NOISE SUPPRESSION (Chesterfield) Ltd

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WESTBROOK DRIVE
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19 MAR 2007
RECEIVED

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cc: Mario Monfredi

Subject: Land at the former Elsecar Railway Station, Hill Street, Elsecar.

Author : Dr B. Quartermain C.Eng., M.I.Mech.E., M.I.O.A.

Date: March 2007

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1. INTRODUCTION.

The following report provides a snapshot of the noise climate on the proposed building site located on land at the former Elsecar Railway Station, Hill Street, Elsecar. The recorded noise levels were obtained on two separate days [28 / 02 / 07 and 06 / 03 / 07]. Recording times spanned the period 10:00 to 19:30. The readings produced represent a fair indication of the noise climate in the area and enable a 24 hour prediction to be made.

2. GENERAL COMMENTS on the site.

The site is elongated and runs parallel to the railway line on one side with a steep bank on the other side. The extent of the proposed site is approximately 180m running West to East. The main entrance to the site will be from Hill Street and a new access to Elsecar Station will be provided. The site is level and currently bounded on the railway side by a small (2m) embankment.

3. MEASURING CONDITIONS.

3.1 The climate conditions on day 1 (28 / 02 / 07) were changeable and ranged from sunny with a slight breeze to strong breeze and rain with impossible measuring conditions.
The second day 2 (06 / 03 / 07) was sunny with a slight breeze (<4m/s wind speed) all day and evening. Temperature ranged from 4°C to 11°C.

3.2 Measuring locations were fixed to represent the full extent of the site. The locations are shown on the FIG showing sound location positions.

3.3 The sound level meter was mounted on a tripod at 1.3m above the ground level.

3.4 The sound level meter was calibrated at the factory in 2006. It was also calibrated pre site measurement.

3.5 The total measuring time on the site was 16 hours.

4. INSTRUMENTATION.

4.1 The sound level meter used to carry out the survey was a B & K 2250 analyzer capable of measuring and recording instantaneous broadband measurements together with $^1/_1$ and $^1/_3$ frequency levels as well as statistical noise levels.

4.2 The sound levels recorded were processed by B & K software viz: programmes BZ 5503 and Noise Explorer software.

4.3 The L_{Aeq} measurements were collected in 15 min intervals thus providing a better prediction of the noise variation on the site.

5. NOISE MITIGATION.

5.1 Any sensitive dwellings close to the railway line should be designed so that the side facing the railway should provide noise reduction which satisfies WHO design standards.

5.2 It is apparent from the measured noise levels that from Table 1 the noise levels outside the window and doors of the dwellings will be less than L_{Aeq} = 55dB, L_{max} = 75dB and therefore standard double glazing (6 / 12 / 6) will produce sound levels inside the houses of 40dB(A) in the daytime and 30dB(A) at night.

5.3 Any ventilation should be taken into consideration when fitting the windows or into the house fabric.

5.4 The roof design should be compatible with the attenuation provided by the windows.

6. COMMENTARY on TABLES 1 – 4.

6.1 The sound measurements on location at Elsecar were carried out on two days viz: Wednesday 28th February 2007 and Tuesday 6th March 2007.

6.2 The weather conditions on the two days were different in that it was fine but breezy on the first day until 3pm and then it became wet and breezy with measurements being carried out between the rain showers. By 19:00 the survey was abandoned. The second day of the survey was perfect in that there was no wind and it was fine.

6.3 The effect of the wind can be seen in the generally higher levels on day 1 after 15:00. Also a comparison of $^1/_3$ octave bands print outs shows the higher levels on day 1 from 12.5Hz to 63Hz due to the wind.

6.4 Consequently the readings of Table 3 are a better indication of the ambient noise levels of the area.

6.5 Even on a windy day the L_{Aeq} levels in the daytime and early evening are below 57dB.

6.6 Table 1 shows the effect of traffic on Hill Street– position 3. This Table also allows a direct comparison to be made between the sound level measurements on a windy and then calm day.

6.7 Table 2 has only been included to show the effect of wind on the site.

6.8 Table 3 shows that apart from the entrance from Hill Street the site is always below an L_{Aeq} of 50dB even with the operation of trains. The period around 17:00 to 18:00 was the most active for trains arriving and departing from Elsecar Station.

6.9 Table 4 shows that ground transmitted vibration was just around the threshold of perception when a through train passed by.

7. CONCLUSIONS.

7.1 Logarithmic averaging of the measured sound levels based on the results obtained on the 6th March 2007 show that:

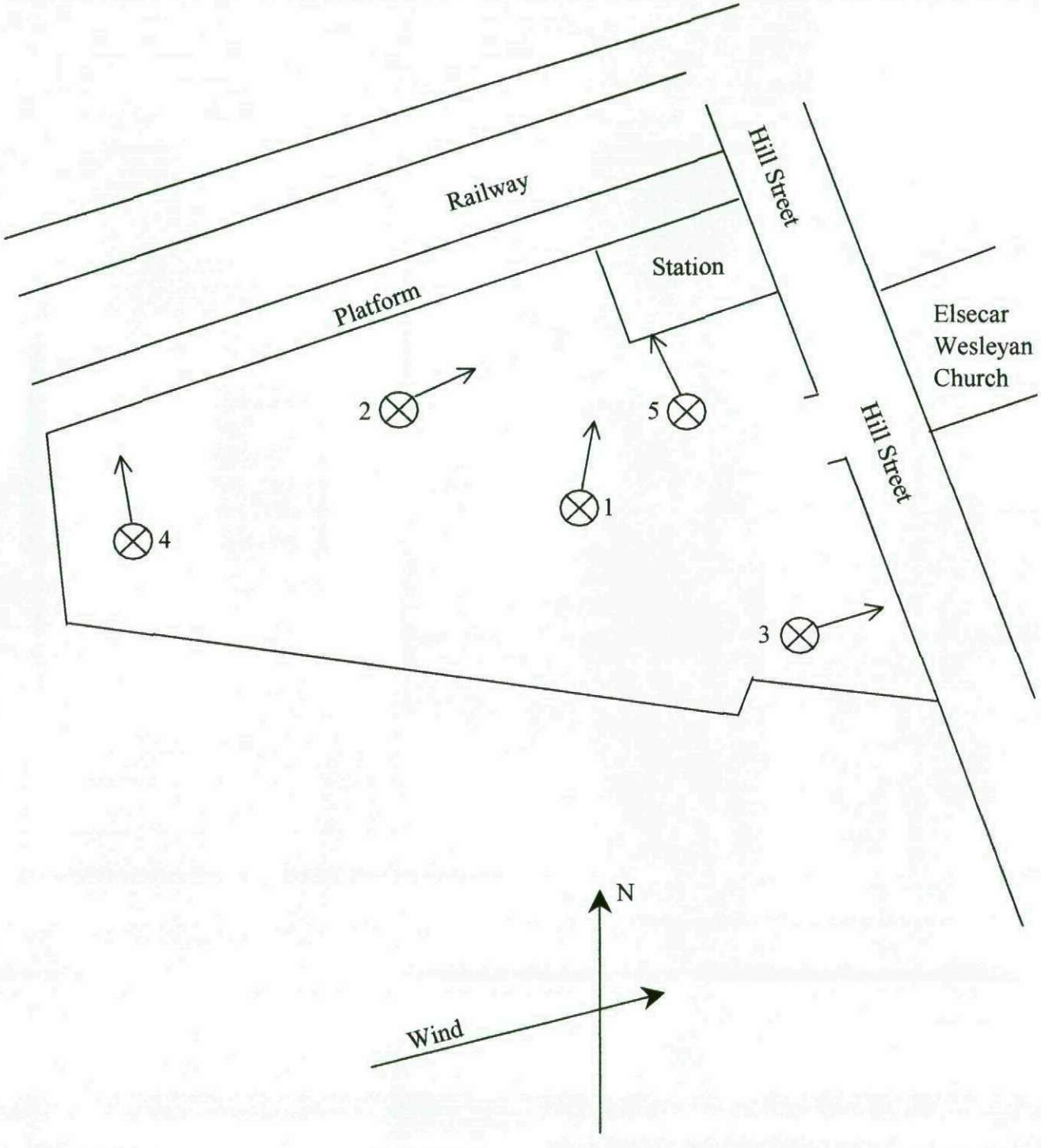
Positions (1,2,4, and 5) :	daytime	L_{Aeq} = 47dB
	evening	L_{Aeq} = 47dB
Position (3 – entrance from Hill St)	daytime	L_{Aeq} = 53dB
	evening	L_{Aeq} = 53dB

7.2 The predicted night time noise level based on the measured results can be found by deducting 10dB from the L_{Aeq} daytime reading. A reference for this statement can be found from Railway Noise and The Insulation of Dwellings – Department of Transport 1991 and Acoustics Bulletin (IOA): March / APRIL 1995 Page 6. Hence, the predicted night time noise will be less than 45dB.

7.3 Reference to PPG 24 (Planning Policy Guidelines) shows that the NEC category into which the site falls for railway noise is Category A.

7.4 The interpretation of the above is that noise need not be considered as a determining factor in granting planning permission. However, Section 5 of this report may be borne in mind.

Sound Measurement Location Positions



Summary - Site Position Noise Measurements.

Location	Time	Date 07	$L_{Aeq\ 15min}$	L_{10}	L_{90}	L_{max}	L_{min}	Lc_{PK}
1	10:50 - 11:06	28-Feb	54.2	54.1	47.2	82.6	44.8	101.0
	14:00 - 14:15	06-Mar	49.0	49.4	42.5	74.4	40.2	99.7
	15:01 - 15:19	28-Feb	57.4	60.5	50.8	70.2	47.7	99.5
	17:58 - 18:13	06-Mar	49.5	50.9	44.3	70.4	42.4	93.6
	18:18 - 18:21	28-Feb	53.6	56.6	48.3	66.5	46.1	108.6
2	11:16 - 11:33	28-Feb	49.2	50.6	44.2	70.4	40.9	100.9
	14:42 - 14:57	06-Mar	43.0	45.5	39.2	62.7	36.8	88.0
	14:45 - 14:59	28-Feb	54.6	56.5	46.7	77.4	44.1	100.1
	18:02 - 18:04	28-Feb	51.5	54.8	47.2	61.3	45.8	83.4
3	11:37 - 11:56	28-Feb	54.7	58.0	48.1	70.9	44.6	100.0
	14:09 - 14:44	28-Feb	54.6	54.8	46.1	86.5	43.8	102.9
	15:19 - 15:34	06-Mar	53.0	56.3	44.6	69.5	41.4	90.7
	17:54 - 18:00	28-Feb	49.1	49.7	45.0	67.2	43.7	95.4
	18:37 - 18:53	06-Mar	49.7	52.4	43.8	67.7	41.4	85.2
	18:56 - 19:00	06-Mar	55.6	52.6	43.6	72.1	41.9	96.5
4	13:36 - 14:07	28-Feb	51.9	53.3	43.2	74.9	40.7	111.7
	14:21 - 14:37	06-Mar	46.8	49.6	41.9	67.9	40.0	101.0
	17:48 - 17:53	28-Feb	56.1	60.4	47.5	69.1	43.3	98.1
	18:16 - 18:33	06-Mar	47.6	49.6	44.2	62.7	41.8	83.6
5	18:22 - 18:27	28-Feb	50.9	53.6	46.0	67.4	44.3	92.2
	18:28 - 18:33	28-Feb	53.6	56.3	48.3	73.5	46.9	105.4
	19:00 - 19:18	06-Mar	47.3	48.4	43.9	61.9	42.0	83.8

TABLE 2

Elsecar 28 / 02 / 2007

Location	Position	Time	$L_{Aeq\ 15min}$	L_{10}	L_{90}	L_{max}	L_{min}	Lc_{Peak}
1	1	10:50 - 11:06	54.2	54.1	47.2	82.6	44.8	101.0
2	2	11:16 - 11:33	49.2	50.6	44.2	70.4	40.9	100.9
3	3	11:37 - 11:56	54.7	58.0	48.1	70.9	44.6	100.0
4	4	13:36 - 14:07	51.9	53.3	43.2	74.9	40.7	111.7
5	3	14:09 - 14:44	54.6	54.8	46.1	86.5	43.8	102.9
6	2	14:45 - 14:59	54.6	56.5	46.7	77.4	44.1	100.1
7	1	15:01 - 15:19	57.4	60.5	50.8	70.2	47.7	99.5
8	4	17:48 - 17:53	56.1	60.4	47.5	69.1	43.3	98.1
9	3	17:54 - 18:00	49.1	49.7	45.0	67.2	43.7	95.4
10	2	18:02 - 18:04	51.5	54.8	47.2	61.3	45.8	83.4
11	1	18:18 - 18:21	53.6	56.6	48.3	66.5	46.1	108.6
12	5	18:22 - 18:27	50.9	53.6	46.0	67.4	44.3	92.2
13	5	18:28 - 18:33	53.6	56.3	48.3	73.5	46.9	105.4

070228 002

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		02/28/2007 11:16:17
End Time:		02/28/2007 11:33:30
Elapsed Time:		00:17:13
Bandwidth:		Broadband
Max Input Level:		140.78

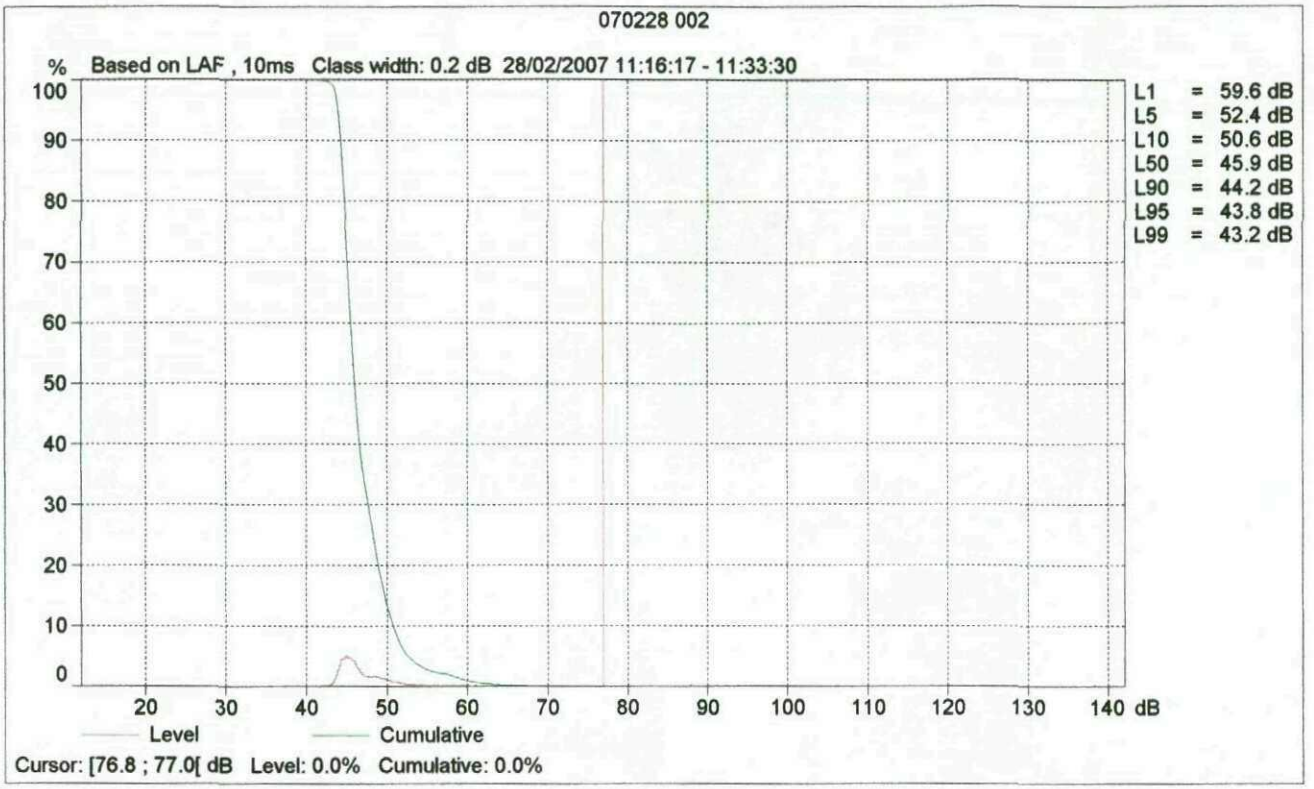
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

