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AGL ENERGY LIMITED

WAUKIVORY PILOT PROJECT

FEBRUARY 2015 NOISE COMPLIANCE SURVEY

REPORT J0215-04-R1
18 MARCH 2015

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1. INTRODUCTION

This report presents results from a noise compliance survey at specified receptors in the vicinity of the Waukivory Pilot Project (the project) which is part of the Gloucester Gas Project being developed by AGL Energy Limited. The project includes construction and operation of the following infrastructure:

- Gas collection equipment fitted to four existing gas wells known as WK11, WK12, WK13 and WK14 located approximately 2 km south of Gloucester, NSW;
- Trenching and installation of gas collection pipelines (gathering lines) between the four wells;
- Trenching and installation of a water transfer pipeline between the southern well (WK13) to two surface dams located approximately 1 km and 2.5 km south of the wells;
- Directional drilling to install gathering lines and the water transfer pipeline under the Avon River, Waukivory Creek and Fairbairns Road;
- Gravel hardstand areas around each well, security fences and other ancillary infrastructure;
- Fracture stimulation of the coal seam around each well to increase gas flow; and
- Ongoing monitoring of gas production from the wells over the life of the project.

Diesel generators located at each of the four gas well sites were operational 24 hours per day during the noise survey. Regular access to and from the well sites by AGL staff and contractors for maintenance works, fuelling, inspections and security during daylight hours, with security inspections continuing during the evening and night, were typical of normal operating conditions.

The project is subject to Environment Protection Licence (EPL) 20358 issued by the Environment Protection Authority (EPA). This report has been commissioned by AGL Energy Limited (AGL) to address Condition M10.1 of the EPL which requires a noise compliance survey at specified receptors during each six month period. The noise survey occurred from 24 to 27 February 2015.

The noise compliance survey described in this report follows previous operator attended construction noise surveys completed in August, September and October 2014.

1.1. Glossary

The following acoustical terms are used in this report:

Sound Pressure	Small air pressure variations above and below normal atmospheric pressure that are perceived by human ears as sound.
Frequency	The rate of sound pressure fluctuations per second, expressed as cycles per second or hertz (Hz). Human ears in good condition can typically detect sound in the frequency range 20 Hz to 20,000 Hz (20 kHz), depending on sound level.
Decibels, dB	A noise level unit based on a logarithmic scale of pascals of sound pressure above and below atmospheric pressure. Expressing a sound pressure level in decibels implies root-mean-squared (RMS) sound pressure unless explicitly stated otherwise. Human ears in good condition can typically detect sound pressures from the threshold of perception at 0 dB (20 uPa) to the threshold of pain at 140 dB (200 Pa), depending on frequency. An increase of 10 dB is perceived as an approximate doubling of sound level by a human ear.
dBL	Linear decibels, the same as dB but used to explicitly define a decibel scale in the absence of any frequency weighting.

dBA	A-weighted decibels, where the A weighting means frequencies below 500Hz and above 10kHz are artificially reduced to approximate the frequency response of an average human ear. Most sound monitoring instruments include an A-weighting option, enabling direct measurement of noise levels in dBA.
LA90	The A-weighted noise level exceeded 90% of the time (which can be thought of as the quietest 10% of the time) over a defined measurement period, usually 15 minutes or one hour, and widely accepted as the background noise level.
LA90,15min	Same as LA90 with the measurement period specifically stated.
LAeq	The A-weighted equivalent continuous, or logarithmic average, noise level over a defined time period either measured or predicted at a specific location.
LAeq,15min	Same as LAeq with the measurement period specifically stated.
Background Level	see LA90.

2. EPL CONDITIONS

Relevant conditions from EPL 20358 dated 11 February 2015 are reproduced below:

L6 Noise limits

L6.1 Noise generated at the premises must not exceed the noise limits in the table below:

Locality and Location	***Day – LAeq(15 minute)***	***Evening – LAeq(15 minute)***	***Night – LAeq(15 minute)***	***Night – LA1(1 minute)***
All privately owned residences not subject to a private negotiated agreement	*35dB(A)*	*35dB(A)*	*35dB(A)*	*45dB(A)*

L6.2 For the purpose of Condition L6.1:

a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;

b) Evening is defined as the period 6pm to 10pm Monday to Sunday and Public Holidays; and

c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and Public Holidays.

L6.3 The noise limits set out in the Noise Limits table under Condition L6.1 apply all meteorological conditions except for the following:

a) Wind speeds greater than 3 metres/second at 10 metres above ground level; or

b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or

c) Stability category G temperature inversion conditions.

L6.4 For the purposes of condition L6.3:

a) Data recorded by the meteorological station identified as EPA Identification Point 26 must be used to determine meteorological conditions; and

b) Temperature inversion conditions (stability category) are to be determined by the sigma-theta method referred to in Part E4 of Appendix E to the NSW Industrial Noise Policy.

L6.5 To determine compliance:

a) with the LAeq(15 minute) noise limits in condition L6.1, the noise measurement equipment must be located:

- *approximately on the property boundary, where any dwelling is situated 30m or less from the property boundary closest to the premises; or*
- *within 30 metres of a dwelling facade, but not closer than 3 metres, where any dwelling on the property is situated more than 30 metres from the property boundary closest to the premises; or*
- *where applicable, within approximately 50 metres of the boundary of a National Park or a Nature Reserve.*

b) with the LA1(1 minute) noise limits in condition L6.1, the noise measurement equipment must be located within 1 metre of a dwelling facade;

c) with the noise limits in condition L6.1, the noise measurements equipment must be located:

- *at the most affected point at a location where there is no dwelling at the location; or*
- *at the most affected point within an area at a location prescribed by Condition L6.5(a) or L6.5(b).*

L6.6 A non-compliance of condition L6.1 will still occur where noise generated from the premises in excess of the appropriate limit is measured:

- *at a location other than an area prescribed by conditions L6.5(a) and L6.5(b); and/or*
- *at a point other than the most affected point at a location.*

L6.7 For the purposes of determining the noise generated at the premises the modification factors in Section 4 of the NSW Industrial Noise Policy must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

L6.8 The limits contained in Condition L6.1 do not apply to fracture stimulation, well workover or other planned maintenance activities undertaken during the following times:

a) between 7:00 am and 6:00 pm Monday to Friday; or

b) between 8:00 am and 1:00 pm Saturdays.

c) At no time on Sundays or Public Holidays.

L6.9 For the purpose of Condition L6.8, fracture stimulation includes any activity required to enable fracture stimulation to be undertaken, but does not include any earthworks, drilling or casing construction.

M10 Noise monitoring

M10.1 To assess compliance with the noise limits specified in this licence, attended noise monitoring must be undertaken in accordance with Conditions L6.5 and:

a) at each one of the locations identified in the table below, as shown on:

Map titled 'AGL Gloucester Gas Project - Waukivory Area', EPA reference DOC14/20568.

b) occur every 6 months in a reporting period;

c) occur during each day, evening and night period as defined in the NSW Industrial Noise Policy for a minimum of:

- *1.5 hours during the day;*
- *30 minutes during the evening; and*
- *1 hour during the night.*

d) occur for three consecutive operating days.

Location	*Frequency*
Lot 2, DP 795361	*Every 6 Months*
Lot 11, DP 841445	*Every 6 Months*

Noise Compliance Assessment Report

R4.4 A noise compliance assessment report must be submitted to the EPA within 30 days of the completion of each noise monitoring event. The assessment must be prepared by a suitably qualified and experienced acoustical consultant and include:

a) an assessment of compliance with noise limits presented in Condition L6.1; and

b) an outline of any management actions taken within the monitoring period to address any exceedences of the limits contained in Condition L6.1.

3. RECEPTORS

AGL previously commissioned the *Waukivory Pilot Project Construction Noise Management Plan* (CNMP) (EMGA Mitchell McLennan, 6 August 2014) to manage construction noise levels at receptors in response to Condition G2.2 of the EPL. The CNMP identified potentially sensitive receptors and assigned identification numbers R1 to R10 as described in Table 1 and shown on the plan reproduced in Appendix A.

Table 1: Identified Residential Receptors (from Table 1.2 in the CNMP).

Location	Address	Coordinates (MGA Zone 56)
R1 [1]	20 Grantham Road, Forbesdale (Lot 11 DP 841445)	402023, 6453041
R2	Intersection of Fairbairns Lane and North Coast Railway	401824, 6452610
R3	176 Fairbairns Road, Forbesdale (Lot 2 DP 795361)	402095, 6452080
R4 [1]	237 Fairbairns Road, Forbesdale	402510, 6451653
R5 [1]	197 Fairbairns Road, Forbesdale	403184, 6452184
R6	114 Maslens Lane, Gloucester	402747, 6453425
R7	304 Fairbairns Road, Forbesdale	402282, 6451332
R8	305 Fairbairns Road, Forbesdale	402822, 6450969
R9	Lot 881 Fairbairns Road, Forbesdale	402942, 6450475
R10	384 Fairbairns Road, Forbesdale	403012, 6450236

1 Receivers R1, R4 and R5 are owned by a mining company.

Condition M10.1a identifies two receptor locations for inclusion in the noise compliance survey and refers to a map showing the location of the two receptors, however the lot and DP references do not appear to match the locations shown on the map. The receptors identified in condition M10.1a are referred to in the CNMP as receptors R1 and R3, while the map indicates noise monitoring is required at receptors R2 (EPA noise monitoring site NWK2) and R3 (EPA noise monitoring site NWK3).

In the absence of a resolution to this inconsistency in the EPL at the time of the noise compliance survey, monitoring occurred at all three receptors R1, R2 and R3.

4. NOISE CRITERIA

Noise criteria for the assessment are sourced from EPL conditions L6.1 and L6.5 which specify the following noise limits and measurement locations:

- 35 LAeq,15min measured at the most affected point within 30 m of a residence during the day, evening and night; and
- 45 LA1,1min measured 1 m from the most affected bedroom window during the night only.

According to EPL condition L6.3, the noise limits apply under the following weather conditions:

- Stability categories A to E and wind speeds of 3 m/s or less at 10 m above ground level; and
- Stability category F and wind speeds of 2 m/s or less at 10 m above the ground.

The noise limits do not apply under higher wind speed or stability category G conditions as the strong noise enhancement and potentially higher noise levels at receptors caused by such conditions are considered atypical for this area.

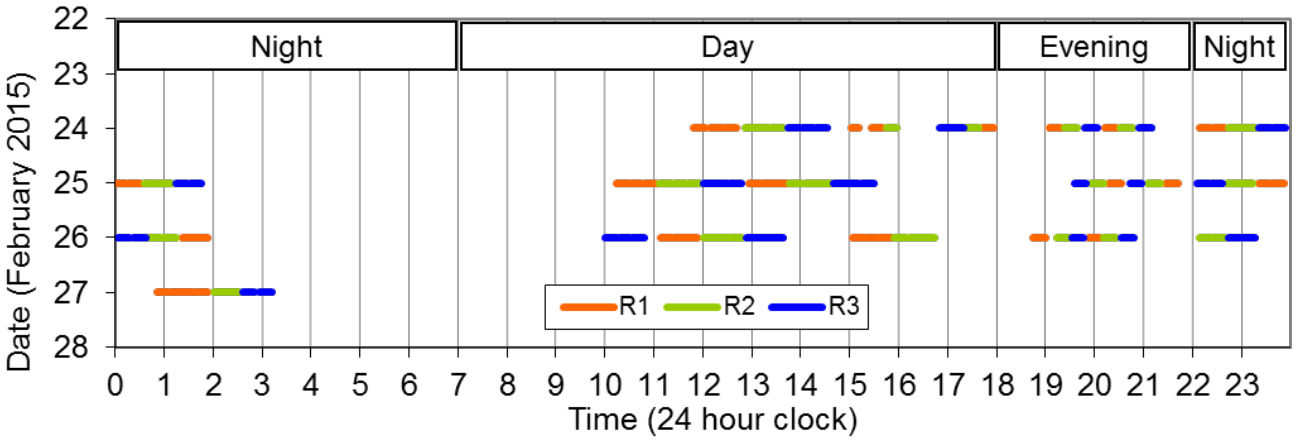
5. SURVEY METHODOLOGY

The noise survey was designed to satisfy all relevant EPL conditions including condition M10.1 which requires operator attended noise measurements to be taken:

- a minimum of 1.5 hours during the day, 30 minutes during the evening and 1 hour during the night; and
- for three consecutive days.

Figure 1 presents the noise survey schedule which indicates the date and time of noise measurements at each receptor.

Figure 1: Noise Survey Schedule, February 2015.



The noise survey was consistent with relevant recommendations in the *NSW Industrial Noise Policy* (EPA, 1999) (INP). The survey was programmed to occur from Tuesday 24 February to Friday 27 February 2015, representing typical operating days. Noise measurements were taken using a Svantek 957 sound level analyser programmed to measure and store one second 1/3 octave Leq data in each 15 minute period, with results subsequently processed to determine 15 minute average and percentile noise levels.

Instrument calibration was checked at the beginning and end of each day using an 01dB Cal-01 acoustic calibrator which produces 94 dB at 1kHz. Copies of current calibration certificates for these instruments, from a NATA-accredited laboratory, have not been attached to this report but are available upon request.

The analyser microphone was mounted on a pole projecting approximately 1 m above the front of a vehicle and 2.3 m above the ground. While this microphone height is above the usual range of 1.2 to 1.5 m above the ground as recommended in Australian Standard 1055, the noise level difference from a remote and line of sight source is not significant. If anything, noise levels from insects and other local extraneous sources would be generally higher and noise levels from operating plant associated with the project would be slightly lower if the microphone were located at the standard height, therefore the results of this assessment are conservative.

The separate noise contribution from the project was estimated from the 1/3 octave percentile spectra and from observations and notes compiled during each 15 minute period. Where the project was inaudible or barely audible, the project noise contribution could not be directly measured and an upper limiting noise level or a less accurate estimated noise level is generally reported.

5.1. Determining Project Noise Contribution

Project related noise was not clearly audible or measurable at any time during the noise survey and therefore cannot be reported with any accuracy. Indirect methods to estimate the project noise contribution were therefore required.

Measured total dBA noise levels indicate the level of noise heard by a human ear from all noise sources, including project related and non-project sources, operating at the time. The ear can detect and differentiate sound frequencies generally in the range 20 Hz to 20 kHz and noise from various sources can often be quantified by separately attributing noise levels depending on frequency, even in cases where noise from a specific source is not clearly audible.

Instruments used in the survey returned noise measurement data in 1/3 octave bands from 20 Hz to 20 kHz. Prior noise monitoring experience and detailed analysis of the results obtained for this noise survey indicates the following frequency bands are significant:

- Insect noise is primarily produced in the frequency range 2500 to 5000 Hz;
- Noise from frogs and similar animals tends to be produced in the frequency range 1600 to 2500 Hz;
- Noise from birds varies considerably, however most bird noise is produced at frequencies above 1000 Hz; and
- The project's generator units produce electrical power at the usual frequency of 50 Hz, therefore it is reasonable to expect noise from the diesel generators to occur at 50 Hz or at multiples of 50 Hz. Measured noise levels consistently show a peak at 50 Hz with a smaller peak at 100 Hz, generally in the LA90 and LAmin spectra which indicate noise from constant rather than intermittent sources.

Other sources such as road and rail traffic generally produce noise at a wide range of frequencies, with dominant frequencies often changing for each vehicle passby event, therefore these sources cannot be separately identified by frequency in any reliable manner.

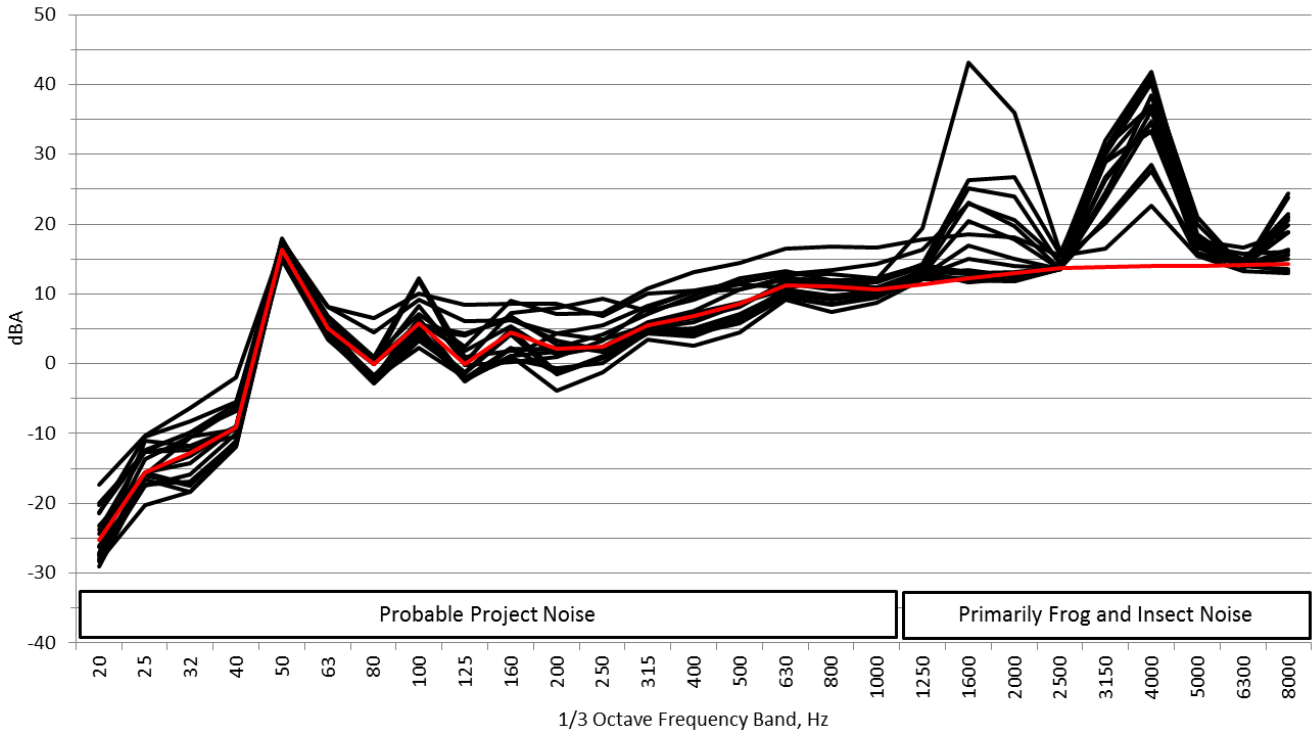
Noise from the project can therefore be generally identified in the 50 Hz and 100 Hz frequency bands. Project noise would also be produced at other frequencies, however cannot reliably be identified and separately quantified at those frequencies. The following strategy has therefore been adopted to estimate the project noise contribution in each 15 minute noise measurement period:

- Estimate the total dBA project noise level in 15 minute periods where project noise is most audible;
- Note the magnitude of the noise level peaks at 50 Hz and 100 Hz and correlate these peaks to total dBA project noise levels;
- Use the 50 Hz and 100 Hz peaks to estimate total dBA noise levels for all 15 minute measurement periods.

Project noise was generally most audible at Receptor R3 during the evening and night, and audible to a lesser extent at Receptor R2. Project related sources operate continuously and are therefore more likely to be represented by the LA90 percentile (the quietest 10% of the time) in each 15 minute period. Figure 2 shows the various LA90 noise level spectra measured at R3 during the evening and night (in black) and the median noise level from the project excluding noise from insects and frogs (in red).

Figure 2 indicates measured noise in the 20 Hz to 1000 Hz frequency bands is most likely due to the project while noise in frequency bands above 1000 Hz is primarily due to other sources such as insects and frogs. The red line in Figure 2 indicates the estimated median noise level excluding insect and frog noise. The very small variation in measured noise levels in the 50 Hz frequency band indicates this band is the most reliable indicator of project noise level.

Figure 2: Measured Noise Level Spectra and Estimated Project Noise, R3 Evening and Night.



A total project noise level of 25 dBA has been calculated by summing noise levels in all frequency bands for the red median line, which is 9 dBA above the measured median noise level of 16 dBA in the 50 Hz frequency band. These results indicate the project noise level can be estimated by adding 9 dBA to the measured noise level in the 50 Hz band for all 15 minute periods. This strategy provides only approximate results, however no other reliable method is available to determine project noise levels that are well below the background level.

The median noise spectrum shown in Figure 2 shows A-weighted noise levels and can be converted to C-weighted levels to determine if a 5 dBA low frequency penalty is required, as described in the NSW Industrial Noise Policy (INP) and required by EPL condition L6.7. A total noise level of 46 dBC is more than 15 dB above the 25 dBA level, therefore a 5 dBA low frequency penalty is required to minimise the intrusiveness of project noise at each receptor. The median spectrum also satisfies the definition of tonal noise as described in Table 4.1 of the INP, however an additional tonal penalty is not required as the tone is in the low frequency range and is therefore covered by the low frequency penalty. Project noise is not impulsive or intermittent, therefore no other modifying factors are required.

6. ASSESSMENT

6.1. Project Operating Conditions

The project currently consists of four gas wells connected by pipelines known as gathering lines. As construction of the wells has only recently been completed, water is currently being extracted from the wells to prepare for gas production. Each well is fitted with a dewatering unit which consists of a diesel powered generator and an electrically driven pump, however the pumps could not be used at the time of the noise survey and the diesel powered generators were operating alone.

As a silenced diesel generator produces significantly more noise than an electric pump, differences in received noise levels with the pumps operating or not operating would be insignificant and the operating conditions during the noise survey were therefore representative of normal operation of the project.

6.2. Weather Conditions

EPL condition L6.4 requires data from the weather station to be used to determine weather conditions during the noise survey. Weather conditions are continuously monitored by AGL's weather station which is located on the Tiedman property approximately 3.2 km south of Receptor R3 and listed in EPL condition P1.1 as EPA Identification Point 26. Hourly data from the weather station were supplied by AGL for analysis and are shown in Figure 3.

Figure 3: Weather Conditions, February 2015.

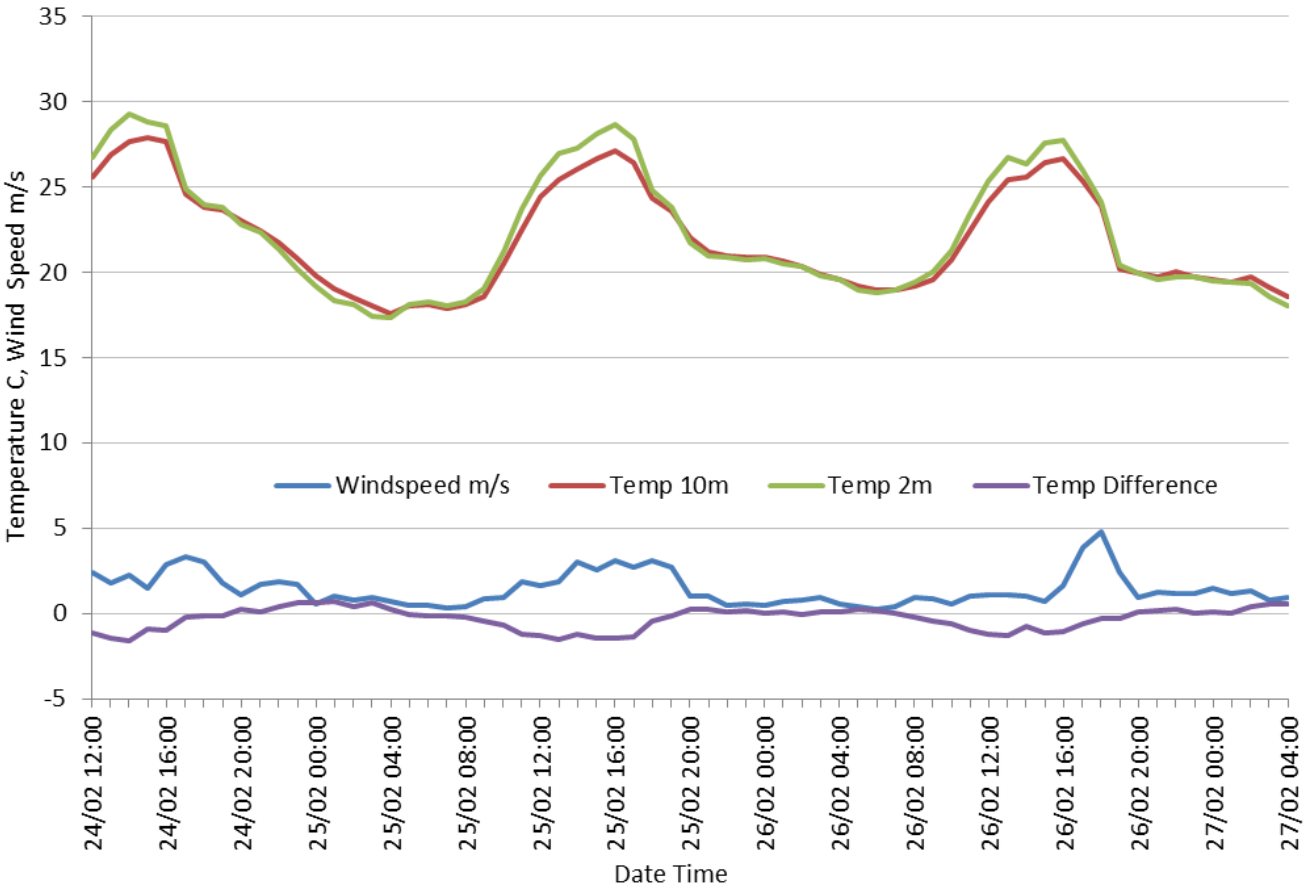


Figure 3 indicates weather conditions were generally acceptable for noise monitoring with wind speeds typically less than 3 m/s. The noise survey was interrupted by rain at the following times:

- During the day of 24 February at approximately 14:30 and again at 15:15 and 16:00; and

- During the night of 26 February at approximately 23:15.

The regular rain interruptions during the day of 24 February resulted in three 15 minute noise measurement periods being truncated as noted in the results section of this report. Two 15 minute noise measurements were omitted, and the truncated noise measurements could not be repeated, due to lack of available time before the 18:00 end of the 'day' as defined in EPL condition L6.2 and relevant NSW government noise policies. Additional rain periods were noted during the three days, however they did not significantly interfere with the survey or prevent sufficient noise data from being collected.

Received noise levels depend on the noise propagation conditions from source to receiver which are affected by a number of weather related factors including:

- Air temperature;
- Relative humidity;
- Vertical temperature gradient (temperature inversion or lapse); and
- Wind speed and direction.

Air temperature, relative humidity, wind speed and wind direction are all directly measured and reported by the weather station. The vertical temperature gradient from ground level to a height of nominally 100 m above the ground cannot reasonably be measured directly as this would require a temperature sensor on a 100 m tower, therefore alternative means of estimating the temperature gradient are required.

EPL condition L6.4 requires temperature inversions to be estimated according to the sigma theta method as described in Part E4 of Appendix E of the INP. This method provides an approximate indication of the times inversions are likely to exist based on the variation of wind direction in a measurement period such as one hour, however the inversion strength cannot be reliably estimated from this method. The weather station does not currently report wind sigma-theta therefore this method cannot reasonably be used.

The weather station does, however, measure and report the air temperature at two different heights of 2 m and 10 m above the ground. According to a detailed analysis of vertical temperature gradients described in *Discussion Paper – Validation of Inversion Strength Estimation Method* (EPA, March 2014), temperature measurement data over a small height interval such as 8 m cannot be used to directly calculate the inversion or lapse strength expressed in °C/100m, however the data can indicate the presence and relative strength of a temperature inversion during the night or a temperature lapse during the day with an accuracy and reliability at least equal to the more common sigma-theta method. The temperature difference is included in the weather data in Figure 3 and indicates:

- A typical difference of approximately -1.5 °C from noon to approximately 4 pm each day, indicating a generally sunny day with a temperature lapse equivalent to Stability Class A which tends to decrease received noise levels;
- A typical difference of zero at dawn and dusk as expected, which neither enhances or inhibits noise propagation from source to receptor; and
- A typical difference of up to 0.5 °C during the nights of 24 and 26 February which indicates a mild temperature inversion and a mild expected increase in received noise levels. No significant temperature difference existed during the night of 25 February, indicating no significant inversion developed during that night.

6.3. Receptor R1

Receptor R1 is located at the eastern end of Grantham Road, generally north of the project site. The property is owned by a mining company and the residence is currently occupied. AGL sought permission for noise survey personnel to access the property, however the occupants were away for the first few days of the survey. AGL advised noise survey personnel could only access the property on the western side of the

Main Northern Railway, resulting in a closest available noise monitoring location approximately 180 m west of the residence. Noise measurements were therefore taken approximately 10 m west of the Main Northern Railway at an elevated location adjacent to the rail overpass. As this noise monitoring location and the residence itself are a similar distance from the project and similarly exposed to project noise sources, the project noise contribution measured at the monitoring location would be very similar to the project noise contribution at the residence. No corrections are therefore required to measured project noise levels.

Table 2 shows a summary of measured noise levels at R1. Project related noise was not clearly audible or measurable at any time during the noise survey, therefore the project noise contribution was estimated by adding 9 dBA to the measured LA90 noise level in the 50 Hz frequency band as described in Section 5.1.

Table 2: Measured Noise Level Summary, Receptor R1, February 2015.

Noise Measurement Period				Total Measured Noise Level			Measured Noise Level in 50 Hz Frequency Band	Estimated Total Project Noise Level
Date	Start	End	Period	Lmax	LAeq	LA90	LA90	LAeq
24/2	11:48	12:03	Day	48	35	32	6	15
24/2	12:09	12:24		56	38	32	7	16
24/2	12:27	12:42		48	37	30	7	16
24/2	15:02	15:11 [1]		57	42	30	8	17
24/2	15:26	15:41		54	46	42	18	27 [2]
24/2	17:42	17:57		57	43	32	14	23
24/2	19:04	19:19	Evening	46	38	35	12	21
24/2	20:12	20:27		54	47	46	12	21
24/2	22:09	22:24	Night	49	42	41	11	20
24/2	22:25	22:40		48	41	40	11	20
25/2	00:00	00:15		43	38	36	9	18
25/2	00:17	00:32		41	39	38	10	19
25/2	10:15	10:30	Day	58	39	28	11	20
25/2	10:31	10:46		50	37	31	12	21
25/2	10:48	11:03		91	71	31	12	21
25/2	12:57	13:12		64	47	27	8	17
25/2	13:13	13:28		52	37	29	8	17
25/2	13:28	13:43		53	40	29	9	18
25/2	20:19	20:34	Evening	60	52	50	9	18
25/2	21:28	21:43		48	45	43	11	20
25/2	23:22	23:37	Night	49	46	43	12	21
25/2	23:37	23:52		51	44	39	11	20
26/2	01:23	01:38		49	44	40	11	20
26/2	01:39	01:54		45	44	41	11	20
26/2	11:09	11:24	Day	69	48	31	11	20
26/2	11:25	11:40		56	38	27	12	21
26/2	11:40	11:55		66	47	30	11	20
26/2	15:05	15:20		49	39	28	9	18
26/2	15:21	15:36		55	40	37	13	22
26/2	15:36	15:51		45	40	37	16	25
26/2	18:45	19:00	Evening	45	41	37	11	20
26/2	19:52	20:07		50	47	44	11	20

Noise Measurement Period				Total Measured Noise Level			Measured Noise Level in 50 Hz Frequency Band	Estimated Total Project Noise Level
Date	Start	End	Period	Lmax	LAeq	LA90	LA90	LAeq
27/2	00:51	01:06	Night	46	40	38	11	20
27/2	01:08	01:23		43	40	39	11	20
27/2	01:23	01:38		42	39	37	12	21
27/2	01:38	01:53		43	39	37	13	22

1 Noise measurement period was reduced to 9 minutes due to rain.

2 Noise measurements were affected by constant operation of a mower on a nearby residential property.

The noise monitoring location is significantly closer to the Main Northern Railway and to other Grantham Road residences, therefore noise levels from some extraneous sources including trains and lawn mowers would be significantly lower at the residence.

Table 2 indicates a project noise contribution in the range 15 to 25 LAeq,15min, excluding a measurement period affected by constant mower noise on a nearby residential property. Noise from the project therefore complies with the 35 LAeq,15min criterion specified in EPL Condition L6.1 at this receptor and would continue to comply with the criterion when a 5 dB low frequency penalty is applied.

6.4. Receptor R2

Receptor R2 is located adjacent to Fairbairns Road on the southern side of the Main Northern Railway, generally at the eastern end of Grantham Road, generally west of the project site. A noise monitoring location on the side of Fairbairns Road approximately 20 m south of the residence was selected for convenient and safe access and to minimise disturbance to residents and dogs at the property.

As this noise monitoring location and the residence itself are a similar distance from the project and similarly exposed to project noise sources, the project noise contribution measured at the monitoring location would be very similar to the project noise contribution at the residence. No corrections are therefore required to measured project noise levels.

The noise monitoring location is further from the Main Northern Railway and a similar distance from passing traffic on Fairbairns Road, therefore noise levels from extraneous sources including trains, cars and trucks are approximately representative of noise levels at the residence.

Table 3 shows a summary of measured noise levels at R2. Project related noise was not clearly audible or measurable at any time during the noise survey, therefore the project noise contribution was estimated by adding 9 dBA to the measured LA90 noise level in the 50 Hz frequency band as described in Section 5.1. Multiple rain delays during the day of 24 February resulted in one of the 15 minute noise measurement periods being omitted from that day, however the lack of noise measurement results from this period does not affect the conclusions in this report.

Table 3 indicates a project noise contribution in the range 16 to 26 LAeq,15min. Noise from the project therefore complies with the 35 LAeq,15min criterion specified in EPL Condition L6.1 at this receptor and would continue to comply with the criterion when a 5 dB low frequency penalty is applied.

Table 3: Measured Noise Level Summary, Receptor R2, February 2015.

Noise Measurement Period				Total Measured Noise Level			Measured Noise Level in 50 Hz Frequency Band	Estimated Total Project Noise Level
Date	Start	End	Period	Lmax	LAeq	LA90	LA90	LAeq
24/2	12:52	13:07	Day	66	46	30	9	18
24/2	13:08	13:23		67	47	30	10	19
24/2	13:24	13:39		66	43	31	11	20
24/2	15:47	15:58 [1]		72	55	36	14	23
24/2	17:24	17:39		84	64	41	17	26
24/2	-	-		Insufficient time to complete this measurement due to earlier rain delays				
24/2	19:28	19:43	Evening	81	63	44	14	23
24/2	20:32	20:47		64	54	51	12	21
24/2	22:46	23:01	Night	65	48	45	14	23
24/2	23:02	23:17		54	47	46	15	24
25/2	00:36	00:51		64	46	44	14	23
25/2	00:54	01:09		50	48	46	15	24
25/2	11:08	11:23	Day	73	51	32	12	21
25/2	11:25	11:40		74	54	29	11	20
25/2	11:43	11:58		69	44	29	10	19
25/2	13:47	14:02		77	55	34	10	19
25/2	14:07	14:22		66	46	34	11	20
25/2	14:22	14:37		65	41	30	7	16
25/2	19:56	20:11	Evening	74	61	57	13	22
25/2	21:06	21:21		64	51	49	12	21
25/2	22:43	22:58	Night	48	45	44	14	23
25/2	22:58	23:13		50	47	47	15	24
26/2	00:42	00:57		54	49	47	12	21
26/2	01:00	01:15		49	47	46	11	20
26/2	12:01	12:16	Day	68	49	30	12	21
26/2	12:17	12:32		69	49	29	13	22
26/2	12:33	12:48		66	44	28	13	22
26/2	15:56	16:11		45	40	37	16	25
26/2	16:13	16:28		79	61	38	16	25
26/2	16:29	16:44		68	52	39	16	25
26/2	19:14	19:29	Evening	85	66	48	10	19
26/2	20:11	20:26		66	61	54	16	25
27/2	22:09	22:24	Night	68	49	46	16	25
27/2	22:25	22:40		50	48	47	16	25
27/2	02:02	02:17		50	47	46	14	23
27/2	02:17	02:32		50	48	47	14	23

1 Noise measurement period was reduced to 11 minutes due to rain.

6.5. Receptor R3

Receptor R3 is located adjacent to Fairbairns Road generally south west of the project site. A noise monitoring location adjacent to the driveway approximately 50 m east of the residence was selected for convenient and safe access and to minimise disturbance to residents.

The noise monitoring location is approximately 50 m closer to the project, however the project noise level difference between the monitoring location and the residence itself would be insignificant. No corrections are therefore required to measured project noise levels.

The noise monitoring location is significantly closer to passing traffic on Fairbairns Road, therefore traffic noise levels would be significantly lower at the residence.

Table 4 shows a summary of measured noise levels at R3. Project related noise was not clearly audible or measurable at any time during the noise survey, therefore the project noise contribution was estimated by adding 9 dBA to the measured LA90 noise level in the 50 Hz frequency band as described in Section 5.1. Multiple rain delays during the day of 24 February resulted in one of the 15 minute noise measurement periods being omitted from that day, however the lack of noise measurement results from this period does not affect the conclusions in this report.

Table 4: Measured Noise Level Summary, Receptor R3, February 2015.

Noise Measurement Period				Total Measured Noise Level			Measured Noise Level in 50 Hz Frequency Band	Estimated Total Project Noise Level
Date	Start	End	Period	Lmax	LAeq	LA90	LA90	LAeq
24/2	13:46	14:01	Day	60	39	32	18	27
24/2	14:03	14:18		70	50	32	16	25
24/2	14:19	14:32 [1]		64	40	28	17	26
24/2	16:50	17:05		67	46	35	18	27
24/2	17:05	17:20		68	51	34	17	26
24/2	-	-		Insufficient time to complete this measurement due to earlier rain delays				
24/2	19:48	20:03	Evening	46	42	41	14	23
24/2	20:55	21:10		43	42	42	15	24
24/2	23:22	23:37	Night	43	40	38	16	25
24/2	23:39	23:54		44	43	42	16	25
25/2	01:14	01:29		38	36	36	18	27
25/2	01:31	01:46		39	36	35	17	26
25/2	12:01	12:16	Day	56	38	31	13	22
25/2	12:16	12:31		55	34	30	13	22
25/2	12:33	12:48		61	40	28	12	21
25/2	14:42	14:57		55	39	31	12	21
25/2	14:57	15:12		48	33	28	14	23
25/2	15:16	15:31		61	43	29	13	22
25/2	19:35	19:50	Evening	65	44	31	18	27
25/2	20:43	20:58		48	47	47	17	26
25/2	22:06	22:21	Night	68	46	37	16	25
25/2	22:22	22:37		66	45	37	16	25
26/2	00:03	00:18		64	43	37	16	25
26/2	00:23	00:38		41	40	39	16	25

Noise Measurement Period				Total Measured Noise Level			Measured Noise Level in 50 Hz Frequency Band	Estimated Total Project Noise Level
Date	Start	End	Period	Lmax	LAeq	LA90	LA90	LAeq
26/2	10:01	10:16	Day	78	56	29	16	25
26/2	10:17	10:32		65	47	27	16	25
26/2	10:33	10:48		67	48	31	16	25
26/2	12:53	13:08		68	47	28	15	24
26/2	13:09	13:24		67	44	27	15	24
26/2	13:24	13:39		70	49	28	16	25
26/2	19:32	19:47	Evening	69	48	34	17	26
26/2	20:33	20:48		45	44	43	18	27
27/2	22:46	23:01	Night	50	40	36	15	24
27/2	23:02	23:17		67	44	31	16	25
27/2	02:37	02:52		62	44	42	17	26
27/2	02:57	03:12		45	42	39	17	26

1 Noise measurement period was reduced to 13 minutes due to rain.

Table 3 indicates a project noise contribution in the range 21 to 27 LAeq,15min. Noise from the project therefore complies with the 35 LAeq,15min criterion specified in EPL Condition L6.1 at this receptor and would continue to comply with the criterion when a 5 dB low frequency penalty is applied.

6.6. Maximum Project Noise Levels

EPL condition L6.1 specifies noise limits of 35 LAeq,15min during all time periods which have been assessed in previous sections. The condition also specifies a noise limit of 45 LA1,1min, which is approximately equal to 45 LAmax, at each receptor during the night period only. This part of the condition is intended to minimise the potential for sleep disturbance at residential receptors.

Noise sources associated with the project currently include diesel powered generators and pumps, which operate continuously and have no significant potential to produce short periods of louder noise that may disturb sleep. Maintenance or similar activity may have some potential to produce higher noise levels for brief periods, however maintenance work does not occur during the night and noise from vehicle movements within the project site was no more than barely audible at any time during the noise survey.

Maximum noise levels from the project would therefore remain no more than 5 dBA above average noise levels and would therefore comply with the 45 LA1,1min sleep disturbance criterion at all receptors.

7. CONCLUSION

This report describes results from an assessment of environmental noise levels produced by operation of the Waukivory Pilot Project. The noise compliance survey described in this report follows previous operator attended construction noise surveys completed in August, September and October 2014.

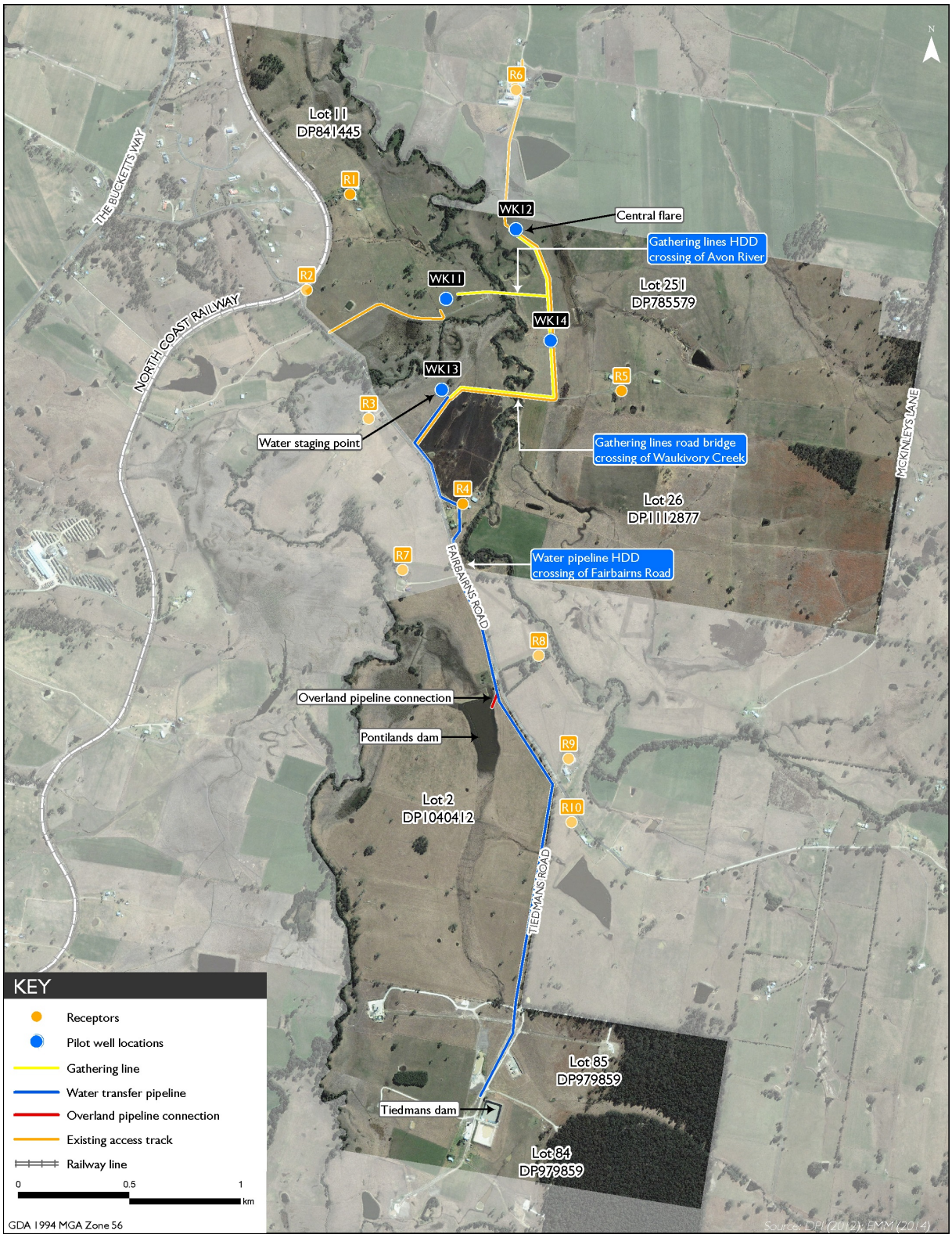
Results show noise from the project remains well below relevant Environment Protection Licence (EPL) conditions, particularly condition L6.1 which requires noise levels to meet an intrusive noise limit of 35 LAeq,15min during all time periods and a sleep disturbance limit 45 LA1,1min during the night. Noise from the project meets the NSW Industrial Noise Policy definitions of low frequency and tonal noise, with the tone occurring at 50 Hz. As the tone occurs in the low frequency range, a single 5 dBA penalty is

required. Addition of 5 dBA to the estimated project noise contributions results in continued compliance with the noise limits in condition L6.1.

Noise from the project was generally inaudible during the day at all three monitoring locations and just barely audible as a low hum during the evening and night at the closest two locations R2 and R3. Vehicle movements were intermittently visible within the project site during the day, however noise from those vehicles was not audible at any receptor. Security vehicles were also occasionally visible during the evening and night, however noise from those vehicles was barely audible and would be approximately the same level as constant noise from the project's generators. Vehicle movements therefore did not appreciably change the estimated project noise contribution at any receptor and have no significant potential for exceeding the 45 LA1,1min sleep disturbance limit.

Based on the results of this assessment, no additional operational noise mitigation or management measures are recommended and no project related noise impacts are occurring at any receptor.

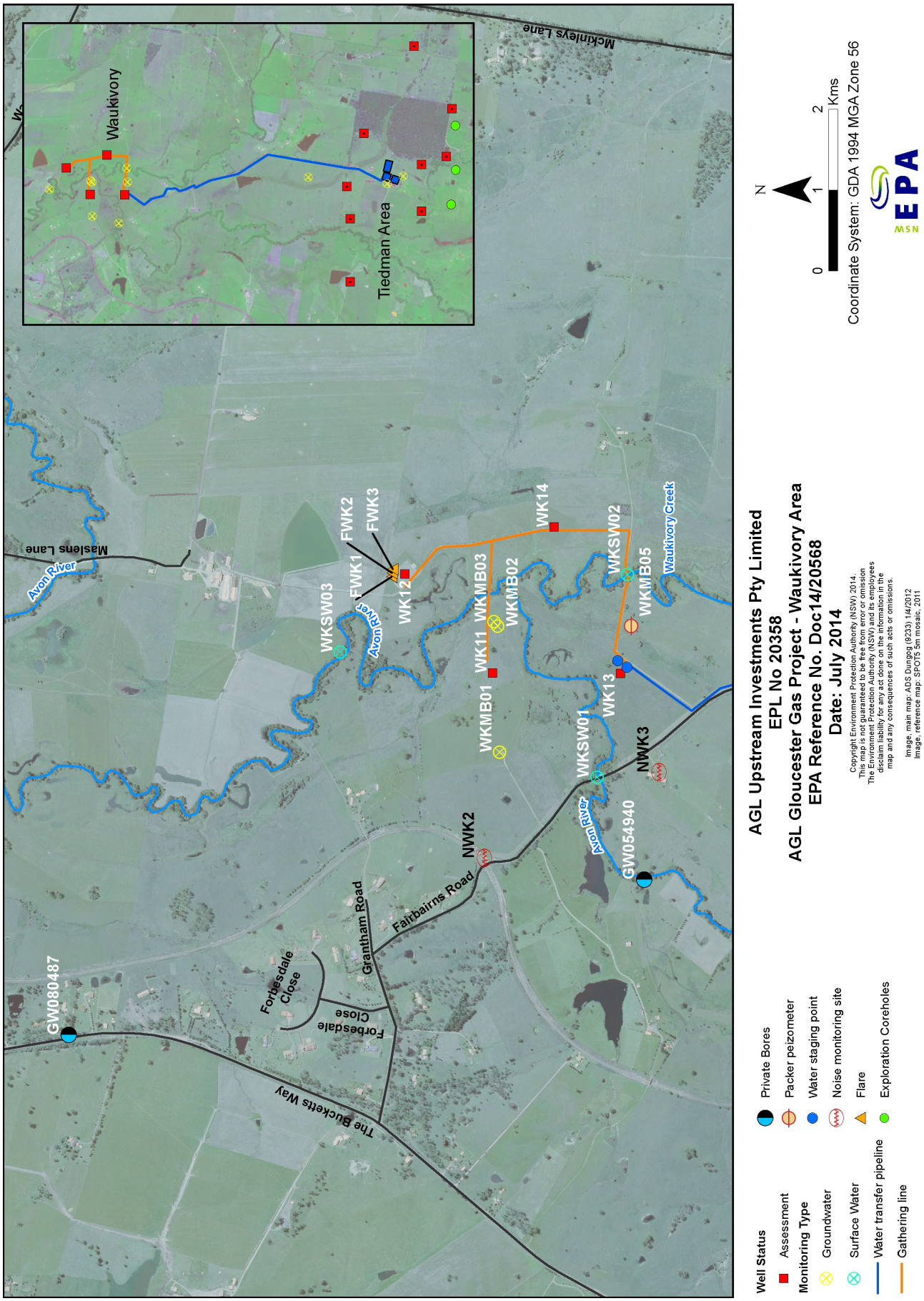
APPENDIX A – PLANS



EMM
EMGA Mitchell McLennan

Proposed work areas
Construction Noise and Vibration Management Plan
Waukivory Pilot Project
Figure 1.1

This plan showing nearest receptors has been reproduced from the CNMP prepared by EMGA Mitchell McLennan.

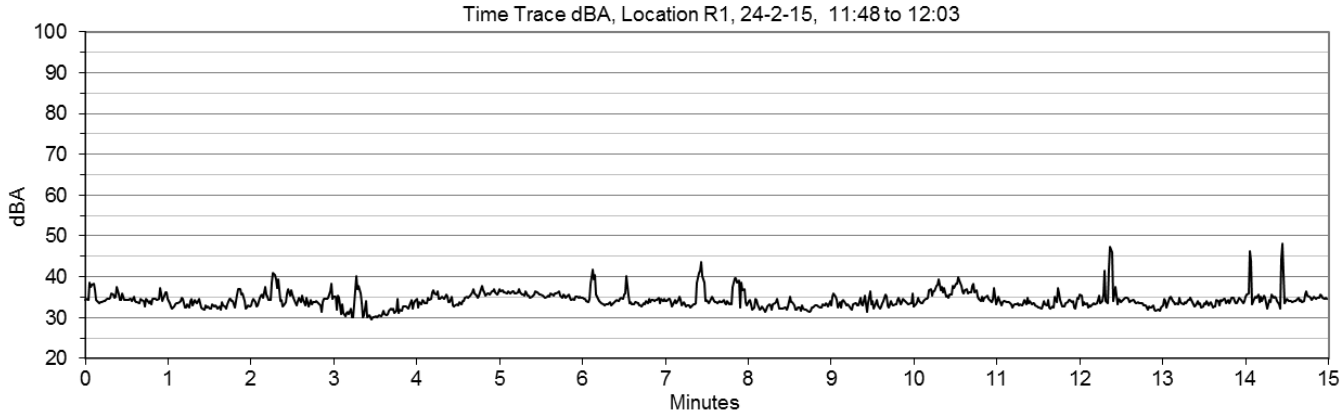

Waukivory
Tiedman Area
Mckinleys Lane
Masleins Lane
Avon River
FWK2
FWK3
FWK1
WK12
WK14
WKSW03
WKSW02
WKMB03
WKMB02
WKMB05
Waukivory Creek
WK11
WKMB01
WK13
WKSW01
NWK3
NWK2
GW054940
GW080487
Fairbairns Road
Grantham Road
Forbesdale Close
The Bucketts Way
Well Status
Assessment
Monitoring Type
Groundwater
Surface Water
Water transfer pipeline
Gathering line
Private Bores
Packer peizometer
Water staging point
Noise monitoring site
Flare
Exploration Coreholes
AGL Upstream Investments Pty Limited
EPL No 20358
AGL Gloucester Gas Project - Waukivory Area
EPA Reference No. Doc14/20568
Date: July 2014
Copyright Environment Protection Authority (NSW) 2014.
This map is not guaranteed to be free from error or omission
The Environment Protection Authority (NSW) and its employees
disclaim liability for any act done on the information in the
map and any consequences of such acts or omissions.
Image, main map: ADS Dungog (9233) 14/2012
Image, reference map: SPOT5 5m mosaic, 2011
N
0
1
2
Kms
Coordinate System: GDA 1994 MGA Zone 56
EPA
NSW

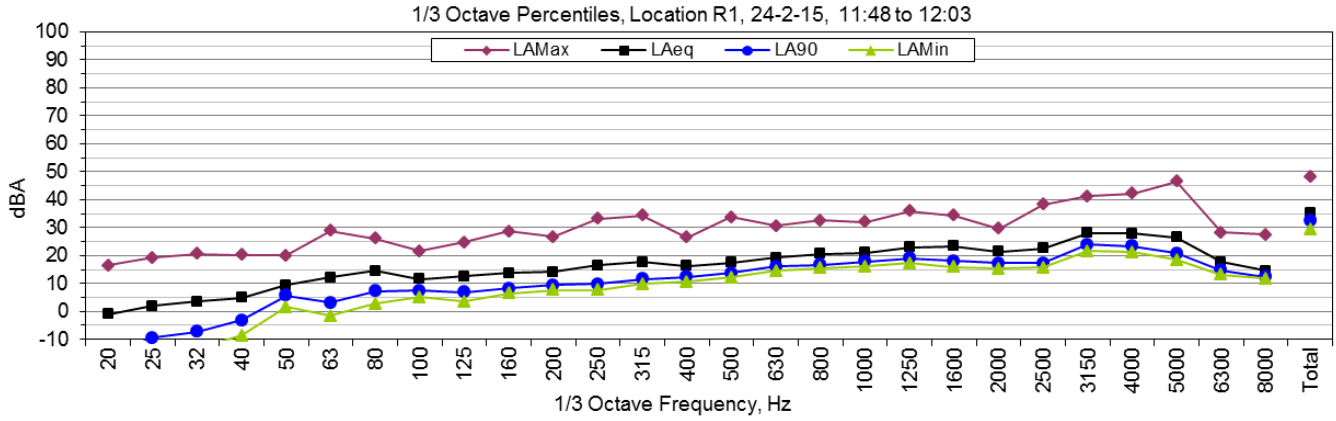
APPENDIX B – MEASURED NOISE LEVELS, RECEPTOR R1

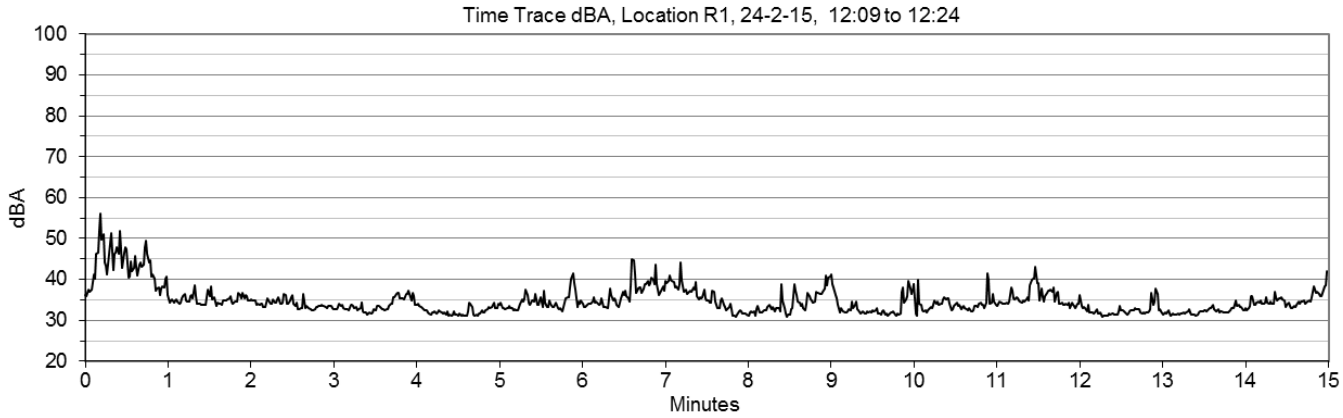
Charts on the following pages show measured noise levels at Receptor R1. Measured noise levels are presented in the order they were measured, with the date and time shown in each figure.

