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FIELD IMPACT INSULATION TESTS

U609 SAVVI APARTMENTS, 35 KELBURN ST, UPPER MT GRAVATT

TEST REPORT

Commissioned by:	Next13 PTY LTD
Date:	31 May 2021
Project number:	5236
Version:	V.1
Author:	Eric Huang

24 Mexicanus Drive PO Box 790 Park Ridge Queensland 4125 Australia p. +61 7 3802 2155 hasitha@palmeracoustics.com www.palmeracoustics.com

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TITLE	Field Impact Insulation Tests U609 Savvi Apartments, 35 Kelburn St, Upper Mt Gravatt, QLD 4122 Test Report
TESTS BY	Eric Huang Acoustic Engineer - Palmer Acoustics (Australia) Pty Ltd
REPORT DATE	31 May 2021
TEST DATE	26 May 2021
TEST LOCATION	Level 6 Unit 609 Living, Kitchen/Dining Room to Level 5 Unit 509 Living, Kitchen/Dining Room
FOR	Next13 PTY LTD

CONTENTS

1.0 INTRODUCTION

Next13 PTY LTD has engaged Palmer Acoustics to perform field impact insulation tests at U609 Savvi Apartments, 35 Kelburn St, Upper Mt Gravatt. A standard tapping machine was positioned on the flooring samples/floors installed in the living, kitchen/dining room of Unit 609 on level 6. Receiving room noise levels were measured in the living, kitchen/dining room of Unit 509 on level 5 (directly beneath living, kitchen/dining room of Unit 609).

Floor systems tested:

Test 1 - Bare Concrete Slab

Test 2 - 8mm thick Trojan Professional Hybrid flooring sample (rubber backing) with black plastic on 3mm thick Trojan IQ underlay

Test 3 - 8mm thick Trojan Professional Hybrid flooring sample (rubber backing) with black plastic on slab

2.0 EQUIPMENT AND PROCEDURES

2.1 Measurement Procedures

Testing was in conformance with ISO 16283-2:2015 "Field measurement of impact sound insulation of floors". The evaluation of the results, to derive the single figure L'nT,w rating, was conducted to ISO 717-2 2013 "Rating of insulation in buildings and of building elements – Part 2 Impact Sound Insulation".

Each flooring sample/floor installed in the living, kitchen/dining room of Unit 609 was tapped in two (2) different orientations, with the receiving space's sound measurements averaged over 60 seconds periods - per test position.

The ambient sound levels were measured before testing, with the results assessed as per standard.

The receiving room reverberation measurements were taken with a Norsonics Sound Analyser Nor140, at four (4) locations throughout the space, with the results arithmetically averaged.

2.2 Instrumentation

The following instruments were used in the evaluation.

- NTI XL2 Sound Analyser (serial number A2A 08208 E0)
- B&K Type 3207 tapping machine EM50 (serial number 2574503)
- B & K 4231 Calibrator (serial number 2153030)

The sound level measuring equipment was field calibrated before and after each measurement session and was within 0.2dB of the reference signal. All instrumentation used in this assessment holds a current calibration certificate from a NATA accredited calibration laboratory.

3.0 DESCRIPTION OF ROOMS

All windows and doors were closed in the source room and receiving room.

Slab: **180mm thick concrete**

Transmitting Room (Living, kitchen/dining Room of Unit 609 on Level 6)
Test Floor: Flooring samples/floors;
Walls: Plasterboard;
Room finish: Not finished.

Receiving Room (Living, kitchen/dining Room of Unit 509 on Level 5)
Ceiling: 13mm Plasterboard with 200mm ceiling cavity;
Floor: Tile floor;
Walls: Plasterboard;
Room finish: Not finished.

(i) **(ii)**

Figure 1: (i) Test 1, **(ii)** Test 3

4.0 RESULTS

Our tests gave the following results:

Table 1: Test Result Summary – Floor impact tests

	Test System	L'nT,w	FIIC
1.	180mm Concrete Slab	64	36
2.	8mm thick Trojan Professional Hybrid flooring sample with black plastic on 3mm thick Trojan IQ underlay	49	57
3.	8mm thick Trojan Professional Hybrid flooring sample with black plastic on slab	49	57

Test Certificates detailing the 1/3 octave band results are provided in Appendix C to this report in terms of L'nT,w following ISO 717 - 2: 2013.

