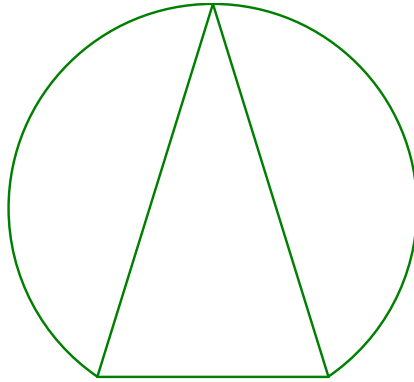


- Private & Confidential -



White Mark Limited

Fryderyk Chopin University of Music Warsaw, Poland

- Acoustic Design Commentary Phase 1: User Comment Response -

Our reference;
WML/2755 ADC - 1

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Suffolk, England

December 2013

Acoustic Design Commentary Document- User comment response

This document has been created to answer the specific points raised in response to the Phase 1 commentary issued by White Mark Limited.

3(a) Tolerances of reverberation time targets

It is the intention of the design in this area to create a reverberation time response against frequency that is accurate to the prediction. Due to modal response issues within any room and the change in the mean free path of any sound as both the source and monitoring positions move within the space, some variation will be noted over the area of the room. Assuming that the edges of the floor area are avoided other than in cases of specific need, the diffuse design characteristics employed should ensure as even a response as possible across the whole room. Individual band tolerances can be expected to be within 10% of the predicted value but it is anticipated that an iterative approach can be taken during installation whereby check measurements can be taken and adjustment of the final acoustic treatment made. This should allow a more accurate response to be tailored but it is noted that this calibration process must be allowed for in the construction programme and budget and the costs of measurement and design refinement be included at that stage.

A revised RT prediction is offered showing the adjusted response requested, both in the room's normal state and after the addition of curtains to render the space suitable for cinema style use. The RT prediction is compared to a Dolby recommendation for a space of such a volume for reference and is shown to offer a response compatible with the monitoring environment in the Dolby ATMOS theatre.

White Mark Limited

Room response calculation sheet

Main Live Room

Boundary surface

Floor: Concrete	0
Floor: Parquet tile/solid wood on concrete	165
Painted concrete block side walls	335
Metal element ceiling	0
Plastered ceiling	0
Windows and doors	5
Curtains	0
Floor: Carpet on border	0
Wood Panel Walls	0
Big Windows	0
Absorber	100
Polycylinder 45" x 16" empty	50
Poly Cylinder 20" x 8" empty	0
Poly Cylinder 20" x 8" filled	0
Totals	655

Metric ? Yes (Yes/No)

Area	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
0	0.01	0.01	0.01	0.02	0.02	0.02
165	0.01	0.01	0.015	0.02	0.02	0.02
335	0.1	0.05	0.06	0.07	0.1	0.1
0	0.01	0.01	0.01	0.01	0.01	0.01
0	0.14	0.1	0.06	0.05	0.04	0.03
5	0.35	0.25	0.18	0.12	0.07	0.04
0	0.14	0.35	0.55	0.72	0.7	0.65
0	0.02	0.06	0.14	0.37	0.6	0.65
0	0.24	0.19	0.14	0.08	0.13	0.10
0	0.45	0.35	0.18	0.12	0.07	0.04
100	0.78	0.98	0.95	0.95	0.90	0.90
50	0.4	0.4	0.33	0.23	0.21	0.22
0	0.22	0.28	0.3	0.22	0.22	0.23
0	0.27	0.40	0.32	0.22	0.22	0.22

Room dimensions (in metres):

15 11.3 6

125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
0	0	0	0	0	0
1.65	1.65	2.475	3.3	3.3	3.3
33.5	16.75	20.1	23.45	33.5	33.5
0	0	0	0	0	0
0	0	0	0	0	0
1.75	1.25	0.9	0.6	0.35	0.2
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
78	98	95	95	90	90
20	20	16.5	11.5	10.5	11
0	0	0	0	0	0
0	0	0	0	0	0
134.90	137.65	134.98	133.85	137.65	138.00