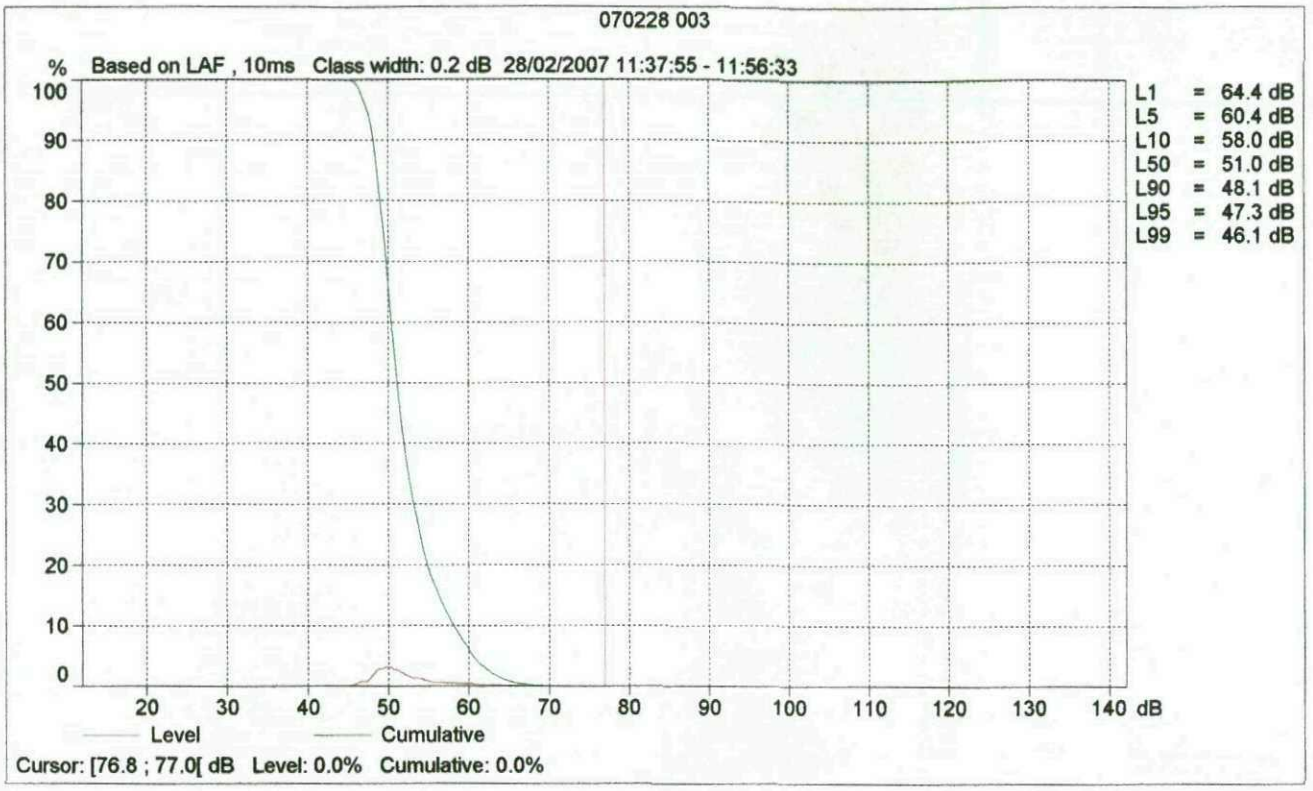
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070228 002

	Start time	End time	Overload [%]	LAIeq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	52.5	70.4	40.9	49.2	100.9
Time	11:16:17	11:33:30						
Date	28/02/2007	28/02/2007						


070228 002
% Based on LAF , 10ms Class width: 0.2 dB 28/02/2007 11:16:17 - 11:33:30
100
90
80
70
60
50
40
30
20
10
0
20 30 40 50 60 70 80 90 100 110 120 130 140 dB
L1 = 59.6 dB
L5 = 52.4 dB
L10 = 50.6 dB
L50 = 45.9 dB
L90 = 44.2 dB
L95 = 43.8 dB
L99 = 43.2 dB
Level
Cumulative
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%


070228 003
% Based on LAF , 10ms Class width: 0.2 dB 28/02/2007 11:37:55 - 11:56:33
100
90
80
70
60
50
40
30
20
10
0
20 30 40 50 60 70 80 90 100 110 120 130 140 dB
L1 = 64.4 dB
L5 = 60.4 dB
L10 = 58.0 dB
L50 = 51.0 dB
L90 = 48.1 dB
L95 = 47.3 dB
L99 = 46.1 dB
Level
Cumulative
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070228 003

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		02/28/2007 11:37:55
End Time:		02/28/2007 11:56:33
Elapsed Time:		00:18:38
Bandwidth:		Broadband
Max Input Level:		140.78

	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070228 003

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	57.1	70.9	44.6	54.7	100.0
Time	11:37:55	11:56:33						
Date	28/02/2007	28/02/2007						

070306 004

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		03/06/2007 15:19:17
End Time:		03/06/2007 15:34:22
Elapsed Time:		00:15:05
Bandwidth:		Broadband
Max Input Level:		140.78

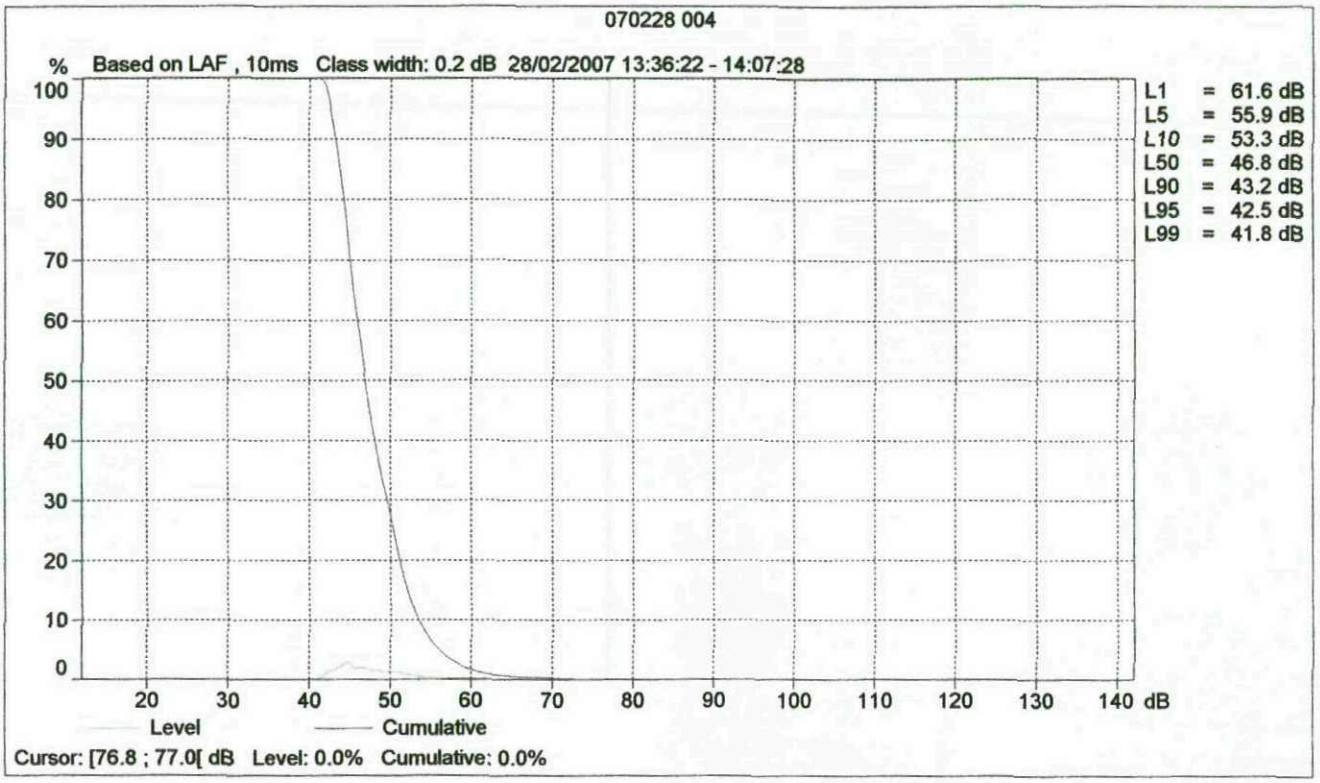
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070306 004

	Start time	End time	Overload [%]	LAIeq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	55.9	69.5	41.4	53.0	90.7
Time	15:19:17	15:34:22						
Date	06/03/2007	06/03/2007						


070228 004
% Based on LAF , 10ms Class width: 0.2 dB 28/02/2007 13:36:22 - 14:07:28
100
90
80
70
60
50
40
30
20
10
0
20 30 40 50 60 70 80 90 100 110 120 130 140 dB
L1 = 61.6 dB
L5 = 55.9 dB
L10 = 53.3 dB
L50 = 46.8 dB
L90 = 43.2 dB
L95 = 42.5 dB
L99 = 41.8 dB
Level
Cumulative
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070228 005

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		02/28/2007 14:09:59
End Time:		02/28/2007 14:44:03
Elapsed Time:		00:29:31
Bandwidth:		Broadband
Max Input Level:		140.78

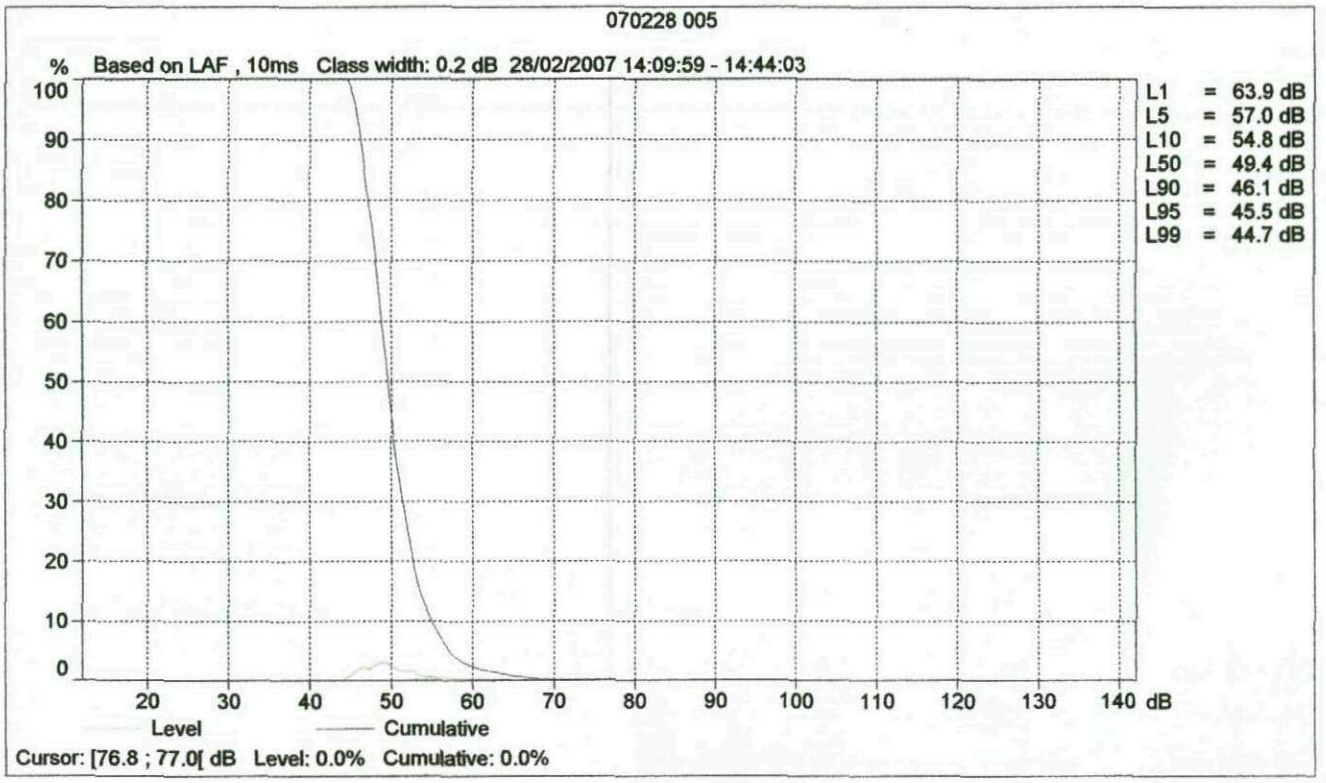
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070228 005

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	63.3	86.5	43.8	54.5	102.9
Time	14:09:59	14:44:03						
Date	28/02/2007	28/02/2007						


070228 005
% Based on LAF , 10ms Class width: 0.2 dB 28/02/2007 14:09:59 - 14:44:03
100
90
80
70
60
50
40
30
20
10
0
20 30 40 50 60 70 80 90 100 110 120 130 140 dB
Level
Cumulative
L1 = 63.9 dB
L5 = 57.0 dB
L10 = 54.8 dB
L50 = 49.4 dB
L90 = 46.1 dB
L95 = 45.5 dB
L99 = 44.7 dB
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070228 005

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		02/28/2007 14:09:59
End Time:		02/28/2007 14:44:03
Elapsed Time:		00:29:31
Bandwidth:		Broadband
Max Input Level:		140.78

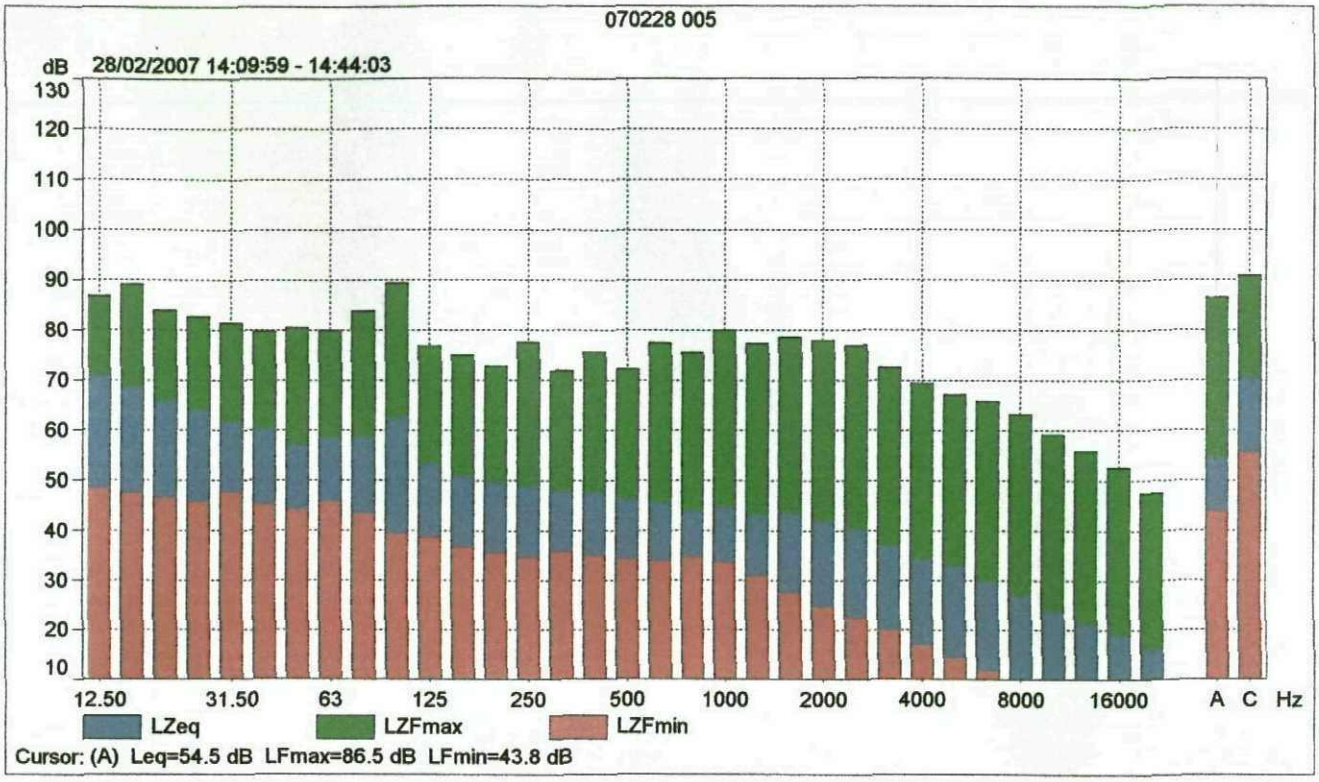
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