The L'nT,w term is used in the Building Code of Australia (BCA); see also Appendix A. It should be noted that L'nT,w is a weighted room noise level and that a lower number represents better performance.

FIIC is an ASTM term which represents a floor/ceiling assembly's ability to resist the transmission of impact noise. A higher value represents greater performance.

5.0 DISCUSSION

The following table shows the Trojan Professional Hybrid flooring samples' impact insulation rating improvement from the bare concrete slab (with plasterboard ceiling):

Flooring types	Δ L'nT,w
1. Trojan Professional Hybrid flooring sample with black plastic on Trojan IQ underlay	15
2. Trojan Professional Hybrid flooring sample with black plastic on slab	15

Under the National Construction Code Series 2016 (NCC) specifies a minimum sound insulation performance rating for floors. Compliance with this rating is demonstrated by compliance with Verification Methods FV5.1 (b) *'impact: a weighted standardised impact sound pressure level with spectrum adaptation term (L'nT,w) not more than 62 when determined under AS/ISO 717.2.'*

The 8mm thick Trojan Professional Hybrid flooring in the Savvi Apartments comply with NCC floor impact rating.

Under the Association of Australian Acoustics Consultants (AAAC) "Guideline for Apartment and Townhouse Acoustic Rating" (re: www.aaac.org.au) an L'nT,w rating of 65 represents a 2 star level of quality, L'nT,w rating of 55 represents a 3 star level of quality, L'nT,w 50 represents 4-star and L'nT,w 45 represents 5-star performance.

- 2 Star L'nT,w 65
- 3 Star L'nT,w 55
- 4 Star L'nT,w 50
- 5 Star L'nT,w 45

Author:

ERIC HUANG MEngSc
Senior Engineer

Approved by:

ROGER HAWKINS RPEQ 6022
Senior Engineer

APPENDIX A

GLOSSARY

IMPACT MEASUREMENT AND ASSESSMENT DESCRIPTORS

- $L_{Aeq,T}$ – Time average A-weighted sound pressure level is the average energy equivalent level of the A-Weighted sound over a period "T".

- L_{Aeq} – Equivalent Continuous Noise Level. The noise level in dB(A), which is present for the entire measurement period, would produce the same sound energy to be received as was actually received as a result of a signal which varied with time. Normally abbreviated to "L_{eq}" or "L_{Aeq}", often followed by a specification of the time period (such as 1 hour or 8 hours) indicating the period of time to which the measured value has been normalized;

- $L'_{nT,w}$ – Weighted Standardised impact sound pressure level; a measurement of impact sound transmission between rooms. Lower values denote better performance. The single figure measure is derived by adapting a standard response curve to measure 1/3 octave band sound pressure levels. Measured results are adjusted based upon a reverberation time of 0.5 sec in the receiving room. Normally derived from a field test.

- $L'_{n,w}$ – Weighted Normalized impact sound pressure level; a laboratory measurement of impact sound transmission between rooms. Lower values denote better performance. The single figure measure is derived by adapting a standard response curve to measure 1/3 octave band sound pressure level measurements. Measured results are adjusted based on the absorption of 10m² in the receiving room. Normally derived from a laboratory test.

- C_I – A spectrum adaptation term compensating for the effect of floor coverings when applied to bare floors under test. The usually negative value, in decibels, is added to the single-number quantity, L'_{nw} or $L'_{nT,w}$.

- L'_{nT} – ***Standardised Impact Sound Pressure Level*** – the impact sound pressure level is standardised to room with a reference reverberation time of 0.5 seconds.

- L'_n – ***Normalized Impact Sound Pressure Level*** – the impact sound pressure level normalized to reference absorption area of 10 metric sabins (108 sabins).

