Report VA2752.200710.NIA

10-12 Old Station Business Park, Compton

Noise Impact Assessment

23 July 2020

Carbosynth
Axis House
High Street
Compton
Newbury
Berkshire
RG20 6NL

VENTA ACOUSTICS

01962 461016
0203 8650332
mail@ventaacoustics.com

registered company no. 10139494

Contents

Attachments

1. Introduction

Following complaints by neighbours relating to noise, Venta Acoustics has been appointed to investigate the noise issues at Carbosynth, 10-12 Old Station Business Park, Compton.

A set of measurements were undertaken to determine the primary sources of noise from the site and assess the impact at the neighbours. Outline mitigation measures are then discussed.

2. Design Criterion and Assessment Methodology

2.1 BS4142:2014

British Standard BS4142:2014 *Methods for rating and assessing industrial and commercial sound* describes a method for rating and assessing sound of an industrial and/or commercial nature, which includes sound from fixed installations comprising mechanical and/or electrical plant and equipment.

The assessment methodology considers the Specific Sound Level, as measured or calculated at a potential noise sensitive receptor, due to the source under investigation. A correction factor is added to this level to account for the acoustic character of the sound as follows:

Tonality – A correction of up to 6dB depending on the prominence of tones;

Impulsivity - A correction of up to 9dB depending on the prominence of impulsivity;

Other sound characteristics - A 3dB correction may be applied where a distinctive acoustic character is present that is neither tonal nor impulsive;

Intermittency - A 3dB correction may be applied where the specific sound has identifiable on/off conditions.

An estimate of the impact of the source is obtained by subtracting the typical background noise level from the corrected Specific Sound Level.

- Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB could be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context.

2.2 NANR45 Criteria

In the report '*Proposed criteria for the assessment of low frequency noise disturbance (2005)*' prepared by Salford University for DEFRA, a criteria for the assessment of low frequency noise is proposed based on laboratory measurements of participants threshold of hearing and response to low frequency sound.

The reference curve, which should not be exceeded as an L_{eq} level measured in rooms of concern, is as follows:

Freq Band (Hz)	25.0	31.5	40.0	50.0	63.0	80.0	100.0	125.0	160.0
NANR Reference Curve	64	56	49	43	42	40	38	36	34

Table 2.1 – NANR low frequency assessment curve

If the L_{eq}, taken over a time when the noise is said to be present, exceeds the values in the reference curve, it may indicate a source of low frequency noise that could cause disturbance.

If the sound only occurs during the day, then a 5dB relaxation may be applied to all third octave bands.

If the noise is steady, then a 5dB relaxation may be applied to all third octave bands.

3. Site Description

As illustrated on attached site plan VA2752/SP1, Carbosynth is located in a business park on the edge of Compton surrounding by agricultural fields.

The dwellings which have raised complaints regarding noise are located on Yew Tree Stables, at a distance of approximately 125m to the west.

Carbosynth operate out of an established warehouse and a newly constructed building, each of which have an air handing unit, a chiller and a collection of extract fans. There are also refrigeration units for the established warehouse located on the north west corner of the building. In addition to these, there are 4 free standing cold room containers located to the north of the established warehouse.

The Carbosynth site is at a lower level than the boundary to the field to the west, with a bank approximately 1.8m high between the access road and the field. The field then slopes down to the dwellings.

3.1 Nature of Complaints

From discussions with the neighbouring residents, there are two distinct issues reported.

At night there is a low frequency hum that is heard in the first floor bedrooms and is of an intrusive nature, albeit at a very low level.

In warm weather a more definitive sound is clearly heard in the gardens as well as in the houses when windows are open.

4. Environmental Noise Survey

4.1 Survey Procedure & Equipment

A noise survey a noise survey was carried out between Thursday 2nd and Monday 6th July 2020 at the front of the residential dwellings and on the edge of the Carbosynth site at the locations shown in site plan VA2752/SP1.

Continuous 5-minute samples of the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were undertaken at each of the measurement locations to capture source noise levels, the resultant noise levels at the dwellings as well as the background noise levels in the locality.

The weather during the survey period was variable. Thursday evening into Friday morning was generally fine and mild. However strong winds and rain were present through the remainder of the weekend. The noise levels measured on Thursday night into Friday morning are considered to provide a fair representation of the noise climate.

Measurements were made generally in accordance with ISO 1996 2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*.

The following equipment was used in the course of the survey:

Manufacturer	Model Type	Serial No	Calibration	
			Certificate No.	Date
NTi Class 1 Integrating SLM	XL2	A2A-15993-E0	FL-19-122	14/3/19
NTi Class 1 Integrating SLM	XL2	A2A-15892-E0	FL-19-121	14/3/19
Larson Davis calibrator	CAL200	13069	UCRT20/1562	26/6/20

Table 4.1 – Equipment used for the survey

The calibration of the sound level meters was verified before and after use with no significant calibration drift observed.

4.2 Results

The measured sound levels are shown as time-history plots on the attached charts VA2752/TH1-4 for the location adjacent to the dwellings and VA2752/TH5-7 for the position at Carbosynth.

Review of the Carbosynth monitor (TH5-7) shows a fairly flat L_{A90} background sound level, indicative of continuously running plant. There are frequent peaks which are likely to be due to the nearby cold storage containers having their compressors turn on and off intermittently. It is expected that this would occur more frequently in warm weather. Two periods were noted when the sound levels

dropped off, on Thursday morning during testing of the various items of plant and on Saturday morning when power to the site is understood to have been cut off briefly.

At the residential monitor (TH1-4) a normal diurnal noise profile is seen with very low background noise levels at night down to L_{A90} 25dB (seen on Thursday night / Friday morning). Over the weekend period the noise levels are considered to be influenced by weather. It is noted that the background noise levels on Friday morning during the survey were lower than measured during a previous survey. This is likely to be due to a combination of reduced traffic due to Covid19 and different weather patterns.

The noise levels measured at the dwellings do not follow those measured at the Carbosynth monitor, even during the early hours of Friday morning. This suggests that the plant noise from Carbosynth was below the background level at the dwellings and hence not measurable. This is supported by observations during the site visits that noise from Carbosynth was not evident.

5. Testing of Plant

In order to determine the noise contribution of each item of plant, an exercise was undertaken from 03:00 on Friday morning whereby the plant was turned off one by one, then individual items were operated briefly before the plant was brought back into operation in turn.

Short duration logging was activated on the monitors during this exercise to measure the changes in noise levels. The following programme is understood to have been implemented:

Event	Plant ID	Time Switched On/Off
1	Unit 10 -12 Chiller & Supply Fan	03:00 – Off
2	Unit 10-12 Extract Fans	03:10 – Off
3	Warehouse Extract Fan	03:18 – Off
4	Unit 7-9 Chiller and AHU supply	03:30 – Off
5	Unit 7-9 Chiller and AHU Extract	03:40 – Off
6	Container 1 – Left East Boundary	03:49 – Off
7	Warehouse Cold rooms	03:52 - Off
8	Container 2 – Centre East Boundary	04:00 – Off
9	Container 3 – Right East Boundary	04:09 – Off
10	Container 4 – West Single (All Plant Off)	04:20 - Off
11-12	Container 1	04:30 – On 04:40 – Off
13-14	Container 3	04:41 – On 04:47 – Off
15-16	Container 2	04:50 – On 04:55 – Off
17	Warehouse Cold rooms	04:57 - On
18	Warehouse Extract Fan	05:01 – On
19	Unit 7-9 Extract Fans	05:05 – On
20	Unit 7-9 Chiller	05:10 – On
21	Containers 1,2,3	05:19 – On
22	Container 4	06:16 - On
23	Units 10-12 Extract Fans	06:49 - On
24	Unit 10 -12 Chiller & Supply Fan	06:55 – On

Table 5.1 – Schedule of Plant Switching On and Off

The measured sound levels during the testing are shown in the following charts. The above switching times are also marked by vertical blue lines.