Room volume =

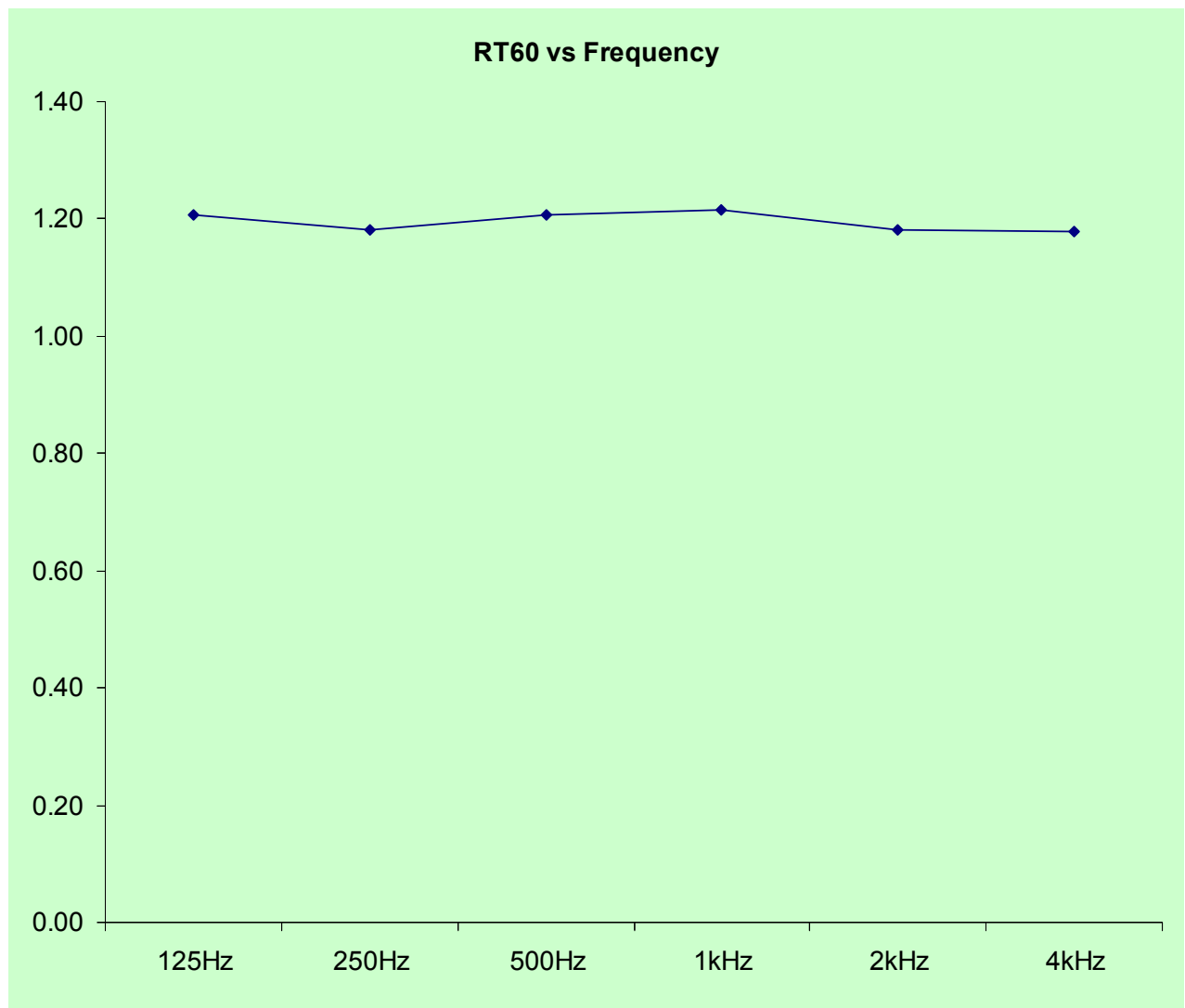
(655) m2 Air 0
1,017 m3

RT60

1.20

1.21 1.18 1.21 1.22 1.18 1.18

RT against Frequency: Room 004



White Mark Limited

Room response calculation sheet

Main Live Room

Boundary surface

Floor: Concrete
Floor: Parquet tile/solid wood on concrete
Painted concrete block side walls
Audience members
Plastered ceiling
Windows and doors
Curtains
Floor: Carpet on border
Wood Panel Walls
Big Windows
Absorber
Polycylinder 45" x 16" empty
Poly Cylinder 20" x 8" empty
Poly Cylinder 20" x 8" filled

Metric ? Yes (Yes/No)

Area	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
