CONABEARE ACOUSTICS

ACOUSTIC REPORT

NO CS7621/1

Royal Free Hospital,
Pond Street,
London
NW3 2QG

12th March 2015

Prepared By:

Stuart Metcalfe

Stuart Metcalfe MIOA

CLIENT:

Royal Free Hospital NHS Trust,
Pond Street,
London
NW3 2QG

Royal Free London NHS
NHS Foundation Trust

Conabeare Acoustics Limited
11 Chiltern Enterprise Centre, Station Road, Theale, Berkshire. RG7 4AA
Telephone 0118 930 3650 Facsimile 0118 930 3912
sales@conabeare.co.uk

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FORWARD

An environmental acoustic survey has been carried out to the rear roof area of Royal Free Hospital, Pond Street, London NW3 2QG.

The results of the survey will establish the Background Sound Level for new mechanical services plant in order that it complies with planning/design requirements.

SUMMARY

The lowest $L_{A90,15min}$ levels measured on the roof area were;

$L_{A90,15min}$ 47dB(A) between 07:00 hours to 19:00 hours.

$L_{A90,15min}$ 47dB(A) between 19:00 hours to 23:00 hours.

$L_{A90,15min}$ 47dB(A) between 23:00 hours to 07:00 hours.

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CONABEARE ACOUSTICS

1. **Author**

   Stuart Metcalfe MIOA

   The author of this report has been practicing in building services acoustics and noise control engineering for 25 years, is a Member of the Institute of Acoustics (MIOA) and is a Director at Conabeare Acoustics Ltd.

2. **Client**

   The report and survey has been undertaken on behalf of:

   Royal Free Hospital NHS Trust,
   Pond Street,
   London
   NW3 2QG

3. **Introduction**

   The survey has been carried out to establish a maximum noise level for the proposed plant so that it does not have a detrimental effect on the local surroundings and in particular residential premises for testing purposes.

4. **Noise Principles**

   The environmental survey has been carried out generally in accordance with the principles of BS7445–1 (2003) and BS4142 to establish the Background Sound Level

   The Background Sound levels measured is in terms A-weighted sound pressure level L_{A90} with a time interval of 15 minutes.

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GLOSSARY.

L_{A90}	The sound pressure level in dB(A) which is exceeded for 90% of the time and is taken to be the effective lowest background sound level for the period by such methods of sound rating as that recommended in British Standard 4142. It will also be used as a basis for selecting limiting sound levels from new plant by Local Planning Authorities when setting Planning Consent Conditions.
L_{eq}	The "equivalent continuous sound level" for the measuring period, defined as the level in dB(A) which, if held constant over the measuring period, would produce the same amount of sound energy as does the actual varying ambient sound level. It is a measure of the amount of sound energy affecting the site from sources other than new plant or operations.
L_{A10}	The sound level exceeded for 10% of the time over the sample period. Originally used as a measure of subjective reaction to traffic noise in particular, it can also be taken as an indication of the practical maximum sound level that the building envelope will have to protect against.
dB(A)	Describes measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3dB(A) is the minimum perceptible under normal conditions, and a change of 10dB(A) corresponds roughly to halving or doubling the loudness of a sound.

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5. **The Site**

The site is located to the South of the Hospital facing the rear elevation of premises to Aspern Grove.

The nearest residential façade is therefore at a distance of approximately 35 metres from the proposed plant.

We would judge that a mixture of existing plant and transportation noise are the dominant sound sources within the area.

6. **Measurement Methodology**

A CEL593 (precision) Environmental Sound Level Analyser, fitted with a CEL Electret Microphone was located at the rear of the property on the flat roof containing the existing plant.

The Survey commenced at approximately 14:30 hours on Thursday 5th March 2015 until approximately 13:20 hours on Sunday 8th March 2015 when the battery failed.

The Analyser was checked for calibration before readings commenced and at the end of the measurement period using a CEL 284/2 Class 1 calibrator. There was no measurable deviation on the Analyser.

The weather was mostly dry with some showers and cold throughout the measuring period.

The weather in our opinion did not have a detrimental effect on the readings obtained.

7. **Planning noise requirements.**

The Planning noise requirement of this area usually states, that any proposed plant should be at least 10dBA below the Background Sound level (L_{A90}) measured at 1 metre from the nearest effected residential property. Allowance should also be made for any tonal noise emanating from the proposed units.

This is generally acceptable to local authorities. However, this should be verified with the local Environmental Health or Planning Departments.

8. Assessment

The Environmental Sound Level Analyser was located at a height of 1.5 metres above the ground level to the rear of the property to pick up the existing ambient noise and the background noise.

The values of L_{A90} measured on site are therefore assumed to be representative of the background levels at the façade of other nearby properties.

The objective of any specification limiting new noises should therefore be to ensure that sound emission from the new building services plant and any other new sources in particular should not materially add to the existing ambient sound climate.

As to the level at which the target should be set, this is normally specified by the planning authority in their planning consent conditions – in this instance the proposed level would be 10db(A) below the measured background.

The target limits should be achieved with all plant operating normally, any plant exhibiting characteristics which are tonal or intermittent in nature should be designed to criteria 5dB(A) more stringent.

