integrating sphere (Fig A1.3 of E903 (1996)). Total reflectance measurements were obtained in the solar spectrum from 2500nm to 250nm at an incident angle of 15°. The measurements employ a detector-baffled, wall-mounted integrating sphere that precludes the necessity of employing a reference standard except to define the instrument's 100% line. The measurements are properly denoted as being `hemispherical spectral reflectance'.

Total Solar ρ reflectance was obtained by integrating the spectral data against Air Mass 1.5 (ASTM G159-98) direct solar spectrum utilizing 105 weighted ordinates. All spectral data are submitted herewith in the original.

Emittance

Near-normal infrared reflectance measurements were performed in accordance with ASTM E408-71 (reapproved 2002), Method A. A Gier Dunkle Instruments Infrared Reflectometer Model DB 100 was utilized for the measurements.

HEMISPHERICAL SPECTRAL REFLECTANCE
and
TOTAL EMITTANCE TEST REPORT

2.0 TEST METHODS AND PROCEDURES (cont'd)

Inside the detector portion are two semi-cylindrical cavities. One of the cavities is heated by an electrical heater and the other stabilizes at approximately room temperature. Thus, the two cavities are maintained at different temperatures. As the cavities rotate, the sample is alternately irradiated at 13 Hz. A vacuum thermocouple views the sample through an optical system that focuses through slits in the ends of the cavities. The detector receives energy emitted by the sample and energy reflected by the sample. Only the reflected energy contains an alternating component as the sample is alternately irradiated by the hot and cold cavities. An amplifier is synchronized with the cavity rotation to pass only the desired alternating signal, which is then rectified and filtered. The zero and gain are set with standards of known emittance. The calibration is rechecked at several intervals during the measurement. The Gier Dunkle Infrared Reflectometer is calibrated using high and low emittance standards. The standards were calibrated at and obtained from the National Physical Laboratory in England. The emittance value for the glass standard equals 0.89. The emittance value for the mirror standard equals 0.01.

Near-normal emittance for the client's specimens was calculated from Kirchhoff's Relationship where:

$$\rho + \alpha + \tau = 1, \alpha = \varepsilon$$

Since these specimens are opaque and have no τ in the far IR, the preceding equation reduces to:

$$\rho + \varepsilon = 1 \text{ and } 1 - \rho = \varepsilon$$

3.0 OBSERVATIONS, DEVIATIONS, AND WAIVERS

All measurements were performed on the side designed by the client.

The values reported for emittance represent the average of at least four measurements.

With all test methods, there typically is a level of uncertainty for the test data due to the acceptable operating tolerances of the instrumentation and variation caused by the test method. The estimated tolerances are expected to be less than plus or minus 2% for most materials tested to *ASTM E903*.

HEMISPHERICAL SPECTRAL REFLECTANCE
and
TOTAL EMITTANCE TEST REPORT

4.0 RESULTS

Reflectance:

Specimen Code	% Solar Reflectance
TruProtect	81.5

Emittance:

Specimen Code	Reflectance (ρ) Measured	Near-Normal Emittance (ε) Calculated
TruProtect	.98	.02

ACOUSTIC SYSTEMS
ACOUSTICAL RESEARCH FACILITY
OFFICIAL LABORATORY REPORT
AS-TL2729

ACOUSTIC SYSTEMS
Acoustical Research Facility

Subject: **Sound Transmission Loss Test**

Date: August 24, 2005

Contents: Transmission Loss Data, One-third Octave Bands
Transmission Loss Data, Octave Bands
Sound Transmission Class Rating
Outdoor / Indoor Transmission Class Rating

on

TruProtect™ Building Cladding - Thickness 1/2"

for

MiLyn LLC

ACOUSTIC SYSTEMS ACOUSTICAL RESEARCH FACILITY is NVLAP-Accredited for this and other test procedures.

National Institute of Standards and Technology

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National Voluntary Laboratory Accreditation Program

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415 East Saint Elmo Road Austin, Texas 78745 • PO Box 3610 (78764) • 512/444-1961 • FAX 512/444-2282 • 800/749-1460
www.acousticsystems.com • e-mail: lab@acousticsystems.com

INTRODUCTION

Sound Transmission Loss of a partition in a specified frequency band is defined as ten times the common logarithm of the airborne sound power incident on the partition to the sound power transmitted by the partition and radiated on the other side. The quantity so obtained is expressed in decibels.

APPLICABLE STANDARDS

ASTM E 90-04	"Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements"
ASTM E 413-04	"Standard Classification for Rating Sound Insulation"
ASTM E 1332-90 (2003)	"Classification for Determination of Outdoor-Indoor Transmission Class"
ASTM E 2235-04e1	"Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods"
ISO 717-1:1996	"Acoustics -- Rating of sound insulation in buildings and of building elements Part 1: Airborne sound insulation"

SPECIMEN DESCRIPTION

The test specimen consisted of two (2) nominal 1219 mm in width by 2438 mm in length by 13 mm in depth *[48 by 96 by 1/2 inches]* panels. Panels were placed in the test frame to create a 2438 mm in length by 2438 mm in width by 13 mm in depth *[96 by 96 by 1/2 inches]* assembly. The test specimen was designed, manufactured, submitted for test, and designated "TruProtect™ Building Cladding - Thickness 1/2" " by MiLyn LLC of Lubbock, Texas. Each panel was identically constructed from exterior (Source) to interior (Receive) as follows: one (1) face layer of 0.13 mm *[0.005 inch]* metal foil with adhesive; one (1) layer of nominal 6 mm *[1/4 inch]* for fiberboard with Class A&C flute; one (1) layer of 0.05 mm *[0.002 inch]* foil without adhesive; one (1) layer of nominal 6 mm *[1/4 inch]* layer for fiberboard with Class A&C flute; and, one (1) face layer of 0.05 mm *[0.002 inch]* foil with adhesive. All sides were sealed by wrapping the interior face layer of foil around the edges and sealing with the exterior face foil layer. The vertical joint on the panel assembly was sealed with metal tape on both interior and exterior sides of the test specimen.

The surface area of the specimen was 5.95 square meters *[64.0 square feet]*. The weight of the test specimen was measured as 16.1 kg *[35.5 pounds]*, giving a weight per unit area of 2.7 kg/m^2 *[0.6 pounds/ft^2]*.

TEST SPECIMEN MOUNTING

The specimen was mounted in a filler wall in the 2440 mm by 2440 mm transmission loss test opening. The face of the specimen was sealed to the edge of the test aperture with dense mastic putty. The calculated transmission loss of the composite assembly (test specimen and filler wall) was adjusted to account for sound power transmitted through the filler wall.

DESCRIPTION OF TEST

Two (2) loudspeakers in a 200 cubic meter reverberation chamber, designated as the "Source Room", produced broadband pink noise. A 255.6 cubic meter reverberation chamber, designated as the "Receive Room", is coupled to the Source Room through the transmission loss opening. The steady-state space-time average sound pressure levels in the Source and Receive Room were determined using rotating microphone booms and a Norsonic Dual-Channel Real-Time Analyzer Nor-840. Sound absorption in the Receive Room was determined by performing decay rate measurements. Measurements are made in the ISO-preferred one-third octave bands from 50 Hz to 10000 Hz. Sound Transmission Class (**STC**) is the single number rating that is calculated from Sound Transmission Loss values to provide a performance estimate of a partition in certain interior sound insulation situations. Airborne Sound Reduction Index ($\mathbf{R_w}$), defined in ISO 717-1, is used internationally and is a similar rating to Sound Transmission Class (**STC**). Outdoor-Indoor Transmission Class (**OITC**) is the single number rating that is intended to rate effectiveness of building façade elements at reducing transportation noise intrusion.

Precision of calculated Sound Transmission Loss values varies with frequency band and is included in the table within this document. The test was performed in strict accordance with ASTM E90-04. Data for laboratory flanking limit and reference specimen tests are available on request.

This test took place at **ACOUSTIC SYSTEMS ACOUSTICAL RESEARCH FACILITY**, Austin, Texas, on August 18, 2005.

TRANSMISSION LOSS DATA

Sound Transmission Loss of the test specimen at the preferred one-third octave band center frequencies is tabulated below and then presented graphically. Octave-band Transmission Loss values are calculated as described in Section 12.3 of ASTM E90.

MiLyn LLC – TruProtect™ Building Cladding - Thickness 1/2"

1/3 Octave Band Center Freq (Hz)	Transmission Loss (dB)	Uncertainty (+/- dB)	Notes	Octave Band TL (dB)	STC Deficiencies
50	10		[g]		
63	9		[g]	8	
80	7	3.0	[g]		
100	5	3.0			
125	10	2.1		8	
160	11	1.9			
200	11	1.4			
250	13	0.7		13	
315	14	0.5			1
400	15	0.5			3
500	16	0.5		16	3
630	18	0.3			2
800	19	0.3			2
1000	20	0.3		20	2
1250	21	0.3			2
1600	21	0.2			2
2000	20	0.2		20	3
2500	19	0.2			4
3150	19	0.2			4
4000	20	0.2		20	3
5000	21	0.2			
6300	23	0.4			
8000	26	0.6		26	
10000	30	0.6			
STC	**19**	**R_w**	**19**		
OITC	**15**				

Note: [a]: Receive room L_p corrected for background noise; [b]: Receive room L_p too close to ambient. Correction of 2 dB applied. Result represents lower bound for TL in this band; [c]: Correction made for flanking transmission; [d]: Transmission Loss of specimen too close to facility limit. No facility correction applied. Result represents lower bound for TL in this band; [e]: Transmission Loss of specimen too close to filler wall. Result represents lower bound for TL in this band; [f]: Test uncertainty exceeds limits of Section A.2.2 of ASTM E 90; [g] Insufficient number of statistically independent samples to determine test precision.