- ***Field Impact Insulation Class (FIIC)*** – a single-number rating derived from measured values of normalized one-third octave band impact sound pressure levels in accordance with Eq 4 and the reference contours in Classification E 989. It provides an estimate of the sound insulating performance of a floor-ceiling assembly and associated support structures under tapping machine excitation.

- ***Impact Insulation Class (IIC)*** – This classification covers the determination of a single-figure rating that can be used for comparing floor-ceiling assemblies for general building design purposes.

- ***Impact Sound Pressure Level (L)*** **–** the average sound pressure level in a specified frequency band produced in the receiving room by the operation of the standard tapping machine on the floor assembly, averaged over each of the specified machine positions.

- ***Receiving room*** **–** a room below or adjacent to the floor specimen under test in which the impact sound pressure levels are measured.

- ***Source Room*** **–** the room containing the tapping machine.

STANDARDS

- ***ISO 16283 – 2***
  Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 7: Default procedure for sound pressure level measurement

- ***ISO 717 – 2***
  Acoustics – Rating of sound insulation in building and of building elements – Part 2: Impact sound insulation

- ***ISO 3382-2:2008***
  Acoustics – Measurement of room acoustic parameters — Part 2: Reverberation time in ordinary rooms.

- ***ASTM Classification E 1007 – 97***
  Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures

- ***ASTM Classification E 989 – 89***
  Standard Classification for Determination of Impact Insulation Class (IIC)

APPENDIX B

CALCULATION METHODOLOGY - L'nT,w

Standardized impact sound pressure level – ISO 16283-2:2015

$$L'_{nT} = L_i - 10 \log \left(\frac{T}{T_0}\right)$$

L'_{nT} is the standardized impact sound pressure level;
L_i is the impact sound pressure level;
T is the reverberation time in the receiving room;
T_0 is the reference reverberation time in the receiving room; for dwellings, T_0 = 0.5 s.

Method of comparison – ISO 717-2:2013

To evaluate the results of a measurement of L'_{nT} in one-third-octave bands, the reference curve is shifted in increments of 1 dB towards the L'_{nT} curve until the sum of unfavorable deviations is as large as possible but not more than 32 dB.

An unfavorable deviation at a particular frequency occurs when the results of measurements exceed the reference value. Only the unfavorable deviations are taken into account.

The value, in decibels, of the reference curve at 500 Hz, after shifting in accordance with this procedure, is $L'_{nT,w}$.

Correction to the signal level for background noise – ISO 16283-2:2015

If $(L_{sb} - L_b) > 10$, then $L = L_{sb}$
If $10 > (L_{sb} - L_b) > 6$, then $L = 10 \log \left(10^{\frac{L_{sb}}{10}} - 10^{\frac{L_b}{10}}\right)$
If $6 > (L_{sb} - L_b)$, then $L = L_{sb} - 1.3$

L is the adjusted signal level, in decibels;
L_{sb} is the level of signal and background noise combined, in decibels;
L_b is the background noise level in decibels.

CALCULATION METHODOLOGY – FIIC

Correction to the signal level for background noise – ASTM E 1007 - 97

If $(L_{sb}- L_b) > 10$, then $L_s = L_{sb}$

If $10 > (L_{sb}- L_b) > 5$, then $L_s = 10 \log \left(10^{\frac{L_{sb}}{10}} - 10^{\frac{L_b}{10}}\right)$

If $5 > (L_{sb}- L_b)$, then $L_s = L_{sb} - 2$

L_s is the adjusted signal level, in decibels;
L_{sb} is the level of signal and background noise combined, in decibels;
L_b is the background noise level, in decibels.

Normalized impact sound pressure level – ASTM E 1007 - 97

$$L_n = L_p - 10 \log \left(\frac{A_0}{A_2}\right)$$

$$A_2 = 0.921 \left(\frac{Vd}{c}\right)$$

L_n = normalized impact sound pressure level;
L_p = average one-third octave band sound pressure level;
A_2 = equivalent sound absorption area of the room, in m²;
A_0 = reference sound absorption area of the room, A_0 = 10 m²;
V = volume of the room, in m²;
d = rate of decay of sound pressure level in the room, in dB/s (d = 60/T, T = reverberation time);
c = speed of the sound in air, in m/s ($c = 20.047\sqrt{273.15 + t}$, t = receiving room's temperature).