0	0.01	0.01	0.01	0.02	0.02	0.02
165	0.01	0.01	0.015	0.02	0.02	0.02
190	0.1	0.05	0.06	0.07	0.1	0.1
60	0.36	0.43	0.47	0.44	0.49	0.49
0	0.14	0.1	0.06	0.05	0.04	0.03
5	0.35	0.25	0.18	0.12	0.07	0.04
200	0.14	0.35	0.55	0.72	0.7	0.65
0	0.02	0.06	0.14	0.37	0.6	0.65
0	0.24	0.19	0.14	0.08	0.13	0.10
0	0.45	0.35	0.18	0.12	0.07	0.04
100	0.78	0.98	0.95	0.95	0.90	0.90
50	0.4	0.4	0.33	0.23	0.21	0.22
0	0.22	0.28	0.3	0.22	0.22	0.23
0	0.27	0.40	0.32	0.22	0.22	0.22

Totals

(655) m2
1,017 m3

Room volume =

RT60

0.66

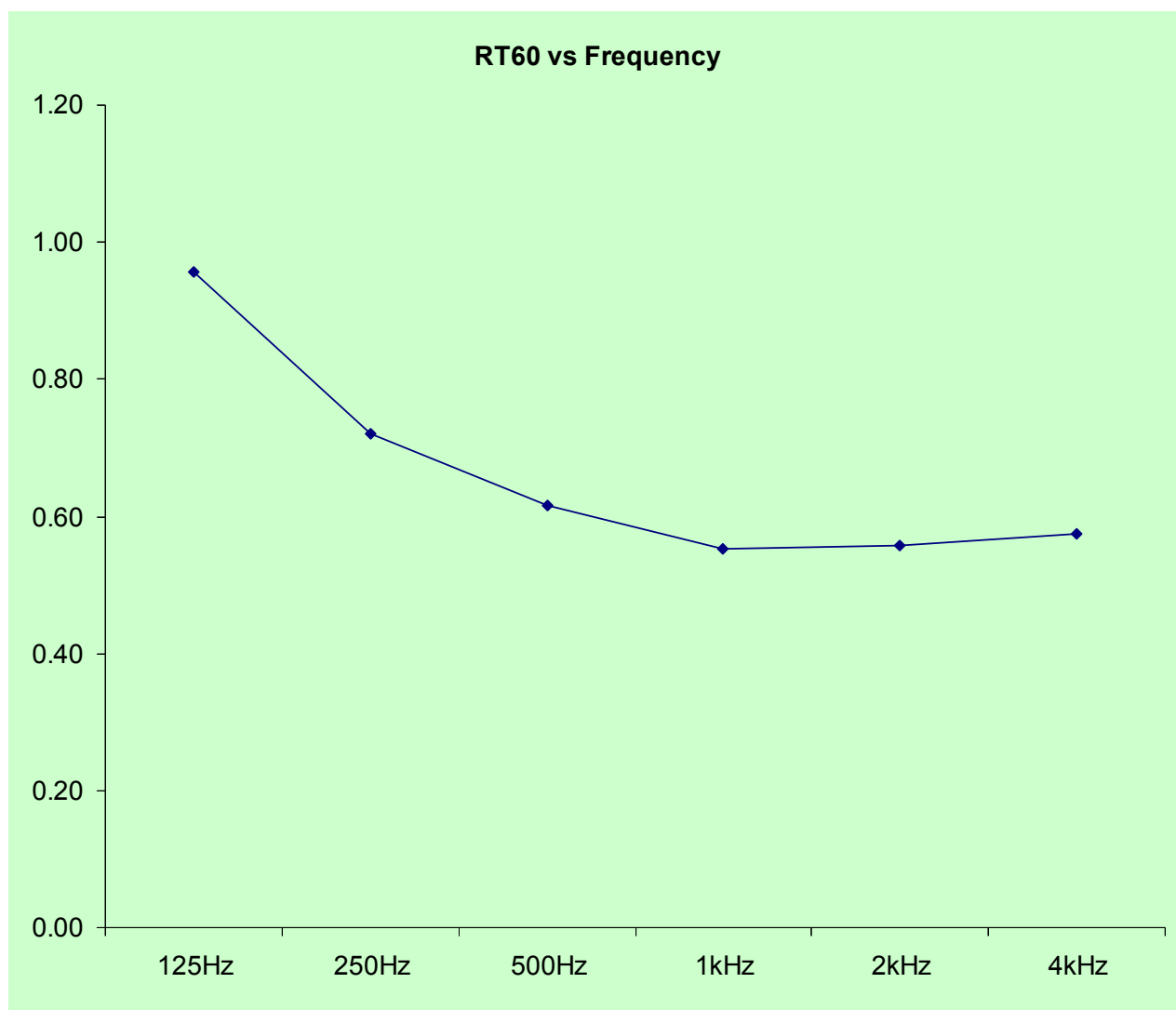
Room dimensions (in metres):