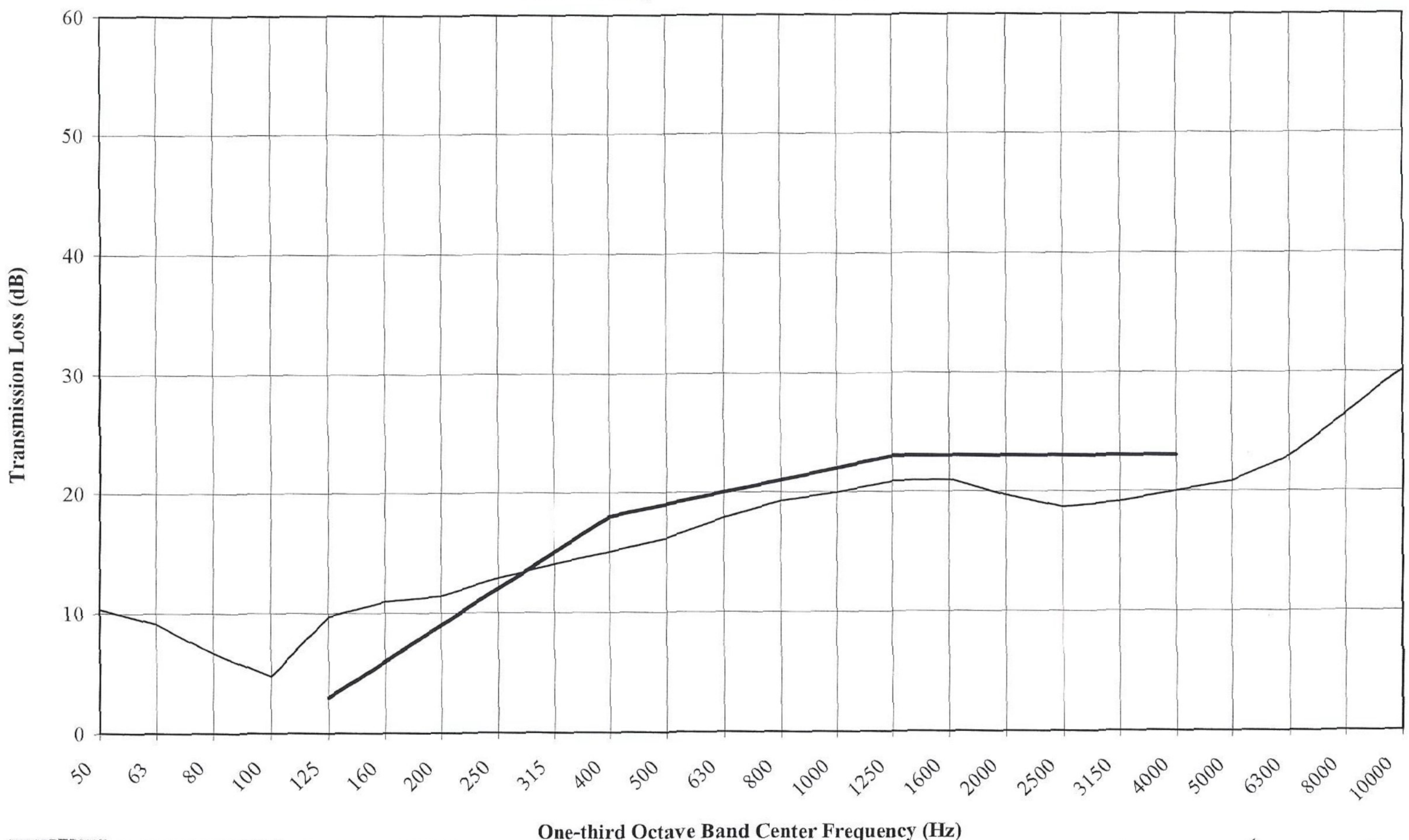
Method Precision, Bias, 95% Confidence Interval – Precision: Repeatability depends on the specimen tested. Round robin testing on ASTM E1289 reference specimen produced reproducibility standard deviation of 2 dB or less at all test frequencies 125 Hz to 4000 Hz. **Bias:** No bias in this method as true value defined by the test method. **95% Confidence Interval:** Facilities and microphone systems produce one-third octave band Transmission Loss measurement uncertainties less than: 80 Hz – 6 dB; 100 Hz – 4 dB; 125 Hz, 160 Hz – 3 dB; 200 Hz, 250 Hz – 2 dB; 315 Hz to 4000 Hz – 1 dB.

During the test, environmental conditions in the Receive Room were 24.4C with 88.4% relative humidity. Conditions in the Source Room were 24.0C with 89.3% relative humidity.

Respectfully Submitted,

Michael C. Black
Laboratory Technical Director

MiLyn LLC TruProtect™ Building Cladding; Thickness - 1/2"
AS-TL2729; STC 19 OITC 15



ACOUSTIC SYSTEMS ACOUSTICAL RESEARCH FACILITY

NVLAP LAB CODE 100286-0

ACOUSTIC SYSTEMS
ACOUSTICAL RESEARCH FACILITY
OFFICIAL LABORATORY REPORT
AS-TL2961

Subject: **Sound Transmission Loss Test**

Date: 29 June 2006

Contents: Transmission Loss Data, One-third Octave Bands
Transmission Loss Data, Octave Bands
Sound Transmission Class Rating
Outdoor / Indoor Transmission Class Rating
Airborne Sound Reduction Index

on

SWS317 Wall Assembly w/TruProtect™ Building Cladding on Exterior and Interior Sides - Total Assembly Thickness 8"

for

MiLyn, LLC

ACOUSTIC SYSTEMS ACOUSTICAL RESEARCH FACILITY is NVLAP-Accredited for this and other test procedures.

National Institute of Standards and Technology

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www.acousticsystems.com • e-mail: lab@acousticsystems.com

INTRODUCTION

Sound Transmission Loss of a partition in a specified frequency band is defined as ten times the common logarithm of the airborne sound power incident on the partition to the sound power transmitted by the partition and radiated on the other side. The quantity so obtained is expressed in decibels.

APPLICABLE STANDARDS

ASTM E 90-04	"Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements"
ASTM E 413-04	"Standard Classification for Rating Sound Insulation"
ASTM E 1332-90 (2003)	"Classification for Determination of Outdoor-Indoor Transmission Class"
ASTM E 2235-04e1	"Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods"
ISO 717-1:1996	"Acoustics -- Rating of sound insulation in buildings and of building elements Part 1: Airborne sound insulation"

SPECIMEN DESCRIPTION

The test specimen consisted of a nominal 2438 mm in length by 2438 mm in width by 203 mm in depth *[96 by 96 by 8 inches]* single plate/staggered stud asymmetrical wall section. The test specimen was fabricated, submitted for test, and designated "SWS317 Wall Assembly w/TruProtect™ Building Cladding on Exterior and Interior Sides - Total Assembly Thickness 8"" by MiLyn, LLC of Lubbock, Texas. The surface area of the specimen was 5.9 square meters *[64.0 square feet]*. The weight of the test specimen was measured as 204.1 kg *[450.0 pounds]*, giving a weight per unit area of 34.3 kg/m^2 *[7.0 pounds/ft^2]*. The test specimen was fabricated as given below:

The test specimen was fabricated as given below:

Source Room (Noise Side)
A base layer of TruProtect™ Building Cladding was attached vertically (parallel) to nominal 51 mm by 152 mm *[2 by 6 inches]* yellow pine studs on 406 mm *[16 inches]* centers. The TruProtect™ Building Cladding was supplied in of two (2) nominal 1219 mm in width by 2438 mm in length by 13 mm in depth *[48 by 96 by 1/2 inches]* panels. Each panel was identically constructed as follows: one (1) face layer of 0.13 mm *[0.005 inch]* metal foil with adhesive; one (1) layer of nominal 6 mm *[1/4 inch]* for fiberboard with Class A&C flute; one (1) layer of 0.05 mm *[0.002 inch]* foil without adhesive; one (1) layer of nominal 6 mm *[1/4 inch]* layer for fiberboard with Class A&C flute; and, one (1) face layer of 0.05 mm *[0.002 inch]* foil with adhesive. Panel sides were sealed by wrapping the interior face layer of foil around the edges and sealing with the exterior face foil layer. The joint on the TruProtect™ Building Cladding panels was sealed with metal tape. A 6 mm *[1/4 inch]* bead of latex caulking was applied to the perimeter of the wood stud frame in order to provide a positive panel seal. The TruProtect™ Building Cladding was then mechanically attached to the studs with 57 mm *[2-1/4 inches]* bugle head wood screws on nominal 305 mm *[12 inches]* centers in the field of these panels.

A face layer of 13 mm *[1/2 inch]* gypsum wallboard was then attached to nominal 51 mm by 152 mm *[2 by 6 inches]* yellow pine studs on 406 mm *[16 inches]* centers. This face layer was applied horizontally, perpendicular to the base layer. The gypsum board was attached to studs with 57 mm *[2-1/4 inches]* bugle head wood screws on nominal 305 mm *[12 inches]* centers in the field and on along top and bottom assembly members. The center horizontal joint was not taped and floated.

Cavity
The cavity between studs was filled with nominal 9.6 kg/m^3 *[0.6 pounds per cubic foot]* kraft-faced fiberglass as manufactured by Owens Corning. The thickness of the material was 165 mm *[6-1/2 inches]*, giving an R-19 rating per the material supplier.

Receive Room (Quiet Side)

A base layer of TruProtect™ Building Cladding was attached vertically (parallel) to nominal 51 mm by 152 mm *[2 by 6 inches]* yellow pine studs on 305 mm *[12 inches]* centers. The TruProtect™ Building Cladding was supplied in of two (2) nominal 1219 mm in width by 2438 mm in length by 13 mm in depth *[48 by 96 by 1/2 inches]* panels. Each panel was identically constructed as those used on the Source Room side of the assembly. The joint on the TruProtect™ Building Cladding panels was sealed with metal tape. A 6 mm *[1/4 inch]* bead of latex caulking was applied to the perimeter of the wood stud frame in order to provide a positive panel seal. The TruProtect™ Building Cladding was then mechanically attached to the studs with 57 mm *[2-1/4 inches]* bugle head wood screws on nominal 305 mm *[12 inches]* centers in the field of these panels.

A face layer of 13 mm *[1/2 inch]* gypsum wallboard was then attached to nominal 51 mm by 152 mm *[2 by 6 inches]* yellow pine studs on 305 mm *[12 inches]* centers. This face layer was applied horizontally, perpendicular to the base layer. The gypsum board was attached to studs with 57 mm *[2-1/4 inches]* bugle head wood screws on nominal 305 mm *[12 inches]* centers in the field and on along top and bottom assembly members. The center horizontal joint was not taped and floated.

TEST SPECIMEN MOUNTING

The specimen was mounted in the 2440 mm by 2440 mm transmission loss test opening. The face of the specimen was sealed to the edge of the test aperture with dense mastic putty. The calculated transmission loss of the test specimen was evaluated against facility flanking limits to determine any affects on specimen performance.