The premises in closest proximity to the proposed facility are residential in usage and must be given particular consideration in terms of acceptable levels of noise exposure from the proposed fixed mechanical plant installation.

We would therefore propose the following design targets for any the new plant when measured at 1 metre from the nearest residential premises.

The lowest $L_{A90,15min}$ levels measured on the roof area were;

$L_{A90,15min}$ 47dB(A) between 07:00 hours to 19:00 hours.
$L_{A90,15min}$ 47dB(A) between 19:00 hours to 23:00 hours.
$L_{A90,15min}$ 47dB(A) between 23:00 hours to 07:00 hours.

The maximum limiting noise levels L_{Aeq} should therefore not exceed the following noise levels when measured at 1 metre from the nearest residential premises;

$L_{A90,15min}$ 32dB(A) between 07:00 hours to 19:00 hours.
$L_{A90,15min}$ 32dB(A) between 19:00 hours to 23:00 hours.
$L_{A90,15min}$ 32dB(A) between 23:00 hours to 07:00 hours.

This level should be a cumulative level from all plant running normally and makes allowance for any tonal or intermittent noise from the plant.

This would equate to a level of approximately 62dBA at 1 metre from the plant which may be excessive for the windows within the hospital itself and thought should be given to sleep disturbance at night-time.

In general terms a reduction of 10-15dB can be expected even through an open window and as such we would also recommend setting a level of 40dBA at 1 metre outside the nearest effected hospital window as this would then provide an internal level of approximately 30dBA which is within the WHO guidelines for sleep disturbance.

In our opinion all of the above should generally be acceptable to the local authority for this area, but all design targets should as a matter of course should be verified with the local Environmental Health or Planning Departments.

Once plant details are established we will carry out Acoustic Calculations to predict the noise levels and propose any mitigating measures accordingly.

Report carried out for and on behalf of Conabeare Acoustics Limited by,

Stuart Metcalfe

Stuart Metcalfe MIOA

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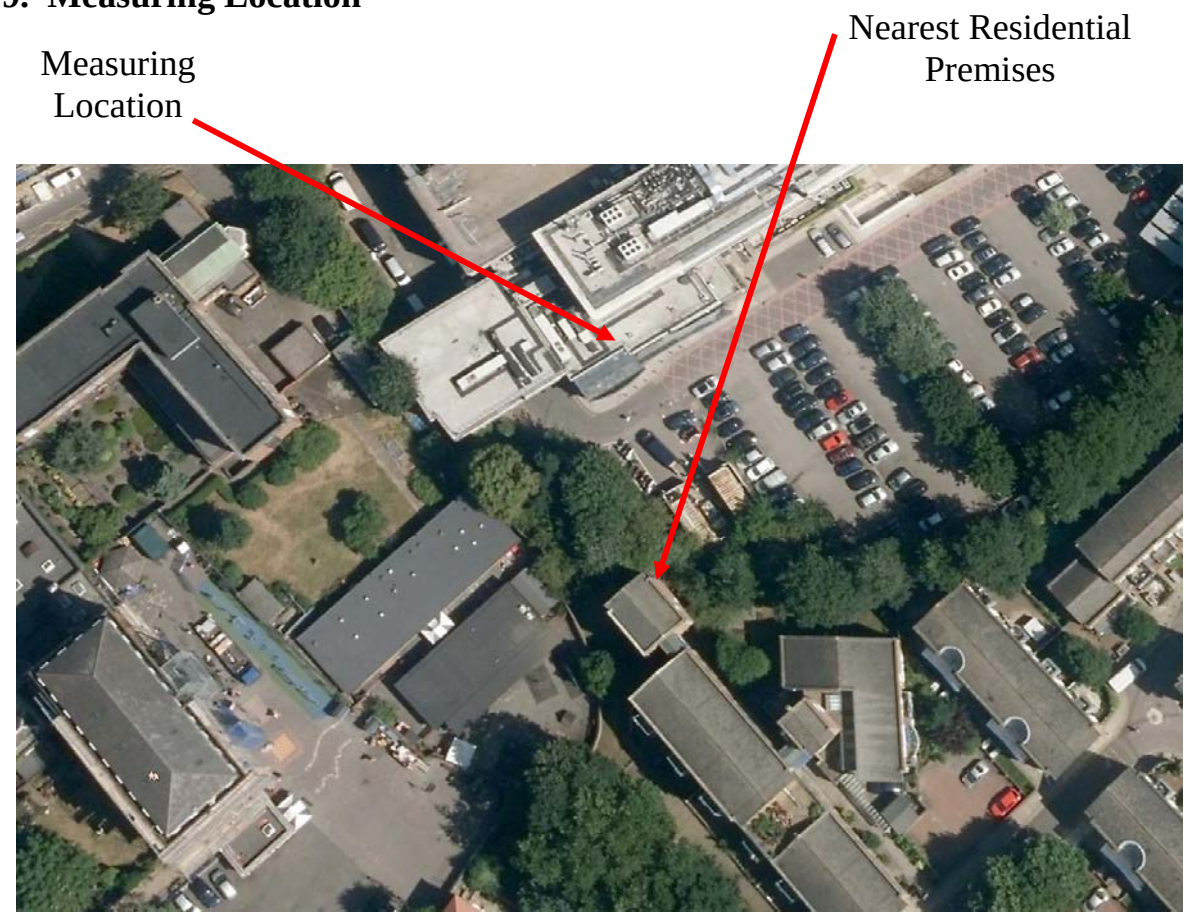
9. Measuring Location