15 11.3 6

125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
0	0	0	0	0	0
1.65	1.65	2.475	3.3	3.3	3.3
19	9.5	11.4	13.3	19	19
21.6	25.8	28.2	26.4	29.4	29.4
0	0	0	0	0	0
1.75	1.25	0.9	0.6	0.35	0.2
28	70	110	144	140	130
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
78	98	95	95	90	90
20	20	16.5	11.5	10.5	11
0	0	0	0	0	0
0	0	0	0	0	0
170.00	226.20	264.48	294.10	292.55	282.90

0.96 0.72 0.62 0.55 0.56 0.58

RT against Frequency: Room 004 with curtains



5. Reverberation



Studio Name **FCUM with curtains**

Date **09/12/2013**

Ident **Room 005**

Dolby Measurements

INPUT CELLS

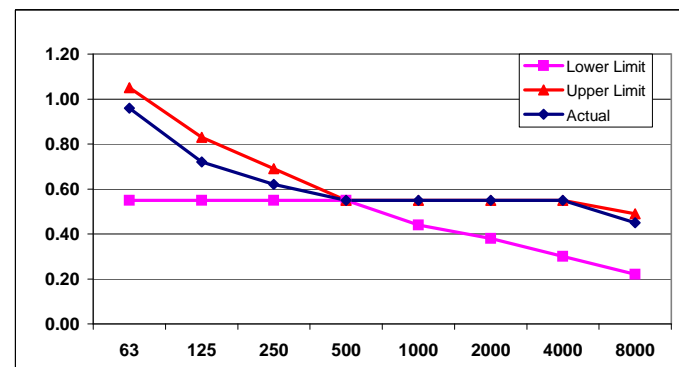
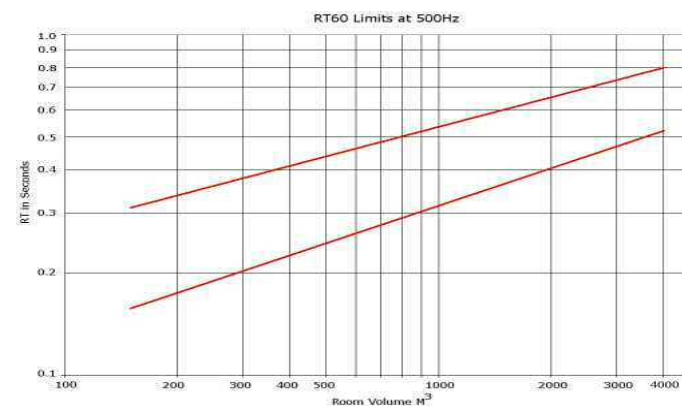
NOTES