DESCRIPTION OF TEST

Two (2) loudspeakers in a 200 cubic meter reverberation chamber, designated as the "Source Room", produced broadband pink noise. A 255.6 cubic meter reverberation chamber, designated as the "Receive Room", is coupled to the Source Room through the transmission loss opening. The steady-state space-time average sound pressure levels in the Source and Receive Room were determined using rotating microphone booms and a Norsonic Dual-Channel Real-Time Analyzer Nor-840. Sound absorption in the Receive Room was determined by performing decay rate measurements. Measurements are made in the ISO-preferred one-third octave bands from 50 Hz to 10000 Hz. Sound Transmission Class (**STC**) is the single number rating that is calculated from Sound Transmission Loss values to provide a performance estimate of a partition in certain interior sound insulation situations. Airborne Sound Reduction Index (**R_w**), defined in ISO 717-1, is used internationally and is a similar rating to Sound Transmission Class (**STC**). Outdoor-Indoor Transmission Class (**OITC**) is the single number rating that is intended to rate effectiveness of building façade elements at reducing transportation noise intrusion.

Precision of calculated Sound Transmission Loss values varies with frequency band and is included in the table within this document. The test was performed in strict accordance with ASTM E90-04. Data for laboratory flanking limit and reference specimen tests are available on request. This test took place at **ACOUSTIC SYSTEMS ACOUSTICAL RESEARCH FACILITY**, Austin, Texas, on June 28, 2006.

ENVIRONMENTAL CONDITIONS

During the test, environmental conditions in the Receive Room were 20.9C with 63.3% relative humidity. Conditions in the Source Room were 20.3C with 59.6% relative humidity. Environmental conditions remained within strict limits imposed by the laboratory.

Respectfully Submitted,

Michael C. Black
Laboratory Technical Director

TRANSMISSION LOSS DATA

Sound Transmission Loss of the test specimen at the preferred one-third octave band center frequencies is tabulated below and then presented graphically. Octave-band Transmission Loss values are calculated as described in Section 12.3 of ASTM E90.

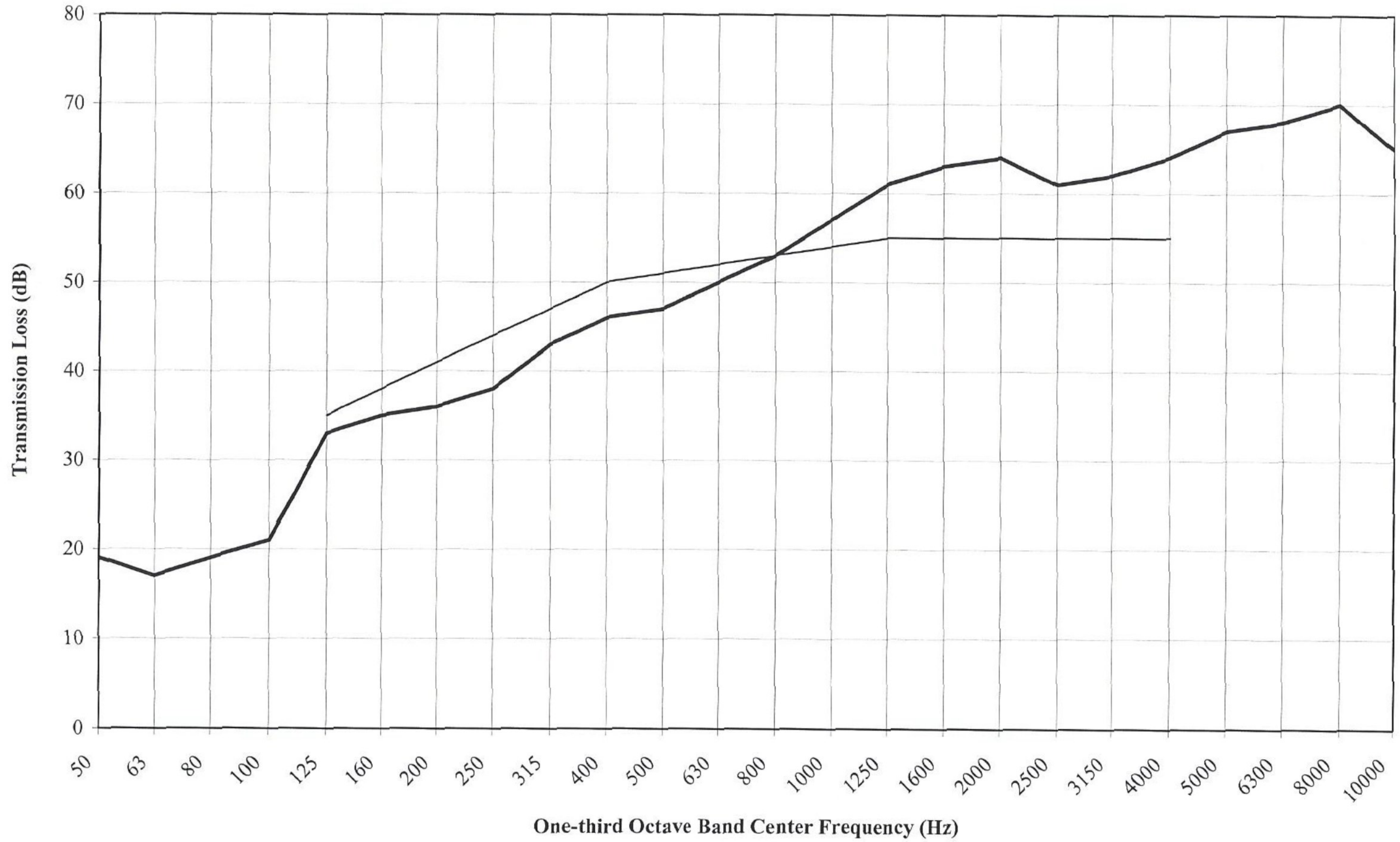
MiLyn, LLC – SWS317 Wall Assembly w/TruProtect™ Building Cladding on Exterior and Interior Sides - Total Assembly Thickness 8"

1/3 Octave Band Center Freq (Hz)	Transmission Loss (dB)	Uncertainty (+/- dB)	Notes	Octave Band TL (dB)	STC Deficiencies	R_w Deviations >8dB
50	19		[f]			
63	17		[f]	18		
80	19	2.9				
100	21	2.9				9.1
125	33	2.1		25	2	
160	35	1.9			3	
200	36	1.4			5	
250	38	0.7		38	6	
315	43	0.5			4	
400	46	0.5			4	
500	47	0.5		47	4	
630	50	0.3			2	
800	53	0.3				
1000	57	0.3		56		
1250	61	0.3				
1600	63	0.2				
2000	64	0.2		62		
2500	61	0.2				
3150	62	0.2				
4000	64	0.2		64		
5000	67	0.3				
6300	68	0.4				
8000	70	0.7	[b]	67		
10000	65	0.6	[b]			
STC	**51**	**R_w**	**49**			
OITC	**35**					

Note: [a]: Sound Pressure Level in Receive Room less than 5 dB above ambient. Correction of 2 dB applied. Value represents lower bound for specimen TL in this band; **[b]**: Specimen TL within 10 dB of facility flanking limits. No correction applied. Value represents lower bound for specimen TL in this band; **[c]**: Specimen TL corrected for sound transmission through laboratory filler wall per ASTM E90-04 Section 7.3.1.6; **[d]**: Specimen TL too close to laboratory filler wall. Values represents lower bound for specimen TL in this band; **[e]**: Uncertainty in this band exceeds limits of ASTM E90-04 Section A2.2.; **[f]** Insufficient number of independent microphone samples to determine test uncertainty.

Method Precision, Bias, 95% Confidence Interval – Precision: Repeatability depends on the specimen tested. Round robin testing on ASTM E1289 reference specimen produced reproducibility standard deviation of 2 dB or less at all test frequencies 125 Hz to 4000 Hz. **Bias:** No bias in this method as true value defined by the test method. **95% Confidence Interval:** Facilities and microphone systems produce one-third octave band Transmission Loss measurement uncertainties less than: 80 Hz – 6 dB; 100 Hz – 4 dB; 125 Hz, 160 Hz – 3 dB; 200 Hz, 250 Hz – 2 dB; 315 Hz to 4000 Hz – 1 dB.

MiLyn, LLC SWS317 Wall Assembly w/ TruProtect™ Building Cladding on Exterior and Interior Sides
Total Assembly Thickness 8" *AS-TL2961; STC 51 OITC 35*



ACOUSTIC SYSTEMS
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NVLAP LAB CODE 100286-0

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SRG

Shielding Resources Group, Inc.

RADIO FREQUENCY SHIELDING EFFECTIVENESS TEST REPORT

TEST REPORT NUMBER TR-TRU-PROTECT-M

Submitted To: Tru-Protect
7012 Cedar Avenue
Lubbock, Texas 79404

Prepared For: Tru-Protect
7012 Cedar Avenue
Lubbock, Texas 79404

Prepared By: Shielding Resources Group, Inc.
9512 E. 55th Street
Tulsa, Oklahoma 74145

Test Date: January 12, 2012 & January 13, 2012

Submission Date: January 13, 2012

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Tulsa, Oklahoma
74145
(918) 663-1985 Fax: 663-1986
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www.shieldingresources.com

TABLE OF CONTENTS

1.0 __INTRODUCTION__

This document is a report of attenuation/shielding effectiveness testing conducted on a RF shielded enclosure located at Shielding Resources Group, Inc. (SRG). The primary purpose of this test was to determine the levels of shielding effectiveness that the enclosure afforded with the introduction of RF shielded components manufactured by Shielding Resources Group, Inc. (SRG), The enclosure is located at the office/ manufacturing facility of SRG, 9512 E. 55th Street, Tulsa, Oklahoma 74145. The intended use or purpose of this enclosure is to determine what levels of RF shielding effectiveness are attained with 3 layer Tru-Protect" panels and SRG components..

Testing was performed by Shielding Resources Group, Inc. in accordance with MIL-STD-285 (frequency modified), for the purpose of shielding effectiveness performance verification. Testing consisted of measurements of the enclosures shielding effectiveness characteristics following the procedures of MIL-STD-285, IEEE 299, modified and NSA 73-2A.

2.0 __DESCRIPTION OF THE TEST ARTICLE__

The article under test was a fixed site RF shielded enclosure which was designed to be an externally supported, (RF Shielding media attached to a host substrate). The RF panels were supplied by Tru-Protect and the door, electrical filter(s), honeycomb waveguides and floor were supplied by SRG.

The host structure was fabricated with conventional 2 X 4 steel studs and 2 X 4 steel stud tracks. The stud tracks were mechanically attached to SRG's modular floor panels. Once the stud tracks were secured, the studs and ceiling joists were installed. A layer of ½" OSB was attached to the interior stud walls and ceiling of the enclosure. This ½" layer of OSD was the mounting surface for the Tru-Protect panels.

The shielding media utilized for the walls and ceiling consisted of 3 layers 5 mil aluminum, designated as Tru-Protect product description "1/2" 3 Layers Alum 2 Board". To attain RF shielding effectiveness, the internal joints or seams of the 3 layer aluminum panels were "butted" together. Each "joint" was than sealed with a conductive 5mil aluminum tape.