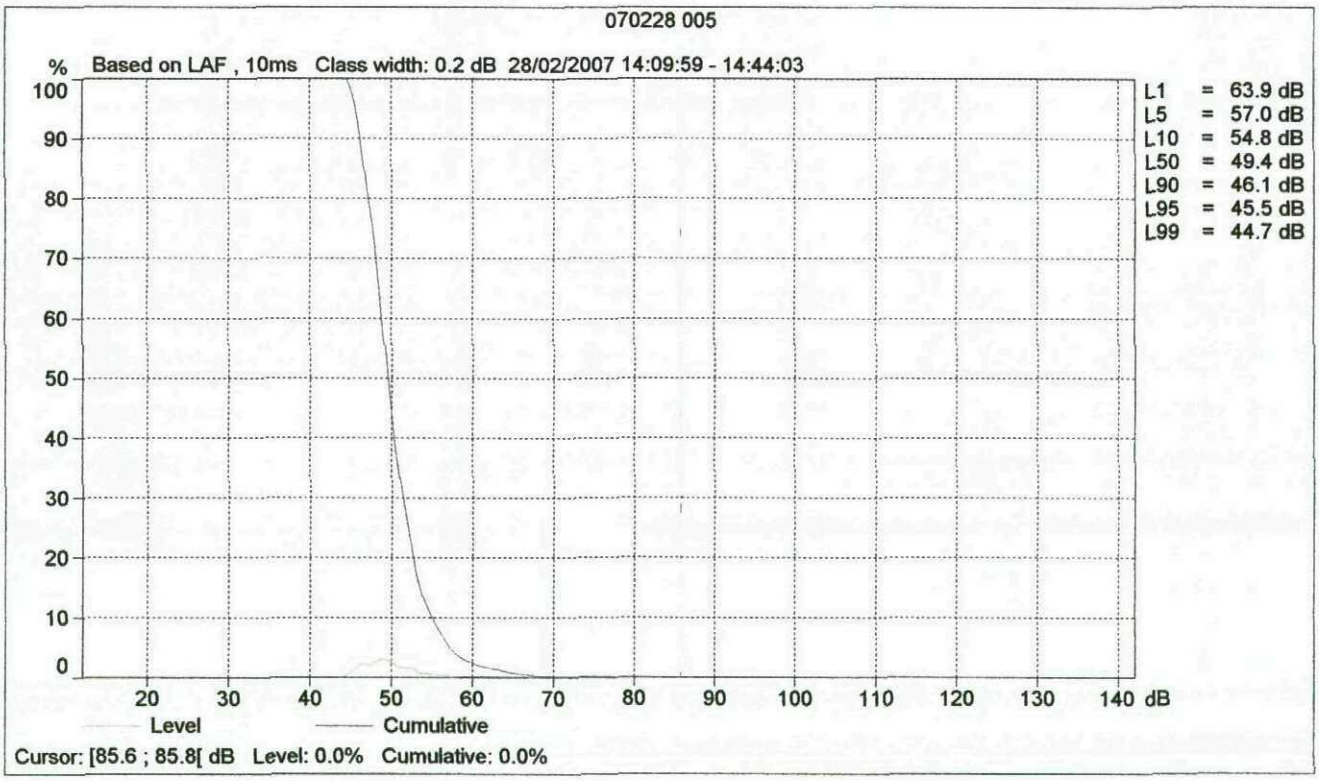
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070228 005

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	63.3	86.5	43.8	54.5	102.9
Time	14:09:59	14:44:03						
Date	28/02/2007	28/02/2007						


070228 005
dB 28/02/2007 14:09:59 - 14:44:03
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A C Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=54.5 dB LFmax=86.5 dB LFmin=43.8 dB


070228 005
% Based on LAF , 10ms Class width: 0.2 dB 28/02/2007 14:09:59 - 14:44:03
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
L1 = 63.9 dB
L5 = 57.0 dB
L10 = 54.8 dB
L50 = 49.4 dB
L90 = 46.1 dB
L95 = 45.5 dB
L99 = 44.7 dB
Level
Cumulative
Cursor: [85.6 ; 85.8[dB Level: 0.0% Cumulative: 0.0%

070228 009

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		02/28/2007 17:54:18
End Time:		02/28/2007 18:00:32
Elapsed Time:		00:05:49
Bandwidth:		Broadband
Max Input Level:		140.78

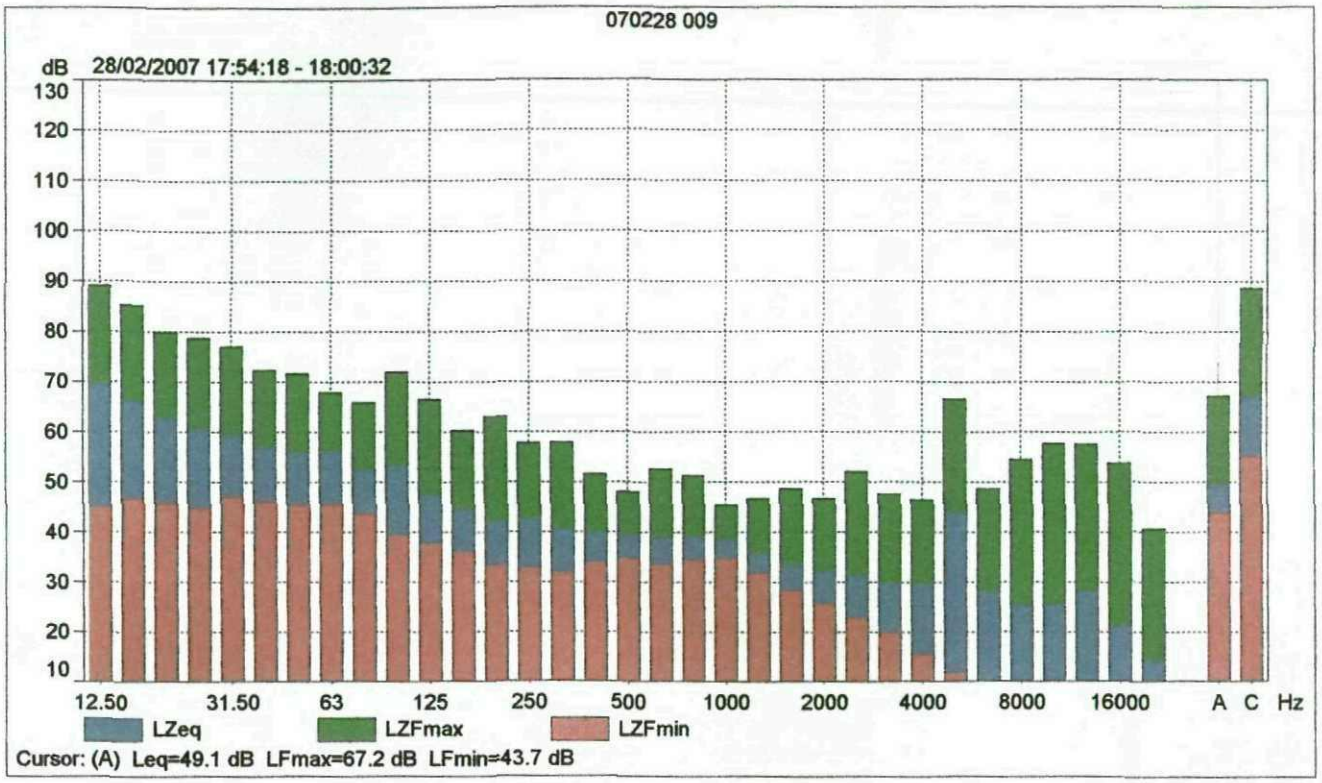
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

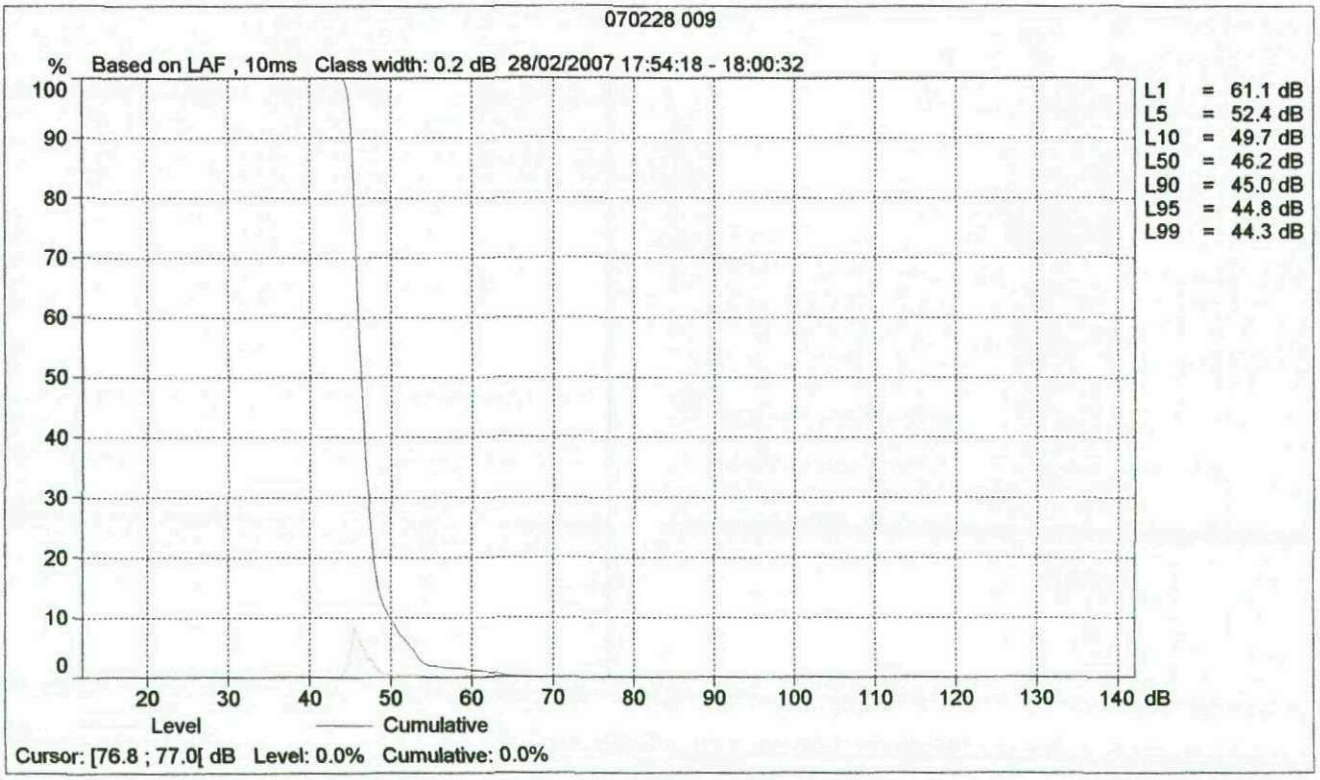
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070228 009

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	52.2	67.2	43.7	49.1	95.4
Time	17:54:18	18:00:32						
Date	28/02/2007	28/02/2007						


070228 009
dB 28/02/2007 17:54:18 - 18:00:32
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A C Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=49.1 dB LFmax=67.2 dB LFmin=43.7 dB


070228 009
% Based on LAF , 10ms Class width: 0.2 dB 28/02/2007 17:54:18 - 18:00:32
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
Level
Cumulative
L1 = 61.1 dB
L5 = 52.4 dB
L10 = 49.7 dB
L50 = 46.2 dB
L90 = 45.0 dB
L95 = 44.8 dB
L99 = 44.3 dB
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070228 013

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		02/28/2007 18:28:30
End Time:		02/28/2007 18:33:34
Elapsed Time:		00:05:04
Bandwidth:		Broadband
Max Input Level:		140.78

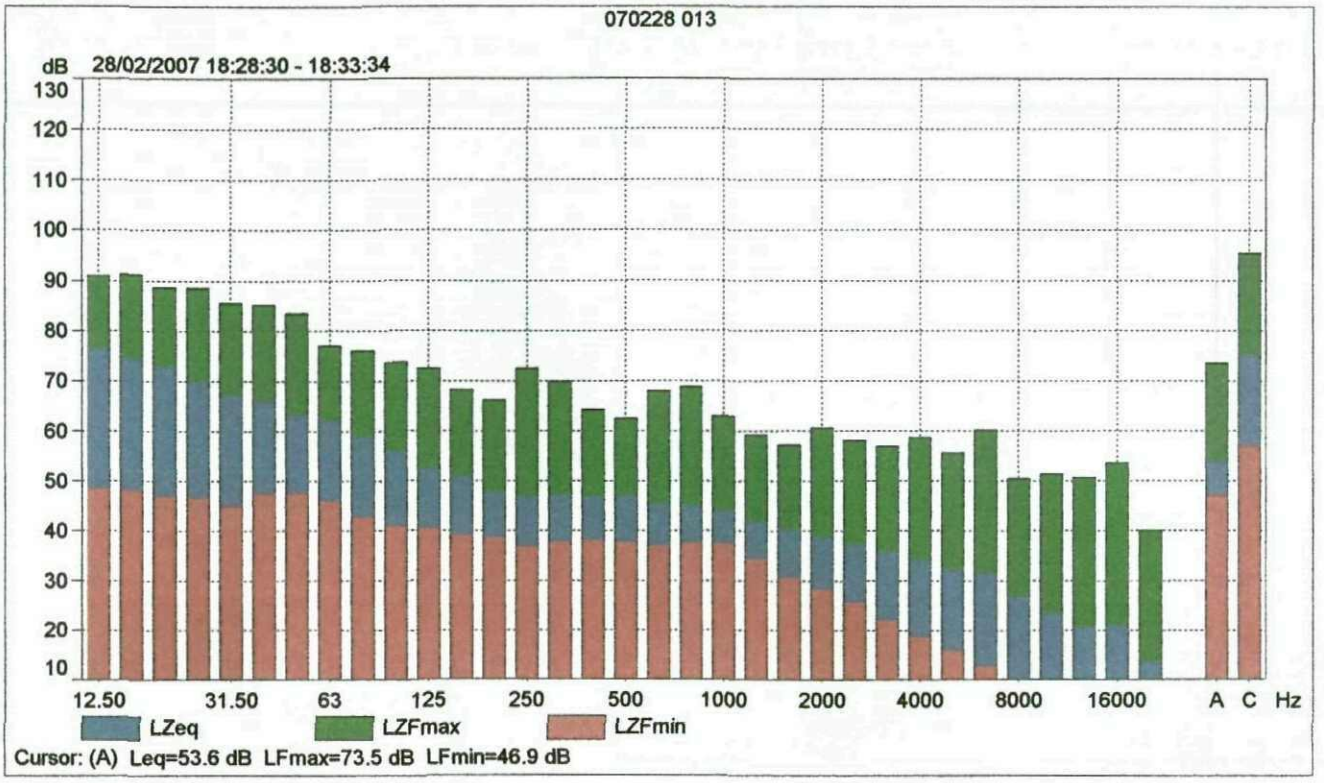
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