Determination of Impact Insulation Class – ASTM E 989 - 1999

To determine the impact insulation class (IIC) of a floor-ceiling assembly, the reference IIC contour is shifted vertically relative to the normalised impact sound pressure levels until the following conditions are fulfilled:

- The sum of the deviations above the contour do not exceed 32 dB
- The maximum deviation at a single test frequency do not exceed 8 dB

The normalised sound pressure level at the intersection of the contour and 500 Hz ordinate is subtracted from 110 to obtain the impact insulation class.

APPENDIX C

Test certificates (3)

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FIELD IMPACT SOUND INSULATION - TEST CERTIFICATE

Test 1 of 3

Bare concrete slab

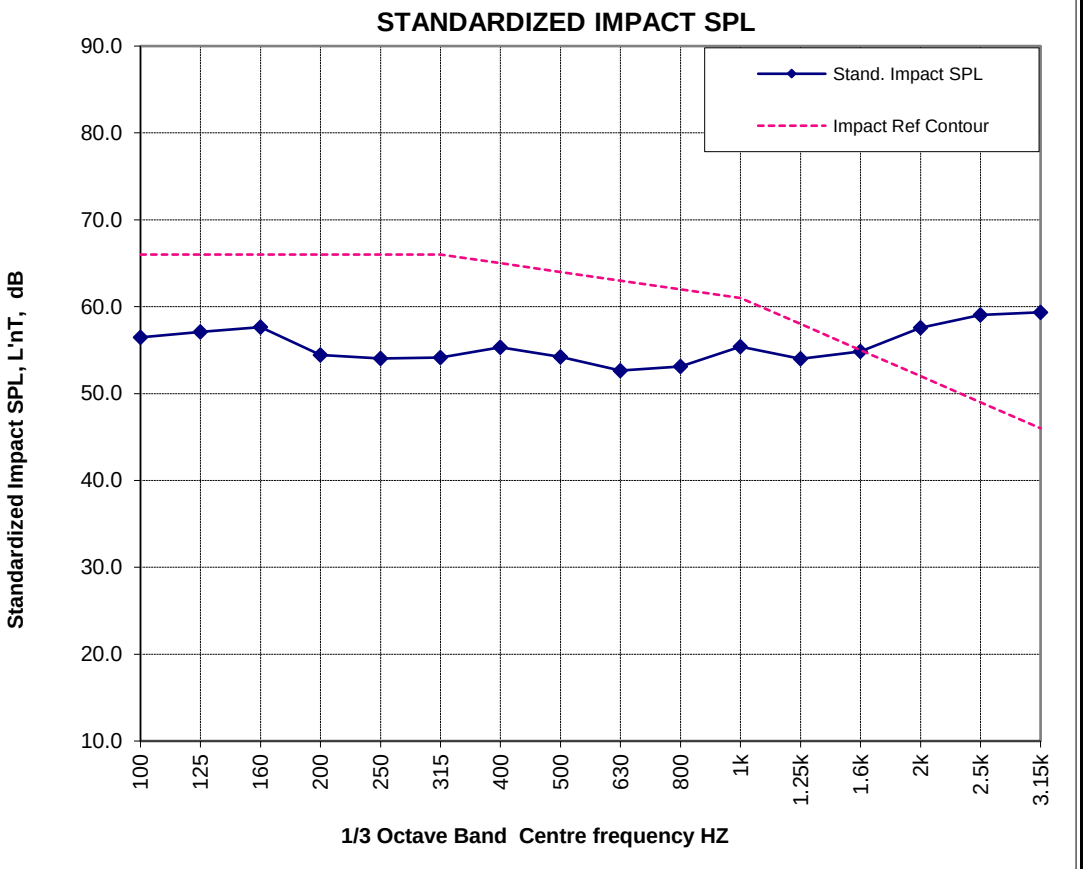
PROJECT:	PN5236 U609 35 Kelburn Street, Upper Mt Gravatt LNT			
Test Location:	Level 6 U609 Liv, Kit/Din room to Level 5 U509 Liv, Kit/Din room	**Meas. Date:**	26-May-2021	
		Meas. Parameter:	LLeq	
Client:	Next13 PTY LTD	**Tapping Machine:**	Look Line EM50	
Test Performed:	Eric Huang	**Receiving Room Volume:**	84	m^3