The floor consisted of SRG's modular galvanized panels which were jointed along the edges with a counter sunk "hat & flat" assembly. A interface member was installed between the floor panel face and the wall panel face.

For the introduction of electrical power to the enclosure, attenuative power filters were used. The power filters were designed to comply with the requirements of MIL-STD-220A. Heating, air conditioning was introduced through the use of SRG's 3/16" X 1" steel honeycomb waveguide (which was installed in a "L" angle frame. The RF shielded door was a 3'-0" X 7'-0" SRG "ULTRA-COVERT" series door.

3.0 __SHIELD PERFORMANCE CRITERIA__

The performance criteria of the RF shield enclosure is to provide an interference free environment and eliminate RFI signals within the shielded environment when tested in accordance with MIL-STD-285 and IEEE 299. It is noted, that due to the design characteristics of the shielding media, a single point ground was not attained or attempted.

Shielding effectiveness (or attenuation) is defined as the level of electromagnetic reduction provided by a shield. For this purpose, the shielded environment was tested to determine what levels of shielding effectiveness (or attenuation) are attainable with the Tru-Protect panels and the SRG components. The goal shielding effectiveness is as shown in paragraph 3.1 which is based on NSA 73-2A. Since this was a determination of shielding effectiveness, no required vale of S/E is given.

3.1 RF SHIELDING

FREQUENCY FIELD SHIELDING EFFECTIVENESS

10 MHz Electric Field TBD
50 MHz Electric Field TBD
100 MHz Electric Field/Plane Wave TBD
400 MHz Plane Wave TBD
1 GHz Plane Wave/Micro Wave TBD
2 GHz Micro Wave TBD
3 GHz Micro Wave TBD
4 GHz Micro Wave TBD
5 GHz Micro Wave TBD
6 GHz Micro Wave TBD
7 GHz Micro Wave TBD
8 GHz Micro Wave TBD
9 GHz Micro Wave TBD
10 GHz Micro Wave TBD

4.0 SHIELDING EFFECTIVENESS REFERENCE AND MEASUREMENT PROCEDURE

The following procedures describe the method of test which was used to determine the levels of attenuation (shielding effectiveness) of the RF enclosure. During the test process, the transmit and receive antennas were co-polarized.

During electric field and plane wave attenuation measurements, the transmit antenna was located in a fixed position at each test point location. The receive antenna was scanned over a five (5) foot distance (where practical) from the test point location, where possible and at a fixed distance from the shield surface. When testing HVAC openings, electrical filters and penetrations, full scans were made over the entire area.

Figures 1 through 4 depict test equipment arrangements of test equipment for plane wave levels and shielding effectiveness (attenuation) measurements.

4.1 ELECTRIC FIELDS (HIGH IMPEDANCE)

Prior to performing the shielding effectiveness measurements, a reference level and dynamic range was established. To establish the reference level and dynamic range, the transmit (tunable rod/monopole) antenna and the receive (tunable rod/monopole) antenna were placed outside of the enclosure to ensure there was no case leakage of the receiver or spectrum analyzer. The antennas were placed twenty-four inches (24") apart plus the thickness of the shielding media which is approximately one inch (1") thick, for a total separation of twenty-five inches (25") as depicted in Figure 1. The antennas were oriented in a vertical polarization during the reference level and dynamic range establishment procedure.

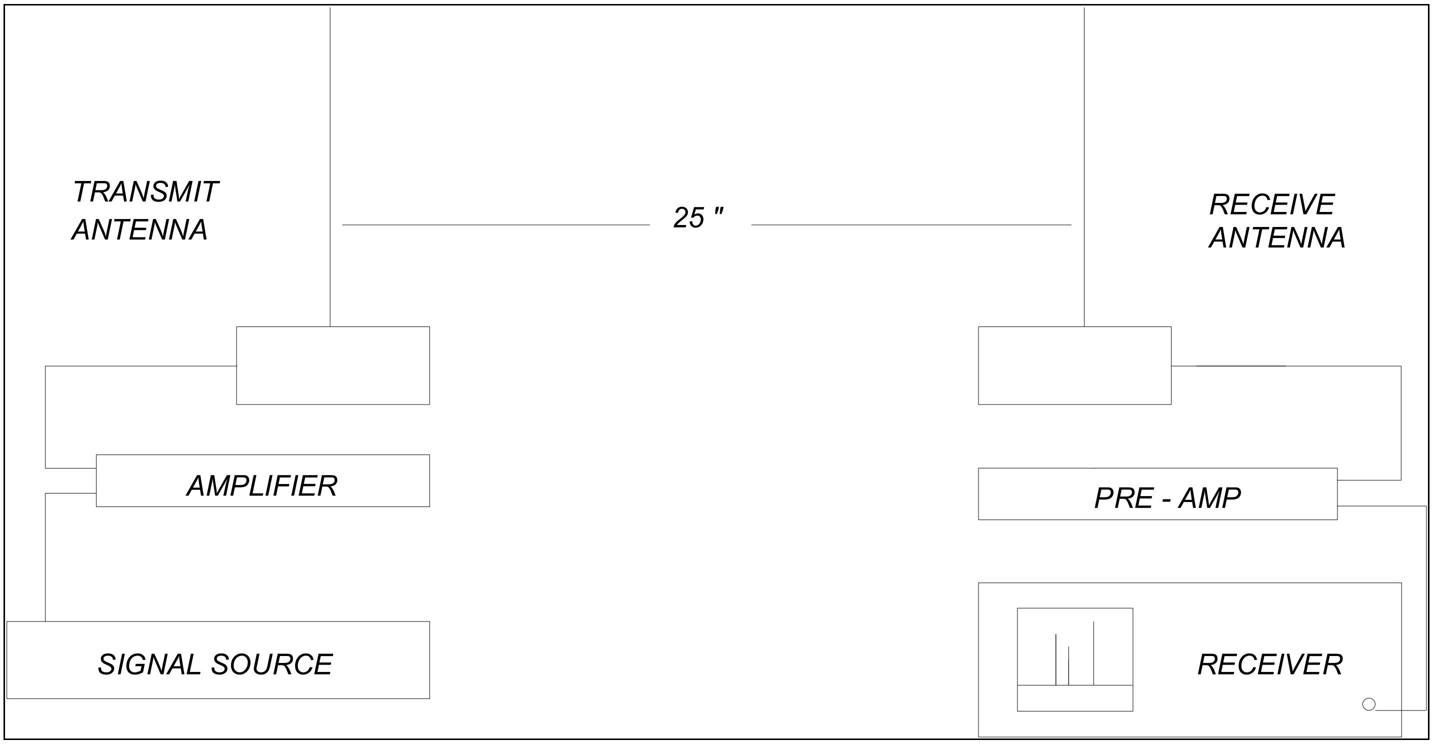


FIGURE 1

The received signal level value was recorded in the "Reference Level" (REF LEVEL, dBm) column of the "Shielding Effectiveness Test Results" form. The reference level value was determined by combining the value of any external attenuation and the received signal level which was displayed on the spectrum analyzer (or receiver).

With the reference level established and recorded, the receiver sensitivity (or noise floor) was determined. This was accomplished by placing the receive antenna inside of the enclosure and removing any fixed attenuation and or any spectrum analyzer/receiver internal attenuation. If pre amplification of the received signal was required, the pre amplifier remained on during this measurement. The receiver sensitivity level, which is in dBm, was recorded in the "Receiver Sensitivity" (RCV SEN, dBm) column of the "Shielding Effectiveness Test Results" form. During this measurement, there was no power amplifier connected to the output of the transmitter or source.

The system or measurement dynamic range was now be established. The dynamic range, which is recorded in the "DYNAMIC RANGE" column of the "Shielding Effectiveness Test results" form is the numerical difference between the reference level value and the receiver sensitivity value.

With the reference level, receiver sensitivity and dynamic range established and recorded, the receive antenna was placed at a predetermined test point location within the enclosure. The distance of the antenna to the shield surface (panel) was twelve inches (12") and in the same orientation as was used during the reference establishment. The source antenna was placed at the same test point but on the outside of the enclosure. The antenna was placed twelve inches (12") from the shield surface (panel) and in the same orientation as the receive antenna (Figure 2). Any fixed attenuators that were used during the reference establishment were removed from the receive or transmit lines and the enclosure door(s) was closed.