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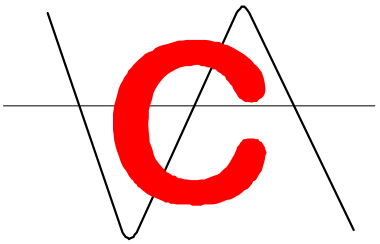
CS7621 - Royal Free Hospital, Pond Street, London NW3 2QG - New MRI Facility

- Period result profile -

Overload occurred	Yes
Low battery occurred	Yes
Pause was used	No
Frequency weighting	A
Band	Broadband
Period time	15 min
Periods too short for LNs	No
First period listed	1 : 284



Period number	Flags	Date and Time	LN90.0% F	LN10.0% F	Leq
	OBPZ		dB, (A)	dB, (A)	dB, (A)
1	O---	05/03/2015 14:37	54	57	55.9
2	O---	05/03/2015 14:52	55	61	58.7
3	O---	05/03/2015 15:07	54	60	57.7
4	O---	05/03/2015 15:22	53	57	55.5
5	O---	05/03/2015 15:37	52	55	54.7
6	O---	05/03/2015 15:52	51	55	53.6
7	O---	05/03/2015 16:07	52	57	54.9
8	O---	05/03/2015 16:22	52	56	54.7
9	O---	05/03/2015 16:37	52	55	53.7
10	O---	05/03/2015 16:52	51	55	53.5
11	O---	05/03/2015 17:07	52	55	54.2
12	O---	05/03/2015 17:22	52	56	54.6
13	O---	05/03/2015 17:37	51	55	53.7
14	O---	05/03/2015 17:52	52	56	54.4
15	O---	05/03/2015 18:07	53	55	54.2
16	O---	05/03/2015 18:22	53	55	54.2
17	O---	05/03/2015 18:37	49	54	51.5
18	O---	05/03/2015 18:52	48	53	51
19	O---	05/03/2015 19:07	49	52	50.9
20	O---	05/03/2015 19:22	49	51	50.2
21	O---	05/03/2015 19:37	49	54	53.3
22	O---	05/03/2015 19:52	48	52	50.5
23	O---	05/03/2015 20:07	47	53	50.9
24	O---	05/03/2015 20:22	48	52	50.4
25	O---	05/03/2015 20:37	48	52	51.1
26	O---	05/03/2015 20:52	49	51	50.3
27	O---	05/03/2015 21:07	49	51	50.8
28	O---	05/03/2015 21:22	48	52	50.4
29	O---	05/03/2015 21:37	48	51	49.8
30	O---	05/03/2015 21:52	47	51	49.6
31	O---	05/03/2015 22:07	48	52	50.1
32	O---	05/03/2015 22:22	49	51	49.9
33	O---	05/03/2015 22:37	48	51	49.6
34	O---	05/03/2015 22:52	48	51	49.8
35	O---	05/03/2015 23:07	48	51	49.5
36	O---	05/03/2015 23:22	48	50	49.6
37	O---	05/03/2015 23:37	47	51	49.4
38	O---	05/03/2015 23:52	47	50	49.1
39	O---	06/03/2015 00:07	48	50	48.8
40	O---	06/03/2015 00:22	48	50	49
41	O---	06/03/2015 00:37	48	54	50.9
42	O---	06/03/2015 00:52	53	54	53.5
43	O---	06/03/2015 01:07	53	54	53.3
44	O---	06/03/2015 01:22	52	54	53.2
45	O---	06/03/2015 01:37	52	54	53.7
46	O---	06/03/2015 01:52	52	54	53.1