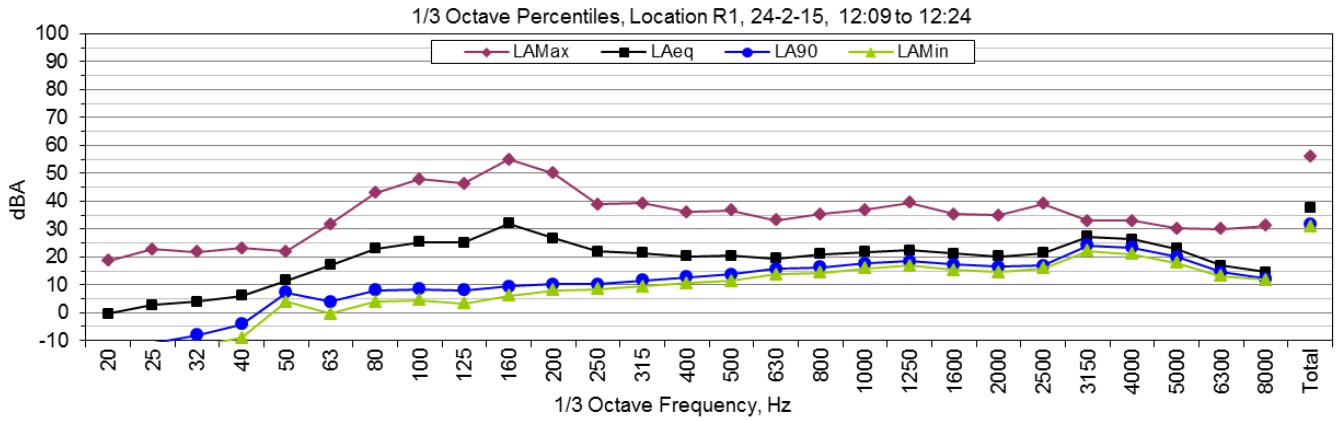
Two charts are shown for each noise measurement. The first chart shows a 'noise level trace' for the duration of the noise measurement in one second intervals in dBA. The second chart shows the measured maximum (LAmax), average (LAeq), background (LA90) and minimum (LAmin) noise levels in 1/3 octave bands from 20 Hz to 8000 Hz and total dBA noise levels.

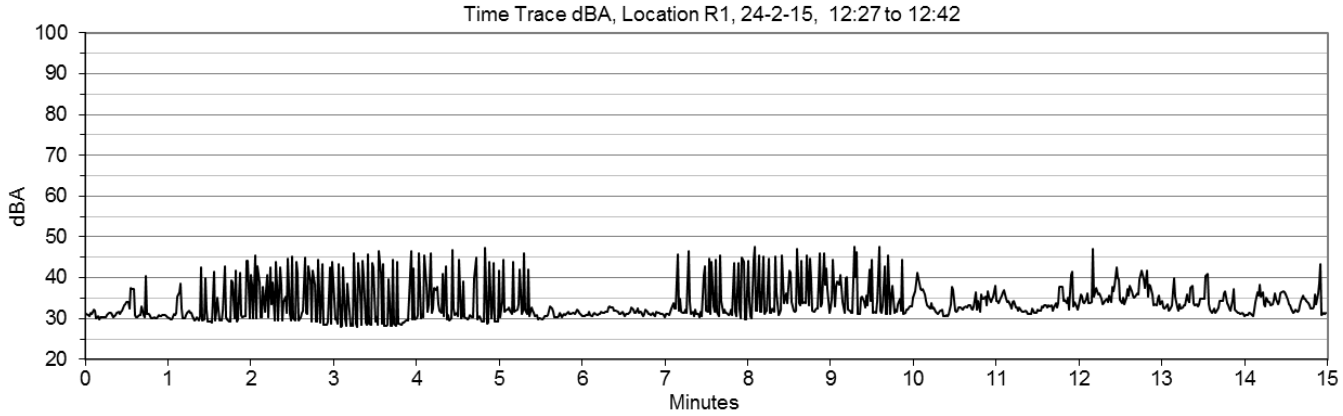
Day 1 – Tuesday 24 February 2015

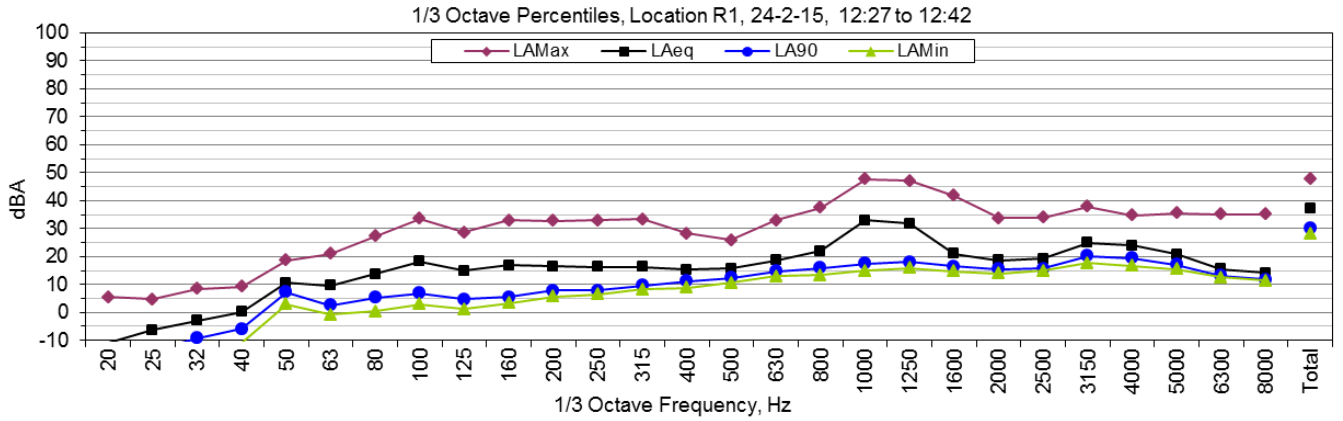


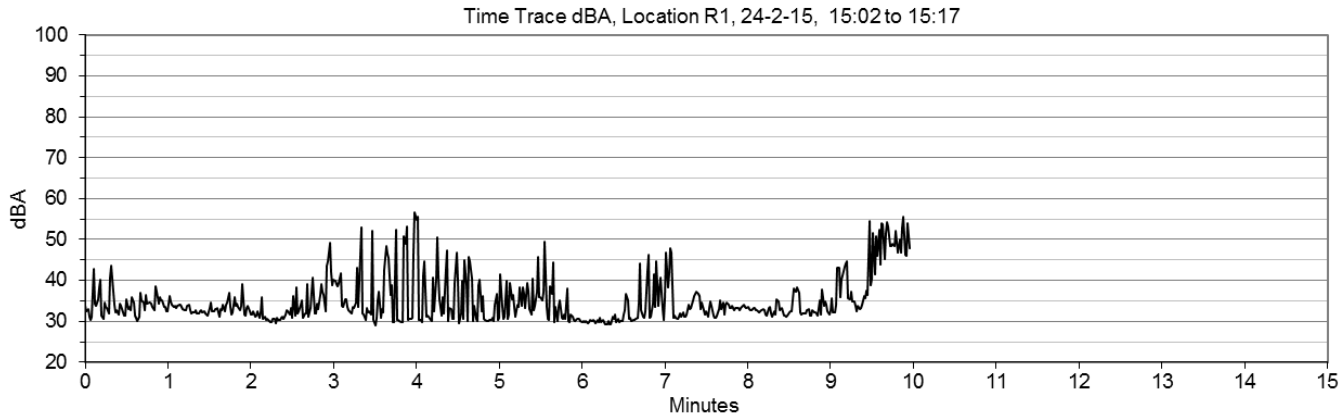


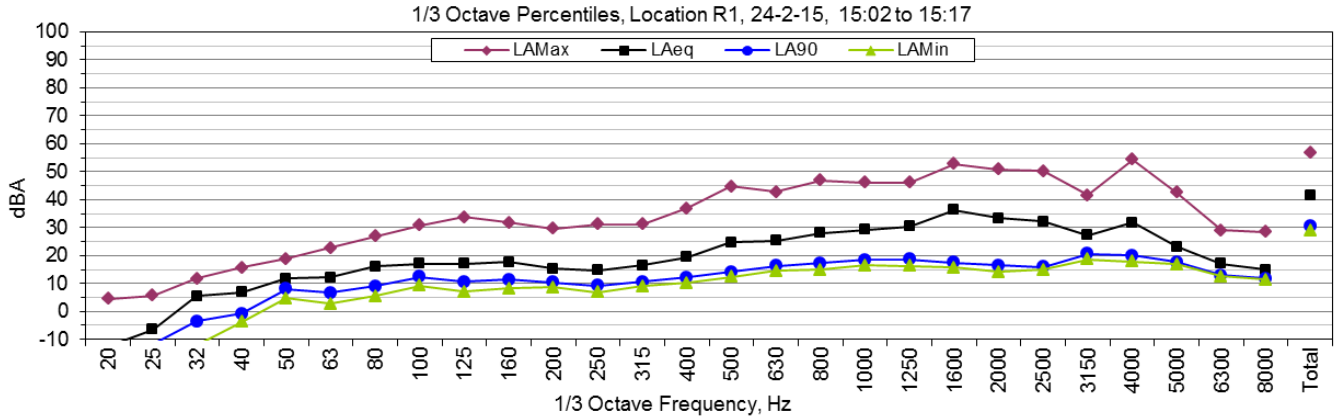


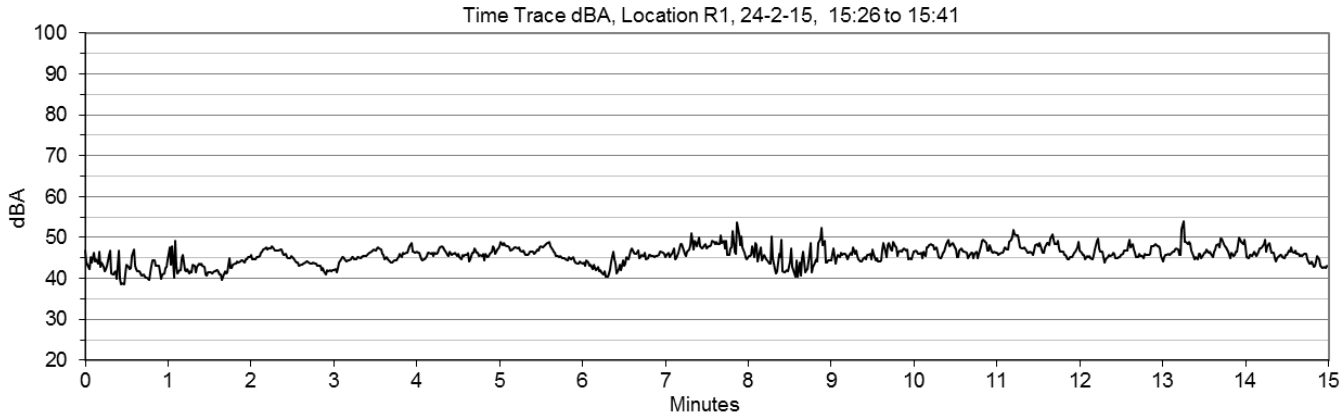


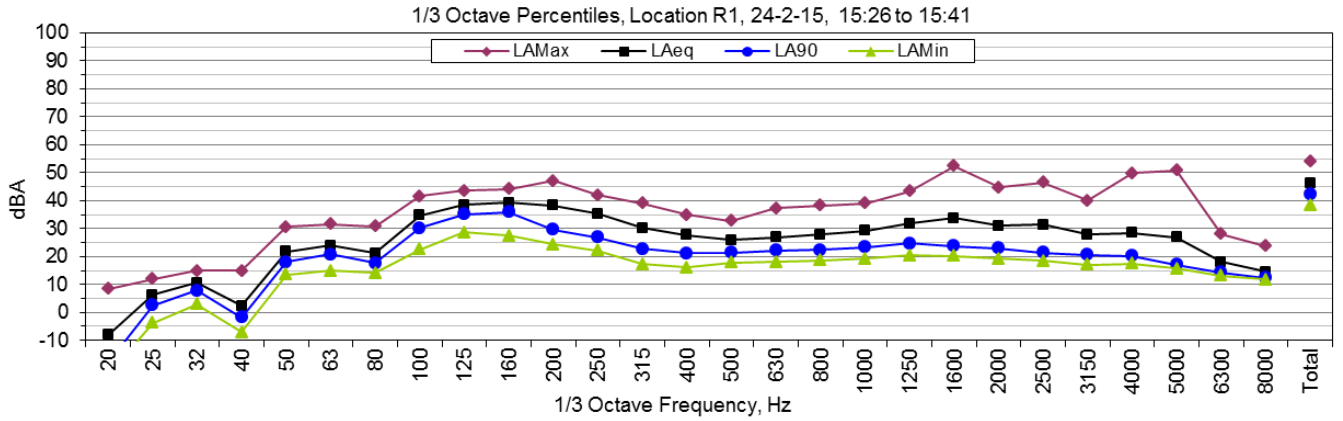

Time Trace dBA, Location R1, 24-2-15, 12:27 to 12:42
dBA
Minutes

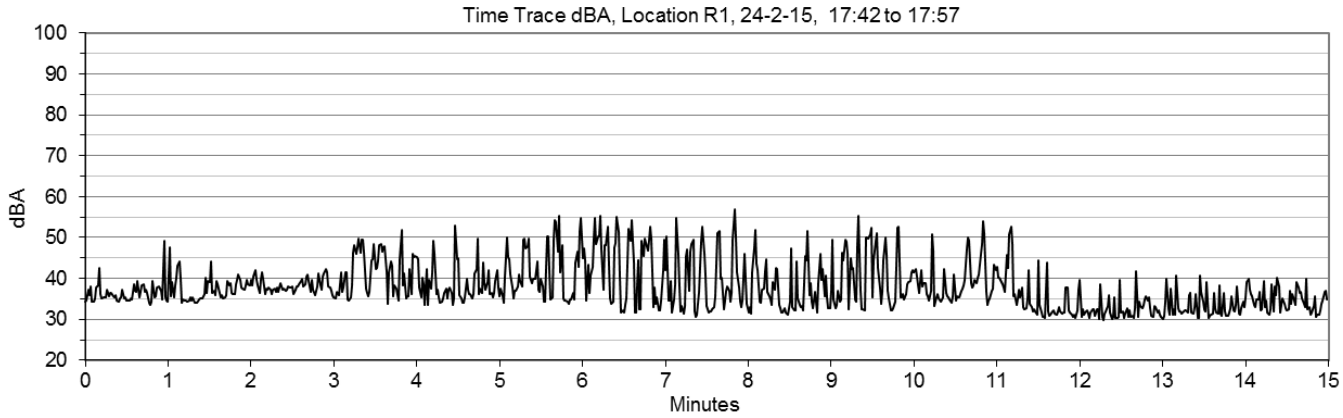

1/3 Octave Percentiles, Location R1, 24-2-15, 12:27 to 12:42
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

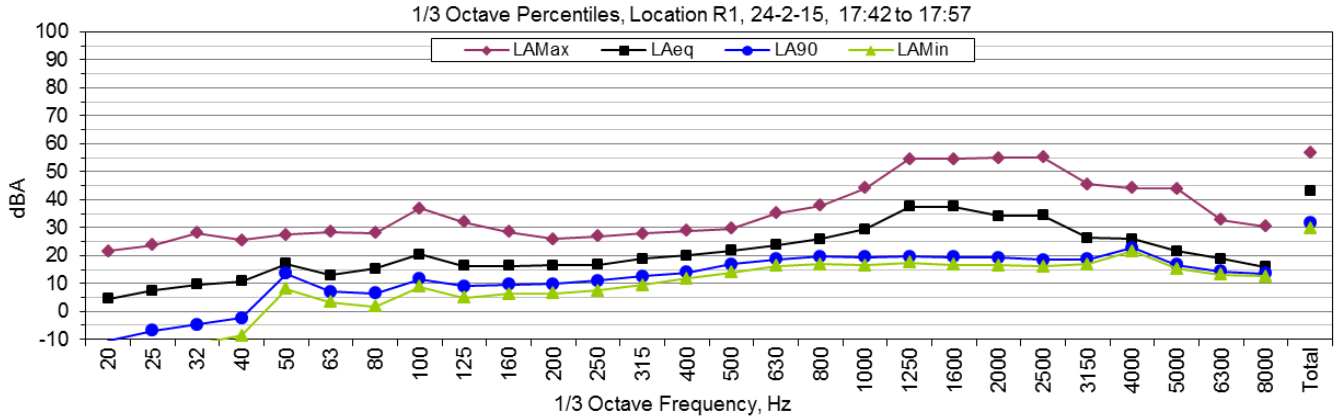

Time Trace dBA, Location R1, 24-2-15, 15:02 to 15:17
dBA
Minutes


1/3 Octave Percentiles, Location R1, 24-2-15, 15:02 to 15:17
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

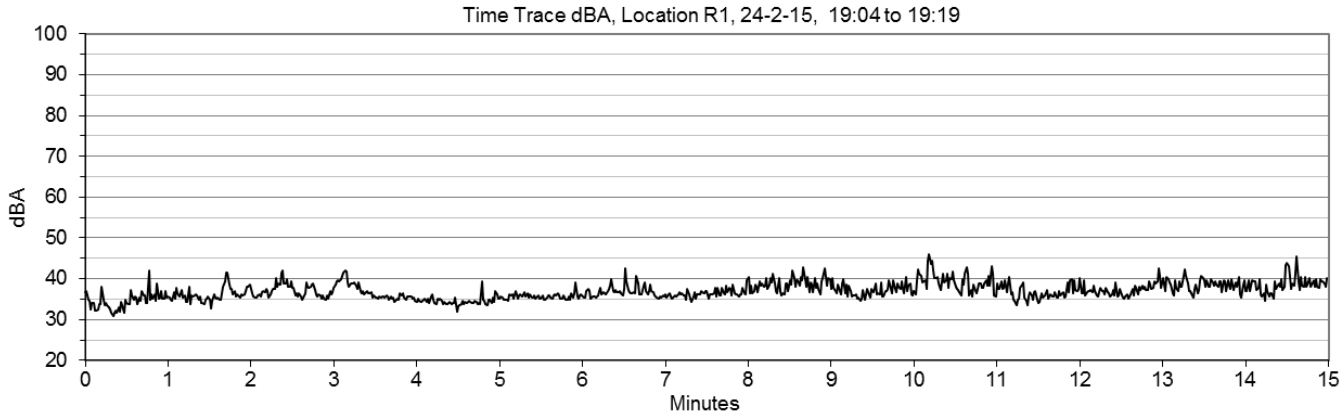

Time Trace dBA, Location R1, 24-2-15, 15:26 to 15:41
dBA
Minutes

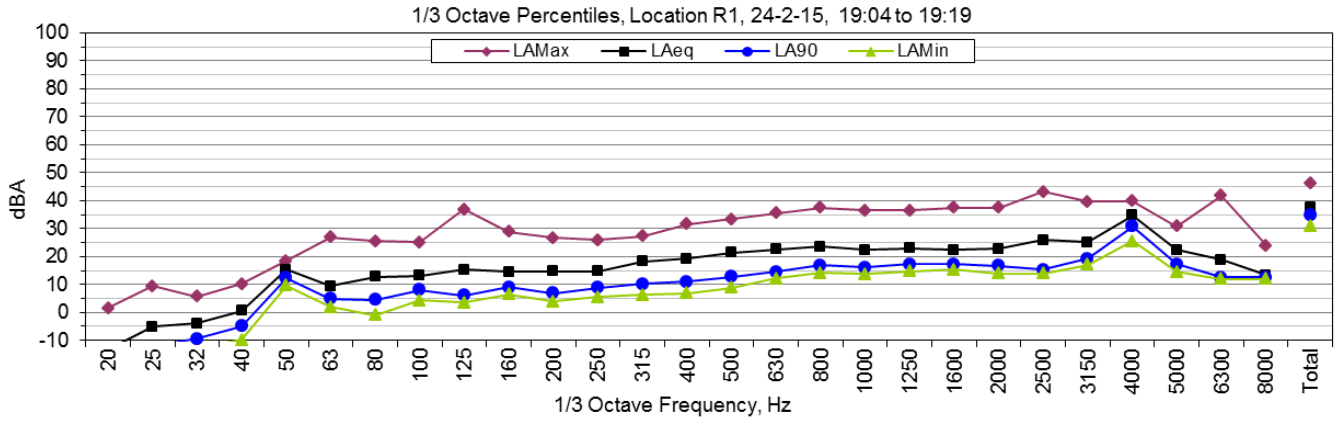

1/3 Octave Percentiles, Location R1, 24-2-15, 15:26 to 15:41
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

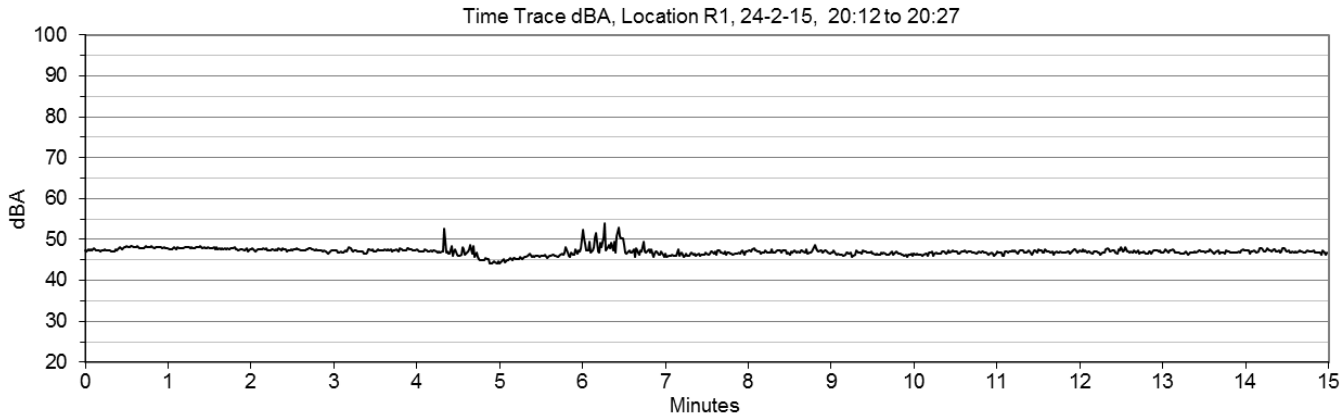

Time Trace dBA, Location R1, 24-2-15, 17:42 to 17:57
dBA
Minutes

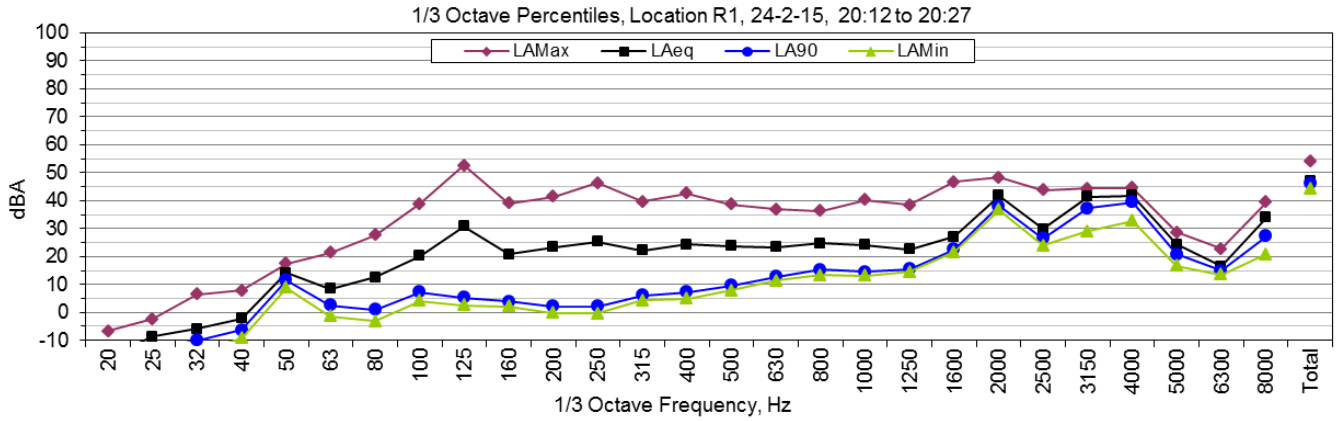

1/3 Octave Percentiles, Location R1, 24-2-15, 17:42 to 17:57
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

Evening 1 – Tuesday 24 February 2015

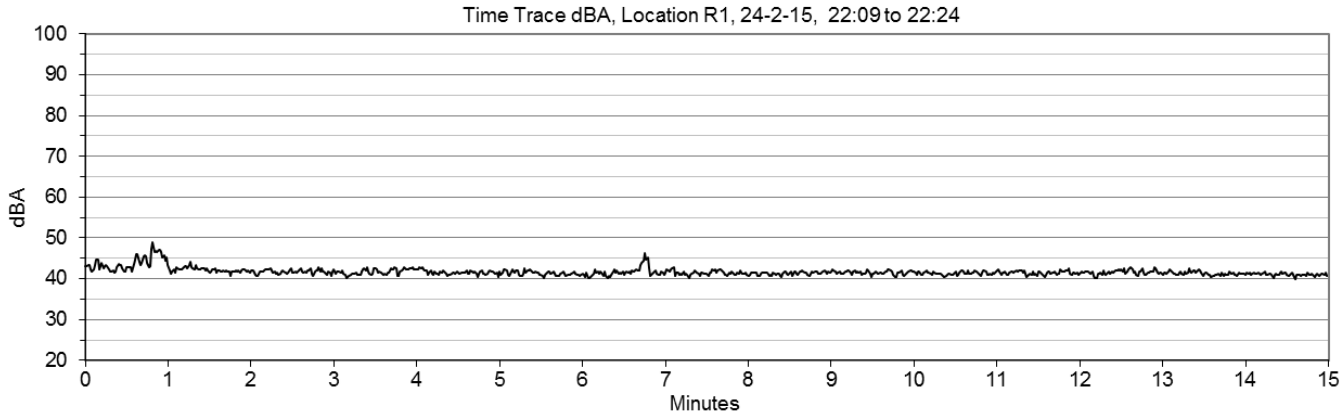


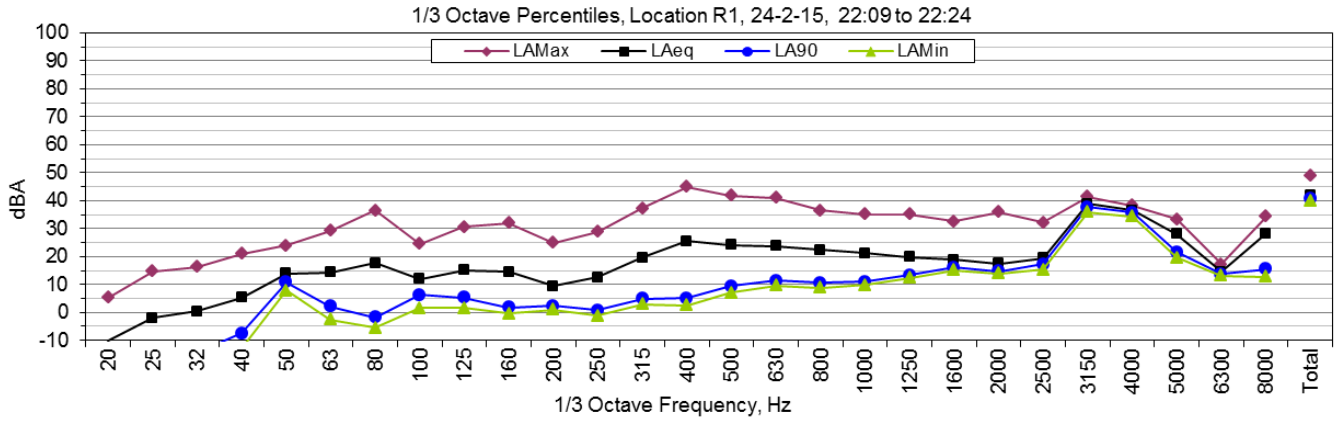


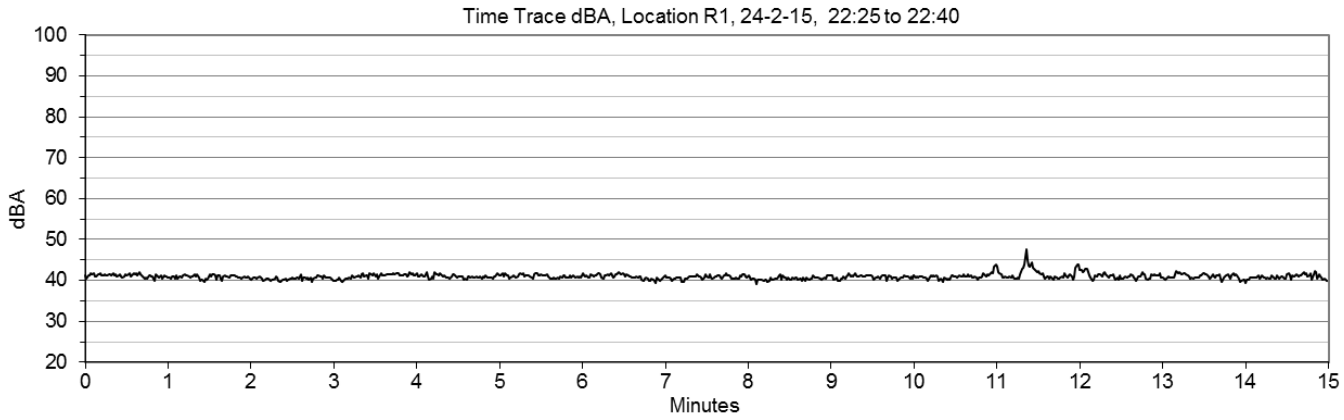


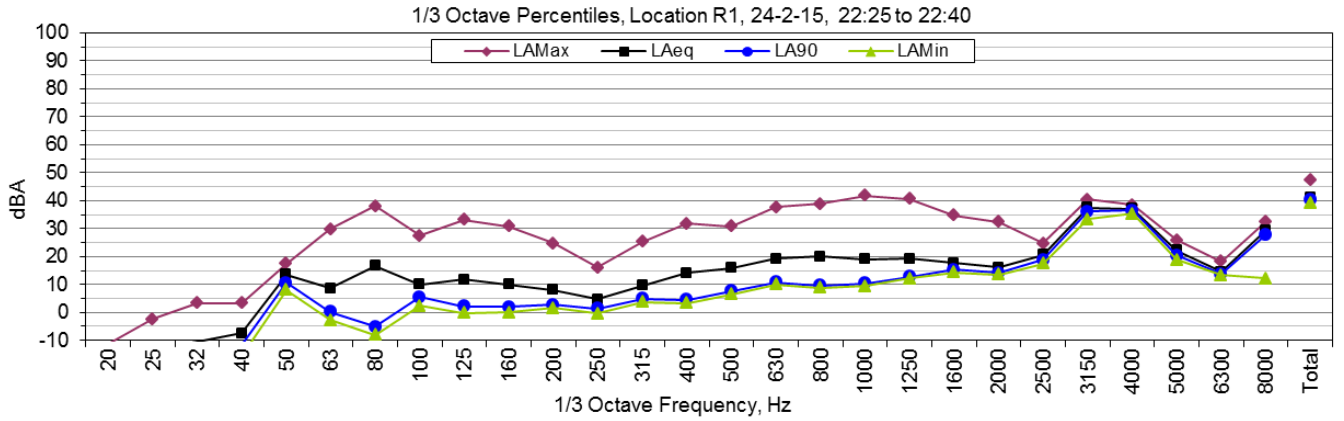


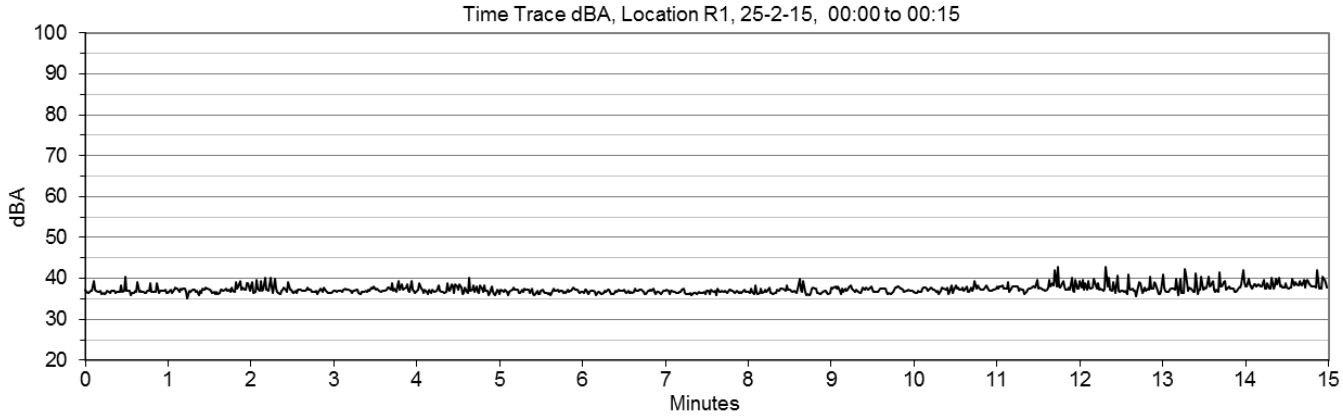
Night 1 – Tuesday 24 February 2015







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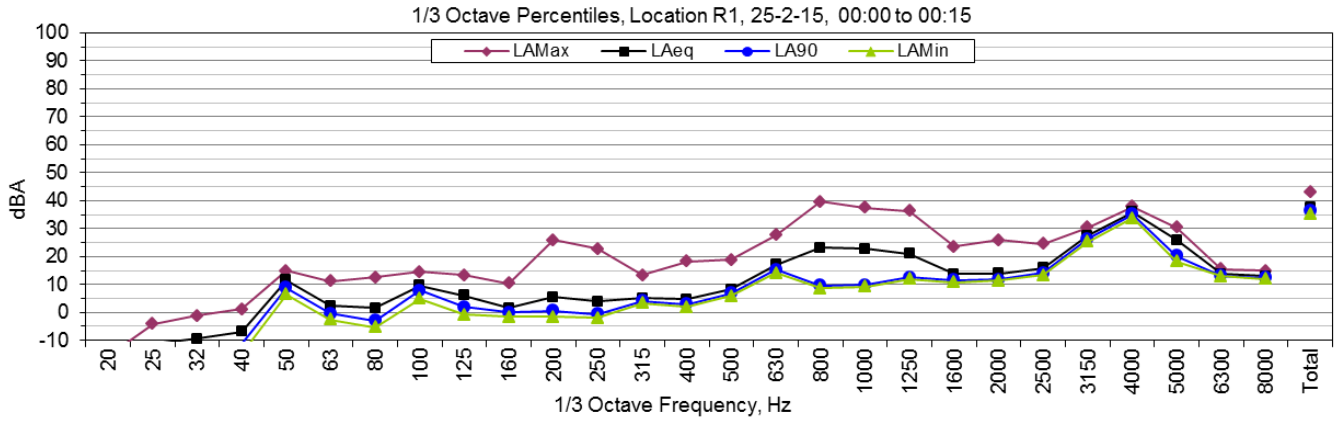
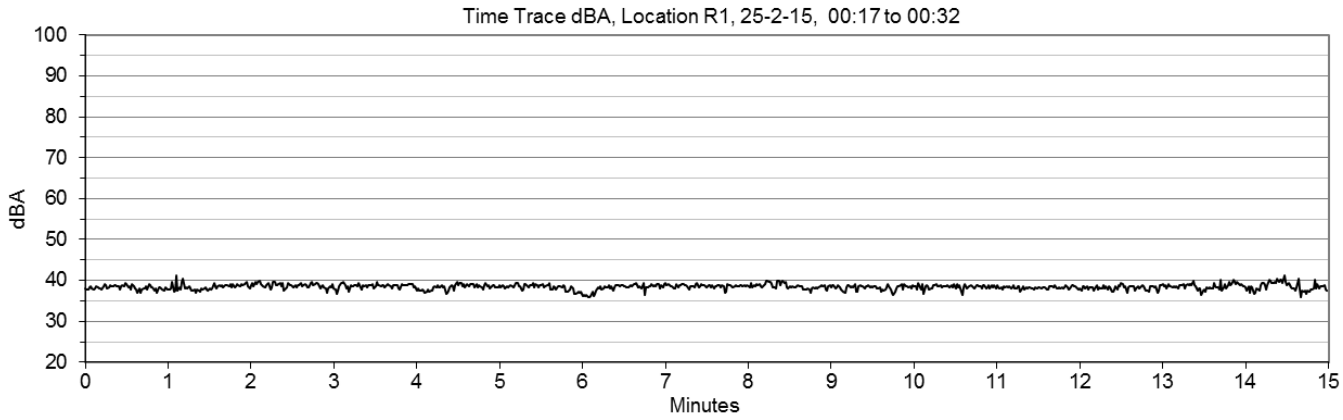
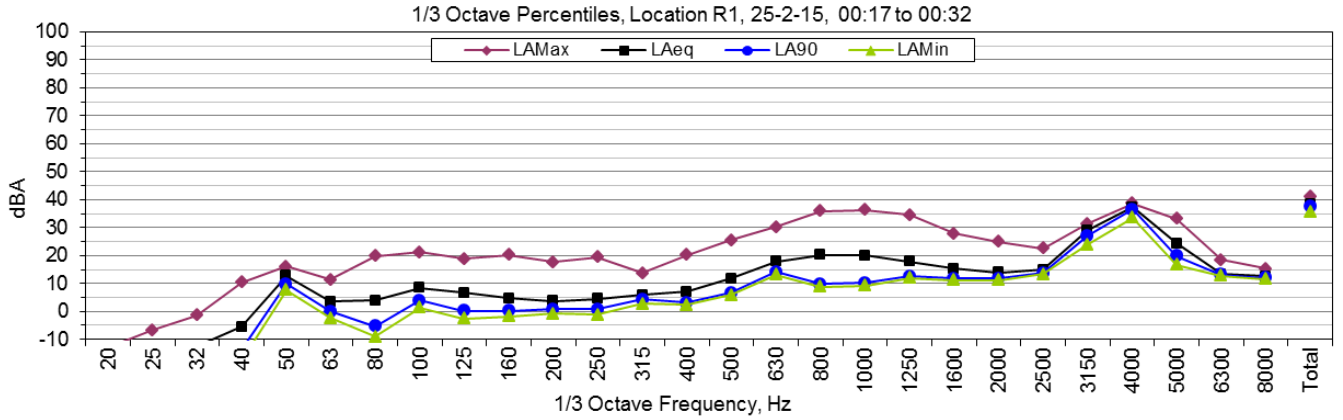
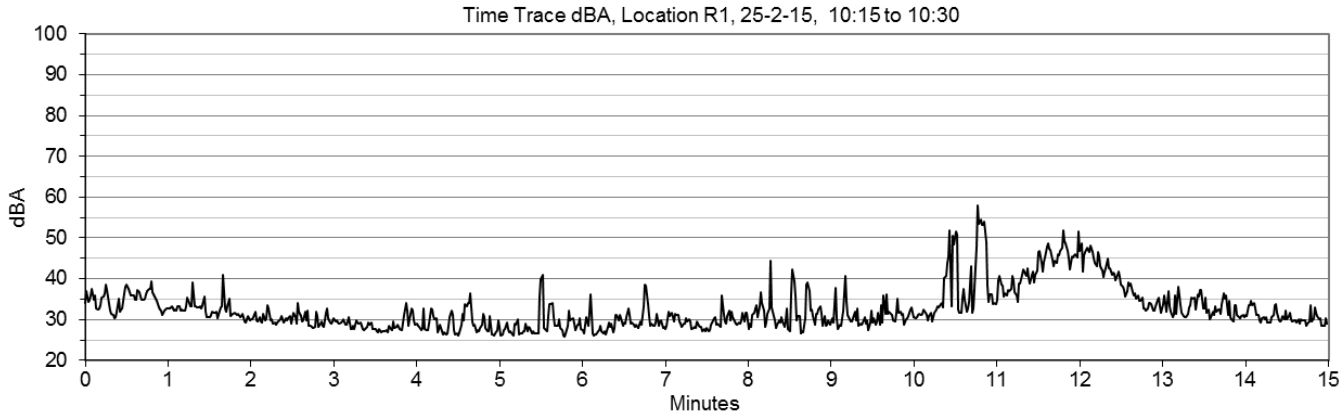
dBA
Minutes

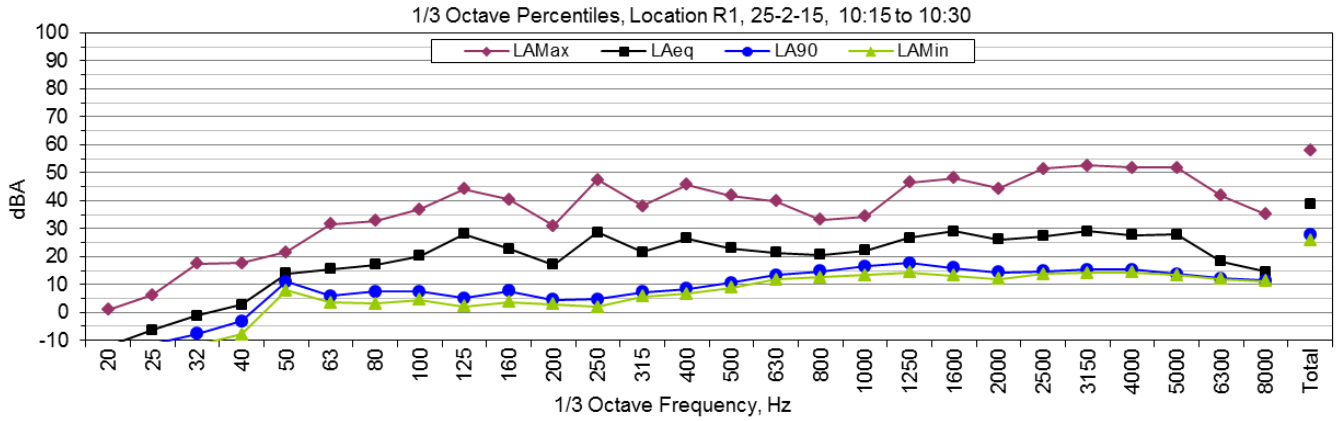

1/3 Octave Percentiles, Location R1, 25-2-15, 00:00 to 00:15
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

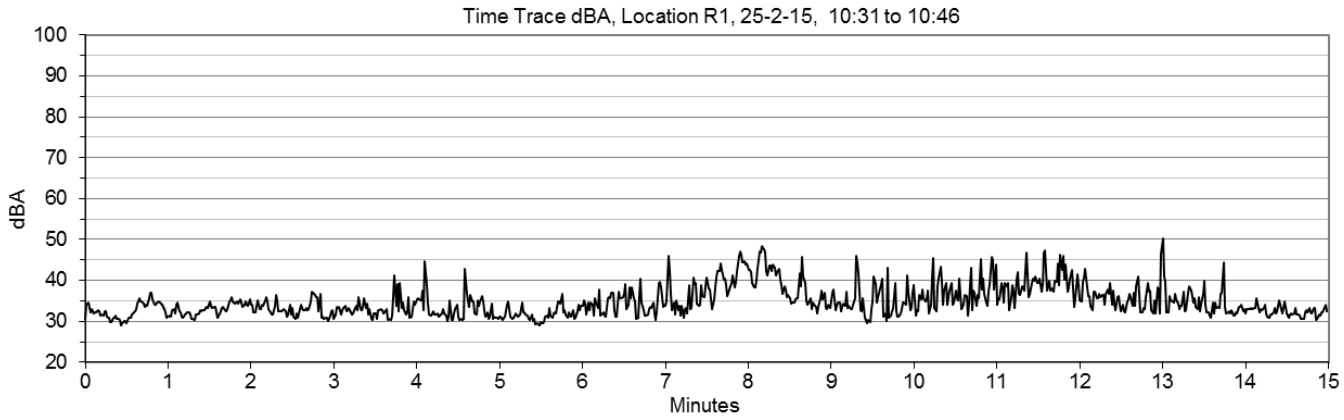

Time Trace dBA, Location R1, 25-2-15, 00:17 to 00:32
dBA
Minutes

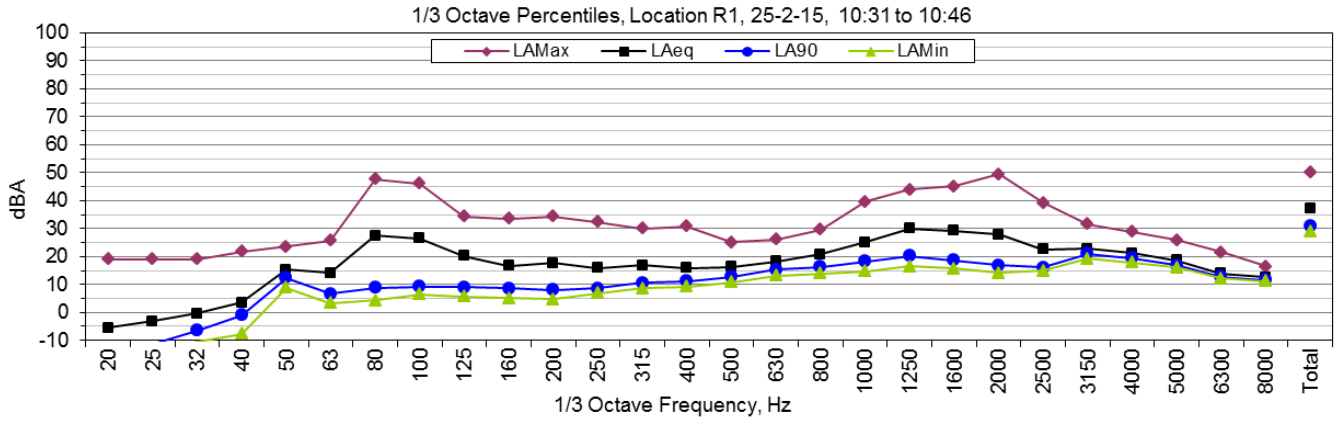

1/3 Octave Percentiles, Location R1, 25-2-15, 00:17 to 00:32
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

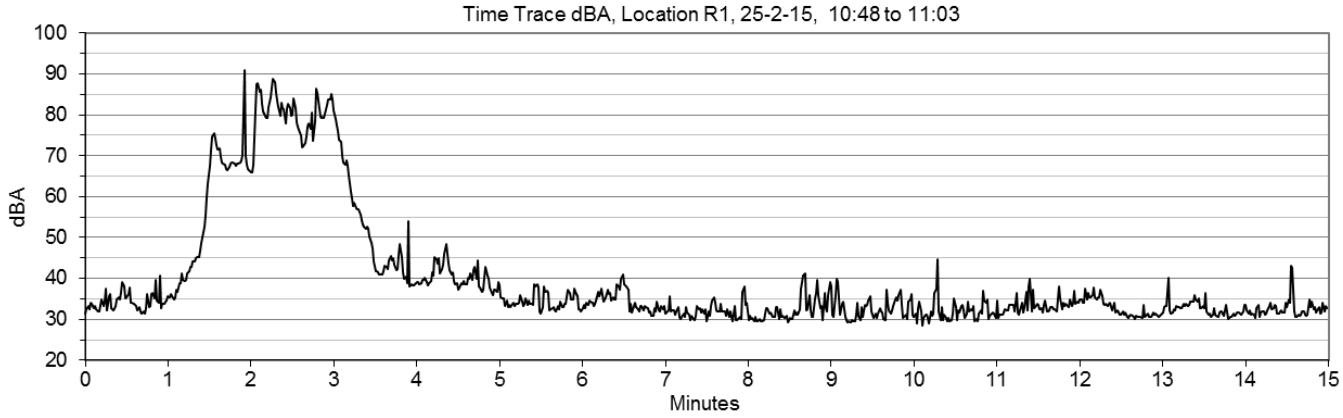
Day 2 – Wednesday 25 February 2015







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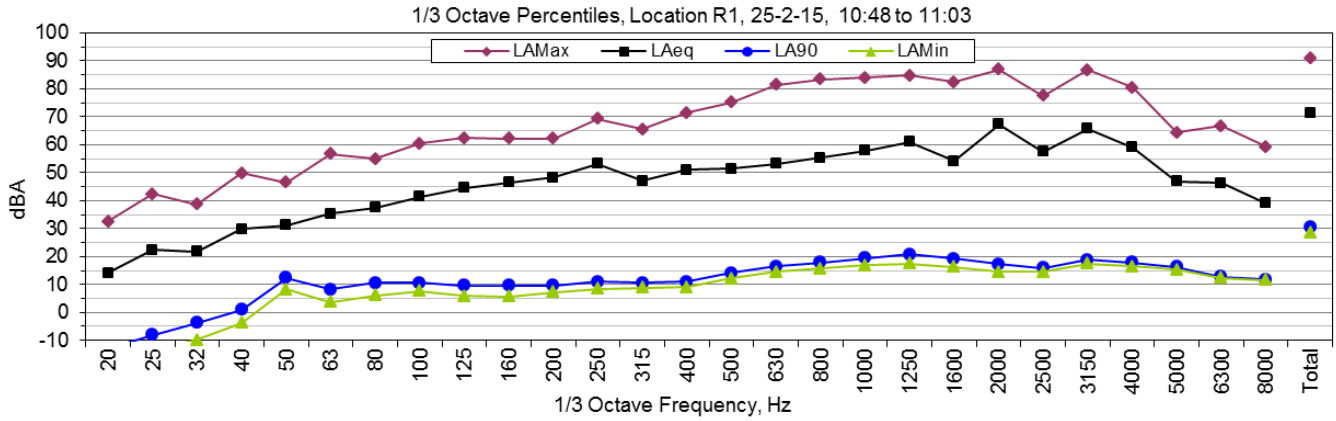
dBA
Minutes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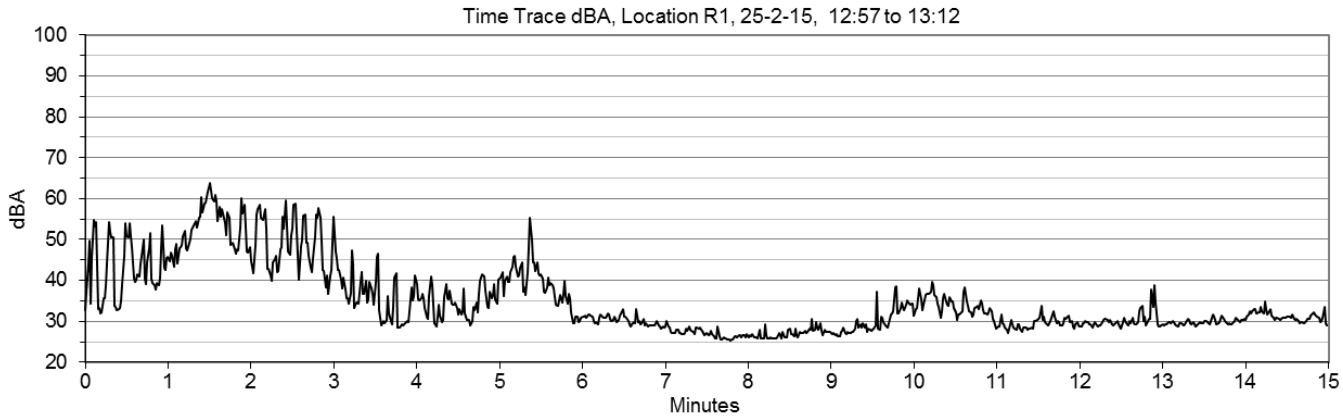
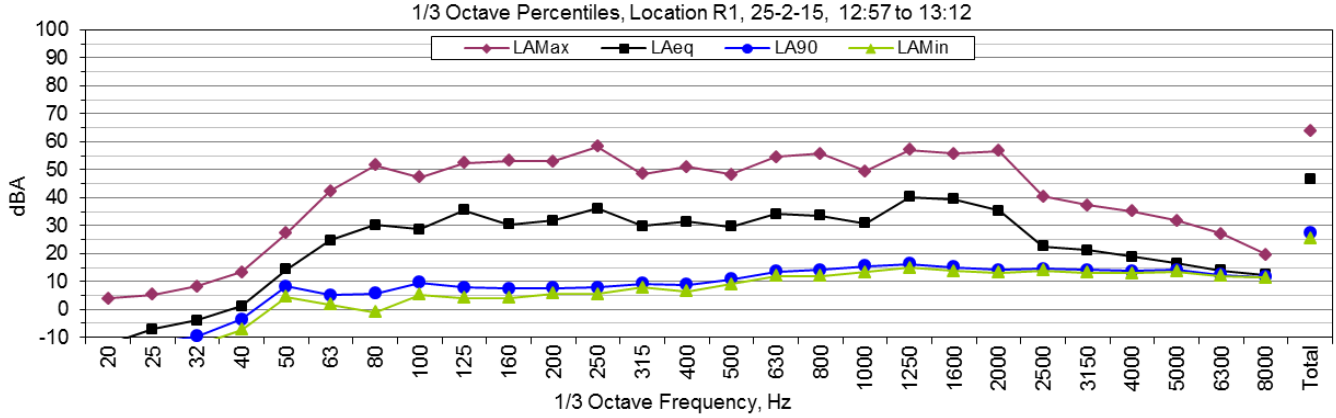
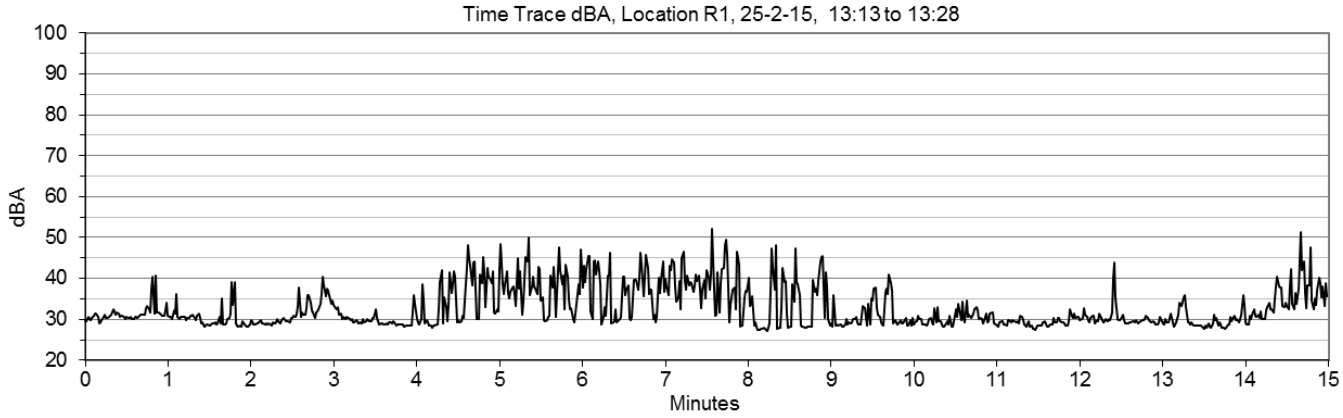
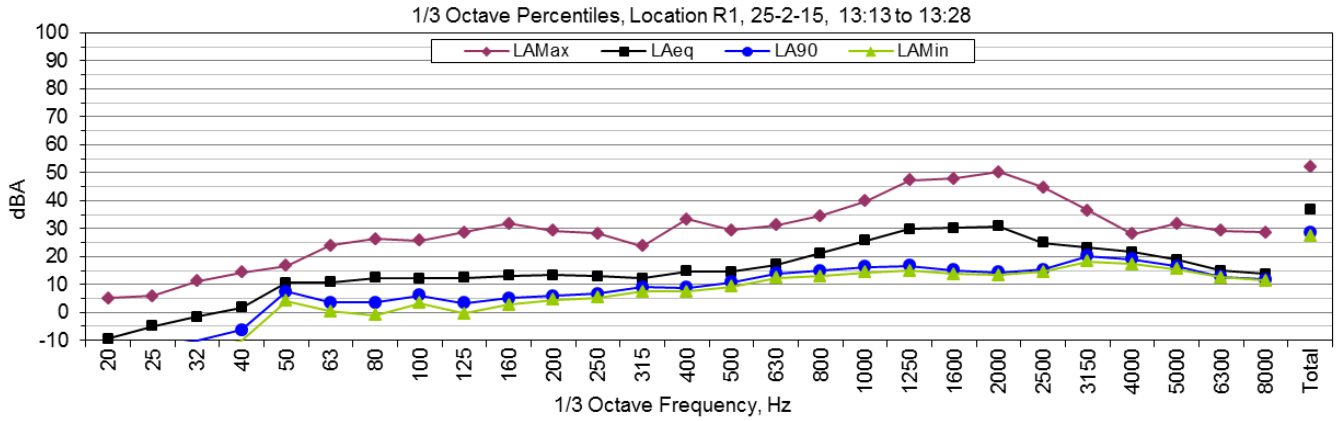
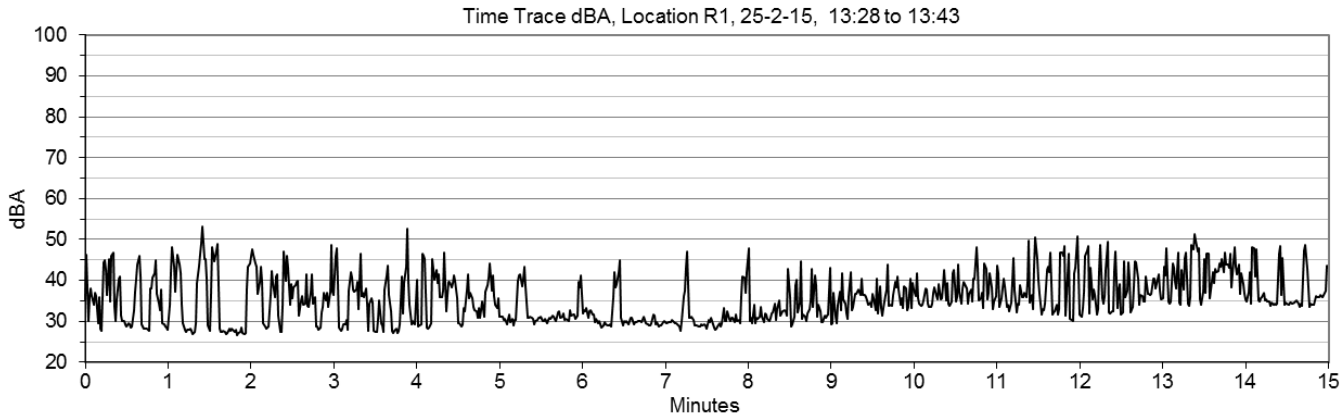
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