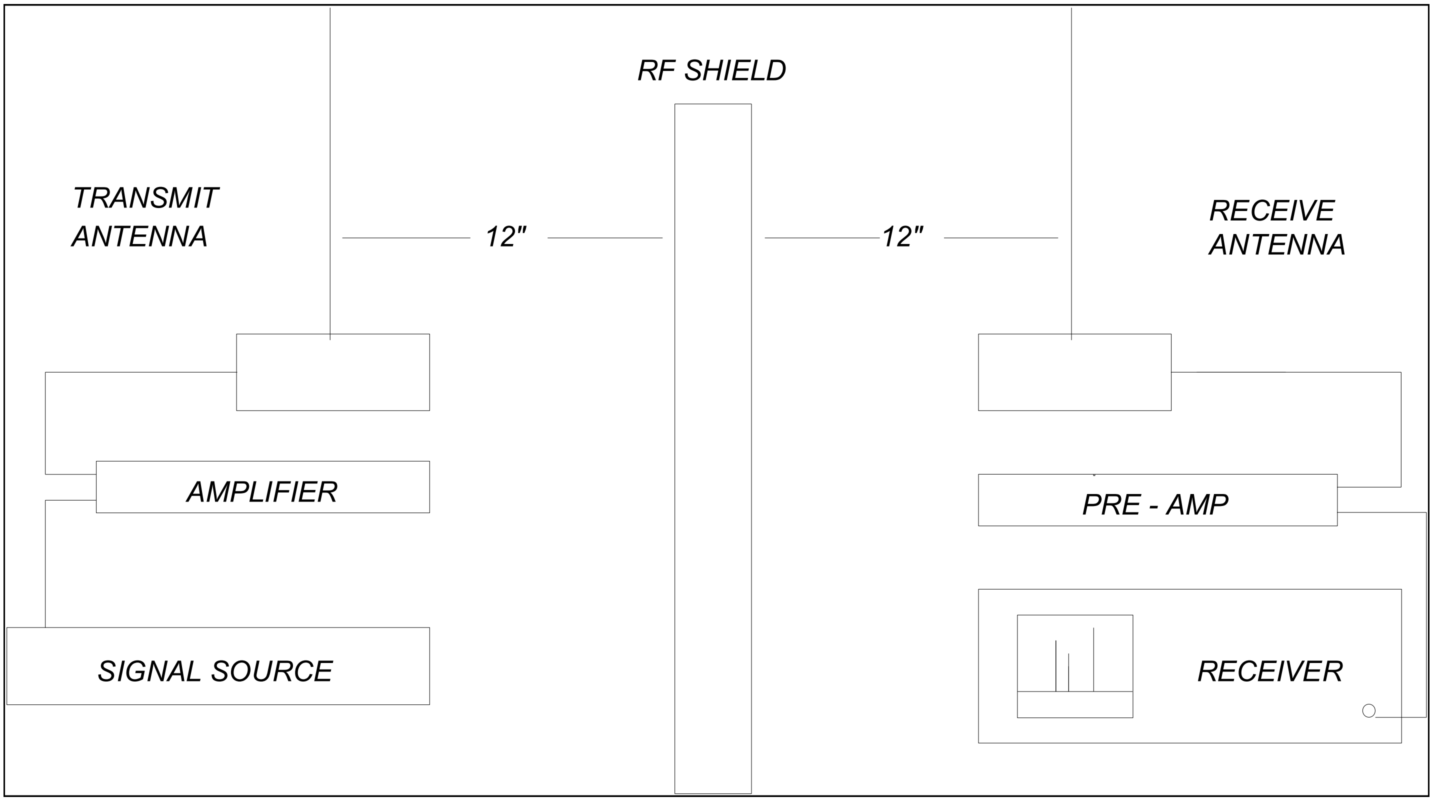


FIGURE 2

The received signal level at this point was recorded in the "Receiver Level" (RCV LEVEL, dBm) column of the "Shielding Effectiveness Test Results" form. The numeric difference between the "Reference Level" and the "Receiver Level" is the attenuation or shielding effectiveness of this test point. This value was recorded in the "Attenuation (S/E), dB column of the "Shielding Effectiveness Test Results" form. The transmit and receive antennas were placed at the remaining test point locations and the received signal levels were recorded. Upon completion of all test points, a second reference level was taken to ensure that the source gain or receiver sensitivity did not change. The lowest recorded value is the attenuation or shielding effectiveness at this frequency.

4.2 PLANE WAVE

Frequencies of test for plane wave measurements were as listed in Table Section 3.1.

Prior to performing the shielding effectiveness measurements, a reference level and dynamic range was established. To establish the reference level and dynamic range, the transmit (dipole or log periodic) antenna and the receive (dipole or log periodic) antenna were placed outside of the enclosure to ensure there was no case leakage of the receiver or spectrum analyzer. The antennas were placed seventy-four inches (74") apart plus the thickness of the shielding media which is approximately one inch (1") thick, for a total separation of seventy-five inches (75") as depicted in Figure 3. The antennas were co-polarized (either horizontally or vertically) during the reference level and dynamic range establishment procedure.

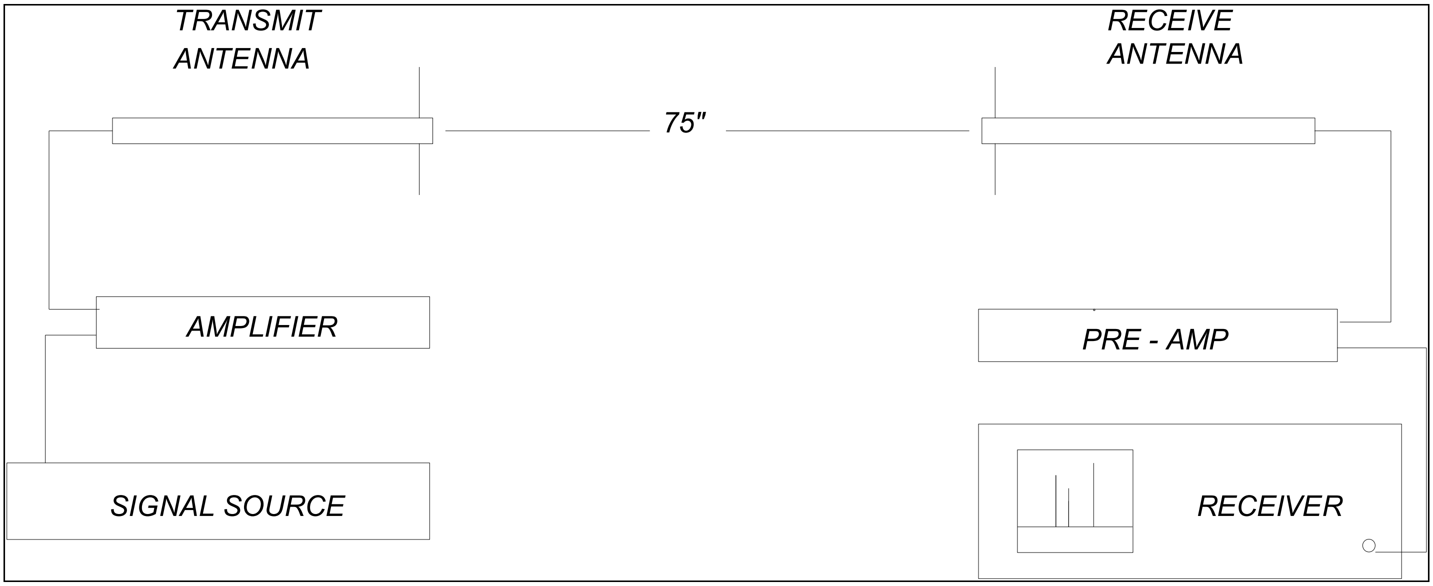


FIGURE 3

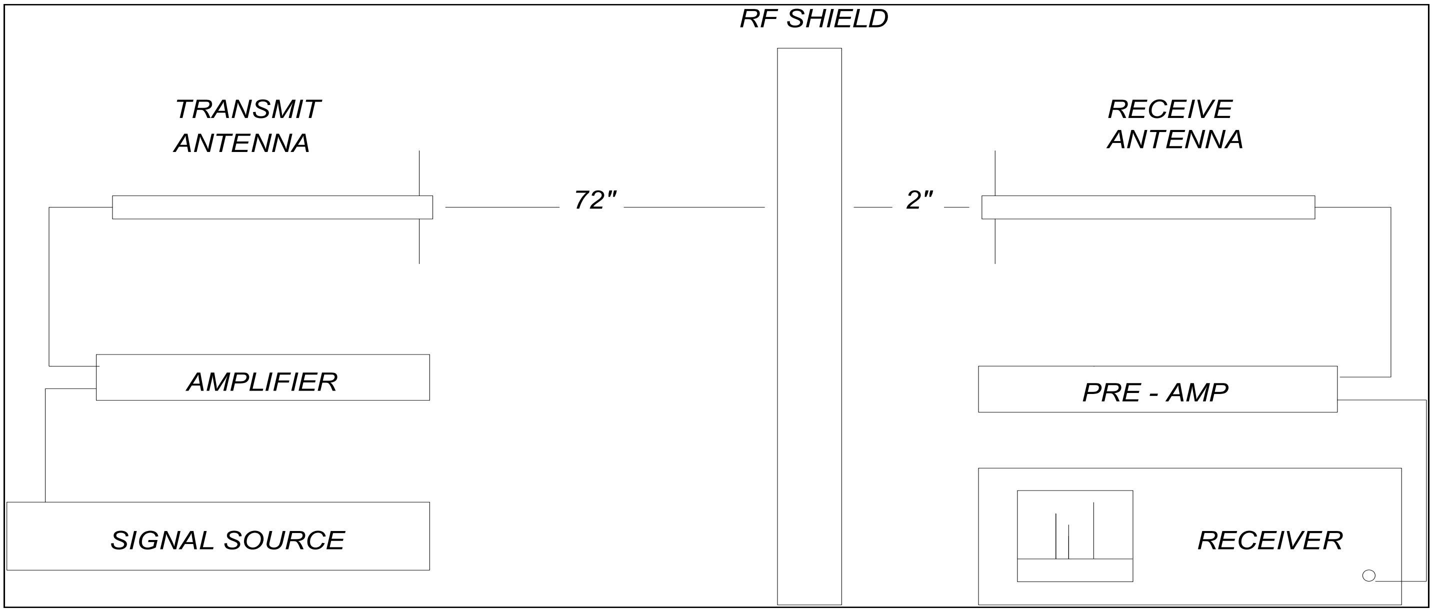
The received signal level value was recorded in the "Reference Level" (REF LEVEL, dBm) column of the "Shielding Effectiveness Test Results" form. The reference level value was determined by combining the value of any external attenuation and the received signal level which was displayed on the spectrum analyzer (or receiver).

With the reference level established and recorded, the receiver sensitivity (or noise floor) was determined. This was accomplished by placing the receive antenna inside of the enclosure and removing any fixed attenuation and or any spectrum analyzer/receiver internal attenuation. If pre amplification of the received signal was required, the pre amplifier remained on during this measurement. The receiver sensitivity level, which is in dBm, was recorded in the "Receiver Sensitivity" (RCV SEN, dBm) column of the "Shielding Effectiveness Test Results" form. During this measurement, there was no power amplifier connected to the output of the transmitter or source.

The system or measurement dynamic range was now established. The dynamic range, which is recorded in the "DYNAMIC RANGE" column of the "Shielding Effectiveness Test results" form is the numerical difference between the reference level value and the receiver sensitivity value.

With the reference level, receiver sensitivity and dynamic range established and recorded, the receive antenna was placed at a predetermined test point location within the enclosure. The distance of the antenna to the shield surface (panel) was less than two inches (2") and in the same orientation as was used during the reference establishment. The source antenna was placed at the same test point but on the outside of the enclosure. The antenna was placed seventy-two inches (72") from the shield surface (panel) and in the same orientation as the receive antenna (Figure 4). Any fixed attenuators that were used during the reference establishment were removed from the receive or transmit lines and the enclosure door(s) was closed.

FIGURE 4



The received signal level at this point was recorded in the "Receiver Level" (RCV LEVEL, dBm) column of the "Shielding Effectiveness Test Results" form. The numeric difference between the "Reference Level" and the "Receiver Level" is the attenuation or shielding effectiveness of this test point. This value was recorded in the "Attenuation (S/E), dB column of the "Shielding Effectiveness Test Results" form. The transmit and receive antennas were then placed at the remaining test point locations and the received signal levels were recorded. Upon completion of all test points, a second reference level was taken to ensure that the source gain or receiver sensitivity did not change.

The lowest recorded value is the attenuation or shielding effectiveness at this frequency.

5.0 TEST RESULTS

This section contains tabulated data (lowest & highest reading) resulting from the RF radiated shielding effectiveness tests. Copies of the actual test data and test point locations can be found in Appendix A and Appendix B.