Period number	Flags	Date and Time	LN90.0% F	LN10.0% F	Leq
	OBPZ		dB, (A)	dB, (A)	dB, (A)
47	O---	06/03/2015 02:07	52	54	53.2
48	O---	06/03/2015 02:22	53	54	53.2
49	O---	06/03/2015 02:37	53	54	53.3
50	O---	06/03/2015 02:52	53	54	53.3
51	O---	06/03/2015 03:07	53	54	53.2
52	O---	06/03/2015 03:22	52	54	53.1
53	O---	06/03/2015 03:37	53	54	53.3
54	O---	06/03/2015 03:52	53	54	53.3
55	O---	06/03/2015 04:07	53	54	53.2
56	O---	06/03/2015 04:22	53	54	53.5
57	O---	06/03/2015 04:37	53	54	53.5
58	O---	06/03/2015 04:52	53	54	53.6
59	O---	06/03/2015 05:07	53	54	53.6
60	O---	06/03/2015 05:22	53	54	53.4
61	O---	06/03/2015 05:37	53	56	54.2
62	O---	06/03/2015 05:52	53	55	54
63	O---	06/03/2015 06:07	53	54	53.6
64	O---	06/03/2015 06:22	53	54	53.7
65	O---	06/03/2015 06:37	53	54	53.9
66	O---	06/03/2015 06:52	54	55	54.4
67	----	06/03/2015 07:07	54	56	54.8
68	O---	06/03/2015 07:22	54	56	55.3
69	----	06/03/2015 07:37	53	55	55.6
70	O---	06/03/2015 07:52	54	55	54.5
71	O---	06/03/2015 08:07	54	56	55.2
72	O---	06/03/2015 08:22	54	56	55.1
73	O---	06/03/2015 08:37	54	56	54.7
74	O---	06/03/2015 08:52	54	56	54.9
75	O---	06/03/2015 09:07	54	55	54.7
76	O---	06/03/2015 09:22	54	58	56.3
77	O---	06/03/2015 09:37	54	56	55.2
78	O---	06/03/2015 09:52	53	56	56.2
79	O---	06/03/2015 10:07	54	56	55.2
80	O---	06/03/2015 10:22	54	57	55.5
81	O---	06/03/2015 10:37	52	56	54.8
82	O---	06/03/2015 10:52	54	60	57.4
83	O---	06/03/2015 11:07	54	62	58.6
84	O---	06/03/2015 11:22	52	59	57.9
85	O---	06/03/2015 11:37	52	58	55.7
86	O---	06/03/2015 11:52	53	59	56.9
87	O---	06/03/2015 12:07	53	60	57.4
88	O---	06/03/2015 12:22	52	59	56.8
89	O---	06/03/2015 12:37	54	57	55.5
90	O---	06/03/2015 12:52	53	57	55.2
91	O---	06/03/2015 13:07	54	63	59.7
92	O---	06/03/2015 13:22	58	63	61.1
93	O---	06/03/2015 13:37	56	63	60.4
94	O---	06/03/2015 13:52	57	63	60.9
95	O---	06/03/2015 14:07	53	60	57.1
96	O---	06/03/2015 14:22	53	56	55.2
97	O---	06/03/2015 14:37	53	58	56.7
98	O---	06/03/2015 14:52	55	62	59.7
99	O---	06/03/2015 15:07	54	61	58.1
100	O---	06/03/2015 15:22	53	56	55.2
101	O---	06/03/2015 15:37	54	56	55.1
102	O---	06/03/2015 15:52	53	56	54.9
103	O---	06/03/2015 16:07	54	58	56.4
104	O---	06/03/2015 16:22	53	57	55.3
105	O---	06/03/2015 16:37	54	59	57

Period number	Flags	Date and Time	LN90.0% F	LN10.0% F	Leq
	OBPZ		dB, (A)	dB, (A)	dB, (A)
106	O---	06/03/2015 16:52	53	55	54.3
107	O---	06/03/2015 17:07	53	55	54.1
108	O---	06/03/2015 17:22	53	55	54.5
109	O---	06/03/2015 17:37	54	55	54.5
110	O---	06/03/2015 17:52	53	57	55.3
111	O---	06/03/2015 18:07	53	55	54.4
112	O---	06/03/2015 18:22	53	55	54.1
113	O---	06/03/2015 18:37	50	54	52
114	O---	06/03/2015 18:52	50	52	51.3
115	O---	06/03/2015 19:07	50	53	51.6
116	O---	06/03/2015 19:22	50	54	53
117	O---	06/03/2015 19:37	50	53	52
118	O---	06/03/2015 19:52	50	53	51.6
119	O---	06/03/2015 20:07	50	53	51.7
120	O---	06/03/2015 20:22	50	55	53.1
121	O---	06/03/2015 20:37	50	53	52.2
122	O---	06/03/2015 20:52	50	54	52.2
123	O---	06/03/2015 21:07	50	52	51.2
124	O---	06/03/2015 21:22	50	52	50.9
125	O---	06/03/2015 21:37	50	52	51.3
126	O---	06/03/2015 21:52	50	52	52.1
127	O---	06/03/2015 22:07	50	52	51.2
128	O---	06/03/2015 22:22	50	53	51.6
129	O---	06/03/2015 22:37	50	52	51.2
130	O---	06/03/2015 22:52	50	52	51.1
131	O---	06/03/2015 23:07	50	52	50.8
132	O---	06/03/2015 23:22	50	52	51.3
133	O---	06/03/2015 23:37	50	52	51.1
134	O---	06/03/2015 23:52	50	52	51.6
135	O---	07/03/2015 00:07	50	53	51.3
136	O---	07/03/2015 00:22	50	51	50.7
137	O---	07/03/2015 00:37	50	52	51.2
138	O---	07/03/2015 00:52	50	51	51.1
139	----	07/03/2015 01:07	50	51	50.1
140	----	07/03/2015 01:22	50	51	50.7
141	----	07/03/2015 01:37	50	51	50.2
142	O---	07/03/2015 01:52	50	52	51.5
143	O---	07/03/2015 02:07	49	51	50.6
144	O---	07/03/2015 02:22	49	50	49.7
145	O---	07/03/2015 02:37	49	50	49.8
146	O---	07/03/2015 02:52	49	50	49.6
147	O---	07/03/2015 03:07	49	51	49.9
148	O---	07/03/2015 03:22	49	51	49.8
149	O---	07/03/2015 03:37	49	51	50
150	O---	07/03/2015 03:52	49	51	49.9
151	O---	07/03/2015 04:07	49	50	49.5
152	O---	07/03/2015 04:22	49	50	49.6
153	O---	07/03/2015 04:37	49	50	49.5
154	O---	07/03/2015 04:52	49	51	49.8
155	O---	07/03/2015 05:07	49	51	49.8
156	O---	07/03/2015 05:22	49	51	50
157	O---	07/03/2015 05:37	49	51	50.5
158	O---	07/03/2015 05:52	49	51	49.8
159	O---	07/03/2015 06:07	49	51	50.2
160	O---	07/03/2015 06:22	49	50	49.8
161	O---	07/03/2015 06:37	50	51	50.2
162	O---	07/03/2015 06:52	50	52	50.9
163	O---	07/03/2015 07:07	50	52	51.3
164	O---	07/03/2015 07:22	50	52	51.3