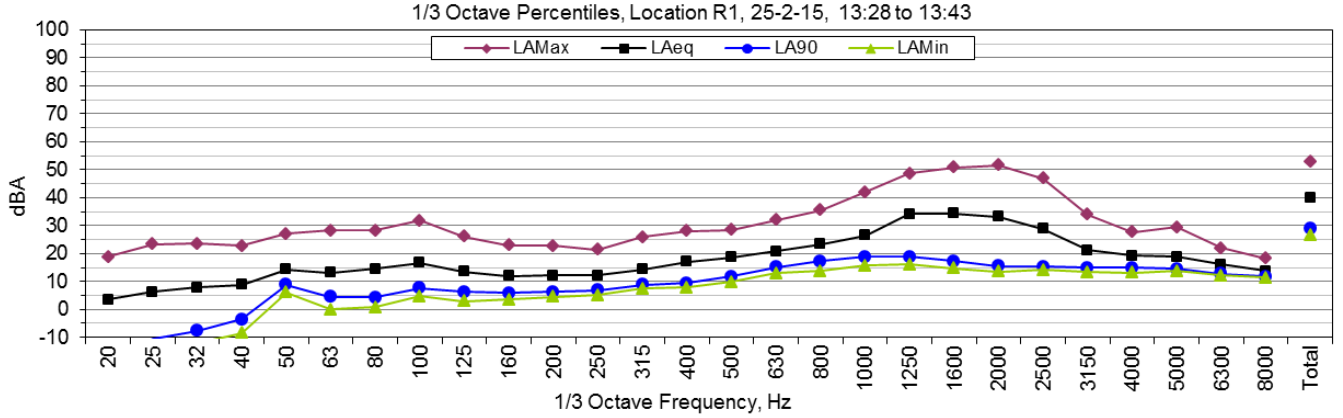

Time Trace dBA, Location R1, 25-2-15, 12:57 to 13:12
dBA
Minutes


1/3 Octave Percentiles, Location R1, 25-2-15, 12:57 to 13:12
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

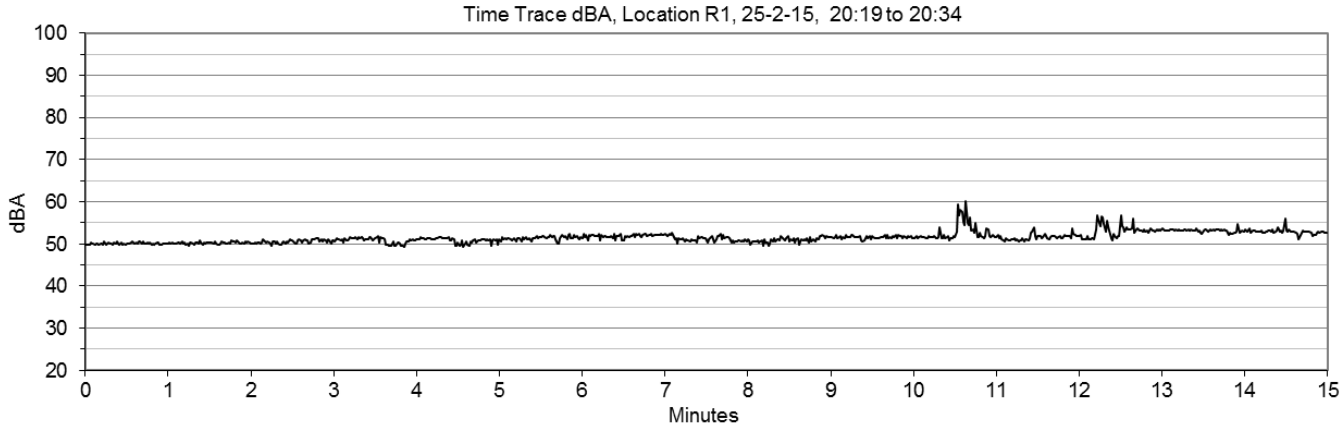

Time Trace dBA, Location R1, 25-2-15, 13:13 to 13:28
dBA
Minutes

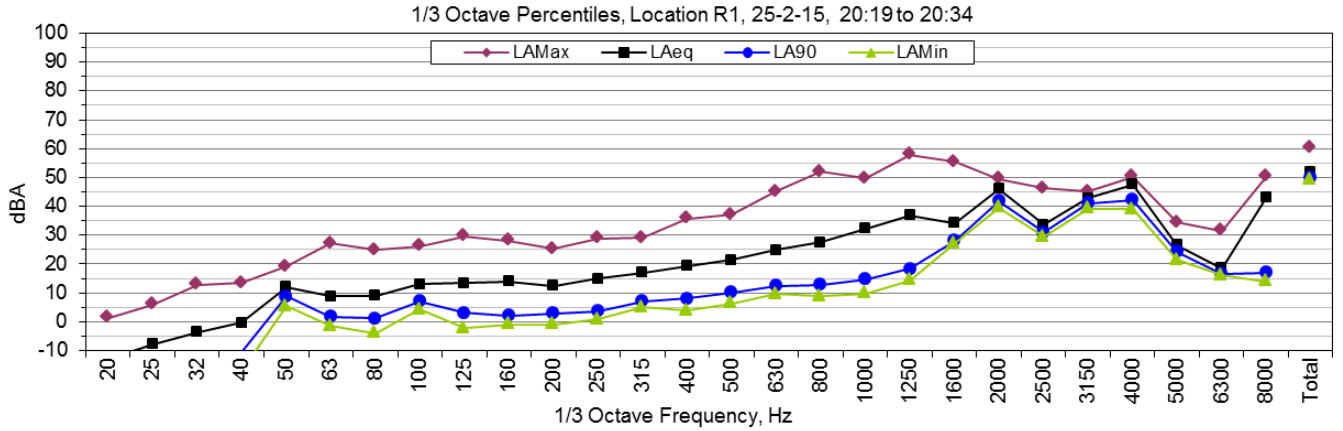

1/3 Octave Percentiles, Location R1, 25-2-15, 13:13 to 13:28
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

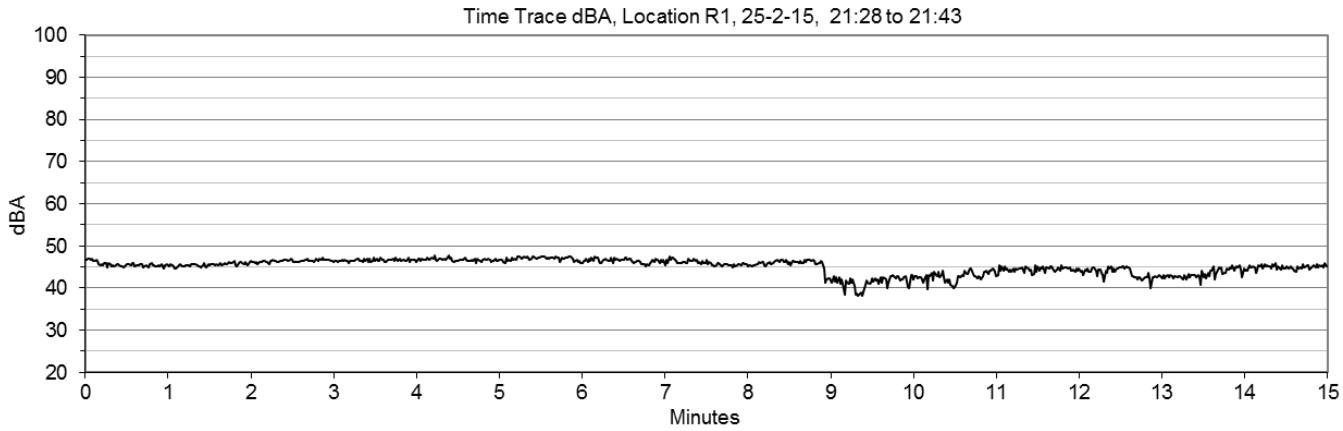

Time Trace dBA, Location R1, 25-2-15, 13:28 to 13:43
dBA
Minutes

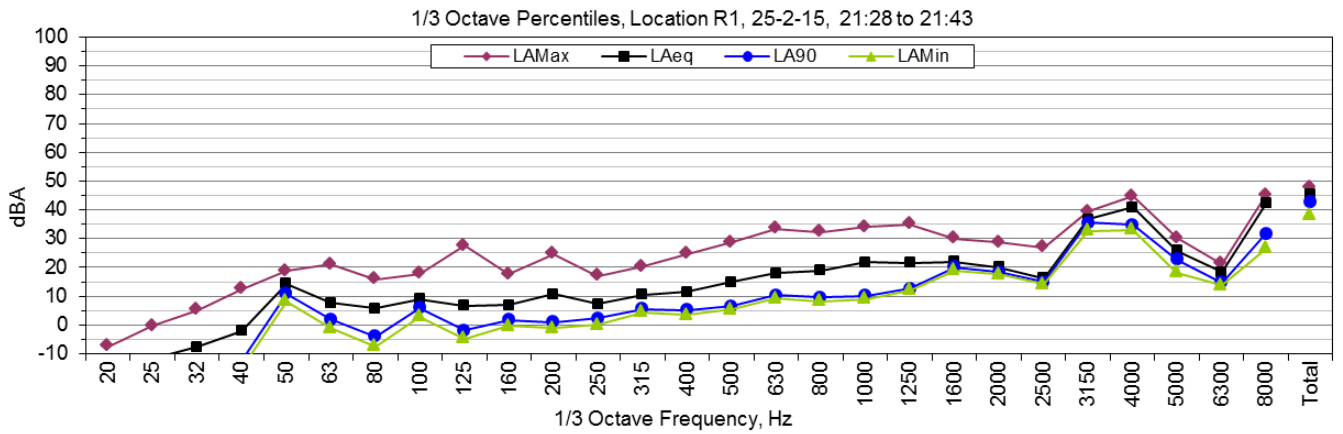

1/3 Octave Percentiles, Location R1, 25-2-15, 13:28 to 13:43
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

Evening 2 – Wednesday 25 February 2015

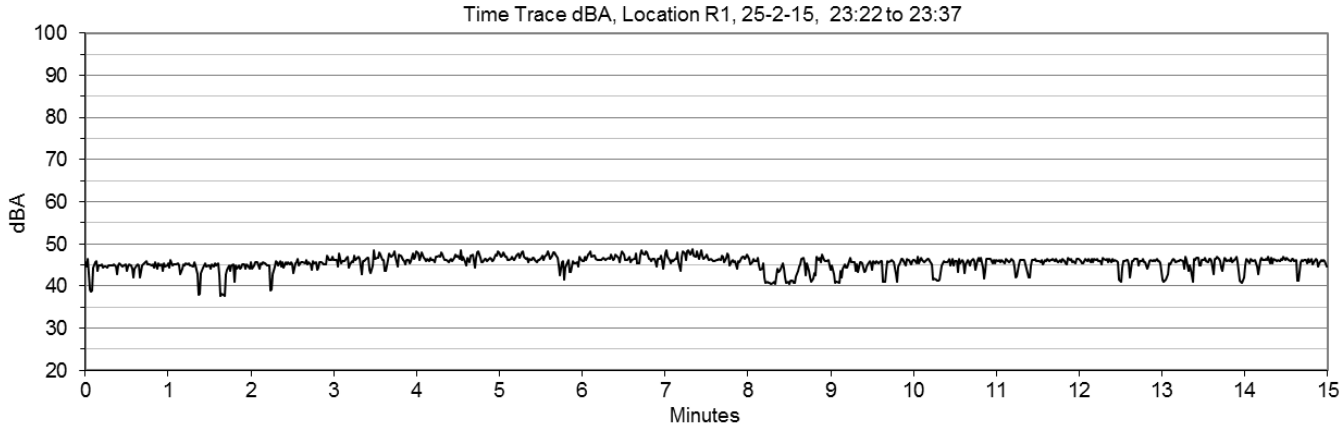


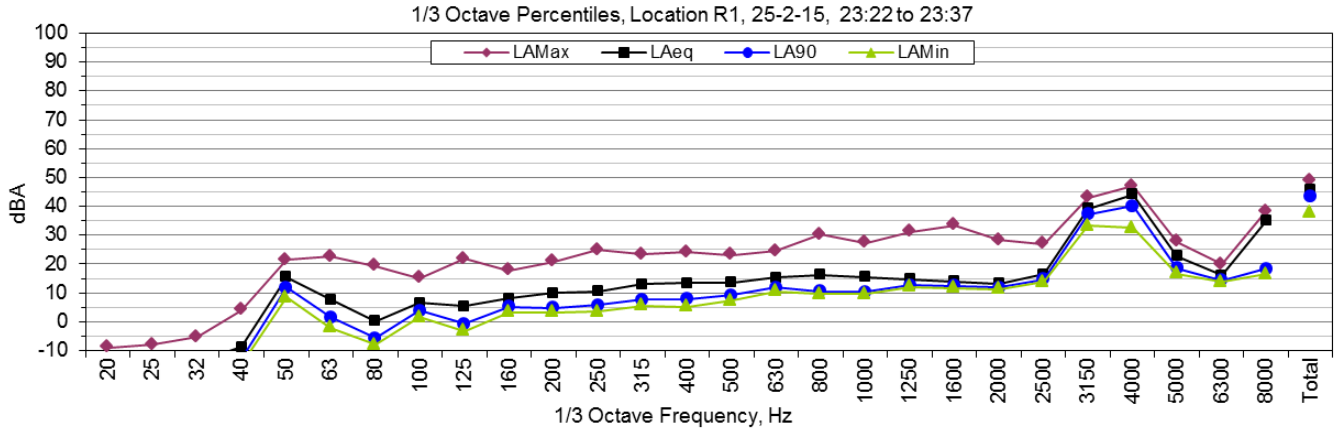


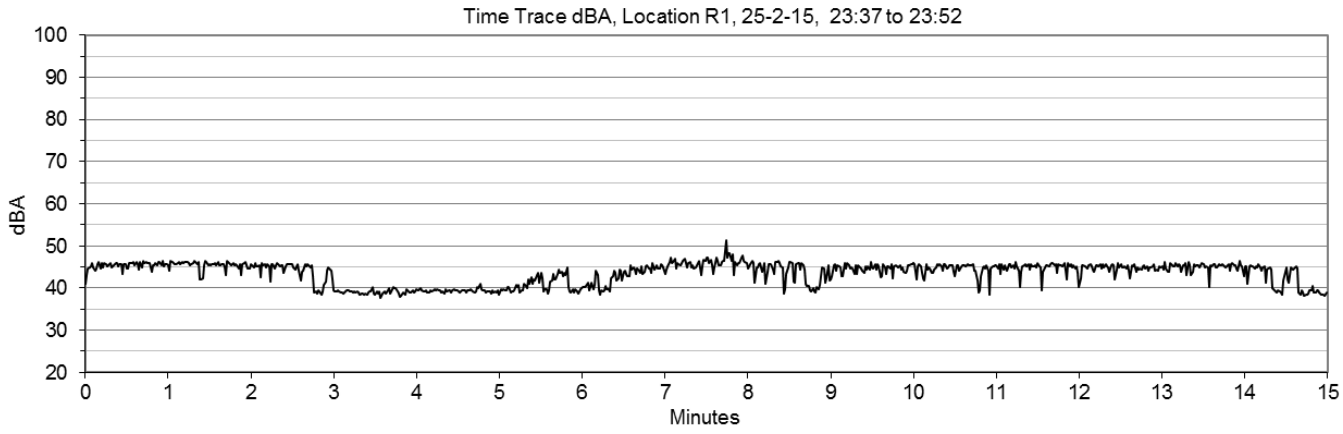


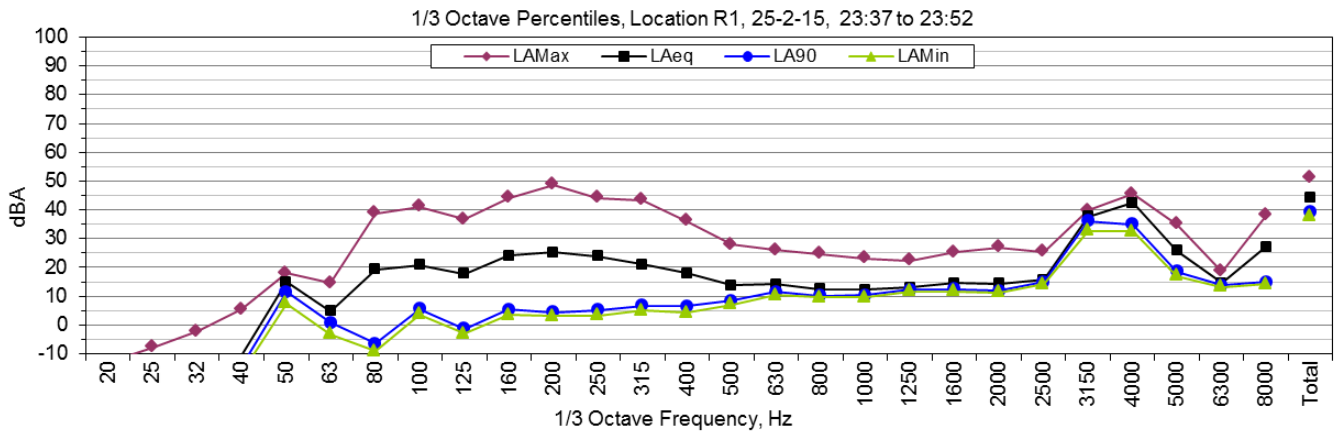


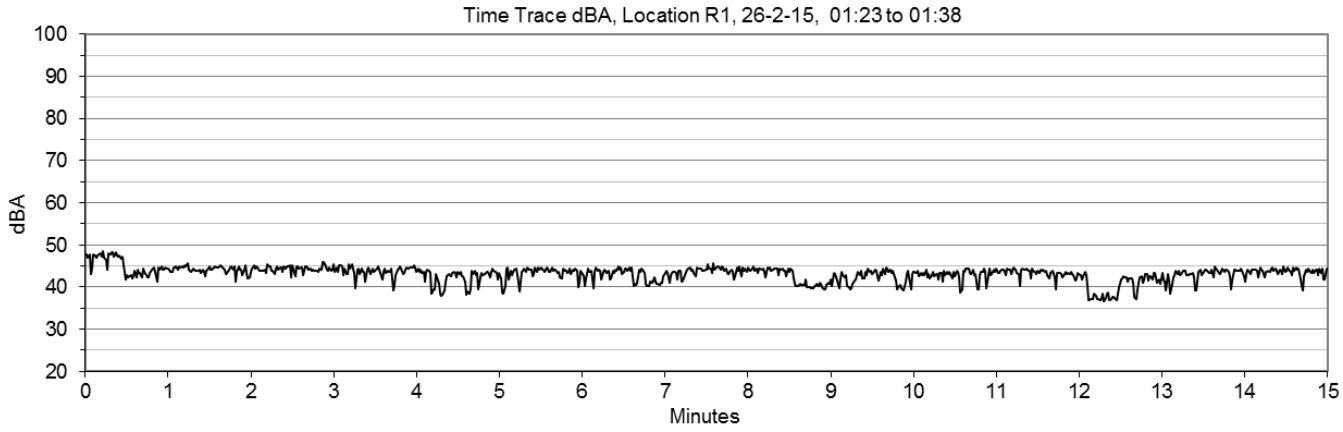
Night 2 – Wednesday 25 February 2015

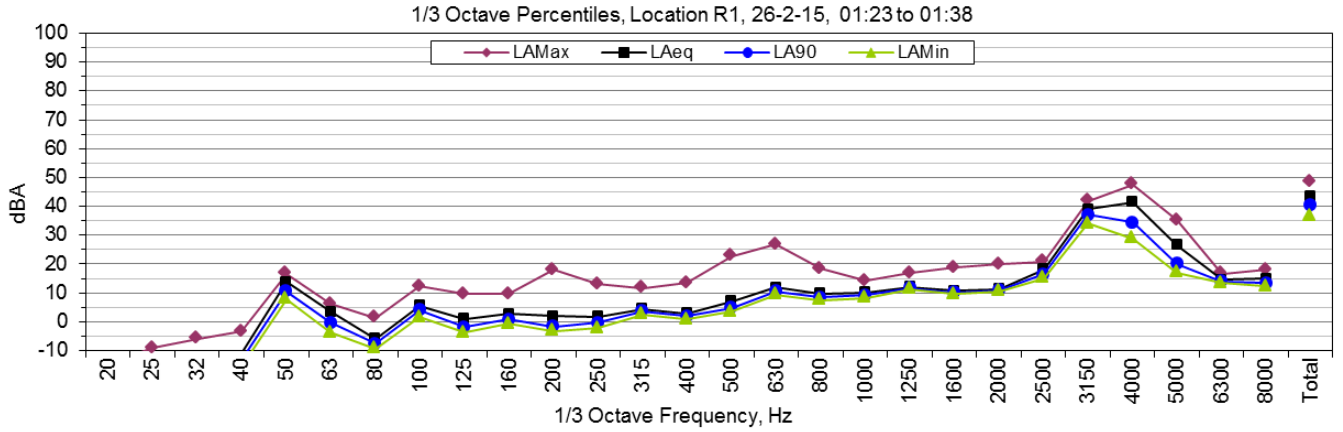


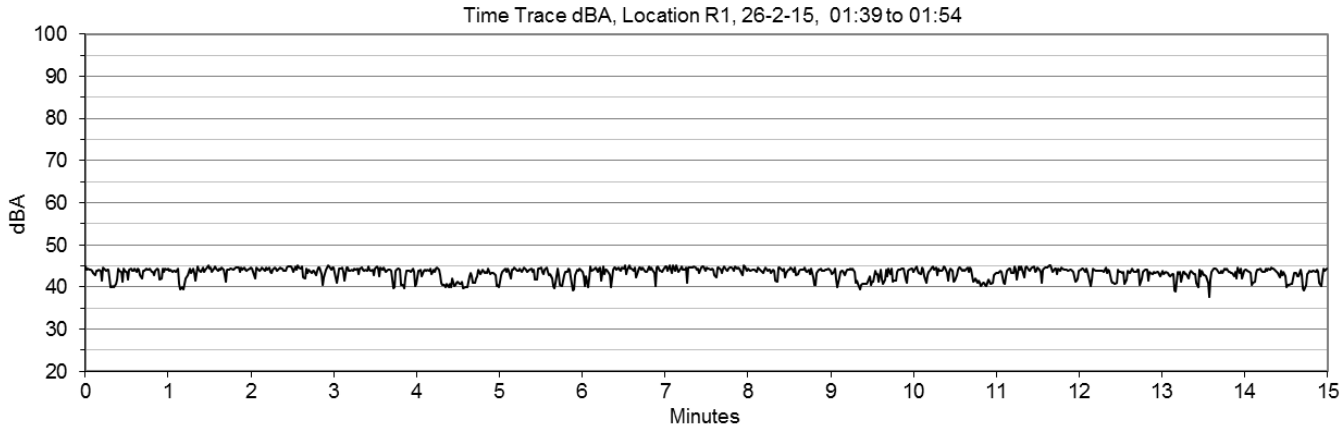


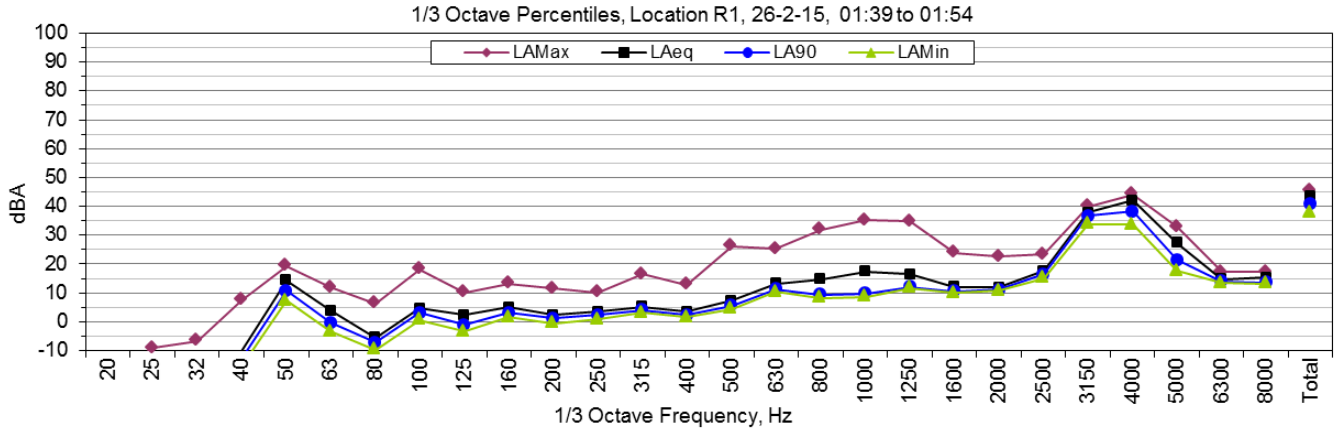




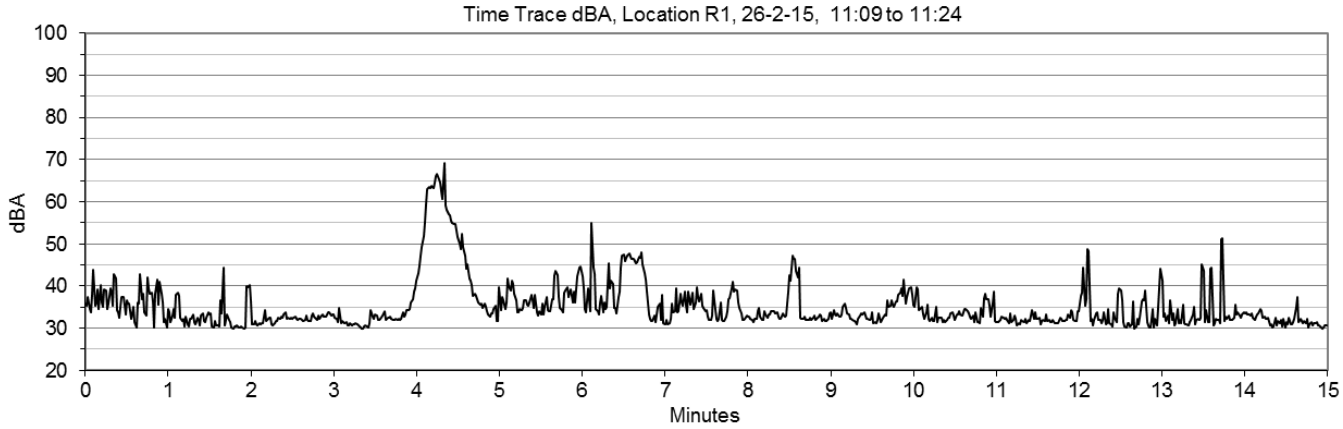

Time Trace dBA, Location R1, 26-2-15, 01:23 to 01:38
dBA
Minutes

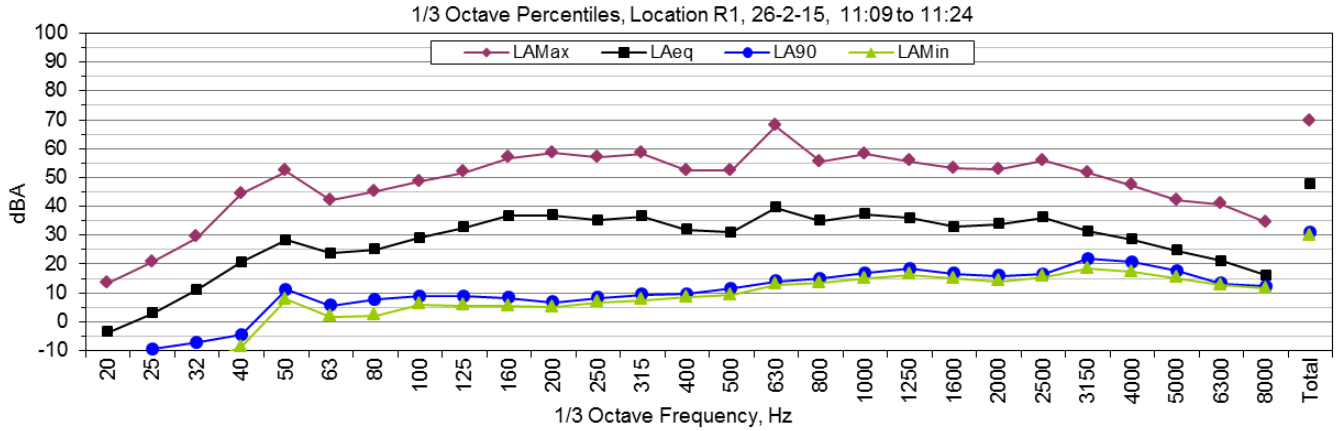

1/3 Octave Percentiles, Location R1, 26-2-15, 01:23 to 01:38
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

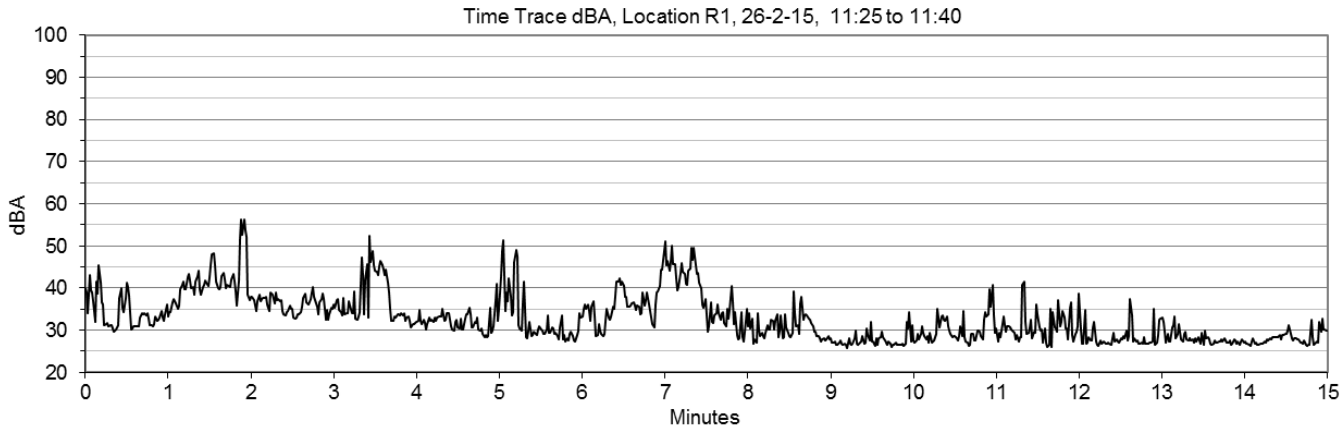

Time Trace dBA, Location R1, 26-2-15, 01:39 to 01:54
dBA
Minutes

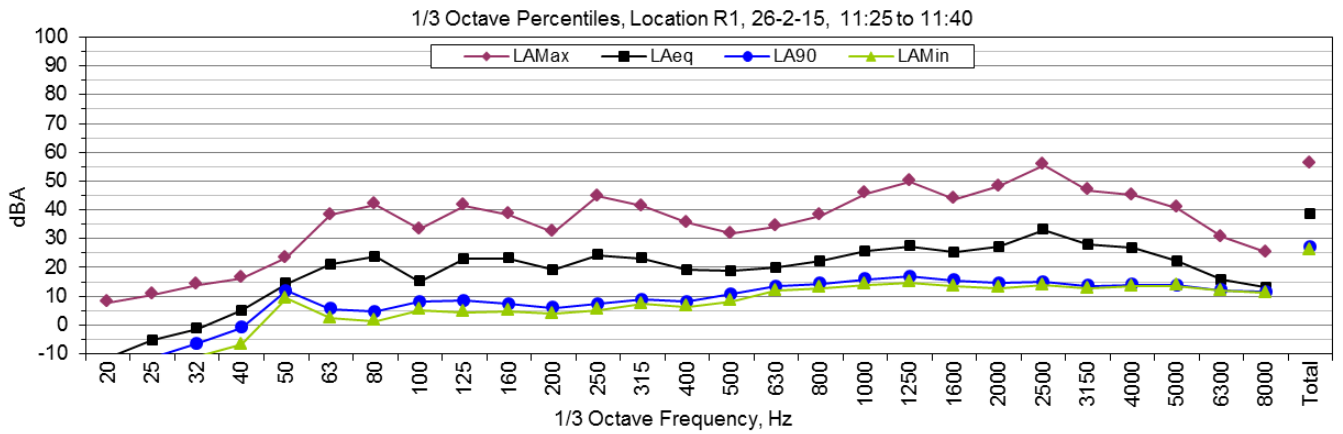

1/3 Octave Percentiles, Location R1, 26-2-15, 01:39 to 01:54
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

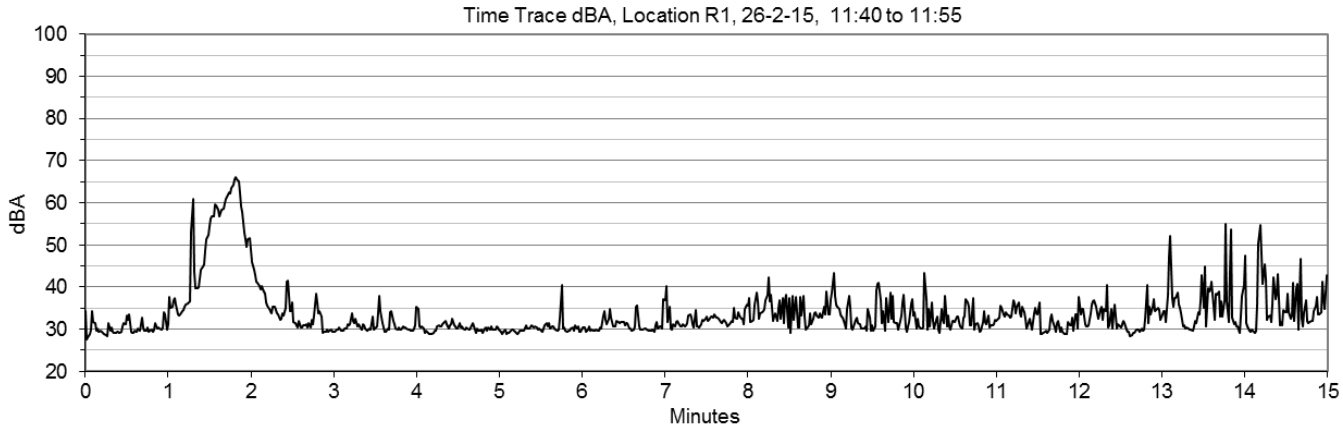
Day 3 – Thursday 26 February 2015

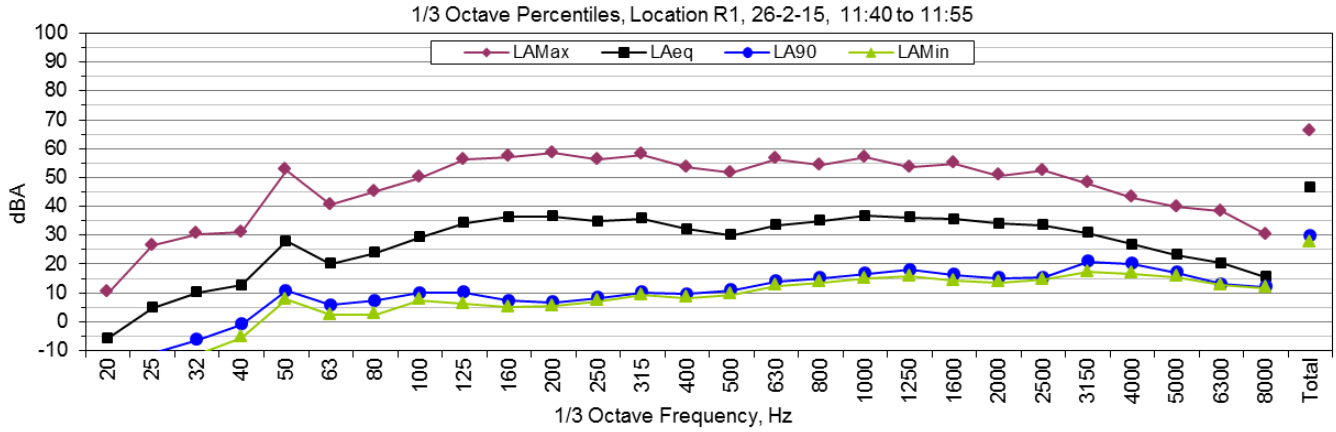


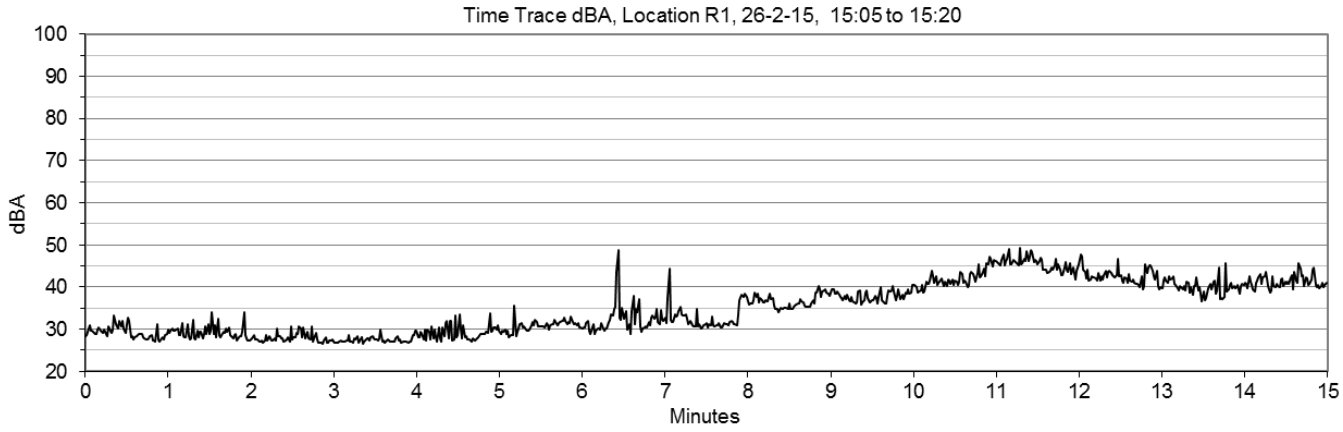


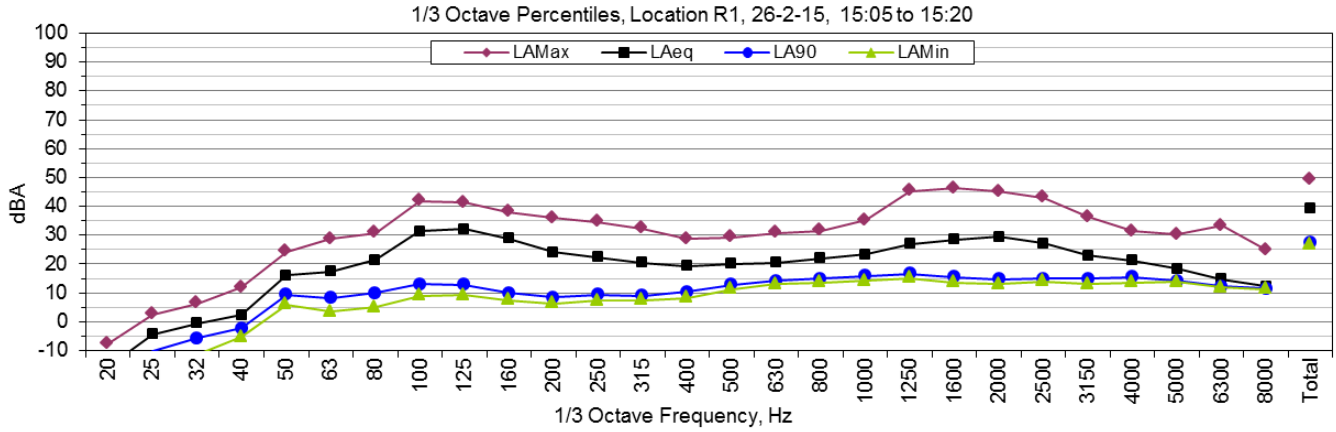


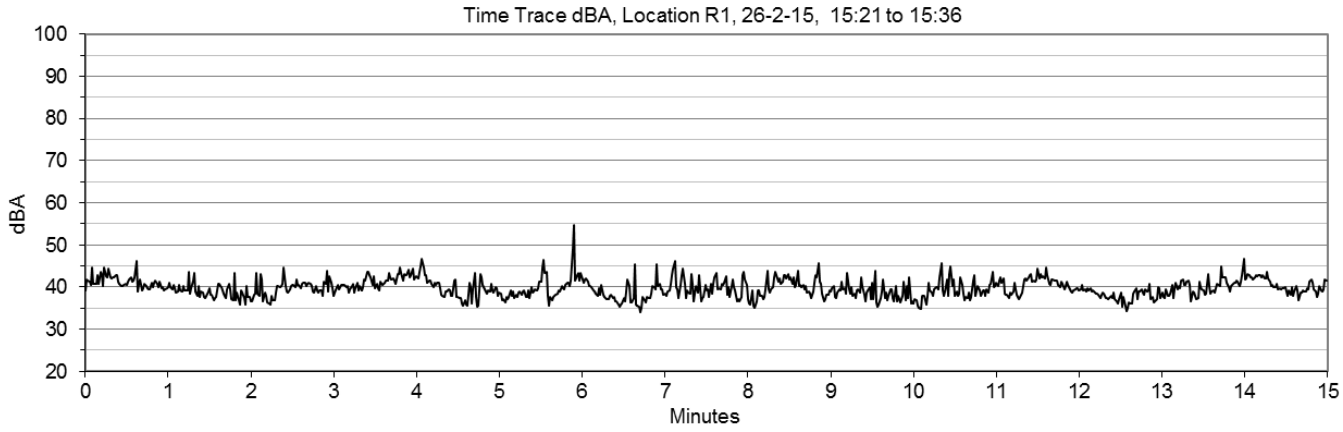


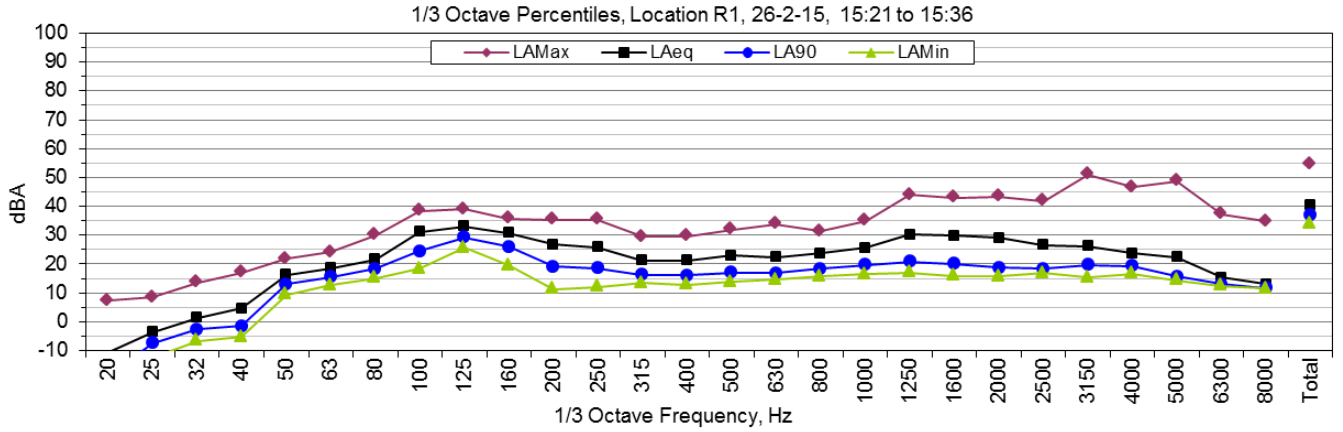

Time Trace dBA, Location R1, 26-2-15, 11:40 to 11:55
dBA
Minutes

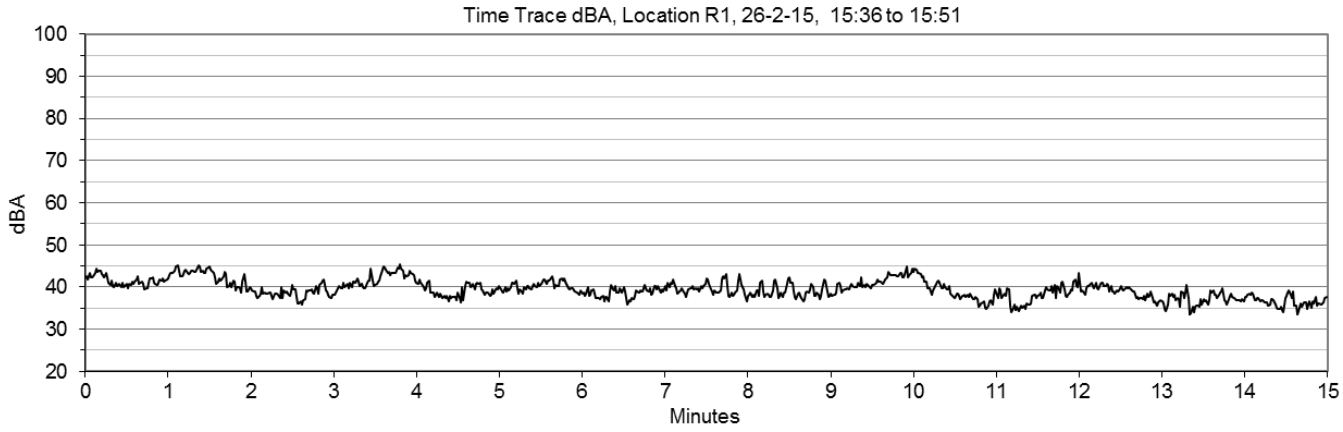

1/3 Octave Percentiles, Location R1, 26-2-15, 11:40 to 11:55
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

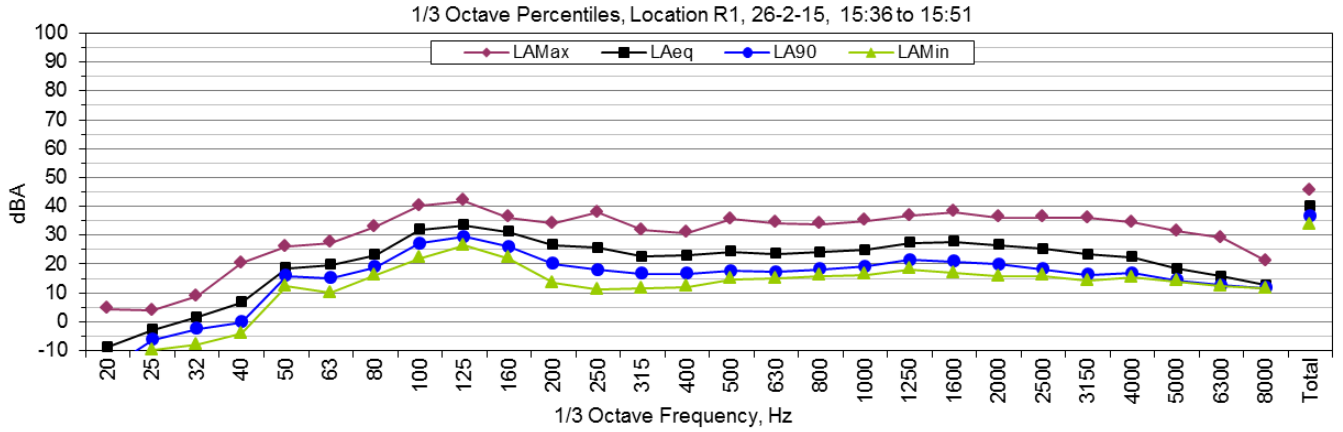

Time Trace dBA, Location R1, 26-2-15, 15:05 to 15:20
dBA
Minutes


1/3 Octave Percentiles, Location R1, 26-2-15, 15:05 to 15:20
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

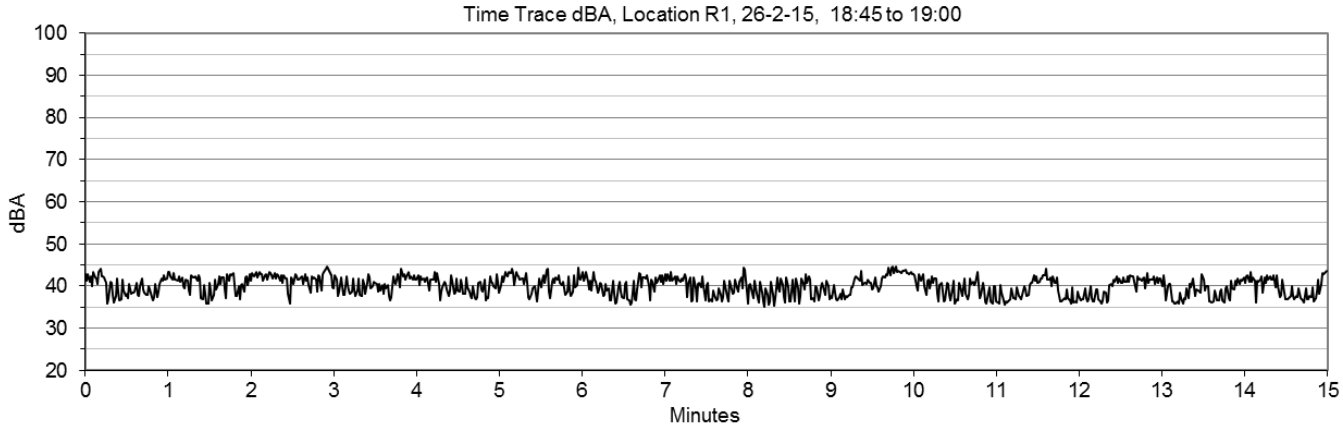

Time Trace dBA, Location R1, 26-2-15, 15:21 to 15:36
dBA
Minutes

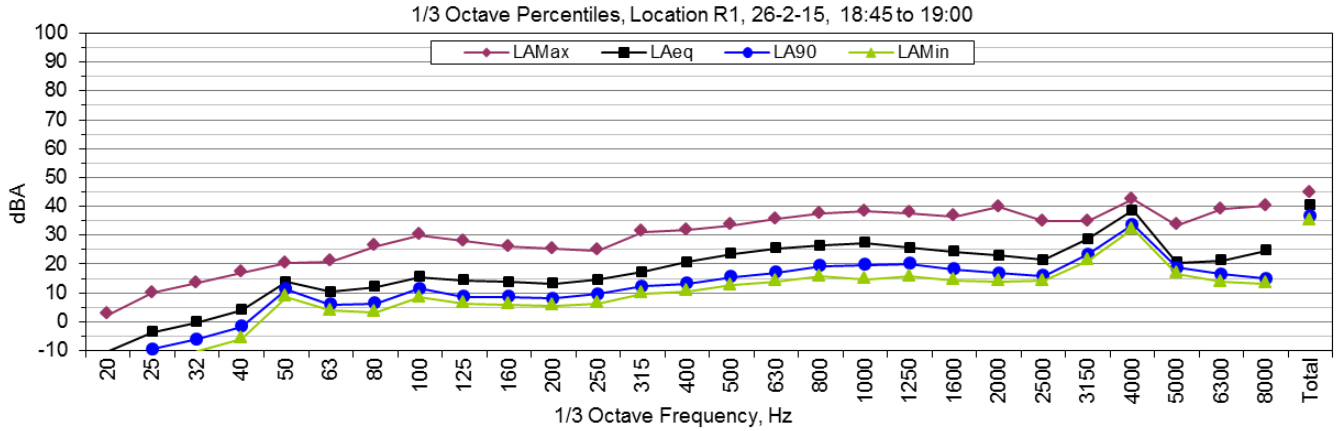

1/3 Octave Percentiles, Location R1, 26-2-15, 15:21 to 15:36
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

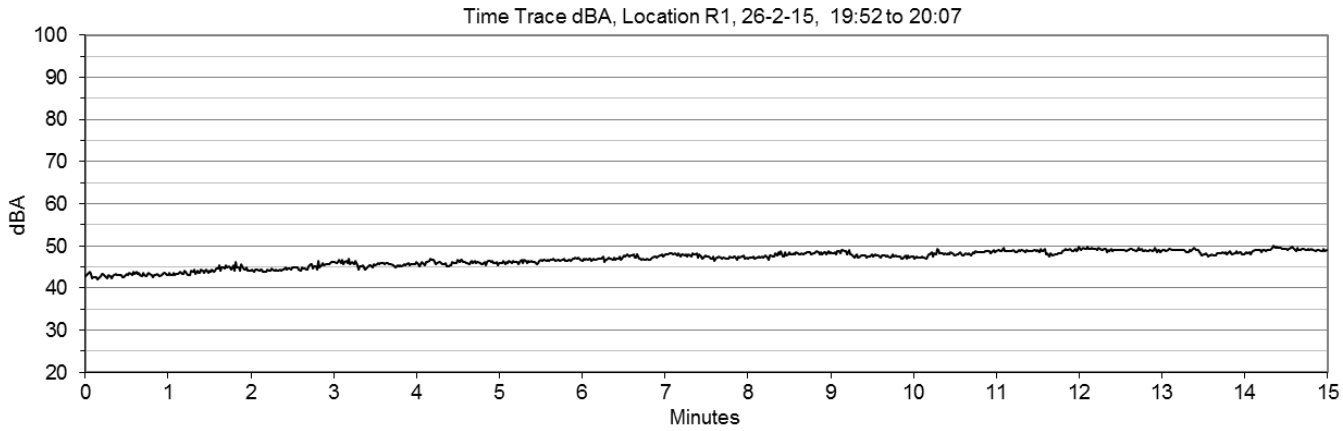

Time Trace dBA, Location R1, 26-2-15, 15:36 to 15:51
dBA
Minutes

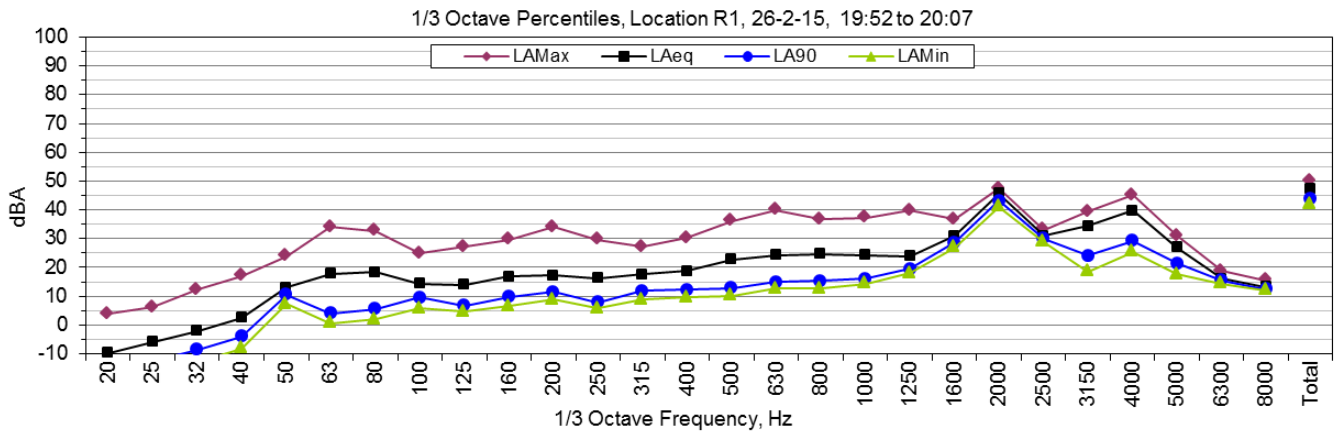

1/3 Octave Percentiles, Location R1, 26-2-15, 15:36 to 15:51
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