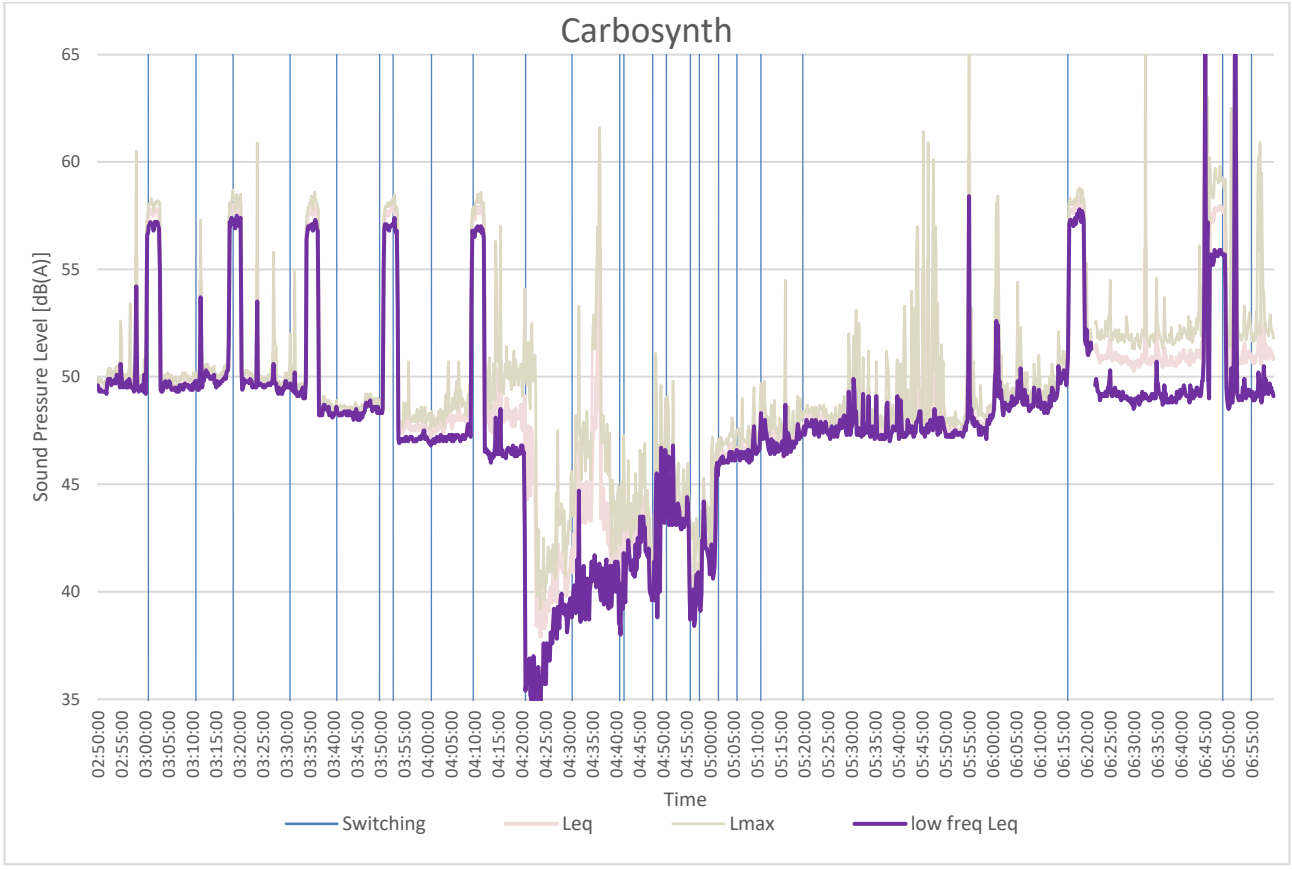


Figure 5.2 – Time history during testing – Carbosynth Monitor

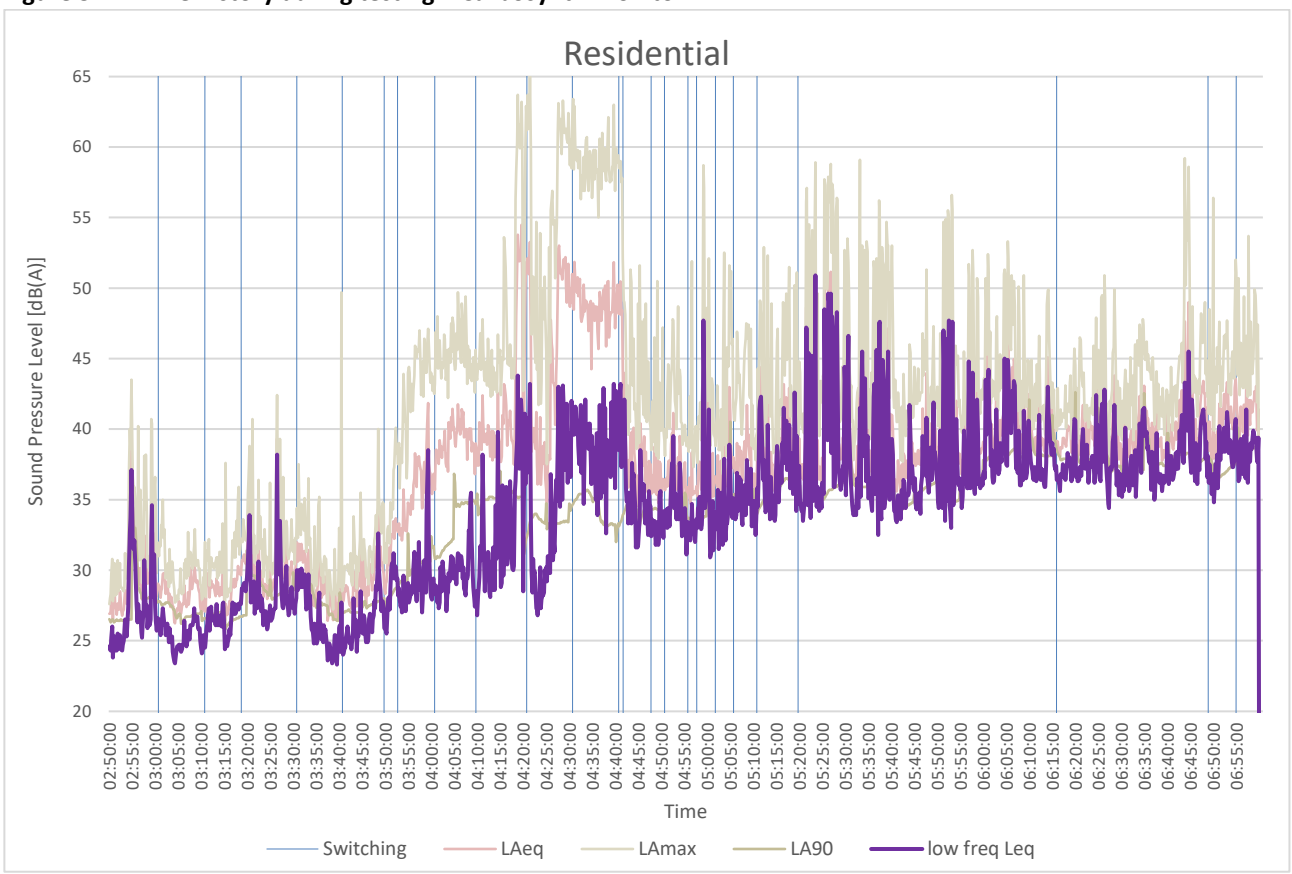


Figure 5.3 - Time history during testing – Residential Monitor

As the 'dawn chorus' begins at around 4:30 during the testing, the plots have used an A-weighted value summed between 50Hz and 1250Hz to reduce the influence of bird song and insects at higher frequencies.

At the Carbosynth monitor the intermittent peaks, expected to be from Container 4, are seen at levels of around L_{Aeq} 58dB. Once Container 4 is turned on at 04:20 these do not appear again until it is turned on at 06:16.

Switching off of equipment is seen to have a relatively small effect except for when Container 4 (approx. 10m from the monitor) is switched off at 04:20. Switching on and off the other containers (approx. 30m) and turning on the warehouse extract fan at 05:01 are other notable changes in sound level at the Carbosynth monitor. Moderate changes in level are also noted when switching off the warehouse cold-rooms (approx. 10m) at 03:52 and turning off Unit 7-9 supply fan (approx. 15m) at 03:30.

No corresponding patterns are seen at the residential monitor. Specifically, low noise levels of under 30dB are present at the dwellings while all plant was operating prior to the testing from 03:00. Again, this indicates that at the time of testing, the sound levels from Carbosynth were below the background levels at the dwellings.

The low frequency sound components are investigated as single band (50Hz) plots in the following graphs:

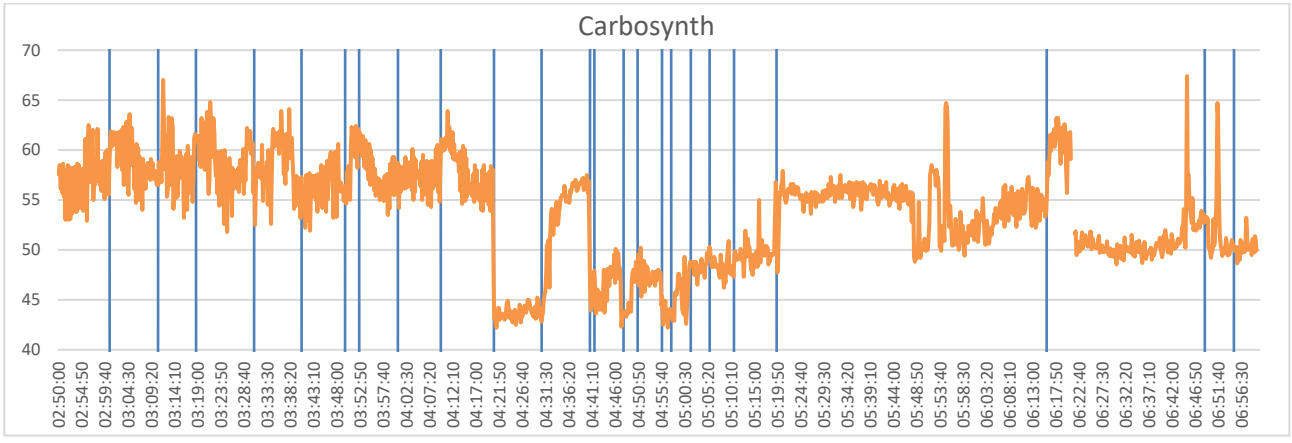


Figure 5.4 – Plot of 50Hz 1/3 octave band measured at Carbosynth

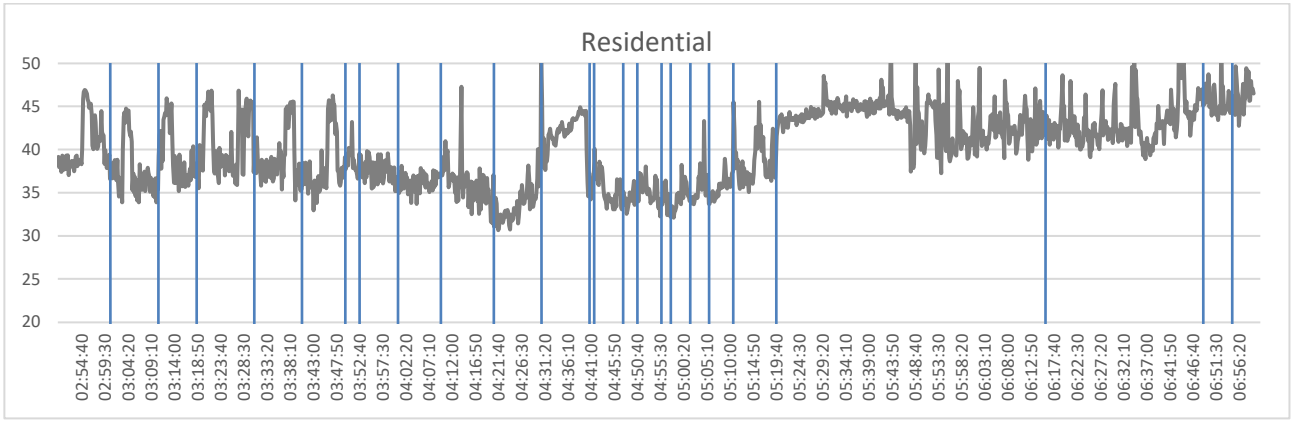


Figure 5.5 – Plot of 50Hz 1/3 Octave band measured at residential

It can be seen that the Containers have a strong low frequency component which is seen at both the source and at the residential dwellings. In particular, this can be attributed to Container 1 (which is turned on and off at 04:30-04:40) but may also be applicable to the other containers.

This is likely to be the cause of the low frequency complaints. The levels measured at ground floor at the residential units are above the NANR curve (43dB at 50Hz) and may be slightly higher at first floor level (benefit from less screening) and in bedrooms (where resonances may occur). This indicates a source of low frequency sound that could cause a disturbance.

6. Derived Source Sound Levels

The sound levels of the individual items of plant are derived based on the change in noise level measured as they are turned on and off. This is then corrected for distance from the monitor and normalised to a sound pressure level at 10m from each item of plant. No corrections for screening have been applied.

It should be noted that for the majority of the testing the sound from Container 4 dominated and so clear contributions from the other plant were not generally identified. The derived sound levels therefore have a significant margin of uncertainty.

Equipment	Measured Distance	dB(A)	63Hz	125Hz	250Hz	500Hz	1000Hz
Container 1	30m	52	65	50	53	41	40
Container 3	30m	49	57	57	61	46	48
Container 2	30m	51	55	62	52	53	44
Container 4 - continuous	10m	48	58	53	51	44	38
Container 4 – loud periods	10m	57	61	63	56	56	49
Unit 10-12 Chiller + Fan*	50m	52	65	57	54	53	50
Warehouse Cold Rooms	10m	39	48	45	46	43	31
Warehouse Extract Fan	15m	37	44	42	43	39	29
Unit 7-9 AHU Extract Fans*	40m	47	49	51	53	-	-
Unit 7-9 Chiller and supply*	15m	46	54	55	49	46	40
Units 10-12 Extract Fan*	50m	52	64	63	58	52	44

Table 6.1 – Derived source sound pressure levels (normalised to 10m)

*Clear measurements of these items were not obtained, and a high uncertainty is attributed to the derived values, likely to significantly overestimate the noise levels.

7. Sound Levels at Dwellings

Based on the derived source sound levels, the following sound levels are calculated at the dwellings, some 125m to the west, for individual items of plant.

Equipment	Predicted Sound Level at Dwellings dB(A)	Note
Container 1	25	Low frequency Noise Significant – Confirmed in survey
Container 3	32	When Operating Loudly
Container 2	30	Significant 100Hz Tone – Confirmed in survey
Container 4 - continuous	19	
Container 4 – loud periods	29	
Unit 10-12 Chiller + Fan	31	Uncertainty in derived sound levels
Warehouse Cold Rooms	16	
Warehouse Extract Fan	22	
Unit 7-9 AHU Extract Fans	24	Uncertainty in derived sound levels
Unit 7-9 Chiller and supply	24	Uncertainty in derived sound levels
Units 10-12 Extract Fan	31	High uncertainty in derived sound levels Indicates 100Hz Tone – Not confirmed in survey

Table 7.1 – Calculated sound pressure levels at dwellings

These predicted levels are generally higher than measured at the dwellings during the survey and should be used to prioritise mitigation rather than confirm impacts. The calculations do not allow for wind direction or temperature inversions which may affect the sound propagation.

The derived sound levels of 31dB the extract and supply fans from units 10-12 are higher than the levels previously calculated based on the product datasheets. Additionally, the calculated noise levels are higher than measured at the dwellings while the plant was running, These items were at a greater distance from the monitoring location and the measurements are not considered reliable.

The low frequency content of the Containers was identified at both monitoring locations and are considered the primary concern.

As discussed above, there is a level of uncertainty in the derived sound level of all plant. The items noted as uncertain in Table 7.1 did not show a clear step change in noise during the survey and so there is low confidence in the derived levels.

The cumulative levels with all plant running (e.g. on a warm day) are show below. The plant associated with units 10-12 have been excluded from this due to the low levels of confidence in those measurements.

Source	Predicted Sound Level at Dwellings dB(A)
Cumulative Level - Containers	36
Cumulative Level - Equipment Exclude Containers	30
Cumulative Level - All Equipment	37

Table 7.2 – Cumulative noise levels (worst case)

8. Impact Assessment

The background noise levels have been measured to be low in the locality, being around L_{A90} 25dB at night and L_{A90} 30-35 dB during the day. This occurs at the quietest times. Previous surveys have measured background noise levels approximately 5dB higher than these, possibly due to higher traffic flows under 'normal' times and different weather conditions.

During the testing noise from Carbosynth was not evident at the dwellings, indicating a low impact. However, this may not be representative of the worst case scenario of a hot, calm day.

Under worst case scenarios, the calculated noise level of up to 37dB would be clearly heard at the dwellings on still days when background noise levels are low.

Following the BS4142 assessment methodology, penalties are allocated to the specific sound level where tones are present, equipment operates intermittently or where there are other acoustic characteristics. Where the resulting noise level exceeds the local background, an adverse impact is indicated. The severity of the impact increases as the exceedance over the background increases.

Noise Source	Specific Sound Level	Character penalties			Rating Level	Difference from Background (35dB)
		Tonality	Impulsivity	Intermittency		
Cumulative Level - Containers	36 dB	2	0	3	41 dB	+6dB
Cumulative Level - Equipment Exclude Containers	30 dB	0	0	3	33 dB	-2 dB
Cumulative Level - All Equipment	37 dB	2	0	3	42 dB	+7dB

Table 8.1 - BS4142 Summary Assessment - Daytime.

Noise Source	Specific Sound Level	Character penalties			Rating Level	Difference from Background (25dB)
		Tonality	Impulsivity	Intermittency		
Cumulative Level - Containers	36 dB	4	0	3	43 dB	+18dB
Cumulative Level - Equipment Exclude Containers	30 dB	0	0	3	33 dB	+8dB
Cumulative Level - All Equipment	37 dB	4	0	3	44 dB	+19dB

Table 8.2 - BS4142 Summary Assessment – Night time*.

* It is understood that many items of plant are operate at a lower duty at night. The above assumes a worst case of all items operating at maximum measured noise levels simultaneously and is likely to overestimate the impact.

The BS4142 assessment indicates a significant adverse impact is likely during times when the background noise level is low (no wind and little traffic noise) and all equipment is operating at full

duty, particularly at night. During the day when background noise levels are towards 35dB, a low impact is likely if the containers are excluded.

The cumulative rating level of all plant excluding the containers of 30dB is considered quiet. Allowing a 10dB reduction for a partially open window, this would result in internal noise levels of around 20dB(A), well below the internal sound level of 30dB recommended within BS8233 for bedrooms.

The scenario of all equipment operating on full duty at the quietest periods is understood to be uncommon. During the site visits the background noise levels were in the mid-to high thirties on a mild day. Noise from the plant was not evident at the dwellings. However, it is recommended that mitigation is introduced to reduce the impact during those worst case scenarios.

Review of the low frequency components against the NANR45 curve indicates a low frequency impact at 50Hz and 100Hz from the containers. This is supported by the measurements which show the 50Hz tone to be up to 15dB above the background while the containers are operating.

9. Mitigation

It is recommended that in the first instance, mitigation is concentrated on the cold storage containers.

Mitigation of low frequency sound is notoriously challenging and will likely require a trial and error approach.

The measurements suggest that container 1 is of primary concern regarding low frequency sound although this may be equally applicable to all containers.

It is recommended that the units are serviced to ensure that all fans and reciprocating equipment is correctly balances and running smoothly.

If possible, it is recommended that container 1 be turned off when not in use, with preference given to the other containers.