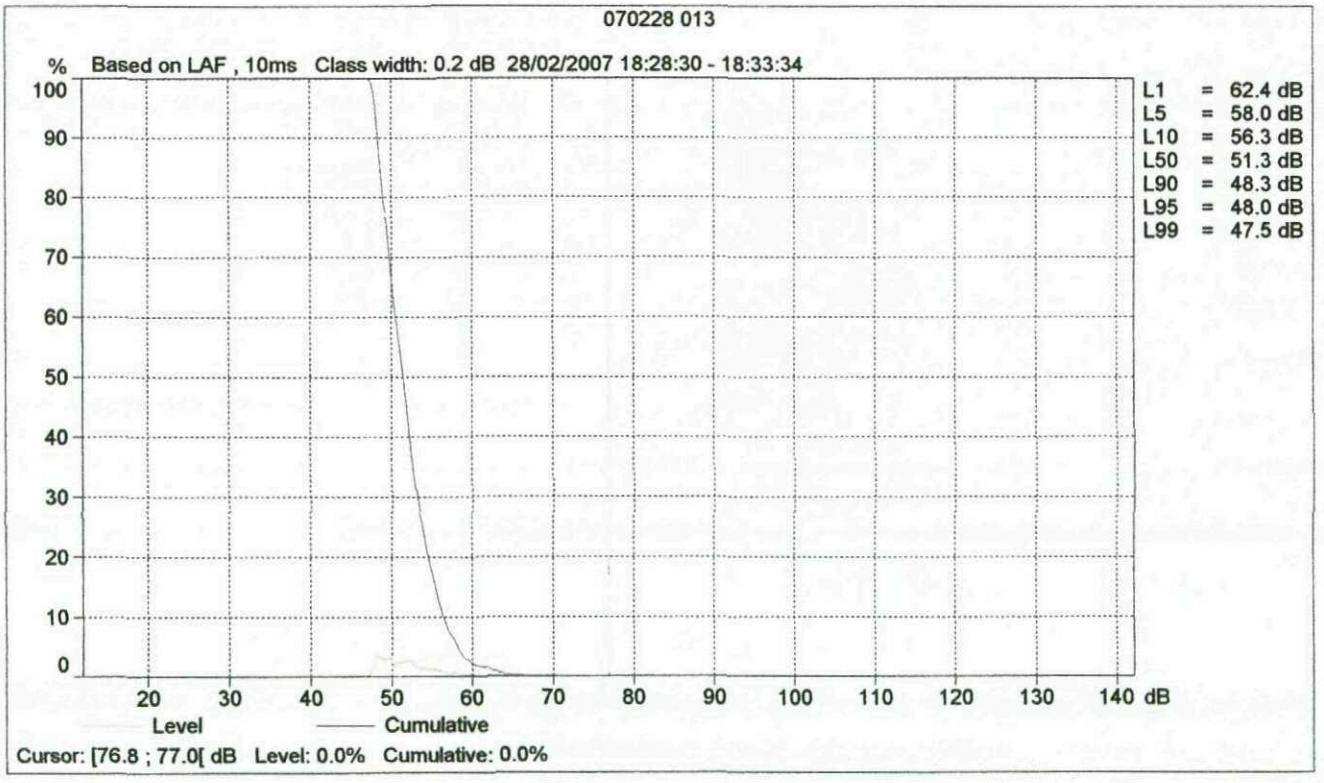
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070228 013

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	58.3	73.5	46.9	53.6	105.4
Time	18:28:30	18:33:34						
Date	28/02/2007	28/02/2007						


070228 013
dB 28/02/2007 18:28:30 - 18:33:34
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A C Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=53.6 dB LFmax=73.5 dB LFmin=46.9 dB


070228 013
% Based on LAF , 10ms Class width: 0.2 dB 28/02/2007 18:28:30 - 18:33:34
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
Level
Cumulative
L1 = 62.4 dB
L5 = 58.0 dB
L10 = 56.3 dB
L50 = 51.3 dB
L90 = 48.3 dB
L95 = 48.0 dB
L99 = 47.5 dB
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070228 001

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		02/28/2007 10:50:41
End Time:		02/28/2007 11:06:05
Elapsed Time:		00:15:05
Bandwidth:		Broadband
Max Input Level:		140.78

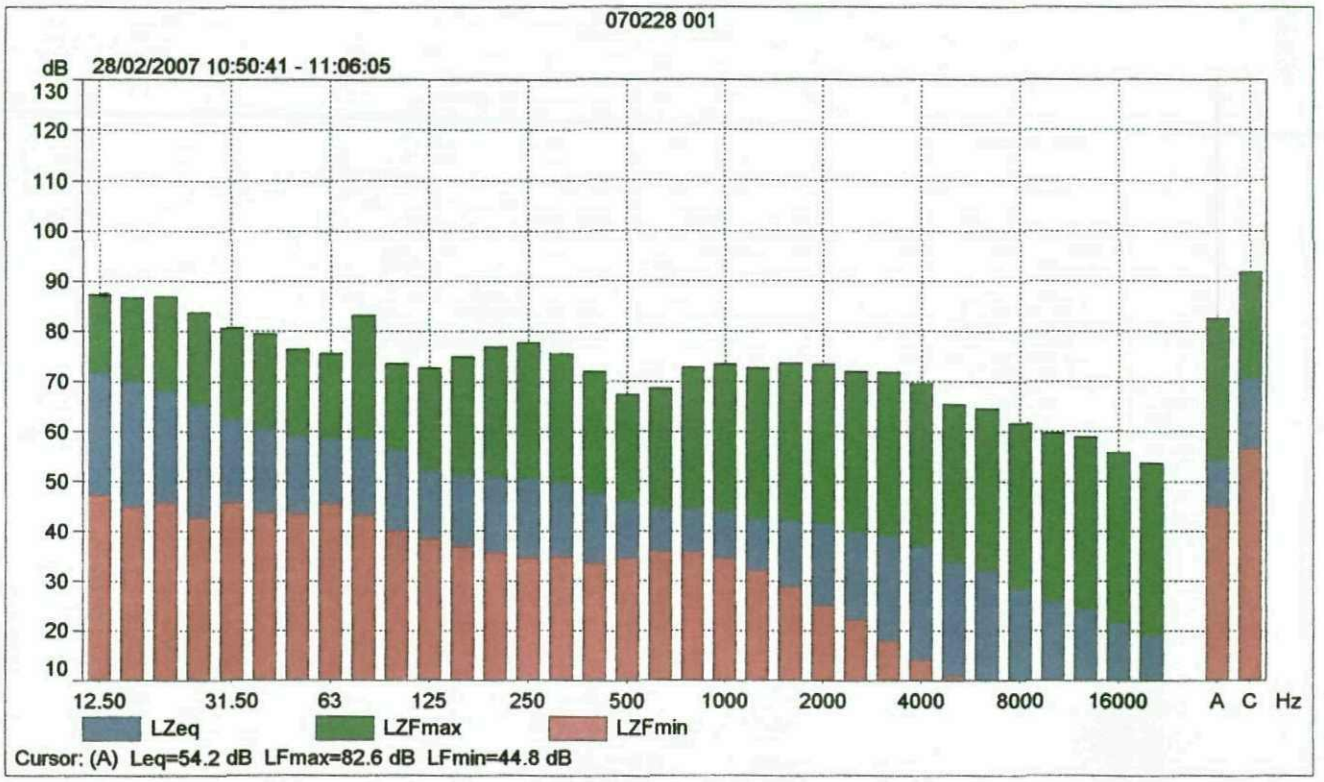
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070228 001

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	59.3	82.6	44.8	54.2	101.0
Time	10:50:41	11:06:05						
Date	28/02/2007	28/02/2007						


070228 001
dB 28/02/2007 10:50:41 - 11:06:05
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A
C
Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=54.2 dB LFmax=82.6 dB LFmin=44.8 dB

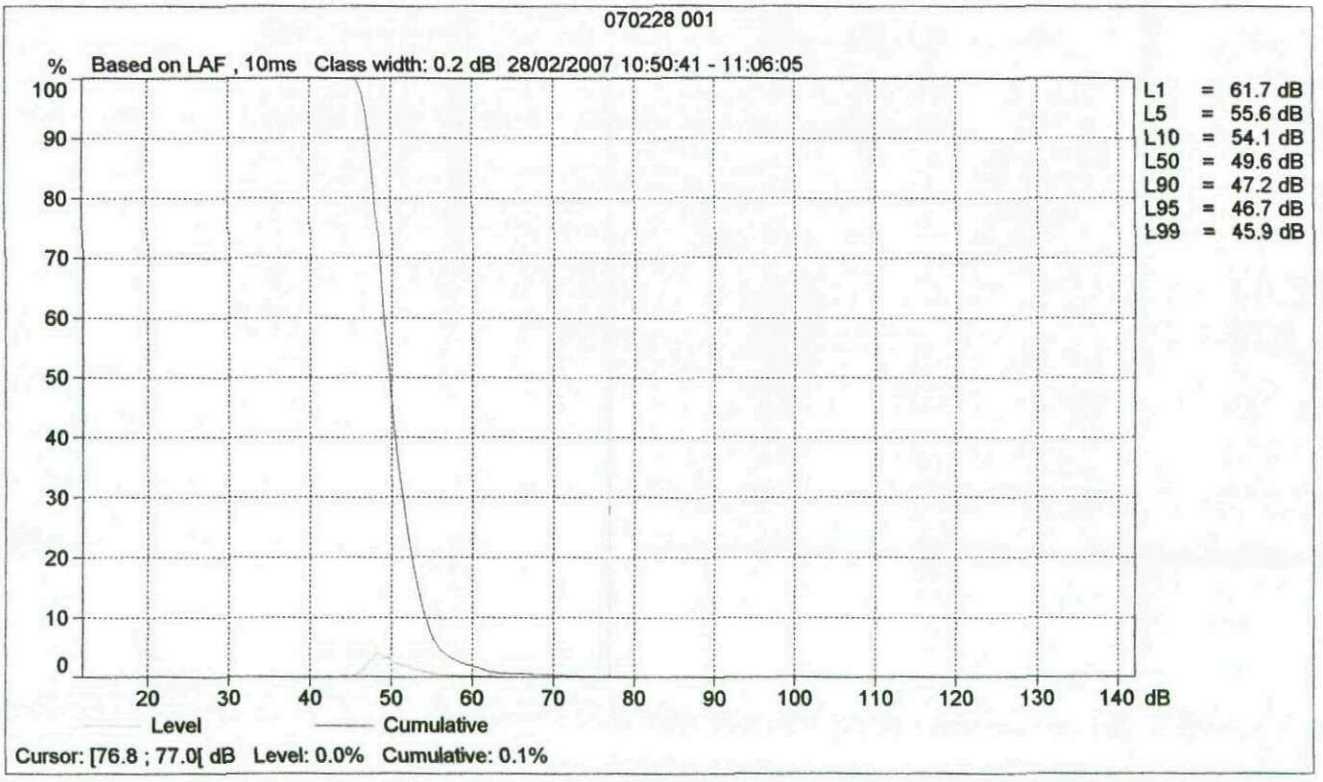

070228 001
% Based on LAF , 10ms Class width: 0.2 dB 28/02/2007 10:50:41 - 11:06:05
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
Level
Cumulative
L1 = 61.7 dB
L5 = 55.6 dB
L10 = 54.1 dB
L50 = 49.6 dB
L90 = 47.2 dB
L95 = 46.7 dB
L99 = 45.9 dB
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.1%

TABLE 3

Elsecar 06 / 03 / 2007

Location	Position	Time	$L_{Aeq\ 15min}$	L_{10}	L_{90}	L_{max}	L_{min}	Lc_{Peak}
1	1	14:00 - 14:15	49.0	49.4	42.5	74.4	40.2	99.7
2	4	14:21 - 14:37	46.8	49.6	41.9	67.9	40.0	101.0
3	2	14:42 - 14:57	43.0	45.5	39.2	62.7	36.8	88.0
4	3	15:19 - 15:34	53.0	56.3	44.6	69.5	41.4	90.7
5	1	17:58 - 18:13	49.5	50.9	44.3	70.4	42.4	93.6
6	4	18:16 - 18:33	47.6	49.6	44.2	62.7	41.8	83.6
7	2							
7	3	18:37 - 18:53	49.7	52.4	43.8	67.7	41.4	85.2
8	3	18:56 - 19:00	55.6	52.6	43.6	72.1	41.9	96.5
9	5	19:00 - 19:18	47.3	48.4	43.9	61.9	42.0	83.8

070306 001

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		03/06/2007 14:03:37
End Time:		03/06/2007 14:18:41
Elapsed Time:		00:15:04
Bandwidth:		Broadband
Max Input Level:		140.78

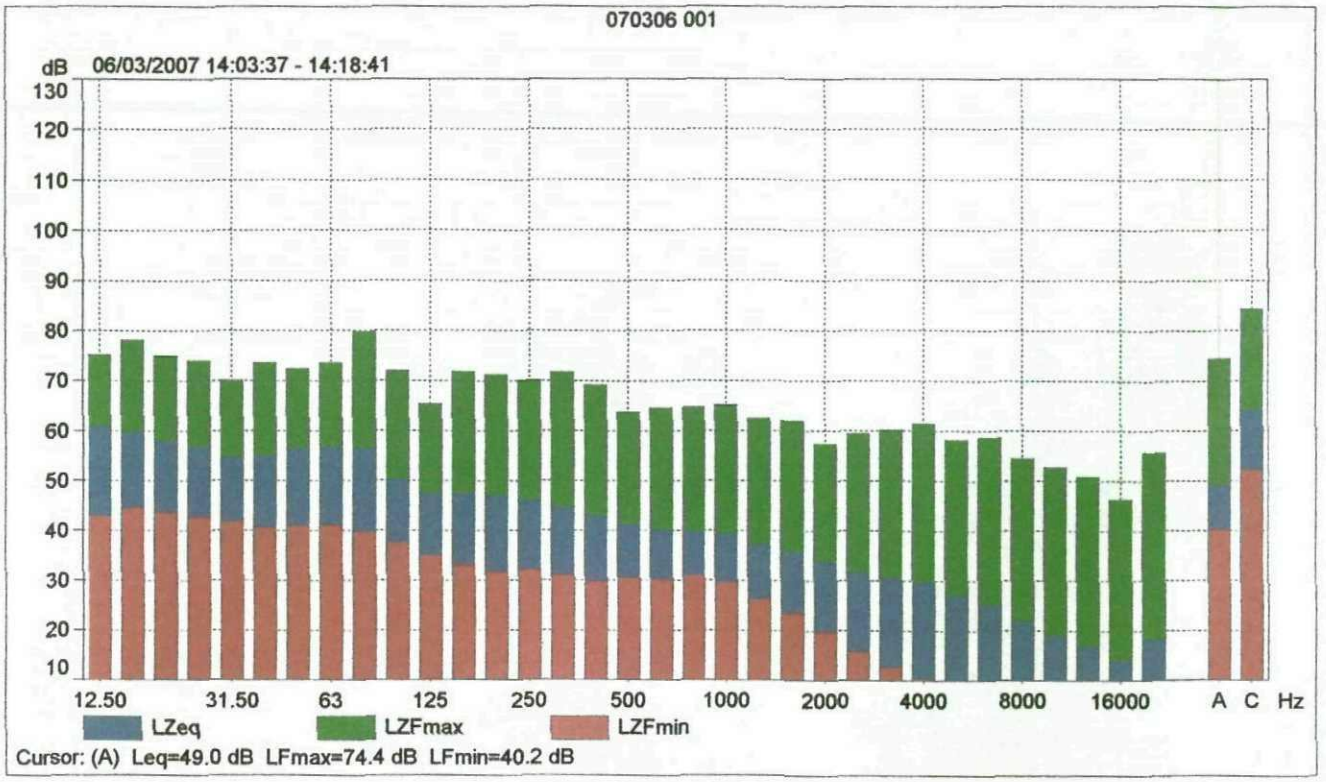
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