Evening 3 – Thursday 26 February 2015

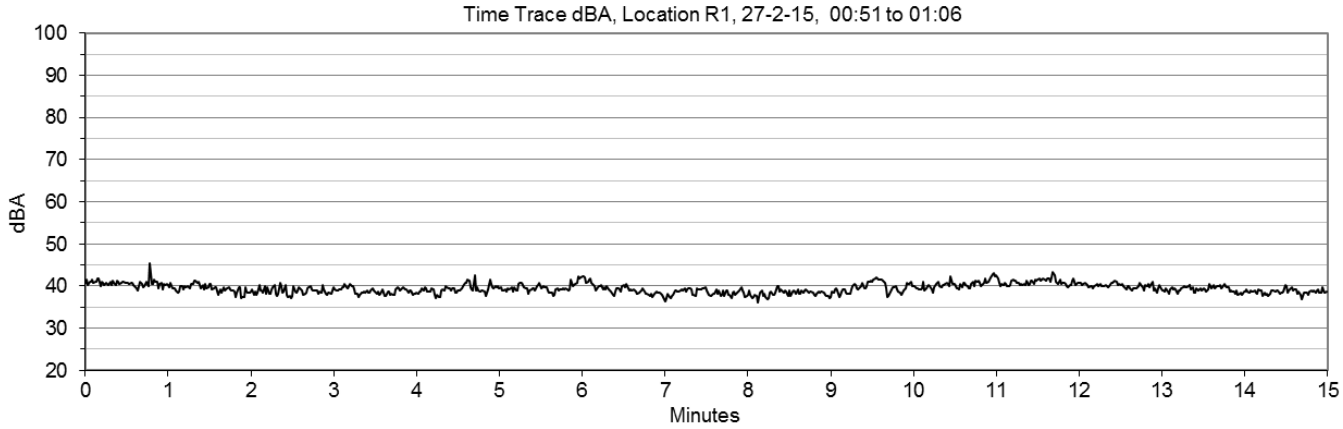


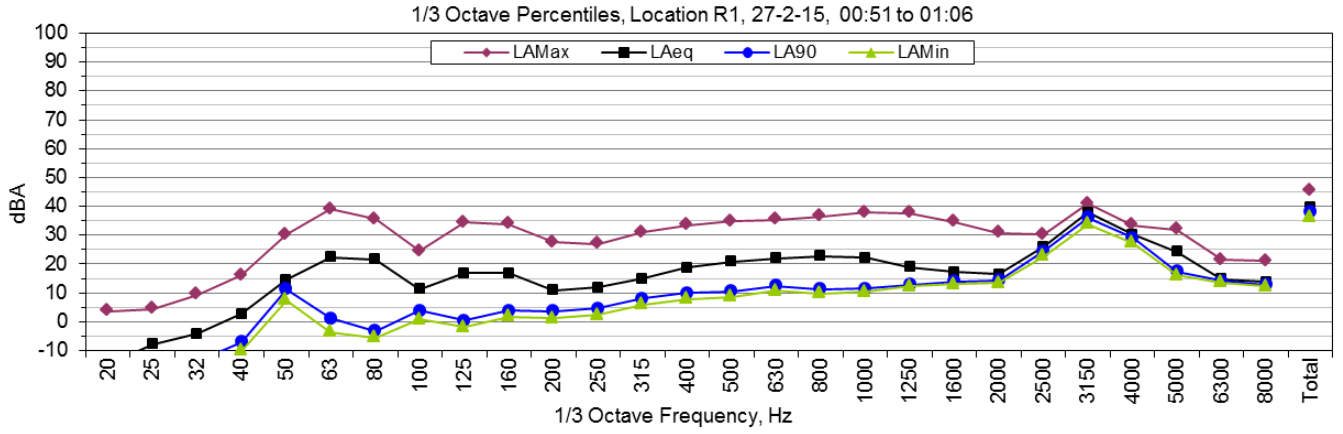


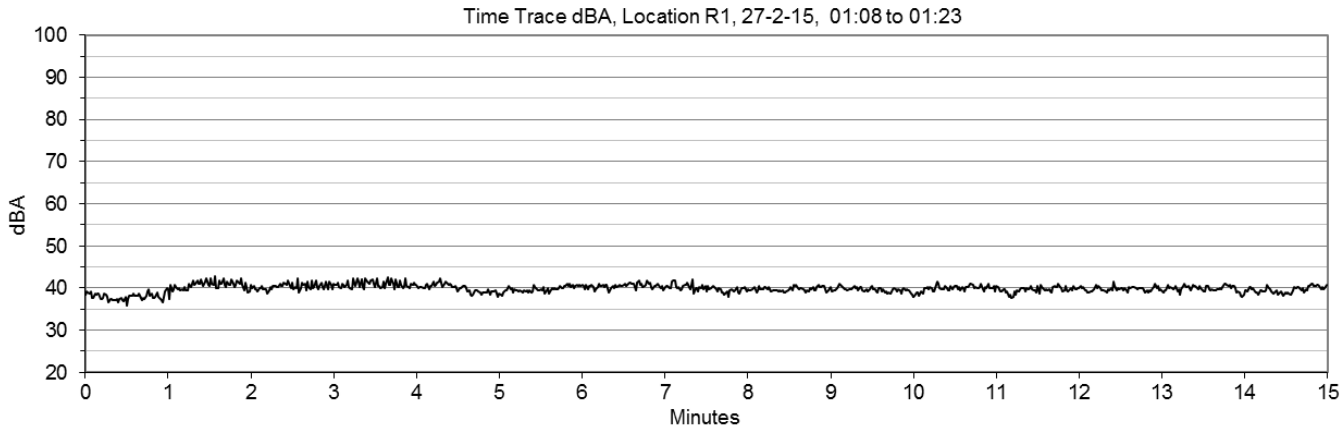


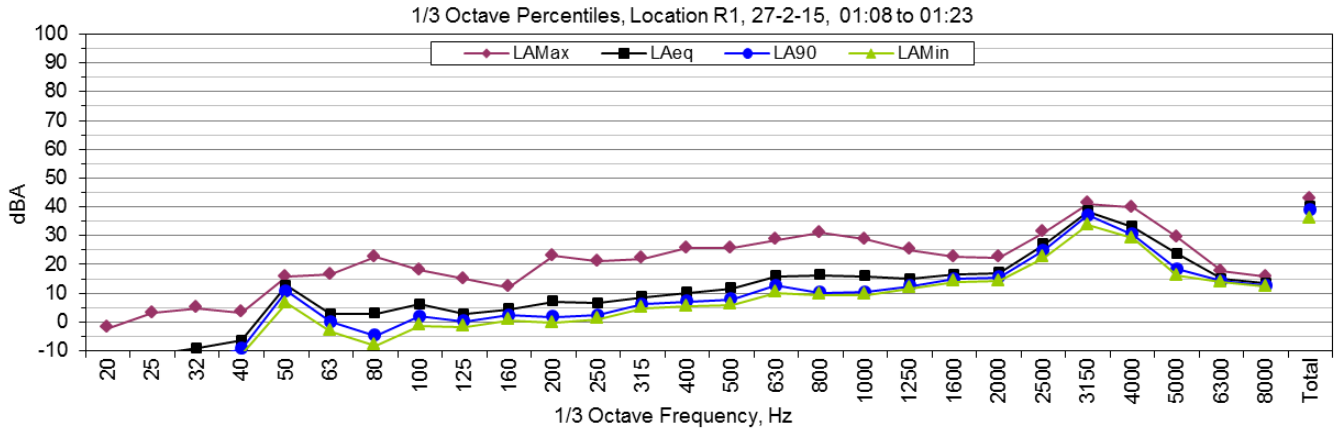


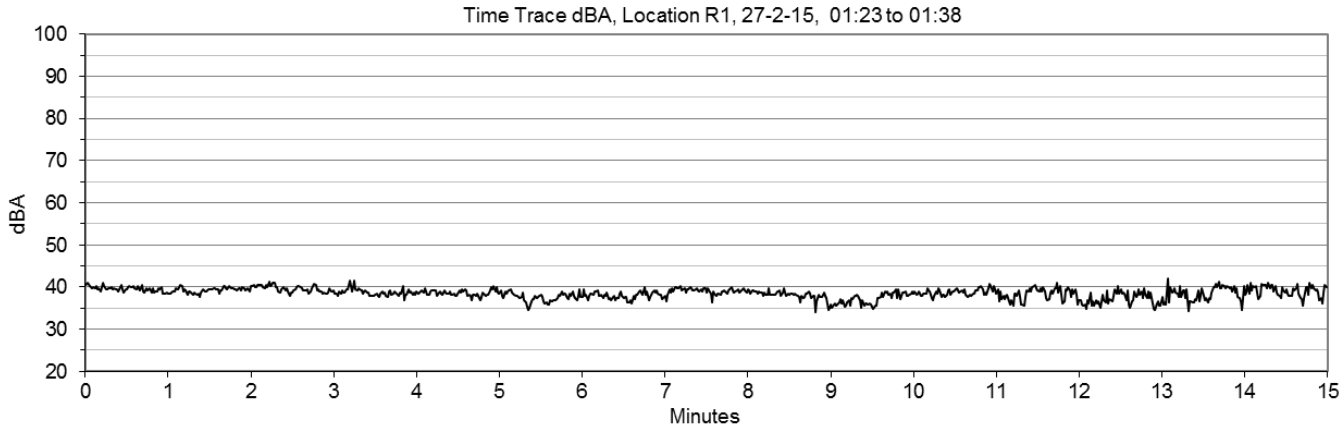
Night 3 – Thursday 26 February 2015

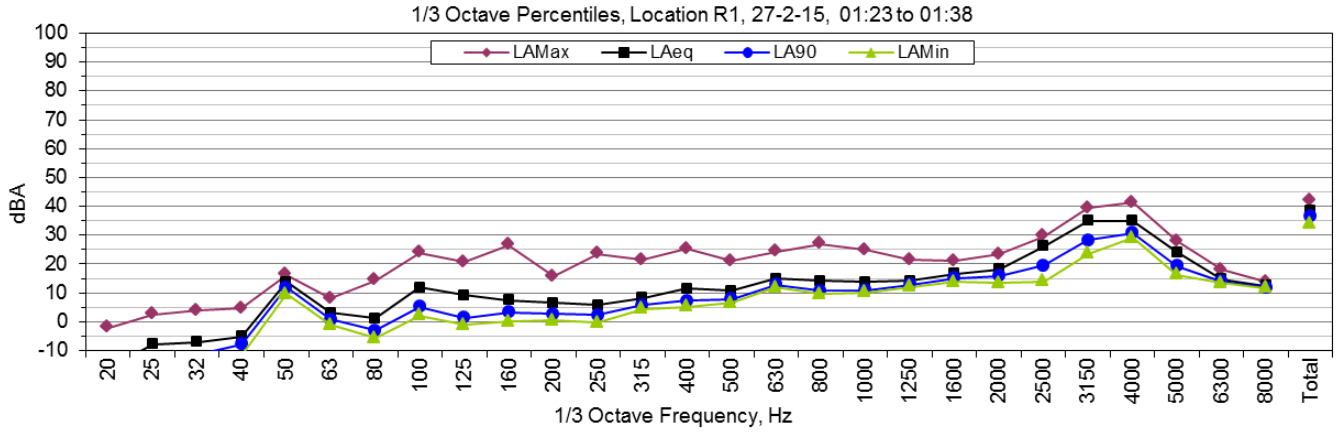


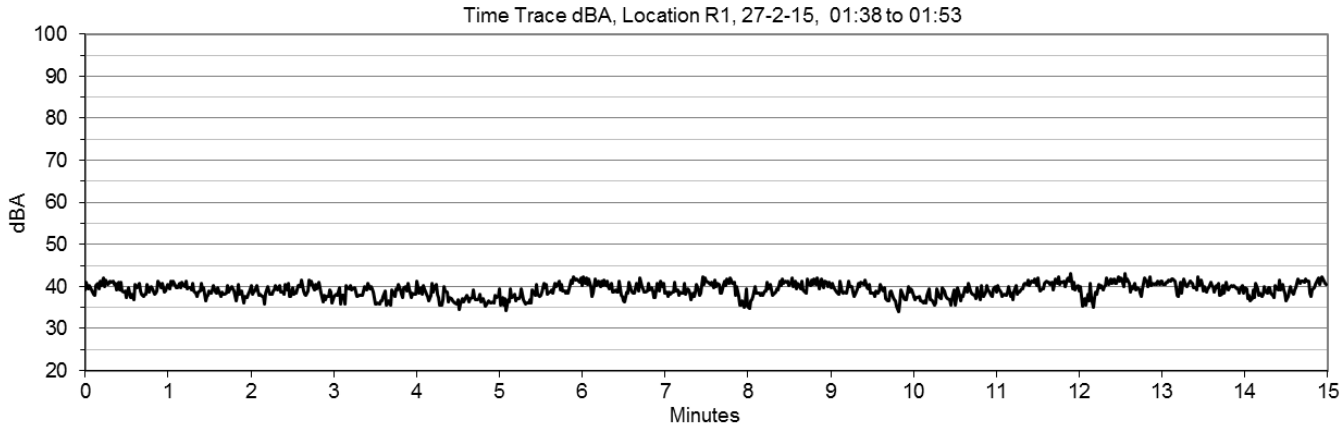


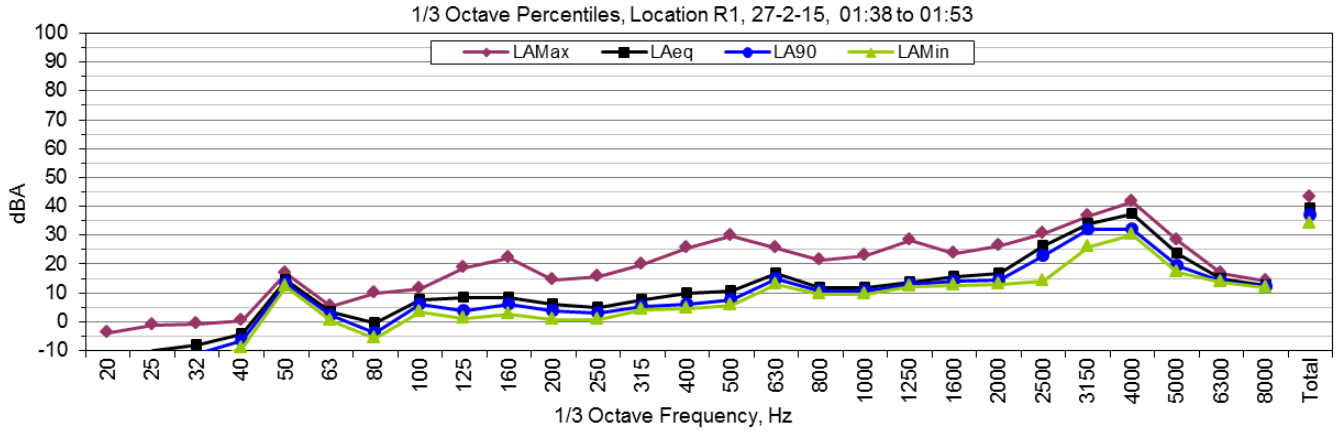





Time Trace dBA, Location R1, 27-2-15, 01:23 to 01:38
dBA
Minutes


1/3 Octave Percentiles, Location R1, 27-2-15, 01:23 to 01:38
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz


Time Trace dBA, Location R1, 27-2-15, 01:38 to 01:53
dBA
Minutes

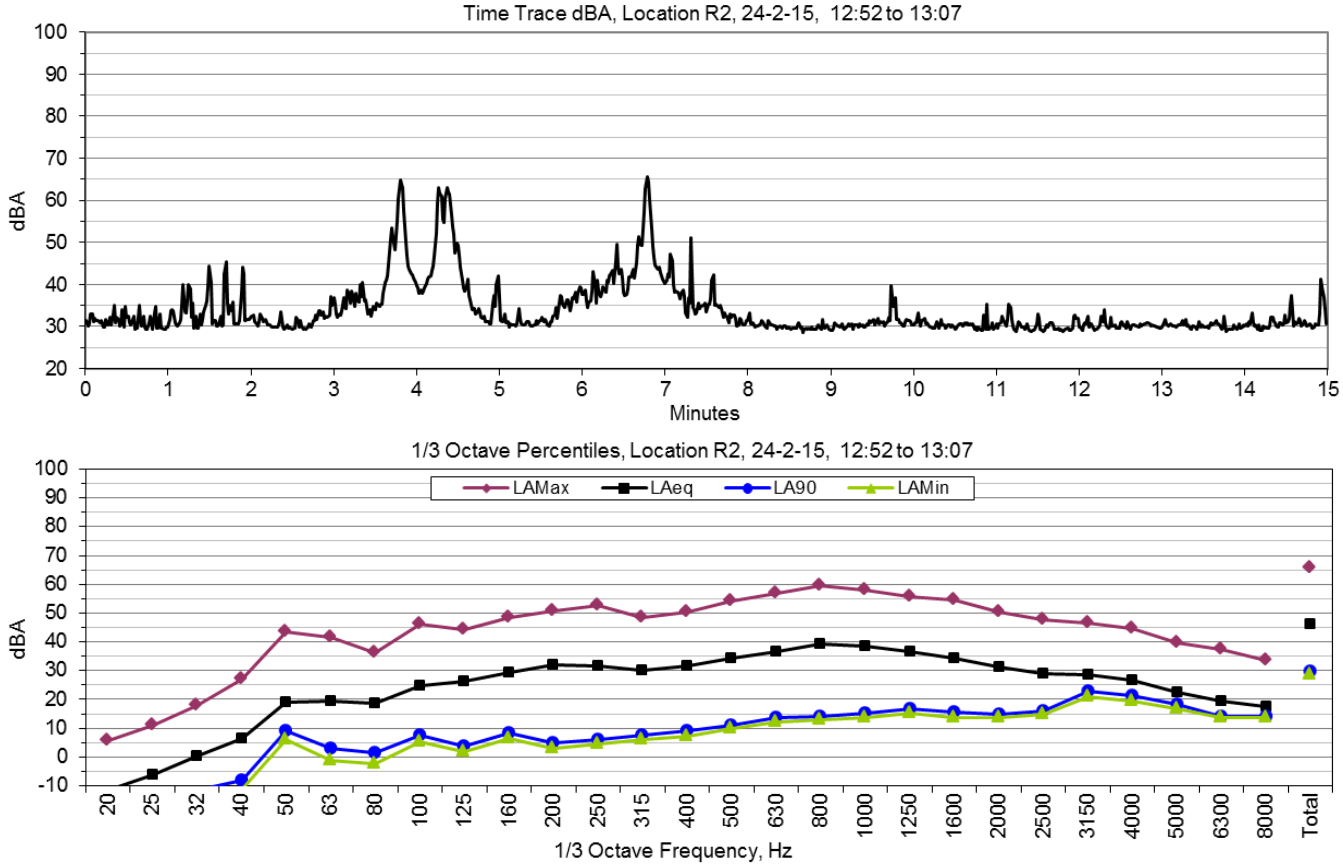

1/3 Octave Percentiles, Location R1, 27-2-15, 01:38 to 01:53
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

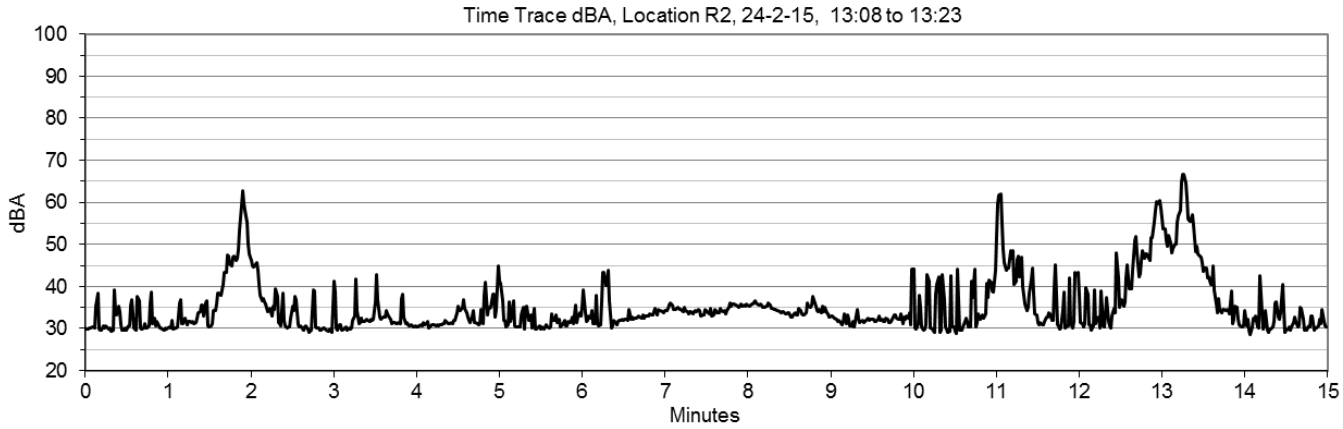
APPENDIX C – MEASURED NOISE LEVELS, RECEPTOR R2

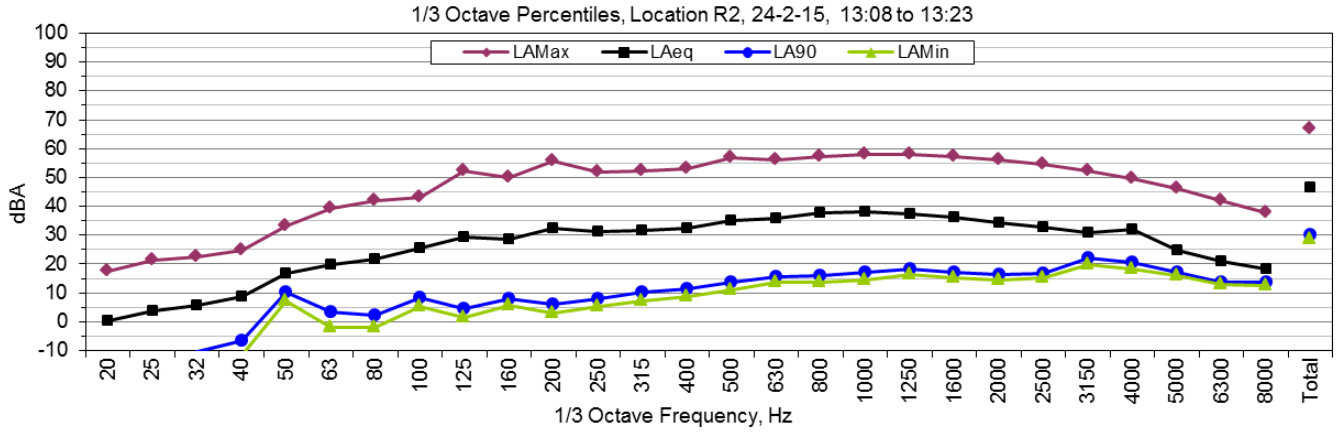
Charts on the following pages show measured noise levels at Receptor R2. Measured noise levels are presented in the order they were measured, with the date and time shown in each figure.

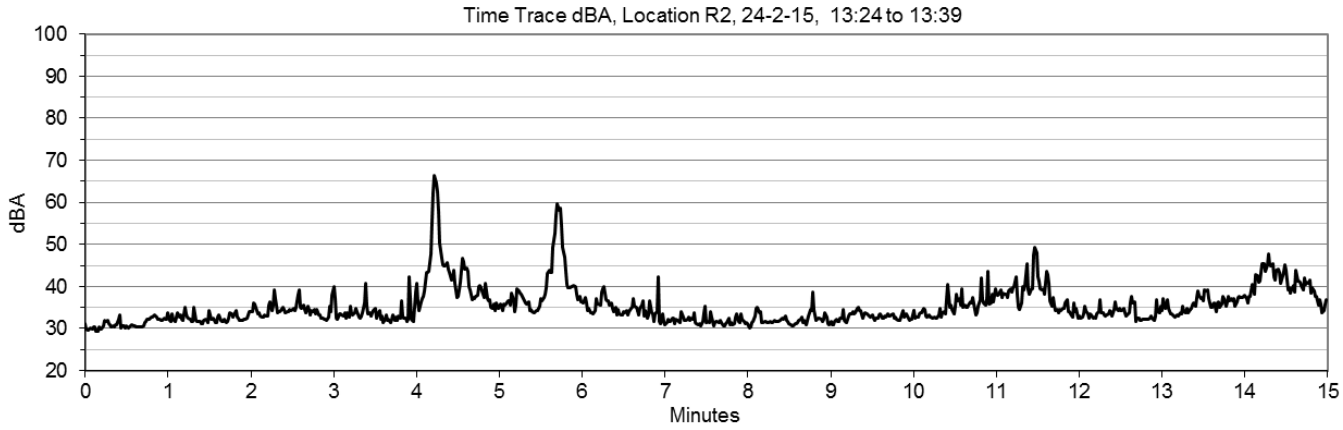
Two charts are shown for each noise measurement. The first chart shows a 'noise level trace' for the duration of the noise measurement in one second intervals in dBA. The second chart shows the measured maximum (LAmax), average (LAeq), background (LA90) and minimum (LAmin) noise levels in 1/3 octave bands from 20 Hz to 8000 Hz and total dBA noise levels.

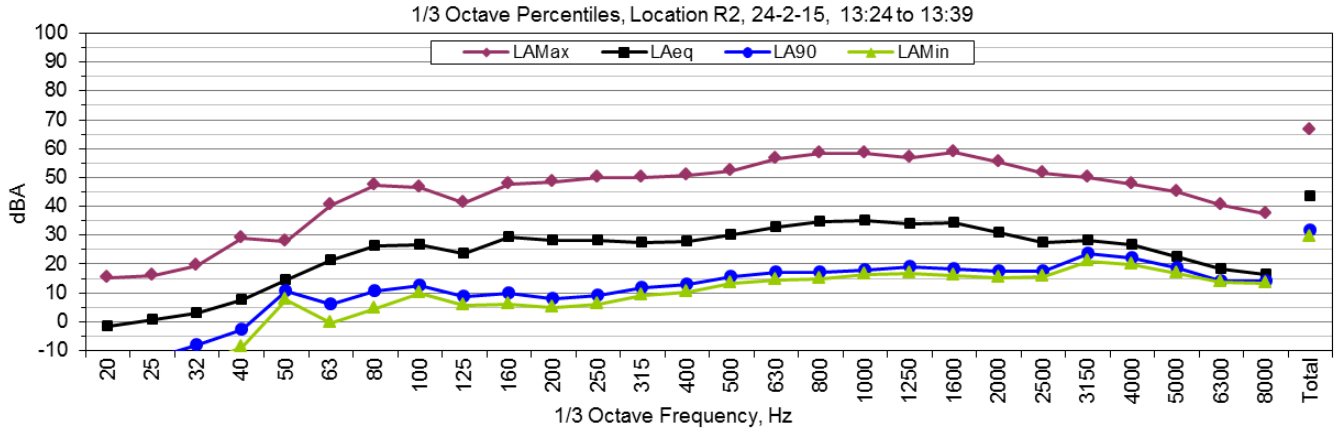
Day 1 – Tuesday 24 February 2015

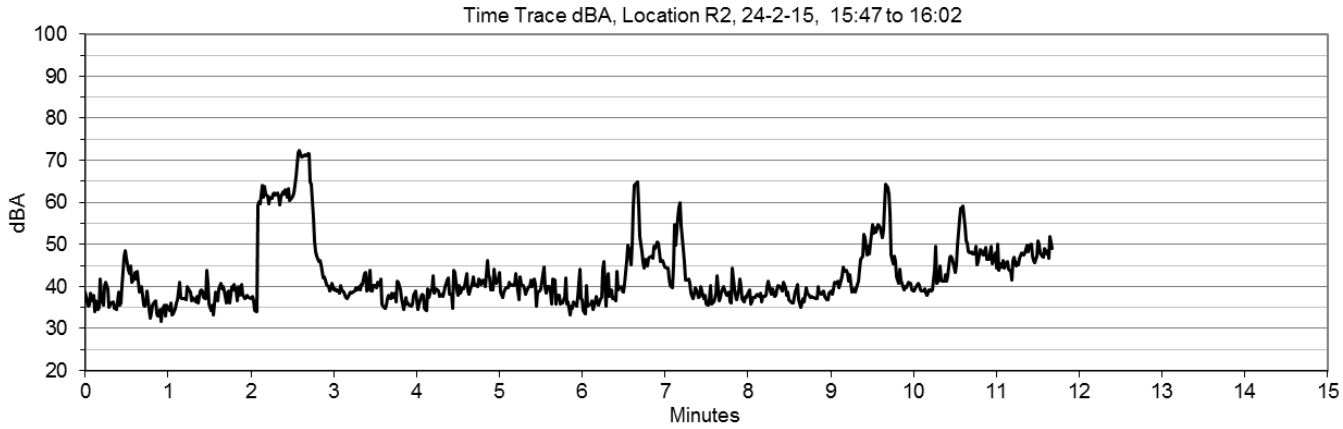


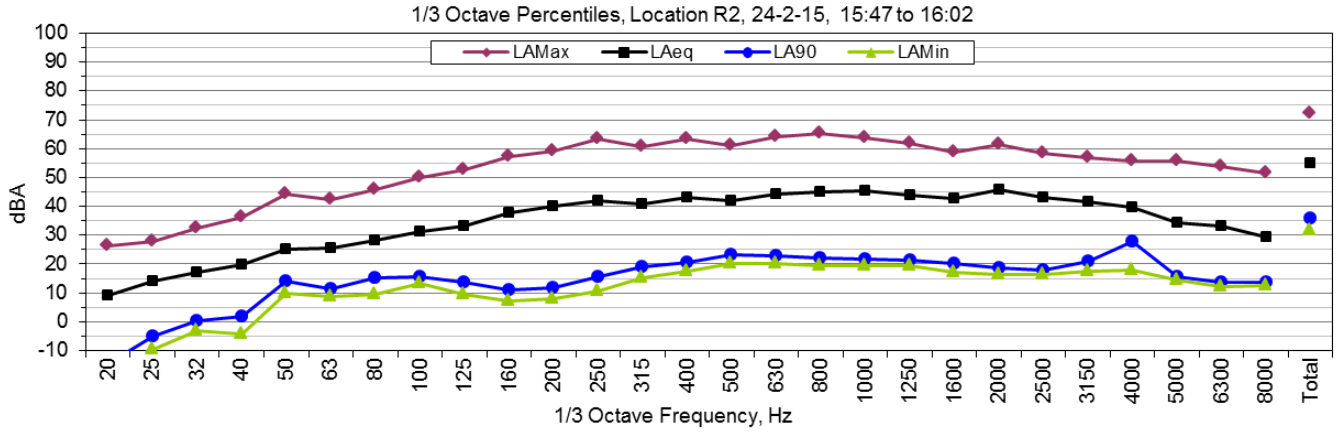

Time Trace dBA, Location R2, 24-2-15, 13:08 to 13:23
dBA
Minutes

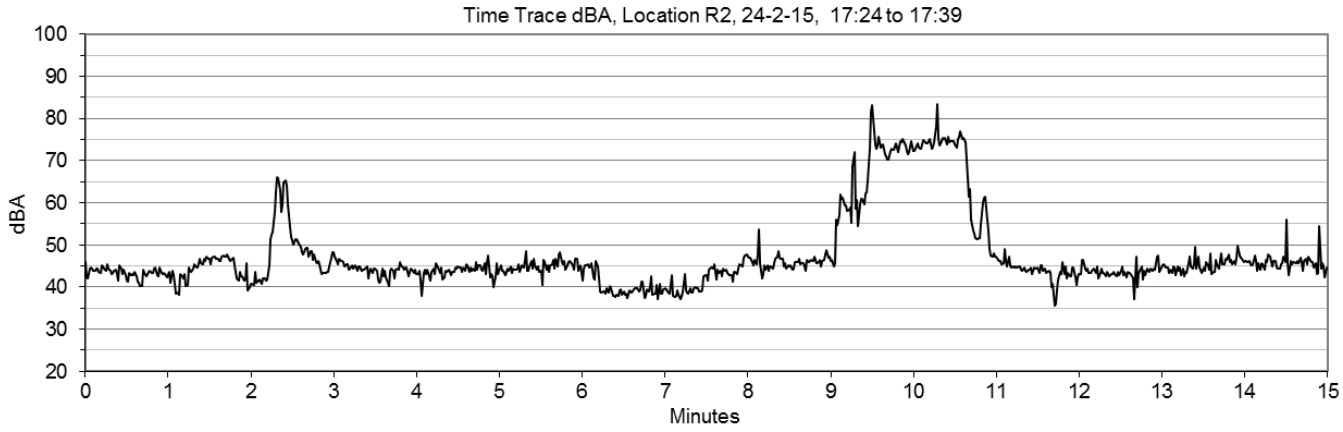

1/3 Octave Percentiles, Location R2, 24-2-15, 13:08 to 13:23
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

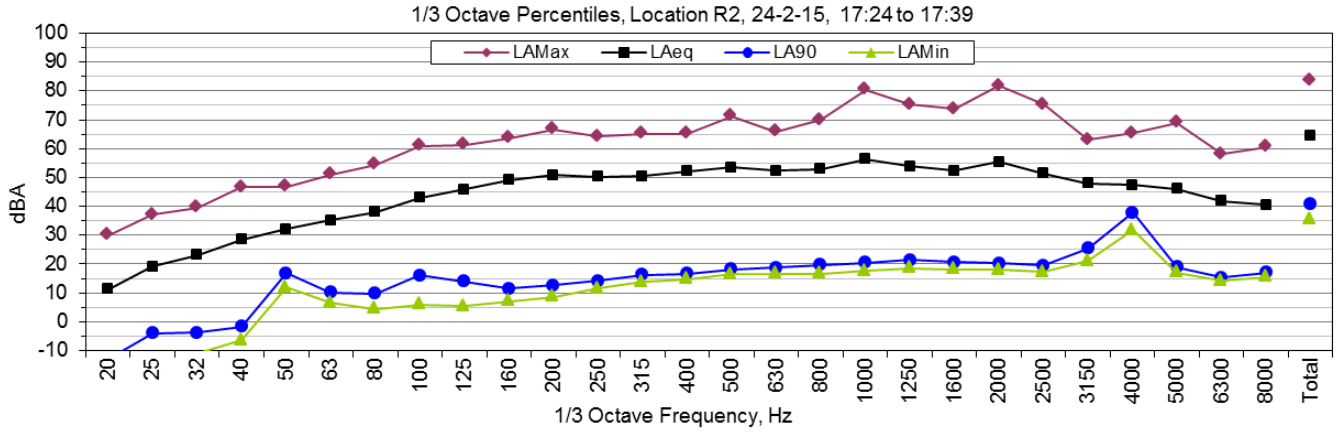

Time Trace dBA, Location R2, 24-2-15, 13:24 to 13:39
dBA
Minutes


1/3 Octave Percentiles, Location R2, 24-2-15, 13:24 to 13:39
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

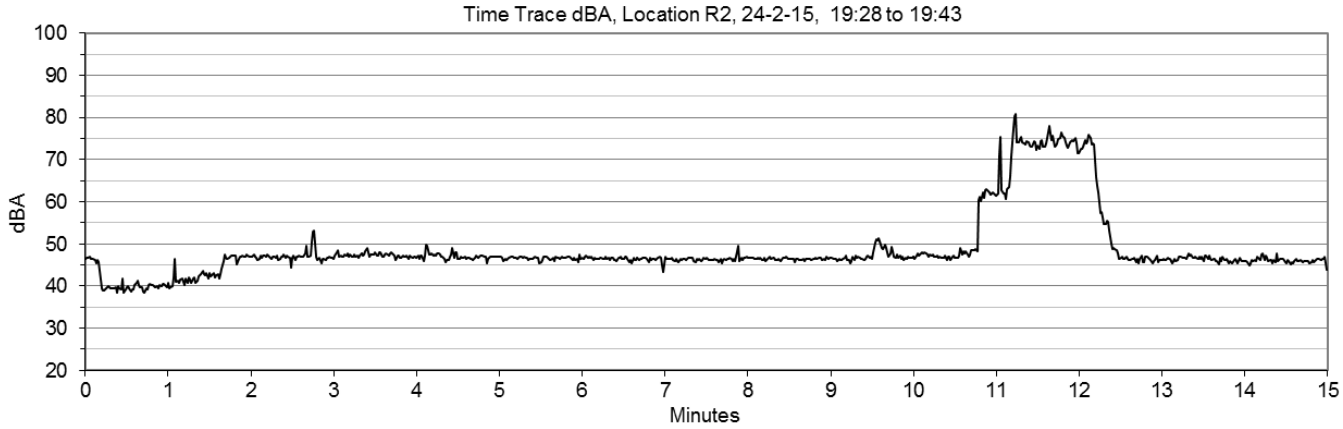

Time Trace dBA, Location R2, 24-2-15, 15:47 to 16:02
dBA
Minutes

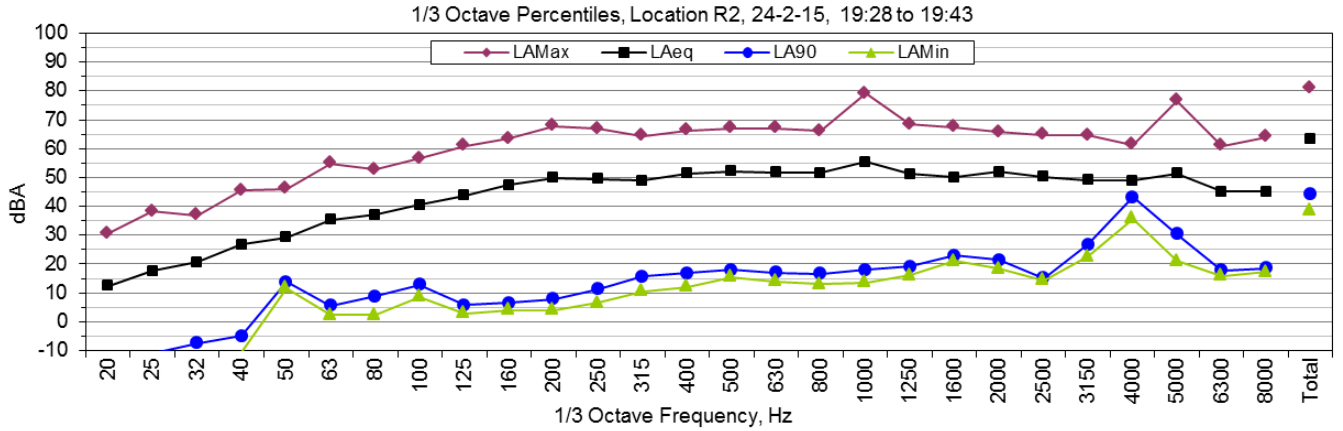

1/3 Octave Percentiles, Location R2, 24-2-15, 15:47 to 16:02
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

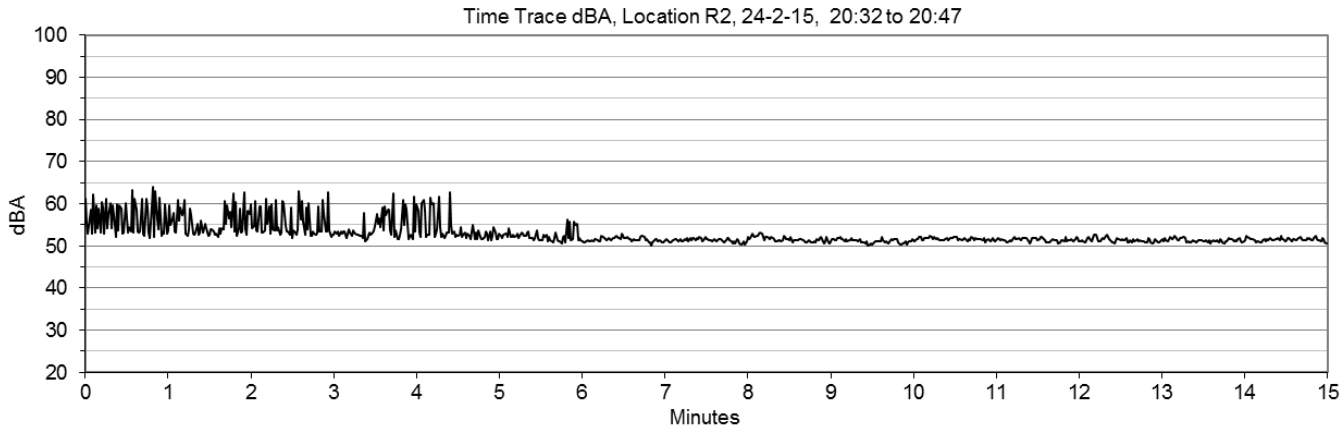

Time Trace dBA, Location R2, 24-2-15, 17:24 to 17:39
dBA
Minutes

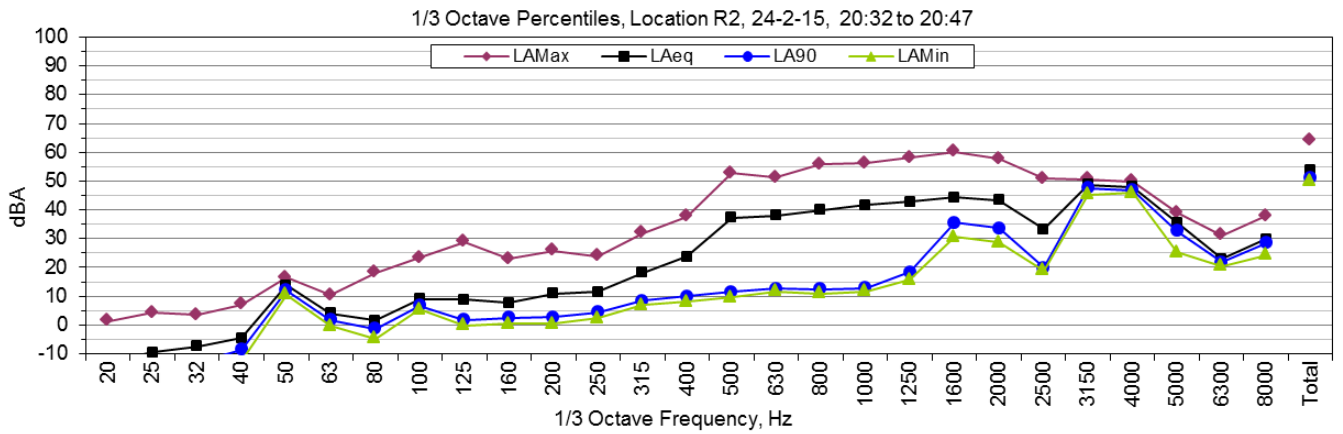

1/3 Octave Percentiles, Location R2, 24-2-15, 17:24 to 17:39
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

Evening 1 – Tuesday 24 February 2015

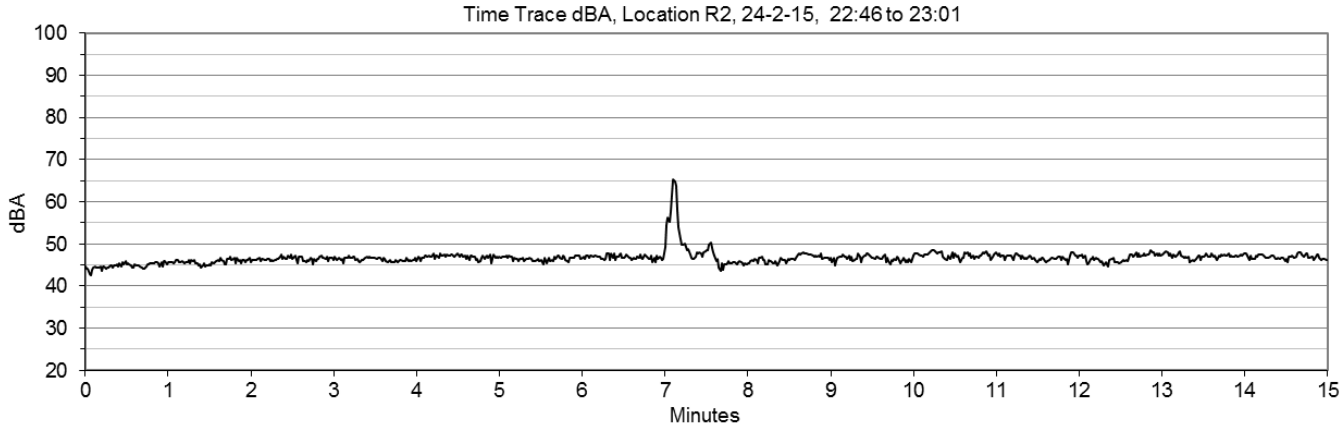


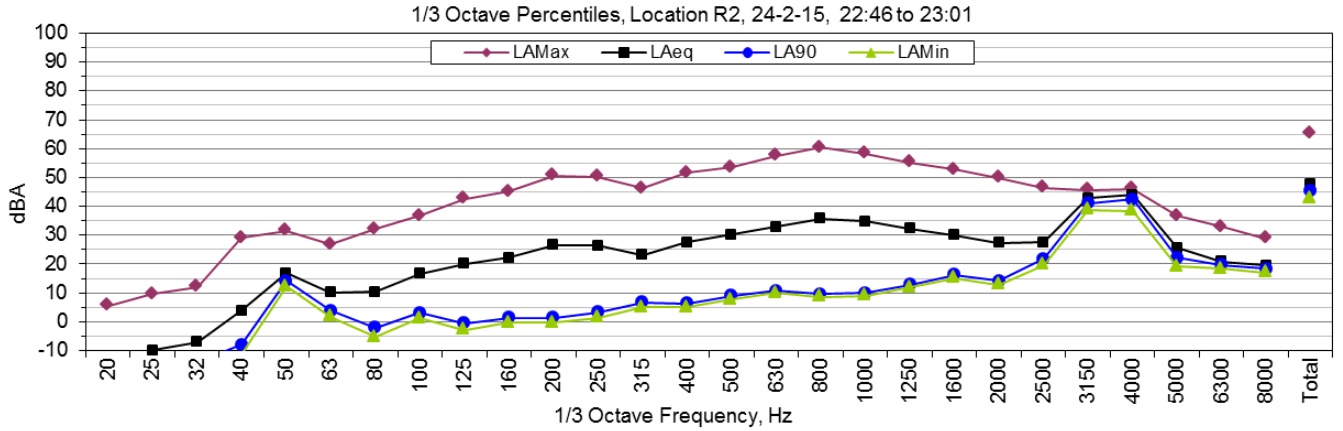


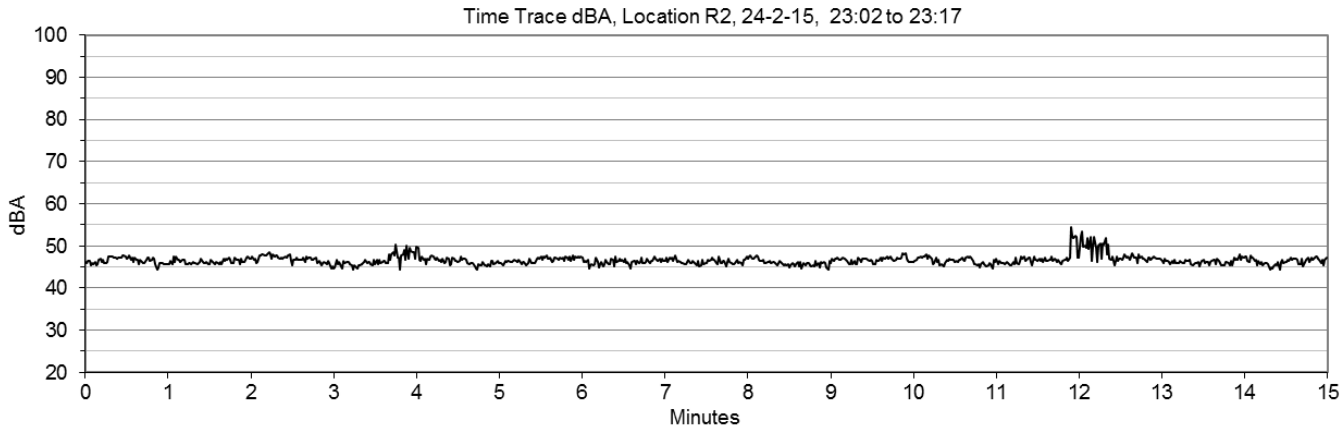


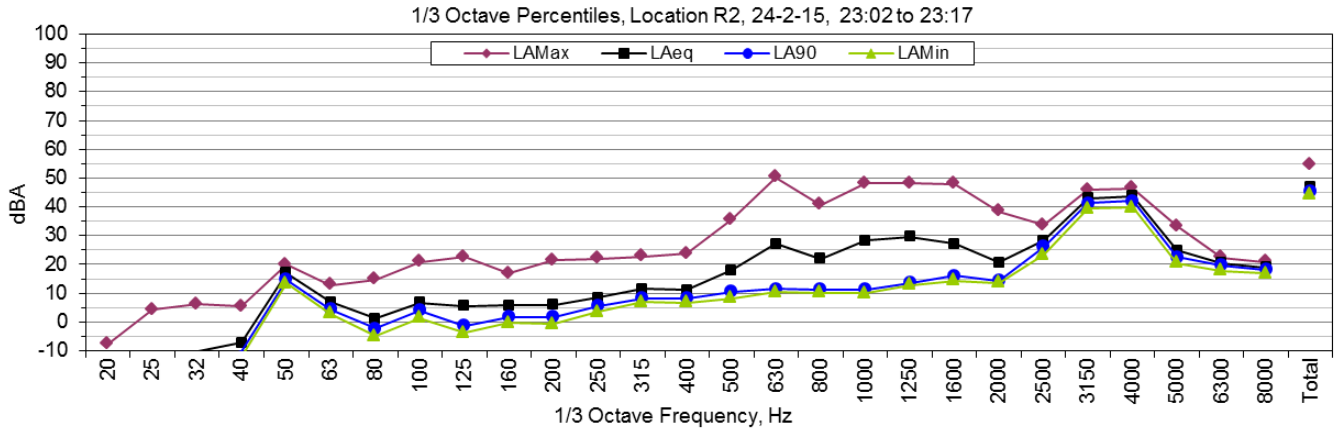


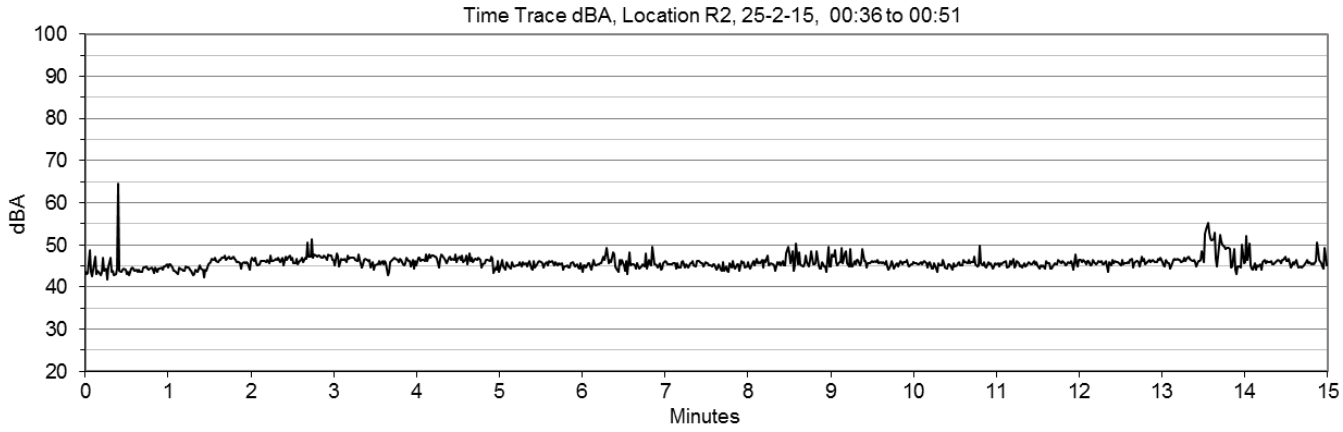
Night 1 – Tuesday 24 February 2015

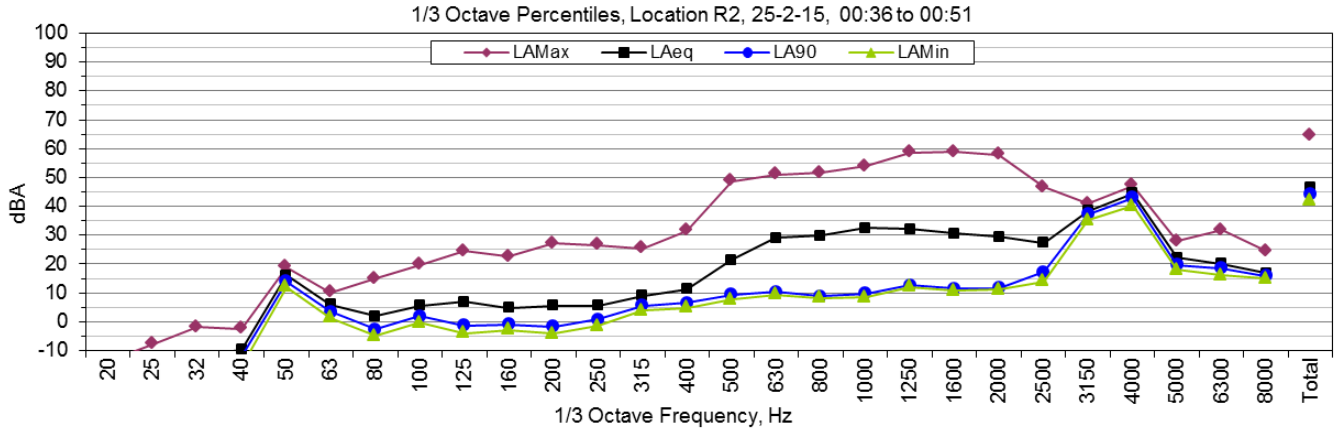


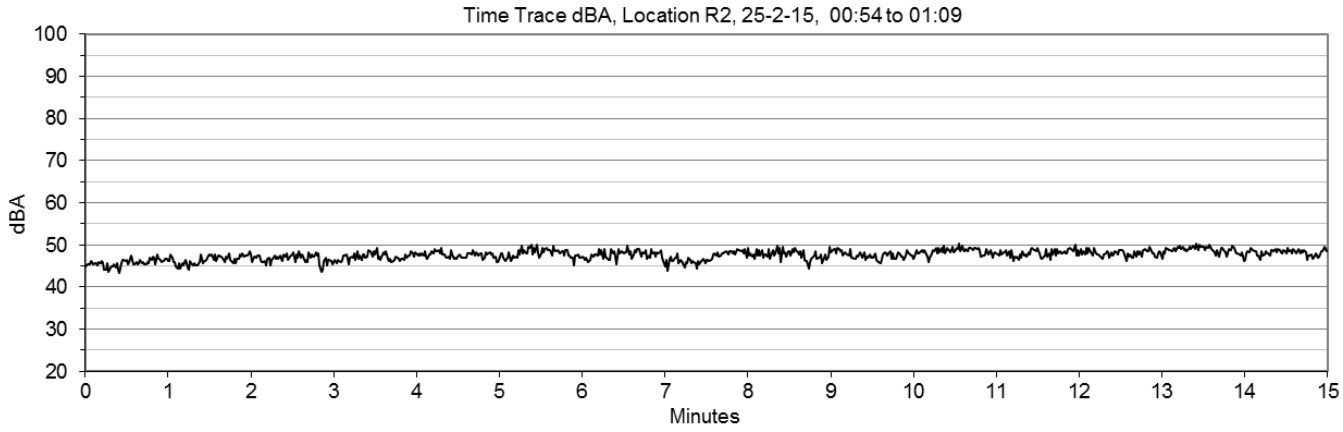


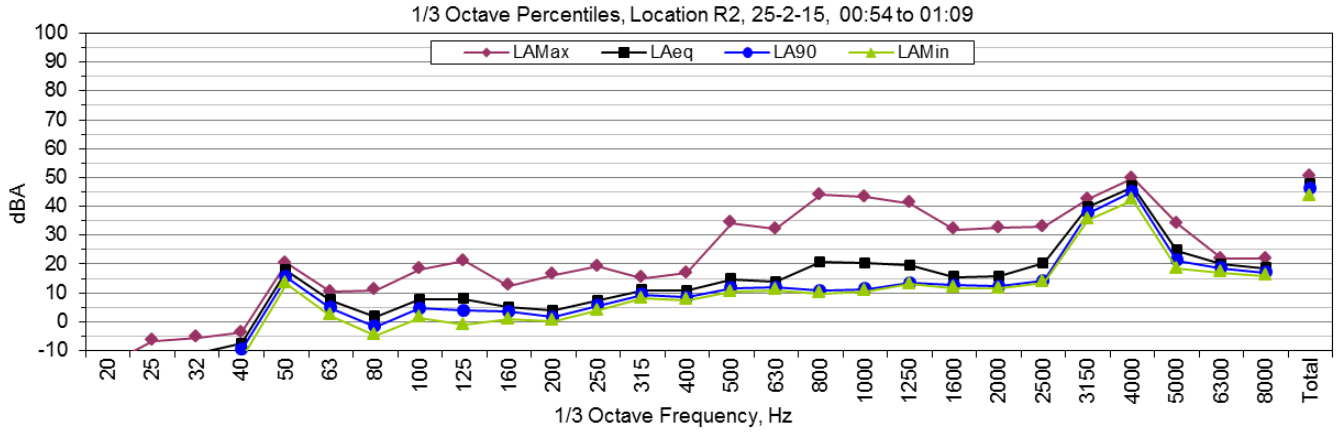




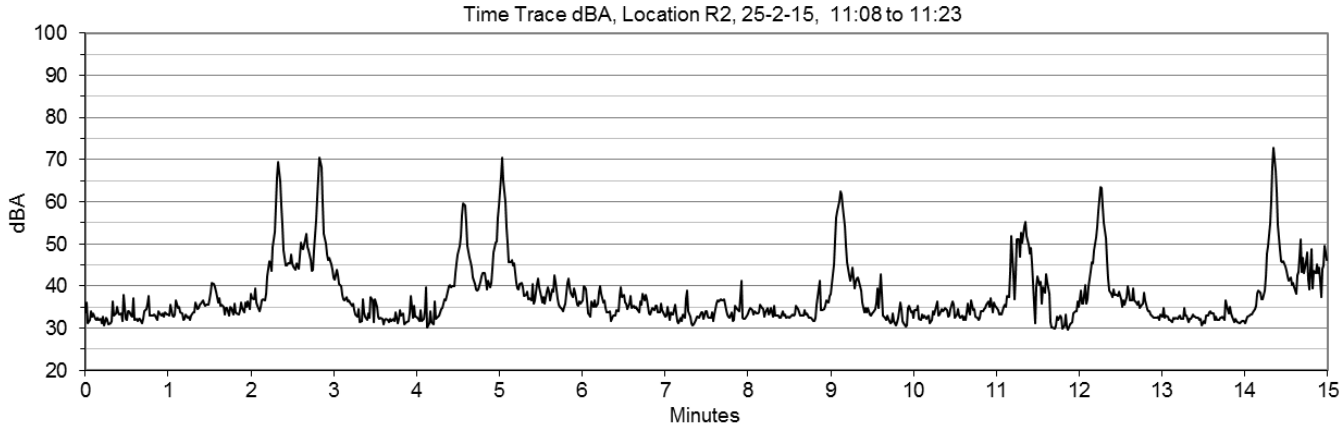

Time Trace dBA, Location R2, 25-2-15, 00:36 to 00:51
dBA
Minutes

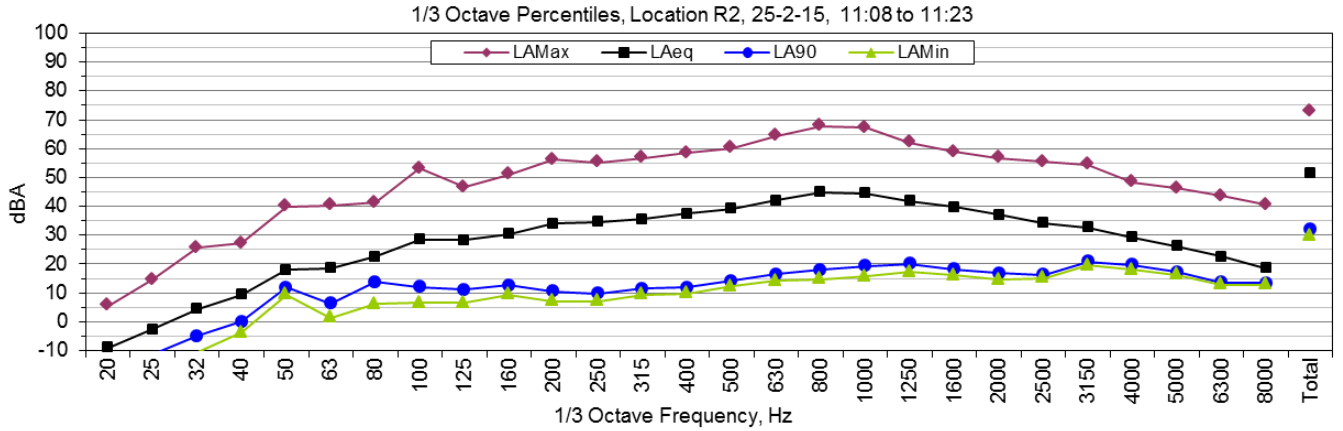

1/3 Octave Percentiles, Location R2, 25-2-15, 00:36 to 00:51
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