It is not believed that the containers can be attenuated at source through attenuation components. However, the suppliers may be able to advise if silencer kits are available.

The containers 1-3 back onto an earth bank. It is possible that low frequency sound is exacerbated by sound reflections between then containers and the bank. Container 4, which is not against a bank, showed less pronounced low frequency effects (although this may be a different model). Relocating the containers may reduce the effect of sound reflections off the bank, reducing low frequency sound and the over all noise levels.

Alternatively, rolls of mineral wool (in their plastic packaging) may be piled behind the containers at the base of the bank to absorb some of the reverberating low frequency sound.

Additionally, a screen may be introduced to reduce the line of sight sound transmission. Ideally, this would be as close to the source as possible, such as built over the containers 1-3. Alternatively, a

screen built at the top of the bank on the west boundary would provide a lower level of attenuation of low frequency sound. The screen could be an imperforate timber fence with a minimum superficial density of 12kg/m^2.

To provide sound reduction at low frequencies of approximately 15dB it is likely that the containers would need to be placed in a brick/dense block building with a heavy roof. The building would need to be ventilated via attenuated air paths.

10. Conclusion

A survey of noise from the plant at Carbosynth, 10-12 Old Station Business Park, Compton and the impact on the nearby residents has been undertaken following noise complaints.

Although the weather during the survey was not suitable to show the worst case scenario of a warm day with no wind, the measurements provided an indication of the impact and the primary sources of noise.

During the surveys, noise from Carbosynth (understood to be operating normally, albeit under mild weather) was too low to be measurable at the nearby residential properties and was not evident during the site visits. However, a low frequency component, which was regularly present, was identified and associated with the cold containers. While the low frequency elements may be indicative of a disturbance, the overall noise levels during the survey did not indicate an adverse impact.

To understand the worst case scenario of all plant operating on a warm, still day, the maximum sound levels of individual plant was derived from measurements in close proximity to Carbosynth and summed in a theoretical manner to obtain a cumulative level. This exercise illustrated that under particular conditions, which are understood to be uncommon, a significant adverse impact can occur (when assessed following the BS4142:2014 methodology).

It is considered that the cold containers located outside the Carbosynth buildings are the primary source of noise with measurements and calculations indicating an adverse impact from low frequency sound and overall noise from this plant (under a worst case scenario).

The noise measurements of the remaining plant is indicative of a lower impact.

Outline mitigation has been discussed which focus on reducing the impact of the cold containers with a view of minimising the low frequency components and the overall noise levels.

Steven Liddell MIOA


AHU and Chiller
Units 10-12
Extract Fans
Noise monitoring locations
Cold Storage Containers
Warehouse Refrigeration
Carbosynth
AHU and Chiller
Extract Fans
Warehouse
Extract Fans
Units 7-9
Yew Tree Stables
School Rd
Wilson C/

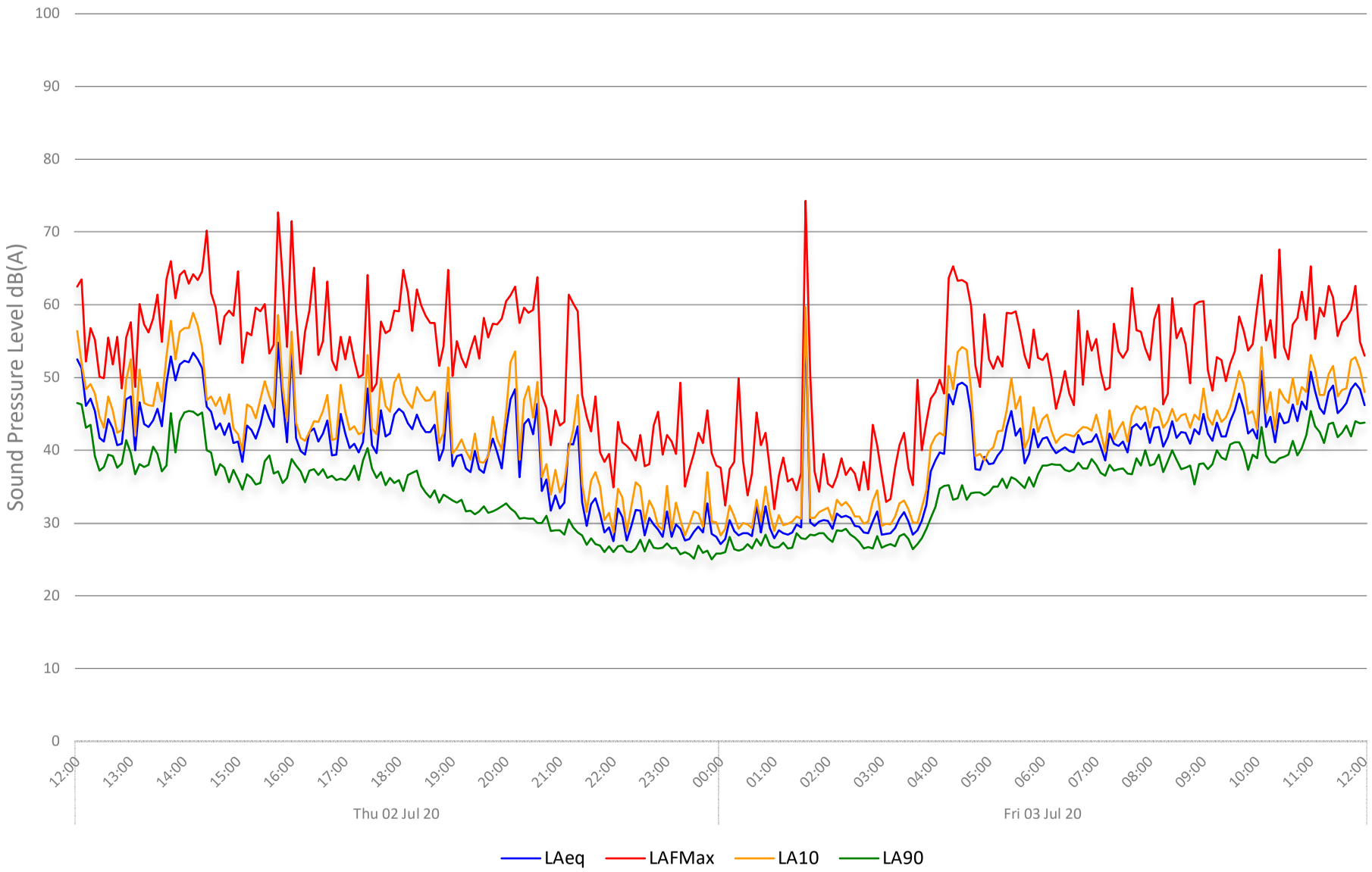
10-12 Old Station Business Park, Compton

Environmental Noise Time History: 1

Yew Tree Stables

VENTA ACOUSTICS

Figure VA2752/TH1



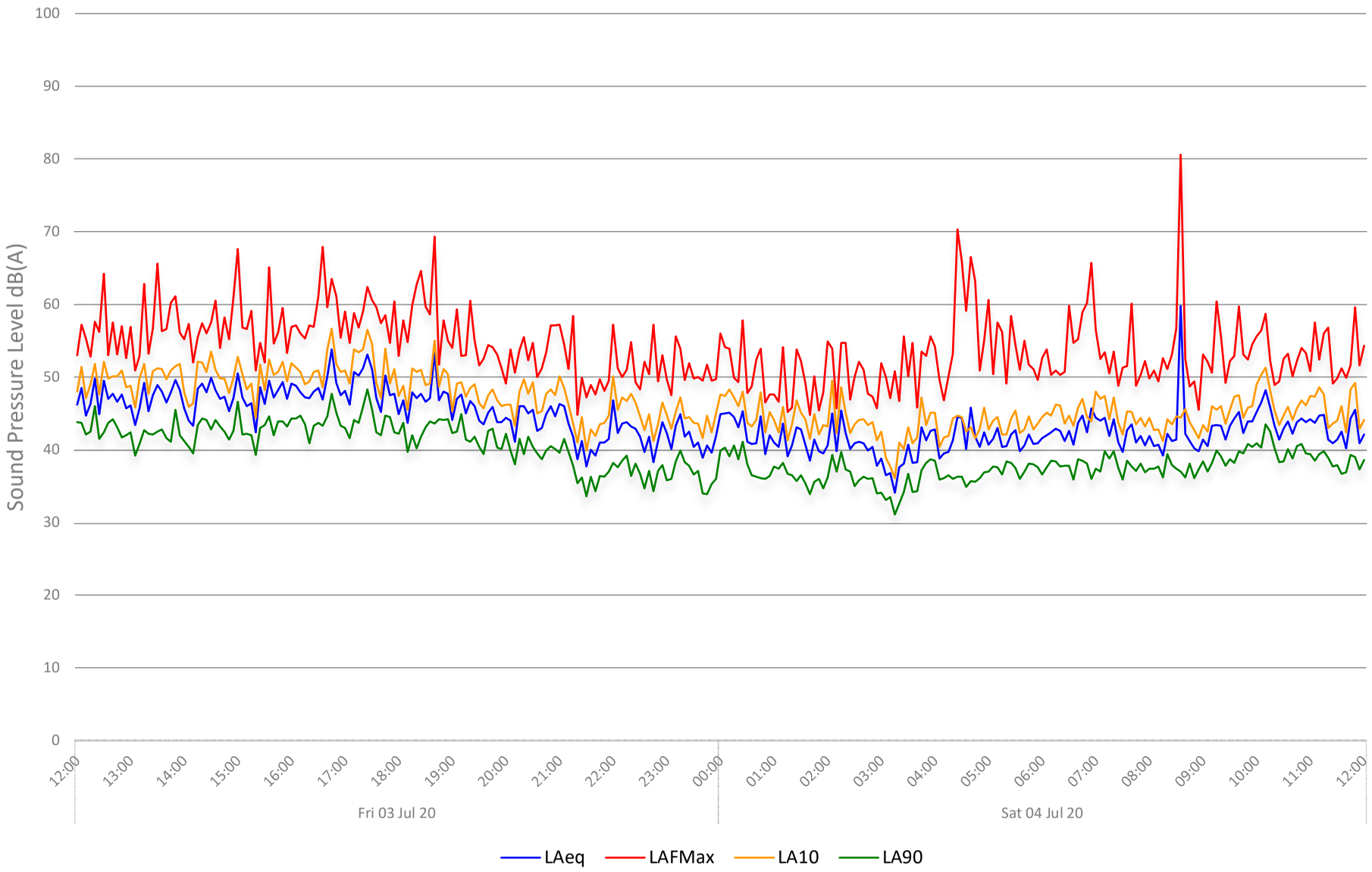
10-12 Old Station Business Park, Compton