DESCRIPTION OF FLOOR AND SPECIMEN

		No. of Source posn:	2	
Test Surface:	Bare concrete slab	**Mic. posn:**	2	sweeps
		RT meas:	4	Imp.
Underlay:		**SLM:**	Nti XL2	
Adhesive:				
Ceiling:	13mm plasterboard with 200mm ceiling cavity			
Slab:	180mm Concrete			

Weighted Standardized Impact SPL Results standardized to a RT of 0.5 seconds	**L'nT,w**	**64**	ISO 16283-2:2015 & 717-2:2013
Impact Insulation Class	**FIIC**	**36**	ASTM E1007-97 & E989-89

Centre Frequency	Stand. Impact SPL	Impact Ref Contour	Deficiencies
Hz	dB	dB	dB
100	56.5	66	
125	57.1	66	
160	57.6	66	
200	54.4	66	
250	54.0	66	
315	54.1	66	
400	55.3	65	
500	54.2	64	
630	52.6	63	
800	53.1	62	
1k	55.4	61	
1.25k	54.0	58	
1.6k	54.8	55	
2k	57.6	52	5.6
2.5k	59.0	49	10.0
3.15k	59.4	46	13.4
			Total
L'nT,w	64		29.0



24 Mexicanus Drive Park Ridge QLD 4125
Ph (61 7) 3802 2155 www.palmeracoustics.com

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FIELD IMPACT SOUND INSULATION - TEST CERTIFICATE

Test 2 of 3

Trojan Professional Hybrid Flooring - 8mm thick with rubber backing
black plastic on top of 3mm thick Trojan IQ underlay

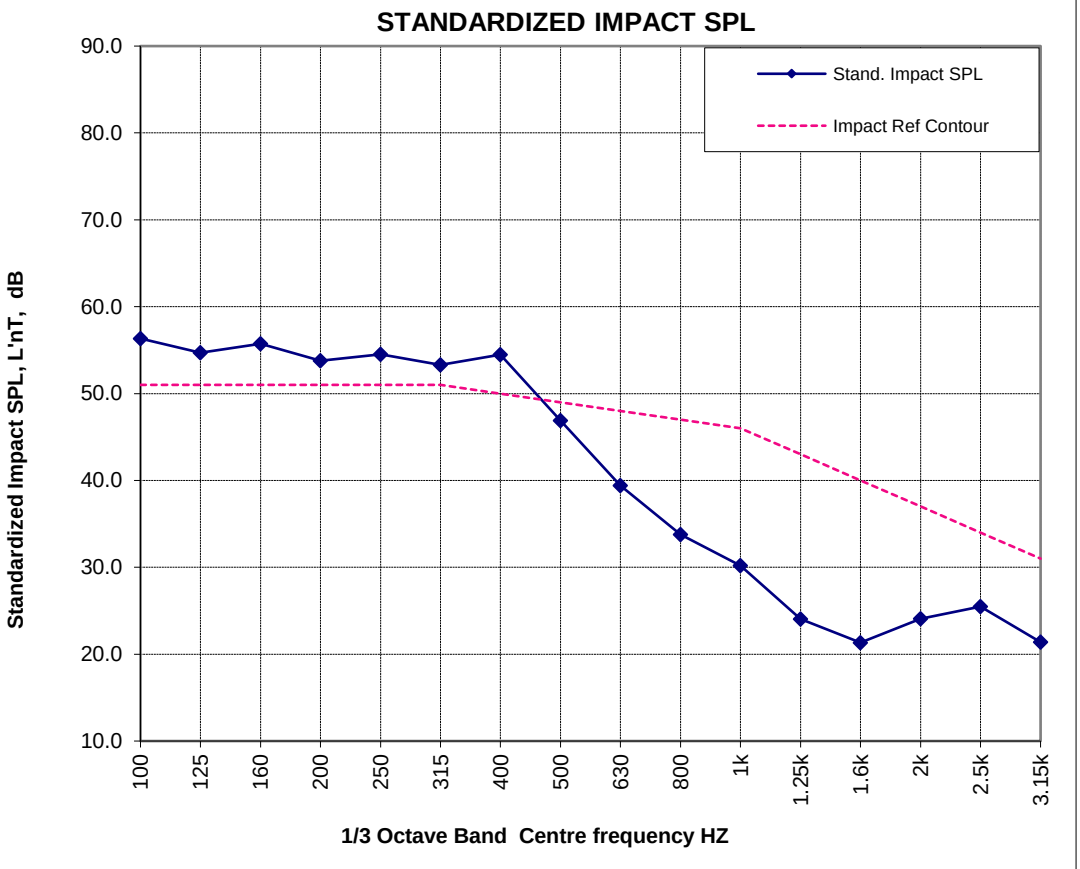
PROJECT:	PN5236 U609 35 Kelburn Street, Upper Mt Gravatt LNT		
Test Location:	Level 6 U609 Liv, Kit/Din room to Level 5 U509 Liv, Kit/Din room	**Meas. Date:**	26-May-2021
		Meas. Parameter:	LLeq
Client:	Next13 PTY LTD	**Tapping Machine:**	Look Line EM50
Test Performed:	Eric Huang	**Receiving Room Volume:**	84 m^3