Period number	Flags	Date and Time	LN90.0% F	LN10.0% F	Leq
	OBPZ		dB, (A)	dB, (A)	dB, (A)
165	O---	07/03/2015 07:37	50	52	50.8
166	O---	07/03/2015 07:52	50	53	51.6
167	O---	07/03/2015 08:07	50	53	51.5
168	O---	07/03/2015 08:22	50	54	53.1
169	O---	07/03/2015 08:37	50	57	53.3
170	O---	07/03/2015 08:52	50	56	53
171	O---	07/03/2015 09:07	49	53	51.7
172	O---	07/03/2015 09:22	50	53	52.3
173	O---	07/03/2015 09:37	49	53	51.5
174	O---	07/03/2015 09:52	50	54	52.1
175	O---	07/03/2015 10:07	49	54	51.9
176	O---	07/03/2015 10:22	50	53	51.6
177	O---	07/03/2015 10:37	50	55	52.7
178	O---	07/03/2015 10:52	51	58	54.2
179	O---	07/03/2015 11:07	50	58	55.6
180	O---	07/03/2015 11:22	50	53	51.4
181	O---	07/03/2015 11:37	49	59	54.3
182	O---	07/03/2015 11:52	49	55	52.5
183	O---	07/03/2015 12:07	49	52	51
184	O---	07/03/2015 12:22	49	52	51.2
185	O---	07/03/2015 12:37	49	52	50.7
186	O---	07/03/2015 12:52	47	52	50.5
187	O---	07/03/2015 13:07	48	52	50.7
188	O---	07/03/2015 13:22	48	52	50.7
189	O---	07/03/2015 13:37	50	52	51.4
190	O---	07/03/2015 13:52	50	52	51.2
191	O---	07/03/2015 14:07	49	54	52
192	O---	07/03/2015 14:22	50	52	50.9
193	O---	07/03/2015 14:37	48	52	50.9
194	O---	07/03/2015 14:52	49	52	51.2
195	O---	07/03/2015 15:07	49	53	52.2
196	O---	07/03/2015 15:22	50	54	52.5
197	O---	07/03/2015 15:37	50	54	51.9
198	O---	07/03/2015 15:52	49	52	50.8
199	O---	07/03/2015 16:07	49	53	51.5
200	O---	07/03/2015 16:22	49	52	51.2
201	O---	07/03/2015 16:37	49	51	50.3
202	O---	07/03/2015 16:52	50	53	53.3
203	O---	07/03/2015 17:07	50	56	53.6
204	O---	07/03/2015 17:22	50	52	50.8
205	O---	07/03/2015 17:37	50	52	50.8
206	O---	07/03/2015 17:52	50	52	50.8
207	O---	07/03/2015 18:07	50	52	51.3
208	O---	07/03/2015 18:22	50	52	51.2
209	O---	07/03/2015 18:37	50	52	51.3
210	O---	07/03/2015 18:52	50	52	50.9
211	O---	07/03/2015 19:07	50	52	51.1
212	O---	07/03/2015 19:22	50	52	51.2
213	O---	07/03/2015 19:37	50	52	50.9
214	O---	07/03/2015 19:52	50	52	50.9
215	O---	07/03/2015 20:07	50	52	51.2
216	O---	07/03/2015 20:22	50	52	51.2
217	O---	07/03/2015 20:37	50	52	51
218	O---	07/03/2015 20:52	50	53	51.8
219	O---	07/03/2015 21:07	50	52	51.4
220	O---	07/03/2015 21:22	50	52	51.4
221	O---	07/03/2015 21:37	51	52	51.6
222	O---	07/03/2015 21:52	51	52	51.9
223	O---	07/03/2015 22:07	51	52	51.5