Room volume	1035	m ³	
Measured RT60 at 500Hz	0.55	s	OK
Enter Noise Criteria value	25	NC	OK

Frequency Variation

	Lower	Upper	Actual	
RT60 at 63Hz	0.550	1.050	0.96	OK
RT60 at 125 Hz	0.550	0.830	0.72	OK
RT60 at 250Hz	0.550	0.690	0.62	OK
RT60 at 500	0.550	0.550	0.55	
RT60 at 1kHz	0.440	0.550	0.55	OK
RT60 at 2kHz	0.380	0.550	0.55	OK
RT60 at 4kHz	0.300	0.550	0.55	OK
RT60 at 8kHz	0.220	0.490	0.45	OK

Version Ver 1.2 19-11-09



3(b) Isolation calculations for open microphone areas

It is noted that the noise floor in all open microphone areas is requested to be set at NC15. The following charts illustrate the previously issued calculations so adjusted.

Note that the operating levels within Room 007 have been set at lower values to reflect the necessary management of room use and also the illustrated need for cavity damping in the isolation walls to achieve the necessary noise floor in Room 004.

Room 005 to Room 004 and to exterior space above

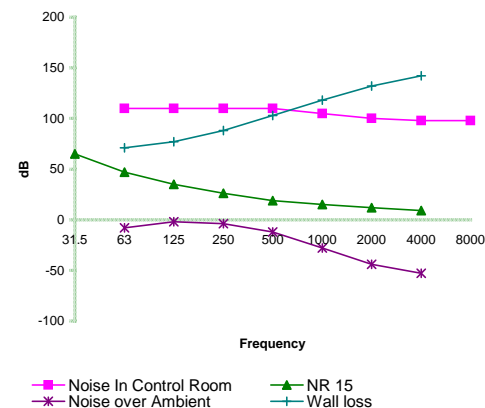
Existing wall: 250mm solid brick rendered (400kg/m2)

Studio wall: 140mm concrete block, 150mm air gap, 100mm mineral wool void damping.

Rw: 101

M-A-M resonance: 10Hz

Frequency	Noise In Control Room	Wall loss	NR 15	Noise over Ambient
0 31.5			65	
1 63	110	71	47	-8
2 125	110	77	35	-2
3 250	110	88	26	-4
4 500	110	103	19	-12
5 1000	105	118	15	-28
6 2000	100	132	12	-44
7 4000	98	142	9	-53
8 8000	98			



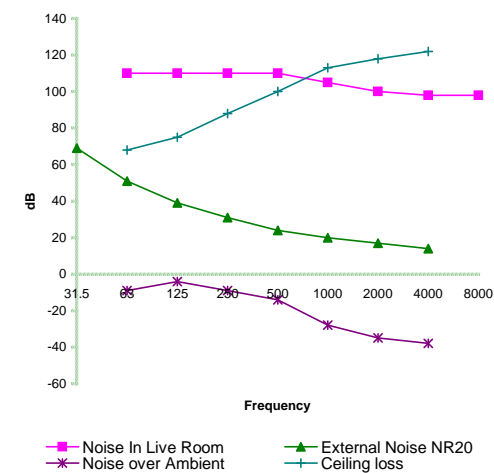
Existing roof: 300mm concrete cast floor with masonry above and support beams

Studio Isolation Cap: 15mm marine ply and three layers of 12.5mm plasterboard with studs on 600mm centres, 200mm Air Gap, 100mm mineral wool void damping.