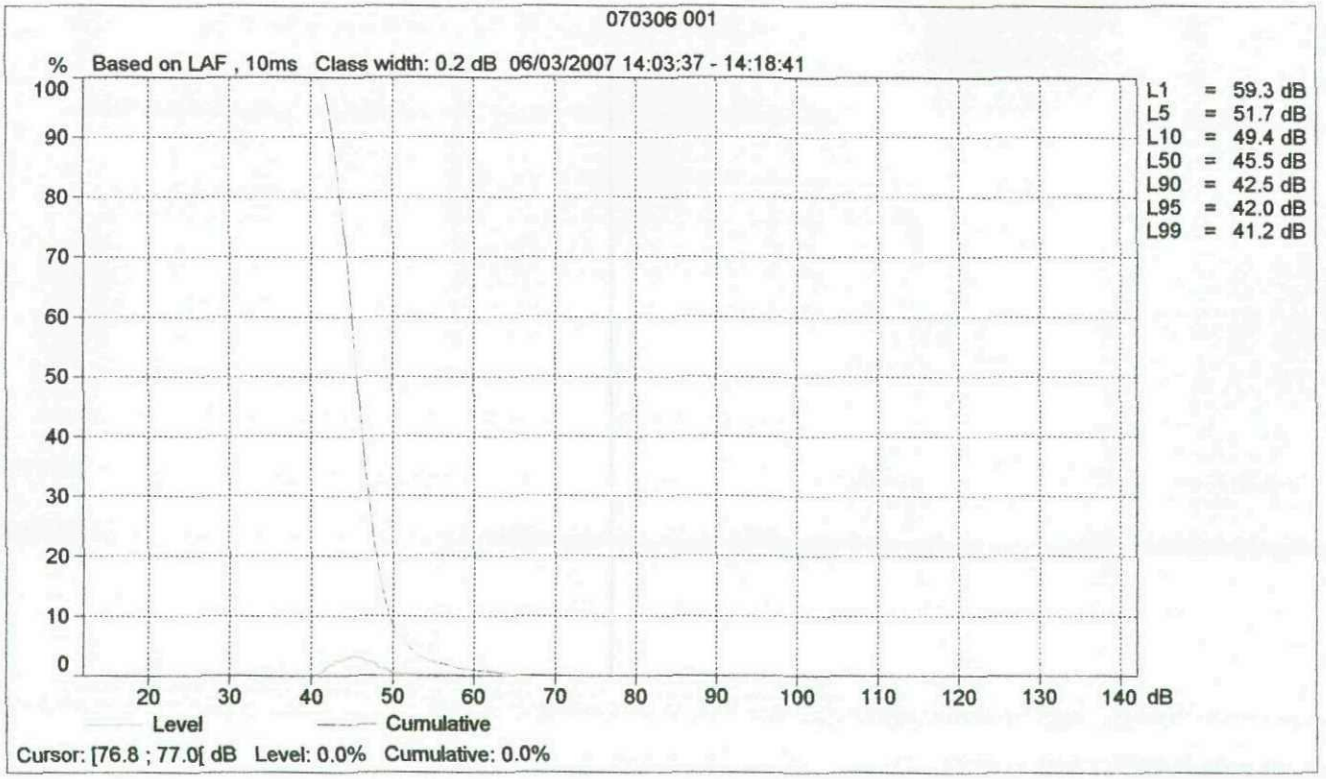
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070306 001

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	54.1	74.4	40.2	49.0	99.7
Time	14:03:37	14:18:41						
Date	06/03/2007	06/03/2007						


070306 001
dB 06/03/2007 14:03:37 - 14:18:41
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A C Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=49.0 dB LFmax=74.4 dB LFmin=40.2 dB


070306 001
% Based on LAF , 10ms Class width: 0.2 dB 06/03/2007 14:03:37 - 14:18:41
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
L1 = 59.3 dB
L5 = 51.7 dB
L10 = 49.4 dB
L50 = 45.5 dB
L90 = 42.5 dB
L95 = 42.0 dB
L99 = 41.2 dB
Level
Cumulative
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070306 002

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		03/06/2007 14:21:45
End Time:		03/06/2007 14:37:42
Elapsed Time:		00:15:04
Bandwidth:		Broadband
Max Input Level:		140.78

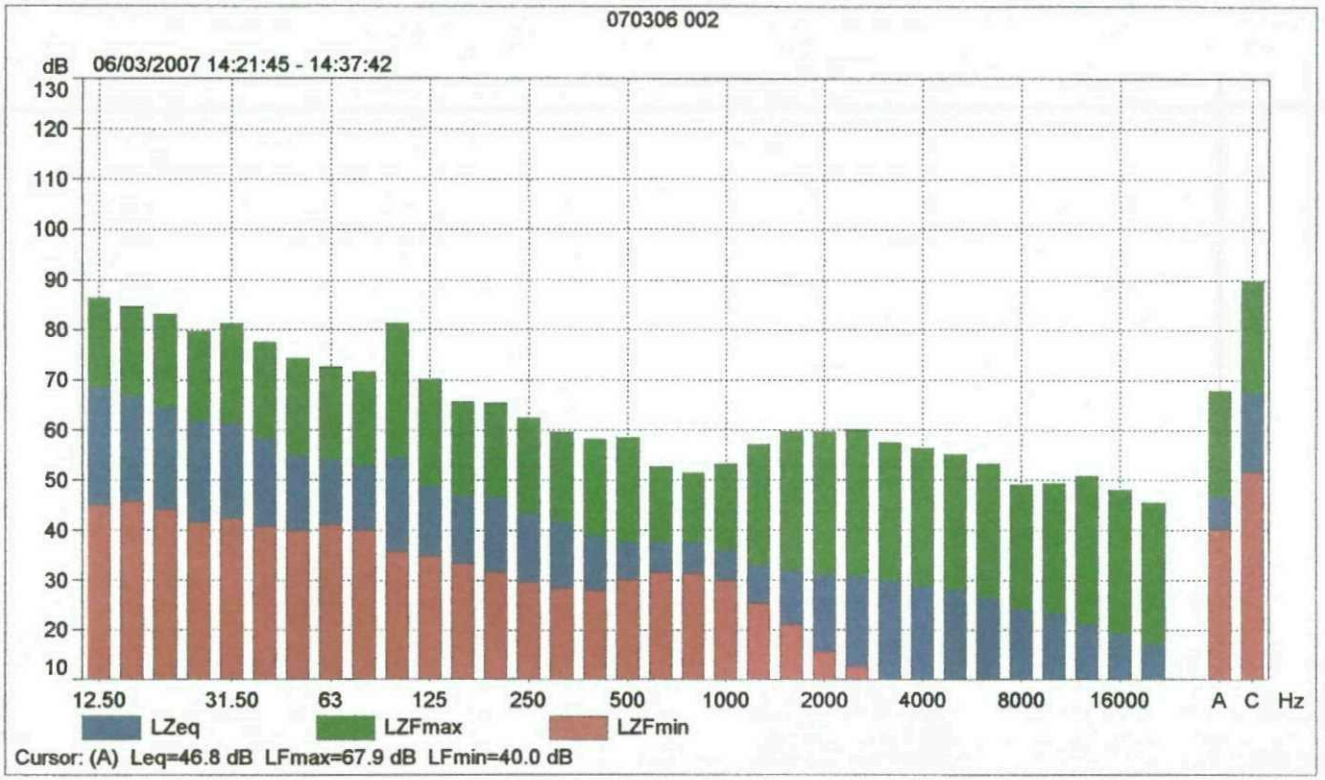
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

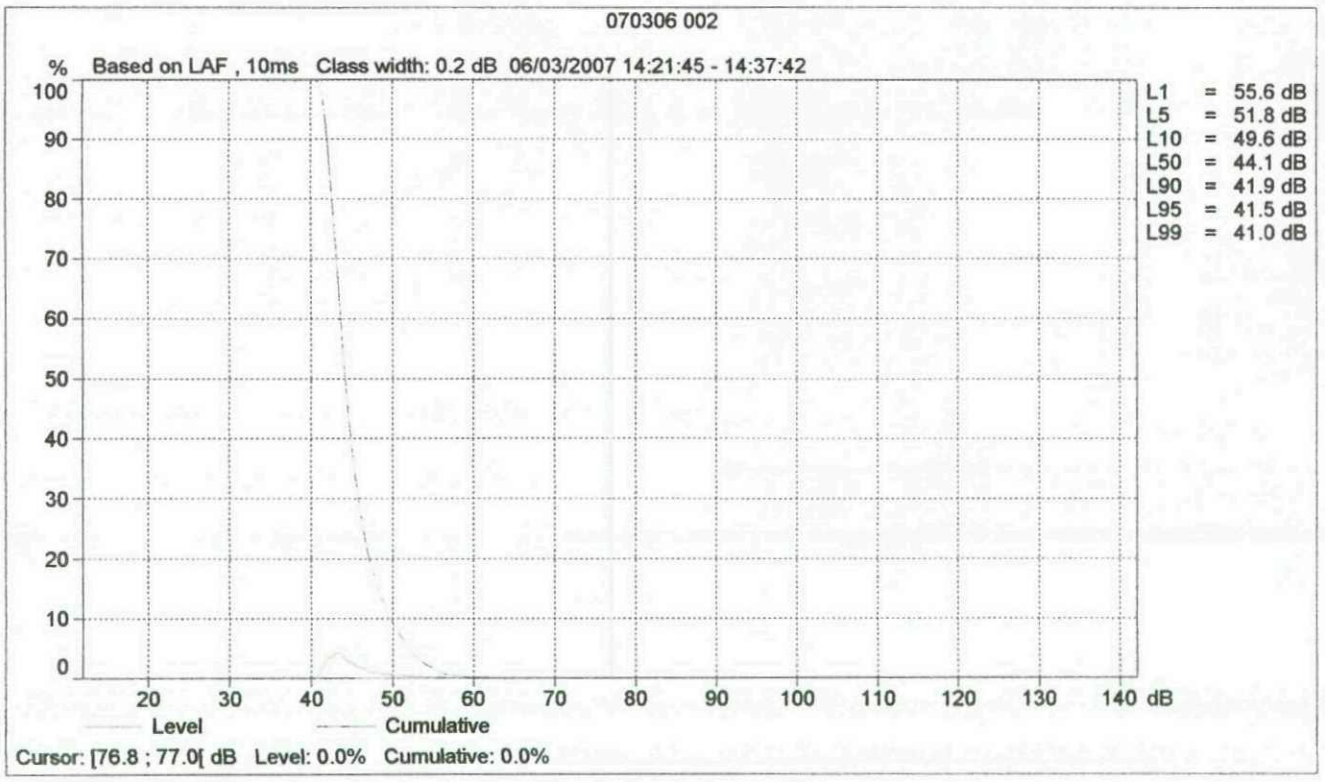
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070306 002

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	51.7	67.9	40.0	46.8	101.0
Time	14:21:45	14:37:42						
Date	06/03/2007	06/03/2007						


070306 002
dB 06/03/2007 14:21:45 - 14:37:42
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A C Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=46.8 dB LFmax=67.9 dB LFmin=40.0 dB


070306 002
% Based on LAF , 10ms Class width: 0.2 dB 06/03/2007 14:21:45 - 14:37:42
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
L1 = 55.6 dB
L5 = 51.8 dB
L10 = 49.6 dB
L50 = 44.1 dB
L90 = 41.9 dB
L95 = 41.5 dB
L99 = 41.0 dB
Level
Cumulative
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070306 003

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		03/06/2007 14:42:15
End Time:		03/06/2007 14:57:46
Elapsed Time:		00:15:04
Bandwidth:		Broadband
Max Input Level:		140.78

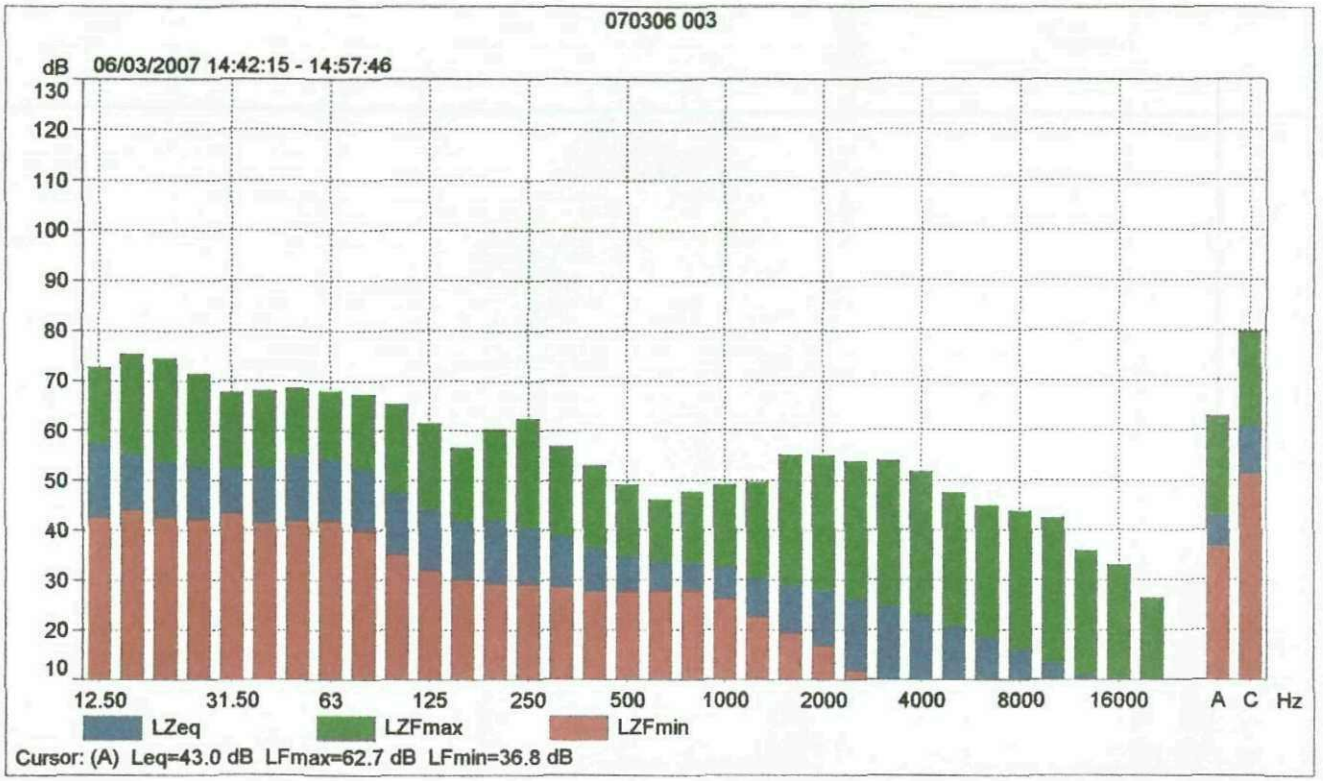
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