Period number	Flags	Date and Time	LN90.0% F	LN10.0% F	Leq
	OBPZ		dB, (A)	dB, (A)	dB, (A)
224	O---	07/03/2015 22:22	50	52	51.1
225	O---	07/03/2015 22:37	51	52	51.5
226	O---	07/03/2015 22:52	51	52	51.2
227	O---	07/03/2015 23:07	50	52	51.1
228	O---	07/03/2015 23:22	50	52	51.2
229	O---	07/03/2015 23:37	50	51	50.8
230	O---	07/03/2015 23:52	50	51	50.5
231	O---	08/03/2015 00:07	50	51	50.7
232	O---	08/03/2015 00:22	50	51	50.7
233	----	08/03/2015 00:37	50	51	50.3
234	O---	08/03/2015 00:52	50	51	50.7
235	O---	08/03/2015 01:07	50	51	50.2
236	----	08/03/2015 01:22	50	51	50.3
237	----	08/03/2015 01:37	50	51	50.6
238	O---	08/03/2015 01:52	49	51	50.2
239	O---	08/03/2015 02:07	49	51	50.1
240	O---	08/03/2015 02:22	49	51	50.1
241	O---	08/03/2015 02:37	49	51	50.5
242	O---	08/03/2015 02:52	49	50	49.7
243	O---	08/03/2015 03:07	49	51	50
244	O---	08/03/2015 03:22	49	50	49.7
245	O---	08/03/2015 03:37	49	51	50
246	O---	08/03/2015 03:52	49	51	50
247	----	08/03/2015 04:07	49	50	49.6
248	O---	08/03/2015 04:22	49	51	50
249	O---	08/03/2015 04:37	49	51	50.1
250	O---	08/03/2015 04:52	49	51	49.9
251	O---	08/03/2015 05:07	49	51	49.8
252	O---	08/03/2015 05:22	49	50	49.7
253	O---	08/03/2015 05:37	49	51	49.8
254	O---	08/03/2015 05:52	48	50	49.3
255	O---	08/03/2015 06:07	48	50	49.4
256	O---	08/03/2015 06:22	48	50	49
257	O---	08/03/2015 06:37	47	52	51
258	O---	08/03/2015 06:52	48	51	49.7
259	O---	08/03/2015 07:07	49	51	50.1
260	O---	08/03/2015 07:22	49	51	50.3
261	O---	08/03/2015 07:37	49	52	50.5
262	O---	08/03/2015 07:52	49	52	50.5
263	O---	08/03/2015 08:07	49	51	50
264	O---	08/03/2015 08:22	49	52	50.3
265	O---	08/03/2015 08:37	49	53	51.1
266	O---	08/03/2015 08:52	50	53	51.6
267	O---	08/03/2015 09:07	50	52	50.7
268	O---	08/03/2015 09:22	50	52	50.6
269	O---	08/03/2015 09:37	49	51	50.5
270	O---	08/03/2015 09:52	49	52	50.6
271	O---	08/03/2015 10:07	49	52	50.9
272	O---	08/03/2015 10:22	49	52	50.6
273	O---	08/03/2015 10:37	48	52	50.7
274	O---	08/03/2015 10:52	50	52	50.9
275	O---	08/03/2015 11:07	49	51	50.5
276	O---	08/03/2015 11:22	49	52	50.9
277	O---	08/03/2015 11:37	49	51	50.3
278	O---	08/03/2015 11:52	49	51	50.3
279	O---	08/03/2015 12:07	50	51	50.8
280	O---	08/03/2015 12:22	50	52	51.3
281	OB--	08/03/2015 12:37	50	53	54
282	OB--	08/03/2015 12:52	50	52	50.7

Period number	Flags	Date and Time	LN90.0% F	LN10.0% F	Leq
	OBPZ		dB, (A)	dB, (A)	dB, (A)
283	OB--	08/03/2015 13:07	49	53	51.1
284	OB--	08/03/2015 13:22	50	52	51