Rw: 99

M-A-M resonance: 10Hz

Frequency	Noise In Live Room	Ceiling loss	External Noise NR20	Noise over Ambient
31.5			69	
63	110	68	51	-9
125	110	75	39	-4
250	110	88	31	-9
500	110	100	24	-14
1000	105	113	20	-28
2000	100	118	17	-35
4000	98	122	14	-38
8000	98			



Room 005 to Adjacent Booth 007A

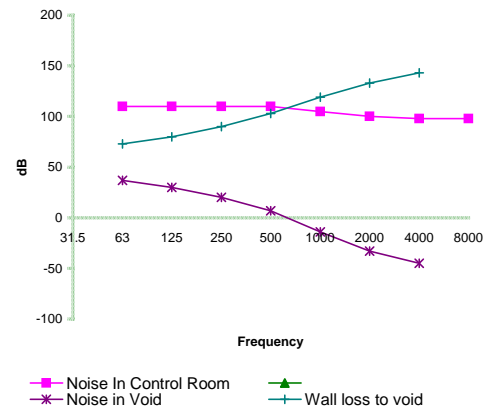
Existing wall: 250mm solid brick rendered (400kg/m2)

Control Room wall: 140mm concrete block, 150mm air gap, 100mm mineral wool void damping.

Rw: 102

M-A-M resonance: 9Hz

Frequency	Noise In Control Room	Wall loss to void	Noise in Void
0 31.5			
1 63	110	73	37
2 125	110	80	30
3 250	110	90	20
4 500	110	103	7
5 1000	105	119	-14
6 2000	100	133	-33
7 4000	98	143	-45
8 8000	98		

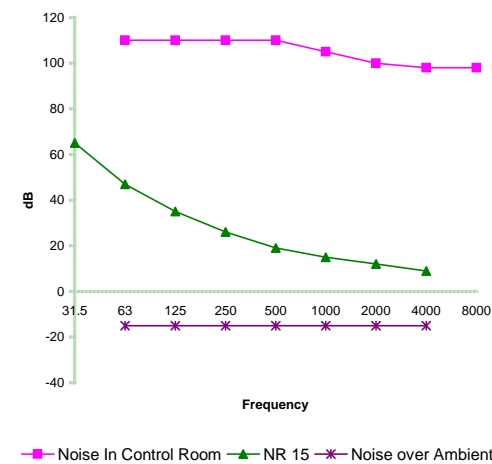


Additional Floated Booth Wall 140mm concrete block, 100mm air gap, 75mm mineral wool void damping.

Rw: 110

M-A-M resonance: 10Hz

Frequency	Noise In Control Room	Wall loss to Booth	NR 15	Noise over Ambient
31.5			65	
63	110	102	47	-15
125	110	115	35	-15
250	110	>120	26	-15
500	110	>120	19	-15
1000	105	>120	15	-15
2000	100	>120	12	-15
4000	98	>120	9	-15
8000	98			



Room 007 to Adjacent Booth, Room 007A

Note: Boundary calculations only, wall/floor excitation ignored

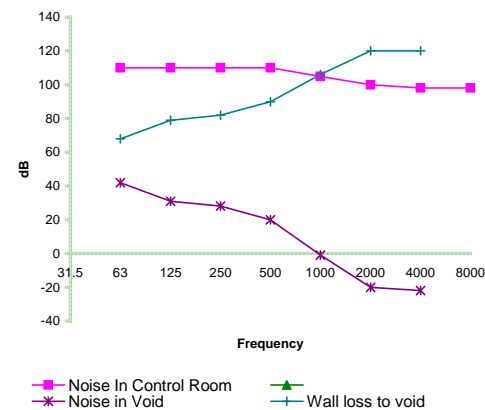
Fixed wall: 100mm concrete block rendered with 155mm Air gap to Control Room 75mm to Booth

Control Room wall: 140mm concrete block, 155mm air gap, 100mm mineral wool void damping.