Environmental Noise Time History: 2

Yew Tree Stables

VENTA ACOUSTICS

Figure VA2752/TH2



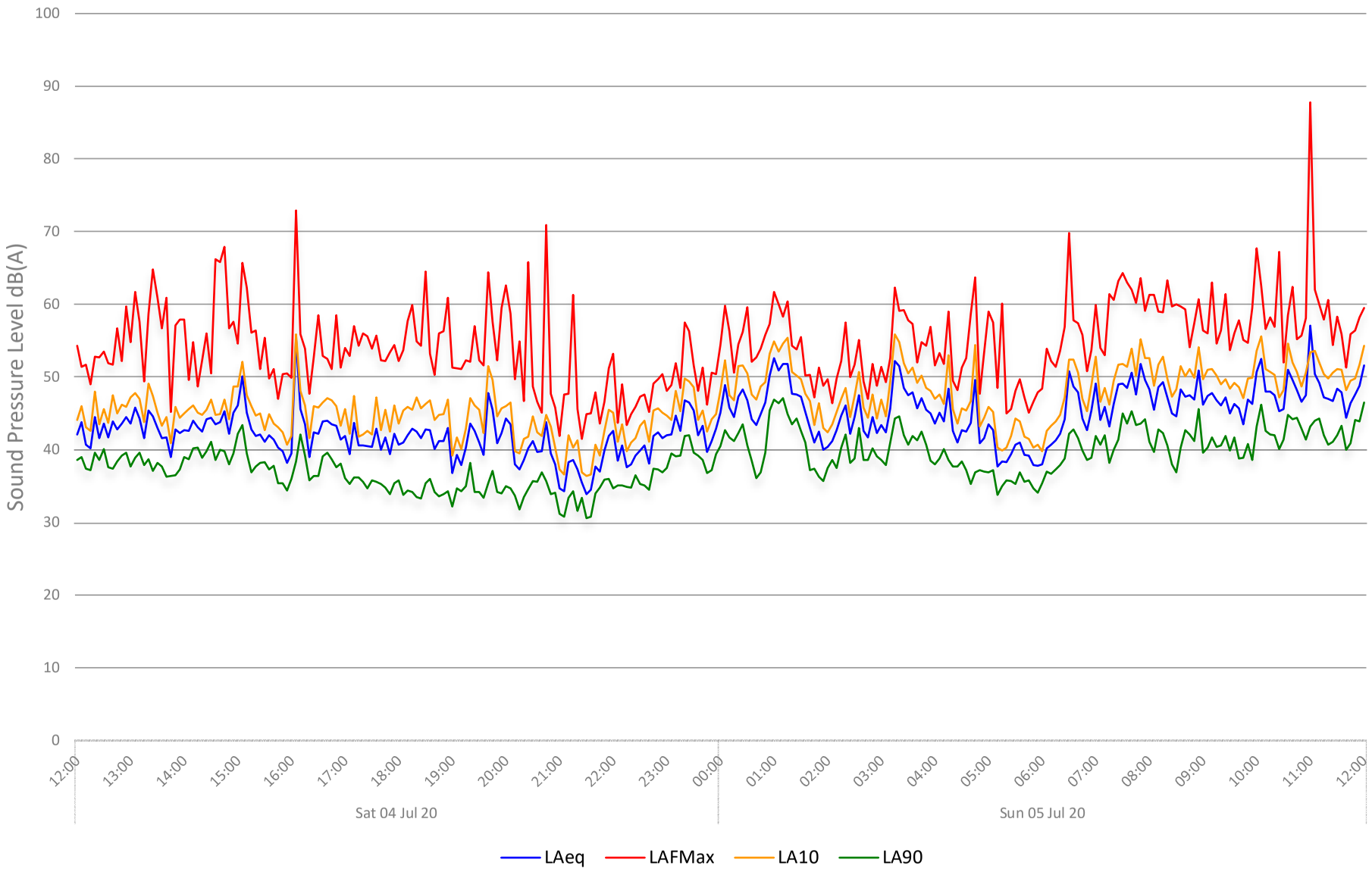
10-12 Old Station Business Park, Compton

Environmental Noise Time History: 3

Yew Tree Stables

VENTA ACOUSTICS

Figure VA2752/TH3



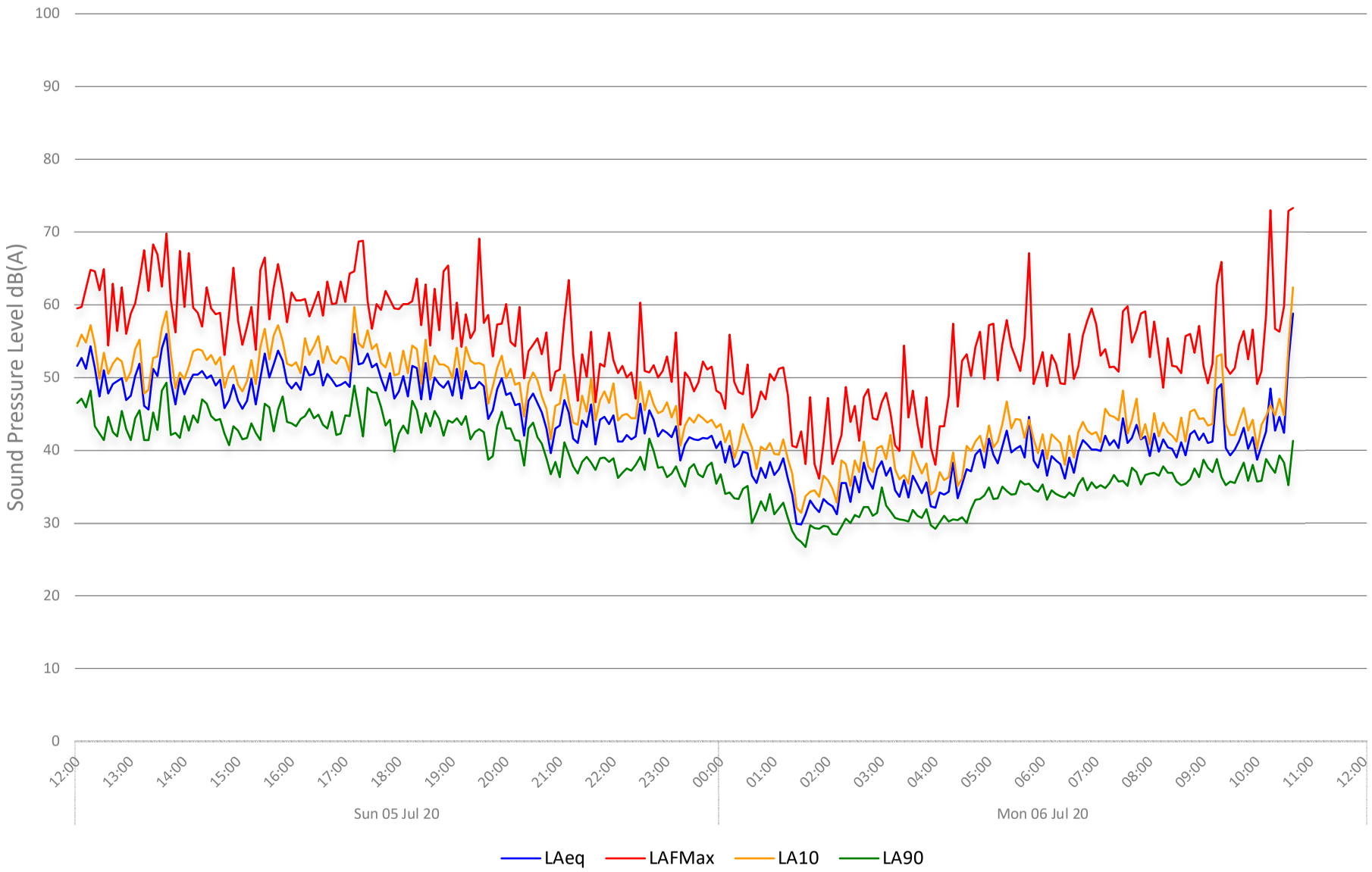
10-12 Old Station Business Park, Compton