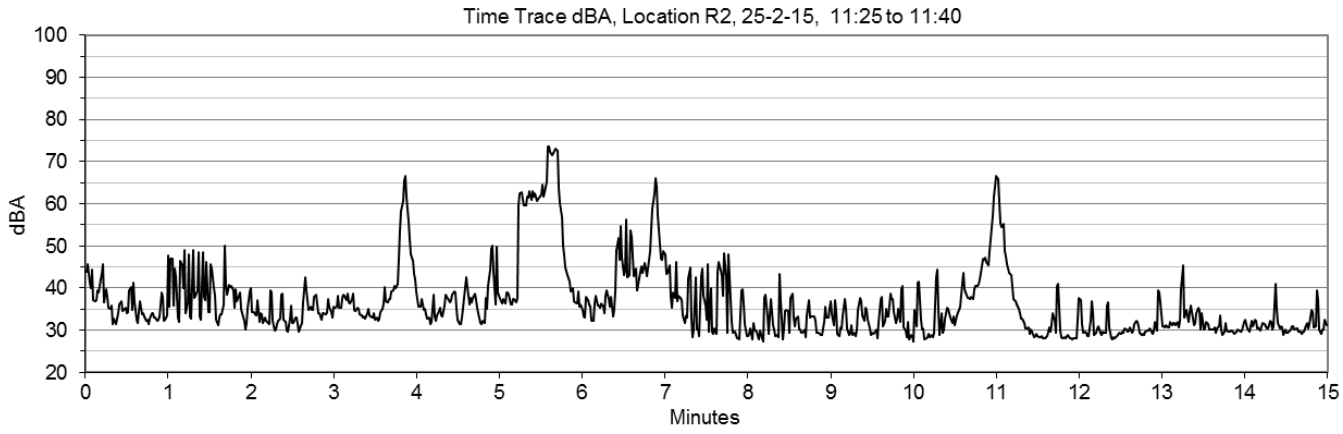

Time Trace dBA, Location R2, 25-2-15, 00:54 to 01:09
dBA
Minutes

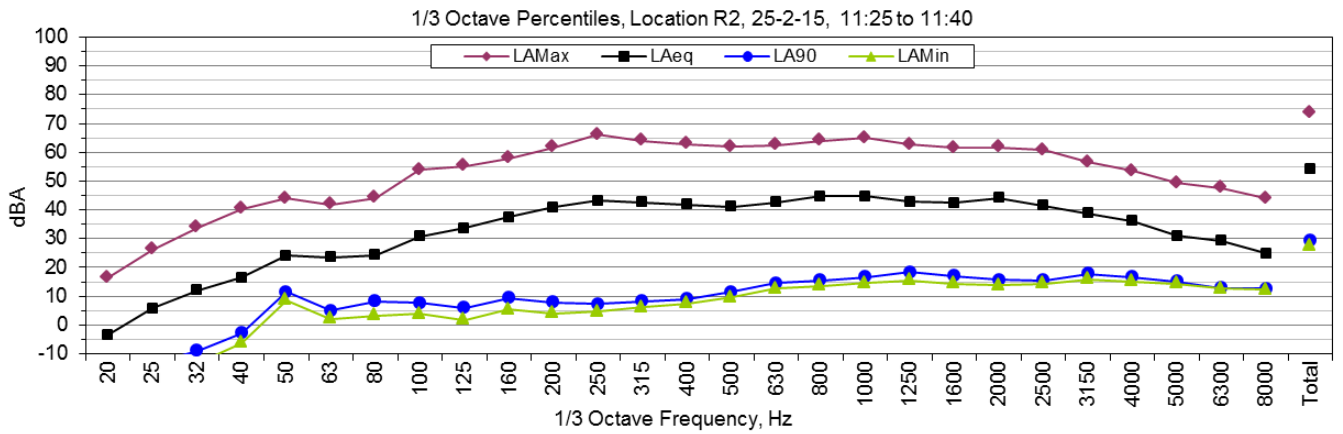

1/3 Octave Percentiles, Location R2, 25-2-15, 00:54 to 01:09
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

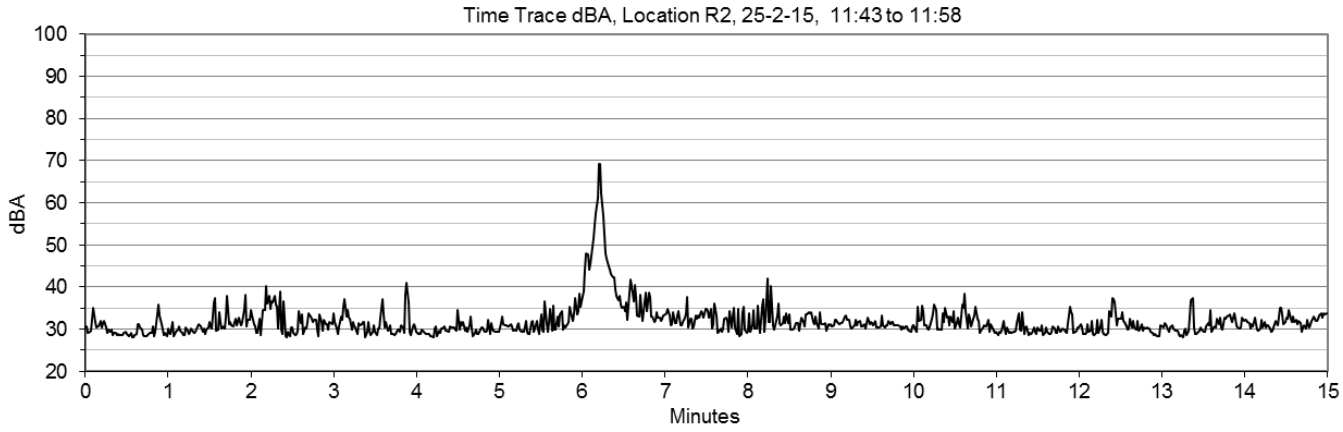
Day 2 – Wednesday 25 February 2015

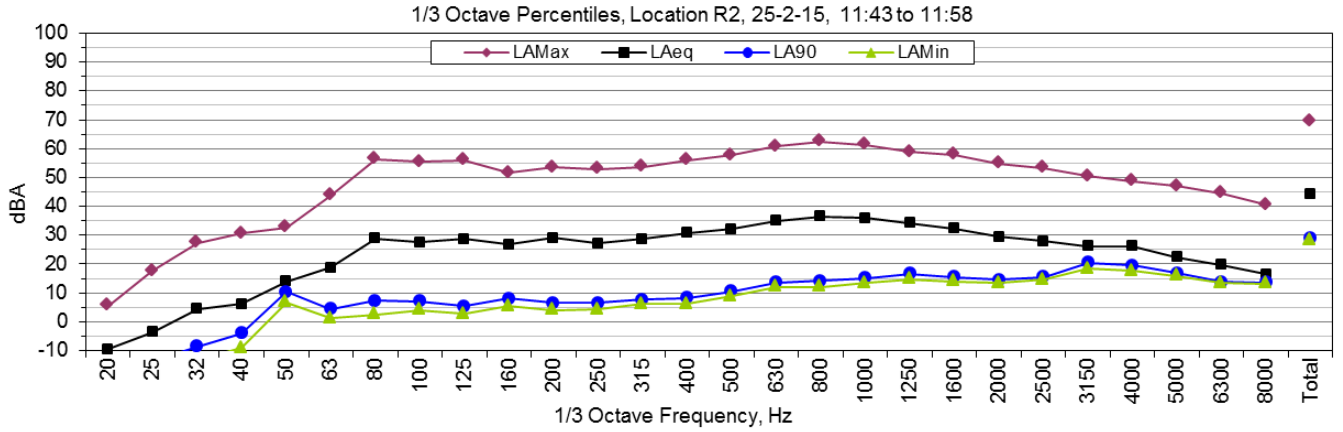


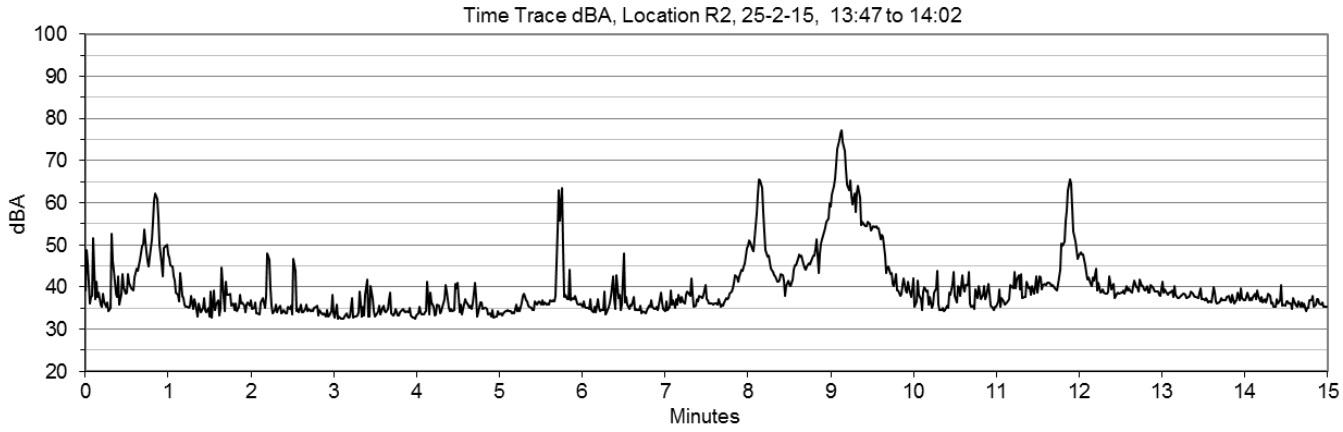


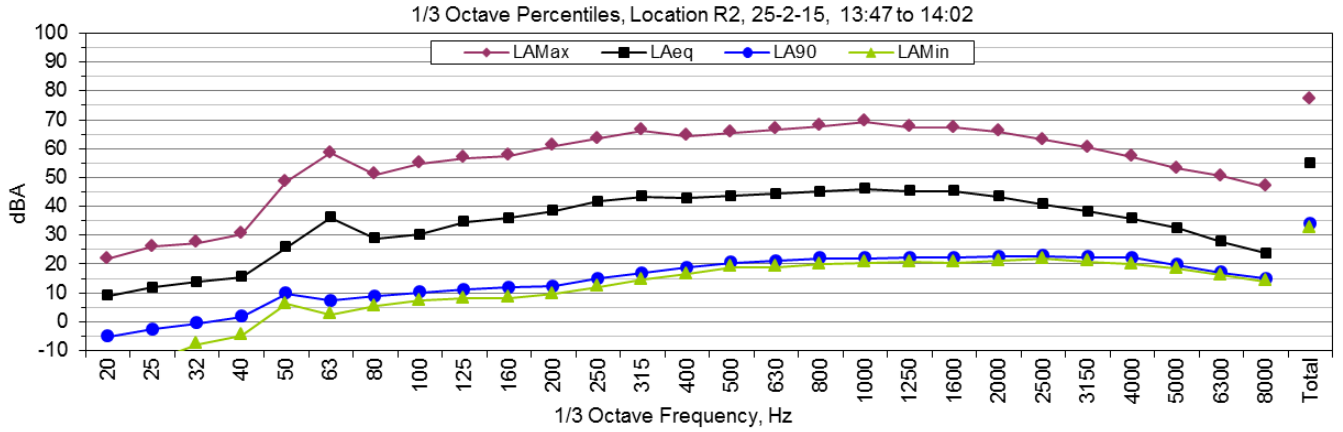


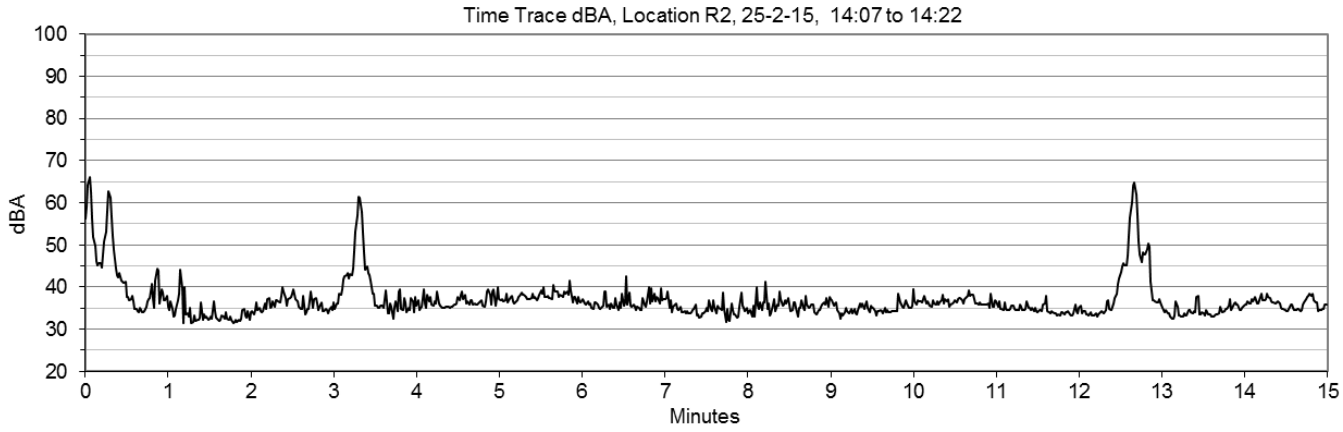


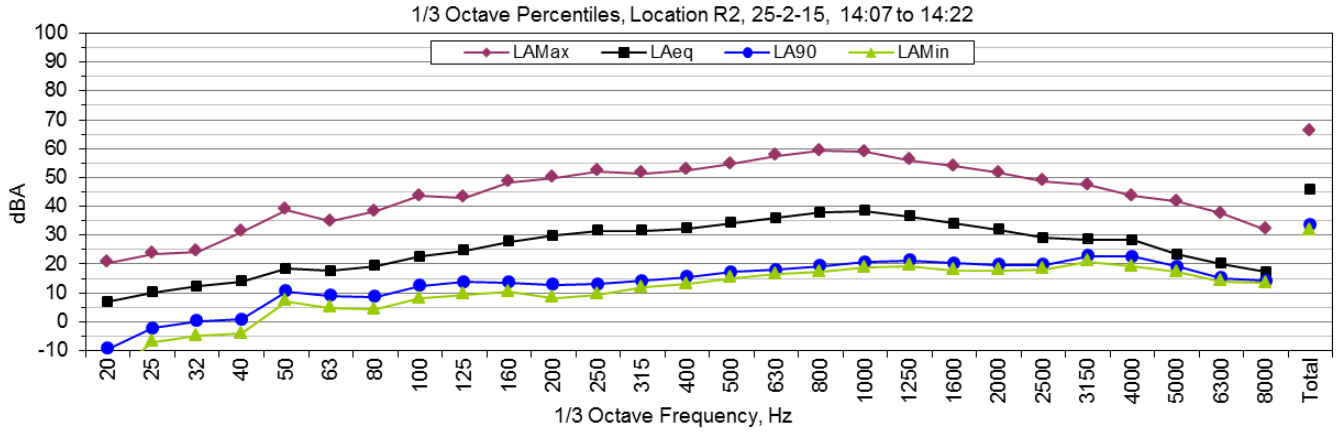

Time Trace dBA, Location R2, 25-2-15, 11:43 to 11:58
dBA
Minutes

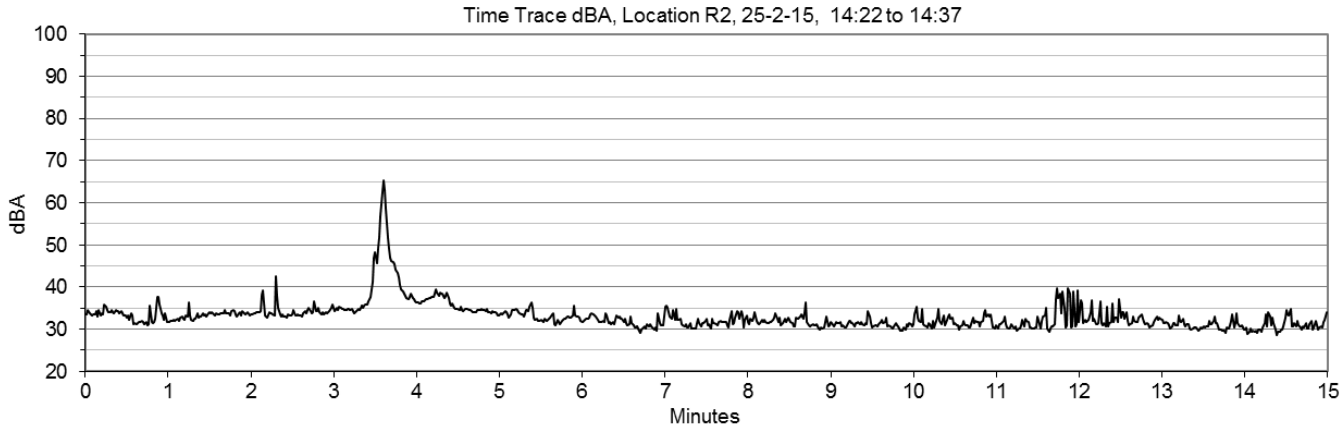

1/3 Octave Percentiles, Location R2, 25-2-15, 11:43 to 11:58
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

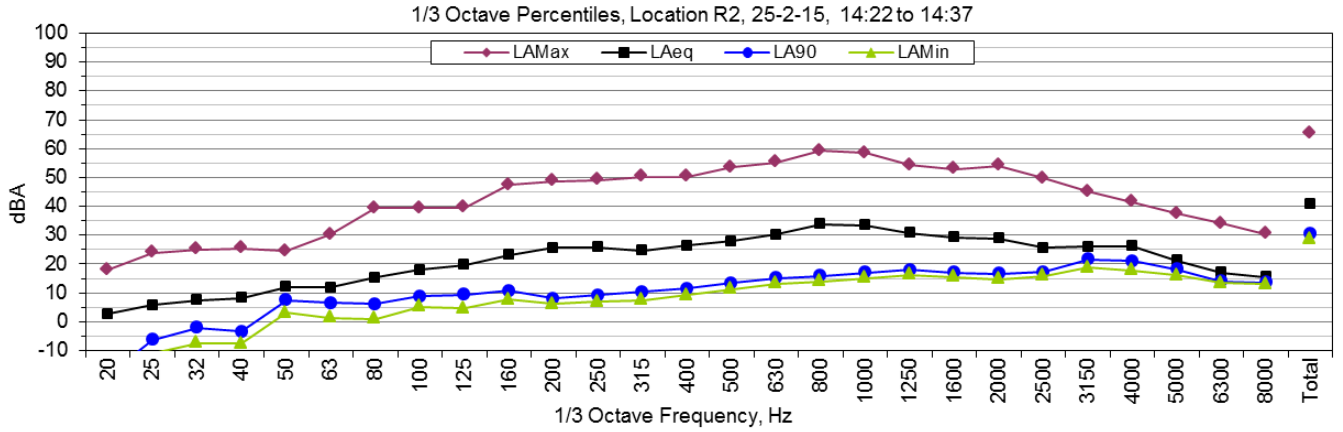

Time Trace dBA, Location R2, 25-2-15, 13:47 to 14:02
dBA
Minutes


1/3 Octave Percentiles, Location R2, 25-2-15, 13:47 to 14:02
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

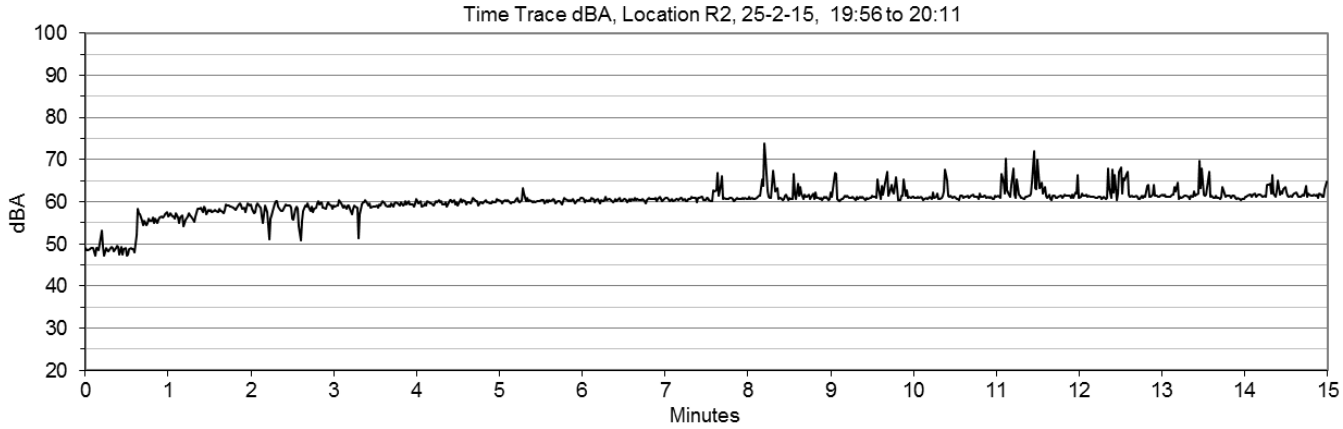

Time Trace dBA, Location R2, 25-2-15, 14:07 to 14:22
dBA
Minutes

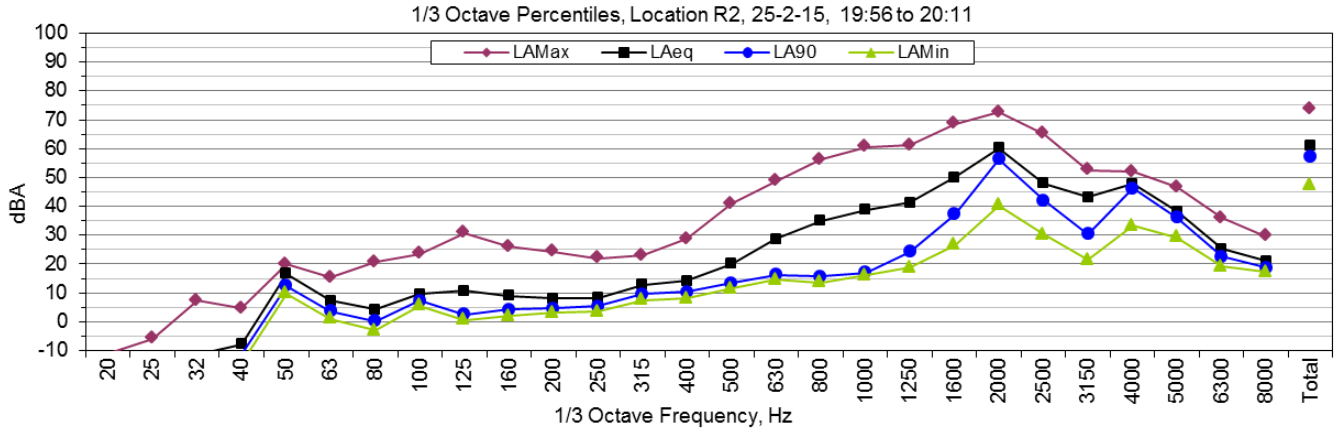

1/3 Octave Percentiles, Location R2, 25-2-15, 14:07 to 14:22
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

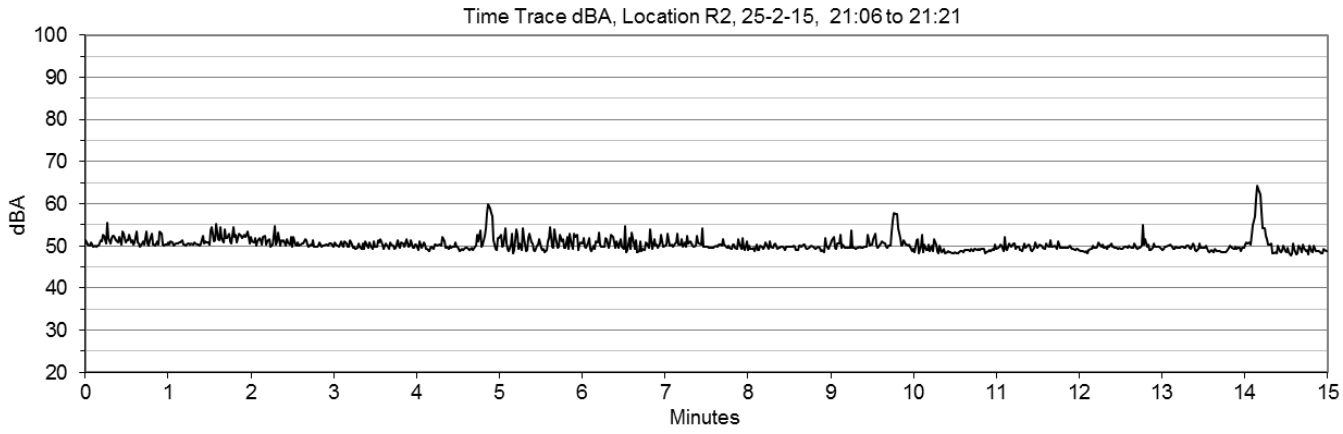

Time Trace dBA, Location R2, 25-2-15, 14:22 to 14:37
dBA
Minutes

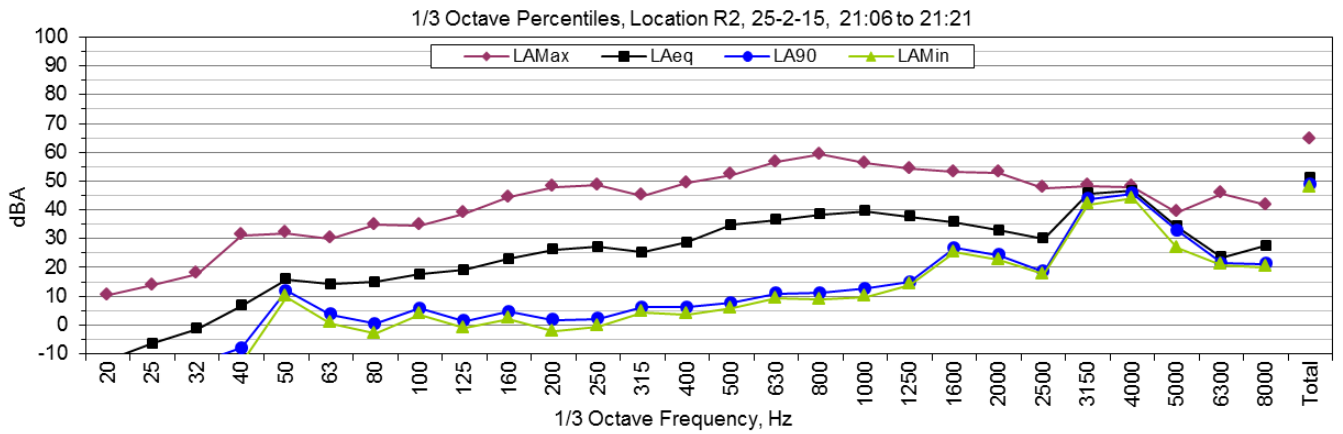

1/3 Octave Percentiles, Location R2, 25-2-15, 14:22 to 14:37
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

Evening 2 – Wednesday 25 February 2015

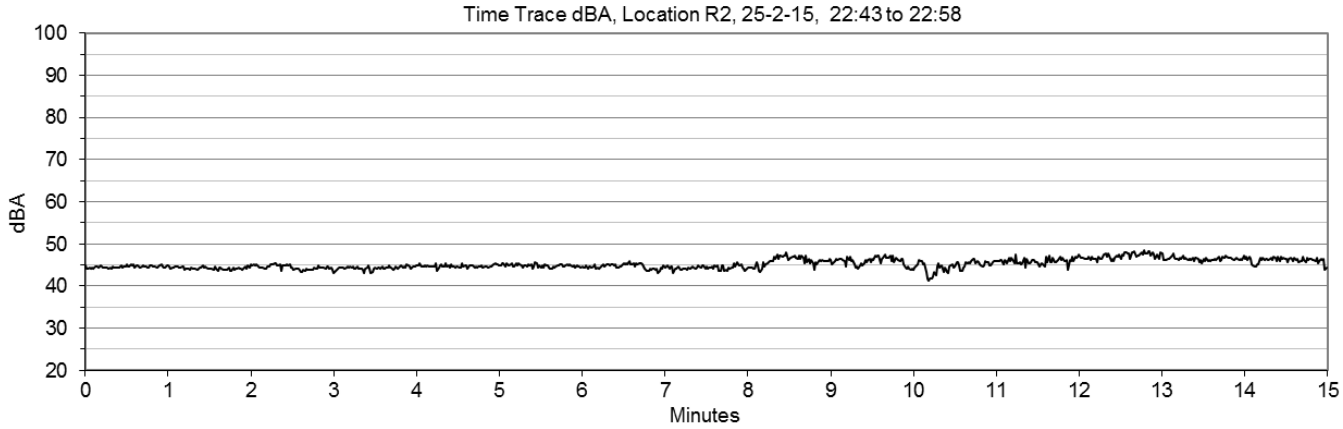


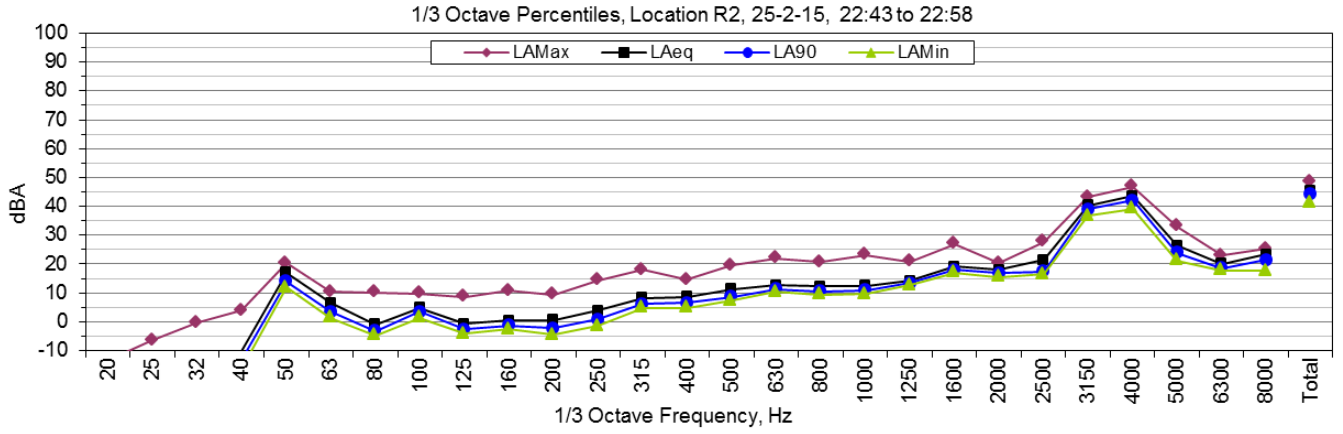


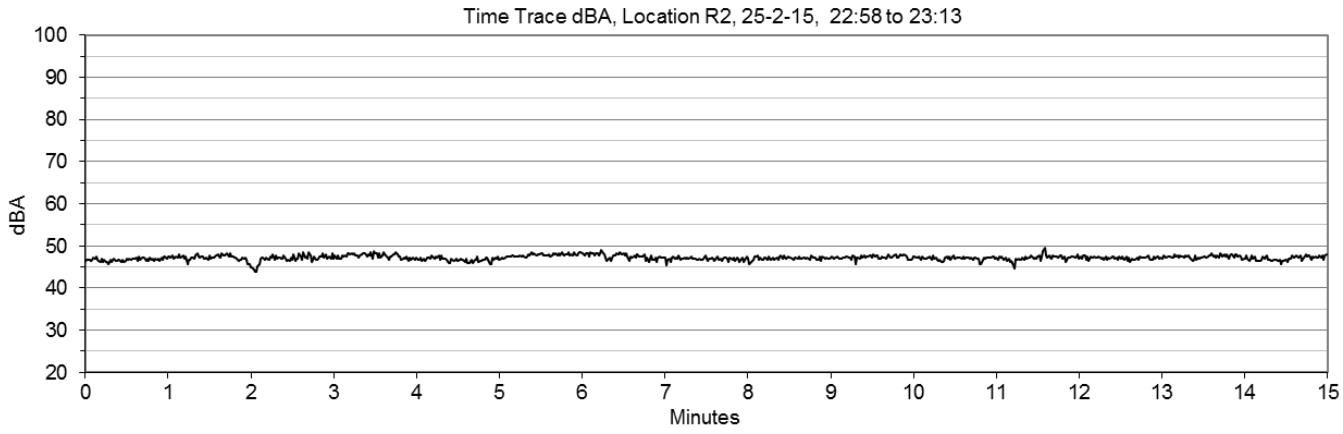


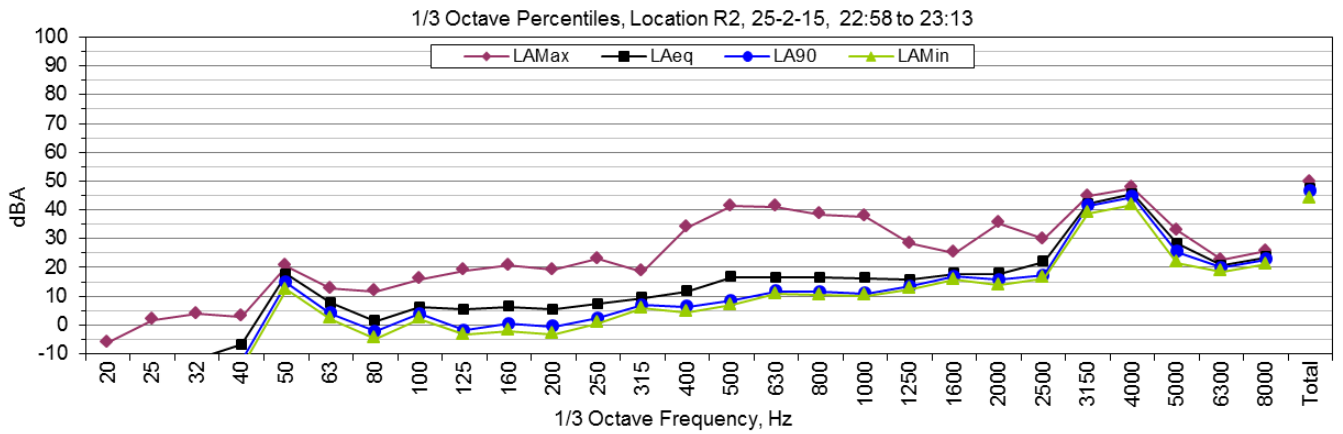


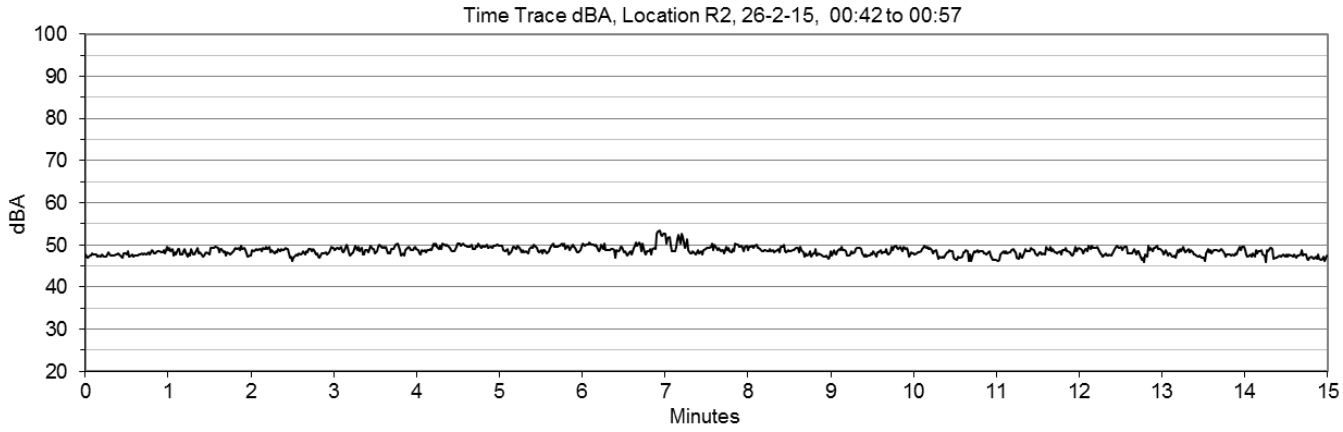
Night 2 – Wednesday 25 February 2015

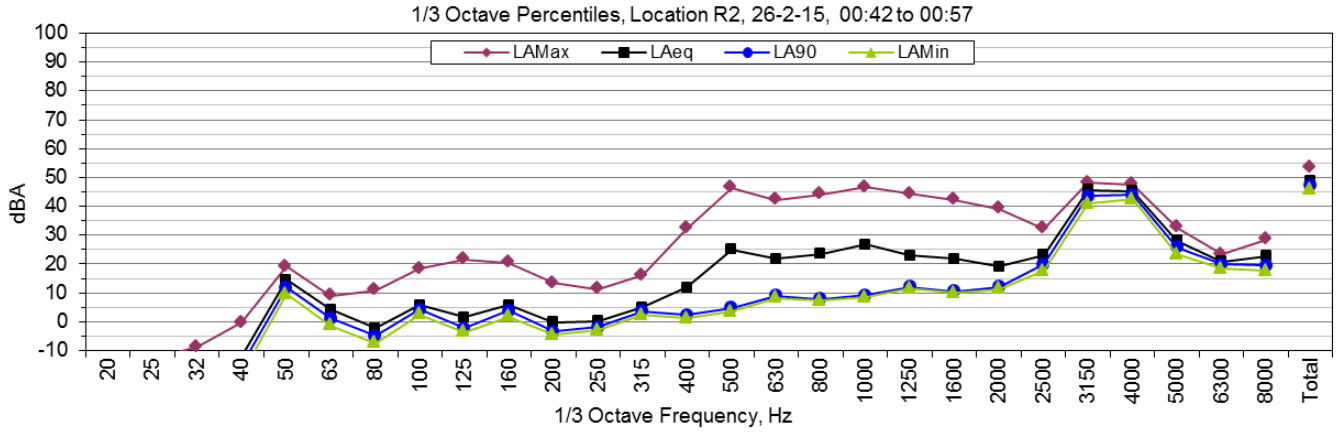


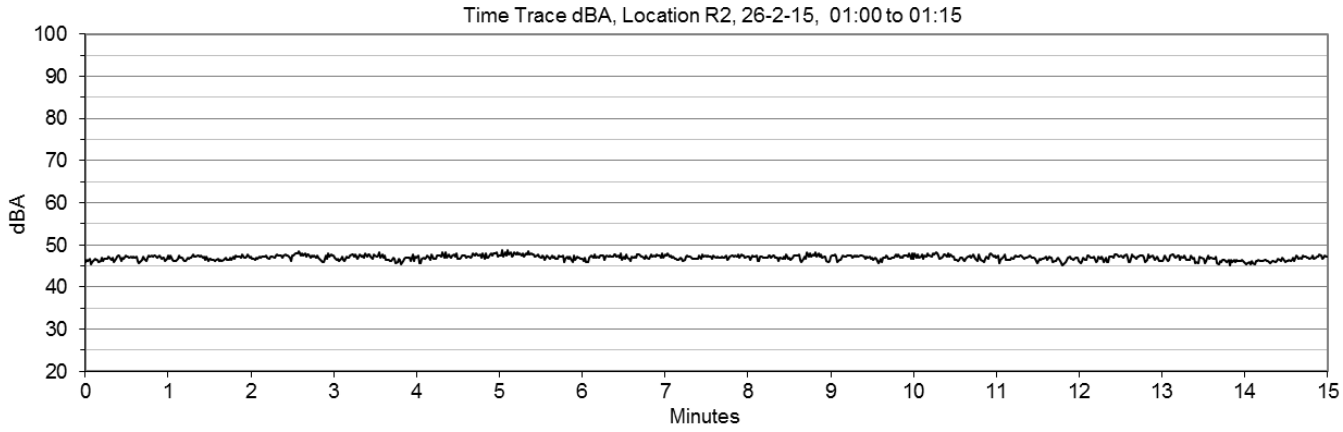


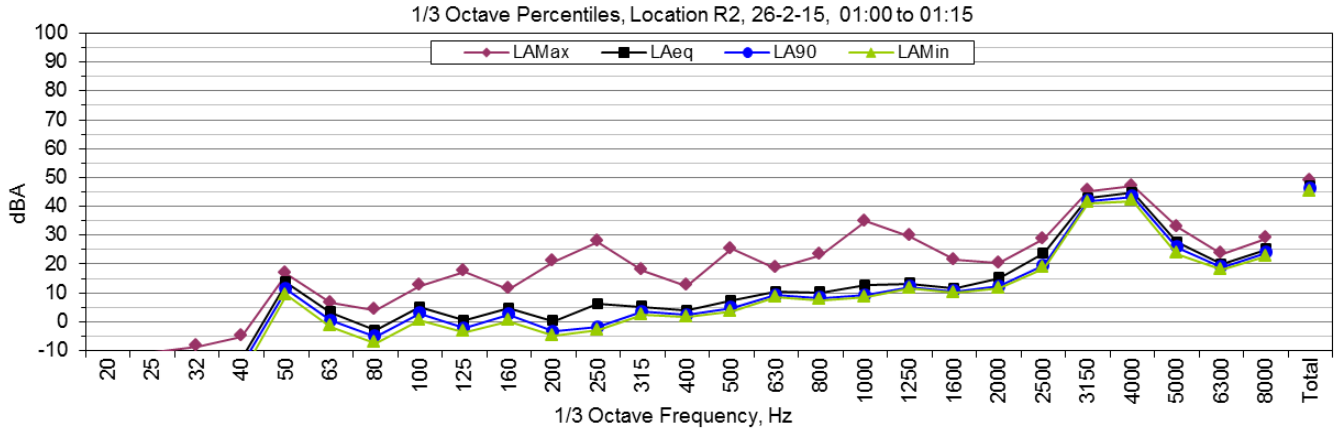




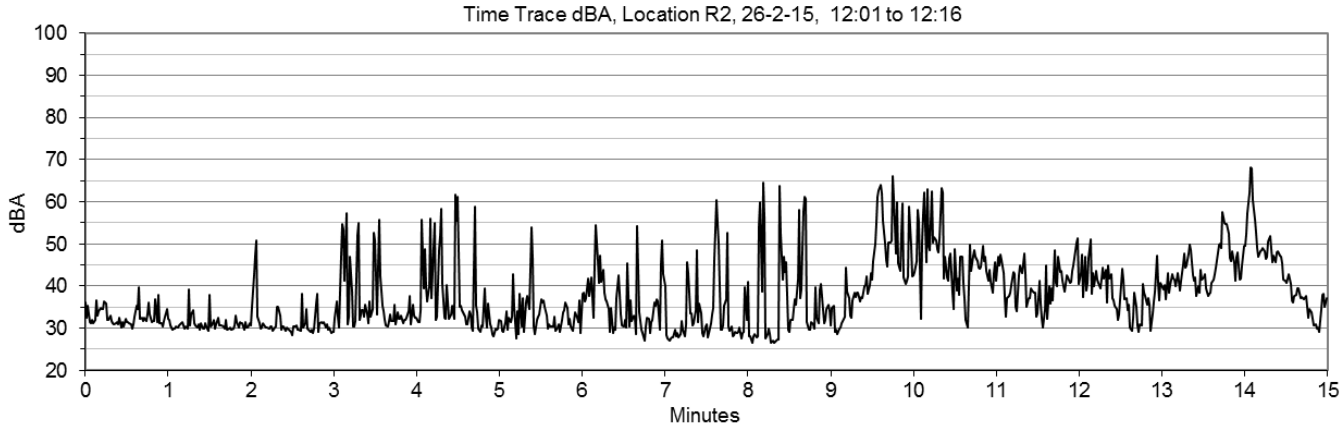

Time Trace dBA, Location R2, 26-2-15, 00:42 to 00:57
dBA
Minutes

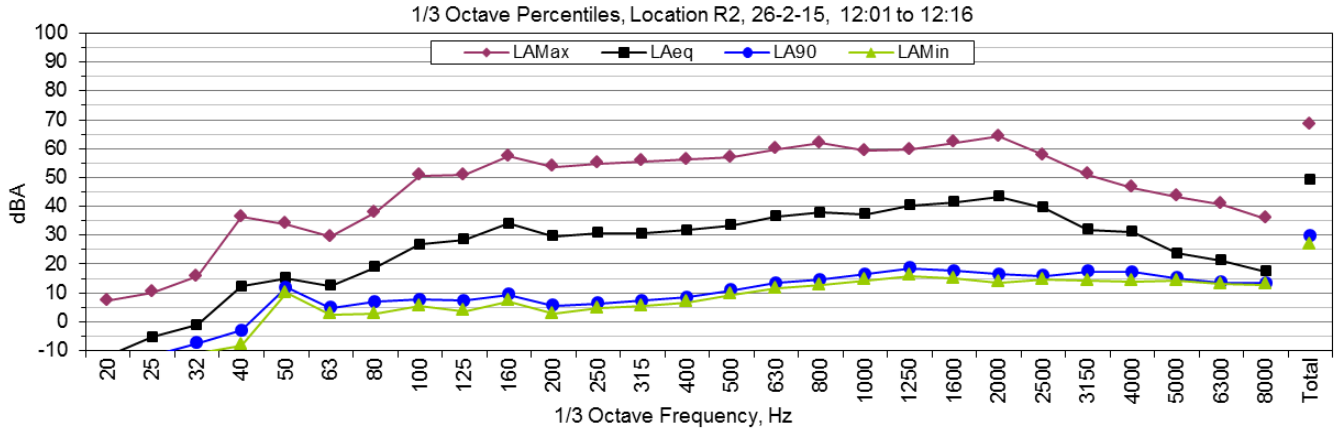

1/3 Octave Percentiles, Location R2, 26-2-15, 00:42 to 00:57
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

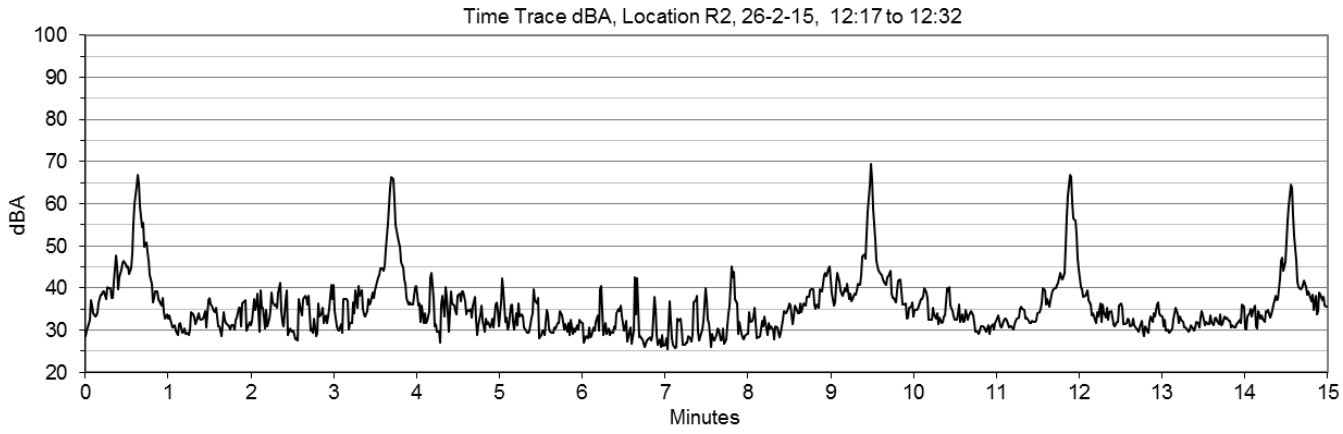

Time Trace dBA, Location R2, 26-2-15, 01:00 to 01:15
dBA
Minutes

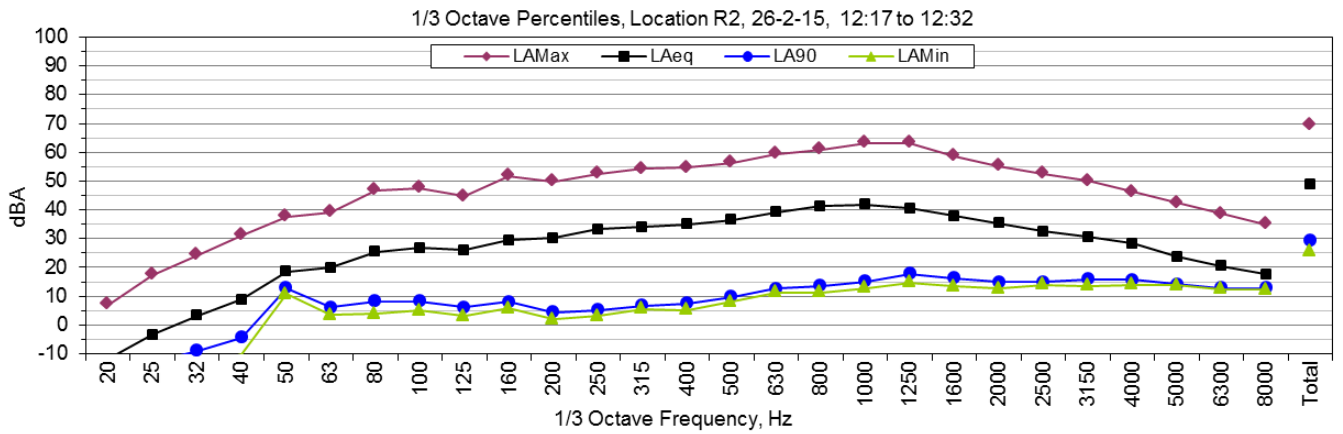

1/3 Octave Percentiles, Location R2, 26-2-15, 01:00 to 01:15
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