5.1 RADIATED RF TEST DATA, PRE-SCAN

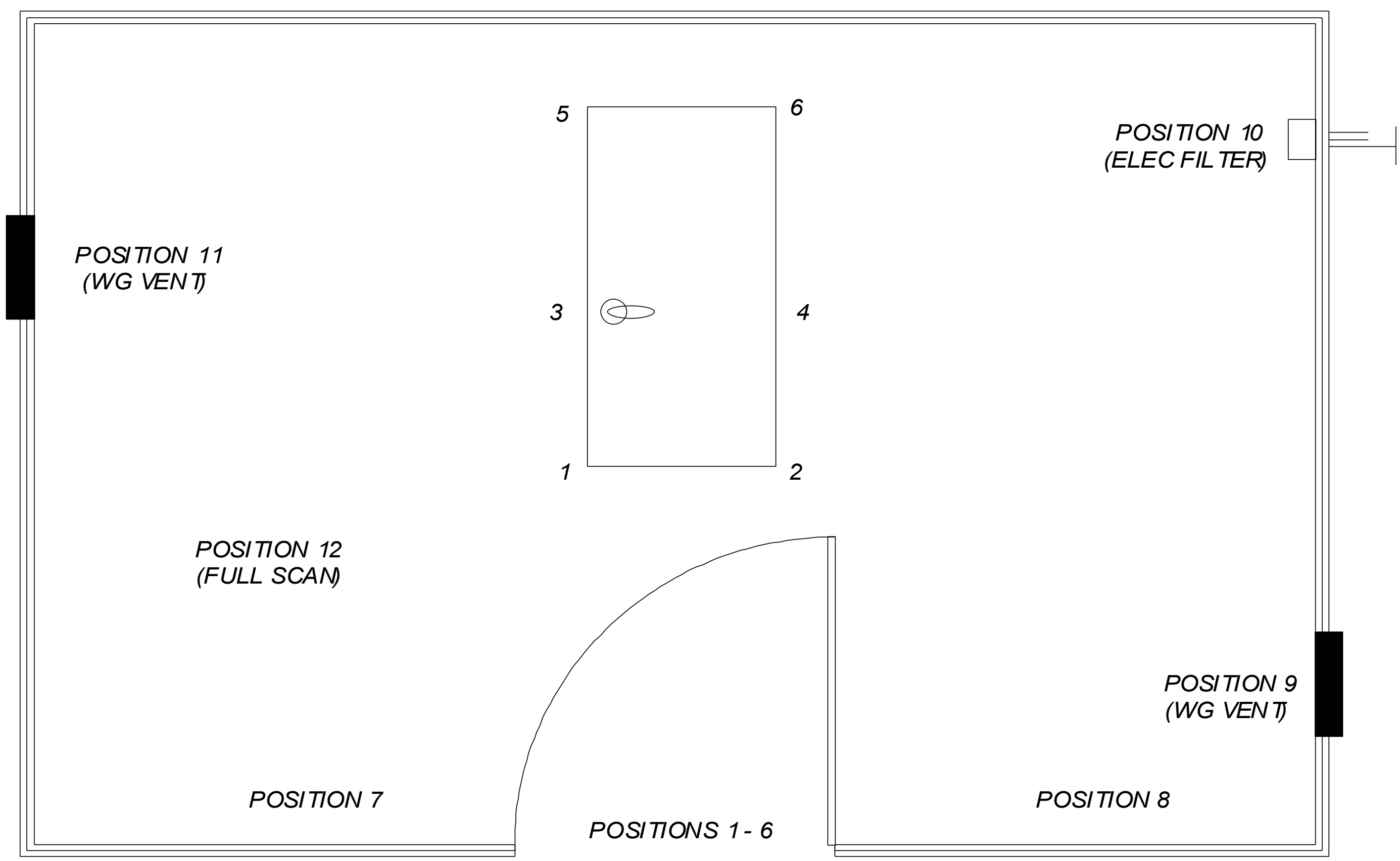
FREQUENCY	FIELD	REQUIRED ATTENUATION	ACTUAL ATTENUATION
10 MHz	Electric	N/A dB	>/= 72 dB
50 MHz	Electric	N/A dB	>/= 64 dB
100 MHz	Plane Wave	N/A dB	>/= 72 dB
400 MHz	Plane Wave	N/A dB	>/= 70 dB
1 GHz	Plane Wave	N/A dB	>/= 64 dB
2 GHz	Microwave	N/A dB	>/= 62 dB
3 GHz	Microwave	N/A dB	>/= 64 dB
4 GHz	Microwave	N/A dB	>/= 66 dB
5 GHz	Microwave	N/A dB	>/= 70 dB
6 GHz	Microwave	N/A dB	>/= 68 dB
7 GHz	Microwave	N/A dB	>/= 62 dB
8 GHz	Microwave	N/A dB	>/= 66 dB
9 GHz	Microwave	N/A dB	>/= 72 dB
10 GHz	Microwave	N/A dB	>/= 68 dB

6.0 CONCLUSIONS & RECOMMENDATIONS

The intent of this test was to determine the level of shielding effectiveness the enclosure would provide over the frequency range of 10 MHz to 10 GHz. It was found, based upon recorded data, that the enclosure with the Tru-Protect panels (and various components), meets and exceeds the requirements of NSA 73-2A and NACSEM 5204, where applicable.

It is felt that this type of construction (panels) can attain higher levels of S/E, but for this evaluation, components that meet and exceed the "40 to 60 dB spec" commonly specified by certain agencies were utilized.

APPENDIX A
TEST POINT LOCATIONS
(NOT TO SCALE)



APPENDIX B
TEST DATA SHEET

Shielding Effectiveness Test Results

Center Frequency	Test Position	Field	Ref. Lvl.	Rcv. Sen.	Dynamic Range	Rcv. Lvl.	Attenuation (S/E)	Specification
10 MHz	1	E	- 30 dB	- 102	72 dB	- 102	>/= 72 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
50 MHz	1	E	- 38 dB	- 102	64 dB	- 102	>/= 64 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
100 MHz	1	P	- 30 dB	- 102	72 dB	- 102	>/= 72 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							

APPENDIX B
TEST DATA SHEET

Shielding Effectiveness Test Results

Center Frequency	Test Position	Field	Ref. Lvl.	Rcv. Sen.	Dynamic Range	Rcv. Lvl.	Attenuation (S/E)	Specification
10 MHz	1	E	- 30 dB	- 102	72 dB	- 102	>/= 72 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
50 MHz	1	E	- 38 dB	- 102	64 dB	- 102	>/= 64 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
100 MHz	1	P	- 30 dB	- 102	72 dB	- 102	>/= 72 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							

APPENDIX B
TEST DATA SHEET

Shielding Effectiveness Test Results

Center Frequency	Test Position	Field	Ref. Lvl.	Rcv. Sen.	Dynamic Range	Rcv. Lvl.	Attenuation (S/E)	Specification
400 MHz	1	PW	- 38 dB	- 102	70 dB	- 102	>/= 70 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
1 GHz	1	PW	- 38 dB	- 102	64 dB	- 102	>/= 64 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
2 GHz	1	PW/MW	- 40 dB	- 102	62 dB	- 102	>/= 62 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							

APPENDIX B
TEST DATA SHEET

Shielding Effectiveness Test Results

Center Frequency	Test Position	Field	Ref. Lvl.	Rcv. Sen.	Dynamic Range	Rcv. Lvl.	Attenuation (S/E)	Specification
3 GHz	1	MW	- 38 dB	- 102	64 dB	- 102	>/= 64 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
4 GHz	1	MW	- 36 dB	- 102	66 dB	- 102	>/= 66 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
5 GHz	1	MW	- 32 dB	- 102	70 dB	- 102	>/= 70 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							

APPENDIX B
TEST DATA SHEET

Shielding Effectiveness Test Results

Center Frequency	Test Position	Field	Ref. Lvl.	Rcv. Sen.	Dynamic Range	Rcv. Lvl.	Attenuation (S/E)	Specification
6 GHz	1	MW	- 34 dB	- 102	68 dB	- 102	>/= 68 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
7 GHz	1	MW	- 40 dB	- 102	62 dB	- 102	>/= 62 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
8 GHz	1	MW	- 36 dB	- 102	66 dB	- 102	>/= 66 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							

APPENDIX B
TEST DATA SHEET

Shielding Effectiveness Test Results

Center Frequency	Test Position	Field	Ref. Lvl.	Rcv. Sen.	Dynamic Range	Rcv. Lvl.	Attenuation (S/E)	Specification
9 GHz	1	MW	- 30 dB	- 102	72 dB	- 102	>/= 72 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
10 GHz	1	MW	- 34 dB	- 102	68 dB	- 102	>/= 68 dB	NA dB
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							

OMEGA POINT LABORATORIES

TEST REPORT

ASTM E84-04

SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS

Report No. 17047 - 123862

Tru Protect XL

March 1, 2005

Prepared for:
Milyn, LLC
5507 10th. Street
Lubbock, TX 79416

OMEGA POINT
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Elmendorf, TX 78112
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ACCREDITED
No. 0689-01

ABSTRACT

Test Specimen: **Tru Protect XL**

Test Standard: **ASTM E84-04**

Test Date: **February 18, 2005**

Test Sponsor: **Milyn, LLC**

Test Results:

FLAME SPREAD INDEX	=	25
SMOKE DEVELOPED INDEX	=	20

123862

Eric G. Hutchinson
E84 Operator

March 1, 2005

Reviewed and approved:

William E Fitch PE No. 55296

March 1, 2005

OMEGA POINT LABORATORIES

I INTRODUCTION

This report describes the results of the ASTM E84-04 Standard Test Method for SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS , a method for determining the comparative surface burning behavior of building materials. This test is applicable to exposed surfaces, such as ceilings or walls, provided that the material or assembly of materials, by its own structural quality or the manner in which it is tested and intended for use, is capable of supporting itself in position or being supported during the test period.

The purpose of the method is to determine the relative burning behavior of the material by observing the flame spread along the specimen. Flame spread and smoke density developed are reported, however, there is not necessarily a relationship between these two measurements.

"The use of supporting materials on the underside of the test specimen may lower the flame spread index from that which might be obtained if the specimen could be tested without such support... This method may not be appropriate for obtaining comparative surface burning behavior of some cellular plastic materials... Testing of materials that melt, drip, or delaminate to such a degree that the continuity of the flame front is destroyed, results in low flame spread indices that do not relate directly to indices obtained by testing materials that remain in place."

This test method is also published under the following designations:

ANSI 2.5
NFPA 255
UBC 8-1 (42-1)
UL 723

This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.