Rw: 95

M-A-M resonance: 9Hz

Frequency	Noise In Control Room	Wall loss to void	Noise in Void
0 31.5			
1 63	110	68	42
2 125	110	79	31
3 250	110	82	28
4 500	110	90	20
5 1000	105	106	-1
6 2000	100	120	-20
7 4000	98	120	-22
8 8000	98		

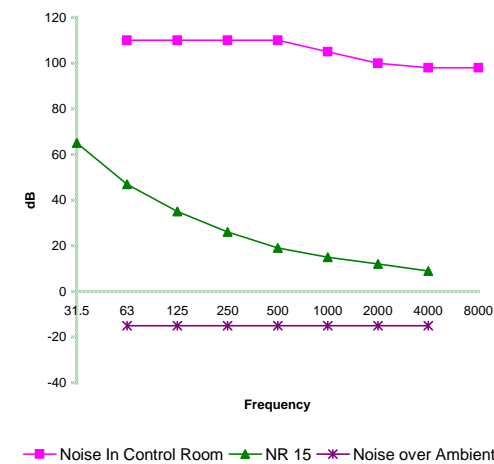


Additional Floated Booth Wall 140mm concrete block, 75mm air gap, 75mm mineral wool void damping.

Rw: 110

M-A-M resonance: 10Hz

Frequency	Noise In Control Room	Wall loss to Booth	NR 15	Noise over Ambient
31.5			65	
63	110	99	47	-15
125	110	117	35	-15
250	110	>120	26	-15
500	110	>120	19	-15
1000	105	>120	15	-15
2000	100	>120	12	-15
4000	98	>120	9	-15
8000	98			



Control Room 007 to Live Room 004

Note: Isolation limited by window design, reviewed elsewhere

Fixed wall: 250mm brick with 100mm Air gap

Control Room wall: 250mm brick with 100mm Air gap

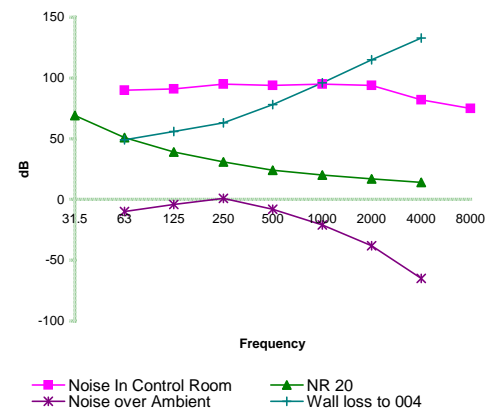
Rw: 76

M-A-M resonance: 17Hz

Frequency	Noise In Control Room	Wall loss to 004	NR 20	Noise over Ambient
0 31.5			69	
1 63	90	49	51	-10
2 125	91	56	39	-4
3 250	95	63	31	1
4 500	94	78	24	-8
5 1000	95	96	20	-21
6 2000	94	115	17	-38
7 4000	82	133	14	-65
8 8000	75			

NB Reduced levels

NB Exceedance



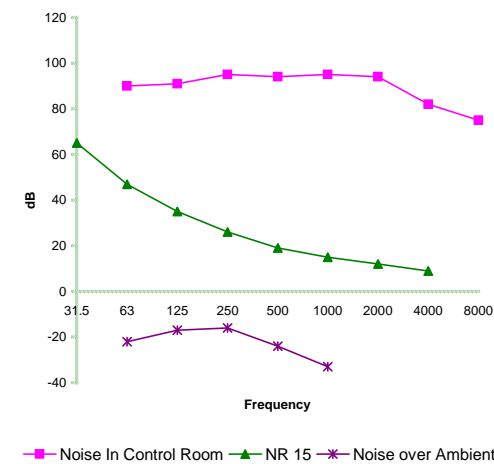
If cavity was infilled: 250mm brick with 100mm Air gap, 75mm mineral wool void damping.