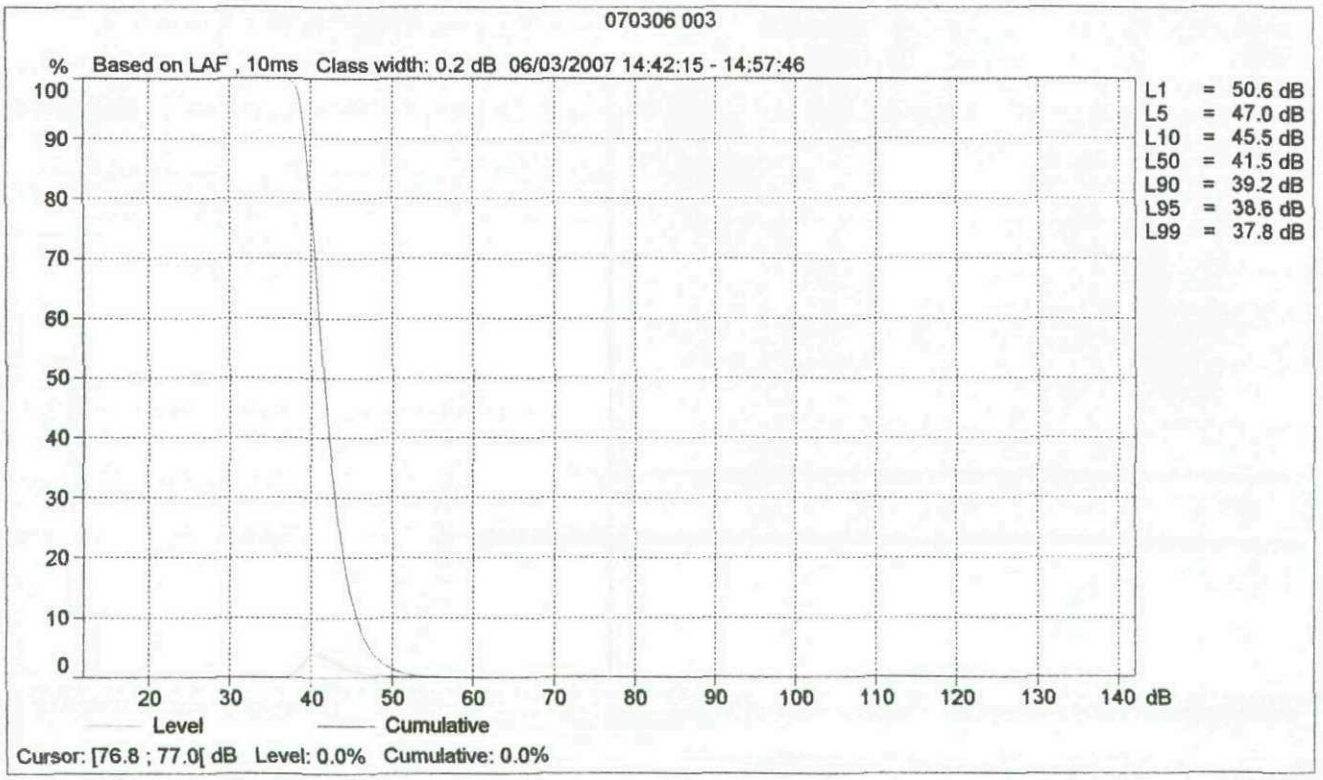
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070306 003

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	47.1	62.7	36.8	43.0	88.0
Time	14:42:15	14:57:46						
Date	06/03/2007	06/03/2007						


070306 003
dB 06/03/2007 14:42:15 - 14:57:46
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A C Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=43.0 dB LFmax=62.7 dB LFmin=36.8 dB


070306 003
% Based on LAF , 10ms Class width: 0.2 dB 06/03/2007 14:42:15 - 14:57:46
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
L1 = 50.6 dB
L5 = 47.0 dB
L10 = 45.5 dB
L50 = 41.5 dB
L90 = 39.2 dB
L95 = 38.6 dB
L99 = 37.8 dB
Level
Cumulative
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070228 004

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		02/28/2007 13:36:22
End Time:		02/28/2007 14:07:28
Elapsed Time:		00:31:06
Bandwidth:		Broadband
Max Input Level:		140.78

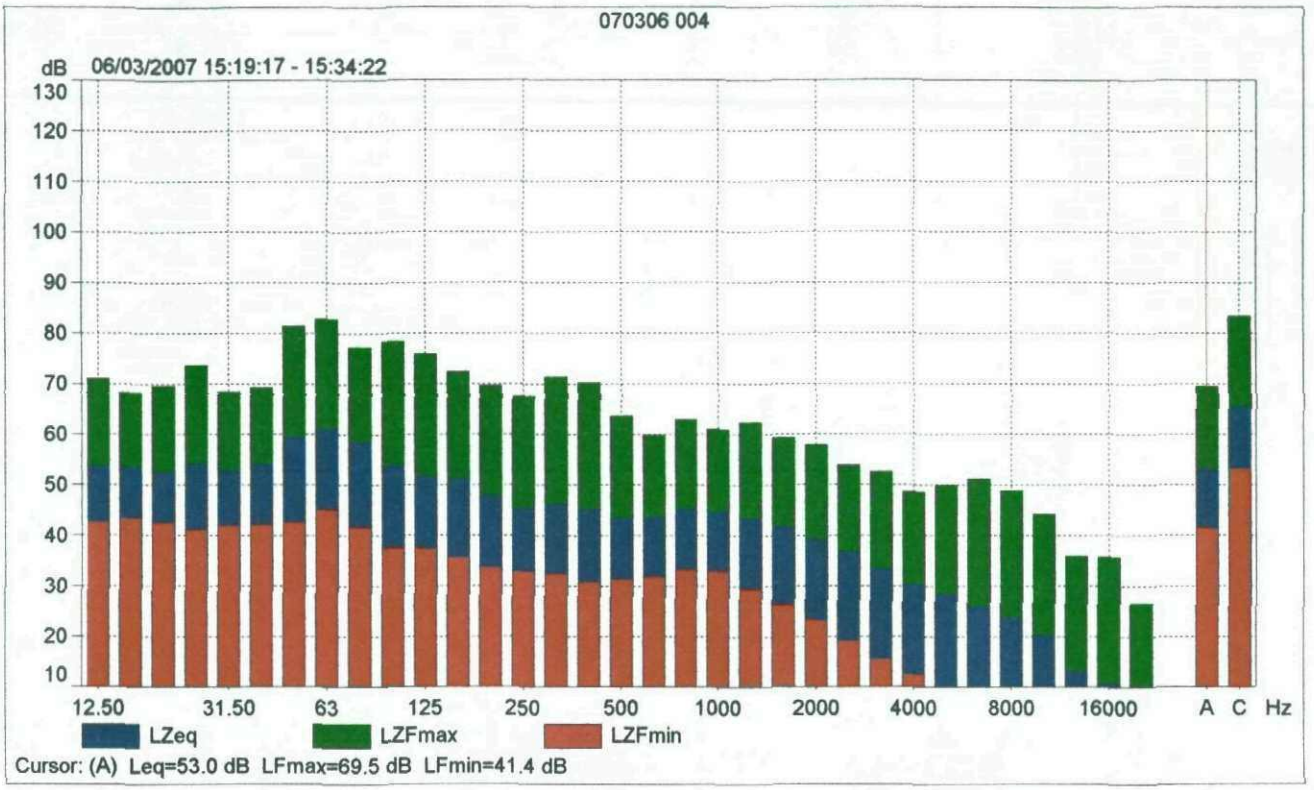
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

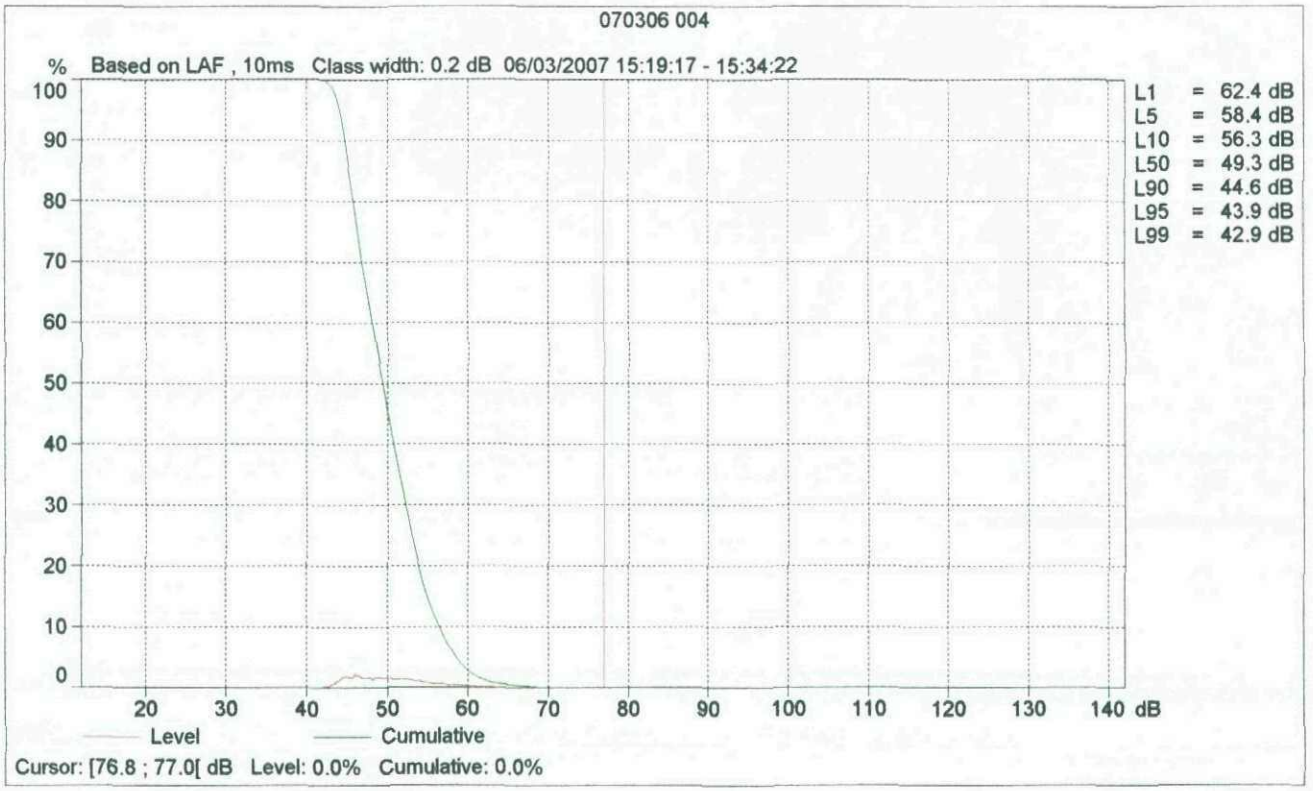
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070228 004

	Start time	End time	Overload [%]	LAIeq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	55.3	74.9	40.7	51.9	111.7
Time	13:36:22	14:07:28						
Date	28/02/2007	28/02/2007						


070306 004
dB 06/03/2007 15:19:17 - 15:34:22
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A C Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=53.0 dB LFmax=69.5 dB LFmin=41.4 dB


070306 004
% Based on LAF , 10ms Class width: 0.2 dB 06/03/2007 15:19:17 - 15:34:22
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
Level
Cumulative
L1 = 62.4 dB
L5 = 58.4 dB
L10 = 56.3 dB
L50 = 49.3 dB
L90 = 44.6 dB
L95 = 43.9 dB
L99 = 42.9 dB
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070306 005

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		03/06/2007 17:58:20
End Time:		03/06/2007 18:13:40
Elapsed Time:		00:15:20
Bandwidth:		Broadband
Max Input Level:		140.78

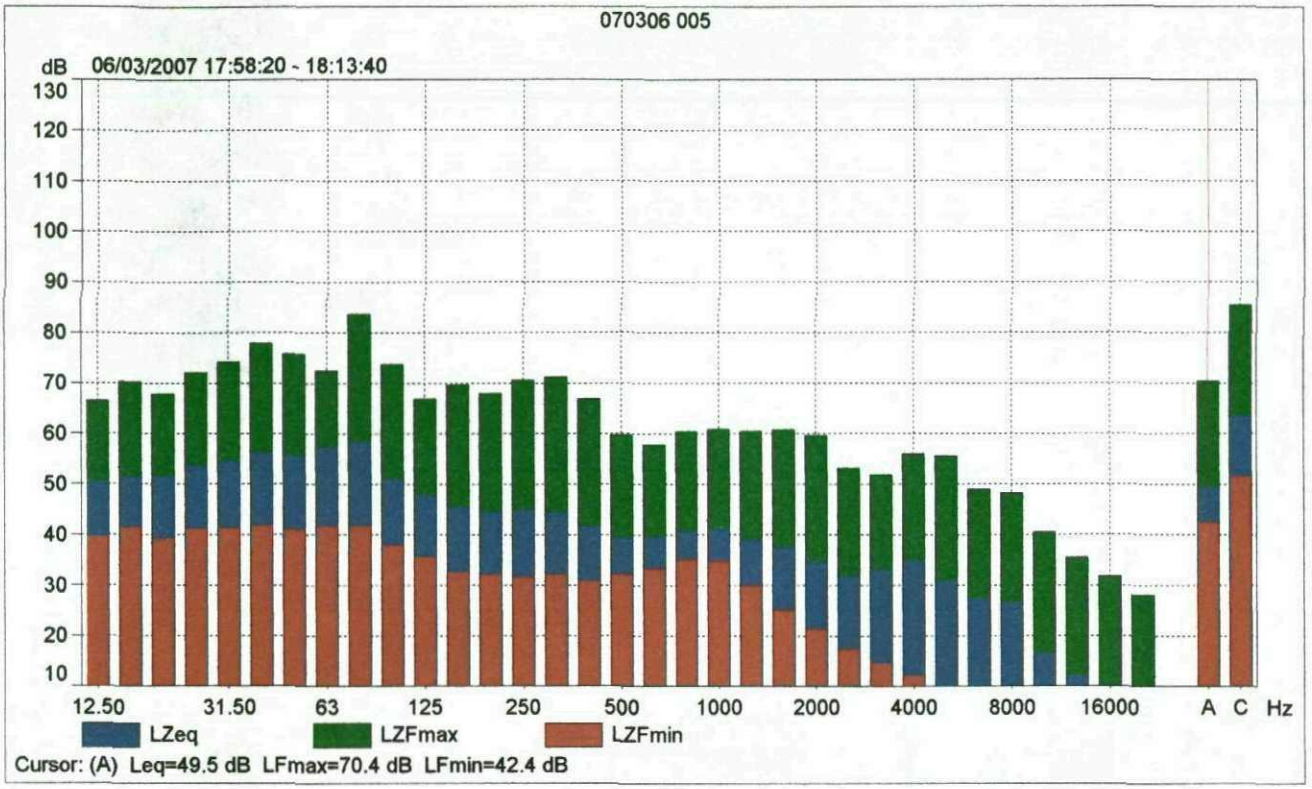
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