II PURPOSE

The ASTM E84-04 (25 foot tunnel) test method is intended to compare the surface flame spread and smoke developed measurements to those obtained from tests of mineral fiber cement board and select grade red oak flooring. The test specimen sur-face (18 inches wide and 24 feet long) is exposed to a flaming fire exposure during the 10 minute test duration, while flame spread over its surface and den-sity of the resulting smoke are measured and recorded. Test results are presented as the computed comparisons to the standard calibration materials.

The furnace is considered under calibration when a 10 minute test of red oak decking will pass flame out the end of the tunnel in five minutes, 30 seconds, plus or minus 15 seconds. Mineral fiber cement board forms the zero point for both flame spread and smoke developed indexes, while the red oak flooring smoke developed index is set as 100.

III DESCRIPTION OF TEST SPECIMEN

Specimen Identification: Tru Protect XL

Date Received:	2/17/2005
Date Prepared:	2/17/2005
Conditioning (73°F & 50% R.H.):	1 days
Specimen Width (in):	24.25
Specimen Length (ft):	24
Specimen Thickness:	0.5630-in.
Material Weight:	N/A oz./sq. yd
Total Specimen Weight:	26.80-lbs.
Adhesive or coating application rate:	N/A

Mounting Method:

The specimen was self-supporting and was placed directly on the inner ledges of the tunnel.

Specimen Description:

The Test specimen was described by the client as the "1/2" Insulating Sheeting." The specimen consisted of (3) 8-ft. long x 24.25-in. wide x 0.5630-in. thick, 1/2-in. thick, double layer, cardboard core encapsulated in a foil facer. The foil facer on the exposed side of the specimen was 0.005-in. thick. The foil facer on the backside of the specimen was 0.002-in. thick. The cardboard core of the specimen contains a mold inhibitor and fire retardant. The cardboard core is manufactured by Corrugated Services L.P. 855 E. Hwy 80 Forney, TX 75126. The foil facer is manufactured by US Foils 15541 NEO Parkway Cleveland, OH 44128. The specimen was identified by the client as "Tru Protect XL".

IV TEST RESULTS

The test results, computed on the basis of observed flame front advance and electronic smoke density measurements are presented in the following table. In recognition of possible variations and limitations of the test method, the results are computed to the nearest number divisible by five, as outlined in the test method.

While no longer a part of this standard test method, the Fuel Contributed Value has been computed, and may be found on the computer printout sheet in the Appendix.

Test Specimen	Flame Spread Index	Smoke Developed Index
Mineral Fiber Cement Board	0	0
Red Oak Flooring	100	100
Tru Protect XL	**25**	**20**

The data sheets are included in the Appendix. These sheets are actual print-outs of the computerized data system which monitors the ASTM E84-04 apparatus, and contain all calibration and specimen data needed to calculate the test results.

V OBSERVATIONS

During the test, the specimen was observed to behave in the following manner: The foil facer began to warp at 0:23 (min:sec.). The foil facer began to sag at 2:35 (min:sec.). The cardboard core ignited at 2:53 (min:sec.). Minute pieces of the cardboard core began to fall at 7:41 (min:sec.). The test continued for the 10:00 duration. After the test burners were turned off, a 60 second afterflame was observed.

After the test the specimen was observed to be damaged as follows:
The specimen was burned through from 0-ft. - 6-ft. The foil facer and the cardboard core was consumed from 0-ft. - 8-ft. The cardboard core was charred and cracked from 9-ft. - 24-ft.

APPENDIX

ASTM E84-04
Data Sheets

ASTM E84 DATASHEETS

Client:	MILYN, LLC.
Date:	2/18/05
Time:	09:07 AM
Test Number:	1
Project Number:	17047-123862
Operator:	EH/TA
Specimen ID:	"TRUPROTECT XL, 1/2" INSULATING SHEETING". THE SPECIMEN WAS SELF-SUPPORTING. THE TEST WAS WITNESSED BY MIKE AND LYNN MCDONALD FROM MILYN, LLC.

TEST RESULTS

FLAMESPREAD INDEX:	**25**
SMOKE DEVELOPED INDEX:	**20**

SPECIMEN DATA . . .

Time to Ignition (sec):	173
Time to Max FS (sec):	396
Maximum FS (feet):	8.0
Time to 980 °F (sec):	Never Reached
Max Temperature (°F):	654
Time to Max Temperature (sec):	393
Total Fuel Burned (cubic feet):	51.93

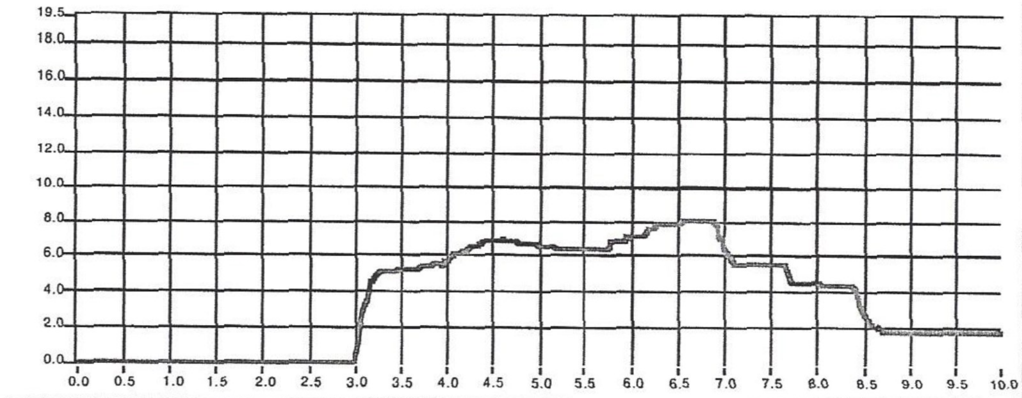
FS*Time Area (ft*min):	50.0
Smoke Area (%A*min):	18.2
Fuel Area (°F*min):	5667.9
Fuel Contributed Value:	8
Unrounded FSI:	25.8

CALIBRATION DATA . . .

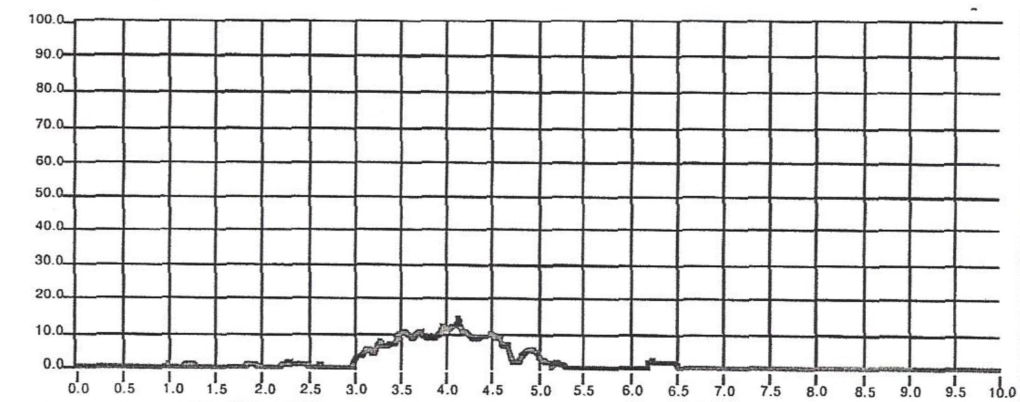
Time to Ignition of Last Red Oak (sec):	38
Red Oak Smoke Area (%A*min):	96.00
Red Oak Fuel Area (°F*min):	8587
Glass Fiber Board Fuel Area (°F*min):	5396

Project No: 17047-123862

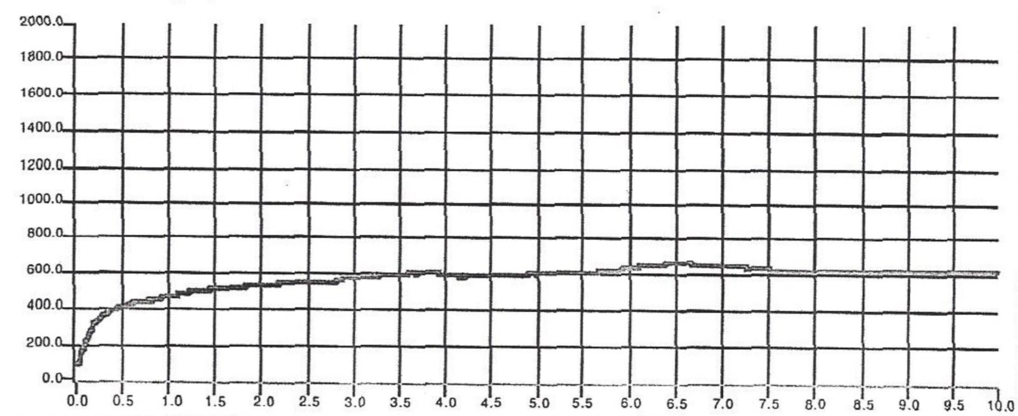
FLAME SPREAD (ft)



Smoke (%A)



Temperature (°F)



Time (min)

TP

TRUPROTECT™

Hail Damage Reduction

The Underwriters Lab 2218 test requires two samples: one with the product being tested and one without. The first sample used TruProtect™ as the underlayment; the second sample used the same construction except without TruProtect. In the test, four pound steel balls were dropped from a height of 20 feet. The balls were dropped twice on each pre-selected spot. The impact location was then analyzed to determine the damage.

The sample using TruProtect received significantly less damage than the sample without TruProtect. The TruProtect roof showed 50% less surface damage and 100% less structural damage.

Architectural Testing

UL 2218 TEST REPORT

Rendered to:

MILYN, LLC

SERIES/MODEL: TruProtect XL

PRODUCT TYPE: Roof Covering Underlayment

Report No.:	**55717.01-801-44**
Test Date:	**02/15/05**
Report Date:	**03/02/05**
Expiration Date:	**02/15/09**

2865 Market Loop, Suite B
Southlake, Texas 76092
phone: 817-410-7202
fax: 817-424-8463
www.archtest.com

Architectural Testing

UL 2218 TEST REPORT

Rendered to:

MILYN, LLC
5507 Tenth Street
Lubbock, TX 79416

Report No.:	**55717.01-801-44**
Test Date:	**02/15/05**
Report Date:	**03/02/05**
Expiration Date:	**02/15/09**

Project Summary: Architectural Testing, Inc. (ATI) was contracted by MiLyn, LLC to perform testing according to UL 2218 on asphalt shingles with and without TruProtect XL underlayment. Impact locations were identical for each specimen. Test specimen description and results are reported herein.