Environmental Noise Time History: 4

Yew Tree Stables

VENTA ACOUSTICS

Figure VA2752/TH4



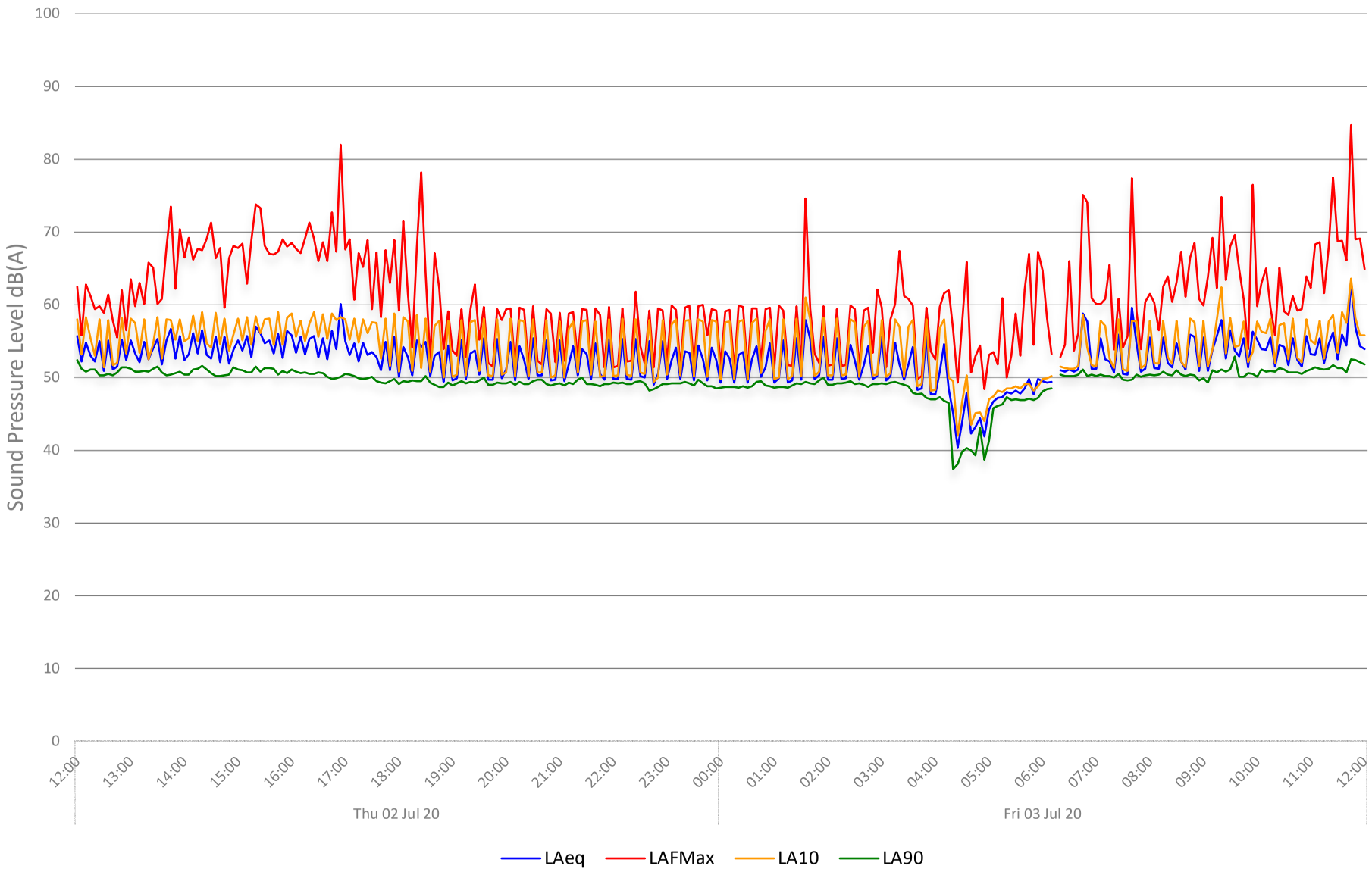
10-12 Old Station Business Park, Compton

Environmental Noise Time History: 5

Carbosynth

VENTA ACOUSTICS

Figure VA2752/TH5



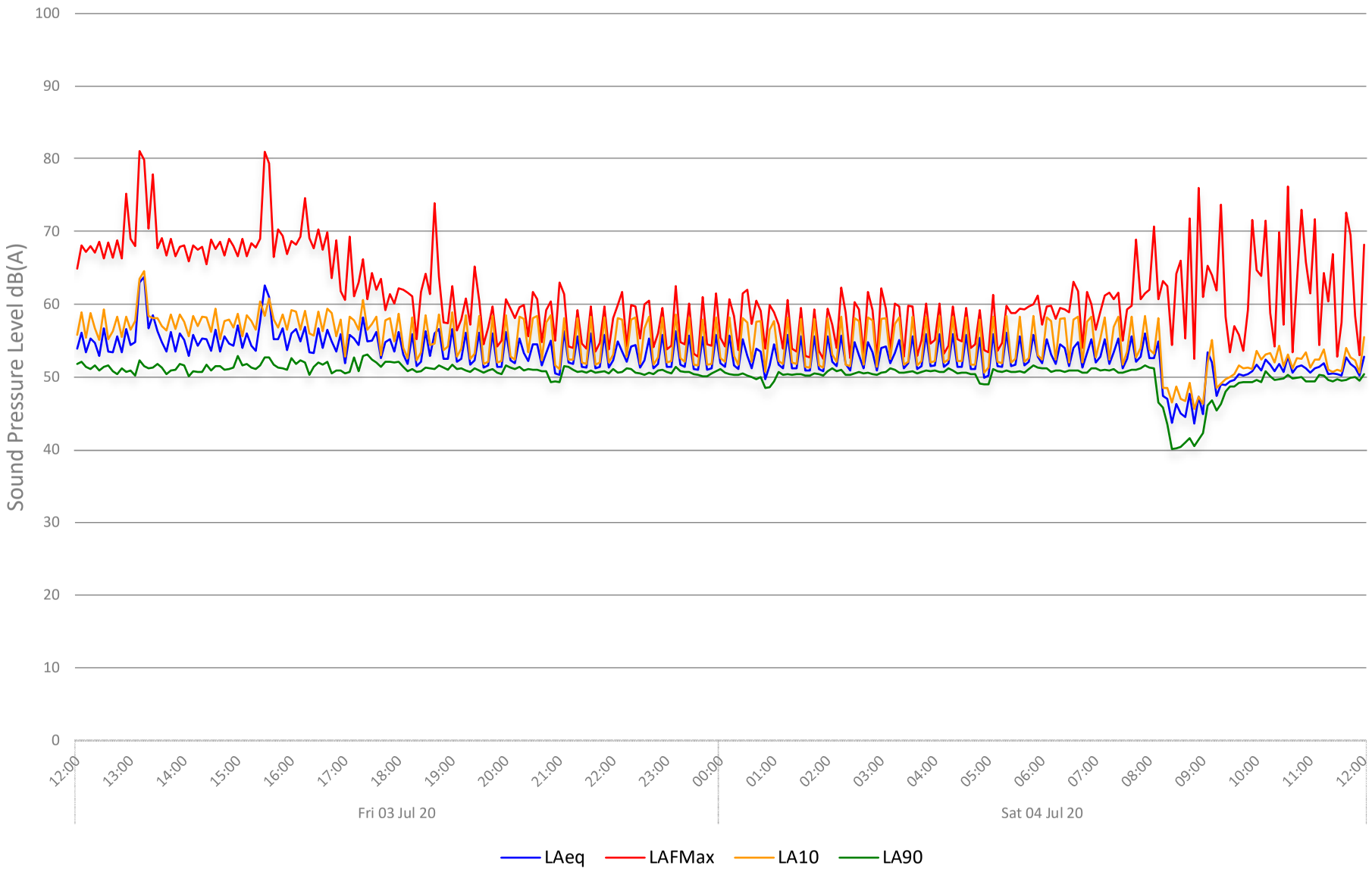
10-12 Old Station Business Park, Compton