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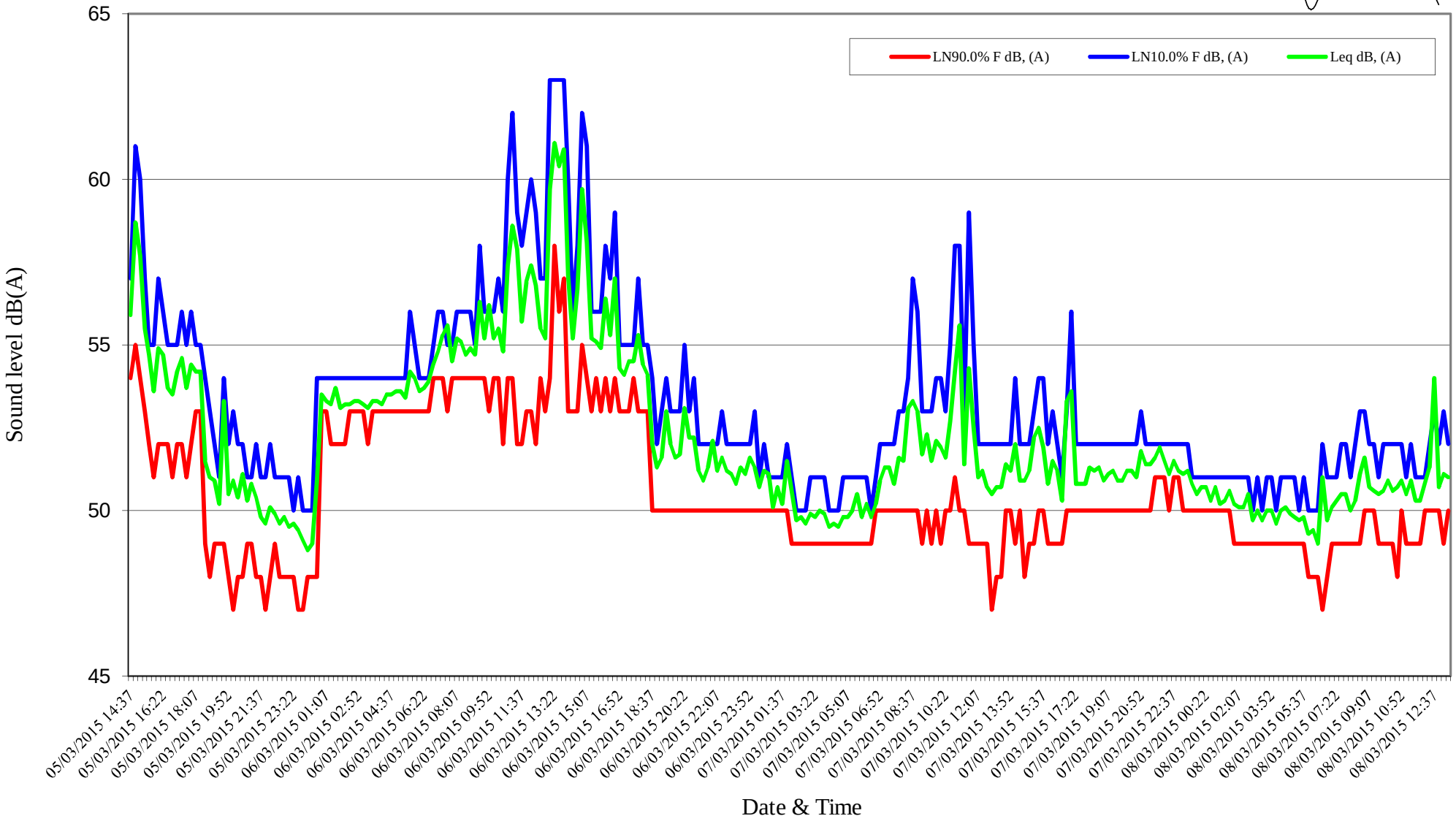

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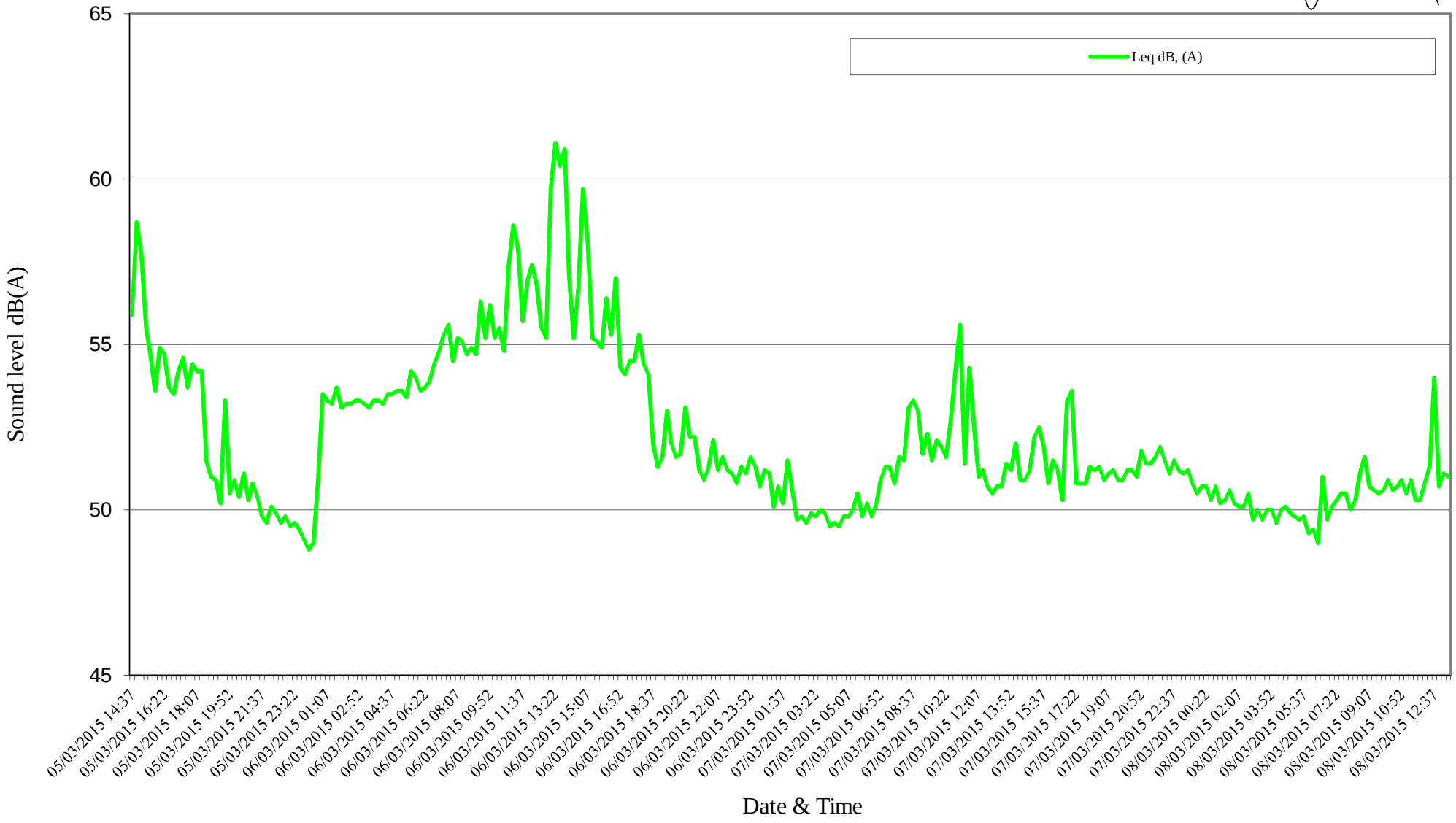