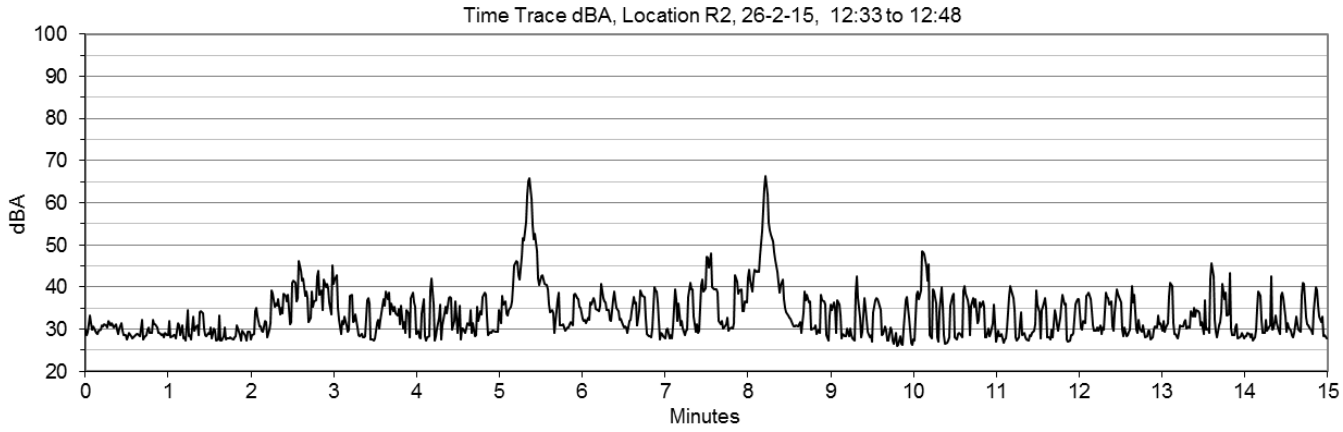
Day 3 – Thursday 26 February 2015

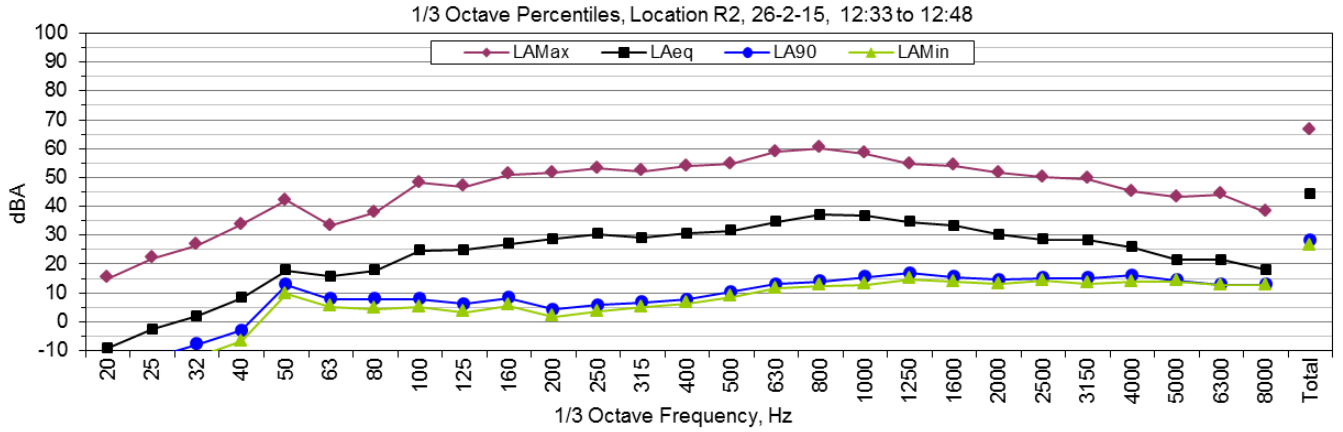


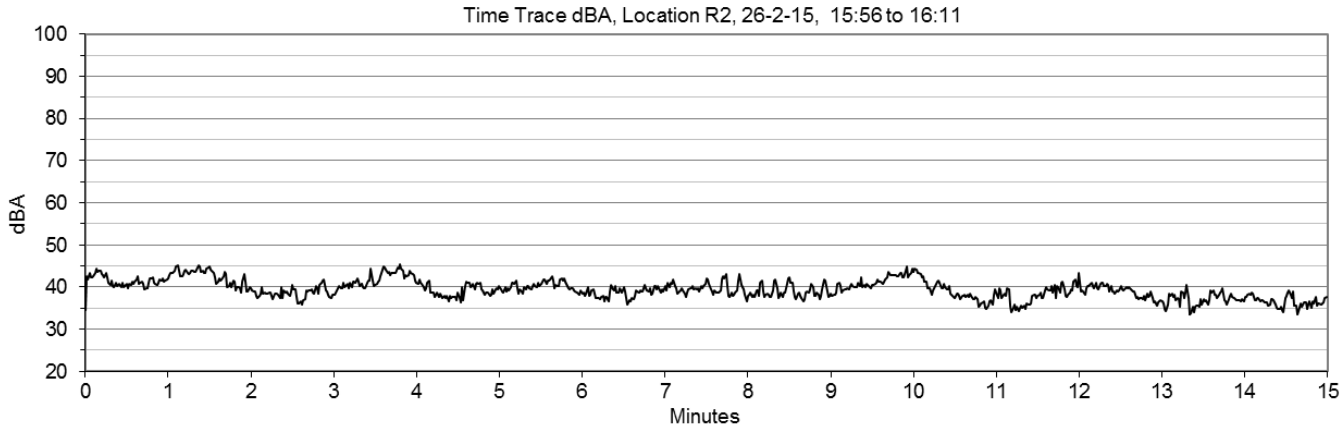


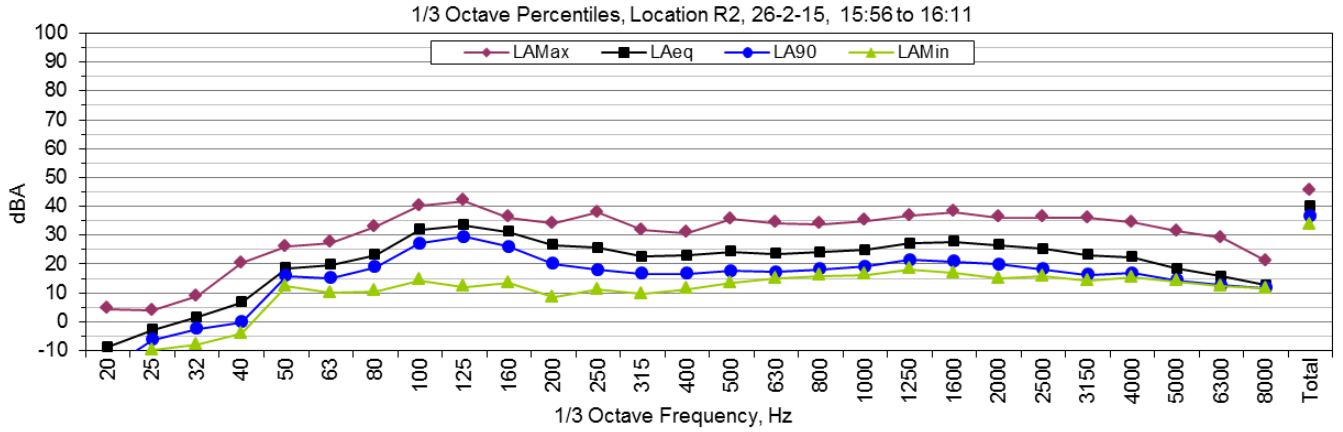


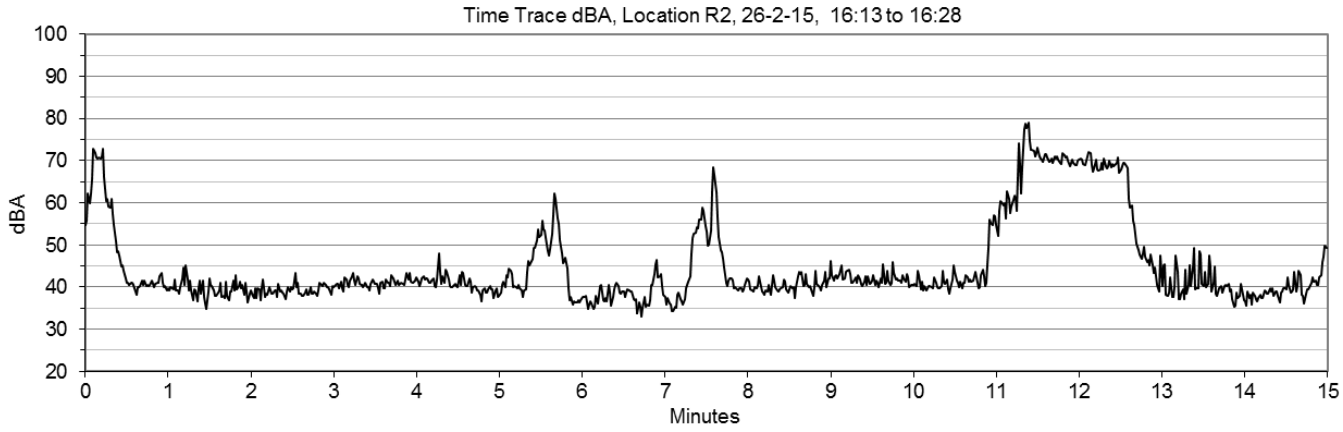


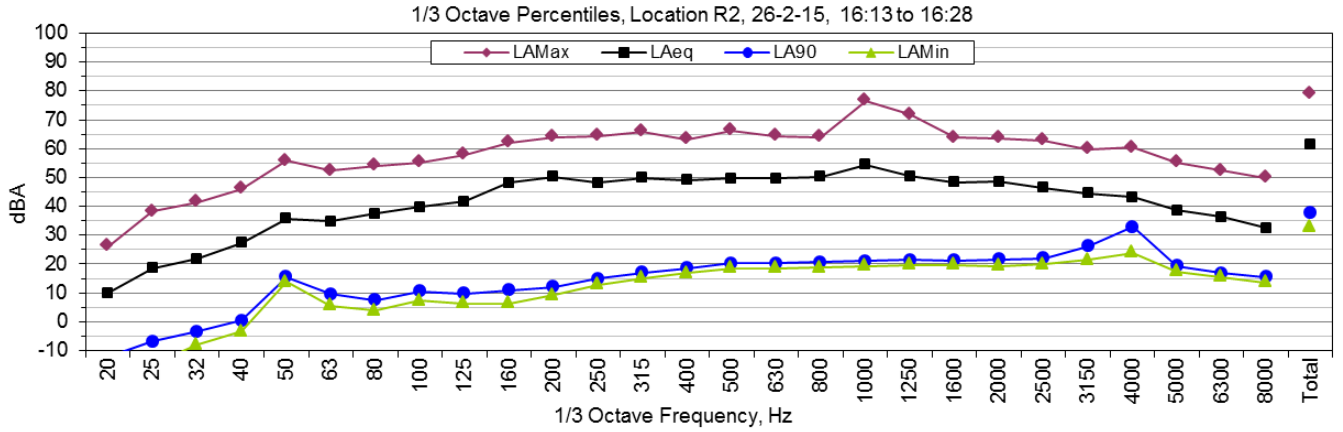

Time Trace dBA, Location R2, 26-2-15, 12:33 to 12:48
dBA
Minutes

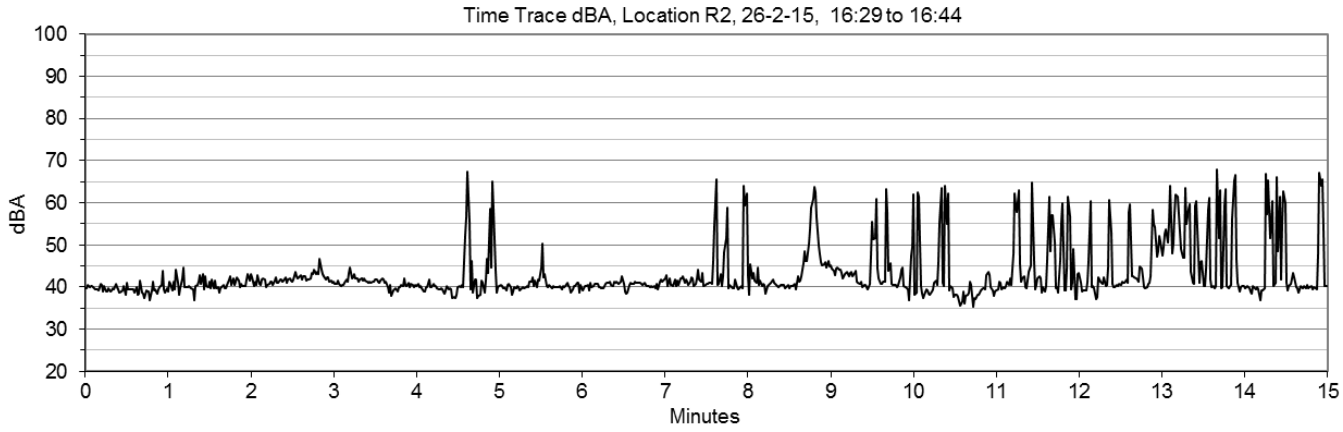

1/3 Octave Percentiles, Location R2, 26-2-15, 12:33 to 12:48
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

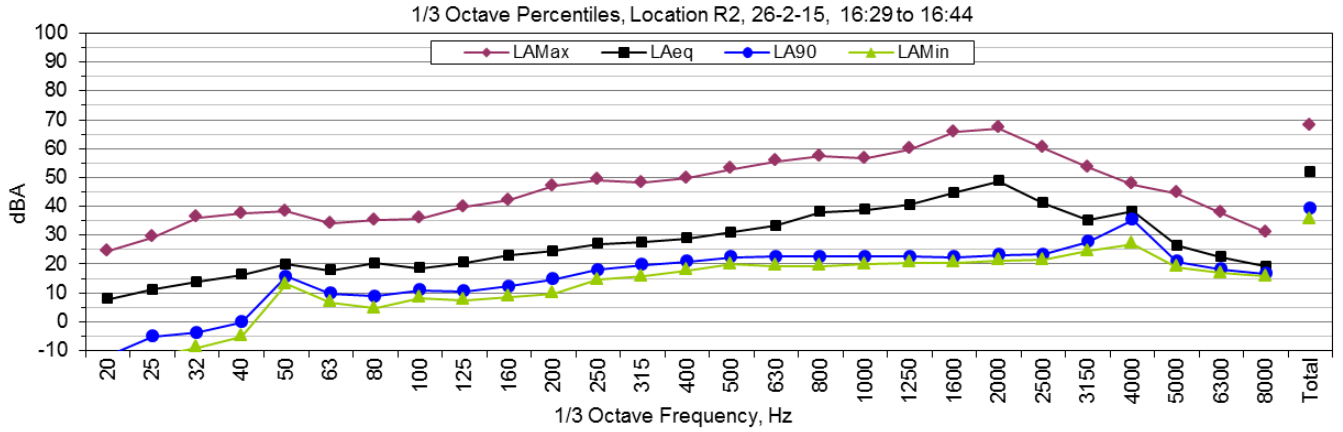

Time Trace dBA, Location R2, 26-2-15, 15:56 to 16:11
dBA
Minutes


1/3 Octave Percentiles, Location R2, 26-2-15, 15:56 to 16:11
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

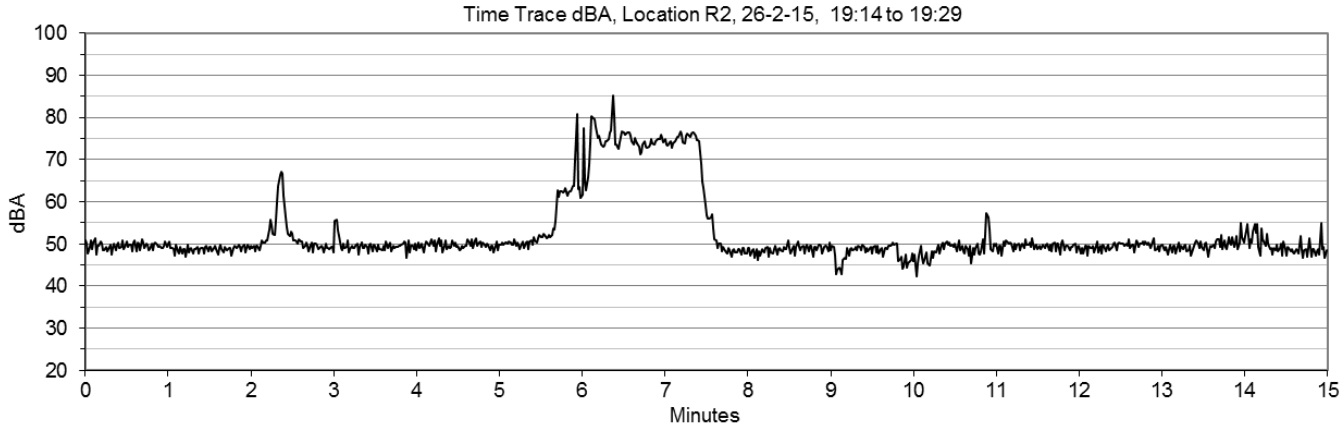

Time Trace dBA, Location R2, 26-2-15, 16:13 to 16:28
dBA
Minutes

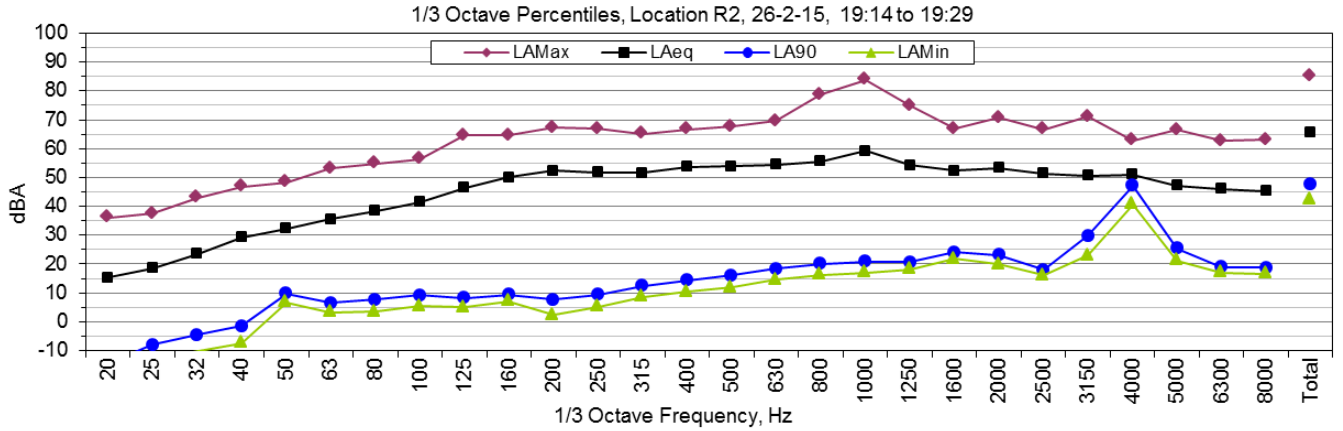

1/3 Octave Percentiles, Location R2, 26-2-15, 16:13 to 16:28
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

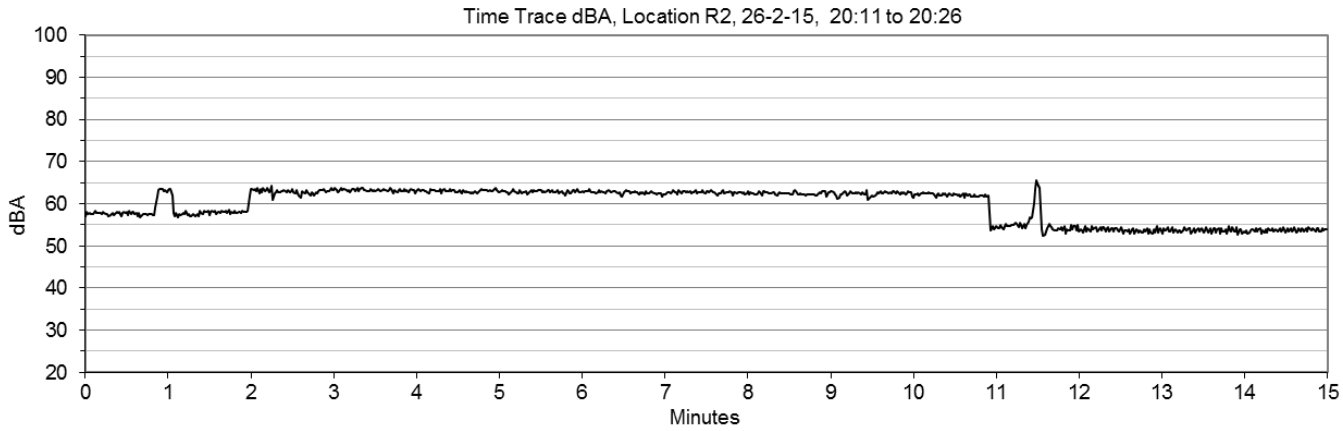

Time Trace dBA, Location R2, 26-2-15, 16:29 to 16:44
dBA
Minutes

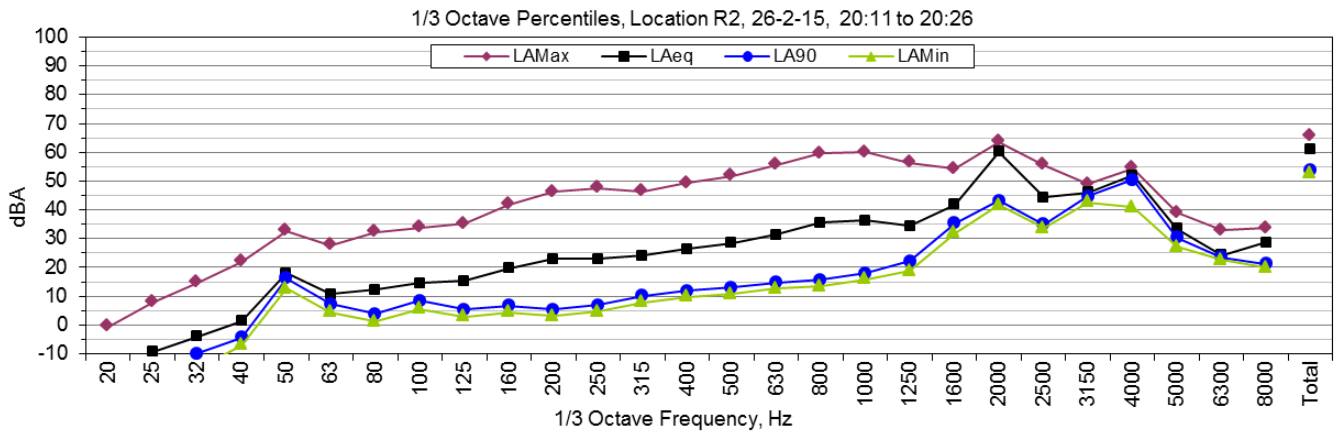

1/3 Octave Percentiles, Location R2, 26-2-15, 16:29 to 16:44
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

Evening 3 – Thursday 26 February 2015

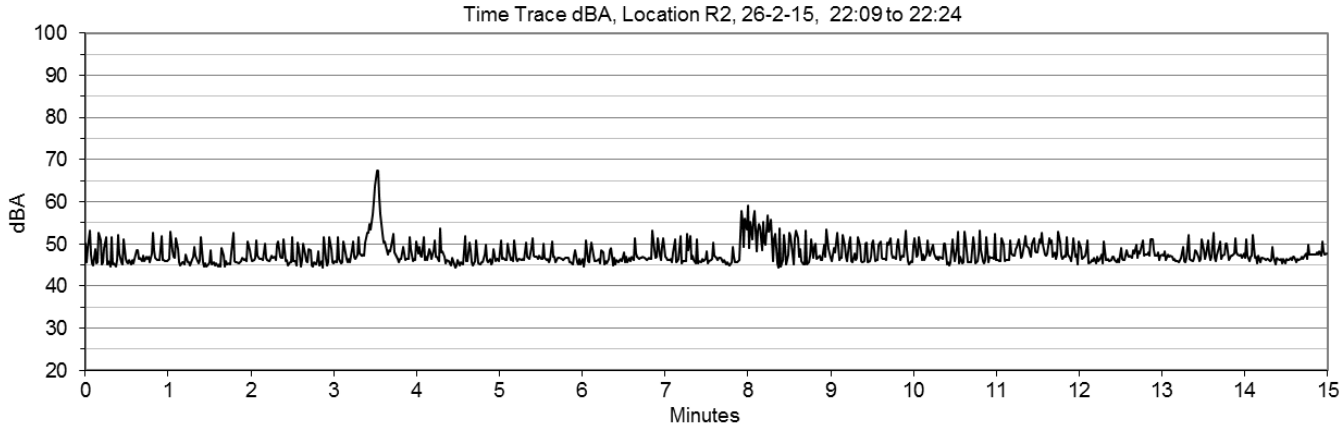


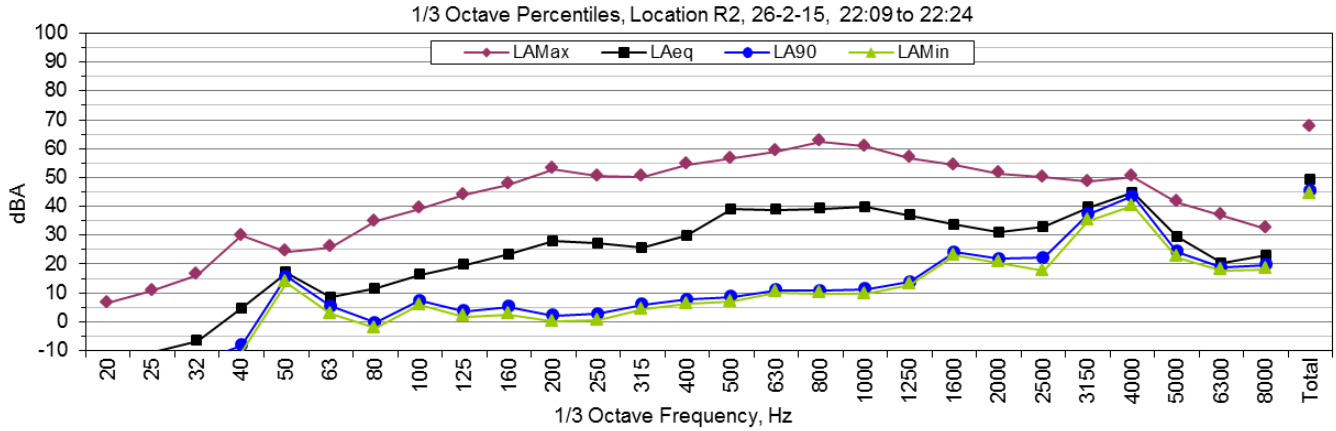


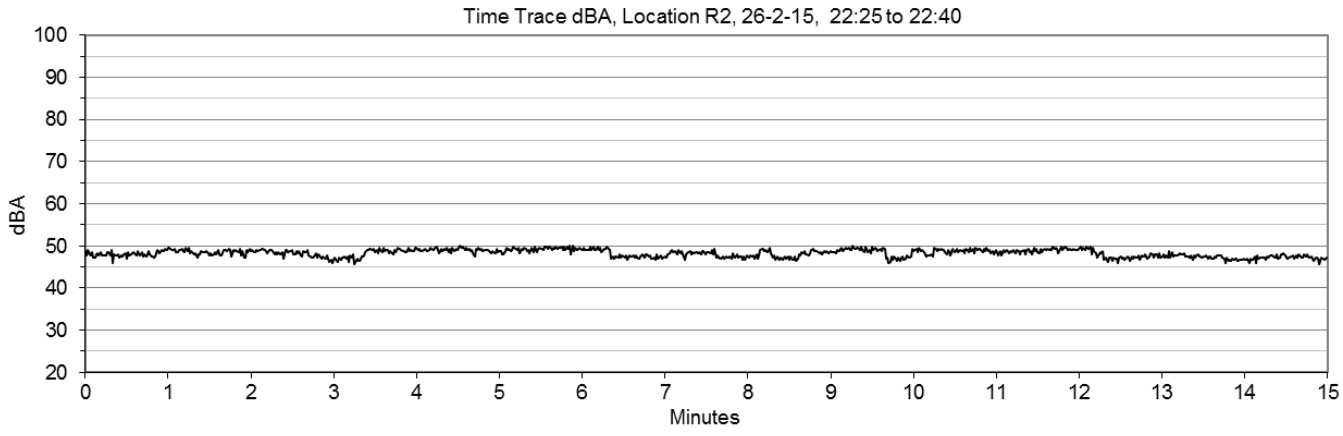


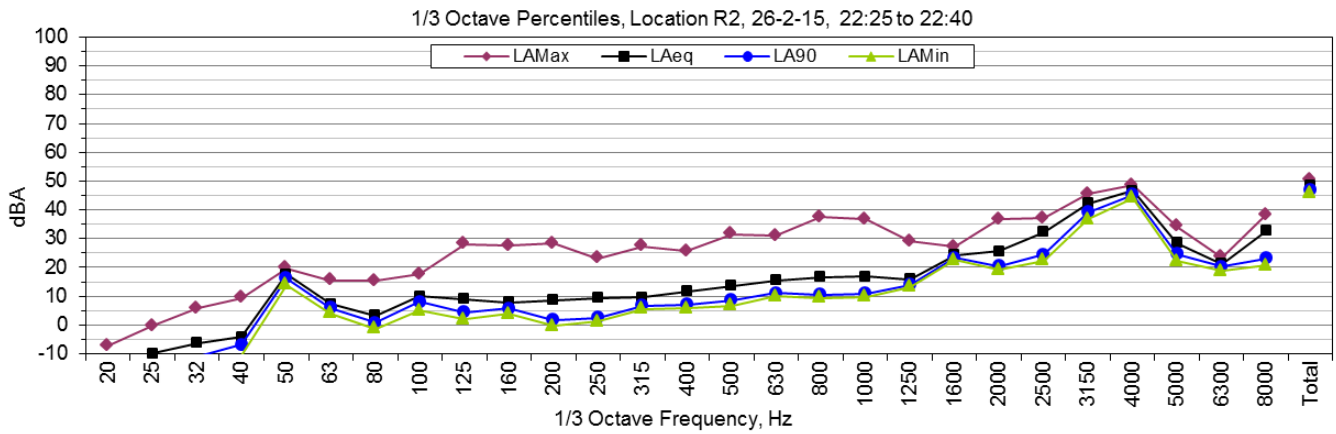


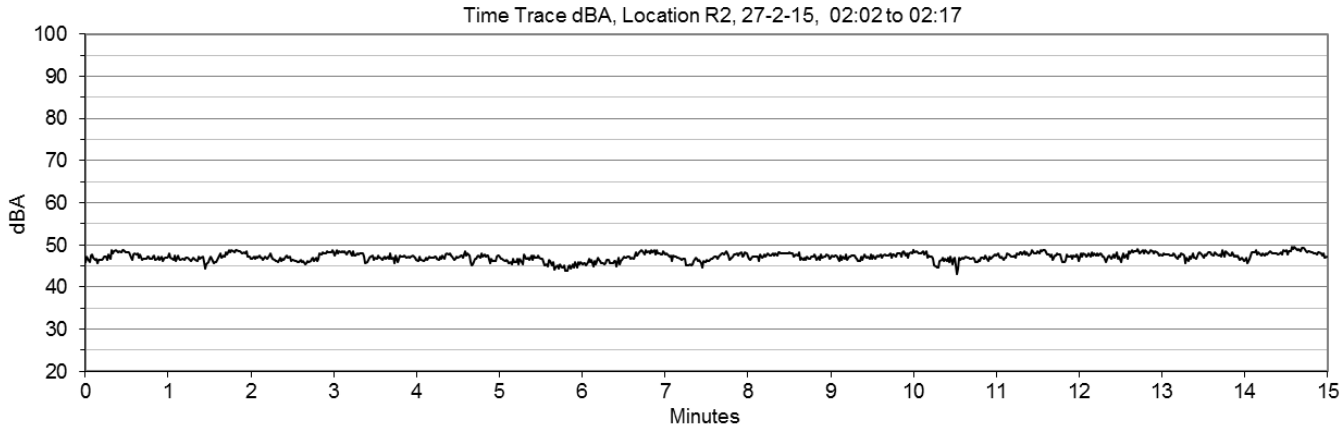
Night 3 – Thursday 26 February 2015

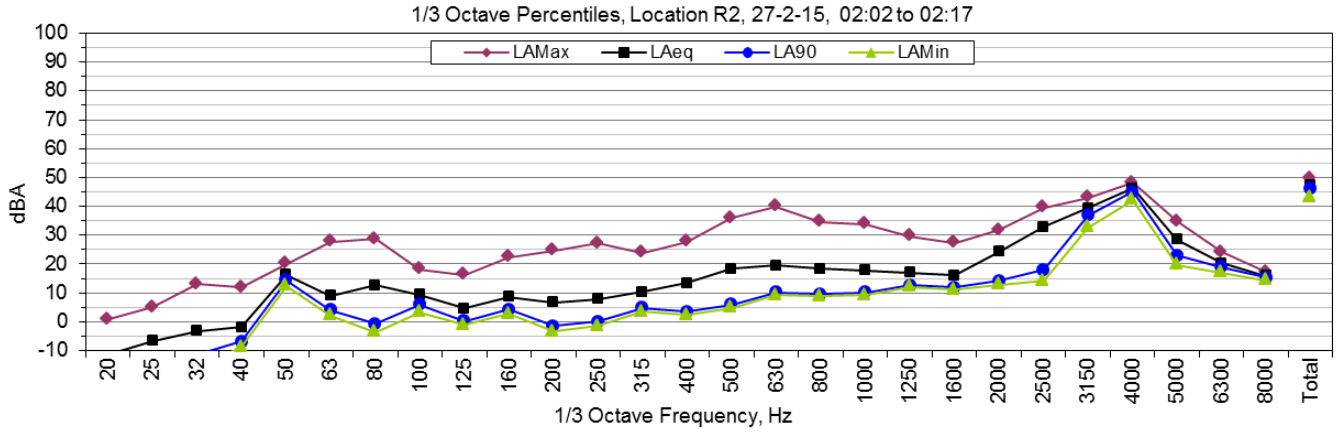


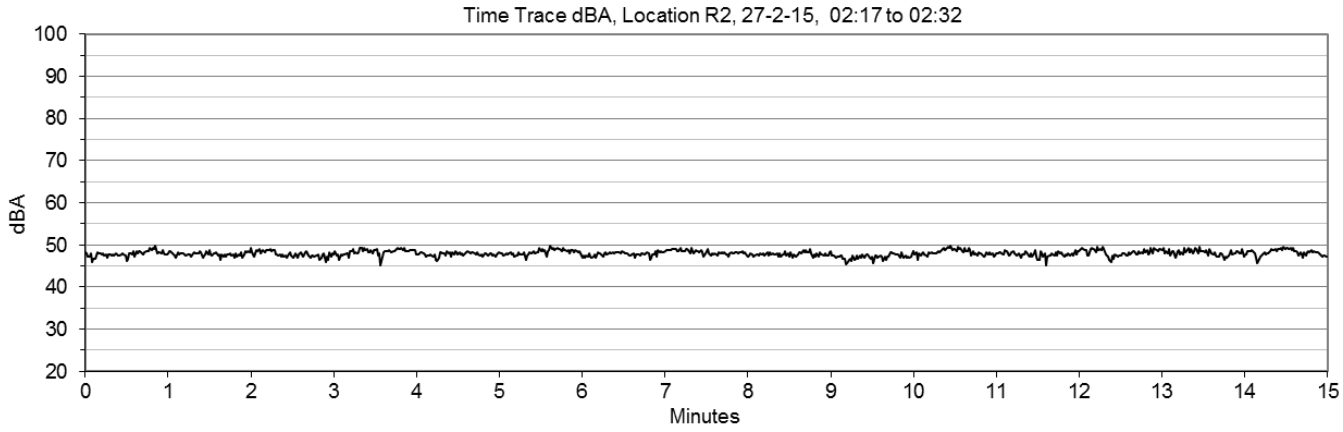


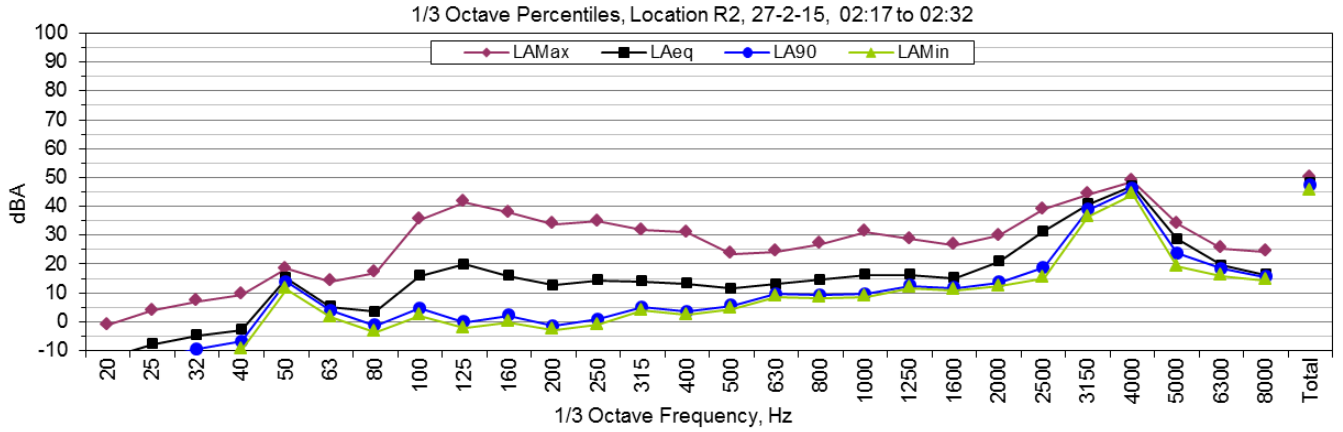





Time Trace dBA, Location R2, 27-2-15, 02:02 to 02:17
dBA
Minutes


1/3 Octave Percentiles, Location R2, 27-2-15, 02:02 to 02:17
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz


Time Trace dBA, Location R2, 27-2-15, 02:17 to 02:32
dBA
Minutes

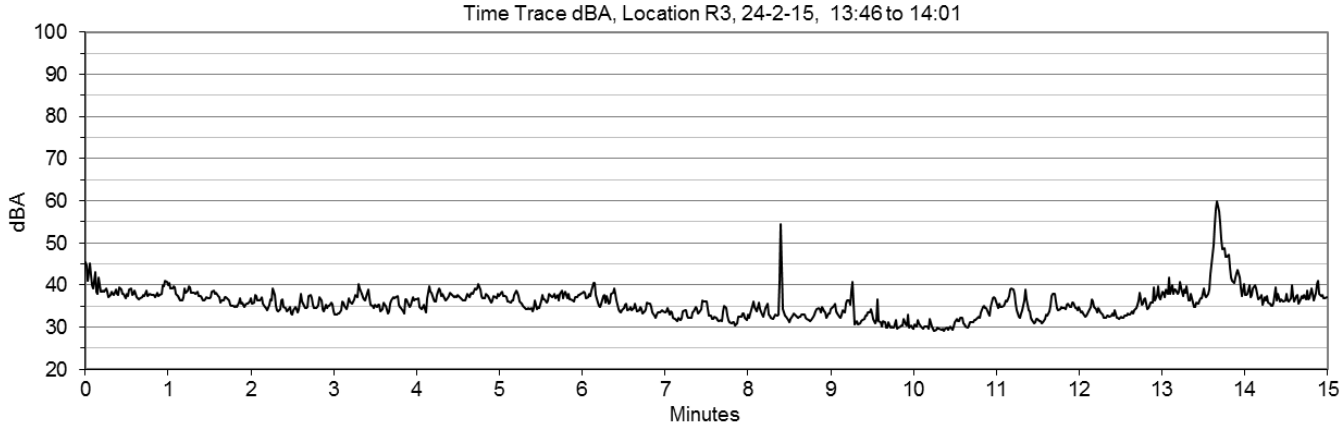

1/3 Octave Percentiles, Location R2, 27-2-15, 02:17 to 02:32
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

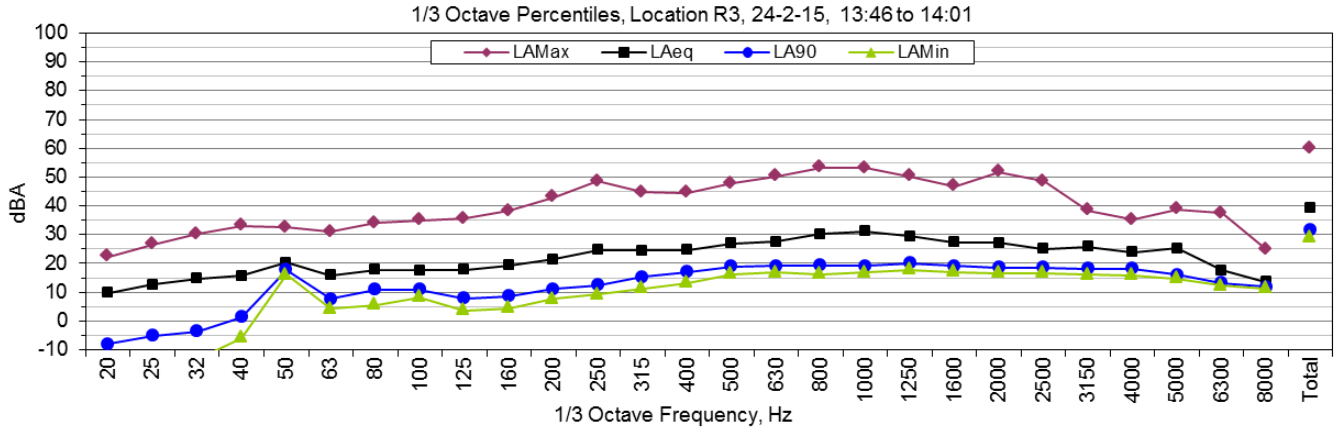
APPENDIX D – MEASURED NOISE LEVELS, RECEPTOR R3

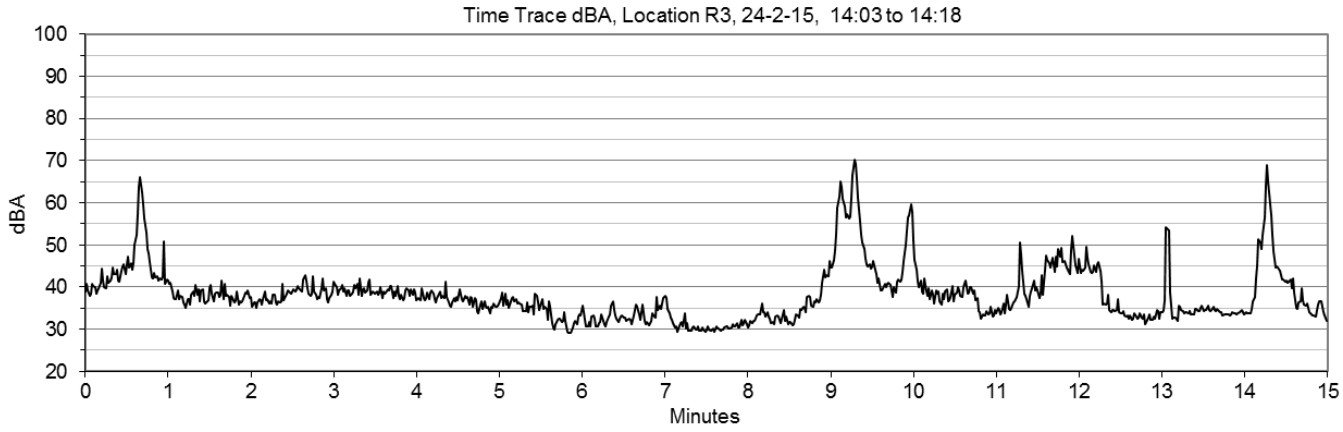
Charts on the following pages show measured noise levels at Receptor R3. Measured noise levels are presented in the order they were measured, with the date and time shown in each figure.

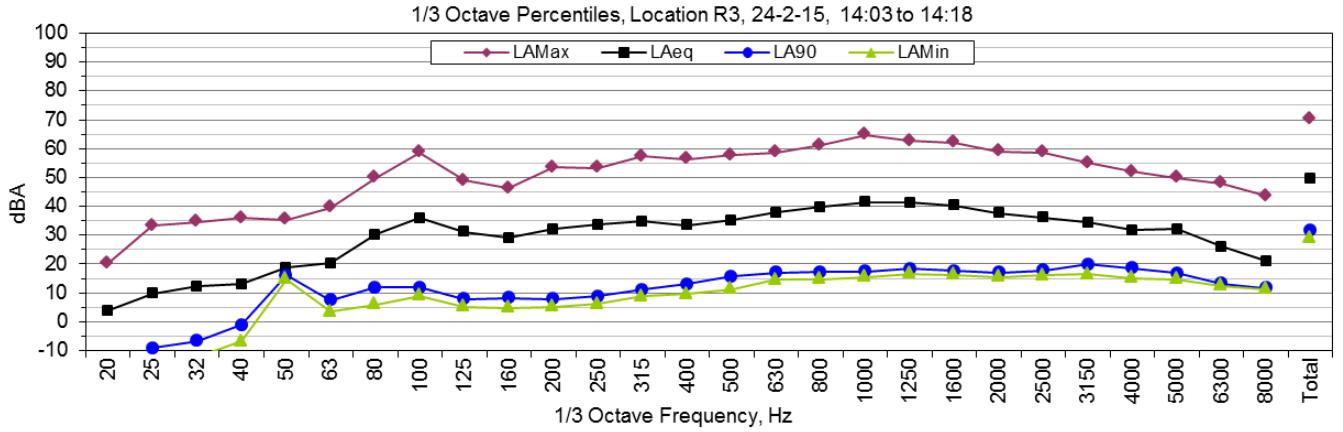
Two charts are shown for each noise measurement. The first chart shows a 'noise level trace' for the duration of the noise measurement in one second intervals in dBA. The second chart shows the measured maximum (LAmax), average (LAeq), background (LA90) and minimum (LAmin) noise levels in 1/3 octave bands from 20 Hz to 8000 Hz and total dBA noise levels.

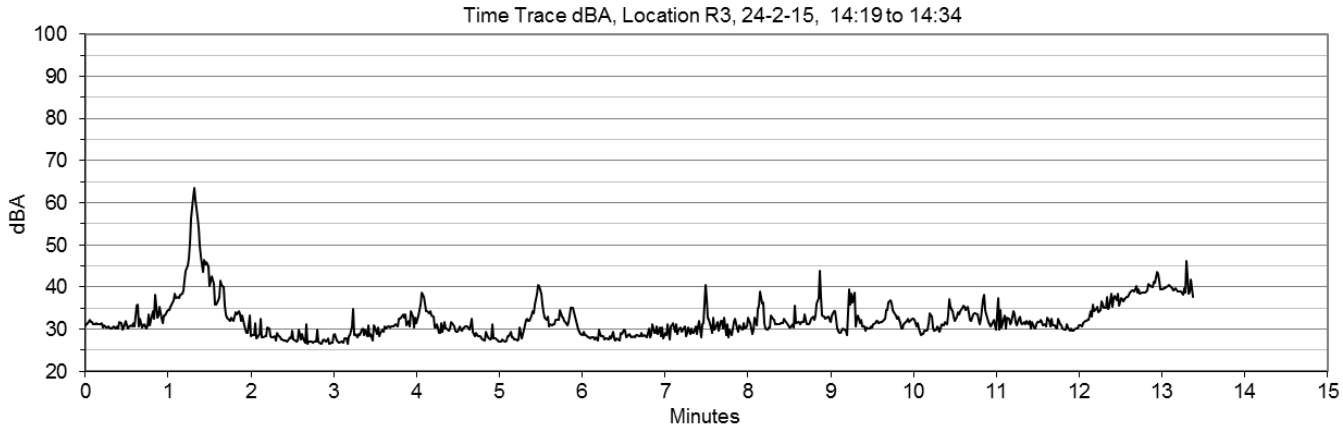
Day 1 – Tuesday 24 February 2015

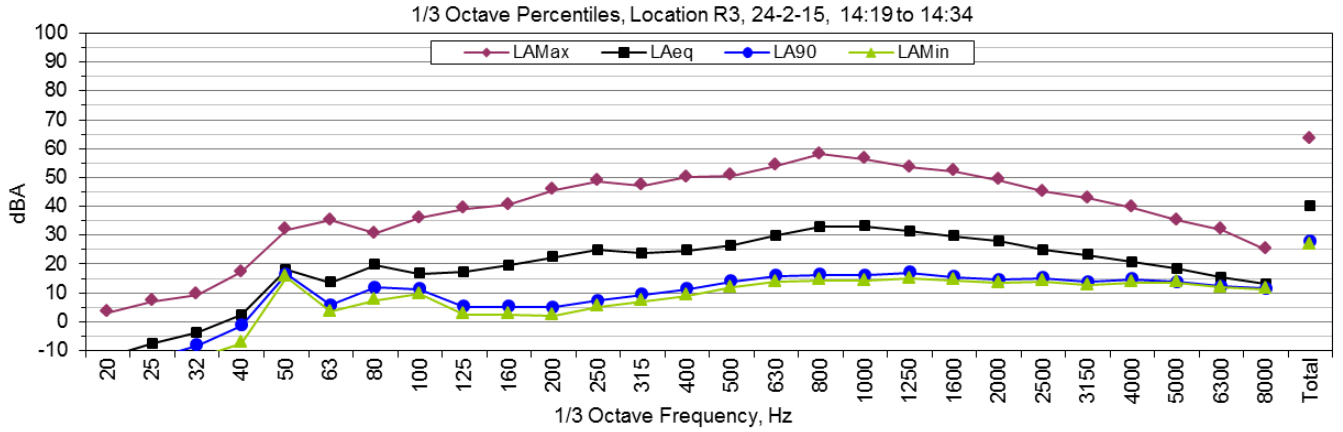


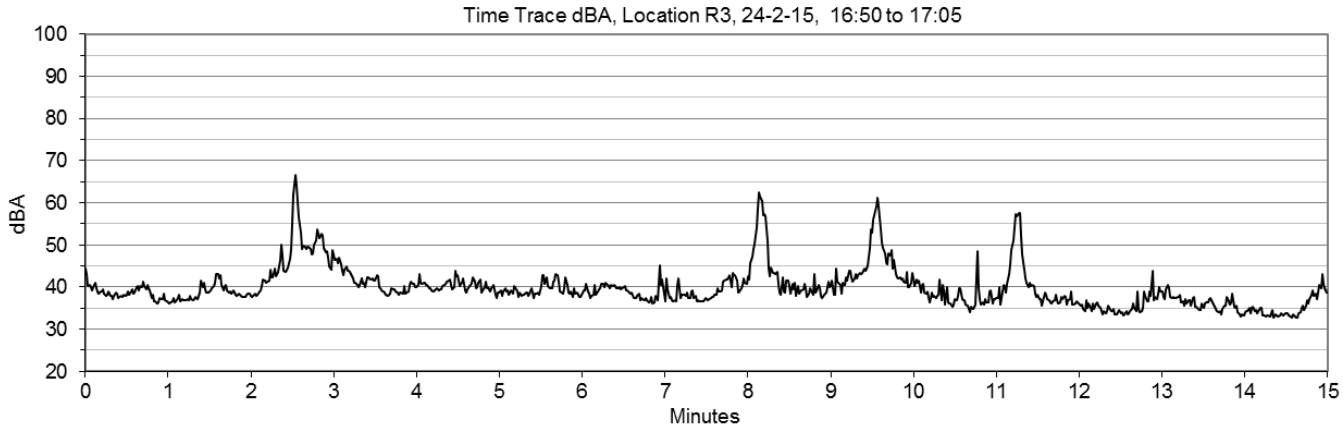


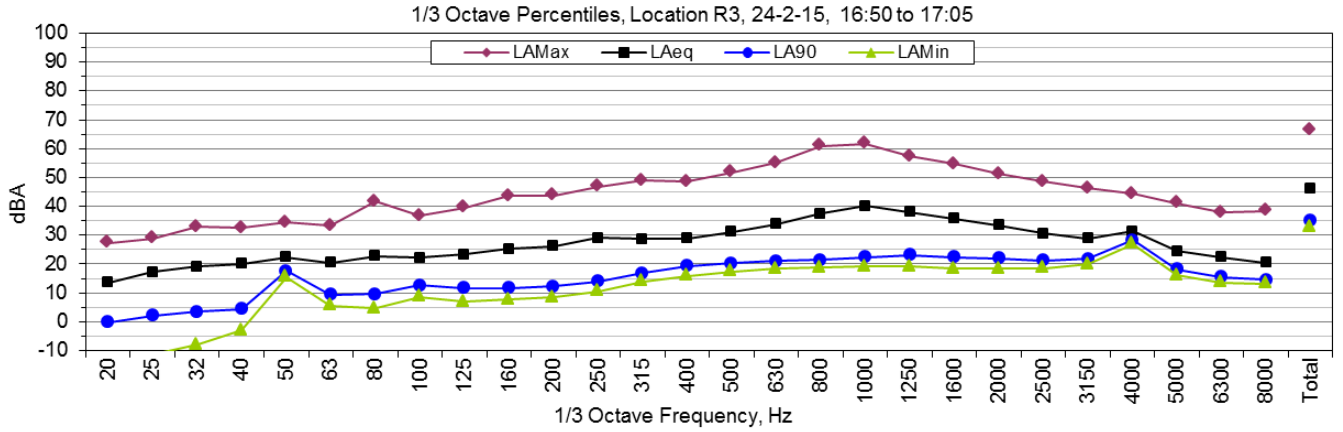

Time Trace dBA, Location R3, 24-2-15, 14:03 to 14:18
dBA
Minutes

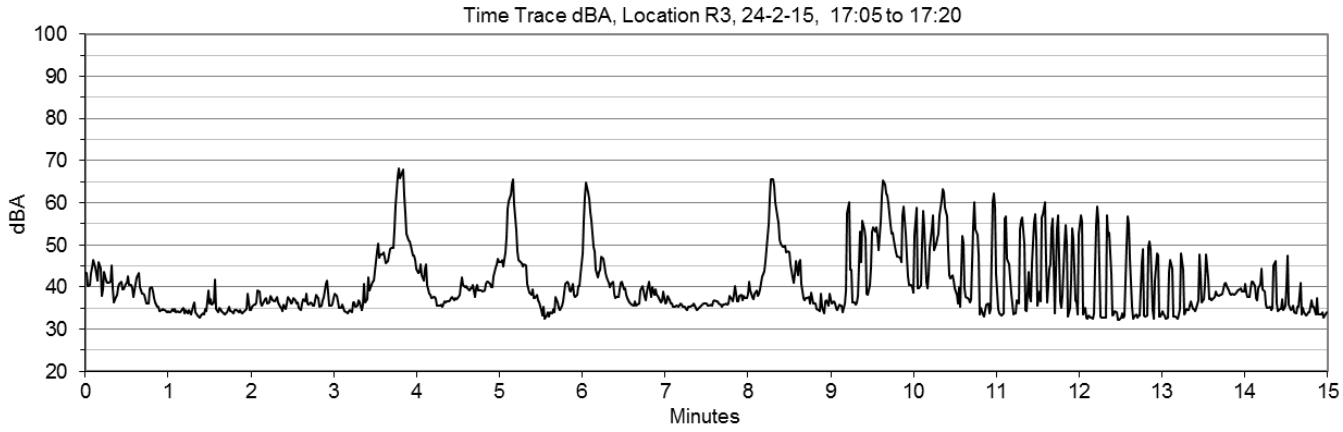

1/3 Octave Percentiles, Location R3, 24-2-15, 14:03 to 14:18
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

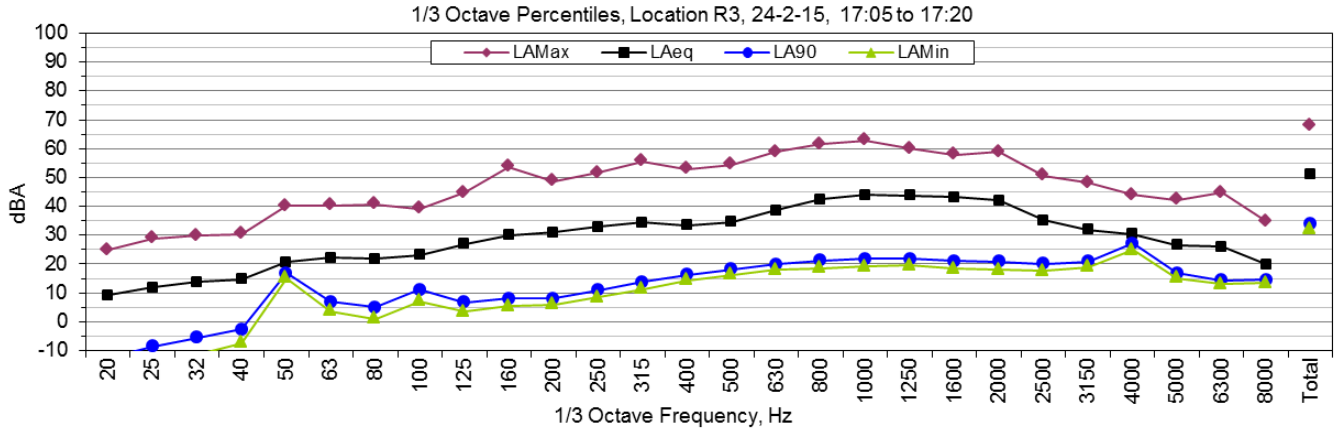

Time Trace dBA, Location R3, 24-2-15, 14:19 to 14:34
dBA
Minutes


1/3 Octave Percentiles, Location R3, 24-2-15, 14:19 to 14:34
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