Rw: 96

M-A-M resonance: 14Hz

Frequency	Noise In Control Room	Wall loss to 004	NR 15	Noise over Ambient
31.5			65	
63	90	65	47	-22
125	91	73	35	-17
250	95	85	26	-16
500	94	99	19	-24
1000	95	113	15	-33
2000	94	>120	12	
4000	82	>120	9	
8000	75			

NB Reduced levels



3(c) Isolation calculation for Anechoic chamber (Room 009)

Calculations have been performed for the isolation expected between the new Control Room (Room 004A) and the Anechoic Chamber (Room 009) and are illustrated here. These consider the wall constructions only, as it is unknown whether Room 009 is floated on isolation mounts or has an isolation cap to its inner wall structure.

It can be seen that the highest expected normal running level in the Control Room comes close to causing disturbance in the Anechoic Chamber when the isolation is assessed on the basis that the cavity is un-damped and NR05 is adopted as the target noise floor. The improvement in the performance with a damping fill of 75mm RW3 mineral wool is also illustrated and it would be strongly recommended that this is installed during construction, as is also the case in the cavity of the isolation walls of Room 007.

Fixed wall: 250mm Brick wall with 200mm air gap

Control Room wall to cavity: 15mm marine ply and three layers of 12.5mm plasterboard with studs on 600mm centres, 200mm Air Gap, 100mm mineral wool void damping.

Rw: 90

M-A-M resonance: 20Hz

Frequency	Noise In Control Room	Wall loss to void	Noise in void
0 31.5			
1 63	110	56	54
2 125	110	65	45
3 250	110	82	28
4 500	110	93	17
5 1000	105	105	0
6 2000	100	109	-9
7 4000	98	116	-18
8 8000	98		

Control Rm to Anechoic Chamber: 200mm Brick wall with 100mm air gap

Rw:

M-A-M resonance: 13Hz

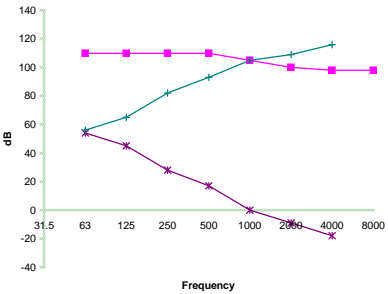
Frequency	Noise In Control Room	Wall loss to 004	NR 5	Noise over Ambient
31.5			58	
63	110	70	40	0
125	110	82	27	1
250	110	109	17	-16
500	110	130	10	
1000	105	>120	5	
2000	100	>120	1	
4000	98	>120	-1	
8000	98			

Control Rm to Anechoic Chamber: 200mm Brick wall with 100mm air gap 75mm RW3 mineral wool void damping

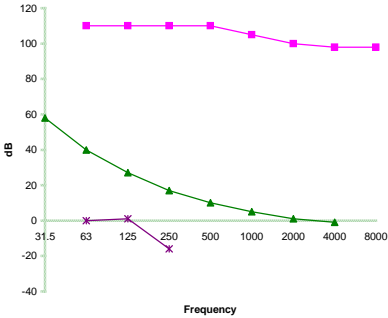
Rw:

M-A-M resonance: 11Hz

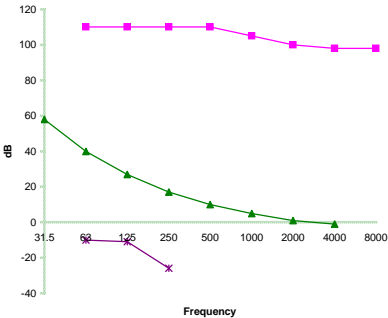
Frequency	Noise In Control Room	Wall loss to 004	NR 5	Noise over Ambient
31.5			58	
63	110	80	40	-10
125	110	94	27	-11
250	110	119	17	-26
500	110	>120	10	
1000	105	>120	5	
2000	100	>120	1	
4000	98	>120	-1	
8000	98			



Noise In Control Room Noise in void Wall loss to void



Noise In Control Room NR 5 Noise over Ambient



Noise In Control Room NR 5 Noise over Ambient