Test Specification: The test specimen was evaluated in accordance with the following:

UL 2218, *UL Standard for Safety for Impact Resistance of Prepared Roof Covering Materials.*

Test Specimen Description:

Series/Model: TruProtect XL

Type: Roof covering underlayment

TruProtect XL Construction: The underlayment consisted of a 0.002" top aluminum layer, 1/4" double cardboard layer, 0.002" center aluminum layer, 1/4" double cardboard layer, and a bottom layer of 0.005" aluminum. The layers were secured together with adhesive.

Deck Construction: The test decks measured 36" x 36", and consisted of A-C grade, Group 1, exterior 15/32" thick plywood securely nailed to a 2x4 SPF perimeter batten frame. An additional 2x4 SPF batten was located at the midspan of the deck.

Installation:

Sample #1, with TruProtect XL underlayment- One layer of TruProtect XL was laid directly over the plywood deck. The TruProtect was then covered with one layer of #15 asphalt saturated felt building paper, followed by GAF Sentinel asphalt shingles attached with three 1-1/2" electro-galvanized roofing nails (3/8" diameter head, 0.120" shank) per shingle. The shingles were installed in standard weatherboard fashion, with two layers of shingle between the underlayment and the environment at each course.

Sample #2, without TruProtect XL underlayment- The roofing material was installed in exactly the same manner as before, omitting the Truprotect XL layer.

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Conditioning: All samples were stored indoors at 70 °F for a minimum of 48 hours prior to testing.

TEST RESULTS
Date: 02/15/05
Ambient Exterior Air Temperature: 70 °F

UL 2218, Impact Resistance of Prepared Roof Covering Materials

Ball Diameter: 2"
Drop Height: 20 ft.

Test Unit #1, w/ Truprotect XL underlayment *(Note: reference Photo # 1 for impact locations.)*

Impact #1:
Impact Area: Center of shingle
Depth of depression after 1st impact: 0.128"
Observations after 2nd impact: Both shingle layers, felt layer, and top aluminum and first paper layer of TruProtect XL torn. Decking not dented.

Impact #2:
Impact Area: Side seam between shingles
Depth of depression after 1st impact: 0.092"
Observations after 2nd impact: Both shingle layers torn, felt, and TruProtect XL layers dented but intact. Decking not dented.

Impact #3:
Impact Area: Center of shingle
Depth of depression after 1st impact: 0.170"
Observations after 2nd impact: Both shingle layers, felt layer, and top aluminum and first paper layer of TruProtect XL torn. Decking not dented.

Impact #4:
Impact Area: Bottom-center edge of shingle
Depth of depression after 1st impact: 0.055"
Observations after 2nd impact: Both shingle layers torn, felt, and TruProtect XL layers dented but intact. Decking not dented.

Impact #5:
Impact Area: Bottom corner of shingle
Depth of depression after 1st impact: 0.090"
Observations after 2nd impact: Both shingle layers torn, felt, and TruProtect XL layers dented but intact. Decking not dented.

Impact #6:
Impact Area: Center of shingle, near #5
Depth of depression after 1st impact: 0.107"
Observations after 2nd impact: Top shingle layer torn, 2nd shingle, felt, and TruProtect XL layers dented but intact. Decking not dented.

Test Unit #2, without TruProtect XL underlayment *(reference Photo # 2 for impact locations)*

Impact #1:

Impact Area: Center of shingle
Depth of depression after 1st impact: 0.160"
Observations after 2nd impact: Top shingle layer torn, 2nd shingle and felt dented but intact. Decking dented.

Impact #2:

Impact Area: Side seam between shingles
Depth of depression after 1st impact: 0.069"
Observations after 2nd impact: Shingle and felt dented but intact. Decking not dented.

Impact #3:

Impact Area: Center of shingle
Depth of depression after 1st impact: 0.185"
Observations after 2nd impact: Shingle and felt dented but intact. Decking not dented.

Impact #4:

Impact Area: Bottom-center edge of shingle
Depth of depression after 1st impact: 0.250"
Observations after 2nd impact: Both shingle layers torn and felt dented but intact. Decking dented.

Impact #5:

Impact Area: Bottom corner of shingle
Depth of depression after 1st impact: 0.075"
Observations after 2nd impact: Shingle and felt dented but intact. Decking dented.

Impact #6:

Impact Area: Center of shingle, near #5
Depth of depression after 1st impact: 0.082"
Observations after 2nd impact: Top shingle layer torn, 2nd shingle and felt dented but intact. Decking dented.

Representative samples of the test specimen and a copy of this report will be retained by ATI for a period of four years from the original test date. This report is the exclusive property of the client so named herein and is applicable to the sample tested. Results obtained are tested values and do not constitute an opinion or endorsement by this laboratory. This report may not be reproduced, except in full, without approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC:

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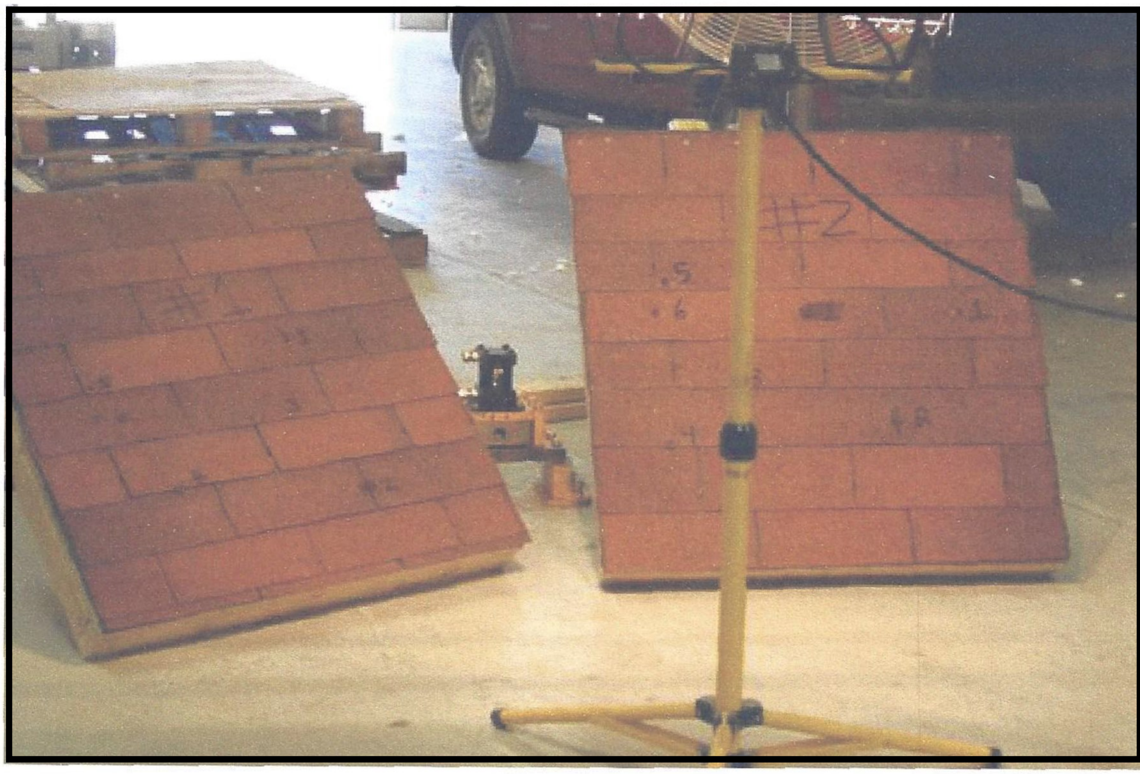
Attachments (pages):
Appendix-A: Photographs (1)

Architectural Testing

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	03/14/05	N/A	Original report issue

Physical results of a UL 2218 test with TruProtect



Side by Side Class 4 Hail Impact Test

TruProtect Non ASTM Testing on

Walk-In Refrigeration Units

There is no established test protocol for measuring the insulation effectiveness of walk-in freezer and refrigerator units. TruProtect mocked up such a unit in its factory under the direction of someone experienced in this field. The goals were to test how much TruProtect might reduce energy consumption, and to determine how it might help to maintain a stable temperature. Fluctuations of temperature can occur even with thermostatic control. These variations can destabilize food and start the spoilage process.

Until testing laboratories develop a standard for such testing, TruProtect submits this anecdotal testing as at least an indicator of how the product might perform for the refrigeration industry.

The mockup unit measured 8' x 8' x 6' with 2"x4" framed stud walls. The walls were lined with the standard R-13 insulation. The outer and inner layers were standard half-inch OSB. Workers added a refrigeration unit and ran a 44 hour monitored test. Afterward they lined the mockup refrigerator with TruProtect.

The initial 44-hour test with the standard design established baselines both for energy usage and temperature fluctuation.

With TruProtect now lining the unit, the factory ran a second 44-hour monitored test.

Test Results

The monitors noted that cool-down time with TruProtect in place was much shorter. The cooler unit barely ran after the initial cool down period. The temperature did not vary during the entire test, in contrast with a five degree swing without TruProtect. For this second test period, the monitoring equipment recorded an astounding 99 percent reduction of energy consumption.

Our conclusion is that adding TruProtect as a liner to freezer and refrigerator units is an economical way gain at least a 90 percent reduction in energy usage. The flat temperature regardless of outside conditions could support the stabilization of food and might help retard spoilage. TruProtect may also help guard the refrigerator's contents against short term damage should there be a power failure.

44-hour electronically monitored tests, with and without TruProtect lining the refrigerator mockup.

Set temperature	Time	Date	Cooler temp	Warehouse temp	Outside temp	KWH meter reading
		WITHOUT TRUPROTECT				
45	2:00 PM	30 Aug	44	89	89	663
45	8PM		42	91	90	665
45	8:00 AM	31 Aug	42	82	70	667
45	11:45 AM		39	88	89	669
45	3:15 PM		44	91	87	671
45	8AM	1 Sep	40	68	68	672
45	10AM		39	79	79	674
Total run time 44 hours using 11 KWH or .25 KWH per hour run time						
			With 1/2" TruProtect installed on all 6 sides			
45	3:00 PM	1 Sep	47	95	93	674
45	8:00 AM	2 Sep	45	79	66	674
45	11:30 AM		45	88	81	674
45	3:15 PM		45	99	96	674
45	8:00 AM	3-Sep	45	77	62	674
45	11:00 AM		45	81	67	675
Total run time is 44 hours using 1 KWH or .023 KW per hour run time						

TP

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MULTI-LAYER HIGHLY ENERGY EFFICIENT REFLECTIVE SHEETING

True Insulation Protection for the 21st Century

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