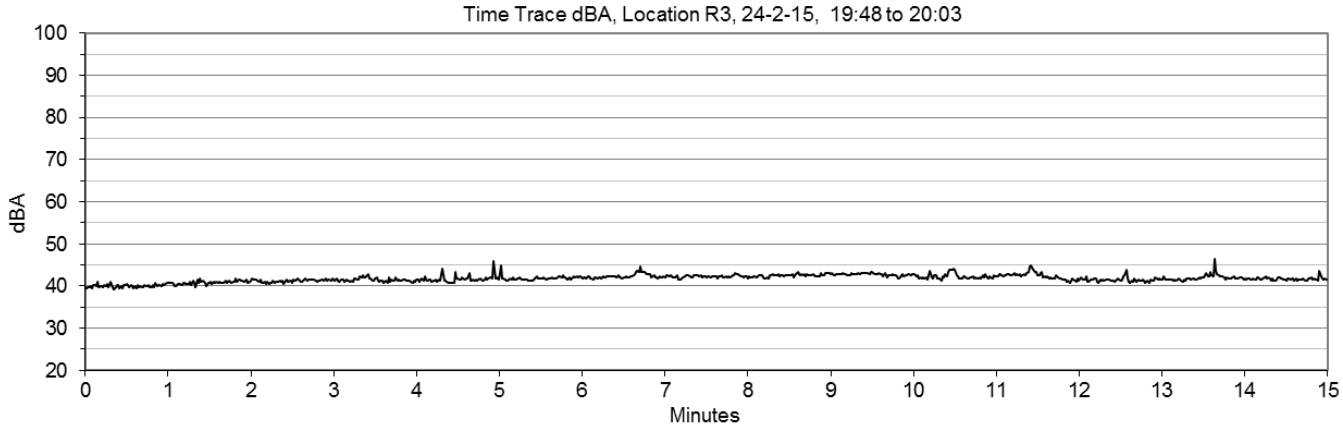

Time Trace dBA, Location R3, 24-2-15, 16:50 to 17:05
dBA
Minutes

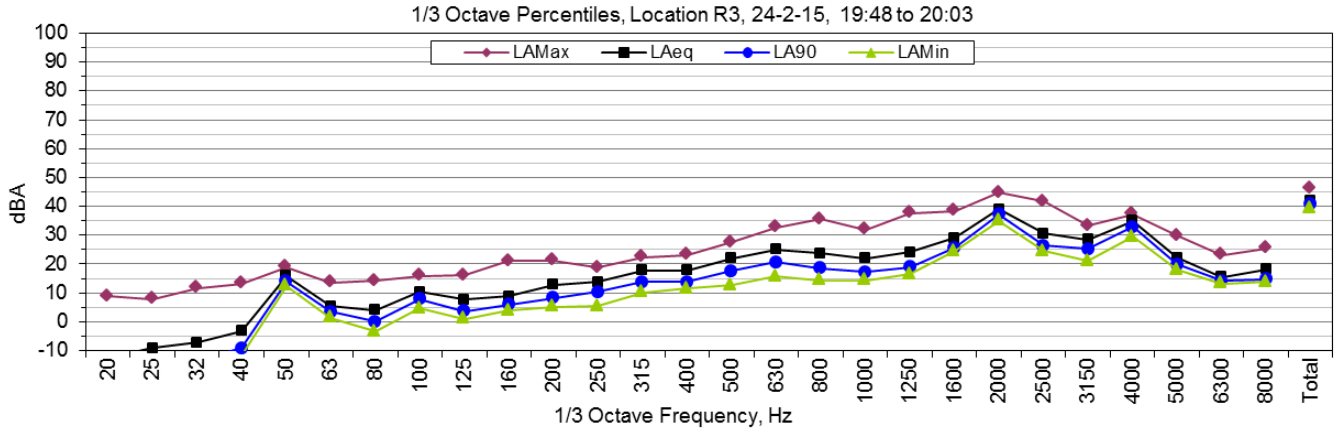

1/3 Octave Percentiles, Location R3, 24-2-15, 16:50 to 17:05
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

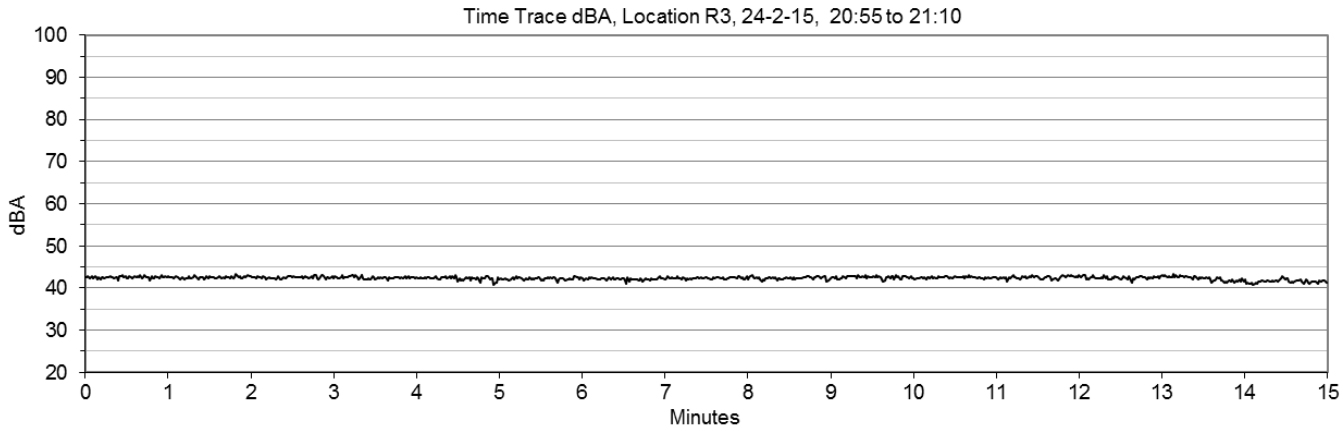

Time Trace dBA, Location R3, 24-2-15, 17:05 to 17:20
dBA
Minutes

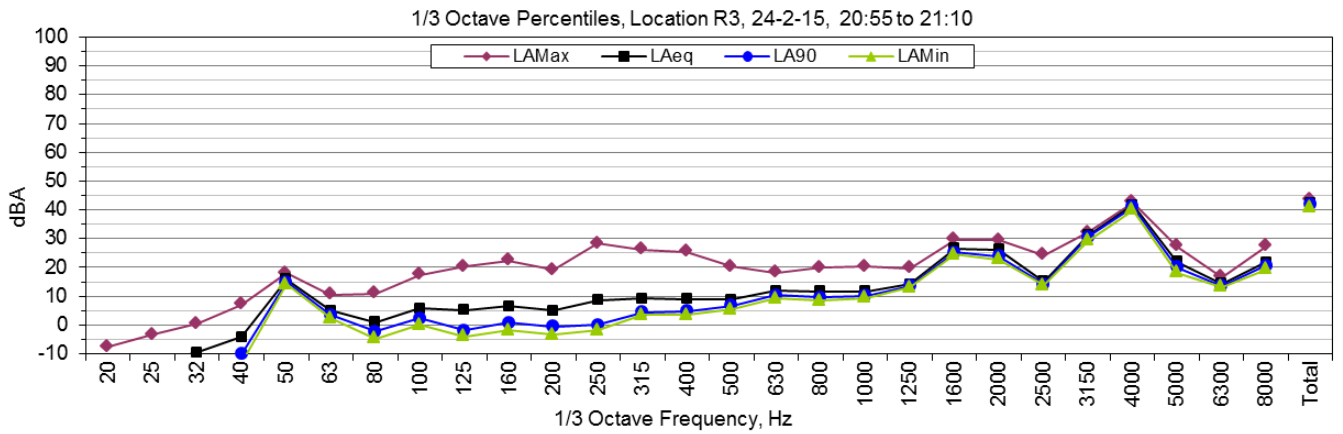

1/3 Octave Percentiles, Location R3, 24-2-15, 17:05 to 17:20
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

Evening 1 – Tuesday 24 February 2015

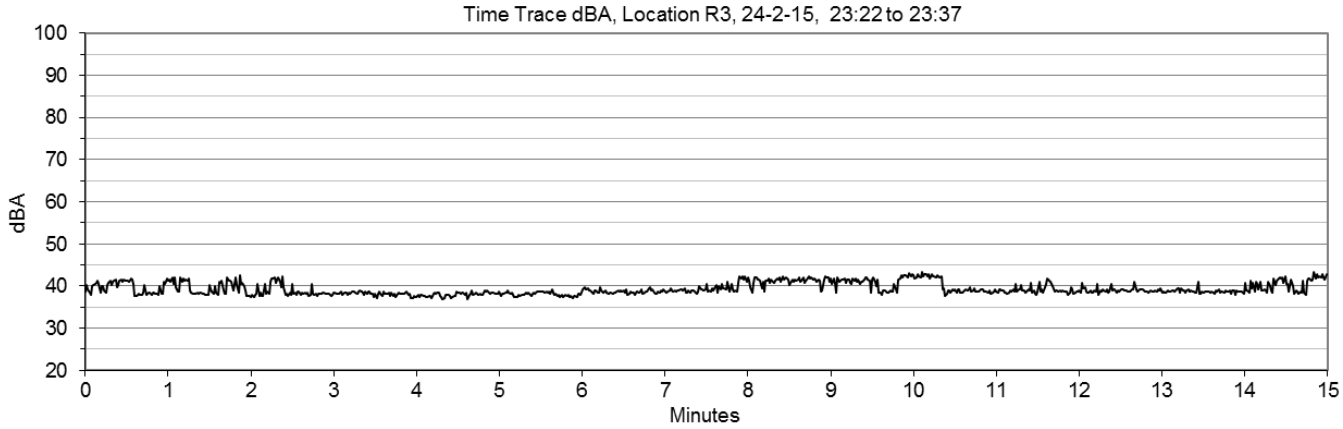


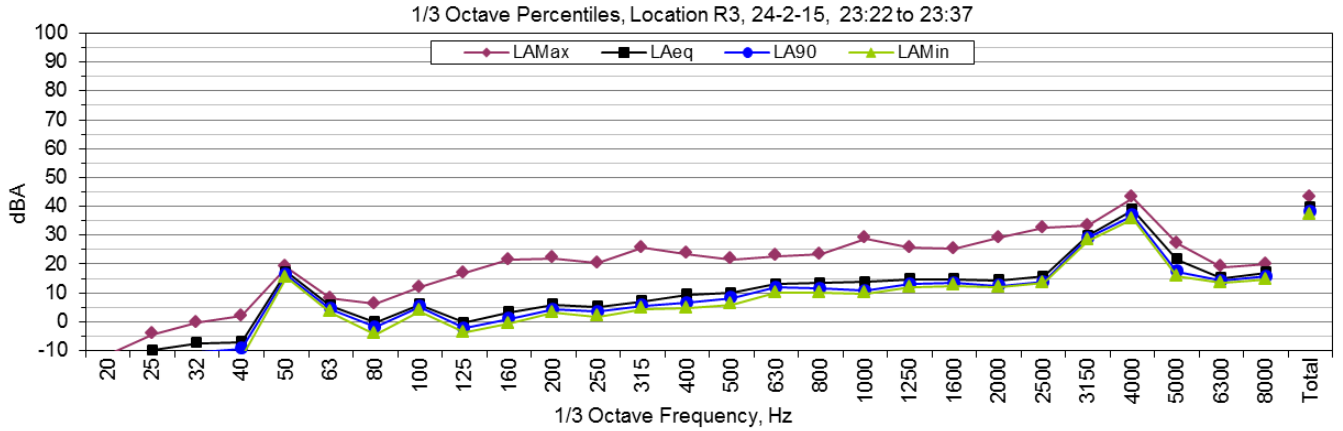


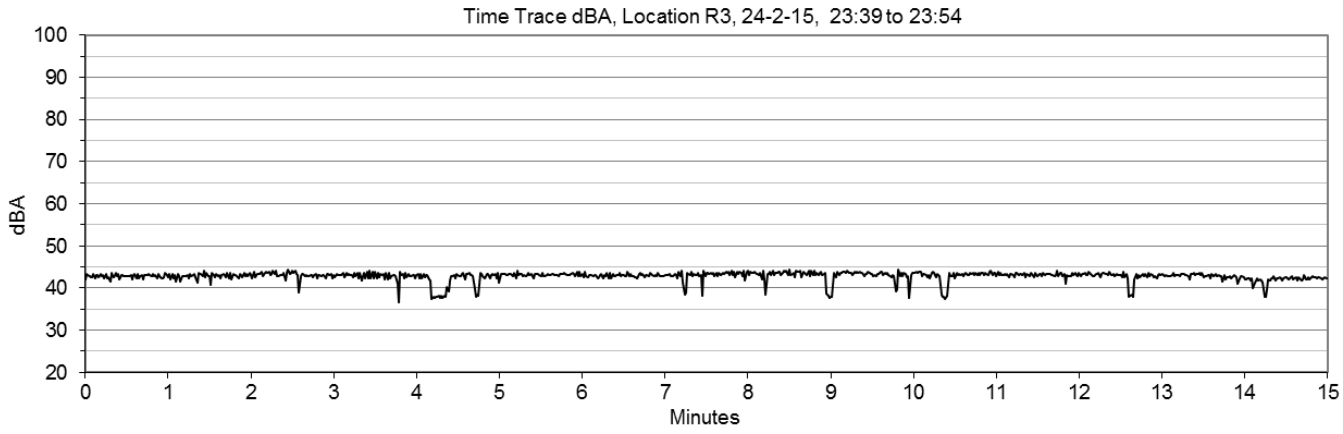


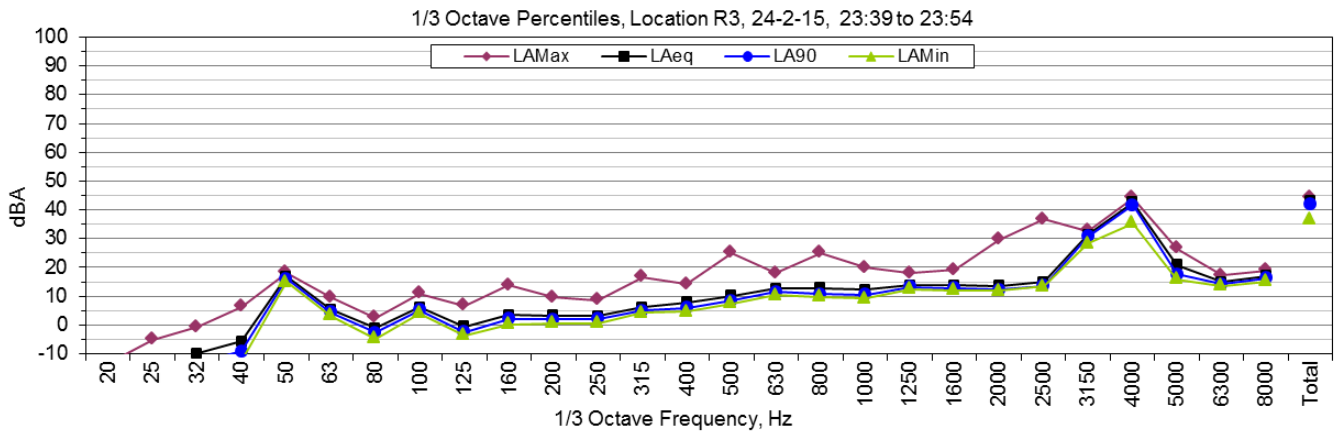


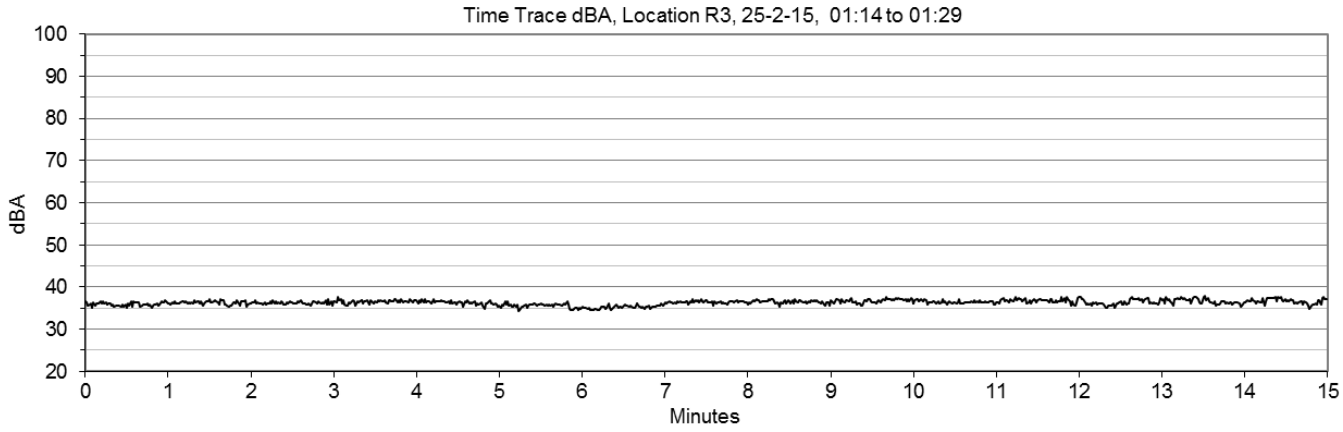
Night 1 – Tuesday 24 February 2015

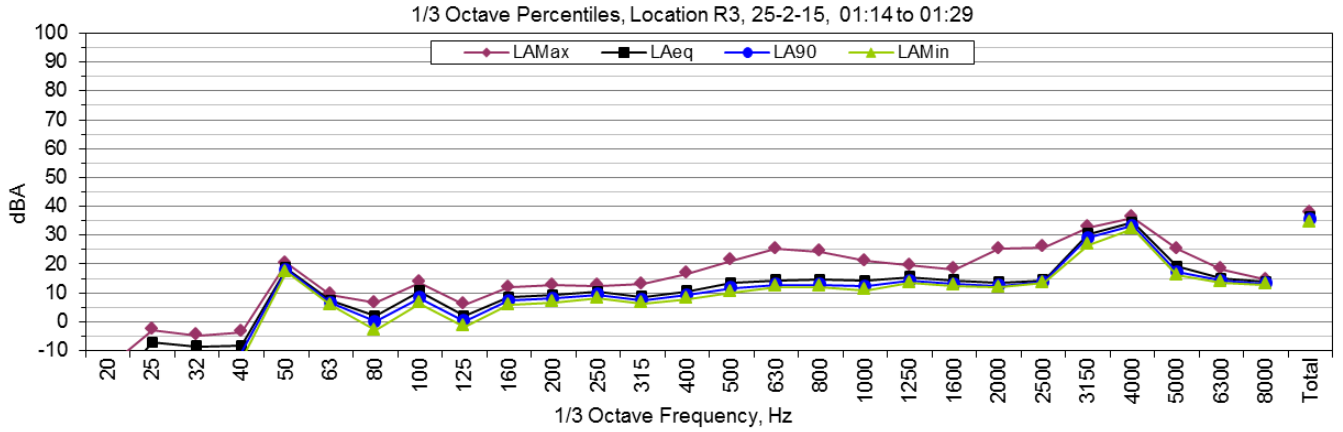


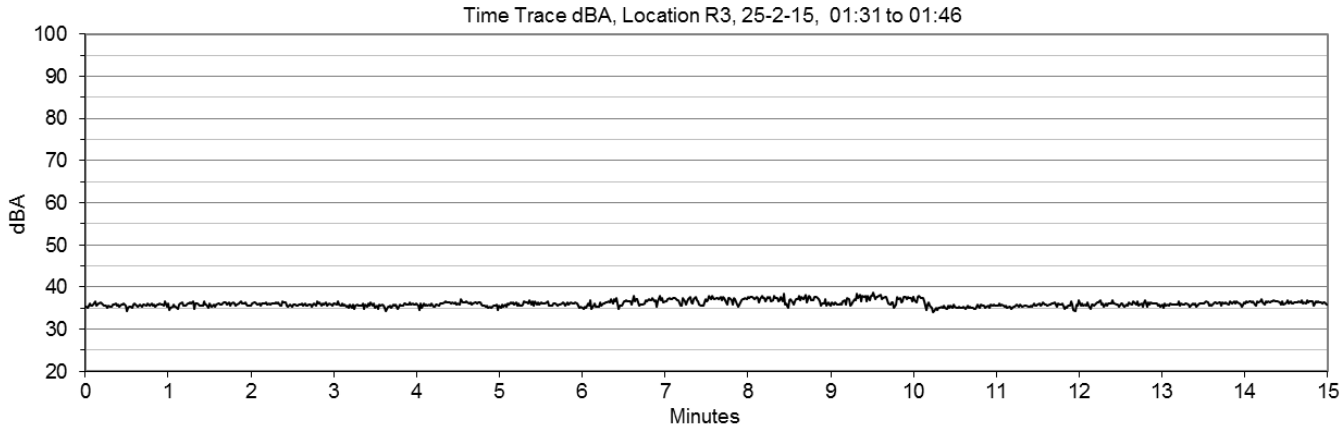


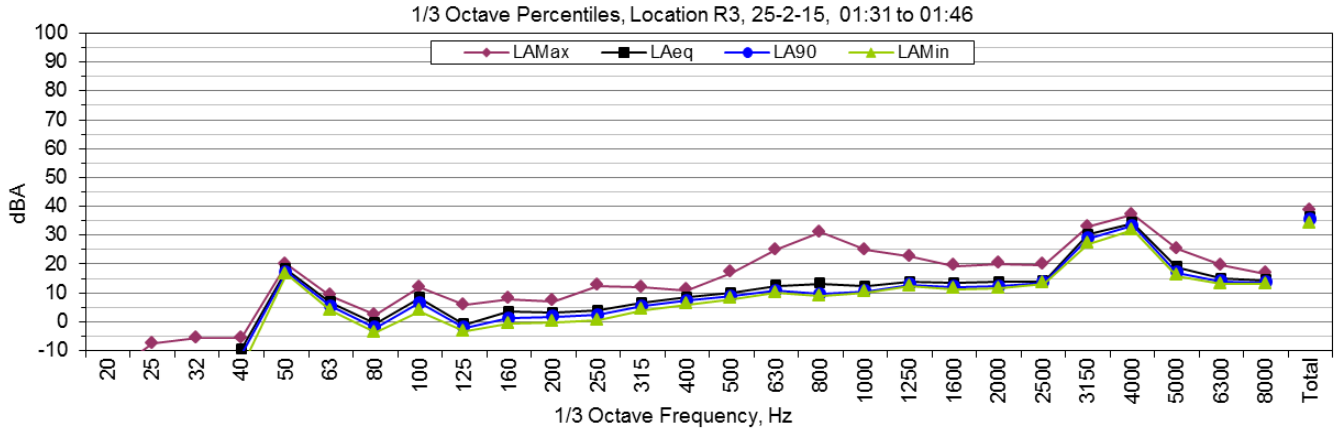




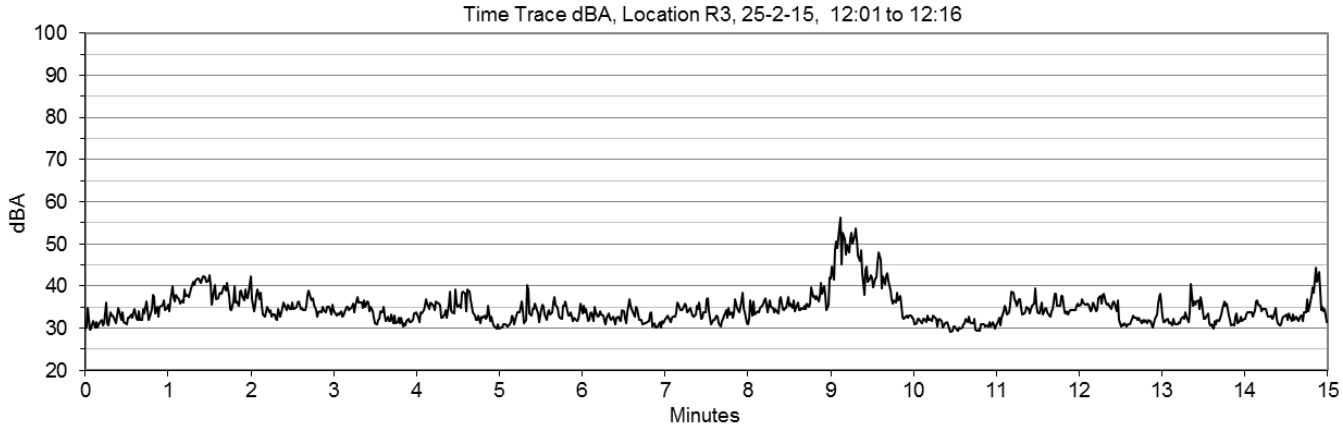

Time Trace dBA, Location R3, 25-2-15, 01:14 to 01:29
dBA
Minutes

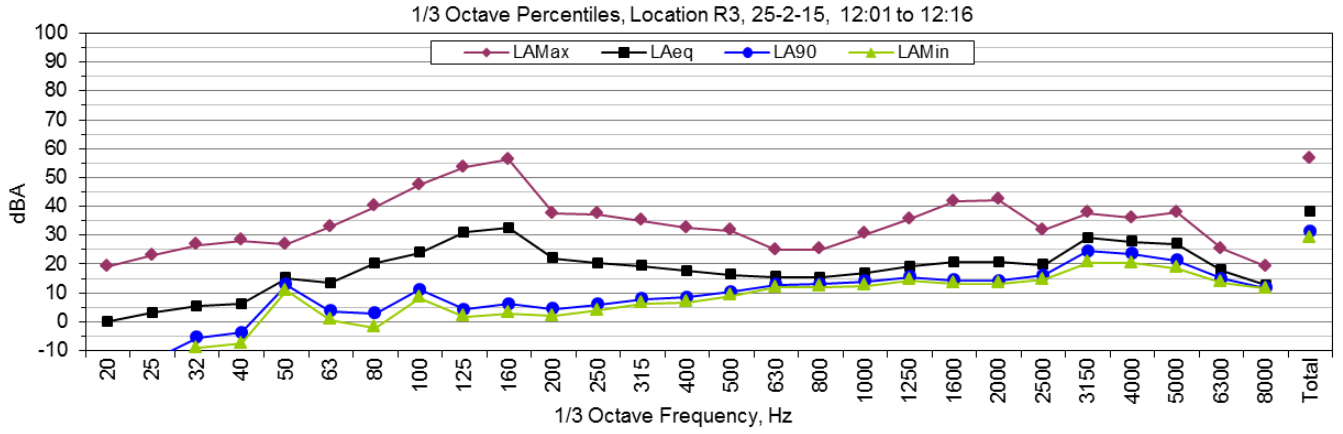

1/3 Octave Percentiles, Location R3, 25-2-15, 01:14 to 01:29
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

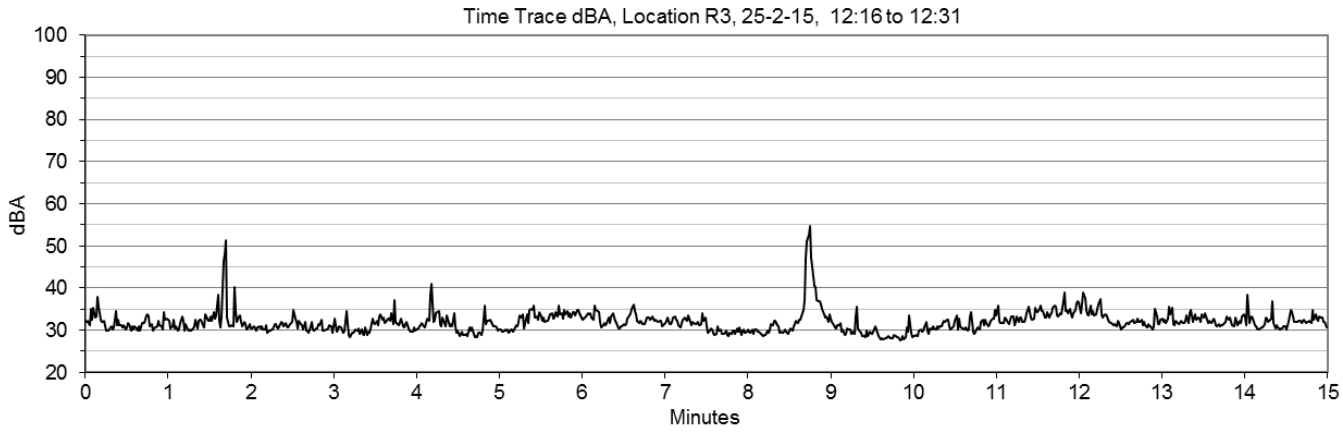

Time Trace dBA, Location R3, 25-2-15, 01:31 to 01:46
dBA
Minutes

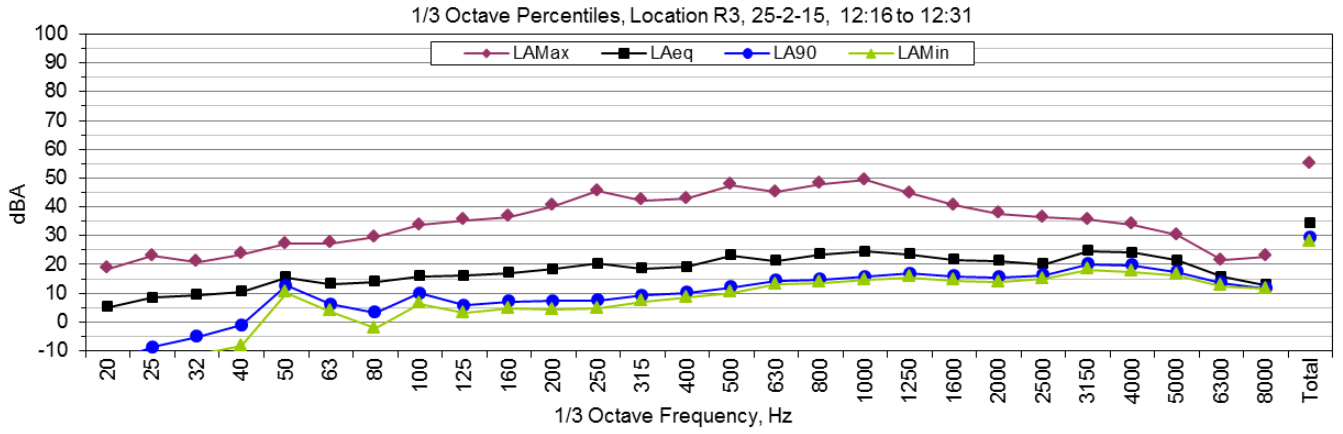

1/3 Octave Percentiles, Location R3, 25-2-15, 01:31 to 01:46
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

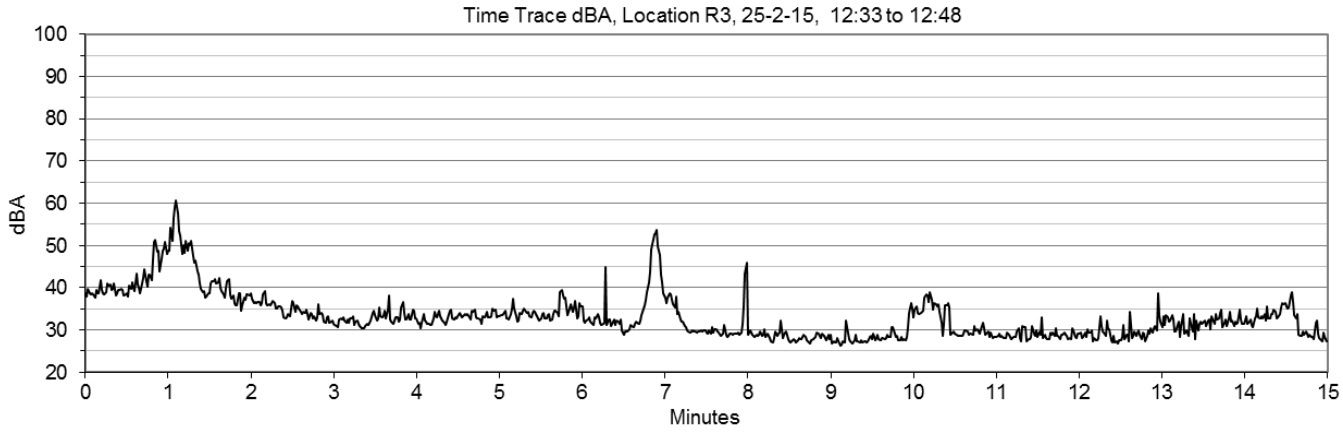
Day 2 – Wednesday 25 February 2015

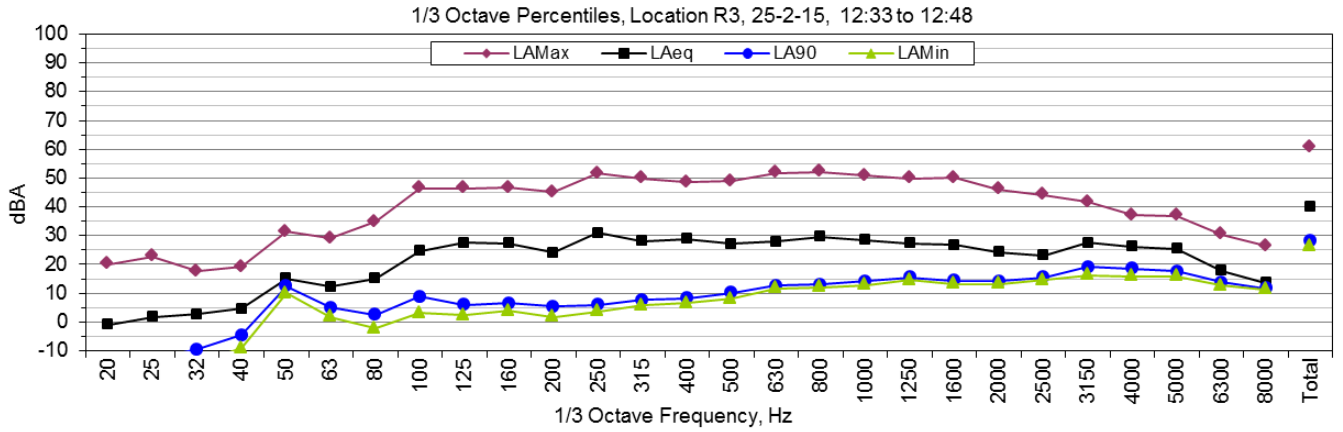


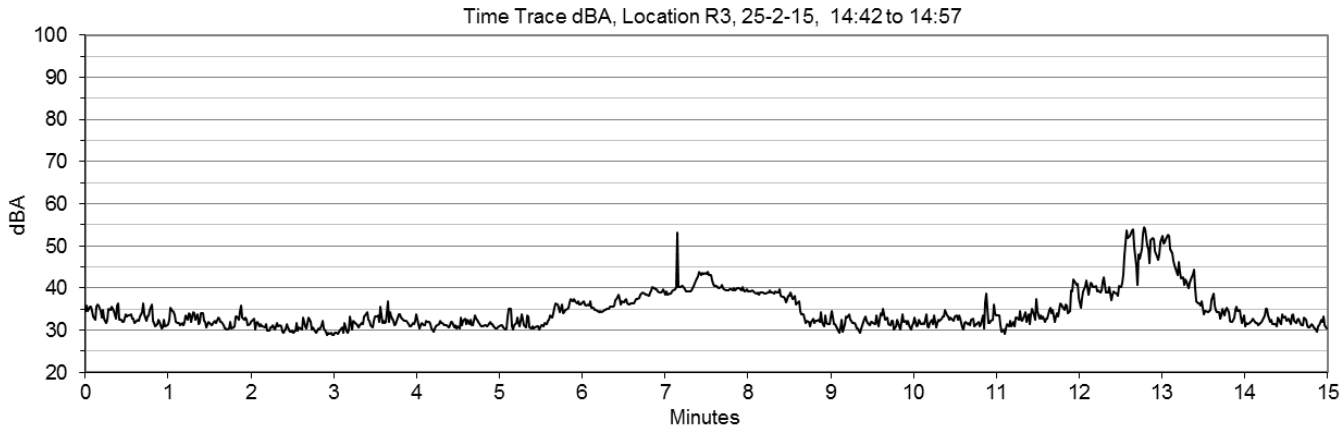


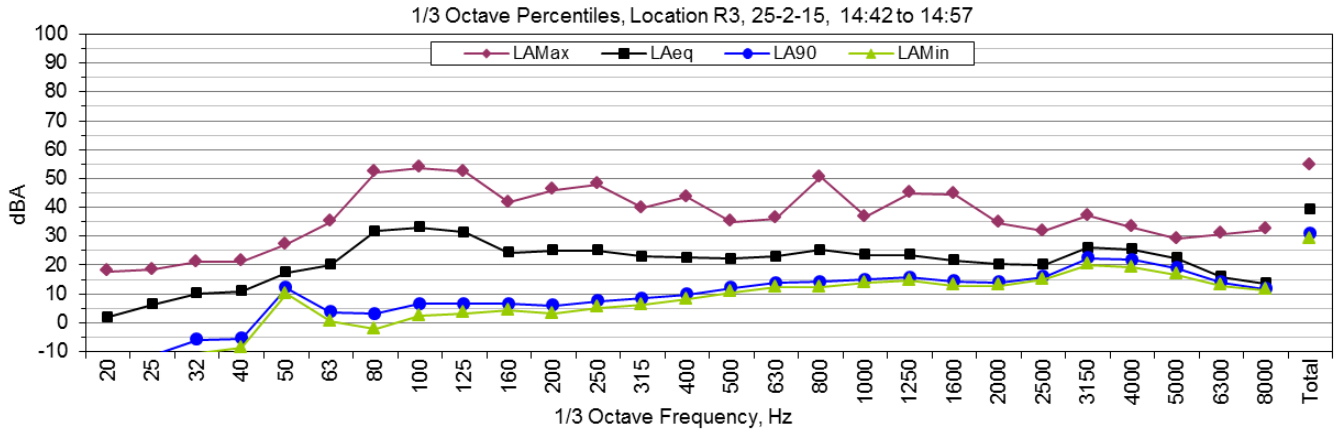


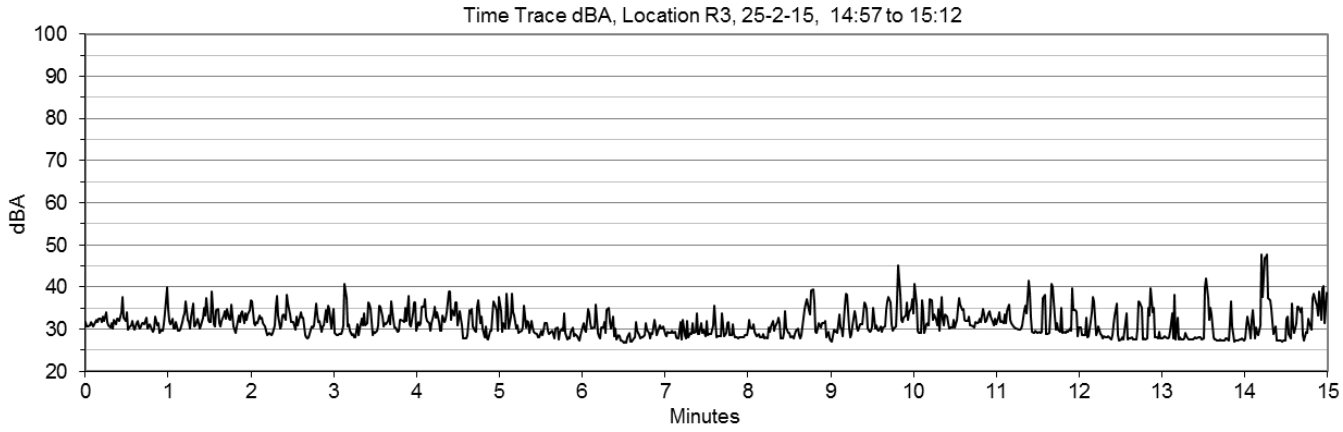


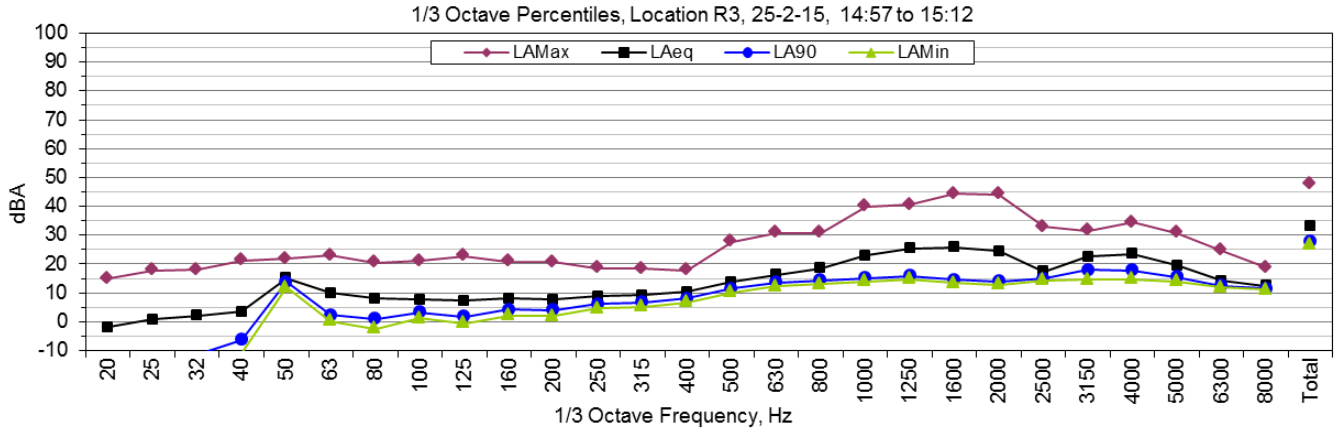

Time Trace dBA, Location R3, 25-2-15, 12:33 to 12:48
dBA
Minutes

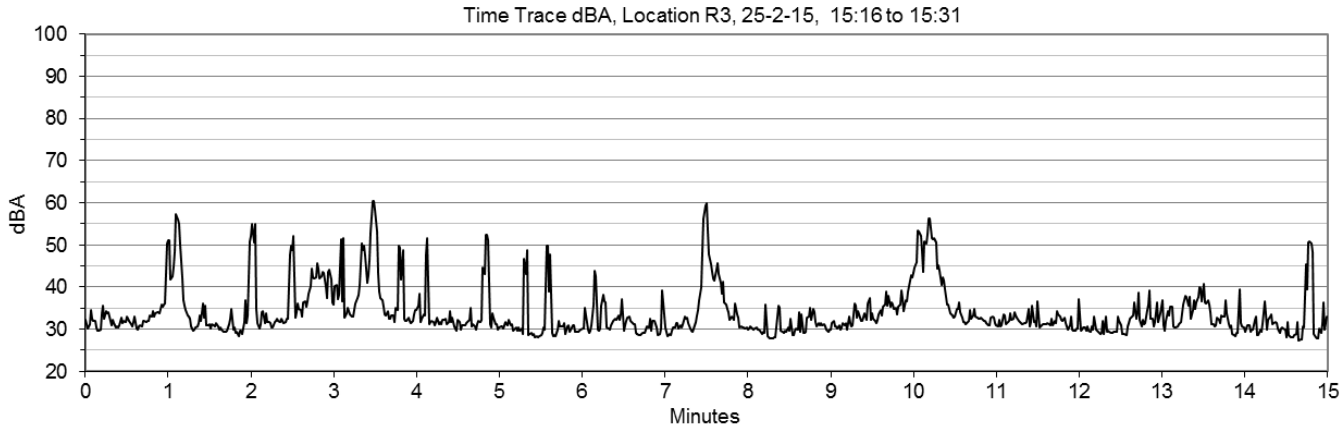

1/3 Octave Percentiles, Location R3, 25-2-15, 12:33 to 12:48
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

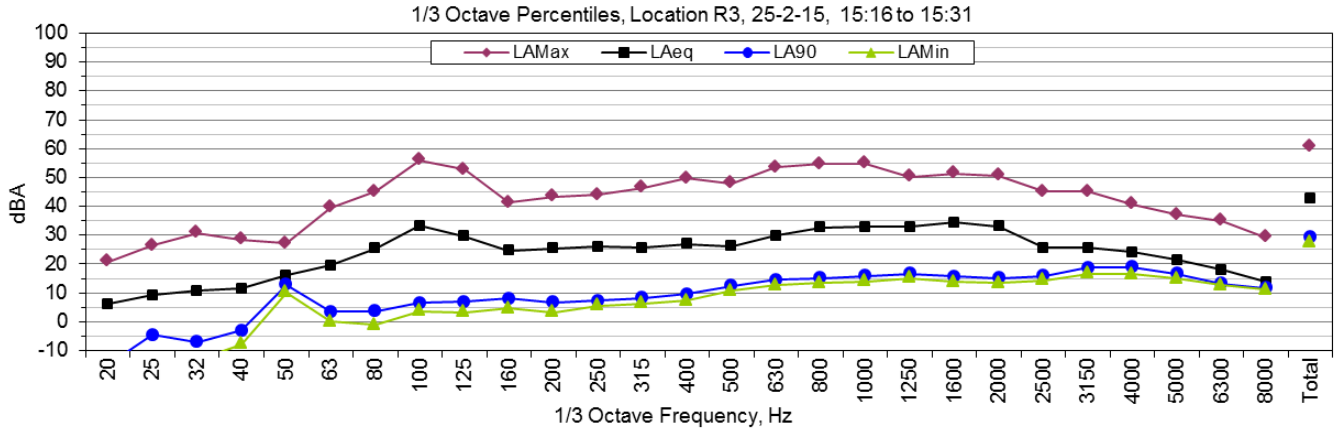

Time Trace dBA, Location R3, 25-2-15, 14:42 to 14:57
dBA
Minutes


1/3 Octave Percentiles, Location R3, 25-2-15, 14:42 to 14:57
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

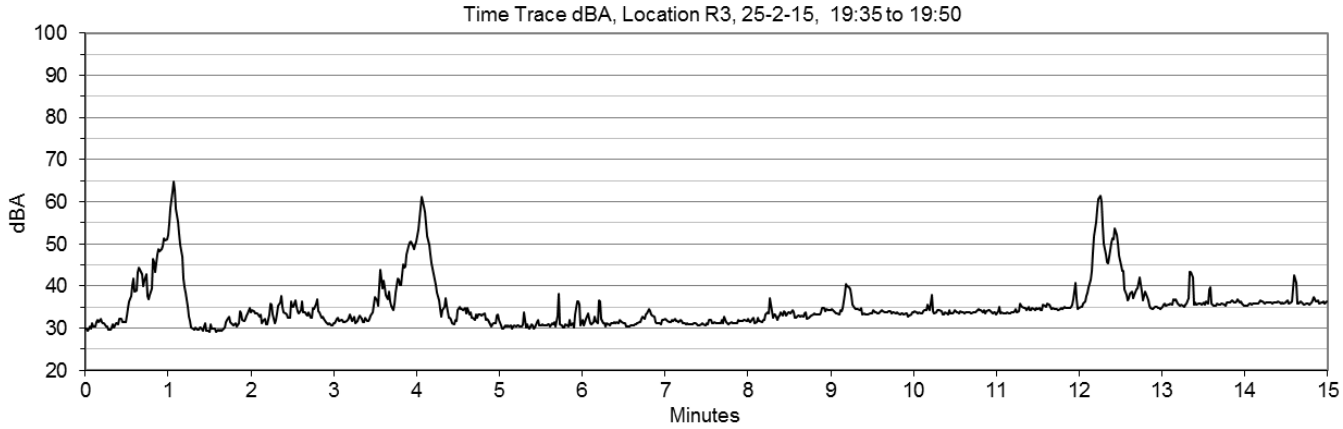

Time Trace dBA, Location R3, 25-2-15, 14:57 to 15:12
dBA
Minutes

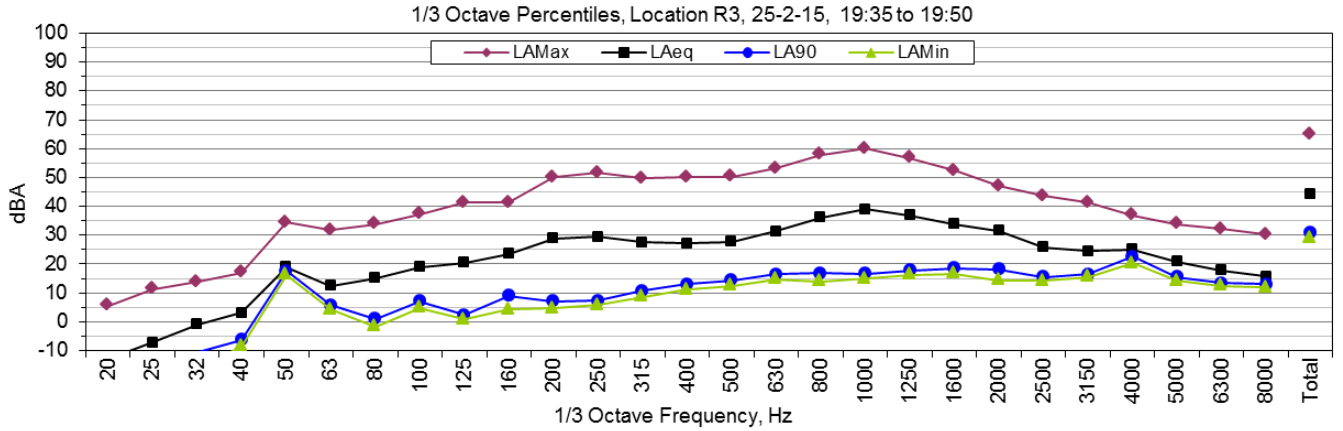

1/3 Octave Percentiles, Location R3, 25-2-15, 14:57 to 15:12
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

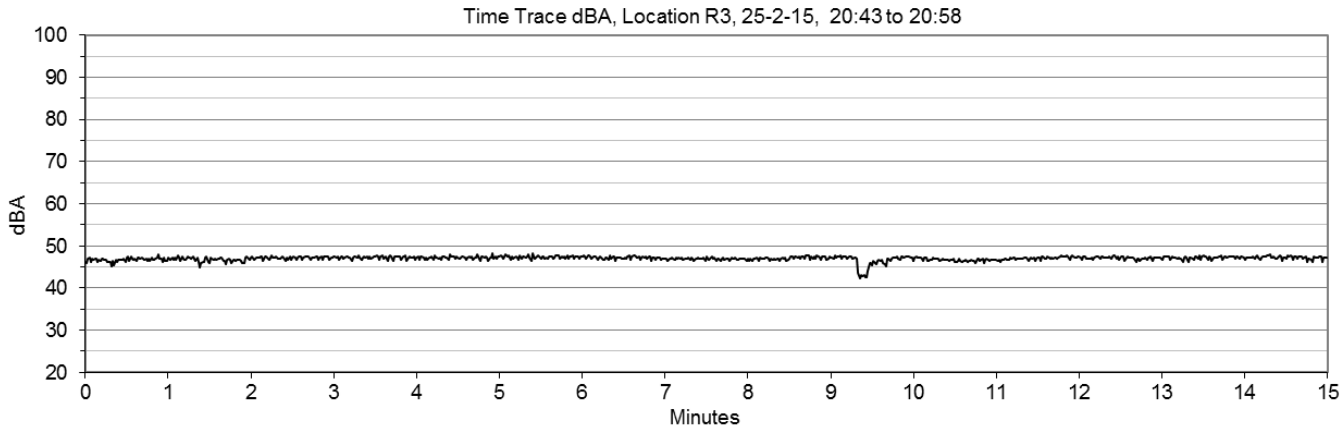

Time Trace dBA, Location R3, 25-2-15, 15:16 to 15:31
dBA
Minutes

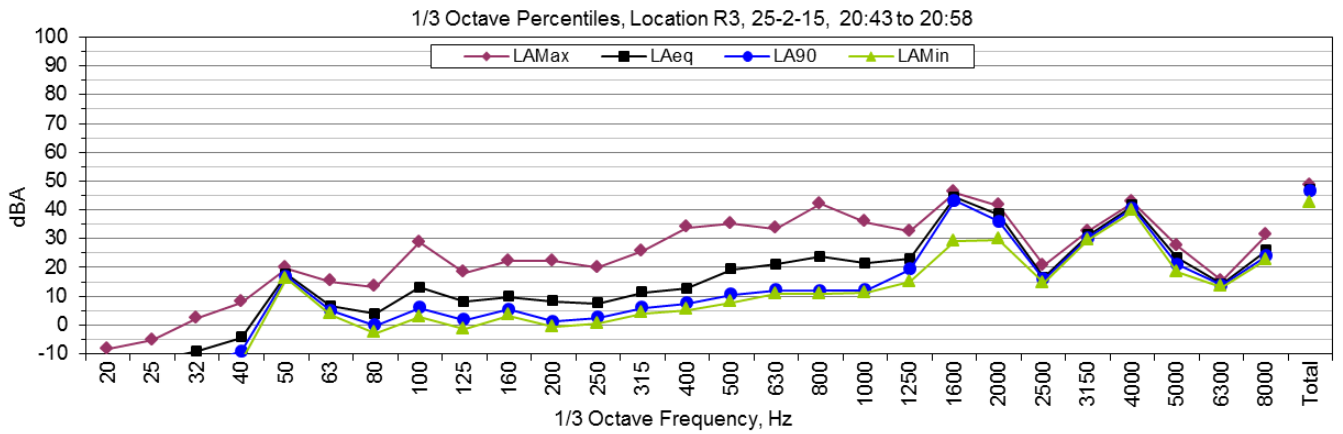

1/3 Octave Percentiles, Location R3, 25-2-15, 15:16 to 15:31
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