Environmental Noise Time History: 6

Carbosynth

VENTA ACOUSTICS

Figure VA2752/TH6



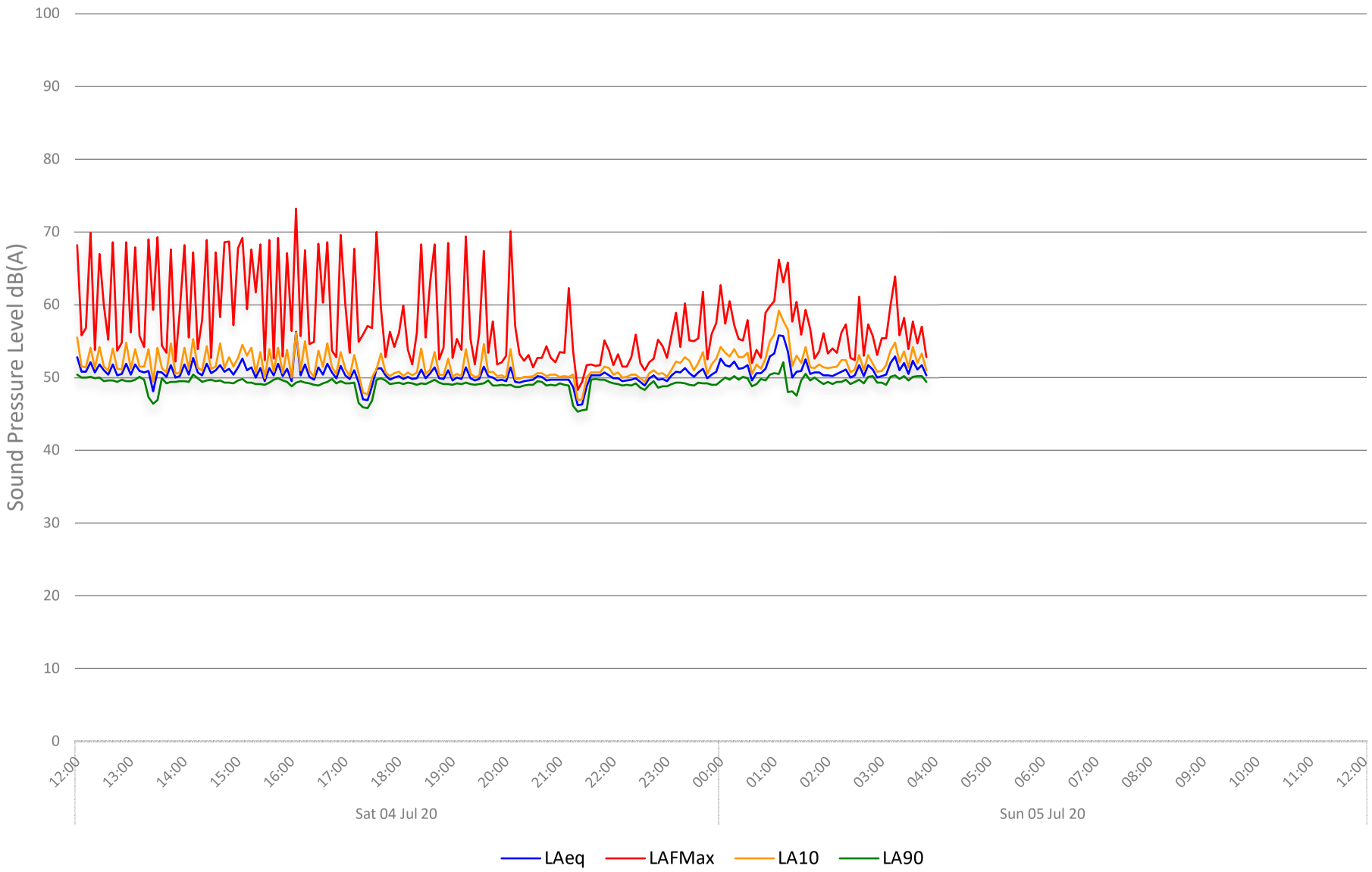
10-12 Old Station Business Park, Compton