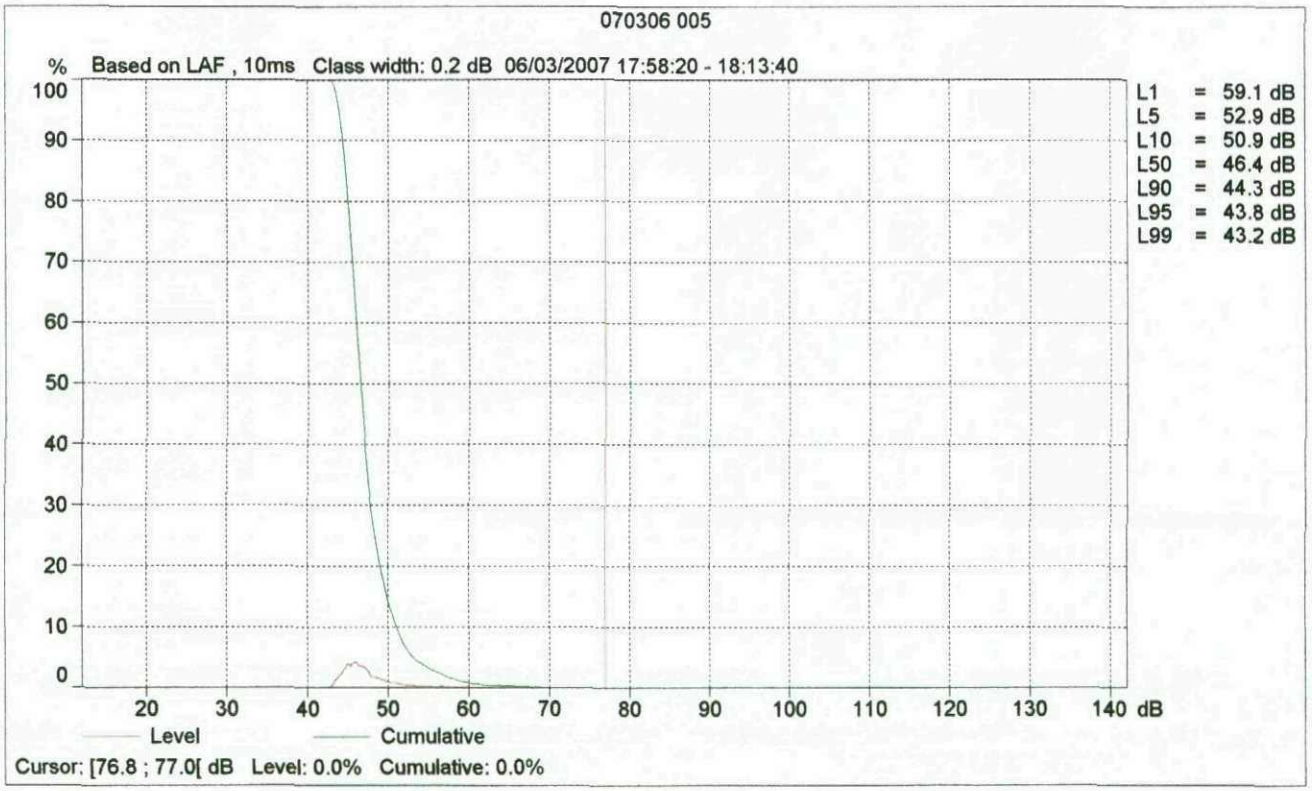
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070306 005

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	52.6	70.4	42.4	49.5	93.6
Time	17:58:20	18:13:40						
Date	06/03/2007	06/03/2007						


070306 005
dB 06/03/2007 17:58:20 - 18:13:40
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A C Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=49.5 dB LFmax=70.4 dB LFmin=42.4 dB


070306 005
% Based on LAF , 10ms Class width: 0.2 dB 06/03/2007 17:58:20 - 18:13:40
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
L1 = 59.1 dB
L5 = 52.9 dB
L10 = 50.9 dB
L50 = 46.4 dB
L90 = 44.3 dB
L95 = 43.8 dB
L99 = 43.2 dB
Level
Cumulative
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070306 006

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		03/06/2007 18:16:36
End Time:		03/06/2007 18:33:22
Elapsed Time:		00:15:06
Bandwidth:		Broadband
Max Input Level:		140.78

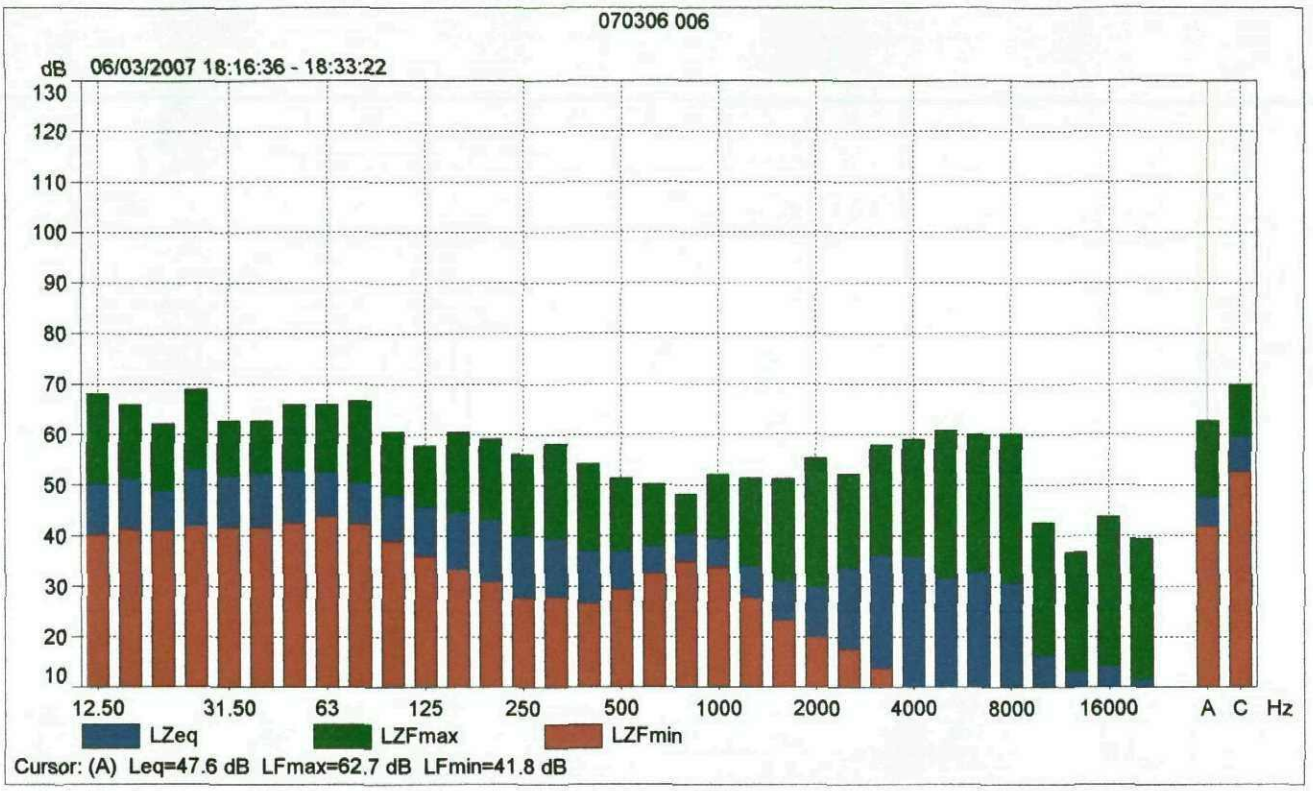
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

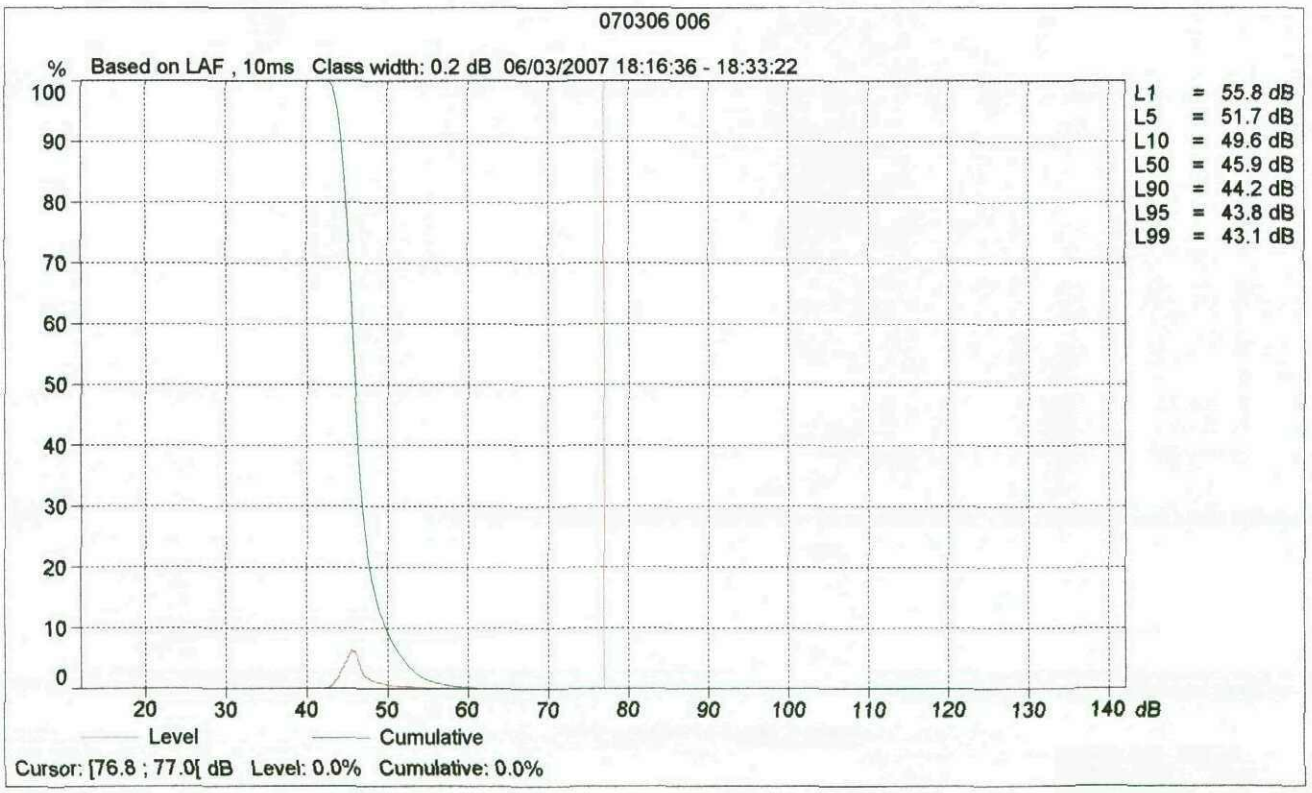
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070306 006

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	51.0	62.7	41.8	47.6	83.6
Time	18:16:36	18:33:22						
Date	06/03/2007	06/03/2007						


070306 006
dB
06/03/2007 18:16:36 - 18:33:22
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A
C
Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=47.6 dB LFmax=62.7 dB LFmin=41.8 dB


070306 006
%
Based on LAF , 10ms Class width: 0.2 dB 06/03/2007 18:16:36 - 18:33:22
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
L1 = 55.8 dB
L5 = 51.7 dB
L10 = 49.6 dB
L50 = 45.9 dB
L90 = 44.2 dB
L95 = 43.8 dB
L99 = 43.1 dB
Level
Cumulative
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070306 007

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		03/06/2007 18:37:47
End Time:		03/06/2007 18:53:32
Elapsed Time:		00:15:04
Bandwidth:		Broadband
Max Input Level:		140.78

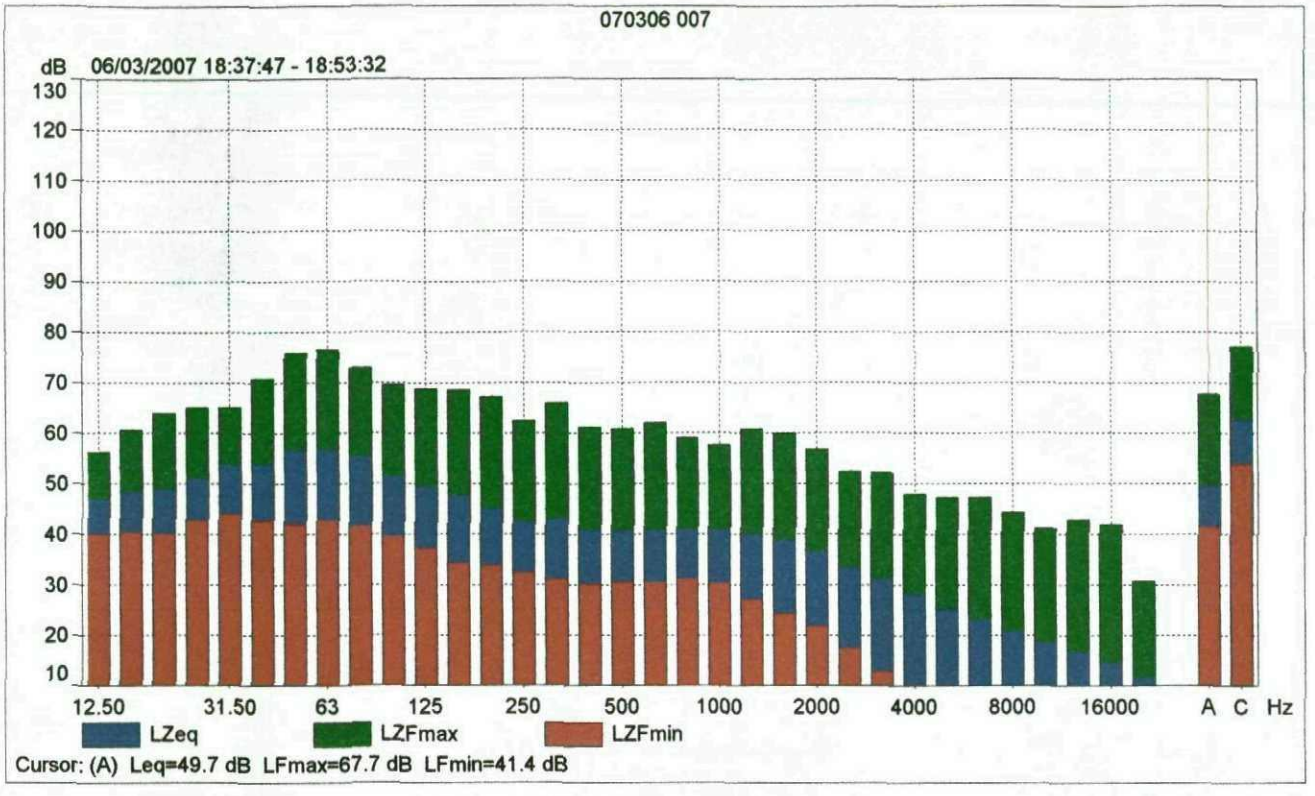
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070306 007

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	52.3	67.7	41.4	49.7	85.2
Time	18:37:47	18:53:32						
Date	06/03/2007	06/03/2007						


070306 007
dB 06/03/2007 18:37:47 - 18:53:32
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A C Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=49.7 dB LFmax=67.7 dB LFmin=41.4 dB


070306 007
% Based on LAF , 10ms Class width: 0.2 dB 06/03/2007 18:37:47 - 18:53:32
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
L1 = 58.1 dB
L5 = 54.7 dB
L10 = 52.4 dB
L50 = 46.8 dB
L90 = 43.8 dB
L95 = 43.3 dB
L99 = 42.5 dB
Level
Cumulative
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070306 008

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		03/06/2007 18:56:10
End Time:		03/06/2007 19:00:12
Elapsed Time:		00:00:51
Bandwidth:		Broadband
Max Input Level:		140.78