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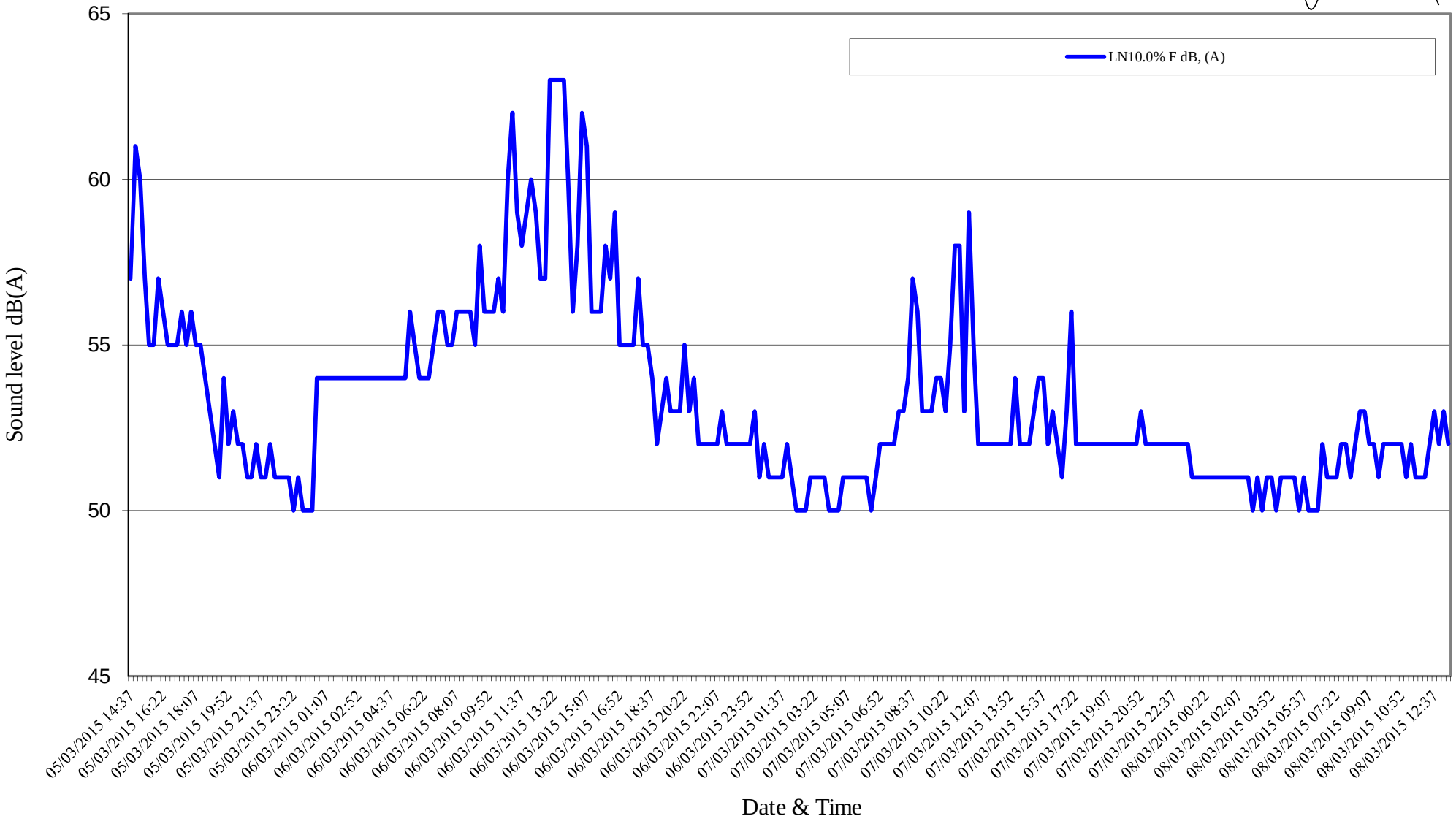

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