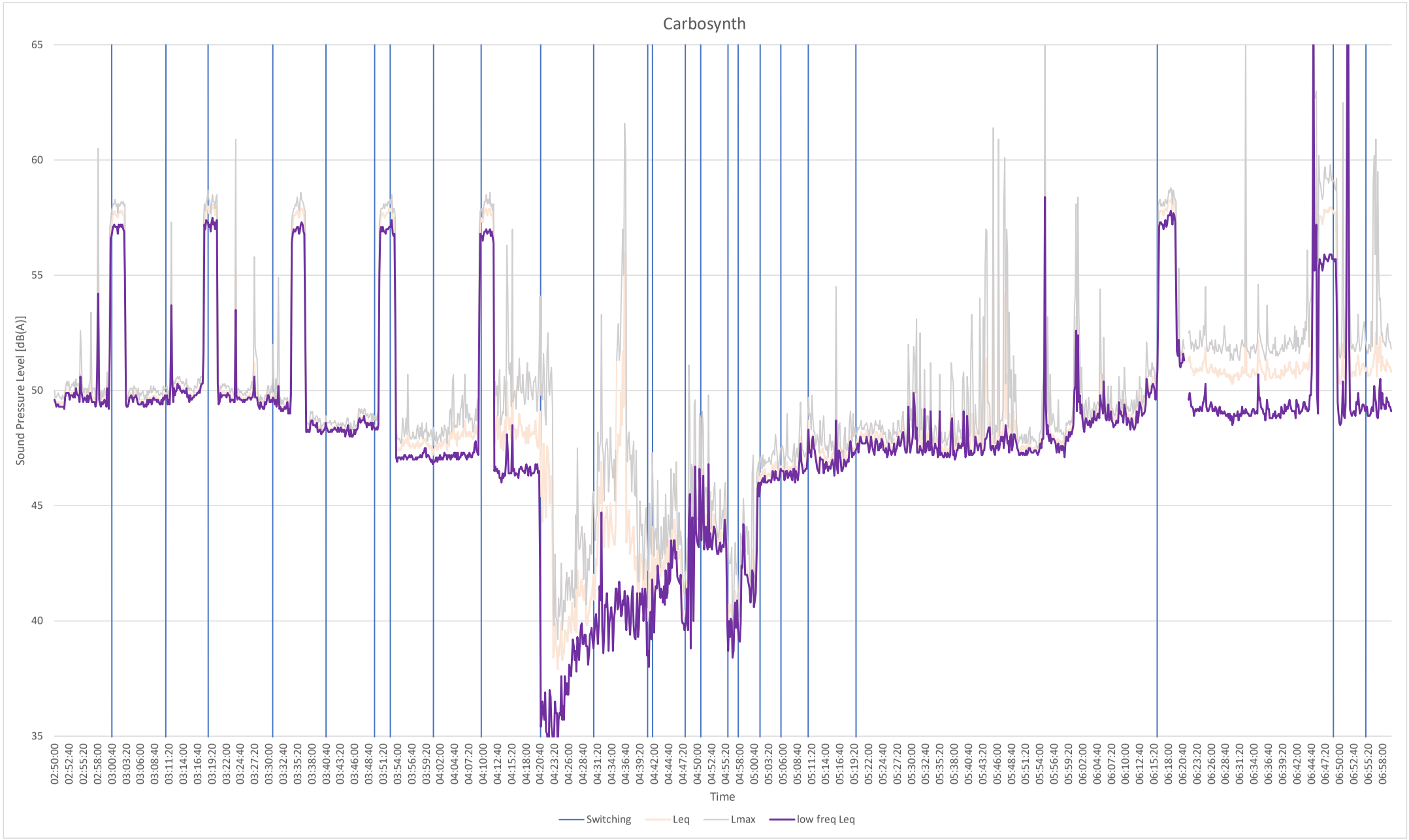
Environmental Noise Time History: 7

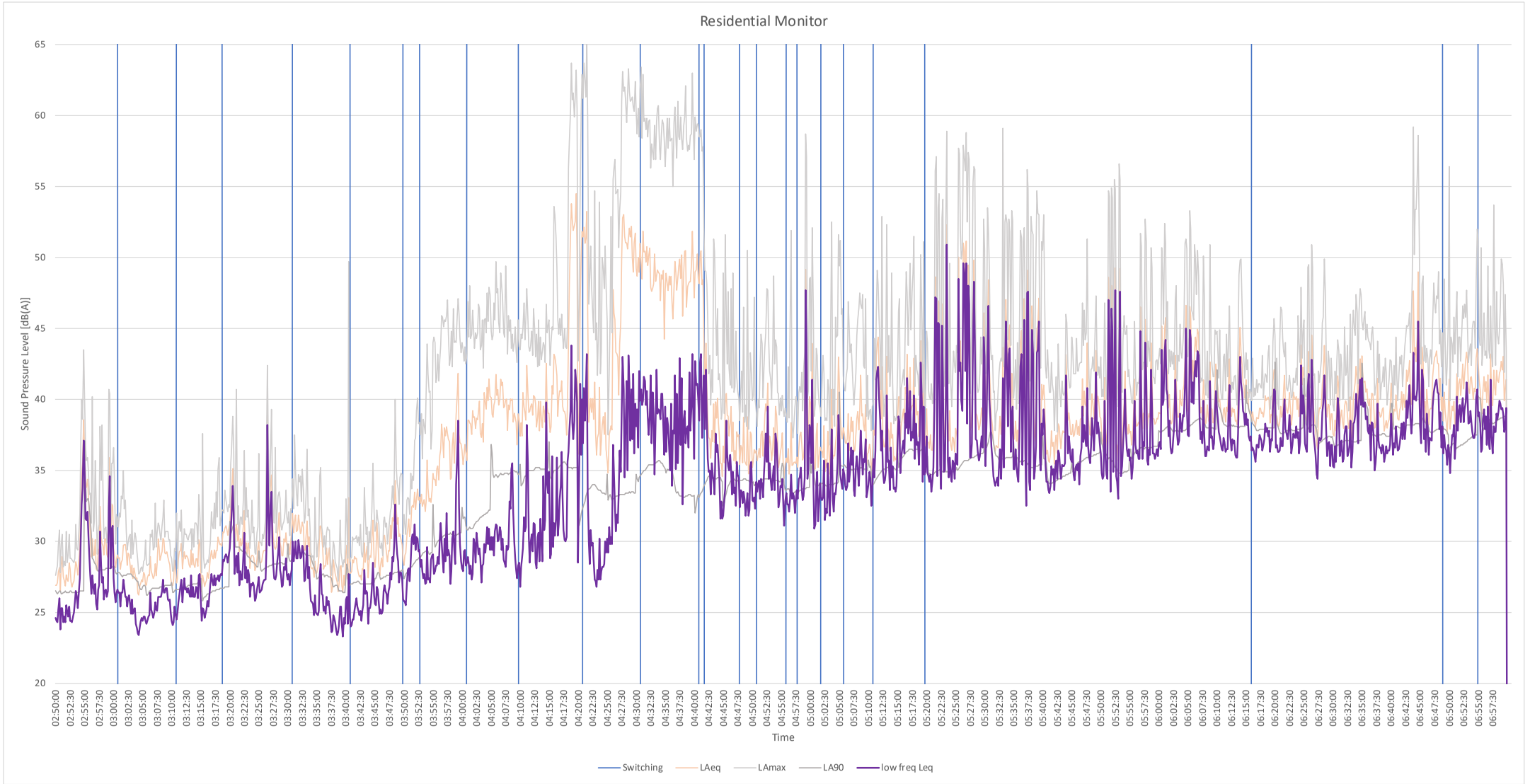
Carbosynth

VENTA ACOUSTICS

Figure VA2752/TH7




Carbosynth
Sound Pressure Level [dB(A)]
65
60
55
50
45
40
35
Time
02:50:00
02:52:40
02:55:20
02:58:00
03:00:40
03:03:20
03:06:00
03:08:40
03:11:20
03:14:00
03:16:40
03:19:20
03:22:00
03:24:40
03:27:20
03:30:00
03:32:40
03:35:20
03:38:00
03:40:40
03:43:20
03:46:00
03:48:40
03:51:20
03:54:00
03:56:40
03:59:20
04:02:00
04:04:40
04:07:20
04:10:00
04:12:40
04:15:20
04:18:00
04:20:40
04:23:20
04:26:00
04:28:40
04:31:20
04:34:00
04:36:40
04:39:20
04:42:00
04:44:40
04:47:20
04:50:00
04:52:40
04:55:20
04:58:00
05:00:40
05:03:20
05:06:00
05:08:40
05:11:20
05:14:00
05:16:40
05:19:20
05:22:00
05:24:40
05:27:20
05:30:00
05:32:40
05:35:20
05:38:00
05:40:40
05:43:20
05:46:00
05:48:40
05:51:20
05:54:00
05:56:40
05:59:20
06:02:00
06:04:40
06:07:20
06:10:00
06:12:40
06:15:20
06:18:00
06:20:40
06:23:20
06:26:00
06:28:40
06:31:20
06:34:00
06:36:40
06:39:20
06:42:00
06:44:40
06:47:20
06:50:00
06:52:40
06:55:20
06:58:00
Switching
Leq
Lmax
low freq Leq


Residential Monitor
Sound Pressure Level [dB(A)]
65
60
55
50
45
40
35
30
25
20
Time
02:50:00
02:52:30
02:55:00
02:57:30
03:00:00
03:02:30
03:05:00
03:07:30
03:10:00
03:12:30
03:15:00
03:17:30
03:20:00
03:22:30
03:25:00
03:27:30
03:30:00
03:32:30
03:35:00
03:37:30
03:40:00
03:42:30
03:45:00
03:47:30
03:50:00
03:52:30
03:55:00
03:57:30
04:00:00
04:02:30
04:05:00
04:07:30
04:10:00
04:12:30
04:15:00
04:17:30
04:20:00
04:22:30
04:25:00
04:27:30
04:30:00
04:32:30
04:35:00
04:37:30
04:40:00
04:42:30
04:45:00
04:47:30
04:50:00
04:52:30
04:55:00
04:57:30
05:00:00
05:02:30
05:05:00
05:07:30
05:10:00
05:12:30
05:15:00
05:17:30
05:20:00
05:22:30
05:25:00
05:27:30
05:30:00
05:32:30
05:35:00
05:37:30
05:40:00
05:42:30
05:45:00
05:47:30
05:50:00
05:52:30
05:55:00
05:57:30
06:00:00
06:02:30
06:05:00
06:07:30
06:10:00
06:12:30
06:15:00
06:17:30
06:20:00
06:22:30
06:25:00
06:27:30
06:30:00
06:32:30
06:35:00
06:37:30
06:40:00
06:42:30
06:45:00
06:47:30
06:50:00
06:52:30
06:55:00
06:57:30
Switching
LAeq
LAmax
LA90
low freq Leq

APPENDIX B

VA2752 - 10-12 Old Station Business Park, Compton

Noise Impact Assessment

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Container 1	Lp @ 10m	65	39	37	49	43	43	50	49	45	40	30	28	34	35	36	**52**
Distance Loss	To 125m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Level at receiver		**43**	**17**	**16**	**27**	**21**	**21**	**28**	**27**	**23**	**19**	**8**	**6**	**12**	**13**	**14**	**25**

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Container 3	Lp @ 10m	52	54	48	49	55	49	50	59	55	40	41	43	38	44	44	**49**
Distance Loss	To 125m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Level at receiver		**30**	**33**	**26**	**27**	**33**	**27**	**28**	**37**	**33**	**18**	**19**	**21**	**16**	**22**	**22**	**32**

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
container 2	Lp @ 10m	55	39	47	61	31	48	49	45	45	51	47	45	41	37	39	**51**
Distance Loss	To 125m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Level at receiver		**33**	**17**	**25**	**40**	**9**	**26**	**27**	**23**	**23**	**29**	**25**	**23**	**19**	**15**	**17**	**30**

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Container 4 - continuous	Lp @ 10m	56	38	53	52	44	44	47	48	45	38	41	38	34	31	33	**48**
Screening (by bank)		-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	
Distance Loss	To 125m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Level at receiver		**29**	**11**	**26**	**25**	**17**	**17**	**20**	**21**	**18**	**11**	**14**	**11**	**7**	**4**	**6**	**19**

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Container 4 – loud periods	Lp @ 10m	60	50	51	61	58	53	47	53	52	55	49	47	44	44	43	**57**
Screening		-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	
Distance Loss	To 125m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Level at receiver		**33**	**23**	**24**	**34**	**31**	**26**	**20**	**26**	**25**	**28**	**22**	**20**	**17**	**17**	**16**	**29**

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Unit 10-12 Chiller + Fan	Lp @ 10m	63	56	57	55	49	49	49	49	49	51	43	46	49	42	38	**52**
Distance Loss	To 125m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Level at receiver		**41**	**34**	**35**	**33**	**27**	**27**	**27**	**27**	**27**	**30**	**21**	**24**	**27**	**20**	**17**	**31**

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Warehouse Cold Rooms	Lp @ 10m	48	34	34	45	32	36	34	36	45	41	40	27	20	23	29	**39**
Screening (by bank)		-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	
Distance Loss	To 125m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Level at receiver		**21**	**7**	**7**	**18**	**5**	**9**	**7**	**9**	**18**	**14**	**13**	**0**	**-7**	**-4**	**2**	**16**

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Warehouse Extract Fan	Lp @ 10m	48	48	36	52	48	42	41	52	45	43	38	37	36	37	38	**46**
Distance Loss	To 125m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Level at receiver		**26**	**26**	**14**	**30**	**26**	**20**	**19**	**30**	**23**	**21**	**16**	**15**	**14**	**15**	**16**	**26**

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Unit 7-9 AHU Extract Fans	Lp @ 10m	44	42	46	50	42	44	43	45	52	46	34	-	30	-	-	**47**
Distance Loss	To 145m	-23	-23	-23	-23	-23	-23	-23	-23	-23	-23	-23	-23	-23	-23	-23	
Level at receiver		**21**	**19**	**23**	**27**	**18**	**21**	**20**	**22**	**29**	**23**	**11**	**-23**	**7**	**-23**	**-23**	**24**

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Unit 7-9 Chiller and supply	Lp @ 10m	51	46	49	55	38	42	43	43	45	44	37	37	37	34	31	**46**
Distance Loss	To 125m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Level at receiver		**29**	**24**	**27**	**33**	**16**	**20**	**21**	**21**	**23**	**22**	**15**	**15**	**15**	**12**	**9**	**24**

		50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Units 10-12 Extract Fan	Lp @ 10m	61	54	59	62	49	54	54	48	54	50	46	42	41	38	39	**52**
Distance Loss	To 125m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Level at receiver		**40**	**32**	**37**	**40**	**27**	**32**	**33**	**26**	**32**	**28**	**24**	**20**	**19**	**17**	**17**	**31**

	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz
NANR Reference Curve	**43**	**42**	**40**	**38**	**36**	**34**

	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	dB(A)
Cumulative Level - Containers	**44**	**33**	**30**	**41**	**35**	**32**	**33**	**38**	**35**	**32**	**28**	**26**	**23**	**24**	**24**	**36**
Cumulative Level - Equipment Exclude Containers	**31**	**29**	**29**	**35**	**27**	**25**	**25**	**31**	**31**	**27**	**20**	**18**	**18**	**17**	**17**	**30**
Cumulative Level - All Equipment	**44**	**35**	**33**	**42**	**36**	**33**	**33**	**39**	**36**	**33**	**28**	**27**	**24**	**25**	**25**	**37**