DESCRIPTION OF FLOOR AND SPECIMEN

Test Surface:	Trojan Professional Hybrid Flooring - 8mm thick with rubber backing	**No. of Source posn:**	2	
		Mic. posn:	2	sweeps
		RT meas:	4	Imp.
Underlay:	black plastic on top of 3mm thick Trojan IQ underlay	**SLM:**	Nti XL2	
Adhesive:	loose laid			
Ceiling:	13mm plasterboard with 200mm ceiling cavity			
Slab:	180mm Concrete			

Weighted Standardized Impact SPL Results standardized to a RT of 0.5 seconds	**L'nT,w**	**49**	ISO 16283-2:2015 & 717-2:2013
Impact Insulation Class	**FIIC**	**57**	ASTM E1007-97 & E989-89

Centre Frequency	Stand. Impact SPL	Impact Ref Contour	Deficiencies
Hz	dB	dB	dB
100	56.3	51	5.3
125	54.7	51	3.7
160	55.7	51	4.7
200	53.8	51	2.8
250	54.5	51	3.5
315	53.3	51	2.3
400	54.5	50	4.5
500	46.9	49	
630	39.4	48	
800	33.7	47	
1k	30.2	46	
1.25k	24.0	43	
1.6k	21.3	40	
2k	24.1	37	
2.5k	25.5	34	
3.15k	21.4	31	
			Total
L'nT,w	49		26.8



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FIELD IMPACT SOUND INSULATION - TEST CERTIFICATE

Test 3 of 3

Trojan Professional Hybrid Flooring - 8mm thick with rubber backing black plastic