Evening 2 – Wednesday 25 February 2015

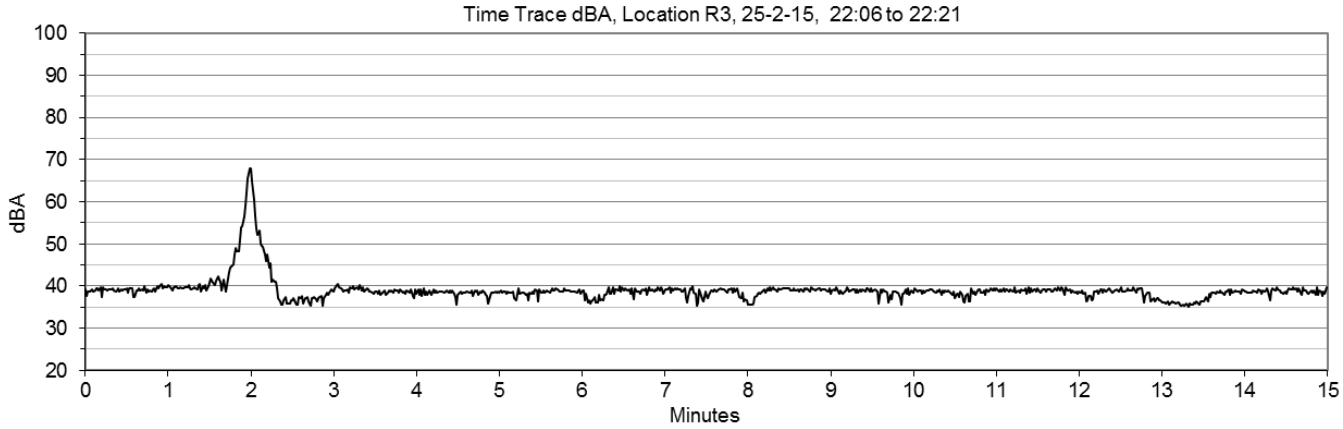


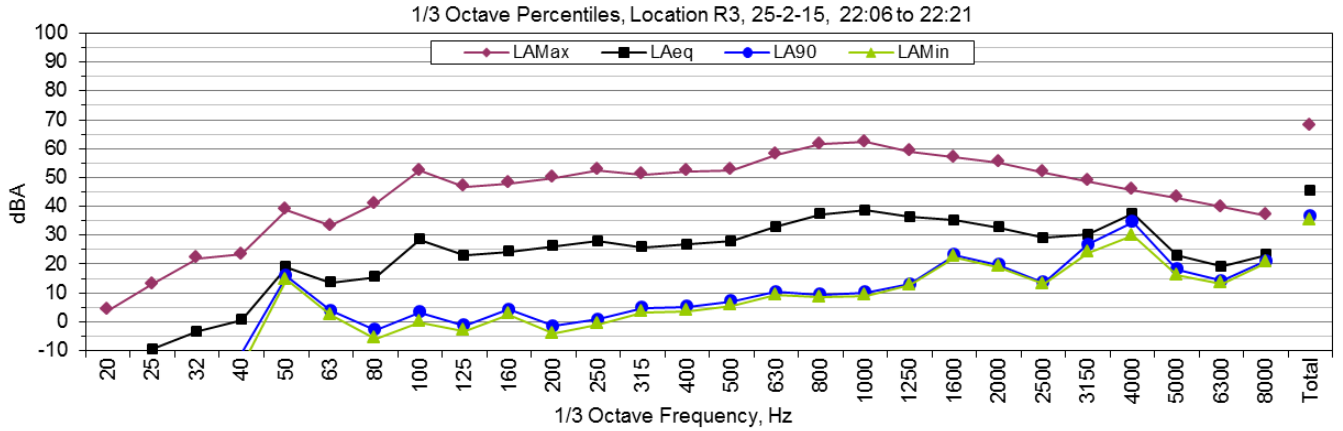


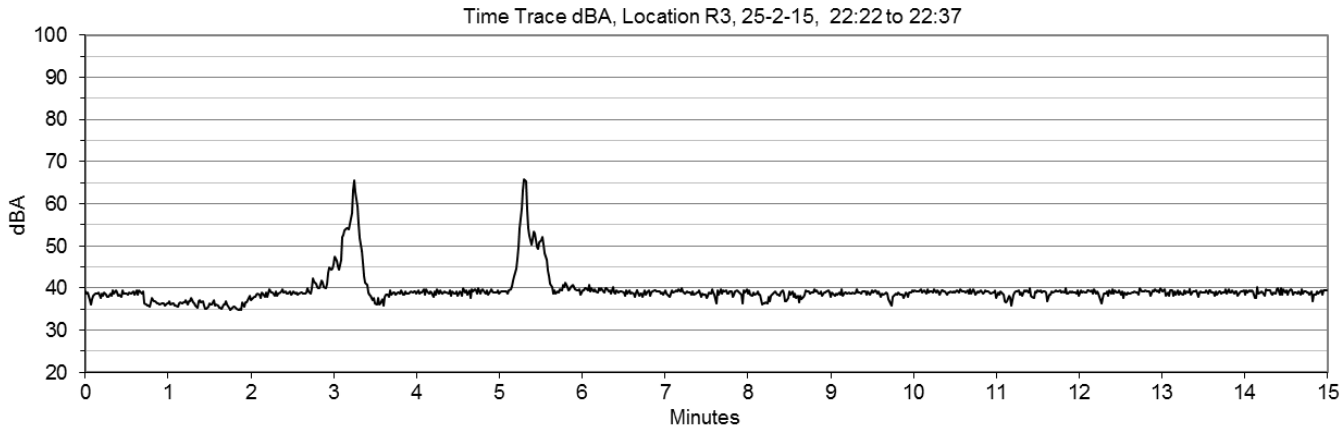


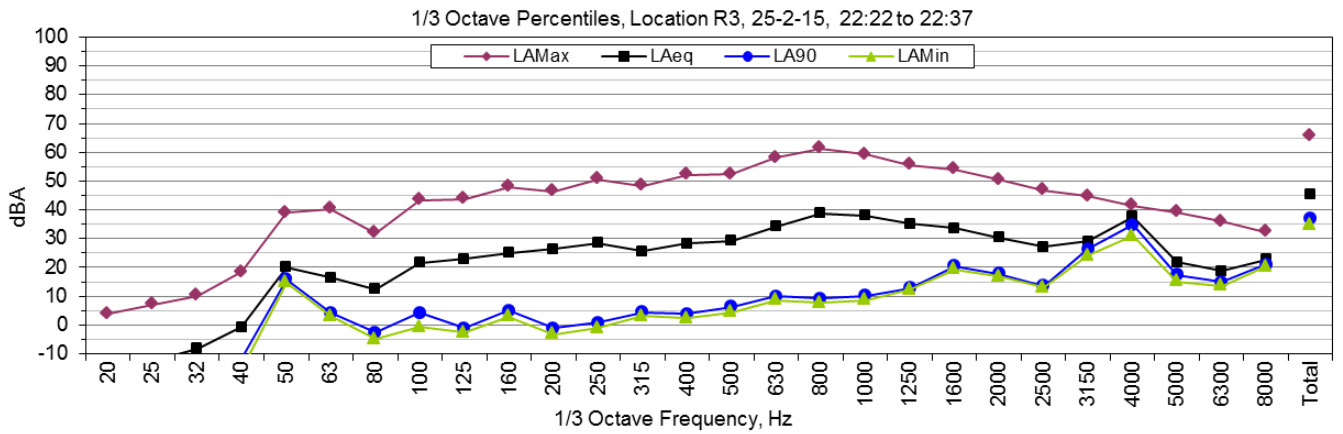


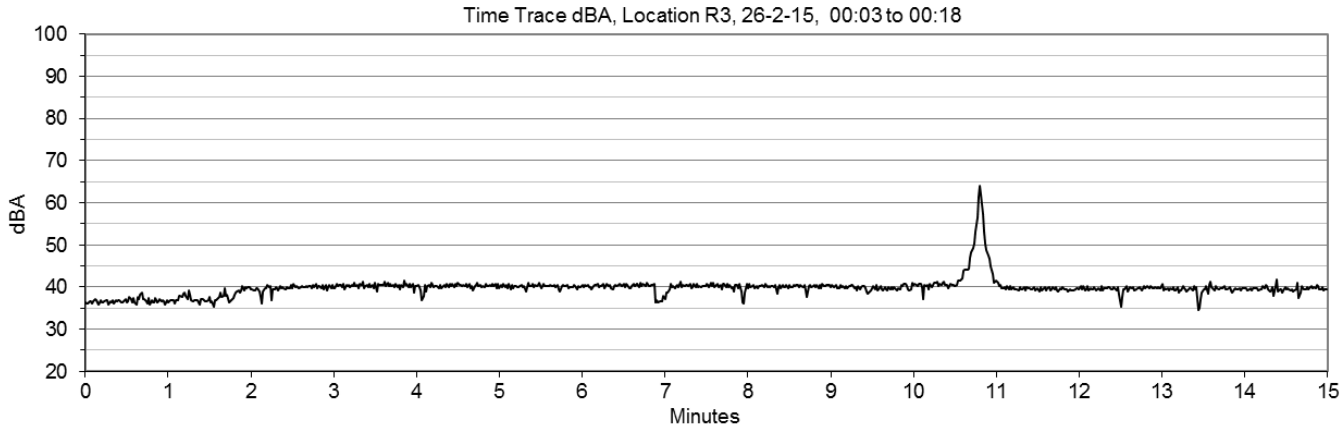
Night 2 – Wednesday 25 February 2015

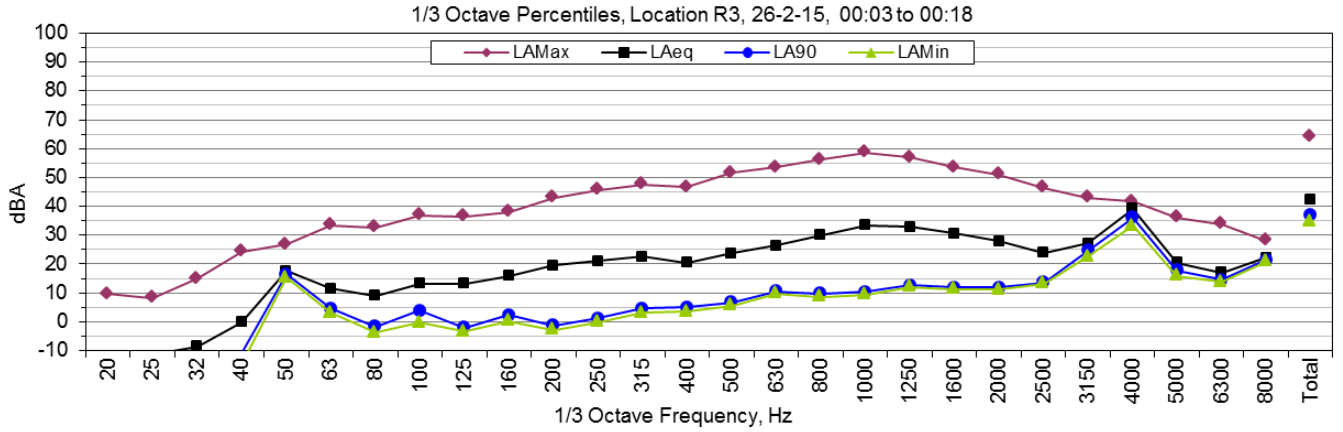


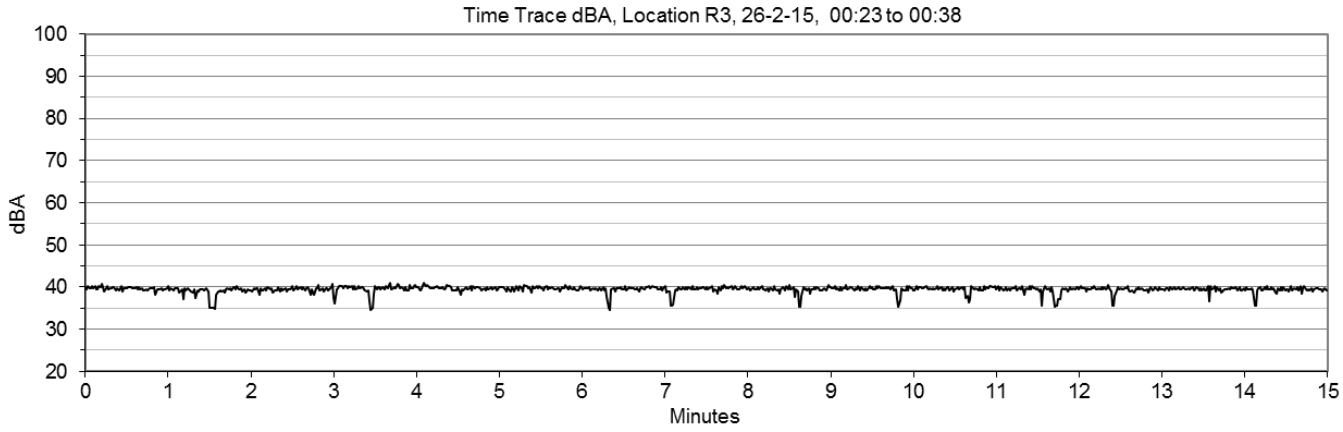


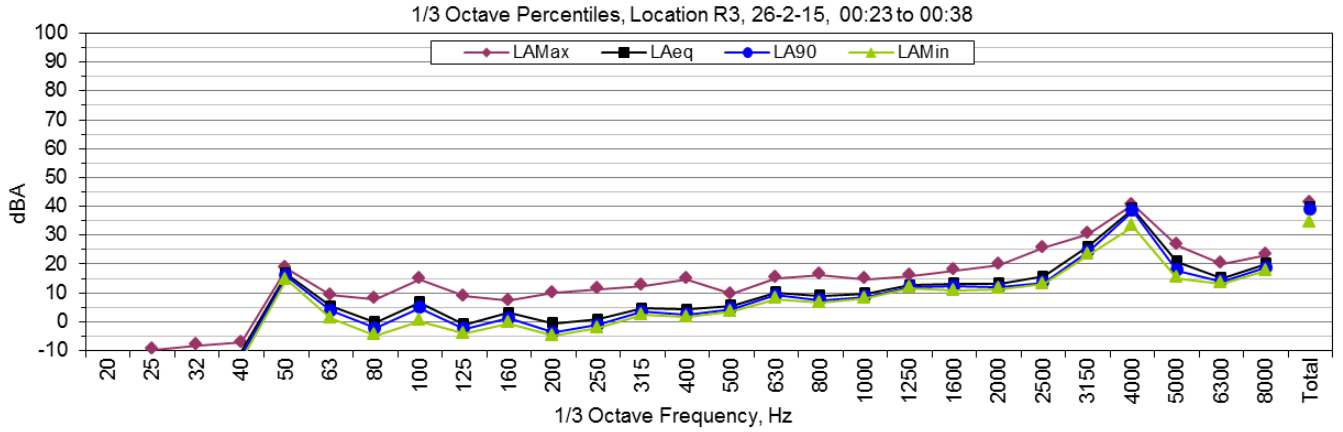




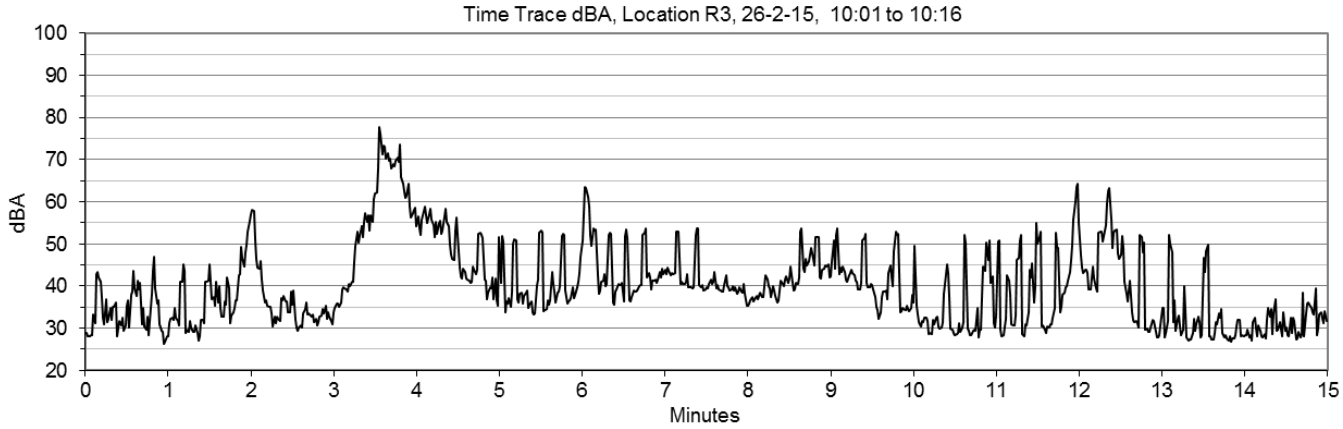

Time Trace dBA, Location R3, 26-2-15, 00:03 to 00:18
dBA
Minutes

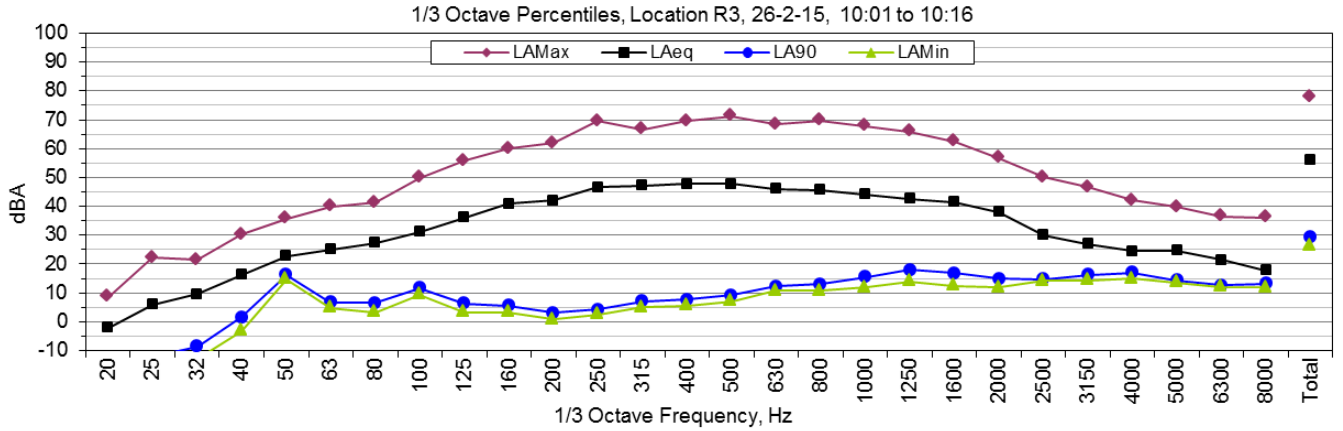

1/3 Octave Percentiles, Location R3, 26-2-15, 00:03 to 00:18
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

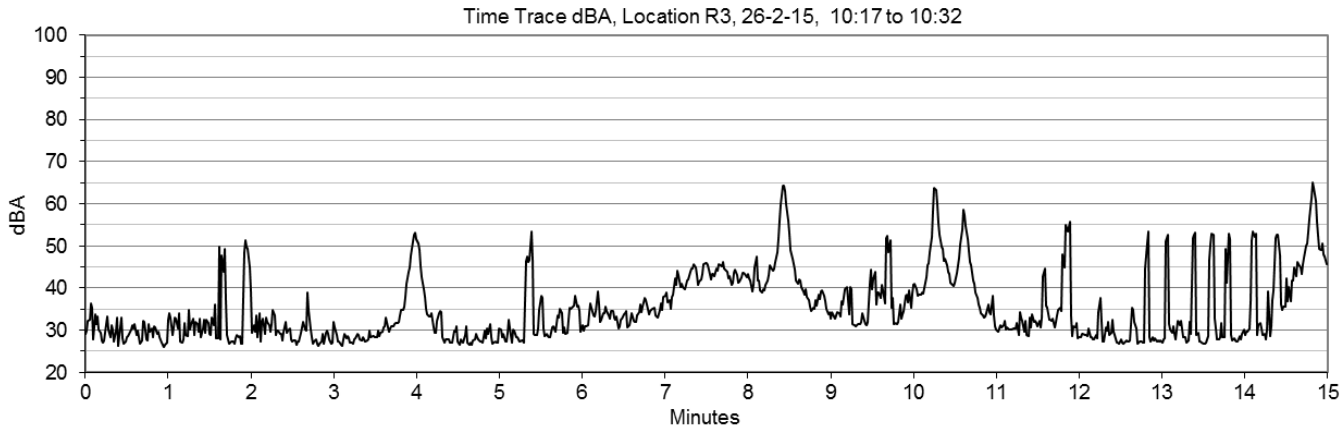

Time Trace dBA, Location R3, 26-2-15, 00:23 to 00:38
dBA
Minutes

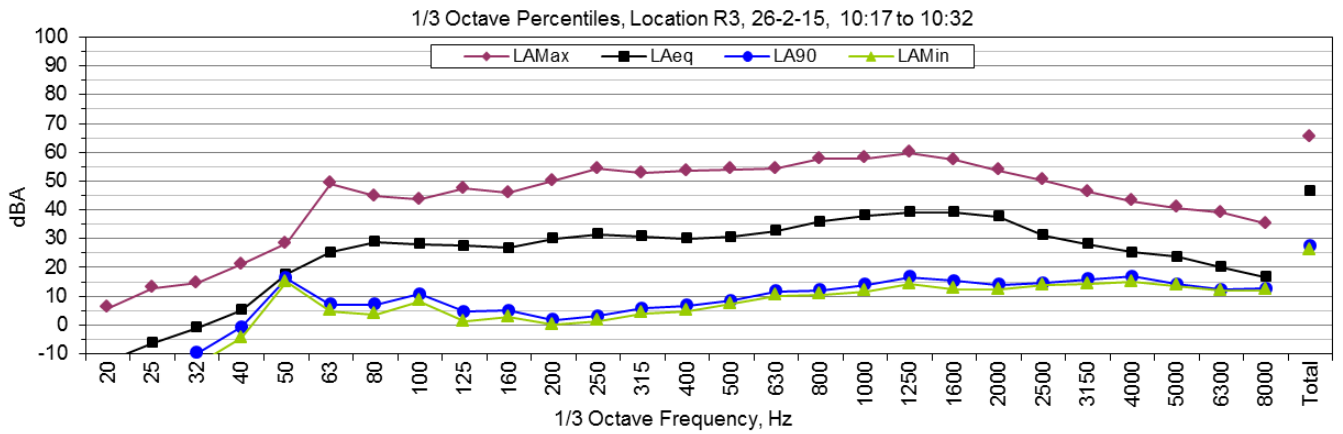

1/3 Octave Percentiles, Location R3, 26-2-15, 00:23 to 00:38
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

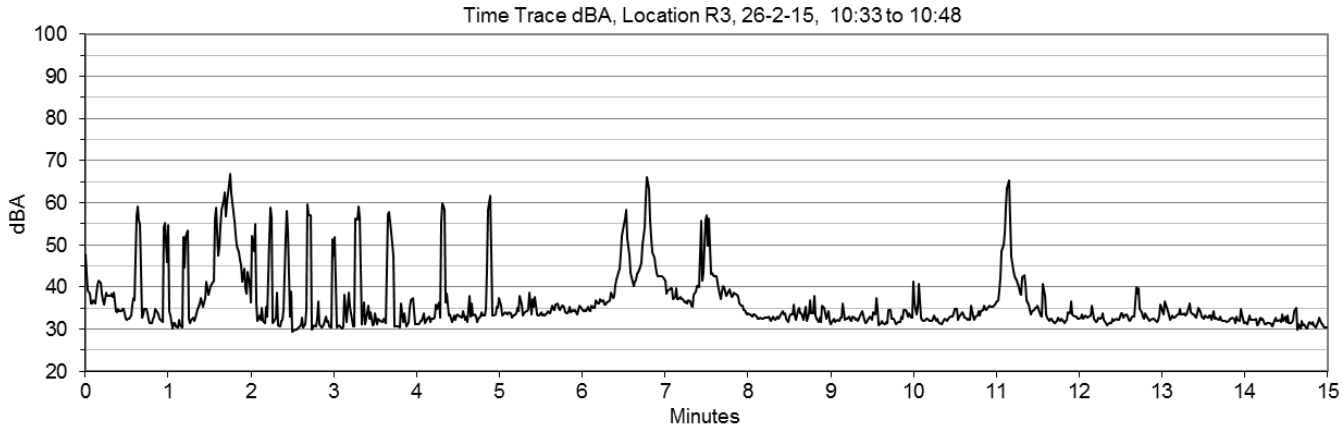
Day 3 – Thursday 26 February 2015

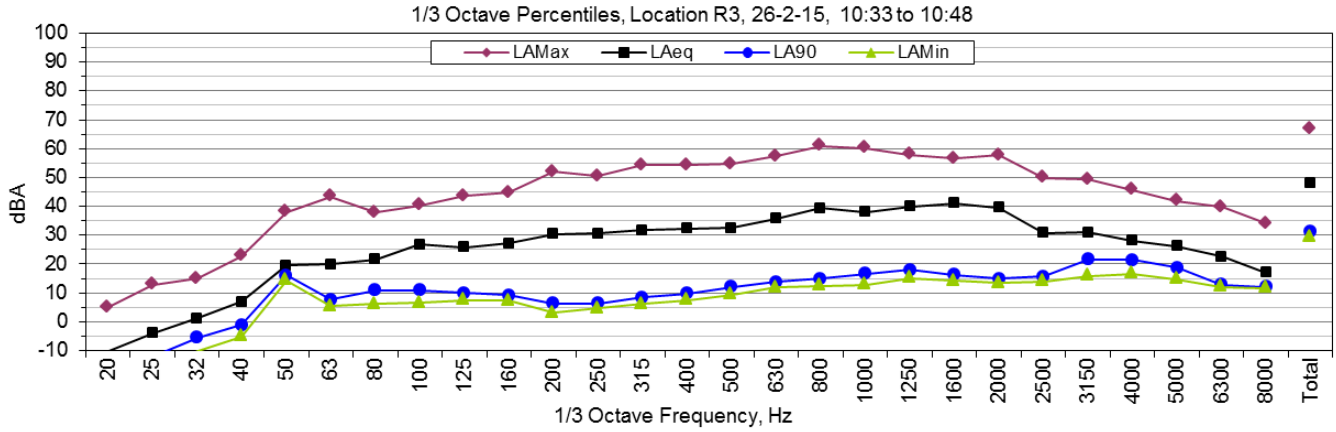


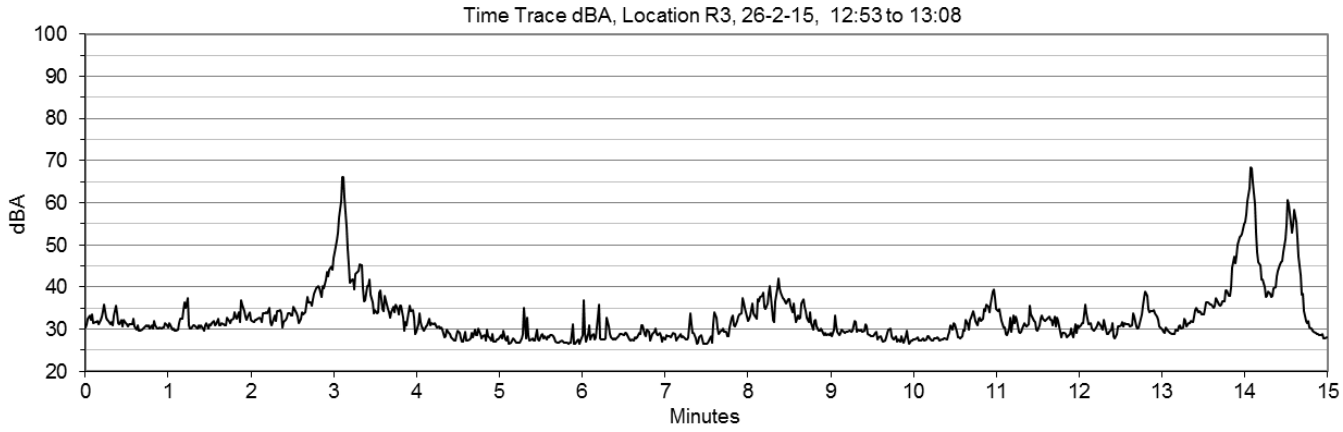


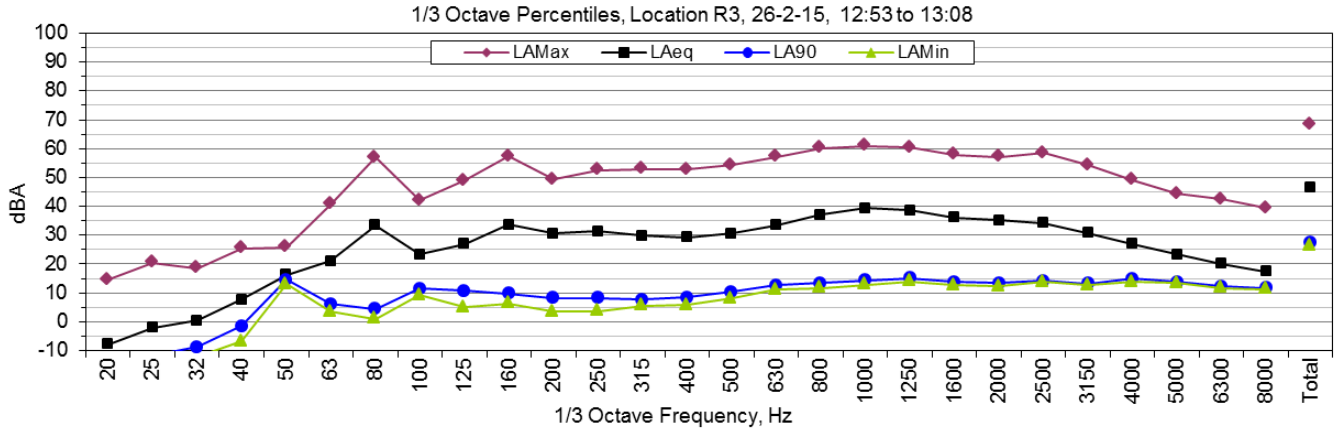


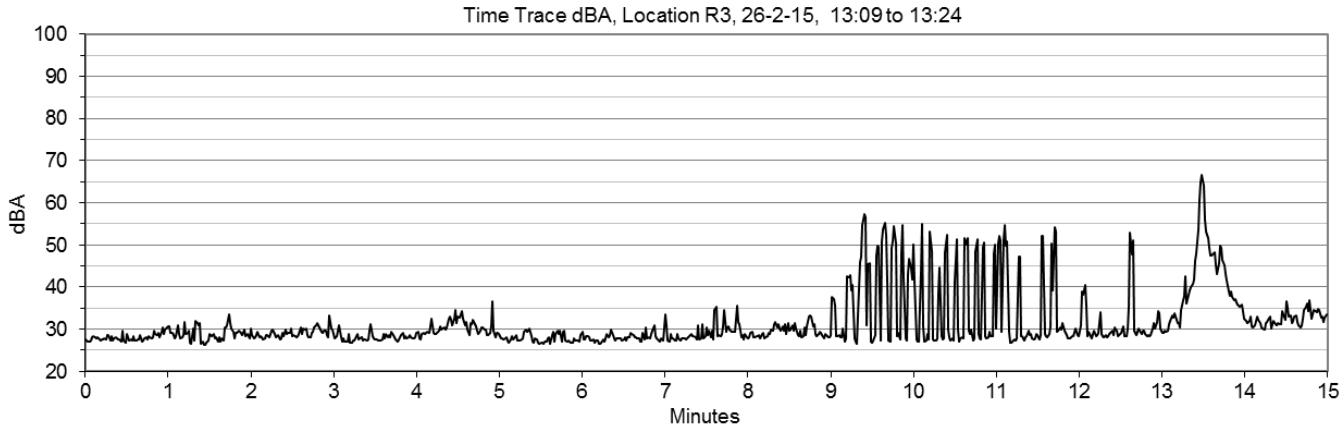


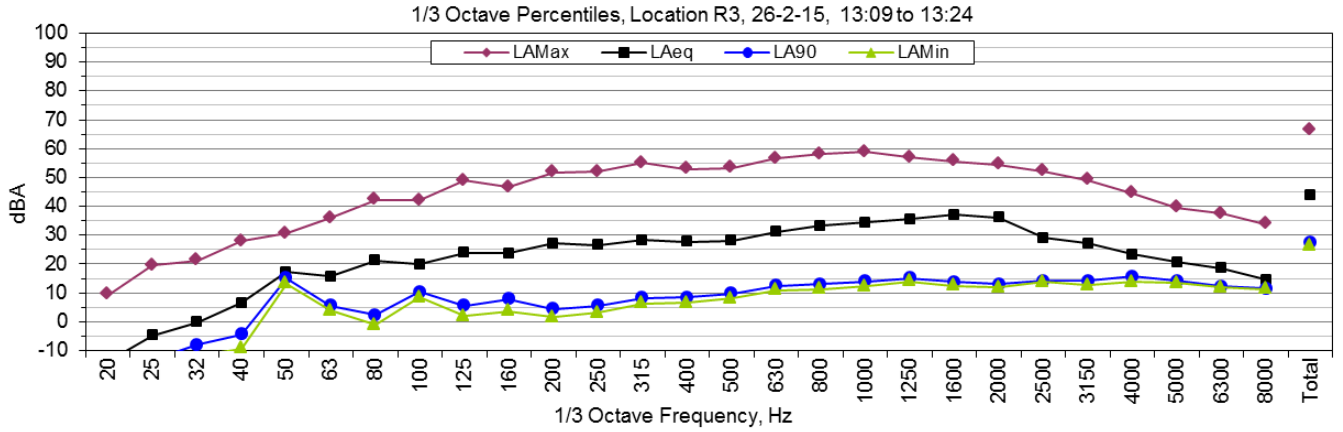

Time Trace dBA, Location R3, 26-2-15, 10:33 to 10:48
dBA
Minutes

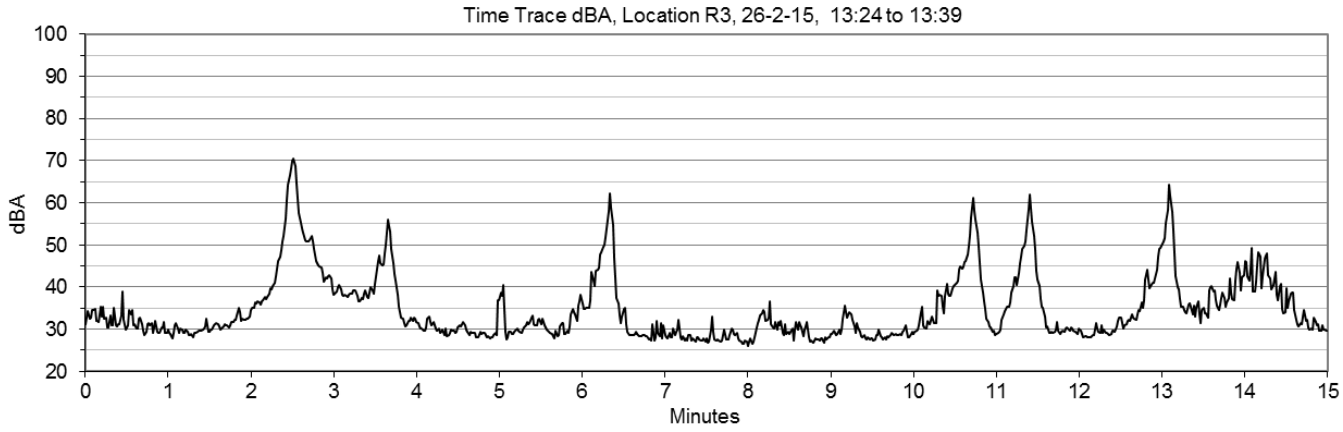

1/3 Octave Percentiles, Location R3, 26-2-15, 10:33 to 10:48
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

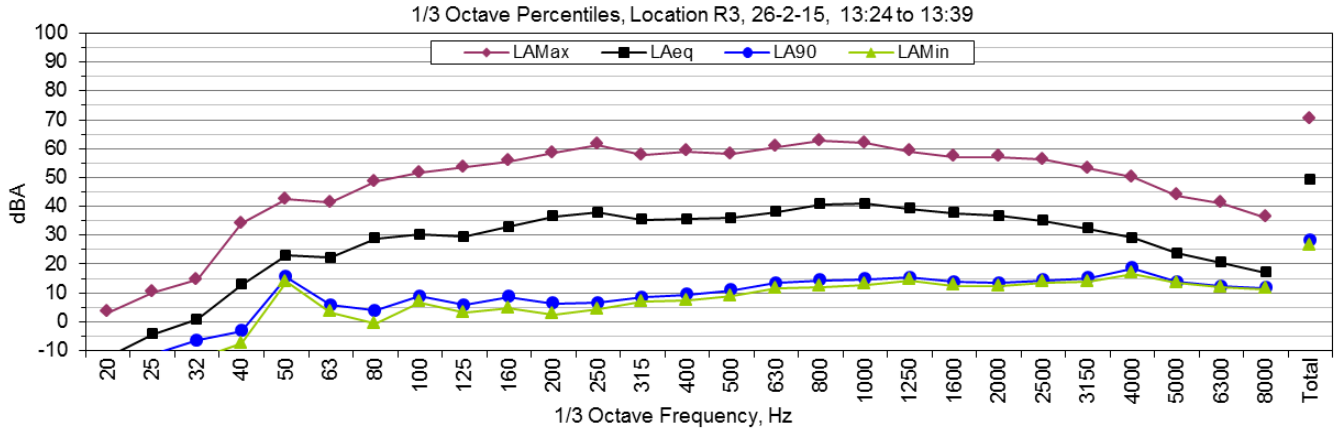

Time Trace dBA, Location R3, 26-2-15, 12:53 to 13:08
dBA
Minutes


1/3 Octave Percentiles, Location R3, 26-2-15, 12:53 to 13:08
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

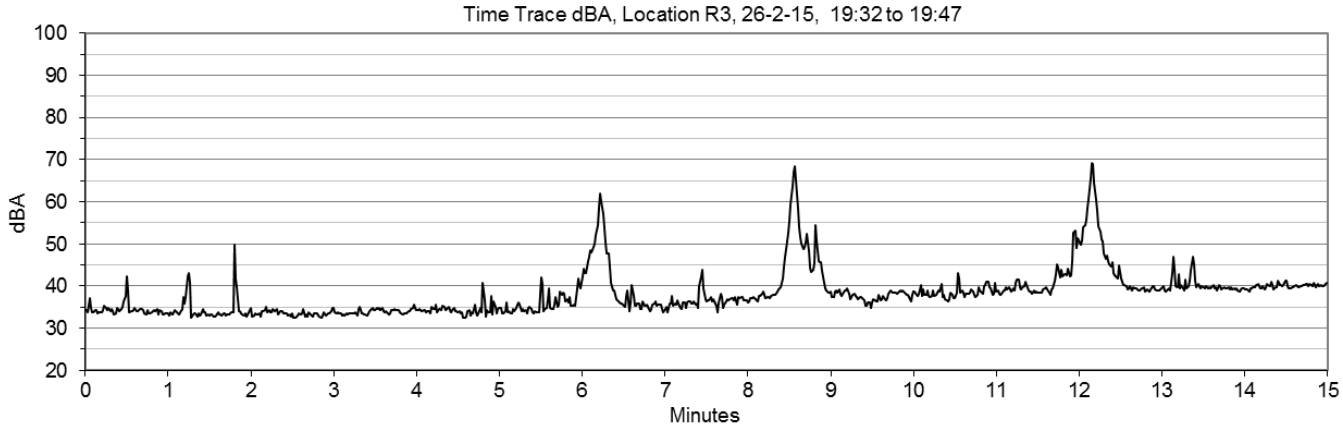

Time Trace dBA, Location R3, 26-2-15, 13:09 to 13:24
dBA
Minutes

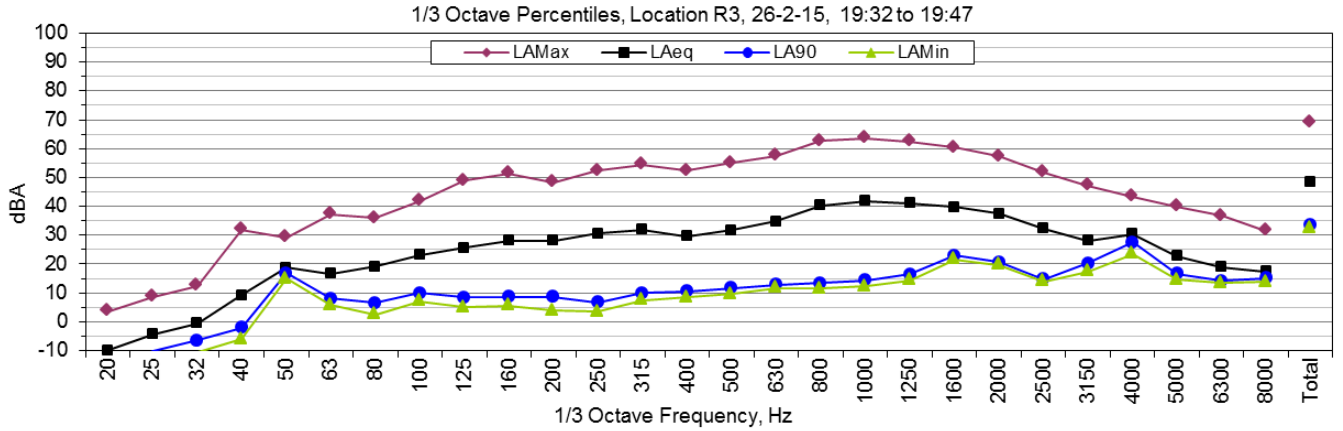

1/3 Octave Percentiles, Location R3, 26-2-15, 13:09 to 13:24
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

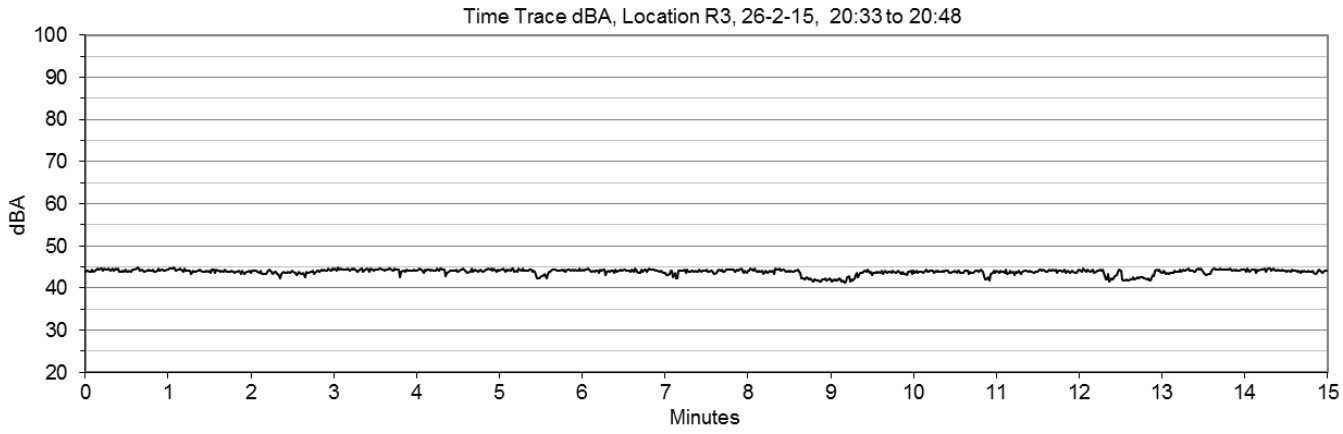

Time Trace dBA, Location R3, 26-2-15, 13:24 to 13:39
dBA
Minutes

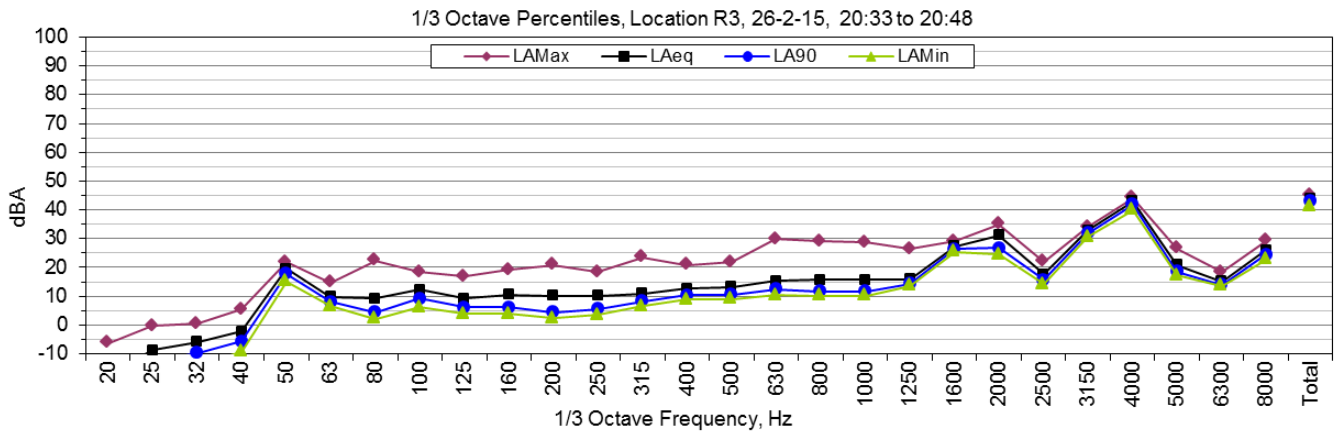

1/3 Octave Percentiles, Location R3, 26-2-15, 13:24 to 13:39
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz

Evening 3 – Thursday 26 February 2015

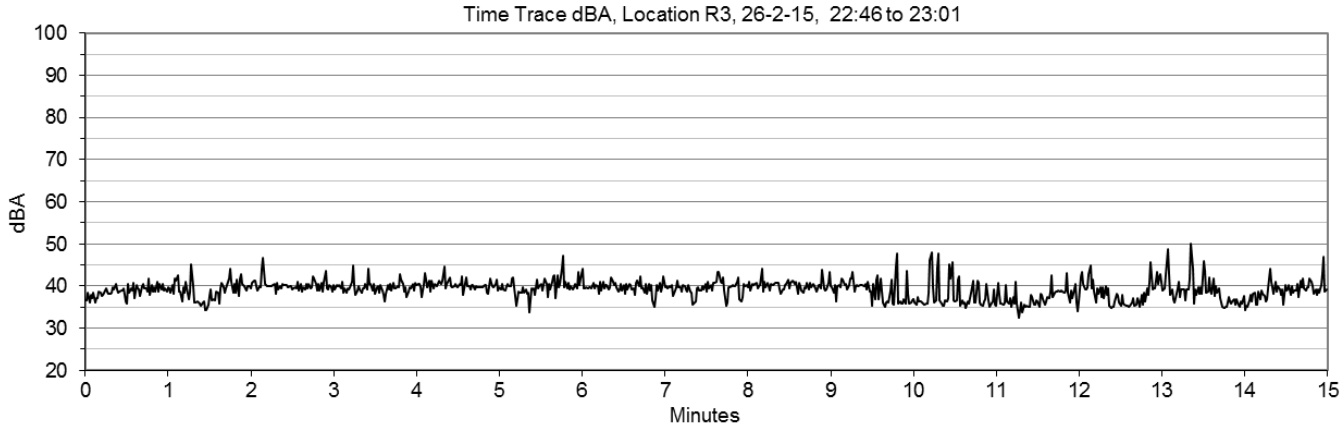


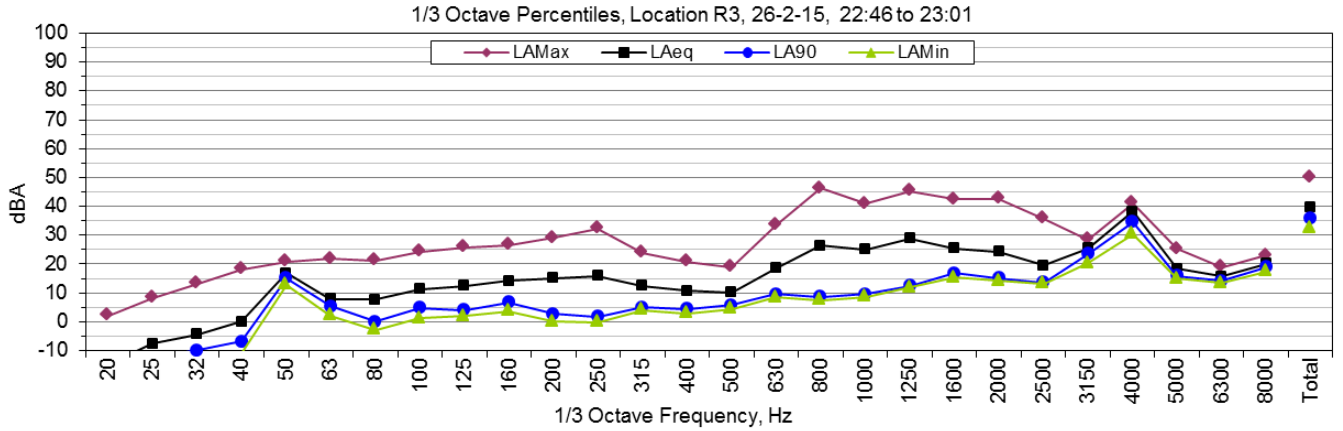


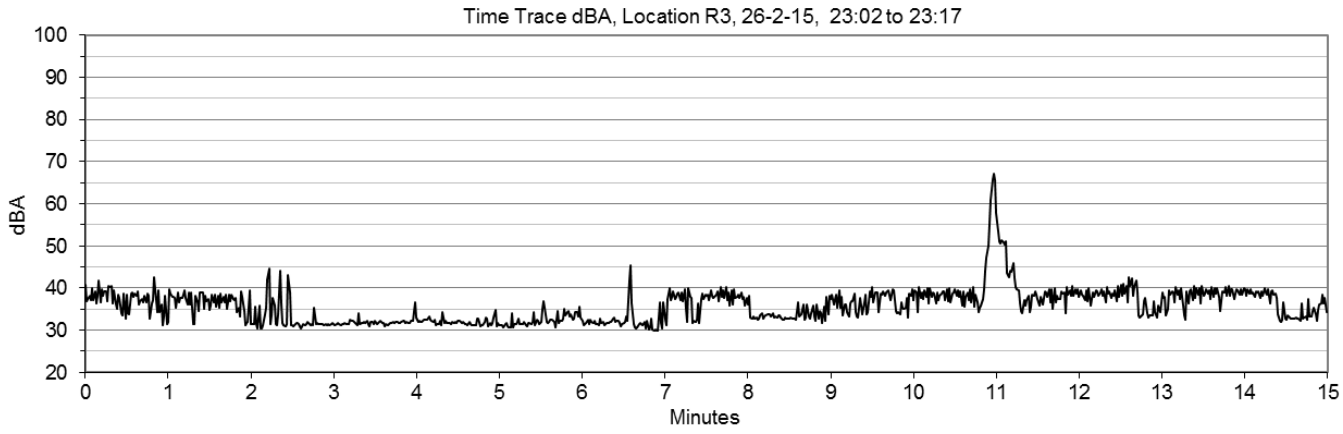


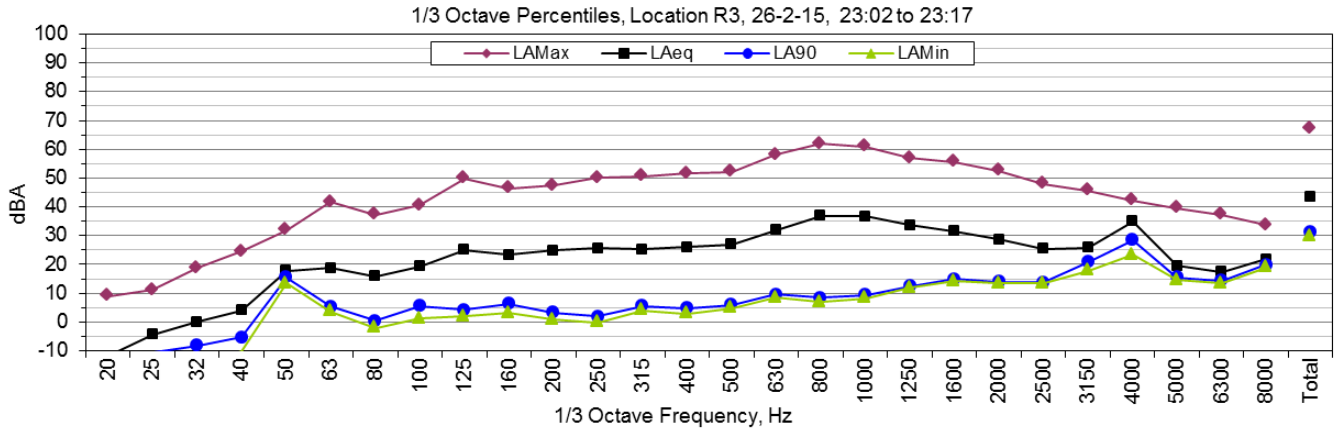


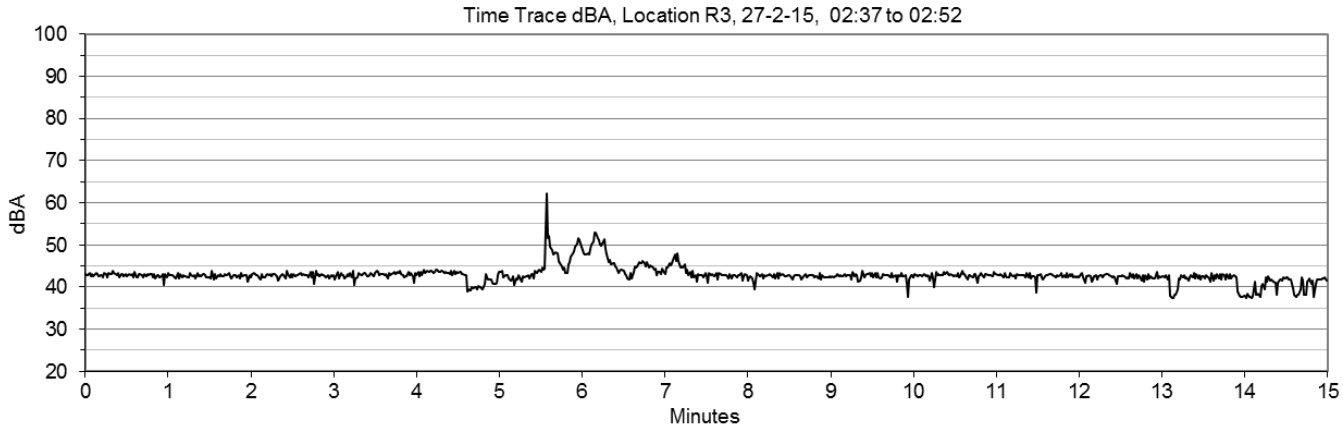
Night 3 – Thursday 26 February 2015

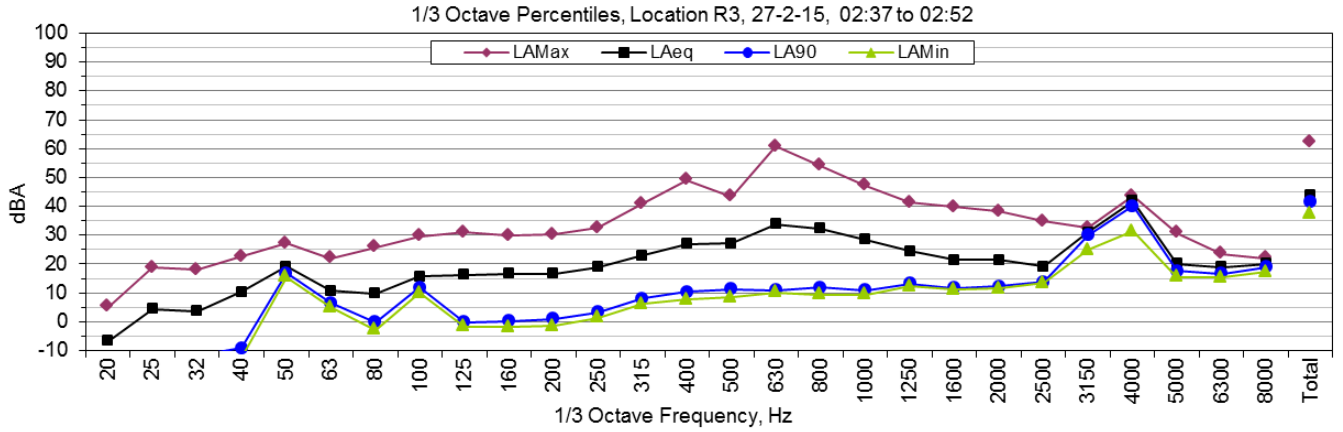


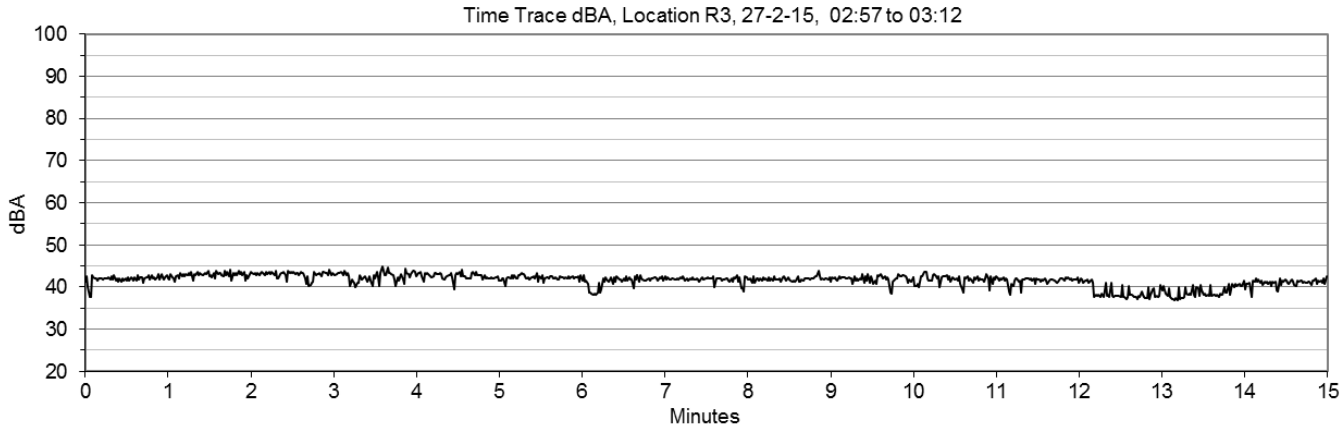


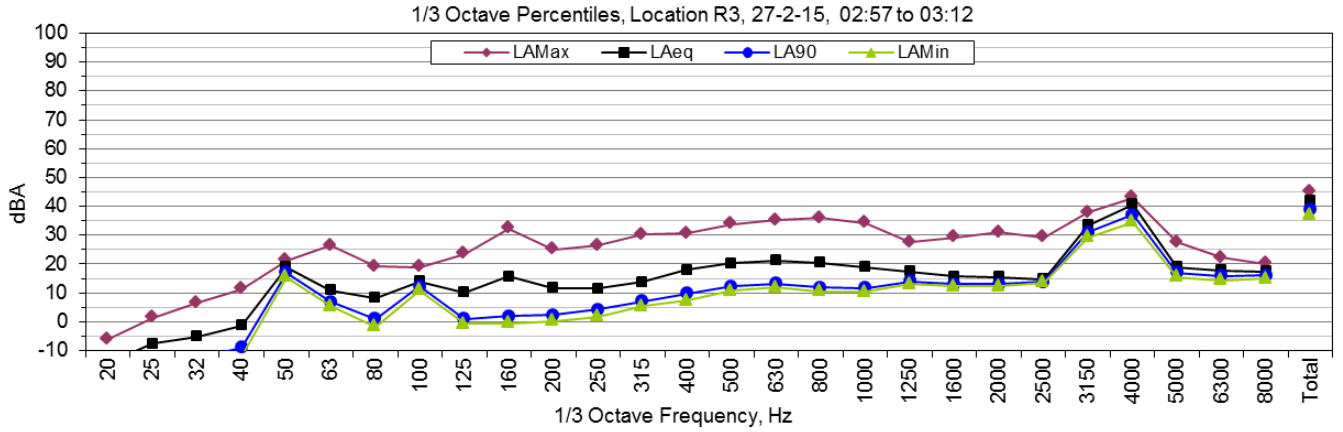





Time Trace dBA, Location R3, 27-2-15, 02:37 to 02:52
dBA
Minutes


1/3 Octave Percentiles, Location R3, 27-2-15, 02:37 to 02:52
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz


Time Trace dBA, Location R3, 27-2-15, 02:57 to 03:12
dBA
Minutes


1/3 Octave Percentiles, Location R3, 27-2-15, 02:57 to 03:12
LAMax
LAeq
LA90
LAMin
dBA
1/3 Octave Frequency, Hz