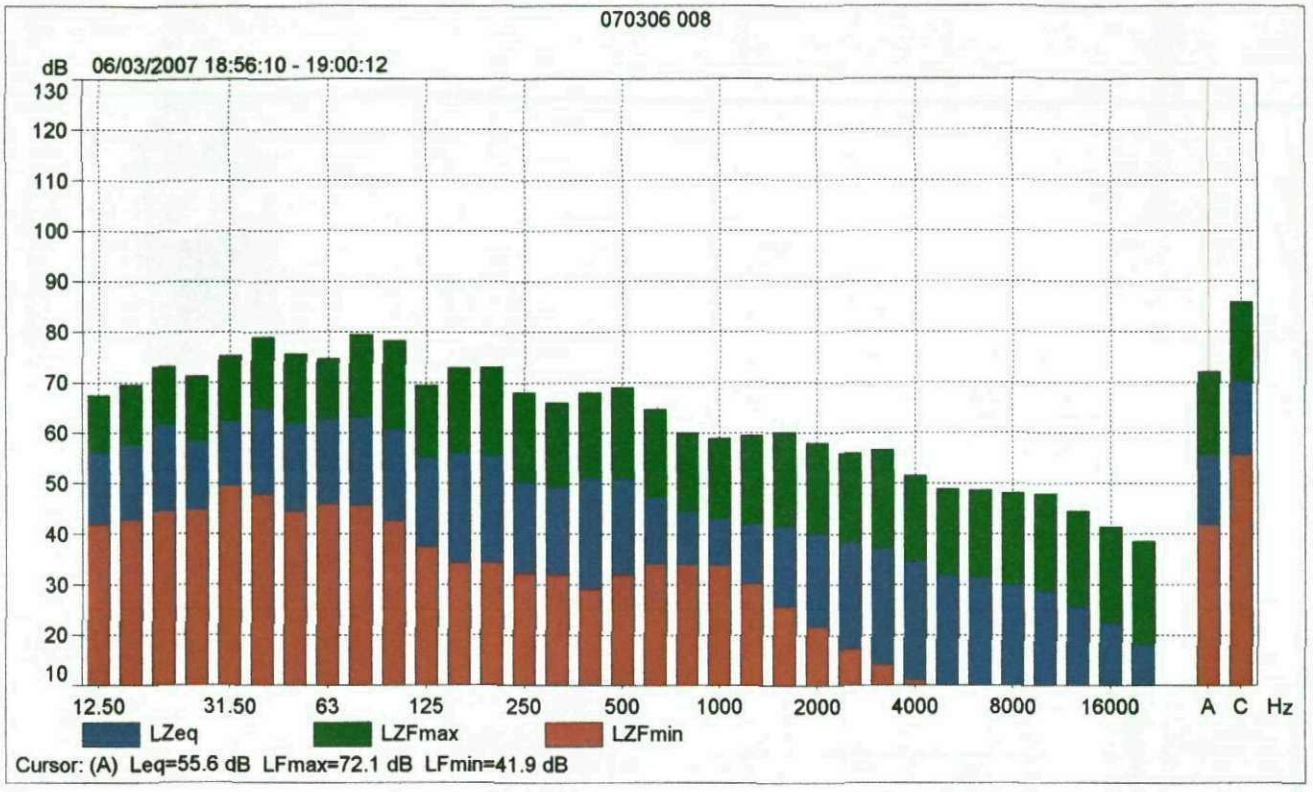
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

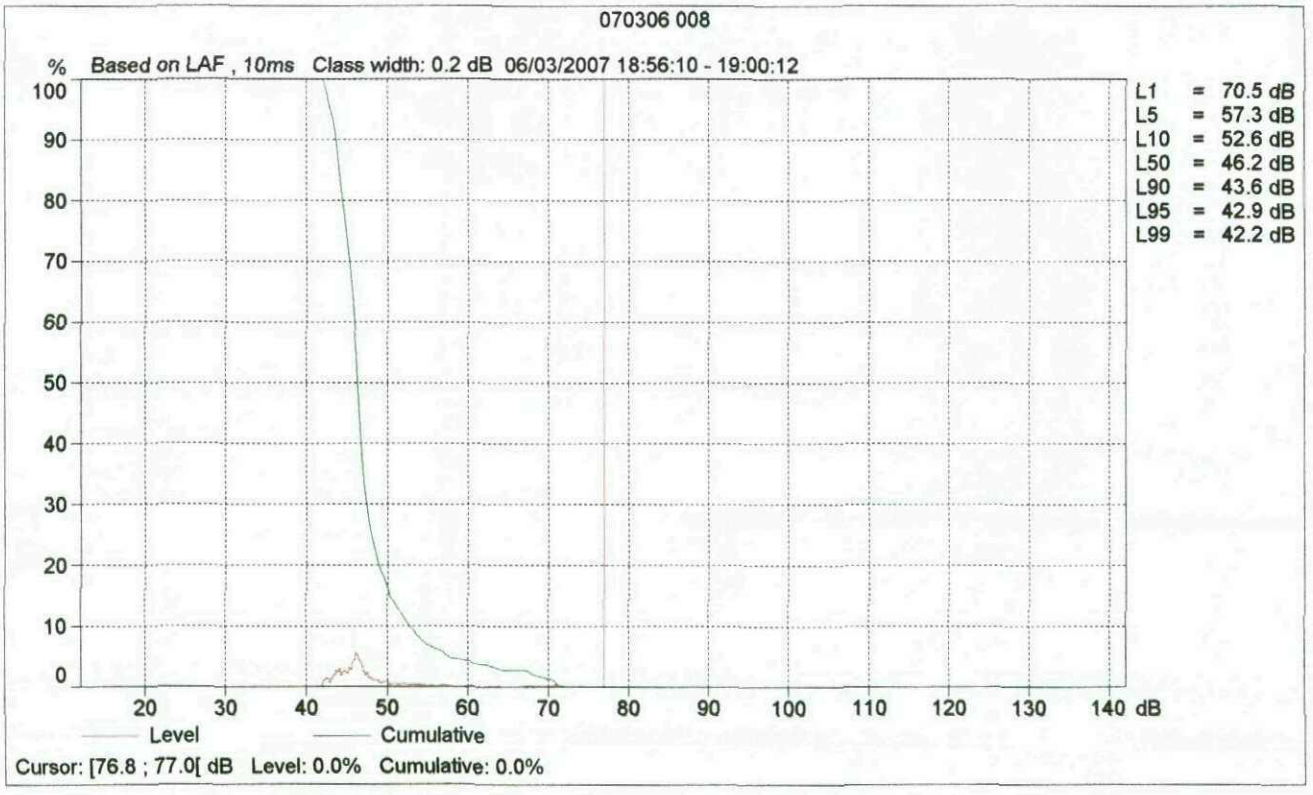
Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070306 008

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	58.5	72.1	41.9	55.6	96.5
Time	18:56:10	19:00:12						
Date	06/03/2007	06/03/2007						


070306 008
dB 06/03/2007 18:56:10 - 19:00:12
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A C Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=55.6 dB LFmax=72.1 dB LFmin=41.9 dB


070306 008
% Based on LAF , 10ms Class width: 0.2 dB 06/03/2007 18:56:10 - 19:00:12
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
Level
Cumulative
L1 = 70.5 dB
L5 = 57.3 dB
L10 = 52.6 dB
L50 = 46.2 dB
L90 = 43.6 dB
L95 = 42.9 dB
L99 = 42.2 dB
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

070306 009

Instrument:		2250
Application:		BZ7223 Version 1.4
Start Time:		03/06/2007 19:00:44
End Time:		03/06/2007 19:18:47
Elapsed Time:		00:15:06
Bandwidth:		Broadband
Max Input Level:		140.78

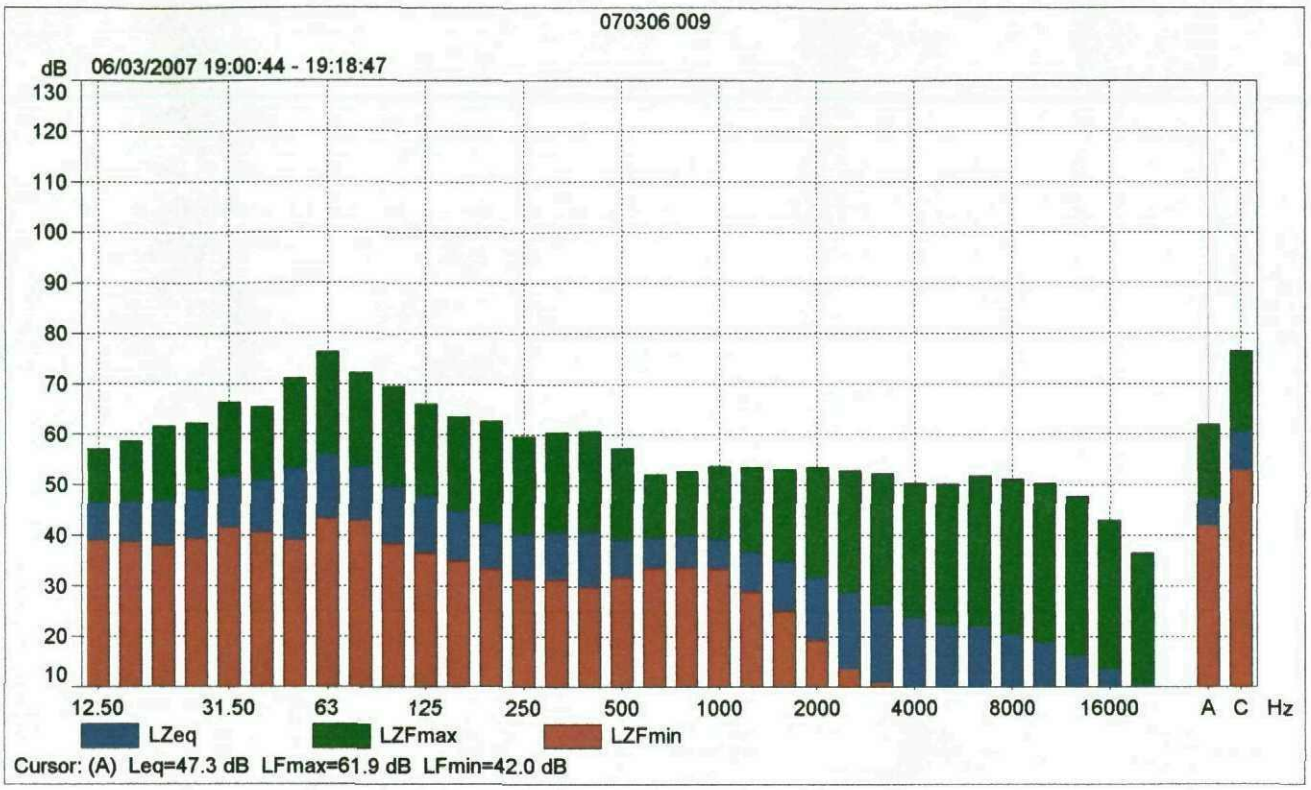
	Time	Frequency
Broadband (excl. Peak):	FSI	AC
Broadband Peak:		C
Spectrum:	FS	Z

Instrument Serial Number:		2505925
Microphone Serial Number:		2508695
Input:		Top Socket
Windscreen Correction:		UA 1650
Sound Field Correction:		Free-field

Calibration Time:		02/23/2007 11:27:46
Calibration Type:		External reference
Sensitivity:		50.99 mV/Pa

070306 009

	Start time	End time	Overload [%]	LAleq [dB]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LCpeak [dB]
Value			---	49.4	61.9	42.0	47.3	83.8
Time	19:00:44	19:18:47						
Date	06/03/2007	06/03/2007						


070306 009
dB 06/03/2007 19:00:44 - 19:18:47
130
120
110
100
90
80
70
60
50
40
30
20
10
12.50
31.50
63
125
250
500
1000
2000
4000
8000
16000
A
C
Hz
LZeq
LZFmax
LZFmin
Cursor: (A) Leq=47.3 dB LFmax=61.9 dB LFmin=42.0 dB

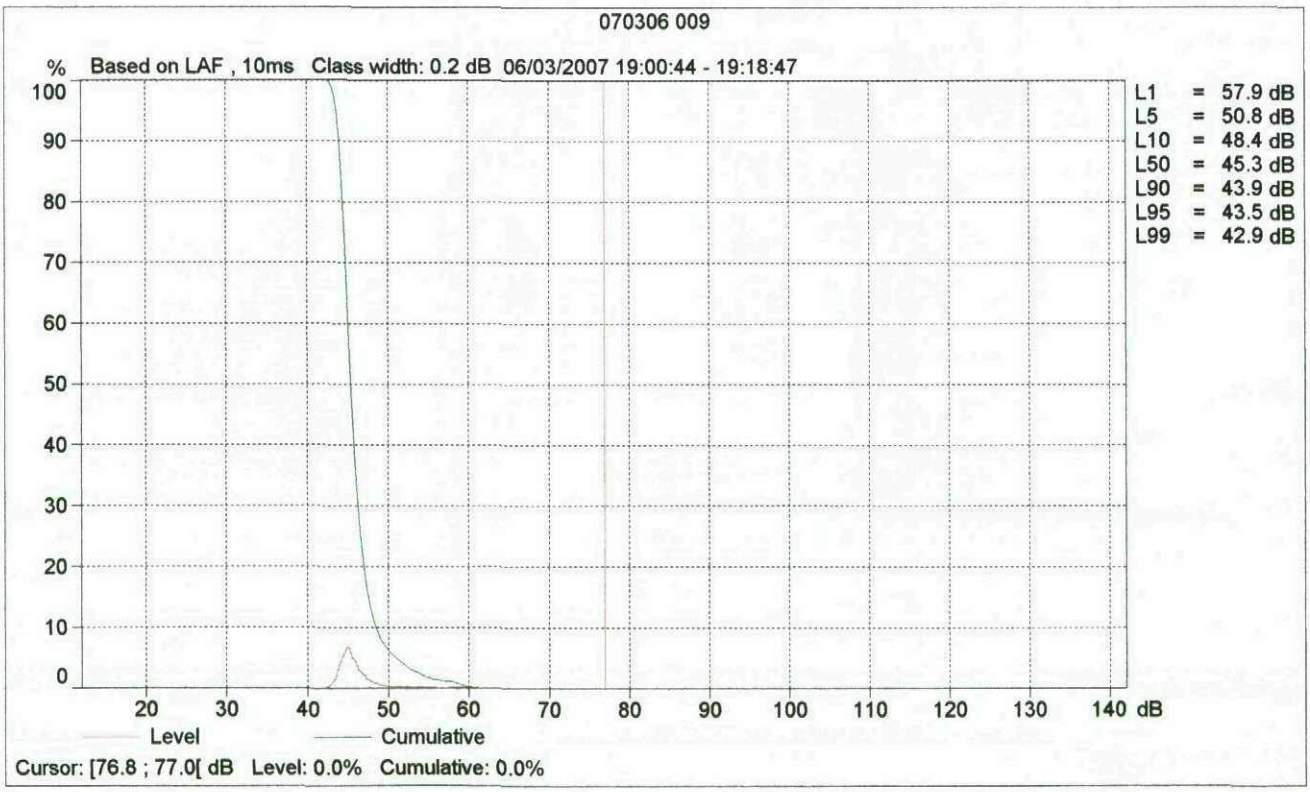

070306 009
% Based on LAF , 10ms Class width: 0.2 dB 06/03/2007 19:00:44 - 19:18:47
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100
110
120
130
140 dB
Level
Cumulative
L1 = 57.9 dB
L5 = 50.8 dB
L10 = 48.4 dB
L50 = 45.3 dB
L90 = 43.9 dB
L95 = 43.5 dB
L99 = 42.9 dB
Cursor: [76.8 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

TABLE 4

Vibration Measurements at Position 4

Groundborne Vibration.
Mode Vertical - Linear Peak Particle Velocity.
Surface Vibration.
Range 5m from Rail Track.

1	Background (No Passing Trains)	=	$0.15 mms^{-1}$
2	Stopping at Station	=	$0.26 mms^{-1}$
3	Through Train	=	$0.58 mms^{-1}$

Note :

$0 - 0.15 mms^{-1}$ Vertical Peak Particle Velocity is imperceptible by people and does not produce any intrusion.

$0.15 - 0.3 mms^{-1}$ is the threshold of perception.

$2 mms^{-1}$ - vibration becomes perceptible.

$2.5 mms^{-1}$ - virtually no risk of architectural damage to normal buildings.