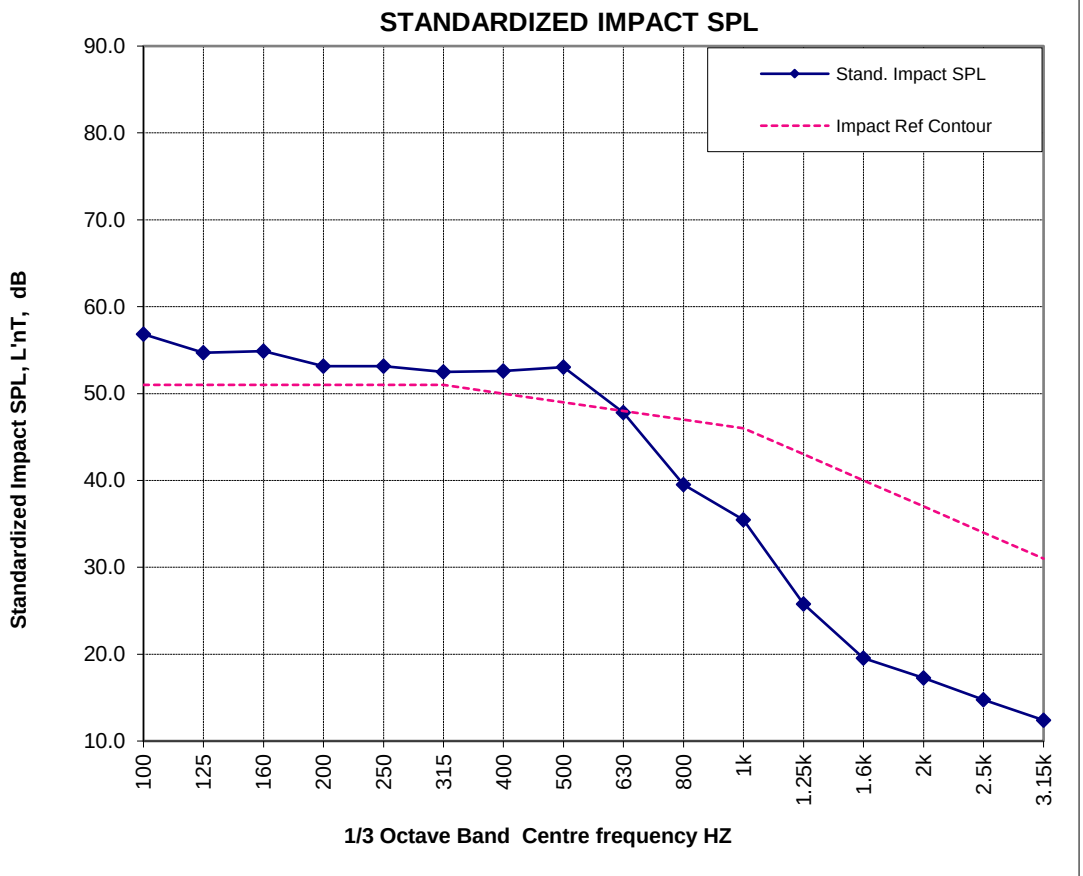
PROJECT:	PN5236 U609 35 Kelburn Street, Upper Mt Gravatt LNT			
Test Location:	Level 6 U609 Liv, Kit/Din room to Level 5 U509 Liv, Kit/Din room	**Meas. Date:**	26-May-2021	
		Meas. Parameter:	LLeq	
Client:	Next13 PTY LTD	**Tapping Machine:**	Look Line EM50	
Test Performed:	Eric Huang	**Receiving Room Volume:**	84	m^3

DESCRIPTION OF FLOOR AND SPECIMEN

		No. of Source posn:	2	
Test Surface:	Trojan Professional Hybrid Flooring - 8mm thick with rubber backing	**Mic. posn:**	2	sweeps
		RT meas:	4	Imp.
Underlay:	black plastic	**SLM:**	Nti XL2	
Adhesive:	loose laid			
Ceiling:	13mm plasterboard with 200mm ceiling cavity			
Slab:	180mm Concrete			

Weighted Standardized Impact SPL Results standardized to a RT of 0.5 seconds	**L'nT,w**	**49**	ISO 16283-2:2015 & 717-2:2013
Impact Insulation Class	**FIIC**	**57**	ASTM E1007-97 & E989-89

Centre Frequency		Stand. Impact SPL	Impact Ref Contour	Deficiencies
Hz		dB	dB	dB
100		56.8	51	5.8
125		54.7	51	3.7
160		54.9	51	3.9
200		53.1	51	2.1
250		53.1	51	2.1
315		52.5	51	1.5
400		52.6	50	2.6
500		53.0	49	4.0
630		47.8	48	
800		39.5	47	
1k		35.5	46	
1.25k		25.8	43	
1.6k		19.6	40	
2k	<	17.3	37	
2.5k	<	14.7	34	
3.15k	<	12.4	31	
				Total
L'nT,w		49		25.8



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